



CODES Newsletter

Centre for Ore Deposit and Exploration Studies, University of Tasmania

April 1995

1994 Highlights

- Twenty-five major research projects were under investigation in 1994 with particular focus on base metal provinces in both volcanic and sedimentary terrains in Tasmania, Queensland, NT and WA (see table p. xx)
- Dr Bruce Gemmell was successful in gaining an ARC Large Grant of \$55 000 pa to continue his studies on active seafloor sulphide deposits in collaboration with Ray Binns from CSIRO.
- Postgraduate student numbers showed healthy growth in 1994, the current numbers standing at 16 PhD, 5 MSc, 20 M. Econ. Geol and 13 Honours students in economic geology.
- Forty industry geologists have now enrolled in the Master of Economic Geology course since commencement in 1990, with 87% thesis completions within the required time of 30 months.
- The successful textbook *Volcanic Textures*, published by CODES, sold over 1200 copies in 1994 and will go to a second printing in 1995.

CODES Short Course Program

3-15 July 1995 — Exploration geophysics, remote sensing and image processing

6-18 November 1995 — Economic management and environmental aspects of exploration and mining

March 1996 — Volcanology and mineralisation in volcanic terrains

July 1996 — Ore deposit studies and exploration models

From the Director

Future funding for CODES

The CODES Key Centre has now completed six years of operation, and over this period it has gained a strong reputation for teaching and research in economic geology, with focus on areas of direct relevance to the mineral exploration industry.

CODES outside funding for research was \$1.24 million in 1994, being provided by grants from industry (30%), Australian Research Council (57%) and the Tasmanian Government (13%).

However, Federal Government funding for the three Key Centres (UWA, JCU and Tasmania) will cease in 1996/97 and our major objective for the next triennium is to ensure the continued growth and development of the successful formulae for economic geology teach-

ing and research established in Australia by the Key Centres.

At a recent meeting of the CODES Advisory Board it was agreed that funding to replace the Commonwealth Grant would be sought by increased sponsorship from the mining industry, combined with increased support from the State Government and the University of Tasmania. The Executive Dean of Science and Technology has indicated that the University will provide a portion of the funds required on the understanding that matching funds will be sought from the State Government and mining industry sponsors. The establishment of a funding package to maintain and further develop CODES' research programs is our major priority for 1995.



As part of the Siemens Summer Science School, some 100 students were introduced to the joys of gold panning by CODES staff. Here we see the unmistakable silver hair of Peter McGoldrick helping the students in his usual friendly manner, politely pointing out deficiencies in their panning techniques.

Developments at CODES

New Master of Exploration Geoscience degree

CODES has been running a very successful coursework MSc in economic geology since 1990 which is outlined elsewhere in this newsletter. In mid-1994 the University Council approved the development of a new research masters degree for the Key Centre. There is a growing demand amongst students and sections of the industry for a masters course combining a major research thesis with selected advanced coursework units in exploration geoscience. It is anticipated that the course will also be attractive to overseas students, especially from SE Asian countries.

Development of the SE Asian geology initiative

Key Centre and Geology Department staff have considerable expertise in the geology and mineral deposits of SE Asia. An immediate advantage of the integration of CODES and Geology will be to bring the Asian expertise together for a series of major interdisciplinary research projects on the tectonics and mineral potential of this rapidly expanding part of the World. Dr Khin Zaw (CODES Research Fellow) has recently completed an industry funded project on the geology and mineral deposits of Burma. Extension of this research into Northern Thailand, Laos and Vietnam is proposed for 1995–97, and will involve a team effort by Dr Khin Zaw (CODES) with Dr Tony Crawford and Dr Clive Burrett (Geology Department). The budget for this project will be about \$200,000 pa with funding sought from the Targeted Institutional Links Program and AMIRA.

Important parts of this new initiative will be specialist short courses on tectonics and mineral deposits in SE Asian countries and encouragement of Asian geologists to undertake postgraduate training at the Key Centre. Several Australian mining com-

panies are keenly interested in this initiative, and it is likely that the project will commence in mid-1995.

New developments in Tasmanian research

An on-going commitment of the Key Centre is to concentrate 50% of the research effort in projects relevant to the Tasmanian mining industry. This commitment is strongly supported by the Tasmanian Government and our major sponsor companies (Aberfoyle, Pasminco and RGC — all with Tasmanian operations). To this end, a major new research project, to receive funding from AMIRA and the ARC collaborative scheme, has been developed to study geological and geochemical vectors to massive sulphide deposits in volcanic terrains. The research program, with a budget of \$310,000 pa, will concentrate on the Mt Read Volcanics in western Tasmania, plus other volcanic belts in Queensland and Western Australia. Eight Australian mining companies are contributing to the project.

New developments in mainland Australia research

Our major AMIRA–ARC Collaborative research project on Proterozoic sediment-hosted Pb–Zn deposits, has concentrated on the North Australian Zinc Belt, including the McArthur Basin (NT) and Lawn Hill Platform (Qld). A multidisciplinary team of six research staff, four postgraduate students and five honours students have been involved in the project. Results have been very encouraging and the project has received enthusiastic support from sponsor companies. Application for a three-year extension of the project was made in late 1994, in order to broaden the range of styles of sediment-hosted lead–zinc–copper mineralisation considered and

include shale-hosted Pb–Zn, MVT and sedimentary copper deposits. Collaboration with AGSO and the Northern Territory Geological Survey will continue to be an important aspect for this research.

Copper-gold research developments

The Key Centre has maintained a research project on Proterozoic Cu and Au deposits for the past six years. The results of this research culminated in the very successful four-day Cu–Au short course for industry held at CODES in July 1994 (attended by eighty industry geologists), and the publication of a series of papers by CODES staff in a 1994 issue of *Mineralium Deposita*. Over the next three years we plan to extend this program, in collaboration with the JCU Key Centre, and to introduce a project to concentrate on porphyry Cu–Au deposits. The latter project will involve research on ore deposits and granite-related hydrothermal systems in Tasmania, NSW and SE Asia. Dr David Cooke, Lecturer in Hydrothermal Geochemistry has been appointed to lead the project.

Book on alteration geochemistry and textures

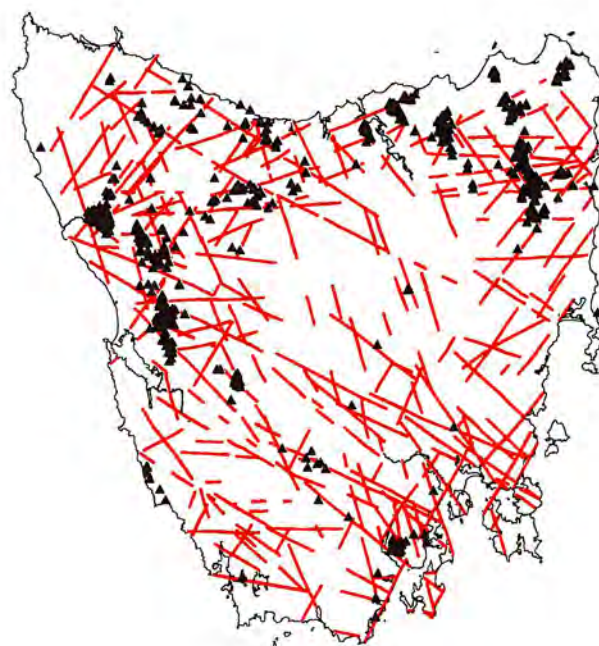
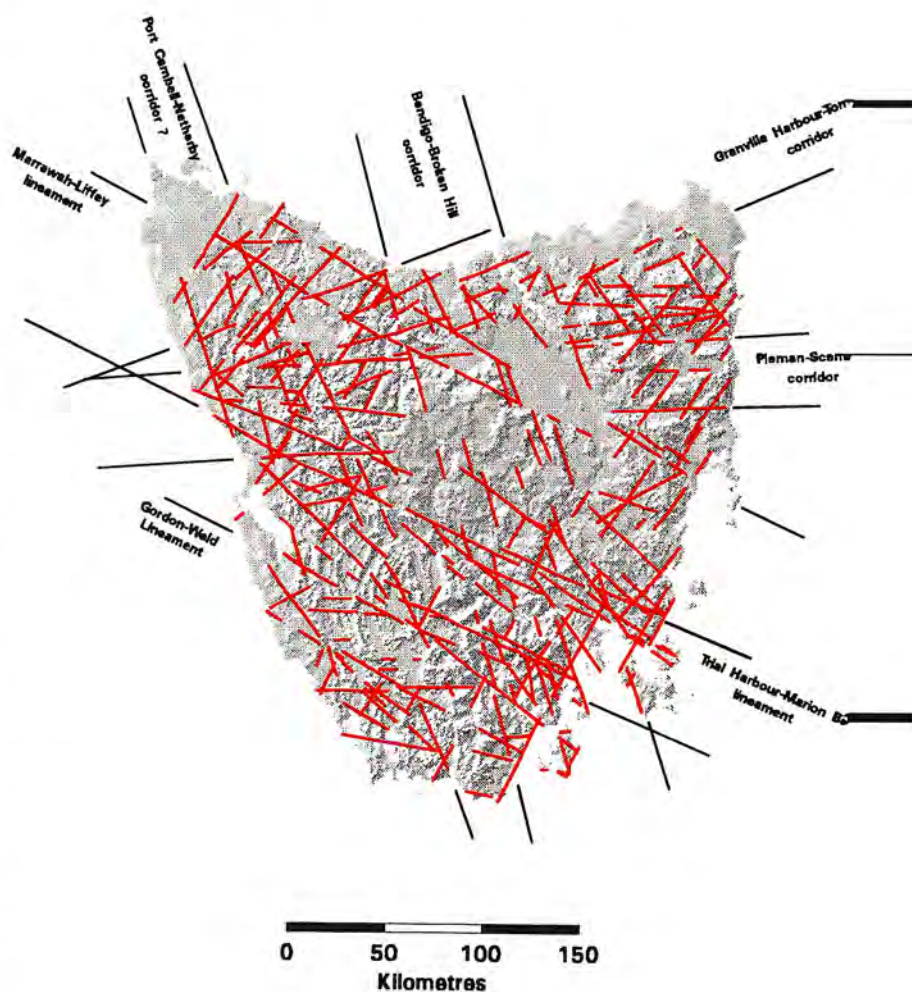
As a follow-up to the highly successful Key Centre publication, *Volcanic Textures: a guide to the interpretation of textures in volcanic rocks*, it is planned to produce a book on alteration geochemistry and textures in volcanic rocks. This project will involve considerable research over the next three years, collecting and analysing data from volcanic successions in Tasmania, Queensland and Western Australia. Funding will come partly from AMIRA and partly from the revenue generated from sales of *Volcanic Textures*.

Topographic lineaments in Tasmania

An MSc project undertaken at CODES by Peter Rice is providing new information on the relationship between major topographic lineaments, crustal structure and gold mineralisation in Tasmania. This research, which is supported by a scholarship from the Tasmanian Government Scholarship Scheme, has identified new areas of gold potential which warrant exploration follow-up.

Contours captured at 1:250 000 scale by the Tasmanian Department of Environment and Land Management have been used to generate a digital elevation model (DEM) of Tasmania (upper map). Lineaments in the DEM (red lines on both maps) have been interpreted by artificially illuminating the image from four orthogonal directions. Major lineaments that are persistent across the island are highlighted and named. By analysing large-scale data sets, features can be traced which may not be apparent from field observations. An example is the Trial Harbour–Marion Bay lineament which is mapped in Palaeozoic rocks in western Tasmania and continues as a topographic lineament across southeast Tasmania. Here it forms the northern margin of the Derwent graben, and faults in the Hobart area display a dextral offset about the lineament identical to Devonian structures on the western side of the island.

Major faults in the crust are good sites for focusing mineralising fluids. This is most important for locating secondary or vein-type mineral deposits. A plot of all gold deposits (black triangles on lower map) from the Tasmanian Development and Resources mineral-deposit database shows spatial correlation with several lineaments. Gold-mining fields such as Lisle and Gladstone have strong spatial association with the Granville–Tomahawk corridor. Also, gold deposits in northwest Tasmania are clustered at the intersection of the Marrawah–Liffey lineament with the Arthur mobile zone. Major topographic lineaments provide a good starting point for mineral exploration in areas under cover, such as southeast Tasmania, where prospective 'Mount Read like' volcanics are known to exist beneath a blanket of Carboniferous cover.



GUEST COMMENT

Australian Economic Geology in a World Perspective

Late in 1993 I attended a small conference in the USA, mostly devoted to economic geology. There were representatives from several Australian companies and from four Australian universities. This representation by Australians was totally out of proportion, far higher than could be expected on any reasonable basis.

The tone at this conference was generally pessimistic, and in some quarters all was gloom and doom. In the USA the universities were seeing budget cuts and falling student numbers. Many geology departments had moved to teaching environmental subjects, and in many, economic geology was dead. The USGS was in despair, with active opposition from government, and virtually no funding for geological programs apart from work on national parks and environmental clean-up. Their fears have since come to pass, as there is currently a move to effectively disband the USGS.

The Australian university representatives there were in marked contrast, with a message that they had to work at it, but they could get support from industry and government. So, is the situation so different in Australia? And why?

There is no doubt in my mind that, for economic geology, the situations are very different in different parts of the world, and in most it is far worse than in Australia. In the USA there are still old, well-endowed universities that teach economic geology. Some are producing excellent graduates, and doing outstanding research. But not nearly so many as in the past. For exploration geophysics, the USA is a disaster area, with virtually no-where teaching it now. Remember, the USA is by far the most populous western nation. A large reduction in graduate numbers from the USA means a large proportional drop for the western world.

Canada is in much better shape. There are good departments teaching and researching in economic geology, but the number of graduates is not large. In the UK, only a few universities are doing anything much on economic geology. There are key individuals working in universities, some with excellent facilities, but they work alone. They do good work, but they are so few. There are no organisations like the Key Centres to build up real momentum

in tackling issues. In western Europe there are very few economic geologists. In eastern Europe and Russia there are many economic geologists, some with huge amounts of detailed data on deposits, but bringing them into the mainstream of western geological thinking is a daunting challenge.

Why do we have this situation, and why is Australia, at least somewhat, different? Of course, a lot of the problem in some parts of the world is simply the decline of the mining industry. But countries like the USA, with a large mining industry, are also affected. I think a lot of the problem is simply that most people in western society have grown away from reality — when many do not know that eggs come out of the backsides of hens, they can hardly know where copper, zinc or lead come from. And mines are nasty, polluting things that destroy the environment, and waste scarce resources, so we would be better off without them, wouldn't we? So develops a kind of cargo cult mentality that says, yes, we do want the things that are made with metals, and no, we do not want to pay more for them, and no, we don't want mines. Given this attitude it is hardly surprising that economic geology does not get a lot of support.

So, you think I exaggerate? Did you know that in the last US presidential election campaign one of President Clinton's senior officials campaigned on the slogan "Mine free in '93"? It is only ignorance elevated to an art form that allows that sort of thing. Public attitudes in Australia are not that bad yet, but it will require a lot of effort to stop the slide in that direction. Even among geology students you find a much clearer understanding of the role of exploration and mining in Western Australia or Queensland, than you do in Victoria or NSW.

GUEST COMMENTATOR



Noel White joined BHP as a trainee cadet in 1964, and his university studies culminated in a PhD degree from the University of Tasmania in 1975. He worked as a Geologist in NSW and WA, prior to his appointment, in 1979, as Group Leader responsible for all exploration for VHMS deposits throughout Australia. After a short period, in 1982, as Group Leader responsible for volcanic base metal and nickel deposits in WA, he transferred to Melbourne in 1983 to be Senior Research Geologist responsible for project generation for gold in eastern Australia, technical consulting and training. This position was expanded to cover the Asia-Pacific region later in 1983 as Principal Research Geologist, and again in 1988 as Senior Principal Geologist (Research). In 1992 he was appointed Chief Geologist (Exploration) as chief technical and operational advisor to the Manager (Exploration) responsible for technical standards, research, graduate recruiting, training and staff career development. In 1994, he transferred to London in the same capacity to be closer to expanding operational regions in Africa, Europe and the Americas.

That the situation in Australia is not yet disastrous probably results from several factors. One is the recognition in at least some quarters (particularly the states dependent on mining) that the mining industry is vitally important for Australia's economic health. Another is that there is a strong tradition of economic geology in Australian universities, and while students keep coming, courses keep being given. Students keep coming because it is a subject that is interesting, and it has real employment opportunities at the end. Another factor is that the industry in Australia has supported courses and university research, and has employed graduates and vacation students. Support for the universities from industry has probably been stronger here than anywhere else, possibly apart from Canada (the only other relatively healthy place).

But the key factor is probably employment opportunities. Students may be idealistic, but they have a strong pragmatic streak as well. It is very fine to be studying some fascinating esoteric discipline that employs two graduates a year, provided you do not expect to find a job in that field. But, as soon as the students start thinking of the future, they realise that at the end of it all, they have to live. Many students study

geology because it is interesting, and it has reasonable job prospects (as well as offering outdoor work and travel opportunities). While the exploration and mining industries are strong and employing graduates, the universities can expect demand for geology courses. When the industry stops employing graduates, then demand for courses will drop, and departments will look around for alternative ways to survive — environmental courses, for instance.

That situation maintains demand for training in geology, a proportion of which is in economic geology. Economic geology offers many opportunities for research, and the mining industry in Australia has a relatively enlightened attitude to research. Even though the companies are aggressive and fiercely competitive, they know they need information, and they all have much the same need. But competitive advantage does not lie in the knowledge you have, but in how you use it. So in Australia the industry has been prepared to support collaborative research projects, and on a much larger scale than elsewhere. Much of this has been done through AMIRA. Attempts to form similar associations in Canada (MITEC) and the UK (MIRO), have been less successful, and in the USA

have failed. There the attitude seems to be to keep everyone in the dark for fear that if you turn on a light your competitors may see something before you do!

One of the best results of this relatively enlightened attitude from both government and industry in Australia has been the development of the Key Centres in economic geology. Most university researchers are solo players, and fiercely defend their independence. But working alone, no matter how good they are, their productivity is limited. The Key Centres build teams of researchers who work collaboratively to produce results that would not have been possible 'alone'. I hear academic purists sneer, that the research is not always of the first quality, but apart from them, who cares? I want to see good work, focussed on relevant problems, reported quickly and clearly. And on the whole the Key Centres deliver that. More strength to them.

So in Australia economic geology is much healthier, on average, than almost anywhere else in the world. For all our sakes, I hope we all have the good sense to keep it that way by continuing to support collaborative research, continuing to provide access and support for student projects, and continuing to employ students and graduates.

Noel White



Inside a rain cloud atop Mount Read in western Tasmania, Jocelyn McPhie paying homage to a subaqueous quench fractured rhyolite lava during the March 1994 Volcanology Short Course. Others in the group (l to r) Garry Davidson, Jim Thornett, Ian Ledlie, Rob Reid, Clive Calver, Andrew Graham and Kelvin Hussey.

CODES Volcanology Group

1994 saw the birth of the CODES Volcanology Group. The meetings are informal and intended to serve the needs of those at CODES who are struggling with (or enjoying) the challenges of research that involves volcanic rocks. Meetings have been called on demand, and occur as often as twice a month to as infrequently as not at all. Diverse topics have been considered, including conference reports (e.g. International Volcanological Congress in Ankara, Turkey), accounts of overseas field trips (Alaska, Hawaii, Greece, Turkey, New Zealand, Italy, Japan), progress on PhD research and presentations on specific subjects (silicic lavas, perlite, peperite, caldera formation).

Although the meetings mostly attract volcanology enthusiasts, other CODES and Geology Department staff and students have contributed. The input from igneous petrologists, economic geologists, hydrothermal geochemists, sedimentologists and geophysicists is of particular value — giving a different perspective, asking questions that challenge some of our tacit assumptions, and generally keeping us honest

Jocelyn McPhie



CODES on the High Seas

Research on Active Seafloor VHMS Deposits

Between September and November 1994, Leg 158 of the Ocean Drilling Program investigated the subsurface nature of the active TAG hydrothermal mound on the Mid-Atlantic Ridge. Bruce Gemmell was onboard as the Australian representative in a team of 30 international geoscientists including Mark Hannington, Peter Herzig, Susan Humphris, Jeff Alt, Yves Fouquet and Mr TAG himself, Peter Rona. Being part of an ODP cruise is a fantastic experience. The cruise left from, and returned to, Las Palmas in the Canary Islands and transited to the TAG site in five days. We logged and photographed core, examined thin sections, assayed the core and wrote reports for 12–14 hours a day, ate every 6 hours (with cookie breaks every three hours inbetween), worked out, played ping pong, watched laser disks or videos and basically lived in each others back pocket seven days a week for two months. The occasional fire drill or barbecue on the bow broke up the routine.

The active TAG sulphide mound was discovered in 1986 and is located at a water depth of 3,650 m at the base of the eastern wall of the Mid-Atlantic Ridge at 26°N. The mound is distinctly circular, measures 200 m in diameter and rises about 50 m above the seafloor and is the largest, singular sulphide mound yet discovered on the seafloor. A cluster of black smoker chimneys emitting fluids up to 360°C and consisting of chalcopyrite, pyrite and anhydrite is located northwest of the centre of the mound on the top of a 10–15 m high cone. A field of sphalerite dominated white smokers venting fluids from 260 to 300°C is located in the southeast quadrant of the mound approximately 70 m away from the black smoker chimneys. Fluids from the white smokers have temperatures of 260–300°C, are zinc-rich, and have lesser amounts of iron and copper than the black smoker fluids.

Seventeen holes were drilled in five areas of the mound, with the deepest penetration of 125 m. Drilling in different areas, including a high-temperature black smoker complex and a lower-temperature white smoker vent field, revealed a multi-stage depositional history, complex fluid interactions, and the extent of sub-seafloor mineralization and alteration. The upper 10–20 m of the TAG mound consist of massive pyrite and pyrite breccias, with significant chalcopyrite and sphalerite in places, which are underlain by an pyrite-anhydrite breccias from about 20 to 30 m below seafloor. With increasing depth, quartz-pyrite mineralization and quartz veining in the pyrite breccias becomes dominant and represents the top of a quartz-pyrite stockwork zone. Quartz-pyrite breccias at the top of the stockwork grade into silicified wallrock breccias below 40 m. Chloritised basalt breccias were sampled at depths greater than 100 m. Recovery of relatively unaltered basalt near

the edges of the mound has constrained the extent of the stockwork mineralization and intense alteration to a pipelike feature of about 80 m diameter.

The complex assemblage of breccias which comprises the bulk of the mound includes clastic sulphide debris, chert breccias, anhydrite cemented pyrite breccias and quartz-pyrite breccias. These lithologies may be the

products of multiple episodes of mass-wasting, cementation, hydrothermal reworking, and replacement during the growth of the mound. Repeated episodes of cementation and replacement are responsible for the complex stratigraphy encountered during drilling, the present surface morphology, and the distribution of vents.

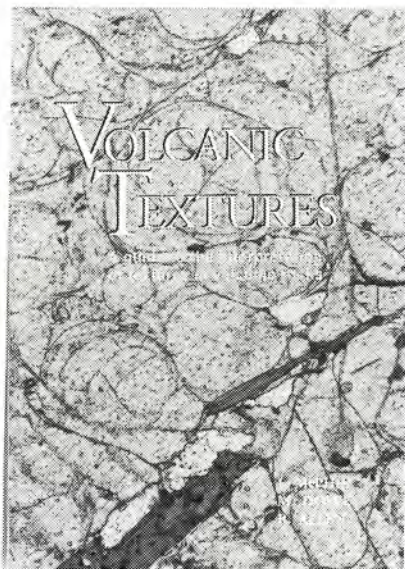
Continuing studies of this unique drill core combined with further drilling will provide significant insights into the mechanisms of sulphide precipitation, zone refining processes, and the evolution of major black smoker systems on the seafloor as modern analogs for ancient massive sulphide deposits on land. One hundred samples of drill core throughout the lateral and vertical extent the TAG mound are housed at CODES where research is concentrating on sulphide and sulphate mineralogy and sulphur isotopes. For further information contact Bruce Gemmell on (002) 202893.



ODP drill ship *JOIDES Resolution*.

Volcanic Textures into second print run

Codes publication *Volcanic Textures* — a guide to the interpretation of textures in volcanic rocks was launched at the end of 1993 and topped 1000 sales in Australia and overseas within a year. The promise of continuing demand has prompted ordering of a second print run.



The book has been well received by both the volcanological and exploration communities. It has been favourably reviewed in the *Bulletin of Volcanology*, *The Australian Geologist* and the *Proceedings of the Geological Society of Sweden*.

"It is a valuable asset to exploration geologists and suitable as both an introductory and graduate level textbook for the interested student." GSS

"... an excellent book and strongly recommended to all geologists and students working in volcanic sequences." TAG

Volcanic Textures can be ordered from CODES (fax 002 207662, ph. 002 202472) for \$75 per copy (plus \$9 for postage within Australia; \$20 for overseas economy air postage). Students and bulk orders receive significant discount!

International Volcanological Congress, Turkey 1994

Turkey, hosted the International Volcanological Congress, IAVCEI (International Volcanological Association and Chemistry of the Earths Interior) in September 1994. The conference was held in Ankara, providing a rare opportunity for volcanologists and petrologists from western countries to meet and exchange ideas with those from Middle Eastern and former Eastern Block countries. As at IAVCEI, Canberra 1993, interest expressed by industry geologists was significant, reflecting the growing role of volcanic facies analysis in mineral exploration.

CODES researchers, Jocelyn McPhie, Joe Stolz and Mark Doyle, presented papers at the conference and participated in pre- and post-congress field excursions to the Neogene-Quaternary Cappadocian volcanic field, central Turkey. The excursions considered the deposits associated with large volume pyroclastic eruptions, addressing problems which included: emplacement and transportation mechan-

isms in pyroclastic flows, subaerial versus subaqueous transportation and deposition, devitrification and vapour-phase crystallisation in ignimbrite, and structural controls on the alignment of volcanic centres. Visits to underground cities carved into non-welded ignimbrite provided insight into ancient cultures with an unsurpassed taste in rocks.

The return trip to Australia took Mark Doyle via the volcanoes of Italy and Hawaii. Italy boasts some of the most active and best known volcanoes (e.g. Vesuvius, Etna) in the world. Fieldwork hosted by Guido Giordano (University of Rome) around Roccamonfina volcano was followed by excursions to the volcanoes of southern Italy, a highlight being a night spent atop Stromboli stratovolcano viewing explosive eruptions.

From Italy, it was a short jump to the west to view ancient and active lava flows on Kilauea volcano, Hawaii Island.



Bad-lands developed through weathering of non-welded Upper Goreme Ignimbrite, Cappadocia, Turkey.

Success for copper-gold workshop

Run in conjunction with the Master of Economic Geology unit *Advanced ore deposit studies and exploration models*, the copper-gold workshop was held over four days (4–7 July 1994). The workshop was split into distinct sections — two days on Phanerozoic porphyry systems, one and a half days on Proterozoic systems, and a half day on copper-gold skarns and volcanic-hosted seafloor deposits. Course leaders included John Thompson (University of British Columbia), Paul Heithersay (North Exploration), Imants Kavalieris (consultant), Doone and Leslie Wyborn (AGSO), David Cooke (CODES), Pat Williams (JCU), Garry Davidson (CODES), Nicki Netherway (Placer Pacific), Larry Meinert (Washington State University), Ross Large (CODES), and a spontaneous contribution from John Haggman of Climax Mining.

The workshop was extremely well attended, with 114 participants from exploration and research. Generally it was appreciated as a timely overview of a lively, blossoming scientific field.

Participants were treated to overviews of each subject, mixed with many specific case studies, and displays of core from Cu–Au deposits across the globe. Of twenty-four attendees who later answered the question “how would

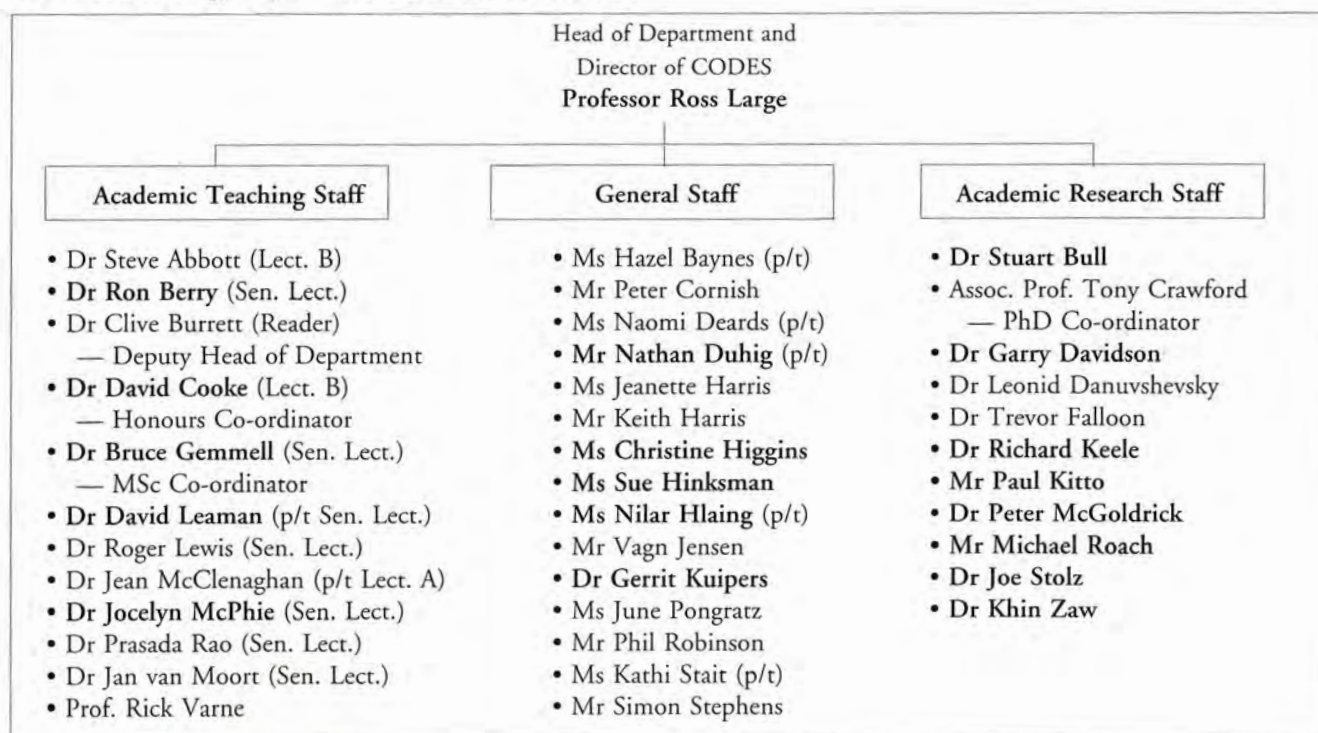
you recommend this course to others in your company”, nineteen voted it “highly recommended”.

CODES is committed to a tradition of future workshops to serve the needs of industry and research alike.



(l to r) Michael House, Andrew Graham, Ian Ledlie, Peter Ellis, Garry Davidson, Rob Reid, Bruce McQuitty and Blackwell Singoyi deeply involved in an exercise during the Ore Deposit Models short course.

Combined Geology Department/CODES Staff Structure



Key Centre staff are shown in bold.

Geology Department achieves 100% employment record

Although unemployment remains a major problem in Australia, and especially in Tasmania, the Geology Department/CODES at the University of Tasmania is very pleased to report 100% employment for all its 1994 fourth-year graduates. Twelve BSc (Hons) students completed their geology degree in November last year, and by the end of December all had been offered, and had accepted, permanent positions in their preferred profession of geoscience. A full list of our 1994 graduates and the companies they joined is shown below. Nine of the twelve BSc(Hons) graduates have joined mineral exploration companies as junior geologists in exploration and mining. Three students have been

offered postgraduate scholarships to undertake PhD research study.

A further ten MSc graduates have gained employment with mining and exploration companies in Australia, including Tasmania.

It is very satisfying to see our Tasmanian graduates gain employment so quickly. The reasons are two-fold: firstly, there is considerable demand for geoscientists and secondly, the Geology Department/CODES at the University of Tasmania has a strong reputation for producing high quality and "employable" graduates.

Last year we had a large number of companies visit the University seeking out our geology graduates. Some of the top students were offered two or three

positions before they had even completed their degree. Times are changing and universities now need to become more involved in assisting students to gain employment. This means providing courses and training that fit the demand and better prepare the student for employment, and also to encourage employers to visit and interview graduates, and talk about job opportunities. Departments with a high profile in this area are gaining the rewards by effectively placing their students in employment. Because of our excellent graduate employment record we are now attracting students from other mainland Universities who want to complete their degree in our Department in order to improve their chance of employment.

Geology BSc (Hons) graduates 1994 and employers

Mark Aheimer
Outokumpu Exploration
James Cannell
CRA Exploration
Roger Crawford
Geological Survey of Western Australia
Tony Donaghy
PhD research at University of New England
Anne McPherson
Aberfoyle Exploration
Briony Sinclair
Central Norseman Gold Corporation
Rebecca Sproule
PhD research at Melbourne University
Chris Stott
Western Mining Corporation
Glen van Kerkvoort
Pasminco Mining
Steven Varga
Geological Survey of WA
Andrew Wellington
Western Mining Corporation
Rohan Wolfe
PhD research at University of Tasmania

CODES major research projects 1994-95

- **Controls on Proterozoic sediment-hosted base-metal deposits** — AMIRA, ARC Collaborative, AGSO. Leaders: Ross Large, Peter McGoldrick
- **Structure and mineralisation in western Tasmania** — AMIRA, ARC Collaborative. Leader: Ron Berry
- **Facies architecture of the Mount Read Volcanics** — ARC Large Grant, APRA-I. Leader: Jocelyn McPhie
- **Fluid chemistry of VHMS deposits** — ARC Large Grant. Leader: Khin Zaw
- **Metal zonation in the Dundas Trough** — ARC Large Grant. Leaders: David Cooke, Paul Kitto
- **The character and setting of the Camboon volcanic arc, central Queensland** — ARC Large Grant (Tas-UQ). Leaders: Jocelyn McPhie, Tony Ewart
- **Studies of VHMS-related alteration vectors** — AMIRA, ARC Collaborative. Leaders: Ross Large, Bruce Gemmell, Jocelyn McPhie
- **Tectonic setting of massive sulphide deposits, eastern Australia** — ARC Fellowship: Joe Stolz
- **Copper-gold deposit styles in the Cloncurry district** — AMIRA, ARC Collaborative (JCU). Leader: Garry Davidson
- **Active metal-rich sulphide deposits, Manus Basin** — ARC Large Grant, CSIRO. Leader: Bruce Gemmell
- **Mineral deposits and exploration potential of Burma** — AMIRA. Leaders: Khin Zaw, Clive Burrett



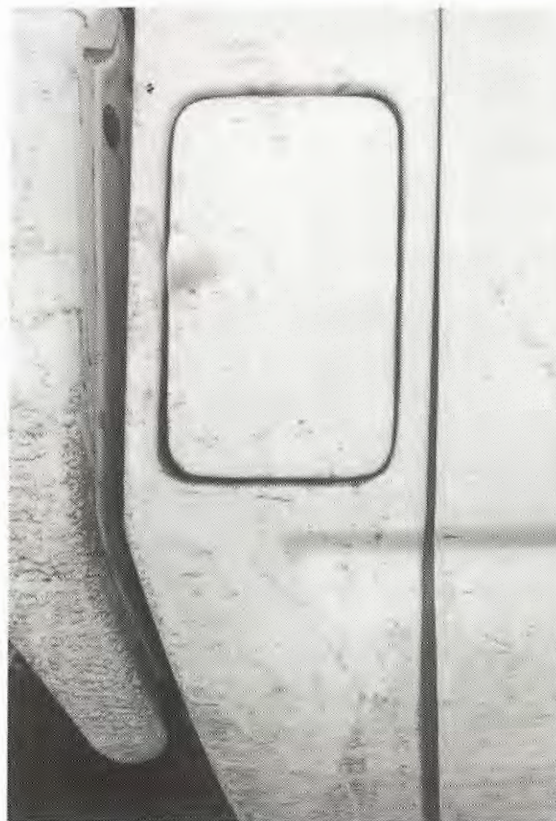
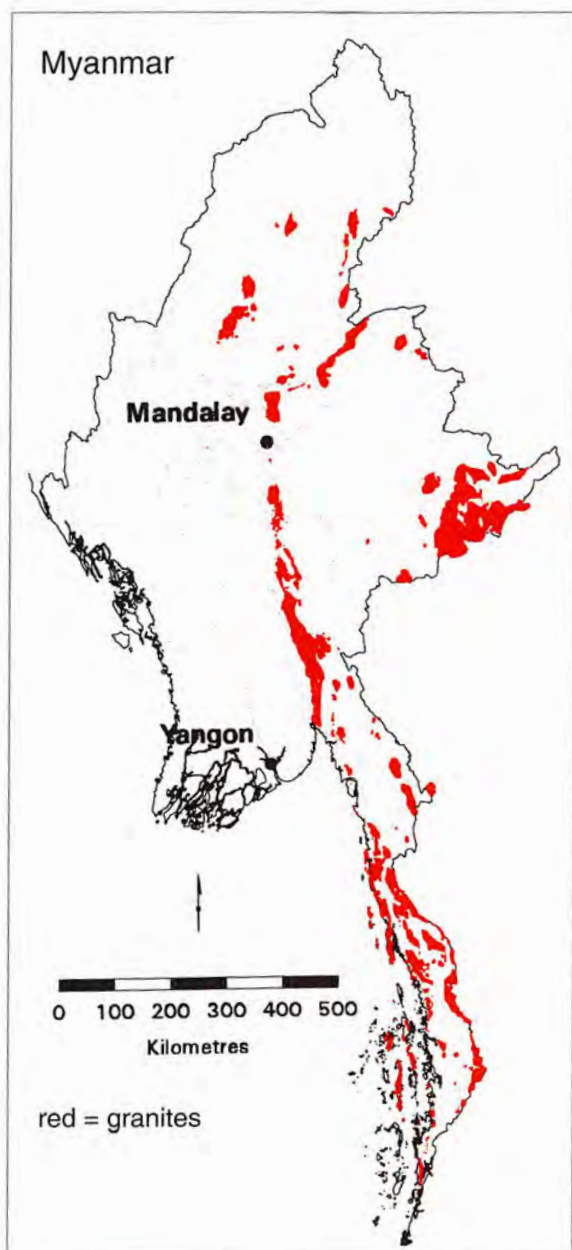
Research in SE Asia

Southeast Asia has the highest growth in the world and has now displaced the EEC as Australia's second largest export market. Some consider that SE Asia is the key to the Australia's future and perhaps survival. Mainland SE Asia consists of mineral-rich countries with commercially important mineralised belts, however, the geology and mineral deposits of these countries are under-researched. The countries are slowly opening-up and will provide unprecedented access and avenues for ore genesis research on regional as well as deposit scales.

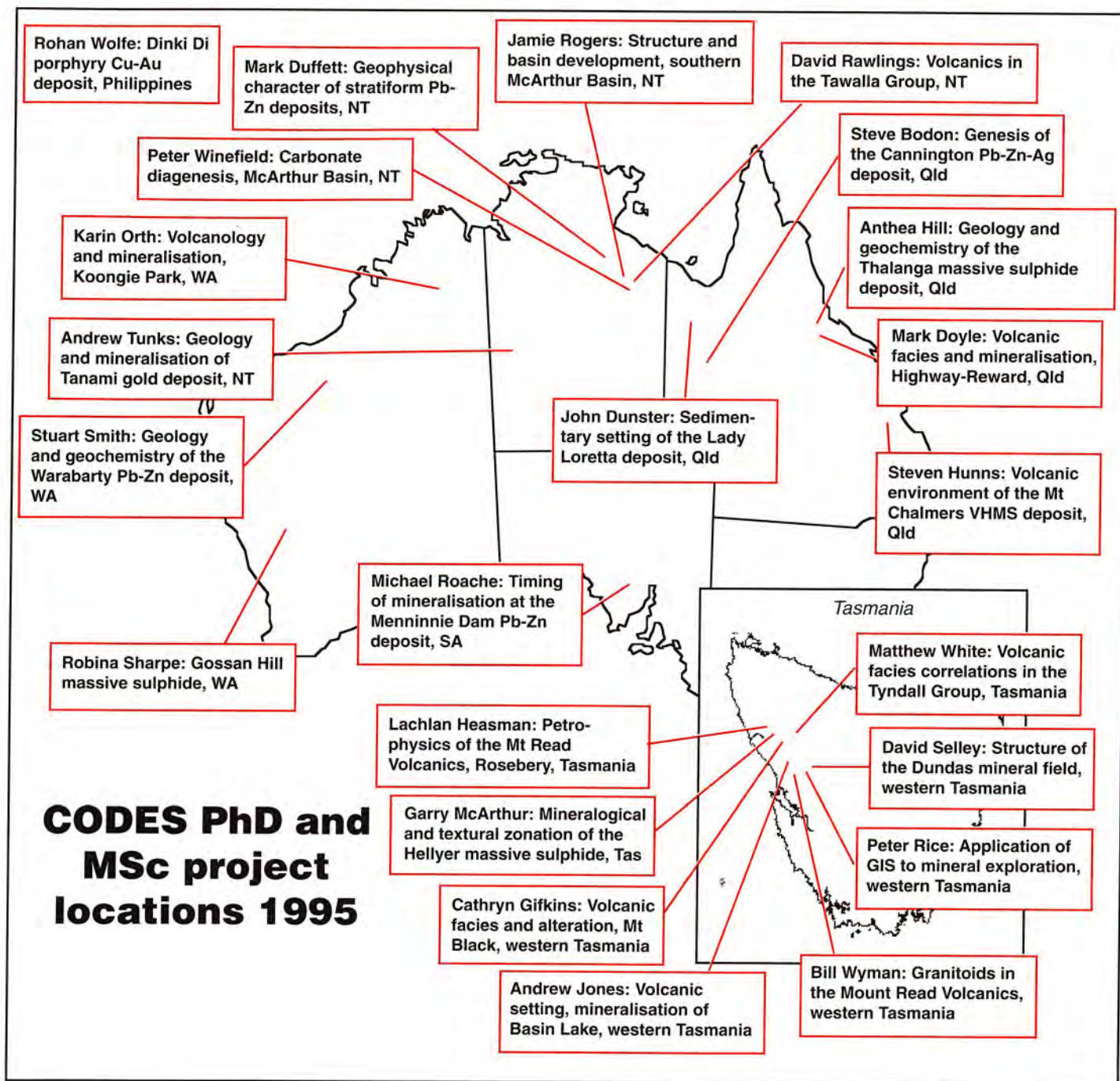
CODES is launching a major program of geological education, research training and ore deposit studies in mainland SE Asia. This will include short courses, collaborative research projects, and personnel exchange between CODES and universities and government agencies in Asian countries.

Under AMIRA project P390, a digital database on Myanmar (Burma) mineral deposits and geology has been successfully established using GIS technology. The GIS database allows independent Myanmar geoscience and mineral deposit data to be displayed at a variety of different scales and as integrated overlays for metallogenic interpretation and evaluation. A new AMIRA project (P390A) "Geological, tectonic and metallogenic relations of mineral deposits in mainland SE Asia" is under negotiation with Australian mining companies.

The aims of this new project are to establish a similar GIS (ARC-Info and ARC View II), digital geoscience data set and mineral deposit database for other mainland SE Asian countries building on the very successful studies for Myanmar. This GIS database will be used as the framework to undertake modern geotectonic and geochemical studies on mineralised volcanics, ophiolites and granite belts in mainland SE Asia, and to apply modern ore deposit research techniques to investigate the styles and origin of SE Asian copper-gold ore systems. The ultimate aim is to provide sponsor companies with a tectonic and metallogenetic synthesis, and ore deposit models, for predicting and locating the world-class ore deposits in mainland SE Asia. For further information contact David Tucker, AMIRA, ph. (03) 654 8844, fax (03) 654 8661, email detucker@amira.com.au or Dr Khin Zaw, CODES, University of Tasmania, ph. (002) 202787, fax (002) 207662, email zaw@geol.utas.edu.au



Mystery object!! See page 12.



The Centaur for Ore
Deposit and Exploration
Studies



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Copyright restrictions have imposed a limit to the availability of CODES short-course manuals. They can only be distributed to University of Tasmania students, CODES sponsor companies and short-course participants. Sorry folks!



CODES Publications and Industry Reports — 1994

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CODES CLASSIFIEDS

BIRTHS

COOK — David and Helen and proud to announce the arrival of Steven, on 6 March 1994. A Billy Brownless look-alike who will be drafted by Geelong under the father and son rule.

SMITH — Sam Smith was born on 1 April 1994. Stu and Jack are still laughing.

STOLZ — On 15 November 1994, in Germany, to Joe and Vanessa, a son, Christian John Guthrie.

TUNKS — To Andrew and Andrea, a son, Joseph, born 16 March 1994. A brother for Grace.

ROACH — To Dr Michael Roach, a healthy thesis entitled *Geology and geophysics of NE Tasmanian granites and associated gold mineralisation*.

KITTO — To Dr Paul Kitto, a long-awaited 484-page epic entitled *Structure and geochemical controls on mineralisation at Renison, Tasmania*.

To Dr Kim HEIN a thesis entitled *The structure and geochemistry of gold mineralisation in the Mt Todd gold-field, Pine Creek Inlier, Northern Territory*.

MARRIAGES

Bruce Gemmell, recently promoted to Senior Lecturer, married Veronica Sackell on 18 December 1994. Will this slow down his globe-trotting?

Lachlan Heasman surprised us recently when the news of his marriage to Jen, an audiologist from Sydney, filtered through to Hobart.

Steve Bodon married Fiona Fowler on 4 April 1994 in Melbourne. A second little Bodon is on the way.

MARRIAGES

Another April '94 wedding saw **Anthea Hill** marry Mark Turkington in Perth, WA.

ARRIVALS



Nathan Duhig, originally a University of Tasmania honours graduate, has joined CODES after three years in exploration with Pasminco. He will be involved as a research assistant on the AMIRA-funded volcanic-hosted alteration research project in 1995.



Nilar Hlaing has worked as a casual research assistant for CODES for several years. This year she moves on to a one-year contract which will involve her in several research projects, as well as being the administrative mind behind the distribution of *Volcanic Textures*.

ARRIVALS



Yoshi Goto is a visiting research fellow from the University of Hokkaido, working with Jocelyn McPhie on aspects of felsic volcanology in the Archean Pilbara, and the volcanology of Tertiary volcanics at Stanley in Tasmania. He will be with us until November 1995.

Uros Herlec has joined CODES for a year, from University of Ljubljana, Slovenia, and departs at the end of April 1995. He is here to undertake research on some Slovenian mercury and base metal deposits, and to observe aspects of our teaching program.

Steve Hunns is back again (from Elura this time), but for how long?

FOR SALE

Volcanic Textures — a guide to the interpretation of textures in volcanic rocks by J. McPhie, R. Allen and M. Doyle can be ordered from CODES (fax 002 207662, ph. 002 202472) for \$75 per copy (plus \$9 for postage within Australia; \$20 for overseas economy air postage). Students and bulk orders receive significant discount!

DEPARTURES

Sue Hinksman, our secretary for two years, has moved on to new challenges. The position is currently being advertised and in the meantime **Jeanette Harris** (pictured below) is the face behind the voice.



TRIUMPHS

Garry Davidson represented Tasmania in Underwater Hockey in Brisbane. The "Coodabeens" lost to WA in the final.

June "the living legend" Pongratz won individual silver and bronze medals and her team won bronze in the teams event of the badminton competition at the World Masters Games held in Brisbane in October last year.

The University of Tasmania Wildcats gridiron team, coached by Bruce Gemmell, completed an undefeated season (9 wins, 0 losses) by winning the Tooheys Island Bowl 60-0 against the Glenorchy Raiders. Next challenge, the San Francisco 49ers!



Masters degree courses in Exploration Geology

Did you know that about 28% of industry geoscientists have a Masters or PhD qualification? It is considered that this figure will increase to over 50% during the next decade. At CODES, a National Key Centre at the University of Tasmania, we offer you the opportunity to undertake one of two top-class Masters degree courses which are designed specifically to produce exploration geologists at the cutting edge.

Master of Economic Geology

A program of course work (60%) and research thesis (40%), designed to bring industry and government geologists up-to-date with recent advances in economic geology, ore deposit modelling and field mapping procedures, with special emphasis on applications to mineral exploration and mine geology.

MSc in Exploration Geoscience

A new MSc course designed for geoscientists who wish to select certain fields of economic geology for detailed study, combined with an in-depth research thesis topic. The MSc (Exploration Geoscience) program combines research thesis (70%) and coursework (30%).

Each course-work unit is taught in an extended short-course format consisting of an intensive program of lectures, seminars and practicals over two weeks. The course leaders are specialists selected from industry and universities who are well recognised in their fields. The course-work units are:

- Exploration geochemistry and hydrothermal geochemistry (March 1995)
- Exploration geophysics and remote sensing (July 1995)
- Exploration management and mineral economics (November 1995)
- Volcanology and mineralisation (NZ and Tasmania) (March 1996)
- Advanced ore deposit studies and exploration models (July 1996)
- Tectonics, structure and ore deposits (November 1996)

All six units are studied in the M.Econ.Geol., three of the six units are studied in the MSc (Exploration Geoscience).

Normal entry requirement is BSc (Hons) or BSc plus at least two years industry experience.

Enquiries and requests for application forms to: Professor Ross Large or Dr Bruce Gemmell, CODES Key Centre, University of Tasmania, GPO Box 252C, Hobart, Tasmania 7001.

Ph. (002) 202472, fax (002) 207662,

or email Bruce.Gemmell@geol.utas.edu.au



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Student intake for the M.Econ.Geol. coursework degree

Name (Employer) • Research thesis topic

1991 Intake

Kim Denwer (RGC Exploration, PNG) • The Lemenga epithermal gold deposit, PNG *

Richard Downs (Aberfoyle, Tas) • Faulting and structure at Hellyer mine *

Steven Cooper (Livore Holdings, Vic) • Genesis of zeolite deposits *

Ian Hart (Contract geologist, Tas) • Timing of the North Lyell Cu deposits *

Stuart Jeffrey (Cobar Mines, NSW) • Geochemistry and geophysics of the CSA deposit *

Greg Lear (Contract geologist, Tas) • Diamond exploration indicator minerals *

Lachlan Reid (Pasmaico, Tas) • Structure of the Rosebery north end lenses *

Marcel van Eck (Mt Leyshon, Qld) • Geology, geochemistry of Mt Windsor Volcanics *

Simon Henderson (Beta Ltd) • Nickel mineralisation in North Vietnam

1992 Intake

Greg Ebsworth (Contract geologist, Vic) • The Currawong massive sulphide deposit, Vic *

Andrew Graham (Penrice, SA) • Effect of blasting fracture on marble quality

Kim Grey (RGC Exploration, WA) • The Sunset Well gold deposit, WA *

Walter Herrmann (Pancontinental, Qld) • Immobile element geochemistry of altered volcanics and exhalites at the Thalanga deposit, Qld *

Michael House (North Broken Hill Peko, NSW) • Gold distribution at the E26 porphyry Cu-Au deposit, Goonumbla, NSW *

Tracey Kerr (BHP, WA) • Magnetic character of BHT deposits *

Nick Langsford (Newcrest, WA) • Regional target generation for Archaean gold, WA *

Steve Lynn (Mt Kersey Mining, WA) • Palaeochannel gold deposits, Kalgoorlie, WA *

Bruce McQuitty (Renison mine, Tas) • Structure of the Rendeep tin zone *

1993 Intake

Singoyi Blackwel (Overseas student) • The Kara Tungsten deposit, Tasmania

Peter Ellis (Contract geologist, Tas) • Namosi porphyry Cu deposit, Fiji

Rob Kremarov (Homestake, Qld) • Geology of the Greenmount Cu-Au deposit (Qld)

Robert Reid (Contract geologist, Tas) • The Garfield copper prospect, western Tasmania

1994 Intake

Ian Ledlie (CRA) • Chilean project.

Craig Miller (Pancon) • Liontown VHMS prospect, Qld

Bruce Mowatt (RGC) • Epithermal prospect, PNG

Anna Ryba (contract geologist) • to be decided

Janusz Ryba (contract geologist) • to be decided

Stella Searston • GIS for the Herberton Sn province, Qld

John Watkins (NSW Geol. Survey) • Sofala and Hill End volcanics, NSW.

1995 Intake to date

Mark Arundell (RGC) • Mineralisation of the Sofala area, NSW.

William Goodsall (Copper Mines of Tasmania) • Mount Lyell, Tasmania.

Scott Marsh (Acacia) • The Tanami goldfield, NT.

* thesis submitted and accepted

Mystery object!! The only undented panel in the CODES vehicle after a CODES researcher rolled it in Northern Tasmania in February of this year. No injuries, and no names ...