Preview

Australian Society of Exploration Geophysicists

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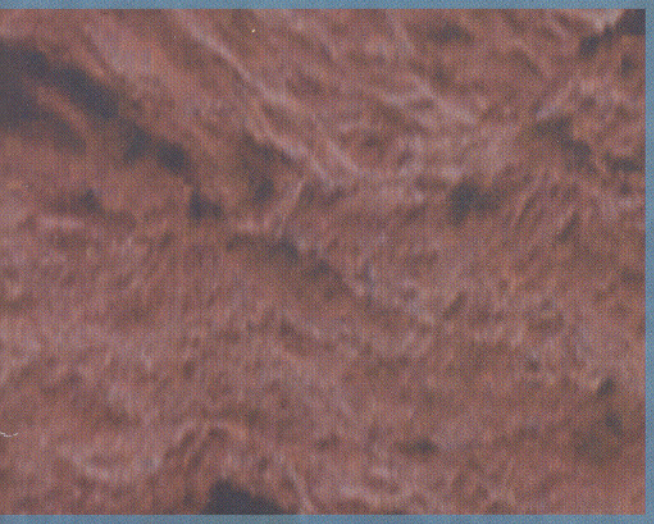
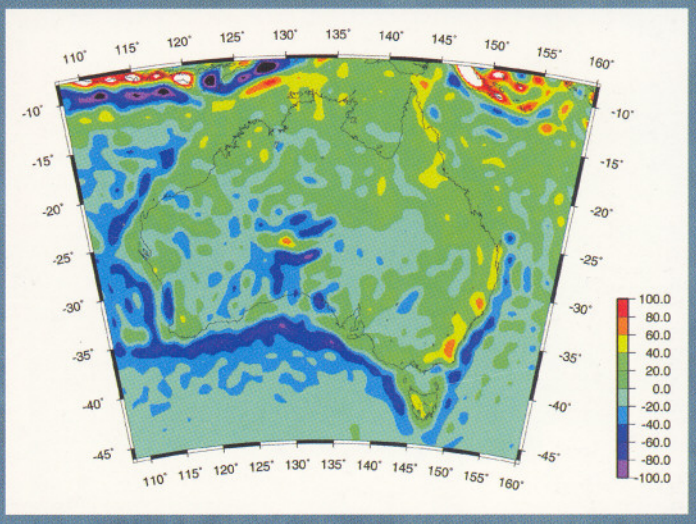
Regional gravity anomalies from global spherical harmonic models





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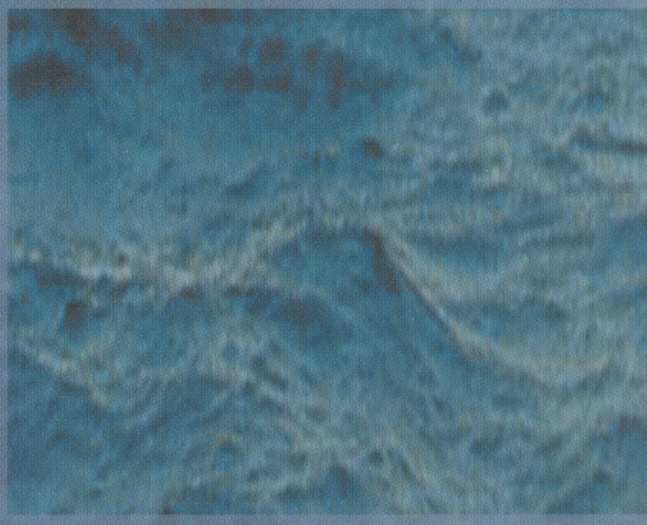

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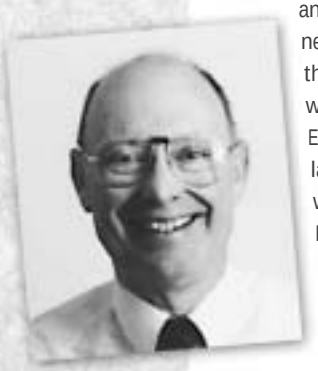


David Denham

New Executive

The new ASEG Executive was duly elected at the May AGM and we welcome President Klaas Koster and his new team on board, who will lead the society through until mid-2004. It is a very strong team, with experienced officers from the previous Executive and some new people who were not on last years' Executive but have served the ASEG well in previous roles. Klaus's first 'President's Piece' identifies some of the main issues facing the ASEG, particularly, in the publication activities. He also describes the great work done by retiring members.

Former President Kevin Dodds stays on the Executive as Past-President, responsible for International links, and Bob White, who seems to have been Treasurer for as long as I can remember, is taking a well-earned break. As you can see from his report in this issue, the Society's finances are in good shape.

In previous years we have published the audited financial statements, but for this year I thought it would be more meaningful to show how the cash ebbs and flows through the ASEG's books. So you can now see in more detail, in this issue of Preview, where our money comes from and where it is spent.

2003/04 Federal Budget

Talking of money brings me to the Federal Budget, which was brought down by Peter Costello in May. There are two items in this year's Budget, which are particularly relevant to the ASEG. The first relates to the science and innovation component, which affects all the federal science and research agencies such as CSIRO, GA and ANSTO.

The second relates to the new tertiary education package: *Backing Australia's Future* which was released by Brendan Nelson, the Minister for Science Education and Training, as part of the budget papers.

We have contained a more comprehensive summary than usual in this issue of *Preview*, because of the importance of research and teaching to our members. The Higher Education package is critical because it is in effect the first substantial review since John Dawkins moved and shook the sector in the 1980s.

In effect, the government is proposing to introduce a new funding formula, which is based more on the cost of courses and on national priorities than the current scheme. However, even with the provision of an additional $1.5 billion in the period 2004-07, students will still be expected to pay more for their courses than they do now. This contribution will, on average, rise to nearly 28% by 2008. The government is also introducing some new scholarships for the less well off and for those who would like to study overseas for a semester. However most of the money does not start to flow until 2006, so there will be not much extra until then, if the package is approved.

The government is also insisting on an end to compulsory union membership at universities, and reforms in the workplace relations environment, before some of the new money will be available. So I can see some battles ahead in the Senate, which may well see the package favouring the wealthy more than it should.

National Strategic Plan for Geoscience

In the meantime, the Australian Academy of Science's Earth Science Committee, under the leadership of Phil McFadden, is finalising the first public draft of a national strategic plan for Australian geoscience. I can say at this time that it will be built around the two core themes of Wealth and Sustainability, and how we expect geoscience to contribute to these priority areas in the next ten years.

However, before the report is published it will be circulated for comment, and I urge members to examine it closely when it becomes available, and provide constructive comments so that we can all support the way forward. Hopefully, we can discuss this in the August Preview.

Until then, enjoy the June issue.

David Denham

Strategic Review

The National Annual General Meeting (AGM) was held in Perth on 14 May. It was preceded by a full day devoted to a strategic review attended by 18 Executive and State committee representatives from across Australia. The intent was to take a step back from the day-to-day running of the society and discuss what we want the society to be in a few years time. One of the most far-reaching changes we foresee is a move away from a quarterly hardcopy version of Exploration Geophysics. This would be replaced by a facility to get a digital version of EG articles to the membership, as they become available. The objectives of this move are three-fold: 1) increased relevance for researchers worldwide through easy access via the internet; 2) reduced cycle time because individual articles are immediately available once they are completed; 3) reduced costs because publishing, printing, and distribution is by-passed. The room was evenly split over the question of whether this move should be completed within three years from now or take longer. It is likely that you will be asked for your opinion on this issue in the near future.

ASEG WA President Kirsty Beckitt presenting Greg Street (left) and Graham Elliott with their Silver Certificates.

Another issue that was discussed was our relationship with other societies. It is possible to formalise this relationship at member level by offering for instance an 'affiliate' membership. This would be a new type of low-cost membership, offered to members of other professional societies, with reduced benefits: e.g. only Preview and notification of technical meetings and other ASEG events. The objective of this initiative is to connect with sister societies and thereby increasing our membership, which in turn would increase our relevance to our industries.

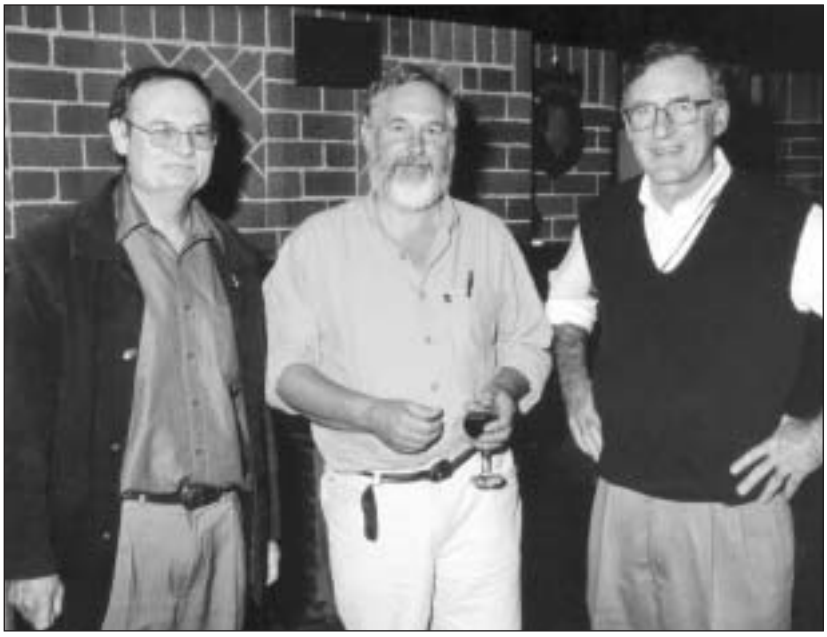
Stephen Mudge

The Annual General Meeting

The AGM itself was well attended: in total some 30 members were present with representation from four State Branches. Greg Street, Graham Elliott and Stephen Mudge were recognised for their continued support of the society over the past 25 years, and Anita Heath received her ASEG Service Certificate. Bob White presented a summary of the society's financial situation. As expected, after the very successful Adelaide Conference we are in good shape financially. However, there is also concern that we are suffering from ever increasing overheads. Kevin Dodds gave an overview of the Federal Executive accomplishments in the last year. Under his leadership two long running initiatives came much closer to successful completion: the drafting of a new Constitution and a Procedures Manual. Although the introduction of these two documents will admittedly have little impact on most members, they are key in the growth of the ASEG into an ever more professional society. The new Constitution will ensure that our society fulfils all legal requirements for an organisation of this kind. The Procedures Manual spells out what the specific responsibilities are of the various people who run the society. Several people were instrumental in the drafting of the Constitution, but Ray Shaw deserves special recognition for his efforts.

Klaas Koster

Left to right: Jenny Bauer (Second Vice-President), John Watts (Treasurer), new President Klaas Koster and Howard Golden (First Vice-President).



Left to right: Andrew Mutton, Bob White and Past-President Kevin Dodds

New Federal Executive

At the end of the AGM the nominated members of the new Federal Executive were elected. The new FedEx saw the following changes: We said farewell to Treasurer Bob White whose able hands were on the financial rudder of the society for the past five years. He has done an excellent job over the years and certainly deserves a great deal of gratitude from the society's members. Kevin Dodds naturally progressed from President to Past-President. The members of the new FedEx in general, and I in particular, will undoubtedly find his advice in the coming year very valuable. Tim Pippett left his position as Past-President and is also commended for his contribution to the FedEx. Tim will continue serving the society as co-chairman for the Sydney Conference. As David Denham already announced in the previous issue of *Preview*, we also saw Andrew Mutton retire from the Publications Committee. The praise he then so deservedly received from David Denham is certainly echoed by the rest of us.

Newly elected were John Watts as Treasurer and Howard Golden as First Vice-President. Both John and Howard are long standing members of the society and are very well regarded in the minerals community. John already served as Treasurer of the WA Branch and is as such an ideal candidate to take over from Bob. Howard was previously active in the Research Foundation. Lisa Vella and Jenny Bauer were re-elected as Secretary and Second Vice-President respectively, and I, Klaas Koster, take on the role of President. We also welcome John Hughes as the new Chairman for the Technical Committee.

As members of the FedEx, we will make sure through reference to a comprehensive business plan, that we continue building the society as described by the strategic review. At the same time we will review the society's costs and particularly its overheads to ensure that the society remains good value for money. Most importantly though, we will make certain the society is relevant for its members by enabling the various committees to provide interesting publications and technical lectures of high quality.

Klass Koster
President

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@webone.com.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. 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 Pty Ltd, 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.

References

References should follow the author (date) system as used by the SEG (see their website for full details). 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: Explor. Geophys., 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 usually the 15th of the month prior to the issue date.

Advertisers

Please contact the publisher, RESolutions Resource and Energy Services Pty Ltd, (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 2003 issue will be 22 July 2003. A summary of the deadlines is shown below:

Preview Issue	Text & articles	Advertisements
105 Aug 2003	15 Jul 2003	22 Jul 2003
106 Oct 2003	15 Sep 2003	22 Sep 2003
107 Dec 2003	15 Nov 2003	22 Nov 2003
108 Feb 2003	15 Jan 2003	22 Jan 2003

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2003

August 31-September 4
9th European Meeting of Environmental and Engineering GeophysicsVenue: Prague, Czech Republic
Website: www.guarant.cz/EEGS

August 31-September 4
EAGE/SEG Summer Research Workshop, Trieste, Theme: the role of velocity models in seismic processing and imaging
Website: www.eage.nl

September 1-4
EAGE Workshop on Fault and Top Seals: What do we know and where do we go? La Grande Motte (France)
Website: www.eage.nl

October 6-9
1st North Africa/Mediterranean Petroleum & Geosciences Conference and Exhibition, Tunis, Tunisia
Website: www.eage.nl

October 13-15
Water in Mining 2003
Theme: The role of water in a sustainable minerals industry
Venue: The Sheraton Brisbane Hotel and Towers
Sponsor: The AusIMM; Website: www.ausimm.com
Email: Conference@ausimm.com.au

October 26-31
SEG International Exposition & 73rd Annual Meeting, Dallas, Texas, U.S.
Email: meetings@seg.org

2004

February 8-13
Geological Society of Australia
17th Australian Geological Convention, Hobart, Tasmania
Theme: Dynamic Earth: Past, Present and Future
Website: www.17thagc.gsa.org.au

March 28 - 31
APPEA Conference & Exhibition
Venue: National Convention Centre, Canberra
Contact: jhood@appea.com.au
Website: www.appea.com.au/Events/AppeaEvents.asp

June 7-11
66th EAGE Conference and Exhibition, Paris, France
Website: www.eage.nl

August 15-19
ASEG, in collaboration with PESA
17th International Conference and Exhibition,
Theme: Integrated Exploration in a Changing World
Venue: Sydney Convention Centre, Sydney NSW
Website: www.aseg.org.au/conference/sydney

October 10-15
SEG International Exposition & 74th Annual Meeting, Denver, Colorado, U.S.
Website: www.seg.org

Honorary Treasurer's Annual Report

The financial statements presented herein for the year ending 31 December 2002 refer to the consolidated funds held and managed by the Society as a whole, including the State Branches. A complete audited version of the Profit and Loss and Balance sheet figures can be seen on the Society's website.

The Society receives funds from membership subscriptions, corporate sponsorship, publications sales, subscriptions to publications, publications advertising, surpluses from conventions, meetings, and income from accumulated investments.
These funds are used to promote, throughout Australia, the science and profession of geophysics. This was achieved during 2002 by:

- Publishing Exploration Geophysics and Preview;
- Paying capitation fees for the administration of State Branches;
- Funding the national administration of the Society;
- Funding continuing education programs;
- The provision of loans and grants for conventions and meetings and;
- Contributing to the ASEG Research Foundation.

The Profit and Loss account for the year shows a loss of $15,462 (see table below). The Balance Sheet indicates the retained surplus decreased during the year from $613,213 at 31 December 2001 to $597,751 at 31 December 2002. This loss was anticipated in the budget and represents the operating loss when no surpluses from conferences are available.

Publications were the largest expense for the Society, amounting to $181,966 ($257,728 in 2001). After income, this resulted in a loss from publications of $70,650 for the year.

The Society has budgeted for a surplus in 2003 of $147,000. This surplus is mainly from the Adelaide Conference.

The costs of running the society have been steadily rising over the last 20 years, with outsourcing of many of the functions previously undertaken by members on a voluntary basis. It is hoped that this expense will result in increased service and satisfaction to the membership.

The Society is in a sound financial position going into 2003, but careful long term planning and management are needed if the Society is to continue grow.

R.M.S. White
Honorary Treasurer

ASEG Profit and Loss analysis for calendar years 2001 and 2002[1]

Item	2002	2001
Income		
Functions and Conferences	2,075	24,213
Brisbane 15th Convention	15,824	759,359
Publications	111,316	176,197
Memberships	117,565	120,153
Other income	26,088	17,257
Total Income	272,868	1,097,179
Expenditure		
Functions and Conferences	1,244	9,867
Brisbane 15th Convention	64	512,879
Publications	181,966	257,728
Capitation	5,842	7,540
Research Foundation	22,500	0
Secretariat Fees	52,000	55,589
Insurance	9,053	4,573
Merchant fees	4,975	5,974
Miscellaneous	10,686	9,747
Total Expenditure	288,330	863,897
Profit/(loss)	(15,462)	233,282

[1] *The numbers in this table are a summary of the information provided by the Treasurer in April 2003. The audited accounts will be slightly different. (Ed.)*

Options for employers?

Do you need part-time, full-time, casual or temporary staff? A recent graduate or final year student could be the answer. Capable graduates are keenly sought after by many major commercial organisations. Typically graduates are:

- Hard working;
- Flexible;
- Competent; and
- Keen to establish themselves.

They offer your business:

- A well-trained, analytical mind;
- An intelligent, enthusiastic individual to fit your organisation's culture and expectation;
- A fresh perspective; and
- The potential to be one of your leaders of the future.

Designing newspaper advertisements, costs of advertising, targeting the right people, dealing with unsuitable applications, organising and scheduling interviews etc. are just a few of the onerous thoughts that go through the minds of employers when they contemplate recruiting staff.

But wait; does it have to be like this? Definitely not!

Every university provides a careers service, the staff of which will be more than willing to help your business grow by facilitating your recruitment of students and graduates.

These services aim to assist all companies regardless of their size. The Careers Service staff will provide advice on the best methods of targeting students, whether it be advertising your vacancy via notice boards, the internet, newsletters, and mail outs, or providing space to conduct interviews and organising the scheduling of interviews – either as part of their campus interview program or at other times. No matter what level of qualification you require, you will find the promotion of your company and vacancies to be convenient and cost-effective

In addition to the above, careers services are able to provide:

- An opportunity for companies to maintain a presence on campus throughout the year by holding copies of your annual reports, brochures, company outlines, product or service manuals or newspaper cuttings in their careers resource area;
- An opportunity for you to give a presentation to students about your firm or organisation;
- Contact with staff who have responsibility for coordinating industry placement of students as an essential requirement of their degree; and
- A facility of direct mail-outs to students in particular courses and/or majors.

This is a service that has been very successfully used by large employers for some time. Realising the opportunity to become multi skilled many students appreciate the benefits of working for smaller organisations, so would welcome the opportunity to speak to representatives from these organisations.

So if you are thinking of recruiting a graduate a university's Careers Service should be your first port of call.

This contribution has been written by Malcolm McKenzie, Manager, Careers Service, University of Technology, Sydney. Any enquiries can be directed to him on 02 9514 1471 or Email: careers@uts.edu.au

New Members

We welcome the following new members to the ASEG. Membership was approved by the Federal Executive at its meetings on 2 and 30 April 2003.

Name	Organisation	State
David Ross Burbidge	Geoscience Australia	ACT
Bronwyn Michelle Calleja	Halliburton Australia	WA
Barry A. Goldstein	Petroleum Group, PIRSA	SA
Jhana Hale	University of Tasmania	Tas
Jason Scott Parker	Velseis Pty Ltd	Qld
Christopher James Parker	University of Tasmania	Tas
Brigitte Sarah Petrie	Mineral Deposit Research Unit	Canada
Claire Robertson	Curtin University	WA
Christopher John Robinson	Hematite Consultants	Vic
Carina Mai Simmat	University of Sydney	NSW
Hugh Christopher Tassell	University of Tasmania	Tas
Michael Wilkins	Woodside Petroleum	WA
Scott Wilkinson	Woodside Petroleum	WA

Beverley Ronalds to head CSIRO's Petroleum Division

Professor Beverley Ronalds has started her appointment as Chief of CSIRO's Petroleum Resources Division. "Professor Ronalds has a distinguished career, both in research and in the application of that research to solving industry problems," said CSIRO Chief Executive, Geoff Garrett.

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Former Director and Woodside Chair with the University of Western Australia's School of Oil and Gas Engineering, Professor Ronalds has extensive industry experience including design, installation and operations support for fixed and floating offshore platforms, in the Australian North West Shelf, the North Sea and the Gulf of Mexico.

CSIRO Petroleum is a significant provider of research, technology and associated services within the global petroleum industry, employing about 150 staff operating across three sites in Perth, Sydney and Melbourne.

CSIRO Petroleum has its headquarters at the Australian Resources Research Centre (ARRC) in Western Australia, which was a major initiative of the WA Government, CSIRO and Curtin University of Technology.

ARRC, developed in conjunction with the petroleum and mining industries, has more than 200 scientific and technical staff and focuses on collaboration with Cooperative Research Centres (CRCs), universities, resource companies and suppliers.

ARRC's international oil and gas research and development capability has been further consolidated by the recent (Feb) signing of the Global Energy Research Alliance, in which CSIRO Petroleum is a participant.

Professor Ronalds' research interests include offshore structural reliability and production facilities selection, having worked with engineering companies such as Kvaerner Earl and Wright, Ove Arup and Hardcastle and Richards.

Professor Ronalds becomes the second Chief of CSIRO Petroleum since it was created in 1994, the inaugural Chief being Adrian Williams. Greg Thill has been acting in the position for the past 12 months.

ASEG Silver Certificates

Congratulations to the 53 members below who have been awarded ASEG Silver Certificates this year for 25 years of membership of the Society.

Eric Allison	Aberdeen	Scotland
Richard Almond	Gungahlin	ACT
Alan Appleton	Athelstone	SA
Peter Atkinson	Auckland	New Zealand
Jenny Bauer	Brisbane	Qld
Raymond Butler	South Guildford	WA
Roger Caven	Gibsons, BC	Canada
David Clark	North Ryde	NSW
Robert Cobcroft	Canberra	ACT
David Cockshell	Adelaide	SA
Salvatore Coniglio	Leeming	WA
Bruce Dickson	North Ryde	NSW
Bevan Dockery	Joondalup	WA
Barry Drummond	Canberra	ACT
Ken Duckworth	Calgary	Canada
Peter Elliott	West Perth	WA
Graham Elliott	North Dandalup	WA
Douglas Finlayson	Canberra	ACT
Nigel Fisher	Kenmore	Qld
Kim Frankcombe	Perth	WA
Brian Groves	Toronto	Canada
Peter Hill	Canberra	ACT
Patrick Hillsdon	Bowral	NSW
Kenneth Horsfall	Canberra	ACT
Peter Hough	Adelaide	SA
Tony Howland-Rose	Chatswood	NSW
John Iredale	Toorak Gardens	SA
Chris Johnson	Mapleton	Qld
Tom Kerr	Wushan	China
Jan Klein	Burnaby	Canada
David Lappi	Anchorage, AK	USA
James Leven	Quatre Bornes	Mauritius
Phillip Lock	Melbourne	Vic
David Love	Payneham	SA
Colin Mackie	Wahroonga	NSW
John Major	Canberra	ACT
Andy McGee	Stepney	SA
William McLellan	Gabarone	Botswana
Andrew Mitchell	Adelaide	SA
Alice Murray	Canberra	ACT
Misac Nabighian	Highlands Ranch, CO	USA
Bruce Phillips	Forestville	NSW
Timothy Pippett	Sutherland	NSW
Keith Potts	Cumberland Park	SA
Peter Purcell	Scarborough	WA
Rodger Quick	Darra	Qld
Peter Sceney	Melbourne	Vic
David Searle	Brisbane	Qld
Nick Sheard	Brisbane	Qld
Barry Smith	St Ives	NSW
Greg Steemson	Kalamunda	WA
Gregory Street	Cottesloe	WA
John Sumpton	Bassendean	WA

ASEG Members receive Centenary Medals

On 21 April 2003 the Prime Minister announced the awardees of the Centenary Medal.

This medal was created to recognise the achievements of a cross-section of the Australian community at the time of the centenary of federation and to prepare for the

Cont'd on page 11

Australian Capital Territory - by Ben Bell

On 26 March, the ACT Branch of the ASEG held its AGM in Geoscience Australia's main meeting room. The 2003 Committee was elected as follows:

President:	David Robinson
Vice President:	Eva Papp
Secretary:	Benjamin Bell
Treasurer:	Trevor Dhu:
Committee Members:	Peter Milligan, Alice Murray, Nick Rawlinson, and Jacques Sayers.

The first meeting of this new committee occurred on 11 April where the discussion revolved around the key topics of promoting the ASEG to university geoscience students and identifying potential speakers for the Branch's monthly meetings. A number of presenters are consequently being pursued and the ACT Branch membership should expect the high calibre of technical presentations to continue over the coming year.

An example of the relevance and quality of the technical sessions to ACT Branch members is the presentation given by Ken Lawrie in March. Ken spoke about the latest CRC LEME research on mapping salinity and groundwater through a multi-disciplinary approach based on the integration of geophysics with regolith geoscience. This seminar is timely given the attention land-use and environmental issues are currently receiving in the political arena and the increased funding governments are dedicating to this field.

Twenty-seven members also took advantage of Dr Dubrule's Distinguished Instructor Short Course on Geostatistics for seismic data integration in Earth models, which the ACT Branch of the ASEG coordinated on 5 May in collaboration with the SEG and EAGE. Covering such topics as the use of geostatistics for interpolation and uncertainty quantification, the course enabled participants to have an increased appreciation of the added value geostatistics can contribute to the construction of Earth models.

New South Wales - by Michael Moore

The NSW Branch held its Annual General Meeting in conjunction with the April gathering. Last year's office bearers were unanimously re-elected for 2003, they are:

President:	Steve Webster
Secretary:	Michael Moore
Treasurer:	Roger Henderson

The AGM was followed by two very informative presentations on recent results of borehole radar imaging research conducted at Sydney University. Naomi Osman, a recent PhD graduate, discussed the issues of 3D interpretation in borehole radar imaging, while Carina Simmat presented a field example of borehole radar in use at a South African Platinum Mine.

Activities for May included a joint PESA-ASEG (NSW Branch) golf day and a presentation by Julian Vrbancich

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challenges of the new century by honouring persons who have contributed to Australian society or government.

Congratulations to ASEG members: Andy Green, Stewart Greenhalgh, Ken McCracken, Bob Smith, Brian Spies and Keeva Vozoff who each received a medal.

As the Prime Minister stated, "This is an important medal and it is desirable that contributions made during the centenary year especially by those who helped make it a memorable time in the life of the nation be recognised.

The contribution may have been to the local community, a region, a particular activity or profession. Many who are being recognised have served selflessly and without regard for personal recognition for lengthy periods on a voluntary basis through, amongst other activities, the elderly, youth, rural fire service and emergency services, veterans and their families and indigenous Australians. The medal is also being awarded to those whose achievements have made a national or international impact through science, research or the arts."

The citations for the ASEG members are given below:

Andrew Ashley Green	For service to Australian society in geophysics
Robert James Smith	For service to Australian society in geophysics and mineral exploration
Stewart Alan Greenhalgh	For service to Australian society in geophysics
Kenneth Gordon McCracken AO	For service to Australian society and science in geophysics
Brian Roy Spies	For service to Australian society in exploration geophysics
Keeva Vozoff	For service to Australian society in geophysics

It is good to see that our discipline of geophysics also gets recognition.

The full list can be found at: http://www.itsanhonour.gov.au/cent/cSearch.cfm.

Cont'd from page 11

(Maritime Operations Division (Sydney), Defence Science and Technology Organisation) on the potential use of airborne EM as a rapid environmental assessment tool.

South Australia - by Graham Heinson

After a brief pause for breath following the 16th ASEG Conference and Exhibition in February, the SA Branch has run an AGM, a monthly meeting and are planning events for the coming year. They have had a change in committee with a new President, Secretary and Treasurer. Their thanks to former President, Andrew Shearer and former Treasurer, Mark Tingay, for their many hours of volunteer work to the ASEG.

The new committee comprises:

President:	Graham Heinson
Secretary:	Tania Dhu
Treasurer:	Dave Cockshell
Committee Members:	Alan Appleton, Iestyn Broomfield, Dennis Cooke, Selina Donnelley, Mike Hatch, Philip Heath, Richard Hillis, Thomas Klopf, Rod Lovibond, Emma Nelson, Kathryn Powell, Doug Roberts, Suzanne Roberts, Andrew Shearer, Mark Tingay and Stephen Tomlin.

Lecturer Olivier Dubrule (right) relaxes at a post-workshop sundowner (sponsored by SRK Consulting) with Professor Brian Evans of Curtin University.

March AGM and 16th ASEG Conference and Exhibition Highlights

Petroleum: *A Desert Seismic Crew of the Future*, John Hughes from Santos

Minerals and Environmental: *Salinity Monitoring of the Murray River using a Towed TEM Array*, by Brian Barrett, Graham Heinson, Michael Hatch and Andrew Telfer, from the University of Adelaide, Zonge Engineering and Australian Water Environments.

April Meeting: *Developing a Pore Pressure Prediction Strategy in a Tertiary Delta: An Example from the Baram Delta Province, Brunei*, by Mark Tingay, NCPGG (Sponsored by Santos).

May Meeting: *The business side of the resource sector*, by Michael Whiting from Taylor Collison Ltd.

Events have been attended (35-40 people) by a broad cross section of the geoscientific community and it was encouraging to see large numbers of students attending the technical meetings.

Western Australia - by David Heath

The scenic views from the balcony of the King's Park Tennis Club in West Perth are a refreshing change of venue for technical talks. Please stop by on your way home on the first Wednesday of the month for a beer. Refreshments are served at 5:30pm and technical talks begin at 6pm. Dates for meetings are:

2 July- Perth Basin theme
6 August
3 September
7 October

April saw presentations by award winning speakers Boris Gurevich on *A new model for fluid substitution in fractured reservoirs* and visiting academic Hermann Maurer with *Psychic Phenomena, Magic and Technology*. Professor Maurer demonstrated how direct projection onto our retinas and virtual reality will reduce the need for lugging computer hardware around, as virtual keyboards and larynx microphones record, reinterpret and send our messages to a computer clipped to our belt. He also reminded us that miracles of science have happened in the past – and will happen again – to turn our lives upside-down. But if he knew what the miracle would be, it wouldn't be a miracle!

In May Graham Jenke presented: *Nuclear Magnetic Resonance: Applications for Groundwater Exploration in Queensland*. Ann-Marie Anderson-Mayes gave a talk entitled: *A conceptual framework for interpretation of airborne geophysical data*. The month also saw a successful DISC workshop given by Olivier Dubrule and attended by 60 people. The Branch is grateful to Landmark, SRK,

Hampson Russell, Petrel and Roxar for providing displays and sponsorship.

The ASEG WA Branch has initiated a student mentor scheme. It is designed to assist students in understanding the profession they are joining. Mentors from industry are asked to give up a little of their time to provide students with an idea of the real-world responsibilities and tasks of a geophysicist. They will also be asked to give professional guidance with future decisions made during the year. The first Mentor BBQ was held at Curtin University on Friday 9 May.

Victoria - by Jim Cull

Retirement Dinner - Lindsay Thomas

The retirement dinner for Lindsay Thomas was a major highlight in the social calendar for the Victorian Branch in 2003. The Kelvin Club was suitably decorated for this event involving many of the major personalities from the ASEG membership in Melbourne. Many members have long memories and this was an occasion to spill the beans on the many adventures of a close colleague and friend. Even spouse Jan had to join the queue struggling for air-time with all too ready to share their experiences and observations involving the many foibles and adventures of Lindsay Thomas.

Notable among the speakers were Jim Cull and Paul St John, while a highlight was the off-the-cuff address by Colin Kerr Grant, Lindsay's predecessor and colleague. Among former students present were Marion Rose, who was in his first class with Terry Lee and Geoff Pettifer, through to Steve Bos and Rich Griffin (Honours 2001).

Lindsay was awarded a PhD in 1968 from the University of Adelaide, for studies in the dispersion of seismic surface waves (see Rayleigh Wave Dispersion in Australia: Seismol. Soc. Am. Bull., 59, 167-182, 1969. His original BSc and BSc (Honours) degrees were also from the University of Adelaide, where he majored in Physics and Applied Mathematics. As a result Lindsay was well equipped to entertain a generation of students thinking about career options within the exploration industry.

After his PhD in 1968, Lindsay joined the University of Melbourne as a lecturer in geophysics in the Department of Geology (now the School of Earth Sciences). He continued in that role until his recent 'retirement' in 2001. During that period he supervised several higher degree students and approximately 60 honours students, many of whom are now leaders or disruptive powers in the profession. As well as providing supervision for students, he has been personally involved in a broad range of innovative projects in almost all areas of geophysics.

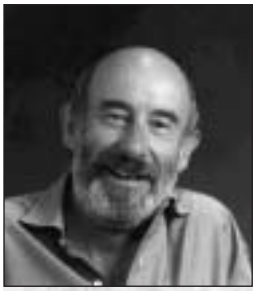
During the early 1970s, he became interested in the geophysical (mainly gravity) responses of the Newer Volcanic eruption points in Victoria. At the same time he was also involved with experimental determinations of earth tides and their global response. During the late 1970s Lindsay became directly involved in the emerging field of electromagnetic methods in Australia with major impacts on electromagnetic modelling, both physical and numerical. At the same time he has been an enthusiast for new technologies in computing, IT and GIS, which are central to modern geoscience. As a result he became a major resource for the development of Geomatics at Melbourne.

Lindsay is a well-known enthusiast for VIEPS (The Victorian Institute for Earth and Planetary Sciences), which was formed as a joint venture between Melbourne, Monash, and Latrobe Universities. It provides a forum for collaboration and co-operation notably in coursework options for students at postgraduate level. Of course different lecturers at each university operate in different ways and the grades awarded can be highly variable.

Lindsay 'volunteered' to sort out this mess and bring order out of chaos. VIEPS is now widely regarded as a model for higher education in Australia thanks in large part to Lindsay's work. Even after his retirement Lindsay has continued in the role of course co-ordinator for VIEPS and finds time to provide lectures as required.

In the broader professional community Lindsay has always been a willing volunteer for committee work of benefit to geophysics in Australia. He is a long-standing member of the Victorian ASEG executive assisting as treasurer for many years. In addition, he is well known for his attention to detail and positive feedback to authors in numerous editorial roles. Lindsay has always enjoyed potential field theory but he has also made many other original contributions particularly in TEM applications. Anyone who can follow and contribute to Terry Lee's derivations must know his stuff. Lindsay has now agreed to suffer additional burdens for ASEG in the role of Managing Editor for *Exploration Geophysics*.

Lindsay has always been great company on numerous field trips with students and colleagues. He has managed to avoid indulging (at least in public) in his passion for opera and maybe the classics by campfire do sound OK after a bottle of port goes down. Lindsay will continue working with his many friends in the ASEG (and the broader profession) and he will even assist with teaching through VIEPS, so maybe this is a Clayton's retirement.



Lindsay Thomas

2003 Budget delivers more for Science and Innovation, but new Higher Education package creates some controversy[1]

[1]*The main sources for this contribution are the 2003/04 Budget Portfolio Statements, the Science and Innovation media release by Ministers Nelson and McGauran, the 'Our Universities; Backing Australia's Future', document and the NTEU budget summary.*

Science and Innovation

The 2003/04 Budget will deliver a $437M increase in support for Australian science and innovation. This increase brings the total Commonwealth support to for this sector to $5.43 billion, equivalent to 0.68% of the GDP, which is the highest it has been since 1996/97.

The new funding for the 'Backing Australia's Ability' program has been delivered in full. As a result, the Australian Research Council as well as the Cooperative Research Centres have received a total increase of $104M in 2003/04. The main outcomes for the larger Commonwealth science and research agencies are given below and a summary is shown in Table 1.

CSIRO

Although CSIRO received a $20M one off contribution to its new flagship programs, its future is not clear. The next triennium funding agreement has essentially been put on hold pending the findings of a review into funding models applied to Commonwealth research agencies. The government is looking for arrangements that will bring the universities and the government agencies closer together to enhance collaboration.

At the same time, the external earnings targets appear to dominate the organisation. According to the budget papers, CSIRO is expected to increase its external earnings from 30% ($285M) in 2002/03 to 42% ($435M) in 2006/07. This might not be too bad, but it is finding it more and more difficult to meet its targets. The 2002/03 budget papers gave a target of $303M for external earnings but in the 2003/04 budget papers the outcome for 2002/03 is given as $285M. The difference will not even be covered by the extra Flagship Program funding and will result in a cut to it's work program.

Furthermore, the increased emphasis on short-term tactical research is likely to lead to a decline in the longer-term public good strategic research and a distortion of CSIRO's program. It is to be hoped that this situation will be rectified, and we will await the outcome of the funding reviews, announced in the Budget, with interest.

Australian Research Council

The total expected appropriation for the ARC in the 2003-04 Budget is $426M, comprising $414M from the NCGP and $12M from DEST to administer the program. The ARC is now the second largest research agency in Australia, thanks to the boost in funds as a result of the Backing Australia's Ability program and funding is scheduled to rise to $573M in 2006/07.

The National Health and Medical Research Council

The NHMRC consolidates within a single organisation the functions of research funding and development of advice. Its budget for 2003/04 is $378M, which represents an increase of $39M over the previous year.

Defence Science and Technology Organisation

DSTO is one of Australia's largest research agencies, it has a budget of $355.3M in 2003/2004, but the increase over the previous year is only about 2.5 percent, so it has not done well in the competition for operational funds within the Defence Department.

Bureau of Meteorology

The Bureau of Meteorology did well in the Budget with an additional $62M being committed (over four years) to upgrade its weather radar network and a $31M boost over four years to improve its weather forecasting facilities. It does not have to bear a large external earnings target. The budget papers indicate that this will be held at about $14M/year through 2006/07. The government appropriation for 2003/04 will be $192M.

Australian Nuclear Science and Technology Organisation

ANSTO has a total appropriation budget of $219M. In summary, it receives $79M as capital funding for the new reactor and an additional $18M to upgrade the security upgrade at Lucas Heights. However, according to the forward estimates it appears that the operating budget provided by the Commonwealth will decline to $111M in 2005/06 (see the Table 1 above).

Geoscience Australia

Geoscience Australia did very well, with an increase of $61M over four years. This funding will be used to undertake geoscience research programs aimed at identifying new frontier areas for petroleum exploration. The additional funding will also be used to preserve the deteriorating seismic archives that are held by GA.

Without new oil discoveries, Australia's oil output is likely to fall by 40% over the next 10 years (see Bruce Hobbs article in Preview, April 2002), and this will result in an additional import bill of around $5 billion per year. GA is also not being burdened by external earnings targets; these will remain at about $12M through 2006/07.

The Australian Greenhouse Office

The AGO is the leading Commonwealth agency on greenhouse issues. It is responsible for promoting a whole of government position on greenhouse issues to the broader domestic and international community.

Agency	Government appropriation in $M				Comments
	2002/03	*2003/04*	*2004/05*	*2005/06*	
CSIRO	532	568	561	572	See text above for comments on CSIRO's budget.
ARC	363	414	483	561	Increases due to implementation of Backing Australia's Ability programs.
NH&MRC	339	378			Forward estimates not available.
DSTO	346	355			A 2.5% increase, a cut in real terms from 2002/03 to 2003/4. Forward estimates not available.
CRCs	149	202	205	267	Numbers from BAA for forward estimates.
BoM	162	192	195	201	Increased funding in2003/04 for upgrade inweather forecasting equipment and replacement radar stations.
ANSTO	182	121	114	111	Government appropriation from portfolio statements.
GA	86	96	100	104	Increased funding for petroleum promotion program in 2003/04.
AGO	73	108	91	85	Core appropriation will reduce to $61M in 2006/07.
AntarcticDivision	84	87	87	88	No new money, but $69M committed over four years to improve transport facilities.
AIMS	24	22	23	23	Will be amalgamated with the James Cook University in 2003/04.

Table 1. A summary of appropriations for the main Commonwealth-funded science agencies.

However, although it had an increased appropriation in 2003/04 Budget, to $108M, the future years do not look good with the forward estimates indicating a fall to $61M in 2006/07. It is not clear what this means in the context of outputs in its work program.

Antarctic Division

The Antarctic Division of the Department of the Environment and Heritage is responsible for Australia's commitment to the protection of the Antarctic as well as conducting world-class Antarctic scientific research. The 2003/04 Budget provides for an appropriation at similar levels to last year and a commitment to invest $17.4M into new shipping support to supply our permanent bases. The annual appropriation of $87M remains constant for the next three years.

Australian Institute of Marine Science

AIMS mission is to generate and transfer the knowledge to support the sustainable use and protection of the marine environment through innovative, world class scientific and technologies research. The basic operating budget has been reduced in 2003/04 by approximately but it will receive additional funds for the Major National Research Facility in Darwin ($3.25M); for facilitation of affiliation with James Cook University ($2.9M); and to finalise refurbishment of AIMS facilities ($2.1M).

The newly affiliated body will be called The Australian Institute of Marine Science at James Cook University.

Backing Australia's Future: the Nelson reforms to higher education

The Minister for Education Science and Technology, Brendan Nelson, announced $1.5 billion worth of additional funding for higher education over the period 2004 to 2007. However, most of the new funding will be provided in the later half of the package, as can be seen in Table 2.

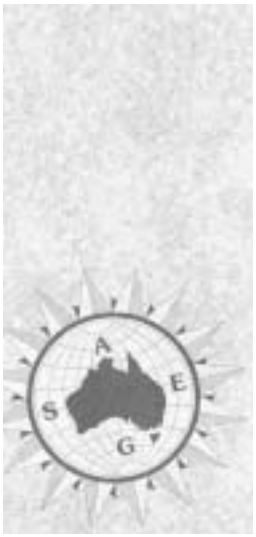
In addition, the Government has announced a series of policy reforms, with much of the funding being conditional on universities compliance with workplace relations and governance reforms.

A brief overview of the changes is given below.

New Funding Mechanism

The Government is moving away from Block Operating Grants to a new funding system called Commonwealth Grants System (CGS). Under CGS the Commonwealth will provide each university with a fixed amount of funding per student (see Table 1 for estimated contributions for different clusters of students) on top of which each university will set its own fees (capped at 30% above the 2005 equivalent HECS charge).

The level of Commonwealth contribution varies between discipline areas grouped into 12 clusters (this model is



Expenditure by Commonwealth ($M)	2004	2005	2006	2007	2004-2007
Commonwealth Course Contributions	0.0	61.6	133.5	209.2	404.3
Transition Fund	0.0	12.6	0.0	0.0	12.6
Regional Loading	27.9	30.3	31.5	32.9	122.6
Conversion of Marginal Places	0.0	64.8	118.7	164.1	347.6
Growth Places	11.9	0.0	0.0	10.9	10.9
National Priorities	11.2	47.5	49.8	51.8	161.0
Commonwealth Scholarship Program	0.0	30.0	49.8	70.8	161.8
Learning and Teaching Initiatives	0.0	0.0	79.3	108.9	188.2
Equity Initiatives	0.3	5.4	7.1	9.1	21.9
Workplace Productivity Program	0.0	0.0	27.3	27.9	55.2
Collaboration and Structural Reform Fund	0.0	6.5	6.7	6.8	20.0
Quality Initiatives	0.0	0.9	0.9	0.9	2.7
Higher Education Information Management System	4.3	5.4	5.1	5.3	20.1
Implementation on costs	10.2	0.0	0.0	0.0	10.2
Marcus Oldham	2.1	0.0	0.0	0.0	2.1
HELP Programs	0.0	-15.7	-23.4	-37.2	-76.3
Total	67.9	249.3	486.2	661.1	1464.5

Table 2. Major funding elements in new Higher Education package.

essentially that proposed by the Australian Geoscience Council, in its submissions to the Review).

Table 3 shows the 12 clusters, the estimated level of the Commonwealth contribution in 2005, the maximum fees universities will be allowed to charge, and funding per student, assuming the university fee is the same as the HECS charge.

All of the data presented in Table 3 are 2005 estimates. For example, in 2005, for every science student enrolled at a university, the Commonwealth contribution will be $12,303. The university has the option of adding its own fee on top of Commonwealth subsidy. The fees for science students (which is where geoscience will fit) will then range from $0 to $7,137. The $7,137 cap represents a 30% top-up over and above the 2005 equivalent HECS charge. Therefore the amount of revenue a university receives for each science student will be in the range between $12,303 and $19,440 depending on the fee the university imposes.

CGS Loading for Industrial Relations and Governance Reform

The package includes loadings to CGS contributions of 2.5% in 2005 (included in the estimates presented Table 2), 5% and 7.5% in 2006 and 2007 respectively. The loadings are over 2004 notional contribution levels. The total value of this component of the funding package is estimated to be $404M over the three years from 2005 to 2007.

The loadings are however, conditional on universities achieving certain workplace relations and governance reforms, the exact details of which are yet to be determined.

Summary of other major measures

Workplace Productivity Program

Funds totalling $55.2M over two years from 2006 will be for institutions committed to workplace reform, and contingent on implementation of flexible working arrangements, improved productivity and performance.

Higher Education Loan Program (HELP)

This program will incorporate the current HECS and two new loan schemes. From 2005, universities will set their own student fees within the ranges set by the Commonwealth, and will be allowed to increase the maximum number of full fee payers to 50% of their students. Postgraduate and undergraduate full-fee payers will be able to access the new FEE-HELP loans scheme borrowing up to $50,000, and indexed to the CPI plus 3.5% each year for a maximum of 10 years, before returning to the CPI indexation. The repayment threshold will increase insubstantially to $30,000 from 2005.

Fee Paying HELP and Overseas Study HELP

These HELPs will provide loans for students who do not access an income contingent loan scheme (up to $50,000); and for full time undergraduates to study abroad for one or two semesters (up to $5000).

Regional loading

A total of $122.6M from 2004 to 2007 will be provided to regional institutions that face particular disadvantages in changes to the funding model. The CGS, which replaces the current base operating grants, will contribute towards the cost of an agreed number of places in each discipline at undergraduate, postgraduate non-research and enabling course levels. Universities will be classified in one of the four loading bands: Northern Territory (30%), 'distant and small' (7.5%), 'proximate and small or distant and large' (5%), and 'proximate and large' (2.5%). 10,000 EFTSUs and 300 km are the criteria for the size and distance respectively.

Conversion of marginal places

Marginally funded places provided for 'over-enrolled' students will be replaced with about 25,000 new places distributed on the basis of labour market needs, and will cost $347.6M for the period 2004-2007.

Growth places

In 2007, the Commonwealth will provide additional 1400 supported places worth $10.9M to areas of labour market needs, and in negotiation with States and Territories. The details of consultative processes for this are unclear.

National Priorities

Teacher and nurse education are among national labour market priorities. There will be:

- Additional nursing places from 2004 to 2007, worth $40.4M;
- Additional teaching places from 2005, worth $81.4M over three years; and
- No increase in the maximum HECS level for

Cluster	Description	Commonwealth Contribution	2005 HECS	Maximum Fee	Funding per Student with 2005 HECS
1	Law	1509	6427	8355	7936
2	Account Admin, Econ, Commerce	2481	5490	7137	7971
3	Humanities	4180	3854	5010	8034
4	Maths, Statistics	4937	5490	7137	10427
5	Behavioural Science, Social Science	6636	3854	5010	10490
6	Computer, Built Environ, Health	7392	3854	5010	11246
7	Languages, Vis & Perform Arts	9091	3854	5010	12945
8	Engineering, Science, Surveying	12303	5490	7137	17793
9	Dentistry, Medicine, Vet Science	15422	6427	8355	21849
10	Agriculture	16394	5490	7137	21884
11	Education (1)	7278	3854	3854	11132
12	Nursing (1)	9733	3854	3854	13587

(1) Education and nursing are National Priority areas and student fees are capped at current equivalent HECS rate

Table 3. Commonwealth Course Contribution Schedule 2005.

teaching and nursing students, that is institutions will set these fees between $0 and $3,854.

Commonwealth scholarship program

Four new scholarships programs will be means-tested, merit-based, and non-repayable, and costed over the period 2004-2007:

- Commonwealth Education Costs Scholarships (CECS) for students from low socio-economic, rural, and indigenous backgrounds, number 17,630, at $2,000 per year for up to four years, worth $84.4M.
- Commonwealth Accommodation Scholarships (CAS) of $4,000 per year for up to four years for students from rural and isolated areas, worth $75.8M.
- International Scholarships for 30 international students to study in Australia, worth $7.9M.
- Additional $1M a year for Australian language teachers to undertake professional development in the country whose language they teach.
- Additional 31 Australian Postgraduate Awards for postgraduate research students by 2007 and a $1M funding program for young researchers, doctoral and post-doctoral, to participate in international specialist forums in their fields.

Learning and teaching initiatives

- Learning and Teaching Performance Fund of $138.5M for 2006 and 2007 for institutions that choose to focus on undergraduate teaching and learning, with eligibility based on a range of performance indicators.
- National Institute for Learning and Teaching in Higher Education will be formed in 2004 to provide a national framework for improving institutional performance in teaching and learning and perform secretariat functions to the Australian Universities Teaching Committee. It will be funded from 2006 at $21.9M per year.
- Additional Australian Awards for University Teaching will be provided at a cost of $2.7M per year from 2006.

Equity initiatives

- Indigenous Support Fund will increase to a total of $10.4M for 2004-2007, for institutions that can provide evidence of increased indigenous participation.
- Indigenous Staff Scholarships program for indigenous academic and general staff who have actively encouraged indigenous students to participate in and complete their courses, enabling a one-year leave from work to take up full-time university study in their field. Five scholarships will be provided per year from 2004, each covering $10,400 in tuition fees and a non-taxable stipend of $20,900.
- Indigenous Higher Education Advisory Council will be established to advise the Minister and DEST as a formal advisory mechanism with indigenous higher education staff, funded at $260,000 per year, starting in mid- 2003.
- Higher Education Equity Program will be reviewed to develop a new performance-based funding formula. Block grants will not be provided. New funds will total $2.3M per year from 2005.
- Students with Disabilities Program will be increased by $1.1M per year from 2005 for additional institutional infrastructure and services for this equity group.

Collaboration and Structural Reform Fund

This fund will absorb the current Higher Education Innovation Program aimed at fostering collaboration between universities, business, industry, professional and community groups and other organisations. The total of existing and new funds for 2005-2007 is $36.6M.

Quality initiatives

- From 2005, $590,000 per year will go to Australian Universities Quality Agency to conduct audits of offshore programs.
- There will be an extended version of the Course Experience Questionnaire, more intensive use of its qualitative data and a shift towards electronic delivery and publication of results and outcomes.
- Additional $270,000 per year from 2005 will go to promote the Graduate Skills Assessment Test to and expand its use by employers.

Implications of the package

The implementation of the Government's 'reforms' will cost $10.2M in 2004. The centrepieces of the Crossroads package are the proposed workplace relations and governance reforms, the deregulation of student fees, and changes to the funding model for universities. The scope of the latter is still unclear, pending the results of the separate review of research funding schemes.

The positive aspects of the package include initiatives to improve participation in higher education by members of the targeted equity groups, such as students from low socio-economic backgrounds, rural and regional areas, and indigenous communities. Indigenous education in particular is a single area seeing the most significant improvements, especially the support for Indigenous Employment Strategy and additional assistance for Indigenous staff and students.

The most contested aspect of the reforms are changes to industrial relations and university governance, on which much of the funding is contingent. Coupled with the planned introduction of voluntary student unionism legislation, the changes can be seen to represent a move by the Commonwealth to restrict industrial rights of both staff and students.

CSIRO's National Research Flagships Program launched

The 2003/04 Budget included a $20M contribution to boost the CSIRO's Flagship Initiative, which was launched by the Prime Minister on 14 April 2003.

The Flagships Initiative

The National Research Flagships initiative aims to deliver scientific solutions to advance six of Australia's most important national objectives:

- Strong, sustained economic growth, new industries, competitive enterprises and quality jobs;
- Healthier, more productive lives for Australians;
- Clean, cost-efficient energy;
- More productive and sustainable use of water;
- To generate sustainable wealth from our oceans; and
- Growth and prosperity for regional Australia.

Each Flagship addresses two or more of these overarching national objectives, and the initiative as a whole is closely aligned to the Commonwealth Government's National Research Priorities.

The Flagships comprise:

Preventative Health: Australia will have 4M people over 65 by 2020. This Flagship program aims to help Australians live longer, healthier lives through early diagnosis and prevention.

Light Metals: The Light Metals Flagship program aims to help Australia become a world leader in light metals, by increasing exports and reducing the cost and environmental impact of this growing industry.

Healthy Country: A healthy country has thriving urban and rural landscapes, safe and clean air and water, dynamic industries using natural resources wisely and healthy people. The Healthy Country Flagship is aiming for a tenfold increase in the social, economic and environmental benefits from water use by 2025.

Agrifood Top 5: This program aims to transform the international competitiveness of Australian agrifood and add $3 billion per annum through innovative agrifoods and processing technologies.

Ocean Wealth: The Ocean Wealth Flagship program will enhance existing industries and develop new and sustainable products and industries from our seas.

Energy Transformed: The Energy Transformed Flagship program will help position Australia as a world leader in clean, cost-efficient, reliable and secure energy supply and use.
The CSIRO website at http://www.csiro.au/index.asp?type=blank&id=FlagshipPrograms, is worth a visit to find out who is leading the programs and more details of the programs.

It may be worth a small diversion to visit the CSIRO's place in the Outcomes and Outputs demanded by the government in today's world.

There is only one outcome:
The application or utilisation of the results of scientific research delivers:

- Innovative and competitive industries
- Healthy environment and lifestyles
- A technologically advanced society

The four outputs are shown below together with the budgets for 2003/04

Output Group 1
Information Technology, Manufacturing and Services
Total program: $289M
Appropriation: $189M

Output Group 2
Sustainable Minerals and Energy
Total program: $124M
Appropriation: $75M

Output Group 3
Environment and Natural Resources
Total program: $228M
Appropriation: $141M

Output Group 4
Agribusiness and Health
Total program: $248M
Appropriation: $163M

The appropriation number is that provided by the Commonwealth through the Budget. The difference between the two numbers is the target for external earnings. As can be seen, the Minerals and Energy group has a very high target.

Cooperative Research Centres Evaluation

The April 2003 *Preview* reported that a review into the CRC Program was being conducted. It has now been announced that the consulting firm, Howard Partners, has been appointed to conduct the evaluation of this Program.

The evaluation is being overseen by a steering group comprising Geoffrey Vaughan, Chairman of the CRC Committee; Tony Peacock, CRC Association; Ron MacDonald, Convenor of the AVCC's Committee of Deputy Vice- Chancellors and ProVice Chancellors dealing with research; and Paul Donaghue, industry research manager.

Howard Partners has developed a set of specific matters on which they are seeking views and opinions from stakeholders and CRCs. The consultation process will include a series of focus group meetings in capital cities for CRC participants and a questionnaire managed by Orima Research.

Further information is at the CRC Program website at http://www.crc.gov.au or
Email: crc@howardpartners.com.au
Tel: (02) 6273 5222.

Geoscience Australia

New detailed gravity from Broken Hill

Geoscience Australia has conducted (under contract by Daishsat Pty Ltd) a ground gravity survey of 182 stations in the Broken-Menindee area of NSW.

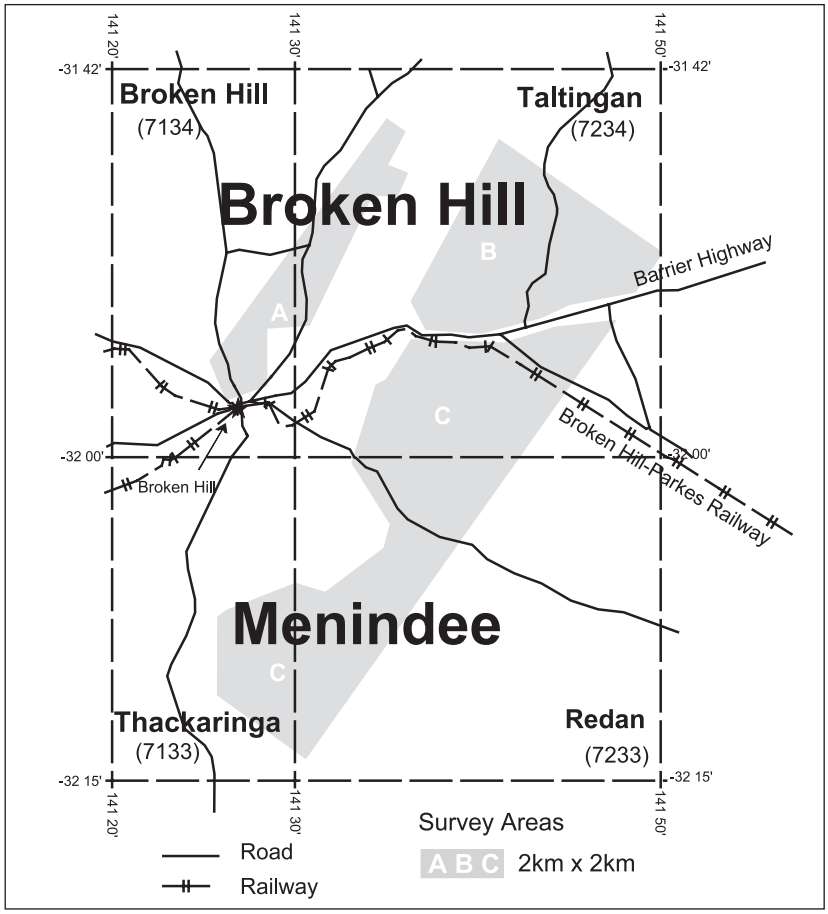
The survey was carried out from 3 to11 May 2003 and covered three areas near Broken Hill at a station spacing of 2 km x 2 km. Figures 1 and 2 show the areas surveyed and the extent of previous gravity surveys in the region.

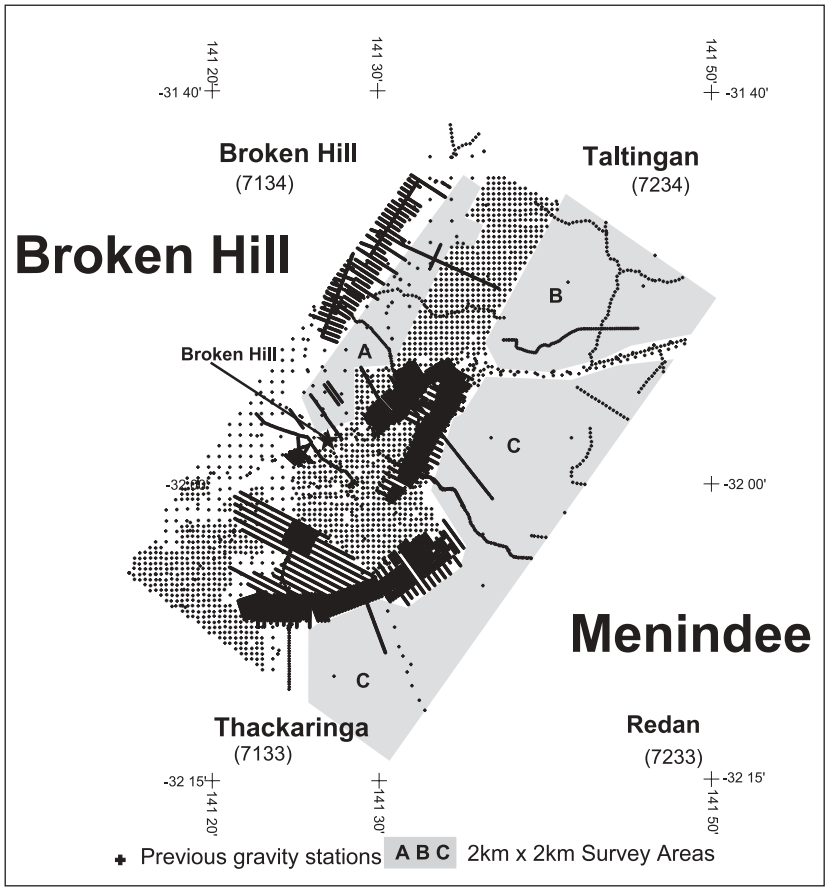
This new data set will supplement the existing data in the Broken Hill region and also ground truth the recent Falcon airborne gravity data, which was acquired over the same area.

The new ground gravity data will be released early in the 2003/04 financial year.

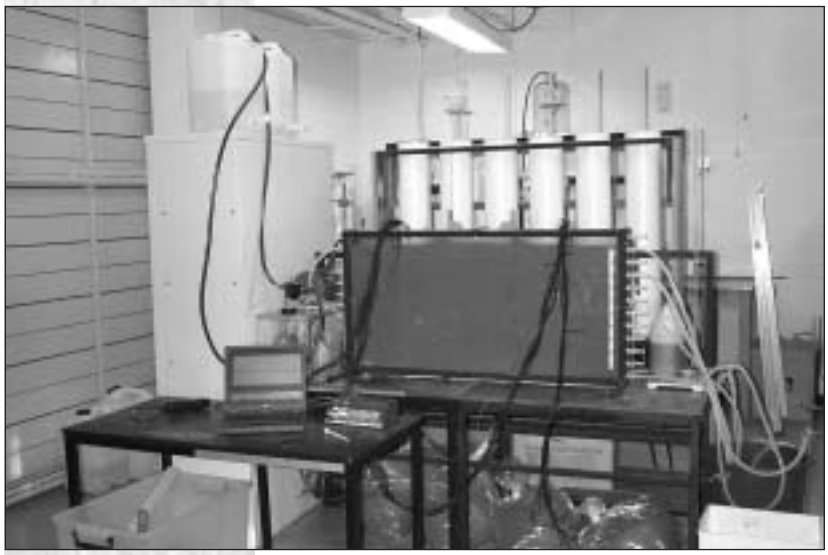
Fig. 1. (right) Locations of the areas A, B & C, which were surveyed.

Fig. 2. (below right) Locations of previously occupied gravity stations near Broken Hill.





ASEG Research Foundation: project results



Tania's lab set up, conducting crosshole resistivity soundings in a controlled tank with a saline plume added. Tania built the electronic system, and worked on visual compared with numerical modelling.

The ASEG Research Foundation has been supporting students in all facets of Applied Geophysics at the BSc (Honours), MSc, and PhD (or equivalent) levels for 13 years. In this issue of *Preview* we complete (see April *Preview* for 1st part) a summary of the research outputs from Honours students at Adelaide University during 2002.

ASEG Research Foundation RF02E01

Project Title: Environmental monitoring using electrical resistivity tomography

Student:	Tania Dhu
Honours title:	Environmental monitoring using electrical resistivity tomography
Host Institutions:	Adelaide University
Supervisors:	Graham Heinson and Stewart Greenhalgh (Adelaide University), Craig Simmons (Flinders University) and Todd Halihan (Oklahoma State University)
Industry Mentors:	Craig Simmons (Flinders University) and Mike Hatch (Zonge Engineering)
Funding:	$3000

Project Summary

Intensive studies have been conducted in the shallow subsurface to develop methods and models to detect the location, predict the movement, and possibly remediate salinity and contaminant problems. Previous studies have relied primarily on two detection and monitoring strategies. The first strategy involves point sampling of fluids using wells or multilevel piezometers whose data is integrated and interpreted by hydrogeologists, civil engineers, and other scientists. The second strategy uses indirect measurements through surface or borehole geophysical techniques.

The difficulty with point sampling techniques is that sufficient sampling can be expensive because of drilling costs, sampling time, sample analysis and data integration and interpretation. For long term monitoring projects, this technique can cost more than either the initial site assessment or remediation. Additionally, this point sampling method can miss saline or contaminant plumes that are transported on flow paths not sampled by wells. This is especially problematic if the fluids are driven as fingers by density differences, or occur in isolated flow paths in a heterogeneous media.

To overcome these detection and monitoring problems, a robust, low-cost, high-speed electrical resistivity tomography (ERT) system is required. An ERT system is an advanced method of obtaining resistivity measurements that determines the electrical conductivity of the ground in two or three dimensions. A single measurement does not yield significant information, similar to a single pixel on a digital photo. However, hundreds of measurements of a site can produce a high quality 2D or 3D image of the subsurface of a contaminated site. This technique has been used for monitoring, but it has either been inefficient or expensive.

Questions considered in this project were:

1. Can an instrument capable of irregular placement of electrodes with high-speed data collection and inversion be developed for solute detection and monitoring, especially in the presence of free convection?
2. What is the correlation is between hydrogeological parameters and the data obtained using ERT?
3. Can an ERT system installation and monitoring be simplified for consultants and regulators, and integrated into current regulatory standards?

Project Outcomes

The principal outcomes of the project were:

1. A numerical study was carried out to assess the optimum location for electrodes in boreholes and on the surface. A uniform distribution was shown to not be optimal; instead, a logarithmically increasing distance from and down the boreholes provided a more even and efficient distribution of current pathways.
2. A laboratory-scale experiment was set up to simulate field conditions with electrodes down hole and on the surface. A monitoring system was developed using the DataTaker800 model with an additional pre-amplifier

Cont'd on page 21

News from FASTS

FASTS has proposed that 100 postdoc positions be established in industry to stimulate investment in R&D. FASTS met with industry representatives and Minister Ian Macfarlane to discuss its proposal for the government to meet some of the costs of employing new PhD graduates in private industry over the first two years of their employment. After the two years, the industry partner and the graduates would be released from their obligations, but the company would be free to offer continuing employment to the graduates. The Minister showed healthy scepticism but acknowledged the benefits of breaking down the cultural barriers between research and industry, and encouraging industry to make use of research to improve existing products and create new ones. FASTS believes it will also create a cadre of people who understand both research and corporate culture well enough to be able to identify and lobby for R&D opportunities in which Australia is competitive against corporate R&D headquarters overseas.

FASTS has invited the Presidents of all its Member Societies to attend an open session at our next Board meetings to be held in Sydney (4/5 August) and Canberra (later in the year). These opportunities for Presidents to meet the FASTS Board will contribute to discussion on issues of importance. It is part of a general push to bring FASTS closer to our Members, which has included the production of a quarterly newsletter sent to all member societies and posted on www.fasts.org.

The U.S. Congressional Science and Technology Fellows Program has been an impressive part of the daily life and decision-making in the US for 30 years. Over 1300 scientists and technologists have participated in the program, bringing their scientific skills to Washington and working within the Congressional system to keep members and senators abreast of rapidly moving events in science. The scientists are attached directly to the staff of senators or members of the House of Representatives, or to Committees attached to either House. This has introduced a source of expertise into congressional deliberations; assisted members of congress become more familiar with policy issues involving science; and helped the scientific and technological community come to grips with the realities of policy-making. FASTS is exploring the adoption of the program in Australia and has arranged a visit by four former Fellows to explain the program to leading figures in the Australian Parliament from 14-21 June 2003. The Americans will also visit a number of major research institutes, to learn more about the range and quality of top-level Australian science. The visiting team comprises:

Rosina Bierbaum, School of Natural Resources and Environment, University of Michigan;
Jeffrey Payne, NOAA Coastal Services, Charleston;
Brendan Plapp, Optical Society of America; and
Danny Wedding, Missouri Institute of Mental Health.

Science Meets Parliament for 2003 will be held in Canberra on Tuesday-Wednesday October 14-15. This event has been described by a political insider as, "the most effective interaction between scientists and Parliament I've ever seen." The format will be freshened up in line with comments from participants, but retaining all the strong features - briefing by senior politicians, the cocktail reception at Parliament House, one-on-one meetings with MPs, and the dinner where scientists can talk shop with MPs and industry. Registration will open later in the year, and the latest information is posted on the website: www.fasts.com.

Mike Smith
FASTS Board

Cont'd from page 20

designed as part of the project. Dense, saline fluids were introduced, and a comparison between a visual record of plume evolution (taken with a digital camera) and the electrical image produced by tomography was made.

Results from this experiment have been incorporated into a large National Science Foundation (NSF) program led by Todd Halihan that will be used to develop a system available for consultants and hydrogeologists. The NSF program is in review at the present and is likely to be funded from mid-2003.

Tania received 1st class Honours grade for her work, and was also awarded the Best Presentation at ASEG (SA Branch) Students' Night in November 2002.

She also gave an oral presentation at the 16th ASEG Conference and Exhibition on her work.

ASEG, in collaboration with PESA NSW 17th International Conference and Exhibition

15-19 August 2004
Sydney Convention Centre

Integrated Exploration In A Changing World

On behalf of the 2004 Conference Organising Committee, you're invited to attend the 17th ASEG Conference and Exhibition in Sydney. The Conference is being organised jointly by the ASEG and PESA NSW, and these societies will co-host the event at the Sydney Convention Centre, Darling Harbour, from 15-19 August 2004.

Please come to Sydney and be part of one of Australia's most significant resource events. Our conference theme, '***Integrated Exploration in a Changing World***', will address the integrated use of geophysical, geological and engineering technologies at a time when the petroleum and minerals industries are undergoing change both domestically and globally.

Sydney was the venue for the 'Best Ever' 2000 Olympic and Paralympic Games and it will be the host city for the forthcoming Rugby World Cup. Regarded as one of the world's most beautiful cities, Sydney is vibrant and offers a wide variety of activities for conference participants and their partners. We think that you'll really enjoy your time in Sydney.

We encourage you to visit the Sydney 2004 website, that way you'll be sure to receive early notification of the call for papers and registration information.

2004 ASEG-PESA Conference Organising Committee

POSITIONS	PERSON
Co-Chairman	Barry Smith, Tim Pippett
Finance	Graham Butt, Max Williamson
Secretary (PCO)	Francis Child, Louise Pitney
Publicity	Toby Gilmour, Ken Grieves
Sponsorship Co-Chairman	Mike Smith, Wes Jamieson
Technical Program Co-Chairman	Peter Gunn, John Mebberson
Exhibition Co-Chairman	Pat Hillsdon, Simon Stewart
Workshop Co-Chairman	Dave Robson, Mark Hitchings
Student Liaison	Dave Schmidt

Conference web site:
http://www.aseg.org.au/conference/sydney
Email: sydney2004@aseg.org.au

ASEG Awards at Adelaide 2003 (Part 2)

ASEG Service Certificates for outstanding service to the ASEG

Anita Heath

Anita has served the ASEG consistently and professionally on the State, Federal and Conference Committees since 1986.

Kevin Dodds awarding Anita Heath her Silver Certificate.

She served on the WA State Branch Committee from 1986 to 1988 and in 2003; was a member of the Federal Executive Committee from 1989-1991; the Perth Conference Committees: in 1987, 1994 and 2000 and Editor of Preview from 1988 to 1992 producing 22 issues.

Anita has worked as a petroleum geophysicist for Woodside Petroleum and Cultus Pacific. During this period she found time to marry a fellow Woodside geophysicist, David, and have two children. She currently works as a consultant through H&H Geophysical Pty Ltd. She is always willing to take on tasks for the ASEG and is a highly valued committee member.

John Denham

John Denham is a long-standing member of the ASEG-having joined at the time of its foundation. He is, therefore, a living history of the ASEG and geophysics in Australia, particularly in petroleum exploration. John Denham graduated from Sydney University in 1961 and started his geophysical career with Australian GeoProspectors and its successors; he gives his first job title as a "computer". He had a long prosperous journey from "computer" to chief geophysicist of BHP Petroleum. John was instrumental in introducing seismic workstations to BHP where one of the earliest Landmark machines was used.

He has been an active participant in ASEG conferences both as a presenter and an attentive audience. Many petroleum geophysicists will recall his pertinent comments and questions at these meetings.

Kevin Dodds awarding Silver Certificates to John Denham (left) and Steve Hearn (above).

John has been on the ASEGRF Committee and Convenor of the Petroleum Subcommittee since its inception.

For years, John was also a committee member of the ASEG Victorian Branch. He organised a technical meeting on seismic polarity in 1987 . In this meeting, seismic contractors were given the same data to process, and brought the processed sections to the meeting. Amazingly, we found words "normal polarity" did not have the same meaning to everyone. John was the technical chairman of ASEG's 7th International Geophysical Conference.

Leaving BHP Petroleum did not mean the end of his geophysical career. John continued his involvement as Executive Editor of Exploration Geophysics with the help of his wife, Jane. He carried out this hard work for six years from volume 25 to 30.

For this enormous contribution to ASEG, John has been awarded the ASEG Service Certificate.

Steve Hearn

Steve Hearn gained his PhD in seismology and computational geophysics at the University of Queensland under legendary Sydney Hall and the late Jack Webb.

In the early 1980s Steve worked for Seiscom Delta in Brisbane and Melbourne. Steve the spent two years with Velocity Data, writing the Velseis processing system, and helping develop VSP and weight-drop uphole systems. In 1987 Steve returned to UQ to lecture in exploration geophysics. In 1995 Steve joined Veritas DGC (formerly Digicon) in their R&D Division. Currently, Steve is the Chief Geophysicist of Velseis Pty Ltd.

Steve has been heavily involved with the ASEG at both State and Federal levels since his graduation. During the 1980s and early 1990s he was a regular Queensland Branch Committee member and he was Branch President and Treasurer during the late 1980s.

From 1996 to 2000 Steve served on the ASEG Federal Executive and was also First Vice-President and Publication's Chairman. In this role and as part of the ASEG Business Plan Committee, he put significant effort into examining ways in which the costs of ASEG's publications could be reduced.

Through much of the 1990s and early 2000s Steve was the main instigator of ASEG Queensland Branch Student Nights, and other combined student/industry functions to encourage participation of young professionals in the ASEG. Steve also gives his time freely to promote geophysics and the ASEG at both UQ and High School careers days.

In addition to his service to the Queensland and Federal Executive Committees, Steve has volunteered considerable time to ASEG Conferences. Steve has twice acted as the Technical Program Chairman for ASEG Conferences, first in 1992, and more recently for the Brisbane 2001 Conference. This role requires dedication and a significant time commitment to ensure a smoothly-run, technically-innovative program. As part of his role for the 2001 Conference, Steve was instrumental in producing ASEG's first Conference Proceedings on CD-ROM.

Steve's willingness to give his time to local and national ASEG activities over the past 20 years is testament to his commitment to the promotion of geophysics through the ASEG. He is a worthy recipient of the ASEG Service Medal.

Dave Pratt

Dave holds Honours and Masters degrees in science from the University of Sydney, and a PhD in physics from the University of Newcastle. He is highly respected within the exploration industry for his expertise and specialist knowledge and has published many papers. Dave was a founding partner of the software and services company, Encom, in 1984 and has had overall responsibility for Encom's operations as Managing Director since 1999.

Kevin Dodds awarding the Silver Certificate to David Pratt.

David is the Chairman of the ASEG Standards Committee.

For over 20 years, David Pratt has led a small team of researchers in the development of digital standards for point located data for adoption by the ASEG and more recently by the SEG.

The ASEG GDF standard grew out of David's frustration in dealing with a diversity of formats for airborne magnetic and radiometric data. This led to the need to produce software to import/export data for further processing and interpretation. David took on the leadership role in developing a format that would become a national standard. During the 1980s, the ASEG GDF standard was refined within a small committee that included Graham Pilkington from the South Australian Geological Survey, Pat Hillston and Paul Wilkes from Exploration Computer Services with Kit Dampney's input with the SEG Point data standard. Since the GDF standard was endorsed and published by the ASEG in 1985, most Australian State Geological Surveys have adopted it as their format for submission of geophysical data. This adoption was followed by leaseholders and airborne geophysical contractors. Through David's leadership, the ASEG also provided free computer software to assist with the reading and writing of ASEG-GDF compliant data. During the mid 1990s, GDF2 was adapted as a plug-in module by Geosoft's Oasis Montaj and by DFA's Intrepid, both for international software application.

In David's role as Chairman of the ASEG Standards Committee, he has now adapted GDF to include airborne EM and gravity data applications. David's objective is to provide a self-documenting and consistent method for exchanging and archival of located geophysical data between organisations with different hardware and software systems. David is also a member of the SEG Gravity and Magnetic Committee and ASEG-GDF2 has been extended to support the recording of the SEG Geographic Coordinate System that applies to the sample locations with each data set. The SEG Standards Committee has recommended that ASEG-GDF2 becomes a full SEG Standard.

For services to the ASEG from 1980 to the present in developing an internationally accepted data exchange standard, Dave is a worthy recipient of the ASEG Service Certificate.

SEG - Moving into the New Millennium[1]

By Walt Lynn
SEG Past-President
walterlynn@aol.com

[1]Walter Lynn, a Past-President of the SEG, made one of the more interesting presentations at the Adelaide ASEG. His talk described the challenges facing the Society of Exploration Geophysicists; what strategies it has adopted to meet these challenges and also what the future may hold. In this article we summarise the main points of his talk, which are very pertinent to the ASEG.

Our society is facing similar challenges and, by the time you receive this issue of Preview, a strategic planning workshop in Perth will have been completed after the 2003 AGM. (Ed.)

[2]In the decade 1991-2000 global R&D investment by the major oil companies fell from about $0.14/boe to $0.06/boe and in Australia R&D levels in the resources industries have fallen by 40% in the five year period 1995-2000 (Ed. see Preview 97, p9).

It is a real pleasure for me to be in Adelaide during the ASEG's 16th International Conference and Exhibition. Professional societies, and particularly those in the geosciences, are facing uncertain and rapidly changing times. I would like to say a few words about some of the challenges the SEG faces and what we plan to do, so that we can confidently go forward in the 21st Century as a healthy and robust society. These challenges are not unique to the SEG and should relate well to the ASEG.

The current environment

The main factors affecting the SEG's future are:

- Changing demographics - age and regional distribution,
- Industry consolidation,
- Tighter margins,
- Commodity price volatility,
- Political instability,
- Continued need for hydrocarbon,
- Development of alternative energy sources,
- Use of applied geophysical technology in other disciplines and industries,
- Expanded use of the internet for communication, business and education,
- Demand for technical talent, and
- Increased emphasis on environmental, cultural and social responsibilities.

These factors impact on the SEG and its members because of:

- Changes in workforce and how we work,
- Changes in education, and
- Changes in technology development and transfer.

One of the main issues for the SEG, which has a large petroleum oriented membership, will be the continued demand for hydrocarbons. Figure 1 shows the expected global supply and demand curve through 2020. This means that there will be a continued demand for new technologies to find more hydrocarbons and extract these with improved efficiency.

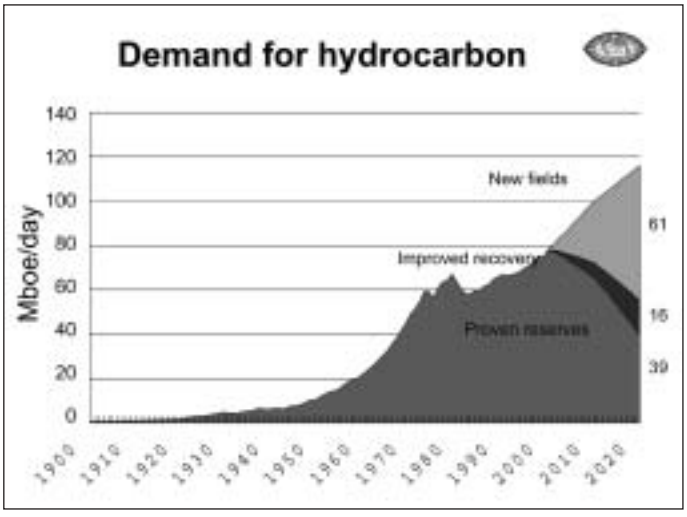


Fig. 1. Past and expected demand for hydrocarbons together with production trends.

Unfortunately, although there will be demands for improved technologies, current R&D efforts are diminishing, both within the resource and the service parts of the industry[2]. Furthermore, the business models that were in place from the 1960s through the 1980s have broken down and long-term R&D investment is not fashionable anymore.

The demand for talent will continue, but there is still a poor public image of the resource industries and there is also competition with demands from other industries.

Another major factor in our industry has been the rationalisation as a result of globalisation. There are now fewer companies in both the mineral and the petroleum sectors, and these companies tend to be global giants operating throughout the world.

Changes in SEG membership

The globalisation of the resource-exploration industries has had a major impact on the SEG. A much higher proportion of our members live outside the US, as shown in Figure 2, which shows the international extent of our members.

The globalisation of the SEG has also had a major impact on the age profile of our membership. As can be seen in Figure 3, the non-US component has a much younger profile than the US cohort; we must tap into youth and energy.

In summary we have:

- Over 18 000 members from over 100 countries,
- 46% of members are outside of US,
- Membership continues to grow, but growth is outside of US,
- Nearly 1200 global members (all sponsored by Apache Corporation),
- 113 student sections,
- Free student membership as of January 2003 (courtesy of Halliburton), and
- 59 corporate members.

The Strategic Planning Process

About two years ago, the SEG Executive Committee, under the leadership of Sally Zinke, undertook the exercise of building a

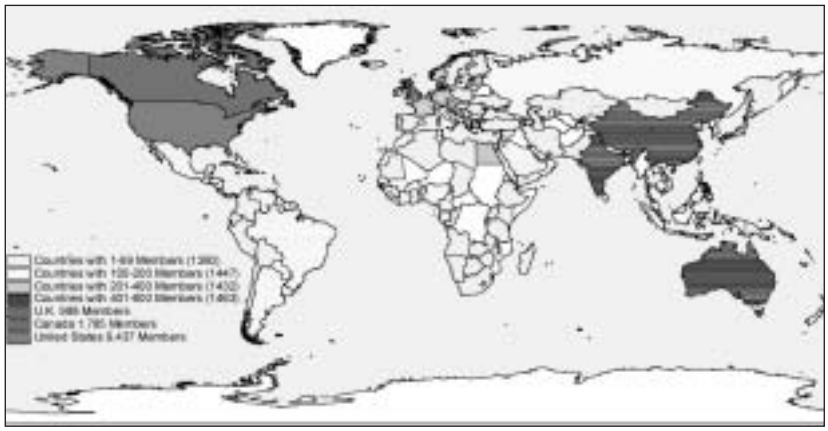
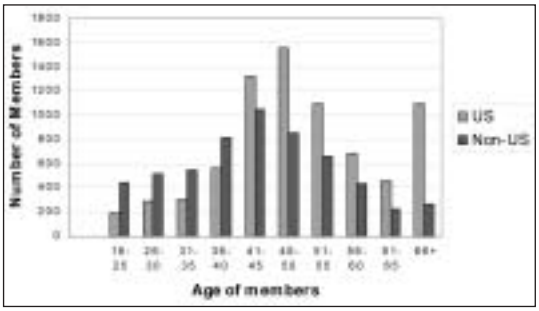


Fig. 2. Locations of SEG membership in 2002.

Fig. 3. Age profiles of the US and non-US members of the SEG.



[3]This list was compiled before the SARS epidemic, and the cancellation of at least one event due to the risk of terrorism.

strategic plan for the SEG. The plan has four levels of hierarchy:

Vision - What will the world look like 25 - 30 years from now from a geoscientists' point of view?
Mission - What roles should our professional societies play as we look 10 - 15 years ahead?
Strategy - What can we do to accomplish these missions (3 - 5 years)?
Tactics - Specific actions to accomplish the strategies (1 - 3 years)

A summary of the strategic plan can be found in the July and August 2001 issues of The Leading Edge or online at www.seg.org. Today, I would like to just focus on some of the more relevant strategies to this audience.

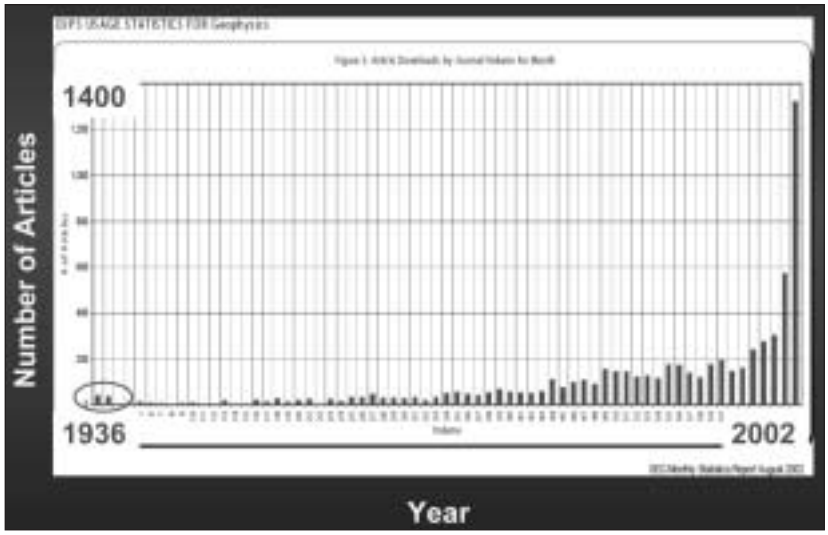


Fig. 4. Geophysics article downloads.

1. Electronic journals and publications

This issue is very important to our members and crucial to ensure that technology transfer and innovation are encouraged. Today, all issues of Geophysics and The Leading Edge are available on-line.

The environment in which we now work demands that information is available rapidly and from comprehensive sources. It is our experience that if graduate students cannot find what they want from the web within a few minutes, then they will not search for it elsewhere. It is also our experience that there is a steady demand for older articles. As an example, Figure 4 shows the number of Geophysics' article downloads during August 2002, which indicates this trend. Clearly, the electronic availability favors the access of articles, regardless of age.

To improve the Internet access throughout the whole of the geosciences we are participating with AAPG, AGI, GSA, GSL, MSA and SEPM in a pilot project called GeoscienceWorld. This project aims to provide a geoscience e-journal aggregate incorporating all the journals produced by these societies and ensuring that all these articles are available as downloads via the web. We expect that this will lead to:

- Increased journal readership,
- Greater accessibility, wider audience,
- Preservation, accessibility of past,
- Enhanced literature searches,
- Reduced duplication of research, and
- Greater integration of earth science literature.

However, it is a very large ambitious project and the resources involved to see the project through to finality will be substantial.

2. Sponsorship and support of conferences world-wide

As a result of our increasing international membership we are becoming more involved with international meetings. Some of the SEG sponsored events are shown below[3]:

ASEG 2001 - Brisbane, Australia
SAGA 2001 - Drakensberg Mountains, South Africa
SBGf 2001 - Salvador, Bahia; Brazil
SPG 2002 - Mumbai, India
GEO 2002 - Bahrain
Balkan Geophysical Society 2002 - Sofia, Bulgaria
AMGE 2002 - Veracruz, Mexico
Azeri SEG Section, Baku, Azerbaijan
Cairo 2002 - In cooperation with AAPG, EGS, EPEX and EAGE
SEGJ 2003 - Tokyo, Japan
ASEG 2003 - Adelaide, Australia
Rio 2003
Beijing 2003 (likely to be postponed to 2004)
Indo 2003 - Yogyakarta, Indonesia (cancelled)

3. Web-based conferences
As a result of the cost and time involved with travel to conferences, the SEG is investigating web-based facilities that will provide real-time feedback for oral sessions and virtual exhibitions for those who are not able to trawl the exhibition displays.

At SEG 2002, a start was made by capturing presentations for later playback and merging the audio and slide presentations. The six lectures from the Recent Advances and Road Ahead session are now available online at www.seg.org. In addition, 61 authors granted permission for SEG to post their presentations online.

Other key strategies are:

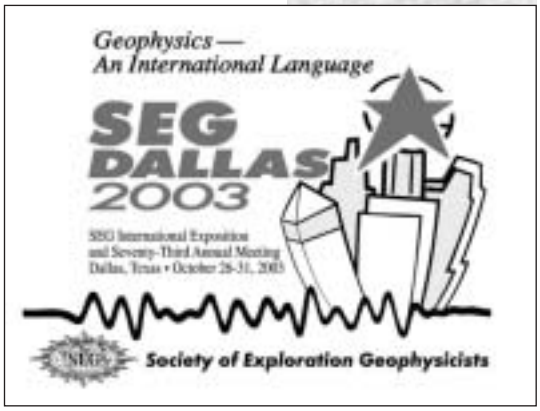
4. Promoting geo-science to pre-college students
5. Promoting the value of the SEG to non-members
6. Increasing cooperation and communication with other geoscience societies, and
7. Networking with other industries to cross-pollinate technologies and job opportunities.

We have been very active with strategy No. 6 which includes: The E-journal aggregate mentioned above,
- Cairo 2002 with AAPG, EGS and EPEX,
- Virtual Student Expo with AAPG and GSA,
- Reciprocal membership agreement with AAPG and SPE,
- Reciprocal Distinguished Lecturer Programs with AAPG and SPE,
- SEG/EAGE DISC Program,
- AGI - Education initiatives,
- Cooperation with IAGC, EEGS, AGU and others.

Future of SEG

Overall we are very positive about the future. We will aim for greater worldwide membership; continue to promote applied geophysics technology around the world; increase our efforts on non-hydrocarbon applications; adapt to changes in industry, academia, governments and economics; and build on the outstanding dedication and integrity of members.

I look forward to your company at the next annual SEG conference in October of this year in Dallas.



Regional gravity anomalies from global spherical harmonic models

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Abstract

This article gives a brief overview of global geopotential models (GGMs), which are truncated spectral expressions of the Earth's gravity field in terms of spherical harmonic basis functions. GGMs can be derived from the analysis of the orbits of artificial Earth satellites, terrestrial gravity and terrain data, or a combination of both. Almost all of these GGMs are available in the public domain, as is software to compute various gravity field parameters (e.g., gravity anomalies, gravity disturbances, geoid heights, and gravity gradients). Gravity anomaly maps are plotted over the Australian region from three recent GGMs, two of which include data from the CHAMP dedicated satellite gravimetry mission. A technique is then presented where these GGMs are high-pass filtered (thus yielding band-limited gravity anomalies) so as to enhance near-surface structures (acknowledging the inherent non-uniqueness of potential field data).

1. Introduction

Some of the earliest global geopotential models (GGMs) of the Earth's gravity field were computed in the 1950s from the then-limited coverage of terrestrial gravity data. These GGMs were normally restricted to spherical harmonic degree and order 10 or less, and thus only showed broad global structure, as well as omitting information in areas devoid of data, notably the oceans. The most significant advance to global gravity field observation came in the 1960s and 1970s from the ground-based tracking and analysis of the orbits of artificial Earth satellites. These ***satellite-only GGMs***, which – while giving improved information on the global gravity field – are limited in spatial resolution due to the decay of the Earth's gravitational field with altitude. The procedures used to compute satellite-only GGMs from ground-based tracking data are given in, for example, Reigber (1989).

As terrestrial gravity and terrain data coverage improved (as well as more data appearing in the public domain), so did the spatial resolution of GGMs. This is permitted through the combination of the satellite and terrestrial data, including marine gravity anomalies derived from satellite radar altimetry, to generate what are commonly called ***combined GGMs***. These extend the spatial resolution to typically ~50 km. Different research groups around the world have computed numerous combined GGMs, using different datasets and techniques. Rapp (1997b) reviews the methods commonly used to construct combined GGMs.

Another class is ***tailored GGMs***, where regional gravity data are used to refine a satellite-only or combined GGM (e.g., Wenzel, 1998). These extend the spatial resolution to typically ~10 km. However, these models have proven relatively unsuccessful over Australia (*ibid.*) because of the restricted access to Australian gravity data for overseas investigators. As such, this study will only deal with satellite-only and combined GGMs.

This article briefly reviews the GGMs published over the last five years, including two new GGMs derived purely from the CHAMP (CHAllenging Mini-satellite Payload) dedicated satellite gravimetry mission. The CHAMP satellite was launched on 15 July 2000, and orbits in a near-circular orbit at an initial altitude of 454 km and an inclination of 87.3° to the equatorial plane. The mission uses a combination of high-low satellite-to-satellite tracking from GPS and on-board accelerometer data to improve satellite-only GGMs by over one order of magnitude (e.g., Reigber *et al.*, 2002; Rummel *et al.*, 2002).

This article will show how gravity anomalies can be easily computed from the spherical harmonic coefficients, using public domain data and software. It will then show how the GGMs can be efficiently high-pass filtered to enhance [assumed] near-surface structures, acknowledging the inherent non-uniqueness when attempting to interpret potential field data. It will also be argued that GGMs can provide a more objective means of removing regional trends from local gravity data because they are based on observed data, as opposed to arbitrarily selected polynomial functions.

2. New and recent GGMs

Lambeck and Coleman (1983) gave the first major review of GGMs, which is extended by Rapp (1997a). This article will only summarise the most recent public domain GGMs, and the interested reader is referred to the literature cited for the specific details of the computation of each GGM. Also, the exact details of the construction of a GGM differ sufficiently among groups so as to render a simple summary of the techniques used very difficult.

Table 1 shows the GGMs published over the last five years, the maximum degree of spherical harmonic expansion (equivalent to the minium spatial resolution; shown later), the class of model (satellite-only, combined or tailored), and a citation. The URLs of the websites from which the geopotential coefficients can be downloaded are given in the reference list. Alternatively, several of the GGMs in Table 1 can be downloaded free of charge from the International Geoid Service. (http://ipmtf14.topo.polimi.it/~iges/db/model.html) or the late Prof H-G. Wenzel's web-site (http://www.gik.uni-karlsruhe.de/~wenzel/geopmods.htm).

The most notable recent advance in global gravity field observation will be through the current and planned dedicated satellite gravimetry missions (i.e., CHAMP, GRACE and GOCE) (e.g., Rummel *et al*., 2002). These missions will significantly improve the determination of the long-wavelength components of the Earth's gravity field. This is achieved through the combination of satellite-to-satellite tracking of the low-Earth orbiting dedicated gravimetry satellites by high-orbit GPS satellites, the orbit pattern, on-board accelerometry, and in the case of GOCE, an on-board gravity gradiometer. EIGEN-1 and TEG-4 in Table 1 include some data from CHAMP, whereas UCPH2002_02 and EIGEN-2 are derived solely from CHAMP data.

The main improvement offered by dedicated satellite gravimetry data is that they are complete over the Earth (excepting the poles), and thus provide a more homogeneous dataset than the limited number of orbital arcs and satellite inclinations that could previously be tracked using ground-based techniques. Accordingly, they will give a much better determination of the long-wavelength global gravity field. The concepts and parameters of the CHAMP, GRACE and GOCE missions, as well as simulated errors, are summarised in Rummel *et al*., (2002).

Another point worth noting is that all current satellite-only GGMs, though provided up to degrees 70 and above (Table 1), contain significant noise beyond degrees 20-30. This is as expected from the decay of gravitational acceleration with altitude. Also, some authors argue that the combined GGMs contain largely noise beyond degree 120. However, this does not appear to be the case over Australia, where the complete expansions of the combined GGMs give a good fit to the Australian gravity field.

model	*degree*	*class*	*citation*
EGM96S	70	satellite-only	Lemoine *et al*. (1998)
UCPH2002_02	90	satellite-only	Howe *et al*. (2002)
GRIM5-S1	99	satellite-only	Biancale *et al*. (2000)
EIGEN-1S	100	satellite-only	Reigber *et al*. (2002)
EIGEN-2	120	satellite-only	Reigber *et al*. (2003)
GRIM5-C1	120	combined	Gruber *et al*. (2000)
TEG-4	200	combined	Tapley *et al*. (2001)
GFZ97	359	combined	Gruber *et al*. (1997)
EGM96	360	combined	Lemoine *et al*. (1998)
EGM96COR	360	combined	ibid.; Rapp (1997a)
PGM2000A	360	combined	Pavlis *et al*. (2000)
GPM98A	720	tailored	Wenzel (1998)
GPM98B	1800	tailored	Wenzel (1998)
GPM98C	1800	tailored	Wenzel (1998)

Table 1. Global geopotential models published over the last five years.

3. Computation of gravity anomalies from a GGM

The GGM-implied gravity anomaly (on and above the Earth's surface) can be computed to any spherical harmonic degree L ($\leq M_{max}$, the maximum complete degree of expansion of the GGM) using

$$\Delta g = \frac{GM}{r^2} \sum_{n=2}^{L} \left(\frac{a}{r}\right)^n (n-1) \sum_{m=0}^{n} (\delta \bar{C}_{nm} \cos m\lambda + \bar{S}_{nm} \sin m\lambda) \bar{P}_{nm}(\cos\theta) \quad (1)$$

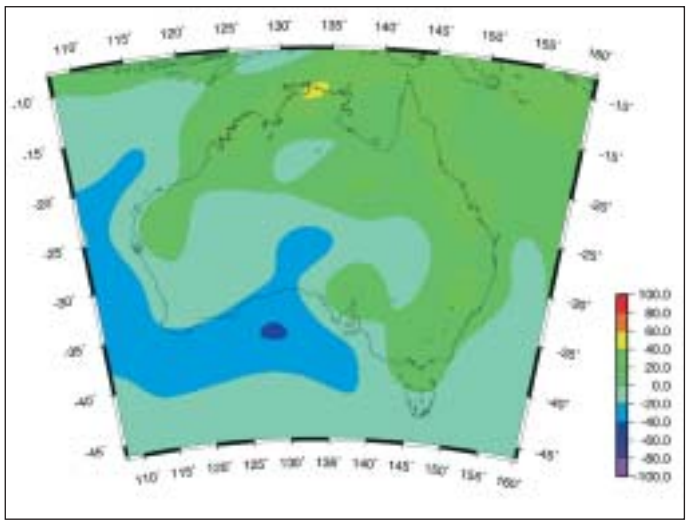

Fig. 1. Australian gravity anomalies from the EIGEN-2 CHAMP-only GGM to Mmax=40 [~890 km minimum wavelength] (units in mGal[1]).

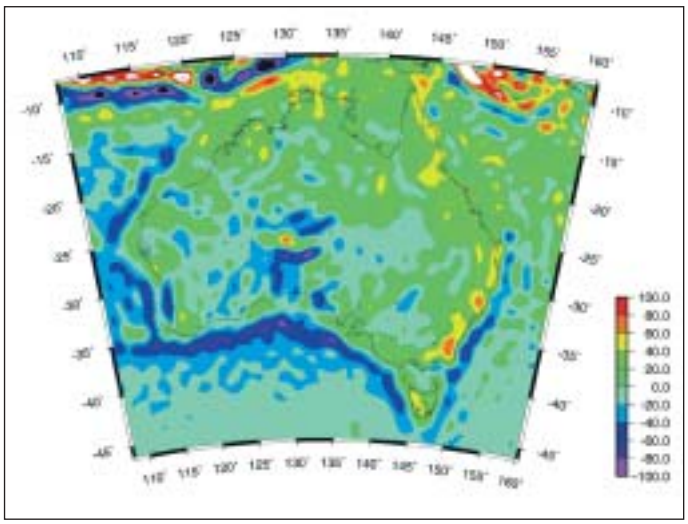

Fig. 2. Australian gravity anomalies from the TEG-4 combined GGM, which includes CHAMP data, to Mmax=200 [~178 km minimum wavelength] (units in mGal).

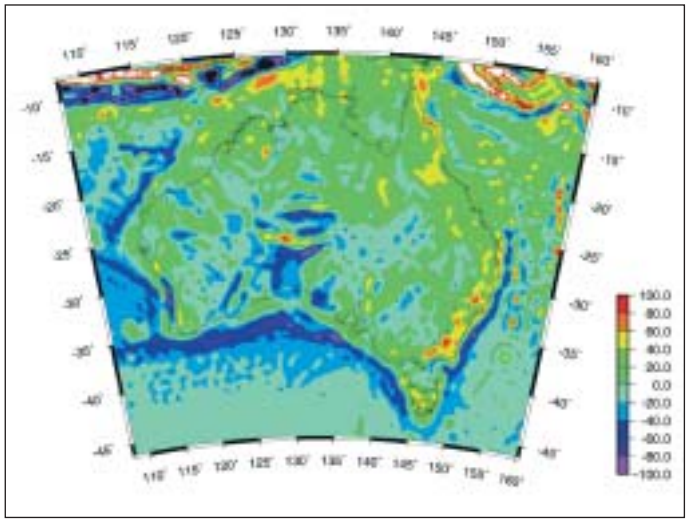

Fig. 3. Australian gravity anomalies from the EGM96 combined GGM, which excludes CHAMP data, to Mmax=360 [~99 km minimum wavelength] (units in mGal).

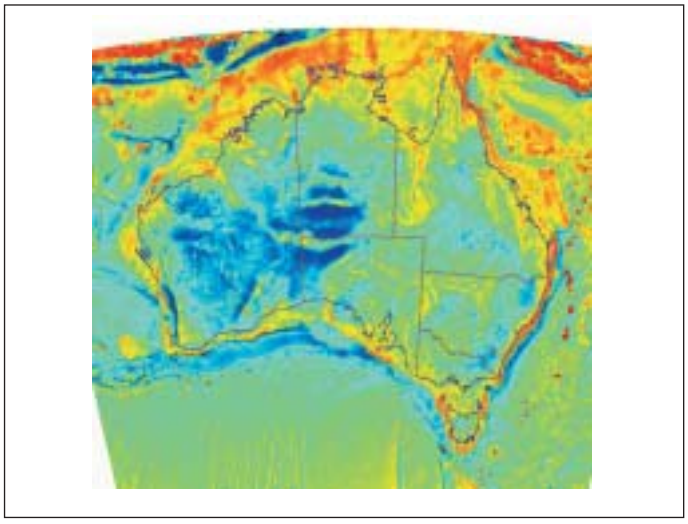

Fig. 4. Simple Bouguer gravity anomalies on land, computed from Geoscience Australia's gravity database, and marine gravity anomalies, derived from satellite altimetry. (Image courtesy of Geoscience Australia).

[1]*mGal = 10μm/s²*

where *GM* is the product of the universal gravitational constant and mass of the solid-Earth, oceans and atmosphere, (r, θ, λ) are the geocentric spherical polar coordinates of the computation point, $\bar{P}_{nm}$ are the fully normalised associated Legendre functions for degree *n* and order *m*, and $\delta\bar{C}_{nm}$ and $\bar{S}_{nm}$ are the fully normalised geopotential coefficients that have been reduced by the even zonal harmonics of the reference ellipsoid. The GRS80 reference ellipsoid (Moritz, 1980) is used in modern geodetic computations so will be used here.

The relationship between the degree of spherical harmonic expansion (L) and the spatial wavelength (?) is given by

$$\lambda[km] \approx \frac{39{,}980\cos\phi}{L} \qquad (2)$$

where is the geodetic latitude (taken as 27°S for a mean value over Australia), which accounts for meridional convergence towards the poles. The spatial resolution is simply half the spatial wavelength. The minimum spatial wavelength (and thus minimum resolution) of a GGM can be deduced by inserting M_{max} = L in equation (2).

Public domain FORTRAN77 software for computing gravity anomalies (and several other parameters) from geopotential coefficients (i.e., evaluating equation 1) is available from http://164.214.2.59/GandG/wgs-84/egm96.html. From equations (1) and (2), the user can simply generate gravity anomalies at any spatial resolution (as permitted by the particular GGM) for any area of interest. This may offer a useful new dataset for the exploration geophysicist.

4. Regional gravity anomaly maps from selected GGMs

Figures 1, 2 and 3 show Australian gravity anomalies computed from the EIGEN-2 CHAMP-satellite-only GGM,

the TEG-4 combined GGM, which includes CHAMP data, and the EGM96 combined GGM, respectively. These maps were generated from regular geographic grids of gravity anomalies computed using a modified version of the above FORTRAN77 software, and gridded using GMT (http://gmt.soest.hawaii.edu/).

The GGM-implied gravity anomalies were evaluated at the Earth's surface on a grid of half the Nyquist frequency implied by equation (2). EIGEN-2 was truncated to degree 40 because this is the point beyond which it loses signal power accompanied by an increase in noise (Reigber *et al*., 2002). Therefore, the different spatial resolutions in Figures 1 through 3 are simply a consequence of the 'spherical harmonic degree of expansion used.

The gravity anomalies mapped in Figure 1 are essentially free-air gravity anomalies at the Earth's surface. Figures 2 and 3 map Faye gravity anomalies, which are essentially terrain-corrected free-air gravity anomalies. This is because geodesists are interested in the figure of the Earth (notably the geoid), which requires that the mass of the Earth be preserved, whereas Bouguer anomalies - used more routinely in geophysics - attempt to remove the gravitational effects of the topographic masses (Figure 4). If Bouguer gravity anomalies are required from Figures 1 through 3, then the user must incorporate a DEM to model the Bouguer correction terms. Over Australia, the map in Kirby and Featherstone (2002, Figure 2) can be used as an alternative.

Figure 1 shows only the long-wavelength components of the Australian gravity field (due to the reliable degree of this GGM; equation 2), and maybe of less value to local investigations. Nevertheless, it does show some broad regional structures. Figures 2 and 3 show many of the already well-known geological structures in Australia, which can also be seen from the regional [Bouguer] gravity anomaly maps produced by Geoscience Australia (Figure 4). However, Figures 2 and 3 are somewhat contaminated by the topographic gravity signal, notably along the Great Dividing Range, because the [reasonably large] Bouguer plate/shell correction is omitted. A noteworthy point is that the use of these public domain GGMs provides gravity anomalies without the need to purchase the Australian dataset.

5. High-pass filtering to give band-limited gravity anomalies

One particularly useful, but apparently less well-known, application of GGMs is the removal of regional trends from local gravity data. The removal of regional trends is a routine activity when interpreting local gravity data. However, some polynomial function is usually fitted to the regional gravity anomalies, and then this is subtracted from the local gravity data. It is argued here that the use of a GGM is far more objective because the GGM is based on gravity observations as opposed to a somewhat arbitrary selection of a polynomial. Moreover, it is simple to achieve given the ready availability of the GGM potential coefficients and software (described earlier).

Alternatively, the GGMs can be used alone (as will be demonstrated here), where all the low-degree coefficients are simply omitted from equation (1), and the spherical harmonic expansion used to give a *band-limited* gravity anomaly signal. Introducing the minimum degree of expansion M_{min} in equation (1), as well as taking the maximum available degree M_{max}, equation (1) gives

$$\Delta g = \frac{GM}{r} \sum_{n=M_{min}}^{M_{max}} \left(\frac{a}{r}\right)^{n} (n-1) \sum_{m=0}^{n} (\delta \bar{C}_{nm} \cos m\lambda + \bar{S}_{nm} \sin m\lambda) \bar{P}_{nm}(\cos\theta) \quad (3)$$

Using the relation in equation (2) then shows the corresponding range of spatial wavelengths offered by the band-limited gravity anomalies.

Bowin (1983) derives a simple, but quite useful, relationship between the maximum possible depth of a point source mass (z) and the wavelength of the resulting gravity anomaly at the Earth's surface (also see Featherstone, 1997). Of course, it is important to remember that this is only an indicative extreme relationship because of the non-uniqueness problem. Featherstone (1997) gives

$$z_n = \frac{R}{(n-1)} \quad (4)$$

where z_n is the maximum depth of point source mass corresponding to spherical harmonic degree n, and R is the radius of the Earth (6,371,005 m for GRS80; Moritz, 1980). For example, a gravity anomaly feature of wavelength one arc-degree at the equator (i.e., n = 360 from equation 2) is assumed to correspond to mass anomalies above a depth of z_{360} = 18 km (numbers are rubbery because of non-uniqueness).

Figures 4 through 7 show high-pass filtered (i.e., band-limited) gravity anomalies over Australia derived from the GGMs shown in Figures 1 through 3. Three minimum degrees are used in equation (3), where appropriate. These are M_{min} = 60, 120 and 180, which correspond to spatial wavelengths at the Earth's surface over Australia of λ = ~594 km, 297 km and ~198 km (equation 2) and maximum point source depths of z_{60} = ~108 km, z_{180} = ~54 km and z_{180} = ~36 km (equation 4), respectively. These values have been chosen somewhat arbitrarily, and other choices can be made according to the user's requirements.

From Figures 5 through 8, it is evident that the band-limited gravity anomalies implied by the GGMs enhance the more detailed gravity field features over Australia, as is normal for any high-pass filtered dataset. The potential coefficients from one GGM are not subtracted from another (e.g., EIGEN-2 from EGM96) because they contain different long-wavelength components, due mainly to the improved data offered by the CHAMP mission, especially in

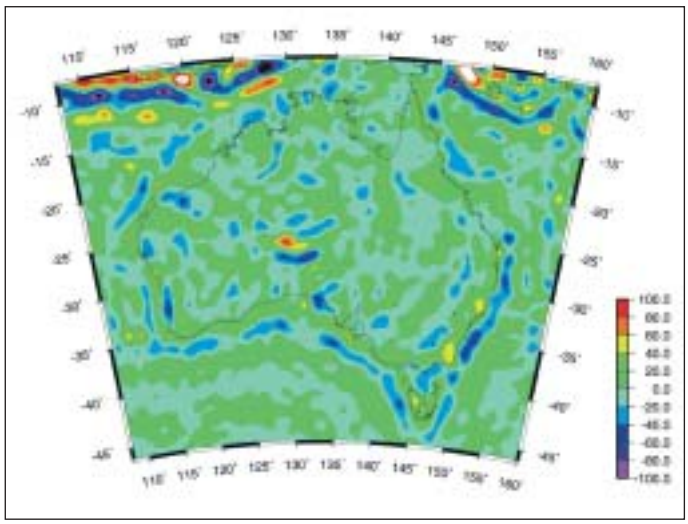

Fig. 5. Band-limited Australian gravity anomalies from TEG-4 (M_{min} = 60 to M_{max} = 200) corresponding to a source-mass depths less than z_{60} = ~108 km (units in mGal).

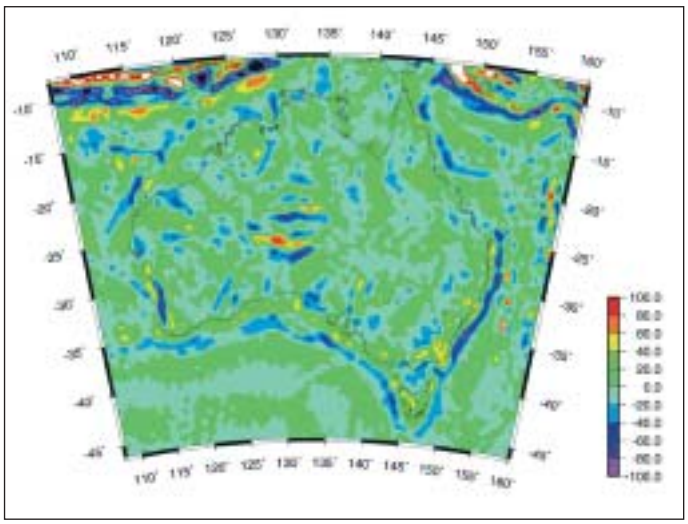

Fig. 6. Band-limited Australian gravity anomalies from EGM96 (M_{min} = 60 to M_{max} = 360) corresponding to a source-mass depths less than z_{60} = ~108 km (units in mGal).

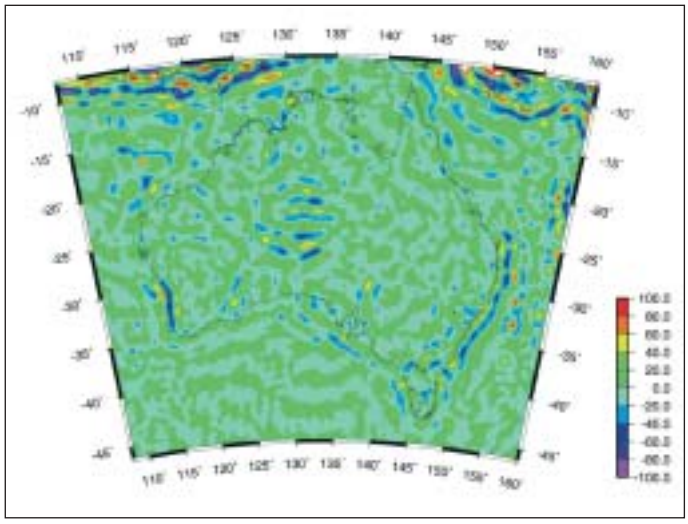

Fig. 7. Band-limited Australian gravity anomalies from EGM96 (M_{min} = 120 to M_{max} = 360) corresponding to a source-mass depths less than z_{60} = ~54 km (units in mGal).

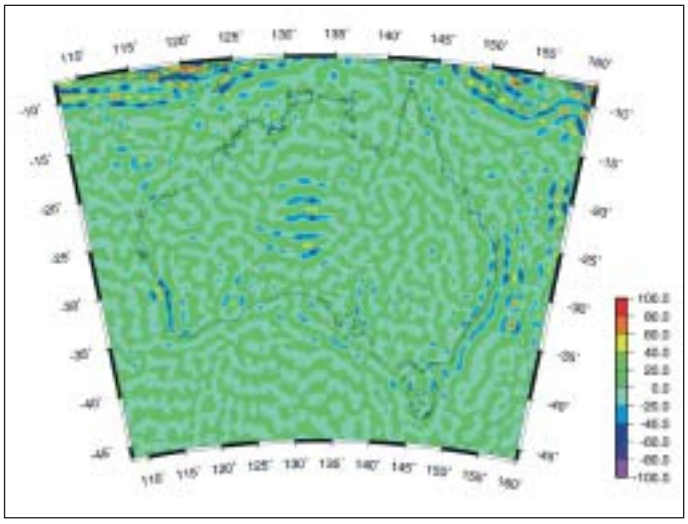

Fig. 8 Band-limited Australian gravity anomalies from EGM96 (M_{min} = 180 to M_{max} = 360) corresponding to a source-mass depths less than z_{60} = ~36 km (units in mGal).

relation to the long-wavelength contamination from terrestrial gravity anomaly errors.

Figures 5 through 7 are probably the more informative because Figure 8 is dominated by a 'cantaloupe' effect due to the relatively small amount of signal power in the high degree geopotential coefficients. However, Figure 8 does reveal the large abrupt density contrasts, such as the edge of the continental shelf, the Darling Fault in southwest Western Australia, and seamounts offshore eastern Australia. Figures 5 through 7 show many features that correlate well with many mapped geological structures across Australia, but some do not. Therefore, the GGMs may provide a useful additional data source for regional studies.

6. Summary and concluding remarks

This article has briefly described the various classes of GGMs, listed the ones published over the last five years, including three new GGMs that include data from the CHAMP dedicated satellite gravity mission, then presented techniques to high-pass the GGMs to yield band-limited gravity anomalies over Australia. Acknowledging the inherent non-uniqueness of potential field data, these may show the gravitational effects of masses above a certain limiting depth. Nevertheless, these band-limited gravity anomaly maps reveal regional structures that may be of interest to the exploration geophysicist.

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WesternGeco

Overview

WesternGeco assists the exploration & production industry with seismic-driven solutions for reservoir imaging, monitoring and development. WesternGeco has the most extensive seismic crews and data processing centres in the industry as well as the world's most diverse multiclient seismic library. Services range from 3D and time-lapse (4D) seismic surveys to multicomponent surveys for delineating prospects and reservoir management. In 2002 it had an operating budget of more than US$13.5 billion.

WesternGeco is active on every continent, with an unmatched array of resources available to meet reservoir challenges anywhere in the world. The company operates a region-based organisation with eight regions. These regions are comprised of local operations that bring together geographically-focused teams to meet local needs and provide customized solutions. The WesternGeco Australasian operation is headquartered in Perth.

The Western Monarch, currently active offshore Australia.

PC clusters provide seismic processing operations with very cost-effective computing cycles.

Current Australasian operations

WesternGeco has had a marine seismic vessel operating continuously in southeast Australian waters since 2001. The *Western Monarch* has been in place since November 2002, is equipped with solid-streamer technology, which is ideally suited to operate in the marginal sea conditions characteristic of the area. She is currently undertaking a large 3D program on the North West Shelf, which will take approximately six months. In April 2003 the *Geco Emerald* entered Australian waters and is acquiring several 3D surveys off the Western Australia coast.

The *Geco Eagle*, the highest capacity WesternGeco seismic vessel, is operating in South East Asia. Less than one week's transit time from Australian waters, she is capable of acquiring extremely large cost-efficient 3D seismic surveys.

WesternGeco has a mixed dynamite/vibroseis land crew operating continuously for many clients in New Zealand. The crew recently completed a large 3D dynamite program 20% ahead of schedule, and has just embarked on two 3D surveys in the Taranaki region. The local mountainous terrain and often difficult weather conditions make helicopter-supported operations very challenging. Local knowledge and experience help immensely in getting the job done on time and within budget.

Data Processing

The WesternGeco Perth seismic data processing centre uses the company's proprietary Omega* seismic processing system running on PC clusters. Advanced processing techniques – Kirchhoff prestack time migration with curved-ray and anisotropic corrections, depth imaging, amplitude variation with offset (AVO) analysis, borehole calibrated processing – are commonly employed at the centre. The centre has extensive experience in working with seismic data from all environments – 2D and 3D surveys from marine, land and transition zone, acquired with conventional, ocean-bottom cable or multicomponent systems.

Multiclient Services

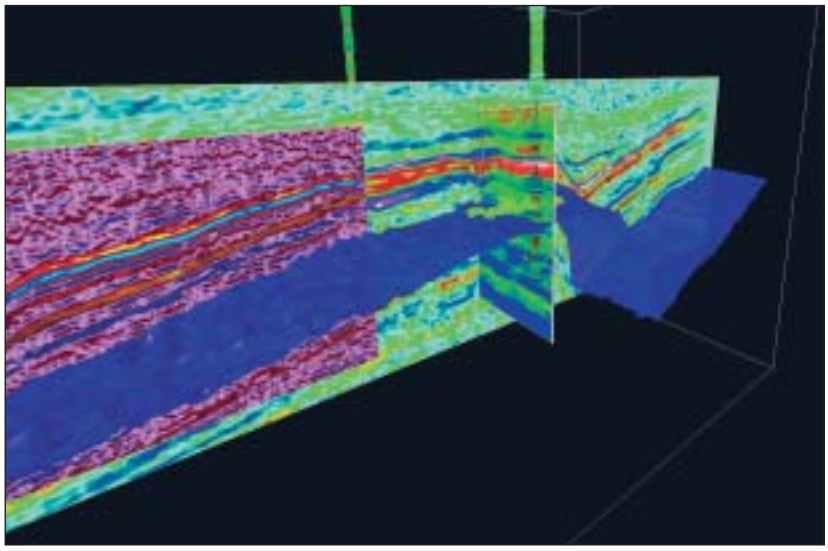
The WesternGeco Multiclient Services group plans, acquires, processes, interprets, and markets multiclient surveys throughout the world. WesternGeco has the world's

most extensive and diverse seismic data library, providing high-quality data across the most prospective hydrocarbon basins.

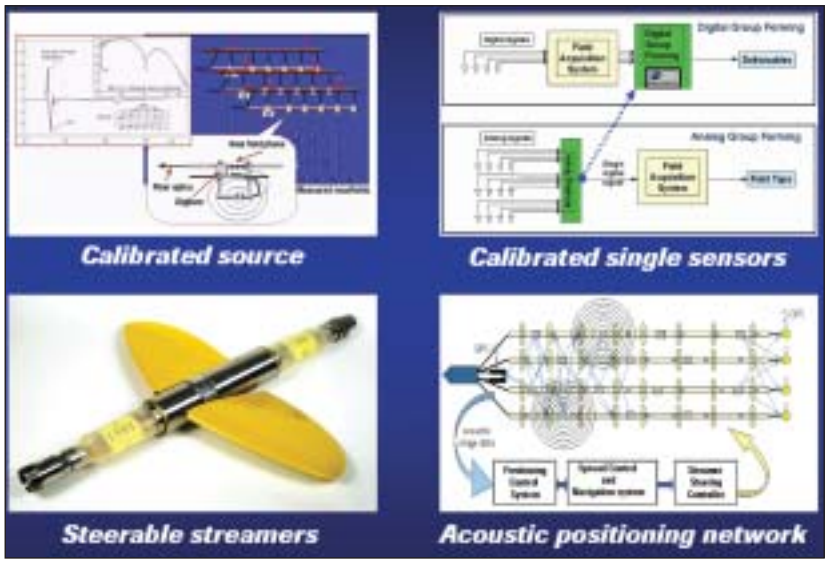
The Multiclient Services team in Perth is currently screening its portfolio of over 30,000 km^2 of 3D data offshore Australia in consultation with industry participants. Companies will be offered the opportunity to participate and invest in the use of advanced data processing techniques to further enhance subsurface images covering some of the most prospective acreage offshore Australia. For existing license holders and potential new entrants, such projects can significantly reduce the risks of exploration, facilitate effective pre-license screening over permits pending release, identify new venture opportunities, and assist in the development of new play concepts.

Recently, the WesternGeco Houtman 2D survey, a joint venture with Fugro Multiclient Services, allowed domestic and international oil companies to evaluate key acreage offered in licensing rounds. Interpretation of these data allowed operators to reduce technical and commercial risk through the detailed evaluation and realistic assessment of the expected financial return for a specific block. This allowed them to more effectively target their exploration dollars to develop Australia's offshore resources.

In addition to recent licensing rounds, WesternGeco is also offering high-quality 3D data over areas in forthcoming gazettals. In particular, its West Barrow survey, lying between the giant Gorgon gas field and Barrow Island, will help both existing and new investors better understand this established hydrocarbon province. Moving north, the Adele Phase 1 and North Browse surveys, surrounding Inpex's exciting WA-285-P block, offer excellent opportunities for acreage appraisal, in what is considered to be one of the most attractive areas in Australia's territorial waters.



Q provides seismic-driven solutions across the reservoir life-cycle.



Features of a Q-Marine operation.

Q

Q* is the WesternGeco suite of advanced services and technologies for enhanced reservoir delineation, characterisation, and monitoring throughout the life of the field. Q takes advanced seismic technologies into the reservoir, providing life-of-field seismic services, assisting not only explorationists, but also reservoir and petroleum engineers, appraisal, and production teams. Our network of Reservoir Services groups around the globe have the people, the tools, and the technology to integrate these disciplines and thereby help asset teams reduce their risk profile, have increased confidence in their decisions, and realise the full potential of their subsurface resources.

The technology utilised by Q includes the world's only fully calibrated single-sensor seismic acquisition systems. Q-Marine*, Q-Land*, and Q-Seabed* (in development) are proprietary systems that deliver optimally sampled data, providing the seismic imaging quality needed for new-generation reservoir imaging, monitoring, and development. Specific features of Q-Marine include a calibrated source, calibrated single sensors, an acoustic positioning network, and steerable streamers. These features bring a much higher degree of repeatability to Q-Marine surveys compared to conventional surveys; they are 4D ready. Q-Marine has typically demonstrated a 40% improvement in bandwidth and 300% improvement in repeatability.

Well-Driven Seismic*, an integral part of the Q service, is the proprietary WesternGeco approach to integrating borehole and seismic data. By analysing complementary borehole and seismic data, amplitudes can be calibrated, more multiple energy eliminated, and better velocity models generated, leading to reservoirs that are imaged with greater accuracy, and reserves that are estimated with higher confidence.

Rubber-tracked vibrators, developed in Australia in conjunction with a third-party engineering company, help minimise the environmental impact of land seismic operations.

Working with our clients to understand the reservoir's challenges is the first step in the Q approach. For simple reservoirs, this may be achieved through the information supplied by wells that penetrate the reservoir. For complex reservoirs (and most are complex), the information provided by seismic data when combined with well data is far more illuminating, as it gives a view of the reservoir in the inter-well space.

Reservoir-related problems, which Q may help resolve, can be grouped into three types that cover the life of the reservoir:

1) Understanding the internal and external geometry of the reservoir
2) Characterising the reservoir in terms of rock type, pore space, structural or stratigraphic heterogeneities, and fluid fill
3) Measuring changes in the distribution of fluids within the reservoir

Q data provide reliable quantitative measurements of reservoir properties away from the well. Calibrated amplitudes from Q surveys with Well-Driven Seismic data enable improved inversion and AVO for fine-tuning geological models in terms of rock type, pore volume, heterogeneities, and fluid saturations. A seismic-based reservoir description can reduce drilling and facilities costs, accelerate production of first oil, and extract maximum value from a field by guiding the placement, and optimising the number of, appraisal and development wells.

Q services enable operators to get more from their investment by providing greater confidence in reservoir decisions from exploration to abandonment.

Research and Engineering

WesternGeco recognise that its long-term business success depends on its ability to constantly improve the quality of our products and services. WesternGeco has continued to heavily fund research and engineering efforts despite the difficult financial circumstances that have faced the industry over the last few years.

Technology centres in Houston, London, and Oslo are focused on generating and implementing improvements to the Q-Marine and Q-Land seismic acquisition systems as well as on the launch of the Q-Seabed system. In the seismic processing arena, improvements are being sought in all aspects of the speed and fidelity of seismic algorithms with an emphasis on earth/reservoir modelling, multiple attenuation, and time and depth imaging. In addition, a program is underway to launch the successor to Omega - the world's most successful seismic data processing software system.

Quality, Health, Safety, and the Environment (QHSE)

WesternGeco leads the industry in implementing QHSE programs and policies, reflecting a firm commitment to the protection of personnel, the environment, and service quality.

WesternGeco requires an active commitment to QHSE from all employees. In addition, a leadership role is demanded of line management in the communication and implementation of, and ensuring compliance with, QHSE policies and standards.

One recent example of the company's commitment to QHSE is the introduction of EcoSeis*, an innovative program that provides an effective tool to monitor, track, and ensure environmental regulatory, contractual, and permit compliance in the field. The EcoSeis environmental monitoring system consolidates all applicable requirements in one place, focuses training, monitors performance and presents results, fosters best practices, and addresses non-compliance through an effective remedial action process.

On a recent survey in the Cooper Basin, Australia, WesternGeco worked closely with clients to monitor the long-term impact of seismic operations in this delicate desert environment. Environmental monitoring tracked the impact of different line preparation methods over time with positive results. EcoSeis was used in monitoring activities in and around archeological and sacred sites, reporting actions and results to clients, government agencies, and local communities.

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* *Mark of WesternGeco*

Some pitfalls encountered when processing and using shear slowness logs

By Mick Micenko
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These days, accurate analysis of seismic data requires models based on good quality compressional and shear wave velocity logs. Acquisition of raw data for these logs is now possible while drilling (eg Halliburton's BAT tool) and through casing (eg Schlumberger's DSI or the Baker Atlas XMAC), but care is required to ensure the delivered results are accurate. This article will review some of the errors associated with log curves derived from this new generation of tools if quality control is overlooked.

The slowness (inverse velocity) curves derived from full waveform data can be affected by a bias (a shift from its true value). Two of the most common causes for of this bias are mode contamination and under-performing electronics.

Mode contamination is a common problem in soft sediments where the undesired modes such as the Stoneley wave interfere with the flexural wave that is used to calculate shear slowness. This results in a mixed mode in the wavetrain that often exhibits a changing velocity with time. When this mixed mode is used when calculating shear slowness there will be a bias in the result. In this case it is best to avoid sampling the impure modes by identifying a narrow time window that contains only the pure flexural mode. Figure 1 shows an example where a wide time window incorporating some mixed mode has been used leading to a biased result.

In some cases there may be a failure in the tool's electronics that leads to a one or more receivers having a small phase shift relative to other receivers in the array. When this occurs the waveforms from each receiver look correct and the problem is not detected while logging however the phase shift leads to a time shift between adjacent receivers resulting in a velocity error as shown in Figure 2. Processing

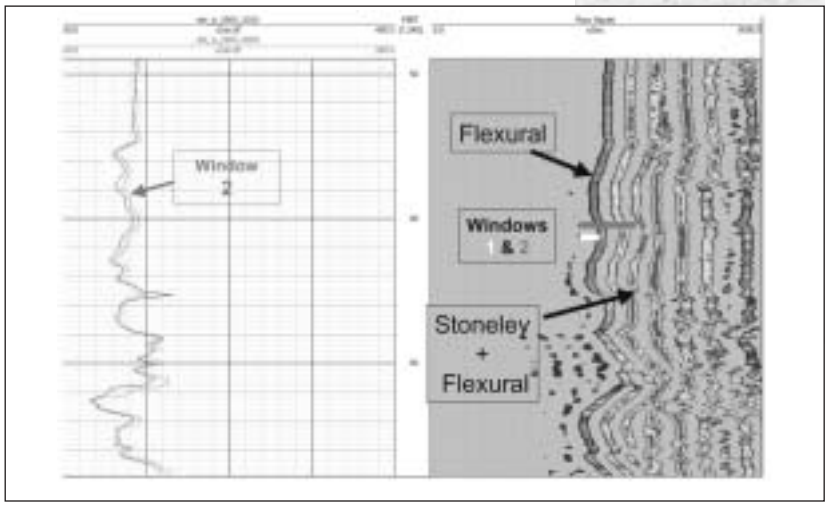


Fig. 1. Shear slowness logs (left panel) calculated using a small and a large sample window. The sampled waveforms and indicative windows are shown in the right panel. When the mixed mode (flexural and Stoneley) is present in the sample window used to calculate shear slowness a biased result is obtained. The smaller window produces a more accurate result in this case.

the data in this example and calculating slowness using the semblance method shows high coherence values and indicates good quality data and does not identify the underperforming receivers. However, the resultant shear slowness (Figure 3) is over-estimated because the semblance method has incorporated the results from the biased receiver elements.

When processing acoustic waveform data, good quality control tools and an understanding of the processing methods, borehole and formation conditions are required to avoid common pitfalls.

I would like to thank Jeff Williams of SuperSonic Geophysical for providing background information and figures for this article.

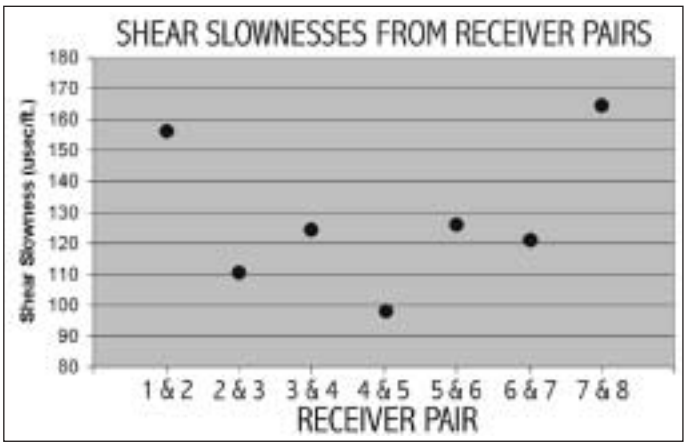


Fig. 2 This plot shows the shear slowness estimated by using adjacent receiver pairs. The estimates obtained from using receivers 1 & 8 are considerably higher than the true formation shear slowness measured by the other receivers and bias the result (Fig. 3) when not taken into account.

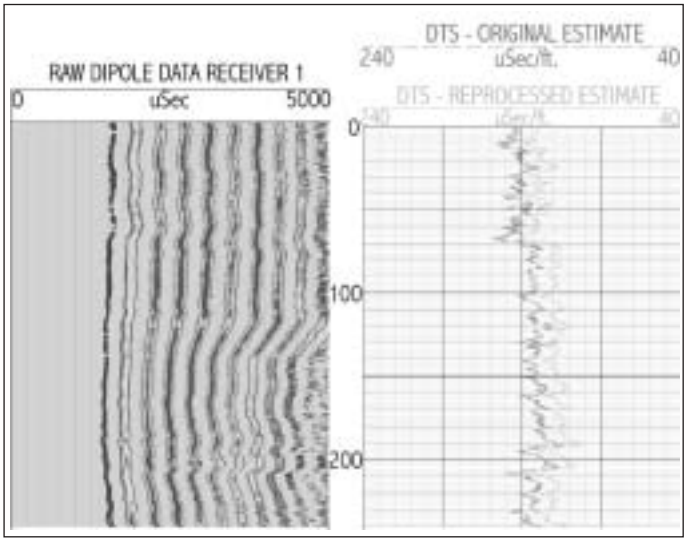


Fig. 3 Raw dipole data on the left is good quality but the shear slowness too high in the original estimate because of biased receivers (Fig.2). When these were taken into account a more accurate shear slowness curve was produced (right).

Newmont maintains exploration focus

Newmont Mining Corp will spend US$85M on exploration this year, more than one-third of which will go in the immediate vicinity of its mines as part of the big American's strategy to replace all of its ounces of production.

Last year, the world's biggest gold miner produced 236 t from its 22 mines spanning five continents, which was more than balanced by the 283 t it put back into the reserve book. The miner has replaced the ounces it has produced every year since 1990 bar one, with cash conservation in 2001 seeing infill drilling reduced.

John Dow, Newmont Australia's Managing Director, said the replacement of reserves remained a core objective for the company, with production of 221 t forecast for 2003. He expects most of the resource ounces at its relatively new Martabe discovery in Indonesia to be converted into reserves and is also expecting significant further additions to the 152 t of reserves at its new Akyem and Ahafo projects in Ghana.

Newmont will spend around US$450M developing the latter two operations. Around 30% of the exploration budget will be spent in Australia, including US$14 million going to Western Australia, US$7M into Central Australia and US$3M into Queensland.

Outside of near-mine exploration, Newmont will spend some US$15M on greenfields exploration; a figure the professionally trained geologist said should "probably" be more.

Santos reports record first quarter revenue and opens office in Perth

Santos reported record total sales revenue of $369M for the three months to 31 March 2003, driven by higher gas sales and increased prices for all products. These results were 14.5% stronger than the $322M for the previous corresponding period. The latest result was 9.9% higher than the company's previous best first quarter revenue of $336M achieved in 2000.

The record revenue for Santos reflected stronger world oil and liquids prices during the quarter, coupled with exceptionally strong gas prices in the United States. Gas sale volumes rose by 5.4% in the latest March quarter with across the board contributions from the Group's Australian and US operations.

Total production for the period of 13 MMboe was steady compared with 13.1 MMboe for the corresponding period of 2002.

Total gas production was a record 53.3 petajoules (PJ), up 4.9% from 50.8 PJ in the previous corresponding period. This offset lower oil production of 2.6 MMbbl for the quarter compared with 3.1 MMbbl from the first quarter 2002.

Santos' MD, John Ellice-Flint, also released Santos' forward exploration program for the year. The 2003 plan is to drill 26 wells for a total expenditure of $146 million. Approximately one-third of these wells will be drilled in areas where Santos does not presently have production.

The opening of the Perth office is to develop the Mutineer and Exeter fields, which have combined reserves in the range of 70 to 196 MMbbl of oil, and were confirmed during 2002. They are currently being developed to target first production by mid-2005. Santos aims to have a Floating Production Storage and Offloading facility (FPSO) onsite at Mutineer/Exeter, 160 km offshore from Dampier, by mid-2005. Ellis-Flint said that:

Santos' Western Australian operations contribute approximately 50% of the company's oil and gas liquids production annually.

In 2002, production from Santos' Western Australian field interests averaged in excess of 30,000 boe per day. The company also drilled nine operated wells in Western Australian waters.

Santos has increased its investment in Western Australia's offshore petroleum sector and currently holds 16,200 km^2 of exploration acreage, including interests in 10 operated permits and 31 non-operated permits.

The new Perth base for Santos will accommodate the Mutineer/Exeter development team and employ 25 new people including engineers, drillers and project management and support staff.

Has Exxon Mobil found the largest Australian gas field?

Meanwhile Mobil Exploration and Producing Australia Pty Ltd, a subsidiary of US company Exxon Mobil, has confirmed that exploratory drilling on the Jansz field, located 200 km off the northwest coast of Western Australia, has identified a world-class gas resource, believed to be the biggest ever find in Australian exploration history.

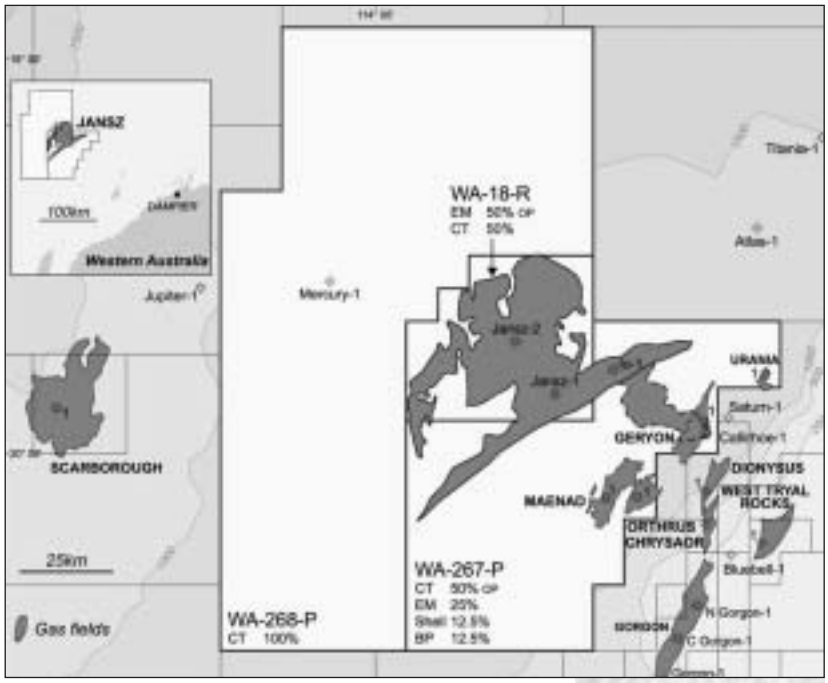
The field covers over 2000 km² and has an interpreted 400 metres gross gas column, including an extension into the adjacent WA-267-P block. The company estimates that the field contains approximately 20 Tcf of recoverable gas.

The Jansz-2 well was drilled in late 2002 to determine the extent of the Jansz-1 discovery made in 2000 in the WA-18-R exploration permit.

Jon Thompson, President of Exxon/Mobil Exploration Company, said, "ExxonMobil believes the Jansz field to be the largest gas discovery ever in Australian waters, representing around 40% of the undeveloped, discovered gas resources in the deep water Carnarvon Basin."

"This discovery is a significant addition to ExxonMobil's resource base, which now stands at 72 billion oil equivalent barrels. During the last 10 years, this base has grown by nearly 30 %, or more than 16 billion oil-equivalent barrels", he added.

ExxonMobil's Australian exploration director, Doug Schwebel, said that a third exploration/appraisal will be drilled in May/June and would provide the additional information needed for the company to begin development planning.



Janz Field location map.

BHP Billiton invests $US327M to develop oil and gas field in the Caribbean

BHP Billiton has also been very active in the petroleum sector. In March this year it announced a $US327M development of the Greater Angostura oil and gas field, which is located in shallow waters approximately 40 km off the northeast coast of Trinidad.

Phase 1 covers the engineering, construction, and installation of production and transportation facilities required to recover the oil reserves of the field

The development consists of three satellite wellhead protector platforms (WPPs), connected via flowlines to a steel jacket central production platform (CPP).

The Greater Angostura Field has an estimated production life for both oil and gas of between 19 to 24 years. Gross mid-case volumes are 450M boe, which comprises 160M (MMbbl) and 1.75 Tcf of natural gas.

Xstrata still fighting for MIM

By the time this issue of Preview hits your desk the battle by Xtrata to take over MIM may well be over. The bid by Xtrata is a $5 billion takeover at $1.72 a share. This offer was first made in April without the support of the Managing Director, Vince Gauci, but with the support of the Chairman and all the Non-Executive Directors. If successful, another Australian resource company will be taken over by an overseas multinational.

Subsequently, Platinum Asset Management, a 2.5% shareholder in MIM, has campaigned against the bid, and the redoubtable Federal MP Bob Katter has also been lobbying against the takeover. Xtrata has therefore had to try and persuade the minor investors and has taken out full-page advertisements in the national newspapers, calling for a 'Yes' vote in favour of the takeover.

For those not familiar with Xtrata, it is an international natural resources group based in Switzerland and has approximately 11,500 employees worldwide. It focuses on low cost operations and has a significant market share in thermal coal, zinc metal, and primary vanadium production as well as a large market share in ferrochrome production.

The Group comprises three major businesses:

- The coal business, which has interests in 28 operating coal mines, 14 of which are located in Australia (mainly in the Hunter valley) and 14 of which are located in South Africa;
- The zinc business, which has a zinc mining and smelting operation in Spain and a zinc smelter in Germany; and

Cont'd on page 40

Physical Principles of Remote Sensing

By William Gareth Rees

Cambridge University Press,
2nd Edition 2002
ISBN 0-521-66948-0
343 pages
Paperback, $A80

(Email enquiries concerning inspection copies should be sent to egilmour@cambridge.edu.au.)

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The first edition of this book was published in 1990. It addressed a subject that had advanced considerably since 1972 when NASA launched the first civilian remote sensing satellite. Since then the continuing rapid development of remote sensing, and its popularity as a subject for university courses, has led to the need for an update. So this revised and expanded second edition is most timely.

The author is Assistant Director of the Scott Polar Research Institute at the University of Cambridge. He has extensive experience in the application of spaceborne remote sensing to glaciers and ice sheets, icebergs, sea ice, and landscape degradation in the Arctic. His research has resulted in numerous publications in polar and remote sensing journals. The author has also written Physics by Example (a book containing more than 200 fully worked solutions to common problems), Essential Quantum Physics (a textbook of quantum physics for undergraduate students) and The Remote Sensing Data Book (a dictionary of remote sensing).

Physical Principles of Remote Sensing (2nd edition) covers all aspects of remote sensing including theory, acquisition systems, and data processing. The book begins with reviews of electromagnetic waves in free space, the interaction of electromagnetic radiation with matter and the interaction of electromagnetic radiation with the Earth's atmosphere. Different techniques of remote sensing are then outlined including:

- Photographic systems,
- Electro-optical systems,
- Passive microwave systems,
- Ranging systems, and
- Scattering systems.

The author begins by reviewing how electromagnetic radiation behaves in space, and how it interacts with matter and the Earth's atmosphere. He then considers the various acquisition systems for remote sensing including photographic, electro-optical, passive microwave, ranging, and scattering. These topics are followed by a discussion of the different platforms used for remote sensing as well as the different types of satellite orbits. The book ends with a discussion of data processing techniques, a short description of global positioning systems, and a useful list of general data. Each of the 11 chapters has a list of numerical problems, for which the answers are given together with useful hints. The book's index is comprehensive but the reference list is limited (only 68 entries); a problem for readers seeking further information on topics. This is however, the book's only weakness.

The *Physical Principles of Remote Sensing* is suitable for undergraduate and postgraduate students, and for established workers in the field. It has numerous excellent figures that are simple and clear, and stunning colour plates that show what remote sensing is capable of. It contains considerable mathematics but these are clearly presented and easy to follow. Remote sensing is an important, exciting, and relatively new area of science, and this book does it full justice. Highly recommended.

Cont'd from page 39

- The ferroalloys business comprising the chrome operations and the vanadium operations, which has integrated production facilities in South Africa and Australia.

In addition, the group has a forestry plantation in Chile.

However, it is a puzzle as to how a company, which has issued 252 million shares worth about $11 each (market capital of ~$2.7 billion) can take over MIM with a market capital of about $3.3 billion. Or perhaps there is something hidden somewhere.

Flinders Diamonds finds diamond at its Boolcunda Basin in SA

Flinders announced in May that it had discovered a diamond and associated pyrope garnets from the drilling at Boolcunda. The discovery was made in Triassic sediments at the base of the Boolcunda Basin, which is part of Flinders Diamonds' flagship Springfield project area northeast of Port Augusta.

Preliminary diamond indicator mineral (DIM) analysis and electron micrography scans of one sample derived from a 5.1 km core sample, revealed a single 100 micron microdiamond described as an octahedral fragment, and 61 fresh angular pyrope garnets. The sample was taken from a depth of 403-409 m in drill hole BL01.

The company believes the results suggest derivation from a diamondiferous kimberlite located within or close to the Boolcunda Basin. This basin is located 30 km east of Quorn in South Australia's southern Flinders Ranges.

They confirm Flinders Diamonds' previous interpretations of kimberlite targets under the Basin, and the interpretations on target depth and structure established from the May 2002 seismic survey.

An interesting geophysical problem to locate the kimberlite pipes.