Preview

Australian Society of Exploration Geophysicists

ABN 71 000 876 040 ISSN 1443-2471 December 2002 Issue No.101

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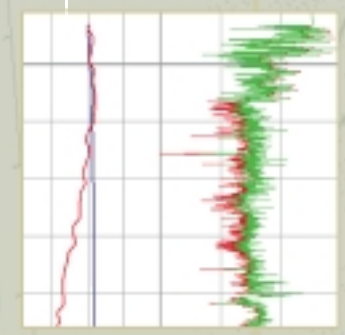

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In this issue

This edition of Preview contains three feature articles. Two deal with some of the more recent advances in seismic processing and the third, written by Colin Reeves, gives an insight into the challenges and opportunities in training geophysicists in developing countries. I think we all too often take for granted the facilities we have for teaching and research in Australia, and although we moan and groan about the "Crisis" in the Geosciences here, all things are comparative. We should be more aware of the problems faced in some of the poorer countries where the opportunities for students to develop a career in the geosciences are really very small. Anyway, Colin has been making a huge contribution in training geophysicists from his base at Delft in The Netherlands and his experiences and comments on this issue make interesting reading.

Prime Minister speaks on Science and Innovation, and Energy

It was good to hear the Prime Minister identifying Science and Innovation as one of the top nine issues being addressed in his third term as Prime Minister. In a speech to the Committee for Economic Development of Australia on 20 November 2002, he stated that:

"Investment in science and innovation is an investment in Australia's economic and social prosperity. New knowledge and new ways of doing science enables us to push the boundary of what is possible with our resources and help build solutions to issues in areas such as health, the environment and industrial development."

He also outlined nine strategic policy areas. These are:

- National Security and Defence;
- Education;
- Sustainable Environment;
- Energy;
- Work and Family Life;
- Science and Innovation
- Demographics and the ageing population;
- Rural and Regional Affairs; and
- Transport.

On Energy he stated that: "Competitive, reliable energy has underpinned Australia's growth and economic prosperity. We must ensure that our energy policy continues to support economic growth and development while also contributing to reduce air pollution and greenhouse gases, and while we develop new technology. Australia is entering a very exciting phase in terms of energy policy. We have large amounts of competitive fossil fuel energy sources, a growing natural gas industry that, as the recent LNG deal with China shows, has enormous export prospects. Rapid advances in technology are giving us cleaner vehicles and fuels as well as growing scope for renewable technology. We are developing a strategic plan for Australia's long term energy policy, bringing together and enhancing many areas of policy work already being done."

They seem like good words. Let's hope he is able to develop action plans that are properly funded for each area. It is clear that Geoscience and Geophysics in particular will have a role to play in the majority of these issues. The full text of his speech is available on http://www.pm.gov.au/news/speeches/2002/speech1996.htm

Any one for Web Waves?

After more than three years of writing Web Waves, Natasha Hendrick has decided to call it a day, so the contribution in this issue will be here last. I would like to thank her on behalf of all readers for the excellent articles she has produced over the last few years. They have been wide ranging and are always of interest. So a big thankyou Natasha, I am sure we have all enjoyed reading her articles and discovering the gems she has found by surfing the Web.

So we now need someone to take over from Natasha. I am therefore asking for any volunteers. The requirements are to produce six articles of interest every year that fill about one page of Preview. The rewards for whoever takes on the job, is the discovery of sites of interest buried in the Web that can be shared with our members.

New Corporate Sponsors

Sponsorship is very important to the ASEG because of our links to many facets of the Resource and Exploration industries. It is therefore very pleasing to welcome two new sponsors for 2003. These are Beach Petroleum and Professional Investment Service; we trust that the relationships will be mutually beneficial.

Seasons Greetings

This is the last issue of Preview before the Conference Edition, which will be released in Adelaide. It looks like we will have another very successful Conference and I hope to meet with many of our readers there next February.

In the meantime, I would like to thank our contributors, readers, advertisers, sponsors and publisher for their support during 2002. I hope you all have a relaxing Christmas and that the New Year brings more exciting challenges for us all.

David Denham

Adelaide Conference

All members have now received the Adelaide Conference Registration Brochure and consequently you can see for yourself the exciting content and technical breadth that has been packed into the proceedings. There is a strong workshop program with international participation from both the minerals and petroleum perspectives, coupled with a comprehensive impressive keynote line up, underpinning a comprehensive technical program.

Take note and book early !

We have also been focussing on a number of issues of importance to the future and growth of the Society in preparation for the opportunity that the Adelaide ASEG Conference will provide for discussion and participation. We are planning to complete the task of previous Executives in defining the roles of all parts of the Society through an excellent Procedures Manual. We have also decided, on the recommendation of the Constitutional Committee to redraft the Constitution to reflect the changes in National character that have occurred since the Society was formed. This brings clarity to the roles of office holders and committees, and in particular the interactive aspects of State and Federal responsibilities. Both documents build on the unique strength of the Society as a National medium for our Geophysical profession. We have also been active in focusing on communication through evaluation of what you see as value in *Preview* and how to reflect these interests in the editorial content. Similarly we are looking to boost the value interactivity of www.aseg.org.au through harnessing new web publishing techniques. We will be able to bring to the Conference the questions for which we need your feedback through the committee meetings that we are planning within the conference framework., and consequently can incorporate feedback this into the formulation of these documents and activities.

Sydney with PESA in 2004

The Federal Executive, as part of its forward planning, has been working with the NSW ASEG committee and PESA, to firm up an August 2004 target for a joint ASEG and PESA conference in Sydney., and most importantly we have obtained a mutually satisfactory agreement with PESA on the distribution of the revenue. This will provide a powerful alliance between the Minerals and Petroleum interests to ensure success in Sydney. Significantly, much effort at State and Federal levels of both societies has been put in to coordinate this conference with PESA's East Australian Basins' Symposium in Adelaide, planned for the same period. This coordination will be achieved through close contact between the committees responsible for the technical and exhibition activities of both conferences. It is of prime importance to us that the interests of all participants to these events are well served with respect to the common constituencies between societies.

Science Meets Parliament

Finally I was able to represent the interests of the ASEG on your behalf to a very successful Science Meets Parliament event organised through FASTS (Federation of Australian Scientific and Technological Societies) of which ASEG is a member. This event crystallised the role of FASTS and more particularly the Australian Geoscience Council (AGC) in representing the challenges facing our profession in various submissions to Parliamentary Committees. We had the opportunity to meet one-on-one and discuss these issues with individual politicians. FASTS prepared a comprehensive briefing document for science in general and policy recommendations focussed on educational initiatives: postdocs for industry, removing the inequities of HECS and investment in the university sector. This was primed by an AGC meeting which defined future imperatives of geosciences such as: sustainability of resources, teaching of geosciences, loss of expertise through industrial consolidations, land access issues and broad access to data and information et al. These processes enhanced my confidence that communication on matters of national importance are well addressed and focussed through these avenues, leaving the ASEG to concentrate on priorities of a professional nature to geophysicists.

The Federal Executive wish you and your families a Happy Christmas and a productive New Year.

Geophysical Signatures of SA Mineral Deposits

The activities of the Federal Executive over the past two months have been quite comprehensively covered in Kevin Dodds' President's Piece. However, I would like to take the opportunity here to briefly touch on one other matter of importance. That is of the upcoming publication of the "Geophysical Signatures of South Australian Mineral Deposits". This publication, being facilitated by Mike Dentith, is an initiative of the University of Western Australia, and is being sponsored by the ASEG. The publication is due to be completed in early 2003, with its official launch being at the Adelaide ASEG Conference. With as many as 20 technical papers, all of the major deposits of interest in South Australia will be covered, in addition to more recent discoveries, such a Prominent Hill and Reliance. Just like its sister publication, "Geophysical Signatures of WA Mineral Deposits", this new volume promises to be a very good read.

New Corporate Member from the finance sector

On a different note, I am pleased to welcome Professional Investment Service Pty. Ltd. as a new Corporate Member to the ASEG in 2003. Interaction with the investment side of the resource sector will surely be beneficial both to our new sponsor and the ASEG.

Lisa Vella
Honorary Federal Secretary

Batten Trough Seismic Project

130 km of seismic reflection data has been successfully collected across the Batten Trough, an important structure in the McArthur Basin that hosts the giant, world-class McArthur River zinc-lead-silver deposit. The survey, which was undertaken in early November, represents the first application of seismic methods to base metal mineralisation in the Northern Territory and is a breakthrough for imaging the basin geometry.

The project is a joint initiative between the Northern Territory Geological Survey (NTGS), Geoscience Australia (GA), Predictive Mineral Discovery Cooperative Research Centre (pmd*CRC), and Australian National Seismic Imaging Resource (ANSIR).

Geoscientists from NTGS and GA will undertake processing and interpretation of the data over the following twelve months. The interpreted profiles will then be used in conjunction with aeromagnetic and detailed gravity data to construct a three-dimensional model of the sedimentary basin (to 15 km), underlying basement heterogeneity (5-30 km), intrabasinal fault systems and the lower crust to 50 km.

The results will have wider applicability in that the basin is an undeformed analogue of the Western Succession of the Mt Isa Province. In particular the seismic will:

- Determine the geometry, thickness, sequence stratigraphy, structure and sub-basin architecture of the McArthur Basin succession within the Batten Trough and onto the adjoining shelves;
- Ascertain what mechanisms were responsible for development of the trough and when they took place;
- Investigate the nature of regional fault systems such as the Emu Fault and their relationship to the trough;
- Lead to a better understanding of regional mineralisation models in the Carpentaria Zinc Belt.

Aims and Scope

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

Contents

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

Contributions

All contributions should be submitted to the Editor via email at denham@atrax.net.au. 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, 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. 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 issue date. However, because the next issue will be the special Conference Edition we need all contributions apart from advertisements to be provided by 20 December 2002.

Advertisers

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

Advertising copy deadline is the 22nd of the month prior to issue date. Therefore, the advertising copy deadline for the **February 2003 issue will be 22 January 2003**. A summary of the deadlines is shown below:

Preview Issue	Text & articles	Advertisements
102 Feb 2003	20 Dec 2002	22 Jan 2003
103 Apr 2003	15 Mar 2003	22 Mar 2003
104 Jun 2003	15 May 2003	22 May 2003
105 Aug 2003	15 Jul 2003	22 Jul 2003

Print Post Approved – PP3272687 / 0052.

Preview is published six times per year by the Australian Society of Exploration Geophysicists and is provided free to all members and subscribers of the ASEG, which is a non-profit company formed to promote the science of exploration geophysics in Australia. This publication remains the legal property of the copyright owner (ASEG).

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Published for ASEG by:

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2003

January 6-10
Deep seismic profiling of the continents and their margins (10th International Symposium)
Venue: Taupo, New Zealand
Organised by Institute of Geological and Nuclear Sciences, Victoria University of Wellington and Geoscience Australia
Website: http://www.gns.cri.nz/news/conferences/seismix2003/
Email: seismix2003@gns.cri.nz

January 20-23
International Conference On Soil and Groundwater Contamination and Cleanup in Arid Countries
Venue: Sultan Qaboos University, Muscat Sultanate of Oman
Contact: Anvar Kacimov, Department of Soil & Water Sciences
Email: anvar@squ.edu.om, arkasimov@yahoo.com
Website: www.squ.edu.om

January 22-24
6th Society of Exploration Geophysicists of Japan's International Symposium on Imaging Technology
Themes: Solutions for Resource Exploration and Environmental Preservation
Organised by SEGJ and co-sponsored by the (SEG), (ASEG), (EAGE) and the Korean SEG
Venue: Nihon-Daigaku-Kaikan, Tokyo, Japan
Website: http://www.segj.org/committee/sympo/is6/index.html

February 16-19
Australian Society of Exploration Geophysicists
16th International Conference and Exhibition
Venue: Adelaide, SA
Theme: Growth through Innovation
Contact: Rob Bulfield (08 8227 0252)
Email: rob@sapro.com.au
Website: www.aseg.org.au

March 31-April 11
ASEG / NGTN / VIEPS Geophysical Field Camp and Software Workshop
Hosted: Monash University, Clayton, Victoria
Contact: Graeme Beardsmore
Tel: (03) 9905 4888
Email: gbeards@mail.earth.monash.edu.au
Website: http://www.earth.monash.edu.au/research/geophysics/courses/GWF+GSW.html

April 6-10
Symposium on the Application of Geophysics to Environmental and Engineering Problems (SAGEEP)
Venue: San Antonio, Texas, US
Organised by Environmental and Engineering Geophysical Society
Website: http://www.eegs.org

April 7-11
Joint Meeting: European Geophysical Society (EGS) XXVIII General Assembly and the American Geophysical Union (AGU) Spring 2003 Meeting
Venue: Nice, FRANCE
Contact: EGS office
Email: egs@copernicus.org;
Website: www.copernicus.org/EGS

June 2-6
65th EAGE Conference and Exhibition
Venue: Stavanger, Norway
Website: www.eage.nl

August 31-September 4
EAGE/SEG Summer Research Workshop
Venue: 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?
Venue: La Grande Motte (France)
Website: www.eage.nl

October 6-9
1st North Africa/Mediterranean Petroleum & Geosciences Conference and Exhibition
Venue: 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
Venue: Dallas, Texas, U.S.
Email: meetings@seg.org

2004

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

August 14-18
Australian Society of Exploration Geophysicists
17th International Conference and Exhibition
Venue: Sydney Convention Centre, Sydney NSW
Website: www.aseg.org.au

ASEG 16th Conference & Exhibition
Growth Through Innovation

16-19 February 2003
Adelaide Convention Centre
www.aseg.org.au/conference/Adelaide/

2003 ASEG Adelaide Conference almost here

The 2003 Conference is creeping on us all at a seemingly increasing rate (you did submit your extended abstract, didn't you, and how are your talk slides going?). Before you know it, it will be February and time to pack your bags for sunny Adelaide and see old friends. By now you should have all received your Registration Brochures, and have most likely already registered (definitely worthwhile to register now and get those early bird rates).

Program Highlights

Many thanks to all of you who submitted extended abstracts for the Conference CD-ROM. Most of the 200 first round abstracts have now been submitted in their final forms as extended abstracts, and the Program Committee is busily working their way through them.

We on the COC are really pleased with the breadth of talks that are scheduled for the Adelaide Conference. From the number of papers submitted there was no choice but to run five sessions concurrently. We have tried to divide current areas of interest in exploration geophysics into areas that not only made sense but are topical as well. As an example, potential fields have four different sessions dedicated to them, with quite different focuses. On Monday morning you can see a session dedicated to innovations; Tuesday morning, analysis of potential field data; Tuesday afternoon extraction of specific targets; and Wednesday morning a session dedicated to inversion of potential field data.

The rest of the traditional minerals-oriented geophysics areas are extensively covered as well. There will be five sessions dedicated to case studies of various ore and locality types, including two sessions dedicated to ore deposits in South Australia, Broken Hill, and the Northern Territory. Not to mention at least 15 other sessions that will be predominantly minerals oriented.

For those of you concerned about the environmental side of our industry there are no less than eight sessions dedicated solely to the detection or remediation of environmental issues. Additionally, many of the talks in other sessions have that environmental edge.

We are certain that there are more than enough talks and interest areas to keep even the most discriminating geophysicist busy for the full three days.

Workshop News

Don't forget that in order to guarantee that your favourite workshops go ahead, you must register for them by the 11th of December (of course you can register later, but we cannot guarantee that your workshop will go ahead). For those of you with interests in petroleum there is Fred Hilterman's course on Seismic Amplitude Interpretation, or Rob Stewart's Application and Interpretation of Converted Waves (along with a host of others). Or for you minerals people: Mike Asten's EM Methods course or Dave Pratt and Peter Williams' course on 4-D Structural Geology Interpretation from Magnetic Images. Time to hit that ASEG2003 website and register.

Sponsorship

We still are overwhelmed by the sponsorship response for the Adelaide Conference and we thank every one of our sponsors for their support. Ongoing thanks to Santos, our first-ever Platinum sponsor; and our two Gold Sponsors, Newmont and Schlumberger/WesternGeco. Without this strength of support, conferences like this would not be able to fulfil their essential role in communicating knowledge throughout the industry.

There are still some sponsorship opportunities available for those of you out there who have not yet decided to sponsor. Keynotes, satchel inserts, afternoon ice cream snacks, or something more original: these are all places for your company name to make an impression. If any of these opportunities are of interest to you or your company do not hesitate to contact John Hughes (john.hughes@santos.com.au) or Mike Sexton (mike.sexton@newmont.com.au).

Exhibition

Similarly, there are still booth spaces available (not too many, so don't wait too long). With an exhibition area as accommodating as the Adelaide Convention Centre your company will certainly benefit from having a booth at this conference. Lunch at this conference is included in the registration and is being served adjacent to the exhibition hall. If you haven't already arranged booth space at this event, please do it soon as the best spaces are going fast. The people to contact are Doug Roberts (dcrgeo@tpg.com.au) and Chris Anderson (euroex@bigpond.com.au).

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SEG 2002 — Salt Lake City

Attending the SEG as a representative of the ASEG provides a different view on how to participate in this conference and how to structure one's time. Without a doubt, the size of the conference and the multiple activities will mean that one cannot adequately cover everything. So if you think I can provide a comprehensive summary, then you have not attended an SEG Conference. With that in mind I will give you my impressions and let you fill in the gaps.

The Conference was held in Salt Lake City, affectionately known as SLC. Despite what you would think, SLC has a high Spanish speaking population and there were no problems with pursuing technical and other conversations after the conference hours. The SLC Convention Centre is one of the best designs anywhere, the setting was superb, lacking only snow, and the weather was equally excellent throughout. Word was that there were 6-7000 attendees, substantially down on the usual 8-10,000. This was less than the budgeted number, even taking into account the distance from the centre of the universe, Houston, resulting in a reported loss of $500k.

The Conference was bustling and in my view upbeat, so it was not absolutely clear why the numbers were not as expected. Perhaps the contraction in the seismic service industry, and uncertainties in exploration contributed to this. There are probably more informed takes on this than what I could venture. The presence of the Conference in SLC and its connection to the mineral component of the profession was reflected in an excellent presence of non-petroleum sessions and talks. On a quick count, 20% of the sessions comprised mineral topics and 25% of the workshops. This was comple-mented by a recognizably high number of corres-ponding exhibitors inclu-ding a good represen-tation of Australians, who were compelled to venture comments of varying tone about my ties.

Yours truly flanked by SEG life members; our own Brian Spies and Egypt's Samir al Moaty with an audience of Fred Hilterman (Adelaide key note speaker) and Global Affairs committee driver Pam Pterekhova politely listening to a dissertation on Australian wines and the value of the ASEG wine offer.

A noticeable shift in emphasis in the US (as distinct from Canada) is the near extinction of mineral exploration-related research, replaced by UXO detection, environmental and groundwater geophysics.

It was with pride that we saw Pat Cuneen's contribution to the global airborne exploration industry being recognized through the prestigious Enterprise Award.

The ASEG stand stood, prominently, next to other geophysical societies and adjacent to the SEG educational stand. It was also on the way to the posters. The Adelaide conference poster had pride of place as it did on rolling advertisements throughout the sessions. I was also given the opportunity to present to features of the Conference at the Asia/Pacific luncheon. Packages describing the Society and its publications disappeared with pleasing rapidity. Personal entreaties to various attendees and exhibitors on attending our conference were received positively and interest, albeit with comments on the distance. This is testament to the appeal that we should capitalize on at future conferences.

In the background of the Conference is the machinery. The Council meeting, to which ASEG is entitled to three seats, provides a means by which the membership sanctions the actions of its Executive Committee. The seating arrangement highlights the prominence of the affiliated nature of the ASEG. It was noted by the outgoing President, Walt Lynn, that although it was recognized that the SEG was

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3DEM Symposium

The organisers of the Third International Symposium of 3-Dimensional Electromagnetics are expecting about 70 to 100 registrants for this two-day meeting occurring directly after the ASEG Conference. Quite a number of the presenters at the 3DEM Symposium will be presenting at the ASEG Conference and vice versa. And remember all of you petroleum people, this symposium is for you also, EM has a lot to offer especially as we push the limits of resolution and depth of investigation.

Social

Arrangements for the social side of the Conference are important to us here in Adelaide. We are gearing up for dinner at Adelaide Oval. Wines are being sampled, menus selected, and entertainment chosen. Will Barry Long's dinner jacket be ready in time, and what does he have in store for us at the Conference Dinner? Will the magician really appear at our Conference Dinner? ... and many more. So it won't be all serious talks and business business business.

For more information on ASEG 2003 please visit our website www.aseg.org.au/conference/adelaide or contact the Conference Co-chairs, Richard Hillis (rhillis@ncpgg.adelaide.edu.au) and Mike Hatch (zongeaus@ozemail.com.au), or the Conference Organiser, Rob Bulfield of SAPRO (aseg2003@aseg.org.au).

Geophysical Field Camp & Software Workshop

(sponsored by VIEPS, MCA and ASEG, 31st March - 11th April, 2003)

The Victorian Institute of Earth and Planetary Sciences (VIEPS), in collaboration with the Minerals Council of Australia (MCA) and the Australian Society of Exploration Geophysicists (ASEG), is pleased to announce its third Geophysical Field Camp and Software Workshop, to run over the first two weeks of April 2003.

Both the Field Camp and Software Workshop are fully accredited by the National Geoscience Teaching Network (NGTN) and may be counted towards a VIEPS Honours or Masters degree or a CODES/G3 Mastersby- coursework degree.

The Geophysical Field Camp will be held from 31 March — 4 April in the town of Maldon in the Victorian Goldfields. Experienced, professional geophysicists will lead participants in a search for palaeo river channels (deep leads) hidden beneath pastoral land. Participants will gain experience in survey design, field procedure, preliminary data reduction and the operation of a wide range of modern geophysical and geotechnical equipment in the search for a real and relevant economic target.

The Software Workshop (7—11 April) will be held immediately following the Field Camp, at Monash University (Clayton Campus) in Melbourne's southeastern suburbs. Course participants will acquire theoretical and practical experience while processing the geophysical data collected during the Field Camp. A variety of "state-of-the-art" software packages will be used during practical sessions covering data import, reduction and filtering; geological modelling; inversion algorithms; presentation and interpretation of results. Short presentations on theoretical concepts will be interspersed with hands-on, practical sessions lead by academic and industry trainers.

Equipment:

Geometrics TR1 OhmMapper, Geometrics G858 magnetometer, Geometrics G856 magnetometer, Scintrex CG-3M microgravity meter, Seistronix RAS-24 seismograph, PulseEKKO 100 GPR, SIROTEM Mk3, Phoenix IP/Resistivity, Scintrex IGS-2/IP-4.

Software:

GM Sys, ERMapper, EMVision, GPR Vista, Oasis montaj, Profile analyst.

Expressions of interest should be directed to:
Graeme Beardsmore
National Geoscience Teaching Network
Telephone: +61 3 9905-4888
Fax: +61 3 9905-4903
E-mail: gbeards@mail.earth.monash.edu.au

Further information and enrolment forms can be found at:
www.earth.monash.edu.au/research/geophysics/NGTN_Home.html
Images from the 2001 course.

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predominantly petroleum, its future lay in building bridges to applied applications of geophysics in all areas. The demographics of the SEG are shifting from predominantly US membership above age 40 and predominantly non-US below this age. This will transform the Society in the next few years to that of a truly International Society and consequently the ASEG, as an International leader will increase. It was also of note, Halliburton's generous offer to fund all new student memberships globally.

The biggest impression I had, was the opportunity the ASEG has to link with sister Societies in Asia/Pacific and to promote ties with the Societies from Brazil and South Africa, with whom we share similar perspectives. This can only enhance the awareness of these Societies to the technical depth present in the Australian geophysical community and hence increase our global opportunities.

Kevin Dodds

Australian Capital Territory - by Nick Rawlinson

In the latter half of 2002, the ACT Branch has held a number of technical meetings featuring a diverse range of talks. On the 26th June at Geoscience Australia, E'va Papp (Department of Geology, ANU) spoke about the use of ground penetrating radar in assessing site contamination in Antarctica. One particular use of ground penetrating radar that E'va alluded to was in estimating the volume of material contained in abandoned waste dumps associated with the Wilkes Station and old Casey Station. Accurate estimation of waste volume is essential for optimising the container and shipping resources required for the removal of the waste material from the continent.

On the 17th July, Prame Chopra (Department of Geology, ANU) presented a talk at Geoscience Australia entitled: *Hot rock geothermal energy - the road from science to the ASX*. Hot Dry Rock (HDR) geothermal energy is a clean, renewable energy resource, which shows much promise in helping to satisfy the world's future energy requirements. In his talk, Prame showed that Australia is well suited to HDR since it contains large volumes of rock at temperatures in excess of 200° C at depths of only 3-4 km. Energy can be extracted by circulating water through boreholes drilled into the rock and generating electricity using conventional geothermal power station technology. Prame, along with Doone Wyborn, are the pioneers of HDR in Australia, and are largely responsible for the resource evaluation, economic modelling and sub-surface design that have identified Australia as having economically viable HDR resources. Prame is a director of Geodynamics, a company set up to commercialise Australia's HDR resources. As well as explaining the science behind HDR, Prame described the political and economic hurdles that had to be negotiated before it could become a commercial proposition.

On August 28th, a lunchtime meeting was held at The Brassey of Canberra near Parliament House. During the cheese course, Todd Nicholson (Research School of Earth Sciences, ANU) gave a fascinating talk on locating earthquakes and nuclear explosions by pattern recognition. Conventional methods of earthquake location depend on seismic velocity models of the earth; however, such models do not extract all the structural information contained in the data. Todd presented his "Arrival Pattern" method for earthquake location, which compares a new event to many previous events in order to determine where the most similar events have occurred. The basic assumption of the method is that the waves emanating from two nearby earthquakes will take similar paths and times to reach common receivers. Todd generated much interest in the audience by relocating 400 US nuclear weapon tests using his arrival pattern approach and showing that mislocation can be reduced by up to 82% over conventional velocity model based methods.

The most recent technical meeting was held at ANU on the 25th September. Richard Lane from GA gave a talk entitled: *A square waveform for all-round performance*, which described the design issues, triumphs and tragedies associated with getting the TEMPEST AEM system off the ground. This airborne electromagnetic mapping system was developed by the Cooperative Research Centre for Australian Mineral Exploration Technologies (CRC AMET). Without revealing any commercial secrets, Richard gave an intriguing talk, which demonstrated the viability of the new system.

The ACT branch attempts to hold technical meetings once a month and tries to keep members informed well in advance of each meeting by email. Most meetings include nibbles and local wine. Everybody is welcome!

Western Australia - by Megan Evans

September's technical evening in WA was based on the topic of geophysics and the environment. Simon Abbott presented a topical paper from the recent Salinity, Land Management and New Technologies conference entitled *Airborne Geophysical Data for Enhanced Rapid Catchment Appraisal*. The paper illustrated how geophysics can be used empirically to model the shape of the catchment's basement. The shape of the basement could then be used to identify potential subsurface flow patterns and delineate where subsurface water runoff and groundwater may flow. In the Kent River Catchment it was shown that contrary to the surface terrain, subsurface water runoff moved into the neighbouring catchment, resulting in flooding and increased salinisation of farmland.

From the other side of the fence, Geordie Clapin from Sinclair Knight Merz presented the results from studies into the effects of seismic air-guns of aquatic life. The studies showed that whale songs are emitted at approximately the same frequency as the blast from the air-guns. This phenomenon may account for the attraction of whales to seismic vessels during survey, but would also mean that the frequency of the blast is unlikely to upset the marine environment. Other studies on the effects of air-gun usage on marine life continues. However, as fish do not have ears, it is thought that it is unlikely that they will be disturbed.

The month of October contained two meetings for the WA branch of the ASEG this year, to fit in all the talks given by the honours students from Curtin University. These talks included:

Adam Kroll - *Comparative study of different AEM systems using real and synthetic data for massive and disseminated Ni-Cu-PGE in Western Australia*

Ryan Metcalfe - *A Comparison of ocean bottom with surface seismic data using calcified physical models*

Reece Foster - *The effectiveness of spectral analysis of surface waves for mapping regolith*

Justin Vermeulen - *Multiple attenuation using periodicity and velocity discrimination based techniques*

Anousha Hashemi - *Inversion of TDHEM data for exploration of manganese ore, East Pilbara Western Australia*

Barrett Cameron - *Rapid acquisition of audio-frequency magnetotellurics*

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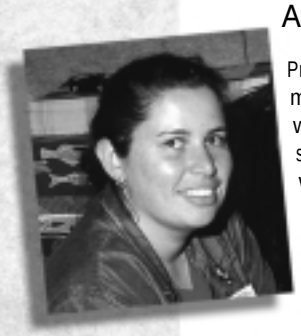
Australian Science



Natasha Hendrick

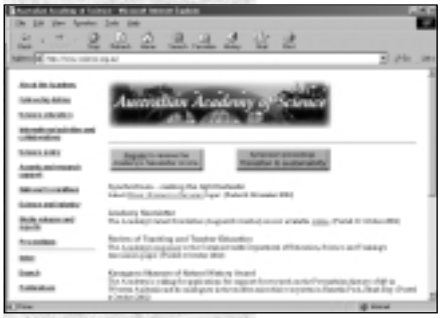
If you have any of your own favourite science sites you would like to share with your fellow ASEG members, please contact me (natasha@velseis.com.au) and I'll include them in future editions of Preview.

Professionals from a wide variety of disciplines make up the membership of the ASEG. However, we are linked by our common interest in the science (and art!) of geophysics. I hope also, that we share a common fascination with science in general. This edition of Preview I highlight a few interesting websites that help spread the word about the trials, tribulations, magic, mystery and fun of science in Australia.

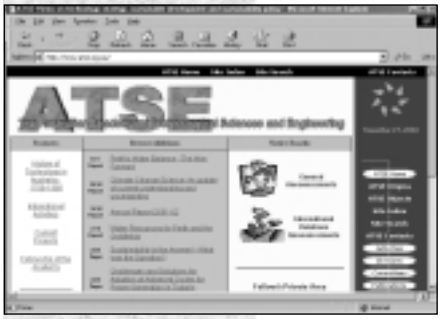
Australian Science Archives Project (ASAP) www.asap.unimelb.edu.au

ASAP aims to improve access to Australia's scientific, technological and medical heritage by helping to preserve records and artifacts, and communicating the existence of this heritage to a wide audience. Established in 1985, ASAP provides a variety of resources relating to the history of science. You can browse or search 'Bright Sparcs' - a register of over 4100 people involved in the development of science in Australia, including references to their archival materials and bibliographic resources. Did you know that there are 26 geophysicists included in the Bright Sparcs register? If you like doing puzzles, you will find crosswords, find-a-words and some double acrostics, all based around Australian science. You'll also find 100's of links to other Australian scientific resources.

Australian Academy of Science www.science.org.au



If you haven't visited the Australian Academy of Science's website before, it's well worth logging-on to check out the latest in science news and views. Here you'll find articles that cover current debate on the future of Australian science research and education. In addition, there are numerous resources for science teachers including links to sites that provide an introduction to basic science concepts, and information on the Primary Investigation science program for primary schools. You'll also find fact sheets on numerous science topics covered in the news, and through the Australian Foundation for Science you'll come across some interesting interviews with a number of outstanding Australian scientists.



The Australian Academy of Technological Sciences and Engineering www.atse.org.au

The ATSE is an applied science academy, formally inaugurated in 1976, that provides advice and assistance to the Commonwealth and State Governments. On this website you'll find an e-book entitled 'Technology in Australia 1788-1988' which gives a condensed history of Australian technological innovation and adaptation during the first two hundred years. There are also a huge number of papers and reports, covering topics such as water resources, sustainability, power generation, mining and minerals, wine research, biotechnology ... the list goes on.

The Lab, ABC Science Online www.abc.net.au/science

Always a fun site to visit ... The Lab is a conglomerate of scientific facts and figures. Find out more about Health Matters and read up on the latest ideas about Environmental science. The Slab is an archive of all the science features covered in The Lab, and well worth a browse. As I mentioned in the June edition of Web Waves, you can find out plenty about our solar system and space via the In Space gatewayThe ABC hosts a number of interactive science forums for those of you who like to participate in scientific debate. Visit Dr Karl (our guest speaker at the 2001 Brisbane ASEG Conference) for some weird and wonderful science tidbits and the results of the infamous Belly Button Lint Survey. You can also read transcripts and summaries from a number of ABC science TV and radio shows.

Exploring and Collecting History Online (ECHO) echo.gmu.edu/center/

ECHO is a virtual centre for cataloguing, annotating and reviewing websites on the history of science, technology and medicine around the world. It incorporates the WWW virtual library for the History of Science, Technology and Medicine established in 1994. Here you will find links to sites covering earth sciences, engineering, physical and life sciences, information technology, behavioural sciences, aviation, space exploration, industrial technology ... the list goes on. You'll also be able to read about some interesting first-hand accounts from people who were there at significant scientific moments in history (such as using the first CD, developing the first artificial heart, drilling through kilometres of Greenland ice, writing the first computer modelling program, making the polymerase chain reaction etc).

Pat Cunneen Receives The SEG Enterprise Award

Congratulations to Pat Cunneen, entrepreneur extraordinaire, who was awarded the SEG Enterprise Award at this year's Convention at Salt Lake City. Pat has made, and is continuing to make, enormous contributions to geophysics in Australia and overseas. The award is well deserved and the citation is reproduced below, along with a historical snapshot from 1997.

"SEG is honouring James Patrick Cunneen with the Enterprise Award in recognition of his courage, ingenuity and achievement while risking his own resources and future in the founding of Aerodata Holdings Limited, an airborne geophysical company that grew into a major world player with the minerals and petroleum industry. Pat is consistently described by many as a visionary and entrepreneur who saw the role of airborne geophysics extending beyond its conventional role and that R & D was the key to success. Pat led and inspired many talented and innovative individuals who contributed to Aerodata and World Geoscience Corporation through three distinct phases airborne geophysics activity. When Aerodata began in 1977, the primary use of airborne geophysics was in mineral exploration. A second phase in the late 1980's saw Aerodata and its subsidiary World Geoscience examining methods in environmental applications for reversing the environmental degradation due to dry land salinity in Western Australia. A third phase was the pioneering of high-resolution magnetics for oil and gas exploration. Many of the advances in high-resolution imaging and visualization of aeromagnetic data can be traced directly to the new methods of processing and interpretation of magnetic and electromagnetic data acquired by Aerodata and World Geoscience."

Pat Cunneen

Pat Cunneen as paymaster on payday 1977, somewhere in Western Australia.

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Gemma King - *A comparison of three-dimensional gravity inversion techniques over the Laverton region of Western Australia*

Christopher Hudson - *Development of a capability to perform analogue seismic modelling of complex structures*

Jared Townsend - *Comparison of TEM sensors for detection of conductive targets beneath a conductive overburden*

Luke Brown - *Numerical analysis of fractured porous rock models*

Karen Gilgallon - *Geophysical investigations of paleo-channels in the Lake Bryde catchment, Western Australia*

Benn Hansen - *Evaluating the impact of fracture-induced anisotropy on reservoir rock property estimates made from seismic data*

The 15th annual ASEG/PESA golf was also held on the 1st of November, at the beautiful Araluen Golf course. Despite some bad weather early on, a great day was had by all. Many thanks go to the organizing committee and sponsors. The results of the day showed the Corporate Challenge Winners as: GeoQuest 1- Tony Blunden, Ian Boserio, Sean Guest and Keith Martens. The winners of the Individual Team were Jason McKenna, Troy Thompson, Don Sherlock and Megan Evans.

New Members

We welcome the following new members to the ASEG. Membership was approved by the Federal Executive at its meeting on 30 October 2002.

Name	Organisation	State/Country
Eric R. Allison	Shell UK	UK
Graham Ascough	Noranda Pacific	Qld
Stephen R. Biggins	SAMAG	SA
Phi Vu Bui	Macquarie University	NSW
Darren Lee Griggs	University of Tasmania	Tas
Bin Guo	Macquarie University	NSW
Thom Jewell	Santos Limited	SA
Glenn D. Morgan	University of NSW	NSW
Andreas Pfaffling	Alfred Wegener Institute	Germany

Mineral Exploration Action Agenda Underway

The whole of Government Mineral Exploration Action Agenda to boost mineral exploration activity in Australia got underway this week with the first meeting of the high-level Strategic Group. Peter Lalor, the Executive Chairman of Sons on Gwalia, is chairing this with representation from the mineral industry, two State Governments (NSW and WA) and the Commonwealth. As far as can be established Neil Williams the CEO of Geoscience Australia is the only Geoscientist on the Group.

Meanwhile, the Western Australian Government is pushing for significant action on this issue. John Bowler has reported to his Minister Clive Brown, and made a series of very significant recommendations aimed at increasing exploration investment (see Industry News in this Preview). Meanwhile Clive Brown has made a few suggestions of his own to the Commonwealth. He stated that: "the lack of a national mineral and energy policy is a major impediment to reversing the decline in mineral exploration in the Australian resources industry and called for a national policy to recognise the strategic nature of Australia's mineral and petroleum resources."

Brown called for the implementation of a national resources and energy policy to provide a clear direction on national exploration policy and act as the first phase needed to stimulate the discovery and continued development of our national resources endowment. Then in good old party-political parlance he said that: "It would provide the long-term strategic direction that is currently lacking from Australia's Commonwealth Government."

It seems that incentives to mineral exploration are clearly on the agenda. We will await the Commonwealth's response.

Earth Sciences Obtain 6% Of Total Grants In ARC 2003 Program

The ARC grants for 2003 were announced earlier this year. The details of the 1252 new projects are contained on the Australian Research Council Website (http://www.arc.gov.au). I do not intend analysing these in any detail but thought it may be of interest to give some information on the more geophysically oriented projects that will receive funding in 2003.

Of the successful 921 Discovery Project Grants 57 are listed under the Earth Sciences and four are categorised as geophysically oriented. These are:

Theoretical and experimental study of elastic properties of porous media permeated by aligned fractures

Researchers: B. Gurevich, M. Urosevic, W. V. Pinczewski and S. A. Shapiro
Funding: 2003, $95 000; 2004, $85 000; 2005, $75 000
Administering Institution: Curtin University of Technology
Summary: The aim of the project is to develop a theoretical model for the elastic properties of fractured porous reservoir rocks, taking into account the wave-induced fluid flow between pores and fractures. This will be done by theoretical analysis based on the model of fractures as planes of discontinuity in porous rock, and on the theory of wave propagation in anisotropic porous media. The theoretical model will be verified using numerical simulations and ultrasonic measurements made on synthetic porous and fractured samples. The results are expected to benefit seismic exploration and the production of oil and gas in fractured reservoirs.

Craton Edges and Sutures in the Australian Mantle

Researchers: B. L. Kennett and G. A. Houseman
Funding: 2003, $120 000; 2004, $120 000; 2005, $120 000
Administering Institution: The Australian National University
Summary: A major seismic experiment using recording of distant earthquakes will be used to provide images of 3-D structure in the Earth's crust and mantle along the length of the edge of the Precambrian Australian Shield and across the suture between the South and North Australian cratons within the Shield. Seismic structures derived from different classes of geodynamic models will be compared with seismic results derived from a variety of styles of data interpretation, including seismic tomography. The experiment will improve understanding of the range of physical processes associated with rifting and building of continents.

Airborne electromagnetic estimation of groundwater quality and distribution in the top 100 m of the Earth

Researcher: J. C. Macnae
Funding: 2003, $60 000; 2004, $60 000; 2005, $40 000
Administering Institution: RMIT University
Summary: This research will develop processing methodology to predict groundwater concentration and quality in the top 100 m of the Earth, using continuously sampled airborne electromagnetic data. The method to be developed will process received responses to separate and identify propagation delays, distinct from the usual diffusive delays caused by shallow conductive materials. The extracted propagation delays then predict ground moisture content. With proposed changes to transmitter hardware, we can also achieve improved shallow resolution of conductive structures, such as shallow saline groundwater layers. However, the new method will pioneer the remote detection of fresh waters.

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Terrorist Threat Forces Cancellation Of Geophysical Conference

One of the casualties of the Bali terrorist attack has been the International Geophysical Conference and Exposition, scheduled for 27th - 30th April, 2003, in Yogyakarta, Indonesia. This has now been cancelled because of the security situation. Below is a letter from Basuki Puspoputro the Technical Co-Chairman of Yogya2003.

Dear friends,

I would like to inform you that the Organizing Committee of Yogya2003 have decided to cancel the International Geophysical Conference and Exposition, scheduled for 27th - 30th April, 2003, in Yogyakarta, Indonesia. The cancellation is in accordance with the opinion of both the Indonesian Association of Geophysicists (HAGI) and the Society of Exploration Geophysicists (SEG), in their response to the uncertain security of the region, following the blast in Bali on October 12, 2002. The decision effective as per November 1st, 2002, is also a consequence of the commitment of the Organizing Committee to the security of the participants, exhibitors, and attendees.

I am preparing the final report of the Technical Committee, including the related financial matters. I can send the copy if you are interested. I have just completed sending email to 96 authors of 96 abstracts. Three authors could not be contacted because of failing in obtaining their email address. They are G.M. Hamada of King Saud University, Saudi Arabia, Yvette HP Djomani of Macquarie University, Australia, and Ronghe S., of University of Brunei Darussalam, Brunei.

I also plan to send email expressing our appreciation to gentlemen who committed to give a lecture or course or keynote speech.

This letter is to express my personal and the appreciation from the Technical Committee to your contribution in supporting the Yogya2003. Together with you we will maintain our spirit to develop geophysics, geophysicists, and the application of geophysics.

Yours sincerely
Basuki Puspoputro, Technical Co-Chairman of Yogya2003.

Very sad how the world has changed since September 11 and October 12.

Tim Besley Appointed New Head Of ARC

Earlier this month the Minister for Education Science and Technology, Brendan Nelson, announced the appointment of Tim Besley AC FTSE as the new Chair of the Board of the Australian Research Council (ARC). Mr Besley is currently President of the Australian Academy of Technological Sciences and Engineering.

He has distinguished himself through outstanding careers in both the public and private sectors, having served as Chairman of the Commonwealth Bank of Australia and Leighton Holdings and as Secretary of the Commonwealth Department of Business and Consumer Affairs. Mr Besley also served as Chancellor of Macquarie University from 1994 until 2001.

He has been a committed advocate for the advancement of science, innovation and education and has performed, with distinction, a range of government and corporate responsibilities. He is highly regarded in the research and scientific communities and will ensure that the ARC continues to provide high quality advice to the Government. As the Minister said:

"The ARC is at an important stage in its development as it moves through its second year of operation and seeks to build on the strong performance established during its first year."

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Numerical Models of Plate Tectonics, Mantle Convection and Slab Dynamics with Evolving Faults

Researchers: L. N. Moresi H. B. Muhlhaus and S. Zhong
Funding: 2003, $110 000; 2004, $110 000; 2005, $80 000
Administering Institution: Monash University
Summary: We plan to develop a method for simulating large-scale geological structures with a much improved treatment of tectonic faults in 3D. Current computer models have sharp geological faults at plate boundaries represented by broad, blurred zones. New techniques for modelling cracks in engineering structures will be scaled up to the whole Earth. This will help us to understand how the Earth's plates move and interact now and in the past and how the structure of the continents arose. Not only is this intrinsically interesting, it will also be of immediate practical benefit to geological modellers.

Of the **Linkage-Infrastructure Equipment and Facilities** program, $25.2 million have been allocated for 2003. In the Earth Sciences four projects totaling $3 million were successful with the largest being the IODP.

The International Ocean Drilling Program - Australian Collaboration

Project Leader: J. B. Keene, The University of Sydney (administering institution)
Partner Organisations: AVCC, Geoscience Australia and CSIRO - Exploration & Mining
Summary: 21 countries support The Ocean Drilling Program. Australia contributes as a 1/3 member of a consortium with Canada, Chinese Taipei and Korea. The drill ship JOIDES Resolution is the unique facility allowing researchers access to the environmental and geological data recorded in the seafloor. 2003 is the final year of the Program. The ship will be drilling sites of international importance in the study of oceanic crust generation; past extreme climates linked to mass extinctions; past ocean chemistry and circulation; and the formation of continental margins. Fourteen Australian Universities, CSIRO and GA support ODP and provide scientists for pre- and post-drilling research and postgraduate training.
Allocation: $1 363 123

Perhaps the most geophysically oriented project approved under this category is GeoWulf.

GeoWulf: An Inference Engine for Complex Earth Systems

Researchers: J. L. Braun, M. Sambridge, A. J. Gleadow, R. W. Brown S. Y. O'Reilly M. C. Dentith, B. R. Minty, C. Beaumont and W. L. Griffin
Partner Organisations: The Australian National University (administering institution), The University of Melbourne, Macquarie University, The University of Western Australia, Geoscience Australia, Dalhousie University and Cougar Computers Canberra Pty.
Summary: The project is to build a 'Beowulf' cluster as a platform for solving complex data inference problems in the Earth Sciences, and in particular the fields of thermochronology, seismology, crustal and mantle dynamics, and landform evolution. A Beowulf cluster is a network-linked set of commonly available 'off-the-shelf' PC-computers configured to give unprecedented performance/cost ratio. Projects using the Beowulf facility will combine state-of-the-art computational techniques recently developed at the ANU, and high quality data sets collected over the past decade to address fundamental questions in the Geosciences.
Allocation: $190 000

In the Linkage Projects and Linkage APAI section the Earth Sciences only scored 14 successful grants out of the 325 approved. Of these five, two are geophysical projects from Tasmania. They are summarised below:

Time-lapse geophysical monitoring of acid mine drainage at Savage River Mine, North-western Tasmania

Researchers: J. E. Reid, M. J. Roach and B. Hutchison
Funding: 2003, $23,033; 2004, $23,033; 2005, $23,033
Administering Institution: University of Tasmania
Industry partners: Australian Bulk Minerals, Department of Primary Industries, Water and Environment
Summary: This project will apply geophysical methods to image and monitor the subsurface distribution, and short and long-term temporal variations in ground conductivity associated with Acid Mine Drainage (AMD) at the Savage River Mine, Tasmania. AMD is a major environmental problem affecting mining operations across Australia. Geophysical techniques are inexpensive means of mapping variations in subsurface electrical conductivity related to changes in groundwater levels and contaminant concentration. The major outcomes of this project will be development of appropriate geophysical methods and interpretation techniques for delineation and monitoring of AMD at sites characterised by high seasonal rainfall and significant topography.

Application of the multichannel self-potential method to detection of seepage from mine tailings impoundments

Researchers: J. E. Reid and M. J. Roach
Funding: 2003, $23,033; 2004, $23,033; 2005, $23,033
Administering Institution: University of Tasmania
Industry partner: Pasminco Rosebery Mine
Summary: This project will use a modern multichannel geophysical data acquisition system to study short and long-term variations in self-potential measurements at a tailings dam. The project will use the self-potential method to detect fluid seepage paths through the dam wall, and will use numerical models to make quantitative estimates of seepage rates. The major outcomes of the project will be a rigorous appraisal of the utility of the self-potential method for mapping seepage in an operating mine environment, and construction of fluid flow paths through the dam which can be used to guide future remediation work.

Congratulations to all successful applicants.

Eristicus
Canberra, 20 November 2002

Bowler Report Recommends Actions To Lift Greenfields Exploration In WA

The Bowler Inquiry into greenfields exploration in Western Australia reported to the State Development Minister Clive Brown on 12 November 2002. The Inquiry was established in April 2002 by the Minister, to investigate the reasons for reduced levels of private investment in greenfields mineral exploration in Western Australia. In addition, the Inquiry was to recommend actions that might be taken by the State and Federal governments to achieve the level of expenditure necessary for a sustainable future for this important sector of the Western Australian economy. John Bowler MLA, Member for Eyre, chaired the Inquiry.

It is the first review of its kind ever undertaken in Australia, and aims to increase the proportion of the world's exploration investment coming to WA. It will form a good basis for the Whole of Government Action Agenda on Mineral Exploration announced in September this year by Ian Macfarlane, the Federal Minister for Industry, Tourism and Resources (see Preview 100, p20).

The 131-page report contains 33 recommendations, and will be open for public comment until 16 December 2002. The report can be accessed at: www.dme.wa.gov.au/news/GovernmentReviews/bowler.html.

Exploration has recently fallen to critically low levels in Western Australia. Mineral exploration activity in 2001–02 was 47% lower than the peak of $705 million expended in 1996–97. Exploration expenditure in greenfields areas (defined as more than 5 km from existing mines) fell 63% during the period 1996–2001. Petroleum exploration expenditure in Western Australia also fell in 2001–02 from $687.5 million in 2000–01 to $479.8 million.

It has been suggested that this reduced level of investment threatens the long-term future of the industry that underwrites the high standard of living enjoyed in this State.

The Inquiry addressed the multitude of reasons behind the decline in mineral exploration and onshore petroleum exploration, including issues such as the world downturn in demand and prices for minerals, amalgamations and rationalisation in the industry as a consequence of globalisation, increased national and global competition for exploration investment, perceptions of prospectivity and relative lack of modern regional geoscience data sets, land access difficulties, and financial issues.

Recommendations

The seven highest-priority recommendations address the following issues:

1. Reducing the backlog of mineral tenement applications
   The State Government should expedite processes, including legislative changes to the Mining Act and issues surrounding Native Title (based on the principles emanating from the recommendation of the Technical Taskforce on Mineral Tenement and Land Title Applications, 2001), to remove the backlog of mineral tenement applications and convert these to exploration titles within two years. The estimated cost to address the Mining Act issues is $5 million over two years.

2. Provide pre-competitive geoscience information
   The State Government should:
   - Increase the availability of pre-competitive geoscientific data and analysis in order to improve WA's competitiveness and to sustain interest in the prospectivity of WA.
   - Maintain a base level of activity within the Geological Survey of WA at no less than the current level by maintaining it's funding at $17 million per year in real terms.
   - Expand regional geophysical data coverage, especially in greenfields regions, with a special allocation of $24 million over six years, as recommended by the 2001 Fardon Review of Funding for the Geological Survey of WA.
   - Provide a counter-cyclical geological-skills retention fund. This would reflect the level of activity within the exploration industry, thus countering the boom and bust nature of the exploration industry to retain geological skills in WA. The fund would be for labour-intensive projects of geoscience data collection, management and analysis, and would decrease in boom periods and increase as the bust period extends (e.g. year 1, $1 million; years 2 and 3, $3 million per year).

3. Issue greenfields exploration titles
   The State Government should, in consultation with the exploration industry, establish a "greenfields regions exploration licence" with special conditions (e.g. increased maximum size; reduced rate of area reduction; extension of expenditure commitment timeframes etc.). This would recognise the greater risk and difficulty of exploring in less understood, remote parts of WA.

4. Improve heritage protection protocols
   To assist in expediting tenement applications, the State Government implements recommendations of the Technical Taskforce on Mineral Tenements and Land Title Application, 2001 by developing Heritage Protection Protocols that:
   - Address the heritage issues of native title claimants;
   - Provide for the continued use of the expedited procedure under the NTA where heritage protection is agreed by the tenement applicant; and
   - Avoid the requirement for multiple heritage surveys over the same ground.

5. Provide support to deal with Native Title
   The State Government should provide guidance and information to prospectors and small companies regarding the Native Title and Heritage processes through a program similar to the business support

provided by the Small Business Development Corporation and Business Enterprise Centres.

6. Introduce flow-through shares scheme
   The State Government should recommend to the Federal Government a flow-through share scheme similar to that operating in Canada where 150% deductions on exploration expenditure apply.

7. Review the Heritage Act
   The State Government undertakes to have the Aboriginal Heritage Act reviewed, using the previous review of the Act by Mr C Senior as the basis for initiating consultation with relevant parties.

Outcomes

It is the belief of John Bowler and the Reference Group that these recommendations have the potential to:

- Restore mineral exploration to a level at which the industry is more likely to be sustainable in the long term. This is probably about $600 million dollars annually, which is about $200 million per year more than currently; and
- Establish a viable and significant petroleum industry in onshore basins.

Economic modelling as part of the Inquiry indicated that if exploration investment were to increase by $100 million (and be maintained for five years), then the projected cumulative effects over a 20-year period (notionally 2001-02 to 2020-21) would be (in nominal dollars):

- $10.4 billion in investment
- $45.8 billion in export revenue
- $32 billion in Gross State Product
- $1.7 billion in State Government revenue (undiscounted and pre-Grants Commission revenue effect).

Compared with the normal levels in the equivalent period, total employment in the State would be 0.8% higher (or about 11 700 jobs) in 2020-21. About 40% of these jobs would be in regional areas.

In summary, a very positive report for the resource industries. We will have to await the response from the Commonwealth and indeed the WA Government to the recommendations.

Rio Tinto Awarded $35 Million Commonwealth Funds For Research Initiative

The Rio Tinto Foundation for a Sustainable Minerals Industry, an Australian-based research initiative between business and government, was launched in early November by The Hon Jan Macfarlane, Federal Minister for Industry, Tourism and Resources. According to the media release:

"The Foundation, which involves Federal Government funding of $35 million and Rio Tinto funding of a similar magnitude, will contribute to the development of the technical strength of the Australian minerals industry in the face of new environmental challenges.

Brian Horwood, Chairman of the Foundation and Managing Director of Rio Tinto Australia said, "The Rio Tinto Foundation for a Sustainable Minerals Industry will encourage research and development programs in Australia focused on significant environmental issues that involve the minerals sector. This approach will offer benefits for Australia and its trading partners, as well as to participating organisations.

"The minerals industry has long been a major contributor in Australia's economic prosperity Rio Tinto, and many other companies, have recognised that a strong and environmentally responsible minerals industry can play an essential role in sustainable development. The Foundation aims to maximise research and development opportunities for practical innovations. In particular, there will be a strong focus on improving the minerals industry's efficiency of energy and water use and reducing emissions," he said.

The Foundation will provide further impetus for Rio Tinto's research and technological development programs and

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other initiatives aimed at improving sustainable development outcomes. Based in Australia, the Foundation will develop and maintain links with relevant international business, government and non-government organisations. Initial Foundation projects will include three research and development programs that have been identified by Rio Tinto and the Federal Government as priorities:

Enhanced bio-fixation of carbon dioxide
Molecular breeding is a promising potential route to developing new chemical and biological processes of carbon dioxide sequestration. In partnership with Maxygen, a Californian company and a leader in this field, Rio Tinto will accelerate its research program in this area.

Increased energy efficiency in mining and processing
More efficient use of energy across all aspects of mining and processing will reduce greenhouse gas emissions significantly. The company will pursue some substantial opportunities for the increased energy efficiency, particularly in the bauxite and iron ore industries.

Development of advanced aluminium smelting cells
Advanced cell technology, including the use of' inert anodes and wetted cathodes, could reduce the electricity needed for primary aluminium production by 25% to 30%. In Australia, where a large proportion of this electricity originates from fossil fuel power stations, success will provide substantial greenhouse gas reductions.

The Foundation will be steered by an Advisory Board, comprising six members:

- Brian Horwood, Managing Director, Rio Tinto Australia
- Sam Walsh, Chief Executive, Comalco
- Robin Batterham, Chief Scientist of Australia and Chief Technologist, Rio Tinto
- Vicki Sara, Chief Executive Officer, Australian Research Council
- John Ryan, Deputy Secretary, Commonwealth DITR
- Bernard Wheelahan, Director, Transfield Services and Chairman, Cooperative Research Centre for Sustainable Resource Processing.

Rio Tinto will provide the Secretariat for the Foundation, with the Secretariat ensuring that Rio Tinto technical professionals are involved in the programs. Mike Hollitt, Rio Tinto General Manager, Strategic Technologies has been appointed as Executive Director of the Foundation and Chairman of the Rio Tinto Working Group.

Details of the agreement have not been announced but at first sight it seems like a good deal for Rio Tinto, because presumably they will be able to obtain R&D tax concessions for the research programs as well as the Federal Funds.

Falcon To Be Used In Diamond Hunt In Northern Australia

The Falcon airborne gravity facility continues to be used in the diamond search. Gravity Capital Ltd has reached agreement in principle with Rio Tinto Exploration Pty Ltd to farm-in to four of Rio Tinto's most advanced diamond exploration areas in northern Australia.

The key element of the farm-in will be the application of the Falcon™ airborne gravity gradiometer system, which has discovered a number of diamond pipes in various parts of the world.

There are four project areas - McArthur, Hodgson, Camooweal and Arnhem, where surface sampling has returned abundant micro-diamonds and significant macro-diamonds. In most cases, the kimberlite source of the diamonds has evaded prior exploration. The Falcon™ system, conceived and developed by BHP Billiton, and will be used in the region to locate new drill targets.

GCap may earn a 51% interest in any pipe discovered by sole funding exploration and assessment sufficient to determine the grade and diamond valuation. GCap will commit to spend $2.5 million in the first year, approximately $2 million of which will be allocated to Falcon™ surveys over the highest priority ground.

Sons of Gwalia Share Price Falls To 25% Of Value Earlier This Year, But Long-term Prospects Look Sound

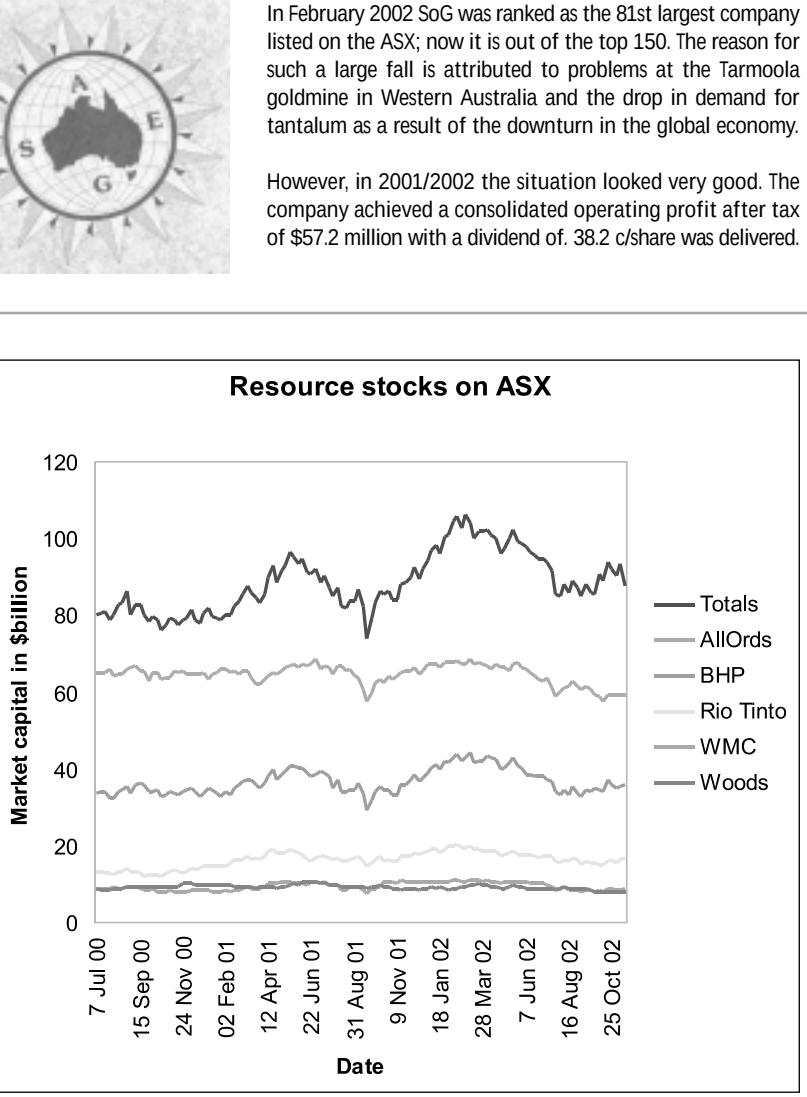
The stock market is always an unpredictable animal, but very few would have forecast the dramatic fall in the value of Sons of Gwalia shares during 2002. From a high of over $8 a share in February the value is down below $2 in mid-November.

In February 2002 SoG was ranked as the 81st largest company listed on the ASX; now it is out of the top 150. The reason for such a large fall is attributed to problems at the Tarmoola goldmine in Western Australia and the drop in demand for tantalum as a result of the downturn in the global economy.

However, in 2001/2002 the situation looked very good. The company achieved a consolidated operating profit after tax of $57.2 million with a dividend of. 38.2 c/share was delivered. The gold production was at a record 16.8 t and 970 t of tantalum (Ta2O5) was also produced.

Peter Lalor forecast a 40% drop in profits for 2002/2003 to between $34 million and $42 million. At the AGM earlier this month and this probably contributed to the drop in share value, but it is difficult to see why the fall should have been so dramatic.

Incidentally, if anyone is interested in reading an excellent annual report, I can recommend the 2001/2002 Sons of Gwalia publication. Beautifully produced and full of interesting geology as well as the normal tables and charts, it is a good read and can be accessed at: http://www.sog.com.au/web/invrelindex.htm.



Resource Stocks Do Well Over The Last Two Years

In spite of the doom and gloom some analysts seem to proclaim over the resource industries, the situation over the last two years has not been too bad. The chart below shows the statistics for the variation in the total market capital of the resource companies over the period July 2000 to November 2002 compared to the All Ordinaries Index. It can be seen that the resource companies perform quite well. Usually there are about 16 companies listed in the top 150 companies but BHP Billiton and Rio Tinto actually dominate the statistics and account for about half of the total.

There are a few steps and jumps in the data. The September 11 phenomenon is clearly seen, but there are also smaller effects when Newmont took over Normandy in March 2002 and when Placer Dome was listed on the Exchange in October this year.

How will the charts go in 2003?

Market Capital of all resource stocks in the top 150 companies listed on the ASX in $billion, and the All Ordinaries Index/50 for the period July 2000 to November 2002..

New WA Centre For Fuels And Energy Research Opened

A new Curtin University facility committed to 'excellence in research and development' into the Fuels and Energy sector was opened by West Australian Deputy Premier and Energy Minister, Eric Ripper, on November 26th.

Founding Director of the Centre for Fuels and Energy, Professor Dong-ke Zhang said the centre is aiming to become a world-class facility for sustainable energy research and development and education.
"The Centre for Fuels and Energy is currently the only research facility of this kind in WA, it is providing an important research node for the Cooperative Research Centre for Coal in Sustainable Development", Professor Zhang said. The centre, located in the recently opened Brodie-Hall Building at Technology Park, Belmont, is working with the CCSD on two major research projects investigating improvements in current power generation technologies and the utilisation of coal wastes and by-products.

Other programs being researched at the centre include:

- Gas to liquid conversion technologies and processes.
- Sustainable energy resources development and use.
- Alternative uses of fossil fuels and value-added utilisation of fossil fuel resources and fuels from waste sources.
- New technologies for renewable fuels and manufactured alternative fuels.

Mr Ripper said people working in the energy sector, including research institutions, governments and the energy industry itself had a role to play in looking for new ways of providing environmentally-friendly energy solutions while increasing energy output levels. "We must strive to balance the environment, the economy and the society so we can provide for future generations of West Australians", he said.

Professor Zhang said the centre was: "committed to excellence in research and development and an industry focus." "I wish to acknowledge the WA Government, CCDS, Chemeq Ltd, BHP Billiton, Wesfarmers, Griffin Coal Mining Group, Western Power, Dyno Nobel and Environmental Solutions International Ltd as well as the Chinese Academy of Science for substantial and continuing support", he said. The Chinese Academy of Science and Chinese Ministry of Energy has funded research collaboration between Professor Zhang and the academy's Institute for Coal Conversion. For further details about the Centre for Fuels and Energy, log on to its website at: feewa.curtin.edu.au.

Pictured left to right: Chairman of the Cooperative Research Centre for Coal in Sustainable Development, Ken Smith, Founding Director of the Centre for Fuel and Energy, Professor Dong-ke Zhang, WA Deputy Premier and Energy Minister, Eric Ripper, Curtin University Vice Chancellor, Professor Lance Twomey and Executive Dean of the Division of Engineering, Professor Peter Lee, at the unveiling of the plaque commemorating the opening of the centre on Tuesday, November 26.

Founding Director of the new WA Centre for Fuel and Energy, (fifth from left) Professor Dong-ke Zhang with students and centre staff out the front of the building following its official opening by WA Deputy Premier and Energy Minister, Eric Ripper, on Tuesday, November 26.

Geophysical Mapping And International Development

Fig. 1. The author takes the podium at an airborne geophysics workshop in India organized by the Association of Exploration Geophysicists. (AEG photo).

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Wealth and resource industries

Is there a "lucky country"? Leaving aside the deep oceans and Antarctica, 60 per cent of the exploitable earth falls under the jurisdiction of countries that may be considered as less-developed. In terms of the endowment of mineral wealth, it is likely that Nature has been fairly even-handed. So, at the level of a generalisation, potentially the same percentage of the world's consumption of energy and metals might be supplied from these countries. The consequent potential for inward investment, new infrastructure, revenue to cash-strapped governments and direct contributions to national consumption (import replacement) in poorer countries could change the world economic order for the better. "Pro-poor" growth of the global economy may ultimately be the only way to give real hope to countless millions and support a peaceful future for us all. And, in the world of business and investment, it is as well to try, at least, to make your own luck.

In the pioneering days of 19th century colonial expansion, this business opportunity was not missed, as can be seen by the gold rushes of California, Australia and South Africa with their heritage of thriving modern economies and the resource companies that emerged from them. A hundred and more years on, making money is still a driving force, but wider ownership of shares in the major petroleum and mining companies and careful regulation of company activities give a different perspective, not least because no-one can any longer afford to be seen to be disrespectful of legitimate environmental concerns. At the same time, sophisticated consumers pay willingly for products based on earth resources and, indeed, could be expected to be a strong political force in the western world if, for example, fuel supplies were to become limited or expensive.

High levels of consumption require exploration to replace reserves. Projected expansion in world demand as economies like India and China take off indicates that — on a timescale of decades — a healthy climate will persist for exploration globally, whatever today's weather might indicate locally. Competition for a share in that action concerns us all in our professional work.

Producers, consumers and governments

Perhaps the greatest difference between rich and poor countries is in the last of these three. Without good government — or at least *governance* — many things we take for granted in the relatively sophisticated western world become very difficult, not least in resource exploration. So, given reasonable expectations of resource distribution, (and often simply large areas of unmapped real estate) what does a country require to become a successful player in the resource development business? How, in other words, can it help to make its own luck?

1. Political stability and good governance,
2. Transparent and fair mining legislation and fiscal regime, and
3. An effective geo-data infrastructure or national geological survey.

While the first two of these are — however desirable — beyond the scope of this article, the importance of good geo-data infrastructure has been established in countries like Australia, the United States and Canada that are evident as success stories for this strategy. Accessible background geoscience information is an important basis upon which any decision-making should take place, both by the private sector (selection of exploration tenements, for example) and by governments (groundwater potential, environmental concerns, natural hazards, land use planning, etc). Acquisition and publication of good geophysical mapping has been established, in turn, as an important part of this infrastructure, pre-eminently in Australia and Canada. In a globalised economy, furthermore, the corporate exploration sector is free to choose where it invests its money, leading inevitably to competition between countries in the attraction of such investment. Africa as a whole, for example, still attracts far less than its fair share of exploration investment, despite being a relative winner from globalisation during the past decade. The poor coverage of geological and geophysical mapping may be an important factor in this.

Geological Survey of Africa

Geophysical techniques that lend themselves well to rapid mapping of large areas at low cost per unit area are gravity and aeromagnetics, followed by airborne gamma-ray spectrometry. The national Australian and Canadian programs of the past fifty years are exemplary in their systematic application. Africa, just four times larger in area than Australia and with a comparable GNP (despite a population almost 40 times bigger!), has over fifty national geological survey organisations. Their success in geophysical mapping obviously varies from country to country and there are some notable success stories.

Botswana (www.gov.bw/government/geology.htm) and Namibia (www.gsn.gov.na) both offer excellent aeromagnetic coverage and are aiming for complete high-resolution coverage in the foreseeable future. Both countries suffer similarly from widespread surface sand cover, frustrating the field geologist over large outcropless regions over which aeromagnetic surveying (particularly) offers an attractive view of the hidden bedrock. The data are readily available to those seeking to carry out detailed exploration. Other African countries, however, are clearly less well-endowed with geophysical mapping and many national surveys are simply in poor shape, having little to offer in the way of data acquired in the post-colonial era. A sample of 10 African countries (Reedman *et al*., 1998) shows that only 46 per cent by area has been mapped geologically at a scale of 1:250 000 or better. Despite efforts from various agencies, almost half of even these maps presently exist only in manuscript form. If this is typical of the whole continent, it means that an area three times that of Australia lacks even basic published

geological information. And even existing information is often difficult for the customer to access, notwithstanding the promise of new information and communication technology (ICT) in offering alternatives to the traditional and costly printing and warehousing of colour maps. In the case of geophysical mapping data, reconnaissance coverage is considerably more complete (Barritt, 1993) but few national surveys have the technical capacity to reproduce or give customer access to data in digital formats.

For many years after independence, many African geological surveys were supported by expatriate expertise under foreign aid budgets. This was essentially an extension of the earlier colonial philosophy that assessment of the potential for finding mineral resources was one of the most important and obvious things to do in any 'virgin' territory. The more recent decades have seen a virtual cessation of such aid where the objective is to support the routine performance of the national geological survey. Aid, where available, comes only in the form of projects with specific objectives. While these projects individually may still be laudable, we see too often that such activities put great strain on an already feeble survey infrastructure. The project teams certainly need to come complete with their own field facilities (vehicles, camping gear) and computer and laboratory equipment, if not office furniture and money for the telephone bill. They thus tend to function at arm's length from the core activities of the survey rather than in support of them. Some funding agencies insist on projects of only immediate humanitarian relevance (such as drought relief) rather than supporting the route to national self-sufficiency through systematic resource inventory development or geo-database establishment in support of it.

Luckily, some agencies have advocated otherwise (e.g. Herfkens, 2001), indicating that government participation through aid money in petroleum development may be a better guarantee of eventual societal improvement than unfettered free enterprise alone. In the 1980s, the World Bank did much to support petroleum exploration in many parts of Africa (with the goal of economic stimulation through import replacement) and subscribed to many projects that invoked systematic gravity and magnetic mapping, as well as the compilation of existing data in support of this cause. SYSMIN (www.acpsec.org/gb/sysmin/sysmin_e.html) is an EU initiative that has shared something of this philosophy in the African mining sector more recently.

While new information technology has much to offer in creating innovative ways of delivering geo-information in user-friendly format, the necessary hardware and software investments are often beyond the capacities of many national survey organisations whose budgets in some cases stretch to little more than the salary bill. Professionals with the necessary ICT skills can also be scarce and may require several years of overseas training. But this may make their professional skills highly marketable elsewhere and the temptation for them, once trained, to leave government service and/or the earth sciences for better prospects elsewhere is understandable. Those visiting geological organisations in many parts of Africa are reminded early on of the importance of reliable electricity, water, telephone, photocopying, transportation and even waterproof roofing that we now enjoy and take for granted in the developed world.

Africa South of the Equator

Similar in area and geological endowment to Australia, the 15 countries of Africa south of the Equator show a wide spectrum of achievement in systematic geophysical mapping as part of their geo-infrastructure.

South Africa, by far the continent's largest economy, had a head-start in the fifties and sixties. More recently, following the western trend of down-sizing and 'projects-for-profit' reorientation of national geoscience organisations, the national geological survey (www.geoscience.org.za) has attracted criticism of its performance nationally. However, active participation in pioneering project work in other parts of Africa may eventually pay dividends both to South Africa-based multinational companies and the wider issues of African development.

Fig. 2. Gravity reconnaissance in the western rift, Uganda, 1990. (photo: author).

Namibia and Botswana, discussed previously, are exemplary in terms of their ongoing aeromagnetic programs and new systematic gravity surveying is also in evidence. Both countries are semi-arid and heavily dependent on groundwater. The application of traditional geophysical methods to groundwater exploration and development from the air has broken new ground here, while the application of NMR technology in the direct detection and quantification of groundwater *in situ* offers new promise for more effective exploration.

Zimbabwe's recent political situation has sapped investor confidence in a country that has had a long association with mining and mineral production, while its easterly neighbour, Mozambique, is finding new stability and increased international support after years of conflict. High on the agenda is repairing the most obvious gaps in the geophysical mapping of southern and eastern Africa with aid projects that should underpin systematic development in the mineral and oil-and-gas sectors, both of which offer enormous economic potential in this large and little-developed land.

Zambia, very much a mineral-based economy from its inception, cries out for new attention to its geophysical coverage. Both gravity and aeromagnetic survey coverage are largely of a generation (1960s) that should now be actively upgraded.

Tanzania (http://tanzania.sgu.se) has been successful in attracting exploration investment in recent years and is enjoying a minor boom in modern gold mining. Recent aeromagnetic coverage is playing its part, but is mostly paid for by the private sector in limited prospect areas rather than as systematic intensification of the far-sighted national reconnaissance coverage now dating from over 20 years ago. Even this is only available digitally from agencies outside the country.

The paucity or non-existence of aeromagnetic and gravity coverage of the large areas and poorly known geologies of Angola, Democratic Republic of Congo, Sudan and Ethiopia effectively isolate the countries of eastern and southern Africa from the rest of the continent and set a limit to what

Fig. 3. Stratigraphic drilling (Botswana, 1970) is an important part of exploration in poorly exposed areas. (photo: author).

can presently be done through using gravity and magnetic anomalies to map systematically the geological structure of the whole continent the way this has been achieved in Australia. While such unexplored territory may be attractive as a final frontier for exploration, lack of systematic basic geoscience coverage makes such enterprises rather hit-or-miss affairs.

Quite apart from new survey initiatives, the systematic archiving and publication of existing geo-data is challenging to many national geological surveys. An EU-funded regional project (Geodesa) to help stimulate the application of new ICT in the solution of this problem for all countries in the region was based at SEAMIC (www.seamic.org) in Tanzania (1996-2000). A CD-rom of metadata for the region was produced which is a valuable resource in itself. National authorities, however, are understandably reluctant to let their national data sets be distributed by any third party. In difficult circumstances, any erosion of an organization's function as sole custodian of a nation's geological database may also threaten its very existence. Emergence of new technologies for the convenient distribution of geo-data will surely require this problem to be revisited imaginatively in the near future. Some countries already allow data to be downloaded via the Internet, but the conversion of the large resource of existing data (maps, reports, etc) into digital format is, in itself, a considerable undertaking.

It seems clear that a national jurisdiction and enforcement of (for example) mining legislation is necessary in each country. But whether Africa as a whole can be well served by having its geoscientific archives distributed over more than 50 national organizations, often in only a pre-digital format, seems an unlikely scenario if the aim is a prosperous continent with a healthy mineral and petroleum sector. In continents that have been notably successful on the world stage (Australia, North America), the role of just one or two efficient national geo-science organizations is undeniably part of that success. In exploration, where under-standing geological evolution is an essential part of the process (i.e. the science behind the resources), applying human intellect to the distillation of databases and their synthesis into better evolutionary models of the (economic) geology is an important part of the process. Thinking that encompasses modern geology essentially goes beyond national boundaries, but may not necessarily flourish in organizations circumscribed by them.

India

India is an example of a country where the potential contribution of earth science to the well-being of the population is enormous. Over 1000 million people live in an area little larger than Western Australia; a whole continent of cultures compressed into a single country. Despite the country's remarkable self-sufficiency in food, the shortfall in mineral-derived products is immense. The main incentive for exploration and exploitation is therefore import replacement.

According to a speech to Indian geophysicists in November 2000 by Ram Naik, then Minister of Petroleum and Natural Gas, the national bill for oil imports in 2000 was about US$ 20 *billion*. Only about one third of consumption — which grows at a healthy 6-7 per cent per annum — is now supplied from Indian reserves. Meanwhile, many of the country's potential petroleum basins remain largely unexplored. While attempts have been made to open up to multi-national expertise, the full impact of modern technology, global venture capital and competitive exploration strategy remains to be felt — perhaps mercifully constraining the level of pollution generated by the primitive and prevalent automotive engines but putting considerable strain on the national economy none the less. Much of India's energy needs are still supplied by coal, where the country retains a position as one of the world's top producers by tonnage.

Gold and diamonds also play important roles in the economy. The personal possession of the yellow metal is used as insurance in traditional culture. As a consequence, India is the world's biggest importer of gold. The country also has a flourishing diamond industry, but the raw gemstones are also largely acquired through importation. For both gold and diamonds, India has highly favourable geology, but the systematic application of modern exploration technology — and the philosophy of open competition in the award of licenses and in the execution of efficient exploration strategies - still lies in the future.

The Geological Survey of India (www.gsi.gov.in) recently celebrated its sesqui-centenniel (1851-2001) and has a long history of systematic geological mapping. It has a scientific staff several thousand strong engaged in its programs. ICT applications are beginning to take a foothold, but representatives of the globalised exploration industry who have worked in India find that accessing basic geo-data is no easy matter. This keeps India at a disadvantage in the competition with other countries for a share in the global marketplace for exploration investment, despite the attractions of promising geology and supposedly 'virgin' territory. Downsizing of national geoscience organizations has led to restricted job opportunities for young graduates over many years, while the virtual absence of a private sector in exploration means that there is little incentive for good students to study geology and geophysics at university. Nevertheless, there is a large community of established and organized earth science professionals striving to improve on this situation.

Despite these difficulties and frustrations, dedicated Indian geoscientists have managed to motivate significant geophysical mapping programs over the decades. Substantial gravity data exist for many areas. Government regulations surrounding the military sensitivity of such data make it difficult to publish or access in digital format. Consequently many available anomaly maps lack station locations and are therefore of uncertain reliability. In the Indian environment it takes some courage for individual scientists to speak out against such scientifically inhibiting restrictions. Hopefully the move into the era of ICT in the management of its geo-data resources will accelerate the closer association and integration of geo-data acquisition and management functions now shared between several important national institutes.

Similar diversity exists amongst the various institutes and organisations that have acquired aeromagnetic data thus far. There has, as yet, been no systematic nationwide program, but a great deal of coverage of (mostly) reconnaissance data exists (see Reeves, 1997). New momentum in both filling the gaps in the coverage and making regional compilations available is currently mooted. The total quantity of aeromagnetic data that has been gathered so far is quite modest, comparable with some countries in Africa with a much smaller land area. Perceived competition between national and international survey capacity appears to be an issue. While there is work enough for all-comers, its slow implementation could be to India's disadvantage, both in the international competition for exploration investment and in benefiting from airborne survey coverage in other fields such as groundwater development and environmental monitoring.

Overview

Part of the difficulty in gaining broader public support for earth science is that our ignorance of the earth's subsurface beggars belief in an age of hi-tech and information overload. This is particularly so for the resource sector where most of the geology of economic interest is hidden below millions of square kilometers of unyielding cover, not to mention the waters of the continental shelves. Regional geophysical mapping is one of the few cost-effective tools to address this problem at an appropriate 'big picture' scale, as has been exemplified by the systematic gravity and aeromagnetic mapping of Australia over the past 50+ years. It often becomes even more difficult to argue for support of public expenditure on this mission where the main beneficiary is perceived to be the private sector with its popular aura of profits, pollution and exploitation. It is easy to forget that we are all consumers of earth resources, fuelling that demand whenever we shop or travel. It takes the output of a sizeable oilfield just to fuel the 747 fleet of a major airline — full of hundreds of happy and innocent travellers. Opprobrium for waste and CO_2 emission is generally reserved for the resource sector that makes it all possible through discovery and delivery of the feedstock to the modern economy. And keeping that economic miracle going requires professional fulfillment of the role of government in the publication and custodianship of basic earth science data, as was eloquently argued in Australia by the Woods (1988) and Richards (1993) reviews a decade ago.

If we advocate "Do-as-I-do" to alleviate poverty in the developing countries, a share in this global economic activity is inevitable as consumers, if not as suppliers. (Credibility of the "Do-as-I-say" alternative, hopefully, ended with the colonial era). The potential for success as suppliers is enormous in view of the vast unmapped acreage that still exists in the Third World. I remember hearing a senior mining company executive advocating publicly that we could now bring Africa "kicking and screaming, if necessary" into the global economy when globalisation first started gaining momentum in the early 1990s. But creating the necessary environment — making more lucky countries - is perhaps more the task of politicians, economists, lawyers and managers than earth scientists *per se*. We should persist, however, in raising the awareness of the opportunities based on applied earth science. In turn we must sustain as far as possible the national geological survey capacities that are an essential — and potentially initiating — part of this success story.

Fig. 4. Training students from Africa and Asia in gravity surveying at an ITC field camp in Spain. (photo: author).

Botswana at independence in 1966 (before the discovery of diamonds) was, even with a population of only 500 000 people, one of the poorest countries in the world. Thanks to good governance and intelligent management of its mineral development, it is now one of the richest per capita in Africa with good physical and social infrastructure. While wealth alone does not solve all problems, it does give a nation democratic choices that are simply not available to the poorest countries. If we seek a stable world with enlightened government, the opportunity for young people to see a promising future in their own countries is a minimum requirement and a sound defence against the need for seeking asylum or economic migration. For countries forging a way to the future, systematic geophysical mapping is at least a good starting point for such a direction.

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[1] *This information has been compiled from GA and GSWA sources.*

New Airborne Geophysical Data In Highly Prospective Parts of WA[1]

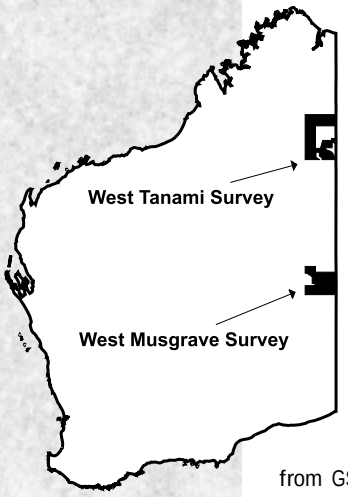

Fig. 1. Locality map.

New airborne magnetic and gamma-ray (radiometric) data will soon be released from airborne geophysical surveys commissioned by the Geological Survey of Western Australia and Geoscience Australia in the West Musgrave and West Tanami areas of Western Australia (Figures 1 - 3). Basic survey parameters are 400 m line spacing, 60 m flying height and north - south flight lines. Fugro Airborne Surveys acquired 45 000 line-km of data in the west Musgrave area, and UTS Geophysics 68 000 line-km in the west Tanami.

The new West Musgrave data, combined with previously acquired private company data, will be released on 16 December 2003. Digital data will be available from GA and pixel image maps from GSWA. The new West Tanami data will be released early in the New Year. A compilation of the latter data and previously acquired private company data will be released mid-2003.

Both the West Tanami and West Musgrave regions are poorly studied geologically, and have not been intensively explored for minerals. However, recent gold discoveries in the Tanami, and the discovery of nickel sulphides in the West Musgrave indicate the potential for further significant mineral discoveries. In fact some 110 tonnes of gold, worth about $2 billion have been mined from Tanami Complex rocks in the last 10 years.

GA will interpret the West Tanami data as part of its North Australia project, extending westwards its investigations of the Tanami in the NT with the Northern Territory Geological Survey. This interpretation will build on existing NTGS interpretations in the NT so that the interpretation of the airborne geophysical data in the Tanami will be consistent across state borders.

The data will form a basis for a field-mapping program of the areas that GSWA proposes to commence in 2003 - 2004. The areas are within Aboriginal reserves adjacent to Western Australia's border with the Northern Territory and South Australia, and are being carried out following consultation with the Ngaanyatjarra Council and the Kimberley Land Council. GSWA hopes to establish a close working relationship with the traditional Aboriginal owners of the area during the course of the program, which will include geological mapping and geochemical investigations of the rocks and regolith, and detailed geochronological investigations. It is expected that the mapping of the entire 200 000 km^2 will take between 6 to 10 years.

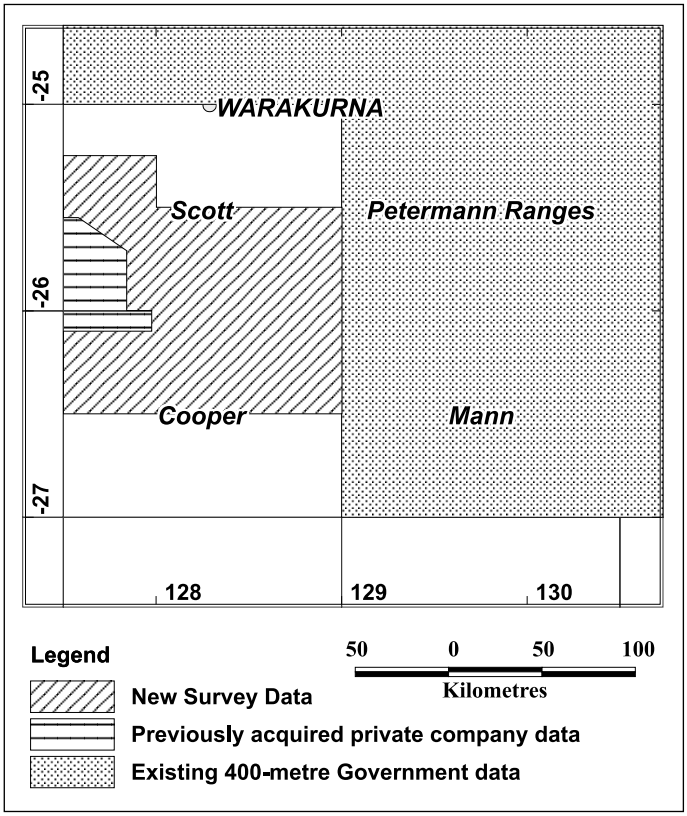

Fig. 2. West Musgrave survey area.

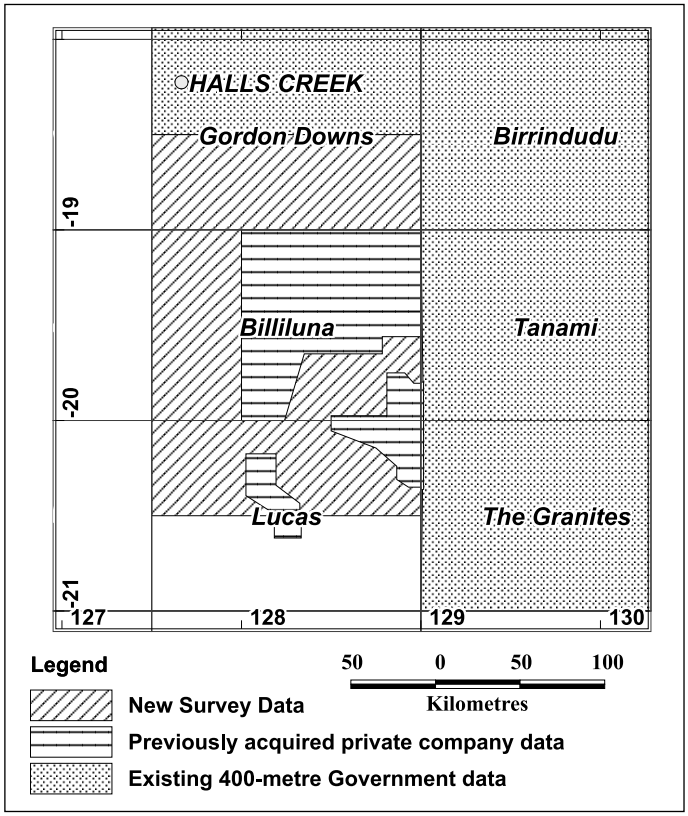

Fig. 3. West Tanami survey area.

Fault Visualization & Interpretation

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Introduction

This article will address the innovative use of volume visualization, multi-attribute analysis and auto tracking of horizons to produce high quality fault frameworks. It will also review how decimation and structure control the quality and accuracy of fault interpretations.

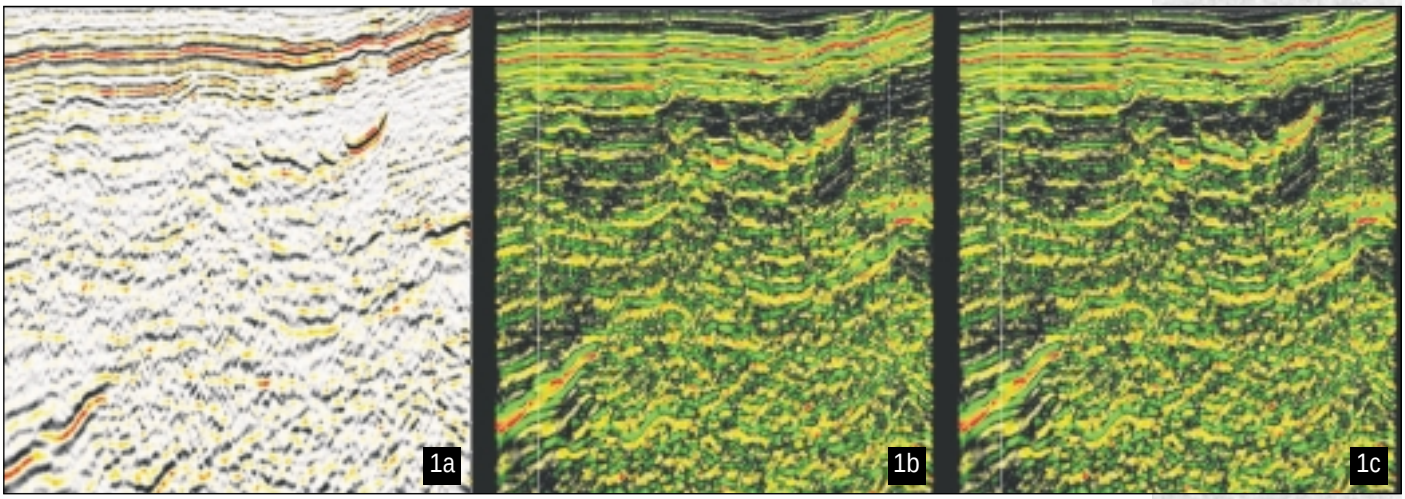
Volume-based fault interpretation

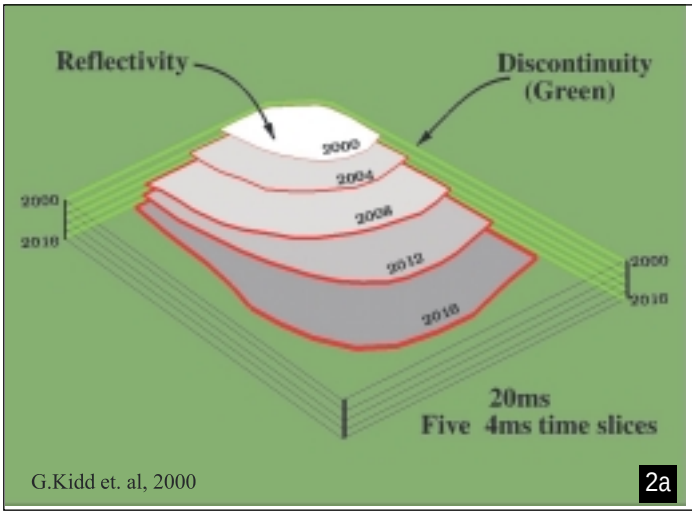
In structurally complex areas, the ability to accurately delineate fault positions and geometries is critical. Mis-picked or missing faults can produce incorrect fault correlations during subsequent horizon correlation and interpretation. This problem is particularly evident in areas of low signal-to-noise. Optical stacking of seismic data in Voxel format can provide a quick method to enhance data for fault interpretation. Optical Voxel stacking assumes that small-scattered points of good data exist on each line. After grouping a series of consecutive vertical or horizontal, 2D lines, opacity is applied to the stack so that the scattered structural data points from multiple 2D lines are visually aligned or optically stacked, thus revealing structure. Often the viewing direction is modified with respect to the strike and dip of the structure. Maximum structural enhancement occurs when visual alignment coincides with the strike and dip of strata and fault plane orientations for structural interpretation.

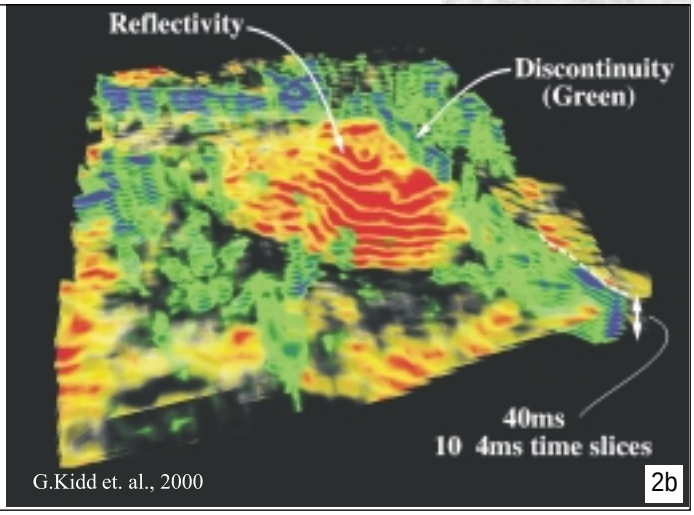
The following example illustrates the use of the optical stacking process. Figure 1a is a single inline from a North Sea Voxel dataset with no opacity applied. It is not readily apparent where to place the faults. In Figure 1b, 10 inlines have been selected and the optical voxel stacking process applied. In this case, a 6-degree elevation "tilt" and a 15-degree counter clockwise rotation along the vertical axis were used to enhance fault definition. This process is performed interactively and may be customized for each given situation. Once the structure has been optimally stacked, interpretation can then performed (Figure 1c). The stack is then shifted to another location for additional interpretation. This process can be performed while viewing the resultant fault picks in a 3D view without the seismic data "turned on". This is an important step to ensure that the geometrical and structural consistency is maintained from one stack to the other. Ultimately the interpretation process produces fault nests, which are then sorted and reassigned for interpolation and gridding. Horizontal optical stacks (time slices) can also be used at this stage to enhance fault interpretation.

Fig. 1(a-c) below. Opaque section (a) with corresponding optical stack without (b) and with interpretation (c). See text for further details.

Fig. 2(a-b) bottom. A simple model of a two attribute optical stacking of time slices (a) and a corresponding 40 ms optical stack from a North Sea data set (after Kidd, et. al., 2000). See text for further details.







Single time slices only show the intersection between that time slice and the attribute. Additional information can be obtained when multiple slices of multiple attributes are consecutively stacked, such as shown in Figure 2a. By utilizing opacity to specifically reveal the critical aspects of each attribute, a stack of time slices produces a three dimensional image of the subsurface. Figure 2b, shows a 40 ms thick optical stack imaging the results of stacking ten 4 ms time slices. A fault-controlled amplitude anomaly, in red, is revealed in 3D space. Faults are interpreted in the multi-attribute optical stacks in the same manner as single attribute volumes. In many cases, vertical stacks and horizontal stacks are used in conjunction to look at different aspects of the fault geometries. Picks made from vertical stacks (or 2D profiles) can be imbedded inside the horizontal stacks providing a guide for interpretation. Similarly, interpretation from horizontal stacks can be embedded into vertical stacks (or 2D profiles).

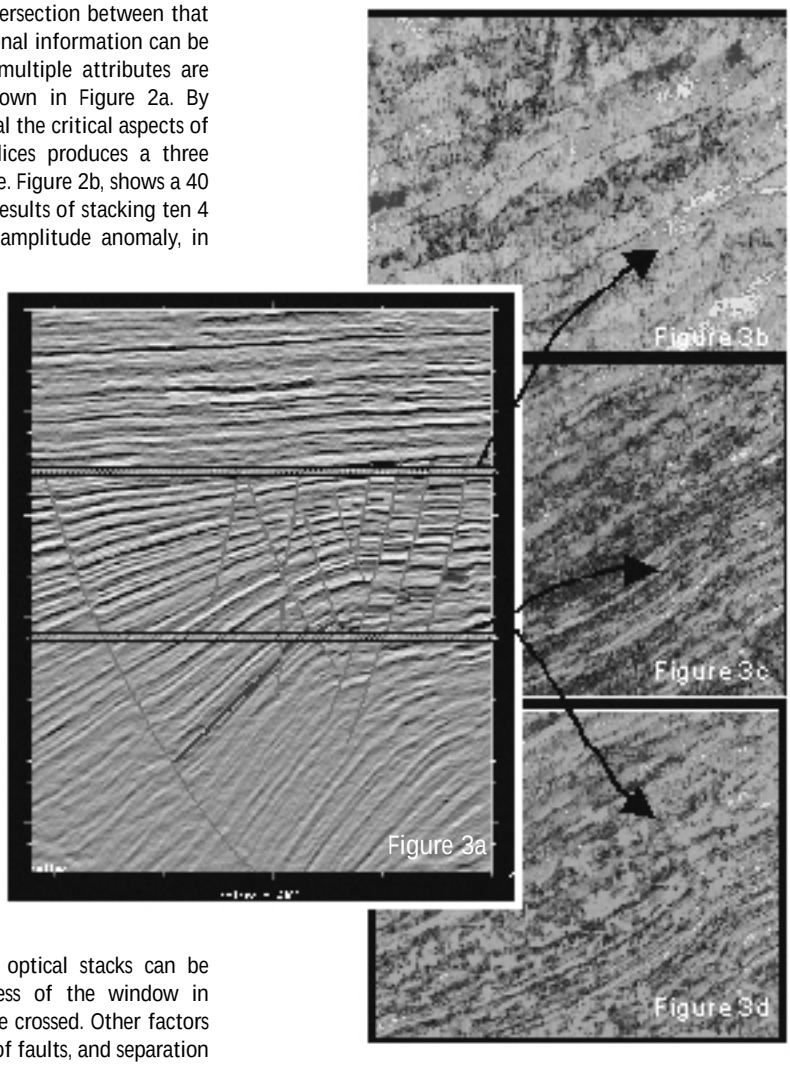


Fig. 3(a-d) right. Examples of how structure affects the quality of optical stacking. Shallow to moderate bedding dips with high angle faults produce high quality fault definition (b) while steeper bedding dips with shallower fault dips produce lower quality optical stacks (c). Additional fault definition attributes such as discontinuity can be used to enhance the optical stack (d).

Fault visualization quality

In general, the best fault visualizations using amplitude volumes are achieved in areas with low to moderate bedding dips, high angle fault dips, and large cutoff angles between bedding and faults. Fault trend interpretation on horizontal optical stacks can be improved by reducing the thickness of the window in situations where low angle faults are crossed. Other factors such as signal to noise ratio, length of faults, and separation between faults can also influence the quality of fault visualizations and subsequent fault interpretation. This is particularly true when decimation has been applied to the data. Decimation of data should generally be avoided, but can be used for regional scale fault interpretation where faults have large separations. Hydrocarbon or fluid effects along faults, which effect amplitude response, tend to enhance the fault visualization.

In Figure 3, the effects of variation of bedding dip and fault dip with depth can be seen. In the top part of the section in Figure 3a, the seismic data shows steep fault dips and gentle to moderate bedding dips. This combination provides a very clear definition of fault trends in the visualization window in Figure 3b. In the deeper part of the section, bedding dips steepen as they roll into the

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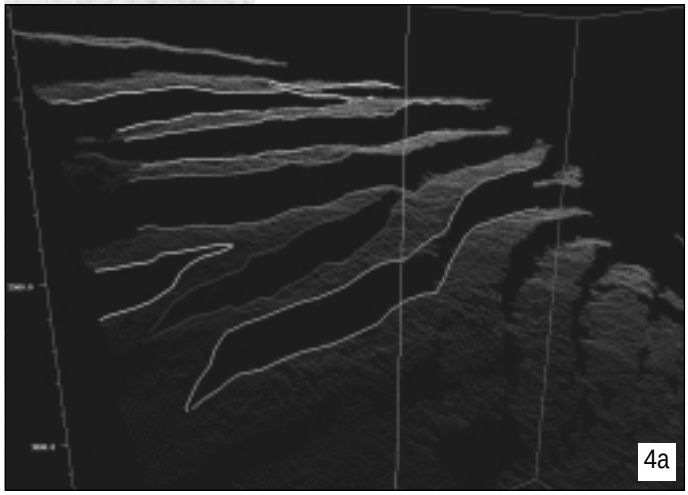
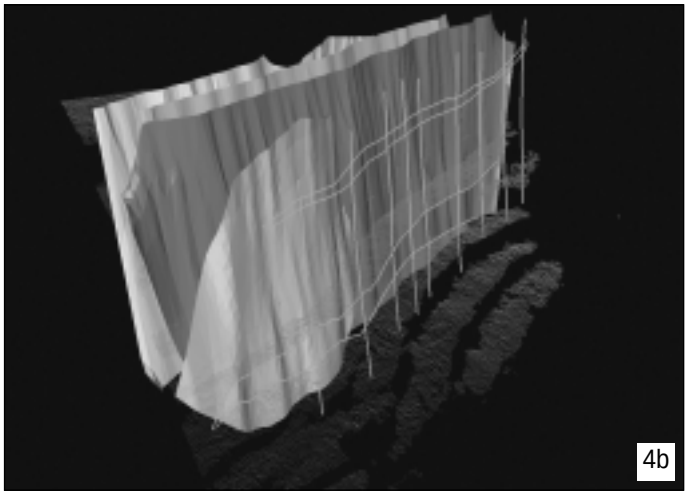
Fig. 4 (a-b) below. (a) is a fault cutoff interpretation made along auto-tracked horizons. The fault cutoff interpretation is then combined with vertical profile interpretation where the results can be gridded into fault planes (b).





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fault. As this optical stack combines both stratigraphic and structural elements, the resulting visualization is less clear as far as fault definition (Figure 3c). The introduction of a discontinuity attribute in the deeper part of the volume greatly enhances fault definition (Figure 3d).

Interpretation of faults along auto-tracked horizons

Surface visualization of auto-tracked horizons can often reveal subtle fault trends, fault linkages, and major fault trends. Interpretations of hangingwall/footwall cut-off lines are made directly on the auto-tracked horizons. This provides immediate fault correlation and fault polygons for subsequent horizon gridding and contouring. Interpretation can be carried out on multiple horizons, providing accurate fault definition along strike. To ensure that cut-off lines made on multiple horizons are consistent and to provide additional geometrical constraints, vertical fault strands should be digitized on 2D sections. Figure 4a illustrates a surface visualization of highly faulted seismic reflector with hangingwall/footwall interpretations for multiple faults. Figure 4b shows the same surface with hangingwall/footwall cut-off lines interpreted from a shallower horizon along with several vertical fault strands. The surfaces behind the green fault were created directly from the fault polylines.

Conclusions

Accurate fault interpretation is an essential part in any interpretation project as faulting may play important roles in reservoir definition, compartmentalization, or setting up or breaching of the hydrocarbon system. The fault interpretation techniques reviewed in this article show how volume visualization and multiple attribute interpretation can provide rapid ways to accurately establish a fault framework taking a lot of the 'guesswork' out of the fault interpretation process.

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Shear Wave Applications From Zero-offset VSP Data

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Schlumberger

Norberto Monroy, Hector Bernal Ramirez & Alfonso Ortega Leite,
Pemex

Summary

Borehole Seismic VSP data acquired on land in vertical wells have traditionally served two primary functions. The first is to obtain seismic time/depth information that are used to calibrate compressional sonic log data. The calibrated sonic log is then used to generate synthetic seismograms that may be used to assist with surface seismic interpretation. The second is to obtain a P-wave reflectivity estimate from the VSP itself, sometimes for look-ahead purposes and sometimes for high-resolution interpretation and surface seismic comparison. Further uses include estimation of dip and anelastic attenuation (Q_p).

In the past shear wave data acquired in rig source VSPs in vertical wells have been of limited value due mainly to the very low amplitudes of shear arrivals on the horizontal components and the limited dynamic range and vector fidelity of the downhole receivers. With high fidelity 3-component sensors, shear body wave transmission and reflection properties can be estimated (see e.g. Hardage, 2000).

In this paper we show that with new borehole seismic tools, even in near zero-offset source VSP data, a large amount of useful shear wave information can be obtained. This includes accurate S-wave interval velocities for calibration of S-wave sonic log data and S-wave reflectivity estimates for comparison with traditional P-wave corridor stacks and synthetic seismograms. Such information is of great value for processing and interpretation of multi-component surface seismic data, AVO modelling and time-lapse seismic calibration.

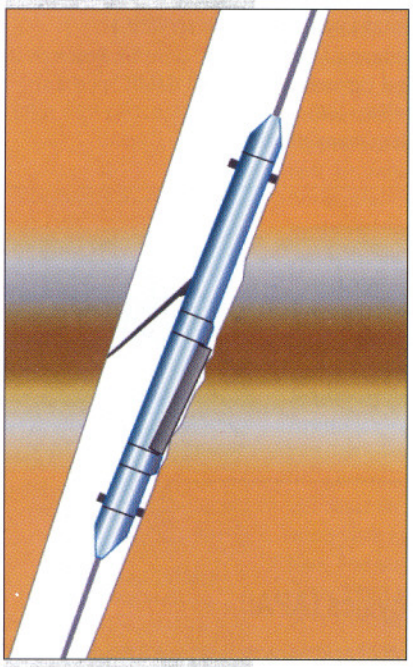


Fig. 1. Illustration of VSI shuttle in the borehole. Note the combination of the standoffs with the decoupled sensor package.

Introduction

With the increasing popularity of multi-component surface seismic recording and the acquisition of time-lapse (or 4D) data, Borehole Seismic (BHS) data can be used to calibrate the surface seismic data and aid in the processing. However, in order to do this, the data must be highly repeatable and have excellent vector fidelity, a requirement that in turn demands excellent acoustic coupling between the sensors and the borehole wall. Other applications for BHS tools, such as salt proximity work and passive monitoring of acoustic emission events, make similar demands on the ability of downhole receivers to record the polarisation of incoming body waves with a high degree of accuracy. High fidelity amplitude measurements are also required for surface seismic AVO calibration, true amplitude imaging and azimuthal anisotropy estimation.

With these applications in mind a new BHS downhole receiver array has been developed. The Versatile Seismic Imager (VSI) has been designed as a versatile tool that can acquire all types of BHS data (Figure 1) and is a key component of Q-Borehole, the new Schlumberger integrated approach to Borehole Seismic, from job planning, through acquisition and data QC to processing and final interpretation.

The tool can be configured with from 1-20 shuttles spaced at intervals appropriate for a given survey in the range from 2-20 m. Other key features of the tool designed to ensure vector fidelity and optimal coupling to the borehole wall include:

- Light weight sensor package acoustically decoupled from main tool body;
- Relative bearing indicator (RBI) in each shuttle, giving direction of horizontal component receivers in deviated wells;
- 3C Geophone Accelerometer (GAC) omnitilt sensors (Kamata, 1999); and
- Shaker in each sensor package to enable in-situ estimation of coupling quality.

In terms of data quality, one of the most important features of the new tool is the lightweight decoupled sensor package, which puts resonant frequencies well outside the seismic band, while at the same time reducing the sensitivity of the sensors to motion of the main shuttle body.

High fidelity data also require excellent coupling between the sensor package and the formation. In an open hole, where the borehole diameter may vary substantially in certain formations due to washout and other reasons, the quality of coupling cannot be guaranteed. However, the presence of a shaker inside each sensor package can be used to give an indication of the *in-situ* coupling condition. The shaker emits a sweep of frequencies in the seismic band and the response of the 3C sensors can be analysed to assess the quality of coupling. Although the shaker results are qualitative rather than quantitative, they are useful because when poor coupling is observed, the tool can often be moved slightly to a new depth at which the coupling is improved.

Data Acquisition and Processing

Zero-offset source field test data acquired with the new tool on land with a Vibroseis source have shown excellent data quality on the horizontal components, enabling an S-wave VSP to be obtained from processing the direct S-wave energy from the source. High fidelity V_P/V_S ratio data were also obtained over a large depth interval and used for calibration of both compres-sional and shear sonic log data.

The field test data shown in this paper were acquired on land in Mexico in a vertical well. The geology in the area is quite simple with very low formation dip. The key acquisition parameters may be summarised as follows:

- 4-level VSI array with 15 m inter-shuttle spacing;
- 260 levels acquired over a depth interval from 30.5 m to 3890 m. 4 s of data acquired at 2 ms sample interval. 5-fold vertical stacking at each depth;

- Cased hole down to 2940 m. 6-inch open hole below this depth;
- Conventional P-wave Vibrator source (8-96Hz sweep) offset 34 m from the wellhead; and
- Acquisition time: 10.7 hours.

The data quality was generally excellent with good coupling in both the open and cased hole sections. Some problems with casing arrivals were experienced in the shallow section above 730 m in the 13 3/8 in casing.

The stacked horizontal component data is shown in Figure 2. The direct shear wave arrival from the source is clearly visible but is indistinct because the shuttles are rotating randomly in the borehole and the orientation of the horizontal component sensors is unknown. As the P-wave first arrival amplitudes are very low in the horizontal component data, these arrivals cannot easily be used to rotate the data to radial and transverse components in the conventional way. The Relative Bearing Indicator cannot be used either because the well is vertical. Therefore it was decided to orientate the data based on maximising the direct S-wave arrival from the source. This worked well as the S-wave hodograms were very linear in the first half-cycle and gave a rotated component with maximum direct S-wave (Figure 3) that could be used to derive S-wave interval velocities and process an S-wave VSP.

The quality of the S-wave data is now apparent, even though the peak-to-peak amplitude of the direct S-wave arrival is on average approximately 20dB below the direct P-wave amplitude on the vertical component. A variety of shear wave arrivals can be seen, including downgoing P-S mode conversions and P-S reflections but the predominant S-wave arrivals are the direct S-wave arrivals from the source and the associated S-S reflections. There is an excellent character match between the V_P/V_S ratio from the VSP travel-times and that from the shear sonic log recorded with the Dipole Shear Imager (DSI) (Figure 4). However, it is clear that on average the log data are indicating a higher value for V_P/V_S than the VSP. Note that the VSP V_P/V_S information extends over a very large depth interval and can be of great value for modelling and processing multi-com-ponent surface seismic data. As the ray paths for both P- and S-wave direct arrivals are essentially vertical, sonic log calibration may be carried out for both in a similar fashion, using the VSP travel-times.

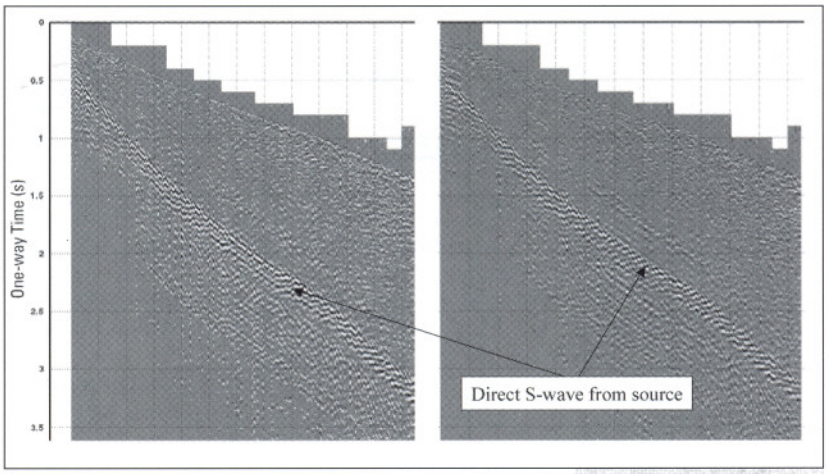


Fig. 2. Raw horizontal component stacks.

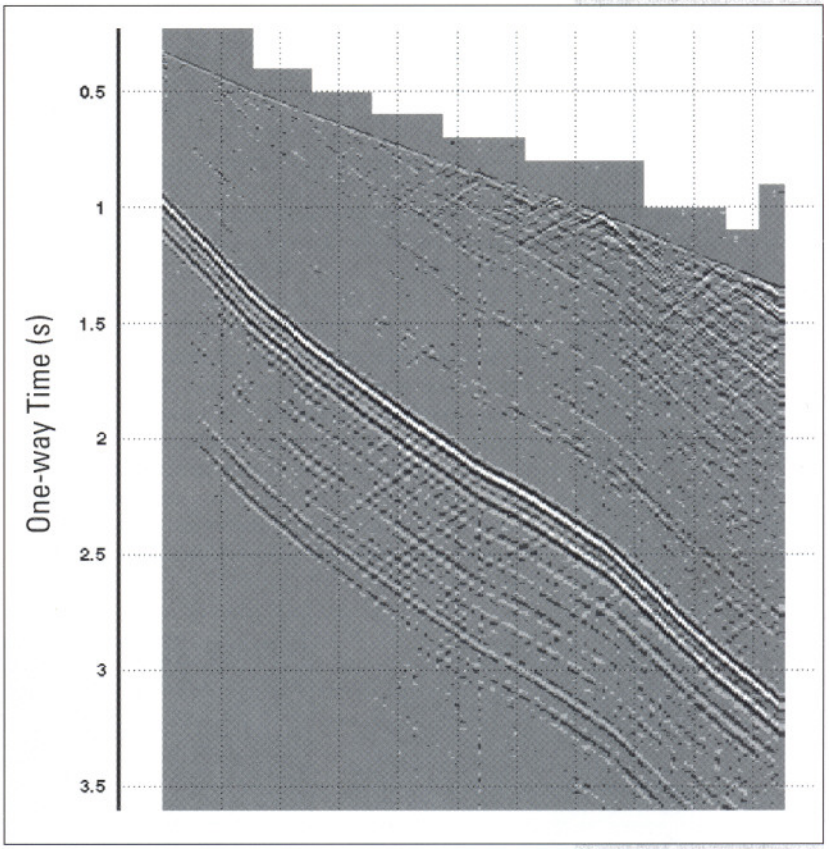


Fig. 3. Horizontal component rotated to the direction of maximum direct S-wave from source. Depth range is from 730-3890 m.

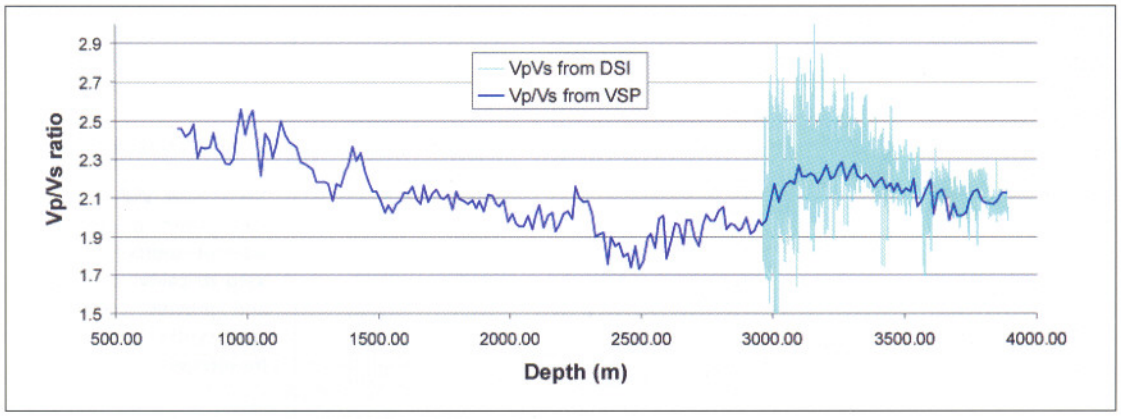


Fig. 4. V_P/V_S from VSP and DSI sonic log.

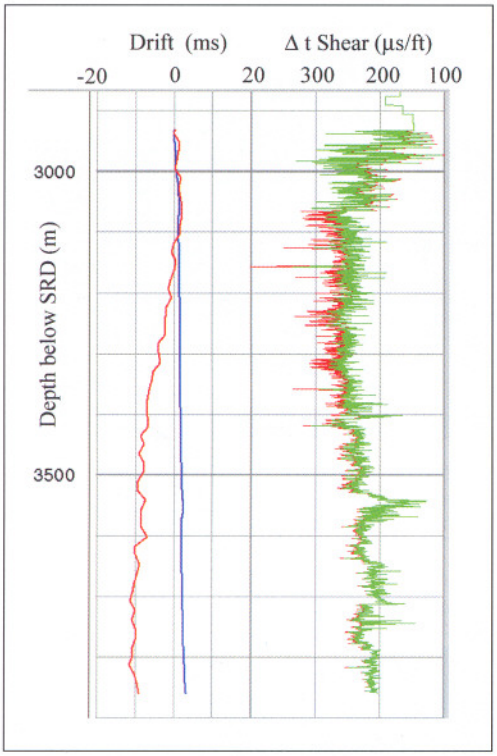


Fig. 5. Compressional (blue) and shear (red) drift curves with raw (red) and corrected (green) shear sonic log. The correction to the compressional log is negligible.

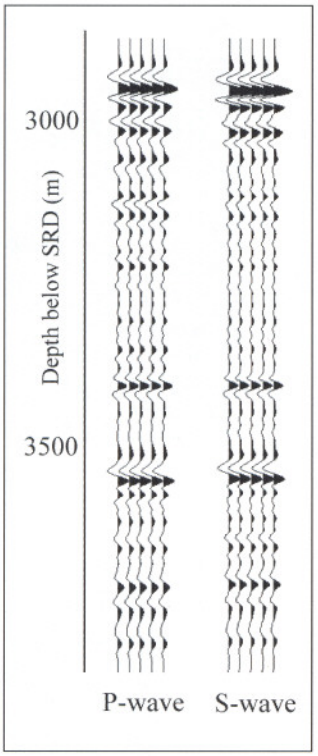


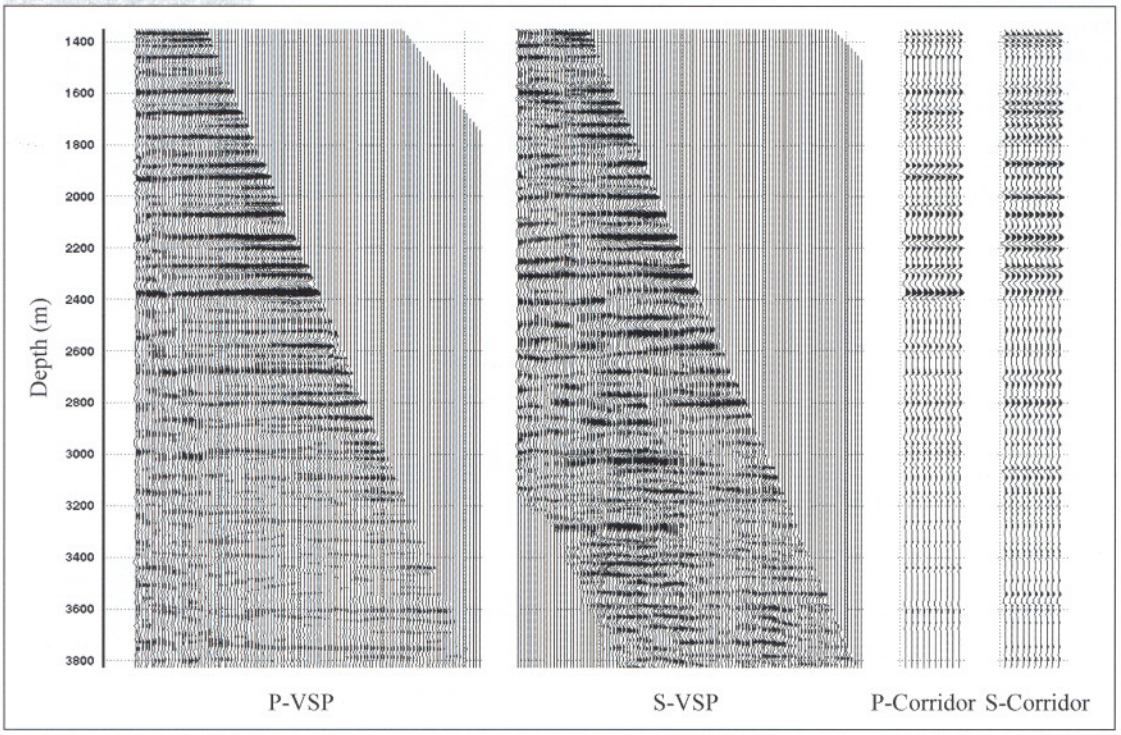
Fig. 6. P- and S-wave synthetic seismograms.

The S-wave sonic log exhibits significant negative drift, with the log velocity being lower than the VSP S-interval velocity so S-wave calibration is required if accurate models for AVO and other applications are to be constructed (Figure 5). The P-wave drift curve within the depth interval of the DSI data shows minimal drift. After calibration, P- and S-wave synthetics can be generated and displayed in depth (Figure 6). It is clear that there is an extremely good match between the two synthetics, testifying to the similarity of the P- and S-wave reflectivity sequences recorded by the DSI sonic logging tool. Being able to generate calibrated S-wave synthetics can be of major benefit to interpretation as changes in P-wave and S-wave reflec-tivity can be used directly for interpretation of fluid boundaries and particular lithologies. In addition, the calibrated logs may be used to generate 1-D models for use in forward AVO modelling. The ability of such models to represent surface seismic data may be limited because of the different scale of seismic and log measurements and the fact that the rock properties local to the well may not be representative of the much larger volume of rock giving rise to the seismic properties. In order to verify the accuracy of log-derived synthetics after calibration, VSP-derived reflectivity estimates are a useful guide as they give a true seismic measurement of the reflectivity and the wavelet phase can be controlled.

In this particular case, because of the quality of the S-wave data, seismic reflectivity estimates for both P- and S-waves can be derived from the zero-offset source VSP data. Figure 7 shows a comparison between the P-wave and S-wave up-going VSP wavefields after a standard zero-offset VSP processing sequence. These have been converted to depth using the time-depth information from the P- and S-wave direct arrivals. Within this depth interval there is very close agreement between the P- and S-wave seismic reflectivity estimates. In terms of phase the match is near perfect. There are, however, some amplitude differences such as those at 2000 m depth, which have a significant inter-pretation in terms identifying fluids or particular lithologies. The extremely good tie between the two datasets testifies to the excellent consis-tency between the P and S-wave travel-time data.

Finally, there are other useful para-meters that can be extracted from this data such as inelastic attenuation. Initial analysis using the spectral ratio method (Raikes and White, 1984) suggests that in the shallow section of the well (1000-2100 m) Q_P=50 and Q_S is approxi-mately equal to 90, though the Q_S figure is much less reliable due to the lower bandwidth of the shear data. In the deeper section where the shear sonic log was recorded, reliable results are difficult to obtain because the values of Q are much higher.

Fig. 7. Up-going wave fields and associated corridor stacks in depth for both P-wave and S-wave VSP results.



Conclusions

Shear wave VSP travel time data from a zero-offset vibrator source have been used to calibrate a DSI log and provide accurate S-wave synthetic seismograms for interpretation.

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News From The Federation of Australian Scientific And Technological Societies[1]

[1] *Compiled from material supplied by* ***Mike Smith***

Science Meets Parliament November 2002

Science meets Parliament Day has once again proven to be a wonderful opportunity for 154 scientists and technologists to put the case for science to the 128 MPs who agreed to participate. Among the science and research issues currently being considered by the Government are the Higher Education Review, National Priority Research Areas and triennium funding for Government-funded research agencies. These are all matters where the science community has well-considered views.

Tuesday 12 Nov The National Press Club lunch was eloquently addressed by Dr Keith Williams, CEO of Proteome Systems Ltd. His company has rapidly expanded to be one of the world forces in proteomics, and employs about 60 PhD graduates. Lunch was followed by a comprehensive Briefing Session for the scientists. Lord Robert May, President of the Royal Society, Robin Batterham, Chief Government Scientist, John Tierney Liberal Party, ALP Science spokesperson Kim Carr, Senator Natasha Stott-Despoja, the Speaker of the House and the President of the Senate all contributed to an informative afternoon. Education Minister Brendan Nelson, and Science Minister Peter McGauran hosted a Cocktail Reception at Parliament House.

Wednesday 13 Nov After breakfast at Old Parliament House, society representatives commenced the rounds of appointments with MPs that continued throughout the day. There was a meeting with the Leader of the Opposition Simon Crean, a Press Conference given by a panel of young scientists and morning tea hosted by the Science Minister Peter McGauran. A new feature this year was a special dinner in the dignified and atmospheric Members' Dining Room at Old Parliament House, with guests drawn from participating scientists, business and industry, and selected Members of Parliament. The after-dinner speaker was Mr Bob Herbert, CEO of the Australian Industry Group. This dinner was arranged as an optional extra for participants wishing to build dialogue with MPs and industry.

Key issues raised by federal Parliamentarians in 2002 are ranked in importance from 1 to 21:

1. Salinity
2. Water quality
3. Energy sources of the future
4. Education & training-school, university and industry
5. Commercialisation, innovation, industry research
6. Climate, climate change, greenhouse
7. Agriculture, agribusiness
8. Sustainability & the triple bottom line
9. Environment & biodiversity
10. Health & medical issues
11. Science in the local electorate
12. Emerging technologies-nanotechnology, photonics, bioinformatics
13. Medical & agricultural biotechnology: benefits & risks
14. Broadband, Telstra & the Bush
15. Brain drain, recruiting
16. Oceans & the Great Barrier Reef
17. Stem cells, tissue engineering
18. Nuclear power & storage-disposal of radioactive waste
19. Mining, resource industries & exploration
20. Defence science & biosecurity
21. Feral animals, noxious weeds & quarantine

Thursday 14 Nov FASTS held the 2002 Annual General Meeting, Council Meeting and Board Meeting. The President-elect for 2003/4 is Professor Snow Barlow, Head of the Department of Resource Management and Horticulture, University of Melbourne. Assoc. Prof. John Rice was re-elected as Treasurer, and Assoc. Prof. John O'Connor was elected as Secretary. The main issues addressed by the meetings were focussed on FASTS future programs.

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In addition, the source-generated shear wavefield on the horizontal components, although low amplitude, has successfully been used to generate an S-wave VSP that ties very well with the standard P-wave VSP image and also contains some interesting amplitude differences that contribute significantly to the interpretation. In addition the VSP provides accurate Vp/Vs information from 750 m to 3890 m, although the DSI log was only acquired in open hole below 2900 m.

The 1-D models created using the shear sonic and VSP data may be used for AVO modelling and surface seismic data processing. They would be of particular value in the processing of multi-component surface seismic data, where Vp/Vs (gamma) is used directly for common conversion point (CCP) binning and S-wave reflectivity information is very useful for calibration purposes.

References

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Groundwater Science

By ***Charles R. Fitts***

Academic Press (an imprint of Elsevier Science), London, UK, June 2002.

450 pages, hardback
ISBN 0-12-257855-4

Price A$143.00 (GST incl).

Reviewed by:
Peter R. Milligan

Groundwater Science has been written as a primary textbook for first courses to undergraduate students in university science departments, and also as a reference text for professionals. It is expected to be adopted by faculties as a main text, and to this end provides many examples and problems throughout. A solution manual will be supplied upon request, and a website offers additional material and links to public and commercial software.

The author is a professor at the University of Southern Maine and has a doctorate in Civil Engineering. He has also been a groundwater consultant and is the author of two modelling packages, TWODAN and SOLUTRANS.

The book contains ten chapters, three appendices, selected answers to problems, references and an index. It starts with an overview of groundwater, moves on to the physical properties of water in various media, the principles of flow, geology and groundwater flow, the flow equations, modelling steady flow, transient flow, groundwater chemistry and finally groundwater contamination. The appendices cover units and conversions and a mathematical primer, standard sections you would expect to find in a book of this type. Appendix C refers the reader to the internet site, where there are further problems, a forum for faculties which adopt the book, interesting links and links to software, and sample sections from chapters.

This is a high-quality hardcopy edition, which you would expect with the price tag of $143.00. It has a very clear presentation, with excellent illustrations on almost every page. By its nature, this subject also requires a rigorous mathematical exposition, and again this is well catered for. The author achieves his aims of presenting in a thorough and understandable manner the basics of groundwater science as required for undergraduate courses, and also does provide a valuable reference for practitioners in the field.

A small criticism of this book is that it has an American bias in the examples, and a bias in the author's interests. For example, the topic of contamination of groundwater by man-made pollutants is well covered, but, of dire relevance to Australia, there is very little mention of the hazard of salinity and its relationship with groundwater. The word "salinity" doesn't exist as a topic in the index, although there are references to "salt water intrusion" and "salt-fresh water interfaces". However, this bias doesn't detract from the main purpose of the book as a text and reference on the fundamentals of the subject.

Copies of this book can be purchased direct from Elsevier Science Customer Service :
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