

Teaching and training program undergraduate



GEMOC's teaching program aims to:

- provide undergraduate and postgraduate students with a broad, integrative understanding of Earth architecture and processes, bridging the discipline boundaries of geology and geophysics
- train undergraduate and postgraduate students in new conceptual approaches and the applications of advanced technology, including geochemical analysis techniques and the integrated field and laboratory use of geographic information systems (GIS)
- develop international links in teaching programs (especially postgraduate) relevant to GEMOC's goals
- develop formal tailored course work components at postgraduate level which also can be packaged for distance education delivery and as short courses available to the mining industry
- enhance the pool of high quality geoscience graduates by restructuring academic programs to attract a new clientele

HIGHLIGHTS 2003

Curriculum Development

- Our tailored problem-based learning units GEOS116 Marine Geoscience and GEOS115 Earth Dynamics, Materials and the Environment continue to be well received by students. The format includes lectures, problem-based workshops and traditional skill-based practicals. The workshops are completed as group work projects and are modeled on real-life scenarios with the students adopting a role as part of a geoscience team. The success can be judged by comments from the end of year evaluation such as:

"the only subject where you get to discuss ideas in a group and come up with team decisions which is important because it is how the real world works. I think it develops important skills"

[Best aspect of the unit] *"studying real life/actual problems of today"*

*GEOS260 South coast
field trip.*



- A team from the department, lead by Kelsie Dadd, was awarded \$5928 under the Macquarie University Teaching Development Grant program for a project entitled “Bringing the workplace into the classroom – the redesign of GEOS377 using Tailored Problem-based Learning and real workplace scenarios”. GEOS377 Environmental Geology is a core unit of the new Bachelor of Environmental Science in Environmental Geology.

- Nathan Daczko co-ordinated two units in 2003 - GEOS307 and GEOS389. GEOS307 Field Geology and Mapping was run in the Broken Hill region in conjunction with the University of Sydney for the first time in 2003. Field studies in the Broken Hill region allow students to gain experience mapping in a geological province not encountered before in their course. The unit attracted 10 students from the Department of Earth and Planetary Sciences in 2003 and current enrolments indicate an increase to 20 students in 2004. GEMOC’s John Ketchum attended as a demonstrator.



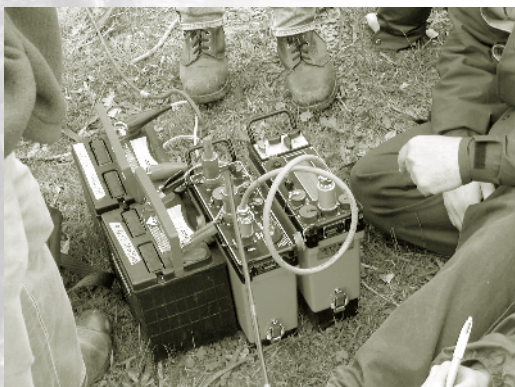
Mapping an outcrop near Broken Hill, GEOS307 Field Geology and Mapping.

- GEOS389 Special Interest Seminar was run under the name “Tectonics along the Pacific margin of the Australian plate in the last 100 or so million years” in New Caledonia. This type of unit is an excellent opportunity for students to experience first hand world-class exposures of a broad range of interesting rocks in an area of recent tectonic activity. The unit attracted 12 second and third year students. Nathan is currently developing our new unit GEOS230 Field and Laboratory Studies in Geoscience introduced after a review of second-year units.
- Simon Jackson revised GEOS314 Magmas, Fluids and Ore Deposits in 2003 around a new teaching team that included Simon Turner, Rhiannon George and Kirsty Tomlinson from GEMOC. The new team brings GEMOC’s world-class research into the third-year teaching curriculum.
- The use of computer packages and web interfaces in Earth and Planetary Sciences continues as a routine feature of content and skills delivery. Both geology and geophysics units incorporate packages used by industry into classroom and field teaching. Our portable computer lab allows students access to up-to-date computer software for use in both the classroom and field.

Teaching Infrastructure changes 2003

- The existing aged XRD instrument was replaced using University equipment funds
- Field equipment was upgraded

Teaching and training program: undergraduate



Waiting for the gravimeter to finish its reading.

Geophysics teaching progress 2003

- Collaboration in teaching and research between GEMOC and Geophysics at the University of Sydney continues.
- The named degree, Bachelor of Geophysics, continued in 2002 after its inception in 1998 to increase the visibility of Geophysics. It has evolved into the advanced geophysics stream in the Bachelor of Science degree.
- The Bachelor of Technology in Exploration Geoscience has a Geophysics strand initiated in 1999, streamed from second year level (see flow sheet in *Appendix 6*).
- Use of an extensive pool of GPS units for undergraduate (and postgraduate) fieldwork continued.
- Extended implementation of new seismic, gravity GPS and resistivity equipment for student field projects in exploration, groundwater, environmental and engineering geophysics.
- Equipment upgrades funded by Macquarie University over the last five years have resulted in an excellent array of new instrumentation. Acquisitions include:
 - GEOMETRICS G856 Proton Precession Magnetometer
 - GEOSOFT, MODELVISION, EMVISION, ERMAPPER and Claritas software was either purchased or upgraded
 - Seismic trigger cable modifications
 - ABEM SAS4000 Resistivity System and an ABEM LUND system
 - ASHTECH Z-Xtreme Differential GPS system

OUTCOMES AT MACQUARIE

The introduction of new units and restructuring of existing undergraduate units at Macquarie as described in each Annual Report has achieved the goals of attracting new clientele. However, this is within an environment of a contracting pool of science undergraduates. Despite this, GEMOC core units at 100 level have maintained average enrolments. Reorganisation of course structures



New resistivity imaging system in action mapping subsurface waters (GEOS315 Environmental and Groundwater Geophysics).

and acquisition of teaching infrastructure (computers, high-technology instruments, GIS units) have increased the visibility of geoscience and have resulted in the presentation of geoscience with an interdisciplinary and innovative approach using state-of-the art technology and concepts.

The following honours projects in GEMOC were completed in 2003:

Daniel Galda: Determination of the elastic properties of alluvium

Lachlan Gibbins: A geophysical investigation of two upland swamps, Woronora Plateau, NSW Australia

Kathleen McMahon: Seismic reflection studies of the Amery Ice Shelf, East Antarctica

Dan Nielsen: A geological, geochemical and geophysical investigation of the Paleroo Creek area near Narrabri

The following Honours projects are relevant to GEMOC in 2004:

Stephanie Carroll: Cretaceous Granulites in Fiordland, New Zealand (mid-year)

Kirsty Liddicoat: Chemical and isotopic signatures of opal genesis at Lightning Ridge, NSW

**Teaching
and
training
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**GEMOC
honours**

GEMOC offers scholarships for students with excellent undergraduate records who are carrying out GEMOC-related projects.

Teaching and training program

GEMOC postgraduate



GEMOC POSTGRADUATE STUDENTS once more provided a high profile for our postgraduate training through 2003, including the Goldschmidt Conference in Kurashiki (Japan), the West Norway Eclogite Symposium in Selje (Norway), the 8th International Kimberlite Conference in Victoria (Canada) and the Hutton Symposium in Japan. Sonja Aulbach and Sonal Rege received travel grants from the Organising Committee to present papers at the peak mantle forum, the 8th Kimberlite Conference.



*Stephanie Touron
in the stable isotope
laboratory at the
Univ. of Jean Monnet,
St Etienne.*

GEMOC's international exchange program with the University of Jean Monnet, St Etienne continued. Stephanie Touron spent 3 months working in the stable isotope laboratory at St Etienne while her Macquarie supervisors (Sue O'Reilly and Bill Griffin) were there for 3 months' research. Guillaume Delpuch was in the final stages of thesis writing in anticipation of completion early in 2004.

completed

Olivier Alard (PhD): Trace element geochemistry and mantle domains, emphasis on PGE and Re/Os; *IPRS with MUIPRA stipend* (graduated 2001)

Sonja Aulbach (PhD): Depletion and metasomatic processes in cratonic mantle; *IPRS with MUIPRA stipend* (submitted October 2003)
(see *Research Highlights*)

Kari Anderson (PhD): Defining the APWP for early to mid Palaeozoic eastern Gondwanaland: paleomagnetic pole information from the northern Tasman Orogen; *IPRS with MUIPRA stipend* (graduated 2003)

Elena Belousova (PhD): Zircon and apatite geochemistry: applications to petrology and mineral exploration; *APA and sponsorship by Rio Tinto* (graduated 2000)

Eloise Beyer (PhD): Contrasting characteristics of Proterozoic and Phanerozoic mantle types; *Field assistance from Ashton Mining* (graduated 2003)
(see *Research Highlights*)

Rondi Davies (PhD): East Australian Diamonds: Characterisation and origin; *Sponsored by Rio Tinto, Kennecott Canada* (graduated 1999)

Oliver Gaul (PhD): Composition of the lithospheric mantle beneath Australia; *APAI collaborative with Stockdale Prospecting, CSIRO EM* (graduated 2000)

Joanne McCarron (MSc): Mantle xenoliths from Queensland and South Australia (graduated 1997)

See advertisement
for GEMOC
postgraduate
opportunities at:
[www.es.mq.edu.au/
GEMOC/](http://www.es.mq.edu.au/GEMOC/)

Bertrand Moine (PhD): The role of fluids in the genesis, segregation and crystallisation of intraplate oceanic mantle magmas: implications for crustal accretion; *Co-tutelle with University of Jean Monnet* (graduated 2000)

Mark Pirlo (PhD): Australian groundwater geochemistry; applications to heat flow and exploration; *APA and Queen's Trust for Young Australians Award* (graduated 2003)

Shixin Yao (PhD): Chromite as a petrogenetic indicator in ultramafic rocks; *Collaborative with Rio Tinto* (graduated 2000)

Xu Xisheng (PhD): The lithospheric mantle beneath eastern China; *Formal exchange PhD, Nanjing and Macquarie* (graduated 2000)

current

Steven Cooper (PhD): Diamonds and mantle-derived minerals, NW Australia and South Australia (commenced part-time 2003)

Guillaume Delpéch (PhD): Isotopic characteristics of lithosphere processes beneath Kerguelen; *Co-tutelle with University of Jean Monnet, IPRS with GEMOC stipend and EURODOC scholarship* (commenced 2000)

Raynald Ethien (PhD): Origin of differentiated magmas from an oceanic island: petrology and geochemistry of volcanic and plutonic silicic rocks from Kerguelen Island (Indian Ocean); *Co-tutelle with University of Jean Monnet, St Etienne* (commenced 2001)

Bin Guo (PhD): An integrated geophysical investigation of the Hunter-Mooki and Peel Fault; *IPRS with MUIPRA stipend* (commenced 2001)

Valeria Murgulov (PhD): Crust-mantle evolution and metallogeny, eastern Australia; *APA* (commenced 2003)

Kathlene Oliver (MSc): Depth and subsurface shape of the Dundee Ignimbrite (part-time, commenced 2001)

Will Powell (PhD): Nature of the lithospheric mantle in the New England Region, NSW; *APA* (part-time, commenced 1997)

Sonal Rege (PhD): Trace-element geochemistry of diamonds; *IPRS with iMURS scholarship* (commenced 2002)

Stephanie Touron (PhD): Geochemical fingerprints of the mantle beneath the Massif Central; *IPRS with MURAACE scholarship* (commenced 2001)



Mark Pirlo, Sue O'Reilly, Eloise Beyer and Bill Griffin at the May 2003 graduation ceremony.

Teaching and training program: postgraduate

*Some of GEMOC's
2003 postgraduate
students: Will Powell,
Stephanie Touron,
Guillaume Delpech,
Sonal Rege and Valeria
Murgulov.*

Esmé van Achterbergh (PhD): Trace-element fingerprints of metasomatic processes in lithospheric mantle (part-time, commenced 1998)



commencing 2004

Brad Bailey (PhD): Law Dome: Ice and Crust Mass Balance Studies

Kathleen McMahon (PhD): Fracturing and deformation along the Amery Ice Shelf: A seismic study

Luke Milan (PhD): The emplacement, pressure-temperature-time path and structural evolution of lower crustal gneisses in Fiordland, New Zealand

Nenad Nikolic (PhD): Evolution of crust-mantle systems near a young rift: NW Spitsbergen, Norway

