PREVIEW

AUSTRALIAN SOCIETY OF EXPLORATION GEOPHYSICISTS

A.C.N. 000 876 040

December 1992, Issue # 41

Special PREVIEW Theme: 7-23

Geophysics in AGSO

Also in this Issue

Special Features

Regular Features

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Artwork by Geophysical Exploration Consultants Pty Ltd
Printed by Snap Printing

Introduction

PREVIEW'S First Colour Edition!

Life begins at 40 it's said. Certainly this is true of the 41st PREVIEW with our first colour edition featuring the geophysical program of the Australian Geological Survey Organisation (AGSO), formerly the BMR.

"Geophysics in AGSO" (p7) is possibly the first time such a comprehensive overview devoted just to AGSO's geophysical program has been published. We are delighted PREVIEW is the publication medium. The article acquaints ASEG members of the broad scope of AGSO's geophysical program at a time when Government changes to AGSO raise questions as to how and whether, the effectiveness of AGSO's contribution to geophysical and geological mapping and understanding in Australia can be maintained and enhanced (see August and October PREVIEWS). AGSO is a major public geophysical resource and as such its programs and directions are of vital interest to ASEG members and the exploration industry. Thankyou to David Denham and fellow AGSO contributors for this special feature and colour production sponsorship.

Greg Turner reports on the opportunities for colour advertising in PREVIEW on Page 3. Snapshots from the conference (p27) figure this issue.Next issue we feature ASEG business news from the Conference. In a new regular feature to PREVIEW, Terry Crabb gives us highlights of what is coming up in the next issue of Exploration Geophysics (p6).

Also new to PREVIEW is a Company News Column (p29). PREVIEW is interested in receiving brief contributions of significant news from companies.

Landmark Graphics International report on a breakthrough in seismic processing turn-around time capability (p28) which realises the dream of seismic processing and interpretation keeping pace with acquisition and influencing survey design.

Peace and re-creation to all ASEG PREVIEW readers this coming Christmas.

Editor

President's Page

This is the closest we will come to a Christmas issue, so on behalf of the Federal Committee, and all those involved with the production of PREVIEW may I offer you seasonal greetings and the positive hope that 1993 will bring success to your endeavours.

Hugh Rutter
President

PREVIEW Deadlines 1993

Copy Deadline	Publication Month
February 19	February, 1993
April 16	April, 1993
June 12	June, 1993
August 14	August, 1993
October 9	October, 1993
November 27	December ,1993

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ASEG People Profile

Lindsay Thomas, ASEG Treasurer 1992

Lindsay Thomas did BSc Honours in Physics in Adelaide in 1962, working in aspects of semiconductor physics. During that year he was intrigued by a seminar by David Sutton on features of the seismogram records from the station operated by the Physics Department, and subsequently he commenced postgraduate work with Sutton, following up an idea on the origin of microseisms.

The original idea having proven unworkable, Lindsay subsequently took his PhD for work on surface wave dispersion in the Australian continent. This work led to a continued interest in aspects of data inversion. Although not directly concerned with exploration geophysics, the seismological work did lead to contact with and observation of exploration methods during the sixties. In 1968 he took up the position of Lecturer in Geophysics at the University of Melbourne, with Colin Kerr Grant (Reader).

As Melbourne did not operate seismic stations, Lindsay took an interest in gravity observations on volcanic features in the Newer Volcanics of Victoria, the formation and structure of which were also of interest to geologists in the Department. As electrical methods seemed likely to provide complementary information about these features, he used a study leave in Utah to learn about electrical and electromagnetic methods duing the mid-70's.

Returning to Melbourne, however, he became involved in shallow seismic reflection profiling and side-scan sonar with other colleagues in Geology and Engineering. While the main aims of the work were studies of recent sedimentation in Bass Strait, this capability led to a series of jobs doing site surveys for sewerage outfalls - which at least paid for the equipment insurance bills!

Over recent years Lindsay has returned to working with students on both gravity and electromagnetic projects. Throughout his career he has taught a wide range of courses, ranging from theoretical geodesy to seismic stratigraphy (and even geology), and would now like to put more effort into using geophysics to solve geological problems.

Apart from geophysics, Lindsay has also been Deputy Head of the School of Geology, and has a very active interest in Orienteering, and less active interests in playing Bridge, attending the opera and having lunch at Jimmy Watson's.

☆☆☆☆☆☆

ASEG Funding Initiatives - Call for Proposals

The ASEG Executive is currently considering proposals for funding of initiatives by the ASEG, from ASEG surplus funds (see Treasurer's Report, October PREVIEW p9), to promote the aims of the ASEG.

One such initiative was announced by Hugh Rutter, the ASEG President in October PREVIEW (p1): a 2 year grant of $15,000 per year to the ASEG Research Foundation.

The Executive subcommittee considering funding initiatives is interested in receiving ideas in the form of brief written submissions from ASEG members as soon as possible.

To discuss ideas or if you have further enquiries please contact:

Geoff Pettifer
Tel: (03) 412 7840
Fax: (03) 412 7803

Colour in PREVIEW!

Congratulations to the AGSO for contributing the first ever colour article in PREVIEW.

With the increasing use of desktop workstations and the drop in the cost of colour printers, colour has revolutionised the way in which many complex geophysical data sets are examined. In line with the routine use of colour in contemporary data presentations in many fields of geophysics we will be continuing to phase in colour into your newsletter.

In future issues, PREVIEW will be publishing occasional tutorial articles in special theme issues along the lines of the GPS surveying tutorial in the October issue. Where appropriate these articles will include a colour spread to highlight state of the art geophysics. In order to maximise the technical benefit of these colour articles without extra cost to the society, we propose to include three pages of article to one page of advertising relevant to the special issue theme. The colour advertising space provides a unique opportunity for high profile advertising in a special issue that will be kept as a reference for years to come.

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Article and advertising Be the centre piece of a special issue devoted to your field of geophysics, with a review article incorporating 3 pages of colour 1 page colour advertisment	4 colour pgs (+ additional monochrome pages as necessary)	$2100
Advertising only Advertise in colour in special issue with high profile in your field of geophysics.	1 colour page	$2100
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REGULAR (subject to sufficient demand)		
Advertising Advertise in colour every two months	1 colour page	$1050
	½ colour page	$550

Please direct all enquiries regarding colour advertisements in PREVIEW to :

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ASEG Branch News

Victoria

November Meeting

Four students from VIEPS (Victorian Institute of Earth and Planetary Sciences) gave short presentations of aspects of their Honours/Masters research work. The four students were:

Chris Durand -	(Monash - Otway basin analysis)
Megan McDougall -	(Monash - acquisition, processing, and interpretation of magnetics)
Neils Stienstra -	(Melbourne - geochemistry and seismic interpretation)
Jarrod Dunne -	(Melbourne - seismic modelling and processing)

While $25 was awarded to each student for their presentation, the industry panel (John Denham, Hugh Rutter, Mike Asten) judged Niels Stienstra's "Origin of carbonate accumulations in the Cooper-Eromanga basins, Central Australia" the winner of the $400 cash prize. Niels' talk presented the thesis that sandstone pore waters in the subsurface of oil fields are believed to have been flushed by organic acids, thereby increasing activity of bicarbonate ions and hence giving rise to carbonate precipitation. Seismic interpretation indicates some carbonate accumulations are associated with major fault zones which may have acted as conduits for fluids containing dissolved organic acids.

October Meeting

The abstract from a talk by Geoff Pettifer at our October meeting follows:

"ADVANCES IN USE OF IMAGE PROCESSING FOR DATA INTEGRATION IN BASIN STUDIES - EASTERN OTWAY BASIN, AUSTRALIA - A CASE STUDY"

by G R Pettifer, B A Simons and A Olshina
Geological Survey of Victoria

Traditionally basin and exploration prospect studies have relied heavily on seismic and drilling as the main tools for structural and stratigraphic analysis and interpretation. The volume of data and interpreted maps from these sources and limitation of existing contour displays creates problems in both effectively visualizing and assimilating the total picture of a basin or prospect. 2D seismic plan view display techniques have lagged behind advances in seismic acquisition and processing and 3D seismic display technology.

Other datasets such as gravity, magnetics, topography, bathymetry, satellite imagery, airborne radiometrics, velocity maps and surface geological mapping containing structural information which could complement or guide the seismic interpretation, have been either overlooked or only partially integrated with seismic and drilling interpretations. Lack of tools to effectively integrate and interpret all geophysical and geological data has been a major impediment to use of all data in basin studies.

Image processing technology has advanced to the stage where enhanced imaging of 2D and 3D seismic data and synergy of all relevant data is now possible. All contoured or spatial (line and/or point) datasets can be gridded to a raster image and maps can be scanned or digitized to raster or vector images for input to an image processor for enhancement, combination, further processing and interpretation/annotation.

A case study from the Geological Survey of Victoria's Eastern Otway Basin study, using ERMAPPER image processing software, illustrates state of the art image processing capability. Enhanced visualization and combined interpretation of 2D seismic (time, velocity, depth), borehole (depth, thickness), gravity (land and marine), magnetics (airborne and marine), topography, bathymetry, surface geological mapping, airborne radiometrics and cultural map data has led to an improved understanding of the structural complexity of the basin.

Bob Harms
Secretary

New South Wales

During October, the New South Wales Branch enjoyed a "Geologist's view of high resolution seismic" focusing on the "first one second" to define coal seams within the Mae Moh basin of Northern Thailand. Dick Evans has retired as Associate Professor at the University of New South Wales, but is still a compulsive geologist by his own admission. Funded by an Australian overseas aid programme, Dick was able to instigate a survey conducted by Velseis to assist the Thais in future mine planning. At the meeting, Dick was able to demonstrate the value of these data in relating the structuring of the coal seams to local and regional tectonics, and also for building a palaeogeographic model of their deposition.

The Annual Christmas dinner held late November was well supported, most probably because of the Lord Nelson Hotel's much deserved reputation for excellent cuisine. The local branch deemed it appropriate to ask a representative from AGSO to give us an insight into some of the good work they are currently doing. Dr. Lesley Wyborn provided an entertaining and informative talk on "GIS integrated". The integration of geoscience activity in the Kakadu and Mount Isa regions provided details of the explorer's case for development in the former area and some interesting directions for future exploration in the latter, and also some good anecdotes as geologists learnt to "get geophysical" and vice versa!

An AGM will be held in late January 1993, and will be the next ASEG social function in New South Wales.

Nigel Jones
President

Western Australia

Don Steeples (Geol. Survey of Kansas) and David De Pledge (Curtin Uni) presented the local membership with talks in early October.

We had two student nights to cater for the large number of presentations(14 total) on a complete spectra of geophysical topics. Thankyou to all of the speakers who participated - without exception the presentations were of a very professional standard, that ensured the judges' job was not simple. The following students participated:

Richard Bunt	Curtin University
Justin Norris	Curtin University
Mohammed Norozi	Curtin University
Mike Hannington	Curtin University
Matt Lamont	Curtin University
Michael Riha	Curtin University
Mike Lennane	Curtin University
Noeleen Dorn	Curtin University
Mathew Fleming	Curtin University
Barry Bourne	U.W.A.
Mike Haynes	U.W.A.
Sara Cody	U.W.A.
John Hart	U.W.A.
Craig Molton	U.W.A.

The eventual prize winners were:

Mohammed Norozi (Curtin) "Seismic Reflection Processing in Anisotropic Meida" and Michael Riha (Curtin) "Recognition of Faulting with variations in Azimuth" (seismic).

Congratulations to those two, and again, well done to all of you, and good luck with your upcoming final exams.

I'm told by Danny Burns that the Lansley-Gonzalez 3D Seismic Exploration Workshop went very well.

Of course we have the annual PESA/ASEG golf day this Friday (4th December) - lets hope that Perth can put on a typical sunny day to help us generate a good thirst.

And finally - for the year - The ASEG Christmas function this year will be a BBQ at President Kim's place on Friday 11th December, 6pm start bring an apron and a stubby holder.

Merry Christmas and Happy New Year to all.

Andie Lambourne
Secretary

ACT

A Christmas function is being held jointly with the ACT branch of GSA at the Athenian Restaurant on Thursday 3rd December at 7pm, with the guest speaker being Mike Smith of Austpac Gold with the talk topic based on the Australian Institute of Geoscientists.

The AGSO-ASEG Spring Classic Golf Tournament proved to be a very enjoyable afternoon outing, with pleasant weather conditions (a rare event at the moment in Canberra), with Alan Hogan (CRAE) taking out the ASEG honours again and richly rewarded with another coveted champion's golfing cap.

The branch meeting in late October was well attended with an interesting talk by Colin Reeves on the geophysical aspects of various locations around the East African Rift Valley System, using mainly magnetic and gravity data.

The 1992 year in Canberra will be remembered as the year that Bureau of Mineral Resources, Geology and Geophysics was partly reorganised and renamed the Australian Geological Survey Organisation, either for better or worse. 1993 may even be a year of even more drastic changes depending on the recommendations of the Richard's Review and the political changes that may result after the next Federal election. Geological and geophysical exploration for resources, is an industry which has always been greatly affected by the whims and woes of politics. And so, for 1993, may your year be free from interventions of economists and politicians (ha, ha, ho, ho, ho) and may more ore bodies and hydrocarbon resources be discovered to enhance sustainable development for Australia.

Kevin Wake-Dyster
Secretary

South Australia

The South Australian Branch has had a fairly active end of year run of activities. The traditional Melbourne Cup Luncheon was a very enjoyable, and for some profitable, luncheon. A total prize pool of $500 was on offer for 1st, 2nd and 3rd, with a Bruce Beer led syndicate making a clean sweep of the pool.

Two monthly meetings were held in late November at which 6 honours students and 1 Phd student presented the results of their work. The quality of the presentations and associated work was excellent and very encouraging to see. The prize for best presentation went to Wendy Watkins of Flinders University, and Angus McCoy from the University of Adelaide was awarded the best thesis award.

Topics presented were:

Wendy Watkins - (Flinders Uni)	A reflection seismic experiment in the Willochra Basin, S.A.
Paul Basford - (Adelaide Uni)	Investigatino of isolated aeromagnetic anomalies in the Kimba region of SA using magnetic, gravity and IP methods.
Alex Bontenakel - (Adelaide Uni)	Three dimensional modelling of the Truru-Sandleton area using aeromagnetics, gravity
Angus McCoy - (Adelaide Uni)	Analysis of the Gairdner dyke swarm using automated magnetic modelling.
Glenn Corrie - (NCPGG)	Evolution and petroleum prospectivity of the Eyre Sub-basin, offshore WA.

Mark Brincat - (NCPGG)	Seismic Interpretation of structure and stratigraphy, permit T-15-p, Durroon Sub-basin, Fast Parallel Processing System
Paul Theologou - (Uni of SA)	A new method for analysing Archie's Equation & the influence of the M and N exponents - an error mapping approach. (Phd project).

Don Robinson gave a short talk on the methodology and uses of reconnaissance AVO before presenting the prizes to the honours students.

The final SA Branch activity for the year will be the Xmas BBQ to be held on 8 December. Overall, 1992 has been a very successful year for the SA branch with a variety of technical talks being presented to members.

Ashley Duckett
Secretary

Queensland

The final branch meeting for 1992 was the Annual Students Night, held at the Gazebo Hotel on the 2nd December. Three Talks were presented, all by Honours Students from Queensland University, as follows:

Justyn Hedges:	Construction and Testing of a Shallow Shear Wave Generator.
John McMonagle:	Elimination of Coherent Noise in Shallow Seismic Reflection.
Robin Luo Mu:	Applications of Polarization Analysis in Multi-component Seismic.

The Best presentation prize was awarded to John McMonagle and the Technical Merit prize was awarded to Robin Luo Mu.

The final function for 1992 will be the Annual Branch Dinner which will be held Saturday 19 December at Giardinetto Restaurant, Fortitude Valley, Brisbane. Phone Howard Bassingthwaite (07) 376 5544 for dettails.

The highlight of the year was the great success of the Gold Coast Conference in October. The Queensland Branch Committee would like to thank all ASEG members who contributed their time and efforts to this success, which demonstrates the continuing maturity and professionalism of the Society as a whole.

The Queensland Branch wishes all members a happy Festive Season, and we look forward to welcoming new members in 1993.

Andrew Mutton
President

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Exploration Geophysics - Update

Bulletin of the Australian Society of Exploration Geophysicists

Publication Report - December 1992

Schedule

The Conference Papers, volume 23, Issue 1 & 2 have been mailed to those ASEG members who did not attend the Conference. If you have yet to receive your copy, contact the ASEG Publisher.

The next issue Volume 23, #3 will be published early in the New Year - in fact it is planned to release issues 3 & 4 together in early February, with issue 3 having an Environmental Geophysics theme, whilst issue 4 will concentrate on sedimentary basin geophysics.

Papers to be included in Volume 23 Issue 3:

Urban geophysics - a review — RJ Henderson

The application of electromagnetics and electrical methods to groundwater problems in urban environments — J Busalliatal

Detection of earth anchors at building sites — N Merrick, G Hocking

Earthquake attack in the Sydney Basin: What is the risk? — D Denham

Geophysical techniques in contaminated lands assessment - do they deliver? — RJ Whitely, C Jewell

Cavity detection - engineering applications for gravity — J Peacock

Magnetic and transient electromagnetic responses of buried drums — DW Emerson et al

Papers to be included in Volume 23 Issue 4:

Application of normalised valocities for depth conversion of the Bookabourdie Field, Cooper Basin, South Australia — JW Chiupka et al

Blina Field - Canning Basin, case history — D Taylor

Brackett Secretariat - ASEG Publishers
P.O. Box 44, Eastwood, SA

Geophysics in AGSO

Geophysics as a discipline has played, and will continue to play, a vital role in the well being of Australia. It is difficult to underestimate the importance of geophysical techniques, in relation to our mineral and petroleum exploration industries.

National geophysical data sets are an important part of that geoscience knowledge base. Over the past decades they have played an essential role in the significant advances made in understanding the structure and composition of the Australian continent and its margins. Ongoing development of these datasets will continue to sustain Australia's mineral and petroleum exploration potential and the industry's competitive position in the global market place. The information is also required for resource assessment, and to provide a basis for sound environmental and land-use decisions

In terms of resource discovery it should be noted that

- all of Australia's oil and gas deposits have been found by using geophysical techniques; and
- national geophysical data sets are used as a basis for most of the mineral exploration programs throughout the continent.

As the more obvious mineral and petroleum deposits are discovered, future exploration will be increasingly directed towards deeper mineral deposits, and petroleum and gas plays that are more difficult to find. These exploration processes will require an even greater reliance on geophysics. Furthermore, geophysical techniques will play an increased role in land use and conservation issues where the geophysical images of gamma-ray spectrometric data and other parameters provide new information on soil types which is needed for land degradation studies.

Since it was formed in 1946 the Australian Geological Survey Organisation (formerly the Bureau of Mineral Resources, Geology and Geophysics) has played a key role in using geophysical techniques to develop an understanding of the geology of the Australian continent. The national gravity, aeromagnetic and gamma-ray spectrometric data sets, acquired in the last 45 years or so, (together with the regional seismic traverses), are essential to understand the on-shore geology. Similarly, off-shore, AGSO's impact through the Continental Margins Program has been enormous in putting together models for the structure and development of the continental margins.

AGSO's commitment to geophysical techniques is considerable; during 1991/92 approximately $30 million or close to 60 percent of the total budget was spent on acquiring, compiling and interpreting geophysical data sets.

The three contributions that follow describe the main achievements of AGSO in exploration geophysics and provide an insight into the range and depth of data sets that have been compiled and published by the organisation in recent years. These contributions are structured according to the current program divisions within AGSO, but between each program area there are strong disciplinary links and common data sets.

GEOPHYSICAL MAPPING

AGSO (including its forerunner, BMR) has been carrying out airborne geophysical surveys (magnetic and gamma-ray spectrometric) for over 40 years. The objectives of these surveys are to accelerate the geological mapping of Australia, to provide the strategic framework for petroleum and mineral exploration, and to assist in the formulation of strategies for resource development and environmental management. In order to promote these objectives, the data collected are distributed as widely as possible. As a result of these efforts, and those of the State and Territory geological survey agencies, Australia has better, more systematic public-domain geophysical survey coverage than any other continent.

Airborne Geophysics

The airborne geophysical program started in October 1951. Up to 1992 about 4.3 million line-kilometres had been flown by AGSO's aircraft and a further 1.2 million line-kilometres of data had been acquired under contract or purchased. In recent years, additions to the national airborne geophysical database have regularly exceeded 200 000 line-kilometres per year.

AGSO's present aircraft—an Aerocommander Shrike—is fitted with a helium-vapour magnetometer, a 4–channel gamma-ray spectrometer (soon to be upgraded to 256 channels) with 33 litres of crystal, a satellite-navigation system (GPS), a Doppler navigation system, and a digital-data-acquisition system (Fig. 1).

Data checking and reduction are carried out in the field, and at AGSO's airborne-data-processing centre in Canberra. The hardware processing facilities are based on a SUN 490 Sparc server at the centre of a network of Sparc workstations and personal computers, which are linked to exploit the advantages of UNIX-based distributed processing.

Fig. 1. AGSO's Aerocommander airborne survey aircraft

Aeromagnetic Reconnaissance Surveys

Reconnaissance survey coverage at (usually) 1.5 or 1.6 km line spacing and 150m altitude covers 84 percent of Australia's land area. Some central regions have been surveyed at lower specifications. Only 3 percent of the land area remains to be covered, most of this being in the Kimberley region of Western Australia. Fig. 2 shows the coverage of aeromagnetic data over the entire continent.

The entire body of public domain reconnaissance aeromagnetic data is now compiled and levelled together into a 15-second (about 400 m) grid for the land areas of Australia; grids are available in blocks equivalent to 1:1 000 000 Sheet areas.

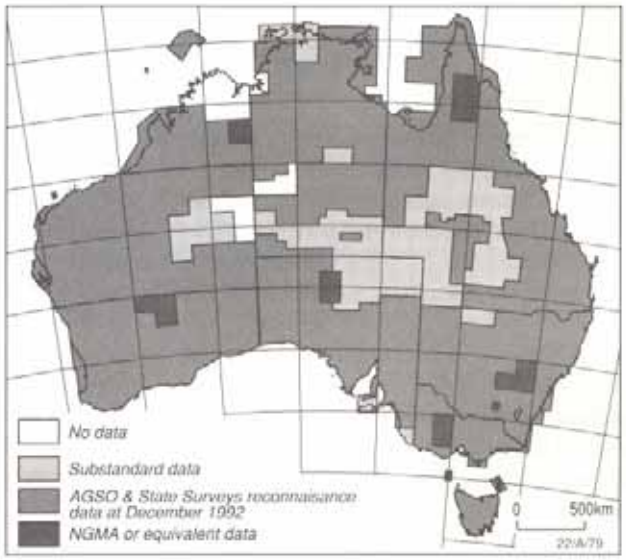

Fig. 2. Availability of Aeromagnetic data

Coverage of the entire country is available as 15-second or one-minute grids. A new edition of the 1:5 million Magnetic Anomaly Map of Australia (reproduced in preliminary form at reduced scale in Plate 1), based on the 15-second grid, will be published as a cartographic quality pixel image at scale 1993.

Gamma-Ray Spectrometer Reconnaissance Surveys

The natural gamma-radiation emitted by the exposed rocks and soils was measured simultaneously on all but the earliest AGSO aeromagnetic surveys.

Only since the early 1990s has the instrumentation, and its calibration and operation, achieved the standards that permit the acquisition of reliable, good-quality gamma-ray spectrometric data. Before then, although data were obtained at reconnaissance scale they fall short of accepted contemporary standards. Therefore the national coverage of these data falls short of that of the aeromagnetic data, and so far they have not been compiled on a national scale. Fig. 3 shows the current coverage. Where available, digitally located profile data may be obtained from the AGSO archives.

Hardcopy maps

For airborne reconnaissance surveys hard-copy maps are produced at 1:250 000 scale for most of the standard Sheet areas of the continent.

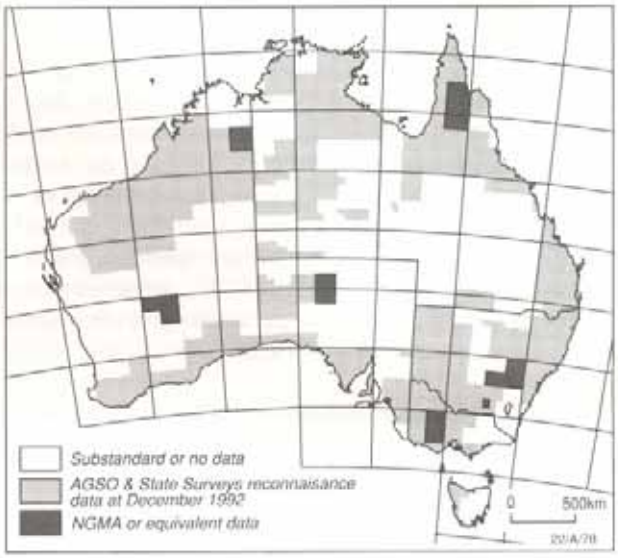

Fig. 3. Availability of gamma-ray spectrometer data.

These maps display flight lines and magnetic and radiometric profiles and contours. A series of photocomposite magnetic contour maps is available at 1:1 000 000 scale.

National Geoscience Mapping Accord (NGMA) airborne surveys

Collaborating with State and Territory geological survey agencies, AGSO initiated in 1990 a new generation of airborne surveys designed to support directly the geological mapping carried out within the framework of the NGMA. The main specifications for these surveys are:

- line spacing of 400 metres;
- ground clearance of 100 metres (but 80 or 60 metres in some areas);
- magnetometer reading recorded every one-tenth second;
- magnetometer noise envelope of 0.2 nanotesla; and
- spectrometer with 33 litres of sodium iodide crystal.

As far as possible, whole 1:250 000 Sheet areas are surveyed at a time applying these specifications. About five Sheet areas are covered per year—three by AGSO's aircraft, and two under contract or in joint projects with State agencies.

Plate 3 shows an example of these surveys from the Dubbo 1:250 000 Sheet area.

Gravity Mapping

National Control Network

One of AGSO's first involvements with gravity surveying in Australia was the establishment in 1950–51 of the 'Australian National Gravity Network', using pendulum observations at 59 gravity stations. This network has now been expanded to about 300 stations and incorporates sites where absolute gravity measurements have been made.

The network provides the reference stations defining scale and datum for reduction of gravity meter readings made during all gravity surveys on the Australian landmass and surrounding ocean. Fig. 4 shows the current network of base stations. The gravity field is usually known to an accuracy of 0.2–1.0$\mu m/s^2$ at each of the base stations. It is one of AGSO's key responsibilities to maintain this network and encourage exploration companies to use the stations as control for all gravity surveys. Location diagrams are available from the AGSO gravity group.

Fig. 4. Australian gravity base-station network. The thick lines and large dots indicate the links between the main stations.

Australian Gravity Database

One of the key responsibilities of AGSO is that of maintaining the Australian National Gravity Data Base. At the time of writing, data from approximately seven hundred individual surveys carried out by AGSO/BMR, State surveys and exploration companies, have been amalgamated into one consistent national data set containing over 600 000 observations. The average station spacing over the continent is approximately 10 km but in many areas the additional surveys have infilled this grid.

The data set is available in its entirety, as grids or as a series of maps at a variety of scales. The coloured gravity map of the whole continent is shown in Plate 2. This map shows Bouguer anomalies (ρ=2.67 t/m^3) on shore and free-air anomalies at sea. The grid mesh interval is 5 km and over a million points were used to generate the map.

Copies of this map and other Geophysical Mapping products can be obtained from AGSO's main office in Canberra.

For further information contact Colin Reeves Tel. (06) 249 9226, head of the Geophysical Mapping Program.

SUB-SURFACE MAPPING — ONSHORE SEDIMENTARY BASINS, YOUNG AND OLD

Sub-surface Mapping using Seismic Profiles

Australia's onshore sedimentary basins of all ages have enormous resources of coal, gas, petroleum, minerals and groundwater. Providing the geological framework for the development and management of these resources in the national interest is an ongoing task which is largely the responsibility of government agencies, both State and Federal. The Australian National Geoscience Mapping Accord (NGMA) is the vehicle for the sub-surface mapping of these basins and the adjacent basement blocks which have affected their evolution.

Inevitably any sub-surface mapping program must rely heavily on seismic methods to define geological features at a scale appropriate for resource exploration and management. Hence AGSO has developed and maintained a program of seismic acquisition since the 1950s. During the 1980s the onshore seismic profiling program has engaged in deep seismic profiling, which complements industry seismic exploration, to examine the fundamental basin geology, including the

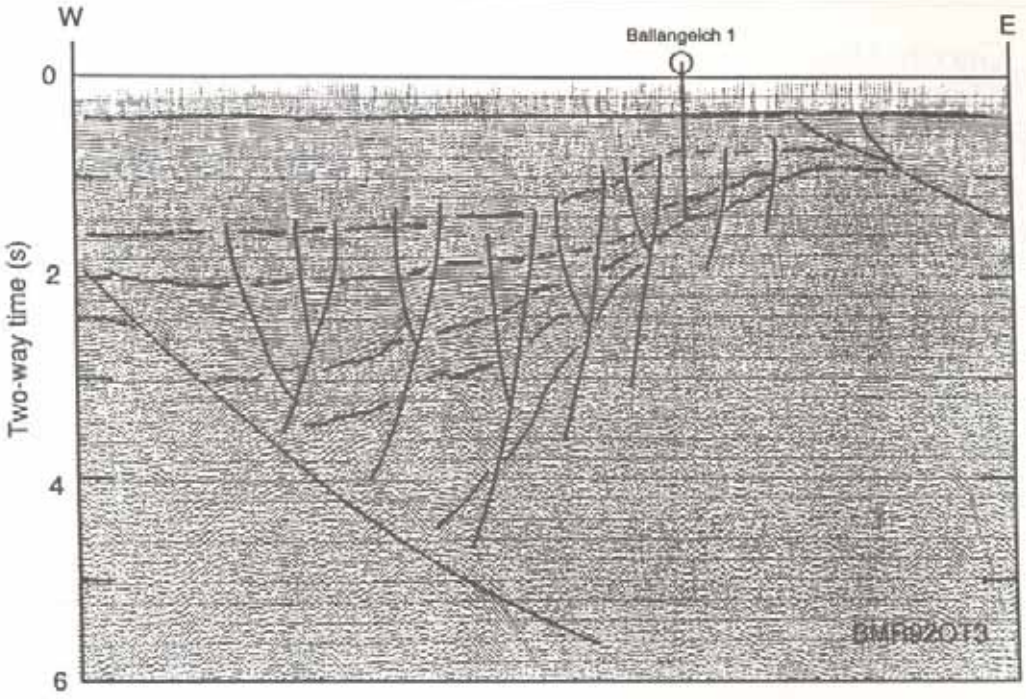

Fig. 5. Interpreted deep rift sequences under the Tyrendarra Embayment of the Otway Basin along AGSO deep seismic line BMR92.OT3.

controlling structures in underlying basement and crust down to depths of about 60 km.

The following brief outlines give some idea of the scope of some current investigations which are conducted within AGSO's Onshore Sedimentary and Petroleum Geology Program—*Chief Scientist, Dr. Tom Loutit Tel. (06) 249 9397.*

Otway Basin Project—mapping early rift segments

Studies of modern rifts and passive continental margins show that the early stages of rifting in the continental lithosphere to form Mesozoic and Cainozoic basins are controlled largely by pre-existing geological structures. Reviews of initial rifting processes suggest that the rifting develops from early isolated pockets of continental extension and that these pockets grow and interact as the rift system matures.

In the Otway Basin of western Victoria and SE South Australia the early rift stratigaphic units are important as source rocks for play concepts developed in the current round of oil and gas exploration activity in the region. The basin is part of the southern margin of Australia and, with its conjugate margin in Antarctica, formed part of a Mesozoic continental rift system. In mid-Jurassic to mid-Cretaceous times, lithospheric extension and rifting processes affected the Australian/Antarctic continental land mass to form the Austral petroleum system.

The current NGMA project in the Otway Basin aims to provide new data on the early onshore structures and improve knowledge of the tectonic events that resulted in basin development and evolution. The strategy is to acquire new information on the deep basin sequences from deep seismic sounding, use complementary industry seismic data to map the early rift segments, and integrate the data sets from other geoscience disciplines to improve tectonic models for the basin.

The seismic section from Line BMR92.OT3 in Fig. 5 illustrates the early Otway Basin sequences under the Warrnambool gravity high within the Tyrendarra Embayment. It shows the thick sequence of interbedded volcanics/clastics of the Casterton Formation at depths not previously identified (4–5 s TWT; 8–9 km).

The partners in this NGMA project are the Australian Geological Survey Organisation, the South Australian Department of Mines and Energy, the Geological Survey of

Victoria, and the Victorian Institute of Earth and Planetary Sciences at Monash and La Trobe Universities.

For further information contact Doug Finlayson Tel. (06) 249 9761; Fax (06) 249 9972.

Sedimentary Basins of Eastern Australia — structural geometry and tectonics

The NGMA project in eastern Australian basins is focused on the Bowen, Gunnedah and Surat Basins. It is being conducted jointly with the Geological Survey of Queensland and the NSW Department of Mineral Resources (Geological Survey and Coal & Petroleum Geology Branches). Geophysical aspects of the project include deep seismic reflection profiling in the Bowen and Gunnedah basins and western New England Orogen, and palaeomagnetic studies of the Late Palaeozoic of eastern Australia. Geological mapping includes the interpretation of seismic stratigraphic sequences on a regional scale (starting in the eastern Surat Basin) using a network of industry and AGSO seismic data.

Bowen Basin

To test various tectonic and structural models of the basin, the AGSO conducted a deep seismic reflection survey across the basin in the vicinity of Blackwater during the latter half of 1989. Seismic Line BMR89.B01 was shot during this project (Plate 4). It clearly shows the (? mid-Triassic) deformation in the sedimentary succession is controlled by thin-skinned thrusting on a series of listric faults which dip to the east and root in a major detachment that also dips to the east.

Gunnedah Basin

In 1991, the AGSO acquired deep seismic reflection data in northern New South Wales to address several geological problems on the origin and development of the Gunnedah and Surat basins and their relationships with the New England and Lachlan orogens. This line, BMR91.G01 shows that the geometry of the Gunnedah Basin is not controlled by bounding faults, that the western part of the Tamworth Belt was thrust westwards over the eastern margin of the Gunnedah Basin, and that the western New England Orogen was underthrust to the west, probably beneath the eastern extension of the Lachlan Orogen.

Surat Basin

Scientists in the project have been using sequence stratigraphic principles to interpret a regional network of seismic data acquired by both AGSO and exploration companies. The results are being compiled into a series of map folios, of which the first is now available in either hard copy or as digital data. This folio, at 1:250 000 scale, covers the non-standard Sheet area between latitudes 25° and 26° and longitudes 149° and 150°30', in which the town of Taroom is the largest centre. It contains the following maps:

- locations of the interpreted lines;
- structure contours of 14 selected horizons (of which many are sequence boundaries) ranging in age from the Early Permian to the Jurassic; and
- isopach maps of 14 selected intervals.

For further information contact Russell Korsch Tel. (06) 249 9495; Fax (06) 249 9972.

The Cobar Basin, NSW—new exploration concepts

The migration paths for mineralising fluids through the Cobar Basin in central NSW, were most likely controlled by fault systems emplaced when the basin formed as a ramp basin above a mid crustal detachment. This is the key result from a deep seismic reflection experiment undertaken by AGSO, the Geological Survey of NSW, Pasminco Exploration, CRA Exploration and Geopeko Exploration.

The seismic data show that the Cobar Basin reaches a present day maximum thickness of approximately 6 km and is asymmetric, with the western margin (BB' in Fig. 6) steeper

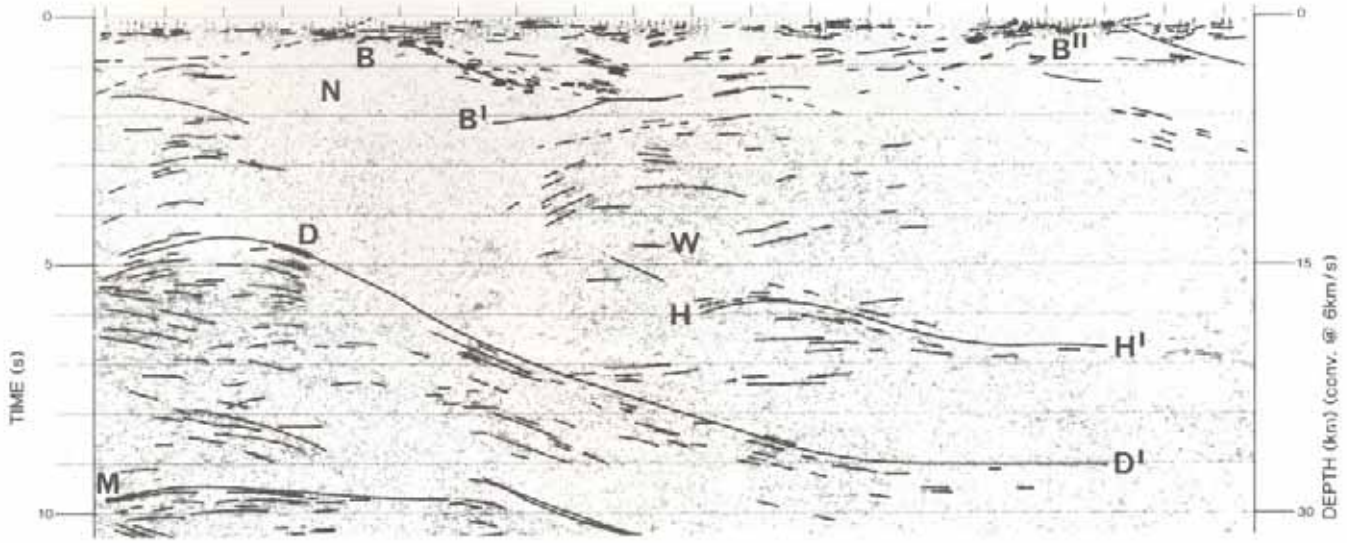

Fig. 6. Cobar Basin: interpreted 58 km E-W deep-seismic section (V/H~1:1) showing mid-crustal reflector (H-H'), major mid-crustal detachment (D-D') and crust-mantle boundary (M).B-B'-B" is the basement below the basin.

than the eastern margin (B'B"). The seismic data also imaged a major east-dipping three-dimensional mid-crustal detachment at depths ranging from 12 to 24 km (DD' in Fig. 6). The basin formed when the upper crust moved across the lower crust along this detachment. The net movement vector, *i.e.* basin opening less the effects of subsequent inversion, was approximately 24 km to the northeast. In adjusting to the flexure caused by movement across the topography in the detachment, the upper plate was fractured along two sets of linked fault systems. One set formed parallel to the structure in the detachment surface, and now defines the margins of the basin. The other set of linked faults correlates with the direction of the upper plate vector.

For further information contact Barry Drummond Tel. (06) 249 9381 or Bruce Goleby Tel. (06) 249 9404 at AGSO or Richard Glen at the Geological Survey of N.S.W. Department of Mineral Resources.

Officer Basin Project — seismic reprocessing in a frontier basin

The Officer Basin is in one of the most arid and inaccessible regions of the Australian continent. The sedimentary section is poorly exposed due to cover either by widespread Pleistocene sand dunes of the Great Victoria Desert to the north, or by Cretaceous to Quaternary platform carbonates of the Nullarbor Plain to the south.

As a result it is perhaps the most poorly understood of the continent's intracratonic basins. However, the stratigraphy of the Officer Basin is analogous to the hydrocarbon productive Amadeus Basin. Oil shows from a number of exploration wells in the eastern Officer Basin have demonstrated *in situ* oil generation. In spite of this potential, there has been no

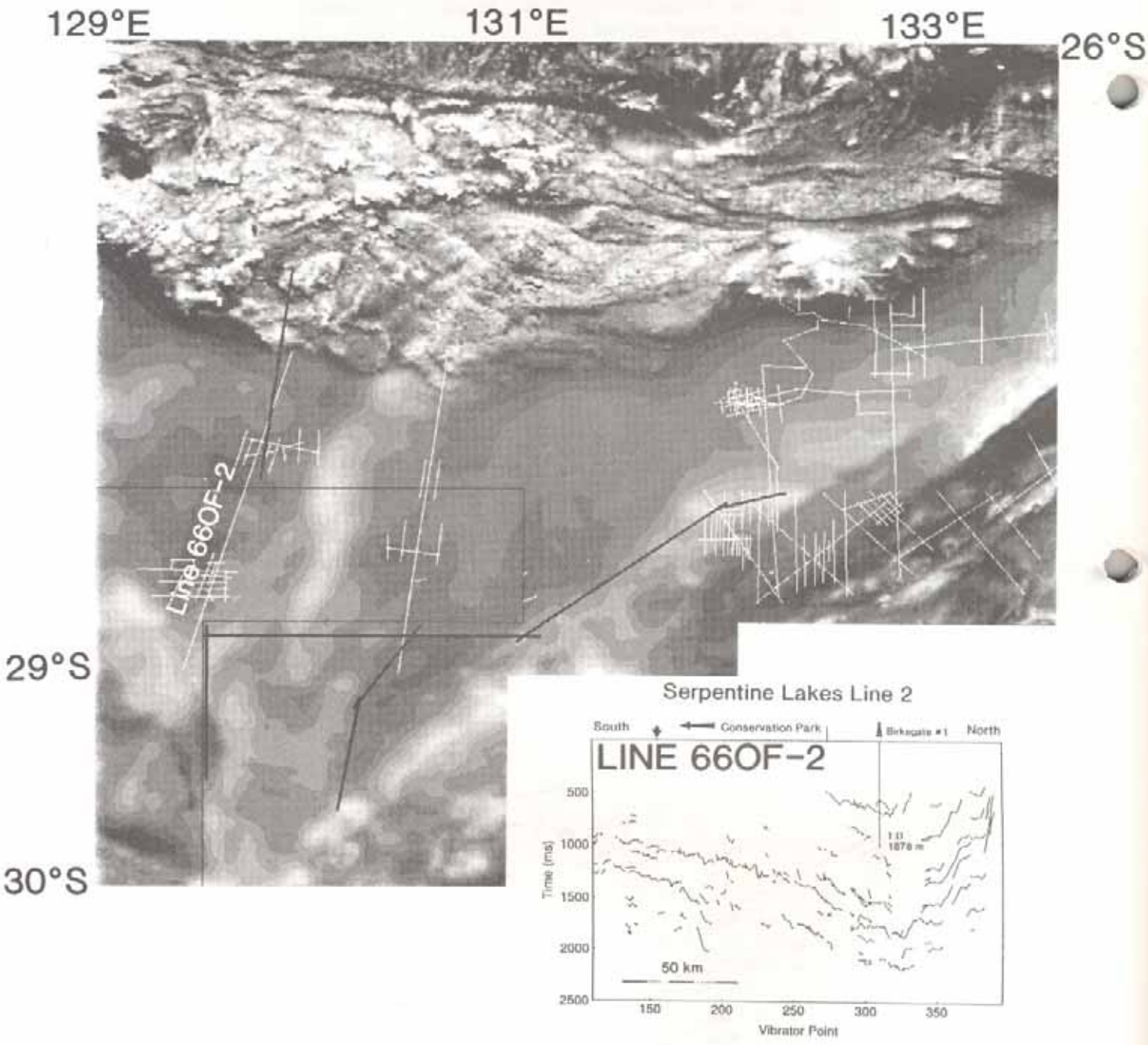

Fig. 7. A total magnetic intensity (TMI) image of the northern Officer Basin in S.A. with existing seismic (white lines) and AGSO 1993 proposed seismic (heavy black lines). Also shown is the boundary of the Namungarintja Conservation Park (thin black line). The inset shows the structure of the basin as seen from the 1966 Conoco Serpentine Lakes Line 2, one of the two regional lines which cross the conservation park.

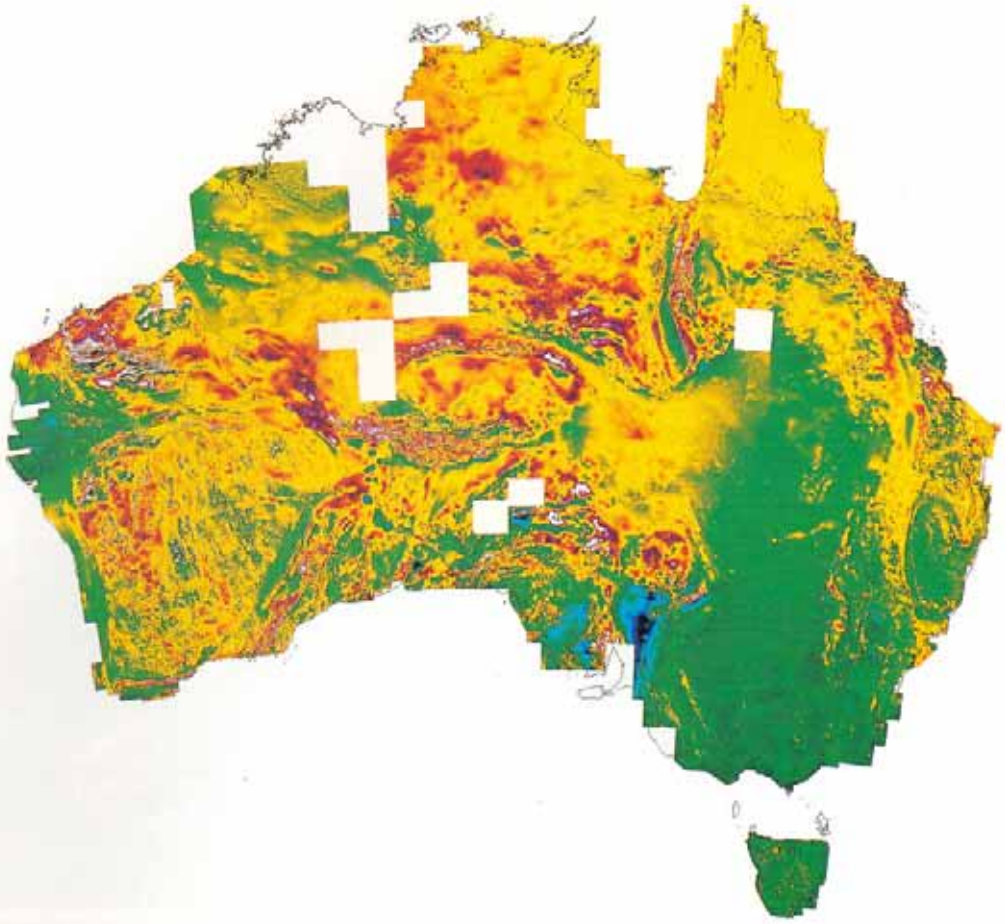

Plate 1 Preliminary aeromagnetic anomaly map of the Australian continent. The anomalies range from white (high) to purple (low) and cover a total of 10 000 nT.

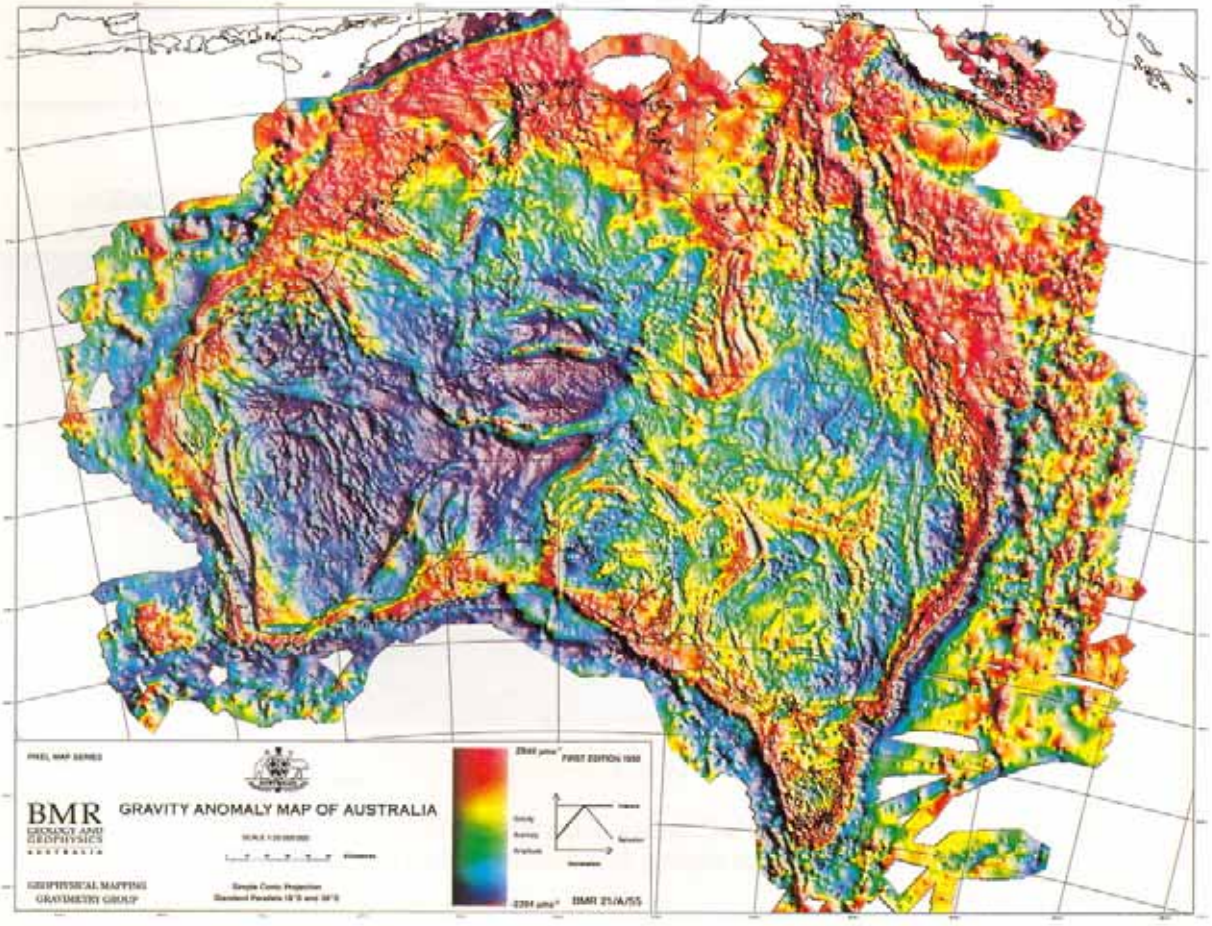

Plate 2 Gravity Anomaly map of Australia. The image was compiled from 600 000 gravity values. The colours range from red (high) to purple (low) and span 5000 m/s^2.

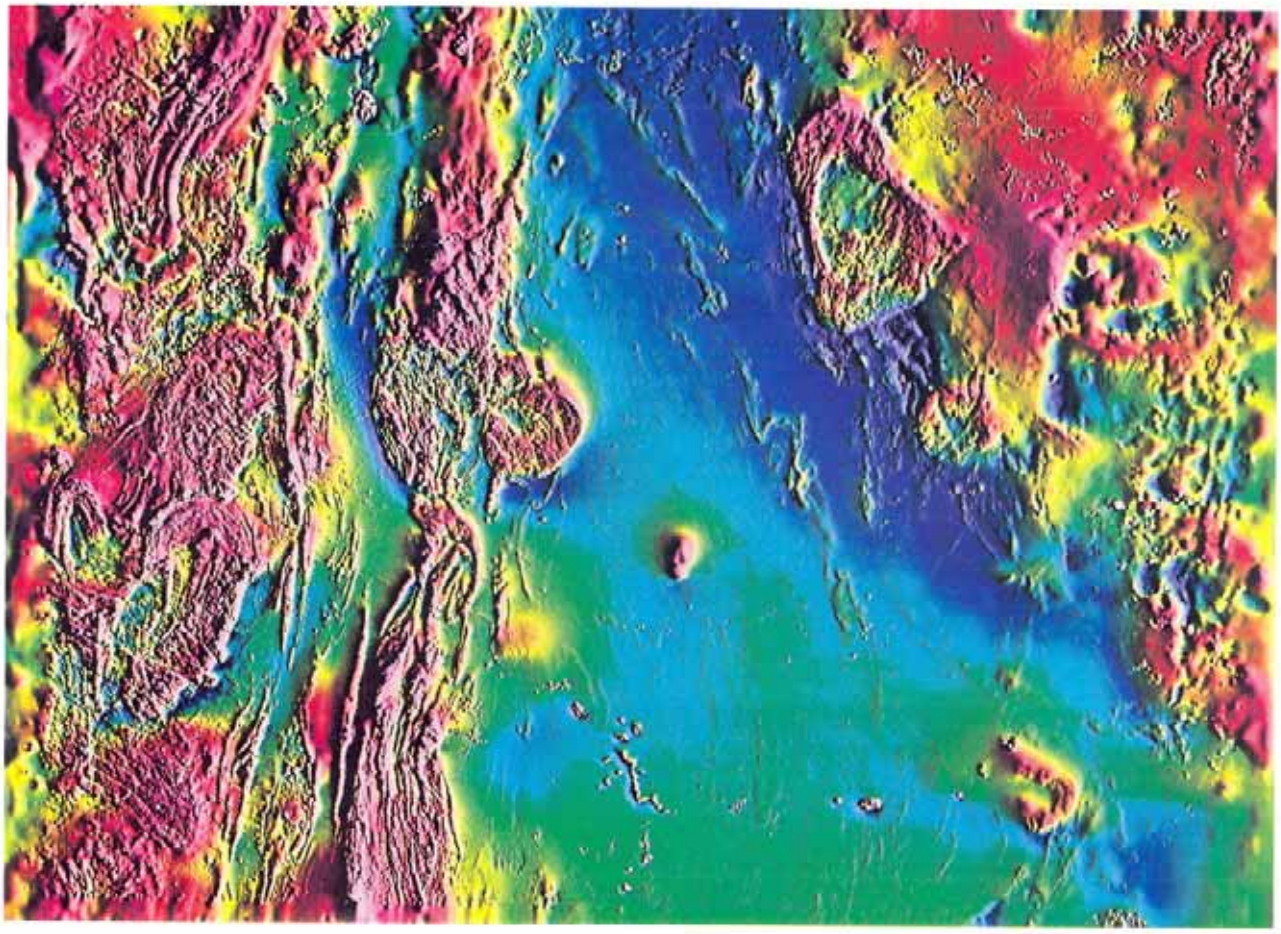

Plate 3 Total Magnetic Intensity Dubbo 1:250 000 Sheet area. The basic data were acquired in 1991 on E-W lines flown 100m above ground level and spaced 400m. The image was compiled from total-field aeromagnetic data from which the International Geomagnetic Reference Field had been removed. The profile data were gridded at a cell size of 80 metres using minimum curvature. Pixel colours were chosen from the natural palette (magenta high, blue low) using histogram equalization. Shaded relief effect with an illumination from the east was achieved by modulating colour intensity and saturation with the east-west gradient of the total magnetic intensity.

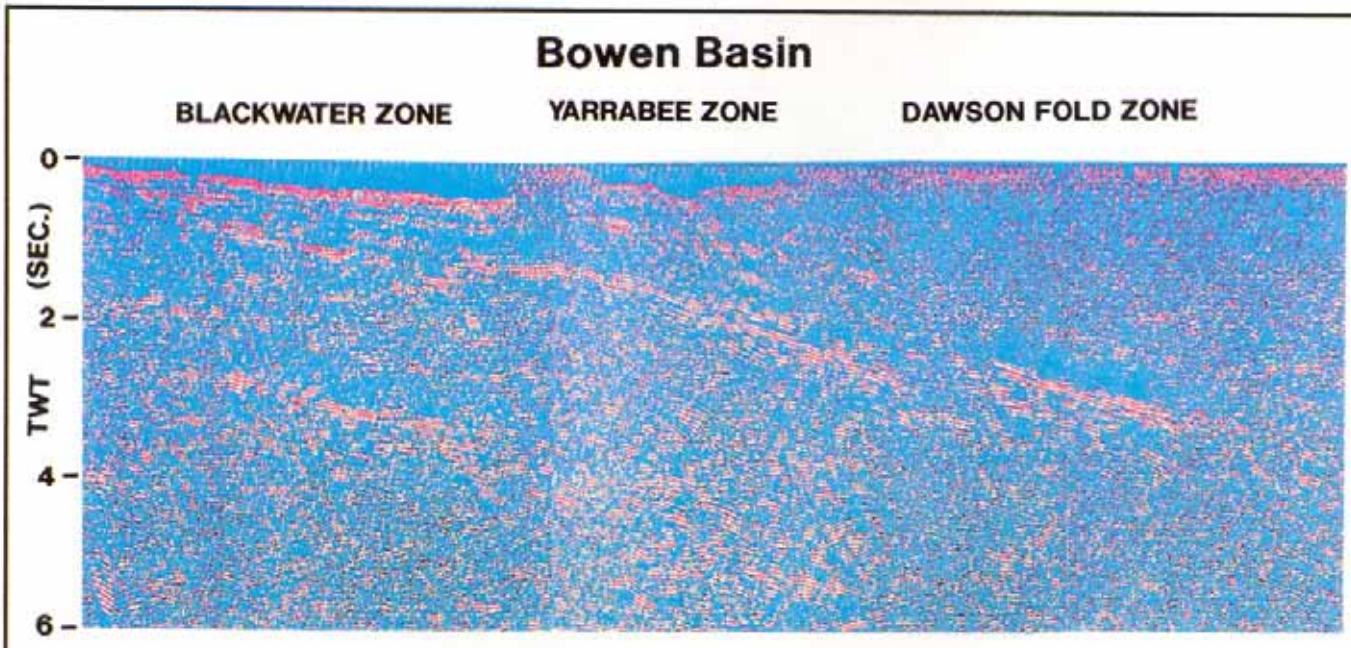

Fig.XX - Bowen Basin: unmigrated seismic reflection profile of the central part of Line BMR89.B01 showing east dipping detachmentextending to about 4 s TWT.

Plate 4 Bowen Basin: unmigrated seismic reflection profile of a central part of Line BMR89.B01 showing east dipping detachment extending to about 4 s TWT.

hydrocarbon exploration in the central portion of the Officer Basin since Conoco relinquished its lease in 1967.

During 1993, the NGMA Officer Basin Project aims to extend the stratigraphic control established in the eastern Officer Basin into the central Officer Basin and investigate its hydrocarbon prospectivity by recording a set of strategic regional seismic traverses. A major constraint in such planning is the Namungarintja Conservation Park whose position precludes regional seismic dip lines across the central Officer Basin.

However, Conoco's 1966 Serpentine Lakes Seismic Lines 1 & 2 do provide regional cross-sections which span the Conservation Park. Acquisition for these early vibroseis lines used the transposed method which is the reverse of modern seismic acquisition method: it used two very large geophone groups and multiple vibrator points between these to give single fold coverage. The original tapes have been read using AGSO equipment and digitised to modern SEGY format.

The reprocessing demonstrates the importance of careful archiving of data and the maintenance of an ability to read such archived data. The alternative scanning of paper sections would not have enabled the reversal of processing sequences such as trace mixing. As shown in Fig. 7, the combination of the reprocessed Serpentine Lakes Lines and the proposed 1993 AGSO will provide a network of regional traverses from which further exploration can expand.

The NGMA partners in this project are AGSO and the S.A. Department of Mines and Energy.

For further information on the proposed seismic acquisition contact Jim Leven Tel. (06) 249 9275; Fax (06) 249 9972.

Canning Basin Project — sequence stratigraphy and new play concepts

Activities within the NGMA Canning Basin Project are concentrated mainly around detailed seismic and sequence stratigraphic studies using shallow company and deep AGSO seismic data, and exploration wells, together with palaeontological and sedimentological research in Devonian outcrops (GSWA and several universities). These studies are being undertaken in relatively small areas within some of the major structural provinces of the basin. It is anticipated that they will form key reference areas which will provide local stratigraphic and structural models to assist in understanding basin evolution, and aid assessment of resource prospectivity.

Initial studies have concentrated in the northwest of the basin and new petroleum plays in sandy floor sands have been identified along the Lennard Shelf and the adjacent northern margin of the Fitzroy Trough (Plate 5). These have not been tested by drilling but similar fans in other countries contain vast quantities of hydrocarbons.

AGSO deep seismic profiling has revealed that the Fitzroy Trough is markedly asymmetrical with a faulted southern margin and a flexured/hinged northern margin. The fault along the southern margin dips northeasterly, is listric, and soles out at about 15 km depth. Major differences in the sediment packages on the two AGSO strike lines (60 km apart) suggests the presence of at least one major transfer system. Three periods of crustal extension can be identified in the period Late Devonian to Permian, with a total extension of about 40 km (or 50%).

A complete shot-point data base for the whole basin (more than 200 surveys, totalling 80 000 km) and a 1:1 million scale structural elements map of the basin and surrounding basement blocks has been compiled. The latter was assembled largely from existing small-scale published maps, supplemented with structural information from seismic interpretations and field work. Additional seismic modelling of small areas on the Broome Arch will be undertaken in an attempt to improve the accuracy of pre-drill stratigraphic prognoses based largely on seismic interpretations.

For further information contact Jim Jackson Tel. (06) 249 9205; Fax (06) 249 983.

Eastern Goldfields Project — Imaging Archaean Greenstones Structure

The greenstone belts of the Eastern Goldfields Province in WA host the area's gold and nickel deposits. Seismic data collected in the Eastern Goldfields region of Western Australia indicate that the greenstone belts have a predominantly planar base that is faulted in places. The faulting at the base of the greenstones correlates with known major mineralised shear zones at the surface. Near Kalgoorlie, the greenstone thickness varies between 6 and 9 km (Fig. 8). This is thinner than suggested by previous geological models. Most granites within the greenstone belts, including post-tectonic types, have a lenticular shape.

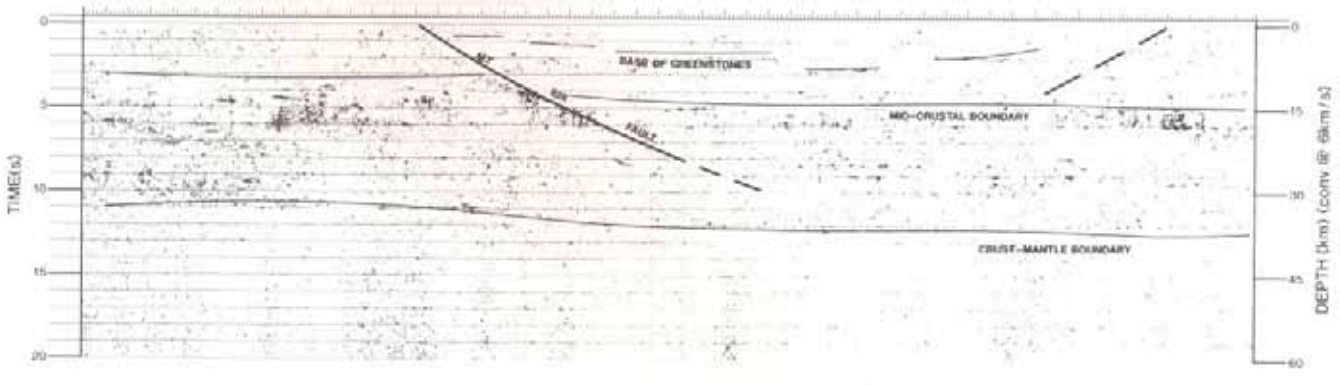

Fig. 8. Interpreted 213 km long E-W seismic section (V/H~1:1) from the Eastern Goldfields.

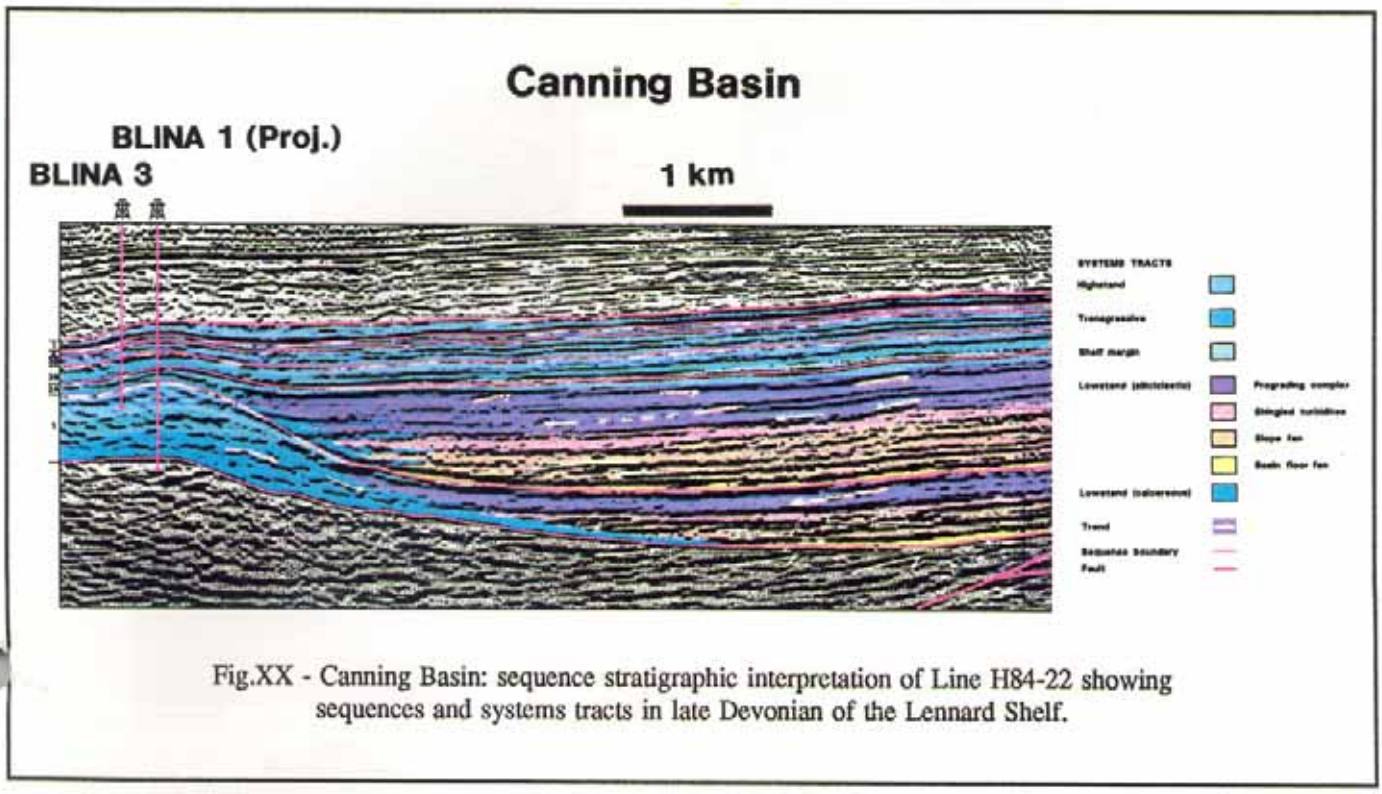

Fig.XX - Canning Basin: sequence stratigraphic interpretation of Line H84-22 showing sequences and systems tracts in late Devonian of the Lennard Shelf.

Plate 5 Canning Basin: sequence stratigraphic interpretation of Line H84-22 showing sequences and systems tracts in late Devonian of the Lennard Shelf.

Plate 6 R/V *Rig Seismic*, AGSO's state-of-the art, multi-purpose, geoscientific research vessel.

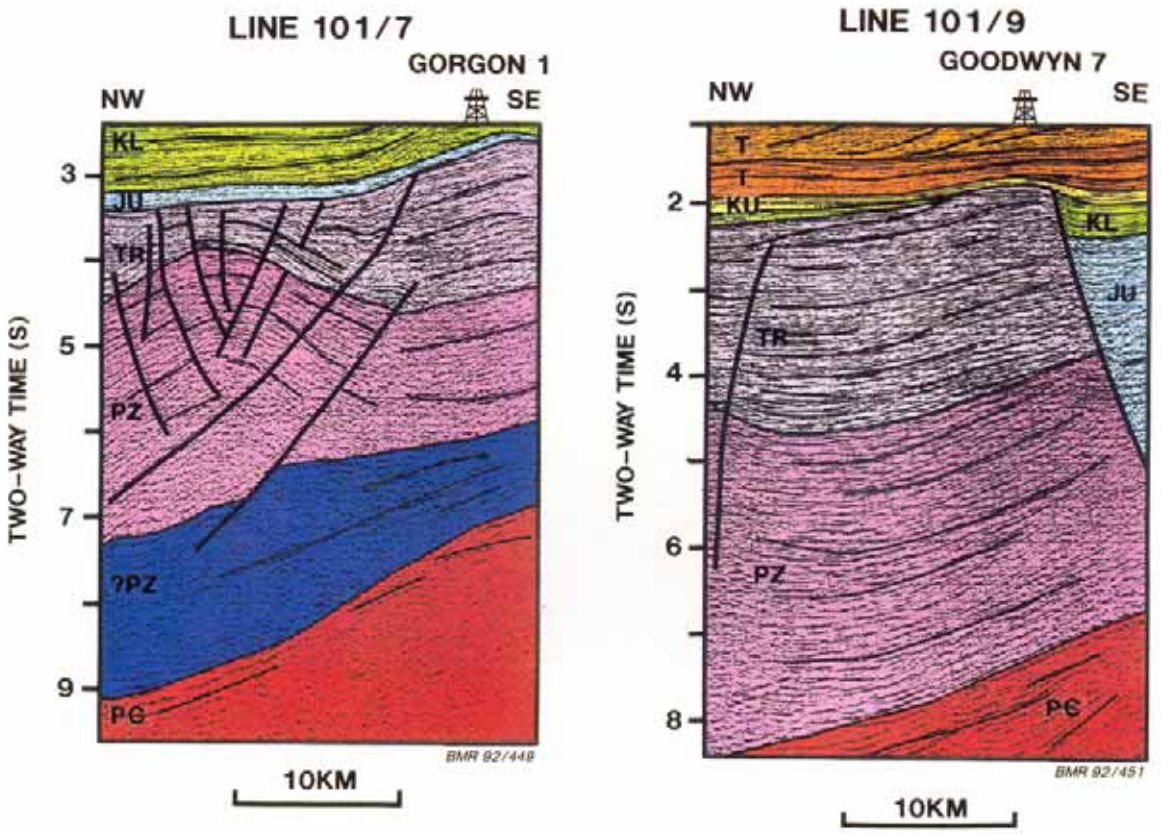

Plate 7 Interpreted examples of *Rig Seismic* (Survey 101) seismic data from the northern Carnarvon Basin. Complete section was recorded to 16 seconds two-way time. Section on the left shows a wrench-related, faulted anticline adjacent to the Gorgon gas field. Section on the right shows the Goodwyn gas-condensate field reservoired at the top of a Triassic fault block.

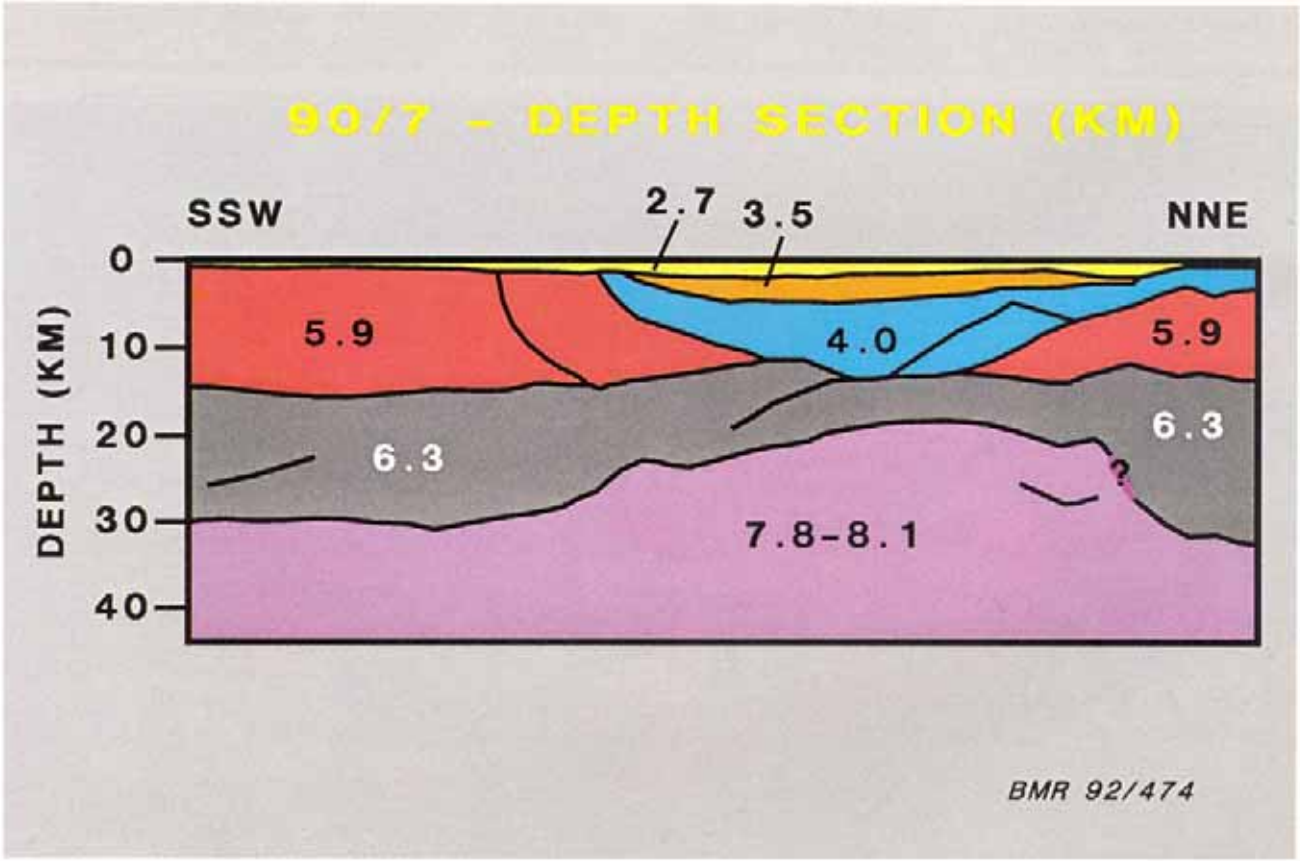

Plate 8 Velocity model of the Gippsland Basin largely determined from ship-shore seismic refraction data. The section shows the thinning of the crust beneath the basin, the well-developed Southern Platform, and the ramp which forms the northern margin to the depocentre. Section is about 200 km long. Maximum sediment thickness in the basin is approx. 16 km. Basement has velocities of 5.9 km/second or greater.

The Ida Fault, the western boundary of the Eastern Goldfields, is imaged as a moderately dipping planar reflector, plunging to the east at approximately 25°–30° to a depth in excess of 25 km.

The crust-mantle boundary is very sharp. The crust beneath both the granite and greenstone regions has a similar reflection character in the upper and middle crust. This suggests the existence of a uniform crust beneath both regions and implies that the greenstones were deposited on a uniform, predominantly felsic crust.

For further information contact Bruce Goleby Tel. (06) 249 9404; Fax (06) 249 9972 or Barry Drummond Tel. (06) 249 9381; Fax (06) 249 9972.

CONTINENTAL MARGINS PROGRAM

Offshore, AGSO's geophysical programs are coordinated by the Division of Marine Geoscience and Petroleum Geology. The activities are focused on the Continental Margins Program (CMP), an initiative started by the Australian Government in 1983 to provide information on the structure, stratigraphy and evolution of Australia's offshore areas (Fig. 9), large parts of which are relatively under-explored. The program is aimed at assisting the petroleum exploration industry as well as providing information on marine geological processes and minerals, and at defining the boundaries of Australia's Legal Continental Shelf under the terms of the 1982 UN Law of the Sea Convention. Virtually all of the work is undertaken using the 1545-tonne *Rig Seismic* (Plate 6), a Norwegian-built research vessel chartered by BMR/AGSO since 1984. Since arriving in Australia, several major equipment upgrades have been undertaken. Currently the vessel is equipped for:

- Conventional and high-resolution multichannel seismic up to 240 channels;
- Sleeve gun array of 32 elements, up to 4800 cu. in.; water gun array of 5 elements, up to 400 cu. in.
- Gravity, magnetics and bathymetry (recorded continuously);
- Shallow seafloor imaging by sidescan sonar;
- Continuous geochemical profiling for Direct Hydrocarbon Detection;
- Vibro, piston and gravity cores and dredges;
- Differential Global Positioning (DGPS); and
- Onboard geochemical, sedimentological and palaeontological work.

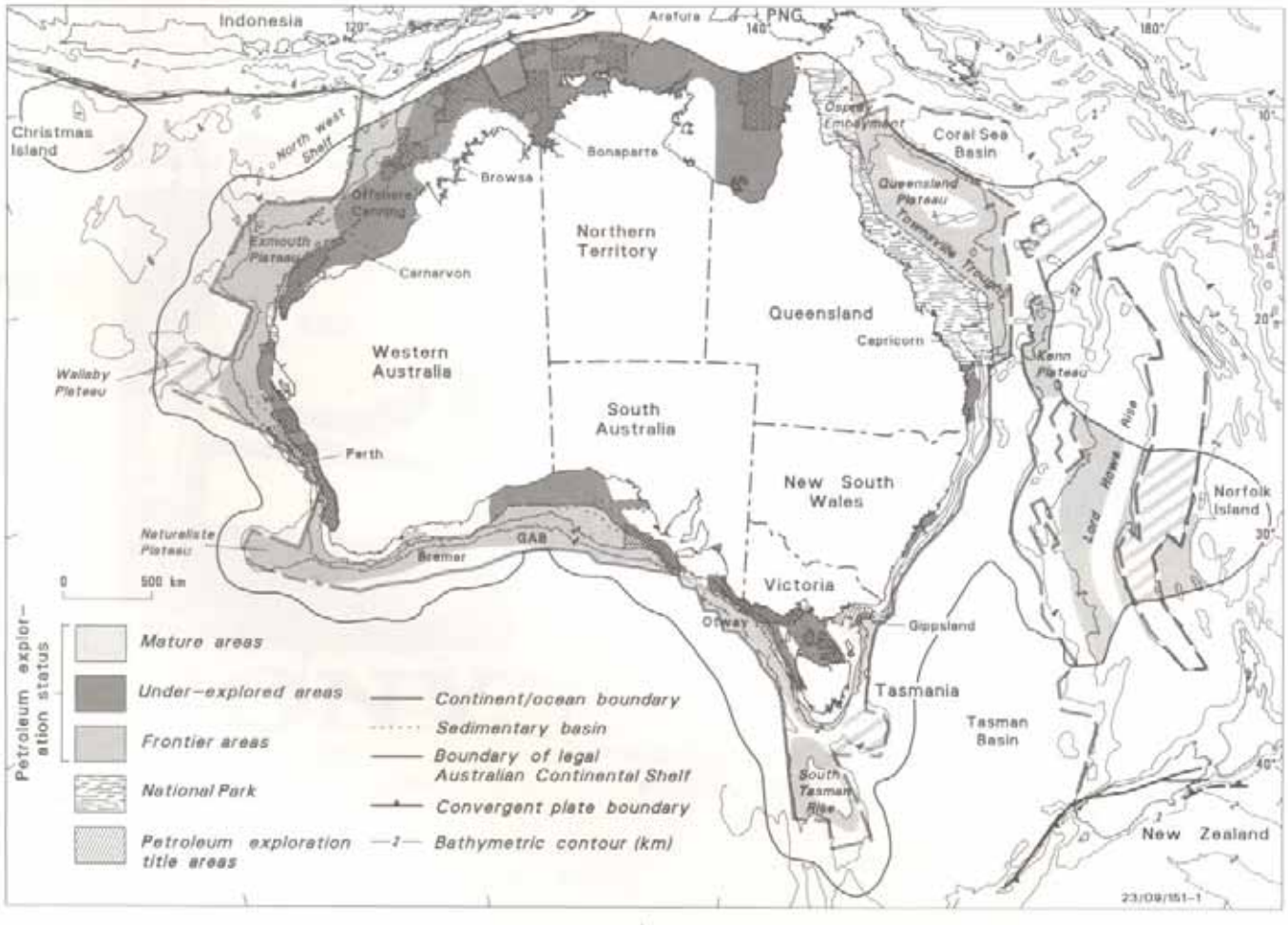

Fig. 9. Australia's offshore region. The 'Legal Continental Shelf' around Australia and its island territories occupies an area of approximately 12 million km2, about 1.5 times the area of the continent itself.

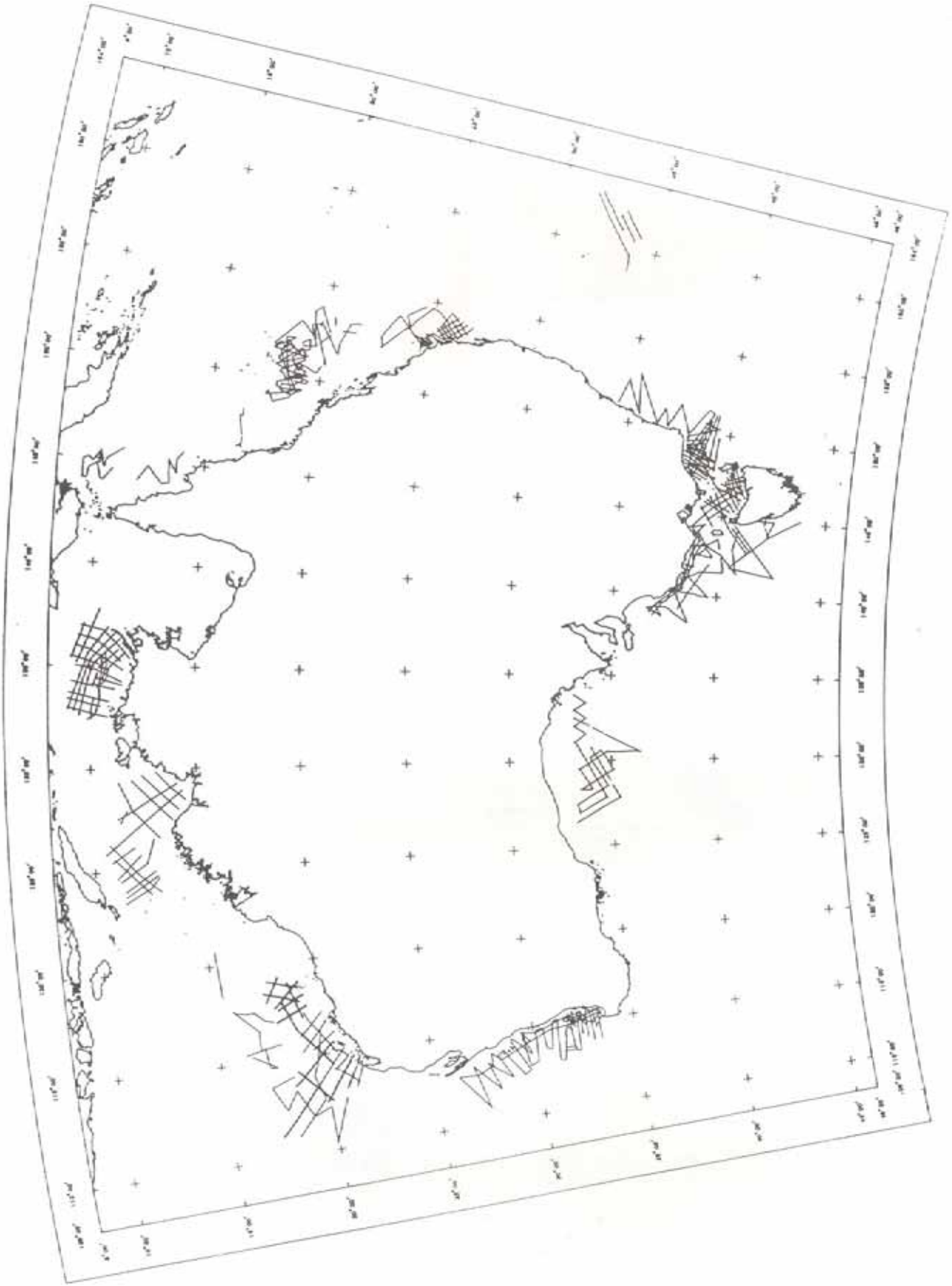

Fig. 10. Distribution of the 53,000 km of AGSO regional data acquired on the Australian continental margin from early 1982 to mid 1992. High-resolution seismic lines not shown.

Since undertaking its first research cruise in early 1985, *Rig Seismic* has worked around much of Australia and its territories (Fig. 10). Its annual work program consists of up to seven 30-day surveys. In 1991/92, cruises with a major geophysical (largely seismic) component were undertaken off southern Queensland (high-resolution seismic; part of a joint project with the Japan National Oil Corporation to study modern carbonate systems), in the Arafura Basin (deep-seismic study of basin structure), in the Christmas Island area (high-resolution seismic; Law of the Sea study), in the Philippines (conventional seismic; externally-funded aid project), and in the northern Carnarvon Basin (deep-seismic structural study).

Much of the work involved the collection of regional data aimed at providing information on the broad basin architecture and structural linkages (e.g. Plates 7 and 8). During 1991/92, other geophysical work undertaken in Marine Division included an aeromagnetic study of the Vulcan Sub-basin of the Timor Sea (jointly with AGSO's Geophysical Mapping Section and World Geoscience), and a heatflow study of Rabaul Harbour (Australian International Development Assistant Bureau funded).

Most of the seismic data collected by *Rig Seismic* is processed at AGSO's Seismic Processing Centre which has recently been upgraded through the installation of a Convex 3420 super-computer. This upgrade has resulted in a greater range of processing options, with a consequent improvement in the quality of the data being released, and greater speed. A commercial agreement, signed in 1992 with NOPEC a/s, provides for the external processing of some seismic data and the marketing of the completed products to industry.

Marine Division's future program is determined by a committee which receives input from industry, other parts of AGSO, government and universities. Most of the proposed program can be placed within one of several categories:

- petroleum research-divisible into 'new basins–future resources' and 'new approaches, new ideas–reduced exploration risk' strategies;
- Law of the Sea and seabed boundaries;
- marine processes and the environment; and
- minerals research.

The major emphasis is on petroleum-related research.

In 1992/93 work has been or will be undertaken off central New South Wales (environmental geochemistry and shelf sedimentology), over the Lord Howe Rise to assess petroleum potential and for Law of the Sea purposes, in the Timor Sea (possibly two deep, regional seismic cruises), and off southwestern Australia (Naturaliste Plateau/Diamantina Zone/Bremer Basin geological sampling).

For further details of proposed program contact the Acting Chief of Marine Division, Dr Neville Exon Tel. (06) 249 9327.

This review was compiled by David Denham, Jim Colwell, Doug Finlayson and Colin Reeves.

ASEG Research Foundation News

Report of the A.S.E.G.R.F. Project: The Effects of Rock Magnetic Properties, Cultural and Natural High Frequency Pulsations and Diurnal Fluctuations on Base Station Corrections in Airborne Magnetic Surveys.

David Boggs conducted a pilot study to investigate some of the factors which determine the validity of high precision base-station magnetometer corrections given the possible dependence of measured temporal variations on the local environment of the base-station and the sample rate of the magnetometers used.

Part one of the study involved synchronized, differential base-station measurements at two field sites. The first site was selected such that one station was located over an anomalously high magnetic body (a near vertical, serpentine lens along the Peel Fault) while the other station was situated 100m away on relatively non-magnetic sediments. The magnetic susceptibility contrast between serpentine and sediments was approximately 50×10^{-3} SI units. The first site was investigated with both total field and three-component, optically pumped magnetometers sampling at up to 10 times per second. The second site was selected where one of the differential pair of total field sensors was placed over a near vertical conductive sheet (Taronga tin vein containing 5-8% by weight sulphide), while the other was located one kilometre away over barren granite.

The second part of the investigation involved measuring the amplitude of the 50Hz field radiated from rural power transmission lines. This experiment involved taking total field measurements at a rate of approximately 200 per second for a period of 10 to 12 seconds (2048 measurements) at each station. Measurement stations were located along a traverse commencing at a 132 kV rural feeder and extending to a point that was several kilometres from the nearest farm house or power line. The total field amplitude at 50Hz and harmonics up to 350Hz were derived from Fourier analysis of the data from each station.

The experiments conducted led to the following important conclusions.

1. The diurnal variation in the total field over the magnetic body differerd from the reference station by an amount that was consistent with theoretical expectation due to magnetic induction. The measured difference was 1.5nT during a 20nT magnetic diurnal. This observation confirms the necessity to consider the susceptibility contrast between the base-station site and the survey area when performing diurnal corrections.

2. The micropulsation variations over the magnetic body differed in amplitude from those at the reference station in a manner that was not predicted. The phenomenon appears to be related to the remanent magnetization of the body. It

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appears to be practical to compute the remanent properties of the body from differential vector field measurements but without this information total field corrections at micropulsation frequencies can be expected to contain errors that may be a significant percentage of the micropulsation amplitude.

3. Temporal variations induce significant magneto-telluric effects in conductive bodies. The magnetic field recorded over the vertical conductive sheet at Taronga differed from the reference station by up to 0.25nT during 20nT magnetic variations at both diurnal and micropulsation frequencies. The time derivative of the total field record correlated well with the difference record between the two stations as would be predicted from Faradays Law.

4. High current power transmission lines produce magnetic fields up to several thousand nT at a distance of 50m. Typical rural feeder lines produce several hundred nT at this distance. The power line interference was confirmed experimentally to diminish as the reciprocal of the distance from the source. Significant 50Hz radiation is present not just in suburban regions but is widespread throughout rural areas. Magnetometers with a measurement period of 100mS or less are most sensitive to this interference.

David was awarded 1st Class Honours and a University medal. A copy of his thesis is held by the A.S.E.G.R.F. David may be contacted at the Geophysical Research Institute at the University of New England where a copy of the thesis is also available. Congratulations David and thanks to the A.S.E.G.R.F. and its sponsors for supporting this worthwhile project (R.F. funds used, $1,950)

John M Stanley
Director, GRI

In coming issues other ASEG RF projects to be reported include:

Imaging of subsurface faults by walkaway VSP waveguiding - physical model experiements

By Mr N Sike
Flinders University of South Australia

Structural and Geophysical studies of the Banker Saddle Area, Southern Cross Greenstone Belt, Western Australia.

Michael House, Department of Geology, University of Western Australia, Nedlands, Perth, W.A. 6009

Geophysical studies of the Regolith, Near Nevoria, Southern Cross Greenstone Belt, Western Australia.

Kylie Paish, Department of Geology, University of Western Australia, Nedlands, Perth, W.A. 6009

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ASEG 9th Conference & Exhibition Photo Gallery

ASEG 9th Geophysical Conference and Exhibition

BEAUTIFUL shirt Richie. Conference Co-Chairman Richie Huber (Department of Resource Industries, Queensland) and Bill French, SEG President (Grant-Tensor Geophysical Corporation) obviously enjoying it all.

BOOZE and the chance to meet old friends is part of the ASEG Conference. Colleen Roberts, Kim Frankcombe (Normanby Poseidon), Tim Pippett (Geo Instruments), Doug Roberts (SAGASCO).

BROTHERHOOD and Sisterhood carrying on the ancient lost arts was our Aussie lot, we were told, by Brother Sven. Three monks in mufti looking decidedly spirit-filled are Brothers Derecke Palmer (UNSW), Bob Smith (CRAE) and Joe Williams (QUT).

Photos courtesy
Henk Van Paridon

BOON to ASEG conferences are sponsors. HGS and many others generously sponsored the conference. HGS employee Warwick Greville (on the right), another leading contender in the beautiful shirt competition, is seen here with fellow oilman Adrian Williams.

BOOTHS abounded. VEISEIS personnel look on as Barry Long tries out the automatic nose picker.

BACKROOM of proceedings, the Conference Committee laboured. Steve Hearn of the committee reassures himself he is at the right conference.

BOOKS to spare. Looking for that unusual Christmas gift? Please contact Terry Crabb for additional copies of the Exploration Geophysics Conference Edition.

The Coming Reunion of Seismic Acquisition, Interpretation and Processing

Landmark Graphics International

During acquisition of a large 2-D seismic survey in the Java Sea earlier this year, Atlantic Richfield (ARCO) Indonesia, Inc. and Landmark Graphics Corporation successfully completed the industry's first known full-scale onboard seismic processing project. The use of interactive processing systems aboard ship allowed seismic acquisition, processing, and interpretation to take place almost concurrently - with significant results.

Beginning in 1992, ARCO's geoscientists were planning to drill many new gas exploration wells in the Ardjuna basin of the northwest Java Sea, based on several vintages of old, fairly low quality seismic data. But they wanted to acquire, process, and interpret a comprehensive new regional 2-D survey in time to influence as many of those well locations as possible. Unfortunately, the new survey could not begin until the spring of 1992. Also, because marine acquisition in the Asia-Pacific is at record levels, processing turnaround from Indonesia's overloaded geophysical contractors can take eight months or more for a survey of this size. Thus the new data would not have been ready for ARCO's interpreters until the spring of 1993. And only after completing a new interpretation would they have been able to make better drilling recommendations.

For this reason ARCO began exploring the feasibility of onboard seismic processing to cut down the time between acquisition and the drilling decision. The goal was not just to improve quality control of field acquisition, but to shoot 6000 kilometres of high quality 2-D seismic data, and attempt to process all of it through a complete, very sophisticated processing flow including dip move out (DMO) and final migration.

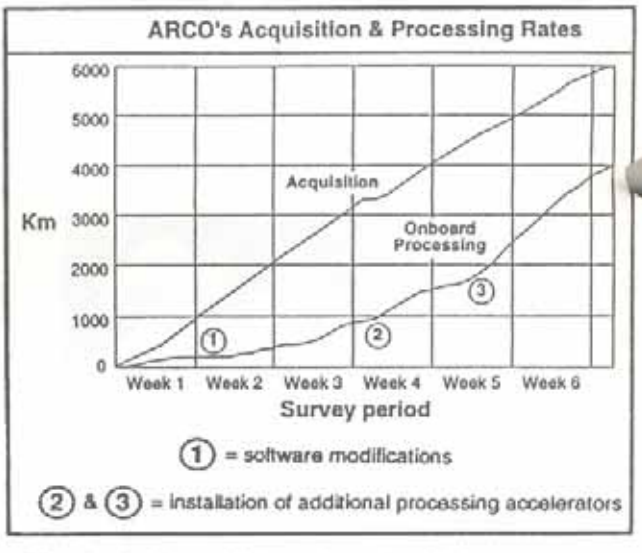
ARCO approached Landmark's Jakarta office in February. Landmark proposed using a single interactive seismic processing workstation, with a second system for 100% redundancy in case of hardware failure. Only one workstation was considered necessary because the system uses multiple processing accelerators called "supercards", which exponentially increase throughput. In addition, its highly sophisticated algorithms were specially developed to minimize runtime without compromising quality. As a result, the system provides both high quality and high throughput on one machine.

On Easter Sunday, Landmark installed the two workstations on an acquisition vessel in Singapore. During the steam from Singapore to the Ardjuna basin, just offshore from Jakarta, an ARCO geophysicist did the initial testing. Processing parameters were selected in real time, tested quickly, and modified to produce the best images. Two Landmark geophysicists manned the system for the duration of the survey. Many of the lines exceeded 50km in length, and at first the operators had to segment long lines to process them efficiently. But Landmark's development centre in North America quickly modified the software to handle larger data sets, and sent the updates to the ship by satellite.

Early results revealed that the basin had somewhat deeper structures than ARCO's explorationists realised. Interactive parameter testing indicated the need to do more complex DMO corrections than expected, to properly image the basin. The decision was made to compute full 60-offset DMO instead of summing traces and doing 15- or 30-offset DMO. This decision effectively eliminated the redundancy of the second workstation, because full DMO processing is so compute-intensive. Interactive velocity analyses were done every four km before and every one km after DMO, increasing the amount of human interaction required as well.

Because of the changes to the software and the more complex processing flow, processing temporarily lagged behind acquisition. To compensate, system throughput was beefed up by doubling the number of supercards in each workstation. Thus, even though the survey was completed almost three weeks ahead of schedule (due primarily to calm seas), the team managed to process two-thirds of the total 6000 km before the ship docked.

This is illustrated below. After software modifications (1) and installation of additional processing accelerators (2 & 3), processing rates exceeded acquisition rates.



Clearly, had acquisition taken the full two months that ARCO originally projected, all of this data would have been processed before the survey was completed. In any case, ARCO's interpreters obtained 4000 km of fully processed data they might not have seen for another eight months, under normal conditions.

During acquisition, tapes of processed data were sent to Jakarta, and loaded on interactive seismic workstations. As a result, the interpreters quickly recognized that the programmed position of a certain line, based on the old data, was inadequate to properly image the subsurface. It was too close to a fault.

They laid out two new lines on a basemap, and sent it out to the ship. Those additional lines were acquired, processed onboard, and returned to Jakarta, where they too were interpreted before the survey was over.

Without onboard processing capabilities, it would have taken a year or more to accomplish the same thing. As it turned out, ARCO's interpreters obtained the seismic data they needed on the first pass, saving both time and the cost of a second survey. The survey was completed June 10th. By July, interpretation of data processed onboard had already favourably influenced a number of exploration well locations.

ARCO's experience in the Java Sea has shown that the advantage of onboard processing far outweigh any imaginable drawbacks:

- acquisition-to-drilling time can be drastically cut
- the costs associated with onboard processing are lower than comparable post-survey processing onshore
- the processing flow itself can be altered, if necessary, to accommodate new perspectives gained in the field
- collaborative acquisition, processing, and interpretation enable explorationists to modify the survey design before the seismic vessel returns to shore, eliminating the need to reshoot inadequate surveys later.

For further information contact:
Karen O'Donahoo
Landmark Graphics International
Tel: (03) 820 3688

☆☆☆☆☆☆

Noel Moriarty (left) is retrained in geophone installation during the recent ASEG Continuing Education 3D Seismic Exploration Workshop in Melbourne. Malcolm Lansley is the teacher.

Company News

(Editors Note - Company News is a new column introduced this issue. We intend Company News to include significant items of news from the Companies, major product launches etc which may be of interest to ASEG members. Please send brief news items to the Editor. Note PREVIEW 1993 deadlines p2.)

Swedish Government to Privatize Geophysical Companies

As a result of the general election in Sweden in autumn 1991, a new non-socialistic government was formed. Within the general issue of privatization of state owned or partly state owned enterprises, the decision was recently taken to withdraw state funds for mineral exploration as well as to divest other geological and geophysical activities.

The SGAB Group has been the state owned enterprise concerned with mineral surveys, exploration drilling and geophysical instrument manufacturing.

SGAB's interest in the geophysical instrumentation area consists of the following three companies which are 100% owned by SGAB:

- ABEM Instrument AB, Stockholm, Sweden
- ABEM Geoscience AB, Malå, Sweden
- Geonics Ltd, Toronto, Canada

In addition, SGAB has minority interests in the following three companies:

- 40% Phoenix Instruments Ltd, Toronto, Canada
- 35% Terraplus Inc, Toronto, Canada
- 39.5% Terraplus Inc, Denver Co., USA

The Terraplus companies are exclusive sales representatives for ABEM Instrument and ABEM GeoScience, in Canada and USA respectively.

The present management of SGAB has been charged with the task to carry out these divestments and is currently searching for investors and companies that could have a potential interest of acquiring the SGAB geophysical companies, as a whole or as parts.

For further information, please contact:
Mr Lars Ransgart, President
SGAB (Swedish Geological AB)
P.O. Box 801, S-951 28 LULEÅ
Sweden
Ph +46 920 60301;
Fax +46 920 224381

Membership

NEW MEMBERS

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

Corporate

Pasminco Manager
Pasminco Exploration
Level 2, The Atrium
290 Burwood Road
Hawthorn Vic 3122
Ph: (03) 818 0044

Victoria

Enjie JING
University of Melbourne
Department of Geology
Parkville Vic 3052
Ph: (03) 344 6521

Christopher RODDA
ESSO Australia Ltd
360 Elizabeth Street
Melbourne Vic 3000
Ph: (03) 270 3946

South Australia

Ahsan ABURAS
5/2E Fifth Ave
St Peters SA 5069
Ph: (08) 362 5911

Rodney BOUCHER
2a Alabama Ave
Prospect SA 5082
Ph: (08) 344 6106

David CLOSIER
112 Esplanade
Hove SA 5048
Ph: (08) 296 3536

Scott MACINNES
Zonge Engineering
240 Glen Osmond Road
Fullarton SA 5063
Ph: (08) 338 1559

New South Wales

Michael HALLETT
The Dept of Geology & Geophysics
University of Sydney
Sydney NSW 2000
Ph: (02) 692 2031

Kerry SLATER
125 Bedford Street
Newtown NSW 2042
Ph: (02) 519 2311

Ying YANG
93 Darlington Road
Darlington NSW 2008
Ph: (02) 692 3304

Queensland

Fiona ALEXANDER
24 Valencia Street
Sunnybank Qld 4109
Ph: (07) 345 7381

Kennerley DUPS
49 Scenic Road
Kenmore Qld 4069
Ph: (07) 378 4453

Benjamin JAMES
256 Formosa Road
Gumdale Qld 4154
Ph: (07) 390 6286

Monica WURFEL
12 Holland Street
Toowong Qld 4066
Ph: (07) 371 5156

Western Australia

Geoffrey HINES
46 Roseberry Avenue
South Perth WA 6151
Ph: (09) 481 2477

James LOW
80A Second Avenue
Mt Lawley WA 6050
Ph: (09) 271 1972

Overseas

Tang MUOI
Union of Geophysics
Thanh Xuan
Dong Da, Hanoi, Vietnam
Ph: 244 240

Kevin STEVENS
Whiteshall Laboratories
Pinawa, Manitoba
Canada, ROE 1L0
Ph: 204 753 2311 (3009)

WHERE ARE THEY?

Does anyone know the new address for the following members:

Mr J.T. FRAZER
Last Known Address:
C/- Petromer Trend
Wisma Atria 16-06
435 Orchard Road
Singapore 0923

Mr J.M. WOODWARD
Last Known Address:
29 The Bulwark
Castlecrag NSW 2068

Mr H.C. BASSINGTHWAIGHTE
Last Known Address:
20 Durness Street
Kenmore Qld 4069

Mr S.R. GREAVES
Last Known Address:
Ampol Exploration
P.O. Box A323
SYDNEY NSW 2000

CHANGE OF ADDRESS

The following changes need to be made to the relevant State Branch Databases:

New South Wales

Daryl EYLES
From: 4th Floor,
186 Blues Point Rd
North Sydney
To: Petroconsultants Digimap

Level 4,
39 Chandos Street
St Leonards NSW 2065

Richard BUTLER
From: 3 Ben Bulen Rd
Glenorie
To: Austirex Internat.
27 Merriwa Street
Gordon NSW 2072

Queensland

Matthew KAY
From: RGC Exploration,
89-91 Tennant St
Fyshwick
To: BHP Minerals -
Exploration Dept
P.O .Box 425
Spring Hill Qld

Overseas

Peter NAPIER
From: AGSO,
P.O. Box 378,
Canberra
To: Hendrik
Ravesteijnplein 91
Rijswijk 2282 Gx
The Netherlands

Richard SMITH
From: Pasminco,
290 Burwood Rd,
Hawthorn, VIC
To: GEOTERREX
2060 Walkley R
Ottawa Ontario
Canada KIG 3P5

Calendar of Events

February 8-10 1993

SPE Asia Pacific Oil and Gas Conference
Singapore
For further details:
SPE, Inc.,
P.O. Box 833836
Richardson, TX 75083-3836
Phone: (214) 669-3377,
Fax: (214) 669-0135
Telex: 730989 SPEDEL

February 8-11 1993

Ninth Thematic Conference on Geologic Remote Sensing: Exploration, Environment and Engineering
Pasadena, California
For further details:
Nancy J Wallman
ERIM
P.O. Box 134001
Ann Arbor MI 48113-4001
Tel: 313 994 1200 Ext: 3234 Fax: 313 994 5123

April 17-20 1993

SEG Conference 93
Integrated Methods In Exploration & Discovery
Red Lion Inn,Denver Colorado
For further details:
SEG Conference 93
P.O. Box 571
Golden, Colorado 80402, USA

April 20-23 1993

3rd Australian Geomagnetic Workshop
Canberra, ACT
Sponsors: AGSO, ASEG, GSA, Specialist Group on Solid-Earth Geophysics, GSA
For further details:
Charles. Barton
Australian Geological Survey Organisation
P.O. Box 278
Canberra ACT 2601
Tel: (06) 249 9111
Fax: (06) 257 6041

April 22-23 1993

Paleomagnetism in Australasia: Applications in Dating, Tectonic and Environmental Studies
Canberra, ACT
Sponsors: AGSO
For further details:
Chris Klootwijk
AGSO
P.O. Box 278
Canberra ACT 2601
Tel: (06) 249 9111
Fax: (06) 257 6041
(Full details in February 1993 PREVIEW)

June 7-11 1993

EAEG 55th Annual Meeting & Exhibition/ EAPG 5th Connference
Stavanger, Norway

June 21-22 1993

DHEM Workshop/ Seminar
Macquarie University, NSW
For further details:
Dr John Bishop
Mitre Geophysics P/L
Buggs Lane
Elliott Tas 7325
Tel/Fax: (004) 363 143

August 1993

Moscow '93 - SEG International Exposition
Moscow, Russia
For Further details:
Moscow '93
C/- SEG
P.O. Box 70240
Tulsa Ok 74170-2740
USA
Tel: +918 493 3516
Fax: +918 493 2074

August 1-6 1993

1993 SEG Summer Research Workshop
Theme: 3D Seismology
Rancho Mirage, California
For further details:
Geoffrey Dorn
ARCO E & P Technology
Plano, Tx 75075-8427
Tel: +214 754 6528

September 26-30 1993

SEG 63rd Annual International Meeting and Exhibition.
Washington D.C.
For further details:
SEG
P.O. Box 70240
Tulsa Ok 74170-2740
USA

February 20-25 1994

ASEG 10th National Conference and Exhibition
Increasing the Resolution; Clearing the haze.
Burswood Convention Centre
Perth, WA
For further details:
Don Pearce
Promaco Conventions
Unit 9a Canning Bridge Commercial Centre
890-892 Canning Highway
Applecross WA 6153
Tel: (09) 364 8311
Fax: (09) 316 1453

April 25-30 1994

Contintental Processes A Decade of Drilling Discoveries
Sante Fe, New Mexico, USA
For further details:
Dr. Barry Drummond
AGSO
GPO Box 378
Canberra 2601
Australia
Ph: (06) 249 9381