

# Preview

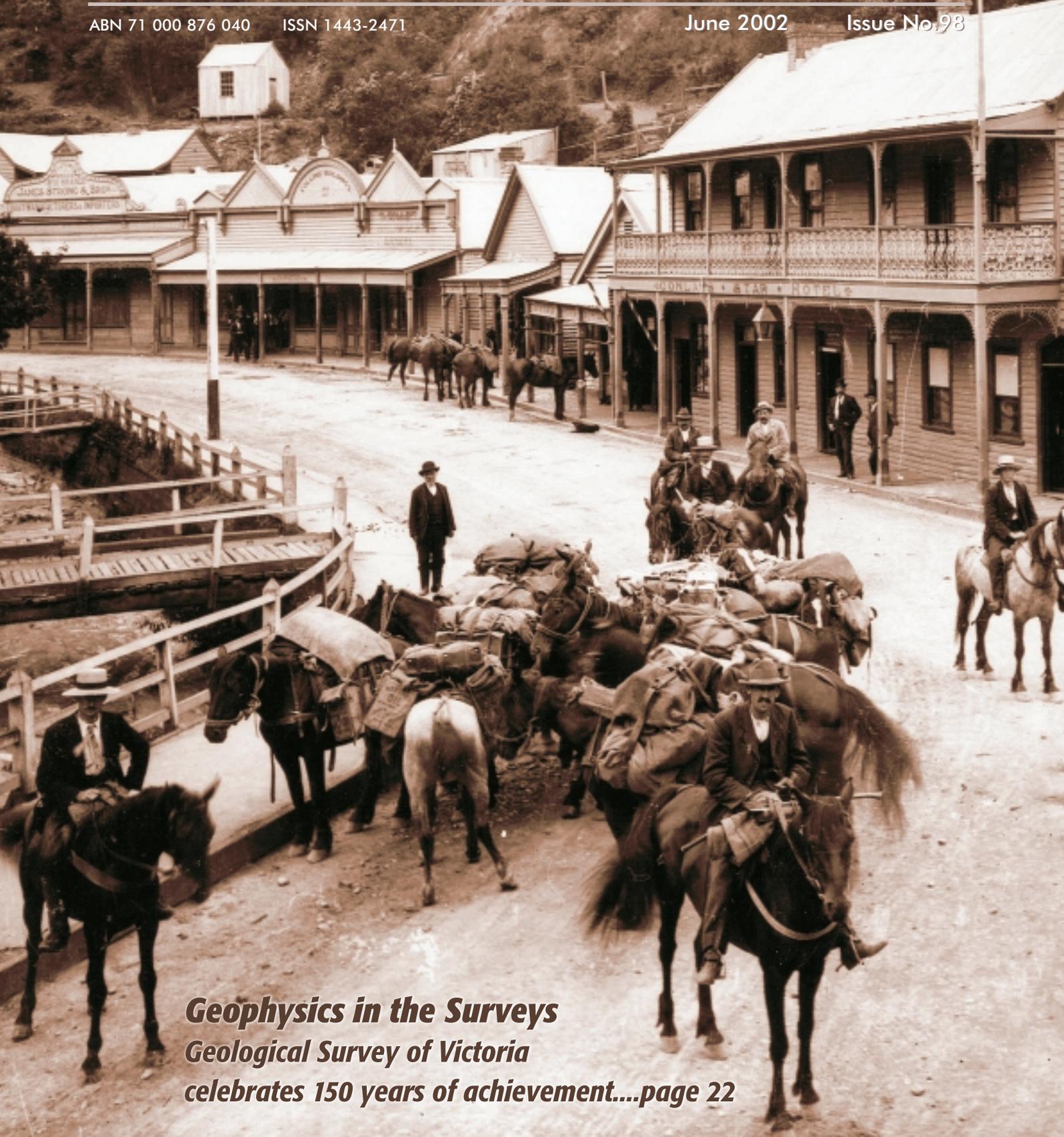


Australian Society of Exploration Geophysicists

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June 2002

Issue No.98



***Geophysics in the Surveys  
Geological Survey of Victoria  
celebrates 150 years of achievement....page 22***

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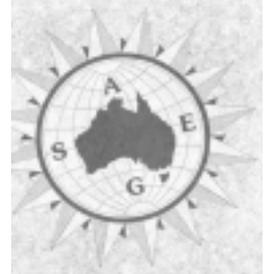
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Cover Image: Geological Survey party leaving Walhalla for Mount Baw Baw, January 1904. On horseback at left is William Baragwanath, who published detailed reports on the Ballarat and Walhalla goldfields and would become Director of the Geological Survey in 1920.



## Minotaur strikes gold as gold production falls

Not a lot of good news crossed my desk this month. Perhaps the best was the drilling results obtained by Minotaur Resources Ltd, as operator of the Mt Woods Joint Venture, in the Gawler Craton (see Preview Dec. 2001, p 33).

Hole DP 010 returned the highest copper (7.64%) and most extensive gold intercepts (extending over 57m) yet reported from the Prominent Hill prospect. The best values were reported from the sections encountered at distances greater than 390 m down a 60 degree angled hole. The hole was extended to 659 m and at 426 m a 57m intersection of enhanced gold (uncut average 3.9 g/t gold) was encountered with 1m samples ranging in value from nil to 18 g/t.

This discovery could not have come soon enough, because the figures released for Australia's gold production for the first quarter of 2002 (65.7 tonnes) indicate that a five-year decline in output is continuing.

If this trend continues through 2002 we are likely to earn about \$A1 billion per year less in export earnings from gold we did in 1997 when the annual production was 314 tonnes which at current prices would be worth close to A\$6 billion.

The main problem is that over the past five years exploration activity for gold has fallen from an investment of \$A728 million in 1996/97 to \$A370 million in 2000/01, and the trend is continuing.

We need to find new deposits of gold, and unless the Commonwealth Government stimulates mineral exploration, our balance of payments figures will decline and a thriving and innovative industry could be choked off.

The Australian Geoscience Council has written to Ian Macfarlane the Minister for Industry, Tourism and Resources calling for a series of three actions from his portfolio. These are:

- 1) Implement a Whole of Government Action Agenda on Mineral Exploration, particularly to consider what can be done to improve equitable land access procedures for exploration and to attract capital back into mineral exploration;
- 2) Provide Geoscience Australia with more funding to obtain geoscience information over under-explored "Greenfield" areas, and undertake focused research on gold formation processes; an additional \$2 million per year over five years would enable a significant impact to be made; and
- 3) Argue strongly for the "well being of the resources sector" as a national priority in the research priority scheme being developed within DEST.

The national research priority issue is very important (see Heard in Canberra in this issue) because this process will determine where the publicly funded research funds provided by the Commonwealth will be spent. I urge all members to have a look at the DEST website at: [www.dest.gov](http://www.dest.gov), have a look at the priority sections and make a submission on behalf of the resource sector. Otherwise the geosciences may just wither away.

## Earth Sciences closes at La Trobe University

Only last month we learnt that La Trobe University will close its Department of Earth Sciences following a three-year phase out of teaching and research.

The Department of Earth Sciences, established in 1972, consistently rated as one of the best Earth Science teaching departments in Australia and is a prominent trainer of graduates and postgraduates in the minerals, petroleum, and environmental industries. The Department also supports teaching in regional campuses at Wodonga, Mildura and Bendigo.

The closure will result in the loss of up to 13 jobs, and the cancellation of the Bachelor of Science (Earth Sciences) and Bachelor of Earth Sciences/Bachelor of Computer Science degrees. The Department also provides compulsory courses in the Bachelor of Environmental Science degree.

The closure of the Department of Earth Sciences was justified on the basis of "financial factors", and follows criticism of the Federal budget for not increasing funding to university teaching. It also comes after news (The Age, 13/5/02) that La Trobe University has recorded a deficit for the second successive year, and despite reassurances from La Trobe Vice-Chancellor Michael Osborne that the university is in "a sound financial position." In other words, not enough students to make the Department financially viable in the context of the government's "bums on seats" financial arrangements.

## In this issue

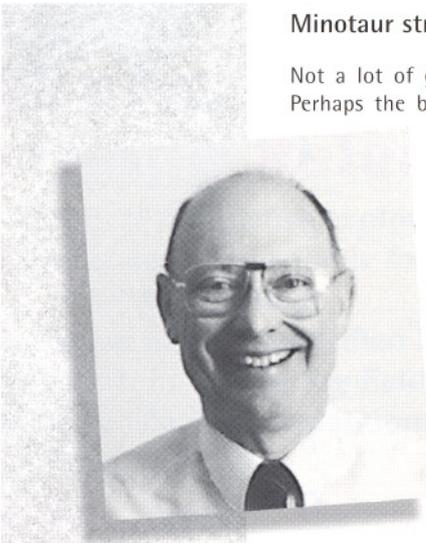
We do not have any feature articles in this issue, but we have an interesting collection of news from members, pictures from the AGM in Sydney, accounts from the Groundwater Conference in Darwin and some results from some ASEG sponsored students.

In the Industry News we have a profile on Santos and more news of the never-ending takeovers; this time it's Placer Dome trying to swallow AurionGold. Globalisation never stops.

Good reading



David Denham



## Executive moves west

With the transfer of the Executive to Perth, it is timely to consider the work and achievements of the Sydney Executive, which led the ASEG from April 1999 to April 2002.

This group of people, acting in an honorary capacity, met essentially every month for three years. They made 424 decisions, of which they classed 213 as major or significant decisions.

I do not intend to go through in detail the issues they had to grapple with, but looking through the summary action lists it is very clear that similar challenges had to be faced throughout their period in office.

As one might expect, money, members, conferences, contracts and publications were the top agenda items. Under the money heading, not only did they have to guide the Society through hard times of declining exploration budgets, but they also had to deal with the ATO over matters relating to the GST, and insurance companies on liability issues.

Conferences always loomed large. These events are the biggest highlights in terms of professional development and financial rewards, but they also expose the ASEG to the greatest risks if things go wrong. Fortunately all went well in the last two conferences, which were both very successful.

After Conferences, publications are the largest set of outputs from the Society and, as a class, incur the largest expense. With Preview, Exploration Geophysics, the Membership Directory and Special Publications all being produced by a society of less than 1500 members, I think we can be proud of our achievements and thank the last Executive for guiding us through some troubled times.

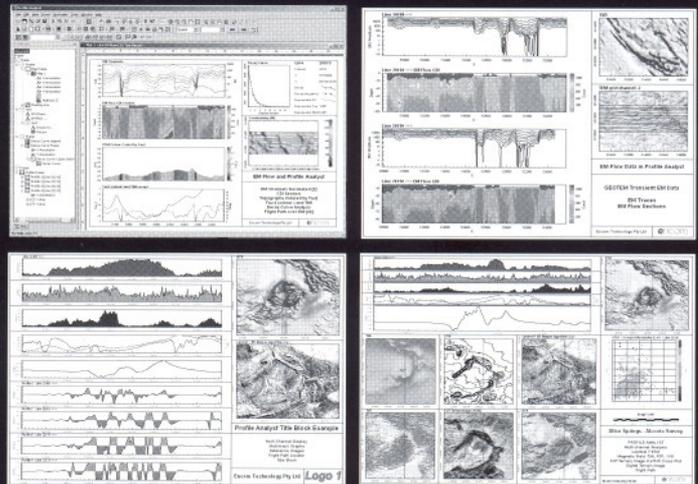
FedEx also has to deal with contracts and appointments. We have two major contracts, one with our secretariat, and the other with our publisher. These have to be carefully negotiated and implemented so that both the ASEG and our service providers are comfortable with the working arrangements. FedEx also has to appoint editors for all our publications, another non-trivial task.

As a Society we can feel well served by the Sydney teams headed by past Presidents Mike Smith, Brian Spies and Tim Pippett, and look forward to the new leadership from the west. We wish Kevin Dodds and his team a successful and enjoyable time in office.

DD

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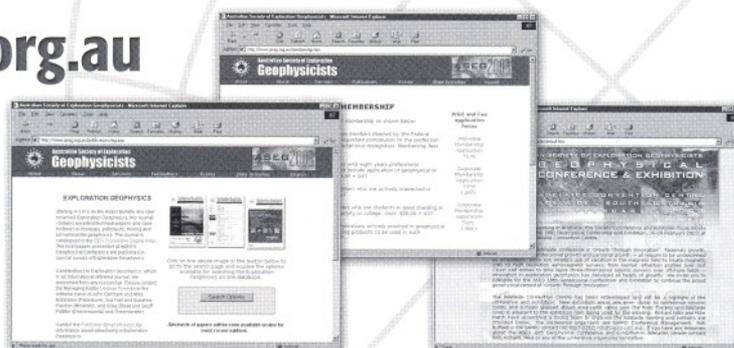


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## President's Piece

It's not hard, when charged with writing a page from the President's perspective, to be pompous, especially when newly elected and not in touch with the wheels and gears of the society.



This issue marks the shift to Western Australia of the Federal Executive, in one of the Society's triennium (seismic?) shifts. This has its ups and downs. The "down" is the new executive has to relearn the ropes; the "up" is that it is an opportunity to inject fresh ideas, energy and people. Ignorance is bliss, so they say, and since I am right in the middle of acquainting myself with what it takes to contribute to the proud tradition of the ASEG, it might be useful to air my uncontaminated impressions.

Diverse communities generate innovation. The SEG, EAGE, SPE, and SPWLA and their Australian equivalents; PESA and FESWA are principally petroleum-oriented societies comprising communities of surface geophysicists and other worlds of sub-surface specialists and engineers. Shades of Eloi and Morlock! The interaction within these communities provides a continual fertile ground for technical development. On the other hand these societies are not able to easily look outside their industry.

The ASEG presents a different dimension; in fact it is a rich spectrum of diverse geophysical expertise across the resource sector. The interplay of advances between the minerals, geotechnical and petroleum sectors provide a different medium for innovation. This is the strength of the society. For example there is a renewal of interest in potential field technology and integration with traditional exploration technologies in petroleum exploration under salt diapirs. In the same way that Australia has nurtured a different fauna, its contribution to the world geophysical community comes from this heritage.

What are the challenges? The importance of the resource sector to Australia's economic future and the part that geoscientists can play in shaping the environmental and greenhouse debate has to be foremost. To be part of these debates we must be technically strong in each sector and financially healthy. As the mineral industry emerges from its hibernation, and the petroleum industry faces the increasing challenges for sustaining our liquid reserves, both industries have experienced an increasing shift to

older demographics. Where does the new blood come from? How do we excite people to contribute? We are at a cusp; we have to take charge of our future!

Enough pomposity, now for reality. How do we make things happen?

The best way forward is in the direction from which we have come. In reading past Previews, it is apparent that the direction of the society has been well guided by a series of talented executive committees. We are indebted to the vision and dedication of the last several executives headed by Tim Pippett, Brian Spies and Mike Smith, who with their respective committees, have set us on a firm foundation from which we, the new committee, and the society as a whole can move forward.

They have established a strong sub-committee system that has served to achieve the interaction of members from a national perspective. This is the means by which we can address the key areas of concern facing the society. Look at the web page to see a "who's who" of the ASEG, and even better, see where YOU may help in some way.

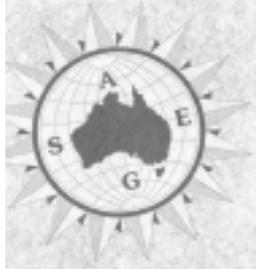
They have opened a path for our communication with government policy makers, ensuring that our perspective is well represented, especially where the focus on our resource priorities has faltered. This is achieved through our membership and interaction within the Australian Geoscience Council (AGC) and FASTS or Federation of Australian Scientific and Technological Societies.

They have put us on a firm financial footing by overhauling all aspects of our core activity of technical communication through Preview, Geophysics and the biennial conference; their success is essential to keeping the society healthy. This has included restructuring the Research Foundation, consolidating the society background tasks within a dedicated secretariat, and establishing a good business relationship with the publisher.

They have also addressed the structure of the society through strategic planning, review of the constitution, and development of a procedures manual.

Where does that leave us? These tasks need continual vigilance, support and completion. We need to help the State Committees maintain their role as principle contact and interaction with our membership across the continent by developing inclusive processes. Particularly, we need to take on the challenge of the role of education of our members through distinguished instructors and workshops. Priority lies in raising the profile of geophysics by exposing top-line secondary and tertiary students to the excitement we have experienced in the past and relevance of geophysics to Australia's future. Through this we will draw in new talent and provide a new generation to carry this and our society forward.

Kevin Dodds



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## Aims and Scope

*Preview* is published by the Australian Society of Exploration Geophysicists. It contains news of topical advances in geophysical techniques, news and comments on the exploration industry, easy-to-read reviews and case histories of interest to our members, opinions of members, book reviews, and matters of general interest.

## Contents

The material published in *Preview* is neither the opinions nor the views of the ASEG unless expressly stated. The articles are the opinion of the writers only. The ASEG does not necessarily endorse the information printed. No responsibility is accepted for the accuracy of any of the opinions or information or claims contained in *Preview* and readers should rely on their own enquiries in making decisions affecting their own interests. Material published in *Preview* becomes the copyright of the Australian Society of Exploration Geophysicists.

## Contributions

All contributions should be submitted to the Editor via email at [denham@atrax.net.au](mailto:denham@atrax.net.au). We reserve the right to edit all submissions; letters must contain your name and a contact address. Editorial style for technical articles should follow the guidelines outlined in *Exploration Geophysics* and on ASEG's website [www.aseg.org.au](http://www.aseg.org.au). We encourage the use of colour in *Preview* but authors will be asked in most cases to pay a page charge of \$440 per page (including GST for Australian authors) for the printing of colour figures. Reprints will not be provided but authors can obtain, on request, a digital file of their article, and are invited to discuss with the publisher, RESolutions Resource and Energy Services, purchase of multiple hard-copy reprints if required.

The text of all articles should be transmitted as a Word document. Tables, figures and illustrations should be transmitted as separate files, not embedded in the Word document. Raster images should be supplied as high resolution (300 dpi) tiff files wherever possible. Vector plots can be supplied using software packages such as Corel Draw or Illustrator. Illustrations produced in any other software packages should be printed to postscript files. Authors are encouraged to contact the publisher, RESolutions, for information to assist in meeting these requirements.

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References should follow the author (date) system. When reference is made in the text to a work by three or more authors, the first name followed by et al. should be used on all occasions. References should be listed in alphabetical order at the end of the paper in the standard form:

Blackburn, G. J., 1981, Seismic static corrections in irregular or steeply dipping water-bottom environments: *Exploration Geophysics* 12, 93-100.

## Abbreviations and units

SI units are preferred. Statistics and measurements should always be given in figures e.g. 10 mm, except where the number begins a sentence. When the number does not refer to a unit of measurement, it is spelt out, except where the number is greater than nine. Confusing mathematical notation, and particularly subscripts and superscripts, should be avoided; negative exponents or the use of a solidus (i.e. a sloping line separating bracketed numerator and denominator) are acceptable as long as they are used consistently. The words 'Figure' and 'Table' should be capitalised (first letter) and spelt in full, when referred to in the text.

## Deadlines

*Preview* is published bi-monthly, February, April, June, August, October and December. The deadline for submission of all material to the Editor is the 15th of the month prior to issue date. Therefore, the deadline for editorial material for the August 2002 edition is 15th July 2002.

## Advertisers

Please contact the publisher, RESolutions Resource and Energy Services, (see details elsewhere in this issue) for advertising rates and information. The ASEG reserves the right to reject advertising, which is not in keeping with its publication standards.

Advertising copy deadline is the 22nd of the month prior to issue date. Therefore, the advertising copy deadline for the August 2002 edition is 22nd July 2002. A summary of the deadlines is shown below:

Preview Issue	Text & articles	Advertisements
99 Aug 2002	15th July 2002	22th Jul 2002
<b>100 Oct 2002*</b>	<b>15th Sept 2002</b>	<b>22th Sept 2002</b>
101 Dec 2002	15th Nov 2002	22nd Nov 2002
<b>102 Feb 2003**</b>	<b>20th Dec 2002</b>	<b>22nd Jan 2002</b>
103 Apr 2003	15th Mar 2003	22nd Mar 2002

**\*Centenary Edition \*\*Conference Edition, abstracts of papers to be submitted by 2nd December 2002.**

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## 2002

### June 30-July 5

16th Australian Geological Convention  
 Theme: Geoscience 2002: Expanding Horizons  
 Adelaide Convention Centre, Adelaide SA  
 Contact: info@16thagc.gsa.org.au  
 Website: http://www.16agc.gsa.org.au

### July 9-12

Western Pacific Geophysics Meeting,  
 Wellington, New Zealand  
 Sponsor: American Geophysical Union (AGU)  
 Contact: AGU, Email: meetinginfo@agu.org;  
 Website: www.agu.org/meetings

### July 29-31

ASEG 2nd Conference and Workshop on Salinity, Land Management & New Technologies, Katanning, WA  
 Themes: Demystify emerging technologies to catchment and land managers and to convey to the technologists and researchers what the land managers actually require.  
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 or Greg Street  
 Tel: (08) 9268 9672  
 Email: ama.mayes@bigpond.com  
 Website: http://www.salinity.org

### September 22-25

Applied Structural Geology for Mineral Exploration and Mining Symposium, Sponsor: Australian Institute of Geoscientists  
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 Contacts: Julian Vearncombe  
 Email: vearncom@iinet.net.au  
 or Jocelyn Thomson  
 Email: aigwa@iinet.net.au

### October 6-11

SEG International Exposition and  
 72nd Annual Meeting,  
 Salt Lake City, Utah, USA  
 Website: www.seg.org

### October 20-23

West Australian Basins Symposium (WABSIII)  
 Burswood Convention Centre, Perth  
 Organised by PESA  
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## 2003

### January 20-23

International Conference On Soil and Groundwater Contamination and Cleanup in Arid Countries  
 Sultan Qaboos University, Muscat, Sultanate of Oman  
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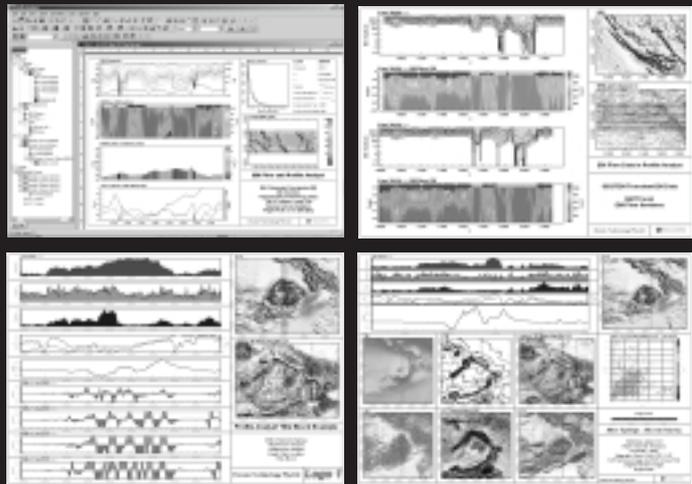
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 Theme: Growth through Innovation  
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### April 6-10

Symposium on the Application of Geophysics to Environmental and Engineering Problems (SAGEEP),  
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## New South Wales – by Mike Smith



New South Wales hosted the ASEG's AGM on 17th April and the Executive effectively moved from Sydney to Perth. We don't have a written account of the meeting but we do have a couple of pictures to prove that it all happened.

*Below: Geoff Mansfield, Peter Gunn, Kevin Dodds and Terry Crabb, enjoying the occasion.*

*Dave Robson, left congratulates Kevin Dodds on his election to the Presidency of the ASEG.*



## Queensland – by Werner Dutler

The Qld Branch held its AGM on the 10th of April. The event was marked by a bloodless coup, which, after 3 years of iron rule by Troy Peters, brought a new junta to power. The new line-up is as follows:

President: Werner Dutler, Santos

Email: [Werner.Dutler@santos.com](mailto:Werner.Dutler@santos.com)

Treasurer: Peter Fullagar, Fullagar Geophysics Pty Ltd c/- Minserve

Email: [p.fullagar@mailbox.uq.edu.au](mailto:p.fullagar@mailbox.uq.edu.au)

Secretary: Natalie Keirnan, Santos

Email: [Natalie.Keirnan@santos.com](mailto:Natalie.Keirnan@santos.com)

### Committee Members:

Kathlene Oliver - webmaster, Troy Peters, Fiona Duncan, Gary Fallon, Natasha Hendrick and Michael Sharry.

The above shows that the new office bearers decided to retain the past leadership as members of the committee (read: workers), so no rash changes in policy are expected.

*Werner Dutler and the Thomsens, enduring the Brisbane winter.*



### Membership

As on 17th May 2002, 132 members are financial.

### Technical meetings

On the night of the AGM, Natasha Hendrick presented a paper by herself and Steve Hearn entitled:

*Vector wavefield-separation techniques for improved multi-component seismic exploration.*

On 8th May, Leon Thomsen and wife Pat arrived in Brisbane for the DISC Lecture on the 9th. The President insisted on having his photo taken with the famous visitor, on a popular Brisbane lookout. Since the taxi was honking, there was only time for one shot of Leon and Pat and one of myself and Pat. However, the situation was saved by our internal sleuth who produced the homely photograph below.

Leon said at the beginning of his lectures that it would be a tiring day and he was certainly right in my case, and I didn't even do any talking.

Although there were numerous geophysical derivations presented, it was more important to Leon that we got an idea of how these derivations affect the geophysical observations and how to apply these observations to our work.

One of neatest things is his trick of helping me to remember the effects of shear waves on layered rock volumes: I now know what to do with that full box of name cards in my desk drawer (Sorry – it's an in-joke).

Towards the end of July we are looking forward to a presentation by Kathlene Oliver, who will divulge ALL the secrets of marine seismic data acquisition, particularly QC aspects.

## South Australia – by Graham Heinson

The SA Branch has had an AGM, two technical meetings and a SEG DISC workshop since our last report in Preview. The AGM on 22nd February was combined with a quiz night; Craig Gumley from Santos was MC and Quizmaster. AGM business was over in a few minutes, with Andrew Shearer (President), Graham Heinson (Secretary) and Mark Tingay (Treasurer) returned for another year. The committee welcomed Brian Barrett, Dennis Cooke and Tania Dhu as new members. A great night was had by all (followed by the opening of the Adelaide Fringe Festival); thanks to Mark Tingay and David Cockshell for organisation and all the companies involved for prizes.

On the 13th March, Jim Hanneson of Adelaide Mining Geophysics Pty. Ltd. gave an excellent talk *On the use of Magnetism and Gravity to Discriminate between Gabbro and Iron-rich Ore Forming Systems*. Jim explained to a packed meeting how magnetic susceptibility and density properties can be superimposed on to a ternary-phase diagram divided into categories of (a) magnetite, (b) hematite and sulfides, and (c) barren host rock. Gabbro with magnetite, a common red-herring in exploration, plots along a specific locus on the phase diagram and can often be distinguished from denser accumulations of hematite and/or sulfides. Mt Gunson Resources kindly sponsored the meeting.

On Wednesday 10th April, Catherine Gibson-Poole from the National Centre for Petroleum Geology & Geophysics spoke on the Geological Disposal of Greenhouse Gas: Putting CO<sub>2</sub> Back where it came from. One of the methods for reducing CO<sub>2</sub> emissions currently under investigation is geological

## New Federal Executive

### Klaas Koster, 1st Vice President

Klaas Koster is head of the Quantitative Interpretation team for Woodside in Perth. This team interprets seismic amplitude data in terms of reservoir and fluid parameters. He joined Woodside as a Shell secondee in 2000 from Norske Shell. He received the 'best paper in the Leading Edge' award in 2001 from the SEG for his work on time-lapse reservoir monitoring over the Draugen Field in the Norwegian North Sea.

Before joining Shell in 1994 he worked for Amoco at the Tulsa research centre on acquisition and processing of mode-converted shear waves, and at the Denver production office on acquisition design, processing, and interpretation of 3D seismic data. During this assignment he also worked on fracture detection using shear-wave anisotropy in the tight gas-sand play of the San Juan Basin.

He graduated with a PhD in geophysics from Delft University of Technology in 1991 after completing his MSc

with Honours, in Mining and Petroleum Engineering at the same university.

Since arriving in Australia he has been actively involved in Curtin University's Reservoir Geophysics Consortium and presented a paper at the WA Branch of the ASEG. He likes to spend his spare time racing a Hobie 16 catamaran on the Swan River. Klaas is a member of ASEG and SEG.

### Lisa Vella, Secretary

Lisa Vella graduated from the University of Sydney with a BSc Honours in Geophysics, in 1991. After two years with Newcrest Mining Ltd., working at the Telfer and Tuckabianna gold mines, she started work with WMC Resources Ltd. Lisa spent almost three years working at Hill 50 Gold Mine, focusing on targeting of BIF-hosted Au deposits and the application of geophysics to the underground environment.

*Continued on page 10*

sequestration. In an excellent presentation in an area of global significance, Catherine discussed how CO<sub>2</sub> that is separated from natural gas prior to sale and also CO<sub>2</sub> produced during the conversion of natural gas to LNG could be injected back into subsurface reservoirs for long-term storage. The meeting was sponsored by APCRC "Geological Disposal of Carbon Dioxide Project".

On 7th May, Adelaide was the host for the SEG DISC workshop *Understanding Seismic Anisotropy in Exploration and Exploitation* by Leon Thomsen. David Cockshell from the ASEG committee was the primary organiser of a very successful workshop. Our next technical meetings are scheduled for Wednesday 22nd May, in which Mike Hatch, a former SA Branch President, will speak on *Improved Near Surface Mapping in Groundwater Studies: Three Short Case Studies using NanoTEM*, generously sponsored by Zonge Engineering. Finally, in keeping with an ever broadening range and diversity of talks for members, on Monday 3rd June, Chris Burton (Western Whale Research) and Peter Farrell (Environmental Adviser, Woodside Energy) will speak on *Marine Fauna Monitoring Program from the Flinders Deepwater Seismic Survey in the Great Australian Bight*.

### Western Australia - by Megan Evans

#### March: CO<sub>2</sub> Sequestration

The theme for the March technical meeting was CO<sub>2</sub> Sequestration which was discussed by Kevin Dodds, the research manager for CSIRO in the 'Context of CO<sub>2</sub> Disposal', and Don Sherlock, also from CSIRO with 'Geophysical monitoring of subsurface CO<sub>2</sub>'.

Kevin Dodds provided an introductory talk on the mechanics of CO<sub>2</sub> sequestration including the parameters needed for the process, as well as what is currently being done around that world. Don Sherlock, as a member of the GEODISC program, then increased the tone of the night by introducing the problem of detecting and quantifying the

CO<sub>2</sub> within the ground. He then provided a brief summary of the other geophysical processes (and there are many) that can be added to seismic to help monitor the CO<sub>2</sub> disposal. These talks helped increased the awareness of a process, which will be of great concern within the next couple of years.

#### April: Geophysics for near-surface problems

The theme for the April talks was near surface geophysics, which was represented by three talks, Justin Anning with 'Trials and tribulations of near surface geophysics', Dominic Howman with 'Detecting cavities under roads and near bridges' and Dr Niels Christensen with 'EM methods for hydrogeological investigations in Denmark'.

Justin Anning, from Landline Geophysics, led the night by giving a description and the pros and cons of the near surface geophysical tools of which he has had extensive use. He also presented a number of case studies from his travels, including, which tools worked best and why.

Dominic Howman from Curtin University then followed with a case study of some work done by Curtin University for the Main Roads Department. He demonstrated the effectiveness (or lack of) for a number of geophysical techniques including seismic, GPR, electrical, EM and gravity methods for detecting cavities – ranging from caves to 2 m holes, beneath a proposed road in Cervantes, Western Australia.

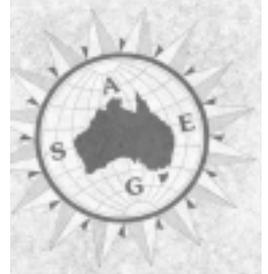
The final speaker for the night was Niels Christensen, an Associate Professor from the Aarhus University Denmark, who presented an overview of the electrical and electromagnetic systems currently in use in Denmark for modelling geology and hydrogeology. Niels emphasised the need for high-density sampling and the need to reject spurious recording from the data to ensure correct modelling and subsequent interpretation of the data.



Klaas Koster



Lisa Vella



## Research priorities process underway

The Commonwealth Government has decided to set national research priorities that will identify and address areas of strength, opportunity or need for Australia.

These priorities will be in areas where an increase in research effort – including collaboration, coordination or investment – will make a significant contribution to national wealth and/or well-being.

The Government is proposing a framework for setting and implementing national research priorities that consists of:

- An approach that identifies a thematic priority and then the particular disciplines or research areas necessary to support it – thematic priorities will relate to national policy objectives, and
- An implementation strategy to better coordinate and refocus effort within the research system.

It is intended that national research priorities be set for science, engineering, technology (SET) in 2002, and for the social sciences and humanities (SS&H) in 2003-04.

### Timetable for developing national research priorities

**May 2002 – Release of issues paper to start consultation process.**

Public comment is invited in response to this document.

**June 2002 – Consultative panel to undertake public consultations.**

The consultative panel will undertake public consultations and accept written submissions from the research and broader communities on the framework and on nominations for national research priorities.

**Early July 2002 – Chief Scientist to report to government.**

The Chief Scientist, on behalf of the consultative panel, will report to government on the proposed framework and on priorities nominated during the consultations.

**Late July 2002 – Release of final framework.**

The final framework for setting national research priorities will be released for public information.

Individuals and organisations will be given the opportunity to make further submissions about their nominations of national research priorities.

**August 2002 – Written submissions close.**

Written submissions on nominations for priorities will close on 9 August 2002.

**September 2002 – Advisory committee reports to government.**

An advisory committee of experts will be formed in early September to assess and nominate priorities, and will submit a short-list of proposed national research priorities to the government for consideration.

**October 2002 – Government to announce national research priorities.**

Written submissions are invited. Comments need not be confined solely to the issues raised in the issues paper if you think there are other matters that need to be considered.

Submissions, in writing or on disc, should be forwarded to:  
The National Research Priorities Taskforce, DEST,  
Location 703  
GPO Box 9880  
Canberra ACT 2601  
or emailed to [priorities@dest.gov.au](mailto:priorities@dest.gov.au).

The deadlines for written submissions are:

- For comment on the framework – 28 June 2002
- To nominate national research priorities – 9 August 2002.

### Consultative panel formed to assist the process

A consultative panel, chaired by the Chief Scientist, Dr Robin Batterham, will undertake the public consultations. The panel comprises members chosen for their individual standing rather than as representatives of a particular interest group or organisation.

*Continued from page 9*

In mid-1996, Lisa transferred to Melbourne to work in WMC's Africa/Eurasia Group, concentrating on exploration for gold, VMS and porphyry Cu-Au deposits in West and East Africa and Kazakhstan. Transferring to Perth in early 1998, Lisa spent two years working in WMC's Global Project Generation team, with her main activities being reconnaissance exploration for nickel in southern Africa, iron-oxide Cu-Au in Brazil and gold deposits in China. During this period, she also provided geophysical support to the Three Springs Talc Mine, in WA.

During 2000 and 2001, Lisa managed a reconnaissance gold exploration project in Xinjiang, north-west China. While the project did not involve a great deal of geophysics, there were a number of other interesting challenges, including the execution of a helicopter-supported geological and geochemical program in a very remote and mountainous region, possibly the first of its type to be undertaken by a foreign mineral company in that part of China.

Currently, Lisa is working on a nickel project in southern China and lives in Perth with her very supportive partner and menagerie of pets. Interests include Asian studies (particularly Asian cultures and Japanese language) and karate.



The panel will be seeking the views of the community and interested stakeholders on the framework and their preferred national research priorities, together with a vision of where they believe Australia should position itself in the future.

Meetings have been scheduled in each capital city and at Albury-Wodonga, Armidale, Kalgoorlie and Townsville. The panel will be listening to and encouraging open debate on the issues raised in this paper.

The panel comprises:

Robin Batterham, *Chief Scientist*,

Stuart Beil, *Chief Executive Officer UCX Limited*,

Janice Burn, *Head Management Information Systems Edith Cowan University*,

Chris Fell, *President Federation of Australian Scientific and Technological Societies*,

Graham Farquhar, *Group Leader Environmental Biology Group, ANU*,

John Keniry, *Chairman Ridley Corporation*,

Melissa Little, *Senior Research Fellow Institute for Molecular Bioscience, University of Queensland*,

Leon Mann, *Pratt Family Chair of Leadership and Decision*

*Making Melbourne Business School, University of Melbourne*, and

Helmut Pekarek, *Chairman and Managing Director Siemens Ltd.*

Prioritisation to date has been restricted to the ARC. When, in January this year, the Minister for Education, Science and Training, announced that a portion of ARC funding (33% in the 2003 new funding round) would be targeted for research in four priority areas:

- nano- and bio-materials
- genome/phenome research
- complex/intelligent systems
- photon science and technology.

This decision caused considerable angst among the research community at the time and it is to be hoped that a better process and outcome will be forthcoming. I recommend that all ASEG members read a copy of the issues paper and make a submission to the process. We do not want the Geosciences left out again. The issues paper and other information about the consultative process can be accessed at <http://www.dest.gov.au/priorities>.

## Higher Education under review: Minister Nelson outlines his plans

The Commonwealth Government is undertaking a comprehensive review of Australian higher education. The purpose of the review is to ensure that Australia's higher education institutions are best placed to contribute to the nation's future. In his speech at the National Press Club on May 8, Brendan Nelson identified six key questions he wanted addressed. These were:

1. How do we define a university? What are its roles and functions?
2. Who is going to university and why?
3. Can we streamline the governance and administration at universities?
4. How do we deal with commercialisation and intellectual Property at universities?
5. How specialised should universities be?
6. How do we set priorities for research and teaching?

To stimulate discussion on these issues he released the first of a series of discussion papers on policy options for the future. To quote the Minister: "This first paper, *Higher Education at the Crossroads: an overview*, is intended to stimulate discussion and debate. Though the issues canvassed in this (and indeed in subsequent papers) do not represent government policy, they will hopefully generate a much-needed discussion about the issues and policy choices facing Australia's university sector. These 'conversations' we will have as a community will culminate at year's end with a forum to consider all the issues raised and the subsequent development of a package of policy measures for consideration by Government.

This paper does not dictate the solutions; rather it asks the questions that we as a nation need to ponder if we are to

build a stronger higher education sector. Some of the specific issues the paper considers are:

**Higher education policy framework** - how can we improve the current policy framework to ensure Australia's higher education system is strategically positioned into the future?

**Learning experiences and outcomes** - is there a need for greater flexibility in approaches, modes and settings for learning?

**Regional engagement** - what level of contribution should regional universities make to capacity building in their local communities and how should this contribution be supported?

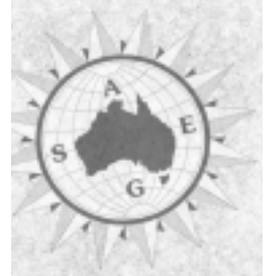
**Efficiency and effectiveness** - how can universities be assisted to enhance their operations?

**Governance and management** - how has the sector changed since the 1995 Hoare Review of university management identified shortcomings in the governance and management of universities?

**Workplace relations** - how do we overcome the rigidity of university structures and attain the workplace flexibility necessary to meet the changing needs of students and the community and enable our universities to be internationally competitive?

**Financing** - what is the best mix of public funding mechanisms to promote a high quality and responsive higher education sector? How do we assist universities to take advantage of the opportunities that exist for further increases in earned income?

**Specialisation** - how can we encourage further specialisation amongst Australia's universities to ensure the best possible use of public resources, and collaboration rather than competition? How can institutions focus on



their strengths in teaching and/or research to build world-class expertise and achieve excellence?

**Bureaucratic red tape** - how do we address the claims that Australian higher education institutions are currently burdened by excessive bureaucratic controls, unreasonable compliance costs and an insufficiently rationalised performance monitoring system?"

These are only some of the issues canvassed in the paper. (The full paper is available from the Department of Education, Science and Training website at: <http://www.dest.gov.au/crossroads/>)

The Minister has appointed a Reference Group to guide him through the complex issues raised during the consultation process.

The rather large Reference Group comprises:

Brendan Nelson (Chair) *Minister for Education, Science and Training*

Peter Shergold (Convenor) *Secretary, DEST*

Deryck Schreuder *V-C, University of WA*

Kerry Cox *V-C, University of Ballarat*

Alan Gilbert *V-C, University of Melbourne*

Dennis Gibson *V-C, Queensland University of Technology*

Jan Reid *V-C, University of Western Sydney*

John Hay *V-C, University of Queensland*

Denise Bradley *V-C, University of SA*

Robert Champion de Crespigny *Chancellor, Adelaide University*

John Keniry *Past President, ACCI and Chairman, Ridley Corporation*

Heather Ridout *Deputy CEO and ED, Public Policy and Communications, Australian Industry Group*

John Schubert *President, Business Council of Australia*  
May O'Brien *Chair, Aboriginal Education and Training Council, WA*

Iain McCalman *President, Australian Academy of the Humanities*

John Beaton *ED, Academy of Social Sciences of Australia*  
Chris Fell *President, FASTS*

James Moody *Young Australian of the Year 2001 (S&T)*

Madeleine Wooley *Director Adelaide Institute of TAFE and Deputy Chair, TAFE Directors Australia*

Vicki Sara *CEO, Australian Research Council*

Claire Baxter *Director, Business Liaison Office, University of Sydney and Vice-Chair, Knowledge Commercialisation Australasia*

Peter Mason *Finance Committee, University of NSW and Chairman, Investment Banking Group, JP Morgan*

It can be seen there is a good representation of Vice-Chancellors, but no student or staff representation.

The Minister clearly means business and there is no doubt that he will deliver a major restructure.

My belief is that he is seeking a good outcome without an investment of any more public money into the tertiary system. A difficult task.

Submissions should be sent to:

Higher Education Review Secretariat, DEST

Location 701

GPO Box 9880

Canberra ACT 2601

or emailed to: [crossroads@dest.gov.au](mailto:crossroads@dest.gov.au)

The deadline for making submissions relating to this paper is 28 June 2002 and I recommend that members consider providing input at an early stage.

## Budget 2002 delivers on Backing Australia's Ability commitments but Higher Education still stagnates

The 2002/2003 Budget delivered a \$281M increase in support for science and innovation, to make a total Commonwealth investment of \$5.1 billion during 2002/03. This is equivalent to 0.7 of our GDP, an increase of 0.03 percent over last year's numbers but still less than the 0.75 level reached from 1993 to 1996.

The main new money, outside of the Backing Australia's Ability (BAA) commitment is for radioactive waste management facilities (\$10M) and the \$104M for the replacement nuclear reactor at Lucas Heights for ANSTO.

Under the BAA program the main increases totaling about \$255M are consistent with the original numbers outlined in the Prime Minister's statement of January 2001. The main changes in government appropriation as a result of the BAA program, and the Science Agencies' appropriations are shown in the table below:

Program/Agency	2001/02	2002/03
ARC Competitive Grants	\$271M	\$356M
CRC Program	\$140M	\$149M

NH&MRC	\$309M	\$339M
Major National Research Facilities	\$3M	\$19M
CSIRO	\$612M	\$640M
DSTO	\$333M	\$338
ANSTO	\$222M	\$286
Bureau of Meteorology	\$195M	\$204
Antarctic Division	\$98M	\$101M
Geoscience Australia	\$90M	\$89M

Geoscience Australia was under considerable pressure to have its funding cut by \$8.5M because the five-year Pre-commercial Oil Exploration Program came to an end in 2002. However, the Government has agreed to a further years funding of \$8.5M to be coupled with a review to investigate options and determine the longer-term future for the program. Of the \$8.5M allocated for this program GA will have to find \$1.5M from existing resources.

As Minister Macfarlane said: "Without major new oil discoveries, Australian production is likely to fall by 40% over the next 10 years.



It is vital to Australia's future that we make the best use of our energy resources. Geoscience Australia plays an important role in meeting this challenge. The data developed by Geoscience Australia allows industry to make well-informed decisions which can reduce the otherwise high risks associated with oil exploration."

It is difficult to see any proper review delivering any thing other than a very positive outcome for this valuable program."

The merger of AGSO with AUSLIG to form Geoscience Australia has led to a major reorganization of GA. There will now be three Divisions:

**Minerals and Geohazards**, which will be responsible for onshore activities,  
**Petroleum and Marine**, which will be responsible for offshore programs, and  
**National Mapping**, which will be responsible for spatial information and fundamental networks.

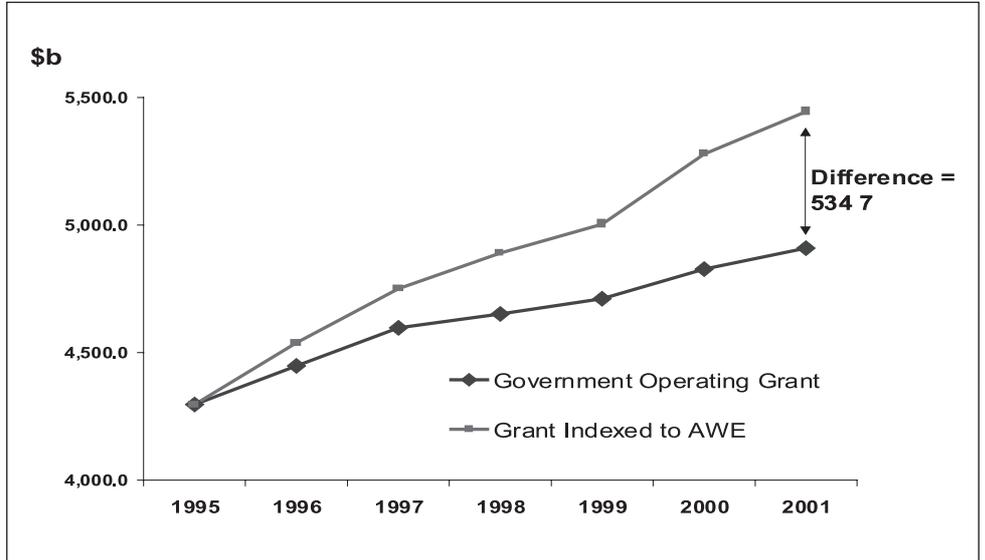
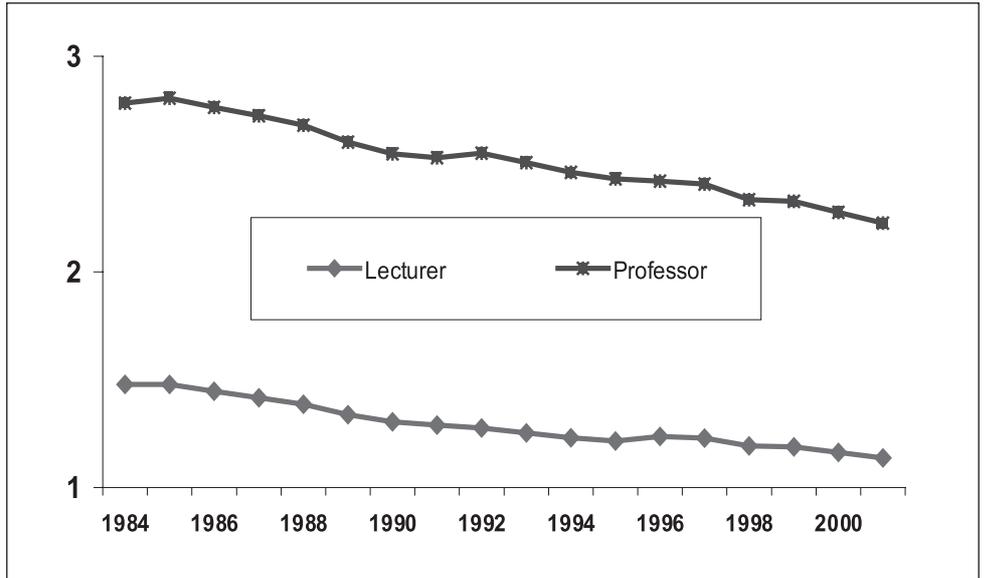
Christopher Pigram, Trevor Powell and Peter Holland will respectively lead these Divisions.

### Higher Education gets a little more from the Commonwealth

The commitment by the Government to Higher Education is of concern. Although Minister Nelson does not like using the word "crisis" to describe this sector there can be no doubt that it is in serious trouble.

A quick glance at the diagrams below indicates the problems. The funding cuts have been huge in the last few years and with salary relativities falling, it is becoming more and more difficult to attract good staff (see Figures 1 & 2 below). Something will have to be done to reverse these trends. Let us hope the Higher Education Review with bear fruit.

One interesting set of figures to note in the budget is the Commonwealth's current allocation to schools and tertiary institutes. For 2002/2003 the government will provide \$2.4 billion for government schools (which of course are mainly funded by the States and Territories), \$4.2 billion for non-



government schools and \$4.9 billion for higher education. The percentage increases over last year are 5.7, 6.9 and 5.8 respectively. If this trend continues the Commonwealth will soon be putting more money into non-government schools than into tertiary institutions.

<sup>1</sup>The Higher Education Finance Debate: Current Issues and Suggestions for Reform, Bruce Chapman, The Australian National University, October 2001

Fig. 1. (Top) Academic Salaries as a Proportion of Average Weekly Earnings (AWE).

Fig. 2. (Above) University Base Grants: Actual Funding Compared to an AWE Index.

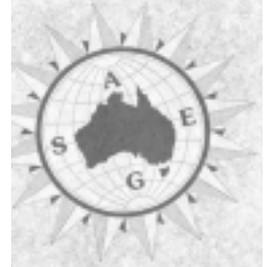
## Robin Batterham re-appointed as Chief Scientist for a further three years

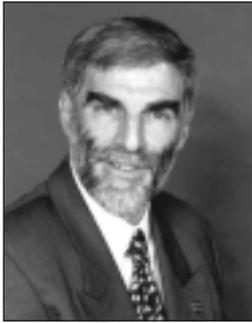
Finally, congratulations to Robin Batterham, who earlier this month was re-appointed as the Chief Scientist for a further three years.

Dr Batterham had been an effective and energetic Chief Scientist who has succeeded in raising the profile of science throughout the community. His efforts and powers of persuasion have been significant factors in

the process of re-building Australia's science base, particularly in providing the impetus for the *Backing Australia's Ability* program, which is bringing a \$2.9 billion investment into the science sector over a five year period.

*Eristicus*





Phil Symonds

## Phil Symonds elected to UN Commission on the Limits of the Continental Shelf (CLCS)

Phil Symonds, a principal research scientist at Geoscience Australia, has just been elected to the United Nations Commission on the Limits of the Continental Shelf (CLCS). The CLCS is the body established under the United Nations Convention on the Law of the Sea that will make recommendations concerning the outer limits of the 'legal' continental shelves of all maritime countries. This has great importance to countries with broad continental margins, such as Australia, in terms of the resource and environmental management of their marine jurisdictions.

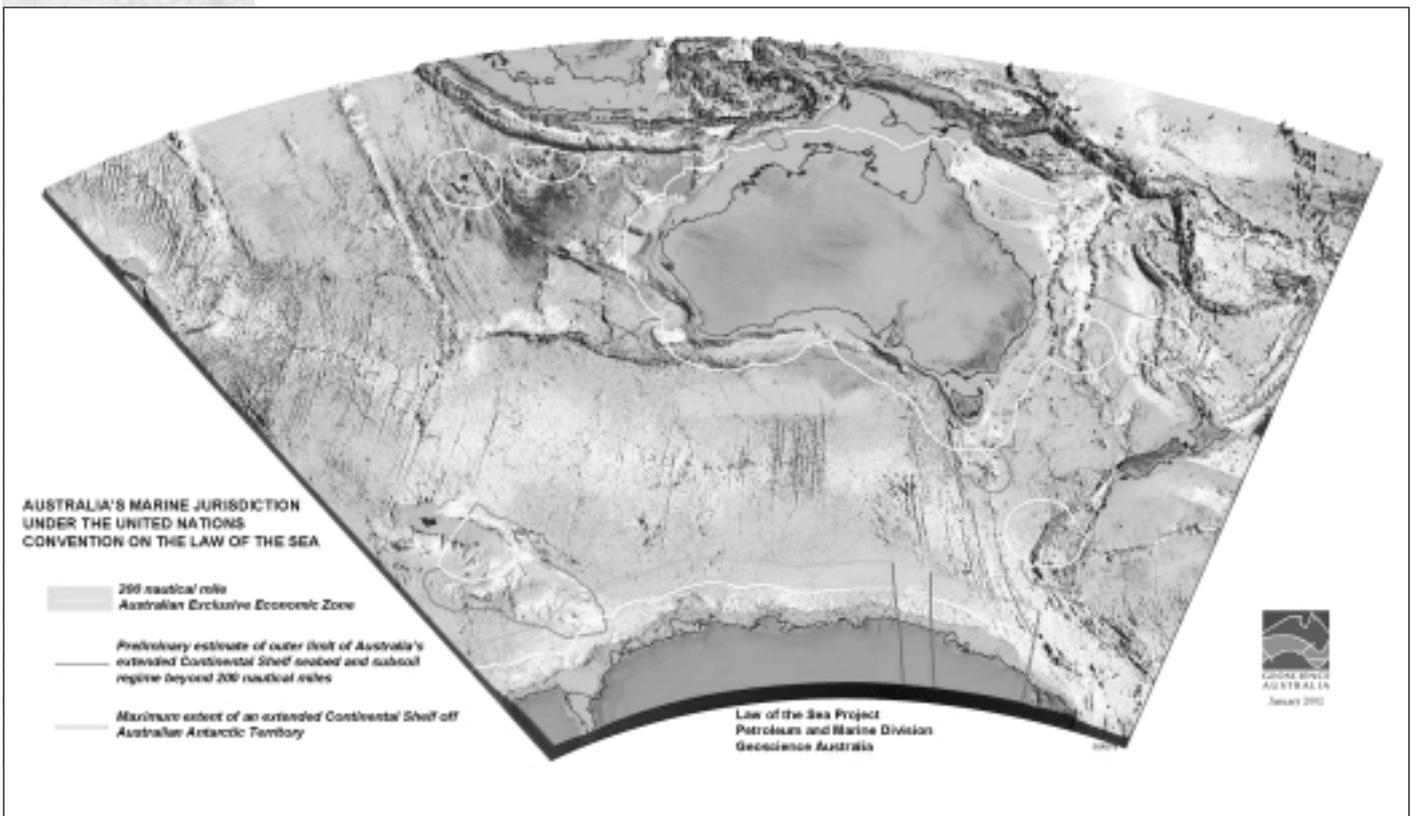
The continental shelf regime relates to the rights of the sea floor and what's beneath the sea floor, and includes both non-living resources, as well as anything that lives on or below the sea floor. The Commission will be responsible for making recommendations defining the outer limits of Australia's extended continental shelf - the seabed and its subsoil beyond the 200 nautical mile Exclusive Economic Zone (EEZ).

Australia, as the world's largest island, has one of the biggest and most diverse areas of extended continental shelf in the world. This extended area, which contains potentially significant resources and unique marine environments, may be equivalent to more than half of Australia's landmass. The CLCS, together with Geoscience Australia, the Department of Foreign Affairs and Trade and the Attorney-General's Department, will have a key role in determining the final and binding limits of Australia's continental shelf.

The limit of the Continental Shelf does not relate to fishing within the water column. A country's rights to this resource only extend up to the EEZ. The EEZ regime includes the water column, sea floor and subsoil, and does not extend beyond 200 nautical miles from the coast. The water column beyond 200 nautical miles forms the regime known as the "high seas", which are international waters open to all countries. The CLCS will examine data and information provided by countries that wish to establish national jurisdiction over areas of sea bed or subsoil beyond the 200 nautical mile EEZ, as laid down in rules contained within the United Nations Convention on the Law of the Sea. These rules are based on geoscientific and other technical information, and consequently submissions for any extended continental shelves need to be assessed by appropriate scientific experts. The Commission is therefore made up of 21 scientists, all from different countries, representing the fields of Geology, Geophysics, Hydrography and Geodesy.

Phil Symonds has worked for Geoscience Australia for the past 32 years. He is one of the world's leading experts in the use of marine geoscience for maritime boundary definition, with experience in regions such as the South Pacific, Indian Ocean and Southern Ocean Regions.

Phil is in charge of Geoscience Australia's Law of the Sea project and has grappled with many of the questions that the Commission is likely to face in considering submissions. Phil will start his five-year term with the CLCS on 24 June 2002.



## ASEG Research Foundation: project results

The ASEG Research Foundation has been supporting students for studies in all facets of Applied Geophysics at the BSc (Honours), MSc, and PhD (or equivalent) levels for 12 years. Members may not be fully aware of the research outputs from these projects, so we will be giving some of the results in this and subsequent Previews. In this issue we give the results from two MSc students at Monash University

### Julie Elders: TEM Methods for Mapping Acid Drainage

Host Institution: Monash University  
 Supervisor: Jim Cull and B McPhail  
 Contact: benandjules@bigpond.com

#### Project Summary

Acid drainage generated by the Loy Yang coal mine overburden pile poses a potential environmental risk to the surrounding fauna, flora, and surface waters, as well as the underlying groundwater system. The overburden pile hosts a heterogeneous distribution of coal and sand and clay-rich sediments. The generation of acid drainage is primarily attributed to trace concentrations of pyrite that are capable of generating low pH, acidic effluent upon exposure to atmospheric oxygen. Over the past decade, evidence of acid drainage in the overburden pile has been manifested in the form of low pH (2.5-4.5) surface seepage on the western batters.

A multidisciplinary approach that incorporated geophysical, hydrogeological, and geochemical techniques was employed over the west end of the overburden. A coincident-loop, time-domain electromagnetic (TEM) survey was conducted to identify regions of elevated electrical conductivity within the survey area. The acquired data were interpreted in three ways:

1. TEM mapping was used to define regions of potential acid drainage,
2. Conductivity-depth inversion of the individual line data was conducted to identify the depth to the water table, and

3. Geochemical water sampling results were compared to apparent conductivity variations to help quantitatively interpret the TEM response.

Results from the TEM survey identified two regions of elevated electrical conductivity on the western batters of the overburden pile. The position of these regions correlates with surface seeps present immediately west of the anomalies. The layered-earth model developed from the TEM data has successfully determined the depth to the water table. The model correlates well with the hydrogeological data and, in particular, has identified a surfacing of the water table in two regions where seepage is evident. Additionally, the results indicate that the depth of the water table increases to the east and to the north. This interpretation is consistent with the south-westerly slope of the natural ground surface and the overburden pile. Finally, it was possible to identify a constant relationship between the TEM data and the electrical conductivity of the pore water, which indicates that the geophysical anomalies identified within the overburden pile may indeed reflect regions of high pore water conductivity, which are likely to correlate to acid drainage contaminated waters.

The successful correlation of the TEM data to both the hydrogeological and geochemical data available within the survey area, indicates that TEM can successfully be used to identify regions of acid drainage in heterogeneous environments such as those encountered in spoil and tailings piles from mining operations.

### Eric Gozlan: Micro-gravity surveys for gold exploration at Fosterville

Host Institution: Monash University  
 Supervisor: Jim Cull  
 Contact: eric@mail.earth.monash.edu.au

#### Project Summary

The Fosterville Goldfield, situated 22 km east-north-east from the city of Bendigo in Central Victoria, forms part of the Central Victorian Goldfields. The geology of the area is dominated by the Fosterville Fault, which provides a prominent mineralised trace striking in a north-south direction extending over several kilometres. Previous geological interpretations have indicated an extension of the Fosterville Fault under cover at the northern end of the mine site. However, no corresponding anomalies have been detected in the geophysical data.

Apart from airborne magnetics and regional gravity data several other methods (IP, TEM, and ground magnetics) have been used in an attempt to locate high-grade prospects in close proximity to the fault. These surveys have been designed, both to delineate the Fosterville Fault structure under cover, and to detect any anomalous concentrations of sulphide mineralisation. However, the results have been inconsistent and there are currently no



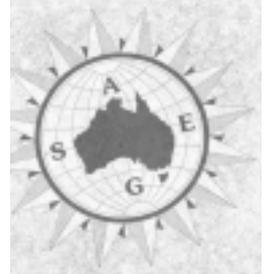
Eric Gozlan

## New Members

We welcome the following new members to the ASEG. Membership was approved by the Federal Executive at its meeting on 16 April 2002.

Name	Affiliation	State
Sakai Hiroaki	Vista P.S	Japan
Frank Lemaire	Dynamic Graphics Inc	USA
Geoff D Peters	Tasmania University	Tas
Brian W Powell	Cameco Corporation	Canada
Grabriella Pracilio	University of WA	WA
Christophe Salti		WA
Jason Storey	WesternGeco	Qld
Adrian Strong	Michael Newton & Associates	Qld
Stephan Thiel	Adelaide University	SA
Zhiyi Zhang	Shell	USA

Continued on page 16



## National Geoscience Teaching Network: Geophysics Field Camp 2002



*Dr George Jung (Monash University) discusses the processing and interpretation of refraction seismic data. Dookie, November 2001.*

Field camps provide an ideal setting in which to teach basic geophysical field methods and demonstrate new instruments and techniques for mineral exploration and geological mapping. However, most university geoscience departments have access to relatively few instruments, and these are often unsophisticated or obsolete. Consequently, there are considerable advantages to be enjoyed from developing collaborative excursions involving several universities. Such ventures extend both the pool of available equipment and the experience/talent base, providing students with an optimal learning experience. The National Geoscience Teaching Network (NGTN) has been established with these collaborative objectives in mind. Funding to promote training in geoscience, mining, and metallurgy has been provided through the Minerals

Council of Australia (MCA) and the Federal Government, initially for a period of 3 years (starting in 2001). Some of this funding has been specifically allocated to provide academics, facilities and coursework material for a national Geophysical Field Camp and a related software-training workshop (currently based at Monash University). To some extent the NGTN Geophysical Field Camp and Software Workshop can be compared with the annual "Summer of Applied Geophysical Experience" (SAGE) program, hosted by the Los Alamos National Laboratory in New Mexico, USA.

The NGTN units are designed to provide an intensive two weeks of geophysical training, focusing on proper field procedure, survey

design, data reduction, presentation and interpretation. The theme of the program is to investigate a real geological problem using a wide variety of geophysical equipment and software, and, in so doing, assess the applicability, advantages and limitations of each technique to the specific problem. Data collected during the Field Camp are processed and interpreted during the subsequent Software Workshop. The courses are open to any interested party, although the fee structure is fashioned to encourage participation by Honours and Masters level students.

The second NGTN collaborative Field Camp and Software Workshop for exploration geophysics was held at Laancoorie in central Victoria (near Bendigo) and Monash University over the period 8-19 April 2002. The theme of

*Continued from page 15*

viable guidelines using conventional methods for routine gold prospecting at Fosterville.

With some notable exceptions (e.g. Olympic Dam) gravity surveys are seldom considered to be a primary tool for mineral exploration. Gravity data are normally slow to accumulate and the sensitivity is often sufficient only for locating major structures. However, productivity can be greatly improved using the new generation of digital gravity meters and fine structure can be reasonably resolved at the microgravity scale. Consequently, high definition microgravity surveys were conducted at Fosterville in an attempt to define any regional trends associated with faulting and to locate any isolated anomalies associated with dense sulphide ore bodies.

A Scintrex CG3M gravity meter was used to obtain data with an average station spacing of 25 m along 22 traverse

lines (separated by approximately 45 m) running east-west across the inferred Fosterville fault-line. Additional in-fill readings were obtained in the region of the fault-line giving a typical station interval of 10 m in the critical region. At the completion of the 2-week survey period a total of 564 data points were obtained; these separate segments were processed and adjusted for static offsets to ensure minimum closure errors prior to gridding using SURFER and ERMAPPER software.

A regional trend to the gravity dataset was observed consistent with an independent structural report suggesting a broad structural northern plunge of basement rocks under cover. Field procedures ensured the precision of the gravity survey and enabled in the identification of a north-south trending gravity residual lineament after regional removal. Two regions of subtle anomalous gravity ( $5\mu\text{m/s}^2$ ) distinguished the gravity lineament. These features have been interpreted as excess mass due to the underlying sulphide mineralisation associated with the Fosterville Fault.



the course was to locate and delineate the Bet Bet Deep Lead, a palaeo-channel buried beneath flat pastoral plains. Fourteen Honours and Masters level students attended the courses, drawn from 5 different universities. The students were guided through the operation of the field equipment and software by nine experienced demonstrators, and enjoyed specialist seminars from three distinguished guest lecturers. (Clive Willman, Victorian Geological Survey; James Macnae, RMIT; Mike Asten, Monash University). Field access, data, software and other services were donated to the course through the generosity of Placer Dome Incorporated, Geoscience Australia, the Victorian Geological Survey, ERMMapper, Geosoft, Encom and the ASEG. Feedback after the course has been very positive, as it was after the initial course, run in November 2001 at Dookie, Victoria.

The next NGTN Field Camp and Software Workshop are scheduled for April 2003. The location and geological context of the Field Camp is yet to be decided, but up-to-date information can be found by following the NGTN link from <http://www.geophysics.monash.edu.au>. Alternatively, information can be requested from:

Graeme Beardsmore  
School of Geosciences  
PO Box 28E  
Monash University,  
Victoria, 3800  
Phone: +61 (0)3 9905-4888  
Email:  
[gbeards@mail.earth.monash.edu.au](mailto:gbeards@mail.earth.monash.edu.au)



Top: Margaret Ang (Monash University) and Matt Bull (University of Adelaide) conduct a resistivity survey using a Geometrics TR1 OhmMAPPER, a capacitively coupled device. Dookie, November 2001.

Above: Professor Jim Cull demonstrates IP resistivity equipment at Dookie, November 2001.



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# ASEG 16th Conference and Exhibition Growth Through Innovation

16th - 19th February 2003, Adelaide Convention Centre

The 16th Conference and Exhibition of the ASEG, to be held in sunny Adelaide in late summer, invites you to exhibit in the stunning, innovatively designed, upgraded Convention and Exhibition Centre on the banks of the Torrens River. Appropriately, the conference theme is **"Growth Through Innovation"** - Innovation stimulates growth - reserves growth, company growth, personal professional growth and discipline growth.

The ASEG 2003 is expected to attract over 500 delegates from Australia and overseas. A vital component of the conference will be the *Trade Exhibition*, which will feature the latest products, services and state-of-the-art information technology available to exploration geophysicists.

To acknowledge the exhibition's importance, the Welcome Reception, all lunches, morning and afternoon teas, as well as two happy hours, will be held within the trade area. Lunches will be included in the registration fee which will encourage delegates to remain in the building and maximise their networking opportunities.

Additionally, there will be trade exhibits/displays; workshops/short courses on geophysical exploration; and,

invited keynote speakers. Given the commitment of our Platinum Sponsor, Santos, and our Gold Sponsors, WesternGeco/Schlumberger and Newmont Australia, we are confident the Conference will be a significant geophysical success.

## Call for Papers

*Technical papers* are invited in all areas of theoretical and applied geophysics (minerals, petroleum, groundwater, engineering, and environmental). Special sessions are being organised on the following themes.

- Geophysical Inversion (Minerals)
- Forensic & Military Geophysics
- Seismic Attributes, including AVO
- From Solid Earth Geophysics to Exploration
- Challenges in Petroleum Geophysics
- Groundwater & Salinity Mapping Applications
- Challenges in Mineral Geophysics
- Geophysical Signatures of South Australian Mineral Deposits
- Southern Margin Basins

**Abstracts (no more than 300 words) due by June 30, 2002. Extended abstracts of papers accepted for inclusion in the Conference CD ROM will be required by October 31, 2002.** Full papers are invited for publication in Exploration Geophysics.

Technical Papers Chairman,  
Stewart Greenhalgh  
Adelaide University, North Terrace, Adelaide SA 5005  
Email: [stewart.greenhalgh@adelaide.edu.au](mailto:stewart.greenhalgh@adelaide.edu.au)  
Fax +61 8 8303 4347

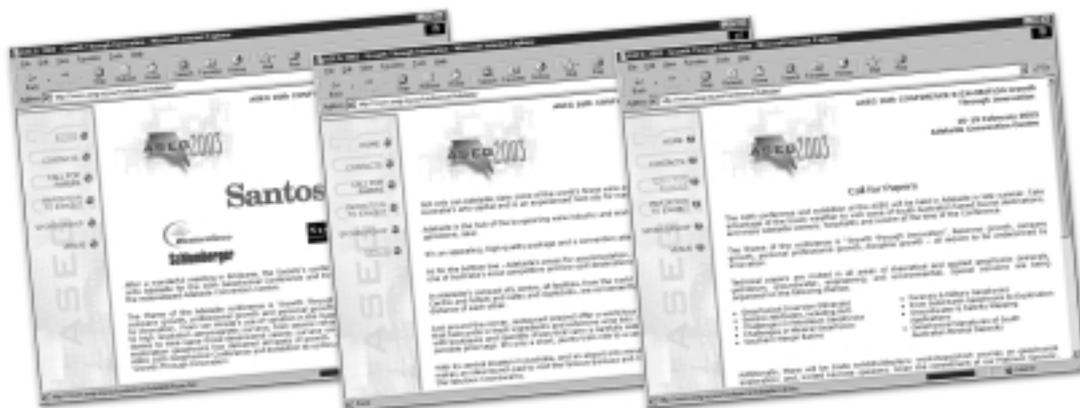
For more information please visit website our [www.aseg.org.au/conference/Adelaide](http://www.aseg.org.au/conference/Adelaide) or contact the conference co-chairs, Richard Hillis ([rhillis@ncpgg.adelaide.edu.au](mailto:rhillis@ncpgg.adelaide.edu.au)) and Mike Hatch ([zongaus@ozemail.com.au](mailto:zongaus@ozemail.com.au)), or the Conference Organiser, Rob Bulfield of SAPRO ([aseg2003@aseg.org.au](mailto:aseg2003@aseg.org.au)).

ASEG 16th Conference & Exhibition  
Growth through Innovation

# Santos

NEWMONT AUSTRALIA

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## International Groundwater Conference "Balancing the Groundwater Budget"

This multi-disciplinary conference was organised by the Northern Territory Branch of the International Association of Hydrogeologists, in Darwin from May 12-17, 2002.

The Northern Territory Government, the Australian National Chapter of IAH, AusAID and UNESCO provided major funding. It was a truly international conference, with over 50 delegates from 30 countries. Invited keynote speakers came from places like PNG, Japan, China, Thailand, and a principal keynote from USA. Supported speakers came also from Nigeria, India, Bangladesh, China, Ghana, Kenya, Portugal and Argentina.



*Compiled from material provided by Gary Humphreys*

*Gary Humphreys, his wife Gaik, Segun Adelana (geophysicist and groundwater scientist from Ilorin, Nigeria), Anh Tho Tien from NT Government and also NT University.*

The full program included a day of workshops run by Centre for Groundwater Studies, followed by one day of plenary speakers, a full-day field excursion and then two days of parallel sessions.

The field excursions included a variety of hydrogeological content, but were as interesting and scenic as possible:

- The Darwin area trip took in spring-fed parks at Howard Springs and Berry Springs, as well as an orchid nursery, wildlife park and hand-feeding fish.
- The Wetlands trip visited springs, wetlands and jumping crocodiles.
- The Litchfield trip visited the rehabilitation of Rum Jungle mine site, the Finnis River and the Litchfield National Park, where water in the Proterozoic sandstones feeds spectacular waterfalls.

Post-conference technical three-day tours comprise Kakadu National Park and Ranger Uranium Mine, Daly Basin and Katherine Karst geology, and Central Australia arid zone hydrogeology.

*Continued on page 20*



*The Litchfield Park Tour.*



*Braving a hungry crocodile on the Coastal Plains Tour.*



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Continued from page 19

The pre-conference workshops attracted an unexpectedly large following (average 40 per workshop), with a world-class list of presenters from CSIRO, Northern Territory University, Centre for Groundwater Studies. The four half-day workshops, which may be available elsewhere on request, were:

- Groundwater chemistry
- Recharge/discharge determination
- Conceptual groundwater modelling
- Surface water / ground water interaction

Over 160 papers and 14 posters were presented, with full papers included on the Conference CD. Abstracts were provided on the conference website in the weeks beforehand, and were distributed in the conference manual interleaved with blank pages for note taking. An additional bonus was the chance to host Mary Hill, the Darcy Lecturer for 2001, from the National Groundwater Association (NGWA) in the US. Mary has been travelling the world delivering her talk on model calibration, which introduces some reality into mathematical models of groundwater or geophysics or anything else we model (except the economy which is pre-optimised to cheat us all).



A full report on the conference, including some pictures, is now on the website: [www1.octa4.net.au/iahnt/conference.htm](http://www1.octa4.net.au/iahnt/conference.htm), including technical summaries of some sessions.

The NT Branch President of ASEG, Gary Humphreys, is also local IAH Vice-President and Treasurer, so he was very busy making sure the budget balanced. Anthony Knapton, also local ASEG member ended up as Conference Secretary, and spent every waking hour of the week reformatting, editing and sorting PowerPoint presentations, all to superb effect. Other distinguished geophysicists to venture into the watery realm included retiring national president Tim Pippett and his ABEM colleague Per-Erik Olssen, and the ever-present Bill Smith who is keeping the Auslog name alive as one of the world's few borehole geophysics manufacturers and an Australian company as well!! Darwin-based contractor/consultant Jon Summer dropped in to the social evening at the Wharf function Centre, to join us for a few beers and hopefully to generate more ground geophysics in the NT.

Of particular interest to all those who conspire against geologists: The hydrogeology conference was chaired by an engineer, treasured by a geophysicist, secretaried by first an engineer then a geophysicist, and enjoyed by everyone. This tells us that the varied technical program and the range of social events appealed to the whole groundwater industry.

And we had a great time all week. See the photos on the website for proof.

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**New South Wales**

**Largest ever data release for the State**

On 23 May the New South Wales Department of Mineral Resources released the largest ever geoscience data package from the State. Geological maps, geophysical data sets, and information systems were included in the data package released. These outputs are part of the \$60 million commitment by the NSW Government through the *Discovery 2000* and *Exploration NSW* initiatives. These programs provide special funding of \$5 million per year until 2007 to provide high quality data to promote petroleum and mineral exploration in that State. In the next issue of *Preview* we will be featuring the full release package, but we are going to give a preview of the hyperspectral survey near Broken Hill and the new MinView DataViewer.

**Hyperspectral Survey, Broken Hill**

This survey was completed in March 2002 using a light aircraft recording a digital image of the Earth's sunlit surface. The data were collected at a height of 1.5 km above the ground. The survey recorded 128 spectral channels with a 3 m pixel size and

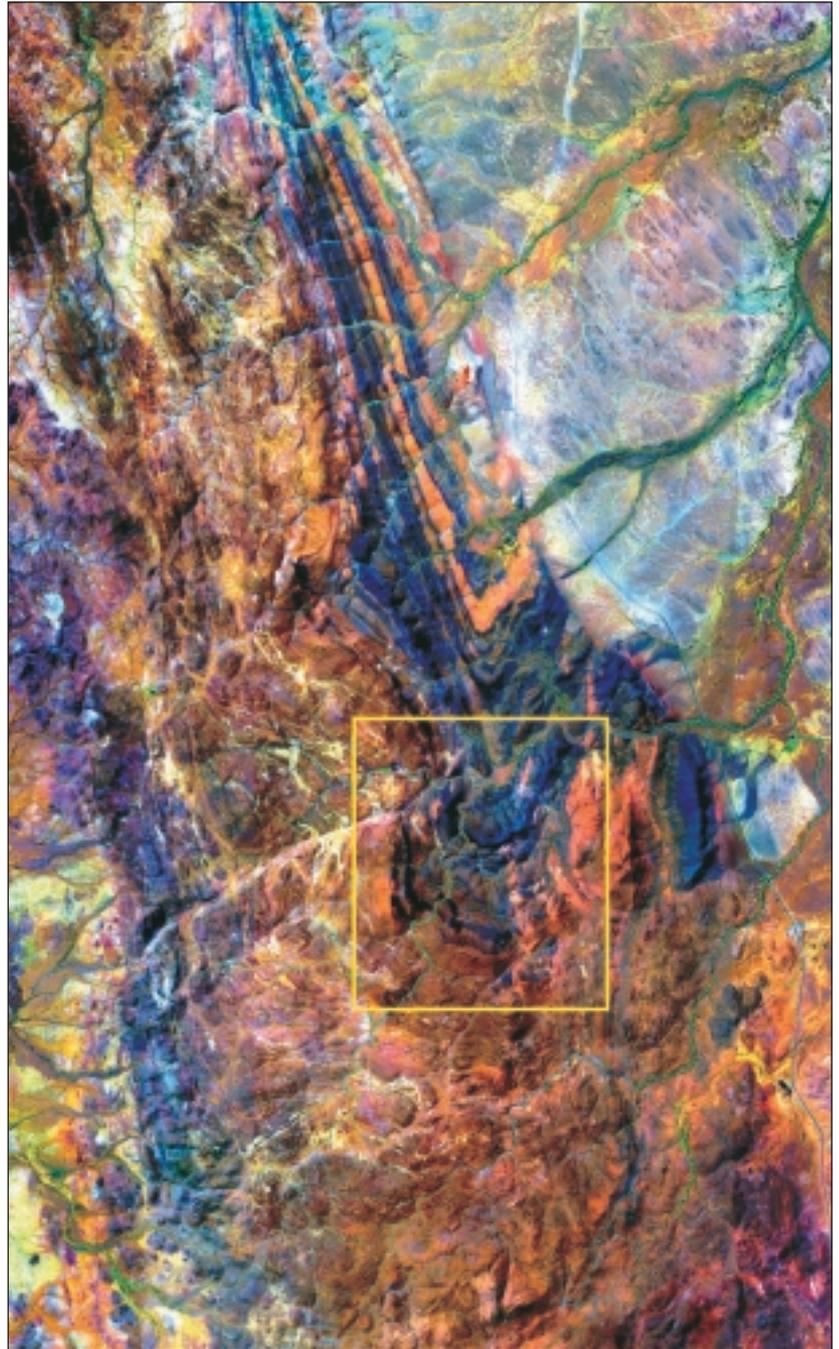


Fig. 2. Detail from Figure 1, expanded.

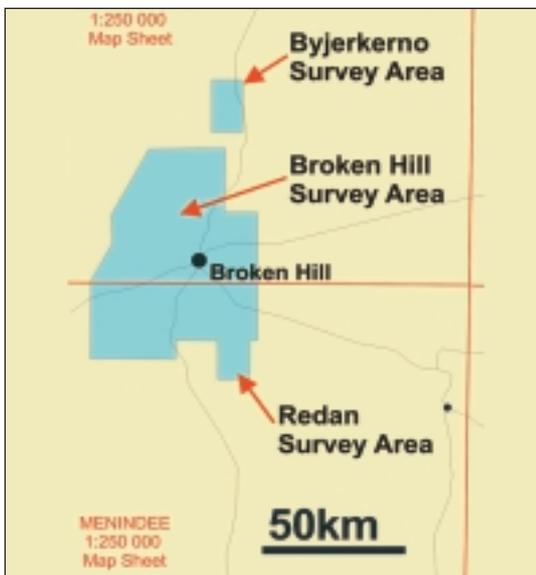


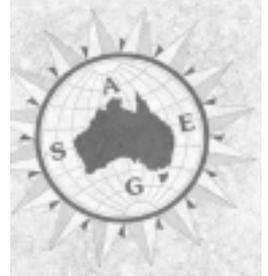
Fig. 3. Map of survey areas.

produced a data set that is equivalent in size to the holdings of 110 DVDs. The sensors measure the Sun's reflectance according to the soil and rock types that are outcropping. This technique is excellent for geological mapping in areas of relatively good outcrop and the diagrams below show two images from the Byjerkerno area which is about 60 km NNE of Broken Hill.

**MinView DataViewer**

MinView is a new web interface that enables the user to view and question current geological and exploration titles free of charge via the Internet. It also provides users with the ability to link geological and exploration titles information displayed on the screen to the exploration reports held in the Department's Digital Imaging of Geological System Reports (DIGS) database. Get on to the website at [www.minerals.nsw.gov.au](http://www.minerals.nsw.gov.au) and try it out. It's good fun.

Fig. 1. Byjerkerno Image (RGB bands).



# ANSIR

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## Call for Research Proposals

for experiments in 2002 and beyond

The Australian National Seismic Imaging Resource (ANSIR) is seeking bids for research projects for experiments in 2002 and beyond.

ANSIR is Australia's Major National Research Facility in the Earth Sciences. It was created to encourage and assist world-class research and education in the field of seismic imaging of the Earth. It operates a pool of state-of-the-art seismic equipment suitable for experiments designed to investigate geological structures from environmental and mine-scale through to continental scale. ANSIR is operated jointly by Geoscience Australia and the Australian National University.

ANSIR equipment is available to all researchers on the basis of merit, as judged by an Access Committee. ANSIR provides training in the use of its portable equipment and a field crew to operate its seismic reflection profiling systems. Researchers have to meet project-operating costs.

Details of the equipment available, access costs, likely field project costs and the procedure for submitting bids for equipment time are available on our World Wide Web site at <http://rse.anu.edu.au/seismology/ANSIR/ansir.html>. The web site also shows an indicative schedule of equipment for projects that arose from previous calls for proposals.

Over the next year our controlled source equipment will be used on both sides of the Australian continent. People interested in proposing piggyback experiments should contact the ANSIR Director for details of the scheduled experiments. Our long period portable instruments are in heavy demand, therefore potential users are urged to submit bids at the earliest opportunity. Spare capacity on our short period portable instruments in 2002 is anticipated.

**Researchers seeking to use ANSIR in 2002 and beyond are advised that research proposals should be submitted to the ANSIR Director by 12 August, 2002.**

### ANSIR

Australian National Seismic Imaging Resource

#### Enquiries should be directed to:

For projects requiring ANSIR's seismic reflection equipment

**Dr Barry Drummond**  
ANSIR Director  
GPO Box 378  
Canberra City ACT 2601

Telephone 02 6249 9381  
Facsimile 02 6249 9972  
Email [Barry.Drummond@ga.gov.au](mailto:Barry.Drummond@ga.gov.au)

For projects requiring ANSIR's portable seismic recorders

**Prof Brian Kennett**  
Research School of Earth  
Sciences  
Australian National  
University  
Canberra ACT 0200

Telephone 02 6125 4621  
Facsimile 02 6257 2737  
Email [Brian.Kennett@anu.edu.au](mailto:Brian.Kennett@anu.edu.au)

## NTGS

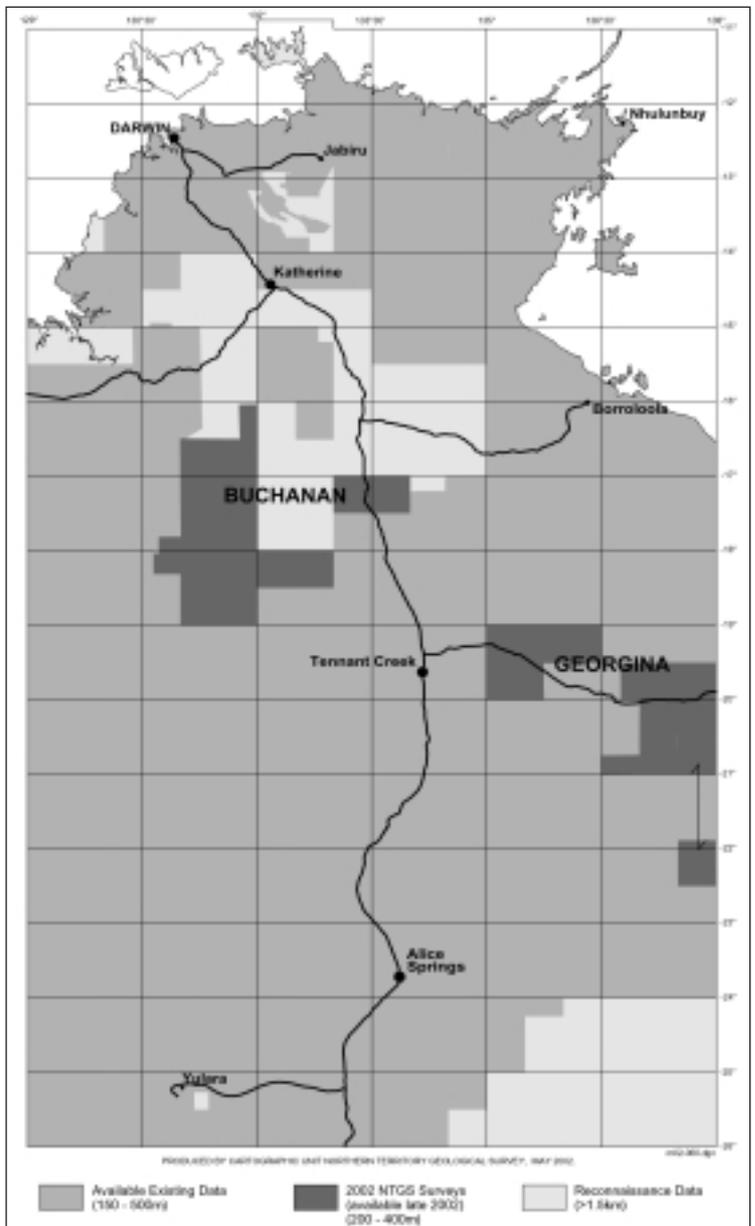
### New airborne geophysics over the Wiso and Georgina Basins

During 2002 NTGS is scheduled to acquire an estimated 185 000 line-km of high-resolution magnetics and multi-channel radiometrics in two separate contractual areas (Buchanan and Georgina), covering substantial portions of the northern Wiso and central Georgina Basins. Both surveys will be flown along 400 m spaced lines at 80 m MTC by Fugro Airborne Surveys. This new flying will be augmented by the acquisition of approximately 71 000 line-km of 200-300 m spaced magnetic and radiometric data from the private sector.

NTGS will continue to use Image Web Server to update explorers as to the status of each survey as they are being flown. Preliminary located magnetic, radiometric and elevation images will be posted on the NTGS Airborne Geophysical Image Web Server approximately every 3-4 weeks throughout the course of each survey.

Additional information and the current extent of the program is shown on the NTGS website at: <http://www.dbird.nt.gov.au/ntgs/geophysics/airborne.html#2002AcqProg>

Both surveys are scheduled to start in late June-early July 2002 and public release of final located data and grids from the 2002 airborne program is targeted for December 2002.



## Victoria

### Geological Survey of Victoria celebrates 150 years of achievement

The Geological Survey of Victoria is celebrating its 150th anniversary this year. An exhibition of maps, plans, photos and implements used in map production will form a special display at the Museum of Victoria. This exhibition, opened by Minister Broad on May 3 will run for several months, and includes a great deal of manuscript material never displayed before.

The Geological Survey of Victoria was the first Geological Survey to be established in Australia, and one of the earliest in the world.

The discovery of gold in Victoria in 1851 sparked a vast rush that led, in the following year, to the appointment of Alfred Selwyn as 'Mineralogical Surveyor' for the colony (then newly separated from New South Wales under the name Port Phillip District).

Selwyn began work immediately upon disembarking in Melbourne, first with a single assistant and later with an additional worker. Selwyn, who had worked as a geologist with the British Geological Survey prior to his arrival in Australia, was formally named as Government Geologist and Director of Mining and Geological Surveys in 1863. Selwyn and his gradually increasing staff made a remarkable series of maps in the sixteen years that he worked in Victoria, including the first geological map of the State in 1863. Maps were produced at such a high rate that he was forced to find new methods to mass print coloured maps.

In the years since Selwyn, the Survey has extended into other areas such as detailed mapping of goldfields and other mineral occurrences, construction materials, and the search for energy resources, first in the form of black and brown coal and later oil and gas. This led the Survey to spend much effort into documenting the various Mesozoic and Cainozoic basins, supported by a large crew of drillers. Work by the Geological Survey led to the successful development of the major brown coal resources in the La Trobe valley in the 1920s.

While the famous American geologist, Lewis Weeks, is given much of the credit, it was the Victorian Geological Survey which first suggested, in 1955 that the search for oil should be conducted offshore in Bass Strait. What followed, of course, was the discovery of one of the world's

finest and most productive oil and gas fields, still producing today after more than 30 years.

The need to find groundwater in rural Victoria became important in the 1960s and the 1980s involved half of the Survey's staff involved in the exploration and management of groundwater resources. An Engineering Geological Section provided vital data on ground conditions for a series of major projects during the latter half of the 20th century. Both groundwater and engineering geological services are today provided by private industry.

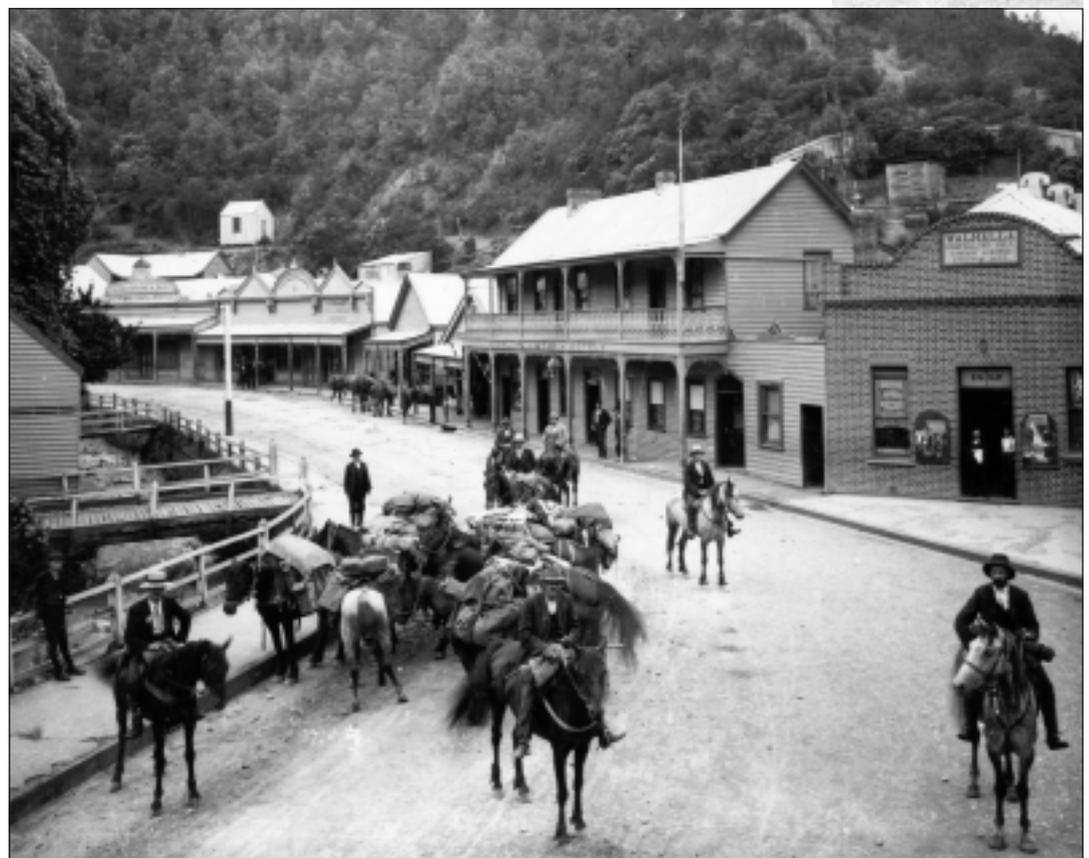
In recent decades, the main effort has swung back to the core activity of mapping. Acquisition of gravity and detailed airborne survey data began in the 1990s under the Victorian Initiative for Minerals and Petroleum. The state is now covered by detailed airborne geophysical data that provide the most comprehensive data set of its type of any Australian state.

Analysis of such data has made a major impact on the approach to geological mapping, and the combination of new geophysical interpretations and new mapping culminated in the publication, in October 2000, of the Tasman Fold Belt System Special Publication.

For further information contact:  
Peter O'Shea  
Manager Geological Mapping  
Geological Survey of Victoria  
Tel: (03) 9412 5093  
Email: Peter.O'Shea@nre.vic.gov.au



*Geological Survey party leaving Walhalla for Mount Baw Baw, January 1904. On horseback at left is William Baragwanath, who published detailed reports on the Ballarat and Walhalla goldfields and would become Director of the Geological Survey in 1920.*



by Peter Hatherly

## Geophysical news from CSIRO

Within CSIRO, geophysics is practised within the Divisions of Petroleum Resources, Exploration and Mining and Telecommunications and Industrial Physics. Different aspects of this work will be discussed in future issues. In this current issue of Preview the activities of the Mining Geoscience Group within the Division of Exploration and Mining are described.

This is a new research group formed through an amalgamation of the previous Mine Scale Geophysics Group and Coal Geology Groups. There are 19 staff with skills in geological and geophysical modelling, sedimentology, petrology, structural geology, nuclear geophysics, seismics, magnetics, electromagnetics, instrumentation design/manufacture and software development. It is led by geologist, Mark Berry and current activities are in the following areas.

**Orebody and host rock delineation, modelling and characterisation** through the implementation of geological and geophysical techniques (seismic, radar, wireline logging) for greater understanding of geological, geotechnical and metallurgical properties.

**Assessment of ground behaviour during mining** for mine design, scheduling and optimisation, through

microseismic techniques providing improved understanding of the stress regime in operating mines.

**Integration of geological and geophysical data** to provide mine staff with the capability to better assess mine design strategies, evaluate planning options and more accurately predict production outputs. Development of a virtual mine concept that incorporates an interactive web based visualisation system using industry standards such as Java and VRML has been a feature of this work.

**Integration of ore quality and material characterisation from mine-to-mill-to-market**, for tighter quality control to achieve defined customer and market expectations.

Most staff are located at the CSIRO laboratories at Pullenvale on the western outskirts of Brisbane. As is the case with much of CSIRO's research at the mine scale, the work is mainly to do with coal mining. It would appear that despite the oft stated desire to apply geophysics in metalliferous mining, the coal miners remain the most receptive to geophysical technology.



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## The universe on the web

I'm certain I'm not the only geophysicist that is fascinated with the science of space. The Internet provides excellent resources for discovering more about our solar system, galaxy and beyond. The rare alignment of all five of the naked-eye visible planets (Mercury, Saturn, Mars, Venus and Jupiter) in early May re-ignited my interest in astronomy and space exploration, and this month I share just a few of the interesting websites I came across during my wanderings on the web.

### Your Sky

[www.fourmilab.ch/yoursky/](http://www.fourmilab.ch/yoursky/)

An awesome interactive planetarium by John Walker. From this site you can produce sky maps for any time and date, viewpoint, and observing location. Very useful for finding your way around the nighttime sky.

### Solar System Live

[www.fourmilab.ch/solar/solar.html](http://www.fourmilab.ch/solar/solar.html)

Another gem from John Walker (founder of Autodesk, Inc. and co-author of AutoCAD) is an interactive orrery of the web, from which you can view the entire Solar System, or just the inner planets (through the orbit of Mars). Controls allow you to set time and date, viewpoint, observing location, orbital elements to track an asteroid or comet, and a variety of other parameters.

### Sky View - The Internet's Virtual Telescope

[skyview.gsfc.nasa.gov](http://skyview.gsfc.nasa.gov)

Sky View is a virtual observatory generating images of any part of the sky at wavelengths in all regimes including optical, x-ray, radio, infrared, gamma-ray and extreme-UV. Successfully using this site may take a bit of reading ... even the non-astronomer interface requires you to have significant knowledge of sky objects. Nevertheless, you will generate some amazing and beautiful images.

### Star Journey

[www.nationalgeographic.com/features/97/stars/index.html](http://www.nationalgeographic.com/features/97/stars/index.html)

Journey through the stars with the National Geographic Star Chart. Maps of the nighttime sky are shown with overlays of Hubble Space Telescope images (however this site doesn't give as detailed sky maps as the 'Your Sky' website introduced above). Visit the Star Attractions highlights of the heavens and be introduced to nebulae, galaxies, constellations, star clusters and the Milky Way. You'll also find information on the Hubble Space Telescope and a variety of links to space-related websites.

### Earth Science Pictures

[pao.gsfc.nasa.gov/gsf/earth/pictures/earthpic.htm](http://pao.gsfc.nasa.gov/gsf/earth/pictures/earthpic.htm)

Get a whole new perspective on Earth science from these press release images from the Goddard Space Flight Center. Here you'll see images of hurricanes, raging bush fires, holes in the ozone layer, sand storms algal blooms and auroras ... all from space.

### Heavens Above

[www.heavens-above.com](http://www.heavens-above.com)

If you're interested in satellites or astronomy, this is the place to visit. This site provides you with the information needed to observe satellites such as the International Space Station and the Space Shuttle, as well as a wealth of other spaceflight and astronomical information.

### Dr Karl in Space

[www.abc.net.au/science/space/drkarl.htm](http://www.abc.net.au/science/space/drkarl.htm)

Enjoy learning more about a variety of topics, including runaway stars, solar eclipses, space weather and how toilets work in space. You'll find information on our planetary neighbours, and discover what's happening in our southern skies via Sky Watch. Beneath the Sky Watch hyperlink you'll also find a comprehensive list of online Australian and international space resources (including links to Australia's planetarium websites).

### Australia Sky On-Line

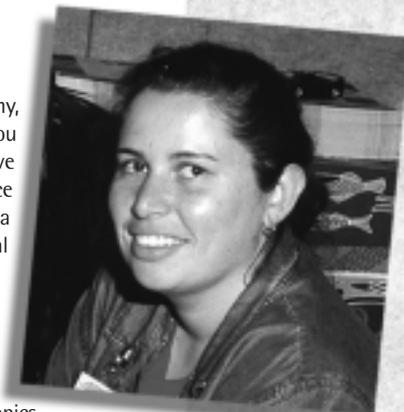
[australiasky.tripod.com](http://australiasky.tripod.com)

An excellent site for simple and easy-to-read information about the things you find in the Australian sky! Information is updated monthly so you can identify planets and constellations you can see from your back garden. Learn how to spot satellites or follow the phases of the moon. This site also contains links to other Australian space-related sites.

### 40 Years of the Dish

[www.abc.net.au/science/slab/parkes/default.htm](http://www.abc.net.au/science/slab/parkes/default.htm)

And where would a collection of space-related sites be without information on our very own grand old lady of astronomy ... the Parkes dish. October 31, 2001 marked the 40th anniversary of its inauguration. Learn about the beginnings of what could arguably be Australia's most successful scientific instrument. To find out more about the work the Dish is currently performing, visit the Parkes Observatory Home Page ([www.parkes.atnf.csiro.au](http://www.parkes.atnf.csiro.au)).



Natasha Hendrick

*If you have any of your own favourite space sites you'd like to share with your fellow ASEG members, please contact me ([natasha.hendrick@mim.com.au](mailto:natasha.hendrick@mim.com.au)) and I'll include them in future editions of Preview. Enjoy your travels through space ...*



## \$125 million of Commonwealth Funds for Rio Tinto's Hismelt Plant

Rio Tinto has announced that it will build an expanded A\$400 million Hismelt plant at Kwinana in Western Australia. The Hismelt process is a revolutionary new direct iron-smelting technology, developed largely by Rio Tinto in Australia.

Hismelt has the potential to:

- Substantially increase demand for Australia's reserves of iron ore by consuming the unsaleable higher phosphorous fines found in vast quantities in the Pilbara. This will significantly enhance the competitiveness and value of the Australian iron ore industry.
- Encourage a cleaner steel industry as it does not require coke ovens and sinter plants and produces less greenhouse gas per tonne of hot metal. It will provide cost effective steel making options for developing countries and replacement for ageing plants in developed countries.
- Meet the demand for new sources of iron metalics as feedstock for the rapidly growing electric arc furnace industry, particularly in the higher growth Asian region.

The Commonwealth Government will provide A\$50 million in initial support funding through it's Strategic Investment Coordination process. Further stages of Federal funding up to a total of A\$125 million are dependent on the success of commercialisation of the process and a doubling of plant size. The State government has provided assistance in securing the land required for the new plant.

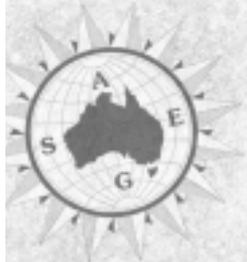
Chief Executive, Rio Tinto Iron Ore, Chris Renwick, said, "Rio Tinto's decision to build a commercial plant at Kwinana represents the culmination of an intensive A\$600 million Australian research and development program, conducted over twenty years. It is a significant step in the development of new-generation technology for the world steelmaking industry.

There is also potential for further economically viable development such as the construction of a steel plant at Kwinana. This could bring the total investment in the new Hismelt project to A\$1.2 billion.

"The new Hismelt plant will produce high quality iron at a lower cost and with a superior environmental performance to any other iron-making process. It will also allow Rio Tinto to use lower grade and lower value iron ore fines, such as the higher phosphorous ores prevalent in the Pilbara.

Construction is scheduled to begin in the fourth quarter of 2002, subject to environmental and other statutory approvals. The plant is expected be commissioned in late 2004 and reach full production in the first half of 2006.

It will employ around 320 people at the peak of its two-year construction phase, and will create up to 65 full time jobs when in operation.



## Placer Dome set to consume AurionGold

AurionGold, which was only formed in December 2001 (see Preview, February 2002) from the amalgamation of Delta Gold and Goldfields, has already become a take over target. On 27 May, Canada's Placer Dome launched a \$2 billion takeover bid in the form of a \$4.51-a-share scrip offer. Placer has offered AurionGold, its joint venture partner in the Granny Smith and Porgera goldmines in WA and PNG, 17.5 of its own shares for every 100 shares held. As a result of this offer, AurionGold shares rose from around \$3.40 to \$4.55 in one day.

If the takeover is successful, the restructured Placer would have interests in 17 operating mines on 4 continents, and significant land holdings in world class gold mining regions within Western Australia (including the Kalgoorlie and Laverton regions), Nevada, Ontario, Papua New Guinea and Witwatersrand.

It would have an annual production of about 118 t, making Placer Dome the 5th largest producer globally and a production of over 37 t per annum in Australia, making Placer Dome the 2nd largest producer in the country.

With estimated cash costs of US\$175 per ounce Placer Dome would be one of the lowest cost gold producers.



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## Company Profile: Santos

### Summary

Santos is a major Australian energy company based in Adelaide, with assets of over \$5 billion, a market capitalisation on the ASX of over \$3.6 billion and an annual production of 55.7 million barrels of oil equivalent. The Company's business is oil and gas exploration and production with interests in every major Australian petroleum province. Santos is the largest producer of gas for the Australian market supplying gas to all mainland Australian States and Territories and also sells oil and liquids to a number of domestic and international customers.

### History

Santos was incorporated in South Australia in 1954. Shortly after incorporation the company acquired exploration leases covering over 325,000 km<sup>2</sup> in South Australia and southwest Queensland, which it explored in its own right until 1958, when Santos entered into a joint venture agreement with Delhi Australia Petroleum Ltd.

The first deep well drilled by the joint venturers, Innamincka 1, was completed during 1959.

Despite the failure to discover petroleum, hydrocarbon shows were present and Permian sediments discovered, which gave incentive for further comprehensive exploration.

The search was accelerated in 1963 by means of a farm-in agreement with the French Petroleum Company (Australia). After Innamincka 1, a further five wells were drilled before the Gidgealpa 2 well flowed commercial quantities of natural gas in December 1963. In July 1966, more gas was found at the Moomba 1 well.

Combined with the reserves established through further drilling on Gidgealpa, the Moomba discovery contained enough gas to satisfy potential demand in South Australia and a sales contract was signed with the South Australian Gas Company.

Gas supplies to Adelaide commenced in 1969 from the Gidgealpa and Moomba fields, following the completion of the 790 km pipeline to Adelaide. In that same year another gas contract was signed with the Electricity Trust of South Australia.

Santos celebrated another landmark in the history of the Cooper Basin by finding a light oil reservoir during the drilling of the Tirrawarra 1 well in 1970. Prior to this, exploration results indicated that the Cooper Basin contained gas only.

In the years 1970 and 1971, there was an unprecedented run of discoveries in the

Cooper Basin and the largest onshore exploration program in Australia.

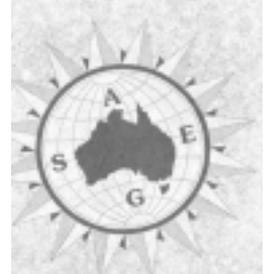
With the great expansion of reserves, negotiations commenced in 1969 with The Australian Gas Light Company (AGL) to supply New South Wales with natural gas. Under the terms of a Letter of Agreement signed in 1971, the Cooper Basin consortium agreed to supply the Sydney region with natural gas and supply commenced in September 1976.

In early 1980 Santos, on behalf of the joint venture partners, announced the decision to proceed with the \$1.4 billion liquids project. During 1981, a site for the liquids terminal was selected, a route for the liquids pipeline chosen, environmental impact studies completed and approved by government.

The focal point of the liquids scheme was at Moomba, until then the centre for gas collection, treatment and dispersal. With the construction of the Liquids Recovery Plant, Moomba had the added roles of extracting natural gas liquids from the gas stream and of receiving and stabilising crude oil and condensate.

The first oil discovery in the Queensland Eromanga Basin was made by Jackson-1 in 1981. Subsequent discoveries were made and a development program undertaken which included the commissioning of the Jackson production facility. In February 1984, the Jackson to Moonie pipeline was completed, enabling Jackson oil to be transported to Brisbane for refining.

*Continued on page 28*



*Continued from page 27*

In the mid-1980s Santos consolidated its activities within the Cooper/Eromanga Basins and expanded its exploration interests beyond the Central Australian acreage in search for continued growth in oil reserves and production. This process included acquisition of interests in mature USA and UK petroleum provinces; in newly emerging areas such as the Timor Sea and Carnarvon Basin of Australia's north west coast; and in frontier exploration acreage in South East Asia.

Santos purchased the upstream oil and gas assets and oil pipeline interests of AGL in 1993. The acquisition extended Santos' Australian onshore oil and gas operations by adding producing acreage in the Surat Basin and Denison Trough, consolidating the Company's investment in the Amadeus Basin, and the Jackson-Moonie pipeline.

In the early 1990s, Santos built the Ballera Gas Plant in southwest Queensland for supply of gas to South Australia, which commenced in 1994. This plant has been further expanded to facilitate the supply to customers in southeast Queensland and gas sales agreements with MIM Holdings for the Mica Creek Power Station and WMC, both located in northwest Queensland.

Further acquisitions were made during the 1990s providing Santos with additional opportunities onshore and offshore Australia including interests in the East Spar gas/condensate field in the Carnarvon Basin and other interests in Indonesia and Papua New Guinea. During that period, Santos participated in a number of discoveries offshore including the Stag oil discovery in the Carnarvon Basin in 1993, the Elang oil discovery in the Timor Sea in 1994, the Undan gas/condensate discovery in the Bonaparte Gulf in 1995 and the successful Legendre appraisal in the Carnarvon Basin in 1997.

Santos acquired an effective 25% interest in the Hides gas field in Papua New Guinea in February 1999, further increasing the Company's position in this increasingly important hydrocarbon province.

Santos strengthened its position in offshore Western Australia through the acquisition of the Theverard and Barrow Islands assets from Shell Development (Australia) Pty Ltd in early 2000. These Carnarvon Basin acquisitions provide the company with producing and exploration interests in this strategic location.

The current Managing Director is John Ellice-Flint, and the Chairman of the Board is Stephen Gerlach

## Current Programs

The core of Santos' business is a majority working interest in the Cooper/Eromanga Basins oil and gas fields located in central Australia. Santos produces gas, ethane, oil and gas liquids from the Basins and is the Operator of production and exploration operations.

Santos also has exploration and production interests in the Surat and Amadeus Basins and the Denison Trough (onshore Australia), the Carnarvon Basin, Timor Sea and Timor Gap (offshore Australia) and the United States (onshore and Gulf of Mexico). Additional exploration acreage is held in the Browse Basin, Bonaparte Gulf, the Gippsland Basins (offshore Australia), the Otway Basin (onshore and offshore Australia), Indonesia and Papua New Guinea. See the diagram below.

In 2001 Santos recorded a profit of \$445.9M, with total production of 55.7 million boe, total sales volumes of 55.1 million boe and total sales revenue of \$1459.7M.

## Reserves

At the end of 2001, Santos had Proved and Probable reserves of 724 million boe. These reserves are equal to an average reserves life of 13 years based on 2001 production levels.

Santos' guidelines are in general conformity with reserve definitions of the Society of Petroleum Engineers (SPE) and the World Petroleum Congresses (WPC).

Proved Reserves (1P) are those reserves that, to a high degree of certainty (90% confidence), are recoverable. There is relatively little risk associated with these reserves  
Probable Reserves (2P) are those reserves which analysis of geological and engineering data suggests are more likely than not to be recoverable. There is at least a 50% probability that reserves recovered will exceed Probable reserves. Probable reserves are generally reported inclusive of Proved reserves as Proved and Probable reserves (2P).

Possible Reserves (3P) are those reserves that, to a low degree of certainty (10% confidence), are recoverable. There is relatively high risk associated with these reserves. Possible reserves are generally reported inclusive of Proved and Probable reserves.





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Contingent Resources are those quantities of petroleum, which are estimated, on a given date, to be potentially recoverable from known accumulations, but which are not currently considered to be commercially recoverable. Contingent Resources may be of a significant size, but still have constraints to development. These constraints, preventing the booking of reserves, may relate to lack of gas marketing arrangements or to technical, environmental or political barriers.

Table 1 summarises the estimates at the end on 2000 and 2001.

## Exploration Results in 2001

A total of 50 exploration wells were drilled in 2001 for a cost of \$150.8 million. The program achieved an overall success rate of 52%.

The exploration highlights for 2001 were:

- Successful offshore wildcat discovery Oyong-1 in the East Java Basin, Indonesia and Corowa-1 in the Carnarvon Basin.
- Successful testing of stratigraphic traps in the Cooper Basin resulting in the Wellington and Crowsnest gas discoveries.
- A significant discovery, Henderson-1 in the Frio Trend of South Texas to follow on from the Runnells discovery in 2000.

Reserves Category	Year End 2000	Production	Revisions	Exploration/ Appraisal/ Acquisition adds	Year End 2001
Proved (1P)	(a)	-56	(a)	17	316
Proved and Probable (2P)	921	-56	-169	28	724
Proved, Probable and Possible (3P)	1,260	-56	169	105	1,478
Contingent Resources	687	-	29	474	1,190
(a) Not calculated					

Table 1.

BASIN/AREA	Wells Drilled		Successful Wells		Success Rate %
	Gas	Oil	Gas	Oil	
Cooper	16	5	13	1	67
East Qld	5	2	3	0	43
Otway	5	0	5	0	100
Carnarvon	0	4	0	1	25
Bonaparte	0	1	0	0	0
Browse	0	2	0	0	0
East Java	5	0	1	0	20
USA	5	0	1	0	20
<b>TOTAL</b>	<b>34</b>	<b>16</b>	<b>22</b>	<b>4</b>	<b>52</b>

Table 2.

- 3672 km of 2D seismic and 3891 km<sup>2</sup> of 3D seismic were acquired or purchased.

A summary of the wells drilled are is shown in Table 2.

## Gold price continues to rise - but Australian production continues to fall

The increase in the gold price to over \$320 at the end of May provided an unexpected boost to the gold sector. The fluctuations in the price of gold have always been enigmatic. Since the heady days of 1979/80 when gold reached ~\$800/oz there has been a gradual decline in the price (see Figure 1). The downward trend has been caused by the strong \$US and the increase in world gold production, which has gone up from about 1000 t/yr in 1980 to the current level of close to 2500 t/yr. The increase

in production has been mainly due to improved technologies for gold extraction and a five-fold increase in the 'Rest of the World' production outside the big four of South Africa, US, Australia and Canada (Figure 2).

However, commentators citing the weak \$US and the conflicts in the Middle East and Kashmir are not telling the

*Continued on page 30*

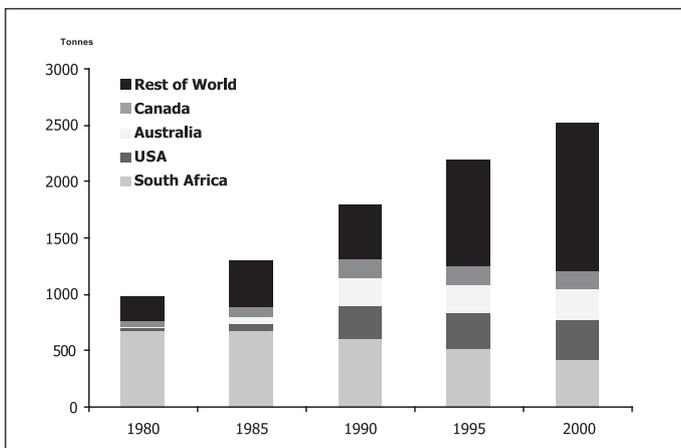
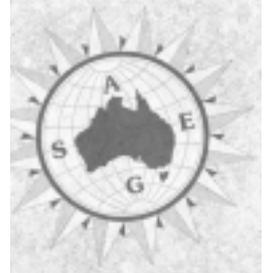


Fig. 1. Gold price since 1979 based on monthly averages (from Jessica Cross's presentation 'The Impact of Derivatives on the Gold Market', at the 2002 ABARE Outlook Conference in Canberra).

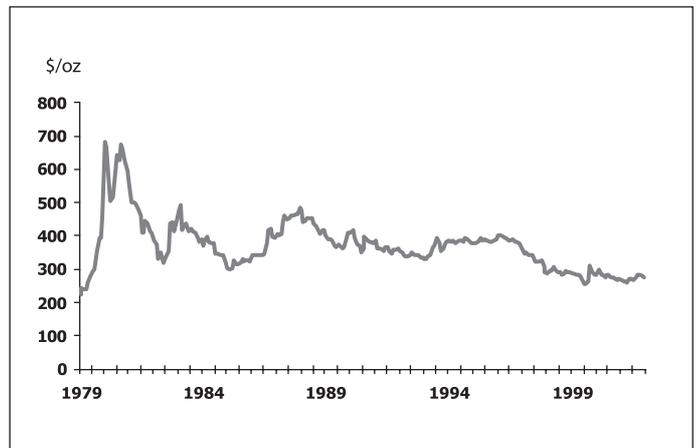


Fig. 2. World gold production from 1980 (from Jessica Cross's presentation 'The Impact of Derivatives on the Gold Market', at the 2002 ABARE Outlook Conference in Canberra).

By Kenneth S Deffeyes

Princeton University Press, 208 pages  
Price \$57  
ISBN 0-691-09086-6

Reviewed by  
David Denham

## Hubbert's Peak: The Impending World Oil Shortage

In 1956, geophysicist M King Hubbert predicted that US oil production would peak in the early 1970s. Although he was widely criticised by many "experts" at the time, his prediction came true in 1970.

Kenneth Deffeyes, who worked with King Hubbert when they were both worked for Shell in the 1960s, uses the same methods to predict that world oil production will peak in about 2005. Because 2005 is almost upon us and because none of the leading politicians, particularly in the gas guzzling US, have faced this issue, he forecasts a short-term catastrophe of soaring oil prices, global economic disturbances and political chaos.

Although these messages form the climax to the book it really has a lot more to offer. In fact if one were looking for a single easy-to-read book that told you all you needed to know about the oil industry in 200 pages, this would do very well.

It starts off with an excellent summary on the origin of oil, then discusses how it finds its way into reservoirs and traps, before going on to how to find it and how big the oil fields are. It is not until page 133 that Deffeyes discusses the Hubbert Peak and the problems associated with the forthcoming oil shortage.

In the first part of the book we learn about the molecular structure of hydrocarbons in terms that even a simple-minded geophysicist can understand. We then learn about the importance of source rocks, how deeply the reservoirs were buried and how palaeontology can be used to estimate the maximum temperature experienced by the rocks.

Then he moves on to Archie's laws, which relate electrical resistance to porosity and how the resistance changes as

oil is substituted for water. We even get a simple derivation of the key equations in the Appendix, which also contains a simple derivation of the Hubbert equations used to forecast production rates from oil fields.

The text is easy to read and Deffeyes has a good sense of humour.

Let me just give you an example:

"The concept of permeability, along with the law of fluid flow through a porous solid, was developed in 1850 by Henri Darcy, in Dijon. The flow law is known as Darcy's law, and the unit of permeability is the darcy. (Scientific immortality comes from being shifted to lowercase: watt, ohm, ampere. An einstein is amole of photons.) The darcy turned out to be a rather large unit; the millidarcy, 1/1000 of a darcy, is universally used in the oil fields. (A millihelen is a face that would launch one ship.) Typical oil field language: "We got 80 feet of saturation and two hunnert millidarcies. We're cuttin' up a fat hawg."

The book is also well referenced and the author is not afraid of leading the reader through some of the simple mathematics involved.

I found it to be a worthwhile and enjoyable book, which would make an excellent text for a first year university course, which required an understanding of the oil business and the physics and chemistry involved. Kenneth Deffeyes is someone who has worked for many years in the oil industry, he has many interesting and amusing stories to tell and a wealth of experience and common sense that shines through.

My only concern is the price. \$57 is a bit much for a book that has only 208 pages, even if it is in hard back.

Continued from page 29



whole story because the gold price has been climbing steadily since the first quarter of 2001, long before the current crises erupted. In any case as Figure 3 shows, the September 11 event had a surprisingly small effect on the main trend during the last year.

It is difficult to see the price going much higher because some of the

world's central banks have started to sell their gold stockpiles, but one never knows for sure. The price rise should provide a welcome boost for gold exploration, which has fallen significantly in recent years and resulted in a major drop in production.

Gold production in Australia for the first quarter of 2002 was 65.7 t. This was 4.5 percent lower than the amount produced in the last quarter for 2001 and 9 percent lower than the corresponding quarter of 2001.

In 1997 the gold production was 317 t. Current trends indicate that for 2002 this will drop to about 263 t, which is equivalent to a loss of about A\$1 billion in export earnings at current gold prices. This trend is likely to continue until there is an increase in exploration investment.

Fig. 3. Price of gold from January 2001, based on daily prices at the London market.