Australian
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Geophysicists
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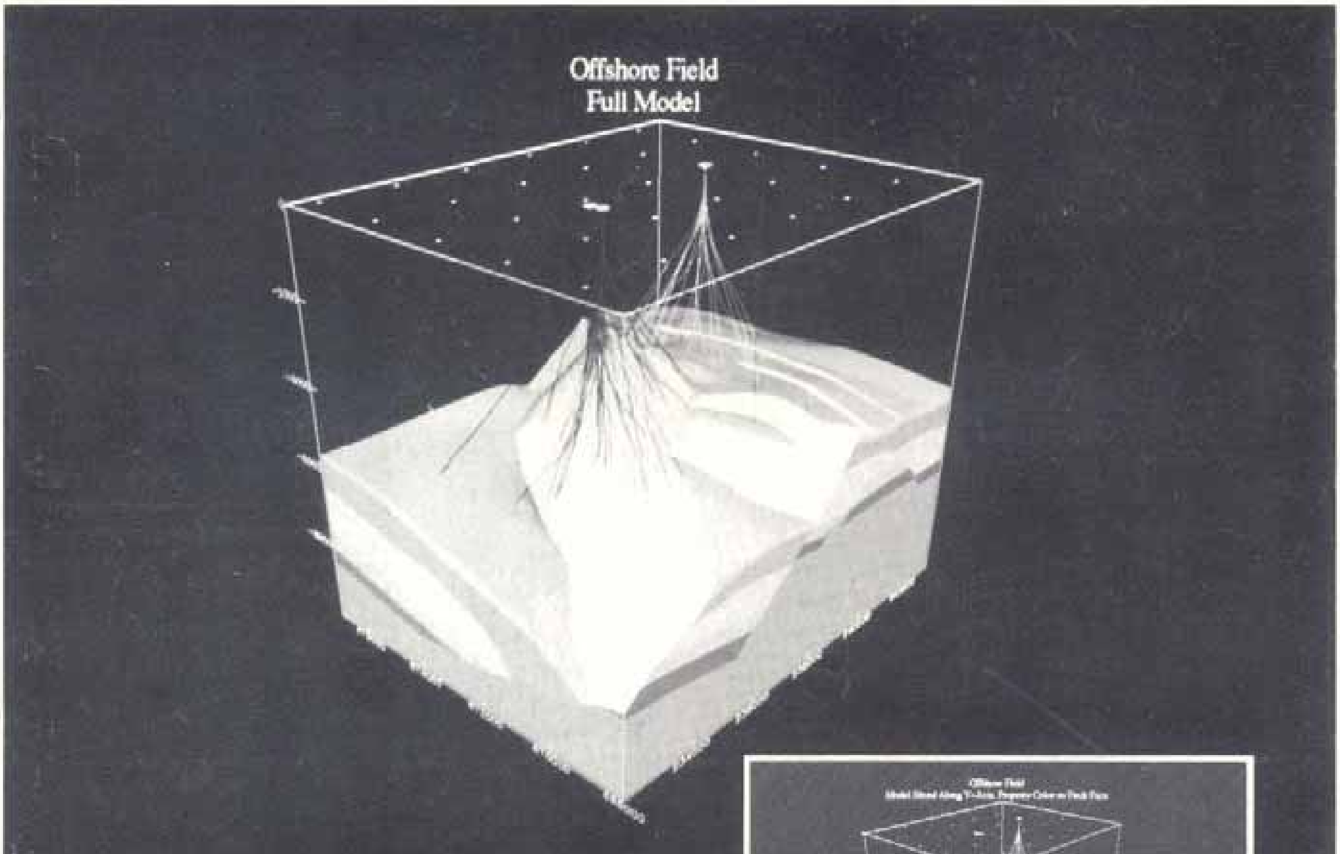
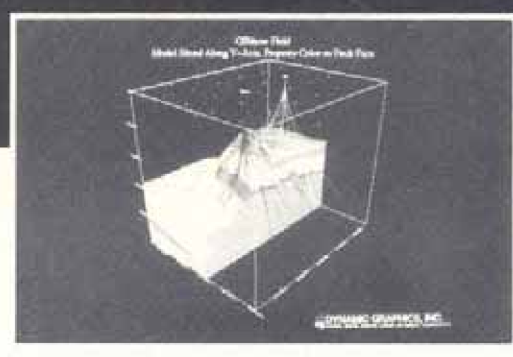
Preview

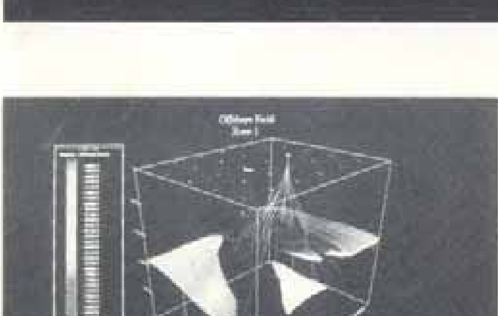
April 1994

Issue No.49

Special Feature







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Editors Desk

Mineral Geophysicists - Stand Up (in Preview) and Be Counted!

It's official - the ASEG (which takes pride in the claim that Australian geophysics is a world leader in mineral geophysics in particular), has a membership breakdown which shows our membership has a heavy bias to mineral geophysics, compared with say the SEG. A survey conducted using the 1994 ASEG membership dues return slips, requested primary interest in geophysics to be shown on the return slip. The results compiled by ASEG Treasurer Lindsay Thomas show the breakdown is minerals (45% active/associate; 54% student), oil/gas (43%; 28%) ; environmental/ engineering /groundwater (7%; 18%) and academia/ education (5%) with 483 active/associate members from 832 return slips responding (i.e. 58% hit rate). Student response was 68 out of 100 (68%).

This is good basic information for an editor. Despite its shortcomings the survey tells me three things about the balance of Preview content to maintain relevance to readers. First, roughly a 50/50 breakdown of content between mineral/oil geophysics related articles is needed; second, an item/article per issue or 1 in say 10 issues devoted to environmental/engineering/ groundwater matters is desirable, ditto for geophysics education issues; and third, roughly 40% of our membership may be apathetic and therefore may not even read Preview.

I have a problem, though. The material I have for coming Previews shows a bias to being of interest to oil geophysicists. Also I generally have no trouble in the supply of material dealing with geophysics education/ research and environmental/engineering/ groundwater to more than satisfy the balance in these areas.

Initiatives are in place or in train to have a regular oil geophysics column (Rob Kirk's Seismic Window - coming issues promise some interesting material on aspects of seismic interpretation and acquisition), and geophysics education/research news/items company news and environmental/engineering/groundwater items. This issue a new regular column on significant geophysical data releases (p47) starts up with the initial help of David Denham of AGSO.

Alas, a sure supply of minerals geophysics material is lacking. I repeat again my plea of December, 1993 issue editorial for a regular Preview column devoted to aspects of minerals geophysics interpretation, acquisition and processing. Preview needs a regular column (a la Seismic Window) with one or more correspondents to set it up and solicit items. Perhaps it could be called "Pulsations". How about a discussion on magnetic interpretation map styles or TEM intepretation problems or whatever happened to SP or gravity mapping in mineral prospects or ...... - no doubt mineral geophysicists are well ahead of me in ideas.

Come on gentle minerals readers how about it! With Preview like everything in life you only get out of it what you put in.

This issue the main item of interest to minerals people is a discussion of everything you wanted to know about magnetic noise, but were too frightened to ask - not for the faint hearted. We appreciate the efforts of Richard Thompson of the Sydney based Ionospheric Prediction Service in giving us solid background material on this bain of high resolution magnetics.

Thankyou to Ian Lilley and Silicon Graphics for their sponsorship of the colour article on the state of the art in computer graphics. Rob Kirk's column returns with part two of his seismic stratigraphy articles - this one on systems tracts (p33)

We pay tribute to Cam Wason and John Pitt, sadly missed by ASEG colleagues (p39).

Finally lots of news and sub-comittee reports from the successful Perth conference (p9) including proceedings of a seminar on Government initiatives to promote exploration (p42). Thanks to Greg Turner who helped out in putting this issue to press.

Next issue Preview turns 50 and we indulge in some ASEG history nostalgia and some navel (with a dash of crystal ball) gazing.

Geoff Pettifer, Editor

Preview - Next Issue

*** Preview 50th Edition ***

- *Geophysics in Victoria - Major Initiatives of the Department of Energy and Minerals*
- *ASEG Early History*
- *Investing in Geophysical Development*
- *Magnetic Susceptibility in Hydrocarbon Search - Sydney Basin*
- *Seismic Window - Volcanics and Intrusives on Seismic*
- *Seafloor imaging - Offshore Tasmania*

President's Piece

The Annual General Meeting of the ASEG was held in April at the Kelvin Club in Melbourne. Sufficient people attended to make a quorum, but only just. Nominations for all positions on the federal committee were called for in line with the constitution of the society; the notice was in Preview, and a number of potential committee members were approached by phone. But there were no new nominations. In the event that this would happen, the committee of 1993-94 had agreed to renominate for 1994-95. As president I acknowledge the work put in by the committee over the past year and thank them for renominating for another year.

It is disappointing that there are not more members willing to put some time into the running of the society; but on the positive side it means that we will have three years of continuity with the same committee. Many of the small changes within the society which may have been postponed on a yearly basis, will now be addressed. The committee is enthusiastic and will do their best to ensure the smooth running of the society on behalf of all members and subscribers.

In 1994 we intend to have the publication of Exploration Geophysics back on schedule. The March edition went out on time, and the June edition is well in hand. Our next step is to attract new advertisers, and encourage those whose advertising lapsed over recent years to return. Membership is close to 1350 including issues that go to libraries in companies, institutions and universities; therefore the advertising exposure has increased.

The possibility of a permanent Secretariat will also be addressed this year. This was discussed briefly at the Council meeting in Perth and has been talked over in an informal manner by the federal committee. I will address this in the next issue of Preview and suggest a few ways in which a permanent secretariat could be achieved.

Hugh Rutter, President

ASEG President Hugh Rutter addressing the Conference opening session watched by Norm Uren (Conference Co-chairman), Michael Schoenberger (SEG President) and Don Pridmore (Keynote Speaker).

Executive Brief

Quite a lot has happened since the last Executive Brief: there have been three Executive Committee meetings, a Council meeting at the Perth Conference and a Federal Annual General Meeting in Melbourne.

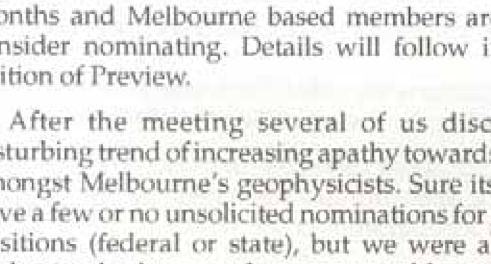
The ASEG Council consists of members of the Federal Executive, state branch Presidents and Secretaries, Standing Committee chairman and other office bearers such as editors, Past President and the Public Officer. The ASEG Conference is the only regular opportunity for this group to meet to discuss and debate resolutions, procedures and general ASEG policy. Standing Committee reports are also tabled.

The meeting in Perth was attended by 20 members and topics discussed included the move of publishing to Melbourne and the appointment of a new editor for Exploration Geophysics, the Adelaide Conference, financial report requirements, expenditure approvals, sponsorship of the President or proxy to attend the annual SEG Conference, the ASEG's role in the appointment of Chairs of Geophysics at Australian Universities and the proposed creation of a permanent ASEG Secretariat. There was lively debate on some of these topics but all motions tabled were passed by a significant majority.

Several of the Standing Committees also use the Conference as an opportunity to meet, discuss and debate.

The Annual General Meeting was held in Melbourne on April 12th. It was disappointing that only 17 members (including nine from the Executive and two from the local branch Committee) and one guest made the effort to attend. President's, Secretary's and Treasurer's reports were presented and in the absence of any other nominations, the incumbent Executive was re-elected. There will be a position or two becoming vacant on the Federal Executive in the next couple of months and Melbourne based members are urged to consider nominating. Details will follow in a future edition of Preview.

After the meeting several of us discussed the disturbing trend of increasing apathy towards the ASEG amongst Melbourne's geophysicists. Sure its typical to have a few or no unsolicited nominations for committee positions (federal or state), but we were at a loss to understand why attendance at monthly meetings has been so low in recent years and very poor of late. I hope we see a better turn-out at the next Victorian branch meeting.



Topics discussed at the monthly Executive meetings have included:

- the payment of editors honoraria, cost reimbursements and editorial requirements and guidelines.
- the move of Publishing to Melbourne, the successul first edition from the new printers and the continuing poor performance from Adelaide.
- following a suggestion from a NSW member to the Executive a motion was passed that any permanently retired member over the age of 55 with at least ten years continuous membership will qualify for the student membership rate.
- Hugh Rutter was nominated by the ASEG for membership of the AGSO Advisory Council. John Denham is our one existing representative, and is also the new editor of Exploration Geophysics.
- appreciation of the efforts of retiring Chairman of the Continuing Education sub committee Henk Van Paridon.
- the Perth Conference in general and the efforts of the Preview team, in particular Geoff Pettifer, in getting the Conference Preview edition (complete with Conference abstracts) out in time. Next year's Adelaide Conference arrangements have also been discussed.
- there has been a large number of inquiries recently from overseas geophysicists looking for employment in Australia and seeking ASEG assistance. We are at a loss to explain this sudden interest in Australia; we generally get only 1-2 inquiries a year.
- 11 Student, 9 Associate, 13 Active and 1 Corporate memberships were approved this period. Welcome!
- Koya Suto has joined the CD-ROM age and has donated his 20 year collection of "Geophysics" to the ASEG-AMF library in Adelaide. These personally autographed journals are now available for borrowing. Many thanks Koya.
- the Promotions Committee have been busy organising further journal exchange programs with overseas geophysical societies. They are currently working on a geophysical model, slide set and presentation aimed at demonstrating geophysics to school students and secondary teachers.

Brenton Oke, Secretary

Preview Deadlines

Issue	Deadline
June '94	May 27 1994
August '94	July 29 1994
October '94	September 30 1994
December '94	November 25 1994

News of Publications

Exploration Geophysics is now in its 25th Volume. The new cover symbolises major changes; John Denham is interim editor, Jenkin Buxton Printers Pty Ltd of Melbourne is the new printer (appointed after we called for competitive tenders), and the ASEG Secretariat in Melbourne has taken over publication responsibilities. Most importantly of all, our technical journal has a new publication schedule; quarterly in March, June, September and December.

Members will be aware of the delays in publication which accumulated over last two years. The Federal Executive concluded that the existing arrangement of Editor in Sydney, printer in Adelaide and financial responsibility in Melbourne was proving inefficient.

The journal is our "flagship" in terms of maintaining our credibility as a geoscientific professional society. It is also our largest financial undertaking, with a gross cost of $50,000 per year for four non-conference issues, and $90,000 for the February 1994 Perth Conference issue. For all these reasons the time for a change in publication and printing responsibilities was due.

A side-effect of the change is that the last Adelaide based issue (June 1993) was posted out to members in May 1994, after the first Melbourne based issue (March 1994).

The position of Editor is advertised in this Preview, and I encourage any interested member to apply. Meanwhile, I encourage members to support John Denham, the new interim editor, with submissions of papers, and preparedness to assist in refereeing and proof-reading. John is ably assisted by Geoff Dickson (advertising) and Andrew Sutherland (Business).

Once again we thank the retiring editor Don Emerson, for his enormous contribution as editor for the past eleven years, and for continuing into this year to oversee the transition to Melbourne-based publication. We also thank outgoing associate editors Ted Tyne and Joe Odins, especially for their dedication in editing two of the last three Conference issues. Dick Facer and Jim Dooley have volunteered to continue as associate editors in their respective specialities; their commitment and experience will be invaluable to the new team. Finally we thank the retiring Chairman of Publications Committee Terry Crabb, who has for seven years been in charge of advertising and business matters for Exploration Geophysics.

Michael Asten
Chairman, Publications Committee.

Exploration Geophysics

The Bulletin of the Australian Society of Exploration Geophysicists

ASEG People Profile

Janine Cross, ASEG Secretariat

Janine joined Geophysical Exploration Consultants in November 1990, after a number of years with a Real Estate Valuers Company. At GEC her role is more that of Office Manager as she has to cope with the switchboard, wordprocessing, ordering, invoicing and all the 1001 tasks which are associated with the successful running of a small business. In the early days not only was she doing this for GEC but also for two other consultancies sharing the same offices.

When the ASEG Secretariat was established in Melbourne, in March 1992 she was well equipped with the necessary skills to take up the new challenge. Janine keeps the membership lists up to date, ensures subscriptions are current; and after an intensive course in desk-top publishing with Ventura, she compiles Preview. The Society appreciates Janine's qualities and her efforts.

ASEG Branch News

Victoria

A combined Annual General Meeting of the Victorian and Federal Branches of the ASEG was held on the 12th April at the Kelvin Club in Melbourne. No nominations were received for any positions in either branch.

Unfortunately therefore the Victorian branch committee does not exist at the moment. As of the 12th April all positions are vacant. We are therefore seeking six or so people who have a little time and enthusiasm to devote to remedying this unsatisfactory situation.

It is an interesting philosophical and legal point whether the State Branch can actually exist without a committee, but I am sure you all will agree it is not a good idea.

We need a President, Vice-President, Secretary, Treasurer and a few committee members. If you feel you can assist in any of these positions please contact Paul McDonald (03) 412 7866 or John Sumpton (03) 863 5205.

John Sumpton & Paul McDonald

Wake up Vic ASEG Sleepy heads!

ACT

The ACT Branch of ASEG has been relatively inactive over the last few months following the ASEG conference in Perth.

However several members managed to find time to participate in the AGSO-ASEG Autumn Classic Golf Tournament held at the Woodhaven Green Golf Course (formerly the Belconnen Golf Course). In excellent weather conditions several members actually improved their golf performances, but Alan Hogan still won the prestigious ASEG "cool" cap award.

The branch will be holding an AGM in the next couple of months and hopefully organise some seminars in the meantime.

Kevin Wake-Dyster, Secretary

Queensland

The year started with a combined meeting with BEDG (Brisbane Exploration Discussion Group), featuring Dr John Bishop outlining Australian zinc deposits and their geophysical characteristics.

On the 17 March, the Qld Branch AGM was held. The president, secretary and vice-president wer re-elected. Troy Peters was elected to treasurer to replace Mike Barlow who was transferred to South Australia. The office bearers are:

President:	Wayne Stasinowsky	Mining Geophysics
Vice President:	Noll Moriarty	Oil Company of Aust.
Secretary:	Howard Bassingthwaighte	Velseis Processing
Treasurer:	Troy Peters	Velseis Processing

The main points from the AGM were:

- Seven meetings were held last year with a good mix between oil and minerals talks.
- The Qld Branch has approximately $14,000 in its account.
- The committee is investigating whether a branch library can be set up for the benefit of Qld Branch members.

The guest speaker at the AGM was Dr Eastern Wren who gave a stimulating talk on seismic field and processing problems. This provoked some detailed questioning and discussion was continued with vigour at dinner after the meeting.

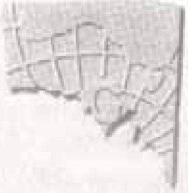
Helen Anderson from World Geoscience addressed a meeting on 29 March about geological mapping capabilities of the QUESTEM Airborne EM System. Helen used examples from the Mt Isa region to demonstrate how conductivity contrasts could help map the geology.

Students have been an active part of the meetings this year and are actively encouraged to continue by not being charged for the meetings. The students would like to have senior members of the Qld Branch give a brief address about themselves and how they got to where they are, e.g. a type of expanded C.V. any visiting members from other states who would also be interested in helping our students in this way can contact the president.

We currently do not have any speakers for the next month. Should anyone have any topics, please let the executive know so we can organise a meeting. We would like to have more "local" talks and would encourage people to present interesting aspects of their current work.

Wayne Stasinowsky, President

South Australia



The SA Branch is functioning again after the traditional Christmas and New Year shutdown. The Annual General Meeting was held on the 15th of February at the Earl of Leicester Hotel and from the feedback received, most people enjoyed the evening. The formalities were dispensed with in record time; all 18 nominations for the technical committee being accepted. This large number was considered workable in light of the extra responsibility of hosting the 1995 conference. I take this opportunity to welcome the new committee members who have not previously held positions within the SA branch. On behalf of the new committee, I would also like to thank past President Craig Gumley for his tireless efforts during the past two years. His presidential style and unwavering enthusiasm ensured two very successful years for the local branch.

Apart from the good food, wine and conversation, entertainment was supplied by winemaker, Wayne Dutscke, who provided an interesting and light hearted insight on turning grapes into wine.

The first monthly meeting for the year on March 16, featured Peter Elliott of Elliott Geophysics, presenting an expansion on his conference poster on FLAIRTEM. This is a new airborne method of TEM, comprising a ground based transmitter loop and an airborne receiver, and promises to be a useful future technique. Thanks to Peter for his interesting and informative presentation.

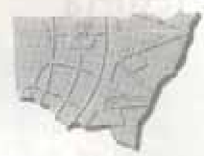
1994 promises to be a busy year and at this stage prospective technical meetings include the annual information evening and a presentation on the Lake Hope 3D seismic survey. As usual the social events for the year are eagerly awaited and are likely to include a beer tasting evening, a nostalgia evening and the Xmas BBQ.

Grant Asser, Secretary

ASEG - SA Branch 1994 Committee

President:	Rod Lovibond	SAGASCO
Secretary:	Grant Asser	SANTOS
Treasurer:	Mike Brumby	PETROSYS
Committee	Andy McGee	SANTOS
Members:	Kim Chatfield	SANTOS
	Neil Gibbins	SANTOS
	Craig Gumley	SANTOS
	Wendy Watkins	SANTOS
	Alan Appleton	SADME
	Terry Crabb	SADME
	Robin Gerdes	SADME
	Peter Dunne	SADME
	Richard Hillis	Uni of Adelaide
	Shanti Rajagopalan	Uni of Adelaide
	Mike Barlow	CRA Exploration
	Andrew Foley	Normandy Poseidon
	Murray Symonds	HGS
	Mark Taylor	SAGASCO

New South Wales



The year started well with a combined ASEG - AIG symposium "Geoscience - Managing the Environment", between 9 and 11 February, 1994. The first day consisted of a geophysics workshop and included key note addresses from dignitaries, such as Roger Henderson, Bob Whiteley, and Greg Street. Other speakers gave examples of the use of potential field methods, electrical techniques, radar, and innovative technologies applied to environmental problems. Many thanks to Tim Pippett, ably assisted by Derecke Palmer in arranging the symposium, which was well attended.

A highlight of the ASEG Conference and Exhibition in Perth was the awarding of honorary membership to Roger Henderson. Roger's career in geophysics has been long and colourful, and his contribution to the ASEG has been outstanding. Congratulations from your associates on the NSW committee!!

The NSW committee has a revised set of office bearers.

President:	Derecke Palmer	University of NSW
Secretary:	Mark Russell	Geo Instruments
Treasurer:	Greg Skilbeck	University of Technology
Committee:	Barry Smith	Command Petroleum
	Jim Tayton	Macquarie University
	Ted Tyne	Geoterrex
	Juliet Salmon	Bridge Oil
	Maki Petkovski	Ampolex Ltd
	Mike Smith	Austpac Gold
	Nigel Jones	Bridge Oil
	Richard Facer	Richard Facer & Assoc
	Steve Webster	Austirex International
	Tim Pippett	Geo Instruments
	Roger Henderson	Geo Instruments

ASEG Library News

Donations of papers and journals were received from Dr. Reg Sprigg of SA and Mr Jim Kemmis of Victoria. Thanks to Reg and Jim.

The number of items in the library is approaching 300.

It is housed in the AMF Building, Conyngham Street, Glenside, Adelaide, SA

Enquiries: Koya Suto Ph: (03) 877 4848.

Errata

The list of Laric Hawkins Award Recipients in the October 1993 Preview No 46 p57, omitted Shanti Rajagalopan 1987 (inaugural winner)and M. Shirov, A. Legchenko and G. Creer, 1991.

ASEG 10th Conference & Exhibition News

The 10th ASEG Conference and Exhibition held at the Burswood Complex in Perth is now over. Judging by the positive feedback and the fact that we did not force the ASEG into liquidation we believe that it was a successful event. (It was certainly enjoyable!).

Conference Venue - Burswood Complex

Altogether there were 555 delegates who attended the Conference. These were divided into 471 full registrants and 41 day registrants. This compares favourably with past conferences despite the rather poor resources industry economic conditions.

On the weekend prior to the conference various workshops were held. These have become a popular addition to the makeup of the conference and were well attended. There were seven workshops in all, with a total of 159 attendees. One popular topic had an attendance of over 90 on its own.

The conference could not take place without the financial support of the industry vendors and we would wish to thank them all for supporting the Exhibition so enthusiastically.

Conference Exhibition Area

Originally the plan was for 50-60 stands, the final total was 92, with an exhibitor personnel count of 55 (in addition to the Exhibitors who had registered as full delegates.) There were also sizeable numbers of people who only came to the Exhibition, hopefully reflecting a willingness in companies to increase investment in the new technologies on display.

Technical papers comprising of 61 hours of presentations on all aspects of Geophysics were well attended. There was a healthy split between the minerals and petroleum industries in contrast to North American conferences where Petroleum interests tend to dominate. SE Asian Companies were well represented giving a healthy international flavour.

There were a number of very good quality presentations at the conference and a lot of technical material to absorb in a short space of time. Keynote addresses covered differing aspects of the Conference theme " Increasing the Resolution: Clearing the Haze", and included such topics as finance, government, environmental geophysics and new technology. Keynote speakers were Don Pridmore (World Geoscience Corporation Ltd), Oz Yilmaz (Schlumberger Geco Prakla), Ross Fardon (Department of Mines and Energy SA.), Eve Howell (Hadson Energy Ltd), Bob Whiteley (Coffey Partners), Bruce Kay (Normandy Poseidon Ltd) and Brian Russell (Hampson-Russell Software Services Ltd).

Keynote Speaker Eve Howell (Hadson Energy) speaking on "Resolution" and Session Chairman Larry Tilbury (Woodside Offshore Petroleum)

The following awards were made by the technical papers sub-committee and the guest editors:-

1. Best Published Paper

"Sub-Audio Magnetics (SAM) -A High Resolution Technique for Simultaneously Mapping Electrical and Magnetic Properties" by Malcolm K. Cattach, J.M. Stanley, S.J. Lee and G.W. Boyd.

Malcolm Cattach

2. Best Petroleum Paper

"Increased Resolution of Processed Satellite Altimeter Data The Development of a Quality Global Gravity Database" by Andrew S. Long and T.A. Spurling.

Andrew Long

3. Best Minerals Paper

"Geophysics and Iron Ore Exploration: examples from the Jimblebar and Shay Gap - Yarrie regions, WA." by Tracey Kerr, A O'Sullivan, D. Podmore, R. Turner, P. Waters.

Tracey Kerr

4. Best Poster

"A Review of Shallow Seismic and Gravimetric Exploration of Brown Coal" by Raimund Seitz, H. Gaertner, H. Schubert.

5. Best Exhibitor

Landmark Graphics Corporation.

Geoterrex Pty Ltd

In addition the Honours and Awards Committee represented by Barry Long made the following awards:

6. Laric Hawkins Award

For the most innovative use of a geophysical technique to:-

Marcus Flis, Newcrest Mining Ltd for his paper: "POSMAG: an Ad Hoc GPS Positioned Ground Magnetic Surveying System".

Marcus Flis receives the Laric Hawkins award from Barry Long.

7. Grahame Sands Award

At the Conference Dinner the Grahame Sands Award was presented to Stuart Nixon, Richard Kurzeja and David Hayward of Earth Resource Mapping.

8. Honorary Membership

Roger Henderson, Geo Instruments. (See ASEG People Profile next Preview No 50, June 1994).

The Conference edition of Exploration Geophysics will be a useful reference volume. The credit for this work must go to the guest editors Joe Odins and Richard Facer. Also a first, was the use of Preview as a conference handbook.

Ice Breaker Cocktail Party by the pool.

On the social side, the conference dinner was attended by 410 persons and as far as anyone can recall was a great success. A few early starters (or were they late finishers) were spotted struggling into the conference on Thursday morning, none of the committee members of course. Thanks to Barry Long for his usual contribution in announcing the awards.

In conclusion we hope that the conference was a success for everyone attending and many thanks for all those people who helped put it all together.

Conference Organising Committee

The ASEG thanks the Conference Committee

Kim Frankcombe	Poseidon Exploration Ltd
Norm Uren	Curtin Univ. of Technology
Greg Street	Aerodata Holdings Ltd
Bill Peters	Southern Geoscience Cons.
Martin Bawden	Nopec Australia
Richard Williams	Tesla-10 Pty Ltd
Greg Steemson	Metana Minerals
Alan Sherrard	Western Mining Corp.
Mick Micenko	Consulting Geophysicist
Anita Heath	Consulting Geophysicist

ASEG Subcommittee Reports to the ASEG Council

Continuing Education

The Continuing Education Committee has been involved in a number of ventures since the last Council Meeting.

- November 1992 - Presentation of SEG Course "3D Seismic Exploration" by M.S. Lansley & A. Gonzales in Perth and Melbourne. Fifty people attended these workshops with mixed response to the course quality. A profit of some $7,000 was returned to the ASEG.
- May 1993 - Three State tour by Prof. Bob Sherriff talking about "Reservoir Geophysics". The course was organised in conjunction with the Curtin University and the Australian Petroleum Co-Operative Research Centre. Forty people, mainly geophysicists, attended these workshops which were informative and entertaining. The ASEG subsidised this tour by approximately $11,000.
- The CEC advertised in April 1993 for submissions for an ASEG course in Mineral Geophysics for Junior Geophysicists. Out of several submissions negotiations with Dr. John Bishop and Dr. Ted Tyne were instigated and are still in progress.

Since the middle of last year, action on the CEC front has been slow. There has been no contact from the ASEG at large. Although there is a general perception that the ASEG should dedicate some of its resources to the CEC no-one has a clear idea about how this might occur on an ongoing basis. One conclusion might be that the training market in Australia is already well served by our conferences and other established training centres.

At this time I feel it is appropriate for me to step aside and seek some new blood into the Committee who may be able to help answer these questions.

H. Van Paridon,
Chairman, Continuing Education Committee

Technical Standards

The work of the Technical Standards Committee has been on three issues during 1993.

1. Re-definition of the ASEG-GDF located data transfer format and implementation of software to achieve this.

2. Radiometric calibration - pads and dynamic test areas.

3. Long term data storage on different magnetic media types.

1. ASEG-GDF

David Pratt and Graham Pilkington have devised a new standard ASEG-GDF2. This is simpler than ASEG-GDF and takes account of media other than 9 track tapes. eg exabtye tape, dat tape optical disk, floppy disk.

New software is being written in C by Graham and should be available at the end of May 1994. Funding of $ 10,000 was approved by the ASEG at its April 1993 meeting of the Federal Executive.

2. Radiometric Calibration

Following the Technical Standards meeting at the Gold Coast ASEG conference (November 1992) and informal meetings during the conference, it was arranged that Bruce Dickson (CSIRO) would produce 4 sets of pads (each 1.0 x 1.0 x 0.3 metres) for AGSO, Geoterrex, Kevron and SADME. These were paid for by these companies/organisations. By building four sets together considerable cost savings were achieved. SADME has installed its set at Whyalla Airport by building them into a parking area. The other sets are mobile.

3. Magnetic Media Studies

The Technical Standards Committee is pooling its collective experience on different types of magnetic media and will produce a report for ASEG on the relative merits of the different media types.

Paul Wilkes,
Chairman, Technical Standards Committee

Promotion

Promotion Committee members

Koya Suto	
Kim Forward	Wesley College
Mike Dentith	Uni. of WA
Peter Clark	Uni. of New Zealand

A meeting was held on 28 November 1993: The aim of this committee is to promote geophysics to the general community. The secondary students are considered to be the initial target to encourage them to choose geophysics for their tertiary course. Production of a slide set is planned.

Koya Suto
Chairman, Promotions Committee

ASEG Library

The library started in May 1993. It is housed in AMF, Adelaide. The first batch of journals, which were kept in SADME storeroom, was transferred to the library in August 1993. At February 1994, about 250 items are in the library.

Journal exchange schemes were established with fellow overseas geophysical societies. So far, five societies have agreed with the proposal. They are Canada, China, Egypt, India and Japan. We received journals from Canada and Japan. We sent back issues of ASEG Bulletin and Exploration Geophysics to the five societies.

Koya Suto

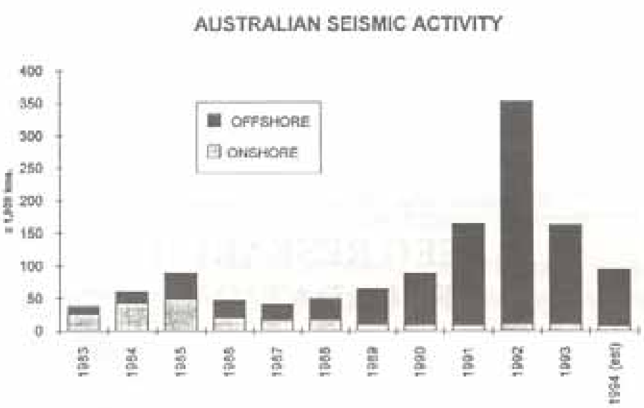
ASEG Subcommittee Reports to the ASEG Council

Geophysical Activity

Seismic Activity in Decline

Official figures for seismic activity in Australia in 1993 reveal that the total line kilometres has fallen off to less than half of the record high of the previous year, at a total of 162,400 line kilometres. The decline comes from the offshore component which is less than half of the previous year, at 152,200 line kilometres, whereas the onshore component is the same as 1992 at 10,200 line kilometres.

It's interesting that the 3D seismic component has risen sharply since the previous year, with 20% of the total of onshore being 3D and 70% of the offshore component.



The accompanying graph shows how the increases of 1991 and 1992 were not a continuing trend. Indeed the forecast for 1994 puts the total seismic surveying line kilometres at no more than 95,000 which is back to the level of 1990.

However, as Mr Dick Wells, the Executive Director said, the enormous amount of seismic work carried should lead to increased drilling activity in the coming years as the seismic information is interpreted.

Roger Henderson,
Chairman, Geophysical Activity Committee

ASEG Research Foundation

The ASEG Research Foundation continues to maintain a reasonable level of activity. During 1993, five projects were funded. These were:

1. **Title:** Magnetic Susceptibility Variations over Hydrocarbons, Sydney-Gunnedah-Bowen and Surat Basins
   University: University of Sydney
   Supervisor: Dr. R.A. Facer
   Student: Khamphira Viravong, B.Sc.
   Amount: $4,280 - primarily used for travel, accommodation and analyses.

2. **Title:** Evaluation of Seismic Trace Inversion in the Surat Basin, Queensland
   University: University of Queensland
   Supervisor: Dr. S. Hearn
   Student: Natasha Hendrick, B.Sc. App. (Geophs) (Hons)
   Amount: $4,800 - primarly used for unlimited access to the University of Queensland's seismic facility for 9 months.

3. **Title:** A Study of the Relationship between the Different Tectonic Styles which Controlled the "Skua Horst" in the Vulcan Sub-basin and the Application of Sequence Stratigraphy in Relation to the Potential for Hydrocarbon Entrapment
   University: University of Sydney
   Supervisor: Dr. J.J. Steinstra
   Student: Jane Johnson
   Amount: $5,000 - for part funding for A3 size Seiko Ethernet Plotter.

4. **Title:** The Removal of EM Coupling Effects from both Time and Frequency Domain IP Data
   University: University of Adelaide
   Supervisor: Dr. P.I. Brooker, Dr. K.L. Zonge and Dr. S. McInnes
   Student: Gerard M. McNeill, B.Sc. (Hons)
   Amount: $5,000 - primarly used for hiring of field equipment and crew.

5. **Title:** Application of Multichannel Aero Radiometric Data
   University: University of Adelaide
   Supervisor: Dr. S. Rajagopalan
   Student: John Caon
   Amount: $3,000 - primarly used for travel and accommodation.

A sixth project was offered sponsorship but was not taken up. It was:

Title: Application of GPS in Gravity Surveying: A Case Study around Widgiemooltha Dome, Norseman, Wiluna, Greenstone Belt, W.A.
University: Curtin University of Technology
Supervisor: Dr. W. Featherstone
Student: No suitable student available.
Amount: $4,920 - primarly used for accommodation, vehicle hire and equipment.

ASEG Research Foundation Report to ASEG Council (cont'd)

Of the five projects supported, four were completed satisfactorily and the fifth is still proceeding, with support, during 1994. This project is an M.Sc. at the University of Adelaide (The Removal of EM Coupling Effects from both Time and Frequency Domain IP Data).

During 1993, the ASEG RF Committee was expanded, current members are:

Prof. D. Boyd	University of Adelaide
Mr. J. Cucuzza	AMIRA Limited
Mr. J. Denham	Consultant
Dr. B.J.J. Embleton	COSSA
Dr. D.W. Emerson	Systems Exploration Pty Ltd
Mr. N.J. Fisher	Digital Exploration Limited
Dr. S. Hearn	The University of Queensland
Mr N Hungerford	Billiton Australia
Mr. W. Jamieson	Bridge Oil Limited
Dr. D. King	Consultant
Mr. S. Mudge	RGC Exploration Pty Ltd
Mr. P.W. Priest	Chartered Accountant
Mr. D. C. Roberts	SAGASCO Resources
Mr. M.J. Sayers	West Australian Petroleum
Mr. N. Sheard	MIM Exploration Pty Ltd
Mr. R.J. Smith	CRA Exploration Pty Ltd
Mr. N. Uren	Curtin University of Technology
Mr. P. Williams	Westen Mining Limited

Sub committees have been formed to rank project proposals in minerals and petroleum geophysics. They are:

Minerals	Petroleum
N. Hungerford	J. Denham
S. Mudge	N.J. Fisher
N. Sheard	W. Jamieson
P. Williams	D. King
	D.C. Roberts
	M.J. Sayers

In 1994, support has been offered to six projects, namely:

1. **Title:** Complex Resistivity Signatures for Mineral Exploration
   University: Monash University
   Supervisor: J. Cull
   Amount: $4,188.00

2. **Title:** Experiments in Multi Channel Aero Radiometric Processing using Burkitt Hill Test Strip Data (Adelaide)
   University: University of Adelaide
   Supervisor: Dr. S. Rajagopalan
   Amount: $4,000.00

3. **Title:** Joint Inversion of Gravity and Magnetic Data
   University: University of W.A.
   Supervisor: Dr. R. List
   Amount: $2,020.00

4. **Title:** An Analysis of Velocities within the Lake Hope 3-D Seismic Survey Area
   University: University of Adelaide
   Supervisor: A. Mitchell
   Amount: $4,940.00

5. **Title:** Seismic Shear Wave Anisotropy Experiment
   University: University of Adelaide
   Supervisor: Dr. R. Hillis
   Amount: $5,000.00

6. **Title:** Depth Conversion of Seismic Reflection Travel Times in Inverted Basins
   University: University of Adelaide
   Supervisor: Dr. R. Hillis
   Amount: $3,500.00

A seventh project (The Removal of EM Coupling Effects from both Time and Frequency Domain IP Data by the Univesity of Adelaide, supervisor Dr. P. Brooker, amount $5,000.00) is also receiving support as a continuation from 1993.

Two of these projects have commenced and funding has been taken up. We expect the remaining four to be taken up shortly. The two which have started are:

(1) An Analysis of Velocities within the Lake Hope 3-D Seismic Survey Area, University of Adelaide, A. Mitchell.

(2) The Removal of EM Coupling Effects from both Time and Frequency Domain IP Data, University of Adelaide, Dr. P. Brooker.

No concerted effort was made to raise additional funds in 1993 and only three donations were received (ASEG, MIM and CRAE). A committee meeting is planned for Tuesday evening, February 22, and efforts will be renewed to raise additional funds. Despite the lack of many contributions during 1993, the ASEG RF remains in fairly good shape financially and existing funds are probably adequate to continue activities through 1995.

Our long term aim, however, is to accumulate sufficient funds for ASEG RF to be able to operate on the interest earned. Consequently, we cannot afford to be complacement and need to raise additional funds during 1994. *(Editors Note: See donation coupon p14).*

R. J. Smith,
Chairman, ASEG Research Foundation

The Occurrence of Geomagnetic Disturbances

Richard Thompson
IPS Radio and Space Services

1. Introduction

During geophysical surveys geomagnetic disturbances are a nuisance which can degrade the quality of the results or even prevent the data from being of any value at all. The occurrence of disturbances may seem to be without pattern in time, except according to Murphy's Law, when a disturbance occurs at a time to cause maximum problems for the survey. However, when viewed more carefully, the occurrence of geomagnetic disturbances has distinct patterns which can be used to advantage. The purpose of this article is to review some of these patterns. However, before we do this, we will need some background information about disturbances and about their ultimate source - the sun.

2. Background Information

2.1 Geomagnetic Disturbances

Geomagnetic disturbances result from changes in the speed or density of the solar wind, the continuous flow of charged particles from the sun past the earth and into interplanetary space. This flow distorts the earth's magnetic field, compressing the field in the direction of the sun and allowing it to expand in the anti-sun direction. Fluctuations in the flow of solar wind change this distortion causing variations in the strength and direction of the magnetic field measured near the surface of the earth. These is called a geomagnetic disturbance and there are many interesting phenomena associated with them. Some of the more notable include: ionospheric storms disrupting High Frequency (HF) communications; heating of the outer layers of the earth's atmosphere altering the orbits of satellites and contributing to their early return to earth; surge currents induced in power lines sometimes leading to the failure of power grids; currents in long pipelines leading to increased corrosion; and sightings of aurorae at more equatorial latitudes such as in mainland Australia.

With events as complex as magnetic storms it is convenient to describe them in simple terms such as by means of a disturbance index. The 3-hourly K index, and its derivative the daily A index, is a commonly used one. The K index is defined from the total variation of the geomagnetic field over a 3 hour interval of universal time with the index being scaled in a manner which depends on the location of the site. K values range from 0 (undisturbed field) up to 9 (extremely disturbed field). The daily A Index is a derivative of the 8 values of the K indices obtained for any one day. This index, which has a range of 0 up to 400, can be defined for any one station or grouped to form a "planetary" index known as Ap. The Ap index has been available since 1932 and the following table shows the occurrence of various levels of the Ap index together with descriptive terms which are used by solar-terrestrial forecasters.

Table I. *Magnetic Disturbances During 1932-1992*

Descriptive Level	Ap Range	Percentage of Days
Quiet	0 - 7	36.8
Unsettled	8 - 15	33.0
Active	16 - 29	19.6
Minor Storm	30 - 49	7.3
Major Storm	50 - 99	2.8
Severe Storm	100 - 400	0.6

Table I shows that the geomagnetic field is mostly at quiet or unsettled levels; storm conditions are less common and the most extreme storms when the Ap index exceeds 100 are rare. The largest recorded Ap index was 280 on November 13th 1960, whilst the largest in recent years was 246 on March 13th 1989 - the second largest on record.

2.2 The Solar Cycle

Geomagnetic disturbances originate from the sun and their occurrence depends on the solar cycle. This cycle is typically 11 years in duration although cycles vary greatly both in amplitude and in length. The solar cycle is manifest in many properties of the sun but is most evident in the occurrence of sunspots on the solar disk. Sunspots are regions of stronger magnetic field which appear darker than the surrounding surface. At times, sunspots are rare and the sun appears almost without blemish. This is known as solar minimum and is regarded as the start of the solar cycle. Later sunspots become more common and it is normal for many groups of spots to be visible. The peak, when sunspots are most common, is called solar maximum.

The number of sunspots gives rise to the "sunspot number" which, when smoothed over a period of 12 months, is the traditional measure of the solar cycle. The peak sunspot number of historical solar cycles varies greatly but five of the last six cycles have been large in amplitude. Using the numbering system given to solar cycles, Cycle 19 (peak sunspot number of 201 in 1957) was the largest cycle on record; Cycle 21 (peak sunspot number of 165 in 1979) the second largest; and Cycle 22 (peak of 159 in 1989) equal third largest. Table II shows the properties of recent solar cycles.

At present we are in the declining phase of Cycle 22. From its peak value in 1989 of 158.5 the sunspot number continued at high levels until early 1992 when it began to fall rapidly. We expect this to continue in a fairly steady manner until solar minimum is reached in mid 1996 and Cycle 23 begins.

Table II. *The Properties of Recent Solar Cycles*

Sunspot Cycle Number	Year of Min	Smallest Smoothed Sunspot Number	Year of Max	Largest Smoothed Sunspot Number	Rise to Max (Yrs)	Fall to Min (Yrs)	Cycle Length (Yrs)
14	1901.7	2.6	1907.0	64.2	5.3	6.6	11.9
15	1913.6	1.5	1917.6	105.4	4.0	6.0	10.0
16	1923.6	5.6	1928.4	78.1	4.8	5.4	10.2
17	1933.8	3.4	1937.4	119.2	3.6	6.8	10.4
18	1944.2	7.7	1947.5	151.8	3.3	6.8	10.1
19	1954.3	3.4	1957.9	201.3	3.6	7.0	10.6
20	1964.9	9.6	1968.9	110.6	4.0	7.6	11.6
21	1976.5	12.2	1979.9	164.5	3.4	6.9	10.3
22	1986.8	12.3	1989.6	158.5	2.8		

2.3 Solar Features

Several solar features and events are connected with geomagnetic disturbances. Firstly, solar flares are huge outbursts of energy seen on earth at many wavelengths from visible light right through to the radio spectrum. From space, flares can also be seen in X-ray observations. Flares are the result of the storage of energy as the magnetic fields of sunspots become twisted and distorted by the rotation of the sun. If the complexity of the magnetic field is sufficiently large, the energy is sometimes released in a dramatic and explosive event - a solar flare. Along with the production of electromagnetic radiation, the flare can be associated with the ejection of clouds of charged particles into the solar wind. This process is called a coronal mass ejection and may be associated with flares or with other types of events. The result of the material reaching the earth is a geomagnetic storm.

The occurrence of individual flares depends on seemingly random factors such as the development of large sunspot regions. However, flares follow the general pattern of sunspots and are most common during the peak phase of the solar cycle.

Coronal holes are another type of solar feature which are connected with geomagnetic disturbances. These are extremely large regions in the solar corona - the outer atmosphere of the sun. They are regions of reduced temperature and density and are the locations of magnetic field lines which are open into interplanetary space. Coronal holes contribute high speed streams to the solar wind which, if they reach the earth, also produce geomagnetic disturbances.

Coronal holes can sometimes exist for as long as a year, although they normally show some evolution in the size, shape and location. Being relatively fixed in location on the sun, a long-lived hole can produce a

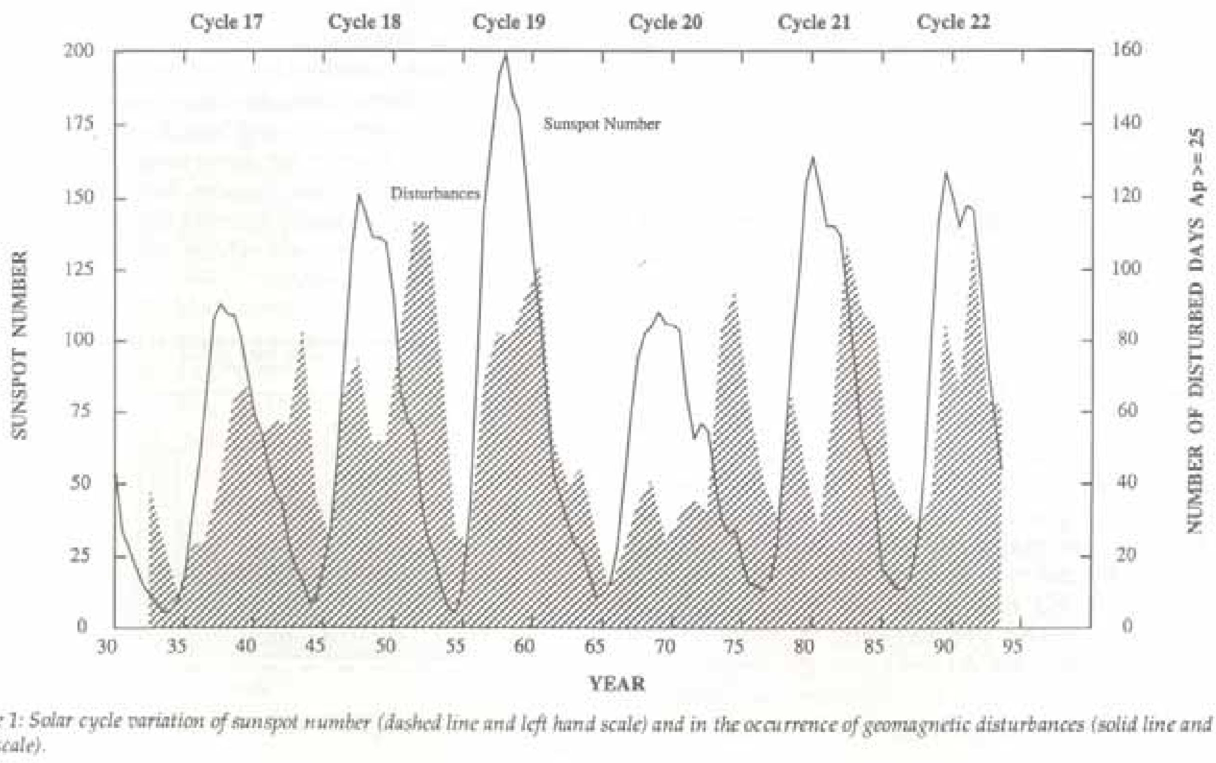


Figure 1: Solar cycle variation of sunspot number (dashed line and left hand scale) and in the occurrence of geomagnetic disturbances (solid line and right hand scale).

geomagnetic disturbance each time the rotation of the sun brings it into a favourable location. This gives rise to sequences of "recurrent" disturbances spaced at intervals of approximately 27 days - the apparent rotation rate of the sun.

3. Solar Cycle Trends

As might be expected, geomagnetic disturbances are not equally likely at all phases of the solar cycle and for all different solar cycles. Figure 1 shows the solar cycles since 1932 in terms of sunspot number (thin dashed line and left hand scale) and the occurrence of geomagnetic disturbances (thick line, hatched area and right hand scale). For the purposes of this graph, a disturbance has been defined as a day on which the Ap index equals, or exceeds, a value of 25 and the number of such days in each calendar year has been counted.

The occurrence of geomagnetic disturbances shows a trend generally similar to the solar cycle with periods of reduced frequency of disturbances near solar minimum. However, there appears to be two components which determine the occurrence of disturbances during the main part of the cycle. Firstly, there is a component which varies in phase with the solar cycle and seems to be related to events such as solar flares. Secondly, there is a component which results in large peaks of disturbance in the declining phase of some, but not all, solar cycles. This component is related to coronal holes and produced large peaks of disturbance in 1950-53 (the declining phase of Cycle 18), in 1974-76 (Cycle 20) and in 1982-84 (Cycle 21) but no corresponding large peak in the declining phase of Cycle 19. The geomagnetic disturbances which make up this activity is distinctive in that they are recurrent disturbances (i.e. spaced at intervals of 27 days) reflecting the properties of the coronal holes from which they arise.

The recurrent disturbances in the declining phase have given rise to a successful technique for predicting the amplitude of the next solar cycle. It turns out that the size and strength of the declining phase burst of disturbances is related to the amplitude of the next solar cycle. Hence, a large solar cycle such as Cycle 19 was preceded by a burst of recurrent disturbances prior to the onset of the cycle (in this case in 1950-53). On the other hand, a relatively weak cycle such as Cycle 20 was preceded by a small burst of disturbances (around 1963 and hardly visible in Figure 1).

Figure 2 shows how the total number of geomagnetic disturbances in a solar cycle depends on both the amplitude of the current cycle and that of the next. The figure plots the number of disturbed days (Ap \(= 25) against the sum of the amplitudes of the current and the next cycle. The good fit to the data indicates that the number of geomagnetic disturbances is well determined by the two amplitudes - if we knew the amplitudes of the two cycles we could accurately estimate how many geomagnetic disturbances to expect. In practice, we do not know the amplitude of the next solar cycle and this restricts our ability to predict future trends in geomagnetic disturbance.

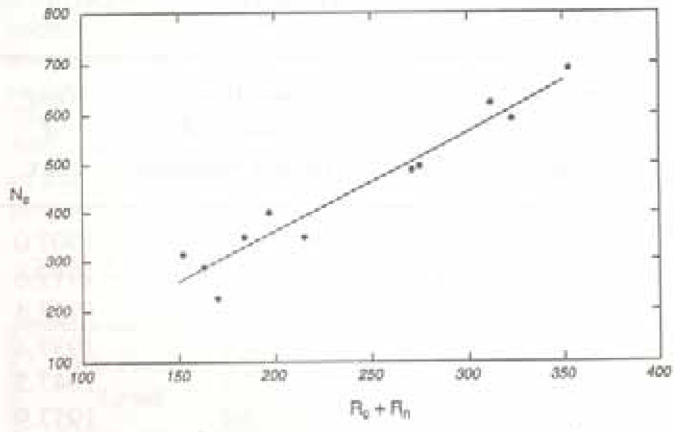


Figure 2: The number of geomagnetic disturbances in a solar cycle (N_c) plotted against the sum of the amplitude of the current cycle (R_c) and that of the next cycle (R_n).

The present time is a good example of these difficulties. We are in the declining phase of Cycle 22 and have seen a burst of recurrent disturbances which may have been the precursor to Cycle 23. If this is the case, then Cycle 23 is of modest amplitude (around 120-130) and the frequency of geomagnetic disturbances will decline steadily from now until solar minimum expected in 1996. On the other hand, we can not yet rule out the possibility that stronger precursor activity has been delayed and will commence shortly, heralding a large amplitude Cycle 23.

4. Seasonal Trends

Geomagnetic disturbances are not equally likely at all times of the year. This arises not from the sun but from the orientation of the dipole axis of the earth's magnetic field relative to the flow of solar wind from the sun. Disturbances are most likely when these are perpendicular as is the case near the the equinoxes (March 21st and September 21st). This seasonal preference is illustrated in Figure 3 which shows the occurrence of disturbances of major storm levels (Ap \(= 50) for each month of the year for data from 1932 to 1992. In the extreme case, disturbances of this level are three times as common during March as during January. The seasonal preference for disturbances becomes even stronger for larger disturbances but less strong for smaller events, eventually turning into a reverse effect for very quiet conditions which are more common during the solstice periods.

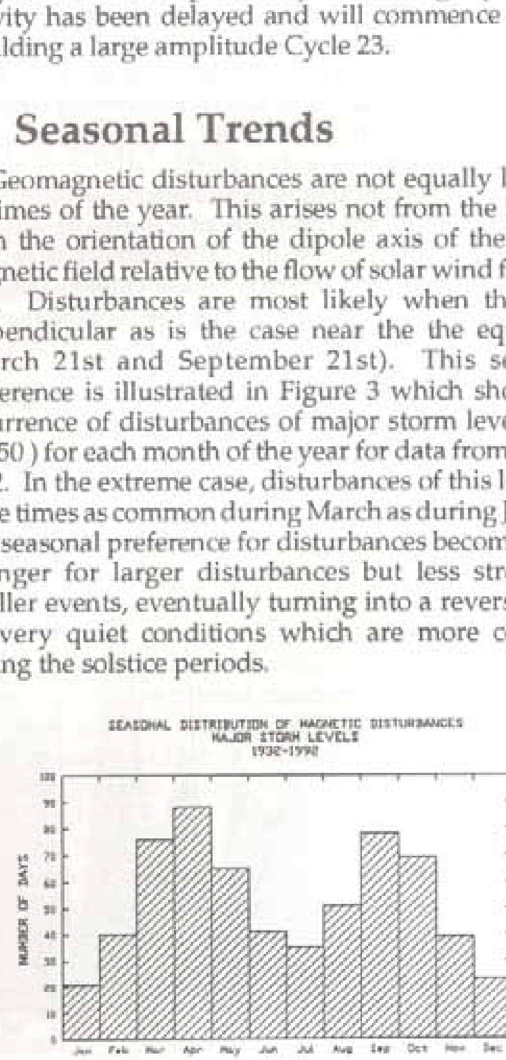


Figure 3: The seasonal effect in geomagnetic disturbances between 1932 and 1992.

The seasonal effect for very large events is illustrated by considering the top twenty disturbed days in terms of the Ap index (Table III). Of these events, 13 fell into the equinox periods of March-April and September-October. Interestingly, the largest event in this group (November 13th 1960) did not fall within the four months, although it was close. The second largest was March 13th, 1989 which fell very close to the equinox. A feature of the table was that Cycle 19 - the largest cycle on record - contributed seven entries whereas Cycle 20 - the weakest of recent cycles - did not contribute to the list although a disturbance on August 5th, 1972 came close (ranked 21st). Cycle 17, a modest cycle in amplitude with a peak sunspot number of 119, contributed six although three of these fell within one week - not a good week for geophysical surveying.

The strength of the seasonal trend in disturbances makes it very valuable for forecasting. Of particular concern to forecasters are periods of intense solar flare activity which happen to fall near an equinox because large disturbances are likely. The March 1989 interval was a classic example. The activity started on March 6th with the appearance of a large sunspot region on the eastern edge of the sun. During the next 14 days there were numerous energetic solar flares but the most outstanding feature occurred on March 13-14 with the large geomagnetic storm. This storm had an amazing list of effects on earth and in space. Power systems in Canada and Sweden failed as large electric currents were induced in power lines and tripped protective relays. Increased atmospheric drag, resulting from the expansion of the earth's outer atmosphere during the disturbance, altered the orbits of many satellites with the result that NASA lost track of some of them for a short period. Satellite navigation systems failed to operate and High Frequency (HF) communication systems were also out of action. Aurorae were sighted at quite equatorial latitudes. The southern regions of Australia were under cloud but numerous sightings were made in Queensland and even at Exmouth in Western Australia. It was indeed an extraordinary period of time!

Table III. *Historically Large Geomagnetic Disturbances*

Rank	Date	Cycle	Ap
1	13 Nov 1960	19	280
2	13 Mar 1989	22	246
3	01 Apr 1960	19	241
4	15 Jul 1959	19	236
5	18 Sep 1941	17	232
6	05 Jul 1941	17	222
7	28 Mar 1946	18	213
8	01 Mar 1941	17	207
9	06 Oct 1960	19	203
10	08 Feb 1986	21	202
11	08 Jul 1958	19	200
12	11 Feb 1958	19	199
12	06 Sep 1982	21	199
14	22 Sep 1946	18	198
15	05 Jun 1991	22	196
16	25 Mar 1946	18	195
17	30 Mar 1940	17	189
18	24 Mar 1940	17	187
19	07 Oct 1960	19	186
20	25 Mar 1940	17	184

5. Solar Rotation Trends

The solar rotation period (27 days as seen from the earth) is another time scale which determines the occurrence of geomagnetic disturbances. This occurs in several different ways. Firstly, a large sunspot region may live for several rotations and produce energetic flares as it crosses the visible disk of the sun. Geomagnetic disturbances associated with these flares then occur preferentially during one half of the solar rotation but not in the other. Secondly, the streams of high speed solar wind produced by coronal holes are sometimes very long-lived and can be associated with a disturbance each time the stream is suitably located with respect to the sun-earth direction. The effect is similar to a lighthouse in which the light is seen once per rotation. Such sequences of recurrent disturbances can sometimes be observed for as long as a year although most patterns are shorter lived, especially near the peak of the cycle. Recurrent patterns tend to show variation from rotation-to-rotation in the timing of the disturbance and in its strength. In particular, the strength is affected by the seasonal trend and there is also an intrinsic variability related to the sun and to the response of the earth's magnetic field to the solar wind.

Recurrent patterns are particularly useful for forecasting purposes as they allow predictions of disturbances and quiet periods some time in advance. Naturally, the most reliable forecasts of this type are a single solar rotation (27 days) in advance but it is sometimes possible to forecast for several rotations. The major problem for forecasters is to pick the start and the end of sequences although there are sometimes difficulties when disturbances are weak, or are delayed. The patterns are most stable in the declining phase and least reliable in the rising phase and maximum of the cycle. Such longer term forecasts can be quite useful but there is always the risk that some unexpected event can produce a disturbance.

6. IPS Forecasting Services

So far, we have discussed only the longer term factors which modulate the occurrence of disturbances. However, geomagnetic disturbances may arise at short notice after events such as solar flares, coronal mass ejections and short-lived coronal holes. The sporadic nature of these events sets a limit to the timescale over which they can be predicted. In the case of a flare, the delay time between the flare and the onset of a geomagnetic storm is typically 1-3 days. It is therefore necessary to monitor the sun continuously and to assess the likely effects of any event. In Sydney, IPS Radio and Space Services operates a "Warning Centre" which receives observations from two solar observatories in Australia (located near Narrabri in NSW and near

Exmouth in Western Australia) and from other international sources. The role of the Warning Centre is to provide warnings of major activity and confirmations of events resulting from solar activity.

The Centre has established a wide range of services which clients can obtain by facsimile, by computer mail, or by telephone. The Centre also provides advice on all aspects of the sun and its diverse effects on the solar-terrestrial environment.

Table IV. *IPS Contact Details*

Manager Customer Services	**(02) 414 8307**
Duty Forecaster	**(02) 414 8329**
Solar/Geophysical Report	**(02) 414 8330**
Warning Centre Facsimile	**(02) 414 8331**
Electronic Mail	**rwc@ips.oz.au**

7. Conclusion

Geomagnetic disturbances are part of a complex phenomena arising from events on the sun. Despite seeming to be random in occurrence, there are a number of strong patterns which determine the chance that there will be a disturbance. These patterns vary from the timescale of the 11-year solar cycle right down to the 1-3 day delay following a major solar flare.

The effects of geomagnetic disturbances can be dramatic but it is possible to reduce any disruption by having access to forecasts. IPS Radio and Space Services in Sydney has established a Warning Centre with the role of monitoring the sun and providing forecasts and confirmations of events such as geomagnetic disturbances. IPS welcomes inquiries about the sun and its effects on the earth as well as the services which it is able to provide to those who are affected by geomagnetic disturbances and related events.

For further information contact:
Dr. Richard Thompson
IPS Radio and Space Services
P.O. Box 5606
WEST CHATSWOOD
NSW 2057

Made In Australia

With Australian flags made in Taiwan and even "Made in Australia" stickers printed in Singapore, I suppose its not surprising to us that most geophysical instruments that we use are made overseas - but need it be so?

SIROTEM is one instrument which has gone against this trend, with over 80 units having been sold and what's more, over 30 of those having been exported to far-flung parts of the world. Another example is well-logging equipment manufactured by Auslog which is marketed throughout the world by Scintrex.

Indigenous geophysical instrument manufacturing has not always been this thin. In the late 1970's, Austral Instruments of Adelaide, headed by John Webb, manufactured a wide range of ground geophysical equipment including magnetometers, scintillometers, resistivity equipment and well-logging units. In this same period Geoex of Adelaide won the tender from 30 applicants to have the rights to manufacture and market SIROTEM. Geoex also began integrating truck mounted well-logging equipment for export to Thailand and China.

Before this time, however, most equipment in the mineral geophysics field was manufactured in Toronto, Canada. It was apparent, even then, that some of it was not ideally suited for the very different conditions of Australia. This was true of the mechanical design and also of the technical specifications in some instances. For example, frequency EM equipment invariably did not have low enough frequencies for the very conductive surface conditions here.

Of course the market in Australia is small compared with that of North America, which made it difficult for local manufacturing to be viable unless it was a product with some unique features that were attractive elsewhere in the world, such as has been the case with SIROTEM. However, this may be changing as the market in Australia grows and as companies continue to show an interest in supporting local industry.

Geo Instruments for one, can see some particular market niches for products that companies are wanting to have developed. For this reason Geo Instruments has appointed to its staff, Brian O'Neill as Chief Design Engineer. Brian is well known for his development of the original SIROTEM and is keen to support the company's interest in building up a local manufacturing industry again.

Roger Henderson
General Manager, Geo Instruments

The Benefits of High Performance 3D Graphics in Exploration.

Ian Lilly, South Asia-Pacific Area Marketing Manager
Mining & Petroleum Industries
Silicon Graphics Computer Systems

Introduction

There are an increasing number of software and hardware Systems in the marketplace claiming to offer benefits to the explorationist through their use of 3D graphics and/or visualisation.

In the last 12 months there has been a large increase in the digital media abilities of some UNIX workstations. Can these features be exploited to provide increased productivity for the geologist, geophysicist or reservoir engineer?

Visualisation and 3D Graphics

What is the rationale for visualisation and 3D graphics displays? After all there must be some underlying reason why the majority of new geoscience software products offer at least a component of this technology.

Scientists from all disciplines have used graphics to display concisely the results of research or investigation. The graphics ranged from elaborate computer generated movies through pen plotted maps, diagrams, cross sections to the simple mud-map drawn in the sand or on the back of a cigarette pack. In all cases the aim was to impart information in a more condensed and more readily assimilated form than words or text could achieve.

An early example of this technique was the "Smoke Rings" movie from Toronto where animation was used to impart the relationship between space and time in TEM modelling results.

Scientific visualisation came into being under that name in the late 1980s largely through the efforts of scientists working at national laboratories in the US (Sandia, Los Alamos etc) and at associated universities.

Their need was to examine and understand quickly the results of large simulations run on supercomputers such as CRAY and CDC. A variety of techniques were investigated and it was found that multidimensional (3D) displays with animation were the most effective tools.

At the time (1987,1988) workstations did not have the graphics power to perform these tasks in real time or even near it. Thus "movie loops" were generated but output was to disk rather than film. Playback was to the workstation screen and "hardcopy" could be made to video or film. Advantages of the digital animation technique included the ability to send all or part of the visualisation across networks to remotely located research collaborators; the ability to edit, at the workstation, the playback data and the faster turnaround compared to output to film.

The principal disadvantage of this technique is the lack of user interaction. Once the playback is made the user is limited to frame deletion, annotation and voice over interaction with his results.

Faster graphics options for workstation in the late 1980s meant that it was becoming possible to interact with moderate sized data sets (a few tens of megabytes). This interaction enabled the scientist to "fly through" his data, to display at will any attribute of the model, to change colour maps, to hide irrelevant information etc.

The current generation of high performance graphics workstations enable quite large data sets to be visualised in near real time. They also enable the interaction with and editing of large (1000000 polygon) geometric models eg of geological structures, reservoir characteristics and offshore platforms.

The rationale for all this effort was the results of numerous studies over time that have shown that the key to successful communication of complex concepts or data is via the use of visual cues. In particular, the human mind has developed particular sensitivity to cues such as colour change, relative depth in a 3D field, and relative movement.

It has been claimed that up to half our brain neurons are engaged in processing visual stimuli of one sort or another. If this is indeed the case then it would seem obvious that the efforts of the '80s toward improved visualisation technology were soundly based.

Visualisation At Work

Data Exploration

"Data Exploration" is the process of examining a multivariate data set looking for relationships between members of the data set. These relationships may be spatial or attribute or a combination. What sets data exploration apart from conventional multivariate techniques is the lack of any statistical model. Data is browsed in multidimensional space until the investigator finds relationships which he/she deems important.

Figures 1(a) and 1(b) show examples of this technique.

Figure 1(a) shows data sets displayed via their histograms and as plans or crossplots. The histograms have been used to partition the data and colour has been used to distinguish this partition with the results displayed colour coded on the plan and cross plot. It is quite obvious that the yellow data set has two populations that are separable both in space and statistically.

Figure 1(b) shows a similar technique but in this case only the resultant views are displayed. However a third parameter is displayable. What makes this particular display valuable and which is lost on paper is the ability to interactively change the viewpoint of the display as well as the variables displayed, their scales, colours and symbols.

Figure 2 shows a matrix crossplot display wherein each variable is posted against every other variable. This type of display can help elucidate subtle relationships in multivariate data sets. In this particular slide colour has been used to partition the data set into a number of subgroups. A variation of this display that can be effective is to display the histogram or cumulative frequency plot along the diagonal. Again fast graphics, large colour ranges and dynamic linked windows enable these displays to be customised and tuned to the users needs as the data is explored.

Data Integration

One of the perennial problems of interpretation is the integration of disparate data sets. In the oil industry this has been exacerbated by the rapid increase in the number of horizontal and deviated wells being drilled. Projecting deviated well tracks onto simple vertical or horizontal sections does not provide the interpretation team with a coherent picture of the true spatial relationships of horizons, faults and wells.

Figure 3 shows data from a 3D seismic volume. Displayed are a vertical section, horizontal time slice, an horizon pick (cyan), two fault surfaces (red and purple), a well track with associated log trace (black/cyan) and a gridded horizon (magenta). Note how the magenta horizon has been displayed semi-transparently thus enabling the relationship between the gridded horizon and the original data to be compared. Similarly the relationships between this horizon and the faults is readily apparent.

Figure 4 from the same dataset shows an additional seismic section section dynamically sampled from the seismic volume along a user's specified zig-zag track. This section has a different colour lookup table to the original section and timeslice. Again transparency is used to facilitate the display of the intersection between fault surfaces and seismic data.

Figures 5-8 show a different aspect of data integration. Here we see the results of an interpretation combined with geological data. As we progress through the figures we can see into the geological volume as progressively more units are peeled away or made transparent. The final slide in this sequence shows one of the reservoirs colour-coded for relief. In a faulted reservoir such as shown the relationships between faults, horizons and wells can be difficult to determine.

Figure 9 shows four frames from a movie loop that demonstrates the three dimensional structure of interval velocities as determined from a 3D seismic volume. The ability to run this loop forward, backward, stop frame etc makes a powerful tool for distributing the results of interpretation to joint venture partners, colleagues and management.

Enabling Technology

The images shown are but a glimpse of what is possible with todays technology. They necessarily lack the dynamics and interaction available within the applications from which they were extracted.

To provide this interactivity and hopefully productivity from the geoscientist requires state of the art and a balanced hardware technology.

The current generation of 3D graphics workstations provide support for advanced graphics primitives in hardware. For example the figures displaying transparency and arbitrary section data utilises multiple bit planes (up to 192 bits/pixel) with hardware support for transparency and lighting.

The ability to display these volumes of data interactively requires very high sustained I/O rates from disk to memory, from memory to CPU and from memory to graphics processing subsystem. Building a high performance graphics systems and then installing it on a low speed bus guarantees poor performance as data volumes grow.

I have not discussed volume visualisation thus far. Volume visualisation is a technology that has its roots in confocal microscopy but has been applied to medical diagnosis, surgical planning, non destructive testing, computational fluid dynamics and 3D seismic interpretation.

Effective use of volume visualisation requires very high pixel rates, hardware zoom, large tables for colour lookup, multiple CLUTs and very high sustained I/O bandwidth throughout the system.

The high end of Silicon Graphics products are capable of sustaining voxel display rates of over 80M voxels/second using application software (not special benchtest software). With multiple graphics subsystems in these machines multiples of this rendering rate can be achieved.

Future Outlook

Many workstations are now multi-media capable. Silicon Graphics entry machine, the Indy, has digital video as standard along with tools to support the creation of movie loops, addition, editing and splicing of sound, video conferencing and digital media mail.

Such a system could be used to take the results of an interpretation together with samples of the original data and build a complete digital report. Co-workers on the project need not be in the same location; the data can be viewed and annotated while being discussed simultaneously on screens on the other side of the country or world.

The technology to use volume visualisation on the desktop with large data sets is just around the corner. I expect it to be available within 12 to 18 months. This will also create demand for additional realism such as stereo display and virtual reality fly throughs of the seismic volume and/or reservoir model. Such systems will be displayed within six months.

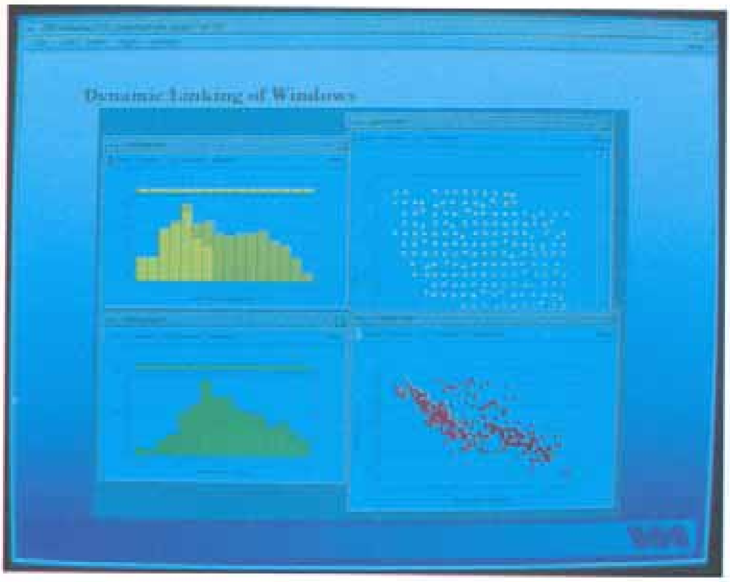


Figure 1(a).
Data exploration using colour histograms and cross-plots to distinguish populations in the data (Courtesy Western Atlas Software).

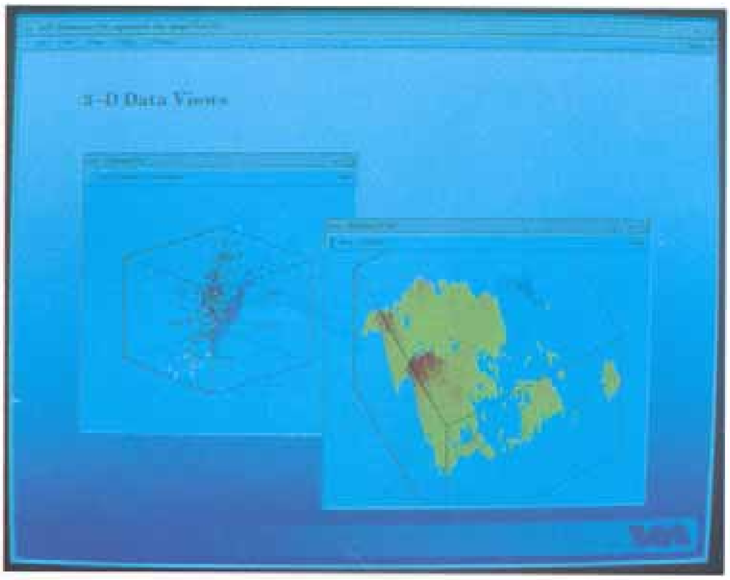


Figure 1(b).
Data exploration using a third variable warrants and is enhanced by creative 3D visualisation techniques (Courtesy Western Atlas Software).

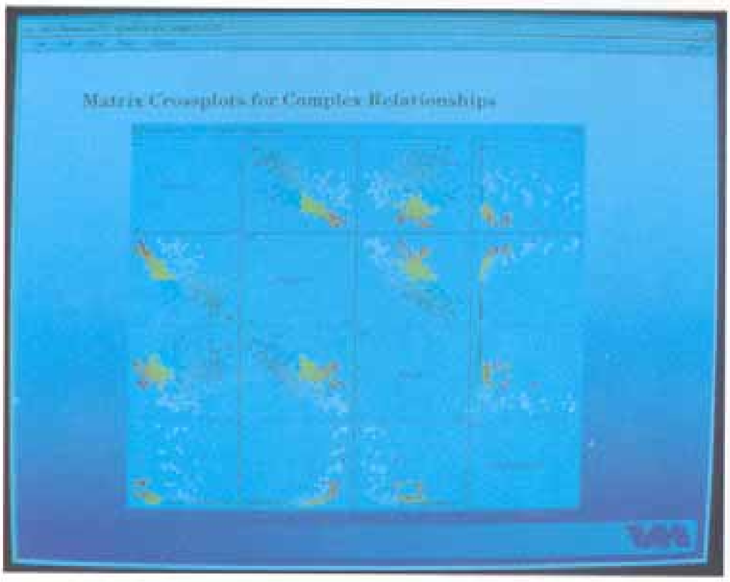


Figure 2.
Matrix cross plots enable all correlations to be easily visualised in multivariate data sets (Courtesy Western Atlas Software).

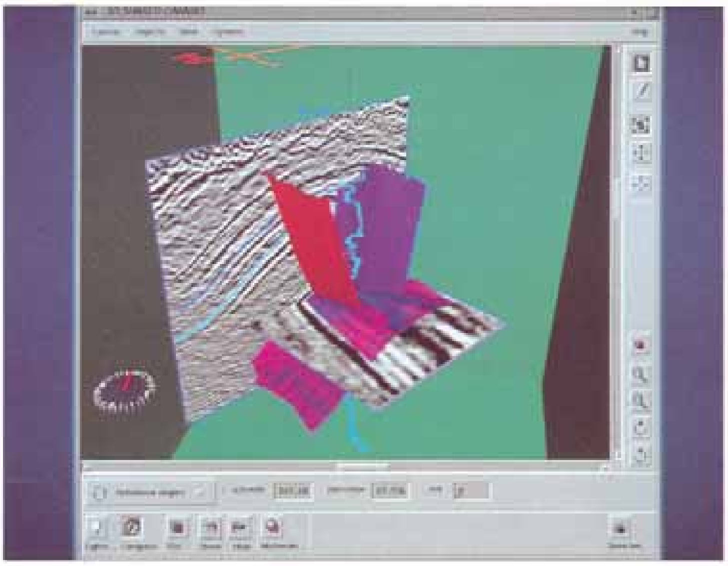


Figure 3.
Multiple sections and plan views of seismic and well data and the interpretation (Courtesy HES now Western Atlas Software).

Figure 4.
An additional section is displayed here (cf. Figure 3). Multiple colour look-up tables are also employed - a feature of 24 bit graphics (Courtesy HES now Western Atlas Software).

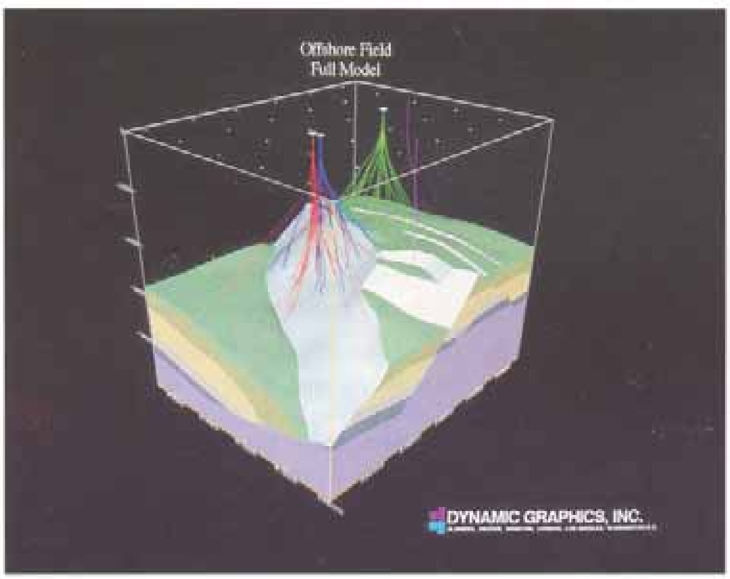


Figure 5.
Perspective view of a complex faulted reservoir and wells (Courtesy Dynamic Graphics Inc.).

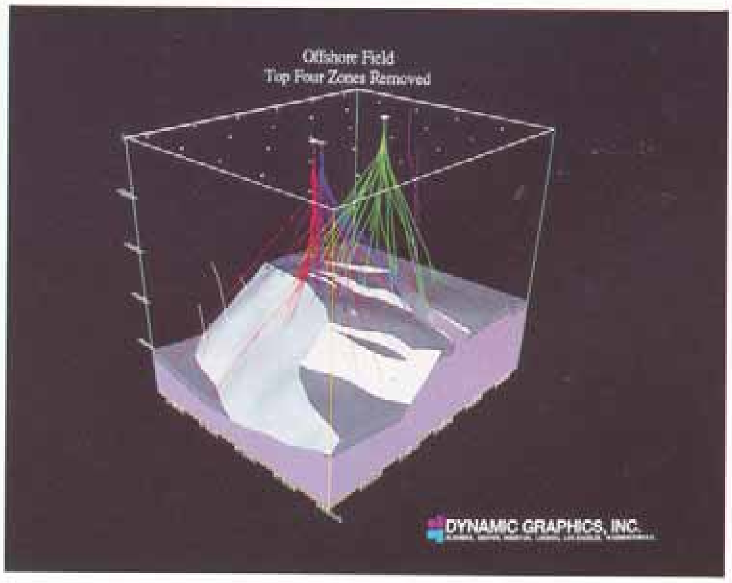


Figure 6.
A closer perspective view of the same reservoir with overlaying layers stripped (Courtesy Dynamic Graphics Inc.).

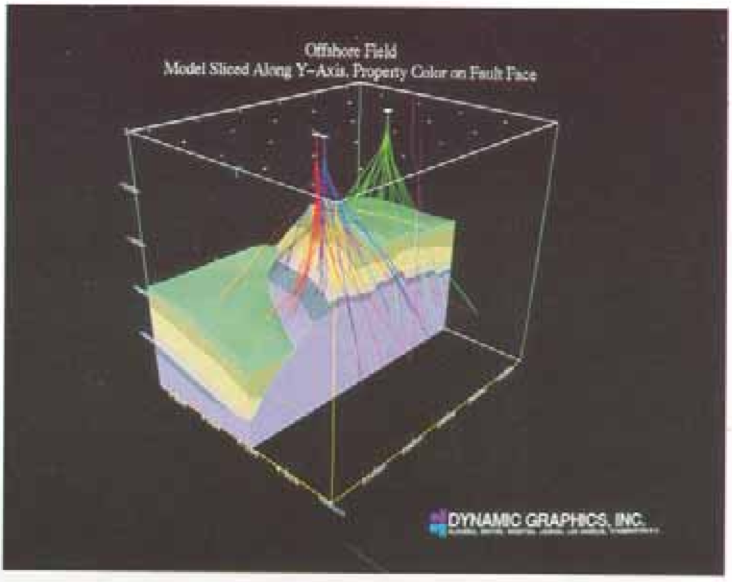


Figure 7.
A cutaway view into the same reservoir (Courtesy Dynamic Graphics Inc.)

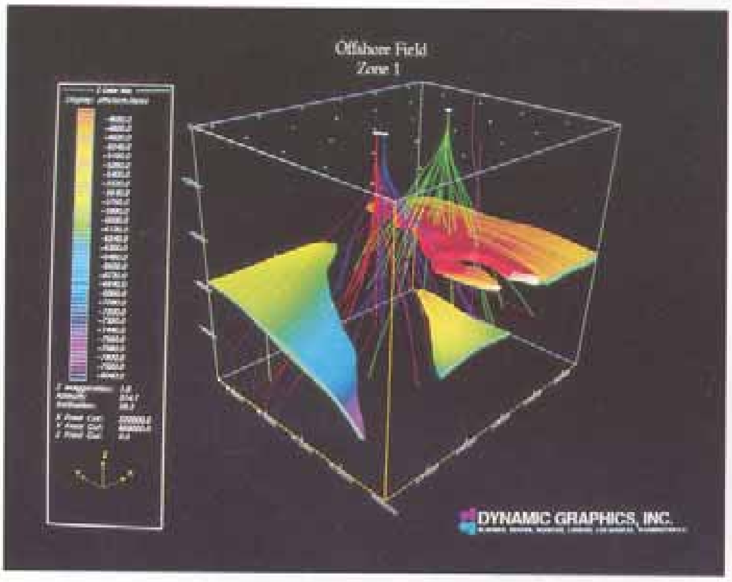


Figure 8.
One of the reservoir's top surface is colour coded for relief (Courtesy Dynamic Graphics Inc.)

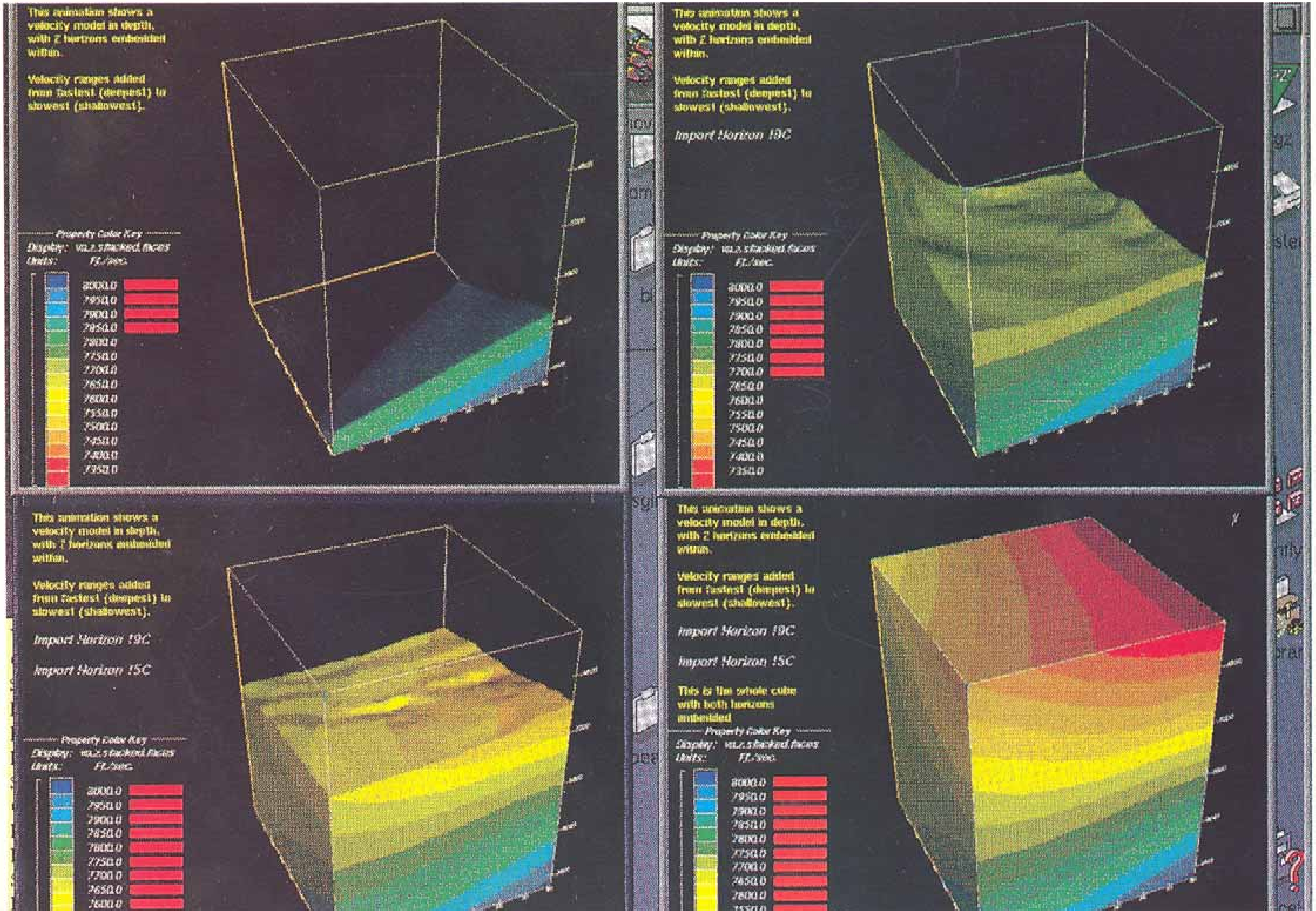


Figure 9. Four frames of a m[...] show layering of interval velocities in a 3D seismic grid (Cour[...]IES now Western Atlas Software).

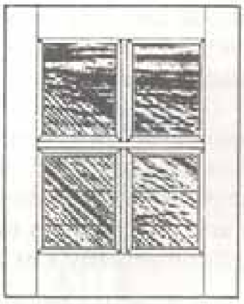
Conclusion

I believe that 3D visualisation and graphics has come of age. It is no longer a gimmick or an add-on. The current new-breed of software has support for 3D built in from the beginning. I expect the geophysical applications software market to follow the mine planning industry which embraced 3D five years ago. Today there is hardly a mine of note that isn't using this technology daily.

Acknowledgements

I would like to acknowledge Western Atlas Software for providing figures 1a,1b and 2. Halliburton Energy Services (now Western Atlas Software) provided Figures 3 , 4 and 9 and Dynamic Graphics Inc provide Figures 5 through 8.

Seismic Window



With

Rob Kirk
BHP Petroleum

Sequence Stratigraphy - Or Why Bother With Systems Tracts

Are you being swamped by geological sounding jargon? Do mfs, dls, bff, sf, pgc's, ci, fs, TST and HST do a lot for you? Do terms such as accommodation space, sequence analysis, well facies, shelf edge, parasequence, third order sequence et al work their way into your seismic interpretation reports? (what do you mean "you don't write them")?

I think that we are all a bit bemused by the "hoo ha" over sequence analysis. What is its use and, if useful, why can't the geologist deal with it? My structural maps are still the vital component of my permit's assessment. True - but there is potentially far more in our seismic data sets than mere 2D sheets (see earlier Preview article on seismic facies mapping). We are entering the world of PETROLEUM SYSTEMS and cannot afford to work any longer in "isolation" from the geologist. The geophysicist using "his" seismic data set has a far better volumetric tool for studying the distribution of seal and reservoir than does the geologist with "his" handful of 1D control points - once Walther's Law comes into play the geologist can be in trouble. Our seismic tool however needs calibrating with hard well or outcrop data.

Seismic stratigraphy is the mapping and prediction of seismic geometries and volumes. Sequence stratigraphy involves the study (mapping and prediction) of discrete geological elements (called systems tracts) within architectural elements called "sequences". Sequence stratigraphy uses seismic, well, outcrop and biostratigraphic facies.

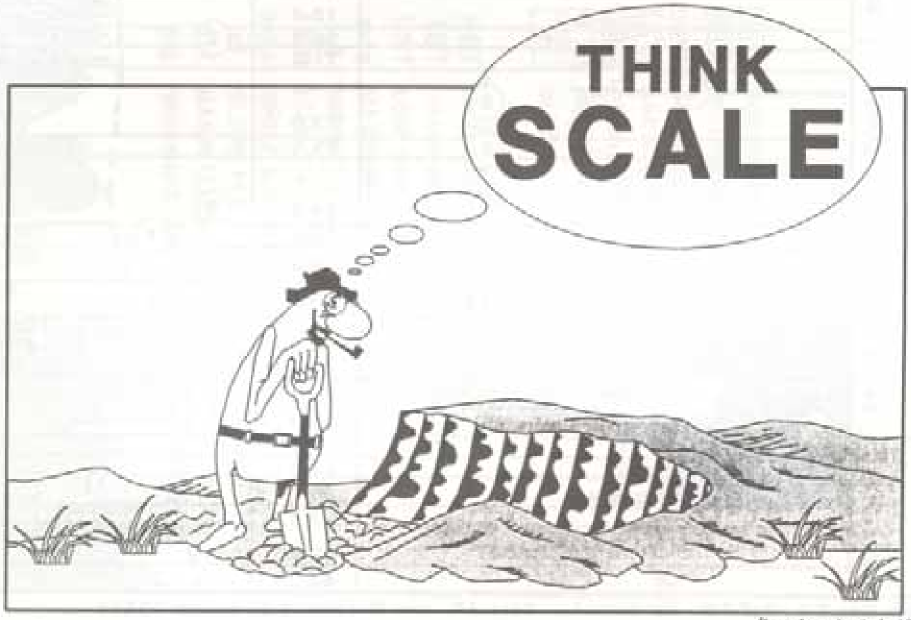
Getting formal - "a sequence is a relatively conformable, genetically-related succession of strata bounded by unconformities or their correlative conformities" (Mitchum, 1977).

Now, if you are content with mapping 2D sheets and being led by the geologist, sequence stratigraphy is not for you. If, however, you want to work together mutually reinforcing each other's interpretations, with the final output potentially a better product than you produced before, then sequence stratigraphy is for you.

OK - we are now going to map volumes using seismic facies analysis. Why sequence stratigraphy? We generally end up with a series of unconformity-bounded seismic sequences. Sequence stratigraphy supplies us with robust geometrical and geological models which allow us to attempt to decipher the "geometrical mess" that our Seismic Facies Maps reveal to us. No model is correct - each has to be modified for "local conditions". **LOCAL CALIBRATION** is the key component of seismic sequence stratigraphy. Our SFM's are always correct (in so far as our picking is valid) even after a well is drilled. We need to look at our sequence model and alter it to incorporate the new well's results and make a new **PALAEOGEOGRAPHICAL MAP** from our unchanged SFM.

(Data quality and scale (e.g. prograding may not be resolved due to the palaeo-shallow water) may well make your maps "correct" but incapable of useful prediction - that is, your predicted elements are too "low frequency" and not "resolved" on the SFM).

Now - once more unto the sequence. An important aspect of this work is scale - see Figure 1. We will discuss the "hierarchy of scale" namely, first, second, third and fourth order cyclicity.



(from Armentrout, J. 1993)

Figure 1

Figure 2 shows the Haq et al (1987) "sea level" curve. (This is produced by stacking together calibrated curves from many different basins - each curve basically being a chronostratigraphic chart made directly from seismic data). The first order sea level curve is the lower frequency element while the fourth order is the highest frequency element.

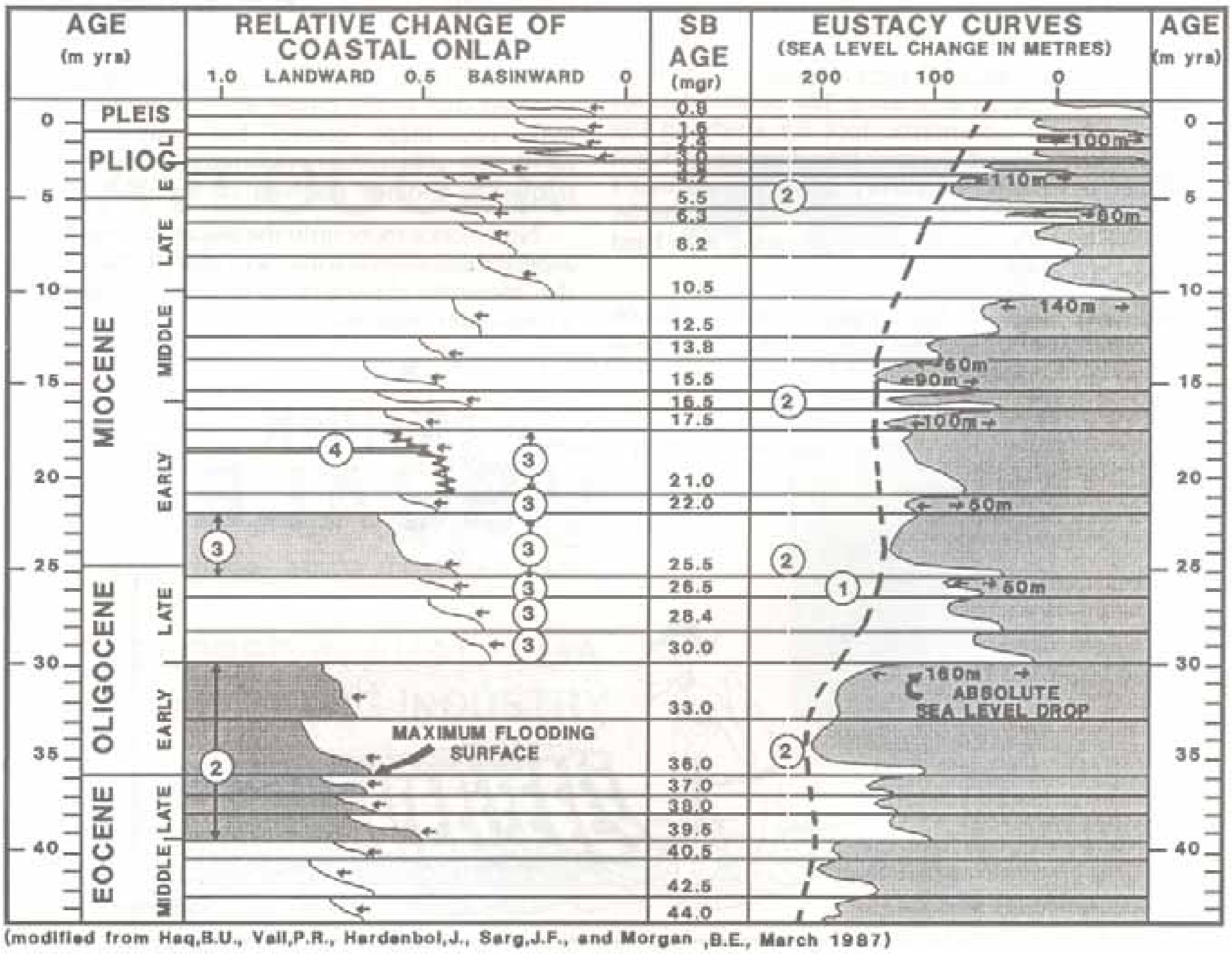
The first order scale is worldwide and composed of two cycles each with a period of some 250 million years. High first order sea level corresponds to a time of maximum plate tectonic spreading (usually warm periods) while the lows correspond to minimum spreading (supercontinent time e.g. Gondwanaland - usually cold periods).

The second order scale is "continent-wide", for example the west coast of Australia with several basins having each cycle of 5's to 10's of millions of years in duration representing the rift, drift, and sag phases of a basin's tectonic history. (Many of our "formations" are second order cycles - often termed "megasequences").

Each second order cycle is composed of two or more unconformity bound, third order cycles - the "sequences", the fundamental mapping element seen on seismic data. Each sequence is from 0.5 to 2 million years in duration and 10's to 100+ metres thick. All the systems tract jargon such as slope fan, basin floor fan etc. refers to the elements which stack together to make a single third order sequence. The third order package is the one we want to identify on seismic and well data as it is this subdivision which controls how we interpret the distribution of the systems tracts, and hence how we map our reservoirs and seals. Each sequence is composed of two or more fourth order cycles (called "parasequences" by Exxon devotees). We cannot see these on seismic but they are visible in outcrop and on logs and are some 5's to 10's of metres thick with the time duration of 10's to 100's of thousands of years.

Now that we have decided where our sequence boundaries are on seismic we need to examine what sort of architectural elements make up the sequence. Then, having identified these (we could be so lucky!) we can have a go at predicting seal and reservoir distribution. Note that all this is "sequential interpretation" (no pun intended) that is "if you believe this, then we go one step further and interpret this etc etc". The end products are highly interpretative (and this, I feel, is what scares many people away from attempting SFM's - they don't want to leave the "comfort zone" of the structural map - to many, stratigraphic elements are processing artifice). Being highly interpretative these SFM's, must be treated accordingly. All interpretation steps need to be well documented and you have to be flexible - be prepared to alter your interpretation - but, I digress - sequence architecture.

SEA LEVEL CHART

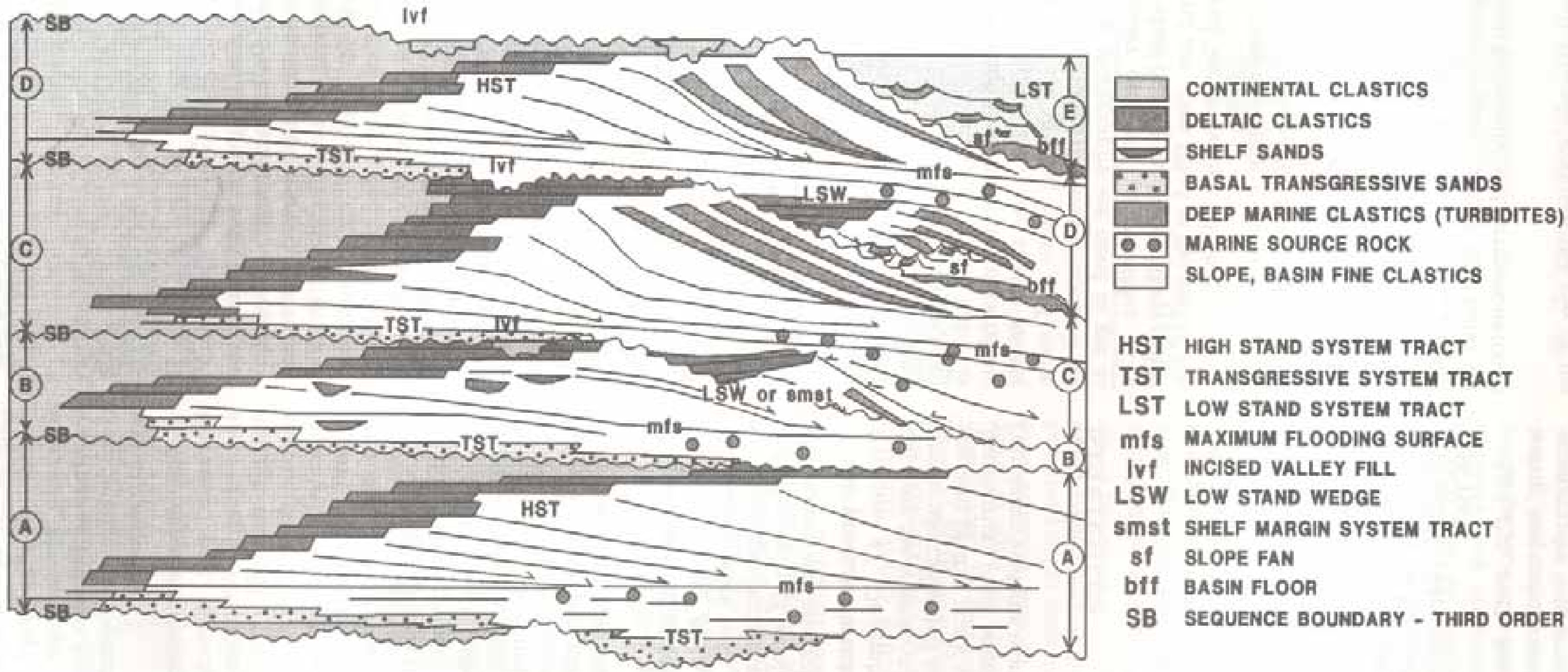


(modified from Haq,B.U., Vail,P.R., Hardenbol,J., Sarg,J.F., and Morgan ,B.E., March 1987)

R.Kirk

Figure 2

CLASTICS
PASSIVE TECTONIC PROVENANCE
(DIVERGENT MARGINS)



(modified after Abbott, 1991)

R.Kirk

October 1993

Figure 3

Figure 3 shows some clastic sequence models (from Abbott, 1991) note that the Exxon model is incorporated in this figure). These are the idealised building blocks to be used in interpreting our seismic. We hardly ever see models exactly like this on seismic but many elements are often present.

Before describing individual "system tracts" how does this sequence "come about"? We need a supply of sediment and a hole to put it into - the latter being called the "accommodation space". Sediment supply is affected by climate and erosion in the "hinterland". Accommodation space is a sum of subsidence (the second order effects mentioned previously) and eustacy (third order sea level rise and fall). If sea level rises and subsidence occurs a greater accommodataion space is created, conversely if sea level falls accommodataion space is diminished. The Exxon workers (P. Vail etc) consider subsidence to be a slowly varying term whereas eustacy is higher frequency and drives the creation of third order sequence boundaries. It can be shown that during the Plio-Pleistocene period the sea level falls were due mainly to glaciation while the rises were due to warm interglacial periods. I refer you to Vail (1987) for the discussions of the subsidence/eustacy interaction.

Figure 3 shows that a sequence is divided into lowstand, transgressive and highstand systems tracts (LST, TST and HST). The "low" and "high" terms refer to the relative sea level position (tectonic plus eustatic effect). A sudden drop in base level is considered to stop one sequence and start the next. Often a shallow shelf may be subaerially exposed by the drop (type 1 unconformity) and incised by the fluvial systems which dump clastics out in the basin. These can take the form of a discrete, basinally-isolated deep water basin floor fan (bf) which may be followed by a slope-attached shaly slope fan (sf). The final lowstand system tract can be the "prograding complex" (pgc). The latter is composed of a prograding prodelta and fluvio-deltaic complex and is characterised by being absent on the shelf. (Note that we are getting more and more geological - this is a continuous one way process. If we want to do sequence stratigraphy we need to get as much geology "under our belt" as possible). The channels cut in the shelf during the lowstand are called "incised valleys" and are often filled at the end of the lowstand with fluvial "incised valley fill" (ivf).

Once base level rises above the exposed shelf edge the shelf is flooded at the commencement of the transgressive system tract. Often we see a basal transgressive marine sand onlapping the sequence boundary (or ivf). This unit represents a beach which is rapidly pushed landward - its most landward location indicating the time of maximum flooding. The fining-up basal sand is often followed by a shale facies as the water deepens (organic carbon can build up within the TST in both the marine and terrigenous (coal) setting).

At the time of maximum flooding the top of the transgressive system tract is known as the "maximum flooding surface" ("mfs") or "downlap surface" - as the succeeding highstand facies prograde out over the mfs. The "condensed section" is often seen on well data at the mfs. This thin unit often contains microfossil concentrations and may have an enriched zone of phosphate, glauconite and organic carbon, due to the long period of starvation and non-deposition at this surface. (Biostratigraphy can be most useful, not only for giving "absolute age" and depositional environment information but also for delineating the mfs which is considered to be the main surface to use as a datum within a sequence).

The highstand systems tract can be similar to the lowstand pgc, namely, prodelta, delta top and succeeding fluvial facies. If the palaeowater was deep enough the HST - prograding may be seen on the seismic data. Occasionally the delta top facies are indicated by increased amplitude and continuity on the seismic data whereas the fluvial facies are variable amplitude and continuity.

Local well calibration is vital to associate a particular lithology with a particular seismic facies. No geological units have a reliably predictable geophysical signature - there are always exceptions to the rule that you want to work with. For example, volcanics can prograde and have good internal geometries, massive shale sections can have good internal reflections and turbidites can have almost any continuity/amplitude pattern.

I hope that this piece has not rambled too incoherently. It's aim was to "beat the drum" of interdisciplinary team work. We, the geophysical community, work with a tool that can potentially add more geological information when our data is calibrated with the help of geological (both exploration and production) and biostratigraphic communities.

The previous article on seismic facies mapping (Preview 47, December 1993, p15) talked about mapping the seismic volume. This article talked about how to use calibrated models to interpret this volume. The aim of this work is to predict reservoir and seal distribution (and source?) and, ultimately, how the Petroleum Systems work in your basin.

References

Abbott, W.O., 1991. Operational seismic stratigraphy: an applied method of interpreting stratigraphy from surface, subsurface and seismic data. AAPG school, South Rim, Grand Canyon.

Armentrout, J., 1993. Integrated stratigraphic analysis - a multidisciplinary approach to defining basin history. SEPM Short Course, New Orleans, Louisiana, April 23-25.

Haq, B.V., Hardenbol, J. and Vail, P.R., 1987. Chronology of fluctuating sea level since the Triassic (250 million years ago to present): Science, Vol. 235, pp. 1156-1167.

Vail, P.R., 1987. Seismic stratigraphy interpretation using sequence stratigraphy. Part 1: seismic stratigraphy interpretation procedure. In: Atlas of seismic stratigraphy, Vol. 1: AAPG Studies in Geology 27, pp. 1-10. Ed Bally, A.W.

Obituaries

Cam Wason

Cam Wason came back to Australia to live on the Gold Coast following diagnosis of Cancer. I met him when he gave a very interesting talk to the Qld Branch two years ago. I found him to be a man with considerable proficiency in his field and a man of vision and ideas.

Although I only met him once, I feel a sense of loss at his parting. I have asked a long time colleague of Cam's to write his obituary.

Wayne Stasinowsky, Qld Branch President

Cam had one of the most creative and wide-ranging minds that I've ever encountered. He was not only creative himself but was able to bring out creativity in others. He retired from the post of research director of Halliburton Geophysical Services (HGS) in 1991 to a consulting role in his native Queensland, Australia.

Cam had a highly productive career, although truncated at the peak of his capability, working six years as a senior engineer in the Equipment Group of Texas Instruments (TI) and then 18 years in Geophysical Service Inc. (GSI) and then HGS. In each of these professional assignments, he became a leader who developed the respect and admiration of his peers and subordinates. His talents and contributions were recognised by TI in 1981, when he was elected to the status of TI Senior Fellow. The requirements for this position were that an individual had to have clearly extended the state-of-the-art in his field, to have made sustained, wide-ranging, and crucial contributions to TI programs, and to have been recognised outside TI for his technical ability. Cam excelled in meeting all these requirements.

In addition to these achievements, Cam also led a very active professional life. He participated in numerous industry forums, committees, and related functions. He was an author of many papers which were published in professional journals. He was granted several patents both in electronic and seismic technologies. However, geophysics was not Cam's first interest. He was a brilliant mathematician, and he first studied general relativity. Later he moved into electrical engineering where the job prospects seemed somewhat brighter. With this background, much of it focused around signal processing, Cam found a natural home in geophysics. During his career he was variously a mathematician, physicist, engineer, inventor and a geophysicist. In due time, Cam was recognised around the world as one of the leading authorities in seismic technology. In all this, he was unpretentious, and always urged co-workers to take the credit in their joint efforts.

But Cam's technical prowess didn't end with these somewhat recondite, scientific pursuits. No subject was too small to consider. As a source of practical advice, he was equally adept at more pedestrian tasks, like helping a friend fix his home air conditioner, fix a malfunctioning car motor, or repair a roof.

He accepted life as it came - accepted with calm courage the physical limitations imposed by his illness, but never accepted the illness as a debilitating barrier preventing him from doing what he could do and wanted to do - a remarkable attitude given the state of affairs. After Cam's first operation and in between chemotherapy and radiation treatments, he made himself available for visits from friends and for consultation on ongoing research projects. Surprisingly, he kept a file in his home on every active research project, and followed assiduously the progress of each one. During these visits, he continued to propose new concepts and to dispense advise about specific issues. In effect, he continued to run the research department from his house, and he was able to do this by working on this good days. During this time period, he submitted two more patents - both now issued.

Cam never gave up - he continued a consulting career out of his home in Australia. It gives us some solace to know that Cam lived a very productive life until his last few days.

Cam's influence lives on through the lives of his family and his many friends and associates who were so greatly inspired by his personal qualities and leadership, and through his many contributions to science and technology.

What good fortune we have had to know such an individual.

Robert J. Graebner

John Pitt

On 25 October 1993, John Pitt died from Cancer but his charisma as a much-admired and much-loved friend makes it hard to believe. He accepted his ilness and the knowledge of its inevitable results with a strength of character and positiveness which coloured his whole philosophical approach to life.

John lived and breathed computing and geophysics yet still found time to nuture a very happy family life with his wife Jenny, to develop a lifelong passion for motorbikes, engage in expansive discussions on life, nature and the universe, indulge in a love of food and good wine, and enthusiastically pursue a myriad of wild and not so wild ideas. His hallmark from his early computing days at Zinc Corporation in Broken Hill to the last weeks of his life was to continually strive for new horizons. Characteristically, his last thoughts were not on what he had achieved but what more could be done.

John was well known for his breadth of vision, innovation and willingness to encourage and support many other people by offering free access to his offices, computers and advice. He was certainly not one to jealously hoard his ability and hard-won resources.

John was born near Hobart in 1933. He held an electrical engineering cadetship and later graduated from the University of NSW in Mechanical Engineering. After working in the Hydroelectric Commission, General Motors and APM, he joined Zinc Corporation at Broken Hill, in 1960, and established an Operations Research Department which initiated the use of technical computing in CRA. Though not a geophysicist by training he devoted half of his life to computer processing developments in geophys'ͺ with a level of dedication and impact on the profession that few formally qualified geophysicists could match.

John's principal motivation was always technological excellence rather than money and he was never afraid of taking risks to achieve his goals. He founded and managed Scientific Computer Systems, Pittman Data Systems and Pitt Research - representing a total of 25 years of living on the financial knife edge of small business while systematically and single-mindedly extending his position as a leading technological visionary. John was never half hearted in his committment; he backed it with everything he possessed, both materially by mortgaging all his assets to buy equipment and intellectually by dedicating a brilliant brain and enourmous innovation with absolute conviction. John was a doer rather than a writer so the real quality of his work is best known to his close colleagues and co-workers, rather than through academic papers.

His move to Adelaide in 1990 was a major turning point and, at last, recognition of the value of his contribution to expanding the horizons of geophysical computing, through his work for SADME, was publicly acknowledged in the mining press. This was better than any obituary. John's persistence and vision, which is illustrated by the fact that his current software can be directly traced back to his original concepts in the 1960s, has culminated in truly leading edge methods of deriving extreme detail from geophysical data by innovative micro-levelling techniques and ways to systematically produce multiple interpretive maps and images from very large data sets. This is well depicted in the work recently published by SADME which is a fitting memorial to his achievements as is the strength of the company founded on his work.

His has been variously described as a boffin, a non-conformist, an unconventional individualist and a brilliant technologist, all of which are true, but to his friends and staff he was kind, concerned, generous to a fault and always ready to help. In return he received the loyalty, respect, admiration and affection of all who worked with him.

On behalf of his many friends and colleagues, I am proud to have the opportunity to pay tribute to John and to express our sympathy to his wife Jenny and his sons, Adrian and Michael. He has left a hole in our lives which cannot be filled.

Mike Aubrey

WA Airborne Surveys Lead the World

Western Australia's World Geoscience Corporation has literally risen above its competitors and won Australia's top award for services exports.

The company's win of the Telecom Services Award category of the 1993 DHL Australian Export awards was announced by Prime Minister Paul Keating at Parliment House, Canberra.

Mr Keating said "the 30 finalists in the 1993 Australian Export Awards had contributed $1.6 billion to Australia's economy and in doing so had created jobs, opportunities for other industries, improved living standards and a more prominent and creative role for Australia in the world".

Accepting the Telecom Australia Services Award at the 1993 Australian Export Awards is Pat Cunneen (centre), Managing Director of World Geoscience Corporation Limited. Also in the picture, MC Paul Lyneham, ABC and Paul Rizzo, Group Managing Director, Finance and Administration, Telecom Australia.

"The Australian Export Awards honour all those people who did not wait for something to happen to them but went out and made something happen for them". Mr Keating said.

Perth-based World Geoscience Corporation has a client list that includes the world's biggest mineral and oil exploration companies and it uses the wolrd's most advanced airborne resource mapping technology.

Operating a fleet of 12 aircraft out of Perth and Sydney it specialises in high resolution airborne mapping of resources using a range of geophysical and remote sensing techniques. It provides processed digital data, a variety of contour and enhanced image maps, and interpretation products for its clients.

All this meant export earnings of $11.3 million in 1992/93. The previous two years saw the export income rise from $4.8 million in 1990/91 to $10.4 million in 1991/92.

In the USA, World Geoscience completed $1.7 million in projects in 1992/93. Surveys in Indonesia netted another $5.1 million and surveys in India $2.3 million. The company has international offices in Houston, Toronto, London and New Dehli and crews are operating on contracts as far apart as Norway and Chile.

One contract underway in India for the Orissa State Government for groundwater and mineral exploration is valued at $17.5 million.

World Geoscience recently acquired the unique "ALF" system which uses an airborne laser flurosensor to assist in offshore oil exploration by detecting evidence for oil seepage. Recent tests of ALF in the Gulf of Mexico have been a huge success and surveys off the Australian coast are planned for the New Year.

The company is a major participant in the recently opened Leeuwin Centre for Earth Sensing Technologies, established to ensure Western Australia's continued leadership in this field.

The Other Winners

DHL Australian Exporter of the Year EFIC large Manufacturers Award

Orlando Wyndham Group Pty Ltd (South Australia)

Pacific Power Commodities and Primary Products Award

Tassal Limited (Tasmania)

Commonwealth Bank Small/Medium Manufacturers Award

AGEN Biomedical Limited (Queensland)

NIES New Exporter Award

Lochard Environment Systems Pty Ltd (Victoria)

(Source: The Australian Exporter - Reprinted with permission of the Editor)

(Editors Note: In the June 1994 issue of Preview we publish the text of Don Pridmore's excellent Keynote address to the Perth ASEG Conference about the commercial realities of R & D in geophysics based on WGC's experience).

ASEG Conference - Proceedings of a Seminar on Government Initiatives to Promote Exploration in the States

(Editors Note: At the ASEG Conference Chief Executives (or their delegates) of AGSO and the State Geological Surveys attended an invited luncheon seminar to give presentations on Government initiatives to promote exploration. All states attended. Three states, NSW, Tasmania and Victoria, have forwarded the text of their presentations or a summary for inclusion in Preveiw).

Current and Future Programs of the New South Wales Geological Survey

J.N. Cramsie
Director, NSW Geological Survey

Introduction

New South Wales is a major mining State. In 1992/93 New South Wales mineral production was in excess of $5 000 million. Exploration activity exclusive of petroleum was $63 million, about 10% of the Australian exploration dollar.

In the few minutes available to me today, I would like to outline a few of the initiatives that the New South Wales Survey is taking to promote and encourage mineral exploration in New South Wales. We have done a good deal of market research with the industry and they tell us we are doing the right thing - they just want more of it!

The New South Wales Geological Survey provides good quality regional geological, geophysical and minerals location mapping products, together with easily accessible historical exploration information. These up-to-date mapping products and information databases provide a very good framework for companies to develop new exploration strategies.

There is no doubt that the provision of these high quality geoscientific maps and reports boosts exploration interest in the regions that they cover. In New South Wales this relationship has been demonstrated in a number of regions, (most notably in Cobar and Broken Hill) and in relation to a number of commodities (including gold, platinum, sapphires, opal and, more recently, diamonds).

Geological Mapping Initiatives

To provide a setting for the Geological Survey's current and future mapping programs, I would like to refer briefly to past mapping activities. New South Wales was one of the first States to have full reconnaissance geological map coverage of areas considered to have greatest mineral potential. The Geological Survey then focussed on areas where work was most urgently required to raise the standard of mapping to a level sufficient to provide a good foundation and framework to support mineral exploration. In this phase of activity, during the 1970's and early 1980's, mapping was undertaken on 24 1:100 000 sheets in the Lachlan Fold Belt, including 9 sheets in the Cobar and Nymagee region. This Cobar/Nymagee mapping has provided a good regional geological framework for the first time in what is an area of high mineral potential, and complex structure and stratigraphy. This mapping has provided a considerable incentive for mineral explorers, and the Cobar-Nymagee area continues to be intensively explored. The Elura, Peak, CSA, Girilambone and Mineral Hill mines are operating in this region.

The other region where important progress was made during the late 1970s and 1980s was in the Broken Hill region, where detailed geological mapping by a team of Geological Survey geologists over the entire Broken Hill Block made major breakthroughs in the understanding of the complex geology of that important area. The breakthroughs include a stratigraphic framework which can be recognized throughout the Broken Hill Block and the adjacent Euriowie Block. The results of this mapping have provided an excellent framework for exploration in the Broken Hill region.

Several years ago, the Department of Mineral Resources recognized that a second generation of mapping was required, and a program to upgrade the regional mapping database was planned and commenced. The Bega, Narromine and Cootamundra 1:250 000 sheets have since been mapped as part of this program.

As part of the National Geoscience Mapping Accord, the New South Wales Geological Survey and the Australian Geological Survey Organization are currently cooperating on a project in the eastern region of the Lachlan Fold Belt. High resolution airborne magnetic and radiometric surveys provide the foundation for this mapping program and have already resulted in major advances in mapping strategies and mapping quality. Mapping is well advanced on the Bathurst 1:250 000 sheet area. The Dubbo and Forbes sheets have also been flown with detailed airborne geophysics and will be geologically mapped over the next few years.

High resolution magnetics and radiometrics have greatly assisted mapping of sedimentary and volcanic sequences on the Bathurst sheet, allowing greater subdivision and more confident correlation. Analysis of this detailed stratigraphic picture is leading to a much improved understanding of what is a very complex structural and tectonic situation. The mapping is also leading to a much better appreciation of the distribution and correlation of the volcanics and intrusives. Both the structure and the distribution of volcanics are considered to be important factors in controlling the distribution of base metal and gold mineralization in the region, which is being intensively explored by a number of companies. Recent exploration successes on the Bathurst sheet have included Newcrest's Cadia Hill and Tri Origin's Lewis Ponds project.

Metallogenic Mapping

The New South Wales Geological Survey has been the leader in Australia with mineral deposits mapping and database development. The Survey's program of metallogenic mapping, begun about 20 years ago, combines mineral occurrence data with geology. The metallogenic maps and accompanying mineral deposit data sheets and reports are compiled from the Survey's own work, from the reports of exploration submitted by companies, and from historical records of previous mining.

The New South Wales metallogenic maps and databases provide a first class framework for area selection for exploration and for accessing detailed records of previous exploration and mining. There are well over 8 000 recorded and located mineral occurrences in our data base.

Coverage of the Lachlan Fold Belt has now been completed, with maps and reports published for all 1:250 000 sheets except Nymagee and Cobar, which are due for publication in the next few months.

Metallogenic mapping has also been completed over the Broken Hill Block, while the New England Fold Belt is about two-thirds completed.

Geophysical Initiatives

The Department has introduced a number of important geophysical initiatives in recent years. Of most significance have been:

- completion of the State Magnetic and Gravity maps;
- undertaking of detailed airborne magnetic and radiometric surveys in the Lachlan Fold Belt;
- participation in a deep seismic survey in the Cobar Region with AGSO and industry.

The Department released new State magnetic and gravity maps last year. In cooperation with the Australian Geological Survey Organization, the Department has had a continuing commitment to obtaining reconnaissance airborne magnetic coverage for the past 30 years. While much of the older information was considered to have reached its "use-by-date", the developments in digital technology over the past 5 years have enabled us to provide a very much improved regional overview of the geology and structure of New South Wales.

The new magnetic map of New South Wales illustrates the structure of the major magnetic features, particularly the volcanic sequences and intrusives, and has real importance for the development of effective strategies for precious and base metal search. It has been very well received by industry.

The new gravity map of New South Wales provides a new perspective of the crustal structures of the State. This map is an invaluable companion to the magnetic map.

These map products are providing new insights into the major regional geological features and structures which control the mineral-bearing rocks of New South Wales. The Geological Survey is currently interpreting these images to develop new interpretative maps of the State's geology. The State magnetics and gravity maps are available both in digital form and as images.

An important part of the Lachlan Fold Belt mapping project has been the flying of the Bathurst, Dubbo and Forbes 1:250 000 sheets. The quality of the data is outstanding.

Geologists working on the Bathurst 1:250 000 have found this geophysical data to be invaluable in their mapping work, particularly in areas of complex structure or poor outcrop.

Future Directions

Over the past few years the New South Wales Geological Survey has focussed its activities more directly on the minerals industry. In the future, the main thrust will continue to be geological mapping, supported by high quality geophysical mapping. The Mapping Accord project in the Lachlan Fold Belt will continue from Bathurst to Dubbo and Forbes, probably followed by Goulburn and Wagga.

Geophysical mapping will be directed to supporting the Lachlan Fold Belt mapping. In addition, we want to use airborne geophysics and our improving knowledge of Lachlan Fold Belt geology to extend our knowledge of that fold belt into areas of poorer outcrop and under shallow cover. Areas which we intend to give high priority are the Cobar - Louth - Bourke - Barnato region, the northern extension of the Parkes zone, and the Wagga - Jerilderie area. The State magnetic map has highlighted the geological continuity of these areas with highly prospective parts of the Lachlan Fold Belt.

The other area that demands more attention is the Koonenberry region, east and northeast of Broken Hill, which has not been explored to the extent that it deserves.

The immediate target for mineral deposits mapping is to complete the coverage of the New England region, while directing more resources to the updating of the Lachlan Fold Belt minerals database.

On the information side, the Department is planning to move to a full GIS environment for titles, geology and mineral deposits databases over the next few years.

The New South Wales Government is currently considering a proposal from the Department for a substantial increase in funding for geological and

The New South Wales Government is currently considering a proposal from the Department for a substantial increase in funding for geological and geophysical mapping to provide an improved framework for mineral exploration.

Conclusions

New South Wales has much to offer you as a target area for mineral exploration and resource development. Some of the advantages of New South Wales are:

- the geological prospectivity of the State
- the availability of infrastructure
- a streamlined, modern Mining Act
- fast titles turnaround;
- sensible State environmental planning policies supportive of development;
- and improved access to agricultural land for exploration.

I would be pleased to organize for further information on the New South Wales scene to be forwarded to you.

Why don't you come and find some more mines in New South Wales?

Mineral Exploration and Development in Tasmania "The Island of Potential"

Preamble

Tasmania can well lay claim to being Australia's forgotten mineral province.

Whilst this statement may appear overly dramatic, some market realities have caused Tasmania to fall from favour with mineral exploration investors. This is all the more surprising when considered in the context of Tasmania's demonstrated mineral wealth and reputation for hosting world class deposits.

Despite an impressive production record, the last decade has witnessed an evaporation of exploration investment in Tasmania. Annual mineral exploration expenditure has fallen from just over 4% of the Australian total to about 1¼%.

The mining and mineral processing sector in Tasmania produced over one billion dollars worth of export wealth for the State in 1992/93. This amounted to approximately 50% of the State's exports.

It is not surprising, therefore, that Tasmania has committed itself to the task of rebuilding confidence in its mining, mineral processing and exploration industries. The State, clearly, cannot afford to loose the lynch pin of its economy.

The Way Ahead

The first political lesson learned in Tasmania was that investment thrives on expectation and perception. The second was that "growth" can be turned off overnight, whilst revival initiatives can take years of sustained effort to achieve success. The third realisation was that exploration is a truly global activity and that eager Governments were "peddling prospectivity" in a buyers' market.

With these lessons in mind, the way ahead must be to maximise Tasmania's natural advantage of mineral wealth by creating a competitive investment climate for growth in mineral exploration, exploitation and processing. Achieving and maintaining the support of the community at large remains a necessity if governments initiatives are to be successful over the long lead times between exploration and mine development, ie the political and sovereign risk factors must be seen by investors to be at minimum acceptable levels.

Political and Organisational Initiatives

The current State Government was elected in 1992 on a strongly pro-development platform.

Tasmania Development and Resources

A new department of State Development, Tasmania-Development and Resources (TDR) was formed by merging the Tasmanian Development Authority, the Department of Mines and related inspectorates. To emphasise government commitment to development this agency was brought under control of the Premier. Active promotion of opportunities to both mainland financial centres and internationally is an essential component of the development strategy.

Legislative, Regulatory and Policy Changes

The State's current mining policy recognises the vital importance of the sector to the State and commits the government to improving land access for exploration and minimising sovereign risk for investors. To achieve this two major legislative changes were required.

The first was the passing of The Mining (Strategic Prospectivity Zones) Act 1993

This Act constitutes landmark legislation in Australia being enacted specifically to remove, or at least minimise, the deterrent to mineral exploration of perceived sovereign risk. It provides a form of resource security and has been well received.

The Act is designed to minimise the effect of policy change on exploration for minerals and the investment of risk capital for development.

Regions of high prospectivity in Tasmania have been geologically defined, and Strategic Prospectivity Zones have been established to protect them. However these zones do not imply that other areas of the State are not prospective.

Protection under the Act requires that any change of status of large parcels of land within these zones be approved by both Houses of Parliament. Should such a change have the effect of revoking a mining or exploration tenement, totally or in part, the tenement holder is entitled to compensation.

Of particular note is the fact that the boundaries of World Heritage Areas and national parks have not compromised to any significant degree, to date, areas considered prospective for minerals by industry and Government Geologists.

The other major legislative change will be the Mineral Resource Development Act 1994

This Act is currently in draft Bill form and is expected to go before Parliament in late 1994. The Bill will promote mineral exploration and mining into the 21st century.

In the main the Mineral Resources Development Act will provide for:

- 5 year exploration terms, with no forced mid-term relinquishment provisions. There will be provision made for extension should geological success support such a request.
- Some forms of open range exploration.
- A tender assessment system for all open ground between "same day applications", otherwise first past the post rules will apply.
- Retention licences to be issued for cases of "non currently commercial" discoveries. These will be for up to a 5 year term, with automatic reversion to open ground if the area is not subsequently developed.

Promotion of Mineral Investment Opportunity in Tasmania

This paper has, so far, concentrated on recognition of the problems contributing to the adverse trends that developed in Tasmania during the 1980s, and of the legislative changes made or being made to overcome them.

Previously extensive restructuring and legislative programs may well have been enough to achieve success. Exploration is now, however, a truly global industry with the investment dollar flowing to those states or countries with a perceived advantage.

Tasmania scores highly on most selection criteria. An extensive suite of minerals is located in a small land mass, more than adequately served with towns, roads, power and other necessary infrastructure. What has to be addressed is why the State is not getting investor attention.

Re-Organisation and Refocus of the "Mines Department"

Following the departmental restructuring, Mineral Resources Tasmania (MRT) has a strong development focus and an accountability for growth in mineral exploration activity. In particular, the geoscientific staff of the Division have been combined into a single Resource Exploration and Development Branch which is responsible for data accumulation, assistance to explorers and promotion of the State's prospective areas.

Promotional Programs

The Division's advice to Government is consistent with the view and approach of other States. In order to attract the exploration dollar, prospective areas must be expanded by innovative and visionary programs that increase the level of precompetitive information and provide for regional scale modelling in the third dimension.

NETGOLD

The perception that Tasmania does not host stand-alone gold deposits of substance was a major reason for the decline in exploration investment experienced in the last decade. Following the discovery of the Henty prospect and revived interest in the high-grade Beaconsfield resource, the time was seen to be right to alter the misconception of industry.

North-east Tasmania is an area which has yielded in excess of 54 tonnes of gold but has long been ignored by modern explorers. Commencing in late 1993, the State Government committed $1 million to the NETGOLD project to better define the controls on the age, genesis and distribution of gold mineralisation in the northeast of the State. The project included:

- High resolution aeromagnetic and radiometric surveys
- Gravity traverses of the mineralised sequences between the granites
- Structural mapping to complement existing surface mapping

Compilation of all information into a comprehensive digital data package for release in April 1994.

Conversion To GIS

Field work by geoscientists has been suspended to allow conversion of all existing useful data to GIS and/or image form. Traditional cartography and drafting practices have been abandoned. Four new GIS-generated 1:250,000 geological maps covering the whole State will be available by the end of 1996. More detailed maps at a scale of 1:25,000 covering highly prospective areas such as the northeast Tasmanian gold belt and the Mount Read volcanics are being progressed as a matter of urgency.

Due either to terrain and vegetation cover, or to sediment and dolerite masking of basement rocks, much of Tasmania lacks detailed subsurface geological information. In general, Tasmania is under explored.

Other proposed programs include:

The Midlands Project

This program will obtain estimates of depth to basement sequences beneath the dolerite and sedimentary rock cover over much of central Tasmania. It is hoped to gain an understanding of the continuation of both the gold bearing sequences from the north-east and possible extensions of the base metal and gold bearing Mount Read volcanics from the northwest.

The Balmin Project

This program will establish the geological framework of copper and precious metal mineralisation in the north-west of the State. This highly prospective area has an historical record of metal production, but must be considered under explored.

In Summary

Tasmania lies on the other side of Bass Strait. It is a highly mineralised island that has yielded many billions of dollars worth of minerals over the last century.

It is still relatively unexplored and is worth looking at for gold and base metals, and in the not so distant future, for tin.

By reducing investment risk and providing timely and accurate data Tasmania is poised to help investors disprove the saying that fortune favours the brave.

New Directions for the Department of Energy and Minerals, Victoria

In October 1992, the new Government recognized the importance of the earth resources sector to Victoria and created the Department of Energy and Minerals. The Government stated that it wants to ensure exploration and mining once more become a driving force for growth in Victoria.

The Department is responsible for promoting, encouraging and co-ordinating all matters associated with minerals exploration and mining in Victoria. The Resources Development Division of the Department is being restructured to focus on commercial goals for Victoria, to produce timely results and to streamline, encourage and facilitate industry activity with customer service and satisfaction as a key priority.

Mr Paul Dowd, ex Managing Director - Macquarie Resources Ltd., has recently been appointed Deputy Secretary - Resources Development Division. As part of the restructure he has incorporated the Minerals and Petroleum Divisions into the Resources Development Division.

Amendments to The Mineral Resources Development Act

The Government is determined to increase the level of genuine exploration activity in this State within a legislative framework that protects the environment and recognizes the interests of private land owners and the objectives of public land policy.

Amendments to the Mineral Resources Development Act, were passed by the Parliament, in January 1994. These changes have been designed to stimulate exploration and mining in Victoria, accelerate the assessment process, reduce the duration of and simplify the planning approvals process for mining development proposals and give certainty to the industry and wider community.

The Mineral Resources Development (Amendment) Act provides that all mining projects subject to an Environment Effects Statement will no longer require planning permits. In addition, exploration and mining will no longer be prohibited uses under any planning scheme, and exploration will no longer require a planning permit.

The changes to the Act has created a great deal of optimism in Victoria's mining industry, evidenced by the significant increase in exploration and mining development.

Geological Survey of Victoria

While it still concentrates on providing fundamental geological data for industry, government and the public, the survey's current emphasis is on encouraging the effective and responsible exploration and development of Victoria's earth resources through the services it provides in Geophysics, Basin Studies, Geological Mapping and advice on Mineral Resources.

The Geological Survey is undertaking airborne geophysical surveys in the Mt Wellington, Orbost and Bendigo areas as the first stage in encouraging renewed investment into mining in Victoria. There is a recognition of the need to have detailed airborne geophysics prior to undertaking geological mapping. GSV is currently devising a programme to infill the State's gravity from 11km down to 1-2 km in conjunction with its mapping programmes

The 1:250 000 geological map series has been digitized and will be available to the industry.

Geological Exploration and Development in Formation System (Gedis)

To assist companies, the Department of Energy and Minerals has a computerised, over the counter service to explorers, to assist them in obtaining information on current and previous titles, reports of previous exploration in the area, borehole information, geological, geophysical, aerial survey and historical data.

Computer-aided mapping is a feature of GEDIS, giving it the ability to display information against background maps of any scale. Comprehensive information can be accessed quickly without the need for physical collating and cross checking. All enquires on tenement information and almost all other minerals enquires received by the Department, are satisfied by GEDIS.

Victoria is open for business.

(Editors Note: See June 1994 Preview issue - for details of Victorian Initiatives).

New Regular Feature - Geophysical Data Releases

Recent Data Releases - AGSO

AGSO continues to make available in the public domain a wide range of geophysical data sets. Some of the fare released in February this year, as follows below:-

Australia national gravity database;

A new updated gravity data base for the whole continent - including offshore, has been released. It contains gravity observations at more than 655 000 stations. The station locations are shown on a 1:5 000 000 scale map (see attachment).

In 1993 approximately 20 000 new values were added from Western Australia, South Australia, Queensland and the Northern Territory.

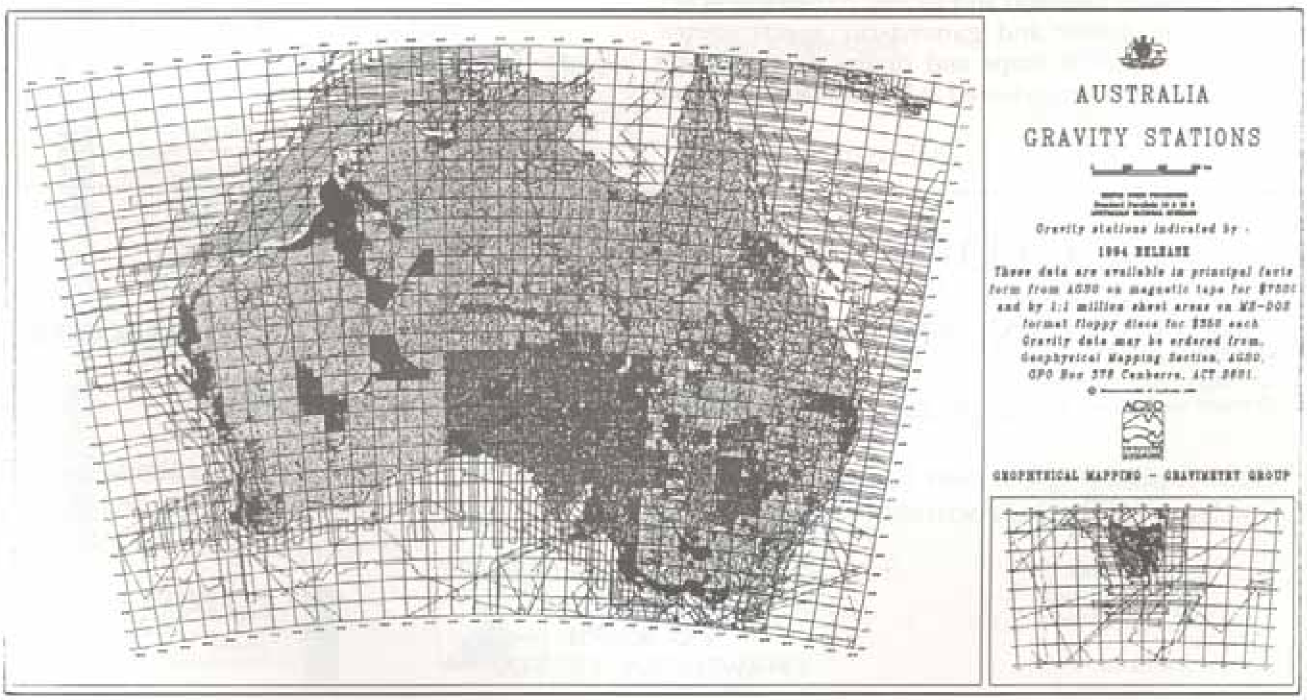
The complete database type costs $7500 and annual updates are provided. Data sets for each 1:1 000 000 Sheet area are available for $350 each.

Maps and data from The Granites (NT) airborne geophysical survey

The data and the first of the series of maps resulting from AGSO's recently completed The Granites airborne survey, part of the Kimberley-Arunta NGMA project, are now available for sale; they are for The Granites and Highland Rocks 1:250 000 Sheet areas.

This survey acquired magnetic and gamma-ray spectrometric data sets along north-south lines 500 metres apart 90 metres above the ground over a large area of the Tanami Desert, currently a focus of considerable interest in the search for gold deposits. Much of the area has a thin veneer of alluvium.

Magnetic and gamma-ray spectrometric maps and digital data for the adjoining Mount Solitaire and Mount Theo 1:250 000 Sheet areas will be released soon.



Digital point-located airborne geophysical (magnetic and gamma-ray spectrometric) data and grid data for both The Granites and Highland Rocks 1:250 000 Sheet areas are available on magnetic tape.

Dubbo (NSW) total magnetic intensity (TMI) pixel-image maps

As a contribution to the Lachlan-Kanmantoo NGMA project, AGSO has released colour and grey-scale TMI pixel-image maps of the Dubbo 1:250 000 Sheet area. These maps will assist detailed geological mapping, facilitate the search for economic concentrations of mineral deposits, and provide valuable information for environmental management.

AGSO, in collaboration with the New South Wales Department of Mineral Resources, acquired the basic data from which these maps were compiled during their Dubbo 1991 airborne geophysical survey, which flew along east-west lines 400 and locally 200 metres apart. Airborne magnetic and gamma-ray spectrometric contour and profile maps and digital data resulting from this survey were released in 1992 and a gamma-ray spectrometry pixel image of the Dubbo Sheet area was issued last year.

The TMI images were compiled from processed total-field aeromagnetic data from which the International Geomagnetic Reference Field was removed. Minimum curvature was applied to grid the profile data to a cell size of 50 metres. For the colour image, histogram equalisation facilitated the selection of pixel colours from the natural palette (magenta high, blue low); a shaded-relief effect with an illumination from the east was achieved by modulating colour intensity and saturation. The grey-scale map displays the easterly gradient of the TMI data.

Forbes (NSW) digital elevation model

A digital elevation model of the Forbes 1:250 000 Sheet area is now available. This model combines the latest elevation data with accurate positional information - both acquired during AGSO's Forbes 1993 airborne geophysical survey - and is presented as a topographic image on which geophysical pixel-image data (acquired during the same survey) can be superimposed at the same scale; geophysical maps and data already released.

The Forbes 1993 survey acquired data, as a contribution to the Lachlan-Kanmantoo NGMA project, along east-west flight lines 400 metres apart (but 200 metres in the northeast); elevation data were sampledevery 300 metres. The topographic image, or contoured elevation map, was derived in a similar way to that outlined for the recently released Sir Samuel (WA) digital elevation model.

The Forbes contoured elevation map costs $40 for a dyeline or $120 for a transparency. The digital point-located and gridded elevation data for the Forbes digital elevation model, on magnetic tape, may be purchased for $1000.

For further information contact:
AGSO Sales Centre
Tel: (06) 249 9519
Fax: (06) 249 9982

GEOPHYSICAL DATA RELEASES

ATTENTION: All Geological Surveys and industry contractors

PUBLICISE YOUR DATA RELEASES IN PREVIEW

Contributions to the new Preview regular feature column - Geophysical Data Releases are welcomed. Brief information and accompanying location maps should be forwarded to:

Geoff Pettifer, Editor Preview
C/- ASEG
P.O. Box 354
HAWTHORN VIC 3122

Membership

New Members

We welcome the following new members to the Society. Their details need to be added to the relevant State Branch database:

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