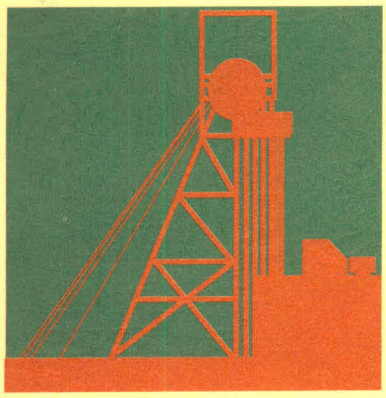
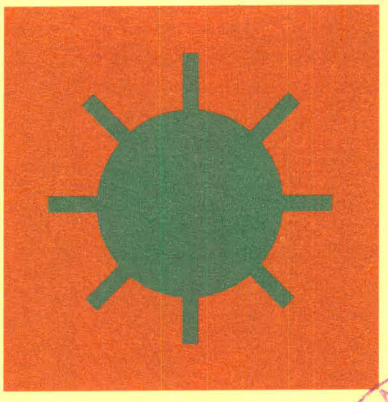
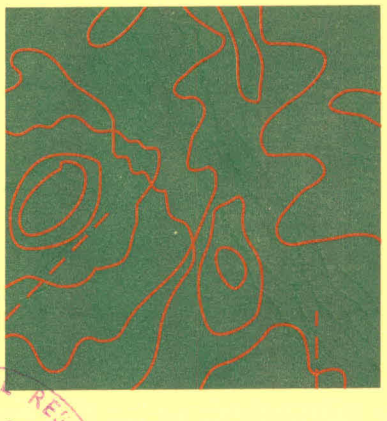
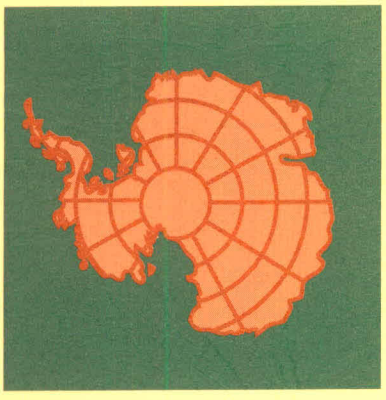
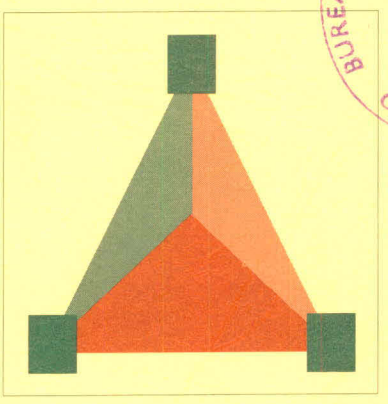

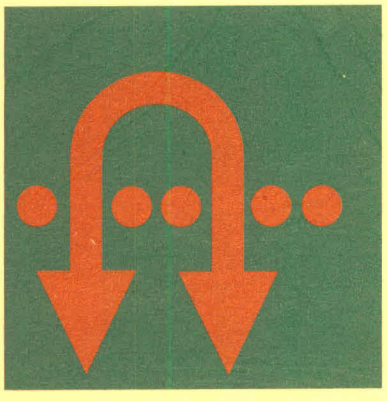
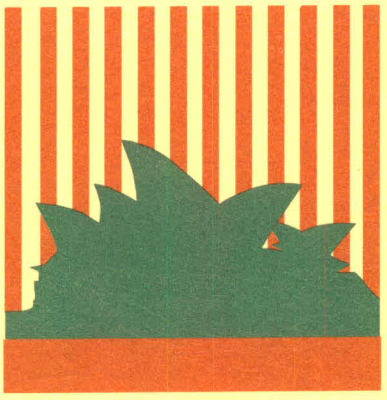
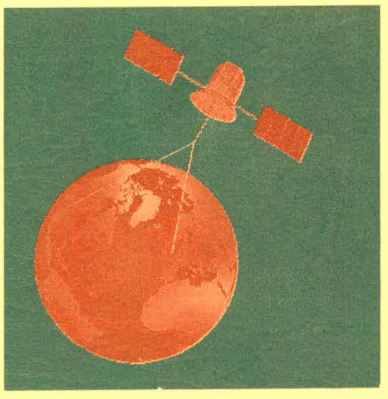

AGSO

AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

GEOSCIENCE FOR AUSTRALIA'S FUTURE

AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

WORK PROGRAM 1992/93

A Research Organisation of the Department of Primary Industries and Energy

AGSO

AUSTRALIAN GEOLOGICAL
SURVEY ORGANISATION

WORK PROGRAM

1992/93

AGSO Record 1992/90

A Research Organisation of the
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Australian Geological Survey Organisation

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Foreword by

the Hon Alan Griffiths, MP

Minister for Resources

On 13 August 1992, measures were announced by the Government to improve both the short and long term performance of Australia's national geoscience effort. The statement has been reproduced elsewhere in this publication but, in summary, these were the major points:

- the name of the organisation has been changed to the Australian Geological Survey Organisation (AGSO) consistent with its contemporary role
- an inquiry into the composition, structure and administrative arrangements under which AGSO will operate has been established under Dr Max Richards an Executive Member of the Australian Mining Industry Council (AMIC) and a Board Member of the Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- elements of the Petroleum and Minerals Resource Assessment Programs within AGSO will be merged with the Bureau of Rural Resources (BRR) to create the Bureau of Resource Sciences (BRS); responsibility for the National Resource Information Centre (NRIC) will reside with BRS
- an explicit management system will be established within DPIE to link AGSO's scientific activities with the resource assessment activities of BRS.

AGSO's 1992/93 Work Program was developed in consultation with the AGSO Advisory Council and once again reflects a strong commitment to the National Geoscience Mapping Accord and the Continental Margins Program. As well as providing the knowledge base necessary for the continued development of our exploration industries, AGSO will continue to help resolve national and global issues, notably in relation to land management and the protection of the environment. This is evidenced in AGSO's research program by the further development of the Environmental Geoscience and Groundwater Program.

I formally approve this Work Program and look to AGSO to make a significant contribution to the achievement of Government objectives.

Alan Griffiths

TABLE OF CONTENTS

DPIE MISSION

Resources for Australia's Future

Increase the contribution that the agricultural, minerals, energy, fisheries and forestry industries make to the well being of Australians.

Its strategic goals are:

- Progressive, adaptable and internationally competitive Australian primary and energy industries;
- Sustainable development of the nation's primary and energy resources, with appropriate returns to the community from their use;
- Expanded commercial opportunities and increased returns for Australia's primary and energy products in world markets;
- Provision of accurate information and high quality scientific, economic and policy analysis and advice;
- Safe, healthy and accurately described primary and energy products for export and domestic consumption, produced in a socially acceptable manner;
- Delivery of government services and programs efficiently and effectively.

AGSO MISSION

Geoscience for Australia's Future

Build the geoscientific knowledge of Australia to underpin effective exploration and responsible resource and land use management.

AGSO is Australia's national geological survey and leading earth science research agency. The creativity, professionalism and commitment of all AGSO staff serve the needs of Government, industry and the community by providing information on:

- the geological framework within which investment and strategic exploration decisions can be made more effectively;
- our resources, and their geological and environmental setting, as a basis for development and land use decisions;
- environmental impacts and natural hazards as a basis for developing mitigation strategies.

AGSO will encourage the development of policies which lead, as far as possible, to sustainable resource development, deriving maximum benefit for the Australian community.

AGSO will develop strategies, services and products that deliver the information needed by industry, Government and the community in a timely and cost-effective manner.

AGSO will promote the use of its expertise and services, and those of Australian industry, by overseas countries and organisations, particularly in the Asia-Pacific region.

AGSO's ROLE

Role

- Develop a publicly available, comprehensive and integrated geoscientific knowledge base for the Australian continent, the Australian offshore area and the Australian Antarctic Territory, especially through the provision and coordination of appropriate databases
  - as a basis for encouraging and improving the effectiveness of exploration for Australia's petroleum, mineral and groundwater resources; and
  - for contributing to land use planning and to the resolution of environmental issues, including the mitigation of natural hazards.

- Provide independent and timely scientific and technical advice and information to Government, industry and the public
  - to facilitate the formulation and implementation of policies necessary for the effective management of the land and its petroleum, mineral and groundwater resources.

- Provide special national geoscientific capabilities, such as the geophysical observatory functions of seismic monitoring for both earthquake risk and underground nuclear explosions.

- Participate in appropriate multilateral and bilateral geoscientific programs to contribute to Australia's international policy objectives.

In carrying out its role, AGSO will:

- With the advice of AGSO's Advisory Council, and through wide consultation, especially with the petroleum and mineral exploration industries
  - develop and implement priorities for strategic national geoscientific research;
  - interact with policy areas of the Department of Primary Industries and Energy and with other Government Departments when geoscientific advice and services are required by Government policy;
  - cooperate with State/NT Government agencies, Commonwealth Scientific and Industrial Research Organisation and other geoscience organisations.

AGSO's FUNCTION

AGSO's functions as the principal Commonwealth Government geoscience agency, will be to:

1. Carry out integrated regional geophysical, geological, geochemical, hydrogeological and tectonic surveys and research into, and syntheses of, the onshore basins, mineral provinces and the regolith of continental Australia. Geoscientific maps and data sets, supported where appropriate by published reports, should be regarded as the most important products of the geoscientific research and related studies undertaken by AGSO;

2. Similarly, carry out major integrated studies of the continental margins of Australia and its off-shore territories and other strategic offshore areas;

3. Help establish and coordinate the national geoscientific knowledge base required for the consideration of resource use, land use and environmental issues;

4. Coordinate Government geoscientific data collection activities and develop suitable standards; be a repository of data concerning the geology of Australia and its territories and facilitate the provision of these data for exploration and research;

5. Maintain geophysical observatories in Australia and Antarctica to monitor seismic, geomagnetic and other natural geophysical phenomena and to respond to specific Commonwealth Government requirements such as nuclear monitoring;

6. Provide a national scientific capability in selected specialist areas, as required to support broad-ranging multidisciplinary research programs and collaboration with research personnel from other institutions (e.g.Commonwealth and State/NT agencies, resource companies and universities);

7. As the national geological survey organisation, be a major focus for both national and international geoscience from an Australian perspective;

8. Assist in the development of overseas programs in the geosciences, and participate in bilateral and multilateral programs;

9. Publish and provide information relating to its role and functions, and especially to meet the needs of the Australian petroleum and mineral exploration industries and those concerned with land use planning.

INTRODUCTION

This is the first Annual Work Program for the Australian Geological Survey Organisation (AGSO), formerly called the Bureau of Mineral Resources, Geology and Geophysics (BMR). In this overview, I wish to:

- look at the major changes that have occurred, or are occurring, and place these changes in the context of the role of a national geological survey;
- examine AGSO's strategic directions in the context of portfolio objectives and explain the bases for the development of AGSO's 1992/93 geoscientific research program; and
- provide some general indications of the impacts of these changes on the management of AGSO.

The Establishment of AGSO

The last twelve months have been a time of great change for Australia's principal geoscientific agency. On 13 August 1992, the Federal Minister for Primary Industries and Energy, Mr Simon Crean, and the Minister for Resources, Mr Alan Griffiths, announced a number of changes to the operational and administrative arrangements for BMR. The text of this Joint Statement is provided in Appendix A.

The name of BMR was changed to the Australian Geological Survey Organisation (AGSO), and the resources previously allocated to petroleum and minerals resource assessment within BMR were merged with the former Bureau of Rural Resources (BRR) to form a new Bureau of Resource Sciences (BRS) which will focus on making better use of scientific research and analysis in the development of policy.

As a result, the non-database programs of the Minerals and Petroleum Resource Assessment Programs are no longer included in this document. A management system is being put in place to ensure close linkages between the outputs from AGSO's programs and the requirements of the new Bureau for geoscientific information.

The Richards' Review

The Joint Statement also announced a review into the administrative arrangements under which AGSO operates under the chairmanship of Dr Max Richards, an Executive Member of the Australian Mining Industry Council (AMIC) and a Board Member of the Commonwealth Scientific and Industrial Research Organisation (CSIRO).

The Terms of Reference (see Appendix A) for the review, recognise the need to maintain an integrated and coherent national geological survey organisation with clear identity, which will remain focussed on geoscientific mapping and database development into the longer term. The review will provide an opportunity to develop, and win support for, the national geological survey role in the national interest; and to argue the case for funding arrangements designed to facilitate the most effective and efficient achievement of national goals.

The Role of a National Geological Survey

In developing its national role over the past 46 years, BMR has developed some particular capacities which are unique in Australia, including the capacity to:

- collect major data sets as bases for strategic programs, especially through airborne geophysics, and seismic profiling onshore, and through ship-borne geophysics and geology offshore;

- coordinate geoscientific information on a national scale, especially through cooperation with state geological surveys, to build unique national databases;
- present geoscientific information in a wide range of products, including GIS based products; and
- use a wide range of geoscientific information to assess resource potential and to advise on resource use, land use and environmental issues.

BMR has argued that its strategic research programs, based on major data acquisition programs necessary to improve the knowledge base, are of high priority because they:

- involve research into the natural environment and resources of Australia, which can only be carried out in Australia;
- underpin Australia's most important export industries; and
- provide a bridge of understanding between development and environmental concerns.

These reasons continue to form the basis for AGSO's current programs.

Current Strategic Plan

The Organisation's current strategic plan (1991–1994) aligns AGSO's objectives with the broader goals of the Department of Primary Industries and Energy (DPIE). AGSO serves the needs of Government, industry and the community by:

- developing the geoscience knowledge base to provide incentives for increased and more effective exploration and discovery and thus to promote the sustainable supply of resources;
- encouraging the development of policies which lead, as far as possible, to sustainable resource development, deriving maximum benefit for the Australian community;
- utilising AGSO's accumulating geoscientific knowledge and expertise to provide accurate information and high quality, independent and impartial scientific and technical advice;
- promoting the use of AGSO and Australian industry expertise and services by overseas countries and organisations, particularly in the Asia–Pacific region, and promoting Australia's role as a member of the regional and global community; and
- developing strategies, services and products that deliver the information needed by industry, Government and the community in a timely and cost-effective manner.

Principal strategies in fulfilling these objectives have been to:

- develop geoscientific maps, databases and regional geological analyses through the National Geoscience Mapping Accord and the Continental Margins Program;
- develop improved understanding of the geoscientific aspects of the natural environment by targeting high priority areas and by coordinating the national geoscientific effort;
- develop the content, utility and accessibility of national geoscientific databases;
- provide independent, authoritative geoscientific advice to Government, industry and the public for the management of Australia's resources, development of multiple land use policies, environment protection, the mitigation of natural hazards, and the detection of nuclear explosions; and
- participate in global and regional scientific programs of importance to Australia, especially in relation to resource potential, global data sets and natural variability.

The 1992/93 Annual Work Program

The 1992/93 Annual Work Program reflects the effective completion of the process of implementation of the recommendations of the Woods' Review. The program changes initiated following the

Woods' Review are now well established and delivering tangible outputs and outcomes as summarised in recent editions of Aus-Geo News and the Research Newsletter.

Resource Allocation

AGSO continues to give top priority to the National Geoscience Mapping Accord (NGMA) and the Continental Margins Program (CMP). The effectiveness and efficiency of these two programs will be enhanced in 1992/93 by:

- acquisition of a geophysical mapping processing system, and an upgrading and expansion of the GIS systems for the NGMA;
- further development of the interactive graphics mapping system in the Cartographic Services Unit for speedier and more efficient map production; and
- a sleeve gun upgrade on the RV *Rig Seismic* and a Vax Network upgrade for the CMP.

Appropriation funds allow three RV *Rig Seismic* cruises in 1992/93. Further cruises are being undertaken through external funding for special projects. There will be some reduction of field activities under the NGMA in 1992/93, but priority continues to be given to the acquisition of airborne geophysical data.

The 1992/93 budget has provided additional resources specifically for the upgrade of the earthquake monitoring network over the next few years in recognition of the fact, following the Newcastle earthquake, that the existing network is inadequate.

In developing the 1992/93 Work Program, the Executive recognised the need to improve the balance of program delivery through the following initiatives:

- there must be further staff reductions in each program area in order to maintain operational capabilities;
- recognising the added value of cooperative programs, AGSO must increase its external linkages (e.g. in Cooperative Research Centres);
- programs must ensure that priority is given to product delivery from project work already carried out;
- AGSO must maintain capacity to conduct major geophysical surveys;
- AGSO must continue the process of technological change to improve effectiveness and efficiency in relation to the collection, processing, management and accessing of geoscientific data;
- improvements must continue to be made in planning and priority setting as reflected in the establishment of an Integrated Planning Cycle (see Figure 1); and
- the need for evaluation must be extended to non-scientific areas, as reflected in the planned evaluation of the Business Management Branch in 1993 and the Corporate Relations, Information and Planning Branch in 1994.

Petroleum and Marine Geoscience Group

The work of the Petroleum and Marine Geoscience Group continues in the direction established last year commensurate with the lower level of resources available to the Group. These directions are:

- acquisition of a deep seismic grid to enable development of an understanding of the structure of the North West Shelf region where arguably Australia's future petroleum potential lies;
- further development of a Marine Environmental Program with external agencies on a jointly funded basis;
- continuation of the NGMA Sedimentary Basin Program including a major seismic survey in the Officer Basin, South Australia;

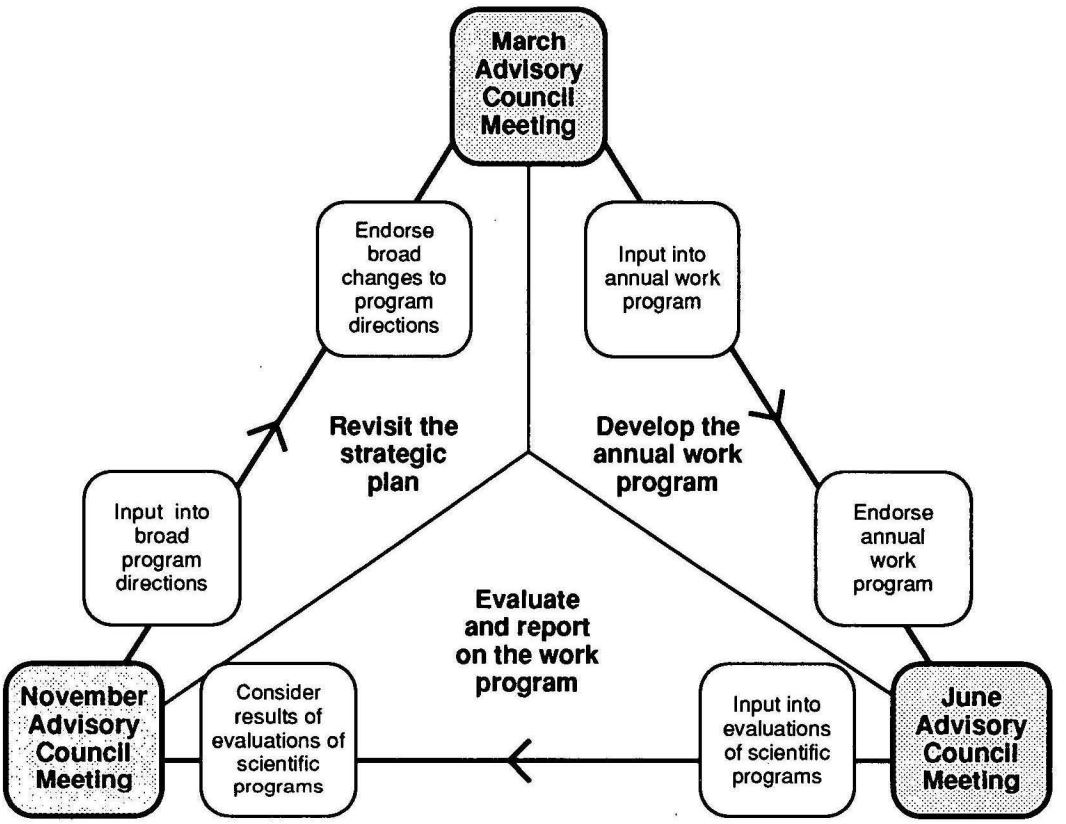


Figure 1. AGSO's integrated planning cycle

- continuation of the 'Petroleum Systems of Australia' project involving sponsorship by fourteen petroleum companies; and
- continuation of the development of the National Petroleum Database through development of additional modules related to stratigraphy and biostratigraphy.

To facilitate the provision of information on Australia's petroleum geology and petroleum systems, new techniques and procedures are being developed for handling, analysis and presentation of information in a digital form.

Minerals and Environment Group

The program for the Minerals and Environment Group will continue to focus on the NGMA and the development of strategies to mitigate the impacts of natural hazards and human activities. The main directions are:

- continuation of NGMA mapping and data releases from the Eastern Goldfields, Kimberley–Arunta, Arnhem Land, Lachlan, Musgrave and North Queensland projects;
- development of GIS and its application to metallogenic studies;
- development of coastal zone geoscience and palaeoclimatic databases;
- development of techniques for mapping soils and land degradation using airborne geophysical data;
- commencement of a three year program in cooperation with State Governments to monitor major urban areas for earthquake risk;
- continuation of monitoring of nuclear explosions;
- in cooperation with State and Commonwealth agencies, development of a perspective on water quality issues and programs on groundwater aspects of land degradation and management;
- continuation of mapping and data releases from the Murray–Darling Basin and Great Artesian Basin projects;
- continuation of monitoring of the geomagnetic field; and
- updating and modernising data acquisition, computing systems and database design and coordination.

RWR Rutland
Executive Director
Australian Geological Survey Organisation

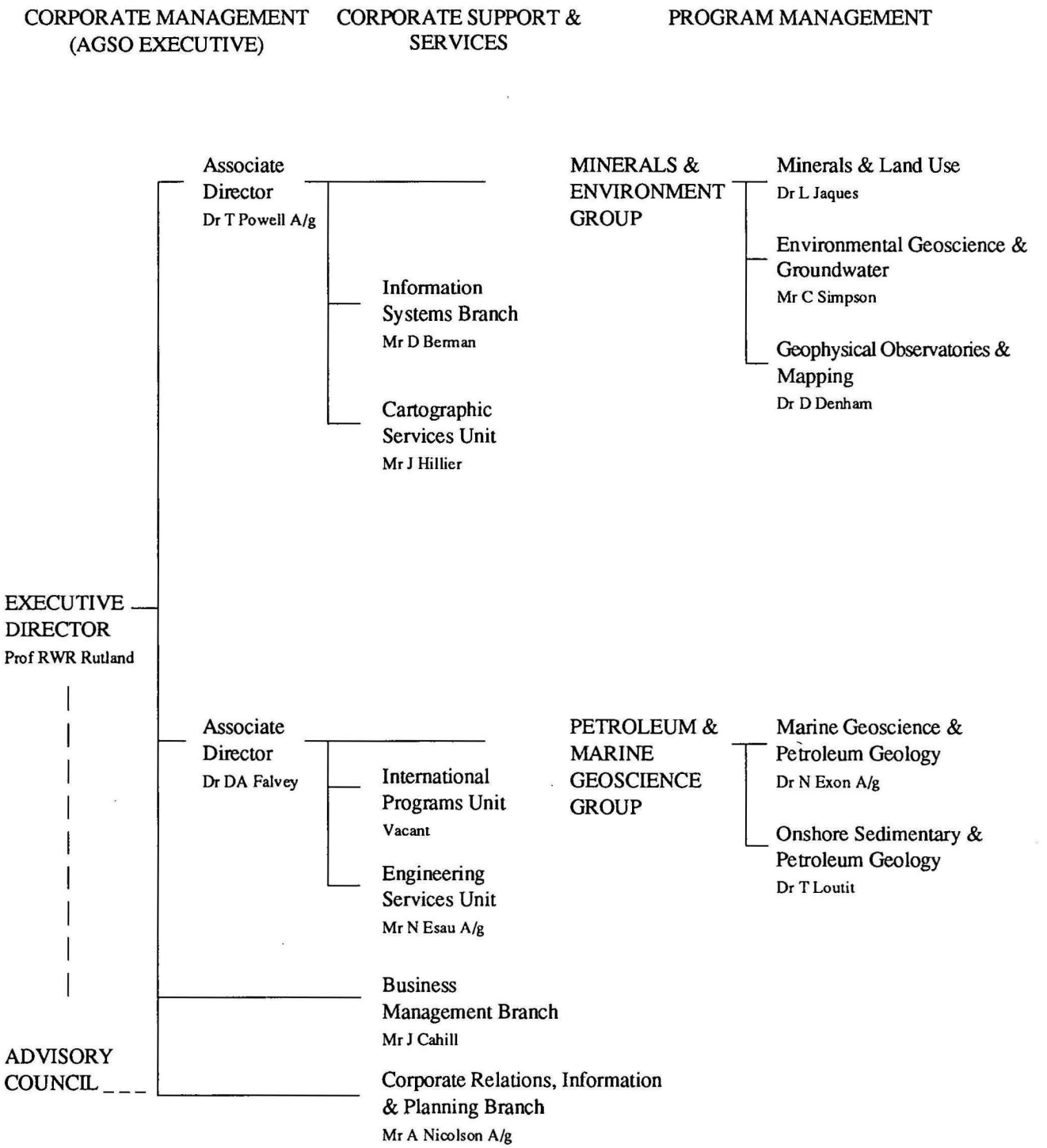
November 1992

AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

AGSO

AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

ORGANISATIONAL STRUCTURE



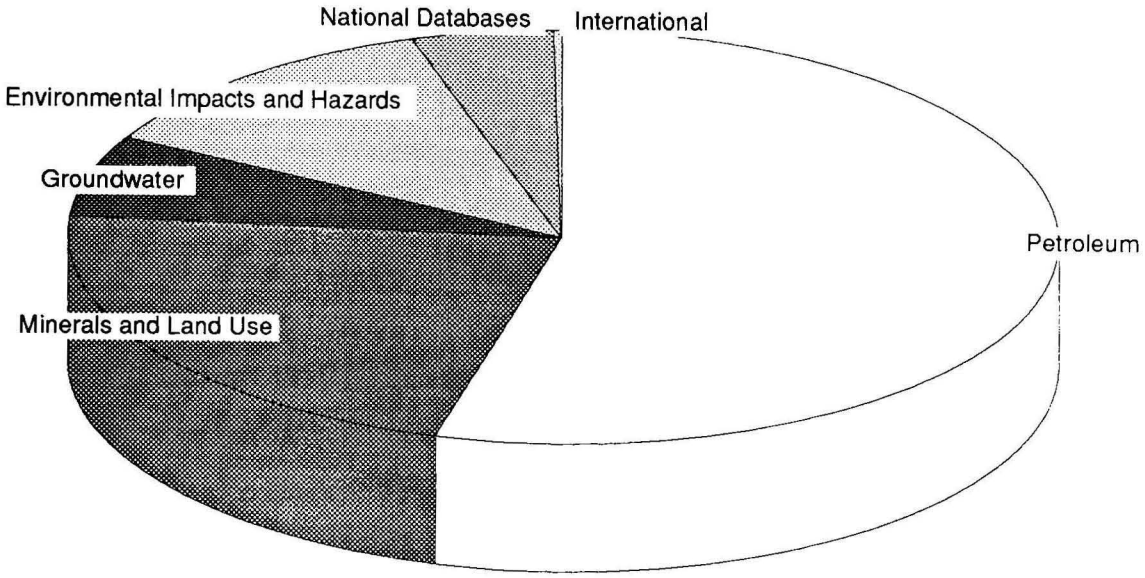
PLANNED SCIENTIFIC PROGRAM 1992/93

	$'m	%
PETROLEUM	**27.06**	**54.25**
110: Onshore Sedimentary Basins (1)	5.18	
120: Continental Margins	21.88	
MINERALS AND LAND USE	**11.06**	**22.17**
210: Mineral Provinces (1)	7.29	
221: Geophysical Mapping (1)	3.77	
GROUNDWATER	**3.18**	**6.37**
241: Groundwater	3.18	
ENVIRONMENTAL IMPACTS AND HAZARDS	**6.12**	**12.26**
120: Continental Margins Program (2)		
222: Australian Seismological Centre	2.59	
224: Geomagnetism	2.35	
242: Environmental Geoscience	1.18	
NATIONAL DATABASE COORDINATION AND RESEARCH	**2.35**	**4.72**
261: National Database Coordination and Research	2.35	
INTERNATIONAL DEVELOPMENT ASSISTANCE AND COOPERATION	**0.12**	**0.24**
120: Continental Margins Program (2)		
242: Environmental Geoscience (3)		
317: International Programs Unit	0.12	
TOTAL	**49.89**	

(1) Largely National Geoscience Mapping Accord
(2) Resources included under Petroleum, Continental Margins Program
(3) Resources included under Environmental Impacts and Hazards, Environmental Geoscience

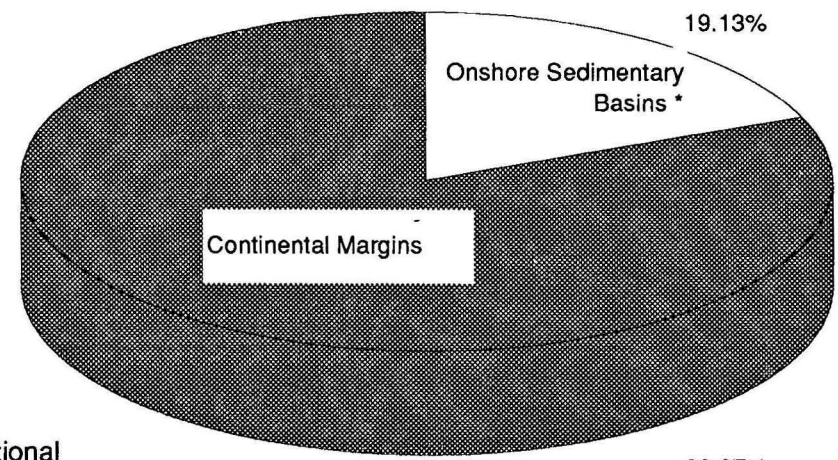
NB: All corporate costs have been proportionately allocated across the programs

Planned Scientific Program 1992/93



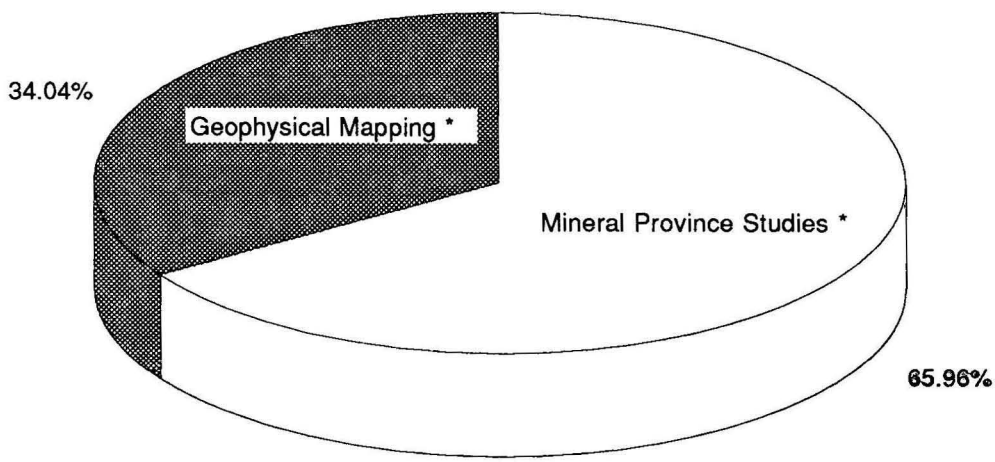
PLANNED RESOURCE USE BY KEY RESULT AREA

Petroleum ($27.06m)



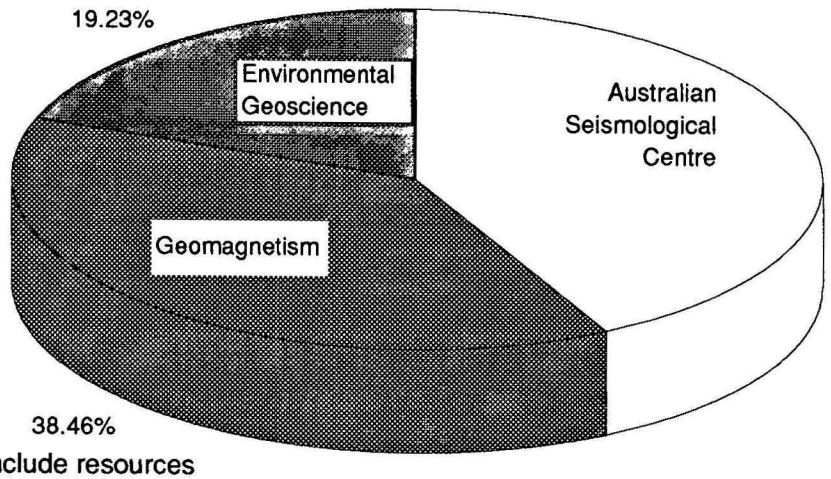
* Largely National Geoscience Mapping Accord

Minerals and Land Use ($11.06m)



* Largely National Geoscience Mapping Accord

Environmental Impacts and Hazards ($6.12m)*



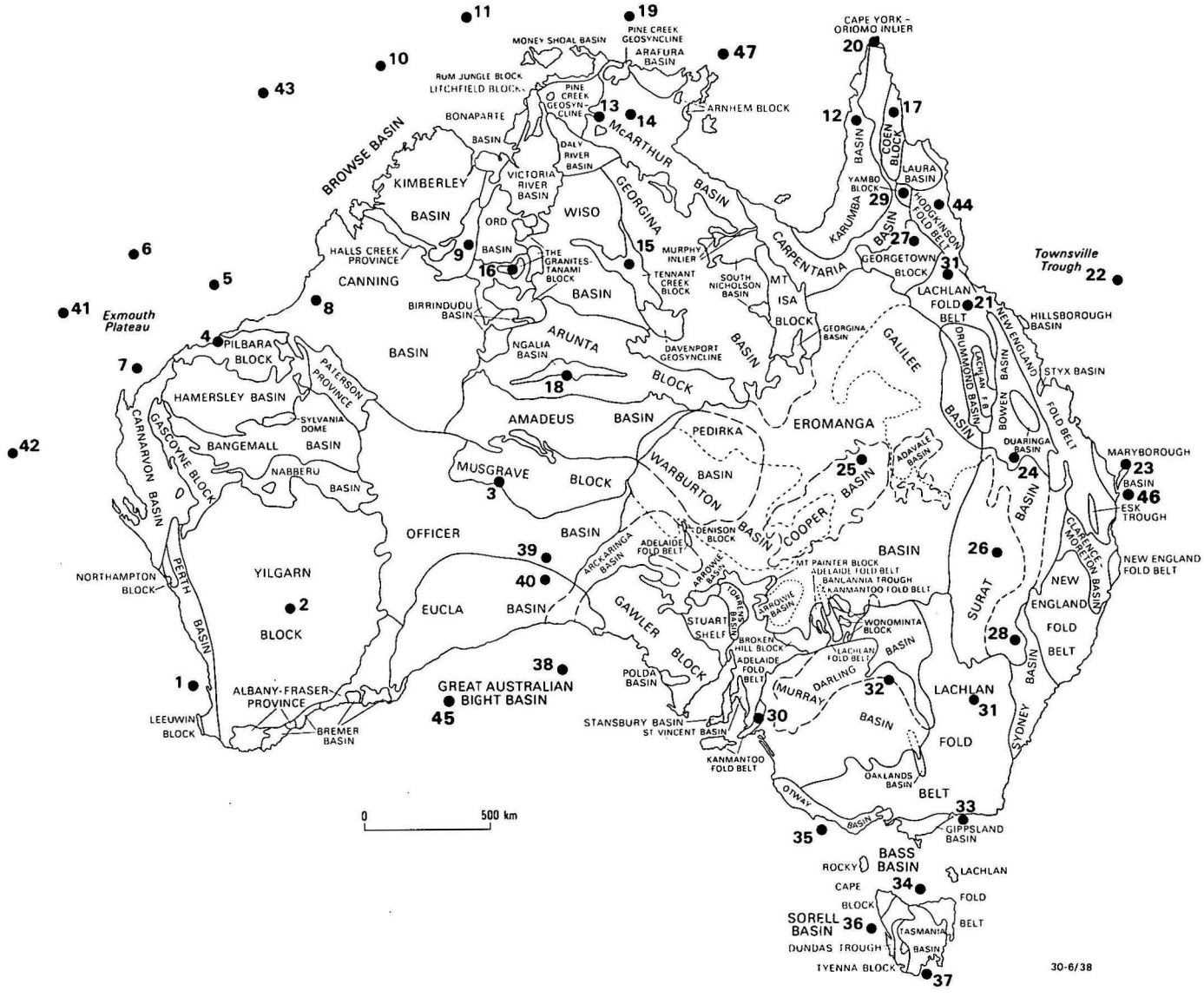
* Does not include resources from Continental Margins Program

GROUNDWATER – $3.18 million

NATIONAL DATABASE COORDINATION AND RESEARCH – $2.35 million

INTERNATIONAL DEVELOPMENT ASSISTANCE AND COOPERATION – $0.12 million

LOCALITY INDEX



LOCALITY — PROJECTS

111: ONSHORE SEDIMENTARY BASINS

Objectives

Provide the geological basis for resource assessment and advice to government on the sustainable development of resources in onshore basins.

Encourage exploration, particularly for petroleum, in onshore basins.

Relevance

The level of onshore exploration for petroleum, as measured by seismic acquisition and drilling statistics, has declined in recent years, with exploration confined to relatively few areas of perceived higher prospectivity and with established infrastructure. As much as half of Australia's onshore sedimentary basins can be considered frontier exploration areas by world standards; even many of our most heavily explored areas are relatively underexplored by North American standards. In the short term, it will be necessary to establish reliable estimates of the resources within all of our sedimentary basins as part of the debate on multiple land use issues and sustainable development; in the longer term, it will be necessary to encourage exploration in the less well explored basins in order to maximise Australia's self sufficiency.

The Onshore Sedimentary and Petroleum Geology (OSPG) Program comprises a number of projects that can be conveniently grouped into:

- integrated, multidisciplinary studies of sedimentary basins; these projects are part of the National Geoscience Mapping Accord (NGMA) and are conducted jointly with the state geological surveys or mines departments in the relevant states
- discipline-based studies which transcend basin boundaries, including the development of a Phanerozoic timescale for Australia and a study of the isotopic and organic geochemical systematics of Australian oils and gases; these projects provide input to all of the basin projects as well as to the Continental Margins Program; and
- framework studies, which draw on the results of the basin and discipline-based studies to produce Australia-wide maps of sedimentary basins, and palaeogeography; these projects not only provide valuable data syntheses but also enable the ongoing assessment and evaluation of the basins not under immediate study.

The development of the program is done within an increasing framework of consultation with industry and the State and Territory geological surveys. In particular, the palaeogeographic studies have just entered their third 3 year phase sponsored 50% by national and international petroleum companies through the Australian Petroleum Industry Research Association (APIRA).

Output from the program will be in the form of a range of geographically located data sets, databases, maps and publications related to the formation of fossil fuels and the age and evolutionary history of major sedimentary basins.

Activities

Generate knowledge and understanding of the geological framework of onshore sedimentary basins.

Define onshore petroleum potential.

Develop models of geological processes for the formation of onshore basins which have led to economic accumulations of petroleum and minerals.

Provide an up-to-date geological framework of Australian sedimentary basins using available public and industry data.

Collect and analyse new seismic and drilling data.

Highlights for 1991/92

Released the first stage folios of structure contour and isopach maps of the NGMA Projects in the Canning Basin and Sedimentary Basins of Eastern Australia.

The Canning Basin Project released a folio of digitised sequence stratigraphic interpretations of key seismic lines and a folio of interpreted logs from wells on the Lennard shelf, and also identified two new play concepts for the Lennard shelf.

Showed that seismic profiling would not produce useful data in the southern Officer Basin, and shifted the focus of the project to the northern basin. Obtained agreement in principle from the Aboriginal communities for access for the seismic crew. Interpreted a skeleton network of regional seismic lines and digitised horizons.

Initiated an NGMA project in the onshore Otway Basin. Acquired 450 kms of seismic data; data processing has begun.

Completed implementation of PETROSEIS mapping software in all basin mapping projects, to store, sort and display map data. Added the Esso STRATDAT database to Oracle databases of point data for storing interpretive horizon data from wells.

Started a pilot project to study the feasibility of using GIS technology in mapping applications in petroleum provinces.

Completed the second 3 year phase of the joint BMR/APIRA palaeogeography project, Phanerozoic Geohistory of Australia, and began a third 3 year phase, Australian Petroleum Systems.

Published the map folio on the palaeogeography of the Jurassic.

Released the last of a set of BMR Records detailing a timescale for the Phanerozoic of Australia.

Initiated a program for determining the absolute ages of key boundaries using single zircon geochronology, in association with the SHRIMP Group at the Research School of Earth Sciences, Australian National University and the University of New South Wales.

Published a catalogue of Bryozoa housed in the Commonwealth Palaeontological Collection.

Continued geochemical studies of oils, gases and source rocks from the North West Shelf, the Cooper/Eromanga Basins and the Surat Basin.

Enlarged ORGCHEM database of geochemical information on Australian oils, with several sales to exploration companies.

Goals for 1992/93

Continue mapping activities in the Canning, East Australian, Officer and Otway Basins as a commitment to the NGMA.

Begin mapping in new areas of the Canning and Eastern Australian Basins.

Begin recording a set of regional seismic lines in the Officer Basin, and interpret existing industry data.

Process AGSO's seismic data in the Otway Basin and, later in the year, interpret AGSO and industry data.

Concentrate palaeogeography studies on the Browse Basin and Dampier Sub-basin/Rankin Trend; emphasis late in the year will shift to the Papuan Basin and the Exmouth and Barrow Sub-basins.

Continue to revise the Phanerozoic timescale; emphasise those parts of the timescale of relevance to basin studies and petroleum exploration. Publish results, probably in the form of a single volume and a wall chart.

Absolute age dating using SHRIMP will focus on the Mesozoic.

Focus geochemical studies on oil from offshore northern and western Australia, from the Cooper and Eromanga Basins, the Bowen and Surat Basins and from Tasmania.

Compile a map showing the distribution and thickness of all Australia basins.

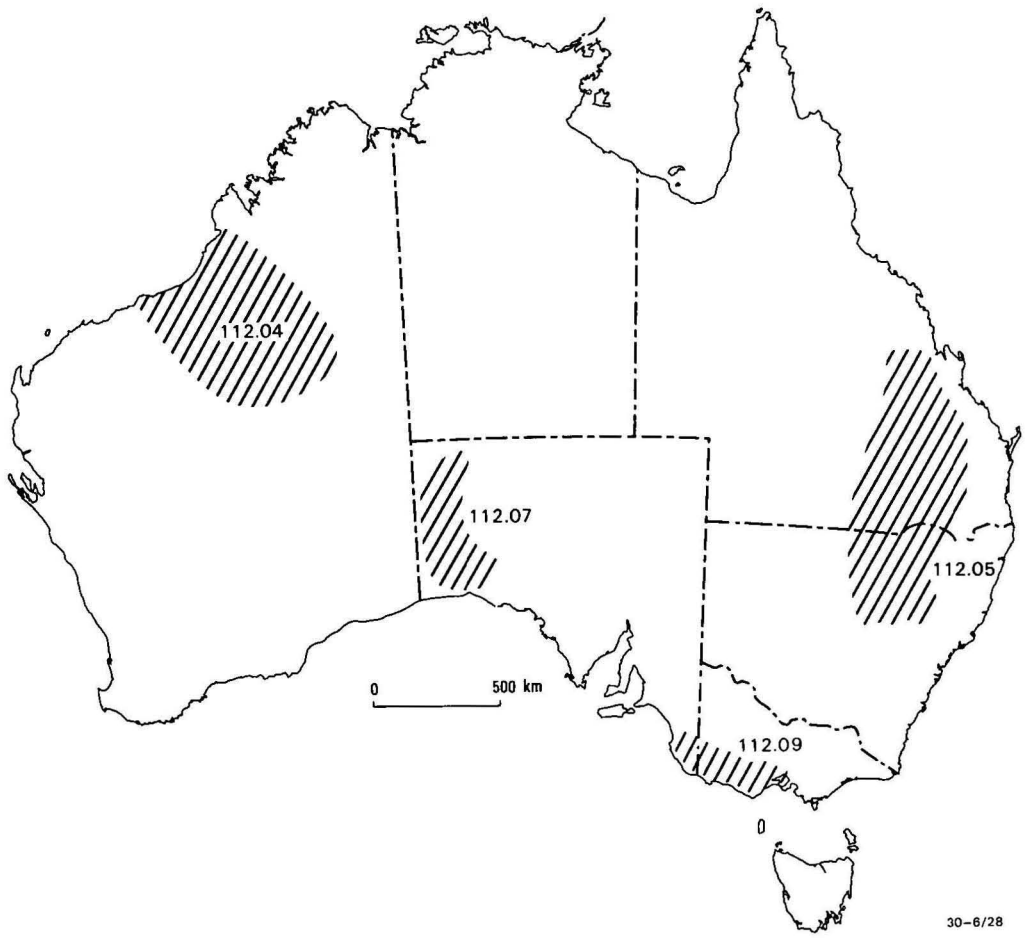
Print the southern sheet of the Tectonic Map of the Tasman Fold Belt, and complete drafting of the northern sheet.

ONSHORE SEDIMENTARY BASINS

Component manager Tom Loutit 06 249 9397

Component projects

111.02B	Australian Petroleum Systems
111.03	Phanerozoic Timescales
111.04	Controls on oil source bed occurrence and composition
112.04	Canning Basin (NGMA Project)
112.05	Sedimentary Basins of Eastern Australia (NGMA Project)
112.06	Tectonic map of the Tasman Fold Belt system
112.07	Officer Basin (NGMA Project)
112.08	National petroleum maps
112.09	Early development of the Otway Basin (NGMA Project)
113.01	Petroleum Group and Industry Information Systems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Project 111.02B Australian Petroleum Systems

Project manager	John Bradshaw	06 249 9659; fax 06 257 6465
Program responsibility	Onshore Sedimentary and Petroleum Geology	
Timeframe	February 1992–1995	

Objective

Determine the controls on hydrocarbon occurrence in several petroleum systems, seeing how palaeogeography affects and is controlled by geological processes.

Relevance

The project is a cooperative research project between AGSO and APIRA, the Petroleum Division of the Australian Mineral Industries Research Association, funded on a 50/50 basis by government and industry. AGSO's Australia-wide activities and its national database, especially in offshore areas, enable it to coordinate a consistent approach to analysis of aspects of hydrocarbon occurrence on a regional basis.

Six petroleum systems have been defined from the two previously sponsored projects, the Palaeogeographic Maps and the Phanerozoic History projects. These systems are all prospective for hydrocarbons and will link coeval basins with similar:

- palaeogeography, source, reservoir and seal
- tectonics, trap formation and maturation
- hydrocarbon prospectivity.

The project has a modular structure focusing on individual basins within each Petroleum System. Companies can choose to sponsor the entire project for three years or individual basin modules. The choice of basins is decided jointly by participants, with consideration for the planned timetable of acreage release outlined in the Government's Offshore Strategy document.

Expected outcomes

A better understanding of the factors that control hydrocarbon accumulation.

A method for consistently relating and making predictions between basins that have common factors.

Activities

Emphasise biostratigraphic control and the subdivision of the analysis into timeslices. This will maintain a link to the products of the previous projects and enable easy comparison of different areas. Predictive analysis based on results from well studied areas, can be applied in those areas where there is poor or little control. New approaches and ideas will be identified in more mature areas.

Develop a relational database of biostratigraphic zone and depth pairs, in conjunction with databases of prospectivity information, such as reservoir data, hydrocarbon shows and total organic carbon content. These databases will be linked to the PEDIN database. A series of palaeogeographic data and interpretative maps will be prepared for selected times slices, as well as regional cross-sections.

Complete 9 – 12 basin modules in the three years of the project. The first five modules to be studied are the Dampier/Rankin, Browse, Papuan, Barrow/Exmouth and Vulcan. Future modules to be studied will be decided at sponsors' meetings which are to be held on a regular basis.

Expected products

The anticipated products for each basin module are:

- regional location map
- well location and hydrocarbon occurrence map
- regional cross-sections including orthorhombic diagrams, generalised structural element and subcrop maps

- interpreted and uninterpreted representative seismic lines
- summary stratigraphic column tabulating reservoir, source and hydrocarbon show information by timeslice
- timeslice data maps compiled from well, seismic and outcrop information, showing lithology, thickness, depth to top of timeslice, reservoir and source parameters and hydrocarbon occurrence
- timeslice interpretation maps showing depositional environments and isopachs overlain on regional structure
- timeslice palaeogeographic maps of Australia showing palaeoenvironments in colour and annotating significant features of the petroleum geology in more explored coeval basins
- global plate reconstructions for selected timeslices showing the location of significant petroleum occurrences in more explored coeval basins
- well analysis data sheets
- well summary time(age)/depth plots
- table of hydrocarbon occurrences
- table of well information
- table of play types
- computer database of information compiled for module study
  - reservoir and source parameters
  - biostratigraphic age control
  - timeslice picks
  - environmental interpretation from log, core and cuttings
- maturation profiles along regional cross-sections.

Highlights for 1991/92

The project was launched in late 1991 and had sufficient sponsors to start in early 1992. New staff were in place by March 1992.

Esso (Aust.) contributed to the project and BMR the framework and data of their in-house biostratigraphic database (STRATDAT). The database represents a major contribution to the BMR's database system and, after migration to the BMR's Oracle database management system, updating and modifications has potential to develop into a national database.

The Papua New Guinea Department of Minerals and Energy (Petroleum Division) has provided access to data from the Papuan Basin. This module will provide feedback to areas of the North West Shelf, as they are coeval basins within the same Petroleum System, and have numerous factors in common, including source and reservoir horizons.

Goals for 1992/93

Complete the Dampier/Rankin and Browse modules.

Start interpreting the Papuan and Barrow/Exmouth modules.

Conduct a two day workshop at the AAPG International Conference in Sydney – August 1992.

Present two papers at the AAPG conference on Petroleum Systems and the Arafura Basin.

Hold second sponsors' meeting in Canberra – 10 – 11 August 1992.

Clients

The companies sponsoring the project are:

Ampol

Amoco Production Co

BHP Petroleum

British Petroleum

Bridge Oil Ltd

Canadian Occidental Petroleum

CONOCO Australia Ltd

ESSO Australia

LASMO Oil (Australia Ltd)

Mobil New Exploration Ventures Co

SANTOS

TEXACO Oil Development Co

Union Texas Co

Woodside Petroleum

Cooperating agencies

Petroleum Division of the Australian Minerals Industry Research Association

State Geological Surveys

Marine Geoscience and Petroleum Geology Program, AGSO

Petroleum Resource Branch, BRS, DPIE

Kevin Hill, Alan Partridge, Latrobe University

Petroleum Division, Papua New Guinea Department of Minerals and Energy

Project 111.03 Phanerozoic Timescales

Project manager	John Shergold 06 249 9410
Program responsibility	Onshore Sedimentary and Petroleum Geology
Timeframe	1983–ongoing

Objectives

Develop an integrated chronological framework for Australian Phanerozoic sedimentary sequences using palaeontological, geochronological, magnetostratigraphic and geochemical techniques.

Apply time framework to the solution of geological and resource exploration problems.

Relevance

Framework studies, including their accompanying taxonomic, magnetostratigraphic, geochronologic and isotopic studies, are the basis for correlating sedimentary sequences. Because of Australia's unique position in the southern hemisphere correlation systems are not readily adopted from overseas and it is necessary to establish an Australian Time Scale.

As a result there is a strong and ongoing demand for an integrated chronological framework in order to understand the sequences and timing of events in the history of sedimentary basins and, on a broader scale, provide a framework for continent wide studies of Australian earth history.

Project personnel apply the framework developed here in a number of other projects, chiefly those concerned with basin analysis and the Phanerozoic geohistory of Australia (see Projects 111.02, 112.04 and 112.05).

Expected outcome

An improved Australian Phanerozoic timescale, leading to better age control on exploration and other geological studies.

Activities

Produce a revised Phanerozoic Timescales Series to provide a basis for an improved Australian timescale, through both discipline based research to provide new data, and the synthesis of existing data from the latest biostratigraphic and geochronological research.

Provide client services requiring biostratigraphic, biogeographic, palaeoenvironmental information, age dating and thermal maturation analysis in support of basin studies, NGMA projects, and the Continental Margins Program.

Manage the national fossil collections and Phanerozoic biostratigraphic and geochronologic databases (PALEO, STRATDAT, STRATAGE) as an information resource.

Expected products

A single volume edition of Australian Phanerozoic Timescale, updated at regular intervals.

An Australian Phanerozoic timescale wallchart, updated at regular intervals.

Reviews of the biostratigraphy of sedimentary basins to support basin studies.

Catalogues of fossils held in the national collections.

Scientific papers, reports, posters and publicity material.

Highlights for 1991/92

Completed and published the provisional series of Australian Phanerozoic Timescales (Cambrian–Cainozoic) (BMR Records 1989/31–40).

Completed and published a study of the Pacoota Sandstone, Amadeus Basin, central Australia (BMR Bulletin 237).

Released a palynological review of the Eastern Australian Basins (BMR Record 1992/5).

Contributed to Canning Basin Stage 1 studies by releasing summaries of biostratigraphic sequences in wells Langoora #1 and Mimosa #1 (BMR Professional Opinions 1991/4 and 1992/2), and producing a palaeontological overview of wells studied to date (BMR Record 1992/2).

Palynological review of UOD Cockatoo Creek #1 and kerogen assessment of selected samples used in geochemical/source rock studies in Eastern Australian basins.

Integrated new conodont/trilobite biostratigraphy with magnetostratigraphy and stable isotope chemo-stratigraphy across the Cambrian–Ordovician boundary in the Georgina Basin.

Produced abstracts and guidebooks as contribution to 6th International Symposium on Ordovician System (BMR Records 1991/47–51).

Produced catalogue of the fossil Bryozoa in the Commonwealth Palaeontological Collection (BMR Report 305).

Published the definitive date on the Devonian–Carboniferous boundary based on single zircon SHRIMP technology.

Goals for 1992/93

Continue to review the Phanerozoic timescale, with growing emphasis on the Mesozoic of the North West Shelf.

Provide radiometric SHRIMP dates for the Carboniferous–Permian of the eastern Australian basins, and for the Jurassic–Cretaceous of the North West Shelf.

Continue commitment to Canning Basin Palaeozoic Studies.

Provide palynofloral correlations between the Early Permian of the Carnarvon Basin in Western Australia and the Cranky Corner Basin in eastern Australia.

Integrate palaeontologically related databases.

Produce a unified Australian Phanerozoic Timescale volume and wallchart.

Produce fossil catalogues for Cnidaria, Archaeocyatha and Porifera in the Commonwealth Palaeontological Collection.

Clients

Exploration companies in the Australian petroleum and mineral exploration industries

Working palaeontologists, geochronologists, magnetostratigraphers

Other AGSO programs and projects (MLU, Marine, 111.02B, 112.04, 112.05, 112.07, 112.09, 121.23, 121.26, 121.31, 224.03)

IUGS Commission on Stratigraphy, various subcommissions; IGCP

Cooperating agencies

State geological surveys

NZ Geological Survey

CALTECH

Weizmann Institute, Israel

Ruhr Universität, Bochum, Germany

University of Hamburg, Germany

ANU

Monash University

Melbourne University

Macquarie University

Sydney University

Newcastle University

University of Adelaide

University of Tasmania

University of New England

University of New South Wales

University of Queensland

University of Western Australia

South Australian Institute of Technology

Australian Museum

Queensland Museum

Western Australian Museum

Santos Ltd

Western Mining Corp Ltd

Union Texas (South East Asia) Inc.

Bligh Oil and Minerals N.L.

Geomar, Kiel, Germany

BHP/Utah

Project 111.04 Controls on oil source bed occurrence and composition

Project manager	Roger Summons 06 249 9515
Program responsibility	Onshore Sedimentary and Petroleum Geology
Timeframe	1987–ongoing

Objectives

Develop an understanding of the factors which control formation, degradation, preservation and maturation of hydrocarbon-prone organic matter with emphasis on the essential role of microbes in early diagenesis. Particular importance is placed on Australian circumstances and Australian exploration objectives.

Develop predictive models of source rock distribution based on depositional setting, geochemical signature and thermal maturation.

Provide an accessible database of organic geochemical information for AGSO and for the petroleum industry.

Relevance

Understanding the distribution of source rocks and controls on the composition of hydrocarbon-prone organic matter is fundamental for determining petroleum prospectivity through analyses of source rocks, oils, gases and the parent organic matter.

The project is developing conceptual models and diagnostic geochemical tools to be used in petroleum exploration.

All geochemical analyses are stored in an Oracle relational database, for use by the exploration industry. The database is continually updated.

Individual work priorities are determined by the requirements of current AGSO basin studies and by collaborative projects with clients in the exploration industry.

Expected outcomes

An improved understanding of how oil occurrence and composition are influenced by

- the nature of the primary organic matter
- depositional setting
- maturation history.

More effective correlation of oils with their source beds.

More effective use of geochemical tools in petroleum exploration.

Activities

Characterise Australian oils and source rocks, including materials from frontier areas.

Collaborate with Australian explorationists in studies of immediate relevance.

Participate in local and international studies of major source rock sequences which are pertinent to evaluation of Australian petroleum systems.

Identify new biomarkers and develop new correlation and analytical methods.

Develop diagnostic correlation tools based on combinations of carbon isotopic and molecular signatures.

Prepare reports and data releases on these topics.

Expected products

Database of oil and source rock characteristics.

Comprehensive reports describing hydrocarbon characteristics of principal oils and source horizons.

Research papers.

Goals for 1992/93

Compare composition of oils from the Cooper/Eromanga Basin system with age equivalents from the Bowen/Surat.

Assess the applicability of aromatic source and maturity parameters for delineation of the origins and relative maturities of eastern Australian oils.

Collaborate with industry clients on biomarker and isotopic characterisation of northern and western Australian oils and source rocks.

Collaborate in the evaluation of Tasmanian source rocks.

Maintain the currency of the ORGCHEM database.

Study the lipids and carbon isotopic fractionations of some of the principal microbes involved in generation of oil-prone organic matter.

Clients

Petroleum exploration companies in Australia and overseas

Specific research projects are underway with

Pacific Oil and Gas

Hadson Energy Ltd

Australian Worldwide Exploration

BHP Petroleum Ltd and BHP Collieries

Cooperating agencies

Oil companies on an opportunity basis, now:

Pacific Oil and Gas

Hadson Energy Ltd

Australian Worldwide Exploration

BHP Petroleum Ltd and BHP Collieries

Chevron Oil Field Research Company

JK Volkman, PD Nichols, Division of Oceanography, CSIRO, Hobart

R Capon and students, Chemistry Department, Melbourne University

D McKirdy and students, Geology Department, Adelaide University

R Alexander, R Kagi and students, Applied Chemistry, Curtin University

J M Hayes and associates, Biogeochemical Laboratories, Indiana University

LL Jahnke, NASA Ames Research Center California

Project 112.04 Canning Basin (NGMA Project)

Project manager	Jim Jackson	06 249 9205
Program responsibility	Onshore Sedimentary and Petroleum Geology	
Timeframe	1987–1993	

Objective

Improve knowledge of the structural and stratigraphic evolution of the basin to encourage more effective and efficient exploration for resources, especially petroleum.

Relevance

Despite more than 20 years of active exploration in the Canning Basin (one of Australia's largest onshore basins) results have generally been disappointing; hydrocarbons, base metals and evaporites have been discovered and exploited to a small extent. AGSO and some industry assessments of prospectivity suggest that the basin has not yet realised its potential.

The project will integrate deep seismic reflection data and shallower company data using the modern method of sequence stratigraphy across much larger areas than conventional exploration permits. This compilation, review and appraisal of the vast amount of recently acquired data will help to streamline the process of resource assessment with the aim of identifying and documenting new play concepts.

This project is part of the NGMA in cooperation with the Geological Survey of Western Australia and, as such, will present results in databases and map folios.

Expected outcomes

Better constrained assessments of the resource potential of the Broome Arch and southern margin of the Fitzroy Trough.

Renewed interest in exploration in this part of the basin, if assessments are positive.

Activities

Compile sets of shallow company seismic and well data for the western onshore Lennard Shelf, Fitzroy Trough, Jurgurra Terrace, Broome Arch, and Willara Basin.

Reinterpret these data using sequence stratigraphic methods, and tie the results into BMR's 1988 deep reflection profiles across the basin.

Undertake biostratigraphic reviews of critical wells to improve dating and correlation of the seismic sequences.

Compile digital database of these interpretations.

Generate structural element, structure contour and isopach maps and cross-sections to illustrate the important features of the geological evolution of the basin.

Undertake seismic modelling, on AGSO's Interactive Seismic Modelling System, of small areas with good well control to test the potential of the technique for improving predrill stratigraphic and structural predictions; hence, assist in validation of play concepts.

Complete compilation and issue of regional aeromagnetic and gravity data of the basin (Geophysical Observatories and Mapping Program) to supplement the regional structural elements map.

Develop tectonic models for evolution of structural provinces in the basin.

Write reports/papers.

Expected products

Maps (probably at 1:250 000 or 1:1 million scale)

- structure contours on main sequence boundaries
- isopachs of important sequences
- structural features, subdivisions.

Well summary sheets (available as PETROSEIS, PEP or ASCII format tapes/discs and hardcopy)

Reports (synthesis of Ordovician biostratigraphy; assessment of play concepts, Broome Arch area).

Professional Opinions for selected wells.

Highlights for 1991/92

Successfully applied sequence stratigraphic techniques to subsurface data, and its extension to outcrop (paper in *Geology*) in the western onshore Lennard Shelf. This has significantly improved well–well and well–seismic correlations, and enhanced knowledge on the main stratigraphic features relevant in petroleum exploration.

Established the Canning Basin at national and international conferences as a classic area for subsurface study of the evolution of mixed carbonate-clastic platform margins in an extensional tectonic setting. Requests have been received to publish the data in APEA and a special issue of AAPG, and to develop a sequence stratigraphic teaching package for Australian universities.

Identified two new untested petroleum plays and the elucidation of the setting and evolution of a third partially-tested play in the Devonian–Carboniferous. Our work has encouraged current permit holders to vigorously assess and develop, for joint-venturing, the most promising of these new play concepts—large lowstand basin floor fans off the edge of the Lennard Shelf. In addition, foreign exploration companies are showing interest in the basin.

Completed a basin wide review of the Ordovician, with an assessment of regional maturation patterns. This is benefiting explorationists by more accurately defining a suitable area to look for petroleum plays where the oil is expected to have originated from the Ordovician.

Released results of the initial biostratigraphic reviews of existing wells in the Lennard Shelf. This information proved invaluable for subdivision and correlation of the Givetian–Tournaisian seismic sequences and has had a positive impact on clients, as they have instigated and financially supported palaeontological studies.

Goals for 1992/93

Produce a uniform data set of geological information, to assist resource exploration planning.

Extend the sequence stratigraphic scheme developed in the Lennard Shelf to the southwest across the Fitzroy Trough on to the Broome Arch to elucidate the stratigraphic and structural evolution of the Ordovician to Permian sequences in the various tectonic subdivisions of this area.

Re-assess and re-evaluate existing petroleum plays.

Develop new play concepts, if possible.

Assess the applicability of seismic modelling to solve stratigraphic/structural inconsistencies at well sites.

Complete publication of the detailed biostratigraphic zonation for the Ordovician from the Prices Creek area.

Improve understanding of some of the major structural features and subdivisions of the basin.

Complete a transect of the central basin, including subsidence models (to be done by Lamont–Doherty).

Clients

The Australian petroleum industry

Current and prospective lease holders in the Canning Basin.

Earth science departments of Australian universities.

Cooperating agencies

Dr P E Playford, Geological Survey of Western Australia

Professor C Powell, Geology Department, University of Western Australia

Dr N Christie-Blick, Lamont Doherty Geological Observatory of Columbia University, New York

Dr H McQueen, Australian National University

Dr B Goldstein, Bridge Oil Ltd, Sydney

Project 112.05 Sedimentary Basins of Eastern Australia (NGMA Project)

Project manager	Russell Korsch 06 249 9495
Program responsibility	Onshore Sedimentary and Petroleum Geology
Timeframe	1990–1994

Objectives

Enhance our knowledge of, and develop models for, the origin and evolution of the Gunnedah, Surat, southern Bowen and associated basins in eastern Australia

Relate these models to potential hydrocarbon occurrences as a basis for future exploration and assessment of resources

Relevance

The late Palaeozoic Bowen and Gunnedah Basins and the Mesozoic Surat Basin contain vast coal resources and are moderately prospective for hydrocarbons, being close to major markets.

There is considerable uncertainty as to the geometry of the basins, the mode of formation (extension, transtension, foreland loading), the relation of basin development to tectonic events in the adjacent orogen, and the implications for the timing of hydrocarbon generation and accumulation. There is also considerable uncertainty as to the timing of events because of poor time control on local biozones.

The area of interest includes southern Queensland and northern New South Wales, and there is a requirement to rationalise geological concepts across the border.

The project is being undertaken under the NGMA in cooperation with the Geological Survey of Queensland and the New South Wales Department of Mineral Resources (NSW Geological Survey and Coal & Petroleum Geology Branch).

Expected outcome

Enhanced exploration for fossil fuels in the Bowen, Gunnedah and Surat basins. This will be achieved by updating the understanding of the geology of the basins and by providing information to explain the distribution of known, potential and undiscovered occurrences of fossil fuels.

Activities

Determine the structure and tectonic and thermal history.

Determine the distribution, thickness, tectonic setting and structural evolution of the component stratigraphic packages.

Determine maturation and burial history.

Analyse industry seismic data and petroleum exploration wells.

Revise biostratigraphy.

Refine the absolute ages of sedimentary sequences.

Collect and analyse 500 kms of deep seismic data.

Analyse maturation patterns and oil source correlations.

Display data in maps at 1:1 million scale.

Expected products

Map folio (1:1 million and larger scales) of various stratigraphic, structural and geochemical features; the maps will be available in hard copy and digital formats.

Digital database, especially of seismic information.

Initial reports as AGSO Records and interim maps of selected areas, followed by a comprehensive volume which will provide an up-to-date synthesis of the regional geological history of the Bowen, Gunnedah and Surat Basins with emphasis on the stratigraphic, structural and petroleum geology.

Research papers.

Highlights for 1991/92

The major emphasis in 1991–92 involved the interpretation of a regional network of industry seismic lines between 25° and 26°S. Fourteen horizons were identified and mapped using sequence stratigraphic principles. Using these horizons, 30 structure contour and isopach maps of the Taroom region have been compiled, and a set of explanatory notes issued as a BMR Record (1991/102, Fossil Fuels 7).

253 kms of deep seismic reflection data from the Gunnedah Basin were processed and a preliminary interpretation made. The seismic data were publicly released in January 1992 and preliminary geological results presented at 11th Australian Geological Convention, at Ballarat in January 1992. One finding was that the Tamworth Belt has been thrust over the eastern margin of the Gunnedah Basin, and that the basin continues to the east for several kilometres beneath the Tamworth Belt.

A BMR Record (1992/5, Fossil fuels 8) summarising the current understanding of the Permian to Cretaceous palynostratigraphy for the eastern Australian basins was prepared. Detailed work on palynological samples from the Cranky Corner boreholes was undertaken to provide a reference section for the Early Permian of eastern Australia.

Preliminary interpretation of the chemical maturity parameters from oils and condensates in the Bowen and Surat Basins suggests that they were generated at very similar maturity levels; thus the process of cracking of oil is not the sole mechanism for gas and condensate formation in the region.

Goals for 1992/93

Complete interpretation of a regional network of industry seismic lines north of 26°S.

Continue interpretation south to the Roma Shelf and St George–Bollon Slope.

Release folio of preliminary maps based on interpretation undertaken in 1992 – March 1993.

Prepare explanatory notes on the maps and release as an AGSO Record – March 1993.

Complete geological interpretation of deep seismic data from Bowen Basin and prepare report.

Continue geological interpretation of the deep seismic data from the Gunnedah basin (in conjunction with the Geological Survey of New South Wales).

Complete report on systematic study of the Early Permian Cranky Corner palynofloras.

Commence documentation of Gunnedah Basin palynofloras.

Continue kerogen assessment of palynological residues to determine organic maturity.

In collaboration with the Geological Survey of Queensland, commence a geochemical investigation for potential source rocks in the Surat Basin. Integrate geochemical analyses of Surat Basin source rocks with previously analysed Bowen Basin source rocks in order to further define oil–source rock correlations.

Clients

The Australian petroleum industry

Current and prospective lease holders in the Bowen, Gunnedah and Surat Basins

Cooperating agencies

Geological Survey of Queensland

New South Wales Department of Mineral Resources (Geological Survey and Coal & Petroleum Geology branches)

Prof A Gleadow, La Trobe University

Dr P Flood and Dr J Stanley, University of New England

Department of Geology, Australian National University

Petroleum companies with leases in the study area

Project 112.06 Tectonic map of the Tasman Fold Belt system

Project manager	David Palfreyman 06 249 9465
Program responsibility	Onshore Sedimentary and Petroleum Geology
Timeframe	1983–1992

Objective

Synthesise data relating to the evolution and structure of the Tasman Fold Belt System in the light of current concepts.

Relevance

Considerable advances have been made in understanding the structure and geological history of the Tasman Fold Belt. There is a need to present these advances in a synthesised form as a basis for further research and to encourage exploration in the area.

Expected outcome

Synthesis of the geology of the Tasman Fold Belt as an aid to exploration and geoscientific research.

Activities

Data on the Tasman Fold Belt system tectonics to be digitised and synthesised on the Intergraph system.

Expected products

Database on the Tasman Fold Belt tectonics.

1:2.5 million scale map of the tectonics of the Tasman Fold Belt System, with explanatory notes.

Highlight for 1991/92

Finalised work on the southern sheet.

Goals for 1992/93

Print southern sheet.

Finalise and print northern sheet.

Finalise and print accompanying explanatory text.

Clients

Mineral and petroleum exploration companies

Secondary and tertiary educational institutions

Government and semi-government bodies

Geoscientific research bodies

Cooperating agencies

State Geological Surveys

Australian National University

Specialist Group in Tectonics and Structural Geology (SGTSG) of the Geological Society of Australia

Project 112.07 Officer Basin (NGMA Project)

Project manager	John Lindsay 06 249 9428
Program responsibility	Onshore Sedimentary and Petroleum Geology
Timeframe	1990–1995

Objectives

Improve the understanding of the basin setting, stratigraphy and evolution of the Officer Basin.

Assess the potential of the basin for petroleum and minerals occurrences.

Encourage development in this remote region of Australia.

Relevance

The Officer Basin area is the least explored region of South Australia. Its mineral and petroleum prospectivity have been inadequately assessed and its setting and geological evolution are poorly known.

Schematic 1:250 000 scale geological mapping by the South Australian Department of Mines and Energy (SADME) of the sparse surface outcrops will take place during the next five years under the NGMA. However, this surface mapping will provide insufficient information on the basin geology such as basin thickness, style, structure and the type of sediments. Such information is essential, basic data necessary for the exploration industry to be attracted to work in such a remote and logistically difficult area.

Expected outcome

Increased exploration industry interest in the Officer Basin, demonstrated by enquiries from petroleum companies.

Activities

Synthesise the subsurface information from industry seismic surveys and drilling programs, to supplement the 1:250 000 scale geological mapping.

Record a grid of regional seismic traverses.

Interpret other BMR/AGSO and industry geophysical data to develop a depositional and post-depositional model.

Expected products

An up-to-date regional synthesis of the geology of the Officer Basin in South Australia.

A folio of geological and geophysical data of the South Australian part of the Officer Basin specifically oriented towards the search for petroleum resources.

A network of regional seismic lines in the central Officer Basin.

A basin model to aid in the prediction of petroleum source and reservoir rocks.

An assessment of the potential for petroleum and mineral accumulations.

Specialised papers and publications concerning the evolution of the basin and its sediment fill.

Highlights for 1991/92

Framework of existing industry seismic lines interpreted with 13 significant seismic horizons mapped.

Transcription of the 1966 Serpentine Lakes analog seismic data to digital format and reprocessing started.

Seismic trials conducted in the Eucla Basin, which overlies the southern Officer Basin. Results showed that seismic profiling would not be effective in areas of surface limestone.

Agreement in principle was reached with the Maralinga and Pitjantjatjara Aboriginal communities to acquire seismic data on their lands.

Reconnaissance and planning for the 1993 seismic acquisition underway.

Presentations outlining program objectives and preliminary results were made to 20 petroleum companies.

Goals for 1992/93

Complete agreement with Aboriginal communities and establish the final seismic traverse locations; begin acquisition of seismic data.

Complete reprocessing of Serpentine Lakes Seismic data, Lines 1 and 2, and release the reprocessed digital data in industry format.

Complete interpretation of industry data.

Produce a preliminary 1:1 million atlas of the eastern part of the study area based on the interpretation of existing seismic and well data.

Present papers at the ASEG Conference in October, 1992 and the AAPG Conference in Sydney in August, 1992

Clients

Mr G Krieg, Dr J Parker, South Australian Department of Mines and Energy

Petroleum industry

Cooperating agencies

Mr G Krieg, Dr J Parker, South Australian Department of Mines and Energy

Project 112.08 National petroleum maps

Project manager	David Palfreyman 06 249 9465
Program responsibility	Onshore Sedimentary and Petroleum Geology
Timeframe	1992–1995

Objective

Provide useful base maps for exploration companies, resource assessment groups and basin analysts for the display and analysis of the occurrence of petroleum in and relating to basins and the petroleum tenements within them.

Relevance

Large scale maps illustrating petroleum geology and geological features pertinent to petroleum habitat provide useful bases for exploration companies, resource assessment groups and basin analysts.

Expected outcome

The routine use of the compiled information by petroleum exploration companies when deciding where next to explore.

Activities

Analyse and display the petroleum geology and geological features pertinent to petroleum habitat on a national scale.

Compile and produce a series of maps at 1:2.5 million scale in a digital format to allow updating.

Produce customised products in conjunction with the PEDIN database.

Expected products

A 1:2.5 million map of Australia's sedimentary basins showing basin outlines, structural elements, basin type and a complementary report.

Series of maps illustrating the following types of features:

- regional isopachs of depth to basement
- period structure maps

- source rock distribution by palaeo-geographic timeslice, distinguishing marine and non-marine sources and organic matter type if known
- location of superposed source, reservoir and seal facies by petroleum systems
- geothermal gradient of Australia
- uplift maps by petroleum systems

Highlights for 1991/92

Compilation of the first workable-scale map showing up-to-date extents of Australia's sedimentary basins and the structural elements within them.

Goals for 1992/93

Compile maps pertinent to the occurrence of and exploration for petroleum.

Publish a commentary summarising Australia's basins and their prospectivity.

Clients

The Australian petroleum industry

Overseas petroleum companies

Cooperating agencies

State and Territory Geological Surveys

Mr H Carstens, Manager and Mr S Berstad, Senior Geologist (Petroleum Exploration Consultants) NOPEC a s, Norway

Project 112.09 Early development of the Otway Basin (NGMA Project)

Project manager	Doug Finlayson 06 249 9761
Program responsibility	Onshore Sedimentary and Petroleum Geology
Timeframe	1991–1993

Objective

Develop a better understanding of the early Otway Basin evolution and associated basement structures and the way in which their evolution/reactivation has influenced fluid migration paths and the formation of structural traps for petroleum.

Relevance

The Otway Basin is one of a number of basins formed on the southern Australian margin at the time of its breakup with Antarctica. The discovery of hydrocarbons has not lived up to the expectations realised in the Gippsland and Bass Basins, partly because of structural complexity recognised in the basin sequences and also because of limited knowledge of the early basin-forming events.

Near-surface geology (limestones, volcanics) makes seismic data acquisition difficult.

Industry standard data using vibrator seismic sources commonly do not image features below 2 s two-way time (twt), or about 3 km depth, and seldom below 3.5 s twt (about 7–8 km). This project will examine the full sedimentary section, including the deepest basin sequences, and the structures within basement that have influenced their deposition.

Expected outcomes

An improved knowledge of the distribution of potential early Otway Basin source rocks through a better understanding of the style of Otway Basin evolution.

An improved knowledge of seismic data acquisition techniques in areas of complex near-surface geology.

Activities

In cooperation with NGMA partners, seismic profiling methods using explosive sources

will be used to improve our knowledge of the early Otway Basin sequences by acquiring new seismic data. In addition, there will be reviews of industry data along key corridors to develop a better understanding of the geometry of early basin faulting. Other geophysical (gravity and magnetic) data will be used in complementary interpretations.

Expected products

Seismic test results comparing seismic acquisition methods in areas of complex near-surface geology.

Interpreted seismic reflection profiles along a number of key corridors.

An integrated shotpoint database.

Structural element maps.

Conceptual models of basin formation.

Appropriate and timely publications and presentations.

Highlights for 1991/92

Workshop meetings of BMR, State, university, and industry geoscientists emphasised the need for an improved understanding of the early basin-forming events, not only to develop models for the onshore basin but also for the offshore areas.

Seismic tests demonstrated the advantages of using explosive seismic sources to improve the signal penetration in areas of difficult near-surface geology produced by volcanics and limestones.

Seismic data acquired across a number of key target areas demonstrated the importance of acquiring deep seismic data to examine structures within basement and to improve knowledge of the deepest basin sequences.

It was demonstrated that, with careful consultation, management and auditing, seismic profiling using explosive sources is an acceptable method for examining subsurface geology in environmentally sensitive areas.

Goals for 1992/93

Process and release BMR seismic data from field work conducted in late 1991 and the first half of 1992.

Consolidate seismic shotpoint database with latest industry information.

In cooperation with State and university partners, interpret seismic sections along a number of corridors and integrate with structural element maps of the region.

In cooperation with State and university partners, interpret structural features in four mapsheet areas covering the onshore Otway Basin using seismic, gravity and magnetic databases.

Clients

Petroleum exploration companies

South Australian Department of Mines and Energy

Victorian Department of Manufacturing and Industry Development

Cooperating agencies

South Australian Department of Mines and Energy

Geological Survey of Victoria

Universities

Exploration companies

Project 113.01: Petroleum Group and Industry Information Systems

Project manager	Tom Loutit	06 249 9397
Program responsibility	Onshore Sedimentary and Petroleum Geology	
Timeframe	Ongoing	

Objectives

Develop, in conjunction with the Bureau of Resource Sciences (BRS), state geoscience agencies and industry, an integrated National Petroleum Information System to assist in the storage, retrieval, management and dissemination of digital and hardcopy geoscience data and information related to the petroleum industry.

Relevance

Geological and petroleum data/information is gathered and utilised by a wide variety of groups in Australia including industry, consultants, and state and federal agencies. An effective national geological and petroleum information system must cater for and include all of these groups.

AGSO, in partnership with BRS, state agencies and industry, is ideally positioned and staffed to play a lead role in the development and implementation of a national petroleum information system. A national petroleum information system (Fig. 1) must contain geological information required to support the ranking of exploration targets (e.g. basins), documentation of proven and unproven petroleum systems and their components (plays, play elements, etc.), the capability to rapidly access geological data required for exploration and access to historical data on production and reserves by field or basin or system. In other words, the system should intimately associate assessment-related historical data and geologic attributes within a geologic (time, process related) and geographic (space) framework.

The goal of a national petroleum information system is to enable petroleum geoscientists to:

- have access to the critical information when decisions are being made
- produce a quantitative estimate of the quality of the work done
- produce a quantitative estimate of the adequacy of attributes such as seal
- document the reasoning behind the interpretation
- document the source of the data used in the interpretation
- document petroleum systems and plays and play elements.

Information management is a key component of exploration and must be tied to the exploration process to define the critical information for both geological and business analysis and the flow of this information to both the explorer (industry) and assessor (BRS). Significant increases in the efficiency of information management will have a major impact on the productivity of AGSO geoscientists.

Expected outcomes

Expansion and implementation of the national well- and sample-based databases (PEDIN/STRATDAT/ORGCHEM, etc). Implementation involves establishment of a data model, transfer of data to users, construction of data input guidelines and interface, establishment of 'ownership', and establishement of rules for transfer of data to central facility.

Establishment of a National Petroleum Information System based on earth system processes and a hierarchy of time-space units ranging from tectonostratigraphic provinces through basins and basin phases to higher order accommodation cycles. The system must include links between the timing, distribution

and character of play elements, and unique tions of elements to form plays, and geological processes. Information on the location and type of geological samples and reports available at storage facilities around Australia is a critical component within the system.

Seamless access to PEDIN-related databases and the Petroleum Information System (managed jointly by BRS and AGSO).

Efficient management of petroleum data held by AGSO on behalf of BRS.

Activities

Actively seek partners, both within AGSO and outside, with the appropriate expertise, such as NRIC, to help in the development of prototype GIS-based petroleum-related geoscience information systems that are customised to the resource evaluation process.

Undertake an examination of the methods employed at AGSO to evaluate the resource potential of Australia's sedimentary basins. Key issues to address include data and information requirements, bottlenecks and gaps in the process and the types of products that should be generated.

Contribute to the investigation of mass storage methods to store and maintain accessibility to all geophysical data used to interpret the geology and resource potential of Australia's sedimentary basins.

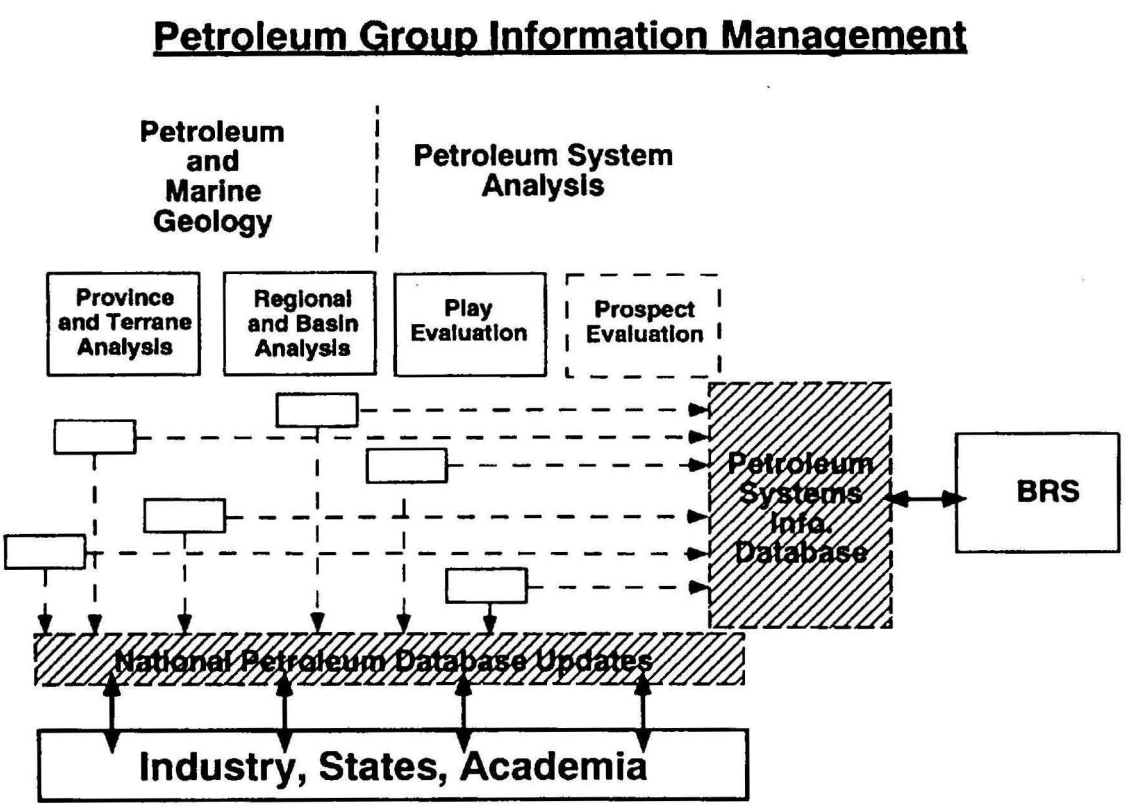


Fig. 1. Schematic diagram illustrating the concept of a National Petroleum Information System and the flow of geological data/information (vertical lines) from projects (small boxes in middle of figure) via National Petroleum Databases to industry, states and academia and petroleum system data/information (horizontal lines) from projects via the Petroleum System Information database to BRS.

Receive, catalogue and store petroleum exploration reports and associated data and well-samples (cores, cuttings and fluid samples) provided to the Commonwealth under petroleum legislation. Implement and maintain systems to more efficiently curate data and sample information.

Provide facilities and technical support to AGSO and BRS programs and the petroleum industry for the examination and borrowing of cores, cuttings and other related information in the Core and Cuttings Laboratory.

Expected products

An implementation plan, in coordination with industry and state agencies, for national petroleum information system.

Implement a coordinated effort to install STRATDAT in state geoscience agencies and industry and establish guidelines for the effective maintenance of the database as a national facility. Serve as a model for future systems.

A report on status of management of data and information required for the evaluation of the resource potential of Australia's sedimentary basins.

A prototype GIS-based National Petroleum Information System.

Highlights for 1991/92

Continued marketing and sale of PEDIN to a further 8 companies of which 5 subscribe to updates.

Release of PEDIN surveys Version 1.0.

Development of a Petroleum Titles database based on the BRS Petroleum Titles key; integration of this database with the PEDIN system.

Provided up-to-date information for AGSO/BRS and the public by ongoing data entry and development of the PEDIN database.

Development of software interfaces between PEDIN and the STRATDAT database.

Contribution to the PETROINFO pilot GIS on ARC/INFO for the purpose of assessing this technology for the integration of spatial and ORACLE datasets.

Core and Cuttings Laboratory now even more active in the receipt, processing and examination of cores, cuttings and other related information generated by AGSO research programs and the petroleum industry. Implementation of barcode technology in the HARDCORE Physical Data Management System was completed.

Goals for 1992/93

Continue development, maintenance, marketing and implementation of PEDIN, ORGCHEM and STRATDAT databases.

Interface PEDIN geophysical data with the proposed Marine Sample database.

Investigate and test methods for mass storage of geophysical data.

Establish a prototype GIS-based National Petroleum Information System.

Clients

Marine Geoscience and Petroleum Geology Program, AGSO

Petroleum Branch, BRS, DPIE

Petroleum Division, MinFish, DPIE

Petroleum Industry

State and Territory geoscience agencies

Academic institutions and the public

Cooperating agencies

Petroleum Branch, BRS, DPIE

National Resource Information Centre, BRS, DPIE

State and Territory geoscience agencies

Petroleum Industry

Academic Institutions

121: CONTINENTAL MARGINS

Objectives

Promote sustainable development of Australia's offshore petroleum and mineral resource potential.

Establish the scientific basis for Australia's claim on its legal continental shelf.

Relevance

The Continental Margins Program (CMP) is an important element in the Government's strategy to promote the efficient exploration of Australia's offshore petroleum reserves commensurate with the efficient use of other resources (labour and capital) for the benefit of all Australians.

At present, 90% of Australia's petroleum production is derived from sedimentary basins of the continental margins (Gippsland Basin, North West Shelf, Timor Sea) and it is widely accepted that future large discoveries are most likely to come from offshore basins. However, the perimeter of offshore petroleum exploration has contracted over the last 10-15 years, leading to a narrower focus on those offshore basins currently perceived to be more prospective by the exploration industry. In the long term, it will be necessary to encourage exploration in areas now considered frontier but which are believed to hold the resources which Australia will need next century.

The CMP aims to expand the offshore area undergoing exploration. New geological, geochemical and geophysical data relevant to petroleum exploration and prospectivity assessment are acquired on a regional basis from offshore areas. The area under investigation is almost 12 million square kilometres.

The CMP aims to assist petroleum exploration by:

- locating and studying new basins in poorly explored shelf areas, upper slope areas adjacent to producing/explored areas, and remote deep water areas.
- developing and applying new approaches and ideas to rejuvenate exploration in areas of declining interest and to increase exploration efficiency in active exploration areas.

Current priority has been given to new basins on the shelf that can be explored with existing and conventional technology such as the northern margin of Australia in the Arafura Sea.

Current priority is also being given to the North West Shelf (Barrow Island to Timor Sea) where, despite extensive exploration effort, there are still enormous gaps in our understanding of critical aspects of structure and basin evolution. A series of projects are being undertaken using deep seismic acquisition and high resolution seismic and direct hydrocarbon detection targeted at particular aspects of regional and structural evolution of interest to the petroleum industry.

The CMP also has an important responsibility in the establishment and management of Australia's seabed jurisdiction. It provides government with relevant geoscientific advice, information and expertise related to the definition of Australia's continental shelf and to delimitation of seabed boundaries with adjacent coastal states.

Priority is currently being given to the Christmas Island area, at the request of the Department of Foreign Affairs and Trade, and to areas where currently no seabed boundaries have been agreed with adjacent states.

A new priority relates to modern marine processes. This development is a natural outcome of the need to understand the geoscientific aspects of Australia's offshore environment, the potential impacts of resource development and the recent history of climate and sea level change recorded in Holocene marine sediments. The strategy is to maximise the opportunity afforded by the extensive collection of seabed cores collected in *Rig Seismic* cruises round the Australian margin and to

lever AGSO's effort in this field through development of selected projects in cooperation with external agencies. (see Environmental Geoscience Program)

Cooperative work is currently underway through the Cooperative Research Centre for Antarctica and the Southern Ocean Environment and with the Technical Research Centre of Japan National Oil Corporation, Sydney University, Sydney Water Board and NSW Geological Survey.

Activities

Acquire new data using the dedicated research vessel *Rig Seismic* which is equipped for modern seismic acquisition, deep sea sampling and the recording of other geophysical and geochemical data.

Process and analyse seismic data and samples to a state ready for interpretation.

Interpret data and integrate with existing exploration industry data to provide new basin analyses incorporating new ideas and understanding of petroleum generation and entrapment.

Provide geoscientific advice related to the definition of seabed boundaries, the extent of Australia's offshore jurisdiction and marine parks.

Develop concepts and understanding of the impact of offshore developments and the history of sea level and climate change.

Release *Rig Seismic* data for industry and public use as soon as practical after completion of processing (1–2 years after acquisition) and basin analyses and assessment of petroleum prospectivity within 2–3 years.

Maintain and develop data acquisition, sampling and processing systems aboard *Rig Seismic* and processing facilities and laboratories in AGSO.

Highlights for 1991/92

The program has expanded and vessel utilisation has become more efficient through establishment of the following joint projects or additional projects:

- completion of first year of cooperative project with the Technical Research Centre Japan National Oil Company
- completion of first year of AIDAB funded Philippines project
- completion of first commercial program of seismic acquisition
- reduction of backlog of seismic processing through commercial joint venture agreement with NOPEC a s and increase in sales of data to industry
- commencement of participation in the Cooperative Research Centre for Antarctica and Southern Ocean Environment
- completion with World Geoscience Corporation of an innovative study of structural analyses in Vulcan Graben incorporating image processed aeromagnetic data and seismic data.

Acquisition and processing systems have been expanded by:

- upgrade of seismic acquisition system to 192 channels
- upgrade of seismic processing system.

Production of first results from deep seismic work on the North West Shelf (Vulcan Subbasin and Carnarvon Basin) with high level of industry interest reflecting the effort placed in upgrade of seismic systems.

Substantial progress in completion of projects begun before 1990.

Goals for 1992/93

Complete all projects and publish results of surveys commenced before 1990 (121.11, 121.12, 121.14, 121.20) plus project 121.23 – December 1992.

Complete upgrade of seismic acquisition system onboard *Rig Seismic* to 240 channels – December 1992.

Upgrade DAS computer systems aboard *Rig Seismic* and non-seismic geophysical processing computers at AGSO.

Complete development of Marine modern processes/environmental program.

Undertake evaluation of Continental Margins Program – November 1992.

Participate in and promote Continental Margins Program at the AAPG conference Sydney – August 1992.

Complete 3 yearly drydock and repairs and maintenance to *Rig Seismic*.

Conduct the following *Rig Seismic* cruises:

June/July	Project 121.17—Southern North West Shelf Cruise II – deep seismic
Aug/Sept	Project 121.37—NSW Shelf – direct hydrocarbon detection and sediment sampling
Oct/Nov	Project 121.30—Lord Howe Rise – seismic and sediment sampling
Jan/Feb	Project 121.36—Australia–Indonesia joint Development Zone deep seismic
Feb/March	Project 121.39—Malita Graben – deep seismic
April/May	Project 121.29—Carbonate facies and climate E. Australia – high resolution seismic and sediment sampling
June/July	Project 121.28—Browse Basin – deep seismic

Deploy coring system aboard *Aurora Australis* – December 1992 – and participate in coring program in Prydz Bay on *Aurora Australis* – Jan/March 1993.

Complete processing and release of following data sets

Project 121.19	Survey 97 – High resolution seismic Vulcan Graben
Project 121.23	Survey 95 – Triassic reefs seismic data set
Project 121.32	Survey 107 – Christmas Island seismic – June 1993
Project 123.03	Survey 108 – Philippines seismic survey – June 1993
Project 121.31	Survey 106 – Eastern Arafura sea seismic – November 1992 (external through NOPEC)
Projects 121.19/20/21	Surveys 79, 89, 105 – Direct hydrocarbon detection data sets
Project 121.17	Survey 109 – Southern North West Shelf – November 1992
Project 121.36	Survey 112 – Joint Development Zone – June 1993 (external through NOPEC)

Cooperate in joint programs and cooperative studies with the following agencies: NOPEC a s; Technical Research Centre, Japan National Oil Company; Sydney University; Sydney Water Board; NSW Geological Survey; AIDAB; Philippines Office of Energy Affairs; ORSTROM/ INFREMER.

CONTINENTAL MARGINS

Component manager Trevor Powell 06 249 9327

Component projects active in 1992/93

121.11(1) Structure, stratigraphy, evolution and regional framework of the Marion Plateau, Townsville Trough and Queensland Plateau

121.12(1) Deep structure of the Gippsland and Bass Basins

121.14(1) Geological framework and hydrocarbon resource assessment of the South Perth Basin

121.17(2) Regional structural framework of the southern North West Shelf and offshore Canning Basin

121.18 Carnarvon Basin surface geochemistry, seafloor sampling and high-resolution seismic

121.19 Vulcan Sub-basin and Cartier Trough: deep crustal structure, structural reactivation and hydrocarbon migration

121.20(1) Southeastern Australia surface geochemistry: the Otway, Bass, North Bass and Gippsland Basins and the Torquay Sub-basin

121.21 Offshore Maryborough Basin, southern Queensland continental margin and northern Tasman Basin: structure, stratigraphy and petroleum potential

121.22 Bonaparte Basin: deep crustal structure, structural reactivation and hydrocarbon migration

121.23(1) Distribution of Triassic and Jurassic reefs in the offshore Canning Basin and northern Exmouth Plateau

121.26(1) North west continental margin stratigraphy

121.27(2) Southern margin geological sampling

121.28 Basin development and hydrocarbon potential of the Browse Basin and adjacent continental margin

121.29(2) Tropical and temperate marine carbonate systems of Eastern Australia: facies, climate and sea level *(revised title)*

121.30(2) Lord Howe Rise and Norfolk Ridge 'Law of the Sea' Study

121.31 Arafura Sea: seismic reconnaissance for the definition of basin configuration and hydrocarbon potential *(Note: Project 121.24 has been incorporated into this project)*

121.32 Seabed morphology and offshore resources around Christmas Island

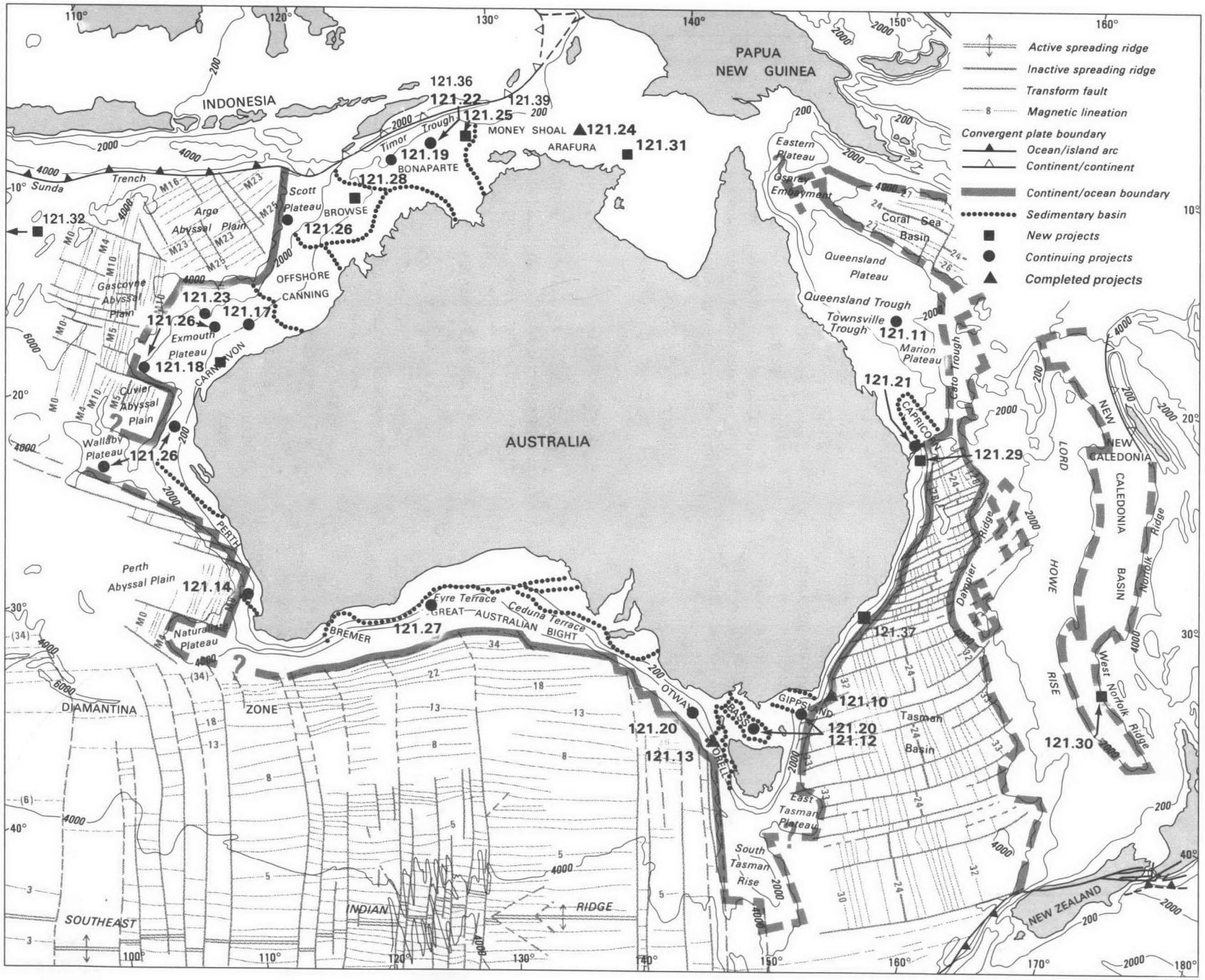
121.34 North West Shelf regional structure project

121.36(2) Northern Bonaparte Basin: deep-basin architecture, structural reactivation and hydrocarbon potential

121.39(2) Malita Graben: petroleum potential and deep crustal structure

(1) Due for completion in 1992/93

(2) Cruise planned in 1992/93 on RV *Rig Seismic*


Active spreading ridge
Inactive spreading ridge
Transform fault
Magnetic lineation
Convergent plate boundary
Ocean/island arc
Continent/continent
Continent/ocean boundary
Sedimentary basin
New projects
Continuing projects
Completed projects
AUSTRALIA
INDONESIA
PAPUA NEW GUINEA
NEW ZEALAND
NEW CALEDONIA
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MONEY SHOAL
ARAFURA
BONAPARTE
BROWSE
OFFSHORE CANNING
CARNARVON
PERTH
GREAT AUSTRALIAN BIGHT
BREMER
OTWAY
GIPPSLAND
BASS
OFFSHORE
CAPRICORN
Timor Trough
Trench
Sunda
Argo Abyssal Plain
Scott Plateau
Gascoyne Abyssal Plain
Exmouth Plateau
Cuvier Abyssal Plain
Wallaby Plateau
Perth Abyssal Plain
Naturaliste Plateau
Eyre Terrace
Ceduna Terrace
DIAMANTINA ZONE
SOUTHEAST INDIAN RIDGE
Eastern Plateau
Osprey Embayment
Coral Sea Basin
Queensland Plateau
Queensland Trough
Townsville Trough
Marion Plateau
Cato Trough
Dampier Ridge
LORD HOWE RISE
NEW CALEDONIA BASIN
Norfolk Ridge
West Norfolk Ridge
Tasman Basin
East Tasman Plateau
South Tasman Rise
30-6/37-1

Project 121.11

Structure, stratigraphy, evolution and regional framework of the Marion Plateau, Townsville Trough and Queensland Plateau

Project manager	Phil Symonds 06 249 9490
Program responsibility	Marine Geoscience and Petroleum Geology
Timeframe	1987–1992

Objectives

Establish the geological framework, tectonic development, and broad environmental significance of the north east Australian margin as a basis for environmental management.

Examine the carbonate sediments off north east Australia for a record of Pliocene and Quaternary sea level and climate change.

Relevance

The north east Australian margin is a relatively rare modern analogue of an important structural and sedimentological association—barrier reef/adjacent rift trough/marginal plateau—which has occurred many times in the geological record.

The north east Australian margin is internationally recognised for its unique variety of depositional systems, which contain clues to understanding ocean history, passive margin evolution, carbonate platform development and environmental change.

The Townsville and Queensland Troughs are large, poorly known rift features, which are fully intact within the margin and therefore of significant geological interest.

Expected outcomes

A regional seismic grid over the Townsville Trough, which will provide the primary database for all future assessments of its geology.

The first synthesis of basin framework for the Townsville Trough and Marion Plateau, and a new understanding of the relationship of these features to the tectonic development of the north east Australian margin.

Models, based on the huge ODP and BMR/AGSO sampling database in the region, showing the interaction of structural, palaeotemperature, palaeogeographic, and sea level controls on carbonate platform evolution and continental margin sedimentation in a rift basin/marginal plateau setting.

Record of Plio-Pleistocene climate and sea level change off north east Australia.

Activities

Four BMR *Rig Seismic* research surveys have been made, primarily using multichannel seismic and sampling techniques, off north east Australia (September/December 1985 and September/November 1987)

Plan and conduct ODP scientific drilling Leg 133 off north east Australia to gain direct information on the structural, palaeoclimatic, palaeoceanographic and relative sea level controls on carbonate platform development, and margin depositional systems.

Undertake an integrated analysis of the structural style and seismic stratigraphic framework of the Townsville Trough:

- map the extent of major depocentres as an aid to understanding the Trough's geology
- synthesise BMR/AGSO and company data from the Queensland Trough to understand the tectonic relationship between the Townsville and Queensland Trough rift systems.

Integrate the direct information on lithofacies and processes from ODP Leg 133 off north east Australia with other seismic stratigraphic and sedimentologic studies to:

- enhance understanding of margin deposition in the region
- define structural and sedimentological factors affecting margin evolution in an attempt to gain an insight into the relative subsidence histories of the Marion and Queensland Plateaus.

Complete an integrated study of the Marion Plateau to determine its geological framework and understand its carbonate platform evolution.

Expected products

Seismic data on a regional grid over the Townsville Trough.

'High resolution' watergun seismic data over the Marion Plateau, the Queensland Trough, and the margins of the Queensland Plateau.

Navigation, bathymetry, gravity and magnetic digital data package over the Townsville Trough and Marion Plateau.

Townsville Trough report and map package integrating the 1985 and 1987 *Rig Seismic* data.

AGSO Record on the geological framework of the Marion Plateau.

Large sample and well-log database from ODP Leg 133 off north east Australia, and the published results of scientific studies on these data by about thirty international scientists—these results will initially be reported in ODP publications.

Report containing well summaries, biostratigraphic review and geohistory analyses for all exploration wells and DSDP holes off north east Australia (BMR Record 1990/07).

Highlights for 1991/92

1987 BMR seismic data over the Townsville Trough was publicly released.

Publication of the Proceedings of the Ocean Drilling Program—Initial Reports for ODP Leg 133 off north east Australia in September 1991. This two volume report contains all the shipboard results and interpretations of about thirty scientists from around the world.

Papers on absolute magnitude of Miocene sea level fall and structural style and tectonic development of the Queensland Trough.

Goals for 1992/93

Complete papers for Proceedings of the Ocean Drilling Program, Scientific Reports, for Leg 133.

Complete seismic interpretation and mapping over the Townsville Trough. Complete report on the results of the study – last quarter 1992.

Prepare and present paper on the geological development of the Townsville Trough at the 1992 AAPG International Conference at Sydney, 2–5 August 1992.

Prepare and present paper on the tectonic controls on major play types in the Papuan basin, PNG, at the 1992 AAPG International Conference at Sydney, 2–5 August 1992.

Prepare paper titled 'Complex continental margin development – implications for petroleum prospectivity in the Torres Shelf/Gulf of Papua region', for publication and presentation at the 2nd PNG Petroleum Convention at Port Moresby, 31 May–2 June 1993.

Prepare draft AGSO Record on the geological framework of the Marion Plateau – last half 1992.

Prepare revised ODP drilling proposal to examine sea level change, carbonate platform development and the tropical/temperate transition on the Marion Plateau – January 1992.

Reports and papers on margin development in industry-related journals and at conferences such as APEA and AAPG.

Clients

Geological Survey of Queensland

Great Barrier Reef Marine Park Authority

Cooperating agencies

Ocean Drilling Program, Texas A&M University, College Station, USA

A Droxler, Rice University, Houston, USA

J McKenzie and others, Swiss Federal Institute of Technology, Zurich, Switzerland

J Ladd, W Pitman, Lamont-Doherty Geological Observatory, USA

D Scott, Australian National University

PJ Davies, Sydney University

Project 121.12 Deep structure of the Gippsland and Bass Basins

Project manager	Barry Willcox 06 249 9273
Program responsibility	Marine Geoscience and Petroleum Geology
Timeframe	November 1989–August 1992

Objective

Promote more thorough exploration of the Gippsland and Bass Basins by providing regional deep crustal data sets and developing new concepts of the tectonic evolution of the region.

Relevance

The style of seismic exploration conducted by the petroleum industry is not appropriate for examining the petroleum potential of large regions, due to the techniques used and the restrictive nature of most lease areas. Several companies working in the Bass Strait region requested that BMR carry out regional basin-wide studies into basin formation and crustal structure in the hope of highlighting new petroleum plays.

Expected outcomes

Enhanced understanding of the tectonics of the Bass Strait region and the inter-relationships of the basins which occur there. Consistency in terms of timing and orientation of stress-fields, for mode of formation of Australia's southern margin basins.

Increased exploration activity, particularly in the Gippsland Basin, in the search for pre-Top Latrobe structural traps.

An appreciation by industry and the international academic community that deep seismic studies of this type can be successful in determining basin formation, the inter-relationships of basins, and the ways in which basin-forming structures influence the migration and entrapment of hydrocarbons.

Activities

Two research surveys using *Rig Seismic*, primarily using deep multichannel seismic techniques to obtain a unique data grid (December 1988 and April 1989).

A ship-to-shore refraction study to determine crustal structure, in cooperation with Monash University (December 1988–ongoing).

Processing of the Gippsland seismic grid within BMR for release and sale to the petroleum industry (September 1990).

Release of field data from the Bass Basin for processing by interested clients (client-processed data now available to AGSO).

Migration of the Gippsland deep seismic profiles to meet industry standards and to improve resolution of deep basin-forming detachments before interpretation.

Interpretation of deep structure of the region to determine relationships of basin-forming structures and hydrocarbon traps.

Provide tectonic models of the Gippsland Basin's evolution and its relationship to other

potentially prospective basins in the Bass Strait/Tasman Sea region. Examine geothermal consequences of such models in relation to the hydrocarbon generation and migration.

Expected products

BMR Cruise Reports (1989/1 and 1989/20).

Release of seismic data packages: field data (April 1988), stacked seismic profiles (September 1990), migrated seismic profiles (immediate release).

Scientific publications:

Refraction methods employed (ASEG, 1990, 1992; APEA, 1991)

Tectonics and petroleum implications (Gippsland EEE Symposium volume, in press)

Global tectonic implications (for ?Tectonophysics)

Interpreted seismic data (AGSO Record)

Refraction acquisition/processing/software (AGSO Records)

Highlights for 1991/92

New seismic interpretation, which is now at an advanced stage, indicates that the Gippsland Basin is a strike-slip to 'transtensional' feature, probably created by left-lateral movement on an ENE-trending fault system, and is part of a linked-basin system which also includes the Bass Basin, Torquay Sub-basin, Otway Basin and probably other southern margin basins to the west.

Migrated seismic data is now available for sale to industry.

Interpretation results were published and presented at the Gippsland Basin Energy Economics and Environment (EEE) Symposium and AAPG International in mid 1992.

Goals for 1992/93

Complete the Gippsland and Bass Basins project by approximately August 1992.

Complete seismic interpretation and tectonic evaluation, leading to publication as an AGSO Record (or 'seismic atlas'), a major paper in the Gippsland Basin Energy Economics and Environment Symposium volume, and one other paper in an international journal (discussing globally significant findings relating to basin-forming detachments).

Publish the processing techniques and software employed for the refraction component of the study. Present a paper at the ASEG Conference – October 1992.

Clients

Shell, ESSO, BHP, Bridge and the general petroleum industry

Petroleum Division, MinFish Group, DPIE

International academic community.

Cooperating agencies

Monash University

Andrew Constantine, Victorian Institute of Earth and Planetary Sciences

Bridge Oil Ltd

Project 121.14 Geological framework and hydrocarbon resource reassessment of the South Perth Basin

Project manager	John Marshall 06 249 9536
Program responsibility	Marine Geoscience and Petroleum Geology
Timeframe	1988–1992

Objective

Stimulate interest in petroleum exploration in the offshore Perth Basin by provision of insights into the basin's development and resource potential.

Relevance

When the project began, the offshore area of the South Perth Basin was vacant. The study was commenced to stimulate exploration by provision of new data and regional interpretations. Exploration permits now cover most of the offshore parts of the basin and companies have active seismic and drilling programs in place. A regional geological analysis of the basin, that presents new insights into the basin's development, is timely.

Expected outcomes

An analysis of the basin's geological history, including a presentation of a new tectonic interpretation, to produce a comprehensive assessment of the basin's hydrocarbon potential.

Activities

Conducted two cruises in the South Perth Basin that acquired some 4400 km of multichannel airgun and watergun seismic reflection data, plus some 30 dredge and core samples from the western edge of the basin.

Prepared a comprehensive report (BMR Record 1989/23) covering the stratigraphy, structure and hydrocarbon potential of the Vlaming Sub-basin, which was released to coincide with the gazettal of lease acreage in the offshore Perth Basin.

Processing of seismic and non-seismic data from the two cruises, plus processing of dredge and core samples to produce a biostratigraphic zonation of the little understood western edge of the basin.

Interpretation of company and BMR/AGSO seismic lines within the basin.

Production of structure contour and isopach maps of key units within the Vlaming Sub-basin.

Development of a structural framework to assist with resource assessment.

Production of a revised biostratigraphic zonation for the Late Cretaceous and Tertiary units within the offshore part of the basin.

Expected products

In addition to the 5000 km of seismic, the extensive sampling program, and the publication of an analysis of the basin's hydrocarbon potential, a final publication will be produced that covers all aspects of the basin's geological development.

Highlights for 1991/92

Renewed seismic activity by exploration companies with 2836 km of seismic shot in 1991. Other than BMR's 4200 km of multichannel seismic, there has been no seismic shot in the area since a limited amount of data (550 km) was shot in 1985.

Completion of the first exploration well in the Vlaming Sub-basin since 1984.

Goals for 1992/93

Complete the project, which has been held up for most of 1991/92 by other commitments.

Present the final results on the structural analysis of the basin, and incorporate this into a final report – November 1992.

Clients

Ampol Exploration Ltd

Petrofina Exploration Australia

Woodside Petroleum Ltd

Shell Australia

Norcen International

Cooperating agencies

Mr Robert Iasky, Geological Survey of Western Australia

Dr Mike Middleton, Department of Exploration Geophysics, Curtin University of Technology

Ms Marjorie Apthorpe, Apthorpe Palaeontology, Perth

Project 121.17

Regional structural framework of the southern North West Shelf and offshore Canning Basin

Project manager	Howard Stagg 06 249 9343
Program responsibility	Marine Geoscience and Petroleum Geology
Timeframe	January 1990–December 1994

Objective

Enhance exploration strategies in the southern North West Shelf and offshore Canning Basin through an improved understanding of the nature and history of the major structural features in the region.

Relevance

Although the southern North West Shelf is one of the most prospective areas of Australia for hydrocarbons, there has been little recent revision of its regional structural framework using modern concepts of extensional tectonics, and large parts of the region, particularly the offshore Canning Basin, remain relatively under-explored.

This project is acquiring a regional grid of deep seismic transects throughout the region which complements the conventional data collected by industry. These transects will improve understanding of the relationships between the major structural elements, allow revision of the gross structure, and provide the basic data to assist in definition of new petroleum plays and the timing of petroleum generation and accumulation.

Expected outcome

Enhanced exploration strategies through an improved understanding of the nature and history of the major structural controls in the region.

Activities

The core data for the project is provided by three cruises of the *Rig Seismic*. The first cruise, southern North West Shelf (SNOWS-I), in May–June 1991, acquired 1654 km of 16 s record-length seismic data from the Barrow and Dampier Sub-basins and inner flank of the Exmouth Plateau. Subsequent cruises are planned for June 1992 (SNOWS-II), when lines will be extended into the Beagle Sub-basin and across the Exmouth Plateau and follow-up lines will be recorded in the Barrow and Dampier Sub-basins, and for 1993 (SNOWS-III) in the offshore Canning Basin.

Determine the broad regional structural framework of the northern Carnarvon and offshore Canning Basins and Exmouth Plateau by examining the boundaries between major structural elements along seismic transects.

Determine the deep crustal structure of these basins and their relationship to the development of the continental margin adjacent to the Argo and Gascoyne Abyssal Plains.

Determine the control of deep structure on the development of the major hydrocarbon fields and plays in the region, and in particular the structural and depositional effects resulting from reactivation of these structures.

Provide seismic ties between wells on the principal structures in the region to allow basin-wide seismic correlations.

Expected products

Pre- and post-cruise reports for each of the three cruises.

1654 km of processed deep seismic data (16 s records) from SNOWS-I, acquired from 4800 m streamer with 3000 cu in airgun source; released in March, 1992.

2000+km of processed deep seismic data from SNOWS-II (Beagle, Dampier, and Barrow Sub-basins, and Exmouth Plateau); expected to be released by end of 1992.

2000+km of processed deep seismic data from SNOWS-III (offshore Canning Basin); release date dependent on survey date and processing arrangements.

AGSO interpretation report containing crustal cross-sections illustrating the main structural elements in the region, selected reduced scale seismic sections, an upgraded structural elements map, burial and thermal geohistory analyses of key wells, and other relevant information.

Reports and papers on the structural framework, the structural and depositional effects arising from reactivation of deep structures, and new play concepts and exploration strategies in the region, in industry-related journals and conferences such as APEA and AAPG.

Highlights for 1991/92

After the first *Rig Seismic* cruise in the Barrow and Dampier Sub-basins and Exmouth Plateau in May–June 1991, agreement was reached with NOPEC a s to allow the seismic data to be processed by a commercial processing contractor. Data processing was completed by March 1992. Data quality is high, and for the first time the deep structure of the North West Shelf has been revealed; strong reflections as deep as 10–11 s two-way time (about 15–25 km) are evident over wide areas. Following several joint BMR/NOPEC marketing rounds, most exploration companies active on the southern North West Shelf have taken the opportunity to obtain the data which is seen as valuable background to their more detailed studies.

Goals for 1992/93

Complete the second cruise (SNOWS-II) of the series and produce post-cruise report – November 1992.

Arrange processing of the SNOWS-II data with a commercial contractor through NOPEC (as for SNOWS-I); make processed data available to industry in time for the November 1992 exploration acreage gazettal.

Present preliminary interpretation of SNOWS-I data at AAPG meeting in Sydney in August 1992.

Commence major interpretation phase combining SNOWS-I and SNOWS-II data in early 1993.

Clients

Petroleum exploration companies

WA Department of Mines

Petroleum Division, DPIE

Alan Williams, Petroleum Resource Branch, BRS, DPIE

Cooperating agencies

NOPEC a s (marketing)

Project 121.18 Carnarvon Basin surface geochemistry, seafloor sampling and high-resolution seismic

Project manager	David Heggie 06 249 9589
Program responsibility	Marine Geoscience and Petroleum Geology
Timeframe	September 1988–1996

Objective

Provide new information on gas and liquid hydrocarbon generation and migration by combining surface geochemistry and source rock data with near-surface and deeper geological information.

Relevance

The North West Shelf is a major producer of hydrocarbon liquids and gas. Early exploration in the Barrow-Dampier Sub-basins of the Carnarvon Basin delineated both a gas and liquid trend in hydrocarbon accumulations.

Surface geochemistry (an underutilised exploration tool on the Australian continental margin) can distinguish gas and liquid accumulations, and provide new information for prospect evaluation. When combined with seismic data, surface geochemical data may provide new clues to sites of hydrocarbon generation, migration pathways and trapping mechanisms.

There is a sub-micron control on primary and secondary migration processes and seepage of hydrocarbons to the seafloor. However, there are no sub-micron structural data on Australian sedimentary rocks. Proposed new experiments (with US Department of Energy) and models of migration will provide new information on hydrocarbon migration processes.

This project is one in a series aimed at evaluating the application of surface geochemistry to offshore hydrocarbon exploration.

Expected outcomes

New information on hydrocarbon generation and migration in the Barrow-Dampier Sub-basins, by a synthesis of surface geochemical (DHD) data with BMR/AGSO seismic data.

A test of DHD techniques in exploration for gas and liquid hydrocarbons in this region, hence a contribution to evaluating DHD methods to assist in exploration offshore Australia.

New scientific information and an improved understanding of the evolution of the north-western Australian continental margin.

A better understanding of primary and secondary migration processes including seepage to the seafloor.

Activities

Participated in scientific drilling off north-western Australia as part of the Ocean Drilling Program Leg 123 (September 1988).

Synthesised organic geochemical data collected as part of ODP Leg 123.

Participated in a calibration (approximately 200 km) surface geochemical (DHD) exercise in the Carnarvon Basin with Transglobal Environmental Geoscience (TEG) (1989).

Analysed the results of the DHD calibration survey conducted in conjunction with TEG.

Conducted a surface geochemical (DHD) calibration program in the Dampier Sub-basin and processed DHD data.

Conduct a 30-day *Rig Seismic* survey (proposed 1993–94) in the Barrow-Dampier Sub-basins, combining DHD with high resolution

seismic data collection. Conduct seafloor sampling and analysis for migrated hydrocarbons. Liaise with the Australian petroleum community to develop this survey.

Production of DHD data releases and appropriate AGSO Records, and direct communication of survey results to the offshore exploration community.

Conduct experiments on cap and source rocks from Australian petroleum accumulations with Oak Ridge National Laboratories in the USA.

Expected products

DHD data releases on the calibration surveys conducted in the Barrow-Dampier Sub-basins.

DHD data release combined with a seismic data collection Record from the (proposed) 1993/94 survey.

Scientific publications as part of the ODP Scientific Results (Leg 123) Proceedings Volume and from cooperative work with Oak Ridge National Laboratories.

Highlights for 1991/92

(Project activities postponed to 1992/93 because of other priorities).

Goals for 1992/93

Synthesise and publish DHD calibration survey results collected from the Barrow-Dampier Sub-basin – December 1992.

Develop cruise proposal for 1993/94 financial year – March 1993.

ODP Leg 123 Scientific Results Volume published.

Conduct experiments on source and cap rocks at Oak Ridge National Laboratories in the USA.

Clients

Australian and overseas scientific community with research interests in development of the north eastern Indian Ocean and north western Australian continental margin

Petroleum Resource Branch, BRS, DPIE

US Department of Energy and Martin Marietta Energy Systems Inc. USA

Cooperating agencies

Australian petroleum companies

Texas A&M University and ODP Scientific Drilling Office

Project 121.19

Vulcan Sub-Basin and Cartier Trough: deep crustal structure, structural reactivation and hydrocarbon migration

Project manager	Geoffrey O'Brien 06 249 9342
Program responsibility	Marine Geoscience and Petroleum Geology
Timeframe	1990–1993

Objective

Improve exploration efficiency in the Vulcan Sub-basin and Cartier Trough and assist in the assessment of the region's prospectivity.

Relevance

The discovery of oil in commercial quantities in Jabiru, Challis and Skua has led to an upsurge in exploration in the Vulcan Sub-basin region of the Timor Sea.

Recently, this exploration effort has been characterised by a marked lack of success. The project is aimed at improving our understanding of the basin architecture and the principal basin forming process, the control of structural reactivation on both hydrocarbon migration and trapping mechanisms, and the timing of structural development relative to hydrocarbon generation and migration.

Expected outcomes

An improved understanding of the role of structural reactivation in hydrocarbon entrapment in the Vulcan Sub-basin, particularly the nature of and controls on structural reactivation throughout the Palaeozoic and Mesozoic

Integration of image processed aeromagnetic data with conventional and deep crustal seismic, Landsat, and potential field data to produce a new understanding of the tectonic development of the Vulcan Sub-basin and, in particular, to determine the role of transfer faults in hydrocarbon entrapment.

Delineation of hydrocarbon migration pathways in the Vulcan Sub-basin.

Establishment of the usefulness of the DHD technique in the region.

Establishment of the deep crustal architecture of the Vulcan Sub-basin and surrounding tectonic elements, with associated implications for structural reactivation and source rock distribution.

An understanding of how the deep-seated structural features in the Vulcan Sub-basin have controlled shallow structural reactivation processes.

Activities

Two research surveys were conducted using *Rig Seismic* (Surveys 97 and 98) in late 1990, and a high resolution aeromagnetic survey was flown in late 1989.

- 2730 km of simultaneously acquired high resolution seismic and water column geochemical (DHD) data were acquired by *Rig Seismic* in October-November 1990 (Survey 97). A total of 34 dip lines and 10 strike lines were acquired between the southernmost Vulcan Sub-basin and the Sahul Syncline to the north. In addition, 56 vibro-cores were taken for the analysis of hydrocarbon gases within the sediments.
- 1894 km of deep crustal seismic data were acquired during Survey 98.

About 20 000 km of high resolution aeromagnetic data were acquired in late 1989.

Modelling of the thermal and tectonic histories of relevant wells.

Image processing of high resolution aeromagnetic data.

Integration of relevant industry seismic data into the AGSO aeromagnetic, seismic and DHD data sets.

Integration and interpretation of disparate data sets such as aeromagnetic, water column geochemical direct hydrocarbon detection (DHD), high resolution, conventional and deep crustal seismic data.

Expected products

Image processed high resolution aeromagnetic data at 1:250 000, 1:500 000 and 1:1 000 000 scale. Integrated aeromagnetic and Landsat imagery. Image processed seismic data integrated with aeromagnetic imagery. Interpreted aeromagnetic images. Maps showing integrated interpreted aeromagnetic and seismic interpretations.

Regional deep crustal seismic sections showing the main structural elements of the Vulcan Sub-basin and their relationship to the surrounding structural elements.

High resolution seismic data with particular emphasis on the resolution of structural features at the Intra-Valanginian Unconformity level and shallower. Maps over selected structural features. Regional maps of the distribution of light hydrocarbons in the water column and in the surficial sediments, and the relationship of any detected geochemical anomalies to sub-seafloor geology

Basin-wide burial and thermal geohistory analyses of relevant exploration wells (and synthetically-generated locations) to constrain the timing of hydrocarbon generation and likely migration pathways.

Highlights for 1991/92

Vulcan Sub-basin

The deep crustal seismic data were fully processed and released at the end of 1991, with very significant industry and academic interest in the data. Preliminary interpretation of these data has shown that the Vulcan Sub-basin is not a Jurassic *rift* in the true sense of the word, but a relatively minor reactivation feature (effectively a successor basin) overlying a large, probably Permo-Carboniferous rift system. This large underlying rift is probably equivalent to the Westralian Superbasin.

The aeromagnetic data have been image processed and interpreted, then integrated with a large amount of conventional and deep crustal seismic data. This study has identified a number of previously unidentified structural features in the Vulcan Sub-basin, including prominent NS- and NW-trending features. These trends intersect with the NE and ENE-trending Mesozoic structural grain in areas of increased structural complexity, and most of the significant hydrocarbon discoveries in the Sub-basin occur at such intersections. The integration of the aeromagnetic and seismic data has resulted in a major advance of our understanding of both the tectonic evolution of the Vulcan Sub-basin and the principal controls on hydrocarbon entrapment in this region. A BMR Folio (Folio 6) on the integrated aeromagnetic/seismic study has been completed.

Goals for 1992/93

Attain an improved understanding of the deep crustal architecture of the Vulcan Sub-basin region and the role that structural reactivation has played in the migration and trapping of hydrocarbons in the region.

Undertake image processing of selected seismic and potential field data sets to test and improve the structural models that have been developed.

Present APEA poster dealing with Vulcan Sub-basin deep crustal seismic and aeromagnetic study.

Publish papers in APEA and AAPG publications, dealing with integration of image processed aeromagnetics and conventional and deep crustal work.

Clients

Petroleum industry

Cooperating agencies

Flinders University

Melbourne University

Project 121.20 South eastern Australia surface geochemistry: the Otway, Bass, North Bass and Gippsland Basins and the Torquay Sub-Basin

Project manager	David Heggie 06 249 9589
Program responsibility	Marine Geoscience and Petroleum Geology
Timeframe	1987–1993

Objectives

Provide new information on the potential to generate liquid/gas hydrocarbons of the Bass, North Bass and Otway Basins and the Torquay Sub-basin using both sediment and bottom-water direct hydrocarbon detection (DHD) techniques and hence reduce risks in geological assessment and enhance prospectivity.

Test and calibrate the bottom-water DHD technique and its application to offshore petroleum exploration around Australia, by conducting calibration surveys in Australia's

major hydrocarbon province, the Gippsland Basin.

Relevance

Surface geochemical techniques have not been widely used as an accepted exploration tool around Australia. This program is the first to systematically evaluate water-column geochemical techniques and their application to offshore hydrocarbon exploration. The program includes a Joint Research Agreement with TEG (USA) to evaluate the use of bottom-water DHD techniques (underway geochemical sampler) around Australia.

The Gippsland Basin is Australia's major producer of hydrocarbons and hence is an appropriate location to conduct calibration exercises for bottom-water DHD geochemical techniques.

The Bass, North Bass, and Otway Basins and the Torquay Sub-basin are underexplored frontier basins. The application of surface geochemical techniques can provide new information about the generation of thermogenic hydrocarbons in these basins. The presence of hydrocarbon strandings on Otway beaches has suggested the Otway Basin is an appropriate location for surface geochemical techniques.

Expected outcomes

An evaluation of the application of surface geochemical techniques to offshore petroleum exploration around Australia, particularly south eastern Australia.

Clients will be provided with new information on the generation and migration of thermogenic hydrocarbons (at both reconnaissance and prospect scales) in these southeastern Australian basins.

Activities

Three research surveys aboard *Rig Seismic* had been conducted before 1991, Surveys 67 (1987) and 79 (1988) using a combination of seafloor sampling and onboard sediment (hydrocarbon-headspace) gas analyses, and Survey 89 (February 1989) using new bottom-water DHD technology (the underway geochemical sampler). The latter survey collected bottom-water DHD data in the eastern Bass Strait (Durroon Basin), the Mussel Platform part of the Otway Basin, the Torquay Sub-basin and the Gippsland Basin.

A fourth survey (Survey 104) was conducted in September 1991. Sediment (hydrocarbon-headspace) data were collected from the Torquay Sub-basin.

Production of DHD data releases and appropriate AGSO Records and communication of results directly to the offshore exploration community.

Expected products

AGSO Records from each survey, DHD data releases and a database including all sediment (hydrocarbon-headspace) data from these south eastern Australian basins.

Information provided directly to clients on the prospectivity and gas/liquids potential of parts of the basins surveyed.

Highlights for 1991/92

Public release of the DHD geochemical data for Surveys 79 and 89.

Publication of overview papers on surface geochemistry of offshore margin in PESA Journal and Offshore Australia Proceedings.

Goals for 1992/93

Complete appropriate records and DHD data releases and scientific publications – December 1993

Publish results from Otway and Gippsland Basins.

Clients

Shell Australia Ltd

Cultus

Esso–BHP

Petrofina

Western Mining Corporation

Bridge Oil

Other petroleum explorers working in the offshore areas of south eastern Australia

Cooperating agencies

B Hartman, TEG–USA

K Spence, B Thomas, Shell Australia

B Donaldson, Amoco–USA

Garry Woodhouse, John Emmett, Esso–BHP

Project 121.21

Offshore Maryborough Basin, southern Queensland continental margin and northern Tasman Basin: structure and stratigraphy

Project manager	Peter Hill 06 249 9292
Program responsibility	Marine Geoscience and Petroleum Geology
Timeframe	1989–1993

Objective

Establish the basin framework, structure and stratigraphy of this region as a basis for environmental management.

Relevance

The geology of the offshore Maryborough Basin is poorly understood. This project is designed to help define the region's geology for future planning purposes.

Expected outcomes

First modern multichannel seismic data set in the region.

The project will establish the structural and seismic stratigraphic framework of the offshore Maryborough Basin, the deep-water Capricorn Basin and northern Tasman Basin. The results of the study will provide information vital for future planning in the region.

Activities

A research survey primarily using multichannel seismic techniques aboard *Rig Seismic* conducted in December 1989 (Survey 91).

Tie the stratigraphy of the Maryborough Basin region to the exploration wells in the Capricorn Basin thus improving the geological knowledge of the area.

Process seismic, navigational and non-seismic (bathymetry, magnetics and gravity) data.

Interpret data and undertake basin analysis incorporating all existing data sets.

Publish results.

Expected products

Processed geophysical data: 2900 km of multichannel seismic data, 10 sonobuoy seismic refraction experiments, 2450 km of magnetic profiles, 3600 km of gravity and bathymetric profiles. The multichannel seismic data will be available as field tapes, stack tapes and processed sections on paper and film.

Reports, maps and papers on the geology and geophysics of the southern Queensland offshore basins.

Highlights for 1991/92

Processing and final display of Survey 91 seismic data completed and released in March 1992.

BMR Record on Survey 91 non-seismic data processing prepared.

Bathymetry, free-air gravity and magnetic anomaly map compilations completed.

Paper on preliminary cruise results presented at PESA (Qld)–ODCAA–SPE Petroleum Symposium (Brisbane, August 1991).

Paper on Maryborough Basin accepted for presentation at the 1992 AAPG Conference (Sydney).

Paper on Capricorn/northern Tasman Basins accepted for ASEG Conference (Gold Coast, October 1992).

Data release brochure prepared for mid-1992 release of Survey 91 seismic and non-seismic data.

Goals for 1992/93

Finalise project by end of 1992: complete basin analysis and interpretation of data and publish results (AGSO Report and research papers).

Clients

Queensland Department of Resource Industries

Great Barrier Reef Marine Park Authority

Cooperating agencies

Geological Survey, Queensland Department of Resource Industries

Project 121.22 Bonaparte Basin: deep crustal structure, structural reactivation and hydrocarbon migration

Project manager	Geoffrey O'Brien 06 249 9342
Program responsibility	Marine Geoscience and Petroleum Geology
Timeframe	1991–1993

Objective

Improve exploration efficiency in the offshore Bonaparte Basin through an improved understanding of the structural controls on basin evolution, hydrocarbon migration and entrapment.

Relevance

The offshore Bonaparte Basin is the site of non-commercial gas and oil discoveries and is presently undergoing a fairly active exploration phase, although a number of significant geological questions need to be answered to improve our understanding of hydrocarbon potential and distribution. These questions include:

- establishing the deep crustal architecture of the Palaeozoic Petrel Sub-basin, and its relationship to the Mesozoic structural elements to the north which have overprinted it (e.g. the Malita Graben, the Sahul Platform and the Sahul Syncline)
- the nature of and controls on structural reactivation throughout the Palaeozoic, Mesozoic and Cainozoic
- how the style of structural reactivation changes as the collisional zone is approached
- what is the present nature of the hydrocarbon charge emanating from the Sahul Syncline and Malita Graben, and how does this relate to the prospectivity of the flanking structural highs
- what is controlling the change from oil prone to gas or gas-condensate prone as one moves from the southern Petrel Sub-basin towards the Malita Graben.

Expected outcomes

An understanding of the tectonic relationships between the offshore Bonaparte Basin and the Vulcan Sub-basin, Ashmore Platform and Londonderry High to the south.

An understanding of the relationships between the Palaeozoic and older structural grain onshore and its control on structural development throughout the Mesozoic and Tertiary.

Activities

The first survey (Survey 100) collected a total of 3446 km (29 lines) of high resolution seismic and remote sensing (DHD) data in February–March 1991.

The second survey (April–May 1991) collected 2100 km of deep crustal seismic data (seven lines) and 2828 km (11 lines) of DHD data. Both surveys focused on the Petrel Sub-basin, the Sahul Syncline and the Malita Graben.

Interpretation of BMR/AGSO and industry data sets.

Expected products

3446 km of simultaneously collected high resolution seismic reflection and remote sensing geochemical (DHD) data completed.

2200 km of deep crustal seismic reflection data and 2828 km of remote sensing geochemical (DHD) data.

Regional deep crustal seismic sections showing the main structural elements of the Bonaparte Basin and their relationship to the surrounding structural elements; revised regional tectonic elements, maps and structural sections.

High resolution seismic data; maps over selected structural features.

Regional maps of the distribution of light hydrocarbons in the water column and in the surficial sediments, and the relationship of any detected geochemical anomalies to sub-seafloor geology.

Basin-wide burial and thermal geohistory analyses of relevant exploration wells (and synthetically generated locations) to constrain the timing of hydrocarbon generation and likely migration pathways; integration of these data with DHD data.

Sediment descriptions in specific areas.

Highlights for 1991/92

Completion of the processing of the Survey 100 deep crustal data.

Completion of the post-cruise reports.

Completion of DHD data release for both surveys.

Goals for 1992/93

Develop an integrated structural framework for the region which relates the reactivation of the basin-forming structures in the offshore Bonaparte Basin to the various periods of structural reactivation from the Palaeozoic to the Late Tertiary, and thereby understand the relationship of such reactivation to hydrocarbon habitat in the region.

Clients

Petroleum industry

Cooperating agencies

Current leaseholders in the offshore Bonaparte Basin

Project 121.23

Distribution of Triassic and Jurassic reefs in the offshore Canning Basin and northern Exmouth Plateau

Project manager	Neville Exon 06 249 9347
Program responsibility	Marine Geoscience and Petroleum Geology
Timeframe	1989-1993

Objective

Develop an understanding of the distribution of Triassic–Jurassic reefs on the North West Shelf and particularly in the Browse and Bonaparte Basins, as a guide to their exploration for petroleum.

Relevance

The discovery of a Late Triassic reef in ODP Site 764 (ODP Leg 122) on the Wombat Plateau north of the Exmouth Plateau, and the realisation that a reef complex was visible on the seismic profiles, led to a new North West Shelf petroleum exploration play. The 1989 seismic and sampling cruise showed that Late Triassic to Middle Jurassic carbonate build-ups are common on the northern Exmouth Plateau, and probably occur in the outer Canning Basin as well.

This study will better evaluate the new play in the region near the initial discovery, and enable its expansion by AGSO and exploration companies to other areas on the North West Shelf.

Expected outcome

An understanding of the distribution of Triassic-Jurassic reefs on the North West Shelf and strategies for their exploration for petroleum.

Activities

Process and interpret new and existing seismic and geological data to refine the geological history of the region, pertinent to Triassic–Jurassic carbonates.

A research survey using seismic and sampling techniques aboard *Rig Seismic* (Survey 95, May 1990).

Petrological, sedimentological and palaeontological studies of Triassic, Jurassic and Cretaceous dredge samples.

Processing of seismic data.

Series of papers on results of Exmouth Plateau ODP Leg 122 printed in Initial Reports (122A) and Scientific Results (122B).

Expected products

Regional and local structure contour and isopach maps.

Palaeogeographic maps.

Papers in national and international literature on aspects of tectonics, geophysics, heatflow, sedimentology, palaeogeography, etc.

Processed seismic data.

ODP Volumes for Legs 122 and 123.

Highlights for 1991/92

Publication of reef complex paper by Indonesian Petroleum Association, after presentation at their conference.

Publication of 'Proceedings of the Ocean Drilling Program: Scientific Results: Volume 122B' with 8 papers by BMR authors.

Goals for 1992/93

Interpret seismic data and integrate them with geological information.

Prepare papers outlining results (early 1993).

Demonstrate to our key clients that Triassic–Jurassic reef complexes are likely to be widespread on the North West Shelf, at AAPG Conference in Sydney in August 1992.

Clients

Petroleum exploration companies

Universities

Cooperating agencies

Bundesanstalt für Geowissenschaften und Rohstoffe, Hannover, Germany

Western Australian Mines Department

Project 121.26 North west continental margin stratigraphy

Project manager	Jim Colwell	06 249 9346
Program responsibility	Marine Geoscience and Petroleum Geology	
Timeframe	1990–1993	

Objective

Assist stratigraphic interpretations and, ultimately, petroleum exploration on the north west continental margin.

Relevance

The project addresses a number of geological and tectonic problems in the region, for example, the nature of volcanic/non-volcanic passive margin segments, and the age and lithology of pre-rift, syn-rift and post-rift sequences. The samples and information generated from the samples provide stratigraphic control for the interpretation of seismic sections in a variety of North West Shelf projects and industry surveys.

Expected outcomes

Enhanced understanding of the nature and geological history of parts of the North West Shelf and adjacent areas.

Evaluation of the petroleum potential of deep water parts of the margin.

Stratigraphic control for input into other North West Shelf projects.

Activities

Provide geological information on poorly-sampled areas of Australia's north west continental margin, through dredging and coring aboard *Rig Seismic* in August–September 1990. Areas sampled include Carnarvon and Rowley Terraces, northern Exmouth Plateau, western margin of the Scott Plateau and the Wallaby Plateau.

Palaeontological, petrographic and stratigraphic analyses.

Application of geological 'ground-truthing' to seismic interpretations.

Expected products

Post-cruise report released in early 1991.

Various scientific papers and reports.

Highlights for 1991/92

Publication of some initial results of project in Proceedings of the 20th Indonesian Petroleum Association Congress.

Definition and correlation of major lithofacies in each of the sampled areas.

Preliminary palynological studies completed and published as a BMR Record.

Goals for 1992/93

Finish detailed description and correlation of rocks.

Use results in other North West Shelf projects.

Prepare paper on the geology of the Wallaby Plateau.

Clients

Australian petroleum industry

Cooperating agencies

Australian National University

University of Tasmania

Project 121.27 Southern margin geological sampling

Project manager	David Feary 06 249 9246
Program responsibility	Marine Geoscience and Petroleum Geology
Timeframe	1991–1995

Objectives

Provide stratigraphic control for the evaluation of the prospectivity of the deeper part of the Ceduna Sub-basin, as a component of the Great Australian Bight region framework study.

Investigate the geological origin of the Diamantina Zone and Naturaliste Plateau.

Develop and evaluate models of passive margin tectonic evolution, high energy cool water carbonate deposition, and mantle magmatism.

Relevance

The Mesozoic Great Australian Bight Basin off southern Australia contains a number of potentially prospective sedimentary basins, but remains inadequately explored for hydrocarbons. Stratigraphic control on seismic interpretation is limited due to lack of wells. Dredging of samples along the margin provides material for dating and stratigraphic analysis.

Australia's southern margin is recognised internationally as being of critical importance in developing and evaluating models of passive margin tectonic evolution, cool water carbonate deposition and mantle magmatism.

Expected outcomes

A comprehensive understanding of southern margin depositional environments through time, that will be relevant to the petroleum exploration of the region as well as the scientific community.

An evaluation of southern margin climate and sea level change for the late Quaternary.

Improved understanding of southern margin tectonic development.

Activities

Plan and execute cruises to collect samples by dredging to illustrate the stratigraphy and nature of the margin.

Evaluate biostratigraphic and sedimentological facies data from the southern margin of Australia in order to complement and constrain seismic interpretation of the tectonic and exploration aspects of the study.

Determine the prospectivity of the deep Great Australian Bight Basin sequence in the Ceduna Sub-basin area as part of the Bight Basin framework study.

Document the Late Quaternary palaeochemistry of the southern margin, in order to evaluate the nature and extent of glacial/interglacial cyclicity as a control on sea level variation, organic carbon fluxes, seafloor mineral accumulation and continental weathering.

Develop appropriate high energy, cool water carbonate reservoir models based on the sedimentary characteristics of Cenozoic carbonate deposits on the Eucla Shelf–Eyre Terrace.

Determine the geochemical characteristics of Southern Ocean magmatism between the continent-ocean boundary and magnetic anomaly 13.

Develop accumulation and diagenetic models for cool water shelf and slope carbonates in view of their potential as hydrocarbon reservoirs.

Expected products

AGSO Reports, AGSO Records and scientific journal publications describing depositional environments, climate/sea level changes and tectonic development.

Highlights for 1991/92

Completion of a successful cruise in the Great Australian Bight.

Realisation of implications for the significance of this study for the re-evaluation of carbonate sediments, particularly with respect to the previously presumed tropical origin of many ancient shallow water carbonate accumulations throughout the world.

Goals for 1992/93

Develop models of cool water carbonate deposition which will be of international significance.

Provide statements of past climatic variability for the southern margin for the late Quaternary, that will be relevant to studies of past variability by the Cooperative Research Centre for the Antarctic and Southern Ocean Environment.

Plan and undertake sampling cruise over the Naturaliste Plateau and Diamantina Zone.

Clients

Australian petroleum exploration industry

Cooperative Research Centre for the Antarctic and Southern Ocean Environment

Cooperating agencies

Dr Y Bone, University of Adelaide

Prof. NP James, Queens University, Ontario, Canada

Project 121.28 Basin development and hydrocarbon potential of the Browse Basin and adjacent continental margin

Project manager	Phil Symonds 06 249 9490
Program responsibility	Marine Geoscience and Petroleum Geology
Timeframe	1993–1995

Objective

Improve understanding of basin evolution to stimulate petroleum exploration interest in the Browse Basin, and develop new exploration strategies.

Relevance

Despite five gas/condensate discoveries in the Browse Basin, including the large Scott Reef field, and two encouraging oil occurrences confirming that hydrocarbons have been generated and trapped within the basin, exploration and drilling have been less intensive than in other major North West Shelf basins. It seems highly likely that the basin has not realised its full potential.

The Browse Basin lies between Australia's two most currently active exploration areas - the Vulcan Graben and the Barrow/Dampier Sub-basins. The time is right to build on improvements in regional understanding resulting from this exploration to reassess the Browse Basin's petroleum potential, and thus promote renewed exploration interest beyond the active areas.

Expected outcomes

Improved understanding of the tectonic development of the Browse Basin and its relationship to major adjacent structural elements.

A resurgence of exploration interest in the Browse Basin.

An up-to-date synthesis of the structural and stratigraphic framework of the basin, as an aid in the development of new petroleum play concepts and exploration strategies.

Activities

Compile, review and analyse company seismic and well data in the region for cruise planning purposes, and for a biostratigraphic and geohistory study of the basin.

Conduct a *Rig Seismic* survey in the Browse Basin region, probably in mid 1993. The survey will collect about 2500 km of deep (15 sec record length) seismic reflection data. These data will tie all major wells in the basin, as well as the 1990/91 BMR data in the Vulcan Graben, and planned deep seismic data in the Rowley Sub-basin to the south.

Process seismic data targeted for release in early 1994.

Determine the regional structural and stratigraphic framework of the Browse Basin.

Develop a model explaining the tectonic, subsidence and thermal history of the Browse Basin in relation to the development of the continental margin and adjacent ocean basin, the Argo Abyssal Plain.

Define new petroleum play concepts for the Browse Basin area, and update assessments of its petroleum potential.

Expected products

2500 km of processed deep crustal seismic data tying wells in the Browse Basin.

Processed non-seismic (navigation, bathymetry, gravity and magnetic) digital data package, partly in image format.

Report containing well summaries, biostratigraphic review and basin-wide burial and thermal geohistory analyses, examining the possibilities for timing of maturation, migration and entrapment of petroleum.

AGSO report on the Browse Basin study containing regional crustal cross-sections, maps and seismic sections illustrating the structural and stratigraphic framework of the basin, and information on new play concepts and petroleum potential.

Reports and papers containing new ideas on tectonic development, deep structure, structural style, reactivation history and petroleum potential of the Browse Basin in industry-related journals, and at conferences such as APEA and AAPG.

Highlights for 1991/92

(Project deferred to 92/93)

Goals for 1992/93

Plan and conduct *Rig Seismic* cruise in 1993 to collect about 2500 km of deep seismic and associated geophysical data, which will form the core data set for a new integrated basin analysis.

Commence a biostratigraphic review and a basin-wide burial and thermal geohistory analysis of the Browse Basin in 1993 to examine the possibilities for hydrocarbon generation and accumulation within the basin.

Clients

Australian petroleum industry

Current and prospective lease holders in the Browse Basin

Petroleum Division, MinFish Group, DPIE

Geological Survey of Western Australia

Cooperating agencies

Petroleum Resource Branch, BRS, DPIE

Onshore Sedimentary and Petroleum Geology Program (Australian Petroleum Systems project 111.02B), AGSO

Geological Survey of Western Australia

Project 121.29

Tropical and temperate marine carbonate systems of Eastern Australia: facies, climate and sea level *(revised title)*

Project manager	John Marshall 06 249 9536
Program responsibility	Marine Geoscience and Petroleum Geology
Timeframe	1991–1995

Objective

Develop models of carbonate accumulation related to variations in facies, climate and sea level.

Relevance

The differences between tropical and temperate build-ups in terms of geometry, composition, diagenesis, and structural and stratigraphic location can aid in the definition of new exploration concepts and new play types in ancient carbonate depositional environments. These sediments also record a history of recent climate and sea level which can be used to assess controls and extent of climate change in the past.

The project is a cooperative research study between AGSO, the Technical Research Centre of the Japan National Oil Corporation, and the Department of Geology and Geophysics of the University of Sydney, aimed at studying the outer shelf and upper slope sedimentary facies of the east Australian margin along critical and contrasting subtropical transects.

Expected outcome

A model for subtropical and temperate carbonate build-ups to assist with the development of new concepts for cool water carbonate reservoirs in international exploration.

Activities

Project management committee meetings twice yearly, alternately in Canberra and Tokyo, for project duration. Negotiate agreements with Japanese counterparts.

Planning and execution of 3 research cruises in November 1991 (completed) and 1993.

Investigate the Recent to Tertiary sequence along critical tropical, subtropical and temperate transects.

Carry out analysis of results obtained from the cruises, in particular seismic interpretation, sedimentological analysis, and palaeoenvironmental variability; prepare and report results at workshops in Australia and Japan.

Define the facies distribution of the outer shelf and upper slope sediments to a depth of 1000 m, their three dimensional geometry, and controls on their distribution, particularly with respect to tectonics, climate and sea level.

Understand the post-depositional factors affecting the physical and chemical properties of the sediments, in particular those factors affecting porosity and permeability.

Relate sediment characteristics and changes in their properties to the understanding of ancient limestones.

Expected products

Several thousand kilometres of multichannel high resolution seismic data that delineates sea level related sediment packages and carbonate depositional facies.

Facies maps of temperate, subtropical and tropical carbonate sediments that relate their depositional systems to principal allocyclic and autocyclic factors.

Highlights for 1991/92

Significant results have been obtained in 1991/92 that bear on the interpretation of facies geometry in ancient petroleum-bearing systems and in understanding the history of sea level in the region.

Discovery of Quaternary and late Tertiary sea level related sediment packages on the outer shelf and upper slope off Noosa Heads that reflect both high and low sea level depositional systems.

Discovery of an Early to Middle Miocene carbonate platform off Fraser Island that is believed to be a subtropical build-up, growing in a time of generally or relatively rising sea level, but subsequently exposed during a substantial fall in sealevel in the mid-Miocene.

Delineation of a younger (Quaternary) carbonate platform, backstepped some 9 km from the Miocene platform, the modern and living equivalent of which is dominated by an encrusting coralline algal and species limited coral assemblage, considered to indicate a marginal tropical or subtropical environment.

Goals for 1992/93

Interpret seismic reflection data and process geological samples collected in 1991 in order to develop a sequence stratigraphic model for the late Tertiary and Quaternary (June 1992).

Develop models for the evolution of temperate to subtropical carbonate platforms, using the southern Queensland margin as a key area (ongoing).

Elucidate the palaeoenvironmental signals from cores of the upper continental slope of southern Queensland to determine the effects of past global and local climatic and oceanographic variations on the development of carbonate platforms in sensitive subtropical regions (ongoing).

Plan and receive acceptance of Project Management Committee in July 1992 and early 1993 for subsequent cruise operations.

Plan and carry out the second cruise of the project.

Process seismic data and geological samples collected during that cruise.

Cooperating agencies

Technical Research Centre, Japan National Oil Corporation

Department of Geology and Geophysics, University of Sydney

Project 121.30 Lord Howe Rise and Norfolk Ridge 'Law of the Sea' study

Project manager	Phil Symonds	06 249 9490
	Barry Willcox	06 249 9273
Program responsibility	Marine Geoscience and Petroleum Geology	
Timeframe	1992–1995	

Objectives

Investigate the structure, stratigraphy and basin development of the southern Lord Howe Rise, southern New Caledonia Basin, and West Norfolk Ridge in the Australia/New Zealand boundary zone, as an aid to assessing its petroleum resource potential.

Determine the major tectonic fabric of the region including the nature of crust (continental or oceanic) underlying the New Caledonia Basin.

Relevance

This project is of direct relevance to the definition of the seabed boundary between Australia And New Zealand as well as having long-term resource implications and increasing our understanding of the evolution of the

Tasman Sea-western Pacific margin. It also provides information to assist with the definition of Australia's 'legal continental shelf' on the southwestern margin of the Lord Howe Rise.

Expected outcomes

Enhanced understanding of the geological framework and resource potential of the area likely to be the subject of negotiations for an Australia–New Zealand seabed boundary.

Background technical input to future seabed boundary negotiations between Australia and New Zealand, and for definition of Australia's 'legal continental shelf' on Lord Howe Rise.

Expected products

Approximately 3000 km of regional seismic data plus, possibly, dredge samples.

Data relevant to seabed boundary negotiations and 'legal continental shelf' definition.

Various scientific papers and reports.

Goals for 1992/93

Undertake RV *Rig Seismic* cruise in November/December 1992.

Produce cruise report.

Commence processing of data.

Clients

Department of Foreign Affairs and Trade

Attorney-General's Department

Policy division of Department of Primary Industries and Energy

Petroleum exploration companies (long-term)

Cooperating agencies

New Zealand Institute of Geological and Nuclear Sciences Ltd

Project 121.31 Arafura Sea: seismic reconnaissance for the definition of basin configuration and hydrocarbon potential *(Note: Project 121.24 has been incorporated into this project)*

Project manager	Aidan Moore	06 249 9583; fax 06 249 9980
Program responsibility	Marine Geoscience and Petroleum Geology	
Timeframe	1992–1994	

Objective

Encourage petroleum exploration of Australia's northern margin by providing new concepts, and technically superior and more appropriate data sets in the Arafura Sea region.

Relevance

The margin of Australia beneath the Arafura Sea is poorly understood in geological terms, hence its prospectivity is downgraded and its exploration neglected. It contains parts of the Money Shoal, Arafura and McArthur Basins. Exploration wells are restricted to the Goulburn Graben where oil shows have been recorded.

Before this project began, the scientific data available were not adequate for proper understanding of the whole basin complex. In the absence of an adequate frame-work of basic geological reconnaissance, industry was not prepared to explore outside the Goulburn Graben.

Expected outcome

Clarification of geological structure and delineation of new basinal area beneath the Arafura Sea that will lead to increased exploration interest in this region.

Activities

2024 km of multifold reflection seismic, gravity and magnetic data collected in the central area in 1990 (Survey 94) have been processed. Interpretation of this data set is underway. 3240 km of seismic and associated data was collected in the eastern area at the end of 1991 (Survey 106) and will be available by September 1992. The resulting combined data set of approximately 5250 km of stacked seismic profile will be marketed by NOPEC a s

Expected product

5250 km of processed seismic data (Surveys 94 and 106), and an interpretation package of survey 94 data by October 1992 in time for acreage release in the region.

Highlights for 1991/92

The project has been able to demonstrate the presence of a major Precambrian to Palaeozoic depocentre in the central area to the north of the Goulburn Graben, and thereby identify a new basinal area in the Australian margin.

An excellent seismic data set was collected in the eastern area at the end of 1991. It includes trans-basin lines that will allow correlation of geology from the centre of the basin complex to the outcrop onshore, and to seismic lines and wells in Indonesian adjacent areas.

Goals for 1992/93

Interpret and release the Survey 94 seismic data by October 1992.

Process and release the Survey 106 seismic data by October1992.

Begin interpretation of Survey 106 data

Clients

BHP Petroleum

BP

Petroleum exploration companies

Cooperating agencies

NOPEC a s

Project 121.32 Seabed morphology and offshore resources around Christmas Island

Project manager	Neville Exon	06 249 9347; fax 06 249 9986
Program responsibility	Marine Geoscience and Petroleum Geology	
Timeframe	1991–1993	

Objectives

Define seabed morphology and sediment thickness around Christmas Island as an aid to seabed boundary delimitation discussions between Australia and Indonesia.

Assess the non-living resources of the seabed adjacent to Christmas Island, especially manganese nodules and cobalt-rich manganese crusts.

Determine the nature and age of the Christmas Island volcanic pedestal and other volcanic rises, and their relationship to the adjacent oceanic crust.

Relevance

The Department of Foreign Affairs and Trade (DFAT) has specifically requested AGSO to undertake work to define the seabed resources of the area around Christmas

Island, before finalising negotiations between Australia and Indonesia on the seabed boundary between Christmas Island and Java.

The project will provide valuable information on the manganese nodule and crust potential of part of Australia's future Economic Exclusion Zone (EEZ).

By sampling volcanic seamounts, the project will provide information on the age of formation of Christmas Island, the larger submarine Christmas Rise, and other seamounts in the area.

Expected outcomes

Advice to DFAT on seabed morphology and non-living resource potential of the area around Christmas Island.

Input into the definition of the seabed boundary between Christmas Island and Java.

Better understanding of the geology and mineral potential of the Christmas Island offshore area.

Activities

Rig Seismic research cruise completed in February 1992 involved high-resolution seismic (and associated bathymetric, magnetic and gravity data) and sampling (free-fall grabs, corers, dredges).

Geochemical analysis of nodules and crusts recovered.

Description and interpretation of shallow-marine carbonates dredged from seamounts.

Dating and description of volcanic and volcaniclastic rocks dredged from seamounts.

Synthesis and reporting.

Expected products

AGSO Record to DFAT, as initial post-cruise report.

Cruise Report, as a synthesis of results.

Scientific papers and reports

Highlights for 1991/92

Cruise successfully completed.

Geochemical analyses in hand.

Post-cruise BMR Record well advanced.

Goals for 1992/93

Complete sedimentological, petrological and palaeontological studies.

Submit cruise report and scientific papers for publication.

Provide advice to DFAT.

Clients

Department of Foreign Affairs and Trade

Mineral exploration companies

Cooperating agencies

Adelaide University

Australian National University

University of Tasmania

Project 121.34 North West Shelf regional structure

Project manager	Neville Exon	06 249 9347; fax 06 249 9986
Program responsibility	Marine Geoscience and Petroleum Geology	
Timeframe	1991–1996	

Objectives

Understand the structural archictecture of the North West Shelf sedimentary basins, the timing of critical development phases, the processes that formed the basins, and the relevance of the above to petroleum exploration.

Relevance

The north western margin of Australia is known to contain viable hydrocarbon source rocks, reservoirs and seals, and is a major gas and oil province. However, exploration is diminishing in some areas because of the structural complexity of plays and the small size of many oilfields. Furthermore, the relationship between structural history, source rock maturation and oil migration is often not well understood.

The development of the basins on the North West Shelf is intimately related to its breakup and collisional history, and shows both similarities and differences along the margin. The margin broke up as part of the breakup of Gondwana, with initial stretching in the Permo-Triassic, and rifting and breakup in the Triassic, Jurassic, and Early Cretaceous. The nature, age and direction of stretching, rifting and breakup varied along the margin, as did the the results of the Cainozoic collision with Timor. The precise timing and character of the various events are generally rather poorly defined, and there are various models extant for both breakup history and collisional events. The rifting and breakup history controlled the formation of depocentres and petroleum source rocks, and the collisional history controlled the final phase of structural reactivation, which is seen as having played a key role in hydrocarbon migration and entrapment along the North West Shelf.

This project aims to assist in addressing the above problems by using the appropriate data sets (e.g. deep crustal seismic, potential field data) to define the nature and age of the original basin-forming structures, and their response to subsequent reactivation phases.

Expected outcomes

A better understanding of the regional structure, megasequences, geological history and controls on petroleum potential of the North West Shelf.

Activities

Assemble a regional geophysical database which, in conjunction with existing well and other geological data, forms the basis for this study.

Map the regional megasequences and structures, and prepare maps of structural framework, structure contours and sediment thickness.

Prepare illustrative regional cross-sections and interpreted seismic profiles.

Carry out modelling and analysis of the effects of the Timor collision.

Prepare geohistory analyses of wells in the region.

Participate in regional stress studies based on borehole breakouts.

Revise and refine the biostratigraphic and lithostratigraphic framework.

Synthesise all these results, and those of other more local North West Shelf projects, into a coherent geological history of the region.

Expected products

Digital seismic shotpoint database

Structural elements map

Time-structure maps

Isopach maps

Structural cross-sections, prepared by local projects

Interpreted composite seismic sections, prepared by local projects

Well geohistory diagrams

Models of marginal flexuring

Scientific papers

Regional synthesis

Goals for 1992/93

Prepare seismic database

Complete initial structural elements map

Start on preparation of maps, cross-sections, and interpreted seismic sections

Complete preliminary geohistory studies

Have preliminary models for marginal flexuring

Release early results, probably as AGSO Records

Clients

Petroleum exploration companies

Western Australian and Northern Territory Mines Departments

Universities

Cooperating agencies

Petroleum exploration companies

State geological surveys

Universities

NOPEC a s

Project 121.36

Northern Bonaparte Basin: deep-basin architecture, structural reactivation and hydrocarbon potential

Project manager	Peter Hill	06 249 9292
Program responsibility	Marine Geoscience and Petroleum Geology	
Timeframe	1992–1995	

Objective

Encourage petroleum exploration and enhance exploration strategies in the northern Bonaparte Basin through a better understanding of the deep structural framework, early basin evolution and Cainozoic structural reactivation mechanisms.

Relevance

This project is a part of AGSO's current integrated Australian north west margin mapping and research program, which will result in the development of a comprehensive regional synthesis on the geological framework, evolution and petroleum potential of this section of the Australian continental margin, from the Carnarvon to the Arafura Basins.

Area A of the Australian/Indonesian Zone of Cooperation was recently opened for exploration; it lies within the northern Bonaparte Basin. Acquisition of deep crustal data (not generally collected by industry) and seismic ties to wells and seismic grids outside the area are a timely complement to present renewed exploration activity.

The study will provide a better understanding of foreland development associated with Eurasian/Indo-Australian plate convergence and collision in the Timor region.

A tie to the deep crustal transect recently completed by the British BIRPS expedition across the plate boundary east of Timor will enhance the value of the proposed data set by helping to place the study area in the context of tectonic processes taking place on a broad regional scale.

Expected outcomes

Definition of the deep crustal architecture of the northern Bonaparte Basin and associated structural elements (such as the Sahul Platform, Sahul Syncline, Malita Graben) and an improved understanding of the evolutionary history of the basin dating back at least to the Devonian.

Predictive models for hydrocarbon migration pathways and accumulations in the northern Bonaparte Basin.

An understanding of how the deep basin-forming structures in the Timor Sea area have controlled shallow (less than ~4 km deep) reactivation processes and hydrocarbon entrapment related to foreland development and lithospheric flexure.

Improvement in exploration efficiency of the Joint Development Zone and associated region.

Activities

Compile, review and analyse existing geophysical and well data; prepare cruise plan for a deep crustal petroleum-oriented geophysical investigation.

Acquire approximately 2500 line km of deep crustal and other geophysical data using *Rig Seismic* in the northern Bonaparte Basin region.

Process seismic, navigational and non-seismic geophysical data.

Begin interpretation of data sets.

Publish results.

Expected products

Approximately 2500 km of processed deep crustal multichannel seismic data and associated bathymetric, magnetic and gravity profile data.

Regional seismic stratigraphic ties between exploration wells and main structural elements.

Revised regional structural and stratigraphic maps and cross-sections; reports and papers on the structure, evolution, new play concepts and petroleum potential of the northern Bonaparte Basin.

Goals for 1992/93

Complete cruise planning and pre-cruise report.

Conduct *Rig Seismic* research cruise in late 1992 (or possibly early 1993).

Produce post-cruise operational report.

Commence processing of seismic data (either within AGSO or through an external agency).

Complete processing of navigation, bathymetry and potential field data.

Clients

Australian petroleum industry

Current and prospective permit holders in the Bonaparte Basin

Petroleum Division, MinFish Group, DPIE

NT Department of Mines and Energy

Geological Survey of Western Australia

Joint Development Zone Authority

Cooperating agencies

Current permit holders in the Bonaparte Basin

NT Department of Mines and Energy

Geological Survey of Western Australia

BIRPS Group (Cambridge University)

Project 121.39

Malita Graben: petroleum potential and deep crustal structure

Project manager	Chris Pigram	06 249 9636; fax 06 249 9980
Program responsibility	Marine Geoscience and Petroleum Geology	
Timeframe	1992–1995	

Objective

Understand the deep crustal structure and petroleum potential of the Malita Graben and Calder Graben region of the Timor Sea.

Relevance

The Malita Graben region has been poorly explored and largely ignored by the petroleum industry in recent times, despite gas and condensate shows in Troubadour, Sunrise and Evan Shoals wells.

The study provides the link between the existing and proposed Timor Sea deep crustal data sets (projects 121.19, 121.22, 121.28, 121.36) and the Arafura Sea data sets (project 121.31). It will also contribute to an understanding of the deep crustal architecture of the north western Australian margin.

Expected outcomes

An increased understanding of how the major basin-forming structures in the Malita Graben region have controlled reactivation processes and their influence on hydrocarbon entrapment.

Improved exploration efficiency in the region.

Activities

Compile and review existing data sets in the region for cruise planning purposes.

Collect 2500 km of multichannel deep crustal reflection seismic data using *Rig Seismic*.

Expected products

2500 km of high quality deep crustal seismic data and a new set of maps and reports on the petroleum potential and geological history of the region

Goals for 1992/93

Plan and conduct research cruise

Begin data processing

Clients

Petroleum industry

211: MINERAL PROVINCE STUDIES

Objectives

Optimise the environment for mineral exploration through the provision of geoscientific data sets, maps and exploration models.

Provide a reliable information base for the assessment of mineral resource potential.

Improve the geoscientific knowledge base to facilitate sound environmental management and land use planning.

Relevance

The National Geoscience Mapping Accord (NGMA), endorsed by the Australian (now Australian and New Zealand) Minerals and Energy Council in August 1990, is a joint Commonwealth-State/Territory initiative to produce a new generation of geoscientific maps, data sets and other information of strategically important regions of Australia over the next 20 years, using modern technology.

Under the Accord, AGSO and State and Territory geological surveys have identified areas of high priority for mineral and petroleum exploration and/or where significant issues of land use exist. The Minerals and Land Use Program is involved in collaborative 5 year work programs in six areas—North Queensland, Eastern Goldfields, Arnhem Land, Kimberley–Arunta, Lachlan–Kanmantoo Fold Belts, and the Musgrave Block.

The focus of the NGMA is to produce a new generation of geoscience maps and data sets which will underpin mineral and petroleum exploration and provide a sound basis for resource assessment and for the development of sustainable land use management strategies. A multidisciplinary approach is being employed using new airborne geophysical and other remotely sensed data sets.

Output from NGMA mapping will include digital maps and data sets with the emphasis on 1:250 000 scale geological maps and related data sets, geochemical maps and data sets, regolith maps and data sets, geochronological data, Geographic Information System packages, predictive models of mineral resource potential, and descriptive and interpretive reports and papers.

Activities

Carry out, in collaboration with the State/Northern Territory geological surveys under the NGMA, multidisciplinary studies of mineral provinces based geological mapping using airborne magnetic and radiometric data and other remotely sensed data sets.

Undertake specialist research in geochronology, geochemistry, regolith studies, petrology and mineral deposit studies in support of the mapping in NGMA project areas.

Use the latest technology to produce a new generation of geological maps in digital format and contribute to national digital geoscience databases.

Build databases of information on the factors influencing the development of major mineral deposits and develop predictive models for the assessment of mineral resource potential.

Improve the geoscientific information base in order to provide a basis for sound environmental management and land use planning.

Highlights for 1991/92

Significant progress in development of digital map products through GIS; release of five 1:100 000 digital geological maps as ARC/INFO coverages from the Eastern Goldfields.

Released the first edition 1:1 million Regolith Terrain Map of the Kalgoorlie Region and accompanying report (BMR Record Surficial Geology series).

Completed of Ebagoola 1:250 000 geological mapping and release of package of digital data including basement geology maps, regolith land form maps, interpreted magnetic features, multi-element stream sediment geochemical analyses, mineral occurrence data, and REGMAP and RTMAP field data observations.

Geochronological studies (U-Pb zircon dating by ion probe) indicating that the Cape York Peninsula Batholith is approximately 408 Ma, and thus implying that the Yambo and Coen Inliers may be substantially younger (Palaeozoic) than the Georgetown Inlier.

Released all Proterozoic ROCKCHEM databases with significant client interest and sales.

Published (June) BMR Bulletin—Petrology and platinum-group-element geochemistry of Archaean layered mafic-ultramafic intrusions, West Pilbara Block, Western Australia.

Mapped approximately two-thirds of the Arnhem Bay–Gove and Blue Mud Bay–Port Langdon 1:250 000 sheets in eastern Arnhem Land.

Completed geological mapping of Blayney and Oberon 1:100 000 sheets (Lachlan–Kanmantoo Fold Belts project).

Completed mapping in the Tomkinson Ranges and outlying areas and progress in preparation of maps.

Completed the petrological study of the layered basic/ultrabasic intrusions of the Giles Complex in the Tomkinson Ranges.

Released contractors reports and other BMR research conducted for the Resource Assessment Commission on the Kakadu Conservation Zone.

Released more than 40 BMR Records including the first in the new Mineral Province and Surficial Geology series.

Major participation in workshop sponsored by BMR and GGDPAC 'Geographic information systems, cartographic and geoscience data standards' held in Canberra – March.

Developed new field mapping techniques, including the routine use of Global Positioning Systems (GPS), for accurate location and the application of radiometric data in regolith landform mapping.

Substantial progress in the development (with Information Systems Branch) of new Oracle databases for standardising, storing and manipulating geological field data to support GIS.

Significant increase in the use of processed airborne geophysical data due to increased availability of data and hardware, and increase in interpretive skills through training.

Goals for 1992/93

The Program will continue basement mapping activities in collaboration with State/Northern Territory counterparts in the Eastern Goldfields, Kimberley, Eastern Arnhem Land, Lachlan and Musgrave provinces. Only a limited geological program will be conducted in North Queensland in 1992, as the focus will be on preparation of products from the previous two field seasons.

Regolith mapping by AGSO will continue in the Eastern Goldfields, Lachlan and North Queensland projects and will commence in Arnhem Land. The North Queensland activities will be focused on meeting the CYPLUS objectives.

The surficial geochemical mapping program will continue in Cape York, although at a reduced level to enable processing and interpretation of data acquired previously.

Developments in GIS and its application to metallogenic studies and assessment of mineral resource potential will continue both through the NGMA projects and through a pilot study of the Mount Isa Province.

Continued effort will be directed towards the development of Oracle databases for the standardising, storing and manipulation of field and laboratory data.

MINERAL PROVINCES

Component manager Lynton Jaques 06 249 9745

Component projects

211.06 Precambrian metallogeny

211.09 North Queensland (NGMA Project)

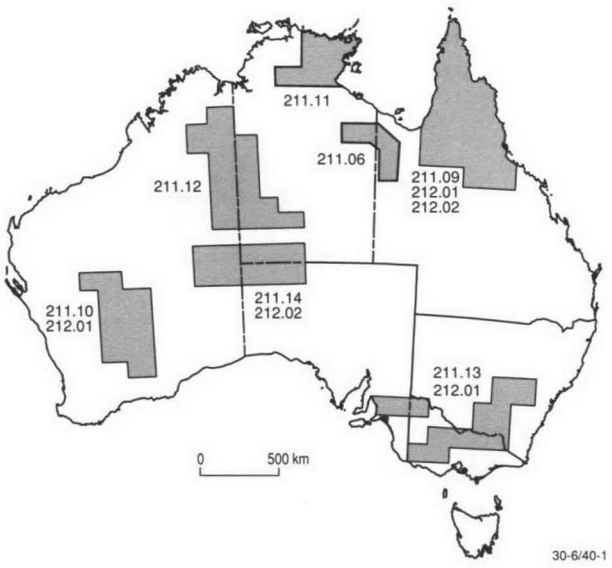
211.10 Eastern Goldfields (NGMA Project)

211.11 Arnhem Land (NGMA Project)

211.12 Kimberley–Arunta (NGMA Project)

211.13 Lachlan–Kanmantoo Fold Belts (NGMA Project)

211.14 Musgrave Block (NGMA Project)



Project 211.06 Precambrian metallogeny

Project manager	Lesley Wyborn 06 249 9489
Program responsibility	Minerals and Land Use Program
Timeframe	1991–1996

Objectives

Develop a comprehensive understanding of the geological evolution of Australian Precambrian provinces and their metallogeny.

Relevance

The Precambrian orogenic provinces of Australia host many major mineral deposits. Many of these provinces have similar tectonostratigraphic histories and metallogeny. This project will provide regional syntheses of the geology and metallogeny of Precambrian Mineral Provinces and develop new mineral deposit models in support of the NGMA projects.

Expected outcomes

A more comprehensive understanding of the tectonic, stratigraphic and metallogenic evolution of the Precambrian provinces of Australia to enable more efficient and effective exploration.

A better understanding of the mineral potential of Australian Precambrian provinces.

Activities

Synthesise existing data, and where necessary acquire new primary data, relevant to metallogenesis on the tectonic, stratigraphic and geochemical development of Precambrian provinces, particularly in poorly known regions.

The project will work in close collaboration with the metallogenic research and syntheses being undertaken as part of the NGMA projects in Precambrian provinces. As necessary, limited field work will be carried out in relevant Precambrian provinces, particularly those provinces where metallogenic information is sparse.

Undertake multidisciplinary studies of the essential geological controls on the localisation and grade of major Precambrian mineral deposit types, with emphasis on their relationship in space and time to regional petrographic, geochemical, geophysical and tectonic features.

Record all data collected digitally and store within Geographical Information System (GIS); sets to be incorporated include

- synthesis of information on mineral deposits, prospects and occurrences
- regional whole rock geochemical data
- regional geophysical surveys, with emphasis on signatures around known deposits (magnetics, radiometrics, gravity)
- specialist studies of selected mineral deposit styles
- geochronological data

Expected products

A catalogue of key parameters (geological, geochemical, geophysical) for the characterisation of the tectonic setting and formation of major Precambrian ore deposits.

A trial GIS package in which individual layers will attempt to highlight the geographical distribution of features of metallogenic importance for specific major deposit types including such features as

- chemically distinctive host rocks
- regional alteration types
- major structures and lineaments
- potential source rocks for certain elements
- regional geophysical images (magnetics, gravity, radiometrics)

- metallogenically important igneous rock associations (e.g. fractionated granite suites, layered mafic intrusives).

Metallogenic province maps, databases and syntheses.

Scientific research papers.

Synthesis reports summarising the essential genetic and empirical criteria for major deposit types.

Highlights for 1991/92

Completed fluid inclusion study at Coronation Hill and determined the composition of the mineralising fluid as similar to those of the other major unconformity uranium deposits of the Pine Creek Inlier. This study also confirmed that the gold–palladium–platinum mineralisation and the uranium mineralisation were precipitated from the same oxidised fluid which was of meteoric origin.

Characterised fluid associated with regional scale alteration during late regional metamorphism around the Mount Isa deposit as being similar to that associated with the copper mineralisation.

Released structural reports on Coronation Hill region which showed that mineralisation in the ore was of unconformity style and related to last, post-Kombolgie Formation movements along the Rockhole–Palette Fault System.

Released sedimentological report detailing sedimentological features of the El Sherana and Edith River Groups in the Coronation Hill area.

Released report on the geochemistry and geochronology of the felsic volcanics south east of Coronation Hill. Once thought to be highly prospective for gold–platinum–palladium mineralisation, these volcanics were found to be younger and of a different composition to those which host the mineralisation at Coronation Hill.

Released all Proterozoic ROCKCHEM geochemical databases.

Released in digital format previous stream sediment surveys from the Mammoth Mines, Siegal and Hedleys Creek 1:100 000 Sheet areas.

Released 17 maps as 24 sheets at scales ranging from 1:5 000 to 1:100 000 covering a transect across the central portion of the Mount Isa. Completed a compilation of 19 detailed papers resulting from the 1983–1989 BMR Mount Isa project to be released as BMR Bulletin 243: 'Detailed studies of the Mount Isa Inlier' and an accompanying map at 1:250 000 scale entitled 'Geology of the Mount Isa–Cloncurry transect'. Both products went to the printers in June 1992.

Prepared a mineral deposit database summarising the 240 largest deposits in the Mount Isa Inlier, in collaboration with the Geological Survey of Queensland.

Prepared first draft of a mineral deposit database on the Pine Creek Inlier.

Began metallogenic maps for the Pine Creek and Mount Isa Inliers.

Goals for 1992/1993

Complete metallogenic atlas on the Mount Isa Inlier/Lawn Hill Platform/Murphy Tectonic Ridge as a GIS package in ARC/INFO. Layers to include magnetics, gravity, geochemistry, petrology, digital geology, mineral deposits. Data to be synthesised and used as a pilot for an assessment of mineral potential of other Precambrian provinces.

In collaboration with the NTGS, complete Pine Creek mineral deposit database, metallogenic and digital geological maps on the Pine Creek Inlier (including Litchfield Block), commence metallogenic atlas and analysis of mineral potential.

In collaboration with the NTGS and GSWA, commence compiling digital geological maps and metallogenic data on the McArthur, Kimberley and Granites–Tanami provinces as a prelude to developing a metallogenic atlas for each.

Undertake research on the timing, structural and chemical controls on base-metal mineralisation in the McArthur Basin (MIM/AGSO Collaborative Research Project).

Geochemical analysis of a selection of the samples used by AGSO to determine the palaeo-Proterozoic polar wander path and to evaluate the feasibility of using palaeomagnetism to delineate the ages of major regional alteration and hydrothermal events in the Pine Creek, McArthur, Mount Isa areas, particularly those known to be associated with mineralisation.

Participate in CODES/AMIRA/ARC research proposal on Proterozoic base metal mineralisation.

Reinterpret lead–model ages, in conjunction with samarium–neodymium and uranium–lead isotopic data; from sequences hosting Proterozoic stratiform base-metal deposits: evaluation of data available on a continent-wide basis to facilitate stratigraphic correlation of sequences hosting stratabound massive sulphides (in collaboration with CSIRO/industry).

Release the Proterozoic OZCHRON database.

Uranium–lead dating of sequences hosting stratiform lead–zinc deposits of the Eastern Succession of the Mount Isa Inlier (contingent on the provision of suitable samples by industry and/or universities in collaboration).

Clients

Minerals industry

Government

University geoscience department

Cooperating agencies

Northern Territory Geological Survey

Geological Survey of Queensland

Geological Survey of Western Australia

South Australian Department of Mines and Energy

Mount Isa Mines

CSIRO

Centre for Ore Deposit and Exploration Studies (CODES), National Key Centre, University of Tasmania

Project 211.09 North Queensland (NGMA Project)

Project managers	John Bain		06 249 9282
	RJ Bultitude	(GSQ)	07 237 1503
Program responsibility	Minerals and Land Use		
Timeframe	1990–1996		

Objectives

Provide a sound geoscientific knowledge base for the development of future management options for the North Queensland region.

Provide a better understanding of the metallogeny and the mineral potential of the region.

Relevance

The project will provide government, industry, and the community with an updated geoscientific knowledge base essential for sound decision making on development and conservation strategies (e.g. mining, agriculture, tourism, spaceport, national parks, Aboriginal lands) in a region of strategic national importance, at an early stage of developing community concern over public land management.

The project has been endorsed by both the former Commonwealth Minister for Primary Industries and Energy, the Hon John Kerin MP, and the former Queensland Minister for Resource Industries, the Hon KH Vaughan MLA.

Expected outcomes

A modern comprehensive geoscientific knowledge base for North Queensland in terms of maps and data sets and significant new information on mineral resources and the physical environment.

A better understanding of regional mineral resource potential.

Environmental data for land management and for State and National resource and heritage inventories.

Activities

Review current databases containing geoscience information for the project area, assess future data handling requirements and develop of appropriate new databases where necessary.

Review exploration company reports in GSQ Library for exploration history of Cape York Peninsula and enter relevant mineral occurrence information into MINLOC & MINOCC databases.

Image processing and interpretation of new colour aerial photographs, LANDSAT TM, and 400 m line spaced airborne radiometric and magnetic data.

Field check interpreted image maps, collect geological, geophysical and geochemical data and samples, enter information into computer databases, and prepare final maps.

Develop spatial data sets in ARC/INFO GIS for integration, interpretation, and new special map generation.

Elucidate relationships between mineral deposit types and geochemical and structural characteristics, ages, modes of emplacement, and petrogenesis of associated Palaeozoic igneous rocks.

Develop quantitative models of landscape evolution for the region.

Carry out an analysis of the mineral potential of the region using a multidisciplinary team applying standard USGS techniques of evaluating the regional data sets for the presence or absence of diagnostic and/or permissive criteria for a range of defined mineral deposit types.

Prepare a comprehensive regional geological synthesis, including tectonic and metallogenic history.

Prepare interpretive reports, research papers and provide professional advice.

Expected products

Integrated, computer-based and multidisciplinary geoscientific data sets for North Queensland comprising:

- new 1:250 000 scale maps (Ebagoola, Hann River, Walsh, Red River) and commentaries (hard copy and GIS);
- a thematic atlas of regional maps (geology, geophysics, stream sediment geochemistry, regolith terrains, morpho-tectonics, metallogeny, and resource potential) at appropriate scales for the entire region (e.g. 1:1 million);
- digital data sets and interpretive reports.

Improved models for regolith development and landscape evolution.

Revised geological maps at 1:1 million, 1:250 000 and 1:100 000.

Early release of field compilation sheets for geological map data at field mapping scale (e.g. 1:50 000 basement, 1:100 000 regolith).

Mineral occurrence maps at 1:250 000 and 1:100 000.

Computer databases containing geological, geophysical, geochemical, geochronological, and mineral resource data (e.g. ROCKCHEM, STREAMCHEM, MINDEP, MINOCC, MINLOC, OZCHRON, REGMAP, RTMAP).

A GIS containing all available digital geoscience information for the project area.

Descriptive and interpretive reports and specialist research papers to accompany maps and data releases.

Highlights for 1991/92

Early release (within 3 months of end of field work) of preliminary basement geological and regolith terrain maps and associated field observation data (REGMAP and RTMAP databases).

GOMP acquired airborne geophysical data for Hann River and part of Walsh 1:250 000 Sheet areas at 400 m line spacing to facilitate mapping planned for 1993.

Recognised a major structural and lithological discontinuity between the Georgetown Inlier and the Coen and Yambo Inliers on the basis of regional magnetic and gravity data. It has also been recognised that intrusion of the Cape York Peninsula Batholith at 408 Ma was synchronous with second deformation and the peak of regional metamorphism. This implies that the metamorphic rocks of the Coen and Yambo Inliers may be Palaeozoic and therefore substantially younger than suggested equivalent rocks in the Georgetown Inlier. This has considerable significance for exploration strategies that have been based on an assumption that both areas are parts of the one province.

Recognition that the weathering and erosional history of the Peninsula is substantially different from previously published models because of the absence of extensive ferricrete-based erosion surfaces, and the paucity of transported regolith on the Coen Inlier.

Goals for 1992/93

Complete pre-field mapping of Hann River, Walsh and Red River by interpretation of the geophysical data, satellite imagery and air photographs; prepare preliminary maps and define field follow-up program (jointly with GSQ).

Collect essential samples for north Queensland metasediments provenance and geochronology study, complete preliminary petrographic and geochemical study (jointly with GSQ).

Publish geological, geochemical, geophysical and regolith terrain maps and commentaries of the Ebagoola 1:250 000 sheet area.

Complete analysis of mineral resource potential of the Ebagoola 1:250 000 sheet (jointly with GSQ).

Prepare and release an Ebagoola ARC/INFO GIS comprising geology, geophysics, geochemistry, mineral occurrences, regolith, and associated information.

Complete the joint planning phase of the regional synthesis aspect of the north Queensland project.

Contribute pro rata (about 75%), as contracted, regolith and basement geological information as GIS coverages to the Cape York Peninsula Land Use Strategy (CYPLUS).

Complete and issue coloured brochure describing the geological features of the Iron Range National Park – January 1993.

Carry out stream sediment geochemical survey of the basement areas of Red River 1:250 000 sheet and prepare data for release.

Clients

Commonwealth, Queensland and Local Government departments and organisations involved in Cape York Peninsula Land Use Strategy (CYPLUS)

Minerals industry

University geoscience departments

The community

Cooperating agencies

Geological Survey of Queensland, Department of Resource Industries

Canberra TAFE

United States Geological Survey

National Resource Information Centre, BRS, DPIE

Project 211.10 Eastern Goldfields (NGMA Project)

Project managers	Peter Williams		06 249 9389
	Arthur Hickman	(GSWA)	09 222 3333
Program responsibility	Minerals and Land Use		
Timeframe	1987–1996		

Objectives

Determine the major structural elements of the Eastern Goldfields, including crustal structure.

Develop models for the local and regional structural and chemical controls on gold mineralisation.

Develop predictive models for the tectonic evolution of the Eastern Goldfields and environs.

Establish the degree to which structure and stratigraphy can be determined beneath the regolith layer.

Establish the major regolith components, their inter-relationships and landscape evolutionary history.

Relevance

The Eastern Goldfields Province of the WA Yilgarn Craton has long been and remains one of Australia's most important mineral provinces. The region hosts a wide variety of deposit types, and is Australia's main source of gold and nickel. A regional overview of the area will provide an important contribution to the national resource knowledge base.

The project has a high priority established by the Chief Government Geologists Conference under the NGMA. The Eastern Goldfields Province continues to be one of the most actively explored areas of Australia.

Expected outcomes

More effective exploration in the Eastern Goldfields.

A better understanding of the metallogeny of the region.

A geoscientific database to facilitate reliable resource assessment.

An improved understanding of the Yilgarn regolith environment.

Activities

Review and compile existing geological information.

Interpret airborne geophysical and remotely sensed data, air photos, seismic information and gravity data.

Identify field areas for detailed studies and carry out appropriate geological mapping.

Collate geoscience data into integrated digital geoscientific spatial databases.

Fluid inclusion and geochemical studies of selected mineralised area to better define gold ore-forming processes.

Regional whole-rock geochemical analyses and synthesis to constrain models of tectonic and geochemical evolution of the region.

Regolith mapping and interpretation of landscape evolutionary history.

Expected products

Ten updated 1:250 000 geological maps with accompanying geophysical and metallogenic maps where appropriate.

Four summary regolith maps at 1:250 000 scale with map commentaries.

Twenty four 1:100 000 regolith compilation sheets.

New 1:100 000 geoscience thematic maps over approximately 24 1:100 000 map areas.

Appropriate geoscientific maps and images over selected 1:250 000 map areas.

Digital geological information systems, incorporating geological, geophysical, geochemical, mineral deposit and regolith data sets, with appropriate analysis of those sets as resources permit.

Seismic reflection profiles and interpreted crustal cross-sections.

Updated process models of gold ore deposition, particularly in relation to Mount Charlotte and Lancefield deposits.

Aeromagnetic and gravity interpretation maps and models as appropriate.

Reports and specialist papers.

Highlights for 1991/92

Produced five complete 1:100 000 geological layers for the Eastern Goldfields integrated digital spatial database.

Defined the structure and data dictionary for the primary geological map databases and used a Geographic Information System for the storage and management of the map data.

Released Kalgoorlie (and Albany) 1:1 million regional geophysical interpretation maps (June).

Processed and prepared the regional and detailed seismic line sections.

Presented results in three papers at a major industry conference in Kalgoorlie.

Goals for 1992/93

Complete geological mapping of the Lake Carey 1:100 000 Sheet.

Contribute to mapping of Edjudina 1:100 000 and Edjudina 1:250 000 Sheets.

Complete investigation of the use of airborne scanner data (Geoscan) for mapping in the Goldfields.

Complete field mapping on the Leonora 1:250 000 Sheet by mapping the Wildara and Weebo 1:100 000 Sheet areas, greenstones on the Mount Alexander 1:100 000 Sheet, and regional sampling of the remaining areas.

Complete digital map databases for Wildara, Laverton, Lake Carey, Mount Alexander and Weebo 1:100 000 Sheet areas.

Commence compilation of Edjudina and Leonora 1:250 000 sheet areas.

Carry out geological interpretation of the regional seismic reflection profile data and prepare a preliminary report of the results.

Carry out geological interpretation of detailed seismic reflection profile in collaboration with Western Mining Corporation.

Commence interpretation of the Wiluna 1:1 million regional airborne geophysical data.

Complete magnetic interpretation layers for Burtville, Laverton, Mount Varden, Lake Carey, Weebo, Wildara, Mount Alexander and Leonora 1:100 000 Sheet areas.

Complete regolith landform mapping of Laverton and Leonora 1:250 000 Sheet areas.

Complete compilation of the 1:100 000 Sheets comprising Menzies and Edjudina 1:250 000 Sheets.

With GOMP, carry out 4 km gravity survey of Laverton and Leonora 1:250 000 Sheet areas

Continue mineral deposit, fluid inclusion and fluid chemistry studies of selected sites, including Missouri, Sand King, Mount Charlotte and Lancefield.

Prepare records of Lancefield, Missouri and Sand King results.

Provide support of current digital map database for other users, and develop to accommodate future requirements.

Collect and collate whole rock granite geochemical data for selected regions.

In collaboration with GSWA, interpret regional multi-element geochemical data from seismic shotholes and prepare a report of the results.

Prepare for major GSWA–AGSO–UWA sponsored conference on the geology of the NGMA area in Kalgoorlie in September 1993.

Clients

Mineral exploration companies

Government organisations involved in land use, resource development and resource assessment activities

Geological research community

Cooperating agencies

Geological Survey of Western Australia

Key Centre for Research and Teaching of Strategic Mineral Deposits, University of Western Australia

CSIRO Division of Exploration Geoscience, Floreat Park, WA

Western Mining Corporation

Project 211.11 Arnhem Land (NGMA Project)

Project managers	Ian Sweet		06 249 9307
	Barry Pietsch	(NTGS)	089 895 214
Program responsibility	Minerals and Land Use		
Timeframe	1990–1996		

Objectives

Enhance our understanding of the geology of Arnhem Land, and develop a more comprehensive geoscientific knowledge base of the region as a basis for the resolution of land use and natural resource development issues.

Relevance

Arnhem Land, a region larger than Tasmania, has two producing mines—Gove bauxite, and Groote Eylandt manganese. Several hundreds of kilometres to the south, the major McArthur zinc–lead–silver deposit, and several promising hydrocarbon shows, have been located in rocks the same age as those in Arnhem Land. Arnhem Land was systematically geologically mapped by BMR in 1962, but little work has been carried out there since. It is desirable to upgrade our knowledge of Arnhem Land in order to assess its land use and resource potential.

The Aboriginal people of Arnhem Land were granted freehold title to their land in 1976. No exploration has been carried out in north eastern Arnhem Land since then. Following extensive negotiations by the NTGS with the Northern Lands Council and local Aboriginal communities, access to the region was granted to AGSO and NTGS for the purpose of scientific study, to allow upgrading of the geoscientific knowledge base. This will assist governments and communities to make considered decisions, should issues of land use and resource development arise in the future.

Expected outcomes

A better understanding of the geology and resource potential of Arnhem Land.

A geoscientific database to facilitate informed land use decisions.

Activities

Develop a comprehensive understanding of the Early to Middle Proterozoic evolution of the Arnhem Land region.

Geological mapping and specialist geological studies.

Image processing and interpretation of aeromagnetic and radiometric data, and integration with geology.

Capture of primary data in digital format.

Geochronology of selected rock units to facilitate regional correlation of major rock units and events, and to enhance our understanding of the geological evolution of the region.

Sedimentological studies (including measurement of stratigraphic sections and stratigraphic drilling, as appropriate) to document the sedimentary evolution of the region.

Baseline stream sediment geochemical surveys, to document levels of abundance of trace elements in rocks and soils.

Regolith landform mapping, and specialist studies on aspects of regolith and geomorphology, to determine the nature and distribution of regolith types, weathering history, and landscape evolution.

Expected products

New 1:250 000 geological maps of Arnhem Bay-Gove, Blue Mud Bay-Port Langdon, Katherine, Milingimbi, Mount Marumba, Roper River-Cape Beatrice, Urapunga, and part of Mount Evelyn, all in digital form.

Databases of geological, geochronologic, regolith and geochemical data, based on a regional sampling program.

Regional stream sediment geochemistry data sets and maps.

Reports and papers on various aspects of the regional geology.

GIS incorporating the geological, regolith, field observation, sample, stream sediment and other geochemical data, and geophysical interpretations.

Highlights for 1991/92

Access to most of north eastern Arnhem Land was granted as a result of sustained effort by NTGS in negotiating and liaising with the Northern Land Council and traditional owners. About 70 per cent of the Arnhem Bay–Gove and Blue Mud Bay–Port Langdon sheets was remapped and sampled in the 1991 field season.

Mapping and sampling in the Katherine area were completed, and much of the new map information captured in digital form.

Initial results from geochronology of the West Branch Volcanics in the Katherine sheet, and of the Fagan Volcanics in Arnhem Land, have provided important new insights into the age and evolution of the McArthur Basin.

Both volcanic units are around 1700 million years old, confirming that the Katherine River Group is of similar age to the Tawallah Group, and that the Fagan Volcanics are much younger than previously thought.

Goals for 1992/93

Negotiate with traditional owners in order to maintain access to all parts of north eastern Arnhem Land. Make initial approaches to them about the desirability of carrying out regional stream sediment geochemical studies.

Complete field mapping and specialist studies in north eastern Arnhem Land, focussing on the Arnhem Bay–Gove, Blue Mud Bay–Port Langdon, and parts of Roper River and Cape Beatrice 1:250 000 sheets.

Commence regolith landform mapping in the Arnhem Bay–Gove and Blue Mud Bay–Port Langdon 1:250 000 sheets, and identify specific research topics to be followed up in 1994.

Complete photoscale compilation sheets of the above map areas and capture the data in digital form for release at 1:100 000 scale as required.

Continue image processing and interpretation of aeromagnetic and radiometric data from Arnhem Bay–Gove and Blue Mud Bay–Port Langdon, and use the images to enhance the mapping and interpretation of the geology.

Continue laboratory studies on material collected during 1991, and add to existing databases of mineral deposits, rock geochemical, regolith, and geochronological data.

Complete preparation of a second edition Katherine 1:250 000 sheet, and provide NTGS with appropriate text for the preparation of an Explanatory Report on the Katherine sheet.

Clients

Commonwealth and Northern Territory government departments

Mineral exploration companies

University geoscience departments

Aboriginal groups

Collaborating agencies

Northern Territory Geological Survey

Project 211.12 Kimberley–Arunta (NGMA Project)

Project managers	David Blake		06 249 9667
	David Young	(NTGS)	089 515 662
	Tim Griffin	(GSWA)	09 222 3606
Program responsibility	Minerals and Land Use		
Timeframe	1990–1995		

Objectives

Develop a better understanding of the metallogeny and mineral potential of the region.

Provide geological and mineral resource information necessary for land use decisions

A comprehensive geoscientific database to facilitate land use decision making.

Relevance

The Kimberley–Arunta region is crucial for developing models for the tectonic evolution of northern and central Australia. Although highly prospective for metals and diamonds, the region has not been subjected to systematic geological mapping using modern concepts and techniques (existing maps are based on work done more than 20 years ago).

The east Kimberley and Granites–Tanami provinces in particular have been, and continue to be, high profile areas for mineral exploration companies. The region is overlapped by parts of the Canning, Amadeus, Ngalia, Georgina, and Wiso sedimentary basins, which are prospective for hydrocarbons. The region also includes aboriginal land and national parks, and has an increasing potential for tourism.

Expected outcomes

A better understanding of the mineral and hydrocarbon potential of the region.

More effective mineral exploration.

Activities

Determine the nature, timing, and distribution of significant geological events in and between the east Kimberley, Granites–Tanami, and west Arunta areas.

Determine the nature of the boundaries between major tectonic units.

Determine the extent of prospective basement beneath thin cover.

Review and compilation of all existing geological information.

Detailed geological mapping (including specialist structural, geochemical, metamorphic and sedimentological studies) of well-exposed parts of the region.

Interpretation of existing regional and detailed geophysical data; acquisition and interpretation of new regional and detailed airborne aeromagnetic, radiometric and gravity data.

Uranium–lead zircon, samarium–neodymium, rubidium–strontium, potassium–argon and argon–argon geochronology to establish timing of igneous and metamorphic events.

Petrological and geochemical studies of key igneous rock units.

Image processing and interpretation of remotely sensed data (satellite imagery) to assist geological mapping.

Studies of mineralisation styles and settings.

Compilation of geoscientific databases for a GIS.

Expected products

Digital and hard copy geological and geophysical maps at scales ranging from 1:25 000 to 1:1 million.

Digital databases, including rock chemistry, geochronology and mineral deposits.

GIS incorporating integrated digital data sets.

Descriptive and interpretative reports.

An analysis of the metallogeny and mineral potential of the region.

Appropriate scientific papers.

Highlights for 1991/92

Hermannsburg 1:250 000 geological sheet, second edition: compilation of map and draft of accompanying explanatory notes completed; U-Pb zircon (ion probe) dating of the Teapot granitic suite at about 1140 Ma and the Glen Helen Gneiss Complex at about 1680 Ma.

Mount Doreen 1:250 000 sheet area: successful completion of fieldwork; compilation of 1:100 000 sheets completed; interpretation of the regional airborne magnetic and radiometric data; recognition and documentation of three major deformation events and two granite suites of possible economic significance.

East Kimberleys: preliminary interpretation of:

- detailed airborne magnetic and radiometric data for the Dixon Range and northern half of Gordon Downs 1:250 000 sheet areas
- TM data for the same area; confirmation that pegmatite dated as Archaean (by Rb-Sr) over 20 years ago is Proterozoic (U-Pb zircon ion-probe age ~1760 Ma); commencement of 1992 field season.

Goals for 1992/93

Update the geology of the east Kimberley by means of geological fieldwork and ground-truthing of airborne geophysical and remotely sensed (satellite) data in the Gordon Downs and Dixon Range 1:250 000 Sheet areas.

Compile, digitise and release Halls Creek, Ruby Plains, and Dixon 1:100 000 geological maps and accompanying data records.

Release compilation of existing geological information, including company data, for Dixon Range and Gordon Downs 1:250 000 Sheets.

With GOMP acquire detailed gravity data to constrain interpretations on the nature of the boundaries between the major tectonic units of the region—Kimberley Basin, Halls Creek Mobile Zone, The Granites–Tanami Block, and Arunta Block.

Complete commitments to the second edition Hermannsburg and Mount Doreen 1:250 000 geological maps and explanatory notes.

Obtain geochronological data (uranium–lead and samarium–neodymium) for 3 rock units in The Granites–Tanami province and up to 8 in the east Kimberley.

Clients

Mineral exploration companies

Petroleum exploration companies

Geoscience consultants

Commonwealth, WA and NT governments

CSIRO

Tourist industry

Environmental agencies

Traditional landowners

Educational institutions

Cooperating agencies

Geological Survey of Western Australia

Northern Territory Geological Survey

Northern Territory Power and Water Authority

CSIRO (Divisions of Wildlife & Ecology and Exploration Geoscience)

Monash University

Australian National University

University of Melbourne

University of Western Australia

Edinburgh University

University of Minnesota, USA

Rijksuniversiteit te Utrecht, the Netherlands

Project 211.13 Lachlan–Kanmantoo Fold Belts (NGMA Project)

Project managers	Doone Wyborn		06 249 9386
	John Watkins	(NSWGS)	02 901 8330
	Fons Vandenberg	(VICGS)	03 412 7811
	John Parker	(SADME)	08 274 7615
Program responsibility	Minerals and Land Use		
Timeframe	1990–1996		

Objectives

Provide governments, industry, and the community with essential information for sound decision-making on resource, land use and environmental issues.

Relevance

The Lachlan–Kanmantoo Fold Belt region has had a long history of mineral production including, gold, copper, lead, zinc, silver, and tin. The geoscientific knowledge base of the most prospective but often poorly known terrains needs updating.

The project will emphasise relations of rock and structural associations with known ore deposits such as the Ordovician magmatic rocks in NSW (copper, gold, platinum), Gilmore Fault Zone (gold), Sn granites of the Wagga Metamorphic Belt (tin, tungsten, bismuth), Bendigo Slate Belt (gold), Stavely Greenstone Belt (gold, copper, lead, zinc), and volcanic associated mineralisation in the Kanmantoo Fold Belt (possible copper–lead–zinc massive sulphide deposits).

Expected outcomes

New geoscientific data for improved decision-making on resource, land use and environmental issues.

More effective mineral exploration.

Activities

Determine the geologic evolution of the Lachlan and Kanmantoo Fold Belts.

Provide a new generation of digital geological data on the Kanmantoo,and especially the Lachlan Fold Belt, supported by tectonic, metallogenic and geomorphic/regolith interpretations based on the new data.

Geological mapping of the most prospective parts of the fold belts using new technologies to produce 1:250 000 maps.

Application and interpretation of airborne and satellite remote sensing techniques with image processing and spatial analysis (GIS).

Petrological and geochemical studies of important rock units.

Geochronological studies of key rock units.

Regolith terrain mapping to produce 1:250 000 maps.

Expected products

Digital magnetic, radiometric, geological, regolith and thematic maps at appropriate scales, with accessible integrated databases of

geochemical, structural, petrographic, mineral deposit and regolith information, and descriptive and interpretive reports, review documents and specialist papers.

New editions of 1:100 000 and 1:250 000 scale geological and regolith maps to be published in collaboration with the State Surveys. Map sheets (1:250 000) to be covered are Bathurst, Forbes, Narromine, Dubbo, and Ballarat. Work will also be carried out on Cootamundra, Wagga Wagga, Bendigo, St Arnaud and Pinaroo sheet areas.

Prepare in conjunction with ANU, a 1:1.25 million scale full colour map and a GIS digital map of the granite plutons of the Lachlan Fold Belt, with associated digital database of 3000 geochemical analyses of the plutons (geochemical data supplied by ANU).

Prepare a popular map and guide to the geology of the ACT, with the map at 1:100 000 scale.

Highlights for 1991/92

Completion of fieldwork for Blayney and Oberon 1:100 000 sheets on the Bathurst 1:250 000 sheet area on schedule.

The exploration interest generated by earlier work in the project has been maintained with increased focus on sites for prospective detailed exploration effort.

The identification of several extensive subsurface magnetic anomalies which may be attributed to magmatic sources for possible porphyry stockwork copper/gold deposits. These rocks and their extrusive equivalents are now known to contain 10 to 50 times the gold contents of normal continental crustal rocks, and are therefore potential sources of metamorphically mobilised gold-rich fluids.

Publication of the 1:1.25 million Lachlan Granite classification map. The concept of this new geological map, the first of its kind in the world, has been welcomed by the mining industry and similar maps are planned for other parts of Australia.

Goals for 1992/93

Compilation and release of digital geological maps of the Blayney and Oberon 1:100 000 sheets; and for incorporation into the new edition of the Bathurst 1:250 000 – end 1992.

Complete digital point databases of Blayney and Oberon 1:100 000 sheet areas for release – September.

Complete Records on the geology of Blayney and Oberon 1:100 000 sheets – February 1993.

Complete digital regolith map of Bathurst at 1:250 000 scale for release – January 1993.

Complete digital geophysical interpretation maps of three 1:100 000 sheets on Dubbo for release – April 1993.

Complete regolith fieldwork on Dubbo 1:250 000 sheet – June 1993.

Commence geological fieldwork on Dubbo and Ballarat 1:250 000 sheets.

Clients

Mineral exploration companies active in the Lachlan Fold Belt

CSIRO

State government departments and organisations (forestry, public works, road and rail transport)

Environmental agencies and groups

Prospectors

Farmers

Developers

Geoscience departments at universities

Cooperating agencies

Department of Mineral Resources, NSW Geological Survey

Department of Manufacturing and Industry Development Resources, Victoria

Department of Mines and Energy, SA

Institute of Earth and Planetary Sciences, Victoria

Geology Department, ANU

Geology Department, University of New South Wales

Division of Exploration Geoscience, CSIRO

Project 211.14 Musgrave Block (NGMA Project)

Project managers	Andrew Glikson		06 249 9591
	Nigel Duncan	(NTGS)	089 51 5663
	John Parker	(SADME)	08 274 7615
	Peter Dunn	(GSWA)	09 222 3333
Program responsibility	Minerals and Land Use		
Timeframe	1990–1995		

Objectives

Provide the regional framework as a basis for decisions concerning the environment, mineral resources and land management by governments and by the Aboriginal communities.

Relevance

The Musgrave Block in central Australia is a major geological province covering an area some 750 by 300 km and extending into three States. Most of this region is occupied by Aboriginal reserves, managed by the Anangu-Pitjantjatjarra Council (SA), Ngaanyatjarra Council (WA) and Central Lands Council (NT). The Musgrave Block is one of the geologically less well documented regions in Australia and current knowledge is based on reconnaissance mapping conducted by the Geological Surveys during the 1960s and detailed investigations of small areas by universities.

The Musgrave Block has potential for base metal (chromium, nickel and vanadium) and platinum group metals. The area contains the Uluru National Park, a major tourist attraction. The mapping program will provide important information for assessment of mineral and groundwater resources and for land use decisions by Government and the Aboriginal communities.

Expected outcomes

Comprehensive documentation of the geology and the natural environment of the Musgrave Province.

New geoscientific data for improved decision-making by government authorities and aboriginal land councils on resource, land use and environmental issues.

Develop scientific insights into the crustal structure and geological history of the Musgrave Block.

Activities

Update and improve the geoscientific knowledge base of the Musgrave Block through systematic multidisciplinary studies.

Prepare a series of thematic geological and environmental maps.

Prepare a series of 1:100 000 and 1:250 000 geological maps, including the Tomkinson Ranges (western Musgrave Block, WA and SA), Petermann Ranges and Bloods Range (NT) and overlying areas within the Cooper, Scott, Mann, Woodroffe, Petermann Ranges, Bloods Range, Ayers Rock, Kulgera, Alberga, and Finke 1:250 000 sheets.

Define the nature and timing of key geological events and the tectonic evolution of the Musgrave Block, using isotopic and structural techniques.

An in-depth petrological and geochemical investigation of the layered basic/ultrabasic intrusions of the Giles Complex, which constitute the largest bodies of their kind on the Australian continent.

Metamorphic and structural studies of the felsic metamorphic and igneous rocks associated with the Giles Complex in the Tomkin-

son Ranges and their relationships with the basic/ultrabasic intrusions.

Systematic mapping and sampling of the Quaternary deposits in the Tomkinson Ranges, culminating in an environmental map of surface deposits and vegetation.

Expected products

New 1:100 000 geological maps covering key areas within the limits of the Scott, Cooper, Mann, Petermann Ranges, Ayers Rock, Woodroffe, Kulgera, Alberga and Finke 1:250 000 sheet areas.

Thematic 1:1 million maps of the geology, geophysics, land use maps (soil/vegetation patterns) based on field observations and remotely sensed data.

Digital databases for the above.

Publications and reports accompanying the above maps and databases, including syntheses of metallogeny and analysis of the mineral potential of parts of the Musgrave Block.

Highlights for 1991/92

Completion of field mapping in the Tomkinson Ranges and outlying areas and progress in preparation of maps.

Completion of the 1:100 000 environmental map and report for the Tomkinson Range.

Completion of the petrological study of the layered basic/ultrabasic intrusions of the Giles Complex in the Tomkinson Range.

Substantial progress in isotopic age studies and development of a geochemistry database for the Tomkinson Range.

Completion of the mapping and structural study of the contacts of the Hinckley Gabbro and of consequent reports, with implications for tectonic history of the Giles Complex and environs.

Goals for 1992/93

Field mapping in the Britten Jones, Allanah, Mt Olga and Ayers Rock 1:100 000 sheet areas jointly with NTGS.

Release of the Tomkinson Ranges special 1:100 000 geological map.

Substantial advance in preparation of material for the Bates, Blackstone, Holt and Finlayson 1:100 000 geological maps.

Publication of papers on the petrology of the Giles Complex.

Completion and publication of isotopic age studies of the Giles Complex and associated granulites of Tomkinson Ranges.

Completion of geochemistry database and publication of papers based on the data.

Publication of papers on the tectonic evolution of the Hinckley Gabbro.

Clients

Commonwealth, Northern Territory, Western Australian and South Australian Governments

Ngaanyatjarra Council Inc

Anangu Pitjantjatjarra Council

Mineral exploration companies

Cooperating agencies

Northern Territory Geological Survey

Geological Survey of Western Australia

Department of Minerals and Energy, South Australia

University of Tasmania

University of Freiburg, Germany

University of Sydney

University of Melbourne

Ngaanyatjarra Council Inc

Anangu Pitjantjarra Council Inc

Central Land Council

221: GEOPHYSICAL MAPPING

Objective

Establish, maintain and make publicly available the best possible national survey coverage and database for gravity anomaly, magnetic anomaly and gamma-ray spectrometer surveys for the benefit of the Australian exploration community, for environmental management and for national and international geoscience.

Relevance

Regional geophysical data and maps are of fundamental importance in the development of a comprehensive understanding of the geology of a region. This regional information provides the framework necessary for both Government and industry to assess resource potential, determine land use and environmental management policies, and plan more detailed exploration activities. Good quality geophysical maps therefore have an important role in Australian geoscience and in the increasing concern for the natural environment.

From the standpoint of the national economy, geophysical techniques and data sets become an increasingly important element in integrated exploration strategies as the more obvious mineral and petroleum resources are developed and exhausted. For the Australian mineral and petroleum exploration industries to remain effective and competitive in the future, they need access to integrated regional geophysical data sets that cover the entire continent and its margins. This is particularly true in the geological setting of Australia where the solid geology of large areas is obscured by surficial cover which limits the application of direct geological mapping, conventional photogeology and remote sensing methods.

Activities

Ensure that the survey information in the national database is in a readily accessible and useful format for those involved in mineral and petroleum exploration and resource assessment, including the National Geoscience Mapping Accord (NGMA) and all other users.

Expand the database through systematically conducting, contracting out and purchasing onshore and offshore airborne magnetic and gamma-ray spectrometer surveys and ground gravity surveys.

Reduce and prepare these newly acquired data for publication and be responsible for their release into the public domain.

Investigate and develop new methods for data acquisition, reduction, processing, enhancement, presentation, analysis and interpretation to improve the quality and usefulness of the data.

Cooperate with the Research School of Earth Sciences, Australian National University, in the development of new algorithms to display and verify data sets and to enhance the capability to derive three dimensional geological models from geophysical map data.

Stimulate and support full use of geophysical data sets in the programs of AGSO.

Highlights for 1991/92

Made airborne geophysical data available for the equivalent of 3 map sheets at the 1:250 000 scale for the NGMA (Murloocoppie, Dubbo, Ebagoola and St Arnaud), 1 map sheet area at reconnaissance spacing (North Gawler Craton), and for the Bathurst sheet area which was flown in a joint project with the NSW Department of Mineral Resources.

Airborne geophysical data acquired by AGSO's aircraft for the equivalent of three and a half 400 m line-spaced 1:250 000 sheets (Hann River, Mt Mulgrave, Murloocoppie, Ballarat and Wagga; Paterson Range, Sahara, Yarrie, Anketell).

Acquired by contract three and a half 1:250 000 sheet areas (Dixon Range, Gordon Downs, Edjudina, Leonora and Laverton).

Digitised and reprocessed analogue aeromagnetic data equivalent to two reconnaissance sheet areas from the Gulf of Carpentaria region.

Completed the first pass checking of the National Gravity Database and released digital data set and new maps at 1:1 million and 1:5 million scales.

Introduced efficiencies into processing and presentation of data by moving geophysical data processing to a Unix-based open hardware platform and operating system.

Generated prototype magnetic maps of Australia and displayed them at a number of forums; released new generation magnetic maps of Ebagoola.

Goals for 1992/3

Acquire at least three 1:250 000 sheet areas in support of the NGMA and to fill gaps in the reconnaissance coverage of the continent, using AGSO's aircraft, and acquire the equivalent of at least two 1:250 000 sheet areas under contract. (The equivalent of 10 sheets a year at 400 m line spacing is required by the NGMA and other projects to meet mapping demands).

Improve the fundamental gravity base network of Australia through station maintenance and re-measurement where possible.

Release new digital maps of magnetic anomalies at 1:5 million scale, and topography for the whole of Australia.

Accelerate the process of release of digital data and paper maps at a low price through a major upgrade of processing system software.

Expand the national gravity database by acquiring and checking existing gravity data from State survey organisations and industry where possible, including an expansion and updating of the marine gravity database.

GEOPHYSICAL MAPPING

Component manager Colin Reeves 06 249 9226

Component projects

221.01	National airborne magnetic and gamma-ray spectrometric surveys and databases
221.02	National gravity database
221.05	Digital magnetic anomaly map of Australia

Project 221.01 National airborne magnetic and gamma-ray spectrometric surveys and databases

Project manager	Ian Hone	06 249 9306
Program responsibility	Geophysical Observatories and Mapping	
Timeframe	1951–ongoing.	

Objectives

Develop and expand the national database for airborne magnetic anomaly and gamma-ray spectrometer surveys through acquisition of as much new survey data as possible.

Release the data acquired into the public domain in a readily accessible and useful format for those involved in minerals and petroleum exploration, environmental and land use issues, resource assessment, and the NGMA.

Expected outcome

Steady upgrading of the quality of airborne survey coverage acquired and available for release to the user community, and greater coverage of the Australian continent.

Activities

Conduct and contract out systematic airborne geophysical surveys.

Investigate, develop and implement improvements in acquisition, processing, enhancement, presentation, and analysis of airborne survey data.

Expected products

Digital data sets of airborne surveys on magnetic tapes.

Contour and profile maps of total magnetic intensity and gamma-ray abundances at scales appropriate to flight-line spacing, organised on the basis of 1:250 000 scale sheet outlines.

New map and computer-compatible products based on enhancements of airborne survey data through image processing and geographic information system (GIS) techniques.

Highlights for 1991/92

Airborne geophysical surveys completed over the following 1:250 000 sheets areas:

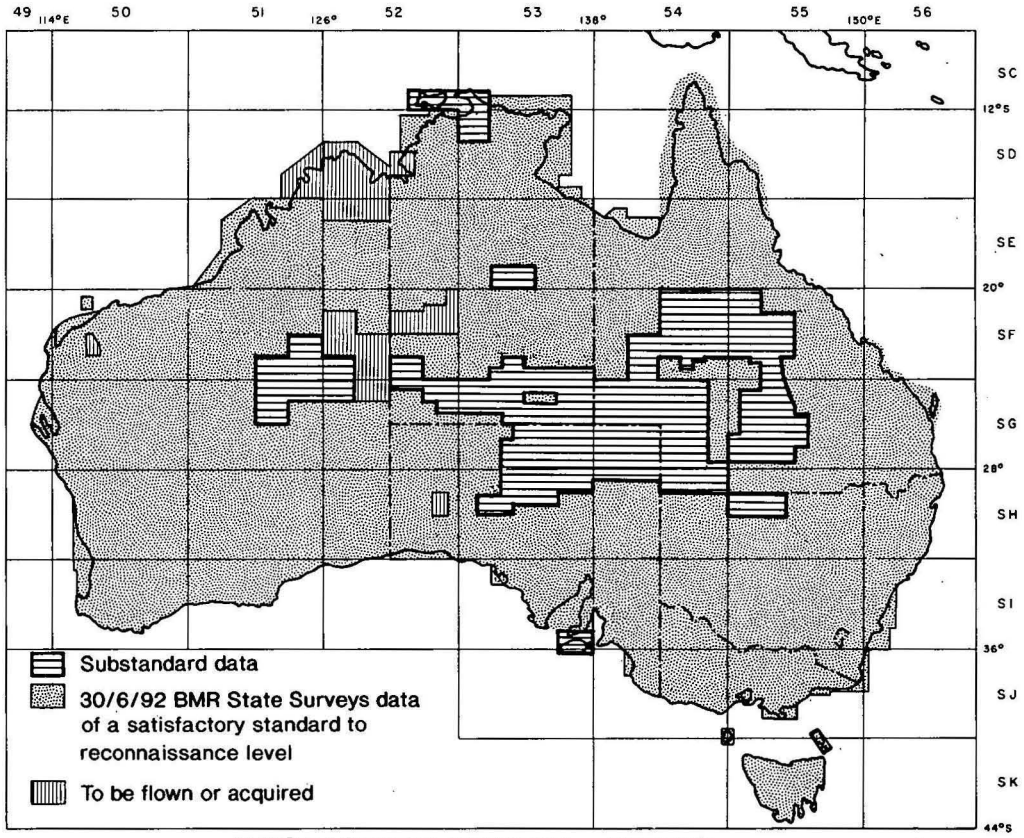
- Hann River (whole sheet)
- Walsh (⅙ th sheet—Mt Mulgrave 1:100 000 sheet)
- Murloocoppie (eastern ⅓ rd of sheet)
- Ballarat (⅚ th sheet)
- Wagga Wagga (⅙ sheet—Wagga 1:100 000 sheet)
- Paterson Range
- Sahara
- Yarrie (western third)
- Anketell (eastern third)

Airborne geophysical data purchased or contract airborne geophysical surveys made of the following 1:250 000 sheet areas:

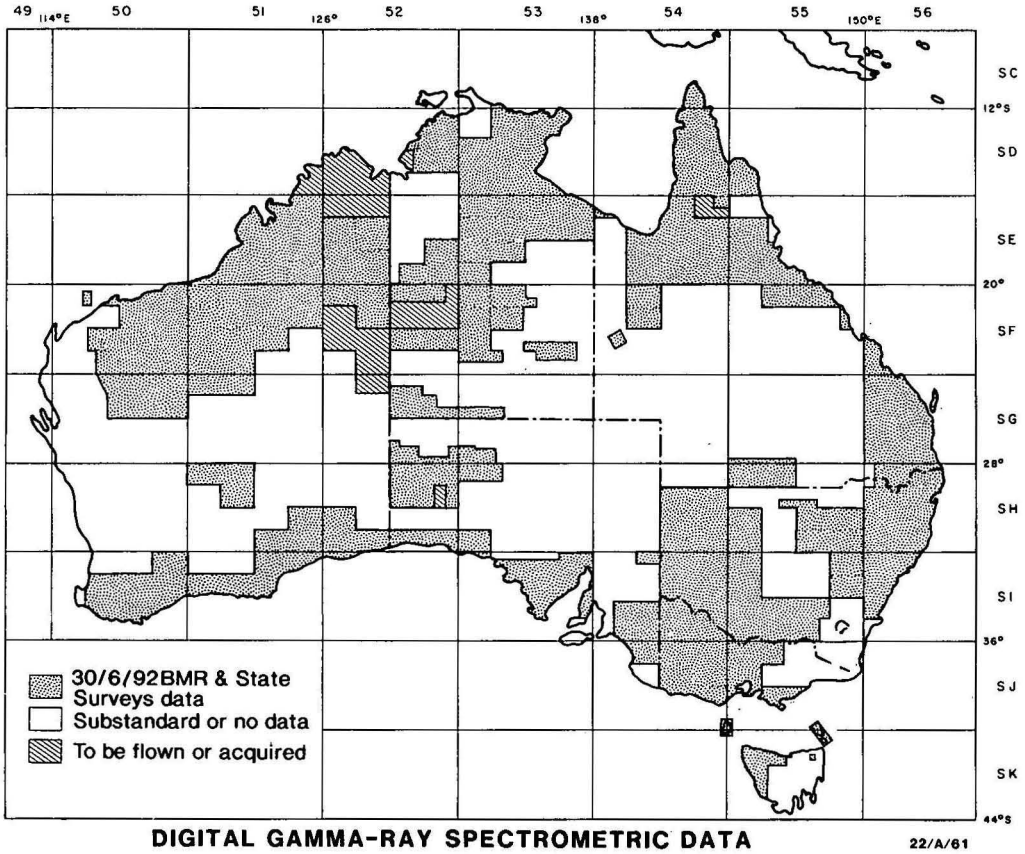
- Edjudina
- Laverton
- Leonora
- Dixon Range
- Gordon Downs (half)
- Yerrie (two-thirds)
- Anketell (two-thirds)
- Wyloo (one-third)

Airborne geophysical data released for the following areas:

- Victoria—Lachlan–Kanmantoo Project; St Arnaud 1:250 000 sheet (south)
- Queensland—North Queensland Project; Ebagoola
- New South Wales—Lachlan–Kanmantoo Project; Dubbo 1:250 000 sheet; Bathurst 1:250 000 sheet (joint project with NSW DMR)



AEROMAGNETIC SURVEYS - STATUS 22/A/62



DIGITAL GAMMA-RAY SPECTROMETRIC DATA 22/A/61

South Australia—Gawler Block Project; Murloocoppie 1:250 000 sheet, eastern one-third

Efficiencies introduced to processing and presentation of airborne geophysical data by moving processing system to a Unix-based open hardware platform and operating system.

Development of techniques and procedures for production and publication of pixel maps of enhanced airborne geophysical data from 400 m line-spaced surveys of NGMA sheet areas and from compilations of reconnaissance surveys.

Publication of pixel maps for Ebagoola.

Paper published on techniques for using small sources to calibrate airborne gamma-ray spectrometers.

Paper published on using full spectrum analysis to determine gamma-ray backgrounds from airborne radon.

Development of techniques for micro-levelling of airborne geophysical data and a paper published describing the method and its application.

Part development of techniques of using histogram matching to level gamma-ray data.

Study partly completed of the effects of micropulsations on high resolution, high sensitivity airborne magnetic data.

Began involvement in the Cape York Peninsula Land Use Study and in the supervision of Aerodata's airborne survey in Oman.

Goals for 1992/93

The NGMA requires the acquisition of detailed airborne survey data (magnetic and radiometric) at 400 m line spacing and 100 m flying height over ten 1:250 000 scale map sheets per year.

The priority of this data acquisition is given below. With the standard resource base it is likely that only the areas italicised can be acquired.

- *Murloocoppie, Wintinna* – 400 m line spacing, AGSO's aircraft, NGMA Gawler Block project
- *Forbes* – 400 m line spacing, AGSO's aircraft, NGMA Lachlan–Kanmantoo project
- *Walsh* (5/6), Red River, Coen (1/2), Hughenden (1/2), Cape Melville (1/2), Cape Weymouth (1/2) – 400 m line spacing, contract, NGMA North Queensland project (financial support from QDRI)
- Billiluna, Mount Ramsay – 400 m line spacing, contract, NGMA Kimberley–Arunta project
- Sir Samuel – 400 m line spacing, contract, NGMA Eastern Goldfields project

Acquire reconnaissance airborne survey data (magnetic and radiometric) at 1500 m line spacing and 150 m height over the following 1:250 000 scale map sheets where surveys of this standard have not previously been available in the national database:

- *Maurice, Tarcoola* – reconnaissance survey (1500 m line spacing), AGSO aircraft
- *Highland Rocks, Mount Theo, Mount Solitaire* – reconnaissance survey (1500 m line spacing), AGSO's aircraft, NGMA Kimberley–Arunta project

Release airborne geophysical data for the following areas:

- New South Wales; Wagga 1:100 000 sheet
- Victoria – Lachlan–Kanmantoo project; Ballarat 1:250 000 sheet
- South Australia – Gawler Block project; Murloocoppie 1:250 000 sheet (western two-thirds), Wintinna, Maurice and Tarcoola 1:250 000 sheets
- Queensland – North Queensland project; Hann River, Walsh, Red River 1:250 000 sheets, Gulf of Carpentaria, Hann River pixel maps
- Western Australia – Canning Basin project; Yarrie, Anketell, Paterson Range, Sahara, Wyloo, Joanna Spring, Crossland, Dummer, Percival and Helena 1:250 000 sheets

Develop and publish prototypes of new image presentations of aeromagnetic and spectrometer survey data.

Publish index and database of AGSO's airborne surveys.

Increase production efficiency by acquisition and integration of new processing software and upgrading documentation of the entire processing system.

Supervise Aerodata's airborne survey in Oman; develop and oversee future programs.

Compile, upgrade and present in appropriate forms airborne magnetic and gamma-ray spectrometric data for the Cape York Peninsula Land Use Strategy.

Investigate questions of terrain models from airborne data.

Clients

Exploration companies

State and Territory mines departments

Tertiary educational institutions

Other government agencies (e.g. CSIRO)

Cooperating agencies

State and Territory mines departments

Exploration companies

University of Adelaide

Other Commonwealth and State government departments

Project 221.02 National gravity database

Project manager	Michael Morse 06 249 9251
Program responsibility	Geophysical Observatories and Mapping
Timeframe	1965–ongoing

Objectives

Maintain and update the network of fundamental gravity stations in Australia (the so-called 'Isogal stations').

Maintain and expand the Australian National Gravity Database and ensure that the gravity anomaly data therein are comprehensive, accurate and readily accessible.

Carry out gravity surveys to assist the NGMA.

Relevance

Fundamental gravity determinations are essential for geodetic levelling purposes and gain a new significance for the general public with the advent of GPS technology for which accurate determination of the geoid over Australia is required. This is also important for Australia's contribution to monitoring of global sealevel change.

The Isogal stations of the national gravity network are the link between AGSO's national gravity coverage and more local surveys conducted by State geological surveys and the exploration industry.

Gravity anomaly data over the whole continent and its adjacent seas constitute a fundamental data set for systematic geological mapping, mineral and petroleum exploration and resource assessment.

The value to geological mapping of detailed gravity anomaly surveying over areas the size of 1:250 000 scale sheets is becoming accepted.

Expected outcome

Steady improvement in the quality of the National Gravity Database and an increase in the range of user-products derived from it.

Activities

Maintain a register of national gravity network stations, repair stations, install new stations as necessary.

Check, maintain and install national calibration ranges.

Acquire, check, validate and incorporate data

from State Mines Departments and private companies into the national gravity database.

Carry out surveys as part of the NGMA and in joint projects with States.

Investigate, develop and implement improvements in acquisition, processing, analysis, enhancements, presentations and interpretations of gravity data, in cooperation with the Research School of Earth Sciences where appropriate.

Expected products

Data sets on tape and diskettes containing gravity information for sale for the whole of Australia or for regions based on 1:1 million sheets areas and special areas.

Contour maps of Bouguer anomaly values at 1:1 million and 1:250 000 scales.

Various new map and computer compatible products based on enhancements of gravity data using image processing and geographic information system (GIS) techniques.

Highlights for 1991/92

A new gravity digital database with almost 600 000 data points was released in 1991 as a digital tape and as a series of maps of gravity anomalies at scale 1:1 million.

New colour and grey-scale image-maps of Australia were generated and released showing Bouguer anomalies at scale 1: 5 million.

Isogal stations and calibration ranges were checked, repaired and installed in association with absolute gravity measurements made by the Defense Mapping Agency of the USA.

Gravity survey of Edjudina 1:250 000 sheet was completed and processed for the NGMA Western Australia Eastern Goldfields Project.

Acquisition and processing of data for the Buchanan and Mt Coolon 1:250 000 sheets was completed in a joint project with the QDRI.

Gravity measurements along seismic lines were made in the Otway Basin and processed for lines near Gunnedah, Kalgoorlie and in the Otway Basin.

Efficiencies were introduced into the processing and presentation of gravity data by migrating the database and processing system to a Unix-based open hardware platform and operating system.

Goals for 1992/93

Release a low-cost gridded version of the Bouguer anomaly and topography data sets for use on simple image processing hardware to encourage use of these data sets for geological interpretation purposes.

Acquire and integrate several thousand gravity stations from State mines departments and company data to expand the national gravity database.

Through cooperation with the South East Asia Gravity Project, incorporate reprocessed profile data for offshore gravity traverses around Australia into the national gravity database.

Carry out detailed gravity surveys for the following 1:250 000 scale sheets in support of the NGMA: Leonora, Laverton and, if resources are available, Dubbo and Ballarat. Conduct traverses in northern WA.

Release data for the Laverton 1:250 000 scale sheets.

Improve the geoid for Australia through cooperation with AUSLIG and the University of New South Wales.

Cooperate with RSES, ANU, in developing a gravity modelling and interpretation system.

Improve processing efficiency by upgrading software and documentation through software purchase where possible.

Complete, upgrade and present in appropriate form gravity data for the Cape York Peninsular Land Use Strategy.

Clients

Exploration companies

State and Territory mines departments

Tertiary education institutions

Other government organisations

Cooperating agencies

AUSLIG

Leeds University, England

Bureau Gravimetrique International, France

State and Territory mines departments

Department of Resource Industries, Queensland

Other government agencies

Australian National University, (including Research School of Earth Sciences)

Defense Mapping Agency, USA

University of Adelaide

Project 221.05 Digital magnetic anomaly map of Australia

Project manager	Chris Tarlowski	06 249 9265
Program responsibility	Geophysical Observatories and Mapping	
Timeframe	1990–1993	

Objective

Create a consistent digital grid of magnetic anomaly values across the whole of the Australian continent.

Produce 1:1 million and 1:5 million scale maps of Australia from the digital grid.

Relevance

The compiled digital grid will provide a framework for interpretation of the magnetic anomalies arising from the geology of the entire continent, consistent with data sets published or in preparation for other continents.

Expected outcomes

Internally consistent digital grid of magnetic anomaly values for the whole of Australia.

Improved understanding of the geological structure and tectonics of Australia and its relation to the other southern continents, their pre- and post-break-up evolution and resource potential.

Activities.

Retrieval and re-gridding (where necessary) of archived survey data, checking for and correcting of errors, linking and levelling adjacent grids and construction of a continental master grid consistent with the Australian Geomagnetic Reference Field.

Cooperation with other organisations in incorporating the Australian data into a magnetic anomaly map of reconstructed Gondwana to help elucidate the evolution and disruption history of all the southern continents as an aid to mineral and petroleum exploration in the region.

Expected products

A consistent digital grid of values at about 400 m intervals for the whole continent, also available on a 1:1 million sheet basis.

A broader grid at about 2 km intervals for the whole continent.

Printed image maps in colour and grey-scale at scales 1:2.5 million (4 sheets), 1:5 million (1 sheet), 1: 10 million (A3) and 1:20 million (A4) using processing sequences designed to enhance the representation of the geological information in the dataset.

A published report of the compilation.

Highlights for 1991/92

A consistent master grid was created by re-gridding and/or correcting existing digital

data from AGSO's archives for most of Australia where surveys exist at 1.5 or 3.2 km line spacing. In other areas where only surveys of lower specifications were available, the digital grid created in 1976 was checked, upgraded and incorporated. Further grids were created by digitizing data that was otherwise only available in analogue format where no other data were available.

Preliminary compilations of data were shown at poster presentations at the IUGG meeting in Vienna (August 1991), the AGC meeting in Ballarat (January 1992), the African Magnetic Mapping Project Final meeting in Arusha Tanzania (April 1992) and the AusIMM meeting in Broken Hill (May 1992).

Goals for 1992/93

Display image-maps at 1:5 million scale at the ASEG Meeting (Gold Coast, October 1992).

Release printed maps at scale 1:5 million and digital grids (at 1:1 million and 1:5 million) – December 1992. Maps at a range of other scales to follow.

Draw up plans for the magnetic anomaly map of Gondwana in collaboration with other organisations studying the geology of the southern hemisphere.

Clients

Exploration companies

State and Territory mines departments

Tertiary educational institutions

Other government agencies

Cooperating agencies

International Institute for Aerospace Survey and Earth Sciences (ITC), The Netherlands

International Association for Geomagnetism and Aeronomy

241: GROUNDWATER

Objective

Contribute to ecologically sustainable development of the nation's natural resources by:

- providing scientific and technical analysis, assessment and advice on strategic national issues relating to groundwater
- participating in the coordination of national groundwater activities.

Relevance

Groundwater is one of Australia's most important resources. Over half the continent is totally dependent on it. The flow and quality of groundwater are closely linked in large sedimentary systems. An understanding of the availability and quality of groundwater and its role in salinisation of agricultural land can only be obtained from the study of its composition and the direction and speed of groundwater flow in relation to basin geometry.

The Component is primarily concerned with multidisciplinary regional studies of the whole or key parts of major groundwater systems. The areas studied were chosen because of their economic and environmental priority. The Murray–Darling Basin study is a joint Commonwealth-State venture under the aegis of the Murray–Darling Basin Ministerial Council.

AGSO's Groundwater Program is currently responding to a number of national issues relating to groundwater as identified by the Water Branch of the Department of Primary Industries and Energy. These priorities include:

- continuing support for the Murray–Darling Basin initiative
- groundwater contamination in areas of economic significance
- groundwater aspects of dryland salinity
- irrigation induced salinity (waning)
- extractive use of groundwater (mainly urban)
- conjunctive use
- recharge/waste disposal.

The research combines regional mapping of aquifer systems and properties and geochemical studies of water and their host rocks.

Output is in the form of major sets of maps, hydrogeological and hydrochemical models and publications and concepts relevant to the availability and composition of groundwaters.

Highlights for 1991/92

Amalgamation of the Groundwater Program and the Environmental Geoscience Program with the appointment of a new Chief.

Release of the first four colour 1:250 000 scale maps in the Murray Basin Hydrogeological Map Series.

Release of the BMR Bulletin 235, Geology of the Murray Basin, south eastern Australia.

Goals for 1992/93

Develop, as part of the portfolio priority, national perspectives on water quality in association with State water and land management agencies.

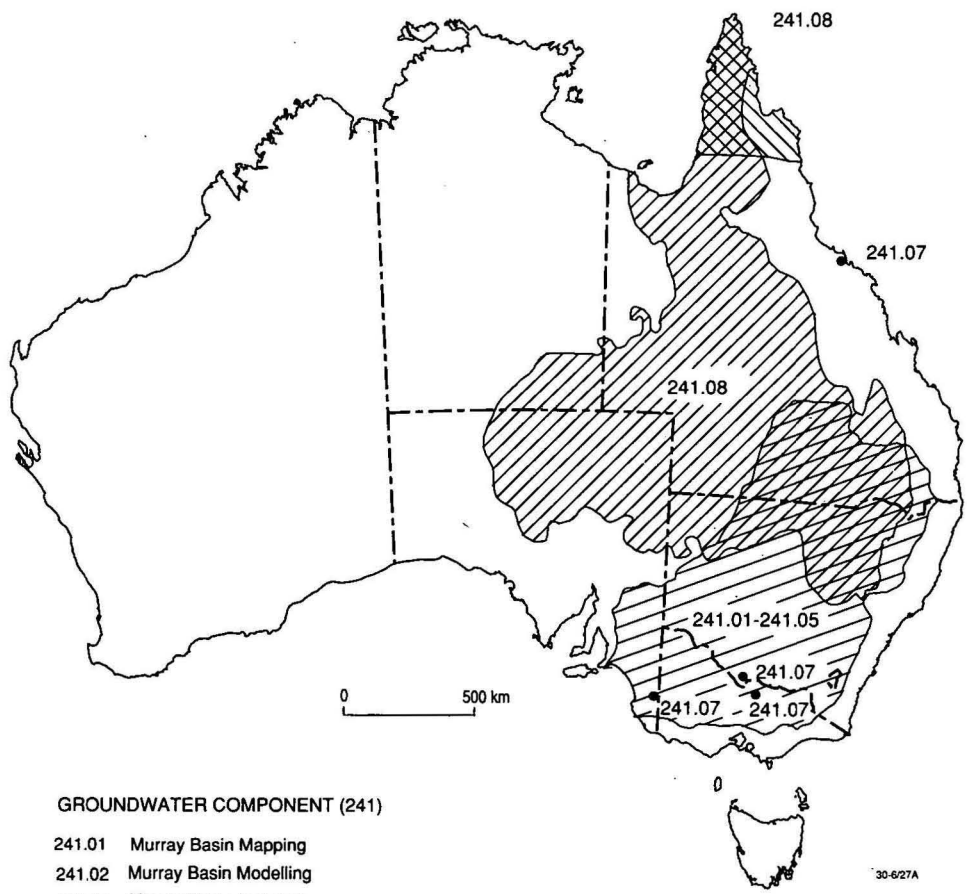
Develop programs on groundwater aspects of land degradation and management.

GROUNDWATER

Component manager Colin Simpson 06 249 9368

Component projects

241.01–241.05	Murray–Darling Basin
241.07	Australian Groundwater Quality Assessment
241.08	Great Artesian Basin



GROUNDWATER COMPONENT (241)

241.01 Murray Basin Mapping
241.02 Murray Basin Modelling
241.03 Murray Basin Isotopes
241.04 Murray Basin Discharge Zone
241.05 Darling Basin Mapping
241 07 Australian Groundwater Quality Assesssment
241.08 Hydrogeology of the Great Artesian Basin

Projects 241.01–241.05 Murray–Darling Basin

Project manager	Ray Evans	06 249 9738
Program responsibility	Environmental Geoscience and Groundwater	
Timeframe	1979–1996	

Objective

Provide high level technical and scientific advice relating to groundwater issues in the Murray–Darling Basin to contribute to ecologically sustainable development of the Basin's natural resources.

Relevance

The most important water catchment in Australia is the Murray–Darling Basin which covers four States, accounts for 75% of irrigation water used in Australia, and each year produces 30 – 40%, or around $10 000 m, of the total production from Australia's natural resource based industries.

Groundwater-related land degradation is conservatively estimated to be annually costing around $150 m. Rising groundwater tables have caused the salinisation of at least 1 million hectares of land in the southern part of the Basin; this area is expected to double in the next 20–50 years. The four governments party to the Murray–Darling Basin Agreement have undertaken to cooperate to improve the management of the Basin's natural resources, and have enacted legislation to establish the Murray–Darling Basin Ministerial Council and the Murray–Darling Basin Commission.

The Government has expressed its commitment to ameliorating the problems of natural resource degradation in the Murray–Darling Basin, including land salinisation and deteriorating surface water quality. The underlying control on these problems is groundwater processes.

One of the major strategic data needs for managing the natural resources of the Basin is therefore an understanding of the groundwater process. This understanding will provide the natural resource managers with an interpretation of the groundwater process upon which they can make immediate natural resource management decisions, and will also provide them with a predictive capability.

Expected outcome

Water/land managers will have the data required to better manage the natural resources of the Basin.

Activities

Produce the Murray Basin Hydrogeological Map Series at 1:250 000 scale and a Basin-wide database.

Produce numerical simulation models of regional groundwater flow systems in the Murray Basin.

Analyse and interpret regional hydro-geochemical and isotopic patterns to identify recharge and discharge processes; this may feed into the Quaternary climates study (242.02).

Assess contamination of groundwater underlying irrigated agriculture by agrichemicals and microbes of public health significance.

Assess the role of indigenous microbial processes in determining the quality and nature of groundwater.

Study the dynamics and geochemistry of selected groundwater discharge features as analogues for evaporative disposal of saline waste waters.

Expected products

A hydrogeological map series.

Numerical groundwater simulation model for the Murray Basin.

Comprehensive baseline conditions for groundwater quality in key irrigation areas.

An understanding of controls on the distribution of concentrated brines under groundwater discharge zones and below salina waste water disposal basins.

Highlights for 1991/92

The release of the following publications and maps:

- Bulletin 235, Geology of the Murray Basin, south eastern Australia, by the late CM Brown & AE Stephenson.
- The schools resource kit 'Groundwater and Salinity in the Murray Basin', which won the Australian Geography Teachers' Award for 1991.
- The first four maps in the Murray Basin Hydrogeological Map Series: Pooncarie, Narrandera, Mildura and Renmark.

Compilation of the Swan Hill, Ouyen, Horsham, Hay and Jerilderie sheets in the Murray Basin map series.

Coordination of the Commonwealth/State groundwater modelling effort in the Murray Basin, and good progress in the Lachlan Fan model.

Quantification of the pre-bomb pulse chlorine-36 signature in the regional unconfined aquifers of the Murray Basin.

Water quality sampling in the Padthaway and Shepparton irrigation areas in association with the United States Geological Survey; the Shepparton sampling was a repeat designed to detect seasonal variability in water quality of shallow unconfined aquifers.

Stratigraphic interpretation of lacustrine sediments in the Nulla Discharge Zone has identified three major deflation and depositional events which, if datable, will provide information on the palaeoclimatic history of the area.

The hydrogeological framework of the Scotia Discharge Zone has been shown to consist of a relatively thin layer of lacustrine clays and sands overlying a thick clay deposit (the Geera clay) which has constrained downwards movement of salt to diffusion but allows lateral flow of brines into the adjacent unconfined aquifers.

Goals for 1992/93

Release of seven new maps in the Murray Basin Hydrogeological Map series.

Murray Basin Modelling—complete Lachlan Fan Model; plan Scotia modelling for 1993/94.

Complete chlorine-36 sampling and measurements in unconfined aquifers of the south eastern part of the Basin.

Complete hydrogeological compilation of the Darling River Basin Hydrogeology.

Finalise interpretation of stratigraphic, hydrologic, geochemical and palaeoclimatic data of the Discharge Zone study.

Expand and develop the Groundwater Quality Project.

Clients

Water Branch, DPIE

Murray–Darling Basin Ministerial Council

Murray–Darling Basin Commission

New South Wales Department of Water Resources

Rural Water Commission of Victoria

Department of Conservation and Environment, Victoria

South Australian Department of Mines and Energy

Engineering and Water Supply Department, South Australia

State land management agencies

The Murray–Darling Basin community

Cooperating agencies

New South Wales Department of Water Resources

Rural Water Commission of Victoria

Department of Conservation and Environment, Victoria

South Australian Department of Mines and Energy

Engineering and Water Supply Department, South Australia

CSIRO

United States Geological Survey

Australian National University

Project 241.07 Australian groundwater quality assessment

Project manager	John Bauld	06 249 9778
Program responsibility	Environmental Geoscience and Groundwater	
Timeframe	1992–ongoing	

Objective

Provide groundwater resource managers and policy makers with the scientific advice necessary to contribute to ecologically sustainable development of both the nation's groundwater resources and groundwater-dependent economic activities.

Relevance

Knowledge of the present status of groundwater quality, and a clear understanding of the biogeochemical processes which determine this, are essential prerequisites to managing one of our nation's essential natural resources.

Groundwater is an important resource in rural and urban Australia where increasingly it is extracted for drinking, industrial, and agricultural purposes. About 15% of the nation's total water requirements are presently met by groundwater, though this proportion may be as high as 50–100% in large areas of inland, arid-zone Australia.

Consequently, the quality of the nation's groundwater resources is of growing concern to water managers in all States. Groundwater quality (i.e. its acceptability as judged by domestic, industrial, agricultural or environmental criteria) is determined by both natural processes and human activities. Groundwater quality may be assessed not only by factors such as salinity but also by nutrient, toxic chemical and microbiological loads.

There is a disquieting lack of information about the quality of Australia's groundwater resources. For example, the application of agrichemicals (including e.g. insecticides, herbicides, fungicides and fertilisers) continues to be extensive and widespread in key areas of irrigated agricultural production throughout the nation. Groundwater resources underlying these areas are commonly exploited for domestic and town water supplies, as well as for irrigation, and/or pumped to adjacent surface waters for disposal. The impact of these activities is essentially unknown yet potentially of far-reaching health, environmental and economic significance to resource management.

The Australian Groundwater Quality Assessment Project will:

- establish baseline conditions in key groundwater resource areas,
- monitor them for subsequent perturbations, and
- develop a firm scientific understanding of subsurface (bio)geochemical processes.

The Project will make a major contribution:

- to the initiation and establishment, in cooperation with the appropriate State and Commonwealth agencies, of a National Groundwater Quality Database
- to the scientific knowledge base required for rational implementation of the National Water Quality Management Strategy,

which includes National Guidelines for Groundwater Protection.

Expected outcomes

An assessment of groundwater quality in vulnerable aquifers.

An understanding of the role of subsurface (bio)geochemical processes in determining the quality and nature of groundwaters.

The establishment of a National Groundwater Quality Database and the provision of value-added interpretation based on a knowledge of subsurface processes.

A firm scientific basis on which to decide groundwater resource management options.

Activities

Assess contamination of groundwater underlying key areas of irrigated agriculture by agrichemicals and microbes of public health significance.

Assess levels of naturally occurring elements, metals or compounds of public health concern in key groundwater resources.

Establish validation criteria for reliability assessment of both historical and contemporary groundwater quality data.

Assess the role of indigenous microbial and geochemical processes in determining the quality of groundwater and examine the resilience of groundwater to environmental insult.

Integrate findings within appropriate hydrogeological framework.

Expected products

Comprehensive baseline conditions for groundwater quality in key irrigation areas.

Easily accessible databases and GIS for resource management decisions.

A comparative evaluation of various minimum data sets which might be used to measure the impact of changes to resource management practices.

Reports and presentations to water resource managers and other clients and stakeholders.

Advice to DPIE land and water policy groups.

Scientific papers of international standard.

Highlights for 1991/92

Completion of field sampling for reconnaissance investigations of Padthaway and Shepparton irrigation areas in collaboration with the USGS.

Presentation to key Victorian client groups on outcomes of an earlier reconnaissance.

Advanced planning for reconnaissance field work in the Burdekin Irrigation Area in collaboration with the Queensland Water Resources Commission.

Goals for 1992/93

Complete reconnaissance field sampling program for Burdekin and one other key irrigation area.

Continue development and testing of sampling and analytical techniques.

Prepare comprehensive reports detailing baseline conditions for groundwater quality in two key irrigation areas.

Clients

Water Branch, AgFor Group, DPIE

Murray–Darling Basin Commission

Department of Water Resources, NSW

Rural Water Commission of Victoria

Department of Agriculture, Victoria

Department of Mines and Energy, SA

Department of Engineering and Water Supply, SA

Department of Agriculture, SA

Water Resources Commission, Queensland

Cooperating agencies

Department of Water Resources, NSW

Rural Water Commission of Victoria

Department of Agriculture, Victoria

Department of Mines and Energy, SA

Department of Engineering and Water Supply, SA

Department of Agriculture, SA

Water Resources Commission, Queensland

National Resource Information Centre, BRS, DPIE

United States Geological Survey

Project 241.08 Hydrogeology of the Great Artesian Basin

Project manager	Rien Habermehl 06 249 9426
Program responsibility	Environmental Geoscience and Groundwater
Timeframe	1984–1995

Objectives

Provide high level technical and scientific advice relating to groundwater issues in the Great Artesian Basin to Commonwealth and State authorities to contribute to ecologically sustainable development of the Basin's natural and economic resources.

Investigate the nature, extent and availability of groundwater resources of Cape York Peninsula as part of the Cape York Peninsula Land Use Strategy–Natural Resources Analysis Programme (CYPLUS–NRAP).

Relevance

The Project has been endorsed by, and is for the most part a response to, a strong demand expressed by Commonwealth and State organisations through:

- the Australian Water Resources Council (AWRC)
- the AWRC - Water Resources Management Committee
- the Interstate Committee on the Great Artesian Basin
- the Great Artesian Basin Groundwater Working Group.

The Great Artesian Basin is Australia's largest groundwater basin and contains some of the nation's most important groundwater resources.

AGSO has extensive basin-wide hydrogeological knowledge and expertise from past and present studies which enables it to contribute to the joint study with State water and geological authorities, to provide the basis for the assessment of groundwater resources in the Great Artesian Basin, and to contribute to the development of management strategies and options for groundwater related problems.

The Great Artesian Basin Project involves defining problems and remedial measures in the Basin in relation to the better management of artesian groundwater resources through:

- the rehabilitation of uncontrolled waterbores
- the establishment of a rational monitoring network
- the digitising of wire-line logs of waterwells
- the identification of basin-wide hydrochemistry to delineate groundwater quality and to define corrosive areas
- the study of hydrochemistry and isotope hydrology, and the study of recharge and discharge
- the compilation of groundwater quantity and quality information in map form.

The Cape York Groundwater Investigation is part of the Cape York Peninsula Land Use Strategy–Natural Resources Analysis

Program (CYPLUS–NRAP), a Commonwealth and Queensland Government initiative.

Expected outcomes

An information set will be available to allow water managers to sustainably manage the natural and economic resources of the Great Artesian Basin.

This information set will include:

- updated and refined computer-based groundwater simulation models of the Great Artesian Basin on a basin-wide and regional scale, and a well model for use by the State water and geological authorities as tools in the Great Artesian Basin Bore Rehabilitation Program, the Great Artesian Basin Monitoring Network and the Great Artesian Basin Management Program
- a review of the Great Artesian Basin Monitoring Network and proposals for the measurements of artesian pressures, flows and hydrochemistry
- wire-line logs of waterwells and data of the logged wells in the Great Artesian Basin in easy accessible digital format on CD–ROM
- groundwater quality information and an understanding of regional hydrochemical processes required by groundwater managers for the sustainable use and management of artesian groundwater resources
- isotope hydrology, recharge and discharge information
- hydrogeological map of the Great Artesian Basin at scale 1 : 2 500 000.

The Cape York Peninsula Groundwater Investigation will provide reports and maps assessing groundwater quantity and quality, and provide information on the potential for the sustainable development of the groundwater resources in Cape York Peninsula as part of CYPLUS–NRAP.

Understanding of regional groundwater quality and hydrochemistry data and processes in the Great Artesian Basin.

Understanding of recharge and discharge in the Great Artesian Basin.

Activities

Update and complete the hydrogeological databases of the Great Artesian Basin, implement GIS.

Update, refine, calibrate and apply the computer-based simulation models of the Great Artesian Basin, and complete the well model for use in the Great Artesian Basin Bore Rehabilitation Program, the Monitoring Network and the Management Program of the artesian groundwater resources of the Great Artesian Basin.

Digitise wire-line logs of waterwells in the Great Artesian Basin, prepare log and well data for release on CD–ROM disks.

Review the Great Artesian Basin Monitoring Network and prepare proposals for the measurements of artesian pressures, flows and hydrochemistry.

Prepare an independent framework based on regional hydrochemistry processes and groundwater quality information using hydrochemistry and groundwater quality data from State Government authorities and BMR data bases.

Collect, compile and interpret isotope hydrology and hydrochemistry, and recharge and discharge information.

Compile hydrogeological data and prepare a hydrogeological map of the Great Artesian Basin for publication using Intergraph CAD–CAM facilities.

Carry out detailed groundwater investigations in Cape York Peninsula during 1992–1994 as part of CYPLUS–NRAP, including the collection of existing data, a bore census, the drilling of several test and observation holes, hydrochemistry and isotope hydrology sampling programs, remote sensing analysis, data compilation, analysis and interpretation, and preparation of reports and maps.

Expected products

Publications and reports showing detailed data and results of hydrogeological studies in the Great Artesian Basin.

Hydrogeological database of the Great Artesian Basin.

Basin-wide and regional computer simulation models of groundwater hydraulics.

Digital data set of the BMR collection of wire-line logs from waterwells in the Great Artesian Basin.

Review of the Great Artesian Basin Monitoring Network.

Hydrogeological map of the Great Artesian Basin at scale 1 : 2 500 000.

Reports and hydrogeological maps of Cape York Peninsula for CYPLUS–NRAP.

Highlights for 1991/92

Hydrogeological data and results continued to be requested from BMR and have been applied by State authorities in regional and detailed projects and in problem solving.

BMR provided expert hydrogeological advice to the Queensland Government Bureau of Emergency Services on the Environmental Impact Assessment Study of the Gurulmundi Secure Landfill.

The Great Artesian Basin hydrogeological databases have been completed, and PC and Workstation based PARADOX and ORACLE databases have been used in the model data input preparation using ARC/ORACLE and ARC/INFO GIS for use in the MODFLOW (modified versions) ground water simulation models. The MODFLOW model and specific created computer programs for the groundwater simulation modelling were completed.

Digitising of all of the natural gamma-ray and neutron logs and part of the collection of the temperature logs for waterwells in the Great Artesian Basin held by BMR was completed.

Goals for 1992/93

Provide a quantitative understanding of, and provide a predictive capability for, the artesian groundwater systems of the Great Artesian Basin.

Provide a digital package of wire-line logs and well data of waterwells in the Great Artesian Basin.

Provide a review of the Great Artesian Basin Monitoring Network.

Carry out the detailed work program of the Cape York Peninsula Groundwater Investigation, including data collation, hydrochemistry and isotope sampling programs, and the drilling of test and observation holes.

Clients

Water Branch, DPIE

State water and geological authorities of Queensland, New South Wales, South Australia and the Northern Territory

Other State Government departments and authorities, including SA Department of Environment and Planning, National Parks and Wildlife Service

Water industry

Pastoral industry

Petroleum and mining industries

Scientific institutions, including CSIRO, universities, museums

Educational institutions, national and international hydrogeological scientific community

General public

CYPLUS–NRAP

Cooperating agencies

State water and geological authorities of Queensland, New South Wales, South Australia and the Northern Territory

Australian Nuclear Science and Technology Organisation

Department of Nuclear Physics and Research School of Earth Sciences, Australian National University

Adelaide University

Division of Water Resources, CSIRO

Department of Environment and Planning, SA
National Parks and Wildlife Service, SA

Petroleum and mining industries
Universities in Europe and USA

222: AUSTRALIAN SEISMOLOGICAL CENTRE

Objectives

Reduce the damaging effects of future Australian earthquakes.

Develop an understanding of the structure and tectonics of the Australian region.

Contribute data from Australian seismographic stations to fulfil international obligations for global hazard reduction and global studies of earth structure and tectonic activity.

Detect and provide information and advice on underground nuclear explosions as a contribution to the attainment of a Comprehensive Nuclear Test Ban Treaty.

Relevance

Earthquakes are a global phenomenon and cause damage throught the world. Significant and potentially damaging earthquakes occur in Australia. To understand them, it is necessary to use information from both national and international seismograph stations.

Australia has a responsibility to operate seismographs on its territory and make the data available internationally for the study of world seismicity patterns and earth structure. In return, seismological information obtained overseas is required to improve the Australia Building Code and make Australian construction practices safer and more cost effective.

The monitoring of nuclear explosions is part of the Government's policy to limit the spread of nuclear weapons by developing appropriate treaty verification systems so that the threat of nuclear war is reduced.

Activities

Operate a national network of seismographic stations to monitor earthquakes and underground nuclear explosions.

Investigate significant Australian earthquakes by monitoring aftershock activity, studying ground movement associated with large earthquakes and assessing damage caused by earthquakes.

Operate a network of strong ground motion recorders to estimate ground motion during significant earthquakes.

Provide information on earthquakes and nuclear explosion to clients within Australia and overseas.

Analyse seismic recordings to detect and locate underground nuclear explosions.

Provide technical advice to the Department of Foreign Affairs and Trade at the U.N. Conference on Disarmament (through the Groups of Scientific Experts).

Cooperate with RSES to optimise the use of seismic arrays in the analysis of earthquakes and nuclear explosion, and to improve procedures used to locate seismic events.

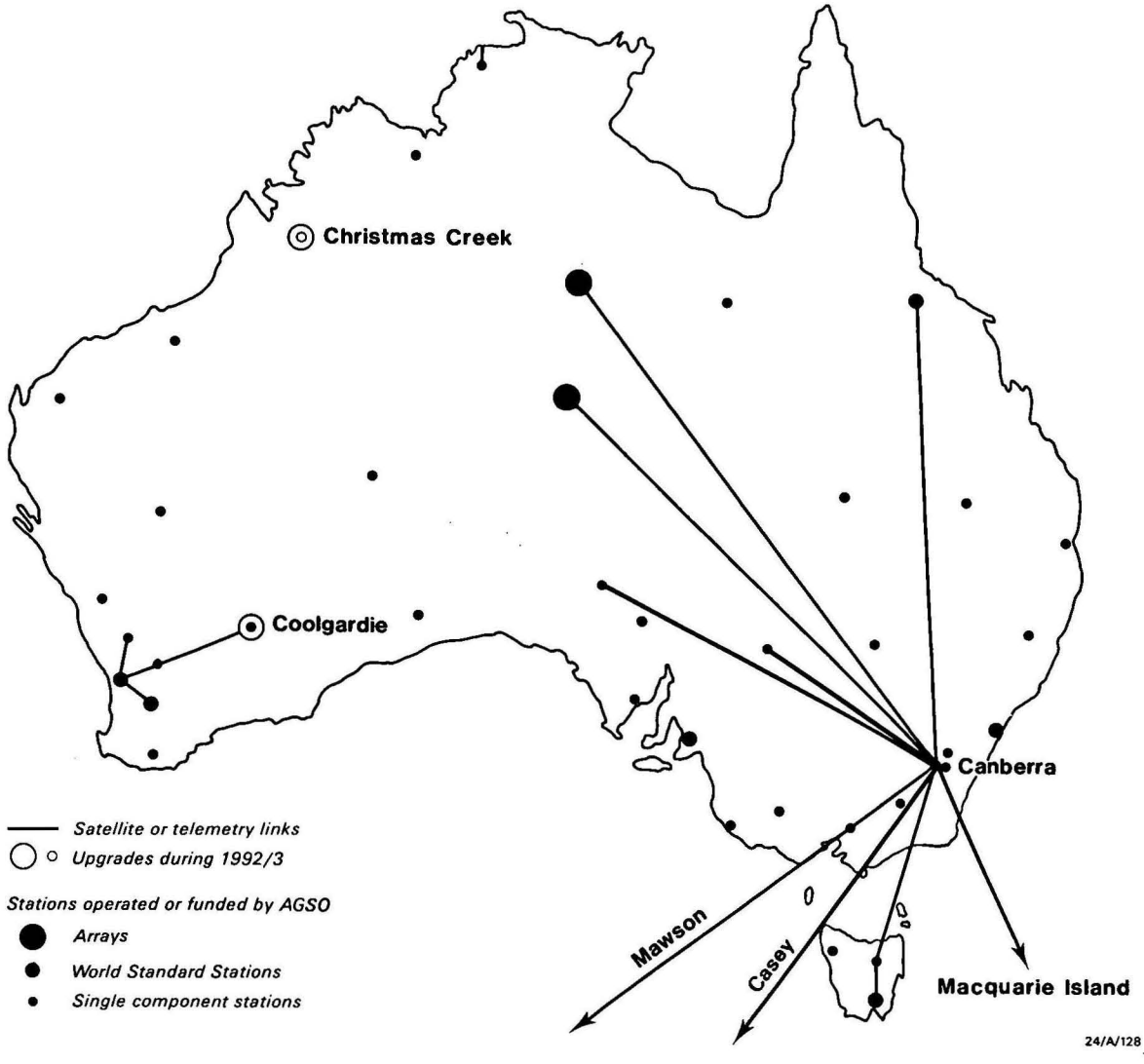
AUSTRALIAN SEISMOLOGICAL CENTRE

Component manager Ken Muirhead 06 249 9481

Component projects

222.01 Earthquake seismology

222.02 Monitoring of nuclear explosions



Seismograph stations operated or funded by AGSO

Project 222.01 Earthquake seismology

Project manager	Kevin McCue 06 249 9675
Program responsibility	Geophysical Observatories and Mapping
Timeframe	1950–ongoing

Objectives

Improve assessments of earthquake risk throughout the Australian continent, especially the major population centres, to mitigate the damaging effects of earthquakes.

Develop an understanding of the structure and tectonics of the Australian region, with particular emphasis on intra-plate seismicity, as a contribution to national and international seismology.

Locate all earthquakes in the Australian region with magnitudes of three and greater and adequately monitor smaller earthquakes in regions of high population density, where the identification of seismically active fault zones will enable significant improvements in earthquake risk assessments to be made.

Relevance

Although the level of seismicity in the Australian continent is lower than in countries such as Japan and Chile, which are situated on active plate boundaries, large significant and potentially damaging earthquakes do occur in the Australian region.

In March 1954, a magnitude ML5 earthquake caused damage of about $100 million in Adelaide SA and in December 1989, a magnitude 5.6 earthquake close to Newcastle (NSW) resulted in 13 deaths and at least $1500 million damage. Earthquakes are therefore quite clearly of major importance to Australians, and the hazard increases yearly as the population expands, yet there is at present no model that accounts for intra-plate earthquakes.

Studies of seismicity patterns, earthquake focal mechanisms, prehistorical fault scarps, pre-instrumental earthquakes and the regional crustal stress field are therefore essential to improve our knowledge in this area of earth science.

The August 1992 budget included $500,000 per year for three years to upgrade the earthquake monitoring program. In cooperation with the States, the supplementary funds will be used to improve the monitoring of the main urban areas and to increase the coverage of the national seismograph network.

In the first year, two accelerographs will be installed in Adelaide, Sydney, Melbourne, Brisbane and Perth. A new seismograph station will be installed either in western or south eastern Australia to fill gaps in our present national network. In addition, a prototype of a system for transmission of seismic data by satellite telemetry will be developed. In subsequent years, this system will be installed at many stations in the national network to provide real time access to seismic data.

Expected outcomes

Improved earthquake monitoring coverage of Australia and its major population centres.

Timely advice to State emergency services, the National Disasters Organisation and the media following significant earthquakes, and better hazard maps for the Australian Building Code.

Activities

Continue to monitor and improve the monitoring of earthquakes in Australia.

Add data from AGSO's National Seismographic Network and State and university cooperative programs to the AGSO's earthquake data file at monthly intervals; analyse that data to provide information as a contribution to national and international seismology

and as a basis for research in seismic hazard assessment, intra-plate tectonics, earth structure, and recent crustal movements.

Ongoing study of historical (pre-instrumental) Australian earthquakes to enlarge the database.

Operate a network of 29 permanent seismographs and 18 accelerographs (for strong ground motion) throughout the Australian continent and the AAT (225.01) and a four-station network near Newcastle (NSW).

Review joint AGSO operation of networks in South Australia, Tasmania, New South Wales and Queensland with State cooperating agencies.

Distribute monthly reports on Australian earthquakes of magnitude 3 or greater.

Monitor and interpret seismic waves from near and distant earthquakes as a contribution to national and international seismology.

Interpret data from earthquakes, recent crustal movements and stress measurements.

Develop new methods to upgrade the Australian Earthquake Risk Map and Building Code.

Update and improve the world earthquake database.

Make the above data and information available.

Expected products

Updated earthquake risk maps of the Australian continent at five yearly intervals.

Bulletins of earthquake phase data for distribution nationally and overseas.

Research papers on Australian seismicity, historical earthquakes and tectonics and significant Australian earthquakes.

Extracts from Australian earthquake data files.

Annual reports summarising Australian and world seismicity.

Highlights for 1991/92

A report drafted by representatives of State and Commonwealth Governments recognised the areas of greatest risk in Australia as the major urban areas that are not currently monitored and noted that the lack of adequate monitoring is the greatest impediment to establishing models to explain the occurrence, frequency and location of Australian earthquakes. Recommendations to upgrade the nat-ional seismographic network and monitor the cities with seismographs and accelerographs are being considered by responsible State and Commonwealth Government ministers.

Peter Gregson (AGSO) and Gary Gibson (Preston Institute of Technology, Melbourne) visited China in Oct/Nov 1991 under the MOU signed on 26 April 1990, installed two Australian digital recorders near Beijing and exchanged relevant earthquake datafiles.

Improved the Australian National Seismographic Network, consisting of 26 permanent seismographic stations in Australia and three in the AAT, including:

- a four-station permanent network of seismographs in the Hunter region;
- Newcastle (NSW) is the only major urban area in Australia which has a dedicated earthquake monitoring network;
- bore holes were hammered at Coolgardie and Fitzroy Crossing WA for broadband seismometers;
- continued the cooperative project with the University College of Central Queensland to monitor the Rockhampton region.

Goals for 1992/93

Commence a three year program, in cooperation with the State Governments, to monitor major urban areas according to a strategy developed by the group of seismological experts at their meeting in Canberra on 25 May 1990.

Mundaring scientists to cooperate with GSWA and Eastern Goldfields mining companies to investigate rockbursts in underground mines.

Move the seismographs at Forrest (WA) and Cobar (NSW) to quieter sites more distant

from railway lines. Install downhole broadband seismographs at Coolgardie and Fitzroy Crossing (WA).

Publish the 1989 and 1990 ASC Reports and Part III of the Isoseismal Atlas. Continue research into Australian seismicity including study of widely felt historical earthquakes.

Host a visit by scientists from the State Seismological Bureau in the PRC under the MOU signed in 1990 to develop cooperative projects of mutual interest.

Finalise and publish the results of the microzonation of Newcastle (NSW).

Hold conference on Australian seismicity/earthquake engineering in Sydney.

Inspect damage, monitor aftershocks and prepare reports on significant Australian earthquakes.

Continue crustal stress mapping of the Australian continent using fault plane solutions of the larger earthquakes.

Monitor, with the University of Queensland, crustal strain near Dalton (NSW) in this active intra-plate seismic zone.

Reconfigure the Antarctic seismograph telemetry links following rerouting of the satellite terminal from Sydney to Hobart.

Clients

The Australian public

The Australian Government

The media

International Seismological Centre, UK

National Earthquake Information Centre, USA

Other international agencies

Standards Australia

The insurance industry

Engineering companies.

Cooperating agencies

Australia

Antarctic Division, DASET

Australian National University

Australian Nuclear Science and Technology Organisation

Queensland Department of Resource Industries

Seismology Research Centre, Royal Melbourne Institute of Technology

Phillip Institute of Technology

South Australian Department of Mines and Energy

St Ignatius College, Riverview, New South Wales

University of Queensland

University of Tasmania

University of Central Queensland

National Disasters Organisation

International

Professor Bolt, University of California, Berkeley

Japan Society for the Promotion of Science

International Association for Earthquake Engineering

USSR Academy of Science

State Seismological Bureau, PRC

Project 222.02 Nuclear explosion seismology

Project manager	Ken Muirhead 06 249 9481
Program responsibility	Geophysical Observatories and Mapping
Timeframe	1984–ongoing

Objectives

Establish and operate a national facility to detect and provide information on underground nuclear explosions, and an international seismological data centre, as contributions to the attainment of a Comprehensive Nuclear Test Ban Treaty (CTBT).

Relevance

This work is in accordance with Cabinet Decision 2996 of 30 July 1984. It is part of the Government's policy to limit the spread of nuclear weapons by developing appropriate treaty verification systems so that the threat of nuclear war is reduced.

Expected outcomes

An international/national facility to monitor underground nuclear explosions.

Detection and reporting of all underground nuclear explosions.

An international data centre to monitor a CTBT.

Australian contributions to the report to the Conference on Disarmament on a modern global seismic monitoring network.

Activities

Establish and operate a national detection facility to monitor underground nuclear explosions with a sufficiently brief response time; this requires the real time transmission of seismic signals from the major Australian seismic stations to the AGSO's Australian Seismological Centre (ASC).

Analyse data recorded at Australian seismic stations to detect and provide information on underground nuclear explosions; as an international data centre, the ASC will receive data from overseas agencies, enabling better source parameters to be determined thus improving global coverage.

Exchange results and basic data with overseas agencies.

Provide technical advice to the Department of Foreign Affairs and Trade, other government agencies and the Group of Scientific Experts (GSE), an ad hoc group of the Conference on Disarmament; Australia has been a member of the GSE since its inception in 1976 and has provided important input to the efforts to achieve a global seismological system for monitoring a CTBT.

Advise Government and the media of the occurrences of underground nuclear explosions.

Expected products

Timely information on underground nuclear explosions.

Quarterly bulletins of nuclear explosions.

Highlights for 1991/92

Participated in the Group of Scientific Experts Technical Test-2 (GSETT-2), a seven week experiment to test procedures of a system to monitor a Comprehensive Test Ban Treaty.

Analysed data acquired during GSETT-2 to obtain improved methods of defining and categorising events recorded by an international network of stations. Made submissions to the GSE.

Participated in the 32nd and 33rd Session of the GSE in Geneva.

Improved algorithms to detect and then locate seismic events.

Conducted workshop on seismological procedures employed at international data centres to form bulletins of seismic events.

Advised Government, media and the public on underground nuclear explosions.

Goals for 1992/93

Upgrade station at Coolgardie.

Install station at Fitzroy Crossing.

Complete analysis of data acquired during GSETT-2 and contribute to the report of the GSE to the Conference on Disarmament.

Set up prototype satellite data communication facility using Optus.

Investigate sites and array geometrics for optimum seismic monitoring network configuration.

Further develop algorithms for the automatic analysis and location of seismic events detected by the Australian network of seismographs.

Advise relevant government agencies and the media of all underground nuclear explosions which are recorded by the Australian seismic network.

Participate in the 34th and 35th sessions of the GSE in Geneva.

Clients

Department of Foreign Affairs and Trade

Australian public

The media

Peace groups

Cooperating agencies

Australian

Research School of Earth Sciences, Australian National University

International

United States Air Force Technical Applications Centre (joint operation of seismic array at Alice Springs

United States Defense Advanced Research Projects Agency (exchange of software)

National Agencies participating in the Group of Scientific Experts within the Conference on Disarmament

224: GEOMAGNETISM

Objectives

Provide accurate information about the temporal and spatial variations of the geomagnetic field over the Australian region.

Fulfil international obligations for monitoring the geomagnetic field on a global basis.

Develop an understanding of the nature and origins of internal contributions to the geomagnetic field (core, crustal and induced), and related applications.

Apply palaeomagnetic and rockmagnetic techniques to help solve geological problems associated with continental reconstructions, tectonic history and evolution of sedimentary basins; as a dating and stratigraphic tool; and for investigating past environmental (climatic) changes.

Relevance

This research is undertaken to develop and exploit applications of geomagnetic, palaeomagnetic and rockmagnetic phenomena. It also contributes to databases essential for fundamental research in geomagnetism and palaeomagnetism, both on a regional and a global scale.

Characterisation of present and past behaviour of the geomagnetic field leads to an understanding of its origins—internal, crustal and external. This not only provides the basis for predicting the behaviour of the field and developing applications, but is also an important fundamental problem in its own right.

Information about the direction and strength of the Earth's field is used for navigation, direction finding, directional drilling, magnetic detection systems, processing of aeromagnetic and marine magnetic survey data, levelling and updating magnetic survey data, identifying and modelling crustal magnetic anomalies, and monitoring natural magnetic disturbances and associated hazards. Information is required in the form of digital data sets, mathematical models of the field, and as magnetic field charts. It is used by mapping and survey organisations, aviation authorities and airlines, the petroleum and mineral industries, the Defence Forces, the Ionospheric Prediction Service, mariners and yachtsmen, the electronics industry, and academic institutions.

Transient fluctuations of the geomagnetic field pose a significant problem for airborne, marine and ground magnetic surveys, particularly as transients have a strong spatial dependence related to crustal and oceanic electrical conductivity properties. Characterising these 'diurnal' variations over the region is important for making appropriate corrections to magnetic survey data. On the other hand, the natural variations of the geomagnetic field can be used to derive useful information about the geological structure of the crust via its internal electrical properties.

Monitoring and analysis of the Earth's magnetic field must be carried out on a global as well as a regional scale. Australia's role in maintaining a global network of magnetic observatories is critical for obtaining coverage of the southern hemisphere and a large sector of Antarctica. It is in our interests to ensure that global models of the field, particularly the International Geomagnetic Reference Field (IGRF), are accurate over this region.

The observatory group has the expertise and facilities for calibration of magnetic compasses and certain types of magnetic survey equipment, for training observers, and for providing advice on aspects of geomagnetism and related applications. These functions are provided as a national service.

Palaeomagnetic research has three major directions. The first is to improve our understanding of the tectonic evolution of the Australian and Antarctic plates within a global plate tectonic framework. The second is to develop a framework for dating and correlating Australian sedimentary sequences (and other rock units including the regolith), and to aid in studies of the evolution of sedimentary basins. The third is to identify and

date major environmental (hence climatic) changes both onshore and offshore. Such changes often leave an imprint on the magnetic character of marine and lacustrine sediments. The palaeomagnetic laboratory is supported not only to satisfy AGSO's needs, but also as a national facility.

Activities

Operate a national network of magnetic observatories in Australia, and in the Australian Antarctic Territory (see Figure below).

Modernise and streamline the magnetic observatories, telemetry communications, and data processing methods.

Conduct magnetic repeat station surveys in the Australian region and in the Australian Antarctic Territory.

Produce regional field models, particularly the Australian Geomagnetic Reference Field (AGRF), covering the continent and offshore areas of interest to Australia.

Contribute towards producing global field models, particularly IGRF, and improve their accuracy over the Australian region.

Collaborate with neighbouring countries to develop a better regional model of the field.

Use magnetometer array studies to investigate transient and diurnal variations of the field over Australia as an aid to aeromagnetic exploration.

Investigate the nature and origins of the present and past geomagnetic field (core, crustal and induced).

Apply palaeomagnetic and rockmagnetic techniques to geological problems associated with continental reconstructions, tectonic history, evolution of sedimentary basins, dating and stratigraphy, and for investigating past environmental (climatic) changes.

Maintain the national geomagnetism and palaeomagnetism services, facilities and data bases.

GEOMAGNETISM

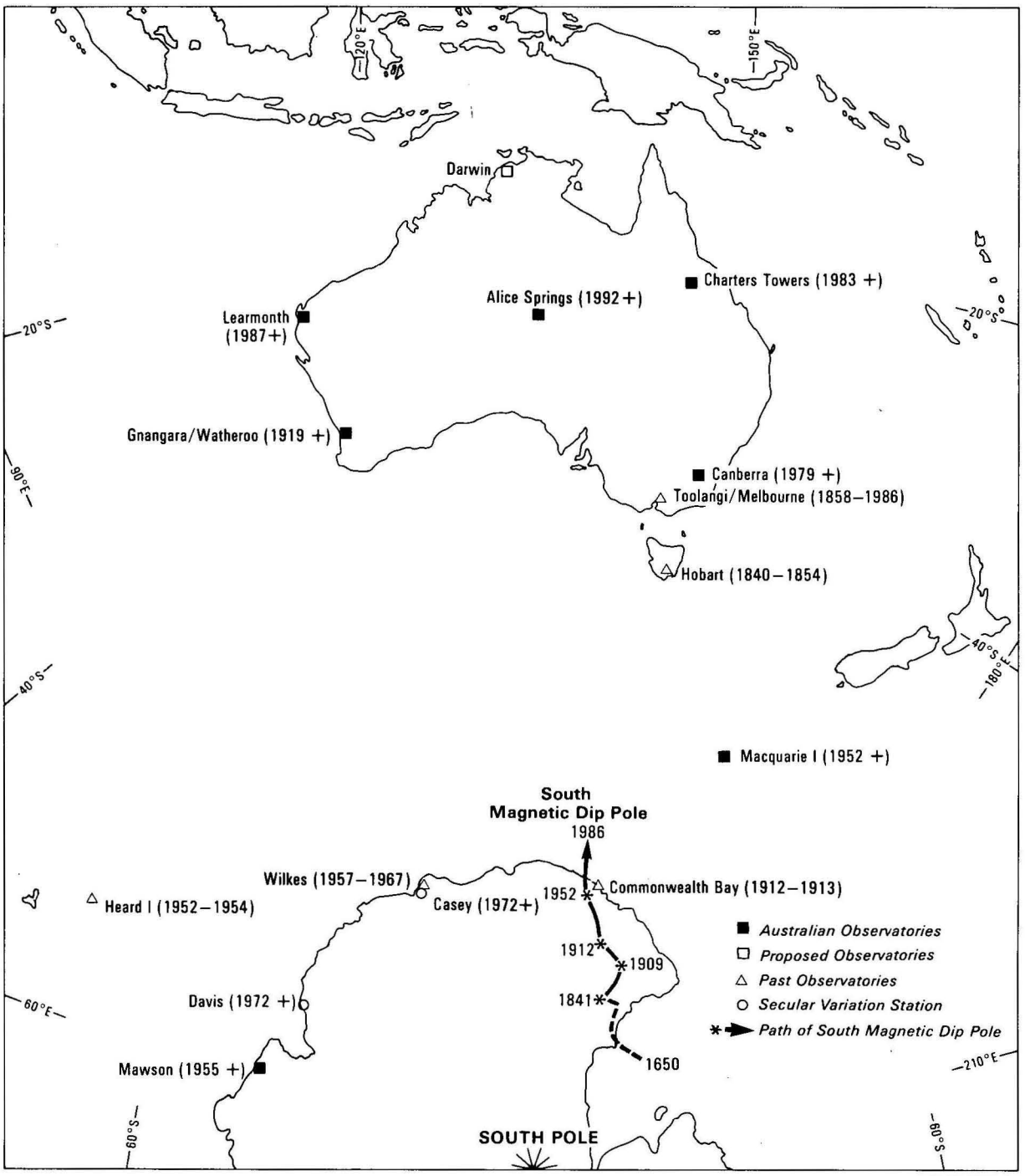
Component manager Charles Barton 06 249 9611

Component projects

224.01: Monitoring, analysis and modelling of the geomagnetic field

224.02: Spatial and diurnal variations of the geomagnetic field

224.03: Palaeomagnetism



Australian Magnetic Observatories

Project 224.01 Monitoring, analysis and modelling of the geomagnetic field

Project managers	Andrew McEwin	06 249 9392
	Charles Barton	06 249 9611
Program responsibility	Geophysical Observatories and Mapping	
Timeframe	1946–ongoing	

Objectives

Monitor and provide information on the morphology and variations of the magnetic field.

Provide numerical models and charts of the field and its secular variation over the Australian region, and offshore areas of interest to Australia.

Investigate the origins of the geomagnetic field and its secular variation.

Relevance

The information is used for direction finding (navigation), reduction of aeromagnetic and marine magnetic survey data, levelling and correcting survey data to common epochs, delineating and modelling long-wavelength magnetic anomalies, and studies of the solid earth and solar-terrestrial relationships.

Magnetic repeat station surveys are essential for supplementing the data from observatories in order to obtain an accurate picture of the secular change of the magnetic field over the Australian region. This is particularly important for updating and merging data from different magnetic surveys.

Expected outcomes

Information about the behaviour and origin of the geomagnetic field, leading to better use of geomagnetic phenomena for the public good.

A geomagnetic data and information service, training courses, and instrument calibration and testing facilities.

Activities

Operate the Australian network of permanent magnetic observatories and repeat stations.

Provide geomagnetic observatory data, mean values, indices of magnetic disturbance, and storm and rapid variation information to the World Data Centres, national and international agencies, and to other clients.

Develop and maintain regional and global models of the geomagnetic field and its secular variation, particularly the Australian Geomagnetic Reference Field (AGRF), and provide field-model software.

Provide geomagnetic information services, calibrations, training and advice.

Liaise and collaborate with neighbouring countries with related interests.

Investigate the nature and origin of the geomagnetic field.

Maintain and develop appropriate databases of current and historical geomagnetic data, and long secular variation records.

Expected products

A database of geomagnetic data focusing on mean hourly values.

Continuous supply of data to the World Data Centres and other clients.

Software packages for regional (AGRF) and global magnetic field models.

A new regional field model covering Australia, Indonesia, Papua New Guinea, the south west Pacific and New Zealand.

Publications: monthly Australian Geomagnetism Report; operations/observatory reports; research papers.

Highlights for 1991/92

Alice Springs observatory was opened. It is equipped with a ring-core fluxgate, digital data acquisition and telemetry to AGSO. A site for the Darwin Observatory, in Kakadu National Park, was identified.

One of the new generation of ring-core fluxgate magnetometers was installed at Macquarie Island, and preparation began for a similar installation at Mawson.

The 1990 revision of AGRF was released. It is the first complete regional field model that uses all the available vector survey data, including the new Project Magnet (U.S. Navy) high-elevation aeromagnetic survey data for Australia.

A technique for integrating vector and scalar data for regional field modelling has been developed in collaboration with DSIR, New Zealand.

The regional repeat station survey for AGRF 1995 was commenced. A new digital data acquisition and processing system has been developed for streamlining repeat station surveys.

Collaborative links with neighbours have been strengthened. Assistance was provided to Papua New Guinea to process data from the Port Moresby Observatory, and steps taken to help secure continuity of operations at Port Moresby. Closer links have been developed with the Geomagnetic Observatory group in New Zealand (for regional surveys, observatory practice, regional field modelling and research into time and spatial variations of the field). The repeat station survey of the south west Pacific is shared with New Zealand.

AGSO's scheme for reporting and classifying repeat station data is being implemented successfully through the International Association of Geomagnetism and Aeronomy (IAGA).

Publication of Australian Geomagnetism Reports monthly and research papers on field modelling, and the nature and origin of the geomagnetic field.

Goals for 1992/93

Continue streamlining the magnetic observatory and repeat station networks, processing methods, data dissemination and communication links, including start of transmission from Canberra observatory into INTERMAGNET—the global system for interchange of geomagnetic observatory data in real time by satellite.

Start recording and long-term testing of the Alice Springs magnetic observatory; prepare the site for the Darwin (Kakadu) observatory.

Obtain assistance for Port Moresby to upgrade to digital acquisition.

Evaluate the algorithms recommended by IAGA for computing K-indices, and start producing computer-generated indices of magnetic disturbance.

Complete the re-occupation of first-order stations in continental Australia and Papua New Guinea.

Prepare a regional model of total field data as a reference surface for the magnetic anomaly map of Australia (part of Project 221.05).

Produce a regional field model to cover the whole Australia–New Zealand–south west Pacific–Papua New Guinea–Indonesia region (in collaboration with New Zealand).

Develop scalar datasets for use in AGRF1995, including the POGS satellite data.

Develop closer links with Indonesia to improve regional field models.

Continue fundamental research in geomagnetism.

Maintain databases; secure international funding for a secular variation database (see Project 224.03).

Clients

Mineral exploration and petroleum industries

Civil Aviation Authority and commercial airlines

AUSLIG

Department of Defence

Ionospheric Prediction Service

AGSO's airborne and marine magnetic programs

Other users: surveyors, mariners, electronics industry

World Data Centres and the international scientific community

Cooperating agencies

Australia

Physics Department, Universities of Queensland

Physics Department, La Trobe University

Division of Wildlife and Rangelands Research, CSIRO

Ionospheric Prediction Service (Solar Observatory at Learmonth)

National Parks and Wildlife Service, NT

Research School of Earth Sciences, Australian National University

Mathematics Department, University of Sydney

International

DSIR Geomagnetic Observatory, New Zealand

Geological Survey, Papua New Guinea

Meteorological and Geophysical Agency, Indonesia

South west Pacific island nations

U.S. Navy (Project Magnet, POGS satellite)

U.S. Geological Survey (INTERMAGNET, global field models)

British Geological Survey, Edinburgh, UK

(INTERMAGNET, production of global indices)

Canadian Geological Survey, Ottawa (repeat station survey methods, regional field modelling)

Prof. RT Merrill, University of Washington

International Association of Geomagnetism and Aeronomy

Project 224.02 Spatial and diurnal variations of the geomagnetic field

Project manager	Charles Barton 06 249 9611
Program responsibility	Geophysical Observatories and Mapping Program
Timeframe	1986–1993

Objectives

Characterise the short-term temporal and spatial variations of the geomagnetic field over the Australian continent; hence establish a scientific basis for the choice of aeromagnetic and ground survey base-stations.

Obtain a broad-scale picture of the subsurface electrical conductivity structure of the continent and long wavelength magnetic anomalies.

Assess the impact of coastal (oceanic) induction effects on Australian magnetic observatory data.

Provide ground truth for satellite and diurnal data for continent-wide aeromagnetic surveys.

Project 224.03: Palaeomagnetism

Project manager	Chris Klootwijk 06 249 9324
Program responsibility	Geophysical Observatories and Mapping
Time Frame	1976–ongoing

Objectives

Provide assistance to other AGSO projects regarding geodynamic, tectonic, structural, magnetostratigraphic and environmental problems at local, regional and global scales.

Improve our understanding of the tectonic evolution of the Australian and Antarctic plates, particularly with respect to orogenic and mineral plumbing phases within regional and global plate tectonic frameworks.

Develop a magnetostratigraphic and chronostratigraphic framework for Australian sedimentary sequences, and other rock units including the regolith.

Identify, correlate, and date major environmental (hence climatic) changes both onshore and offshore.

Develop and apply techniques for magnetic fabric analysis.

Maintain and develop appropriate palaeomagnetic databases.

Provide a national palaeomagnetic training and information service.

Maintain the Black Mountain palaeomagnetic laboratory as a national facility.

Relevance

Palaeomagnetic, rockmagnetic, magnetic fabric, and environmental magnetic studies provide unique contributions to the resolution of a wide range of geological problems, e.g.

- palinspastic reconstructions
- evolution of sedimentary basins
- stratigraphic correlation and dating
- deformation processes and strain analysis
- dating the regolith and land degradation processes
- determination of sediment and volcanic flow transport
- tracing low level orogenic and mineral plumbing phases from palaeomagnetic overprints
- groundtruth data for aeromagnetic interpretations
- rapid identification of major environmental changes in the Cenozoic and their stratigraphic context.

The palaeomagnetic laboratory serves as a national facility. Palaeomagnetic databases are essential for palaeomagnetic interpretations and investigations of the behaviour of the geomagnetic field.

Expected outcomes

Improved capability to analyse and understand geodynamic processes through

- better definition of crucial Tertiary, Late Palaeozoic, Late Proterozoic–Early Palaeozoic, and Early–Middle Proterozoic segments of the Australian and Antarctic apparent polar wander paths (APWPs)
- upgrading of the Australian and the Global Palaeomagnetic databases.

A better understanding of the tectonic evolution of the Australian and Antarctic plates and south eastern Asia through targeted project-oriented and framework palaeomagnetic studies.

Improvements to the Magnetic Polarity Reversal Timescale and to the applicability of magnetostratigraphy in chronostratigraphic studies.

Application and further development of a dating tool for regolith and land degradation studies.

A sensitive tracing tool for orogenic and mineral plumbing phases, at levels that are not otherwise observable.

A sensitive, calibrated strain indicator at mesoscopic and macroscopic scales, through analysis of remanence and susceptibility anisotropies.

A rapid and sensitive scanning technique for long cores for correlation and identification of environmental changes.

A spatial remanence and susceptibility database as an aid to interpretation of aeromagnetic data.

A magnetic palaeoenvironmental record for the Cenozoic of onshore and offshore Australia as a basis for evaluating current global changes.

Activities

Carry out palaeomagnetic, rockmagnetic, magnetic fabric, and environmental magnetic investigations in support of AGSO projects and relevant external programs.

Undertake palaeomagnetic framework studies to enable reliable palaeomagnetic interpretations.

Maintain the Australian and Global Palaeomagnetic databases. Seek international funding for development of a secular variation/polarity transition database.

Develop, upgrade and maintain palaeomagnetic data acquisition and analysis techniques.

Provide a palaeomagnetic information and training service.

Maintain the Black Mountain palaeomagnetic laboratory as a national facility.

Expected products

Publication of palaeomagnetic results on:

- Proterozoic evolution of the Vestfold Hills, Antarctica
- Proterozoic results from the Bunger Hills, Antarctica
- Late Palaeozoic evolution of volcanic fields in north eastern and eastern Queensland:
  - Newcastle Range Volcanics Field
  - Bulgonunna Volcanics Field
  - Featherbed Volcanics Field
  - Lizzie Creek/Carmila Beds Volcanic Field
- The Mount Eclipse Sandstone of the Ngalia Basin, and upgrade of the Late Palaeozoic APWP for Australia
- Constraints on the Late Palaeozoic evolution of the southern New England Orogen from remanence and susceptibility anisotropy data
- The Late Palaeozoic–Cenozoic tectonic evolution of the Bird's Head, Irian Jaya
- The Browns Creek Clays of the Tertiary APWP and reversal stratigraphy for Australia
- The mineral magnetic record of environmental/sealevel changes for offshore north eastern Australia, based on ODP Leg 133 data
- The Holocene environmental record from Lake Johnson, Tasmania.

Highlights for 1991/92

New results from the Eastern and Western McArthur Basin eliminate a major gap in the reversal sequence and in the APWP segment for the Early to Middle Proterozoic, and provide a firm basis for correlation between the Eastern and the Western McArthur Basin sequences and other Early to Middle Proterozoic sequences in Australia. The studies have concentrated on identification and interpretation of overprints, particularly in relation to the HYC mineralisation event and on aeromagnetic and geochronological evidence for intrusive activity around 1300 Ma. Two major papers on Early to Middle Proterozoic palaeomagnetism and evolution of the Eastern and Western McArthur Basin have been submitted for a special issue on 'Proterozoic palaeomagnetism, palaeogeography and palaeoclimates' to appear in Precambrian Research.

Results from the Early to Middle Proterozoic mafic dyke suites in the Mt Isa cratonic block show two main remanence groupings, one group indicates that unmetamorphosed dykes

were intruded around 1100 Ma, the other grouping may represent mid-Proterozoic regional metamorphism (ca. 1620–1500 Ma). A paper has been submitted to the above special issue of Precambrian Research.

Pilot palaeomagnetic data from Late Palaeozoic volcanic fields in north eastern Queensland detail the Australian APWP in the Late Carboniferous–Early Permian interval, show pervasive overprinting of the DCv and Cv sequences, and pose the question whether hydrothermal activity may have affected the isotopic systems. A paper has been submitted.

Results from the Mount Painter Breccia and Sinter Complex confirm pervasive remagnetisation and uranium mineralisation during Late Carboniferous–Early Permian tectonic activity. A paper is in press in the Australian Journal of Earth Sciences.

Results from ODP Leg 121 on Broken Ridge and Ninetyeast Ridge indicate that India–Asia contact was established already by Cretaceous/Tertiary boundary times, detail the Neogene uplift of the Himalayan–Tibetan region and its possible effects on global climate, and support a Kerguelen hotspot origin for Ninetyeast Ridge. Three papers have been submitted to external journals, in addition to contributions that have appeared in the ODP Scientific Results Volume.

Results from Chitral in the Eastern Hindukush have shown supporting evidence for the early India–Asia contact as concluded from ODP Leg 121 studies. A paper has been submitted.

Palaeomagnetic and susceptibility anisotropy results in Tamworth Belt–Texas Block–Coffs Harbour Block–Beenleigh Block show qualified support for oroclinal bending. Three papers have been submitted.

Results from Site 820, ODP Leg 133, offshore north eastern Australia, have shown mineral magnetic variations that appear to reflect detailed sealevel fluctuations, and also climatic conditions during previous glaciations. Preliminary results suggest the intriguing possibility that lake levels in south eastern Australia and sealevel varied in phase during the Holocene.

The final version of the PC-based ORACLE database of Australian and Global Palaeomagnetic Poles has been installed at AGSO.

Provisional indications of intent have been obtained from 7 countries, excluding Australia, to contribute towards funding a global database for secular variation and magnetic polarity transition records (via IAGA).

Goals for 1992/93

Minerals Program

A better understanding of overprint and dating problems in the north eastern Queensland volcanic fields through targeted follow-up studies. Publication of papers on palaeomagnetic results from the Bulgonunna Volcanics Field, Featherbed Volcanic Field, Lizzie Creek/Carmila Beds Volcanics Field, and the Newcastle Range Volcanics Field.

Further analysis of the former relative position of Australian cratonic blocks, and upgrading of the Early–Middle Proterozoic APWP for Australia, through study of volcanic sequences in the Pine Creek region.

Petroleum Program

Unravelling of the accretion history of the New England Orogen through analysis of Carboniferous and Permian igneous sequences.

Provision of assistance to the Palaeogeographic Mapping Project/Australian Petroleum Systems Project on matters of palaeolatitude evolution and reconstruction of the Australian and adjacent plates.

Refinement of Australia's chronostratigraphic record through targeted magnetostratigraphic studies in combination with U-Pb (SHRIMP) zircon dating and biostratigraphic studies, particularly on Permo-Carboniferous and Jurasso–Cretaceous sequences.

Environmental Geoscience Program

Improved understanding of climatic and sealevel changes in the Late Cenozoic record of offshore north eastern Queensland through completion of the analysis of ODP Leg 133 cores. Publication of results.

Detailing of the Late Holocene environmental record of Lake Johnson, Tasmania, and publication of results.

Upgrading of the Proterozoic APWP for

Antarctica from the dyke sequences of the Vestfold Hills, Antarctica. Publication of results

Framework Studies

Final analysis of the Late Palaeozoic to Recent geodynamic evolution of the Bird's Head, Irian Jaya, and publication of results.

Upgrading of the Cenozoic APWP for Australia through study of the Browns Creek Clays.

Linking by magnetostratigraphy the Late Eocene biostratigraphy in southern Australia to the international biozones. Publication of results.

Contribution to the resolution of the dispute on the form of the Late Palaeozoic APWP for Australia and Gondwana through study of the Late Carboniferous–Early Permian sequence of Bonaparte Basin.

Upgrading of the Late Mesozoic APWP for Australia through study of the Strzelecki Group.

Secure funding agreements for the global secular variation/polarity transition database, and let a contract.

Laboratory development:

Finalize transfer of PALDAS from the HP–A600 to PC-based LAN.

Transfer of PALSYS from DG/ORACLE to new UNIX/ORACLE platform.

Clients

AGSO projects

State Geological Surveys

Antarctic Division

Industry Groups

Academic Institutions.

Cooperating agencies

Prof. John Roberts and Dr P Lennox, University of New South Wales

Prof. Brian McKelvey and Dr P Flood, University of New England

Prof. M Rickard, Australian National University

Prof. B Engel and Prof. E Calhoun, Newcastle University

Prof. P Davies, University of Sydney

Prof. P Rochette and Dr C Aubourg, Grenoble University

Dr E Scheibner, Geological Survey of New South Wales

Dr K Orth, Geological Survey of Victoria

Dr C Murray, Geological Survey of Queensland

Dr P Quilty, Australian Antarctic Division

Dr H Tanaka, Tokyo Institute of Technology

International Association of Geomagnetism and Aeronomy.

Relevance

This project is directed principally at tackling the problem of correcting aeromagnetic data for diurnal variations. It also contributes to our basic understanding of the geological structure of Australia and the errors affecting observatory data.

Expected outcomes

A continent-wide picture of the spatial and seasonal dependence of the quiet daily variation (Sq), magnetic storms and disturbances, and coastal induction effects; information about the origins of these signals.

A definition of the large-scale subsurface electrical conductivity structure of Australia.

Information about errors in aeromagnetic data arising from diurnal variations of the field.

An objective basis for choosing base-stations for aeromagnetic surveys in different parts of the country.

Activities

Work centres around a large-scale magnetometer array experiment, the Australia-Wide Array of Geomagnetic Stations (AWAGS), being undertaken jointly with Flinders University of South Australia.

Collaborate in the New Zealand array study (modelled on AWAGS) where there is overlap of interests.

Collaborate with the Research School of Earth Sciences, Australian National University, in testing a method for deducing induction arrows from single-station total-field data together with a reference observatory.

Expected products

An improved version of the magnetic induction map of the country.

An improved version of the aeromagnetic risk map of Australia indicating the expected reliability of magnetic survey base-station data for different parts of the country.

A description of Sq variations over Australia.

Highlights for 1991/92

The first induction picture of the whole continent has been obtained, and a 5000 km Intercratonic Conductor has been identified; manuscript submitted for publication.

A preliminary aeromagnetic risk map of Australia has been produced.

The AWAGS data have been used to make approximate diurnal corrections to BMR's long aeromagnetic traverse data set for 1975–76.

Goals for 1992/93

Complete the processing and calibration of the AWAGS data.

Extend the analysis of the electromagnetic induction properties of the crust to a wider frequency band.

Plan to cover important gaps in the induction picture by more detailed array work when the current round of repeat station survey work is completed (1995+). This task has already been started by Flinders University.

Refine the Aeromagnetic Risk Map of Australia.

Provide information about coastal induction effects and their influence on our observatory data.

Clients

Exploration industry

AGSO's airborne and marine magnetic programs

U.S. Navy

Cooperating agencies

Flinders University, South Australia

Research School of Earth Sciences, Australian National University

242: ENVIRONMENTAL GEOSCIENCE

Objectives

Develop programs to acquire the baseline geoscientific information necessary to understand Australia's natural environment, including its landscapes, soils, prior climates and sea levels.

Use this information to contribute to ecologically sustainable development and management of the impacts of environmental change.

Relevance

BMR's strategic plan, developed in response to the Woods Review, lists among the purposes of the organisation 'to participate in monitoring and developing an understanding of the natural environment'. This environmental concern was expressed in the Prime Minister's Statement on the Environment (July 1989) which focused on the need for accurate information on environmental issues.

The 1991 ASTEC Review of Environmental Science in Australia stressed the need for long term strategies in providing baseline data necessary to manage key environmental issues.

Directives for compiling information on the coastal zone, on Antarctica, and for land degradation issues are treated separately under individual project headings.

Activities

Identify new program directions for AGSO and establish a range of new clients.

Develop a pilot project to standardise map attributes within a National Coastal Zone Database.

Develop a package of products for implementation in the Cape York Peninsula Land Use Strategy (CYPLUS). Projects in Environmental Geoscience and Groundwater (including an overview of coastal environments, an overview of groundwater resources, (now the digitising bedrock geology and the levelling of geophysical data) and costed at around $1 million, have been approved for funding by the Joint Commonwealth-Queensland Steering Committee for CYPLUS.

Development of a work program in environmental history for the Cooperative Research Centre on the Antarctic and Southern Ocean Environment.

Highlights for 1991/92

At this stage the Program is under development, so that the primary focus is on achieving the first objective, which was met during 1991/92 in a substantial way.

There has been considerable progress in setting up the project on the geoscientific aspects of the Australian Coastal Zone. A pilot study involving data from three States was essentially completed, a study on techniques for assessing coastal change was completed for the Resource Assessment Commission, and several research papers published as one outcome of this. Funds were obtained for a major study of the coastal zone of Cape York Peninsula.

A project on climatic change in the Australian Quaternary was established, in part with outside funding. A start was made on the database which is the key activity of this project, and collaboration established with climate modellers.

The project aimed at developing strategies to understand and map land degradation is underway, with three separate sub-projects established, viz, the Wagga Wagga soils mapping project, the regolith component of CYPLUS, and a new project to relate soils, regolith and geophysical data in the Dubbo area.

A re-direction of focus in BMR Antarctic research has been achieved with the establishment of the Cooperative Research Centre on the Antarctic and Southern Ocean Environment, and the identification of research streams within that framework.

A number of products are now available from the geology of National Parks project, and a cooperative program established with ANPWS.

Goals for 1992/93

Develop the geoscience component of a coastal zone database as a foundation for an integrated information resource that can be used to underpin policies on coastal zone management at a national level.

Produce an overview of the coastal environments of Cape York as a key element in the Cape York Land Use Strategy.

Complete the preliminary database to bring together palaeoclimatic information from a range of disciplines in the Australian Quaternary. Together with Cainozoic palaeoclimatic information, use the database to test current climatic models in predicting the cause of future changes in climate.

Develop and instigate a program of surficial mapping and research that will provide the baseline data essential to understand the value of airborne geophysical data for mapping soils and land degradation.

Lift the public profile of earth sciences through the provision of maps, brochures, and posters featuring the geology of National Parks and prominent landforms.

Produce geological maps of selected areas of onshore Antarctica, as a framework for the understanding and management of the region.

Implement programs relating to the history of the Antarctic environment, in order to better understand its role in global change.

ENVIRONMENTAL GEOSCIENCE

Component manager Colin Simpson 06 249 9368

Component projects

121.33(1)	Cooperative Research Centre for the Antarctic and Southern Ocean Environment
121.37(2)	Offshore Sydney Basin and NSW continental margin geochemistry and sedimentology
121.38(2)	Continental margin processes and environmental change: framework studies of continental margin sediments
124.01	Australian Antarctic Territory continental margin
225.01	Antarctic Geophysical Observatories
242.05	Antarctic onshore geoscience
242.01	Geological environment and resources of the coastal zone
242.02	Climate change and palaeoenvironments in the Australian Cainozoic
242.03	Land degradation studies
242.04	Geology of Australian National Parks

(1) Cruise planned in 1992/93 on *Aurora Australis*

(2) Cruise planned in 1992/93 on RV *Rig Seismic*

Project 121.33 Cooperative Research Centre for the Antarctic and Southern Ocean Environment

Project manager	John Marshall	06 249 9536
Program responsibility	Marine Geoscience and Petroleum Geology	
Timeframe	1992–1998	

Objectives

Achieve substantial improvements in the simulation of global climate and the prediction of climate and environmental change through the analysis of palaeoenvironmental processes in the Southern Ocean and Antarctica, and through improved knowledge of the environmental changes which have occurred in the Southern Ocean and Antarctica in the past.

Enhance the knowledge base on which rational decisions can be made for Australian and international management and protection of the Southern Ocean and Antarctica.

Provide, by training post-graduate students, a significant pool of Australian scientists who are expert in the research fields associated with Antarctica and the Southern Ocean, and with broad environmental issues in general.

Involve Australian industry to the extent possible in commercial development of technical spin-offs from the Centre's research.

Relevance

Antarctica and the Southern Ocean hold fundamental keys to questions of global change. Records of the past preserved there provide information on the limits of variability in oceanic and atmospheric systems, and provide baselines against which to assess the impacts of human activity on the current environment. The Natural Variability Subprogram aims to provide statements of the Antarctic environment for time intervals back to about 5 million years, and to relate sedimentological and geochemical processes to past ocean circulation and climate.

The Australian Government has approved the formation of a number of Cooperative Research Centres, one of which is the Cooperative Research Centre for the Antarctic and Southern Ocean Environment. One of the seven subprograms of the CRC is Natural Variability, which is involved with palaeoenvironmental investigations of the Antarctic continental margin and the Southern Ocean. AGSO, as one of the partners to the CRC, is committed to this subprogram.

Expected outcomes

AGSO seen as providing a significant contribution to the CRC.

A definitive statement on past natural variability of the Antarctic and Southern Ocean environment is produced.

Activities

Setting up infrastructure for AGSO participation in the CRC.

Recruitment of AGSO personnel to the CRC.

Participation in the Natural Variability Sub-program of the CRC.

Equipment design for marine geological work on *Aurora Australis*.

Participation in research cruises of *Aurora Australis* in 1993 and 1995

Expected products

Contributions to both national and international scientific journals on aspects of Antarctic and Southern Ocean environmental geoscience.

Highlights for 1991/92

BMR became a signatory to the CRC agreement.

Goals for 1992/93

AGSO personnel recruited and in place in Hobart – July/August 1992 Natural Variability Subprogram at full strength and fully operational in terms of both manpower and equipment – December 1992.

Design and construction of coring equipment is completed December 1992.

Successful completion of first geological sampling cruise by *Aurora Australis* on the Antarctic continental margin in January/February 1993.

Increased awareness of marine geoscience making a significant contribution to Antarctic environmental research.

Clients

Scientific community

Government departments developing policies on climate change, environmental matters and Antarctica (DPIE, DFAT, DASET)

Cooperating agencies

Antarctic Division, DASET

Division of Oceanography, CSIRO

Bureau of Meteorology

University of Tasmania

Project 121.37 Offshore Sydney Basin and NSW continental margin geochemistry and sedimentology

Project manager	David Heggie 06 249 9589
Program responsibility	Marine Geoscience and Petroleum Geology
Timeframe	1992–1994

Objectives

Develop an understanding of the sedimentological and biogeochemical processes controlling the distributions of continental shelf and slope sediments and their chemical composition, with special reference to anthropogenic hydrocarbons and heavy metals.

Trace the distribution and dispersion, in seawater, of anthropogenic hydrocarbon inputs to the coastal waters offshore from a major population centre.

Contribute new information on stratigraphy and petroleum source rock potential of the offshore Sydney basin.

Relevance

The coastal waters of Australia are, with population growth, under increasing stress because of increased discharges of industrial and urban wastes.

This program will use the continuous geochemical tracer (CGT) and seafloor sampling capabilities aboard *Rig Seismic* to examine and document anthropogenic loadings of heavy metal and organic compounds into the coastal zone off Sydney, hence provide baseline data for environmental management purposes.

New information on the offshore Sydney Basin stratigraphy will contribute to new hydrocarbon exploration.

Expected outcomes

An understanding of the sedimentological and biogeochemical processes that control the distributions of sediments and their chemical

compositions on the continental shelf offshore Sydney.

An understanding of estuarine/ocean exchange processes, and their implications for the dispersion of anthropogenic inputs into the coastal zone.

New information on the hydrocarbon prospectivity of the offshore Sydney Basin.

Activities

Consult with cooperating agencies to develop a survey program of direct hydrocarbon detection, vibrocoring and chemical analyses which will be conducted aboard *Rig Seismic* during 1992.

Processing and analysis of data and samples collected during the marine survey.

Production of AGSO Records and joint publications with cooperating organisations, using the results of the 1992 survey.

Dissemination of results to the Australian public through the AGSO publications series and other publications.

Expected products

AGSO Records

Joint publications (including maps) with Sydney Water Board, Sydney University and the NSW Geological Survey, on geochemical and sedimentological processes and the distributions of anthropogenic hydrocarbons, and heavy metals on the continental shelf.

Joint publications, with cooperating organisations, in the scientific literature.

Highlights for 1991/92

Demonstration of the continuous geochemical tracer capability aboard *Rig Seismic* to document the dispersion of anthropogenic hydrocarbons in coastal waters around major population centres.

Goals for 1992/93

Plan and conduct a survey aboard *Rig Seismic.*

Clients

State and Commonwealth Government agencies

Australian public

Sydney Water Board

Cooperating agencies

P Fagan, Dr J Hansen, Dr P Tate, P Schneider Environmental Projects Unit, Sydney Water Board

Dr G Birch, Dr C Jenkins, Dr J Keene, Sydney University

Dr P Roy, NSW Geological Survey

Project 121.38 Continental margin processes and environmental change: framework studies of continental margin sediments

Project manager	John Marshall	06 249 9536
Program responsibility	Marine Geoscience and Petroleum Geology	
Timeframe	1992–ongoing	

Objectives

Develop a sedimentological/geochemical framework and database to understand the major processes controlling deposition of continental margin sediments around Australia and its territories, particularly where they pertain to facies models, climatic change, envi-

ronmental geochemistry and seafloor mineral occurrences.

Provide advice and information to both government and non-government agencies on marine environmental geoscience.

Relevance

CMP has an extensive holding of core and dredge samples that can be used as a basis for research related to climate change, depositional facies, geochemical cycles, oceanography, pollution and seafloor minerals. The project aims to create a database to facilitate access to samples and information. Cooperative projects will be developed with universities and outside agencies using these samples and information as a resource.

The information and samples in the database will provide a resource for the provision of advice on marine environmental geoscience.

Synthesis of data collected in specific projects is required to answer questions of regional climatic change.

Expected outcomes

A regional understanding of the major processes controlling the deposition and accumulation of continental margin sediments, and their significance for climatic variability, pollution, and formation of seafloor mineral deposits.

A database of marine geology samples and analyses.

Advice to government and non-government agencies on marine environmental geoscience.

Activities

Establish and maintain a geological sample and core database of CMP samples and analyses.

In cooperation with universities, conduct palaeoenvironmental research on the continental margin utilising samples collected in CMP.

Provide advice on marine environmental geoscience issues.

Expected products

Maps, reports and publications relating to marine environmental geoscience investigations.

A database for continental margin sediments that can be utilised for facies analysis, environmental geochemistry, climate change, oceanography and seafloor minerals.

Goals for 1992/93

Design and implement a CMP sample database.

Prepare initial results on the palaeoceanography of the north eastern Indian Ocean.

Prepare advice as required.

Clients

Department of the Arts, Sport, the Environment and Territories

Hydrographic Office, Royal Australian Navy

Australian universities

National Resource Information Centre, BRS, DPIE

Cooperating agencies

Y Tsuji, Technology Research Centre, Japan National Oil Corporation

J Hensen, Sydney Water Board

PJ Davies, Department of Geology and Geophysics, University of Sydney

Cooperative Research Centre for the Antarctic and Southern Ocean Environment

W H Veeh, Department of Earth Sciences, Flinders University of South Australia

D McCorkle, Woods Hole Oceanographic Institution

Project 124.01 Australian Antarctic Territory continental margin

Project manager	Howard Stagg 06 249 9343
Program responsibility	Marine Geoscience and Petroleum Geology
Timeframe	1982–ongoing

Objectives

Develop models of processes which have operated or are operating in the offshore Australian Antarctic Territory (AAT), which are relevant to resource assessment and environmental management.

Provide geoscientific advice to support the resource and environmental management of the offshore AAT.

Relevance

This project is the principal Australian contribution to cooperative international geoscience research in offshore Antarctica. The data which are compiled and interpreted also provide valuable background information for the environmental geoscience research of the Cooperative Research Centre for the Antarctic and Southern Ocean Environment.

Expected outcome

An understanding of the factors controlling the Antarctic environment and an ability to respond to requests for geoscientific advice relating to the resource and environmental management of the offshore AAT.

Activities

Develop an understanding of the structure, stratigraphy, and climatic evolution of the Australian Antarctic Territory, in particular the eastern sector of the AAT, which forms the conjugate feature to Australia's southern and south eastern margins.

Expected products

Establishment of a branch of the Seismic Data Library System in Australia as a facility for Australian researchers in offshore Antarctica.

Collaborative scientific papers with Australian and overseas co-workers.

Highlights for 1991/92

Involvement with setting up the Antarctic Seismic Data Library System (SDLS).

- The SDLS aims to incorporate all Antarctic multichannel seismic (MCS) data into a digital library that will facilitate international research and is supported by all nations that have acquired MCS data in Antarctica. Branches of the library can be set up by any nation contributing data.
- The Australian Prydz Bay seismic data was submitted to the library in February, 1992.

Goals for 1992/93

Continue participation in SDLS and set up a branch of the SDLS at AGSO.

Compile digital navigation database for MCS surveys in the Prydz Bay region (Australia, Japan, Russia).

Finalise data exchange with Russia and Japan.

Continue involvement with ANTOSTRAT (Antarctic Offshore Acoustic Stratigraphy Project).

Clients

Cooperative Research Centre for the Antarctic and Southern Ocean Environment

Cooperating agencies

Antarctic Division, DASET

US Geological Survey

Project 225.01 Antarctic geophysical observatories

Project manager	Andrew McEwin 06 249 9392
Program responsibility	Geophysical Observatories and Mapping Program
Timeframe	1950–ongoing

Objective

Monitor the morphology and variations of the magnetic field in the Australian Antarctic Territory (AAT) and provide information on global earthquake activity and nuclear explosions.

Relevance

Geomagnetic data from Antarctica are important for global field modelling, and for auroral and upper atmosphere physics studies. Because of the proximity to the magnetic pole, reliable declination information is essential for compass navigation. Seismic observatories in Antarctica play a vital role in the location of earthquakes and nuclear explosions occurring in certain sectors of the globe. This project also relates to Australia's national interests in Antarctica.

Expected outcomes

Information about the geomagnetic field and its variations in the Australian Antarctic Territories.

Information about natural earthquakes and nuclear explosions.

Activities

Operate magnetic and seismic observatories at Mawson Station (AAT) and Macquarie Island, and a vertical seismometer at Casey Station (AAT).

Support a program of semi-weekly absolute magnetic observations at Casey and Davis Stations (AAT).

Conduct field surveys when opportunities arise.

Expected products

Data from magnetic and seismic observatories at Mawson and Macquarie Island, and the absolute stations at Casey and Davis. Geomagnetic data from Mawson and Macquarie Island are telemetered to Canberra daily.

Monthly publication of mean values of the geomagnetic field, K-indices of geomagnetic disturbance and disturbance effects; geomagnetic secular variation data.

Bulletins of seismological data.

Annual observatory reports.

Highlights for 1991/92

One of the new generation of ring-core fluxgate magnetometers was installed at Macquarie Island; preparations for installation of another began at Mawson.

Data telemetry links to Canberra produced a major improvement in availability and quality of data.

A new procedure for reporting Casey and Davis data via our Mawson geophysicist has much improved the quality of monthly means.

A magnetic repeat station survey was conducted in the Prince Charles Mountains, near Mawson.

The future of the Macquarie Island observatory was under threat as a result of proposed staff reductions by the Australian Antarctic Division. AGSO, CSIRO and the Antarctic Division have agreed to fund an expeditioner, at a cost of $36 000 each per year.

Goals for 1992/93

Operate magnetic and seismic observatories at Mawson Station and Macquarie Island, and

supervise regular magnetic observations at Casey and Davis Stations.

Maintain telemetry to Canberra of seismic and geomagnetic data from Mawson and Macquarie Islands, and seismic data from the seismograph at Casey.

Continue work on determining errors in secular variation estimates derived from different observation sequences and averaging methods.

Clients

Australian Antarctic Division

AUSLIG, expedition parties

World Data Centres and the international scientific community

Polar Research Institute, Japan

Cooperating agencies

Australian Antarctic Division

Project 242.05 Antarctic onshore geoscience

Project manager	Bob Tingey	06 249 9608
Program responsibility	Environmental Geoscience and Groundwater	
Timeframe	1954–ongoing	

Objectives

Develop and document a comprehensive geoscientific understanding of areas of bedrock exposure in the Australian Antarctic Territory (AAT).

Apply this towards achieving a broader understanding of the geology of those parts of the continent that are permanently covered by ice, and of geological relationships with Australia.

Develop an improved understanding of the geological history of the Antarctic ice cap, and its role in global change.

Relevance

This project contributes to the scientific program of the Australian National Antarctic Research Expeditions (ANARE) in accordance with guidelines approved by the Antarctic Science Advisory Committee for its 'Natural Environment' priority area. ANARE activities are a tangible expression of Australia's presence in Antarctica.

It also contributes to the Antarctic-wide programs of the Working Groups on Geology and Solid Earth Geophysics of SCAR (the international Scientific Committee on Antarctic Research) and related Groups of Specialists.

Expected outcomes

A better understanding of the geological framework of Australian Antarctic Territory.

The provision of baseline information necessary to monitor changes in the environment of Antarctica.

Activities

Undertake geochemical, geochronological, geophysical, and palaeomagnetic studies, and contribute geological mapping expertise to the geoscientific work of the ANARE. Work on Antarctic glacial history will occur through the Cooperative Research Centre for the Antarctic and Southern Ocean Environment, Hobart. Other aspects of Antarctic geoscientific research are taken up by university scientists.

Expected products

Regional geological maps and appraisals of outcrop areas in the AAT published as AGSO Bulletins, and drawing together the results of AGSO and university research.

Papers of particular scientific interest to be published in national and international journals.

Geochemical, geochronological, and palaeomagnetic data archived in appropriate databases.

Highlights for 1991/92

Completion and publication of a revised 1:10 000 000 scale geological map of Antarctica together with the explanatory text of BMR Bulletin 238. The Bulletin and map constitute an up-to-date summary of the exposed geology of the continent intended to replace previous maps that are now out-of-date and out-of-print.

Publication of the monograph 'The Geology of Antarctica' by Oxford University Press. The monograph was edited by the Project Leader outside office hours, and BMR scientists contributed five of the nineteen review chapters; it is the first to draw together the diverse strands of Antarctic geology.

Completion of a regional geological appraisal of the Bunger Hills–Denman Glacier area rounds off the regional investigation of this area during the 1986 field season.

Acquisition and reinterpretation of Soviet Antarctic Expedition geophysical data from the Enderby Land/Prince Charles Mountains region. The former Soviet Antarctic Expedition had (but Australia lacks) the capability to acquire geophysical data over large areas of Antarctica. However, BMR can apply its superior computing facilities to produce a more sophisticated interpretation of the data. This exercise is very much in the spirit of international scientific cooperation, as codified in the Antarctic Treaty.

Goals for 1992/93

Publication of a regional geological map and appraisal of the Bunger Hills/Denham Glacier area. (Put back from 1991/92 because of delays in drafting the geological map).

Substantial progress in geochemical and geochronological studies of samples from the northern Prince Charles Mountains. This work is aimed at improving geological understanding of the evolution of the largest inland exposure of the East Antarctic metamorphic shield.

Substantial progress in compiling a regional geological map and appraisal of the northern Prince Charles Mountains by drawing together the results of detailed studies undertaken in the past several years by university geologists.

Arrange publication of a geoscience transect extending from the Gamburtsev subglacial Mountains to Prydz Bay via the Lambert-Amery Graben and Prince Charles Mountains as a contribution to the work of the SCAR Group of Specialists on the structure and evolution of the Antarctic Lithosphere and to the Geoscience Transects project of the International Lithosphere Program.

Publish reinterpretation of Soviet airborne geophysical data over the Enderby Land/Prince Charles Mountains region in cooperation with geoscientists of the organisation that will replace the former Soviet Antarctic Expedition.

Contributions to the operation of the ASAC research grants scheme, the work of AREG (the Antarctic Research Evaluation Group), ANCAR (the Australian National Committee for Antarctic Research), and SCAR.

Provision of geoscientific advice on Antarctic matters as required.

Clients

Australian National Antarctic Research Expeditions

Australian Antarctic Division (DASET)

Antarctic Science Advisory Committee (ASAC)

Cooperating agencies

Australian Antarctic Division

Antarctic and Southern Ocean Environment CRC

Australian National University

University of Adelaide

Edinburgh University, UK

Macquarie University

Melbourne University

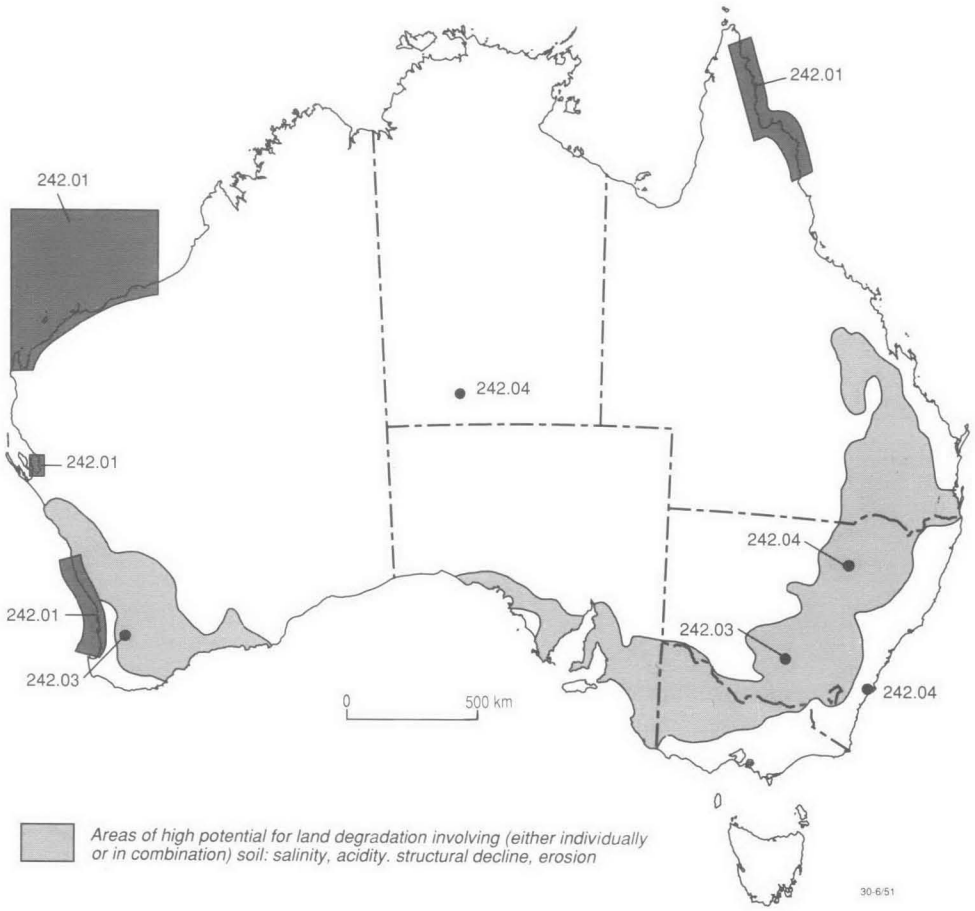
Newcastle University

University of New England

University of New South Wales

Sydney University

University of Tasmania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500 km
Areas of high potential for land degradation involving (either individually or in combination) soil: salinity, acidity. structural decline, erosion
30-6/51

Project 242.01 Geological environment and resources of the coastal zone

Project manager	Bob Burne 06 249 9291
Program responsibility	Environmental Geoscience and Groundwater
Timeframe	1990–ongoing

Objective

Provide the baseline geoscientific data and interpretations necessary for integrated management of the Australian coastal zone, including conservation, the impacts of resource use, developmental and recreational pressures, and environmental change.

Relevance

The need for basic data compilation and research to underpin management of the coastal zone is recognised in the Prime Minister's Statement on the Environment. Following the Woods Review, the BMR strategic plan includes responsibility for the study of geoscientific aspects of the environmental impacts of resource development in the Australian Coastal Zone.

There is a recent agreement between the former Minister for Primary Industries and Energy, the Hon John Kerin MP, and the Western Australian Minister for Regional Development to develop cooperative coastal mapping programs between AGSO and WA agencies.

A proposal for an overview of coastal systems in Cape York has been approved by the joint Commonwealth-Queensland Steering Committee for the Cape York Peninsula Land Use Strategy.

Submissions to the recent House of Representatives Inquiry into the Protection of the Coastal Environment have been incorporated into the recommendations made in the Committee report, pointing to the need for national and regional databases to allow for better decision making, planning and management of the coastal zone.

Similar recommendations were made by the 1985 Workshop on Coastal Geoscientific Studies and by the 1989 IGBP Planning Meeting on Sea Level Change. The development of such national information systems is a priority recommendation of international organisations such as UNEP, IUCN and IPCC.

Expected outcomes

The creation and maintenance of a National Coastal Information System, providing a central facility for the collection, archiving and manipulation of environmental, geoscientific and resource data relating to the Australian coastal zone (defined to include inner shelf areas offshore and Quaternary and Tertiary tracts of marine and coastal origin onshore) will facilitate the development of management policies at the national level.

This system, together with the advanced modelling capabilities of ARC/INFO software, will provide a resource for AGSO and other projects in DPIE. It will facilitate close collaboration with other Commonwealth and State agencies involved in coastal zone research and management. An overview of the coastal data set will be incorporated into the 1:1 million scale National GIS being developed at NRIC.

Activities

Research will be undertaken on the geoscientific evolution of the Australian coastal zone. In addition to new research, existing information on coastal zone geology will be compiled with the cooperation of NRIC. Areas where existing information or understanding is inadequate for management needs will be identified and programs of geological map-

ping to fill information gaps will be designed and implemented.

The Project will bring together the extensive body of existing data held by Commonwealth, state and academic organisations, and augment this with information from remote imagery utilising new technology.

The project will also undertake classification and modelling studies of aspects of coastal environments, including image analysis and ground-truthing.

The information system will make full use of the advanced Image Processing and GIS capabilities of AGSO and NRIC, particularly the ability to integrate processed satellite imagery directly into GIS.

In time, Landsat TM imagery for the entire Australian coastline will be processed to enhance coastal geology, vegetation and environments. Emphasis will be on water penetrating characteristics to reveal offshore substrate variation to a depth of 40 m in clear water, suspended sediment transport, and organic material in the water column The 30 m pixel resolution of Landsat TM will enable information to be displayed to a maximum scale of 1:50 000. This information will be augmented by imagery from other satellites and aircraft scanners as appropriate.

Classification of enhanced images will be undertaken to provide inventories of ecosystems or resources of particular interest (e.g. sea grass, mangroves, reefs, sand and gravel deposits).

In conjunction with cooperating organisations other information levels will be compiled for bathymetry/topography, hydrology, geomorphology, ecology, vegetation, oceanography, lithology, stratigraphy and anthropogenic structures. Classifications will be verified by field ground-truth studies.

Expected products

GIS of the geoscience component of the Australian coastal zone and key areas of topical interest.

Maps, data sets and scientific papers on specific areas.

Advice to policy-making sections of Government.

Highlights for 1991/92

Resource Assessment Commission GIS feasibility study successfully completed and compilation of trial material continuing.

Developed seafloor mapping and bathymetric mapping using remote sensing.

Developed aerial photo digitising and change analysis of coastal features.

Image processing undertaken for AIDAB funded Philippines project.

As part of the study of the Cape York coastal zone, a Torres Strait reconnaissance was undertaken and a project plan is in place for 1992.

Image analysis of the Perth-Geraldton coastal zone was undertaken in cooperation with Western Australian Environmental Protection Authority and Department of Conservation and Land Management.

Image analysis was undertaken over Shark Bay and specific management advice provided to Western Australian Department of Planning and Urban Development.

Promotion of the results of research was undertaken as follows:

- five publications published
- a member of staff contributed to IOC advanced training course in coastal mapping for Asian geoscientists
- presentations to WA local government representatives on coastal change
- media presentations (Cross Country, ABC Radio, ABC TV)

Goals for 1992/93

Undertake a reconnaissance of the coastal zone of the Cape York Peninsula and detailed investigation of selected study areas on the east coast of the Cape, as part of the CYPLUS coastal zone investigations.

Develop research techniques for Image Processing and GIS applications relevant to coastal geoscience.

Develop strategies for research into the geoscientific evolution of the Australian coastal zone.

Continue development of geoscientific guidelines for management strategies for the Shark Bay World Heritage area.

Provide research publications and educational and information materials for the general public.

Clients

National Resource Information Centre, BRS, DPIE

CSIRO

DASET

Resource Assessment Commission

Western Australian Government agencies
- Conservation and Land Management
- Planning and Urban Development
- Geological Survey
- Marine and Harbours

Environmental Protection Authority

South Australian Government agencies
- Environment and Planning
- Mines and Energy

Geological Survey, New South Wales

Mines Department, Queensland

Sydney University

Australian National University

Curtin University

University of Western Australia

Queensland University of Technology

Flinders University

Cooperating agencies

National Resource Information Centre, BRS, DPIE

RAC

CSIRO

Western Australian government agencies

South Australian government agencies

Geological Survey of New South Wales

Queensland Department of Resource Industries

Project 242.02 Climate change and palaeoenvironments in the Australian Cainozoic

Project manager	Liz Truswell	06 249 9427
Program responsibility	Environmental Geoscience and Groundwater	
Timeframe	1990–2000	

Objective

Enhance the understanding of the processes of climate change and improve our predictive capacity.

Relevance

Concern about impact of global change, including that related to greenhouse gases, was expressed in the Prime Minister's (1989) Statement on the Environment. The National Greenhouse Committee was established to advise on priority areas for relevant research.

Allocations have been made to a consortium involving ANU and CSIRO; AGSO input has been sought in an integrating role by this consortium.

Expected outcomes

An enhanced understanding of the range of natural climatic variability and an improved ability to predict the nature of change under postulated greenhouse conditions.

Activities

Use past records of change to determine the natural range of climatic variability.

Use data from the recent geological past to test and improve the performance of current climate models.

Develop and apply biochronologic frameworks for the Cainozoic.

Develop a relational database to integrate chronological, palaeoclimatic, palaeobiological and palaeohydrological data for a number of time intervals in the Quaternary and Cainozoic; translate this information into time slice climatic maps to synthesise boundary data to test climate models.

Examine impact of volcanism on climatic change.

Expected product

Database of past climate change, bibliography, and palaeoclimatic maps for selected time intervals.

Highlights for 1991/92

Produced 'Quaternary Climate in Australia—a Bibliography'.

Established methodology and developed a database structure in collaboration with Information Systems Branch and with input from members of the Australian Quaternary community.

Produced preliminary analyses of palaeomagnetic properties from Lake Johnson cores.

Goals for 1992/93

Input data to test pilot database structure.

Complete design of database and input structure into ORACLE.

Commence major data input.

Design palaeoclimatic map formats.

Complete monitoring of Lake Bathurst.

Prepare general interest paper on volcanic eruptions and atmospheric change.

Produce report on Lake Johnson coring.

Prepare overview of history of Lake Bathurst.

Clients

Policy makers within DPIE and other government departments including DASET and DEET

Climatic modellers within academic institutions

Cooperating agencies

Research School of Earth Science, ANU

Department of Biogeography and Geomorphology, ANU

Department of Geology, ANU

Division of Water Resources, CSIRO

Project 242.03 Land degradation studies

Project manager	Colin Simpson 06 249 9368
Program responsibility	Environmental Geoscience and Groundwater
Timeframe	1990–ongoing

Objective

Provide baseline data essential to understanding land degradation processes.

Relevance

Losses due to soil degradation are estimated at around $600 million annually. The Prime Minister's Statement on the Environment (1989) noted the need for improved resource management and instituted a variety of programs (National Soil Conservation Strategy, Landcare, Natural Resources Management Strategy of the Murray–Darling Basin) to mitigate impact of degradational processes. The proposed program provides scientific understanding necessary to develop management strategies.

Expected outcome

An enhanced understanding of the way in which geological features affect the processes of land degradation; an ability to predict the distribution of attributes within particular landscapes.

Activities

Institute a program of systematic morphostratigraphic or surficial mapping in AGSO, emphasising geomorphology, the stratigraphic relationship of surficial deposits, weathered profiles and soil cover; development of a mapping program is contingent on determining appropriate attributes (in conjunction with CSIRO, ABARS) and scales.

Initial areas of focus will be in the Murray–Darling Basin.

Expected products

Geomorphic maps, including GIS format, at scales to be determined.

Highlights for 1991/92

Recognition of a potential BMR role in providing geological data to support soils survey and land evaluation. Identification of this role in key documents including the Decade of Landcare Plan, and A Strategy for Coordinating Soil Survey and Land Evaluation in Australia (CSIRO Division of Soils).

Began cooperative project with CSIRO Division of Soils, NSW Conservation and Land Management, Charles Sturt University and Centre for Resource and Environmental Studies at ANU.

Exploration of projects, and funding, in collaboration with NSW Forestry Commission.

The regolith component of the Cape York Land Use Strategy commenced, including assessment of land degradation potential, collaboratively with BRR.

Goals for 1992/93

Build a long-term strategy for coordinated land degradation mapping.

Advance the soils-related project in the Wagga Wagga 1:100 000 sheet area.

Develop a project to evaluate attributes of Regolith Topography Mapping, and assess relevance of these to land degradation issues.

Advance the regolith/land degradation interactive project in North Queensland.

Clients

NSW Conservation and Land Management

Commonwealth departments (DPIE, DASET) concerned with strategic planning and policy development in land use

CSIRO Division of Soils

Educational institutions with research programs requiring geomorphic information

Cooperating agencies

Division of Soils, CSIRO

Australian Bureau of Agriculture and Rural Science, DPIE

State agencies, such as QDPI, NSW Soil Conservation Commission

NSW Forestry Commission

Project 242.04 Geology of Australian National Parks

Project manager	Liz Truswell	06 249 9427
Program responsibility	Environmental Geoscience and Groundwater	
Timeframe	1990–ongoing	

Objectives

Lift the profile of geology in the environmental debate.

Provide information for use in park management and educational programs.

Relevance

The Convention concerning the Protection of the World Culture and Natural Heritage (the World Heritage Convention) was ratified by Australia in 1974. To qualify for World Heritage listing, nominated properties must satisfy four criteria; of these, two are primarily geological. In addition to provision of information in this context, ongoing public education in geology will provide a more informed debate on land use issues. National parks provide an obvious point of contact with the public.

Expected outcomes

Increased public awareness of the geological foundations of Australian wilderness areas.

Increased recognition of the role and particular perspectives of geology in the environmental debate.

Activities

Provide publicly accessible information on the geological framework of Australia's major national parks in the form of maps and informative brochures.

Provide baseline information on geology for use in park management.

Much of the basic scientific work has already been undertaken in the course of mapping and research projects; this exercise involves translating that information into a form the wider community can appreciate.

Expected products

Maps, brochures, posters and videos, designed to reach a wide audience.

Geological information in formats appropriate to park management.

Highlights for 1991/92

Publication of book on geology of Uluru, after discussions with ANPWS and traditional owners: inputs of geological information in tour operators' workshops.

Production of booklet on walking trails in Warrumbungles.

Development of Record series with three issues on:

- Kakadu artefacts
- Warrumbungles geology
- Kakadu Walking Trails

Production of popular map on Jervis Bay geology.

Goals for 1992/93

Kakadu

- produce poster of northern Kakadu from space
- finish walking trail notes
- explore production of geology/regolith map

Warrumbungles

- complete poster

Jervis Bay

- hydrogeology and land use map

Queensland Wet Tropics World Heritage Area

- explore needs for geological information in management of area and appropriate outputs

Cape York

- brochure on Iron Range National Park

Strategic Planning

- develop a long term strategic plan for production of geological information in Australian National Parks, in collaboration with ANPWS, state authorities and GSA.

Clients

The public

Tourist industry

Educational institutions

ANPWS

Environmental organisations

World Heritage Unit, DASETT

Cooperating agencies

ANPWS

NSW National Parks

ACT Forestry

261: DATABASE COORDINATION AND RESEARCH

Objectives

Coordinate AGSO database activity with other government geoscience organisations in Australia.

Liaise with other appropriate national and international organisations.

Carry out research relevant to the use and integration of geoscience databases.

Relevance

The activities within this component are designed to satisfy two broad requirements. Firstly, data from AGSO's research projects must be readily available in a useable format to government, industry and researchers. Secondly, geoscience database activity in government organisations in Australia must be coordinated so as to avoid unnecessary duplication of effort.

A key element in these activities is the development and use of standards both in relation to AGSO's national databases, and also in relation to the geoscience data themselves. This is to facilitate the exchange and effective use of data for exploration, research and resource assessment, such as is required under the National Geoscience Mapping Accord (NGMA).

Proper coordination of AGSO's data also assists in maximising cost recovery through the sale of databases and related products.

Activities

Promote the use of the national resources data directory, the custodianship and integration of databases, and database standards for government geoscience data projects.

Support better institutional arrangements at the policy level for information management.

Liaise with State, Territory and overseas geoscience agencies, through direct contact, committee work and technical meetings.

Conduct research into integrating procedures for various geoscience data types.

Highlights for 1991/92

AGSO was represented at several national and international geoscience database/computing meetings and contributed to committee work.

In particular, a national workshop convened on Geographic Information Systems, Cartographic and Geoscience Data Standards was well attended and highly successful.

A Government Geoscience Database Policy Advisory Committee (GGDPAC) working group on geoscience data standards was formed.

Staff contributed to the design, enhancement and documentation of several national scientific databases.

Procedures were developed for integrating images, maps, and data from GIS and relational databases on workstations and PCs.

Goals for 1992/93

Update the geoscience database directory, through the National Resource Information Centre's FINDAR system.

Continue representation on national and international geoscience data-related committees.

Refine methods for the routine integration of image, GIS and mapping data between systems.

Develop draft data standards for geoscience data items, in conjunction with States/ industry.

Represent AGSO at relevant national forums and conferences relating to database coordination and research.

Substantially transfer existing Oracle databases to the UNIX server.

Develop new and existing Oracle databases (standards, NGMA, environmental)

DATABASE COORDINATION AND RESEARCH

Component manager David Berman 06 249 9602

Component projects

261.01	Database Coordination and Liaison
261.02	Integration of Geoscientific Data Sets
261.03	Data Management
261.04	Database Administration
261.05	Scientific Databases and Applications Development

Project 261.01 Database coordination and liaison

Project manager	David Berman	06 249 9602
Program responsibility	Information Systems	
Timeframe	1984–ongoing	

Objectives

Promote geoscience database development, coordination and liaison at three levels:

- within AGSO, so as to maximise the usefulness of AGSO's geoscience and resources data and to facilitate the integration of different types of data by scientists, the exploration industry and other users
- among government organisations in Australia, to avoid duplication of effort, promote development of standards, and to facilitate the exchange of data between agencies
- at the international level, to be the focus for Australian cooperation with organisations involved in geoscience data.

Relevance

Effective mineral and petroleum exploration, research, and informed decision making on natural resource management issues relies on the ready availability of a wide range of geoscientific data.

BMR was given the responsibility in 1984 for 'coordinating government geoscience database activities' by AMEC. AGSO is also a *custodian* for Commonwealth geoscience databases.

Expected outcomes

Nationally and internationally agreed standards and procedures for the definition of, and access to, geoscience data will be developed. Activities within the project, such as the coordination and development of national databases, also facilitate the development of quality database-related products by other programs, agencies and clients.

The project also contributes to enhancing AGSO's national and international standing in geoscience database and related computer applications.

Activities

Within AGSO, coordination is undertaken to promote the development of consistent, interdependent databases, and systems that can access these in an integrated manner.

The project liaises with counterpart State and Territory survey developments in database and related information systems developments. The primary mechanism is through the Government Geoscience Database Policy Advisory Committee (GGDPAC).

Consultation is also undertaken with other natural resource and environment database related activities of government, industry, and internationally.

Expected products

GGDPAC advice to Chief Geologists on questions of data storage and standards.

Commonwealth policy on questions of spatial data pricing, transfer and custodianship, related to AGSO and DPIE needs and priorities.

Newsletters, and reports to clients on developments in national geoscience databases.

Highlights for 1991/92

BMR continued to be represented on the GEOPAC Advisory Council, its Executive Committee, and on the AESIS Advisory Committee. It also maintained its substantial financial support for the Australian Earth Sciences Information System (AESIS), managed by the AMF, and contributed to the financial sponsorship of AMIRA's new AMDEX project.

BMR continued to act as the secretariat of GGDPAC. This committee pursued a number of policy issues including the completion of guidelines for technical documents, endorsement of a pilot project for storing company reports on CD–ROM and compiled a contingency plan for maintenance of the AESIS database. One issue of GGDPAC 's newsletter 'Geoscience Database News' was published. This has a circulation of over 130 within government and industry.

A national workshop on Geographic Information Systems, Cartographic and Geoscience Data Standards was held in Canberra from 18–20 March. The workshop brought together 135 workers from government, industry and universities. Proceedings from the workshop were published as a major BMR Record (1992/27).

BMR represented Australia in 1992 at a meeting of the International Consortium of Geological Surveys for Earth and Computer Sciences (ICGSECS), held at USGS.

Goals for 1992/93

Produce quarterly issues of the newsletter 'Geoscience Database News' (GGDPAC).

Review the long term storage problems of geoscientific data held by governments, and suggest strategies for its preservation, based on developments in mass storage systems (GGDPAC).

Coordinate Australia's contributions to the IUGS sub-commission (COGEODOC, COGEODATA and SGDMIS) projects.

Update and extend the coverage of the National Directory of Australian Resources (NDAR) through NRIC's FINDAR system.

Encourage AGSO data custodians to maintain their own entries in NDAR.

Foster the development of national computer-based geoscientific databases, particularly those supporting geoscience standards, the NGMA and environmental geoscience.

Promote standards for geoscience data attributes required to support the integration of NGMA data sets and maps.

Open some AGSO geoscience standards databases and authority tables to on-line access from outside AGSO.

Promote support for the industry AMDEX project (mining data exchange standards), and the forthcoming Australian Spatial Data Transfer Standards (SDTS).

Coordinate the ongoing introduction of GIS technology to AGSO, integrated with other AGSO computing systems, in collaboration with NRIC.

Influence the development of government policy in the areas of custodianship, cost recovery, and access to resource and environmental databases.

Clients

Chief Government Geologists Conference

State Geological Surveys/Mines Departments, and AGSO projects.

Cooperating agencies

Coordinating Committee on Science & Technology (CCST)—working group on Coordination of Resource & Environmental Databases (PM&C)

Commonwealth Spatial Data Committee (CSDC)

National Resource Information Centre, BRS, DPIE

State Geological Surveys/Mines Departments

Australian Mineral Foundation (AMF)

Australian Mineral Industry Research Association (AMIRA)

Australian Geoscience Information Association (AGIA)

IUGS Sub-commissions:

- COGEODOC (geological documentation)
- COGEODATA (geological data storage, retrieval and processing)
- SGDMIS (global data management and information systems)

International Consortium of Geological Surveys for Earth and Computer Sciences (ICGSECS)

Project 261.02 Integration of geoscientific data sets

Project manager	Prame N Chopra	06 249 9540
Program responsibility	Information Systems	
Timeframe	1988–ongoing	

Objectives

Develop methodologies for the integration of geoscientific information held in AGSO's corporate database computer, image processing centre, geographic information system, digital cartographic facilities, and other computing devices.

Provide effective procedures for exchanging different data types between the facilities.

Provide techniques for integrating, querying, displaying and editing the information on a variety of local workstations.

Relevance

The integration and consequent interpretation of geoscientific datasets is necessary, firstly for the development of new concepts which may lead to the discovery of new mineral and petroleum occurrences and, secondly, as an aid to decision-making in the resolution of land-use issues.

The development of methodologies for the integration of different types of spatially-related datasets is thus a significant objective of AGSO's geoscience database research. These datasets can be very large (e.g. satellite data), dynamic, and of variable quality. The development of effective methodologies therefore requires a multidisciplinary approach involving geoscientific, computing, mathematical and statistical expertise.

Expected outcomes

Standard procedures, being used by Programs to integrate AGSO's geoscience data and manipulate AGSO's main spatial IT systems remotely over BMRnet.

Programs developing new integrated AGSO products based on the methods demonstrated and prototypes produced—for example overlaying BMR and AGSO point, line and polygon data onto co-registered imagery.

Activities

Methodologies for the integration of AGSO's existing spatial information technology systems, and the data that they hold, are being researched. These methodologies will be trialed through pilot projects conducted jointly with other AGSO Programs.

New developments are evaluated as they arise, and those of potential value to AGSO will be implemented as needs dictate.

The current status of 3D data models are being investigated, and AGSO's future options will be assessed.

Expected products

Prototype integrated products. New procedures documented for combining geoscience data in AGSO.

Highlights for 1991/92

PC software packages which emulate the X11 Windows system were evaluated to see whether such packages could be used to provide networked access for PC workstations to BMR's GIS and image processing systems. A particular package was chosen, and a BMR site licence was purchased. AGSO geoscientists can now access imagery and GIS coverages over BMRnet from their desktop PCs.

Routine transfers of images from the BMR image processing centre to the GIS and of GIS-derived vectors to image processing are now possible.

Goals for 1992/93

Set up dynamic links between the ER Mapper image processing software and the Arc/Info GIS and the corporate database server.

Investigate commercial dynamic link modules between IIS and Arc/Info to allow overlay of GIS vector data on IIS images.

Set up pilot data integration projects with other AGSO Programs leading to prototype AGSO integrated products.

Evaluate the usefulness and practicality of 3D data models for AGSO's geoscience data.

Clients

AGSO Programs

State and Federal land use organisations

Mineral and petroleum exploration companies

Cooperating agencies

National Resource Information Centre, BRS, DPIE

Department of Mineral Resources, NSW

Department of Resource Industries, Queensland

ER Mapping Inc. (beta testing)

IIS Corp. (beta testing)

Project 261.03 Data management

Project manager	Geoff Wood	06 249 9398
Program responsibility	Information Systems	
Timeframe	1991–ongoing	

Objectives

Facilitate access to critical data required for cross-program and inter-disciplinary projects and integrated products under the National Geoscience Mapping Accord, Continental Margins and Environmental Geoscience Programs.

Develop policies and procedures on corporate data management.

Coordinate national geoscience data standards activities.

Relevance

The project ensures that internal data standards and management principles (such as custodianship) are coordinated within AGSO, and related to developments in the wider standards community, and industry requirements for geoscience databases.

Expected outcomes

Better mechanisms for consultation and access to geoscience data.

Improved exchange of geoscience data between the Commonwealth, States and Territories, industry and the public.

More efficient use of corporate and national geoscience data.

Activities

A draft georeferencing standard is being developed, along with a core geoscience data dictionary for use in AGSO.

A data standards database in geochemistry for the GGDPAC Working Group on Geoscience Data Standards is under development.

Geoscience standards development and related policy advice is provided within AGSO and coordinated throughout DPIE.

Expected products

First edition of core AGSO geoscience data dictionary and standards.

Delivery of final products from the first phase of the AMDEX project.

Highlights for 1991/92

A draft of a BMR georeferencing standard was developed.

Initial products from the AMDEX data exchange project were distributed to BMR users.

Initial discussions on data transfer standards were completed with most industry users of BMR data.

A paper on the SDTS was presented to workshop on GIS, Cartographic and Geoscience Data Standards.

Support was provided to Australasian Spatial Data Centre user survey on data transfers.

Goals for 1992/93

Develop draft Australian Standards for geoscience data, in conjunction with cooperating State/Territory agencies and industry.

Seek industry and other support for further development of the AMDEX project.

Promote development of the core geoscience data dictionary required for the effective use of SDTS by the geoscience community.

Clients

AGSO programs and projects

GGDPAC Working Group on Geoscience Data Standards

Cooperating agencies

AUSDEC

AUSLIG

AMIRA

Mining Research Associates

Mineral and petroleum exploration companies

State and Territory geoscience agencies

Standards development organisations in Australia and overseas

Project 261.04 Database administration

Project manager	Mirek Kucka	06 249 9685
Program responsibility	Information Systems	
Timeframe	1991–ongoing	

Objectives

Provide a standard relational database environment throughout AGSO in order to facilitate the integration of datasets.

Move the current Oracle database system to an 'Open Systems' environment.

Change the current single Oracle system to a dual 'Test' and 'Production' managed environment.

Relevance

This project aims to maximise the benefits from using open relational database technology in terms of availability, flexibility, security and manageability. It will also position AGSO corporate scientific databases to take advantage of new technologies, such as client-server or fully distributed architectures, to better service AGSO clients.

The project was recommended by the 1990 Information Systems consultancy, and

endorsed by the then BMR Information Resource Management Committee.

The current database server is planned to be phased out by mid–1993, as it is no longer economically viable, and does not have the capacity required for the dual environments.

Expected outcomes

Stable Oracle/Unix database environment, accessible through the corporate ethernet network, for GIS and other integrative applications.

Oracle based databases will be running in a managed dual 'Test' and 'Production' environment.

Savings from reduced running costs.

Activities

Reviewing current and planned geoscience database interdependencies.

Setting up of dual 'Test' and 'Production' Oracle environments.

Setting up change control management between the dual environments.

Expected product

A faster, more reliable database environment.

Highlights for 1991/92

A Data General AViiON Unix database server was acquired, after extensive benchmark testing against the BMR's typical Oracle geoscience database usage patterns.

Goals for 1992/93

Establish dual 'Test' and 'Production' Oracle environments, along with change control management.

Transfer majority of the database applications from the Data General MV\20000 to the new database server.

Clients

AGSO Programs using the Oracle RDBMS.

Industry requiring secured access to geoscience data.

Cooperating agencies

AGSO Programs

Project 261.05 Scientific databases and applications development

Project manager	Rod Ryburn	06 249 9605
Program responsibility	Information Systems	
Timeframe	1991–ongoing	

Objectives

Implement or assist with the design and development of computer databases and applications to do with AGSO's geoscientific mapping and research, natural resource management, natural hazard mitigation.

Develop corporate and national standards databases.

Coordinate the development of AGSO's scientific databases.

Advise AGSO programs on related database applications.

Relevance

The growing reliance on automated methods of data analysis and presentation demands that data be stored and managed as systematically as possible, and that classification schemes be standard at the corporate, national and international levels. Without an integrated approach to design, it is difficult to

combine data from several databases in the one product, such as will be required under the NGMA.

Industry and State government bodies are looking to AGSO to provide national geoscience databases. In addition to providing a pool of expertise to help AGSO's scientific programs with their database requirements, this project increasingly concerns the development of standard tables of terms for use within databases and the promotion of their use.

Expected outcomes

Much better democratic control of, access to, and use of, existing AGSO data sets, and a revolution in methods of analysing, presenting and selling geoscience information to AGSO's clients and the nation as a whole.

Activities

Client discussions are usually followed by design and execution of a prototype database, that then undergoes modification and evolution after client testing.

Publication of a manual, commonly co-authored with the clients, is a major milestone, usually followed by further help with training, more applications, and extraction of data sets for sale.

Development of standard database tables also requires custodian selection, liaison with other geoscience organisations, research into classification schemes and terminology, and collation of available data.

Expected products

Completed infrastructure for databases—including tables, views, indexes, menus, screen forms, report programs, SQL script files, export facilities and help systems.

User documentation for completed databases—usually published as AGSO Records.

Standards databases and authority tables made more readily available to all clients, including external clients via dial-up access.

Posters and published papers on AGSO's geoscientific and standards databases.

Highlights for 1991/92

Completion of the QUAKES world earthquake database in collaboration with the Australian Seismological Centre and the RTMAP regolith database with BMR's Regolith Group.

Conception of the BMR Stratigraphic Authority (standards) Database in consultation with the Geological Society of Australia Stratigraphic Names Committee, the Stratigraphic Index group, the Phanerozoic Time Scale Project, and D Palfreyman.

Development of the SITES, OUTCROPS and PETROGRAPHY databases in support of the NGMA, and the completion of the OZCHRON Database of Australian isotopic geochronology—in cooperation with the Minerals and Land Use Program.

Start of work on a major database for the Environmental Geoscience Program.

Presentation of papers and posters on BMR's geoscientific databases to the National Conference on the Management of Geoscience Information, the 11th Australian Geological Convention, and the Workshop on GIS, Cartographic and Geoscience Data Standards.

Goals for 1992/93

Transfer existing Oracle databases for which the project is responsible to Oracle version 6 on the new corporate Unix platform.

Make available the Stratigraphic Authority Database and other standards tables to external dial-up access.

Complete the NGMA field and laboratory databases, including the STREAMCHEM and SPECPROPS databases.

Substantially complete the Quaternary Climates Database in cooperation with the Environmental Geoscience Program.

Assist Mineral Databases Group and Minerals and Land Use Program with design and development of the new MINDEP Australian mineral deposits database.

Further development of the PALEO database on AGSO's fossil collections.

Set up several geomagnetic databases.

Start work on a taxonomic database for Onshore Sedimentary and Petroleum Program.

Clients

AGSO Programs, components and projects

State and Federal geoscience and land-management organisations

Mineral and petroleum exploration companies.

Cooperating agencies

National Resource Information Centre, BRS, DPIE

AGIA

State and Territory geoscience agencies

Geological Society of Australia

317: INTERNATIONAL DEVELOPMENT ASSISTANCE AND COOPERATION

Objectives

Coordinate appropriate geoscience activities arising from international agreements, development assistance programs and other agencies involved in international geoscience.

Promote the exchange of information and development of research programs between geoscientific organisations in other countries, AGSO and appropriate Australian organisations; and identify commercial geoscientific opportunities relevant to Australian expertise.

Relevance

International geoscientific contact is important for maintaining high standards for the effective prosecution of AGSO's main functions in Australia. AGSO's international program aims to promote better relations between Australia and developing countries, develop closer links with specific geoscientific organisations and assist in improving their geoscience capabilities and development of their mineral and petroleum resources.

Activities

AGSO, as the Commonwealth's principal technical adviser on geoscience matters, represents Australia in various international geoscientific organisations, including those under United Nations auspices, aimed at assisting developing countries. It also assists in various bilateral and multilateral projects initiated through Commonwealth agencies such as the Department of Foreign Affairs and Trade.

AGSO's international activities may be broadly categorised into:

- global geoscience involving contributions to the coordination of or participation in international research, including those under S&T Agreements, which arise from AGSOs specialist knowledge of the Australian and Antarctic regions
- regional cooperation in projects which, although development assistance oriented and funded, bring substantial benefit to AGSO programs
- development assistance projects funded by development assistance agencies, mainly the Australian International Development Assistance Bureau (AIDAB)
- support of Australia's foreign policy or commercial objectives
- where appropriate involvement of AGSO and other Australian organisations in international cost recovery projects and consultancies

Arrangements are in place for cooperation with several countries and international organisations, and include:

- AGSO's major contribution to development of offshore mineral and petroleum resources in the Asia-Pacific region under its membership of SOPAC is in the provision of geophysical data storage, funded by AIDAB
- development of geoscientific knowledge and mineral and petroleum resources in the Asia-Pacific region through:
  - cooperation with the South Pacific Applied Geoscience Commission (SOPAC) in its various activities bilateral cooperation with China under Memoranda of Understanding with the Ministry of Geology and Mineral Resources (MGMR), the Chinese National Nonferrous Metals Industry Corporation (CNNC), and the State Seismological Bureau (SSB) in a variety of geoscientific topics of mutual interest
  - bilateral cooperation with the Indonesian Government in volcanic hazard related heatflow studies of the Rabaul harbour; and a project for the publication in colour of the 1:250 000 geological maps of Kalimantan produced in preliminary form under the

former Indonesia–Australia Geological Mapping Project
- bilateral cooperation with the Philippines Government in a joint seismic framework study in Philippines waters
- multilateral cooperation with several countries in the production of geoscientific maps of the Australia and Pacific region
- participation in commercial ventures relevant to furthering geoscientific knowledge of the mineral resources of the Sultanate of Oman; and of the Islamic Republic of Iran

Develop the International Programs Unit, which was established in July 1991, as a fully functional, substantially self sufficient section responsible for:

- coordinating AGSO's international cooperative activities relevant to the Government's international objectives and policies
- developing consultative links and closer working relations with relevant Australian Government and other organisations, and appropriate Government and international funding agencies
- developing a register of Australian exploration and production services registering with appropriate international aid agencies/data systems
- promoting international commercial involvement of AGSO programs and, where appropriate on a cost recovery basis, other Australian organisations

INTERNATIONAL DEVELOPMENT ASSISTANCE AND COOPERATION

Component manager David Falvey 06 249 9328

Component projects

122.01	Law of the Sea and seabed boundary activities
122.02	Offshore resource map series
123.01	SOPAC geoscience projects: petroleum and mineral resource framework of south west Pacific island arcs and basins; coastal and nearshore studies
123.02	Rabaul Harbour heat flow survey
123.03	Philippines offshore seismic project: regional petroleum exploration and evaluation of basin potential
242.06	Natural hazards mapping in the Australian Region
317.02	China–MOU cooperation
317.03	International maps—Australia and Oceania geoscience compilations
317.04	Geoscience program in the Sultanate of Oman
317.05	Volcanism, tectonics and metallogeny of western Melanesia
317.06	Kalimantan geological maps project
317.07	Geoscientific mapping program in the Islamic Republic of Iran

Project 122.01 Law of the Sea and seabed boundary activities

Project manager	Phil Symonds 06 249 9490
Program responsibility	Marine Geoscience and Petroleum Geology
Timeframe	1988–ongoing

Objectives

Assist in formulation of policy and negotiation maritime boundaries and in the definition of Australia's offshore jurisdiction.

Improve knowledge of morphology and non-living resource potential of the continental margin of Australia and its territories.

Relevance

AGSO's Marine Geoscience and Petroleum Geology Program holds the main technical expertise and regional database on the morphology and resource potential of Australia's continental margin and adjacent ocean basins, and is well placed to provide independent advice to government on these matters. It also has the only research vessel capable of acquiring the range and quality of data necessary to fully define a legal continental shelf around Australia and its territories, and to assess its petroleum and mineral resource potential.

This project fulfils an important AGSO role of providing independent and timely advice and information to government to facilitate the formulation and implementation of policies, and the effective management of Australia's offshore petroleum and mineral resources.

Expected outcomes

Government decisions, policy formulation and implementation, and offshore petroleum and mineral resource management are based on the best available scientific and technical information.

Optimum definition of the legal continental shelf around Australia and its territories.

Improved understanding of the morphology, geology and resource potential of Australia's offshore territory and adjacent ocean basins.

Activities

Provide scientific and technical advice and information on the geomorphology, geology, and mineral and petroleum potential of the continental margin and adjacent ocean basins around Australia, its island territories and the AAT.

Provide independent scientific and technical advice and information to government on the geology and non-living resource potential of areas under consideration for the creation of marine parks and reserves.

Compile the necessary technical and scientific data to define the legal continental margin and shelf around Australia and its territories, using the various international conventions, and provide advice to government on the area and resource ramifications of the various approaches.

Promote collection of new data in areas that will be the subject of future seabed boundary negotiations and deliberations, such as the Christmas Island area (Project 121.32), and the southern Lord Howe Rise/Norfolk Ridge region.

Serve on interdepartmental committees and working groups concerned with Law of the Sea, maritime boundary delimitation, and non-living marine resource matters.

Expected products

AGSO reports, professional opinions and publications on the morphology, resource potential and other maritime boundary considerations around Australia and its territories.

Maps showing the various morphological features and parameters used to define a legal continental shelf around Australia and its territories.

Maps showing Australia's various maritime and resource-related boundaries.

Highlights for 1991/92

Provision of advice and maps to DPIE, DFAT and the Attorney–General's Department on proposed new Adjacent Areas boundary following Cabinet approval to adopt a new legal continental shelf definition as contained in the 1982 UN Convention on the Law of the Sea.

Preparation of a BMR Record on the 'Definition of Australia's Legal Continental Shelf and its resource implications.'

Provision of scientific and technical advice to DFAT—including 1:1 million compilation track charts over the southern Lord Howe Rise area—on matters related to future maritime delimitation negotiations with New Zealand.

Preparation of a draft computer-drawn map showing the various criteria, such as foot-of-continental-slope, used to define a legal continental shelf around Australia.

The map, produced at 1:5 million scale on a digital bathymetric base, will form the basis of a future map showing Australia's maritime boundaries.

Goals for 1992/93

Continue provision of advice and information to government agencies and departments on Law of the Sea matters, maritime boundaries, offshore petroleum and mineral potential, and general morphology and geology of the continental margin of Australia and its territories.

Coordinate technical advice (based on data and interpretations from Project 121.32) to DFAT related to Australia/Indonesia seabed boundary delimitation in the Christmas Island region.

Produce draft Australian maritime boundaries map in consultation with DFAT, Attorney–General's Department and DPIE.

Clients

Policy Divisions, Department of Primary Industries and Energy

Department of Foreign Affairs and Trade

Attorney–General's Department

Petroleum Resource Assessment Program, DPIE

Other government departments and agencies

Cooperating agencies

Policy Divisions, Department of Primary Industries and Energy

Department of Foreign Affairs and Trade

Attorney–General's Department

Project 122.02 Offshore resource map series

Project manager	Chris Johnston	06 249 9353
Program responsibility	Marine Geoscience and Petroleum Geology	
Timeframe	January 1989–1996	

Objective

Provide a planning base for research, and survey and industry operations, in geoscience, fisheries, and oceanography covering the proposed Australian Adjacent Offshore Area (Legal Continental Shelf).

Relevance

The map series will provide fundamental bathymetric and sediment-type information in support of resource exploration and development (i.e. petroleum and fishing) and environmental monitoring, both on the shelf and

extending into deeper waters within the Australian Adjacent Offshore Area.

Expected outcomes

A mapping and seabed information base for activities around the margin including exploration (petroleum and minerals), Australian jurisdiction requirements, fisheries (grounds and licensing), environmental issues and research.

Activities

Compile and publish a series of contoured bathymetric sheets covering the proposed Australian Adjacent Offshore Area (Legal Continental Shelf).

Develop a comprehensive digital database of water depths, by integration of data sets from the Hydrographic Service, General Bathymetric Map of the Oceans (GEBCO) plotting sheets, BMR/AGSO and other sources. The GEBCO data are only available in analogue form and so those data required must be digitised.

Machine contour the data using an algorithm that best handles the unique characteristics of bathymetric data and modify the machine contours so that they are geomorphologically realistic.

Add to the database other required data sets such as seismic lines, well locations and geological sampling localities with surface sediment types.

Present these data in map and digital form so that they are of maximum benefit to clients; the maps are being produced using Mercator projection at 1:1 000 000 scale with 50 m contours to 300 m depth and 100 m contours below 300 m.

Expected products

An initial series of 33 sheets will be published progressively over the next five years.

Digital data will be released in a form that best suits the needs of client groups.

Highlights for 1991/92

The 400 m isobath south east of Albany was used by AFMA to recommend licensing boundaries for a foreign fishing vessel.

Negotiations are underway with CSIRO for assistance in completing the generation of digital shelf bathymetry. Most of the east, west and south coasts have already been digitised.

The GEBCO Bathymetric Editor visited the project in mid-February to meet project personnel and gain familiarity with our activities.

The Cuvier sheet was awarded second prize in the mapping section at an international graphics art competition (Intergraph's Golden Mouse Art Competition, Huntsville, USA).

Three sheets were compiled and significant progress was made on another three sheets.

Goals for 1992/93

Compile ready for publication a further six sheets from south and north west Australia (see figure below). Sheet compilation goals are as follows:

Esperance	July
Christmas Island	September
Argo	November
Rowley Shoals	January
Broome	March
Darwin	May

Assist efficient publication of sheets for the International Bathymetric Chart of the Western Pacific (IBCWP) by active participation on the Editorial Board 'selling' Australian technology and procedures. The IBCWP is a new Intergovernmental Oceanographic Commission (IOC) project. The inaugural meeting of the Editorial Board was held in June 1992.

Clients

Fishing industry

Petroleum exploration industry

Department of Foreign Affairs and Trade (Australian Jurisdiction)

Environmental study centres

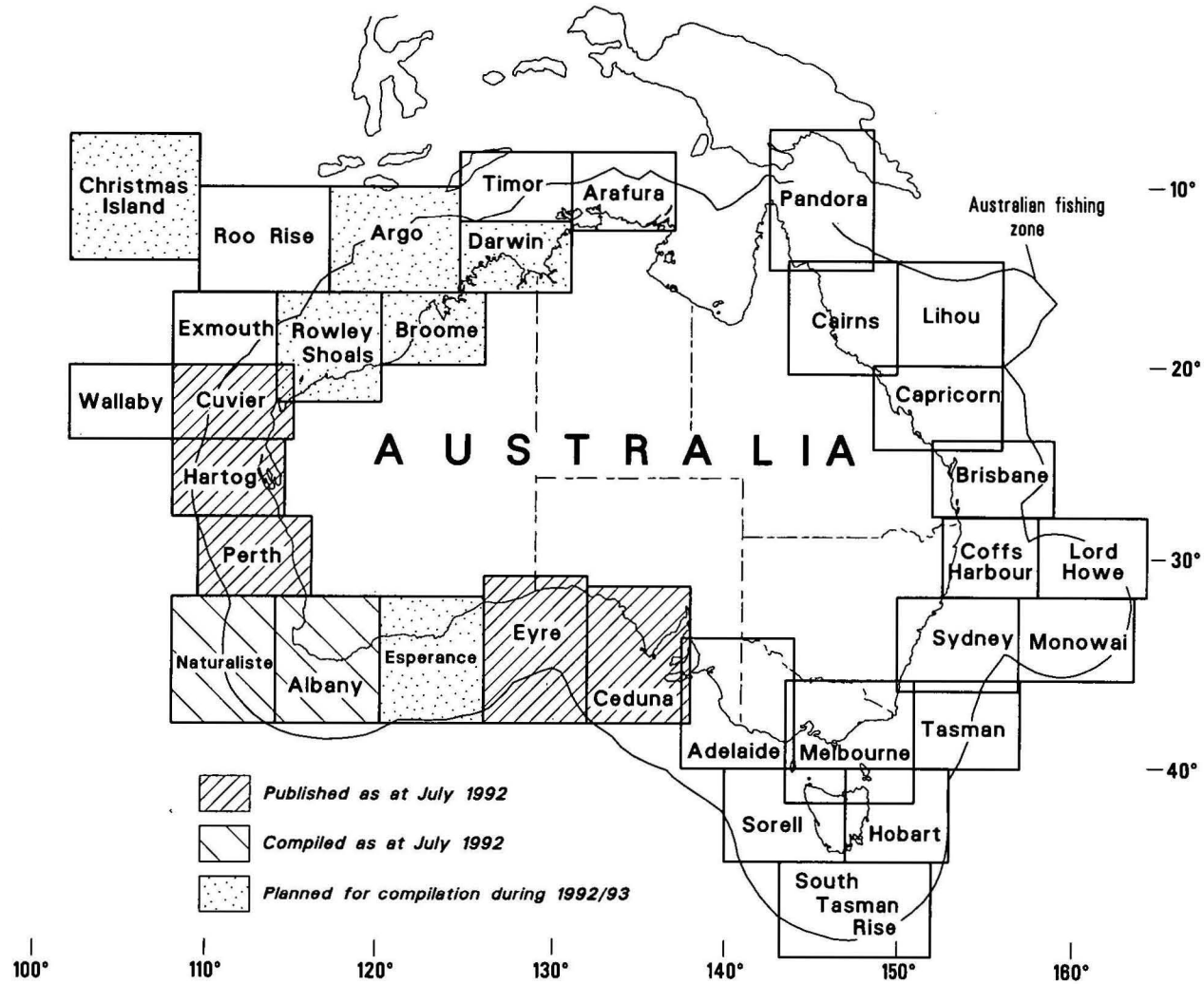
Marine research centres

Cooperating agencies

Jeff Williams, Bureau of Resource Sciences

Bruce Willington, Royal Australian Navy Hydrographic Service, Canberra

Joe Doyle, Royal Australian Navy Hydrographic Service, Sydney



OFFSHORE RESOURCE MAP SERIES (ORMS)

23/OA/570

Project 123.01

SOPAC geoscience project: petroleum and mineral resource framework of south west Pacific island arcs and basins; coastal and nearshore studies

Project manager	Neville Exon	06 249 9347
Program responsibility	Marine Geoscience and Petroleum Geology	
Timeframe	1982–ongoing	

Objectives

Assist in exploration and development of petroleum and mineral resources of the region, by supporting the South Pacific Applied Geoscience Commission (SOPAC).

Advise on coastal problems.

Relevance

Petroleum and seabed mineral potential are poorly known in the south west Pacific. The SOPAC geoscience project is an Australian initiative to help the Pacific island nations assess their petroleum and mineral seabed potential, in particular, as part of a general geoscience program.

Expected outcome

Enhanced economic potential for, and resource knowledge of, the south west Pacific island nations.

Activities

Help SOPAC Technical Secretariat assess the petroleum and mineral potential of the active convergent plate margins, marginal basins and oceanic regions offshore from the Cook Islands, Western Samoa, Tonga, Fiji, Vanuatu, Solomon Islands, Papua New Guinea, Tuvalu, Kiribati, Marshall Islands, Guam and Federated States of Micronesia.

Provide advice on and help SOPAC study geological factors involved in sea level change, coastal change and shoreline protection in Pacific island nations, and their implications.

In conjunction with the SOPAC Technical Secretariat, compile and publish summary volumes and papers on manganese nodules, cobalt-rich crusts and petroleum prospects of the region.

Continue provision of storage and retrieval facilities for Tripartite and other south west Pacific data tapes, in conjunction with Australian Archives.

Continue source rock and other studies on Pacific island cores, as appropriate.

Provide a member for the 1992 SOPAC Program Review Mission.

Expected products

Summary volumes and papers on manganese nodules, cobalt-rich crusts and petroleum prospects of the region.

Highlights for 1991/92

Data storage and retrieval facilities upgraded, and considerable new island country data accumulated and organised.

Publication of various papers on results of the RV *SP Lee*, RV *Moana Wave* and HMNZS *Tui* minerals-orientated cruises.

Publication of the Vanuatu petroleum brochure.

Review of SOPAC work program drafted.

Goals for 1992/93

Publish swath-mapping results from 1987, 1989 and 1990 cruises of the RV *Moana Wave*, HMAS *Cook* and RV *Sonne*.

Publish results of RV *Moana Wave* manganese nodule and crust studies.

Publish results of the Papua New Guinea palaeomagnetic study.

Prepare proposals and reports dealing with coastal processes on Pacific islands.

Finalise SOPAC program review document.

Clients

Island nations of the south west Pacific

AIDAB

SOPAC

IOC

Cooperating agencies

AIDAB

United States Geological Survey

Hawaii Institute of Geophysics

New Zealand Oceanographic Institute

New Zealand Geological Survey

South Pacific Applied Geoscience Commission

Australian Defence Force Academy

Pacific island nation geological surveys

Australian universities

Inter-governmental Oceanographic Commission

Project 123.02 Rabaul Harbour heat flow survey

Project manager	Trevor Graham 06 249 9341
Program responsibility	Marine Geoscience and Petroleum Geology
Timeframe	1989–1993

Objective

Assess the heat distribution in the submarine environment of Rabaul caldera, in order to further constrain geological and geophysical models.

Relevance

Human welfare—understanding the thermal regime of the Rabaul caldera will assist greatly the assessment of volcanic hazards in the region, which have already led to devastating loss of life in the region.

More detailed identification of 'hot spots' may lead to strategies for the permanent monitoring of magma activity.

Geophysical—the 1990 heat flow survey produced an intriguing insight into a complex heat regime in the caldera, with strong convectional transfer from extremely positive heatflow locations to very negative heat flow sinks, suggesting the presence of large convection cells driving pore fluid exchange.

Sedimentological—sediment cores extracted from the harbour reveal the Holocene record of caldera subsidence, marine invasion and volcanic eruptions.

Expected outcomes

A better understanding of the Rabaul caldera's heatflow pattern, leading to a more reliable assessment of the volcanic hazards it poses.

Development of a new technique that could be used in other volcanic calderas around the world where volcanic hazards are present.

Papua New Guinea scientists trained in this style of work.

A new shallow-water heatflow system, capable of being used in other AGSO programs.

Activities

A first generation of equipment designed and manufactured to meet the stringent demands of shallow-water heatflow recording.

A preliminary survey in Rabaul in 1989 tested a new sampling concept.

A completely new system of heatflow equipment was manufactured at BMR and tested.

A major heatflow survey in Rabaul in 1990 produced an interim report on preliminary findings and equipment performance.

Expected products

A more detailed map of heat distribution and convectional cells within Rabaul caldera, constraining present geological models and aiding in volcanic hazard assessment.

A state-of-the-art shallow-water heatflow system, totally BMR/.AGSO conceived and manufactured and leading world design.

Training of Papua New Guinea geologists and geophysicists in marine heat flow and vibrocoring techniques.

Possible development of a strategy for permanent monitoring of sites to aid in volcanic hazard prediction.

Highlights for 1991/92

Full data analysis of the 1990 survey was followed by a final report.

Second generation of equipment has been designed and manufacture started.

Goals for 1992/93

Manufacture a second generation of equipment.

Conduct a further heatflow survey in the Rabaul caldera – November 1992.

Develop possible long term monitoring strategies.

Clients

Papua New Guinea Geological Survey

Cooperating agenices

AIDAB

SOPAC

Papua New Guinea Geological Survey (incl. Rabaul Volcanological Observatory)

University of Papua New Guinea

Project 123.03 Philippines offshore seismic project: regional petroleum exploration and evaluation of basin potential

Project manager	Chao-Shing Lee	06 249 9439
Program responsibility	Marine Geoscience and Petroleum Geology	
Timeframe	1990–1995	

Objective

Assess the petroleum prospectivity of selected offshore survey areas of the Philippines to attract further exploration and drilling activities in these areas.

Relevance

This is an Australian development assistance program, funded by AIDAB, for the Government of the Philippines to help promote petroleum exploration activities in the Philippines.

In September 1988, the Philippines Government formally requested the Australian

Government to provide an exploration assistance program.

Expected outcomes

Enhanced understanding of the petroleum potential of selected offshore areas of the Philippines.

A core of Filipino scientists with improved skills in petroleum basin analysis.

More cost-effective exploration strategies in the survey areas.

Activities

Assist the Office of Energy Affairs in the Philippines to acquire, process and interpret new seismic data and other resource-related information.

Train Filipino scientists in the application of modern geoscientific technology and petroleum basin analyses.

Regular meetings of Project Management Committee consisting of OEA, AIDAB and AGSO staff.

Formation of industry consultative group consisting of Filipino and Australian companies.

Reprocess existing seismic data and interpret regional seismic and well data.

Marine survey primarily using multichannel seismic and underway geochemistry aboard *Rig Seismic*.

Reprocess 500 km of existing seismic data and process seven scenes of LANDSAT image data from the potential survey areas.

Produce 2500 km of new processed seismic data as public geoscientific information on Philippines natural resources.

Publish the results of the project in scientific and technical literature to increase general awareness of exploration opportunities in the Philippines.

Help Australian and Philippines oil companies to design more cost-effective exploration strategies in the survey areas.

Expected products

Reprocessed existing seismic data.

Seven processed scenes of LANDSAT image data from the potential survey areas.

2500 km of new processed seismic data as public geoscientific information on Philippines natural resources.

Highlights for 1991/92

Implementation document finalised.

Interpretation of existing industry seismic data and selection of study areas.

Cruise planning and execution of cruise in Philippines.

Completion of training of first group of OEA staff.

Industry consultative groups formed and advice acted upon.

Goals for 1992/93

Process and display seismic and geochemical data.

Interpret and integrate newly processed data with existing data.

Undertake training of OEA staff.

Hold Project Management Meetings and consultative meetings with industry as appropriate.

Clients

Philippines Government

BHP

Philodrill

Alcorn Oil

Oriental Petroleum

Transasia Oil Company

Woodside Petroleum Ltd

BHP Petroleum Pty Ltd

SANTOS Ltd

Australian Worldwide Exploration Ltd

AMPOL Exploration Ltd

MIM Petroleum Exploration Pty Ltd

Claremont Petroleum NL

Austin Oil NL

Command Petroleum Holdings NL

Crusader Ltd

Bridge Oil Philippines Inc

Bligh Philippines, Inc

Philippines oil companies

Cooperating agencies

Office of Energy Affairs (OEA), Republic of the Philippines

Republic of the Philippines

AIDAB

Project 242.06 Natural hazards mapping in the Australian region

Project manager	Wally Johnson	06 249 9377
Program responsibility	Environmental Geoscience and Groundwater	
Timeframe	1991–2000	

Objective

Focus attention on the vulnerability of different parts of the Australian region to particular groups of natural hazards.

Relevance

Natural hazards in the Australian region have accounted for the deaths of thousands of people, the loss of billions of dollars of property and the destruction of agricultural lands in both Australia and neighbouring countries; from Thailand in the north west, through Indonesia, the Philippines and Papua New Guinea to the Solomon Islands, Vanuatu, New Caledonia, Fiji, Tonga and New Zealand.

In 1989, the Prime Minister called for the establishment of an Australian Coordinating Committee for the International Decade of Natural Disaster Reduction (IDNDR) that began in January 1990. The attention of the Committee will be focused on the disaster preparedness needs of developing countries in the Australian region.

A new initiative endorsed by the IDNDR Committee is the production by the Natural Hazards Map Working Group (NHMWG) of a regional map or maps showing the distribution of areas affected by earthquakes, volcanic eruptions, tsunamis, landslides, and other geological hazards, as well as tropical storms, floods, bushfires, and other climate related hazards.

The published hazard maps will:

- focus attention on the vulnerability of different parts of the Australian region to particular groups of natural hazards
- be based on the best available scientific information supplied through a multidisciplinary working group
- be designed to be understood easily by a wide range of people from the general public in many countries, to authorities concerned with disaster preparedness, to scientific groups specialising in hazard assessment.

Expected outcome

Improved hazard awareness, assessment and preparedness.

Activities

Produce a 1:10 million scale map, with accompanying Explanatory Notes, of the geo-

logical and climatological hazards of the Australian region.

Coordinate regional input to map production as Chair of the Australian IDNDR Working Group (NGMWG) on Natural Mapping in the Australian region, and as Chair of the Circum–Pacific Map Project (South West Quadrant).

Liaise with the CPCEMR Map Project, which will take responsibility for the costs of map production and publish through the US Geological Survey.

Collect multidisciplinary data sets on natural hazards and compile them in map form.

Participate as a member in meetings of VULCAN–AUS (Volcanological/Airspace Liaison Committee Australia Indonesia—Australian Working Group.

Consider ways of establishing a national database on natural hazards in the Australian region.

Highlights for 1991/92

The multidisciplinary NHMWG (Chairman, R.W. Johnson of BMR) met on 25–27 May 1992 at the Australian Counter Disaster College (Department of Defence), Mount Macedon, Victoria, and began compilation of the first draft of the 1:10 million scale hazards map. Discussions were held with NRIC and other groups in relation to the establishment of a national database on natural hazards.

Goals for 1992/93

Produce first draft of 1:10 million hazards map. Continue to develop ways of establishing a national database.

Cooperating agenices

Natural Disasters Organisation

Bureau of Meteorology

Macquarie University

University of New South Wales

Port Moresby Geophysical Observatory

Asian Institute of Technology, Bangkok

La Trobe University

Project 317.02 China–MOU cooperation

Project manager	David Newham	06 249 9571
Program responsibility	International Programs Unit	
Timeframe	1983–ongoing	

Objective

Develop cooperative research projects with appropriate Chinese organisations in a variety of geoscientific topics of mutual benefit and interest.

Relevance

The development of closer links with relevant Chinese research organisations will promote a greater understanding and appreciation of the geology and mineral and petroleum resources in both countries and, where possible, identify opportunities for the involvement of Australian organisations and companies in cost effective ventures in China.

Activities

AGSO involvement relates directly to topics identified in its work program.

Exchange visits between both countries have taken place in the following programs:

- Hydrogeology (MGMR)
- Resource assessment and management in the mineral industry (MGMR)
- Seismology (SSB)

- Cambro-Ordovician boundary study (MGMR)

Joint reports will be published on completion of the above programs and, for seismology, on completion of relevant phases of the cooperation.

The report for resource assessment and management in the mineral industry is awaiting ratification by the Chinese. Further cooperative exchanges will take place in the above and other identified programs with MGMR, CNNC and SSB.

Highlights for 1990/91

Completed the report on resource assessment and management in the mineral industry program.

Established strong motion records in China to distinguish ground motion from earthquakes.

Proposed visit to Australia by the Minister for MGMR.

Goals for 1991/92

Complete the Murray Basin—Huang Huai Hua Plain hydrogeological program.

Executive Director's visit to MGMR to review the cooperation and develop further programs.

A feasibility study of the Dabie Mountains region to evaluate potential fora detailed geoscientific mapping program.

Continue exchange visits in the cooperative programs, and initiate exchanges in new programs.

Clients

People's Republic of China

Exploration and mining industry

State geological surveys

Commonwealth agencies

Cooperating agencies

International

Peoples Republic of China

China Ministry of Geology and Mineral Resources (MGMR)

PRC State Seismological Bureau (SSB)

Australia

Relevant Commonwealth, State and tertiary organisations and industry

Dr C Murray; Queensland Geological Survey

A Bailey, BHP Minerals Ltd

Project 317.03 International geoscience mapping

Project manager	David Palfreyman 06 249 9465
Program responsibility	Onshore Sedimentary and Petroleum Geology
Timeframe	1950s–ongoing

Objective

Contribute to international projects concerned with regional geoscience mapping, particularly in the south east Asian and the south west Pacific regions.

Relevance

The project is part of Australia's contribution to international geoscience cooperation. It will improve understanding of the geology of the south west Pacific as a part of a global study aimed at assisting countries in the sustainable development of their natural, particularly petroleum and mineral, resources.

The results of geoscience mapping and resource assessment in Australia are used in the compilation of geoscience and resource maps for larger areas that portray Australia in its regional and global context, especially its geological relationship with neighbouring countries in the southeast Asian and south west Pacific regions.

BMR/AGSO has been involved with the work of the Circum–Pacific Map Project (CPMP), a major activity of the Circum–Pacific Council for Energy and Mineral Resources (CPCEMR) since its inception in 1973.

Expected outcome

Improve appreciation of the regional context of Australian geology, mineral and petroleum resources.

Activities

Compile 1:10 million scale maps and prepare explanatory notes for the South west Quadrant of the CPMP.

Attend the annual CPMP meetings.

Participate in other international map compilation activities relevant to AGSO's program.

Expected products

AGSO meets its obligations in international geoscience mapping.

South west Quadrant colour maps and Explanatory Notes published by the USGS for CPMP.

Highlights for 1991/92

Completion of a draft compilation of the CPMP Energy Resources map.

Goals for 1992/93

Proof-check CPMP Energy Resources map.

Prepare a draft of the Explanatory Notes for the CPMP Energy Resources map.

Continue compilation of data for the CPMP Natural Hazards map (South west Quadrant); this activity is a contribution to the IDNDR (see 242.06).

Clients

Mineral and petroleum industries, in Australia and overseas

Government and geoscientific organisations in neighbouring countries

Cooperating agencies

Circum–Pacific Council for Energy and Mineral Resources

USGS

Overseas geological surveys

Project 317.04 Geoscience program in the Sultanate of Oman

Project Managers	David Denham	Geophysics	06 249 9267
	Lynton Jaques	Geology	06 249 9745
	David Newham	Coordination	06 249 9571
Program responsibility	Geophysical Observatories and Mapping		Geophysics
	Minerals and Land Use		Geology
	International Programs Unit		Coordination
Timeframe	1990–1992		

Objective

As consultants to the Omani Ministry of Petroleum and Minerals, supervise a program for the geophysical and geological mapping of the Batinah coastal region (north of Muscat) and the Raki-Hayl As Safil area of the Sultanate of Oman.

Relevance

Establish AGSO and other Australian geoscientific expertise as a desirable commodity to the Omani Government for improving understanding of the geology of Oman, and assisting in the development of its mineral resources.

Highlights of 1991/92

Successful completion of a contract to evaluate tenders for the above contract.

Winning the contract to supervise implementation of this project.

Goals for 1992/93

Complete the contract to the satisfaction of the Omani Government.

Clients

Omani Ministry of Petroleum and Minerals.

Cooperating agencies

Geological Survey of Oman

Al Bassim Enterprises, Muscat

Aerodata Australia

Project 317.05 Volcanism, tectonics and metallogeny of western Melanesia

Project manager	Wally Johnson	06 249 9377
Program responsibility	Minerals and Land Use	
Timeframe	1991–1996	

Objective

Determine any relationships between major- and trace-element whole-rock compositions and intrinsic gold (Au) and platinum group element (PGE) magmatic abundances in arc-trench type rocks.

Relevance

Mineral exploration companies based in Australia continue to search actively for high level (volcanic and sub-volcanic) epithermal and 'porphyry' gold-copper systems in western Melanesia, particularly in the Late

Cainozoic island-arc terranes of Papua New Guinea.

AGSO has had a long association with Papua New Guinea and since 1969 has accumulated a vast amount of geological and rock geochemical data on the Late Cainozoic volcanism of western Melanesia including the western Solomon Islands. Much of these data remain uninterpreted.

An existing rock powder collection provides an excellent opportunity to obtain new Au and PGE analytical data. These new data will permit examination of possible relationships between the pristine Au and PGE contents of fresh volcanic rocks and bulk-rock compositions (for example, potassium content). The data will contribute to a major assessment of the volcanism, tectonics and metallogeny of this high profile region.

Activities

Obtain Au and PGE chemical analyses of a selected suite of Late Cainozoic volcanic rock samples from Papua New Guinea and the western Solomon Isalnds.

Finalise a major geochemical analytical subset of west Melanesian whole rock samples (approximately 1500) on AGSO's ROCKCHEM database.

Assess and analyse existing data.

Write reports.

Complete a major synthesis of the relationships between volcanism, plate tectonics and metallogeny in the Late Cainozoic of the region.

Expected outcomes

Provision of improved base for mineral exploration.

Improved understanding of the basic controls of magma generation in island arcs.

Expected products

Database of rock analyses.

Several reports on volcanic areas within the western Melanesian region.

Major synthesis (Bulletin) on volcanism, tectonics and metallogeny.

Goals for 1991/92

Select rock samples for Au and PGE analyses.

Continue development of the ROCKCHEM database subset.

Seek industry and other support for further development of the project.

Complete reports on the volcanic geology of selected areas.

Clients

Mineral exploration companies based in Australia working in the area

Governments of Papua New Guinea and Solomon Islands

Cooperating agencies

Australian National University

Rabaul Volcanological Observatory (PNG)

University of New England

Project 317.06 Kalimantan Geological Maps Project (KGMP)

Project managers	Lynton Jaques	Geology	06 249 9745
	Ian O'Donnell	Cartography	06 245 1363
	David Newham	Coordination	06 249 9571
Program responsibility	Minerals and Land Use		Geology
	Cartographic Services Unit		Cartography
	International Programs Unit		Coordination
Timeframe	1992–1994		

Objective

Using computer-assisted cartographic technology, publish 1:250 000 coloured geological maps of central-western Kalimantan which were produced in preliminary form under the former Indonesia-Australia Geological Mapping Project; and associated explanatory notes.

Relevance

Further AGSO's geoscientific expertise as a desirable, high technology commodity to the Indonesian Government for producing high quality maps to attract international companies interested in developing the mineral and energy resources of Kalimantan.

Highlight for 1991/92

Winning the contract.

Goals for 1992/93

Complete the publication of half the maps, and preparation of most of the explanatory notes.

Clients

Indonesian Ministry of Mines and Energy

Cooperating agencies

Geological Research and Development Centre, Bandung, Indonesia

Mercury Walch

Project 317.07 Geoscientific Program in the Islamic Republic of Iran

Project managers	Lynton Jaques	Geology	06 249 9745
	David Denham	Geophysics	06 249 9267
	David Newham	Coordination	06 249 9571
Program responsibility	Geophysical Observatories and Mapping		Geophysics
	Minerals and Land Use		Geology
	International Programs Unit		Coordination
Timeframe	1992–1995		

Objective

Develop an invited geoscientific mapping project in north eastern Iran covering six 1:100 000 sheets over a mineral prospective sedimentary-volcanic sequence.

Relevance

AGSO would develop and coordinate the project, using subcontractors, as appropriate, to execute relevant activities.Establish AGSO and other Australian geoscientific expertise as a desirable commodity to the Iranian Government (over other invited projects to other countries) for understanding the geology of Iran and assisting in the development of its mineral resources.

Goals for 1992/93

Complete a preliminary study of the region, and develop and initiate an appropriate program for the project.

Clients

The Iranian Ministry of Mines and Metals
Australian industry

Cooperating agencies

Geological Survey of Iran

Australian companies – to be identified

PROGRAM DELIVERY

Engineering services

Program manager	Neville Esau	06 249 9243
Key managers	Malcolm Gamlen	Electronics (Design and Development)
	Lou Zeitlhofer	Electronics (Technical) and Unit Resource Manager
	Mike Burns	Mechanical Engineering

Objective

Provide high quality engineering services to AGSO clients in an efficient and effective manner.

Highlights for 1991/92

Testing of the Series 2 Marine Seismic Data Acquisition System has been completed.

Intensive maintenance and upgrade programs have been carried out on the analog to digital converter systems for the Marine Seismic Data Acquisition Systems.

Development and installation of a new AF Demagnetiser has been completed at the Black Mountain Palaeomagnetic Laboratory. Commissioning tests and adjustments are proceeding.

Significant advances were made in the development and application of automatic test equipment systems.

Marine, Onshore and airborne field support operations were maintained at programmed levels despite staff reductions.

A new steel vibracoring system was developed and constructed.

Development, construction and installation of a new mounting system for the Narod Ring-Core Magnetometer was completed.

Development, construction and installation of the coil cradle system for the new AF De-Magnetiser was completed.

Site preparation was completed and equipment housing installed for the Stephen's Creek seismic monitoring station.

Development and manufacture of a pneumatic-lift gun trolley was finalised.

Goals for 1992/93

Provide higher quality service and advice for clients with on-time product delivery, consistent performance and value for money in all client transactions.

Enhance our technological capabilities, response time and efficiency in resource use to provice high development and maintenance productivity.

Provide higher quality management, technological leadership, and focus on service, to facilitate service and product delivery.

Improve cost recording and reporting systems and processes.

Improve levels of accountability to clients.

Structure operations to enhance job satisfaction and career prospects for all staff.

Prosper under financial and resource constraints.

Design and develop new equipment for remote cable cutting.

Design and develop lightweight heads for vibracoring systems.

Design and develop a new gravity piston-coring process.

Develop and manufacture mechanical equipment for the 'Aurora Australis'.

Enhance productivity through the application of new and upgraded CAD, simulation and ATE systems.

Identify resources for the development and funding of trainee technical officers.

Clients

AGSO Programs

Marine Geoscience and Petroleum Geology

Onshore Sedimentary and Petroleum Geology

Minerals and Land Use

Environmental Geoscience and Groundwater

Geophysical Observatories and Mapping

Cartographic Services

Program manager	John Hillier	06 249 9100
Key Managers	Ian O'Donnell	Resources
	Chris Carter	Production
	Phil Ryan	Information Technology

Objective

Provide cartographic products and related services in support of AGSO objectives.

Highlights for 1991/92

BMR Advisory Council Award – 1991.

Devolution of a range of functional responsibilities from BMR Business Management Branch continued.

Release of 'Symbols on Geological Maps' in digital form for public use.

Commenced publication of contemporary multi-colour 1:250 000 geological maps of west and central Kalimantan.

Began digital data capture of 1:250 000 published geological maps for CYPLUS project in north Queensland.

Visits by members of BMR Advisory Council and industry.

Joint sponsorship of GIS workshop in collaboration with Information Systems, and Minerals and Land Use Program.

Awards of first and second prize for Mapping, first and fourth prize for Plotting in 1992 Intergraph International Graphic Users Group (IGUG) Golden Mouse Competition – May 1992.

Responded to Government Guaranteed Training Program objectives.

Participated in cost recovery through active marketing of CSU services.

- Establish Cost Recovery Committee
- Introduce Cost Recovery Charging System

Implemented Preliminary Disaster Recovery Plan (DRP) options.

Conducted occasional presentations (calendar); fostered social, recreational and sporting activities; undertook client survey.

Undertook skills analysis survey and began job analysis audit to develop strategic training program; allocated Government Guaranteed Training Legislation training component accordingly.

Provided opportunity for Program Leaders to participate in Middle Management Program.

Enhanced digital Cartographic Symbols Library and associated standards; participated in appropriate standards committees.

Allocated resources funding equivalent to 2% of CSU resource allocation per annum for experimental development.

Established a committee to develop standard project documentation.

Completed trial of FINDAR as a solution to an automated file storage recording system.

Introduced CSU planning and programming system for control of resources utilisation, in collaboration with a responsible financial management information system.

Extended hours of operation of selected high technology equipment from 18 hours to 24 hours a day 5 days a week.

Goals for 1992/93

Apply advanced CAD techniques to the continued provision of a comprehensive and timely delivery of service to AGSO programs, specifically those projects identified under the National Geoscience Mapping Accord.

Strive to attain an optimal production environment for the effective delivery of services to programs by the promotion of best practices.

Introduce a CSU planning and programming system for the best utilisation of critical resources in concert with a responsible financial management information system.

Introduce measures to enhance the skills profile of the unit.

Undertake experimental development of cartographic methods by systematic work, using existing knowledge gained from research or practical experience to create new or improved products/processes, with especial emphasis on high technology applications.

Promote improved Occupational Health and Safety practices.

Promote AGSO's Equal Employment Opportunity Objectives.

Corporate Relations, Information and Planning

Program manager	Alex Nicolson	06 249 9572
Key managers	Ian Hodgson	Corporate publications
	Anne Franklin	Library
	Gillian Tidey	Marketing and information
	Louise Emmett	Policy, planning, evaluation and reporting

Objectives

Promote and support AGSO and its programs.

Help AGSO adapt to change.

Highlights for 1991/92

Gave improved support to the BMR Advisory Council and the BMR Executive.

Completed evaluations of the Geophysical Observatories, Minerals Resource Assessment and Petroleum Resource Assessment Programs.

Improved, documented and promoted BMR's Integrated Planning Cycle (Annual Work Program, Three Year Strategic Plan, Yearly Planner, Quarter Planner) and held seminar on planning.

Introduced CD–ROM facilities in the Library.

Promotional efforts in industry, at scientific conferences and other appropriate venues (Royal Canberra Show).

Facilitated the further development of BMR's International Programs Unit.

Assisted with the development of corporate planning and evaluation processes in a range of Commonwealth Government agencies (the Australian Heritage Commission; Department of Industry, Technology and Commerce;

Department of Arts Sport the Environment and Territories).

AUS.GEO News, BMR Research Newsletter and BMR News redesigned to create a 'stable' of corporate newsletters.

Goals for 1992/93

Complete the first full cycle of AGSO's Integrated Planned Cycle (involve stakeholders more in strategic planning).

Continue the development of AUS.GEO News and display material.

Facilitate the development of an effective role and the effective functioning of AGSO's Development Committee.

Facilitate the evaluation of AGSO's Continental Margins Program (our most important Advisory Council Evaluation so far attempted).

Facilitate the further development of AGSO's International Programs Unit.

Improve liaison with, and support for, scientific programs with regard to publication of scientific results.

Maintain interest and advance activities of AGSO Jubilee celebrations.

Provide a higher level of support for the AGSO Executive and AGSO Advisory Council.

Raise standard of AGSO's contributions to policy process, and Ministerial drafting in particular.

Reintroduce the Branch's Occasional Seminar Series to keep AGSO staff informed of changes to AGSO's operating environment.

Review functions and target audiences of all corporate publications.

Plan for the first evaluation of a non-scientific area of AGSO (Business Management Branch).

Business Management

Program manager	John Cahill	06 249 9473
Key managers	Peter Cook	Finance and Services
	Mike Hedley	Personnel Management

Objectives

Manage AGSO's business operations to provide services which promote and further the program and its people through:

- recruiting, servicing and developing AGSO's people
- acquiring and assisting with the cost effective management of AGSO's financial resources
- acquiring and managing AGSO's property, facilities and related assets
- providing advice on business issues and resource management

Highlights for 1991/92

Acquired a site for a new BMR building.

Managed the implementation of the Structural Efficiency Principle outcomes for technical and professional staff.

Implemented the new Senior Officer conditions for BMR staff.

Implemented performance appraisal for Research Scientists, Professional Officers and Senior Officers.

Implemented the Occupational Health and Safety (Commonwealth Employees) Act 1991.

Successfully assisted the general management of BMR resources, including external funding initiatives.

Evaluated, purchased and began using a new Financial Management Information System which will provide more timely, accurate and relevant financial information.

Undertook a stocktake of all BMR assets.

Undertook major repairs, maintenance and renovations to BMR's existing premises.

Furthered the consultative process between management and unions.

Contracted to Employee Assistance Scheme for welfare and counselling services for BMR staff.

Implemented improved reporting for the management of BMR's human resources.

Managed and met the BMR's EEO responsibilities.

Goals for 1992/93

Secure funding and commence development of a new building for AGSO.

Complete implementation of a new computer-based financial, accounting and asset management system for the AGSO's finances and assets.

Enhance resource management skills throughout AGSO through training and development.

Improve the management of human and financial resources and accountability arrangement.

Integrate human and financial management planning and action with the corporate directions of AGSO.

Assist the introduction of workplace bargaining activities and initiatives for AGSO.

Further streamline support services and reduce 'red tape'.

Accelerate AGSO's cultural change through further organisation, development activities, competency development, performance appraisal, workplace practices and evaluation of organisation health.

Implement workforce planning activities to meet emerging priorities in AGSO's program direction.

Information Systems

Program managers	David Berman	06 249 9602
Key managers	John Creasey	(Image Processing)
	David Downie	(Network and Communications)
	Mirek Kucka	(Database Administration)
	Rod Ryburn	(Database Coordination)
	Ian Towers	(Project Management)
	Geoff Wood	(Data Management)

Objectives

Operate and develop corporate computing systems.

Install and support appropriate communications technology in order to promote connectivity between Program and corporate level systems.

Provide objective advice to senior management on information technology issues.

Deliver effective training in the use of corporate computing facilities.

Manage the implementation of corporate information technology projects.

Develop and implement AGSO's Information Technology Strategy, in consultation with program managers, and Departmental interests.

Activities

Help users define their corporate computing needs.

Help users develop appropriate network, hardware and software solutions.

Implement recommendations of the 1990 Information Systems Study.

Move corporate applications to more effective computing environments.

Consult with senior management on corporate information systems and data management priorities.

Highlights for 1991/92

The proposal to introduce a UNIX system to assume the role of a corporate ORACLE database server received funding for 1991/92. After an extensive evaluation of systems, a Data General AViiON 6240 machine was selected, and installed. Training in Unix use, system management and other aspects was organised for some 90 BMR staff.

The Branch also assisted in the planning, acquisition and implementation of a Pyramid Unix server for the new Departmental financial system (Prophecy).

The BMR electronic mail environment took a major step forward with the connection of the Worldtalk gateway to the external world. This now allows CEO mail users to exchange mail with Macintosh users, DPIE and X.400 compliant systems worldwide.

Development of the BMR ethernet backbone (BMRnet) continued at a high rate with the installation of several local bridges and multiport repeaters. The DEC VMS network was bridged to BMRnet, with TCP/IP services available on a microvax gateway machine.

BMRnet now provides Netware users access to TCP/IP services, from six Novell servers and a growing number of PCs.

In a major development for the year, the Branch assumed responsibility for the strategic planning of integrated BMR voice and data facilities, including radio and satellite links and equipment. Consultants were engaged to assist the process, commencing with the development of a 5-year Corporate Communications Strategy.

A cost/benefit study of the existing PABX found both economic and technical advantages in moving to a modern digital PABX, managed in-house by the Branch. Following a tender, a distributed Ericsson ISDN system was selected, with associated call management and analysis software, including voicemail. This initial phase also took the opportunity to partially implement a combined voice and data strategy. The voice and data megalink services between the main BMR building and the CSU location have now been replaced by a single 8 Mbits/s microwave service.

In the Image Processing Centre, additional disk capacity was added, and training and assistance given to users, particularly on the IIS system. New applications were developed and demonstrated, particularly involving visualisation techniques.

A corporate colour copier/postscript printer was acquired to allow programs to realise savings in hardcopy costs, as a network service.

The Centre also undertook a substantial contract for the Marine Program's Philippines Seismic Survey project. Landsat TM imagery was processed to assist in mapping water depth and pre-cruise planning.

Goals for 1992/93

Continue to support and improve existing corporate computing platforms:

- Manage the corporate computing infrastructure: including the provision of operator services, user assistance, file system maintenance, magnetic tape management, system development and general technical consulting services.
- Manage the AGSO corporate Oracle Relational Database; including planning, advice and problem resolution, as well as routine support, security, integrity, software upgrades and day-to-day operational support of the database environment.
- Implement the migration of ORACLE databases to the UNIX server.

- Manage and upgrade the AGSO corporate GIS and Image Processing Centres, and promote corporate GIS and image processing planning.
- Manage the new Prophecy Financial Management Information System server; provide appropriate connectivity to programs, and advice on software.
- Manage the new PABX, and further rationalise voice and data delivery, including investigating the need for microwave connectivity with NRIC.
- Manage the AGSO Ethernet network. In particular, the computer needs of the Executive, to connect and exchange information with all program areas and DPIE, is being reviewed.

Support the implementation of the recommendations of the 1990 Information Systems Study.

Provide support for the Information Resources Management Committee.

Plan for the integration of X.400, UNIX and PC mail within AGSO, as part of the MV 20000 replacement process.

Organise training in and access to major corporate computing systems.

Provide senior AGSO managers with information on relevant technology issues, options, opportunities, and government purchasing policy and procedures.

Provide technical advice and expertise in the design, development and documentation of computer applications, according to corporate priorities.

Provide supplementary technical, administrative and financial support for AGSO's Database Coordination and Liaison projects.

Manage the Branch's running costs, plant and equipment, staff resources and general administration.

Appendix A

COMMONWEALTH DEPARTMENT OF PRIMARY INDUSTRIES AND ENERGY

Minute

Reference

Subject **BMR — CURRENT POSITION**

ALL STAFF

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Since my discussions with you at your Annual General Meeting, there have been a number of developments on future administrative arrangements for the Bureau.

The next steps on this matter are set out in the attached Joint Statement by our Ministers. This statement is being released publicly around noon today. The key points are as follows:

1. There is to be an inquiry chaired by Dr Max Richards on whether BMR should be established as a separate Institute within CSIRO, within the Department of Primary Industries and Energy or some other arrangement. Gerry Gleeson of the BMR Advisory Council will be on this inquiry.

2. The staff and associated resources currently allocated to petroleum and minerals resource assessment within BMR will be merged with the current Bureau of Rural Resources to become the Australian Bureau of Agriculture and Resource Science.

3. The name of the BMR will change to the Australian Geological Survey Organisation, consistent with its primary role of geological mapping and associated research.

While I have met with all BMR staff who could attend the meeting this morning, it is my intention to meet separately early next week with those staff in the minerals and petroleum resource assessment areas who will be more directly affected by these changes.

The implementation of these decisions by the Government will be managed within DPIE following open consultative processes. I shall indicate the nature of these processes over the next few days.

GEOFF MILLER

13 August 1992

JOINT STATEMENT

PE92/73GR **13 August 1992**

NEW ARRANGEMENTS FOR BUREAU OF MINERAL RESOURCES

The Federal Minister for Primary Industries and Energy, Mr Simon Crean and the Minister for Resources, Mr Alan Griffiths, today announced a number of changes to the operational and administrative arrangements for the Bureau of Mineral Resources (BMR).

The Ministers said that in the broad context of resource and environmental management for sustainable development, the Government was anxious to ensure that scientific support for resource decisions was provided in the most efficient way.

BMR has long been a central element in providing that support, as well as providing the knowledge base necessary for the continued development of our exploration industries.

However, in recent years BMR, like national geological survey organisations world-wide, has been asked to do much more to help address national and global issues, notably in relation to land management and protection of the environment. CSIRO has also been developing its research in these fields.

Preliminary consideration has therefore been given to closer integration of the strategic research and national mapping activities of BMR and those of CSIRO in order to improve the efficiency of the national research effort and integration of data bases. At the same time consideration has been given to improving the mechanisms for coordinating scientific and economic resource information in providing advice to the Government on resource assessment issues.

As a result of these considerations we are announcing a number of measures, as follows:

1. An inquiry into the administrative arrangements under which the BMR operates, including whether it should be established as a separate Institute within CSIRO or remain within the Department of Primary Industries and Energy (DPIE)

.../2

- the inquiry will be chaired by Dr Max Richards, an Executive Member of Australian Mining Industry Council (AMIC) and Board Member of the CSIRO
- terms of reference of the inquiry are attached.

2. The resources currently allocated to petroleum and minerals resource assessment within BMR will be merged with the current Bureau of Rural Resources (BRR) in DPIE to become the Australian Bureau of Agriculture and Resource Sciences (ABARS). ABARS will operate as a professionally independent Bureau within DPIE. ABARS will include the National Resource Information Centre (NRIC), which is currently operated jointly by BMR and BRR.

3. A change of name of BMR to the Australian Geological Survey Organisation (AGSO) consistent with its contemporary role.

4. Within DPIE, an explicit management system will be put in place to properly link the AGSO scientific mapping activities with the resource assessment responsibilities of ABARS.

ABARS and the Australian Bureau of Agriculture and Resource Economics (ABARE) will provide a full range of scientific and economic resource information to directly service the Ministers for Primary Industries and Energy and Resources.

The Ministers said the Government would respond fully to the Report of the Review Committee, incduding consideration of the capital requirements for housing the Australian Geological Survey Organisation, as well as any costs associated with changed administrative or staffing arrangements.

The Australian Geological Survey Organisation will remain in its current accommodation until the Review is completed. In the interim, the Government will commit up to $5m to address accommodation issues, incduding immediate safety concerns in the current BMR building.

The Government is confident that the measures we have announced today will improve both the short and long term performance of Australia's national geoscience effort.

For further information: Kristen Barry, Minister's Office, ph. (06) 277 7480

TERMS OF REFERENCE

The Government recognises that the national geological survey organisation is an important strategic asset as we approach the 21st century.

It therefore recognises the need to maintain an integrated and coherent national geological survey organisation with a clear identity.

Any new arrangements resulting from the Review would build on the largely successful implementation of the recommendations of the 1988 Woods Review and will ensure that the resources of the Australian Geological Survey Organisation (AGSO) will remain focussed on geoscientific mapping and database development into the longer term.

The Terms of Reference of the Review are:

1. To examine and report on the appropriate composition and structure of the Australian Geological Survey Organisation and its relationship to CSIRO research activities, and to the activities of State Geological Survey organisations.

2. On the basis of the response to T.O.R. 1, to advise on the administrative arrangements and geographic location of the geological survey organisation, including whether it should be established as a separate Institute within CSIRO, remain within DPIE, or some other arrangement.

3. To examine and report on the mechanisms for coordinating geoscientific and resource information from AGSO and CSIRO in providing advice to client departments.

4. To advise on the most appropriate funding arrangements for AGSO, taking into account the June 1992 report of the Joint Committee of Public Accounts.

5. To examine arrangements for reporting and accountability to Government to ensure the continuing relevance and high quality of AGSO activities.

The review will be conducted by a four person team chaired by Dr Max Richards and including Mr Gerry Gleeson, the current Chairman of the BMR Advisory Council. Other members will include

- another senior business executive with a resources related background
- the Chief Scientist or his nominee.

The review team will consult widely and report to the Governrnent within 12 months. The report will be made public.

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AGSO ADVISORY COUNCIL

Establishment/Functions

The BMR Advisory Council, as it was then called, was established in 1985. Its current terms of reference are to provide ongoing advice to the Minister for Resources, the Hon Alan Griffiths MP, and the Executive Director of AGSO, Professor Roye Rutland, on:

- the objectives and priorities of AGSO's research programs
- the initiation, performance and termination of aspects of the program
- industrial and economic policies which impinge on AGSO's activities
- community interests in relation to AGSO activities.

Membership

The Advisory Council members (as of 1 July 1992) are:

Gerry Gleeson – (nominated by the then Minister for Primary Industries and Energy, the Hon John Kerin MP)

John Cramsie, Director, Geological Survey of New South Wales, Department of Minerals and Energy – (nominated by the Chief Government Geologists' Conference)

Hugh Skey, General Manager, Exploration Division, Aberfoyle Resources Ltd – (nominated by the Australian Mining Industry Council)

Paul Le Messurier, acting Deputy Public Service Commissioner, Northern Territory Public Service Commission, (substantive Director, Northern Territory Geological Survey) – (nominated by the Chief Government Geologists' Conference)

John Williams, acting Chief, CSIRO Division of Soils – (nominated by the Australian Geoscience Council)

John Denham, BHP Petroleum – (nominated by the Australian Society of Exploration Geophysicists)

Ron Vernon, School of Earth Sciences, Macquarie University – (nominated by the Australian Academy of Science)

Bryan Griffith, Executive Director of Exploration and Production, BHP Petroleum Pty Ltd – (nominated by the Australian Petroleum Exploration Association)

Roy Woodall, Director, Exploration, Western Mining Corporation Ltd – (nominated by the Australian Academy of Technological Sciences and Engineering)

Peter Core, Executive Director, Headquarters Group, DPIE – (nominated by the Secretary, DPIE)

Roye Rutland, Executive Director, AGSO – (ex officio)

Wally Johnson, Staff representative, (elected by AGSO staff).

Significant activities in 1991/92

The BMR Advisory Council met in Canberra three times during 1991/92; November 1 1991, March 6 1992 and June 5 1992. The major items of businss during the year were:

November: Presentation of the Annual Work Program, use of postgraduate and PhD students, evaluations of the Geophysical Observatories, Minerals Resource Assessment and Petroleum Resource Assessment Programs, cost recovery, the National Geoscience Mapping Accord, and the Council Project Award.

March: Pricing of airborne geophysical data, decentralisation, cooperative research centres, BMR jubilee, BMR's Three Year Strategic Plan, evaluations of the Geophysical Observatories, Minerals Resource Assessment and Petroleum Resource Assessment Programs and BMR program directions.

June: Draft Annual Work Program 1992/93, resource reductions, role of the Environmental Geoscience and Groundwater Program, regionalisation of BMR, review of BMR's involvement in the Ocean Drilling Program and archiving of BMR material.

Standing agenda items for Advisory Council meetings

June meeting

First Implementation Progress Reports on completed evaluations

Progress report on planning for coming evaluations

Final draft of Annual Work Program

Program Performance Report

Call for Advisory Council Award nominations

November meeting

Draft Evaluation Panel Reports on current evaluations

Second Implementation Progress Reports on completed evaluations

Draft strategic overview for Three Year Strategic Plan

Advisory Council Award presentation

Federal Budget and DPIE Flexibility Tax outcomes

Yearbook tabled

Feedback on Annual Work Program

March meeting

Panel Reports on current evaluations with
- stakeholder reactions
- proposed implementation strategy

Third and Final Implementation Progress Reports on completed evaluations

Proposed Evaluation Strategies for coming Advisory Council evaluations

Final draft of Three Year Strategic Plan (input into annual work program)

Secretariat

Secretariat functions for the council are provided as required through the Corporate Relations, Information and Planning Branch, AGSO.

GLOSSARY OF DATABASES AND COMPUTING APPLICATIONS

AESIS:
AMF's Australian Earth Sciences Information System. [Contact: David Berman 06 249 9602]

BORESTRA:
Interpreted stratigraphy of some 3000 boreholes drilled into the Murray Basin Cainozoic sequence. [Contact: Ray Evans 06 249 9738]

CORE AND CUTTINGS:
BMR's core library houses material from BMR's own stratigraphic drilling, subsidised drilling (1959–74), all offshore drilling and some material donated by exploration companies; inspection and testing facilities are available on site. [Contact: Joe Staunton 06 239 1890]

GABHYD:
Hydrogeological, downhole stratigraphic and lithological, borehole construction, pump test, hydrochemistry, temperature, historic water levels and flow reading data from the Great Artesian Basin. [Contact: Ray Evans 06 249 9738]

GABMOD:
A Basin wide regional numerical model of the Great Artesian Basin. [Contact: Ray Evans 06 249 9738]

GEODX:
A Central Register of Australian Stratigraphic Names including usage, geological provinces, geographic locations and full bibliographic references; also stored are names reserved by geologists for future definition and use. [Contact: Cathy Brown 06 249 9800]

GEOPAC:
A public online set of earth sciences databases managed by INFO-ONE international Pty. Ltd. which includes the AMF AESIS database. [Contact: David Berman 06 249 9602]

HARDCORE:
A loans and inventory system containing well completion reports acquired under the Petroleum (Submerged Lands) Act and the Petroleum (Search Subsidy) Act and any other reports donated to BMR by the petroleum exploration industry. [Contact: Danny Britten 06 239 1899]

ISMS:
Interactive Seismic Modelling System (software package for Cogniseis) [Contact: Mike Sexton 06 249 9543]

LIBRARY:
Australia's premier geoscientific library with holdings including 20 k monographs, 3000 serial titles, a complete collection of BMR publications and a large number of maps and map series. [Contact: Anne Franklin 06 249 9369]

MINDEP:
Fully referenced database on the name, location, regional setting, geology, resources, production history and ownership of known mineral deposits for mineral resource assessment studies. [Contact: Brian Elliott 06 249 9502]

MINDEX:
An index of 80 k items of marine data, with the output of the processing of these data, collected by BMR since 1965. [Contact: Tom Mueller 06 249 9606]

MINLOC:
Fully referenced database on the name, location and commodity of economic interest of over 12 k Australian mineral occurrences. [Contact: Brian Elliott 06 249 9502]

MINOCC:
A Queensland Geological Survey database which records mineral occurrence information roughly equivalent to MINDEP; used by the North Queensland joint NGMA Project. [Contact: Brian Elliott (06) 249 9502, Greg Ewers 06 249 9580]

ORGCHEM:
A petroleum source rock database linked to PEDIN; it contains open file source rock analyses of samples from hydrocarbon exploration, including organic carbon, Rock Eval, extract, elemental analysis and organic petrography data (maceral composition, vitrinite reflectance and spore colour index). [Contact: Chris Boreham 06 249 9488]

OZCHRON:
A national database of isotope geochronology including sample data and bibliographic references as well as analytical and pooled results from the K-Ar, Ar-Ar, Rb-Sr, Nd-Sm and U-Pb mineral and SHRIMP methods for samples from Australia, Antarctica and Papua New Guinea. [Contact: Rod Page 06 249 9261]

PALDAS:
A palaeomagnetic data acquisition system installed at BMR's Black Mountain Palaeomagnetic Laboratory which controls data acquisition from most measuring instruments. [Contact: John Giddings 06 249 9319]

PALEO:
A database of BMR's fossil collection which includes the provenance, geology, biostratigraphy, bibliography, nomenclatural status, and storage of each identified specimen. [Contact: Des Strusz 06 249 9416]

PALSYS:
A PC-based palaeomagnetic data processing and interactive interpretation system. [Contact: John Giddings 06 249 9319]

PEDIN:
A national petroleum exploration data index containing basic information and statistics on petroleum exploration and development drilling, and geophysical surveys which have been carried out in Australia and its Territories and data on all wells and aeromagnetic and gravity surveys subsidised under the Petroleum (Search Subsidy) Act [P(SS)A]. [Contact: Sandy Radke 06 249 9201]

REGMAP:
A Queensland Geological Survey field data management system used in the North Queensland joint NGMA Project. [Contact: Richard Blewett 06 249 9713]

RTMAP:

A regolith terrain mapping database containing information from Kalgoorlie and Cape York which will eventually cover the Australian continent. [Contact: Colin Pain 06 249 9469]

ROCKCHEM (FORMERLY PETCHEM):

A national database of whole rock geochemistry including major and trace element data and bibliographic references from 25 k samples from Australia, Antarctica and Papua New Guinea. [Contact: Leslie Wyborn 06 249 9489]

STREAMCHEM:

A national database of stream sediment geochemistry that is being developed in conjunction with the activities of the National Geoscience Mapping Accord. [Contact: Bruce Cruikshank 06 249 9286]

STRUCTURE:

A database of Australian structural geology mainly from the Eastern Goldfields and the Arunta Block. [Contact: Peter Williams 06 249 9389]

LIST OF ACRONYMS

AAPG	American Association of Petroleum Geologists
AAT	Australian Antarctic Territory
ABARE	Australian Bureau of Agricultural and Resource Economics
ADFA	Australian Defence Force Academy
AGC	Australian Geoscience Council
AGRF	Australian Geomagnetic Reference Field
AGSO	Australian Geological Survey Organisation (formerly BMR)
AIDAB	Australian International Development Assistance Bureau
AMDEX	Australian Mining Data Exchange project
AMF	Australian Mineral Foundation
AMIC	Australian Mining Industry Council
AMIRA	Australian Mineral Industries Research Association
ANARE	Australian National Antarctic Research Expeditions
ANARESAT	ANARE satellite link between the Antarctic and Canberra
ANCAR	Australian National Committee for Antarctic Research
ANPWS	Australian National Parks and Wildlife Service
ANSTO	Australian Nuclear Science and Technology Organisation
ANTOSTRAT	Antarctic Offshore Acoustic Stratigraphy project
ANU	Australian National University
ANZMEC	Australia and New Zealand Minerals and Energy Council
APEA	Australian Petroleum Exploration Association
APIRA	Australian Petroleum Industry Research Association
APWP	Apparent Polar Wander Path
AREG	Antarctic Research Evaluation Group
ASAC	Antarctic Science Advisory Council
ASC	Australian Seismological Centre (AGSO)
ASEG	Australian Society of Exploration Geophysicists
ASTEC	Australian Science and Technology Council
AUSDEC	Australasian Spatial Data Exchange Centre
AusIMM	Australasian Institute of Mining and Metallurgy
AUSLIG	Australian Land Information Group [part of the Commonwealth Department of Administrative Services]
AWAGS	Australia Wide Array of Geomagnetic Stations

AWRC	Australian Water Resources Council
BIRPS	British Institutions' Reflection Profiling Syndicate
BMR	Bureau of Mineral Resources, Geology and Geophysics (now AGSO)
BRR	Bureau of Rural Resources (now BRS)
BRS	Bureau of Resource Sciences
CAD	computer assisted design
CCOP	Committee for the Coordination of Joint Prospecting for Mineral Resources in Asian Offshore Areas
CCST	Coordinating Committee on Science & Technology
CMP	Continental Margins Program
CNNC	China National Nonferrous Metals Industry Corporation
COGEODATA	IUGS Commission on Global Data Management and Information Systems
COGEODOC	IUGS Commission on Geological Documentation
CPCEMR	Circum–Pacific Council for Energy and Mineral Resources
CPMP	Circum–Pacific Map Project (CPCEMR)
CRC	Cooperative Research Centre
CSDC	Commonwealth Spatial Data Committee
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CTBT	Comprehensive [Nuclear] Test Ban Treaty
CYPLUS	Cape York Peninsula Land Use Study
DASET	Commonwealth Department of the Arts, Sport, the Environment and Territories
DEET	Commonwealth Department of Employment, Education and Training
DFAT	Commonwealth Department of Foreign Affairs and Trade
DHD	direct hydrocarbon detection
DPIE	Commonwealth Department of Primary Industries and Energy
DSDP	Deep Sea Drilling Program
DSIR	Department of Scientific and Industrial Research, New Zealand
EEE	Energy Economics and Environment
EEZ	Economic Exclusion Zone
ERIN	Earth Resources Information Network (CSIRO)
GAB	Great Artesian Basin
GEBCO	General Bathymetric Chart of the Oceans
GGDPAC	Government Geoscience Database Policy Advisory Committee
GIS	geographic information system
GOMP	AGSO's Geoophysical Observatories and Mapping Program
GPS	Global Positioning System

GSA	Geological Society of Australia
GSE	Group of Scientific Experts
GSETT2	Group of Scientific Experts Technical Test–2
GSQ	Geological Survey of Queensland
GSWA	Geological Survey of Western Australia
HAZMAP	A Working Group of the IDNDR Committee producing maps in the Australian region showing the distribution of areas affected by earthquakes, volcanic eruptions, tsunamis, landslides, and other geological hazards, as well as tropical storms, floods, bushfires, wave heights, sea ice and other climate related hazards.
HIG	Hawaiian Institute of Geophysics
IAEA	International Atomic Energy Agency
IAGA	International Association of Geomagnetism and Aeronomy
IAGMP	Indonesia–Australia Geological Mapping Project
IBCWP	International Bathymetric Chart of the Western Pacific
ICOG	International Conference on Geochronology, Cosmochronology and Isotope Geology
IDNDR	International Decade for Natural Disaster Reduction
IEA	International Energy Agency
INFREMER	Institut Français De Recherche Pour L'Exploitation De La Mer
IGBP	International Geosphere Biosphere Program
IGCP	International Geosphere Climate Program
IGRF	International Geomagnetic Reference Field
INTERMAGNET	Global interchange of geomagnetic observatory data in real time by satellite
IOC	Intergovernmental Oceanographic Commission
IPCC	Intergovernmental Panel on Climatic Change
IUCN	International Union for the Conservation of Nature and Natural Resources
IUGG	International Union of Geodesy and Geophysics
IUGS	International Union of Geological Sciences
JNOC	Japan National Oil Corporation
LANDSAT	Land satellite
LOS	Law of the Sea [see UNCLOS]
MCS	multichannel seismic
MGMR	Ministry of Geology and Mineral Resources, PRC
MLA	Member of the Legislative Assembly
MOU	Memorandum of Understanding
MP	Member of Parliament

NASA	National Aeronautical Space Administration
NGMA	National Geoscience Mapping Accord
NOPEC a s	Norwegian Petroleum Exploration Consultants
NRIC	National Resource Information Centre (BRS, DPIE)
NSW	New South Wales
NT	Northern Territory
NTGS	Northern Territory Geological Survey
NZGS	New Zealand Geological Survey
NZOI	New Zealand Oceanographic Institute
ODP	Ocean Drilling Program
OEA	Office of Energy Affairs, Republic of the Philippines
OECD	Organisation for Economic Cooperation and Development
ORACLE	A relational database (RDBMS) widely used within AGSO
ORSTROM	Institut Français De Recherche Scientifique Pour Le Developpement En Cooperation
PGE	Platinum Group Elements
PNG	Papua New Guinea
POGS	Polar Orbiting Geomagnetic Survey
PRC	Peoples' Republic of China
QLD	Queensland
QDPI	Queensland Department of Primary Industry
RAC	Resource Assessment Commission
RAN	Royal Australian Navy
RDBMS	Relational Database Management System
RH&BNC	Royal Holloway and Bedford New College; Egham, Surrey, United Kingdom
RSES	Research School of Earth Sciences, ANU
RVO	Rabaul Volcanological Observatory
SA	South Australia
SADME	South Australian Department of Mines and Energy
SAE	Soviet Antarctic Expedition
SCAR	Scientific Committee on Antarctic Research
SDLS	Seismic Data Library System (Antarctic)
SDTS	Spatial Data Transfer Standard
SGDMIS	COGEODATA Sub-commission on Global Data Management and Information Systems
SHRIMP	An ion microprobe facility at the Australian National University
SOPAC	South Pacific

SSB	State Seismological Bureau, PRC
TAS	Tasmania
TM	Thematic Mapper
TMI	total magnetic intensity
TRC	Technical Research Centre (JNOC)
UNCLOS	United Nations Convention on Law of the Sea
UNEP	United Nations Environment Program
USBM	United States Bureau of Mines
USGS	United States Geological Survey
VIC	Victoria
VICGS	Victorian Geological Survey
WA	Western Australia
WALIS	Western Australian Land Information System