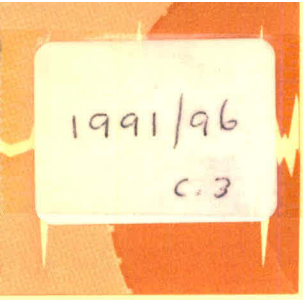
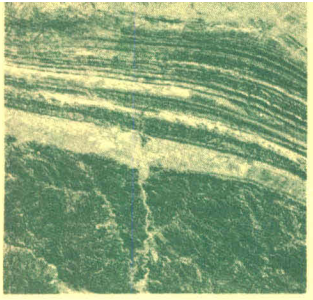
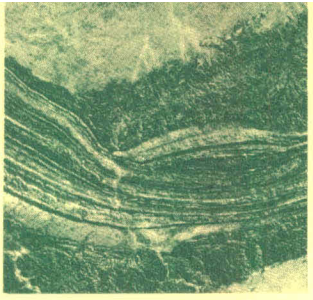
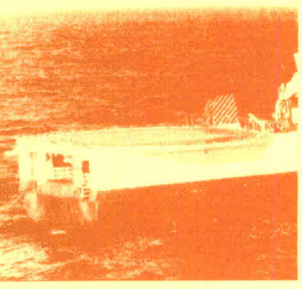
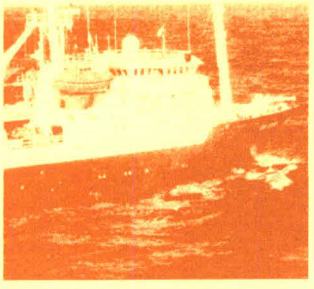
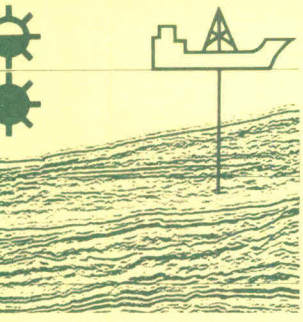
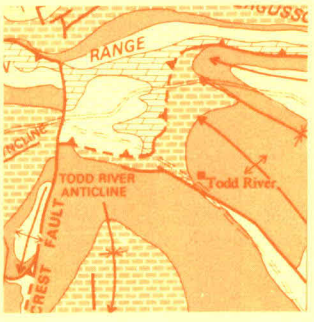
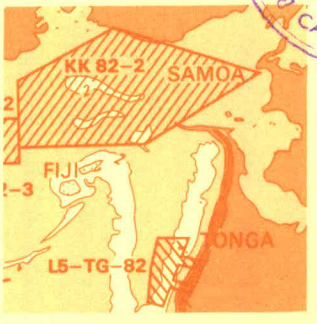
BMR GEOLOGY AND GEOPHYSICS

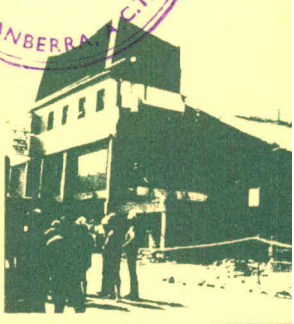
AUSTRALIA

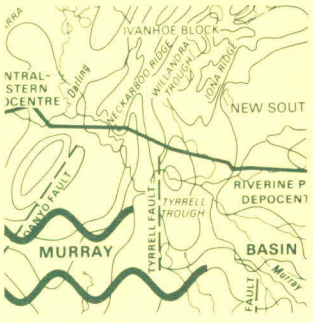






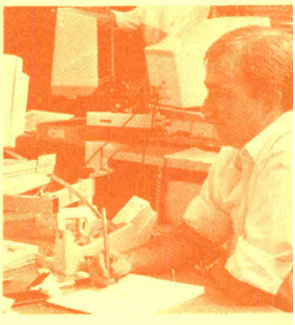

GEOSCIENCE FOR AUSTRALIA'S FUTURE






BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

WORK PROGRAM 1991/92

earch Bureau of the Department of Primary Industries and Energy

BMR
GEOLOGY AND
GEOPHYSICS
AUSTRALIA

WORK PROGRAM

1991/92

Record 1991/96

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Bureau of Mineral Resources, Geology and Geophysics

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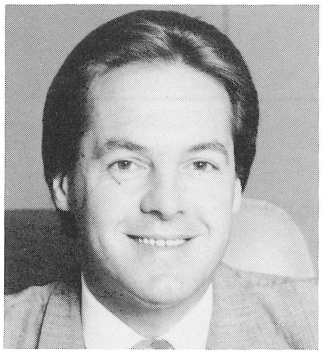
Foreword by

the Hon. Alan Griffiths

Minister for Resources



The Bureau of Mineral Resources, Geology and Geophysics is charged with developing a comprehensive understanding of the geology of the Australian continent, the continental margins of Australia and Australia's offshore territories.

This is a huge and important task. Australia has 5% of the world's land area and has a similar area again under its offshore jurisdiction yet we represent only some 0.3% of the world's population. It took more than three decades of outstanding effort by the Bureau and its State and Northern Territory counterparts using the air-photo based technology available at that time to complete the first generation of reconnaissance level geological mapping of the continent (more than five hundred 1:250 000 scale map sheets). This information base has underpinned the success of our minerals and energy industries.

The importance of the task ahead lies in the need to ensure the continuing success of onshore and offshore minerals and energy exploration through providing a new generation of geoscientific information based on high quality airborne geophysical surveys. It lies also in the need of governments for reliable information to help in assessing and managing the consequences of resource development and use, in order to protect our environment.

The Bureau's 1991/92 Work Program has been developed with the advice of the BMR Advisory Council which represents a wide range of industry, scientific and State and Territory agency interests. The Program presents plans for further development of the National Geoscience Mapping Accord, in particular through an increase in the level of airborne geophysical survey activity, and for strengthening the Bureau's Continental Margins and Environmental Geoscience programs.

I have formally approved this Work Program and I look to the Bureau to achieve the timely delivery of the outcomes described within it.

Alan Griffiths

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PART A: OVERVIEW

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BMR ROLE AND FUNCTIONS

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, and assessment of, Australia's endowment of 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 assessments, 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, BMR will:

- With the advice of the BMR Advisory Council, and through wide consultation, especially with the petroleum and mineral exploration industries, develop and implement priorities for national geoscientific strategic research and resource assessment.
- Interact with policy areas of DPIE and with other Government Departments when geoscientific advice and services are required by Government policy.
- Cooperate effectively and, where appropriate, collaborate with State/NT Government agencies, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and other geoscience organisations.

Functions

BMR'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 BMR;

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

3. assess the quantity and quality of the identified mineral and petroleum resources of Australia and its territories in relation to those of other countries and to the total inventory of earth resources, and carry out scientific and technical research into, and make continuing assessments of, Australia's intrinsic potential to meet future mineral and energy commodity requirements;

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

5. coordinate Government geoscience data activities and develop suitable standards; be a repository of data concerning the petroleum, mineral and groundwater resources of Australia and its territories and facilitate the provision of these data for exploration and research;

6. 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;

7. provide 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).

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

9. assist in the development of overseas programs in the geosciences, and participate in appropriate bilateral and multilateral programs.

10. 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 landuse planning.

SUMMARY STATEMENT

The Bureau of Mineral Resources, Geology and Geophysics is the principal geoscientific agency of the Australian Government. Established in 1946, it is a research bureau of the Commonwealth Department of Primary Industries and Energy.

The purpose of the Bureau is to:

- generate publicly accessible information necessary for the exploration and assessment of the nation's petroleum, mineral and groundwater resources;
- participate in monitoring and developing an understanding of the natural environment;
- participate in global and regional geoscientific programs of importance to Australia;
- provide independent scientific advice to government, industry and the public for the
  - management of Australia's resources;
  - development of multiple land use policies and environmental protection;
  - mitigation of natural hazards; and
  - detection of underground nuclear explosions.

The Bureau's structure brings together its scientific programs in two client and outcome oriented groups, Minerals and Environment, and Petroleum and Marine Geoscience, each headed by an Associate Director.

Budget appropriations for 1991/92 provide for an average staffing level for the year of 539 and base program funding of $53.9 m. The average staffing level during 1990/91 was 569.

The Bureau's 1991/92 program has been developed in close cooperation with the BMR Advisory Council. The Council is chaired by Mr Gerry Gleeson, AC and through its members provides a wide representation of minerals and petroleum exploration industry, scientific and State/Territory agency interests.

The centrepiece of the Bureau's program onshore is the National Geoscience Mapping Accord within which the Bureau participates in cooperative projects with State and Territory agencies. 1991/92 is the second full year of operation of the Accord.

- mineral province projects underway in 1990/91 are North Queensland, Eastern Goldfields (WA), Kimberley–Arunta (WA and NT), Arnham Land (NT, previously described in the McArthur Basin project), Lachlan–Kanmantoo Field Belts (NSW, Vic, SA), Musgrave Block (SA, WA, NT);
- sedimentary basin projects underway in 1990/91 are Canning Basin (WA), Eastern Australian Basins (NSW, Qld), Otway Basin (SA, Vic), Officer Basin (SA).

A feature of the Bureau's contribution to the National Geoscience Mapping Accord during 1991/92 is a projected increase in airborne geophysical survey data acquisition. The Bureau's new aircraft will be fully operational in 1991/92. As well, the use of contract services will remain at the high level of 1990/91.

Additional resources have been provided to strengthen the Bureau's major offshore activity, Continental Margins Program, and speed up processing of data acquired. In1991/92 the research vessel *Rig Seismic* will undertake its first overseas research cruise in the Philippines with funding provided through the Australian International Development Assistance Bureau (AIDAB).

A significant development in the Environmental Geoscience area is the Bureau's participation in the recently announced Cooperative Research Centre on the Antarctic and Southern Ocean Environment based at the University of Tasmania, Hobart.

1991/92 will see a continuing high level of activity in database development across all areas of the Bureau's program much of which is aimed at making the results of the Bureau's research available publicly on electronically readable media. A major example is the establishment of a National Petroleum Database incorporating an archival mass storage system for Bureau and industry petroleum data.

Follows from p. xiii

INTRODUCTION

GEOSCIENCE FOR AUSTRALIA'S FUTURE

Program strategy

In his introduction to the 1990/91 Work Program, the Minister for Resources, the Hon. Alan Griffiths, noted that the Bureau's geoscience has in the past, been focused largely on resource development needs and that while this continues to be the main thrust of the Bureau's program, the Bureau is responding to the broader needs of society for sustainable development—its programs are increasingly concerned with geoscience relevant to the consequences of resource development and use.

The Bureau's program strategy forms part of the wider strategy of the Department of Primary Industries and Energy within which the Bureau sits as one of seven autonomous yet interdependent operating groups. The Bureau's programs focus on two main priorities of the Department:

- assisting the development of internationally competitive mineral and energy industries; and
- supporting policies of sustainable development.

The statement of the Bureau's 'role and functions' adopted by the Government in 1989 and included earlier in this document charges the Bureau, as the principal Commonwealth Government geoscience agency, with a wide range of strategic research, database development and assessment responsibilities. This puts the Bureau in a very strong position to make a substantial contribution to furthering the Department's objectives. This task is facilitated by the present client and outcome oriented management structure of the Bureau in which the scientific programs are clustered in two groups—Minerals and Environment, and Petroleum and Marine Geoscience. Details of the structure are at page xxi.

The strategic intents of the Bureau's programs relate to two of the four categories of national benefit used in the Australian Bureau of Statistics scheme for socio-economic research objectives i.e. 'Economic Development' (mineral and petroleum exploration) and 'National Welfare' (community needs and environmental concerns).

In carrying out its mission, the Bureau has several 'publics'. It provides policy and regulation-related advice to the Commonwealth Government. The new data, interpretations and concepts generated by its regional studies provide the strategic base for the mineral and petroleum exploration industries; and the Bureau also develops a national geoscientific database and understanding to meet wider community needs (e.g. geomagnetic data, earthquake monitoring, groundwater mapping). A diagrammatic representation of program elements, strategic intent and the 'publics' served is provided on page xvi.

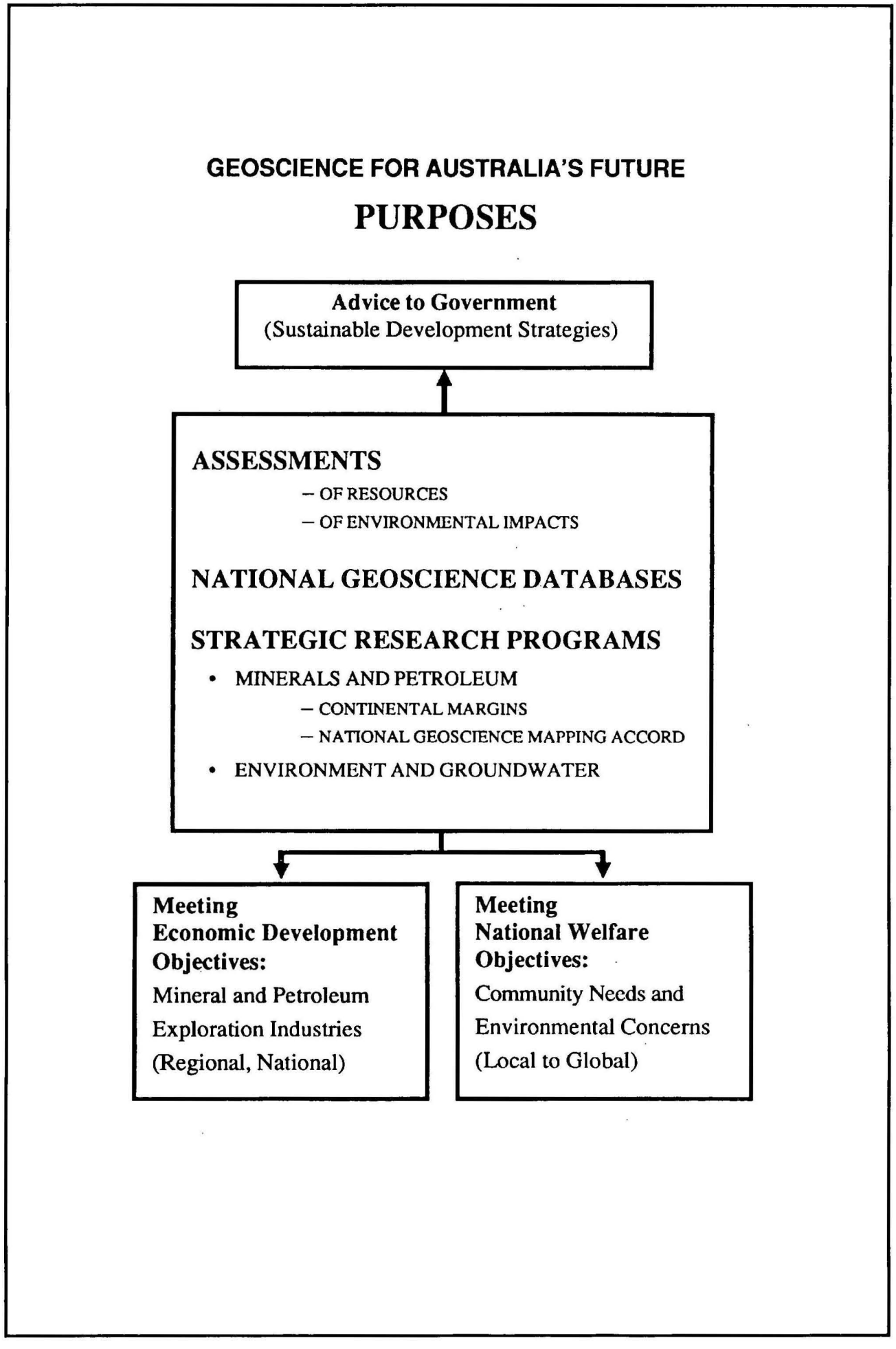
Strategic Research Programs

National Geoscience Mapping Accord

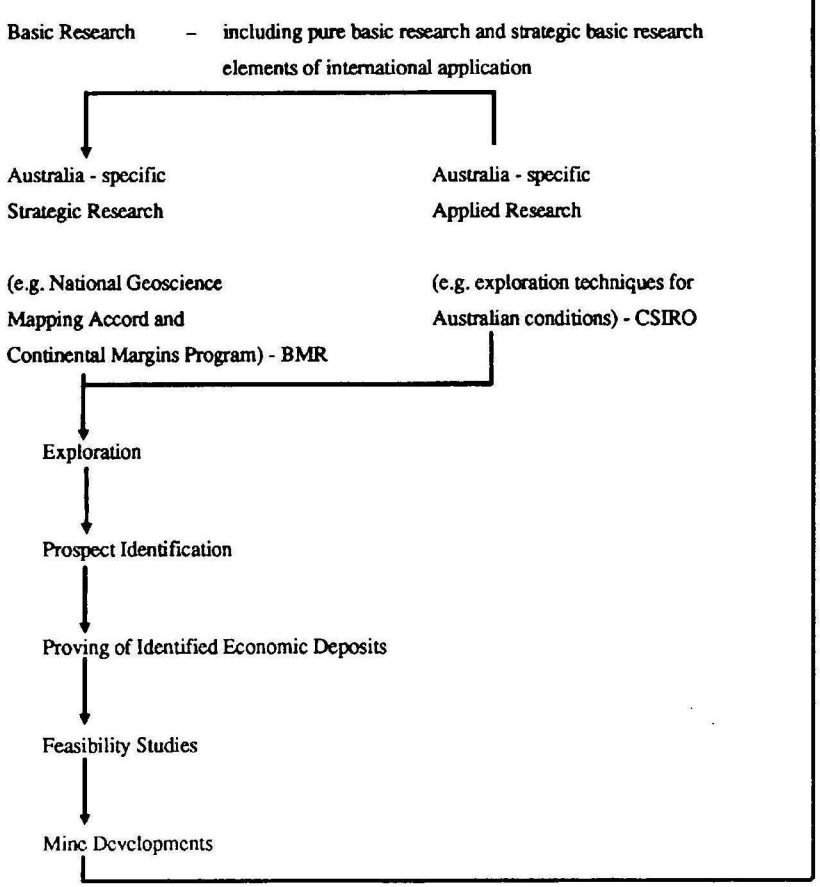
1991/92 is the second full year of operation of the National Geoscience Mapping Accord which is a major part of the Bureau's strategic research effort. It is a cooperative venture between the Commonwealth and the States/Northern Territory which is producing a new generation of geological maps, datasets and exploration models to assist

- mineral and petroleum exploration;
- assessment of potential mineral and petroleum resources; and
- the addressing of environmental and land use problems and issues.

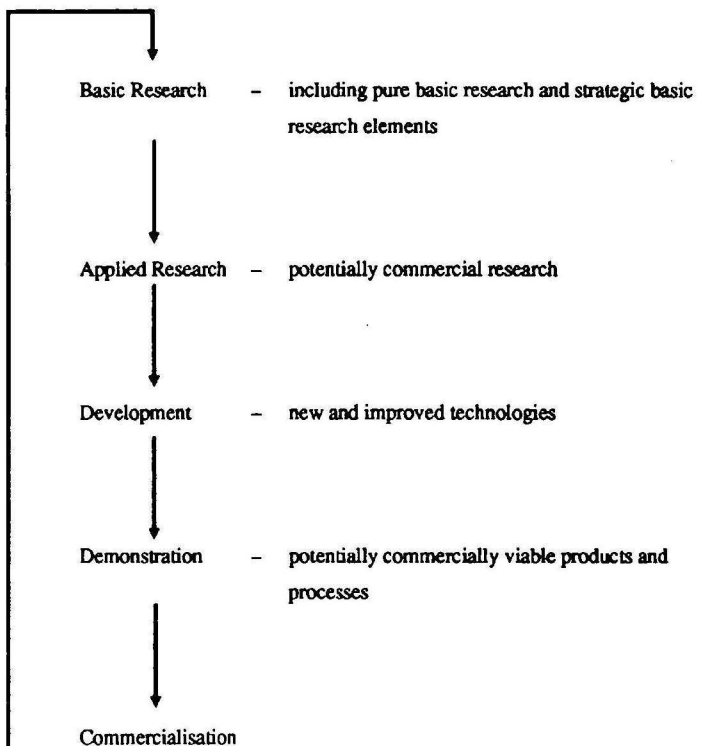
To the extent that the Accord contributes to mineral and petroleum exploration and resource assessment it is part of the strategic research stage of the 'replenishment process' for identified economic mineral


GEOSCIENCE FOR AUSTRALIA'S FUTURE
PURPOSES
Advice to Government
(Sustainable Development Strategies)
ASSESSMENTS
– OF RESOURCES
– OF ENVIRONMENTAL IMPACTS
NATIONAL GEOSCIENCE DATABASES
STRATEGIC RESEARCH PROGRAMS
• MINERALS AND PETROLEUM
– CONTINENTAL MARGINS
– NATIONAL GEOSCIENCE MAPPING ACCORD
• ENVIRONMENT AND GROUNDWATER
Meeting
Economic Development
Objectives:
Mineral and Petroleum
Exploration Industries
(Regional, National)
Meeting
National Welfare
Objectives:
Community Needs and
Environmental Concerns
(Local to Global)

The Replenishment Process for Identified Economic Mineral and Petroleum Deposits (The Upstream Mineral and Petroleum Industries)



The Innovation Process for Manufacturing Industry and Downstream Mineral and Petroleum Industries



and petroleum deposits. A schematic representation of this process and its relationship to the more familiar 'innovation process' for industrial research is shown on page xvii.

Accord projects underway in 1991/92 are:

Mineral Provinces	
North Queensland:	with the Geological Survey of Queensland.
Eastern Goldfields:	with the Geological Survey of Western Australia.
Arnhem Land (described as McArthur Basin project in the 1990/91 Work Program)	with the Northern Territory Geological Survey.
Lachlan–Kanmantoo Fold Belts	with the Geological Survey of New South Wales, the Geological Survey of Victoria and the South Australian Department of Mines and Energy.
Kimberley–Arunta	with the Geological Survey of Western Australia and the Northern Territory Geological Survey.
Musgrave Block	with the South Australian Department of Mines and Energy, the Geological Survey of Western Australia and the Northern Territory Geological Survey.
Onshore Sedimentary Basins	
Canning Basin	with the Geological Survey of Western Australia.
Sedimentary Basins of Eastern Australia	with the Geological Survey of New South Wales and the Coal Geology Branch, New South Wales Department of Minerals and Energy and the Queensland Geological Survey.
Otway Basin	with the South Australian Department of Mines and Energy and the Geological Survey of Victoria.

During 1991/92, for the mineral province projects, emphasis will be placed on building the airborne geophysical database using contract services as well as the Bureau's own aircraft. Field party activity generally will be at a somewhat lower level than last year to provide resources for analysis and publication of information resulting from the extensive 1990/91 field effort. A high level of activity is being maintained in the sedimentary basin projects in the Eastern Australian and Canning Basins while a new project is being commenced in the Otway Basin with a test program for a proposed seismic survey. The basin studies component of the Officer Basin project is proceeding, however, the seismic transect through the Basin has been placed on hold pending resolution of land access issues.

The Accord is succeeding in its aims of developing a high level of cooperative activity. The process of developing formal agreements between the Accord partners is still continuing.

Continental Margins Program

The Continental Margins Program (also referred to as the Offshore Sedimentary Basins Program) is the offshore parallel of the National Geoscience Mapping Accord. Like the Accord, it is a major strategic research undertaking aimed at developing a geological understanding of a significant portion of the earth's global area—the offshore areas under Australia's control are similar in area to the Australian continental landmass which is around 5% of the total global landmass area. Unlike the Accord, the Program operates in an area of Commonwealth jurisdiction and is not complemented by major State/Territory efforts.

The principal aims of the Program are to promote offshore petroleum and mineral development and to provide advice to the Government on offshore resource development. A secondary but important aim is to collect data in key areas of the Australian margin which provide insights into past environments—

this is of very great interest in relation to issues of global climate and sea level change, as well as for petroleum exploration models.

The research platform for this Program is the research vessel *Rig Seismic*. During recent years a very substantial effort has been put into bringing the data acquisition and processing systems up to 'state of the art' standard. The operating requirements of the new systems, together with the effect of attrition of the Program's resource base through application of the Government's annual 'efficiency dividend' funding reduction, has led to the need to reduce the number of appropriation-funded research cruises each year from six to five.

The Bureau is taking steps to supplement the Program and increase the utilisation of the *Rig Seismic* through attracting external funding for cruises. In 1991/92, the ship will be carrying out a cruise in the Philippines funded by the Australian International Development Assistance Bureau (AIDAB). It will also be undertaking a cruise jointly funded with the Japanese National Oil Company examining the sub-tropical and temperate marine carbonate systems of the southern Great Barrier Reef and northern New South Wales Margin. These are modern day analogs of ancient systems which in other locations are of exploration interest.

Environment and Groundwater

These programs of strategic research are largely concerned with providing the information base required to address issues of resource development and use. In the case of the Groundwater Program, understanding the hydrogeology of the Murray-Darling Basin is a necessary prerequisite to developing effective strategies to combat the Basin's salinity problems.

The Environmental Geoscience Program is still in a developmental stage. Resources have been reallocated to this Program from other Programs in 1991/92 resulting in an expanded range of activities, including participation in the newly formed Cooperative Research Centre on the Antarctic and Southern Ocean Environment.

A start is expected in 1991/92 on the Cape York Land Use Study as part of which the Bureau will be conducting a study of the coastal zone in cooperation with other State and Commonwealth agencies. Work is continuing on developing and seeking collaborative funding for other projects on the coastal zone, on climatic variation in the recent geological past and on geological aspects of land degradation studies. A new project dealing with mapping of natural hazards in the Australian region has been endorsed by the Australian Coordinating Committee for the International Decade of Natural Disaster Reduction.

A very positive feature of the development of the Environmental Geoscience Program is the establishment of new cooperative links with other departments and agencies at Commonwealth and State level. Of particular note is the collaboration with CSIRO in the land degradation area, with the Commonwealth Department of Arts, Sport, the Environment, Tourism and Territories in relation to the Cape York Land Use Study and coastal studies generally, the Australian National Parks and Wildlife Service in relation to work on the geology of national parks, and State and Territory environment, forestry, land and soil conservation agencies.

National Geoscience Databases

The Bureau disseminates the results of its research in a wide range of media which includes maps, publications and oral presentations. Increasingly it is moving to make information available in electronic form taking advantage of the computer based systems on which its data is captured, processed, stored and manipulated for analysis.

As well as making its own data accessible in electronically readable form, the Bureau has a considerable interest in acquiring similar data from other agencies, particularly its State counterparts. It provides leadership in this area through the operation of the Government Geoscience Database Policy Advisory Committee. Through the National Resource Information Centre (NRIC), which is a joint venture of this

Bureau and the Bureau of Rural Resources, leadership is provided also in the integration of large spatial datasets and in their application in addressing resource management issues.

Developments in 1991/92 for NRIC include the expansion of the national directory of natural resources data based on the FINDAR software package and the development and application of Geographic Information System (GIS) technology to address resource management issues at regional and continental scale.

A directory of the Bureau's databases is provided at page 170. It includes reference to the Bureau's library which holds Australia's premier geoscientific collection and is accessible to, and widely used by, the geoscience community.

Developments within Bureau program areas include the establishment of a National Petroleum Database incorporating an archival mass storage system for Bureau and industry petroleum data. This system will be linked to the existing PEDIN database of exploration and development drilling information. Information resulting from National Geoscience Mapping Accord projects will increasingly be available in electronic media form. As an example, complete digital graphical databases and geological maps are planned to be completed during 1991/92 for five 1:100 000 scale map sheet areas in the Eastern Goldfields province of Western Australia.

Assessments

The Bureau has had a long-standing role in the assessment of mineral and petroleum resources as a source of advice and information for the Government, industry and the public. An example of this is the Bureau's work as a consultant to the Resource Assessment Commission for the Kakadu enquiry. Resource assessments are conducted by the Minerals and Petroleum Resource Assessment Branches. Both Branches are undergoing major evaluations during 1991/92 with a likely outcome being greater integration with the Bureau's related research programs.

Much of the Bureau's research also provides information which is relevant to the assessment of the environmental impact of resource development and use. Examples such as marine research relevant to climate change, and coastal zone research relevant to the Cape York Land Use study have been mentioned above. The Bureau also makes scientific input to policy development on these issues. An example is its extensive contribution to the work of the Government's Working Groups on Ecologically Sustainable Development.

Allocation of Resources

The Bureau's appropriation in the 1991/92 Budget is $57.6 m. Correcting for special items (new building design $3.2 m, redundancy scheme $0.5 m), gives a base program funding amount of $53.9 m which includes salaries, operating expenses, property operating expenses, plant and equipment and major works. Although this is nominally close to the 1990/91 figure of $54 m it is in effect some $1.5 m less as this year's figure includes that amount for property costs which were previously met by the Department of Administrative Services. The planned average staffing level is 539 compared to an outcome of 569 in 1990/91.

Page xxii provides a summary of the Bureau's expenditure by program area incorporating all overheads. Pages xxiii–xxv show the same information in pie chart form. Direct project running costs (salaries and operating expenses) are shown in the Work Program text.

The Bureau is committed to the whole range of its programs. It has responded to the need to allocate additional resources to those programs of highest priority i.e. the National Geoscience Mapping Accord, the Continental Margins Program and Environmental Geoscience while maintaining other programs at minimum resource levels adequate to meet national needs.

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

ORGANISATIONAL STRUCTURE

BMR GEOLOGY AND GEOPHYSICS AUSTRALIA

CORPORATE MANAGEMENT (BMR EXECUTIVE) | CORPORATE SUPPORT & SERVICES | PROGRAM MANAGEMENT

EXECUTIVE DIRECTOR
Prof RWR Rutland

ADVISORY COUNCIL

Associate Director
Dr N Williams

- Information Systems Branch
  Mr D Berman
- NRIC
  Dr R Bradbury
- Cartographic Services Unit
  Mr J Hillier

MINERALS & ENVIRONMENT GROUP

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  Dr L Jaques
- Minerals Resource Assessment
  Mr G Battey
- Environmental Geoscience
  Dr EM Truswell A/g
- Groundwater
  Mr WR Evans A/g
- Geophysical Observatories & Mapping
  Dr D Denham

Associate Director
Dr DA Falvey

- International Programs Unit
  Vacant
- Engineering Services Unit
  Mr GC Feasey

PETROLEUM & MARINE GEOSCIENCE GROUP

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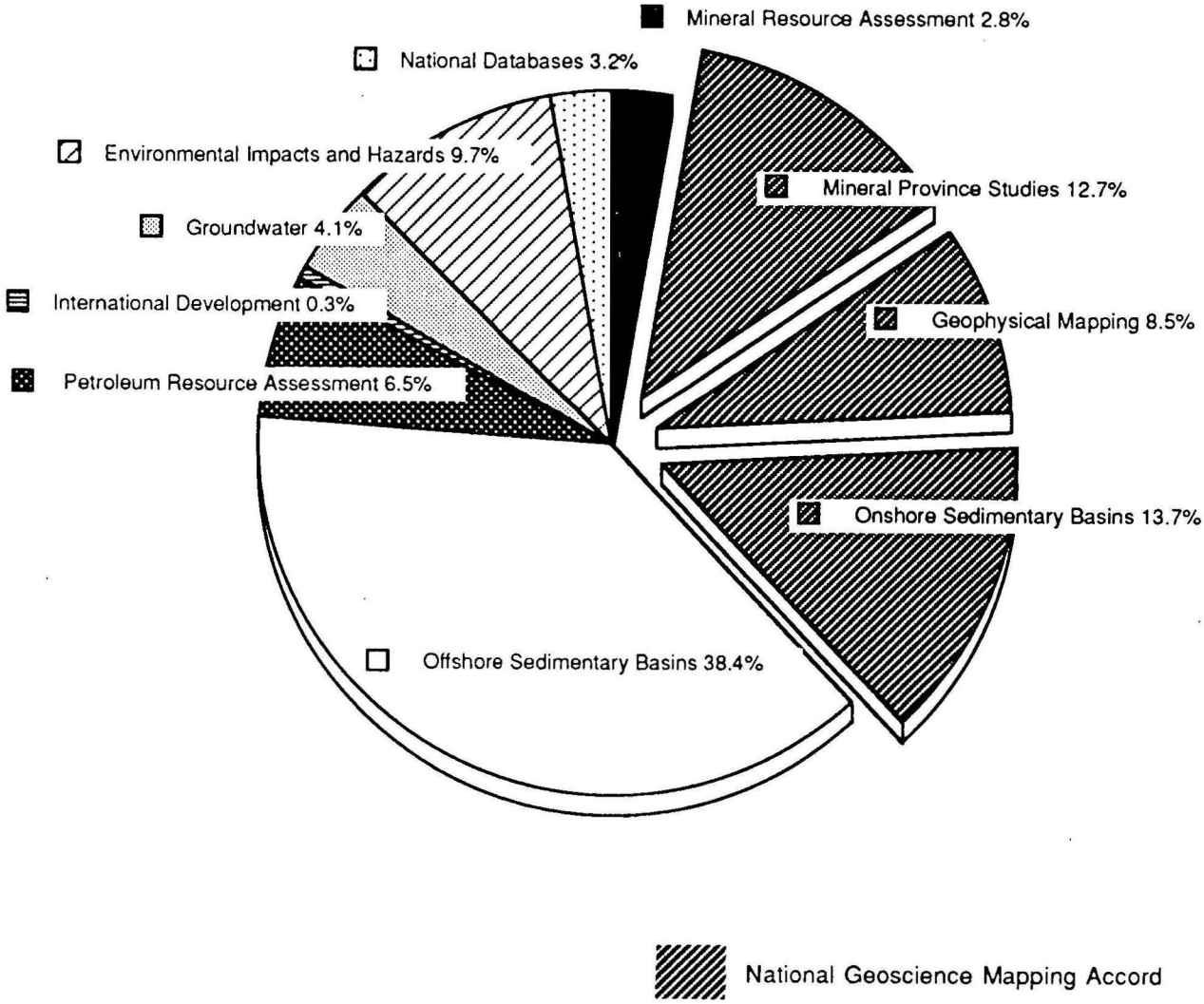
- Onshore Sedimentary & Petroleum Geology
  Dr J Shergold A/g
- Petroleum Resource Assessment
  Dr PE Williamson

- Business Management Branch
  Mr J Cahill
- Corporate Relations, Information & Planning Branch
  Mr M Lee

PLANNED SCIENTIFIC PROGRAM 1991/92

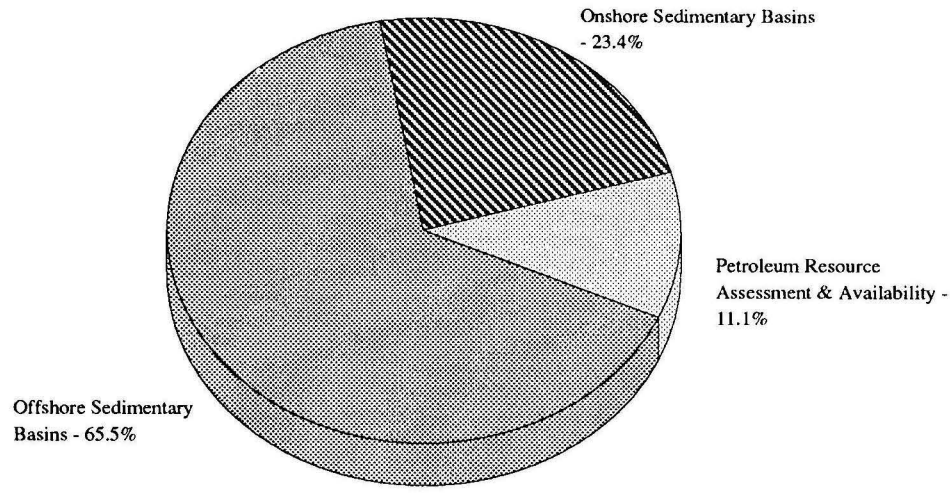
PETROLEUM		
Onshore Sedimentary Basins	7.4	(5.5)*
Petroleum Resource Assessment and Availability	3.5	
Continental Margins	20.7	
	31.6	
MINERALS AND LAND USE		
Geophysical Mapping	4.6	(4.2)*
Mineral Province Studies	6.8	(6.4)*
Mineral Resource Assessment and Availability	1.5	
	12.9	
GROUNDWATER		
Groundwater Research and Assessment	2.2	
	2.2	
ENVIRONMENTAL IMPACTS AND HAZARDS		
Earthquake Seismology	1.1	
Monitoring of Nuclear Explosions	1.3	
Environmental Geoscience	1.1	
Geomagnetism	1.8	
	5.2	
NATIONAL DATABASES		
Database Coordination and Research	0.4	
NRIC	1.3	
	1.7	
INTERNATIONAL DEVELOPMENT ASSISTANCE AND COOPERATION		
Overseas Basins (largely funded externally) }	0.1	
International Agreements/Project Coordination }		
	0.1	
TOTAL	**53.9**	

* Planned expenditure on projects forming part of the National Geoscience Mapping Accord

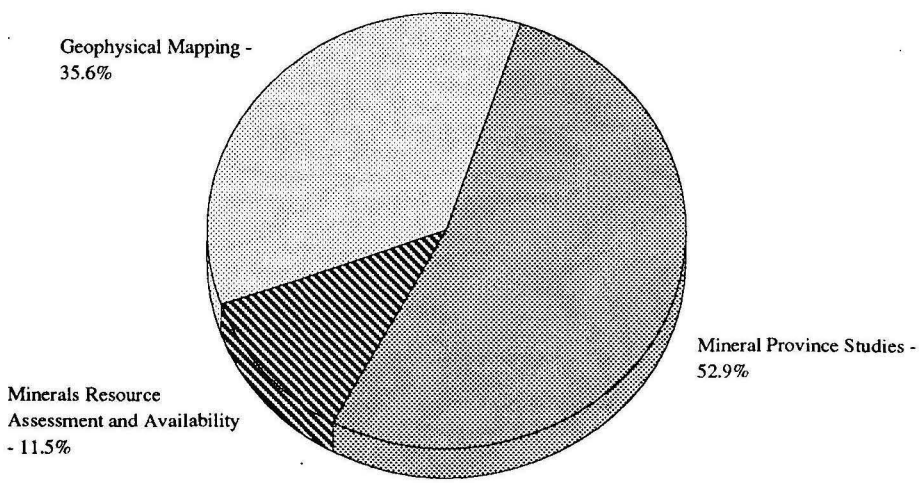

Mineral Resource Assessment 2.8%
National Databases 3.2%
Environmental Impacts and Hazards 9.7%
Mineral Province Studies 12.7%
Groundwater 4.1%
International Development 0.3%
Geophysical Mapping 8.5%
Petroleum Resource Assessment 6.5%
Onshore Sedimentary Basins 13.7%
Offshore Sedimentary Basins 38.4%
National Geoscience Mapping Accord

PLANNED RESOURCE USE BY KEY RESULT AREA

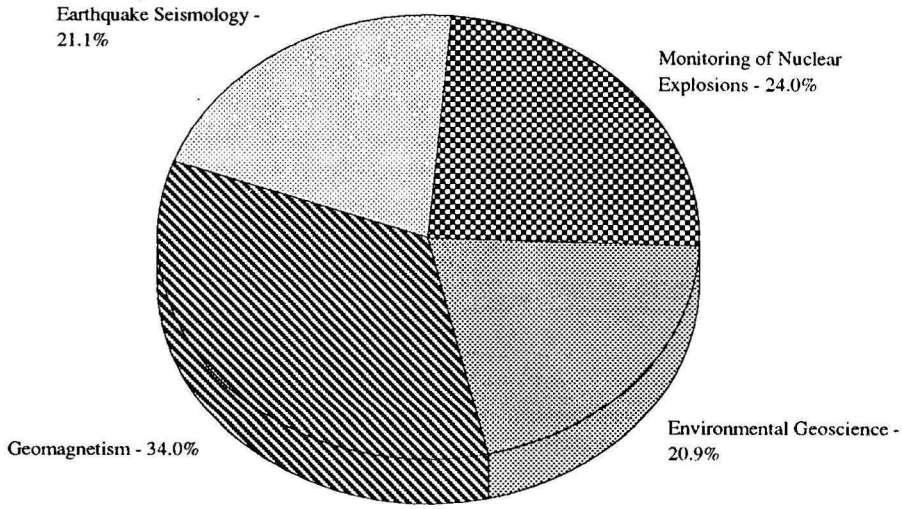
PETROLEUM - $31.6 million



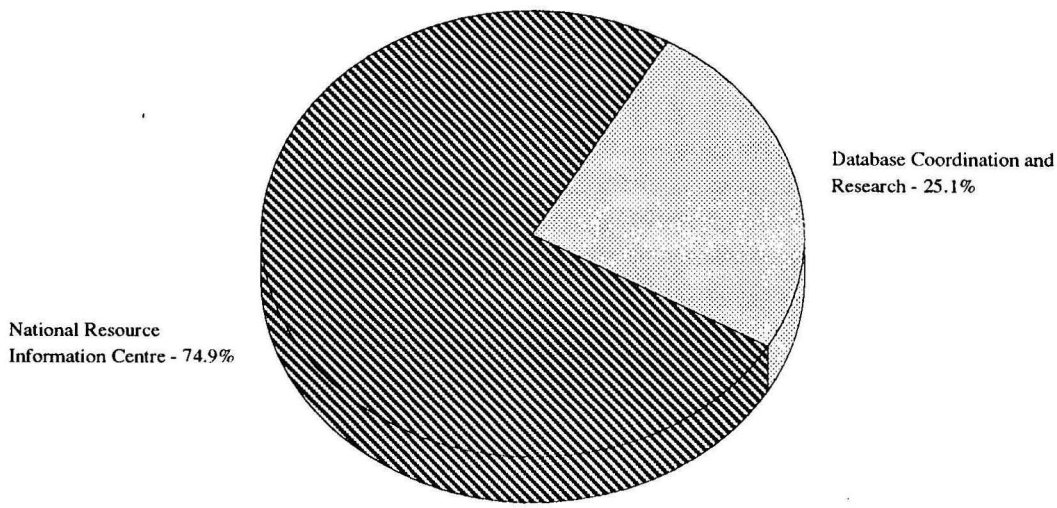
MINERALS AND LAND USE - $12.9 million



ENVIRONMENTAL IMPACTS AND HAZARDS - $5.2 million



NATIONAL DATABASES - $1.7 million



GROUNDWATER - $2.2 million

INTERNATIONAL DEVELOPMENT ASSISTANCE AND COOPERATION - $0.1 million

LOCALITY INDEX

LOCALITY		PROJECTS
1.	Perth Basin	121.14
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3.	Musgrave Block	211.14, 212.02
4.	Pilbara Block	211.04
5.	Southern NW Shelf, (offshore Canning Basin)	121.17
6.	Northern Exmouth Plateau, (offshore Canning Basin)	121.23
7.	Barrow–Dampier sub-Basin	121.18
8.	Canning Basin (onshore)	112.04, 230.01
9.	Halls Creek Province	211.12
10.	Vulcan Graben, Cartier Trough	121.19
11.	Bonaparte Basin (offshore)	121.22
12.	Carpentaria/Karumba/Laura Basin	211.09, 212.01, 212.02
13.	South Alligator River Conservation Zone	211.06
14.	McArthur Basin	211.11
15.	Tennant Creek Block	211.11
16.	The Granites–Tanami Block	211.12
17.	Coen Inlier	221.01
18.	Arunta Block	211.12
19.	Money Shoal/Arafura Basin	121.24
20.	Cape York/Omomo Inlier	211.09, 212.01, 212.02, 252.8.7
21.	Bulgonunna–Silver Hills Volcanic Province	221.02
22.	Townsville Trough	121.11
23.	Maryborough Basin	121.21
24.	Bowen Basin	112.05
25.	Great Artesian Basin	241.02
26.	Surat Basin	112.05
27.	Georgetown Block	211.09, 212.01, 212.02
28.	Gunnedah Basin	112.05
29.	Yambo Block	211.09, 212.01, 212.02
30.	Kanmantoo Fold Belt	112.06, 211.13
31.	Lachlan Fold Belt	112.06, 211.13, 221.01
32.	Murray–Darling Basin	241.01, 252.8.6
33.	Gippsland Basin	121.10, 121.12, 121.20
34.	Bass Basin	121.12, 121.20
35.	Otway Basin	112.09, 121.20
36.	West Tasmanian Margin	121.13
37.	Tasmania Basin	121.13
38.	Great Australian Bight	121.08, 121.27
39.	Officer Basin	112.07
40.	Eucla Basin	112.07
41.	Western Exmouth Plateau	121.25, 121.26
42.	Wallaby Plateau	121.25, 121.26
43.	Scott Plateau	121.25, 121.26
44.	Hodgkinson Fold Belt	211.09, 212.01, 212.02
45.	Ceduna sub-Basin	121.28
46.	Southern Great Barrier Reef/Northern NSW Margin	121.29
47.	Eastern Arafura Sea Basin	121.31

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

Recent onshore petroleum exploration has been confined to relatively few areas of perceived higher prospectivity and with established infrastructure. In the longer term, it will be necessary to encourage exploration in less well explored basins in order to maximise Australia's self sufficiency.

The Onshore Sedimentary Basins research program is part of the National Geoscience Mapping Accord (NGMA). It is not feasible to study all onshore basins in the short term, so the strategy is to study the major basins under the NGMA, supported by continent wide and regional studies of geological events and sedimentary sequences that transcend individual basin boundaries. This will enable the ongoing assessment and evaluation of the basins not under immediate study.

The regional studies have been developed in consultation with industry. In particular, Palaeogeographic Studies have been sponsored by up to 20 national and international petroleum companies through APIRA (Petroleum Division of the Australian Minerals Industry Research Association).

Output will be in the form of a range of geographically located datasets, maps and publications related to the formation of fossil fuels and the age and evolutionary history of major sedimentary sequences.

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 using available public and industry data.

Collect and analyse new seismic and drilling data.

Highlights for 1990/91

Completed processing and interpretation of 254 kms of deep seismic reflection data from the Bowen Basin.

Acquired a further 253 kms of deep seismic reflection data from the Gunnedah Basin.

Completed processing and initial interpretation of 640 kms of deep seismic reflection data from the Canning Basin.

Also completed for the Canning are:

- a detailed sequence stratigraphic analysis and interpretation of shallow seismic and wells in the north west Lennard Shelf
- studies of basin brines and geochemistry of base metal mineralisation
- detailed biostratigraphic analysis of four critical wells (Meda #1, Meda #2, Blackstone #1 and May River #1).

Initiated the Officer Basin Project, an NGMA joint project with the South Australian Department of Mines and Energy.

Published 'Australia: Evolution of a Continent', a full colour book designed for the popular market to make the public aware of the palaeogeographic history of Australia; produced an educational videotape and 35 mm slide package developed from it.

Reassessed the petroleum potential of the Arafura Basin, required as a result of production of regional cross sections and first Palaeozoic palaeontological dating from wells; presented results at APEA 1990.

Successfully integrated geochronology and magneto-stratigraphy with biochronology at the Devonian–Carboniferous and Cambrian–Ordovician boundaries respectively.

Published Cambrian, Ordovician, Silurian, Devonian, Permian, Triassic, Jurassic and Cretaceous biostratigraphic charts and explanatory notes.

Produced a catalog of the Brachiopoda housed in the Commonwealth Palaeontological Collection.

Initiated ORGCHEM, an Oracle relational database containing more than 20 k records of organic geochemical data used in petroleum source rock evaluation; retrieval of information through ORGCHEM or PEDIN.

Identified a new family of fossil steranes, the 3-ethyl steranes, by rigorous organic synthesis; the origin of petroporphyrins in sediments and oils has been further delineated by the use of carbon–13 isotopic composition of individual porphyrins; collaborative research on the origin of numerous stranded bitumens along the shorelines of northern and southern Australia has been aided by the use of age and environment specific molecular fossils.

Successfully presented results and products at national and international meetings (3rd International Cambrian Symposium, Novosibirsk; ICOG 7; GSA/ASEG; APEA; AAPG, Dallas).

Successfully organised BMR program workshops and courses (e.g. Amadeus Basin Workshop, Sequence Stratigraphy Workshop, Clarence Moreton Workshop).

Installed PETROSEIS.

Goals for 1991/92

Complete Project 111.02 'Phanerozoic geohistory of Australia' with publication of final report in 1992.

Initiate new Project 'Australian Petroleum Systems' using the time slice approach and palaeogeographic analysis to allow the prediction of the behaviour of 'Petroleum Systems'; to be sponsored through APIRA.

Revise biostratigraphic time scale with emphasis on those parts of relevance to basin studies; increased emphasis on late Palaeozoic and correlation with absolute time scale.

Apply new correlation techniques using the new stable isotope ratio mass spectrometer studies of source rocks and oils in relation to depositional environment and oil–oil and oil–source correlations with particular emphasis on application of biomarkers and isotopic signatures on gases and condensates; initial emphasis will be on the Harriet and surrounding fields and coal gases.

Release first products from integrated studies of the geology, geological evolution and occurrence and origin of fossil fuel in the Canning Basin (Western Australia) and in the Bowen, Surat and Gunnedah Basins (East Australian Basins) and Officer Basin (South Australia).

Collect new seismic data in the Officer Basin.

Complete Project 112.06 'Tectonic map of the Tasman Fold Belt System'.

Initiate new Project 'National Petroleum Maps' to develop a national series of maps at 1:2.5 M scale illustrating sedimentary basins and structure and petroleum habitat.

ONSHORE SEDIMENTARY BASINS

Component Leader John Shergold (06) 249 9397

Component Projects

111.02	Phanerozoic geohistory of Australia
111.02B	Australian Petroleum Systems
111.03	Chronology of sedimentary sequences
111.04	Controls on oil and source bed occurrence
112.04	Canning Basin
112.05	Eastern Australian Basins
112.06	Tectonic Map Tasman Fold Belt
112.07	Officer Basin
112.08	National Petroleum Maps
112.09	Early Development of the Otway Basin

Component Resources

Project	Average staffing levels				Finances $k		
No	Research	Technical	Other	**Total**	Salary	Operations	**Total**
111.02	1.4	3.3	0.2	4.8	50	76	126
111.03	6.3	3.0	0.3	9.6	400	57	457
111.04	3.7	4.5	0.3	8.5	336	211	547
112.04	8.4	2.0	0.4	10.8	455	99	554
112.05	8.4	1.5	0.3	10.2	447	94	540
112.06	0.3			0.3	14	25	39
112.07	2.2	0.5	0.1	2.8	129	63	192
112.08	0.8			0.9	39	7	45
112.09	5.1	7.7	0.4	13.3	618	1240	1858
Total	**36.8**	**22.5**	**2.0**	**61.2**	**2487**	**1873**	**4360**
Engineering support staff				5.6			187
Cartographic support staff				7.8			373
TOTAL				**74.6**			**4920**

Project 111.02A Phanerozoic geohistory of Australia

Project Leader	Marita Bradshaw (06) 249 9452
Program Responsibility	Onshore Sedimentary and Petroleum Geology
Timeframe	1988–1991

Objectives

Provide information crucial for the conceptual analysis of sedimentary sequences for potential oil and gas plays and mineral occurrences.

Relevance

Palaeogeographic and lithological data maps and stratigraphic correlation charts are crucial for the conceptual analysis of sedimentary sequences for potential oil and gas plays and mineral occurrences. The products are being used by sponsor companies in petroleum and mineral exploration.

Expected Outcomes

An integrated palaeogeographic and plate tectonic history of the Australian Plate from early Mesozoic to the present.

Updated Phanerozoic palaeogeography of the Australian continent with cross sections showing time slice behaviour in the third dimension.

Improved basis for petroleum analysis at the regional scale.

Activities

Construct palinspastic interpretive palaeogeographic maps and data maps for approximately fifteen Phanerozoic time slices and stratigraphic correlation charts and structure maps.

Illustrate structural and time slice relationships through cross sections.

Maintain and update current palaeo-geographic maps.

Extend the maps to the edge of the Australian Plate using palinspastically reconstructed bases.

Supplement the maps with regional structural cross sections and other compilations.

Expected Products

A folio consisting of data, palaeogeographic and tectonic maps, regional structural cross sections and fission track and subsidence plots for the Australian Plate, from the Permo-Carboniferous to the Quaternary; this package will provide a synthesis of Australian geology in its plate tectonic context.

Revised radiometric and biostratigraphic time scale for Australia correlated with other regional biostratigraphies.

An inundation curve for Australia.

Database of time controlled lithologic and palaeoenvironmental information for the areas of the Australian Plate.

Highlights for 1990/91

Geological information has been compiled for areas of the Australian Plate external to Australia, including eastern Indonesia, Papua New Guinea, New Zealand, the south west Pacific and the Indian Ocean. This information has been presented in summary stratigraphic columns and data maps have been prepared for a number of areas for Cainozoic and Mesozoic time slices.

Eleven regional cross sections have been completed covering areas in northern, western and southern Australia. The cross sections and their accompanying notes are being produced as BMR Records.

The palaeogeographic and data maps from the initial BMR–APIRA Palaeogeographic Maps Project (111.01) have been updated with seismic data interpreted during production of the cross sections.

A computer database of fission track ages was compiled with the assistance of Professor Gleadow of La Trobe University and the data presented in a series of time slice maps. The maps produced in the initial BMR–APIRA Palaeogeographic Maps Project (111.01) have been published with accompanying text in a full colour book for the popular market 'Australia: evolution of a continent.'

Goals for 1991/92

Construct revised palinspastic map bases using computer software and plot the final palaeogeographic and tectonic maps on these bases.

Prepare final report to sponsors by October 1991 with publication in 1992.

Clients

AGL Petroleum

Amoco Production Company

Arco Oil and Gas Company

BHP Petroleum

British Petroleum

Bridge Oil Ltd

Canadian Occidental Petroleum

Chevron Exploration Company

Comalco Aluminium Ltd

Delhi Petroleum

Esso Australia Ltd

Japan National Oil Corporation

Marathon Petroleum Australia Ltd

Mobil New Exploration Ventures Company

Pacific Oil and Gas Pty Ltd

Conoco Inc

The Shell Company of Australia Ltd

Texaco Oil Development Company

Union Texas Company

Cooperating Organisations

APIRA (the Petroleum Division of the Australian Mineral Industry Research Association)

Professor Gleadow, La Trobe University

State Geological Surveys

Geological Surveys of PNG, NZ and Indonesia

JT Parrish, University of Arizona

MI Ross, Rice University, Houston

R Langford, BHP/Utah

Project 111.02B Australian Petroleum Systems

Project Leader	Marita Bradshaw (06) 249 9452
Program Responsibility	Onshore Sedimentary and Petroleum Geology
Timeframe	January 1992–1995

Objectives

Analyse the palaeogeographic controls on petroleum source rock and reservoir distribution and burial history in a number of Australian basins.

Relevance

Australian Petroleum Systems is a cooperative research project between the BMR and APIRA, the Petroleum Division of the Australian Mineral Industries Research Association.

From the work of the BMR–APIRA Palaeogeographic Maps and Phanerozoic History projects, Australia's Phanerozoic sedimentary sequences can be divided into six systems, all prospective for hydrocarbons. Establishing this framework stresses the linkages between coeval basins of similar:

- palaeogeographic and tectonic setting
- reservoir, seal and source facies
- trap formation and maturation histories
- hydrocarbon prospectivity.

The project will have a modular structure based on individual basin areas within a Petroleum System. The choice of basins for the study has been developed with consideration of the planned timetable of acreage releases outlined in the Government's Offshore Strategy document.

Activities

The understanding of time slice palaeogeography and how it affects factors controlling petroleum occurrence will remain the key. All maps and compilations will relate back to the biostratigraphically controlled time slice palaeogeographies. In this way, the correspondences between the basins in a petroleum system will be apparent and knowledge of more explored areas can be used predictively in frontier areas.

The project will produce convenient compilations of basic data in a computer database format which will be cross referenced to PEDIN.

Depending on complexity, individual modules will be completed over a four to nine month period, two modules will be in compilation concurrently and a total of nine to twelve are planned over the three year life of the project.

Expected Products

List of Products for each basin module

- regional location map
- well location and hydrocarbon occurrence map
- regional cross sections including orthorhombic diagrams, generalised structural element and sub-crop maps
- interpreted and uninterpreted representative seismic lines
- summary stratigraphic column tabulating reservoir, source and hydrocarbon show information by time slice
- time slice data maps compiled from well, seismic and outcrop information, showing lithology, thickness, depth to top of time slice, reservoir and source parameters and hydrocarbon occurrence information
- time slice interpretation maps showing depositional environments and isopachs overlain on regional structure
- time slice 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 time slices 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
  - time slice picks
- maturation profiles along regional cross sections.

Goals for 1991/92

Complete studies for initial one or two modules.

Clients

Industry sponsors yet to be determined.

Cooperating Organisations

APIRA (Petroleum Division of the Australian Mineral Industry Research Association)

State Geological Surveys

Project 111.03 Phanerozoic Timescales

Project Leader	John Shergold (06) 249 9410
Program Responsibility	Onshore Sedimentary and Petroleum Geology Program
Timeframe	1983–Ongoing

Objectives

Develop a chronological framework for Australian sedimentary sequences using palaeontological techniques.

Apply the time framework to the solution of geological problems.

Relevance

Biostratigraphic studies and their accompanying taxonomic 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, to provide a framework for continent wide studies of Australian earth history.

Project personnel apply the biochronological 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 Outcomes

An improved Australian Phanerozoic Time Scale.

Activities

Integrate data from geochronology and palaeomagnetism into the biostratigraphic framework.

Manage the national fossil collections and database as a resource for biochronology.

Expected Products

Produce biostratigraphic charts and explanatory notes for all Australian Phanerozoic Systems in published and database form.

Provide Phanerozoic geochronological resources to facilitate the integration and calibration of biochronological and radiometric time scales.

Reviews of the palaeontology of the Canning and eastern Australian Basins.

Catalogues of fossils held in national collections.

Scientific papers, bulletins.

Highlights for 1990/91

Successfully completed and reported a pilot study to integrate zircon geochronology (SHRIMP technology) and biochronology at the Devonian–Carboniferous boundary in Eastern Australia.

Completed and published Cambrian, Ordovician, Silurian, Devonian, Triassic, Jurassic and Cretaceous biostratigraphic charts and explanatory notes representing reviews of the Australian Phanerozoic time scale (BMR Records 1989/31–34, 37–39); Permian time scale in press.

Integrated magneto-stratigraphy with conodont biochronology across the Cambrian–Ordovician boundary in the Georgina Basin.

Integrated palynostratigraphy, magneto-stratigraphy and radiometric dating in the Cretaceous of the Otway Basin for the refinement of time scales.

Recognised Early Palaeozoic source rock potential in the Arafura Basin from

determinations of Cambrian and Ordovician fossils and implications of their ages.

Produced summaries of biostratigraphic sequences in Canning Basin wells Meda #1, Meda #2, Blackstone #1, May River #1 (Professional Opinions 1990/002–004, 1991/001).

Goals for 1991/92

Provide dates on those parts of the Phanerozoic column where biostratigraphic correlation with international time scales is weakest.

Set up a database designed to relate published radiometric dates to the biostratigraphic time scales.

Calibrate magneto-stratigraphy as appropriate.

Strengthen management in the area of the national fossil database.

Assess sites in the Phanerozoic of eastern Australia where ion probe techniques for SHRIMP dating can be integrated with biostratigraphy (continuing assessment).

Develop a preliminary Australian Phanerozoic time scale based on radiometric magneto-stratigraphic and biostratigraphic determinations (mid 1992).

Produce biostratigraphic charts and notes for Australian Phanerozoic systems with exception of Cainozoic (to be finalised by end 1991).

Revise Australian Phanerozoic Time scale (commencing mid 1991).

Produce fossil catalogues for Australian Vertebrata, Cnidaria, Archaeocyatha, Porifera and Bryozoa (end 1991).

Publish palaeontological papers supporting NGMA Projects in Australian basins.

Integrate magnetic reversal stratigraphy with biostratigraphy in the Australian Early Palaeozoic and Cainozoic (Cambrian–Ordovician pilot study to be reported end 1991).

Investigate possibilities to develop Ordovician and Devonian micro-vertebrate biostratigraphy (end 1991).

Investigate potential for development of integration of early Palaeozoic palyno-floral and macro-faunal zonations in relation to proposed sub-surface Willara Sub-Basin analysis (1992).

Clients

Explorationists in the Australian minerals and petroleum exploration industries

Working palaeontologists and stratigraphers

Cooperating Organisations

All State Geological Surveys

Geological Survey of Papua New Guinea

Geological Survey of New Zealand

Australian National University

Monash University

Melbourne University

Macquarie University

University of Queensland

University of Tasmania

Sydney University

University of Western Australia

Newcastle University

South Australian Institute of Technology

University of Canberra

Australian Museum

Queensland Museum

Project 111.04 Controls on oil source bed occurrence

Project Leader	Roger Summons (06) 249 9515
Program Responsibility	Onshore Sedimentary and Petroleum Geology
Timeframe	1987–1993

Objectives

Develop an understanding of the controls on formation, degradation and preservation of hydrocarbon prone organic matter with particular emphasis on Australian exploration objectives and on the essential role of microbes in organic matter production.

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

Relevance

Understanding the distribution and control on source rock composition and their derived oils is fundamental information for the determination of petroleum prospectivity. Through analyses of source rocks, oils, gases and their parent organic matter, the project is developing conceptual models to assist in petroleum exploration.

At the same time, a database of analyses is being established that is suitable for the exploration industry. Individual priorities are determined by requirements of current basin analysis projects, both onshore and offshore, and industry requirements.

Expected Outcomes

An improved understanding of the source and maturity controls on oil occurrence and composition in Australia.

Activities

Characterise Australian oils and source beds.

Identify new biomarkers and develop new correlation and analytical techniques.

Determine molecular parameters for key sediment and oil samples and apply to maturation modelling in current basin studies.

Prepare reports and data releases on related topics.

Chemically identify and study the distributions of new biomarkers including porphyrins, plant terpenoids and bacterial triterpenes.

Study the lipid and isotopic compositions of cultured strains of geochemically significant microbes; present subjects of study are Gymnodinium catenatum, a marine dinoflagellate, and some Type I and Type II methanotrophic bacteria.

Expected Products

Database of oil and source rock characteristics.

Comprehensive volume describing hydrocarbon distribution characteristics of principal source horizons in relation to palaeogeography.

Research papers.

Goals for 1991/92

Continue data acquisition for currently available Western Australia oils and source rocks; group according to signatures and examine for consistency in source related and age related biomarkers.

Upgrade our data on selected Cooper Basin oils for comparison with age equivalent Bowen and Surat oils.

Maintain the currency of the ORGCHEM database; our compilation of 24 000 new records is complete.

Undertake collaborative studies of the isotopic compositions of wet gas and coal gas components to determine their value for gas source correlations.

Collaborate on studies of the composition of coastal bitumens.

Clients

Australian Petroleum Industry

Cooperating Organisations

Oil companies on an opportunity basis presently:

- Western Mining Corporation
- Chevron Overseas Petroleum
- Hadson
- Phillips
- Pacific Oil and Gas
- BHP Collieries

CSIRO (Volkman, Nichols, Division of Oceanography, Hobart)

A Hutton, Wollongong University (Geology)

R Capon, Melbourne University (Chemistry)

D McKirdy, Adelaide University (Geology)

R Alexander, Curtin University (Applied Chemistry)

Project 112.04 Canning Basin Mapping Accord Project

Project Leader	Jim Jackson (06) 249 9205
Program Responsibility	Onshore Sedimentary and Petroleum Geology
Timeframe	1987–1992

Objectives

Undertake an integrated basin analysis of the Canning Basin.

Improve the knowledge of the setting and structural and stratigraphic evolution of the Basin and its fluids.

Provide a uniform data set to enhance exploration strategy.

Relevance

Hydrocarbons, base metal mineralisation and evaporites have been discovered within the Basin and exploited to a small extent but many assessments of prospectivity suggest that the Basin has not realised its potential.

The project is being undertaken under the National Geoscience Mapping Accord in co-operation with the Geological Survey of Western Australia. This project will be co-ordinated with project 121.17 which will study the offshore Canning Basin.

Expected Outcomes

An up to date synthesis of the regional petroleum geology of the Canning Basin, and identification of new play concepts.

Activities

Compile, analyse and synthesise company data obtained largely after 1974 (date of previous BMR basin review) and supplement it with new BMR deep seismic profiling.

Undertake an integrated basin analysis and display data in maps at 1:250 k and 1:1 M scale; relate these analyses to potential hydrocarbon occurrences as a basis for future exploration and assessment of resources.

Analyse fluid flow in the Basin to help define the source and pathways of brines associated with hydrocarbons and metals.

Expected Products

Map folio (1:1 M and larger scales) of various stratigraphic, structural and geochemical features.

Digital databases and folios of well and seismic information.

Initial reports as BMR Records and interim maps of selected areas, followed by a comprehensive volume.

Research papers.

Highlights for 1990/91

Completed processing and initial interpretation of BMR deep seismic; this provided significantly revised models for structural style and evolution of the Basin to form a basis for further exploration.

Completed detailed sequence stratigraphic interpretation of shallower company seismic and wells in north west Lennard Shelf; revised stratigraphy enables more accurate predictions for exploration drilling and has identified untested petroleum plays off the shelf margin which enhances petroleum prospectivity of Basin.

Completed studies of Basin brines and geochemistry of base metal mineralisation, the results of which assist in exploration strategies.

Goals for 1991/92

Enhance exploration programs and identify new play concepts by extending sequence stratigraphic interpretation of company shallow seismic and BMR deep seismic from north west Lennard Shelf across Fitzroy Trough onto Broome arch and into Willara Sub-Basin; products include structure contour maps (1:100k or 1:250k) of north west Fitzroy Trough and Jugurra Terrace (end 1991), similar maps of West Broome Arch–Willara Sub-Basin (late 1992); folio of summary review sheets of critical wells (about 20 wells from each area).

Further refinement of composition of structurally different sub-basins by extending structural and tectonic interpretations out from BMR deep seismic lines; products include structural elements map of Lennard Shelf at 1:250 k or 1:1 M (mid 1991); similar map of Fitzroy Trough (mid 1992); 1:1 M. Basin wide structural elements map (late 1992); Basin wide potential fields images at 1:1 M scale (late 1991); reports on K–Ar dating of deformation along northern margin of Basin (1991); major Basin faults (late 1991); Basin structural elements (mid 1992); balanced sections across Basin, with extension and subsidence models (with Lamont–Doherty and Australian National University input, mid 1992).

Compile and interpret regional aeromagnetic and gravity data.

Complete biostratigraphic review of open file palaeontological data; continue providing individual reviews of selected key wells in areas where sequence stratigraphic studies are concentrating; products include a record on biostratigraphic review (mid 1991), professional opinions of reviews of palaeontological information from key selected wells (ad hoc).

Study Ordovician macro-fossils and micro-fossils from Prices Creek area collected in 1990; establish Ordovician biostratigraphic control; products include review of stratigraphy of Ordovician in Prices Creek area (mid 1991); BMR Journal paper "Synthesis of Ordovician biostratigraphy of Canning Basin" (mid 1992).

Biostratigraphic review of published information on Devonian brachiopods, with an assessment of potential for further studies; product is a record (end 1991).

Compile, review and evaluate geochemical data and maturation information from source rocks in the Basin with particular emphasis on the Ordovician section; product is a BMR record (mid 1991) helpful in assessment of potential plays that might have been sourced from organic matter rich Ordovician sections.

Assess potential for new biostratigraphic studies of core material to refine age of Carribuddy and associated formations.

Clients

The Australian Petroleum Industry

Current and prospective lease holders in the Canning Basin

Cooperating Organisations

Geological Survey of Western Australia

N Christie-Blick, A Holmes, G Karner; Lamont Doherty Geological Observatory New York

J Braun, H McQueen; Australian National University

Current Leaseholders in the Canning Basin

Project 112.05 Eastern Australian Basins Mapping Accord Project

Project Leader	Russell Korsch (06) 249 9495
Program Responsibility	Onshore Sedimentary and Petroleum Geology
Timeframe	1989–199

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 Gunnedah and Bowen 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 spans the border between Queensland and New South Wales and there is a requirement to rationalise geological concepts across the border.

The project is being undertaken under the National Geoscience Mapping Accord in cooperation with the Queensland Department of Resource Industries and the Geological Survey of New South Wales.

Expected Outcomes

An up to date synthesis of the regional geological history of the Bowen, northern Gunnedah and Surat Basins with emphasis on the stratigraphic structural and petroleum geology.

Activities

Determine the structure and tectonic and thermal history.

Refine the absolute age of sedimentary sequences.

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.

Collect and analyse 500 kms of deep seismic data.

Undertake a refraction seismic survey.

Analyse maturation patterns and oil source correlations.

Display data in maps at 1:1 M scale.

Expected Products

Map folio (1:1 M and larger scales) of various stratigraphic, structural and geochemical features.

Digital database, especially of well and seismic information.

Initial reports as BMR Records and interim maps of selected areas, followed by a comprehensive volume.

Research papers.

Highlights for 1990/91

Major emphasis in 1990/91 involved the processing and geological interpretation of 254 kms of deep seismic reflection data from the Bowen Basin and the planning and acquisition of 253 kms of deep seismic reflection data from the Gunnedah Basin. The Bowen Basin seismic data were publicly released in September 1990.

In the Bowen Basin, the deformation in the sedimentary succession is seen to be controlled by east dipping listric thrust faults that root onto a major detachment dipping shallowly to the east.

Interpretation of industry seismic lines commenced in the Taroom area at the northern edge of the Surat Basin. Fourteen reflections have been identified initially, including horizons in both the Surat and Bowen Basins. The significance and continuity of the reflection events will be tested on a regional scale and sequence boundaries identified and mapped using sequence stratigraphic principles. Several of these reflections have been tied to petroleum exploration wells and correlate with known lithostratigraphic boundaries.

Seismic velocity interpretations of the New England Orogen highlight the differences between the crust and upper mantle of that orogen and the adjacent Lachlan and Thomson orogens underlying the Bowen–Gunnedah–Bowen Basin system, possibly pre-disposing the eastern basin boundary towards strike slip movements. Low upper mantle velocities under New England are attributed either to the process of geochemical differentiation which produced the I-type batholiths or to the extensional processes which led to the Tasman Sea Basin and the uplift of eastern Australia.

Reconnaissance field work in the Bowen, Gunnedah and Surat Basins has been undertaken to examine the sedimentology and stratigraphic relationships of relevant lithological formations, prior to the major focus on sub-surface interpretation.

Gas chromatography–mass spectrometric analysis of a set of 30 oils from the Bowen and Surat Basins has revealed two main families of oils distinguished by the presence or absence of specific marine biomarkers.

Goals for 1991/92

Continue seismic interpretation of a regional network of industry seismic lines.

Release folio of preliminary maps based on interpretation undertaken in 1990/91.

Preliminary processing of seismic data across the Gunnedah Basin; release of data to public; geological interpretation of the seismic data.

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

Collect seismic refraction data along Meandarra Gravity Ridge; interpret these data.

Complete interpretation of refraction data from the Nebine Ridge and New England Orogen.

Complete a detailed systematic palynological study of the Cranky Corner section, a key time control point in the eastern Australian Basins.

Commence kerogen assessment of palynological residues to determine organic maturity.

Complete an oil–oil and oil–source rock correlation study with particular emphasis on the Taroom and Denison Troughs.

Release a geochemical database on source rock distribution and character.

Clients

The Australian petroleum industry

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

Cooperating Organisations

Queensland Department of Resource Industries

Geological Survey of New South Wales

Prof A Gleadow, Melbourne University

Dr J Tipper, Australian National University

Dr C Fielding, University of Queensland

Dr P Flood and J Stanley, University of New England

Petroleum companies with leases in the study area

Project 112.06 Tectonic Map of the Tasman Fold Belt System

Project Leader David Palfreyman (06) 249 9465

Program Responsibility Onshore Sedimentary and Petroleum Geology

Timeframe 1983–1991

Objectives

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 work and for mineral exploration in the area.

Expected Outcomes

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, synthesised and output via the Intergraph system.

Expected Products

Database on the Tasman Fold Belt System tectonics.

1:25 M scale map of the Tectonics of the Tasman Fold Belt System.

Publish a volume on the Tectonics of the Tasman Fold Belt System.

Highlights for 1990/91

Entered map data into the Intergraph system.

Produced a final colour guide.

Goals for 1991/92

Print map and volume.

Clients

Secondary and Tertiary Educational Institutions

Government and semi-Government bodies

Mineral Exploration Companies

Geoscientific Research Community

Cooperating Organisations

State Geological Surveys

Australian National University

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

Project 112.07 Officer Basin Mapping Accord Project

Project Leader	John Lindsay (06) 249 9428
Program Responsibility	Onshore Sedimentary and Petroleum Geology
Timeframe	1990–1995

Objectives

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

Assess the potential for petroleum and mineral occurrences.

Relevance

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

Systematic 1:250 k 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 National Geoscience Mapping Accord. However, this will provide insufficient geological information on features such as Basin thickness, type and style of sediments and structure.

Expected Outcomes

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

An assessment of the potential for petroleum and mineral accumulations.

Activities

Obtain sub-surface information from seismic surveys and drilling programs to supplement the 1:250 k scale geological mapping.

Undertake a regional seismic line.

Interpret other geophysical data to develop a depositional and post-depositional model of the poorly exposed Basin.

SADME will concurrently undertake stratigraphic drilling to assist in this analysis.

Expected Products

North south seismic profile of the central Officer Basin.

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

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

Specialised papers and publications concerning the evolution of the Basin and the nature of the basin's sediment fill.

Highlights for 1990/91

The Officer Basin Project was initiated in 1990. Consequently the project's main activities have been gathering existing Basin information and developing a database. The main products to date are:

- a shot point map of all seismic lines based on SADME data
- a levelled aeromagnetic grid
- preliminary regional images of the magnetic data
- preliminary re-processing of some analog seismic data
- the initiation of a seismic database.

Goals for 1991/92

Proposed BMR Seismic Line

- program of test shots to determine optimal seismic parameters and feasibility of shooting through the Nullarbor Limestone
- processing the results of the test program

- planning the shooting of the proposed seismic line conditional upon the results of the proposed test program.

Evaluation of Existing Data

- complete the transcription and processing of analog seismic data where available
- interpret industry data and produce preliminary structure contour and isopach maps
- assess well data and integrate well and seismic data.

Preliminary report on gravity and aeromagnetic data analysis.

Preliminary report on sequence stratigraphy and Basin subsidence studies.

Clients

South Australian Government

Petroleum Industry

Cooperating Organisations

South Australian Department of Mines and Energy (SADME)

Project 112.08 National Petroleum Maps

Project Leader	Tony Yeates (06) 249 9420
Program Responsibility	Onshore Sedimentary and Petroleum Geology
Timeframe	1992–1995 (New Project)

Objectives

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 tenement boundaries.

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 Outcomes

Display and analysis of the occurrence of petroleum in and relating to tenement boundaries.

Activities

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

Provide a computer database of the information.

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

Produce customised products in conjunction with the PEDIN database.

Expected Products

A 1:2.5 M 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:

- basin elements and structural features to 4000 m isobath
- basin types
- period extent
- time space plot Australia's basins
- regional isopachy of depth to basement
- source rock distribution by palaeogeographic time slice; distinguish marine and non-marine sources and organic matter type if known
- capped reservoir facies by palaeogeographic time slice

- minerals occurrences in basins
- depoaxes and basement highs
- burial and thermal history of basins
- period uplift maps

Goals for 1991/92

Develop modus operandi and computer hierarchy for the map series.

Clients

The Australian Petroleum Industry

Cooperating Organisations

State and Northern Territory Geological Surveys

Project 112.09 Early development of the Otway Basin Mapping Accord Project

Project Leader	Doug Finlayson (06) 249 9761
Program Responsibility	Onshore Sedimentary and Petroleum Geology
Timeframe	Second half of 1991–end 1993

Objectives

As part of the National Geoscience Mapping Accord, develop a better understanding of 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. Its exploration for 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) make seismic data acquisition difficult. Industry standard Vibroseis data commonly do not image features below 3 s two-way time. The BMR project will examine the deepest Basin sequences and the structures within basement that have influenced their deposition.

Expected Outcomes

A better understanding of the style of early Otway Basin evolution.

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

Activities

Prepare a detailed seismic survey proposal.

Conduct seismic test survey work to determine optimum data acquisition parameters (Oct–Nov, 1991).

Conduct seismic reflection profiling along a number of profiles during the first half of 1992.

Prepare integrated seismic line database.

Seismic data processing.

Interpretion of seismic sections along a number of corridors and integration with structural element maps of the region.

Expected Products

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

Seismic reflection profiles along a number of key corridors.

An integrated database of seismic line information.

Structural element maps.

Conceptual models of basin formation.

Appropriate and timely publications and presentations.

Goals for 1991/92

Pre-survey report.

Seismic data acquisition tests at 4–5 sites.

Seismic reflection profiling along a number of key corridors.

Initial seismic processing and reporting.

Clients

Petroleum Exploration Companies

SA Department of Mines and Energy

Victorian Department of Manufacturing and Industry Development

Cooperating Organisations

SA Department of Mines and Energy

Geological Survey of Victoria

Universities

Exploration companies

121: CONTINENTAL MARGINS

Objectives

Promote sustainable development of offshore resources.

Provide the basic information necessary for the formulation of independent advice to government on offshore resource development.

Relevance

The Continental Margins Program (CMP) was initiated at Cabinet level, and is an important element in the Government's strategy to encourage the exploration for, and development of, Australia's offshore petroleum resources with a view to maximising oil self sufficiency well into the next century. It received support from the petroleum exploration industry in 1988 during the Woods Review of BMR.

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 in the 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 new data are collected using a dedicated geoscience research vessel, *Rig Seismic*, which is fully equipped for modern seismic acquisition, deep sea sampling, and the recording of other geophysical and geochemical data. The new data are integrated with existing exploration industry data to provide new basin analyses which may incorporate new ideas and understanding of petroleum generation and entrapment.

In 1991/92, *Rig Seismic* will be collecting new scientific data from a number of basins with special emphasis on the North West Shelf and northern Australia.

The CMP has been strengthened by Australian involvement in the multi-lateral Ocean Drilling Program (ODP) through a consortium arrangement with Canada. Under ODP, the Research Vessel *Joides Resolution* has undertaken drilling off Australia and Antarctica including the Exmouth Plateau region off north west Australia in 1988 and north east Australia in 1990. ODP provides otherwise unobtainable insights into the geological processes and framework, resource potential, and past environments of Australia's offshore areas.

The data from *Rig Seismic* are publicly released as soon as practical after completion of processing, generally within two years of field acquisition. Basin analyses and reassessments of petroleum prospectivity are publicly released within two–three years. Industry acquire these data and interpretations, integrate them with their own regional concepts and reassess the prospectivity for petroleum exploration of large areas of the Australian continental margin.

The CMP is aimed at frontier areas (not previously explored), areas explored but not now active and currently explored areas where techniques not normally used by industry (e.g. deep seismic profiling, sea bed and underway geochemistry) may be applied in order to gain new insights into basin evolution and petroleum generation.

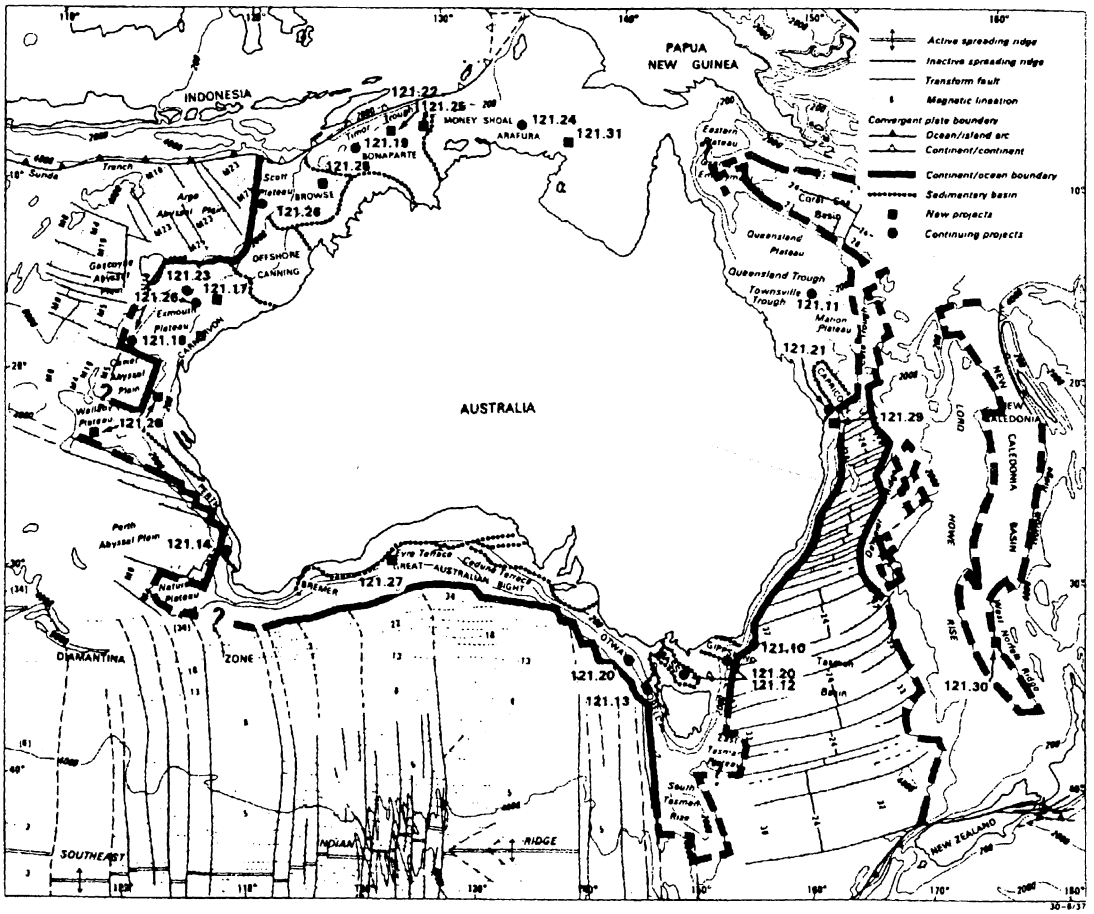
Activities

Develop a knowledge and understanding of the geological framework of the continental margins around Australia and its territories.

Identify the petroleum and mineral resource potential of the offshore area.

Develop models of the geological processes which have formed the Australian continental margin and led to economic accumulations of petroleum and minerals.

Provide insights into the mechanisms and magnitude of past environments on the Australian margin.



Location of Continental Margins Projects

CONTINENTAL MARGINS

Component Leader Trevor Powell (06) 249 9327

Component Projects

121.10	Structure, stratigraphy and kinematic development of the northeast Gippsland Basin, the southern New South Wales continental margin and the conjugate margin on the Lord Howe Rise
121.11	Structure, stratigraphy, evolution and regional framework of the Marion Plateau, Townsville Trough and Queensland Plateau
121.12	Deep structure of the Gippsland and Bass Basins
121.13	Geological framework and hydrocarbon resource reassessment of the West Tasmanian Margin plus preliminary investigations in the Tasmania Basin
121.14	Geological framework and hydrocarbon resource assessment of the South Perth Basin
121.17	Regional structural framework of the southern North West Shelf and Offshore Canning Basin
121.18*	Carnarvon and Barrow–Dampier Sub-basin: geochemistry, sampling and high resolution seismic
121.19	Vulcan Graben and Cartier Trough: deep crustal structure, structural reactivation and hydrocarbon migration
121.20	Hydrocarbon gas geochemistry of 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 resource potential
121.22	Bonaparte Basin: deep crustal structure, structural reactivation and hydrocarbon migration
121.23	Distribution of Triassic and Jurassic reefs in the offshore Canning Basin and northern Exmouth Plateau
121.24	Arafura Sea—seismic reconnaissance with geochemistry
121.25**	North western margin crustal transect to investigate deep crustal structure, crustal flexure and structural reactivation
121.26	North west continental margin stratigraphy
121.27	Southern margin geological sampling
121.28*	Basin development and hydrocarbon potential of the Browse Basin and adjacent continental margin
121.29*	Sub-tropical and temperate marine carbonate systems of the Southern Great Barrier Reef to northern New South Wales—facies, climate and sea level
121.30*	Lord Howe Rise and Norfolk Ridge 'Law of the Sea' study
121.31*	Eastern Arafura Sea—basin definition, development and hydrocarbon potential
121.32*	Seabed morphology and offshore resources around Christmas Island
122.01	'Law of the Sea' activities
122.02	Offshore resource map series

* New project in 1991/92

** Postponed

Project support staff

This Division, with its abundance of projects, cannot readily give recognition to support staff under the following project reviews, because they are moved from project to project frequently.

However, there is no doubt that the support staff are of as much importance to the Division as the project scientists.

The support areas include administration, development, acquisition and processing.

The staff include scientists, technicians, computer specialists and administrative service officers, both within the Division and the Engineering Services Unit.

Component Resources

Project	Average staffing levels				Finances $k		
No	Research	Technical	Other	**Total**	Salary	Operations	**Total**
121.10	2.8	1.2	0.2	4.2	196	139	335
121.11	2.9	1.1	0.2	4.2	266	70	336
121,12	0.3	0.2	0.2	0.6	15	56	71
121.13	2.1	0.2	0.2	2.5	64	56	120
121.14	1.4	0.2	0.2	1.8	86	56	142
121.17	0.2	0.2	0.2	0.6	15	62	77
121.18	0.7	0.2	0.2	1.1	44	62	106
121.19	3.3	2.0	0.2	5.6	243	228	471
121.20	3.4	2.7	0.3	6.4	285	1444	1729
121.21	1.9	2.0	0.2	4.1	132	144	276
121.22	0.6	1.1	0.2	1.9	59	422	480
121.23	1.1	1.1	0.2	2.4	121	228	349
121.24	1.8	2.0	0.2	3.9	79	144	222
121.25*							
121.26	1.2	0.2	0.2	1.6	66	62	128
121.27	2.6	2.6	0.3	5.6	146	761	907
121.28	2.1	1.8	0.3	4.2	140	761	900
121.29	0.4	2.6	0.3	3.3	182	730	912
121.30	0.3	0.2	0.2	0.7	19	60	79
121.31	2.3	1.7	0.3	4.4	163	1439	1601
121.32	2.8	2.7	0.3	5.8	240	1533	1773
121.33**	0.6	0.2	0.2	0.9	37	62	99
122.01	0.8	0.2	0.2	1.1	49	56	104
122.02	1.3	0.2	0.2	1.7	62	65	127
Total	**36.8**	**27.0**	**4.7**	**68.4**	**2708**	**8637**	**11345**
Engineering support staff				25.1			839
Cartographic support staff				4.7			224
TOTAL				**98.2**			**12409**

* Postponed

** Resources set aside by the Marine Geoscience and Petroleum Geology Program for the Cooperative Research Centre on the Antarctic and Southern Ocean Environment (see page 115)

Project 121.10

Structure, stratigraphy and kinematic development of the north east Gippsland Basin, the southern New South Wales continental margin and the conjugate margin on the Lord Howe Rise

Project Leader	Jim Colwell (06) 249 9346
Program Responsibility	Marine Geoscience and Petroleum Geology
Timeframe	March 1987–end 1991

Objectives

Encourage petroleum exploration in the poorly explored, deep water part of the Gippsland Basin Permit a more accurate assessment of their petroleum potential by increasing our understanding of the geological history of parts of the Tasman Sea margin.

Relevance

Because of declining oil production in the shallow water parts of the Gippsland Basin, companies are being forced to look at deeper water areas of the basin and at subtle traps. In the long term, the Lord Howe Rise, which in part forms the conjugate margin to the Gippsland Basin, may be a target for petroleum exploration.

The southern New South Wales data are the first multi-channel seismic (MCS) data collected on this part of the margin and permit the first detailed assessment of the area's petroleum potential.

Activities

Two *Rig Seismic* research cruises (1987 and 1988).

Interpretation of seismic and non-seismic geophysical data.

Mapping of structures and sediment thicknesses.

Merging of part of the dataset with data from Project 121.12.

Expected Outcomes

An enhanced understanding of the geological development and petroleum potential of the north east Gippsland Basin, southern New South Wales margin and Lord Howe Rise.

In conjunction with Project 121.12, development of a model of the formation of the Gippsland Basin.

Expected Products

Post-cruise report published in late 1987.

Release of 3300 kms of processed seismic data in September 1990.

Release of non-seismic geophysical data in June 1990.

Initial results presented at the 9th AGC in 1988.

Results partly incorporated in APEA paper in 1990.

Isopach and structure maps of the southern New South Wales margin and the north east Gippsland Basin.

Scientific papers.

Highlights for 1990/91

Recognition of two major rift megasequences and three post-rift sequences in the deep water part of the Gippsland basin; these sequences reflect extension in both the Gippsland (see Project 121.12) and Tasman Sea Basins.

Goals for 1991/92

Complete mapping.

Release processed 1988 seismic data.

Publish results.

Clients

Australian petroleum industry

Cooperating Organisations

Geological Survey of New South Wales

Ocean Sciences Institute, University of Sydney

M Coffin, Institute of Geophysics, University of Texas at Austin

Project 121.11

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

Project Leader Phil Symonds (06) 249 9490

Program Responsibility Marine Geoscience and Petroleum Geology

Timeframe 1987–1992

Objectives

Define the broad structure, stratigraphy and resource potential of the Townsville Trough and Marion Plateau as a basis for future assessments of the region's prospectivity.

Further clarify understanding of the development and setting of north east Australian carbonate platforms as modern day analogs to important petroleum provinces.

Encourage, and participate in, an Ocean Drilling Program (ODP) scientific drilling leg off north east Australia to gain direct information on the structural, palaeo-climatic, palaeo-oceanographic and relative sea level controls on carbonate platform development, and margin depositional systems.

Relevance

The north east Australian margin is a relatively rare modern analog of an important structural and sedimentological association—barrier reef/adjacent rift trough/marginal plateau —which has occurred many times in the geological record and in places is host to significant petroleum accumulations. The region is therefore important for defining exploration models, particularly those related to rifted margin carbonate platforms, for Australia and the rest of the world.

The unique variety of facies and stratigraphic models that the region provides contain clues to understanding ocean history, passive margin evolution, and carbonate depositional systems.

The Townsville and Queensland Troughs are large, poorly known rift features, which are fully in tact within the margin. The deep water frontier basins beneath the troughs may have significant long term petroleum potential.

Expected Outcomes

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

A regional seismic grid over the Townsville Trough which will provide the primary database for understanding its basin framework and will form the basis of all future

assessments of its regional petroleum prospectivity.

Models based on the huge ODP and BMR 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

- such models are an important aid to petroleum exploration activities as they provide analogs for similar environments throughout the Phanerozoic.

Activities

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

- map the extent of major depocentres and leads, and develop play concepts as an aid to assessing petroleum prospectivity
- synthesise with company data from the Queensland Trough to understand the tectonic relationship between the various segments of the margin rift system.

Integrate the direct information on lithofacies and processes from ODP Leg 133 off north east Australia with other seismic stratigraphic and sedimentological 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, understand its carbonate platform evolution, and assess its petroleum potential.

Model the rift/reef/marginal plateau association for use in the interpretation of other Australian basins.

Continue to integrate and analyse the data from four *Rig Seismic* surveys off north east Australia and supplement this with regional company data, particularly in the Queensland Trough, to deduce the geological framework of the margin and its basins.

Expected Products

Processed airgun array seismic data on a regional grid over the Townsville Trough.

Processed high resolution water gun seismic data over the Marion Plateau, the Queensland Trough and the margins of the Queensland Plateau.

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

Townsville Trough folio containing the results of a comprehensive framework study integ rating the 1985 and 1987 *Rig Seismic* data.

Large ODP sample and well log database, and the results of related studies, will initially be reported in ODP publications.

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

Reports and papers on basin and margin development, and petroleum potential in industry related journals, and at conferences such as APEA and AAPG.

Highlights for 1990/91

Release of report containing well summaries, up to date biostratigraphic review, and geohistory analyses for all exploration wells and DSDP holes off north east Australia (BMR Record 1990/07)

- points to new exploration opportunities in the southern offshore Papuan Basin and forms an important platform on which future studies and exploration programs can build.

Planning of, and participation of four project scientists on, ODP Leg 133, a major scientific drilling program off north east Australia; this leg broke many ODP records such as number of holes drilled, total length of core recovered and produced a quantum jump in direct knowledge of lithofacies, sedimentary processes, Queensland Plateau basement, and the Tertiary subsidence and palaeogeography of a large part of the north east Australian margin

- this information will feed into analyses of margin and basin framework, and will aid the interpretation of other petroleum provinces around Australia
- it also provided important Plio-Pleistocene palaeo-climate and sea level data for understanding the controls on the development of the Great Barrier Reef.

Publication of a study of sea water palaeotemperature through the Tertiary based on a review of regional oxygen isotope data; it documents for the first time the influence of plate motion and palaeo-climate on carbonate platform development, and defines facies models for reefal build-ups which can and have been applied to the exploration of buried Miocene reefs in the Papuan Basin.

Use of BMR framework studies of the north east Australian rift system, and related assessments of its petroleum prospectivity, by the Geological Survey of Queensland in a published review of the petroleum potential of offshore Queensland.

Goals for 1991/92

Encourage interest in deep water frontier basins by:

- public release of a grid of about 3000 kms of high quality airgun array seismic data over the Townsville Trough
- presentation of some of the results of the basin framework study of the Townsville Trough at the International AAPG Convention in Sydney in mid–1992.

Obtain information from continued analysis of the sample and well log data from ODP Leg 133 on lithofacies and depositional processes on the north east Australian margin and their implications for global sea level and climate change.

Commence preparation of a report illustrating the styles of carbonate platform development off north east Australia using seismic and ODP sample and well log data

- it will provide a useful format for the application of north east Australian models to the interpretation of carbonate platforms in petroleum basins around Australia and overseas.

Clients

The Australian Petroleum Industry

Geological Survey of Queensland

Petroleum Division, DPIE

Great Barrier Reef Marine Park Authority

Cooperating Organisations

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

A Droxler, Rice University, Houston, USA

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

J Ladd and W Pitman, Lamont–Doherty Geological Observatory, USA

D Scott and M Etheridge, Australian National University

Project 121.12 Deep structure of the Gippsland and Bass Basins

Project Leader	Barry Willcox (06) 249 9273
Program Responsibility	Marine Geoscience and Petroleum Geology
Timeframe	November 1989–June 1992

Objectives

Promote more thorough petroleum exploration of the Gippsland and Bass Basins by providing regional deep crustal datasets.

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 interested in the Bass Strait region, but most notably Shell, Esso and BHP, 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

A new model for the structural development of the Gippsland Basin.

Activities

Two research surveys using *Rig Seismic*, primarily using deep MCS 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.

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

Release of field data from the Bass Basin for processing by interested clients.

Interpretation of the deep structure of the region to determine relationships of basin forming structures to hydrocarbon entrapment.

Provide tectonic models of the basin's evolution, the geothermal consequences of which can be used to predict the history of hydrocarbon generation and migration.

Cooperative work with the petroleum industry in carrying out seismic correlations through the region.

Expected Products

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

Release of seismic data packages.

Scientific papers dealing with tectonic evolution, hydrocarbon generation and entrapment.

Seismic atlas/folio.

Highlights for 1990/91

Preliminary seismic interpretation indicated that the Gippsland Basin probably formed by very oblique extension in a north west–south east direction, rather than by simple north north east–south south west extension, as had been predicted from the shallower industry data. The implications of this discovery in terms of the development of petroleum traps was presented to the exploration industry at the AAPG Conference in San Francisco and the ASEG Conference in Sydney.

BMR seismic reflection data was processed and released.

Discussions in Bridge Oil's offices regarding a possible common origin of the Gippsland and Bass Basins.

Goals for 1991/92

Completion of seismic interpretation for Gippsland Basin and preparation of seismic atlas.

Publication of new ideas on regional tectonics.

Presentation of final results at the Gippsland Basin Symposium in Melbourne, June 1992.

Clients

Shell

ESSO

BHP

The Petroleum Industry

Petroleum Division, DPIE

Cooperating Organisations

Cooperative interpretation of the refraction data is currently underway between Mr Clive Collins, BMR and Dr Jim Cull, Dept of Earth Sciences, Monash University

Bridge Oil Ltd have processed our seismic data from the Boobyalla Sub-Basin of the Bass Basin using Digicon, Brisbane, as contractor. The reprocessing of some key lines is currently underway (Mr Bob Pickering, Staff Geophysicist).

Project 121.13 Geological framework and hydrocarbon resource reassessment of the West Tasmanian Margin plus preliminary investigations in the Tasmania Basin

Project Leader	Neville Exon (06) 249 9347
Program Responsibility	Marine Geoscience and Petroleum Geology
Timeframe	1988–1992

Objectives

Stimulate interest in the west Tasmanian margin by better defining its structure, stratigraphy, geological evolution and petroleum potential.

Relevance

The discovery that there are a number of basins with thick sedimentary sections off west Tasmania, and of free oil in Cape Sorell No. 1 well, shows that this frontier area has real petroleum potential.

The discovery of oil seeps off south east Tasmania suggests a new exploration play in the Palaeozoic rocks of the Tasmania Basin.

Expected Outcomes

This study will produce the first integrated structural model of the West Tasmanian Margin and the first comprehensive analysis of the history of basin development along the margin. This information will aid in the design of exploration permits and improved exploration work programs.

Activities

Obtain additional seismic, gas and heatflow data and geological samples using systems aboard *Rig Seismic* (Survey 78, April 1988).

Release processed seismic data on western and south eastern Tasmanian margin.

Prepare a comprehensive seismic shot point location map.

Interpret seismic data.

Prepare six structure contour maps of the western margin of Tasmania.

Expected Products

Complete seismic shot point location maps.

Six structure contour maps at 1:250 k scale.

Representative interpreted seismic sections.

A BMR record to accompany the maps and seismic data.

Scientific publications.

Highlights for 1990/91

Showing that this previously poorly known part of the Australian Continental Margin has considerable untested petroleum potential.

Goals for 1991/92

Bring the potential of this margin to the attention of the petroleum industry.

Clients

Tasmanian Mines Department

Maxus Petroleum

DPIE

Petroleum Exploration Companies

Conga Oil

Cooperating Organisations

Flinders University
Tasmanian Mines Department

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

Project Leader	John Marshall (06) 249 9536
Program Responsibility	Marine Geoscience and Petroleum Geology
Timeframe	1988–1991

Objectives

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

Relevance

Exploration permits have recently been awarded within the basin, and several companies will commence drilling programs within the next twelve months.

Expected Outcomes

An up to date analysis of the basin's architecture, including timing of major tectonic events within the basin and their effect on sedimentary facies, so as to produce a comprehensive assessment of the basin's hydrocarbon potential.

Activities

Interpretation of company and BMR seismic lines within the basin.

Production of structure contour and isopach maps of key units within the basin to assist petroleum exploration.

Erection of a definitive structural framework of basin evolution and development to assist petroleum exploration.

Expected Products

4200 kms of 96 and 72 channel processed seismic reflection profiles.

860 kms of eight channel, high resolution water gun reflection profiles.

A folio, including maps, that illustrates the stratigraphic structural, geochemical and economic aspects of the basin.

Several research papers dealing with the basin's structure and hydrocarbon potential.

Highlights for 1990/91

Completion of an exhaustive study on the structural elements of the basin that advocates a radical change in the process of basin formation based on oblique extension within a multi-dimensional framework. The result of this study was presented to key clients and the exploration industry in general at the 8th ASEG/GSA Conference in Sydney in February 1991.

Goals for 1991/92

Completion of the project with the production of a major folio on the basin.

Clients

AMPOL Exploration Ltd

Petrofina Exploration Australia

Shell Australia

Norcen International

Cooperating Organisations

University of New South Wales

Curtin University of Technology

Geological Survey of Western Australia

Project 121.17 Regional structural framework of the southern North West Shelf and offshore Canning Basin

Project Leader	Howard Stagg (06) 249 9343
Program Responsibility	Marine Geoscience and Petroleum Geology
Timeframe	January 1990–December 1994

Objectives

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 structure controls in the region.

Relevance

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

This project will establish a regional grid of deep seismic transects across the margin which will improve understanding of the linkages between major structural elements and allow revision of the gross structure of the region.

Expected Outcomes

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

Activities

Determine the broad regional structural framework of the Barrow, Dampier and offshore Canning Basins by examining the boundaries between major structural elements along key transects across the shelf.

Determine the deep crustal structure of these basins and their relationship to the development of the continental margin adjacent to the south eastern Argo Abyssal Plain.

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

Rig Seismic surveys planned for Barrow–Dampier Basins in mid 1991 and Dampier–Canning Basins in mid 1992 primarily using MCS techniques.

Expected Products

2000 kms of processed deep (12–15 sec record length) seismic reflection data recorded using a 3200 cubic inch dual air-gun array and a 3600 m streamer and associated bathymetric, gravity, magnetic and seismic refraction data, along key transects across the shelf and into deep water where required

- from each of two cruises; first cruise (mid 1991) to concentrate in Barrow–Dampier Sub-Basins; second cruise (second half of 1992) to concentrate in Canning Basin.

BMR folio containing regional crustal cross sections illustrating the main structural elements in the region, an upgraded structural framework map, reduced versions of all of the deep seismic data collected, burial and thermal geohistory analyses of key wells, and other relevant information.

Reports and papers on the structural framework, the structural and depositional effects resulting 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 1990/91

Preliminary examination of regional industry seismic lines in the Barrow–Dampier Sub-Basins and the Canning Basin.

Database of industry shot point data prepared.

Draft program presented to permit holders in December 1990 Cruise I which concentrated on Barrow–Dampier Sub-Basins was completed in June 1991.

Goals for 1991/92

Revised program to be released as a BMR Record in first half of 1991.

Revise the structural framework of the southern North West Shelf.

Clients

Petroleum exploration companies

Project 121.18

Carnarvon and Barrow–Dampier Sub-Basin geochemistry, sampling and high resolution seismic

Project Leader	David Heggie (06) 249 9589
Program Responsibility	Marine Geoscience and Petroleum Geology
Timeframe	April 1992–December 1994

Objectives

Distinguish gas and liquid trends on the basis of their molecular and isotopic contents thereby extending the search for liquid hydrocarbons in the gas trend.

Improve the interpretation of the distributions of light hydrocarbons in sediments for petroleum exploration.

Relevance

The North West Shelf is an important producer of liquid and gas. Early exploration in the Barrow–Dampier Sub-Basins delineated two distinct gas and liquid trends in hydrocarbon accumulations.

More recent exploration has found liquid accumulations (Wanaea, Chinook) in what had previously been thought to be a ring of gas accumulations surrounding a trend of liquid accumulations further inshore.

Surface geochemistry, by potentially being able to distinguish gas and liquid accumulations, may be able to provide new information on exploration for liquid hydrocarbons.

Expected Outcomes

New information on hydrocarbon generation and migration in the Barrow–Dampier Sub-Basins.

An evaluation of surface geochemical techniques in new exploration on the North West shelf.

Activities

Test the application of surface geochemical techniques in new exploration in these basins.

Seek evidence of hydrocarbon gas seeps in the gas and liquid trends within these basins and relate the distribution of seeps to the near surface geology.

A 30 day program combining surface geochemistry, bottom water direct hydrocarbon detection (DHD) techniques combined with side scan sonar and some high resolution seismic reflection will be conducted. Also, a significant sea floor sampling program will be conducted.

Expected Products

Reports, a data release of light hydrocarbon distributions in sediments and bottom waters of the Barrow–Dampier Sub-Basins.

Scientific publications.

Goals for 1991/92

Consult with industry to develop program.

Clients

Australian Petroleum Companies

Cooperating Organisations

H Veeh, Flinders University of South Australia

D McCorkle, Woods Hole Oceanographic Institute, Massachusetts

W Reeburgh, University of Alaska

Project 121.19

Vulcan Graben and Cartier Trough: deep crustal structure, structural reactivation and hydrocarbon migration

Project Leader	Geoffrey O'Brien (06) 249 9342
Program Responsibility	Marine Geoscience and Petroleum Geology
Timeframe	1990–1993

Objectives

Improve exploration efficiency in the Vulcan Graben 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 Graben region of the Timor Sea. Recently, this exploration effort has been characterised by a marked lack of success.

Expected Outcomes

Vulcan Graben

- An improved understanding of the role of structural reactivation in hydrocarbon entrapment in the Timor Sea.
- Integration of image processed aeromagnetic data with high resolution seismic data to produce an understanding of the role of transfer faulting in hydrocarbon entrapment.
- Delineation of hydrocarbon migration pathways in the Timor Sea.
- Establishment of the usefulness of the DHD technique in the Timor Sea.
- Establishment of the deep crustal architecture of the Vulcan Graben and surrounding tectonic elements, with associated implications for source rock distribution, structural reactivation etc.
- An understanding of how the deep-seated structural features in the Vulcan Graben have controlled shallow structural reactivation processes.

Dampier Sub-Basin

- An improved understanding of the geological structure and seismic velocity of the shallow section in the Dampier Sub-Basin.
- Establishment of the usefulness of the DHD technique in the Dampier Sub-Basin.

Activities

Improving our understanding of:

- the basin architecture and the principal basin forming processes
- the control of structural reactivation on both hydrocarbon migration and trapping mechanisms
- the timing of structural development relative to hydrocarbon generation and migration.

Integrating disparate datasets such as aeromagnetic, water column geochemical direct hydrocarbon detection (DHD), high resolution seismic and deep crustal seismic data.

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

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

An additional 336 kms of high resolution seismic data were acquired at the beginning of Survey 1 in the Dampier Sub-Basin as part of our experimental survey with Woodside Petroleum Pty Ltd. 531 kms of DHD data also were acquired during this sub-program.

1894 kms of deep crustal seismic data were acquired during Survey II; 20 k kms 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 BMR aeromagnetic, seismic and DHD datasets.

Expected Products

Vulcan Graben

- Image processed high resolution aeromagnetic data at 1:250 k scale.
- Regional deep crustal seismic sections showing the main structural elements of the Vulcan Graben and their relationship to the surrounding structural elements.
- High resolution seismic data with particular emphasis on the resolution of structural features at the 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-sea floor 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.

Dampier Sub-Basin

- High resolution seismic data between the Wanaea and Angel fields.
- An improved understanding of the geology and seismic velocity structure of the shallow (top 1.5 seconds) section.
- Regional maps of the distribution of light hydrocarbons in the water column.

Highlights for 1990/91

Vulcan Graben

- The 1990/91 cruise program concentrated heavily on the Vulcan Graben in the Bonaparte Basin and surrounding areas. Excellent geochemical, high resolution seismic, and deep crustal seismic data were acquired in these highly prospective areas, and company interest in the data is intense.

Goals for 1991/92

An improved understanding of the structural architecture of the Vulcan Graben region and the role that structural reactivation has played in the migration and trapping of hydrocarbons in the region.

Clients

Petroleum industry

Woodside Petroleum Pty Ltd

Cooperating Organisations

Flinders University of South Australia

Woodside Petroleum Pty Ltd

Project 121.20

Hydrocarbon gas geochemistry of the Otway, Bass, North Bass and Gippsland Basins and the Torquay Sub-Basin

Project Leader David Heggie (06) 249 9589

Program Responsibility Marine Geoscience and Petroleum Geology

Timeframe April 1988–December 1991

Objectives

Test 'calibrate' bottom water direct hydrocarbon detection (DHD) techniques and their application to offshore petroleum exploration around Australia, by conducting a 'calibration' survey in the Gippsland Basin.

Assess the liquid/gas hydrocarbon generating potential of the Bass, North Bass, Otway and Torquay Basins using both sediment and bottom water DHD techniques.

Relevance

Surface geochemical techniques have not been widely used as an accepted exploration tool around Australia. This program is the first of its kind as part of a Joint Research Agreement with TEG (USA) to evaluate the use of bottom water DHD techniques around Australia.

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

The Bass, North Bass, Torquay and Otway Basins are under-explored frontier basins. The application of surface geochemical techniques can provide new information about the possible generation of thermogenic hydrocarbons in these basins. The presence of hydrocarbon strandings on Otway beaches suggest the Otway is an appropriate location for surface geochemical techniques.

Expected Outcomes

An initial evaluation of the potential application of surface geochemical techniques to offshore petroleum exploration around Australia, particularly south eastern Australia, with new ideas to extend the data. The clients will be provided with new information on the potential generation and migration of thermogenic hydrocarbons.

Activities

Two research surveys have been completed aboard Rig Seismic using combinations of sea floor sampling and on-board hydrocarbon gas analyses (Survey 79, (May 1988) and another using new bottom water DHD technology (Survey 89, (February 1989).

Expected Products

Reports and scientific publications.

A geochemical data release and database of light hydrocarbons in the sediments and bottom waters of these south eastern Australian basins.

Highlights for 1991/92

Public release of the geochemical data for these south eastern Australian basins.

Goals for 1991/92

Complete appropriate reports and scientific publications.

Develop new ideas for continued geochemical work in south eastern Australia.

Clients

Shell Australia Ltd

Cultus

Esso–BHP

Petrofina

Western Mining Corporation

Cooperating Organisations

B Hartman, TEG–USA

K Spence and/or B Thomas, Shell Australia

B Donaldson, Amoco–USA

Project 121.21

Offshore Maryborough Basin, southern Queensland continental margin and Northern Tasman Basin—structure, stratigraphy and petroleum resource potential

Project Leader	Peter Hill (06) 249 9292
Program Responsibility	Marine Geoscience and Petroleum Geology
Timeframe	1989–1992

Objectives

Stimulate petroleum exploration in these currently under-explored regions through framework studies of structure, stratigraphy, maturation history and resource potential, and through provision of additional data.

Study the tectonic evolution of the Maryborough Basin, including the Cretaceous/early Tertiary rifting and sea floor spreading processes in the northern Tasman Basin as an aid to evaluation of hydrocarbon potential and plays.

Relevance

The offshore Maryborough Basin is a prospective basin on the east coast of Australia. It has been largely neglected as an exploration target so this project is designed to stimulate interest in the area.

Expected Outcomes

A significantly improved understanding of the geology, evolution and petroleum potential of this poorly explored area.

The results of the study will provide information vital for planning future acreage releases, and will form the basis for future exploration activity in the region by the oil industry.

Activities

Establish the structural and seismic stratigraphic framework of the offshore Maryborough Basin and investigate its petroleum potential.

Investigate and map possible extensions of the Maryborough, or undiscovered basins, along the continental shelf between Fraser Island and Moreton Bay.

Improve our understanding of the structural style and petroleum potential of the Capricorn Basin by enhancing the present seismic dataset through the collection of a series of

high quality regional tie lines along and across the basin.

Examine the structural style, stratigraphic development, and the deep crustal structure of the rift and transform margins of the northern Tasman Basin in relation to conceptual models of passive margin development.

Acquisition of the first modern MCS data in the shallow water Maryborough Basin and adjacent region of the southern Queensland continental margin.

Establish the structural and seismic stratigraphic framework of the offshore Maryborough Basin, the deep water Capricorn Basin and the northern Tasman Basin.

A research survey primarily using MCS techniques aboard *Rig Seismic* (Survey 91, December 1989).

Tie the stratigraphy of the Maryborough Basin region to the exploration wells in the Capricorn Basin.

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

Interpret data and undertake basin analysis incorporating all existing datasets.

Publish results

Expected Products

Processed geophysical data: 2900 kms MCS data, 10 sono-buoy seismic refraction experiments, 2450 kms magnetic profiles, 3600 kms gravity and bathymetric profiles

- the MCS data will be available as field tapes, stack tapes and as processed sections on paper and film.

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

Highlights for 1990/91

The cruise results provide the first evidence that at least three kms of potentially prospective sedimentary section underlies the continental shelf to the south east of Fraser Island.

Goals for 1991/92

Establish a model for the evolution of the Maryborough Basin in relation to the development of the northern Tasman Basin.

Clients

Australian Petroleum Industry

DPIE

Queensland Department of Mines

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

Project Leader	Geoffrey O'Brien (06) 249 9342
Program Responsibility	Marine Geoscience and Petroleum Geology
Timeframe	1991–1993

Objectives

Delineate hydrocarbon migration pathways in the offshore Bonaparte Basin.

Develop predictive models for the nature of reservoired hydrocarbons in the offshore Bonaparte Basin.

Relevance

The offshore Bonaparte Basin is presently undergoing a fairly active exploration phase, although a number of significant geological questions remain unanswered.

These questions include:

- establishing the deep crustal architecture of the Palaeozoic Petrel Sub-Basin, and its relationship to the overprinted Mesozoic structural elements to the north (e.g. the Malita Graben, the Sahul Platform and the Sahul Syncline)
- how these deep seated structures have responded to the collision with Timor, and how this response has controlled structural reactivation shallow in the sedimentary section
- 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 Graben, Ashmore Platform and Londonderry High to the south.

An understanding of how the deep seated structural features in the Bonaparte Basin have controlled structural reactivation processes in the shallow (hydrocarbon prospective) section.

An understanding of how the structural reactivation in the shallow section changes as the collisional system is approached.

Delineation of hydrocarbon migration pathways in the offshore Bonaparte Basin.

Predictive models for the nature of reservoired hydrocarbons in the offshore Bonaparte Basin

Activities

Improve the understanding of:

- the basin architecture and the principal basin forming processes
- the timing of structural development relative to hydrocarbon generation and migration
- the relationship between structural reactivation and hydrocarbon migration and trapping mechanisms
- the usefulness of underway geochemical profiling as a remote sensing tool in this area.

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

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

A small, separate sub-program was carried out during the second survey in collaboration with Kufpec Australia Pty Ltd. This program involved the sampling and analysis of sediments in the offshore Bonaparte Basin in order to characterise their engineering geological characteristics.

Expected Products

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

2100 kms of deep crustal seismic reflection data and 2828 kms 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 subsea floor 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 1990/91

Literature review and examination of existing data completed.

Initial contacts with relevant petroleum companies.

Completion of pre-cruise reports.

Completion of DHD data release for both surveys.

Successful completion of both *Rig Seismic* surveys with the collection of 2100 kms of deep crustal seismic data, 3446 kms of high resolution seismic data and 6274 kms of DHD geochemical data.

Goals for 1991/92

Develop an integrated structural framework for the region which relates reactivation of the basin forming structures to the collision system to the north west.

Clients

The petroleum industry, with the emphasis on the companies with an active interest in the area.

Cooperating Organisations

BHP Australia Pty Ltd

Kufpec Australia Pty Ltd

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 Leader	Neville Exon (06) 249 9347
Program Responsibility	Marine Geoscience and Petroleum Geology
Timeframe	1989–1992

Objectives

Develop an understanding of how to carry the search for Triassic–Jurassic reefs into other areas of the North West Shelf where Triassic–Jurassic carbonates occur, such as Browse and Bonaparte Basins.

Relevance

The discovery of a Late Triassic reef in ODP Site 764 on the Wombat Plateau north of the Exmouth Plateau, and the realisation that a reef complex was visible on the seismic profiles, led to 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 BMR and exploration companies to other areas on the North West Shelf.

Expected Outcomes

An understanding of how to carry the search for Triassic–Jurassic reefs into other areas of North West Shelf where Triassic–Jurassic carbonates occur, such as Browse and Bonaparte Basins.

Activities

Process and interpret new and pre-existing seismic and geological data to refine geological history of region.

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

Petrological and palaeontological studies of Triassic, Jurassic and Cretaceous dredge samples are under way. Processing of all, except key seismic data, deferred.

Cruise Record 1990/57 released.

Article in BMR Research Newsletter No. 13 published.

Series of papers on results of Exmouth Plateau ODP Leg 122; with printers for ODP Science Volume 122B.

Expected Products

Regional and local structure contour and isopach maps.

Palaeogeographic maps, especially of the Late Triassic.

Indonesian Petroleum Association (IPA) publication.

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

Processed seismic data.

Highlights for 1990/91

Being able to demonstrate that the Triassic–Jurassic reef associated seismic facies also occur on the northern Exmouth Plateau and on the southern Canning Basin thereby extending a major new play concept into these areas.

Goals for 1991/92

Demonstrate to our key clients that Triassic–Jurassic reef complexes are widespread on the North West Shelf.

Clients

Petroleum exploration companies

Cooperating Organisations

Western Australian mines department

Project 121.24 Arafura Sea—seismic reconnaissance with geochemistry

Project Leader	Aidan Moore (06) 249 9583
Program Responsibility	Marine Geoscience and Petroleum Geology
Timeframe	February 1990–June 1992

Objectives

Encourage petroleum exploration of Australia's northern continental margin by providing new concepts, technically superior and more appropriate datasets.

Relevance

The northern margin of Australia is poorly understood in geological terms, and is the least explored area within Australia's continental margin. Prior to the initiation of this project, the scientific data available was inadequate to improve our understanding of the area.
Limited areas within the region had been explored but many oil shows had been recorded within the Goulburn Graben.

Key companies in the area (BHP Petroleum, BP) expressed initial and ongoing support for the project as they themselves have little understanding of the prospectivity of the area outside of the Goulburn Graben, and had

previously not been prepared to undertake exploration outside this area.

Expected Outcomes

The discovery of a thick, structured sedimentary section to the north of the Goulburn Graben has resulted in the first major industry seismic survey (by BHP Petroleum) outside the graben in almost a decade. Furthermore, because of the widespread interest generated in the region by this project (over 40 enquiries at the 1991 APEA conference), two additional reconnaissance projects to the east and the west of the 1990 cruise area are now planned for the region.

Activities

2200 kms of MCS, gravity and magnetic data collected in 1990 Seismic processing will be completed in late 1991; regional mapping, integrating existing company and BMR data will then commence and will be completed this financial year

- enquiries have already been received from industry to acquire this dataset as soon as possible
- it is envisaged that there will be close consultation with industry during this phase of the project.

Expected Products

2200 kms of seismic data will be released by 1992.

A folio containing structure contour maps, seismic profiles, geological interpretation and highlighting the petroleum prospectivity of the area will also be produced.

Highlights for 1990/91

The preliminary seismic sections available at the time were displayed at the APEA Conference in Melbourne in 1991, received very favourable comment and regenerated interest in the area to such an extent that BHP proposed shooting a seismic survey north of the Goulburn Graben to follow up on leads shown to exist within their current permit boundary. This program will be the first major industry survey north of the Goulburn Graben in almost a decade.

Goals for 1991/92

Increase industry interest in the Arafura Basin gazettal round by publicising the results of survey 94 within the industry; this should increase the value of the work programs that are bid and also generate some cost recovery funds.

Clients

BHP Petroleum

BP

Canadian Occidental

Texaco

Petroleum exploration companies

Cooperating Organisations

Northern Territory Mines Department

Project 121.25 North western margin crustal transect

Project Leader	Chris Pigram (06) 249 9636
Program Responsibility	Marine Geoscience and Petroleum Geology
Timeframe	1992–1994

Objectives

Understand the dynamics of collisional processes in an oblique convergence situation so as to better understand the nature of structural reactivation and flexing of the North West Shelf foreland.

Relevance

All Timor Sea petroleum plays are reservoired in structural reactivation traps.

Expected Outcomes

Enhanced understanding of the controls on the Late Cainozoic structural evolution of the North West Shelf, its subsidence history, foreland basin formation and mountain building processes.

Activities

Investigate deep crust structure of the North West Shelf of Australia.

Extend the BIRPS deep seismic transect from the collision zone across the Australia shelf foreland.

Investigate the deep crustal structure of the Australian shelf south of the collision zone so they may be compared.

BMR Marine Survey planned for late 1992 primarily using MCS techniques aboard *Rig Seismic*.

Compile and analyse literature on models for the Australia–Timor collision zone.

Expected Products

Processed seismic sections.

Interpreted deep crustal data.

Scientific publications.

Goals for 1991/92

Understand existing models for the Australia–Timor collision.

Clients

Petroleum Exploration Companies

Academic community concerned with convergent margins and convergent margin analogs.

Cooperating Organisations

Cambridge University (BIRPS)

University of London (RH and BNC)

Marine Geological Institute, Indonesia

Geological Research and Development Centre, Indonesia

Project 121.26 North west continental margin stratigraphy

Project Leader	Jim Colwell (06) 249 9346
Program Responsibility	Marine Geoscience and Petroleum Geology
Timeframe	September 1990–September 1992

Objectives

Assist stratigraphic interpretations and ultimately, petroleum exploration in 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. It is of relevance to hydrocarbon exploration, particularly in the long term.

Expected Outcomes

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

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

Input into other North West Shelf projects (e.g. Project 121.23).

Activities

Provide, through dredging and coring, geological information on poorly sampled areas of Australia's north west continental margin.

Sampling cruise aboard *Rig Seismic* in August–September 1990.

Palaeontological, petrographic and stratigraphic analyses.

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

Expected Products

Cruise report, BMR Record 1990/85, released in early 1991.

Various papers and reports, including input into a paper at the Indonesian Petroleum Association Meeting in late 1991.

Highlights for 1990/91

A very successful stratigraphic sampling program was carried out on the continental slope off north west Australia, with a great variety of Mesozoic and Tertiary rocks dredged, which are being used to modify and expand interpretations of seismic profiles.

Confirmation through dredging that build-ups, seen on seismic data to be overlying Triassic fault blocks on the northern Exmouth Plateau, are limestones and not volcanics; this supports the view that Triassic and Jurassic reef limestones are widespread on parts of the North West Shelf

- they have the potential to be excellent reservoirs and extend a major new play concept across the North West Shelf.

Goals for 1991/92

Define a stratigraphy for parts of the north west continental margin by detailed petrographic, geochemical and palaeontological studies.

Publish results.

Clients

Australian Petroleum Industry

Cooperating Organisations

P Wells, Australian National University

A Crawford, University of Tasmania

Project 121.27 Southern margin geological sampling

Project Leader	David Feary (06) 249 9246
Program Responsibility	Marine Geoscience and Petroleum Geology
Timeframe	1991–1993

Objectives

Provide an evaluation of the prospectivity of the deeper part of the Ceduna Sub-Basin, as a component of the Great Australian Bight region framework study.

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

Relevance

The primarily Mesozoic Great Australian Bight Basin off southern Australia contains a number of potentially prospective sedimentary basins, but remains inadequately explored for hydrocarbons.

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

Expected Outcomes

An improved understanding of the petroleum prospectivity of the Great Australian Bight Basin, with particular emphasis on the nature of the deeper part of the sedimentary section.

A new, high energy, cool water carbonate facies model, with particular emphasis on the potential for such facies to act as hydrocarbon reservoirs.

Definition of the extent to which the isotopic characteristics of Southern Ocean oceanic crust reflects the migration of mantle convection cells.

Activities

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.

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

Document the Late Quaternary palaeo-chemistry of the southern margin, in order to evaluate the nature and extent of glacial/inter-glacial cyclicity as the control on sea level variation, organic carbon fluxes, sea floor mineral accumulation and continental weathering.

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

Sample specific sections within the Great Australian Bight Basin (deep Ceduna Terrace area) on Australia's southern margin for biostratigraphic and sedimentological facies data, in order to complement and constrain seismic interpretations as part of the detailed analyses of these basins for tectonic analysis and hydrocarbon exploration (complements completed Project 121.08).

Sample cool water Cainozoic carbonates on the Eucla Shelf, in order to develop accumulation and diagenesis models for a type of carbonate deposit likely to become increasingly important for hydrocarbon exploration.

Sample oceanic basement between the continent–ocean boundary and anomalies 15–20, in the area between the Australia–Antarctic Discordance and the Great Australian Bight, in order to determine isotopic signatures representing differing mantle reservoirs.

Expected Products

BMR Reports, BMR Records and scientific papers

- describing new data on the prospectivity of the region
- describing a high energy, cool water carbonate facies model
- providing a critical test for mantle reservoir migration models.

Goals for 1991/92

Conduct *Rig Seismic* sampling cruise in June/July 1991.

Complete post-cruise sedimentological, petrographic, and biostratigraphic data analysis.

Commence synthesis and interpretation of datasets.

Clients

Japan National Oil Corporation

Australian Petroleum Industry

Cooperating Organisations

Y Bone, University of Adelaide

NP James and/or T Boreen,
Queens University, Ontario, Canada

G Birch, University of Sydney

A J Crawford, University of Tasmania

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

Project Leader	Phil Symonds (06) 249 9490
Program Responsibility	Marine Geoscience and Petroleum Geology
Timeframe	1992–1994

Objectives

Improve understanding of basin evolution to produce a resurgence in interest in the Browse Basin, and the development of 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 has 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.

The Browse Basin has a poorly understood and somewhat different development history to other parts of the North West Shelf, as indicated by its very thick post-Jurassic section. This has produced a range of possible play types, which remain untested.

Expected Outcomes

Improved understanding of the tectonic development of the Browse Basin and its relationship to major adjacent structural elements, and exploration provinces, particularly the Vulcan Graben.

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 to the development of new petroleum play concepts and exploration strategies.

Activities

Determine the regional structural framework of the Browse Basin and its relationship to adjacent features such as the Vulcan Graben, Rowley Sub-Basin and Scott Plateau.

Define the broad deep crustal structure of the region and 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.

Determine the structural style and architecture of the Browse Basin, and the effect of Tertiary reactivation on the older basin forming structures.

Update the stratigraphic framework of the Browse Basin, and examine the nature and distribution of the various depositional processes involved in basin infill, particularly in the Cretaceous sag-phase section.

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

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 June/July 1992; there will be two components to this survey

- 1000 kms of deep (15 sec record length) seismic reflection data recorded using a system anticipated to consist of a 4000 cubic inch sleeve gun array, and a 4800 m, 192 channel streamer, plus associated bathymetric, gravity, magnetic and seismic refraction data, along two or three key transects across the shelf, Scott Plateau and into the adjacent ocean basin
- more than 1500 kms of deep (10–15 sec record length) seismic reflection data recorded using a system anticipated to consist of a 2500–3000 cubic inch sleeve gun array, and a 3600 m, 288 channel streamer, plus associated geophysical data, on a grid of lines over the Browse Basin and its margins.

These data will tie all major wells in the Basin, as well as the transect data above and the 1990/91 BMR data in the Vulcan Graben.

Expected Products

1000 kms of processed deep crustal seismic data on transects across the whole continental margin province, linked to a grid of more than 1500 kms of processed deep seismic data tying wells in the Browse Basin proper, and BMR 1990/91 Vulcan Graben seismic data.

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.

BMR folio on the Browse Basin containing regional crustal cross sections, maps and sections illustrating the structural and stratigraphic framework of the basin, and information on new play concepts and petroleum potential.

Reports and papers on basin development and petroleum potential in industry related journals, and at conferences such as APEA and AAPG.

Goals for 1991/92

Raise the level of awareness of the program by consultation and cooperation with the petroleum industry and government agencies.

Conduct *Rig Seismic* cruise in mid–1992 and collect about 2500 kms of deep seismic, and associated geophysical data, which will form the core dataset for a new integrated basin analysis.

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

Clients

The Australian Petroleum industry

Current and prospective lease holders in the Browse Basin

Petroleum Division, DPIE

Geological Survey of Western Australia

Cooperating Organisations

Current lease holders in the Browse Basin

Geological Survey of Western Australia

Project 121.29

Sub-tropical and temperate marine carbonate systems of the southern Great Barrier Reef and northern New South Wales margin—facies, climate and sea level

Project Leader	Peter Davies (06) 249 9345
Program Responsibility	Marine Geoscience and Petroleum Geology
Timeframe	1991–1995

Objectives

Use the Plio-Pleistocene along these three critical tropical, sub-tropical and temperate deposition transects for developing models of carbonate accumulation and new play concepts for exploration.

Relevance

The differences between tropical and temperate build-ups in sediment composition, diagenesis and structural and stratigraphic location will define new exploration concepts and new plays for discovery.

The project is a cooperative research study between BMR, Japanese National Oil Company (JNOC) and Sydney University aimed at studying the outer shelf and upper slope sedimentary facies of the north east Australian margin along three critical and contrasting latitudinal transects

- Transect 1–Latitude 20S—representing a tropical ramp with active ramp edge reefs and other build-ups
- Transect 2–Latitude 23S—representing a subtropical ramp with sparse build-ups and characterised by biostromal development
- Transect 3–Latitude 25–30S—representing a temperate ramp with extensive temperate build-ups.

Activities

Define the facies distribution on the outer shelf and upper slope to a depth of 1000 m.

Define the three dimensional facies geometry.

Define the principal factors affecting facies distribution, particularly plate tectonics, hydro-isostasy, subsidence, climate and sea level.

Relate facies geometry to the above factors, particularly sea level change.

Understand the post depositional factors affecting the physical make up of the sediments especially those factors affecting porosity and permeability.

Relate sediment characters and causes to the understanding of ancient limestones.

Analyse previously published and unpublished data.

Rig Seismic cruise in November 1991, aimed at collecting high resolution MCS, sidescan mapping, dredging and coring along:

- Transects 1 and 2
- Seismic data processing
- Sediment data processing.

Expected Outcomes

New exploration concepts.

Expected Products

Models of porosity and permeability in carbonate ramps.

Direct comparisons with the Ryukus of Japan and the Canning Basin of Western Australia.

Facies maps of tropical and temperate carbonate ramps 3-dimensional facies models relating sediment distribution to principal allocyclic and autocyclic factors.

Maps and models of climate and sea level change over the past 500 000 years.

Goals for 1991/92

Prepare facies maps.

Model sediment distribution in relation to plate tectonics and sea level change.

Clients

Technical Research Centre, Japanese National Oil Corporation

Cooperating Organisations

Department of Geology, University of Sydney

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

Project Leaders	Jim Colwell	(06) 249 9346
	Peter Hill	(06) 249 9292
Program Responsibility	Marine Geoscience and Petroleum Geology	
Timeframe	1992–1995	

Objectives

Investigate the distribution and structure of sedimentary basins on the southern Lord Howe Rise and Norfolk Ridge and the nature of the crust underlying the central and southern part of the New Caledonia Basin.

Relevance

This project is of direct relevance to the definition of the sea bed 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.

Expected Outcomes

Enhanced understanding of the resource potential of the areas studied.

Activities

BMR Marine Survey planned for November 1991 primarily using MCS and sampling techniques aboard *Rig Seismic*.

Acquire regional seismic and other geophysical data.

Using dredging and coring, obtain stratigraphic control on seismic sequences within the basins.

Expected Products

Approximately 2500 kms of regional geophysical data.

Data relevant to sea bed boundary negotiations.

Various scientific papers and reports.

Goals for 1991/92

Undertake cruise in 1992.

Produce cruise report.

Commence processing of seismic and geological data.

Complete processing of non-seismic data.

Clients

Department of Foreign Affairs and Trade

Attorney–General's Department

Coal and Minerals Divison, DPIE

Project 121.31

Eastern Arafura Sea: seismic reconnaissance for definition of basin extent and hydrocarbon potential

Project Leader Aidan Moore (06) 249 9583

Program Responsibility Marine Geoscience and Petroleum Geology

Timeframe 1991–1994

Objectives

Upgrade the prospectivity of the eastern Arafura Basin, and encourage the petroleum industry to explore it.

Define its eastern boundary, and reconnoitre unknown areas near the border with Indonesia.

Relevance

The sedimentary basins of the northern margin of Australia are little known outside of the Bonaparte Basin and the Goulburn Graben, hence their prospectivity is downgraded and their exploration is neglected.

Preliminary reconnaissance of the Arafura Sea by BMR in 1990 (Survey 94, Project 121.24) aroused interest in the area by finding that a thick and prospective section of ?Cambrian to ?early Mesozoic age is present north of the Graben. This project is designed to define the eastern extent of the Basin and to complement Survey 94.

Expected Outcomes

Definition of the eastern areas of the Arafura Basin, and its relationship to adjacent features and basins.

Improved definition of the stratigraphy of the Basin.

Assessment of the petroleum potential of the Basin, especially of its northern and eastern parts, in preparation for possible future gazettals of exploration permits.

Activities

Explore neglected areas of the Arafura Basin outside existing exploration permits.

Provide a regional seismic grid to tie the northern Arafura Basin, the Goulburn Graben and the Wessel Rise, with potential to extend later to the Carpentaria Basin.

Conduct shipboard operations in the Arafura Sea in November–December 1991 and record up to 2900 kms of seismic and other geophysical profile.

Collect a grid of up to 2900 kms of multi-fold deep crustal seismic reflection profile using a 4800 m cable, about 200 seismic channels and 4000 cubic inch sleeve guns, with associated data such as bathymetry, marine gravity and magnetics, and possibly refraction data.

Expected Products

Up to 2900 kms of multi-fold seismic data plus associated bathymetric, gravity, magnetics, profiles and refraction records.

Goals for 1991/92

Complete pre-cruise planning.

Organise a research cruise in the Arafura Sea.

Use *Rig Seismic* to acquire up to 2900 kms of good quality seismic profile and associated data in the Eastern Arafura Sea late in 1991.

Clients

BHP Petroleum

BP

The petroleum exploration industry

Cooperating Organisations

NT Department of Mines

Project 121.32 Seabed morphology and offshore resources around Christmas Island

Project Leader	Neville Exon (06) 249 9347
Program Responsibility	Marine Geoscience and Petroleum Geology
Timeframe	Second half of 1991–early 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.

Relevance

The Department of Foreign Affairs and Trade (DFAT) has specifically requested BMR to undertake work to define the seabed resources of the area around Christmas Island prior to the finalisation of 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 Economic Exclusion Zone (EEZ).

Through sampling volcanic basement, the project will provide information on the age of formation of Christmas Island and the larger submarine Christmas Rise.

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.

Activities

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

Rig Seismic research cruise in 1991/92 involving high-resolution seismic (and associated bathymetric, magnetic and gravity data), camera traverses and sampling (freefall grabs, grabs, gravity corers, dredges).

Geochemical analysis of recovered nodules and crusts.

Dating of volcanic rocks.

Reporting phase.

Expected Products

Confidential report to DFAT.

Scientific papers and reports (including a cruise report).

Goals for 1991/92

Cruise planning and pre-cruise report.

Undertake cruise and post-cruise geochemical analyses.

Provide advice to DFAT.

Start reporting phase.

Clients

Department of Foreign Affairs and Trade

Mineral exploration companies

Cooperating Organisations

Universities

Project 122.01 'Law of the Sea' and seabed boundary activities

Project Leader Phil Symonds (06) 249 9490

Program Responsibility Marine Geoscience and Petroleum Geology

Timeframe 1980–Ongoing

Objectives

Assist Australian government policy formulation and implementation, and maritime boundary definition and negotiations.

Improve the knowledge of morphology and non-living resource potential of the continental margin of Australia and its territories.

Relevance

BMR'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, the *Rig Seismic*, 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 BMR 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 petroleum and mineral resources.

Expected Outcomes

Government decisions, policy formulation and implementation, and petroleum and mineral resource management related to offshore Australia 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 continental margin, the more remote parts of Australia's offshore territory and adjacent ocean basins.

Activities

Providing scientific and technical assessments, 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 assessments, 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.

Utilise 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.

Compile and analyse seismic, bathymetric and other regional data around Australia and its territories.

Determine the morphology, sediment thickness and resource potential of the continental margin and adjacent ocean basins around Australia and its territories.

Promote collection of new data in areas that will be the subject of future sea bed boundary negotiations and deliberations.

Compile, analyse and synthesise old and new regional data to define and report on the Australian 'legal' continental shelf, as defined using both the 1958 Continental Shelf Convention and 1982 UN Convention on the Law of the Sea (UNCLOS), and on the resource potential of areas affected by LOS, sea bed boundary and marine park negotiations and deliberations.

Serve on inter-departmental committees and working groups concerned with Law of the Sea, maritime boundary delimitation and non-living sea bed and sub-soil resource matters.

Provide scientific and technical advice to government agencies as requested.

Expected Products

BMR 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.

Highlights for 1990/91

Provision of scientific and technical advice in the form of reports and maps to an inter-departmental committee and related working groups examining the adoption of new and revised Australian maritime zones.

Preparation of an attachment to a cabinet submission on this matter titled 'Definition of Australia's continental shelf and its resource implications'.

Provision of scientific and technical advice to an inter-departmental committee examining matters related to future maritime delimitation negotiations with Indonesia.

Goals for 1991/92

Ongoing provision of advice and information to government agencies and departments on the above matters, as required.

Clients

Policy Divisions, Department of Primary Industries and Energy

Department of Foreign Affairs and Trade

Attorney–General's Department

Australian petroleum industry

Cooperating Organisations

Policy Divisions, DPIE

Project 122.02 Offshore resource map series

Project Leader	Chris Johnston (06) 249 9353
Program Responsibility	Marine Geoscience and Petroleum Geology
Timeframe	January 1989–1994

Objectives

Provide a planning base for research and survey operations in geoscience, fisheries, and oceanography covering the proposed Australian Adjacent Offshore Area (Legal Continental Shelf).

Relevance

The initial series of 32 maps will specifically support the extension of petroleum exploration and trawling into deeper waters.

Expected Outcomes

A base for all deep water (beyond the shelf) activities around the margin including exploration (petroleum and minerals), Australian jurisdiction requirements, fisheries and research.

Activities

Compile and publish a series of contoured bathymetric maps covering the proposed Australian Adjacent Offshore Area (Legal Continental Shelf).

Develop a comprehensive digital database of water depths by integrating databases from the Hydrographic Service, GEBCO plotting sheets, and BMR. The GEBCO data is only available in analog 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.

Using INTERGRAPH facilities, modify machine contours so that they are geomorphologically realistic.

Add to the database other required datasets such as seismic lines, well locations and geological sampling localities with surface sediment types.

Present these data in map and digital form such that they are of maximum benefit to clients; the maps are being produced using Mercator projection at 1:1 M scale with contours at 100 m intervals.

Expected Products

Series of 32 maps will be published progressively over the next four years.

Digital data will be released in a form that best suits the client groups needs.

Highlights for 1990/91

Data from priority area (Albany–Exmouth, WA) used by CSIRO Fisheries Division to find deep sea trawlable ground for research cruise in January–February 1991 (Alan Williams, CSIRO, WA).

Same data used by petroleum exploration consultant to map offshore extent of major structural lineaments (Graham Lucas, Qld).

Significant impact on the establishment of a new Intergovernmental Oceanographic Commission (IOC) project concerning International Bathymetric Chart of the Western Pacific (IBCWP); Australian presence resulted in specifications for IBCWP consistent with Australian Series; maps from eastern Australia will form part of IBCWP (Chris Johnston, BMR).

The first three maps were published and significant progress was made with another five maps (see figure opposite page).

Goals for 1991/92

Publish a further eight maps from south and north west Australia.

Assist efficient publication of maps from the IBCWP by active participation on the Editorial Board 'selling' Australian technology and procedures.

Clients

Fishing industry

Exploration industry

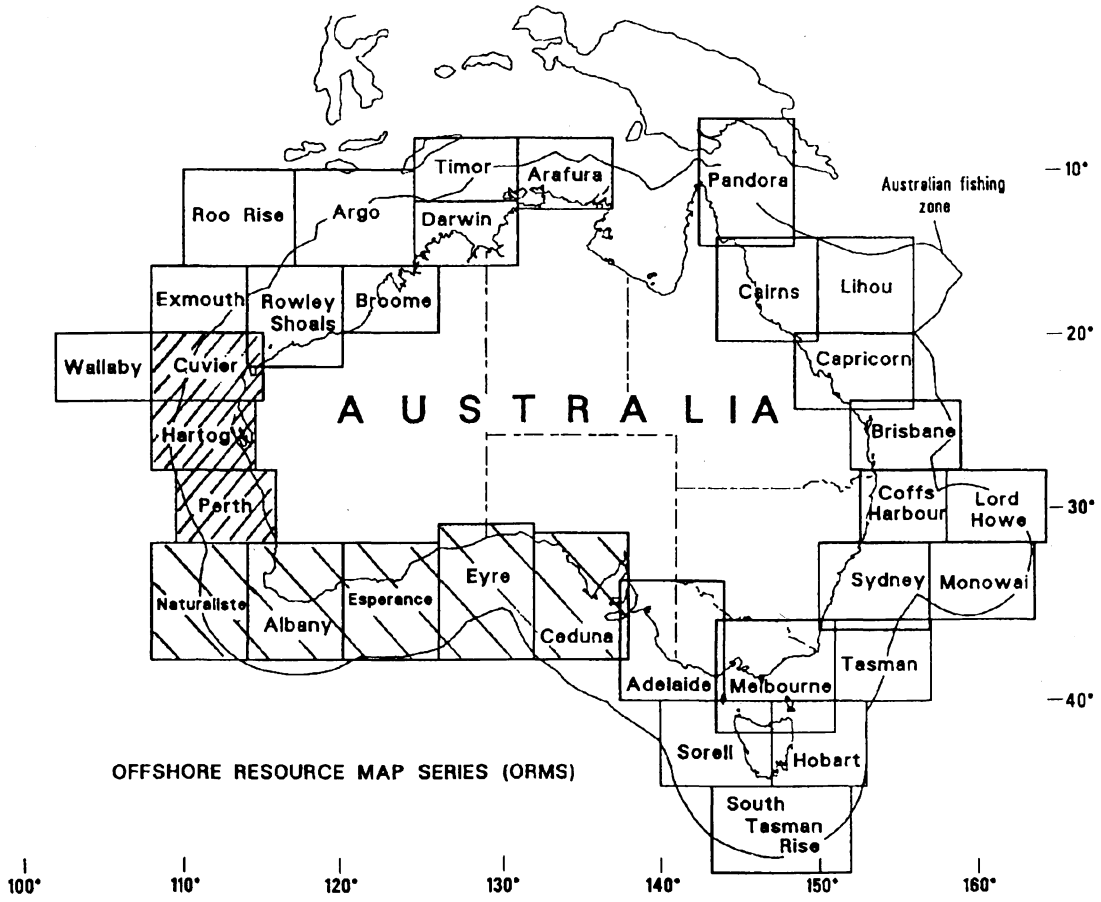
Department of Foreign Affairs and Trade (Australian Jurisdiction)

Marine Research Centres

Cooperating Organisations

Jeff Williams, Bureau of Rural Resources

Bruce Willington, RAN Hydrographic Office



Released as at May 1991

Planned for release during latter half of 1991

131: PETROLEUM RESOURCE ASSESSMENT AND AVAILABILITY

Objectives

Provide accurate and timely advice to Government on scientific and engineering aspects of the administration of the Petroleum (Submerged Lands) Act and on exploration and development activities in Australia and Pacific Basin countries.

Coordinate BMR's assessment of, and provide relevant advice to Government, industry and the public on, the quantity, quality, distribution, and future availability of, Australia's identified and potential petroleum resources.

Provide Government, industry and the public with geoscientific data and overviews relating to the occurrence of petroleum.

Relevance

A considerable part of the component resources is devoted to meeting ongoing advice responsibilities outlined in the Mission Statement utilising the available database. In addition, scientific staff will utilise these data to carry out strategic reviews of offshore petroleum exploration areas to identify areas requiring additional inhouse scientific studies, including the analysis and synthesis of data to develop new plays and leads/prospects. The results of the studies will be published to encourage and assist future explorers.

This program of scientific studies will be integrated with the programs of other BMR components and with DPIE's three year rolling program for the release of offshore exploration areas.

Specific overviews studies have already been produced for some gazetted acreage. These have been sold to industry and, while encouraging exploration, constitute the major cost recovery component for the Branch.

The lodgement by companies of data under the Petroleum (Search Subsidy) and Petroleum (Submerged Lands) Acts allows for integration of these data with data and results from the BMR Petroleum and Marine Geoscience Group to constitute the National Petroleum Database. This database underpins the advice and scientific functions of the component and can, if publicly available, constitute a powerful basis for encouragement of ongoing petroleum exploration in Australia by Australian and foreign petroleum companies.

Activities

Develop and manage the National Petroleum Database.

Analyse, publish and disseminate data and information to facilitate petroleum exploration and development and management of resources by Government.

Contribute to other activities within the BMR Petroleum and Marine Geoscience Group by providing data, information, knowledge, industry experience and research expertise.

PETROLEUM RESOURCE ASSESSMENT AND AVAILABILITY

Component Leader Paul Williamson (06) 249 9362

Component Projects

131.01 Petroleum engineering and identified petroleum resources

131.02 Petroleum exploration and resource potential

131.04 Petroleum industry/information and databases

Component Resources

Project	Average staffing levels				Finances $k		
No	Research	Technical	Other	**Total**	Salary	Operations	**Total**
131.01'	6.2	1.0	0.2	7.4	264	142	406
131.02	13.4	1.0	1.4	15.9	563	171	734
131.03	2.4	6.0	5.4	13.7	357	762	1119
Total	**22.0**	**8.0**	**7.0**	**37.0**	**1184**	**1074**	**2259**
Engineering support staff							
Cartographic support staff				1.7			81
TOTAL				**38.7**			**2340**

Project 131.01 Petroleum engineering and identified petroleum resources

Project Manager	Denis Wright (06) 249 9332
Program Responsibility	Petroleum Resource Assessment
Timeframe	Ongoing

Objectives

Provide confidential advice to Government on:

- the characteristics of and the development of identified petroleum resources
- engineering and safety aspects of the oil and gas industry.

Relevance

The ongoing advice function outlined in the Mission Statement assists Government to act and develop policy in the national interest in respect of petroleum exploration and development and to project petroleum supply for national economic planning.

Expected Outcomes

Informed government decision making.

Activities

Advise Government on development plans and production licences, rate applications, retention leases and 'new' oil applications.

Field assessments of recent discoveries and reassessments of major fields.

Assist DPIE Petroleum Division regarding production statistics data.

Advise DPIE Petroleum Division on metering, sampling, excise system and programs.

Publish reserves and production forecasts.

Publish databases and compilations of Australian identified petroleum resources.

Expected Products

Reservoir simulations

Australian Petroleum Reserves Summaries

Australian Petroleum Accumulations (APA) Reports

Papers on key national issues

Highlights for 1990/91

Published 1989 summary of petroleum exploration and development.

Provided input to review of Petroleum (Submerged Lands) Act.

Participated in Committee on Safe Operation of Offshore Platforms (COSOP).

Participated in negotiations between Australian and Indonesian Governments on Timor Gap Treaty regulations.

Made two staff available to DPIE Petroleum Division as secondees.

Published the PORPERM database, (porosity, permeability and lithology data from 551 wells from BMR core analysis laboratory); several copies were sold.

Issued twice-yearly update of reserves data.

Completed reserves book program revision.

Provided input to revised forecast of Australian crude oil and condensate production.

Provided reservoir geology, reservoir engineering and drilling engineering input to basin release packages for Gippsland, West Barrow and Londonderry Rise.

Issued APA Report No. 6 on the Otway Basin.

Presented BMR paper to International Energy Agency (IEA)—Enhanced Oil Recovery (EOR) collaborative group.

The NERDDC sponsored report on Potential for Enhanced Oil Recovery in Australia was made public and was well received; NERDDC authorised liaison trips to oil companies, universities and industry bodies throughout Australia.

Provided advice to AIDAB for inclusion in annual review of the PNG economy.

Arranged training for PNG petroleum engineer at BMR.

Completed evaluation of a major field using ECLIPSE reservoir simulator.

Goals for 1991/92

Publish a study of economic and technical aspects of development options for water depths greater than 50 m.

Commence study of methane drainage potential in Australia.

Liaise with individual oil companies on outcome of NERDDC–EOR project.

Publish APA reports on Browse, Canning and Carnarvon Basins.

Continue reservoir simulation of oil and gas fields.

Continue work on Cooper–Eromanga, Bowen–Surat and Perth Basin APA reports.

Provide input into three basin release packages.

Continue selling PORPERM database.

Publish 'Brown Book' on development of oil and gas resources of Australia, 1990.

Publish discussion paper on petroleum exploration and development practices in Australia in relation to environmental issues (dependent on funding).

Clients

Petroleum Division, DPIE

Headquarters Group, DPIE

Department of Arts, Sport, the Environment Tourism and Territories; Australian Heritage Commission

Australian National Parks and Wildlife Service

AIDAB

Energy Economics Branch, ABARE, DPIE

State and Territory Mines Departments

PNG Minerals and Energy Department

The petroleum industry

The public

Cooperating Organisations

State and Territory Mines Departments

University of New South Wales

Melbourne University

Murdoch University

International Energy Agency collaborative group on EOR

ABARE

ERDC

CSIRO

Project 131.02 Petroleum exploration and resource potential

Project Leaders	Alan Williams, Regional Assessment David Forman, Potential Resources	(06) 249 9507 (06) 249 9756
Program Responsibility	Petroleum Resource Assessment	
Timeframe	Ongoing	

Objectives

Provide advice to Government on the prospectivity of Australia's sedimentary basins, the significance of exploration results, technical aspects of the administration of the Petroleum (Submerged Lands) Act and related matters.

Provide overviews of petroleum prospectivity of Australian regions to industry to encourage petroleum exploration.

Relevance

Estimates of the quantity, quality, distribution and availability of Australia's undiscovered petroleum resources and geoscientific assessments of prospectivity and exploration programs are required by Government and industry as a basis for policy, planning and administration.

Expected Outcomes

Informed government and petroleum exploration industry decision making.

Activities

Provide geoscientific and technical advice to DPIE with regard to offshore exploration areas currently under licence and for future releases.

Prepare assessments of hydrocarbon prospectivity of areas to be released (petroleum promotional packages).

Advise other BMR programs and portfolio groups and industry on petroleum prospectivity of basins throughout Australia.

Maintain an up to date assessment of the petroleum potential of the sedimentary basins of Australia and its territories.

Investigate the geological and geophysical formation of basins and their development, particularly those aspects most relevant to hydrocarbon accumulations.

Evaluate the results of all exploration as they become available and, in concert with the other research groups, provide the input parameters required for computer programs designed to assess the nation's petroleum potential.

Provide coordination, methodology, computer support and training for basin analysis.

Implement improved methods for qualitative and quantitative assessment of the amount and future rates of production of Australia's undiscovered petroleum resources.

Expected products

Advice to Government and industry on the petroleum prospectivity of Australia's sedimentary basins, the significance of exploration results, technical aspects of the administration of the Petroleum (Submerged Lands) Act and related matters.

Publications providing qualitative (and, where available, quantitative) assessments of petroleum prospectivity to promote exploration in Australia—includes prospectivity packages.

User friendly computer based systems using PEDIN database and links to reserves database.

Quantitative studies of characteristics of generative sedimentary basins.

Quantitative assessments, and quantitative estimates of future oil production.

Contributions to reports in the APA Series.

Scientific papers, petroleum promotional packages and reports relevant to Australia's petroleum resources.

Qualitative and quantitative studies of offshore exploration areas for future releases.

Assessments of Australia's potential petroleum resources published annually; also used in BMR's estimates of future petroleum production.

Highlights for 1990/91

Updated and reassessed the potential petroleum resources of the Bonaparte (offshore), Carnarvon, and Gippsland (offshore) Basins.

Contributions were made to the Canning, Browse, Carnarvon, Cooper–Eromanga and Bowen–Surat reports in the APA series.

Published the Otway Basin Australian Petroleum Accumulation Report.

Contributed to the revision of Petroleum (Submerged Lands) Act.

Provided advice to Government on geological descriptions for vacant areas Release No. 2 of 1990 and assessments of applications for Release 1 of 1990.

Completed a petroleum prospectivity promotional package on the south east Gippsland Basin, Offshore Victoria.

Completed BMR Records promoting the prospectivity of the Canning and central Browse Basins.

Prepared and marketed around thirty promotional packages for Release No. 2 of 1990 on petroleum prospectivity of the West Barrow Area in the Carnarvon Basin and the Londonderry High and Yampi Shelf Areas in the Bonaparte Basin (Timor Sea), offshore Western Australia; a major achievement.

Prepared a manual for the petroleum resource assessment computer program.

Provided assistance in Administrative Appeals Tribunal Hearing into LPG excise.

Goals for 1991/92

Produce three localised exploration packages for gazettal to encourage bidding.

Contribute to two APA series reports.

Coordinate assessments and estimates as required.

Finish the first stage of a reassessment of Australia's potential petroleum resources in 1992.

Demonstrate the menu driven computer based system for assessment of undiscovered petroleum resources to State Mines Departments, private companies and BMR personnel with a view to encouraging use and sale of the system.

Undertake basin analysis/regional review of prospective petroleum exploration areas.

Clients

Petroleum Division, DPIE

State and Territory Mines Departments

The petroleum industry

The public

Cooperating Organisations

State and Territory mines departments

The petroleum industry

Onshore Sedimentary and Petroleum Geology Program, BMR

Marine Geoscience and Petroleum Geology Program, BMR

Project 131.04 Petroleum industry/information and databases

Project Leaders	Sandy Radke	(06) 249 9512	National Petroleum Database Section
	Eugene Petrie	(06) 249 9217	Industry Assessment and Information Section
Program Responsibility	Petroleum Resource Assessment		
Timeframe	Ongoing		

Objectives

Provide timely advice and information to Government, industry and the public on petroleum exploration and development activities in Australia and elsewhere.

Develop an integrated National Petroleum Database to assist in the storage, retrieval and management of all available digital and hard copy petroleum data.

Relevance

Most of the activities within Component 131 and many other petroleum related activities of BMR, Government and industry rely heavily on the availability of relevant petroleum information and databases. The availability of a comprehensive National Petroleum Database is critical in both facilitating good technical decision making by Government and encouraging exploration by local and overseas companies. The development of this broader database is tied to the PEDIN system.

PEDIN has been well supported and the early version sold within the oil industry. Petroleum Resource Assessment is leading a major effort by BMR to develop the National Petroleum Database and to make it increasingly accessible to Government, industry and the public in the next three years using modern information technology.

Expected Outcomes

Timely advice on petroleum activity to Government.

Activities

Maintain and develop petroleum databases.

Maintain awareness and expertise in database methodology and information technology and regularly assess their relevance to petroleum exploration.

Implement modern mass storage technology for the storage of all forms of digital petroleum data.

Utilise PEDIN and PETROSEIS in the management and access of data on a mass storage system.

Develop PEDIN and PETROSEIS databases for integration with other datasets allowing wider utilisation of petroleum data.

Monitor and report industry activity and publish products.

Receive, catalog and store petroleum exploration reports and associated data, and well samples (cores, cuttings and fluid samples) provided to the Commonwealth under petroleum legislation; implement bar code technology to manage this data.

Consolidate petroleum reports, and core and cuttings in repository at Fyshwick to provide upgraded information services.

Survey petroleum exploration development and production information.

Analyse and publish information pertaining to petroleum resources and petroleum exploration and development activities in Australia for use by Government and industry.

Maintain close contacts within BMR and with industry, the Australian Petroleum Exploration Association (APEA) and the States and Northern Territory Mines Departments.

Collect and compile data on petroleum exploration and development in Australia, and the surrounding region, as a basis for resource assessment and advice to government, industry, and the public.

Store samples from BMR drill holes.

Expected Products

A comprehensive database as both digital and hard data for advice to Government and as input to studies of petroleum prospectivity.

A geophysical database module on PEDIN and the mass storage system.

Cost recovery from the sale of PEDIN and related data.

Continued development of the National Petroleum Database to provide products which encourage petroleum exploration.

Corporate well and lease boundary databases on PETROSEIS.

An updated version of PEDIN for public release.

Digital well log, shotpoint location and other geophysical databases on an archival mass storage system.

Weekly well status reports.

Quarterly petroleum exploration and development activity and statistical reports.

Six monthly and an 'on demand' map and key of the petroleum exploration and development titles.

'Australian Oil and Gas – Exploration and Development 1991' (annual summary for 1990).

Petroleum Newsletter series.

HARDCORE database to assist management of the storage and retrieval of petroleum data held by BMR.

Reports and other material to Government and industry as appropriate.

Highlights for 1990/91

Marketed and completed first sale of PEDIN well data.

Acquired a mass storage system for BMR and industry petroleum data.

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

Weekly monitoring of industry activity.

Continuous updating and development of Petroleum Titles Map.

Publications released during the year included weekly drilling reports, quarterly activity information sheets, the Petroleum Titles Map and Key and the Petroleum Newsletter.

Carried out the annual survey of petroleum operators and the activities and expenditure were prepared for inclusion in a new publication currently under development titled 'Australian Oil and Gas – Exploration and Development 1990'.

Made facilities in the Core and Cuttings Laboratory extensively available for the receipt, processing, and examination of cores, cuttings, and other related information by BMR research programs and the petroleum industry.

The examination, indexing, and storage of reports and data, particularly those received under the Petroleum (Submerged Lands) Act, continued; the transfer of these reports and data to a central repository associated with the Core and Cuttings Laboratory progressed significantly following the completion of a second compactus unit.

Developed HARDCORE Physical Data Management System for Core and Cuttings Repository, including database design and implementation, menus, query and reporting software.

Goals for 1991/92

Continue development, maintenance and marketing of the PEDIN petroleum database; it will provide a powerful tool in encouraging petroleum exploration in Australia

- after making the initial sale in 1990/1991, the branch aims for 5–10 sales in 1991/92 with cost recovery contributing to the further development of PEDIN.

Set up an operational archival mass storage system and commence storing digital data; organisation of the physical data stored at Fyshwick and interface of records of this data with the PEDIN database is critical to allow it to be accessed as appropriate by exploration companies and the public.

Integrate PEDIN and other data on the PETROSEIS system as a key development of the National Petroleum Database.

Audit the data in the central repository associated with the Core and Cuttings Laboratory to determine its completeness with the aim of an improved service.

Industry Statistics products in new and conventional form and the first issue of an integrated 'Australian Brown Book' containing overview information from 1990 for the Petroleum Industry.

Clients

Marine Geoscience and Petroleum Geology Program, BMR

Onshore Sedimentary and Petroleum Geology Program, BMR

Petroleum Division, DPIE

The petroleum industry

The public

Cooperating Organisations

Onshore Sedimentary and Petroleum Geology Program, BMR

State and Territory mines departments

The petroleum industry

211: MINERAL PROVINCES STUDIES

Objectives

Optimise mineral exploration.

Provide a reliable geoscientific knowledge base for assessing undiscovered mineral resources.

Improve the geoscientific base for facilitating environmental and land use decisions.

Relevance

The Government in June 1989 responded to the review of the BMR conducted in 1988 by the late Mr Alan Woods, by placing particular emphasis on the widely recognised shortfall in the total national effort in geoscientific mapping. The Minerals and Land Use Program is the spearhead of the new mapping effort in the BMR to be undertaken under the Mapping Accord.

Geological maps (and related data sets and reports) are the primary data source for nearly all applied (and pure) earth science research. Exploration geologists, land use planners, scientists, and engineers use geological maps to address many types of earth science problems of concern to Federal, State, and local governments and to the private sector.

Activities

Carry out, in collaboration with the State/NT geological surveys under the National Geoscience Mapping Accord, multi-disciplinary studies of mineral provinces based on geological mapping, supported by specialist research in geochronology, remote sensing, petrology, geochemistry, mineral deposit and regolith studies.

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

Update 1:250 k and, in some cases, larger and smaller scale geological maps of key mineral provinces.

Use new generation, higher resolution, airborne geophysical data as the core of geological mapping, supported by studies in geochronology and geochemistry, by mineral deposit, regolith, and remote sensing studies, as well as by mineral resource assessment, environmental geoscience, and seismic reflection and refraction studies.

Ensure that output includes a range of digital maps, with emphasis on 1:250 k scale geological maps and related datasets, and also descriptive and interpretative reports.

Highlights for 1990/91

Acquisition of a Geographic Information System and production of first BMR geological map using ARC–INFO (211.10).

Completion of research (maps, reports) on the platinum group element (PGE) potential of layered intrusions in west Pilbara Block, Western Australia (211.04).

Completion of report to the Resource Assessment Commission of the potential mineral resources of the new Kakadu Conservation Zone (211.06).

Goals for 1991/92

Production of geological maps, databases, and reports based on field mapping in the six Accord project areas North Queensland, Eastern Goldfields, Arnhem Land, Lachlan–Kanmantoo, Kimberley–Arunta and Musgrave Range.

Further development of skills in the use of image processing technology, Geographic Information Systems, and computer databases.

Production of databases, maps and reports which provide a synthesis, and assessment of the tectonics and metallogeny of the early to middle Proterozoic of Australia (211.06).

MINERAL PROVINCES

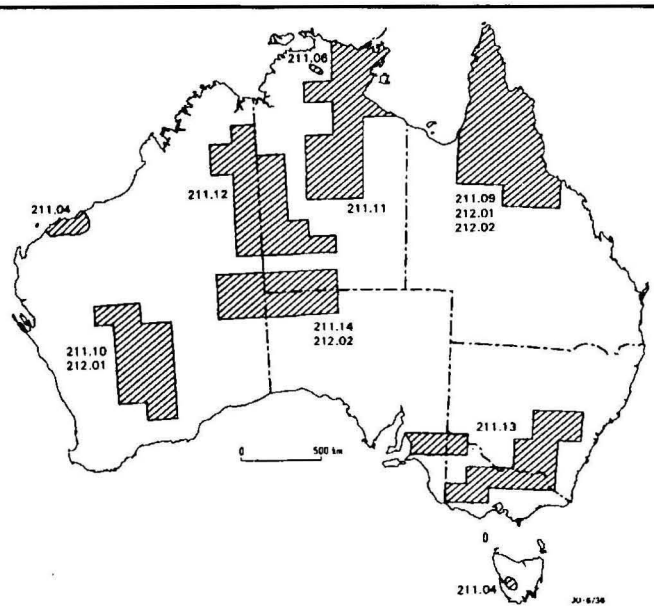
Component Leader Lynton Jaques (06) 249 9745

Component Projects

211.06	Proterozoic Metallogeny
211.09	North Queensland Mapping Accord Project
211.10	Eastern Goldfields Mapping Accord Project
211.11	Arnhem Land Mapping Accord Project
211.12	Kimberley–Arunta Mapping Accord Project
211.13	Lachlan–Kanmantoo Fold Belts Mapping Accord Project
211.14	Musgrave Block Mapping Accord Project

Component Resources

Project	Average staffing levels				Finances $k		
No	Research	Technical	Other	**Total**	Salary	Operations	**Total**
211.06	3.0		0.1	3.1	150	112	263
211.09	12.3	5.3	2.8	20.4	982	447	1429
211.10	8.9		0.7	9.5	457	141	598
211.11	4.8	0.5	1.1	6.3	305	238	543
211.12	5.4		0.3	5.7	273	72	345
211.13	5.9	3.4	0.1	9.4	454	157	611
211.14	2.7		0.9	3.6	174	101	276
Total	**43.0**	**9.2**	**6.0**	**58.2**	**2795**	**1269**	**4064**
Engineering support staff				0.5			17
Cartographic support staff				9.7			463
TOTAL				**68.4**			**4544**



Project 211.06 Proterozoic metallogeny

Project Leader	Leslie Wyborn (06) 249 9489
Program Responsibility	Minerals and Land Use
Timeframe	1991–1996

Objectives

Undertake a predictive assessment of the regional mineral potential of Australian Proterozoic provinces.

Relevance

The Proterozoic orogenic provinces of Australia host many major mineral deposits. These provinces have similar tectono-stratigraphic histories and metallogeny. This project will provide regional synthesis of the metallogeny of Proterozoic mineral provinces and develop new mineral deposit models in support of the NGMA programs. It also incorporates the residual of the Proterozoic Framework Project, the Kakadu Conservation Zone Project and the Mount Isa Inlier Project.

Expected Outcomes

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

Activities

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

Synthesise existing, and where necessary acquire new primary, data on the tectonic, stratigraphic and geochemical development of Proterozoic provinces, in particular poorly known regions.

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

- regional whole rock, mineral and fluid geochemical data, with particular emphasis on regional alterations pattern known to be associated with mineralisation
- geochronological data with emphasis both on the age of the mineralisation as well as the age of the host rocks
- geophysical signatures associated with known deposits (magnetics, radiometrics, gravity)
- synthesis of information on mineral deposits, prospects and occurrences, with particular attention to geochemical, geophysical and geological features
- develop metallogenic maps and syntheses of mineralisation styles
- specialist studies of selected mineral deposit styles involving structural and geochemical investigations.

Expected Products

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

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

- chemically distinctive host rocks (e.g. graphite bearing, sulphide bearing, iron rich rocks)
- regional alteration types (e.g. reduced zones, oxidised zones)
- major structures and lineaments
- potential source rocks for certain elements
- regional geophysical features (magnetics, gravity, radiometrics)
- information on thermal evolution in space and time (e.g. magmatism, metamorphic grade distribution)

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

Metallogenic province maps, databases and syntheses.

Scientific research papers.

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

Highlights for 1990/91

Completed report on the Kakadu Conservation Zone for the RAC.

Released five geochemical data bases from the Mount Isa Inlier, Tennant Creek Inlier, West Australian Proterozoic provinces, South Australian Proterozoic provinces.

Goals for 1991/92

Complete a bulletin on the regional geological characteristics of the Coronation Hill and related deposits of the South Alligator Valley.

Release all Kakadu Conservation Zone reports.

Metallogenic map of the Pine Creek Geosyncline.

Complete mineral deposit map, database and metallogenic synthesis of the Mount Isa Inlier.

Regional geological characteristic of the Mount Isa Copper Deposit.

Release of Pine Creek geochemical database.

Complete and release the Proterozoic geochronological database.

Release Mount Isa geo-traverse maps and reports.

Commence work on a first edition of 'mappable' metallogenic features catalogue to be used in 1992 field season.

Clients

Mineral exploration companies

Government departments

University geoscience departments

Cooperating Organisations

Newcrest Mining

Carpentaria Exploration Company Pty Ltd

Western Mining Corporation Ltd

Pancontinental Resources

Mount Isa Mines

Peko

CRA Exploration Pty Ltd

Monash University

University of Tasmania

Australian National University

Project 211.09 North Queensland Mapping Accord Project

Project Leaders	John Bain, BMR (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 assessments of the mineral potential of the region.

Provide an assessment of coastal hazard (susceptibility to change), resources, and aquifer quality and dynamics.

Relevance

The project will provide governments, industry, and the community with essential information for sound decision making with regard to 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 Minister for Primary Industries and Energy, the Hon. John Kerin MP, and the Queensland Minister for Resource Industries, the Hon. K H Vaughan MLA.

Expected Outcomes

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

An assessment of regional mineral resource potential.

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

Activities

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

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

Develop quantitative models of landscape evolution for the region.

Review of current databases containing geoscience information for the project area, and assessment of future data handling requirements for the project.

Review of exploration company reports in GSQ Library for exploration history of Cape York Peninsula and entry of relevant mineral occurrence information into MINLOC/MINDEP database.

Acquisition and application of relevant new equipment to facilitate new mapping technologies.

Acquisition, image processing and interpretation of new colour aerial photographs, LANDSAT TM, and SPOT IMAGE imagery, and 400 m line spaced aero-radiometric and magnetic data.

Field studies to ground check interpreted image maps, collect geological, geophysical and geochemical data and samples, and build final maps.

Field entry of located observations and sample information to computer database.

Field digitising of geological maps direct from image overlays.

Laboratory studies on collected samples, data analysis and interpretation.

Digital data transferred to GIS for topological definition, integration, interpretation, and new special map generation.

Resource assessment by a multi-disciplinary team applying standard USGS techniques of evaluating the regional datasets for the presence or absence of diagnostic and/or permissive criteria for a range of defined mineral deposit types.

Interpretive reports, research papers and professional advice.

Expected Products

An updated, organised, integrated, computer based and multi-layered geoscientific knowledge base for North Queensland in the form of second generation maps, digital datasets and interpretive reports.

Appropriate models of mineral deposits, regolith development and landscape evolution.

A set of thematic regional maps (geology, geophysics, stream sediment geochemistry, regolith terrains, morpho-tectonics, metallogeny, and resource potential), at appropriate scales for the region (e.g. 1:1 M and 1:500 k).

Revised 1:250 k and 1:100 k scale geological series maps.

New environmental and coastal zone maps at appropriate scales.

Rapid release field compilation sheets for geological map data at field mapping scale (e.g. 1:25 k and 1:50 k).

Computer databases containing geological, geophysical, geochemical, geochronological, and mineral resource data (e.g. ROCKCHEM, MINDEP, MINOCC, MINLOC, OZCHRON, REGMAP, RTMAP, STREAMCHEM).

Integrated digital datasets (image maps) incorporating image processed satellite imagery, geophysical, and geochemical data.

A publicly accessible, computerised GIS containing all available digital geoscience information for the project area.

Descriptive and interpretive reports to accompany maps and data releases.

Appropriate specialist research papers.

Guided field displays and conferences, and public presentations of important findings at local and national meetings.

Highlights for 1990/91

Draft agreement on the NGMA reached with GSQ.

A major integrated multi-disciplinary BMR field program in co-operation and collaboration with GSQ.

New regional geophysical data obtained for Ebagoola at 400 m line spacing facilitates the second generation mapping planned for 1991/92.

New multi-element stream sediment geochemical data covering much of the northern part of the Coen Inlier obtained and sold to clients, demonstrating the viability of the geochemical mapping program.

Regolith terrain mapping of the northern part of the Peninsula completed, revealing amongst other things that the extent of Tertiary sediments shown covering much of the Peninsula batholith on existing maps is greatly exaggerated, thereby increasing the prospectivity of the region.

Application of ion probe U–Pb zircon geochronology and Sm–Nd isotope chemistry as regional reconnaissance tools has provided a rapid, cost effective guide to the chronology of the Cape York Peninsula Batholith.

New field mapping techniques were developed (e.g. integration of GPS location data, computerised field information, and digital field drafting) which will provide a basis for rapid, effective second generation mapping in 1991/92 and beyond.

Goals for 1991/92

Complete the geological, geochemical, geophysical and regolith terrain maps of the Ebagoola 1:250 k sheet area.

Complete assessment of mineral resource potential of the Ebagoola 1:250 k sheet.

Prepare and release a folio of maps, databases and interpretive reports using INTERGRAPH and ARC/INFO GIS.

Contribute data and interpretation to Cape York Peninsula Land Use Study as part of an initial two year program.

Carry out stream sediment geochemical survey and release data for sale.

Develop databases associated with field programs, including REGMAP, RT MAP, ROCKCHEM, STREAMCHEM, MINDEP, MINOCC, MINLOC and OZCHRON.

Clients

Commonwealth, Queensland and Local Government departments and organisations (especially CYPLUS)

Industry

The community

Cooperating Organisations

Geological Survey of Queensland, Department of Resource Industries

Australian National University

United States Geological Survey

National Resource Information Centre

Project 211.10 Eastern Goldfields Mapping Accord Project

Project Leaders	Peter Williams, BMR	(06) 249 9389
	A Hickman, GSWA	(09) 222 3333
Program Responsibility	Minerals and Land Use	
Timeframe	1987/88–1995	

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, particularly at Mt Charlotte and Lancefield.

Develop predictive models for the tectonic evolution of the Eastern Goldfields and environs.

Establish the degree of continuity of structure and stratigraphy beneath regolith cover.

Relevance

The Eastern Goldfields has long been and remains one of Australia's most important mineralised areas. The region hosts a wide variety of significant deposits, including gold, nickel, tantalum, uranium, vanadium, platinum group elements and phosphate.

The project has a high priority established by the Chief Government Geologists' Conference under the National Geoscience Mapping Accord. The area was identified as a high priority through recent questionnaires to the mining industry conducted by GSWA.

Expected Outcomes

More effective exploration in the Eastern Goldfields.

A geoscientific database to facilitate reliable resource assessment.

A geoscientific database to facilitate decisions on development strategies.

Activities

Review and compilation of existing geological information.

Primary data collection by geological mapping, remote sensing, air photo interpretation, gravity, magnetic and seismic surveys.

Petrological studies, including detailed petrologic investigation of the metamorphism.

Geochemical studies, including regional geochemistry of granitoids.

Fluid inclusion studies of mineralised zones.

Collation of geoscience data into integrated geoscientific spatial databases.

Expected Products

Ten updated 1:250 k geological maps with accompanying geophysical and metallogenic maps where appropriate.

New 1:100 k geoscience thematic maps over approximately twenty-four 1:100 k map areas.

Appropriate geoscientific maps and images over selected 1:250 k map areas.

Digital geological information systems, incorporating geological, geophysical, geochemical, mineral deposit, regolith and topographic sets, with appropriate geological analysis of those sets as resources permit.

Seismic reflection profiles and interpreted crustal cross sections.

Updated models of ore deposition.

Aeromagnetic and gravity interpretation maps and models as appropriate.

Reports and specialist papers

Highlights for 1990/91

Completion of Ballard, Leonora, Yerilla, Minerie and Mount Mason 1:100 k geological layers for a comprehensive ARC/INFO GIS.

Specialist paper on extensional faults and compressed metamorphic gradients at Leonora and their significance to mineralisation.

Specialist papers on Archaean lamprophyres, identifying them as part of the Archaean gabbro intrusion association.

Goals for 1991/92

Commence field mapping in the Edjudina 1:250 k map sheet, comprising one 1:100 k map.

Complete mapping of Menzies 1:250 k sheet (the Mount Mason 1:100 k map area).

Complete digital graphical databases and geological maps for Minerie, Yerilla, Leonora, Ballard and Mount Mason 1:100 k sheet areas.

Continue seismic program with collection of 150 line km of deep reflection data, and commence interpretation.

Carry out 4 km spacing gravity survey of Laverton 1:250 k sheet.

Commence interpretation of detailed magnetics of the Edjudina and Laverton 1:250 k sheets.

Continue mineral deposit, fluid inclusion and fluid chemistry studies of selected sites (with GSWA).

Design spatial and attribute data bases to support map and digital products.

Commence compilation of whole rock geochemistry database for the project area.

Carry out regional multi-element geochemistry on samples from seismic shotholes.

Clients

Mineral exploration companies

Geological research community

Government organisations involved in land use and resource assessment activities

Cooperating Organisations

Geological Survey of Western Australia

Prof DI Groves, University of Western Australia

CSIRO

CW Passchier, University of Utrecht

Western Mining Corporation (Kalgoorlie)

Project 211.11 Arnhem Land Mapping Accord Project

Project Leaders	Ian Sweet, BMR	(06) 249 9453
	B Pietsch, NTGS	(089) 895 214
Program Responsibility	Minerals and Land Use	
Timeframe	1990–1996	

Objectives

Assess the mineral potential of the Arnhem Land region.

Assess the likely hydrocarbon potential and timing of hydrocarbon generation in the McArthur Basin sequence.

Relevance

Arnhem Land has been subjected to little previous geological investigation. The region is believed to have significant mineral potential because similar rocks in the south east part of the McArthur Basin host base metal (Pb, Zn, Cu) deposits. The southern McArthur Basin sequence is also prospective for hydrocarbons and previous BMR work has demonstrated the existence of Proterozoic oil.

Expected Outcomes

A better understanding of the mineral and hydrocarbon potential of the Arnhem Land region.

A geoscientific database to facilitate land use decisions.

Activities

Develop a comprehensive understanding of the Early to Middle Proterozoic evolution of the Arnhem Land region.

Identify the styles, timing and settings of mineral deposits.

Geological mapping and specialist studies in north eastern Arnhem Land, focusing on the Arnhem Bay–Gove and Blue Mud Bay–Port Langdon 1:250 k sheets.

Image processing and interpretation of aeromagnetic and radiometric data from Arnhem Bay–Gove and Blue Mud Bay–Port Langdon and integration with geology.

Capture of primary data in digital format.

Surficial geochemical sampling.

Geochronology of selected rock units.

Sedimentological studies and establishment of stratigraphic sections.

Expected Products

New 1:250 k geological maps of Arnhem Bay–Gove, Blue Mud Bay–Port Langdon, Katherine, Milingimbi, part of Mount Evelyn, Mount Marumba, and Roper River–Cape Beatrice, all in digital form.

Databases of geological, geochronological, and geochemical data, including a stream sediment data package based on a regional base line sampling program.

Reports and papers on various aspects of the regional geology.

GIS package incorporating the geological data, field observation and sample data, stream sediment and other geochemical data, geophysical interpretations, and possibly, regolith data and interpretations.

Highlights for 1990/91

Mapping in Waterhouse–Mataranka region led to improvements in our understanding of the geology of the western McArthur Basin which will have an impact on models of the development of the Basin as a whole. Of particular relevance were the recognition of unconformities within the Kombolgie Formation, of intrusive rocks in the upper Katherine River Group, and the presence of hydrocarbons in the uppermost Roper Group.

Goals for 1991/92

Complete mapping on Waterhouse and Mataranka 1:100 k sheets (July and August); finalise compilation sheets.

Complete preparation of a second edition Katherine 1:250 k sheet.

Compile reports on the geology of the Waterhouse–Mataranka region.

Commence 1992 fieldwork in May 1992, including a stratigraphic drilling program to obtain fresh samples of critical units for stratigraphic, geochronologic, and geochemical studies.

Commence geological mapping in the Arnhem Bay–Gove and Blue Mud Bay–Port Langdon 1:250 k sheet.

Produce pixel maps and interpretations of available airborne magnetic and radiometric data for the above two 1:250 k sheets.

Reconnaissance surficial geochemistry sampling program and development of multi-element dataset.

Clients

Petroleum exploration companies

Mineral exploration companies

NT and Australian Governments

Cooperating Organisations

Northern Territory Geological Survey

University of Adelaide

Project 211.12 Kimberley–Arunta Mapping Accord Project

Project Leaders	David Blake, BMR	(06) 249 9667
	C Edgoose and DN Young, NTGS	(089) 515 664
	TJ Griffin and IM Tyler, GSWA	(09) 222 3606
Program Responsibility	Minerals and Land Use	
Timeframe	1990–1995	

Objectives

Describe styles of mineralisation that can be used as predictive exploration models.

Provide geological and mineral resource information necessary for land use decisions.

Determine the nature, timing, and distribution of significant geological events in and between the east Kimberley, the Granites–Tanami and west Arunta areas.

Determine the extent of prospective basement beneath thin cover.

Relevance

The Kimberley–Arunta area is crucial for developing models for the tectonic evolution of northern and central Australia. Although highly prospective for metals and diamonds, the area 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 The Granites–Tanami provinces in particular have been, and continue to be, high profile regions for mineral exploration companies. The area is overlapped by parts of the Canning, Amadeus, Ngalia, Georgina, and Wiso sedimentary basins, which are prospective for hydrocarbons. The area also includes aboriginal land and national parks, and has an increasing potential for tourism.

Expected Outcomes

A better understanding of the mineral and hydrocarbon resource potential of the region.

A geoscientific database to facilitate more informed land use decision making.

Activities

Review and compile all previous geological information.

Detailed geological mapping (including specialist structural, metamorphic, and sedimentological studies) of well exposed parts of areas.

Interpretation of regional geophysical data; acquisition and interpretation of detailed aeromagnetic and radiometric data.

Stratigraphic drilling to identify concealed bedrock and determine thickness and nature of surficial cover/regolith U–Pb zircon, Sm–Nd, Rb–Sr, K–Ar, Ar–Ar geochronology.

Igneous rock geochemistry.

Interpretation of remotely sensed data (satellite imagery).

Compilation and manipulation of structural, geochemical, geochronological, and mineral deposit databases.

Expected Products

Digital and hard copy geological and geophysical maps at scales ranging from 1:25 k to 1:1 M.

Digital databases.

GIS package incorporating integrated digital datasets.

Descriptive and interpretative reports.

Assessment of known and potential mineral resources.

Appropriate scientific papers.

Highlights for 1990/91

Significant revision of previous stratigraphic and structural framework in the Hermannsburg, Mount Doreen, and Gordon Downs 1:250 k sheet areas.

Release of main results of 1990 fieldwork in west Arunta and east Kimberley through an article in the BMR Research Newsletter.

Compilation of two 1:100 k geological sheets (Vaughan and Amburla) in digital form for the project's GIS package.

Preparation and presentation of two papers on geochronology and magmatism in the Hermannsburg sheet area and two on the deep crustal structure of central Australia.

Goals for 1991/92

Complete field mapping in the Mount Doreen 1:250 k sheet area.

Complete compilation of Vaughan, Doreen, and Yuendumu 1:100 k sheets, and compile Mount Doreen 1:250 k sheet (2nd edition).

Complete data record for Vaughan 1:100 k sheet area and explanatory notes to accompany Mount Doreen 2nd edition map.

Complete compilation of Hermannsburg 1:250 k geological sheet (2nd edition) and accompanying explanatory notes.

Acquire, process, and interpret detailed airborne geophysics for Dixon Range and part of Gordon Downs 1:250 k sheets in preparation for 1992 fieldwork.

Obtain geochronological data (U–Pb and Sm–Nd) for 8–10 rock units in the Granites–Tanami and east Kimberley provinces.

Complete review of previous geological work in the east Kimberley and the Granites–Tanami provinces.

Prepare for, and commence, 1992 fieldwork in the east Kimberley.

Clients

Mineral exploration companies

Petroleum exploration companies

Geoscience consultants

NT government departments (Water Resources, National Parks)

Central Lands Council

CSIRO

Tourist industry

Environmentalists

Educational institutions

Cooperating Organisations

C Edgoose, DN Young, Northern Territory Geological Survey

TJ Griffin, IM Tyler, Geological Survey of Western Australia

Australian National University

University of Western Australia

Edinburgh University

University of Minnesota

Project 211.13 Lachlan–Kanmantoo Fold Belts Mapping Accord Project

Project Leaders	Doone Wyborn, BMR	(06) 249 9386
	J Watkins, NSWGS	(02) 901 8330
	Fons Vandenberg, VICGS	(03) 412 7811
	John Parker, SADME	(08) 274 7615
Program Responsibility	Minerals and Land Use	
Timeframe	1990–1995	

Objectives

Determine the geologic evolution of the Kanmantoo and Lachlan Fold Belts.

Provide a new generation of digital geological data on the Kanmantoo, and especially the Lachlan Fold Belt.

Provide tectonic, metallogenic and geomorphic/regolith interpretations based on the new data.

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 (Cu, Au, Pt), Gilmore Fault Zone (Au), Sn granites of the Wagga Metamorphic Belt (Sn, W, Bi), Bendigo Slate Belt (Au), Stavely Greenstone Belt (Au, Cu, Pb, Zn), and volcanic associated mineralisation in the Kanmantoo Fold Belt (possible Cu-Pb-Zn massive sulphide deposits).

Expected Outcomes

Better targetted exploration activity in the Lachlan–Kanmantoo Fold Belt.

Activities

Geological mapping of the most prospective parts of the fold belt using new technologies to produce 1:250 k 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.

Sedimentological studies.

Regolith terrain mapping to produce 1:250 k maps.

Expected Products

A geoscientific database to facilitate resource assessment.

Digital topographic, magnetic, radiometric, geological and thematic maps at appropriate scales, with accessible integrated databases of geochemical, structural, petrographic and mineral deposit information, and descriptive

and interpretive reports, review documents and specialist papers.

New editions of 1:100 k and 1:250 k scale geological maps to be published in collaboration with the State Surveys; map sheets (1:250 k) to be covered or partly covered are Bathurst, Forbes, Narromine, Dubbo, Cootamundra, Narrandera, Wagga Wagga, Tallangatta, Jerilderie, Wangaratta, Bendigo, St Arnaud, Ballarat, Hamilton and Pinaroo.

In conjunction with ANU, a 1:1.25 M scale full colour map and a GIS type 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).

A new edition and resource atlas of the Canberra 1:250 k sheet area.

Highlights for 1990/91

By means of lectures and articles in BMR Research Newsletter, BMR has helped stimulate a new awareness of the mineral potential in the central Lachlan Fold Belt in NSW, with a resulting increase in exploration activity by a number of major mining companies.

University geology departments have focused honours and post-graduate students and undergraduate student mapping camps in areas where BMR is mapping.

Goals for 1991/92

Complete processing of rectified TM images and newly acquired airborne geophysical data.

Carry out analysis of TM images and airborne geophysical data over areas to be mapped.

Complete geological mapping of the Blayney and Oberon 1:100 k sheet areas, and substantially complete 1:25 k digital compilation maps and map commentaries of those two sheets. Emphasis will be on igneous petrology, structural studies, sedimentology and mineral potential (particularly Cu, Au, Pt).

Commence, in association with the NSW Geological Survey, compilation of a second edition of the Bathurst 1:250 k geological map.

Publish a 1:1.25 M scale map of the distribution of granites in the Lachlan Fold Belt.

In association with the Victorian Geological Survey, commence mapping and compilation at 1:100 k scale of a 2nd edition Ballarat 1:250 k sheet, with particular emphasis on understanding the geological setting of the greenstone belts.

Regolith mapping of Bathurst and Forbes 1:250 k sheet areas.

Clients

Mining and exploration companies

Government organisations such as Forestry, CSIRO, Public Works, Road and Rail Transport Departments

Environmental groups

Prospectors, farmers, developers

Universities

Cooperating Organisations

NSW Geological Survey

Geological Survey, Victorian Department of Industry, Technology and Resources

SA Department of Mines and Energy

Victorian Institute of Earth and Planetary Sciences

ANU Geology Department

Monash University

CSIRO Division of Exploration Geoscience

Geopeko

Climax Mining Ltd

Newcrest Mining

RGC Exploration Pty Ltd

Dominion Mining Ltd

Project 211.14 Musgrave Block Mapping Accord Project

Project Leaders	Andrew Glikson, BMR	(06) 249 9591
	AJ Parker, SADME	(08) 274 7615
	PR Dunn, GSWA	(09) 222 3333
	N Duncan, NTGS	(089) 503 663
Program Responsibility	Minerals and Land Use	
Timeframe	1990–1998	

Objectives

Update and improve the geoscientific knowledge base of the Musgrave Block through systematic multi-disciplinary studies.

Provide the regional framework as a basis for decisions concerning the environment, water and mineral resources and land management by governments and by the aboriginal communities.

Relevance

The Musgrave Block has been subjected to only reconnaissance investigations and few local detailed university studies. In the 20 years prior to 1987, little or no work could be conducted due to access problems. BMR is the first geoscience organisation to obtain access permits in WA and SA. BMR's work in the area is considered by State authorities and the mining industry as an essential first step toward future comprehensive documentation of the environment and resources of the Musgrave Province.

Expected Outcomes

Comprehensive documentation of the environment and resources of the Musgrave Province.

Activities

Prepare a series of 1:100 k thematic geological and environmental maps.

Define the nature and timing of key geological events and the tectonic evolution of the Musgrave Block.

Document and provide a modern petrological understanding of the layered basic/ultrabasic rocks of the Giles Complex and their anatectic effects on granulite host rocks of the Musgrave Block.

Geological mapping of the Tomkinson Ranges, western Musgrave Block and outlying areas, including the Davies, Bell Rock, Bates, Blackstone, Holt and Finlayson 1:100 k Sheet areas, the Petermann and Blood Ranges 1:250 k sheet areas (NTGS) and the Mann 1:250 k sheet area (SADME).

Petrological studies of the basic/ultrabasic Giles Complex, SA and WA.

Isotopic, petrological and geochemical studies of felsic granulite, migmatite and granitic units of the Tomkinson Ranges.

Studies of Quaternary deposits and the environmental geology of the Tomkinson Ranges.

Hydrogeological studies of the Tomkinson Range area.

Expected Products

1:100 k geological maps covering key areas within the limits of the Bentley, Talbot, Scott, Cooper, Petermann Ranges, Mann, Ayers Rock, Woodroffe, Kulgera and Alberga 1:250 k sheet areas.

Thematic 1:1 M maps of the geology, geophysics, hydrogeology, geomorphology, 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 and assessments of the mineral and water potential of parts of the Musgrave Block.

Highlights for 1990/91

Progress in the 1:100 k mapping of the Tomkinson Ranges and in petrological studies of the layered basic/ultrabasic intrusions of the Giles Complex.

Completion of the quaternary/vegetation environmental field mapping of the Tomkinson Ranges.

Publication of papers on structure of the Musgrave Block; pseudo-tachylite breccia vein systems in the Giles Complex; PT conditions and metamorphism of the Giles Complex; felsic core complexes in the Tomkinson Ranges; Quaternary deposits of the Tomkinson Range.

Goals for 1991/92

Complete field mapping within the Bell Rock, Bates, Blackstone, Holt and Finlayson 1:100 k sheet areas.

Conduct interpretations of remotely sensed (TM) imagery and airborne magnetic and radiometric data in conjunction with preparation of 1:100 k maps.

Complete petrological study of the Giles Complex intrusions, including the Hinckley, Latitude Hill, Bell Rock, The Wart, Blackstone, Murray Range and Jameson intrusions.

Complete editing the 1:100 k Quaternary/environmental Tomkinson Range and report.

Conduct geochemical, petrological and isotopic age studies of felsic igneous and metamorphic host rocks of the Giles Complex, aimed at elucidating the age of the layered intrusions and their thermal and anatectic effects on the country rocks.

Clients

Commonwealth, South Australian, Western Australian and Northern Territory Governments

Ngaanyatjarra Council Inc

Anangu–Pitjantjatjarra Council

Mineral exploration companies

Cooperating Organisations

AJ Parker, SA Geological Survey

N Duncan, NT Geological Survey

PR Dunn, WA Geological Survey

University of Tasmania

University of Sydney

University of Melbourne

Ngaanyatjarra Council Inc

Anangu–Pitjantjatjarra Council

221: GEOPHYSICAL MAPPING

Objectives

Develop, maintain and make available national, digital databases of magnetic, gravimetric and gamma-ray spectrometric parameters that are suitable for the modern era of exploration.

Develop methods to improve the quality and usefulness of the data; and ensure that the information is in a readily accessible and useful format.

Relevance

Geophysical data and maps covering large areas are of fundamental importance in the development of a comprehensive understanding of the geology of a region. This regional information is an essential requirement for Government and the mineral and petroleum exploration industries to assess resource potential and determine land use policies and for industry to plan more detailed exploration activities.

As the more obvious mineral and petroleum resources are discovered and developed, new exploration targets become deeper and geophysical techniques and datasets become important in exploration strategies. For the Australian mineral and petroleum exploration industries to be effective and competitive in this environment, it is necessary that they have access to integrated geophysical datasets that cover the continent and its margins.

Activities

Conduct and contract out systematic onshore and offshore airborne surveys and ground geophysical surveys.

Investigate, develop and implement improvements in data acquisition, processing, enhancement, analysis and presentation.

Ensure that the information is in a readily accessible and useful format for those involved in minerals and petroleum exploration and resource assessment and for the National Geoscience Mapping Accord (NGMA).

Highlights for 1990/91

Completed project, Aeromagnetic survey, Vulcan Sub-Basin, North West Shelf (221.04).

Released all digitally acquired airborne geophysical data from the reconnaissance survey of Australia.

Substantially completed modification, outfitting, and testing of the new survey aircraft VH–BGE.

Completed aerial surveys over Dubbo (NSW) and St Arnaud (VIC) 1:250 k sheet areas with the new BMR aircraft; acquired aerial data over Ebagoola (QLD) by contract.

Goals for 1991/92

Acquire regional and detailed survey data required for the National Geoscience Mapping Accord for the North Queensland (Hann River), Lachlan–Kanmantoo (Bathurst, Ballarat), Canning Basin (Crossland, Dummer, Joanna Spring, Percival, Helena), Eastern Goldfields (Edjudina, Laverton) and Gawler Craton (Murloocoppie) projects.

Improve the national databases by adding more data in high priority areas and improving the quality and consistency of data.

Provide data in map, image and digital form.

GEOPHYSICAL MAPPING

Component Leader Colin Reeves (06) 249 9226

Component Projects

221.01 National airborne magnetic and gamma-ray spectrometric surveys and databases

221.02 National Gravity Database

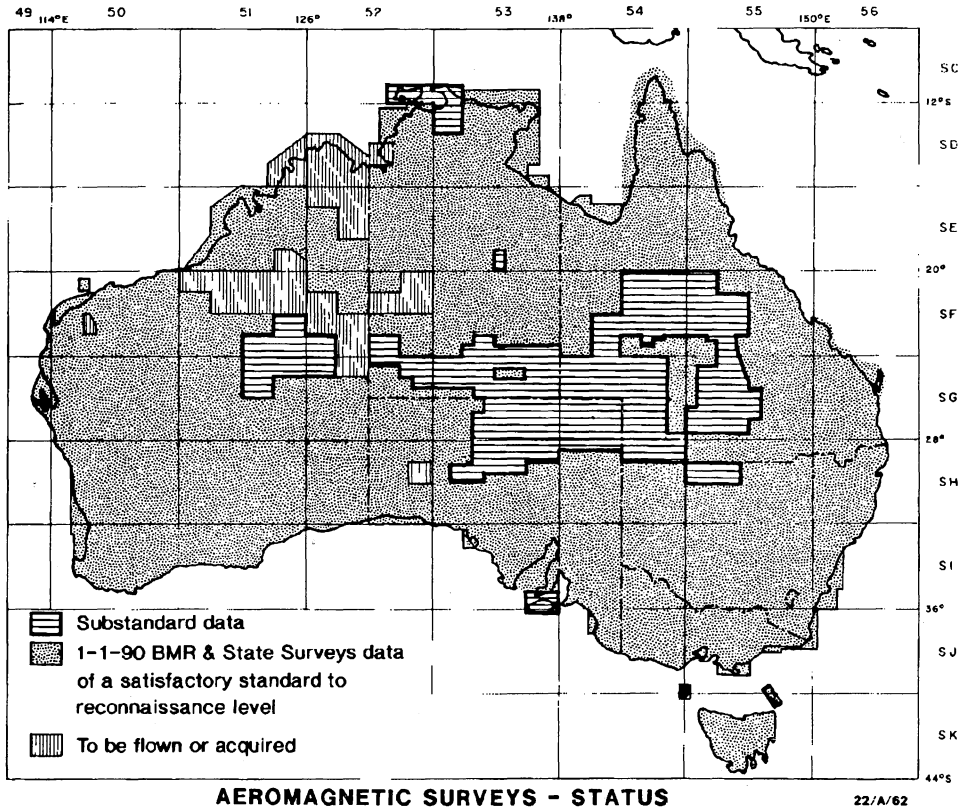
221.05 Digital magnetic map of Australia

Component Resources

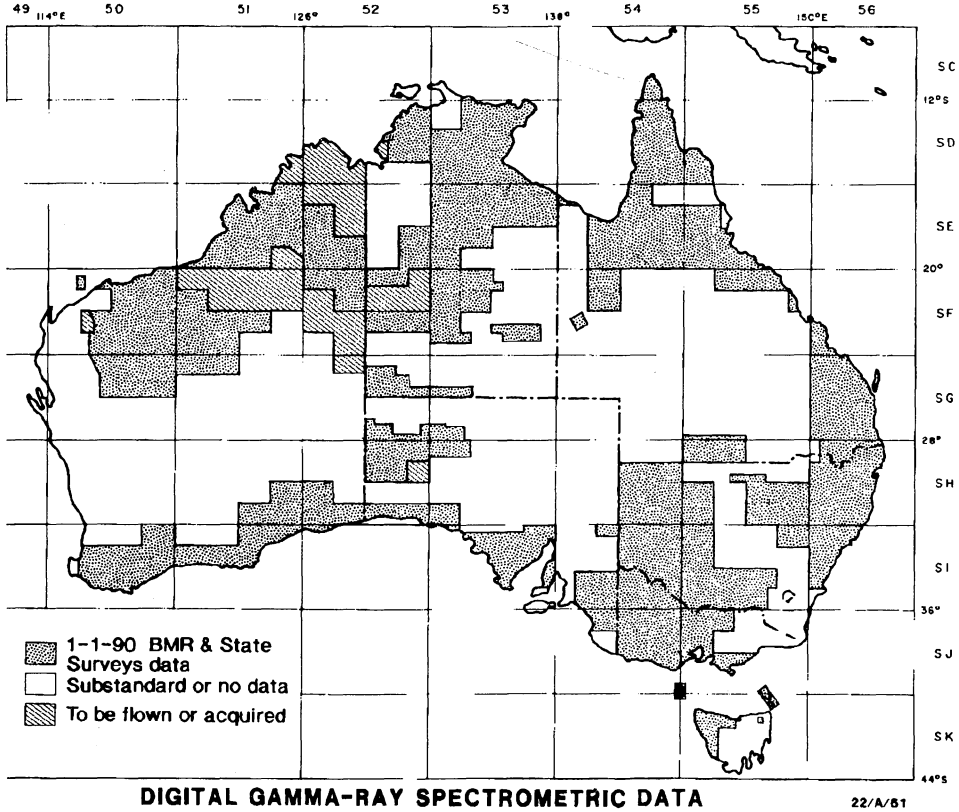
Project	Average staffing levels				Finances $k		
No	Research	Technical	Other	**Total**	Salary	Operations	**Total**
221.01	10.9	6.5	0.8	18.2	658	**1922	2580
221.02	2.1	2.0	0.2	4.3	154	60	214
221.05	1.0	0.5	0.1	1.6	60	5	65
Total	**14.0**	**9.0**	**1.1**	**24.1**	**872**	**1987**	**2859**
* Engineering support staff				12.1			405
* Cartographic support staff				3.9			186
TOTAL				**40.1**			**3450**

* Includes ESU and CSU allocations to 221 (Geophysical Mapping), 222 (Earthquake Seismology, 223 (Nuclear Explosion Seismology) and 224/5 (Geomagnetism)

** The operational allocation of $1922 k includes $955 k allocated for contract surveying.



AEROMAGNETIC SURVEYS - STATUS 22/A/62



DIGITAL GAMMA-RAY SPECTROMETRIC DATA 22/A/61

Project 221.01 National airborne magnetic and gamma-ray spectrometric surveys and databases

Project Leader	Ian Hone (06) 249 9306
Program Responsibility	Geophysical Observatories and Mapping
Timeframe	1951–ongoing

Objectives

Develop and maintain the national magnetic and gamma-ray spectrometric databases.

Ensure the data is in a readily accessible and useful format for those involved in minerals and petroleum exploration, land use issues, resource assessment and for the National Geoscience Mapping Accord (NGMA).

Expected Outcomes

Databases enhanced and generation of products given below.

Activities

Conduct and contract out systematic airborne geophysical surveys.

Investigate, develop, and implement improvements in acquisition, processing, analysis, enhancements, and presentations of the data.

Expected Products

Maps of total magnetic intensity (TMI) and gamma-ray intensities at 1:250 k, 1:100 k, 1:50 k and 1:25 k scales as appropriate for flight line spacings.

1:250 k and 1:1 M TMI and gamma ray spectrometric pixel maps using various enhancements.

1:1 M compilations of TMI contours.

Digital datasets on magnetic tapes.

Highlights for 1990/91

Processed and released all reconnaissance survey data acquired prior to 1990/91.

Modified, outfitted and tested the new survey aircraft, VH–BGE Flew surveys over southern St Arnaud and Dubbo 1:250 k Sheet areas using 400 m and 200 m line spacing.

Successfully completed the joint project with the Victorian Department of Industry, Technology and Resources to acquire data by contract over the onshore Otway Basin and detailed data over the Ararat 1:100 k Sheet area with the release of the datasets.

Flew a 250 m line spacing survey of Bathurst 1:250 k sheet area in a joint project with the NSW Department of Minerals and Energy.

Completed the contract survey of Ebagoola (QLD).

Released airborne geophysical data for Western Australia

- Mandora, Munro, McLarty Hills, Crossland (pt), Marble Bar, Mount Anderson, Pyramid, Noonkanbah, Derby, Roebourne, Yampi, Pender, Dampier, Port Hedland, Charnley, Lennard River, Lagrange.

Northern Territory

- Tanami East

Victoria

- Hamilton, Portland, Colac (onshore), Ararat (1:100 k)

South Australia

- Streaky Bay (pt), Yardea (pt), Elliston, Kimba, Lincoln, Olary (pt).

Released reprocessed data for Western Australia

- Medusa Banks/Port Keats, Cambridge Gulf/Auvergne, Kennedy Range, Winning Pool, Wooramel, Yanrey, Yaringa, Glenburgh (pt), Ajana, Byro (pt),

Murgoo (pt), Mount Phillips (pt), Ningaloo (pt), Minilya(pt), Shark Bay (pt), Edel (pt), Edmund (pt), Quobba(pt)

Northern Territory

- Auvergne, Waterloo, Limbunya, Birrindudu, Delamere, Victoria River Downs, Wave Hill, Cape Scott (pt), Tennant Creek

South Australia

- Alberga, Tallaringa (pt), Coober Pedy(pt), Tarcoola, Kingoonya, Abminga

New South Wales

- Bourke, Goulburn, Forbes, Narromine,Cargelligo, Booligal

Victoria

- Ivanhoe, Warragul (offshore), Sale (offshore), Deal Island (offshore), Mallacoota (offshore).

Released pixel maps for Cape York (1:1 M).

Goals for 1991/92

Finalise fine tuning of the aircraft VH–BGE and its geophysical and data acquisition systems.

Acquire, either by contract or by BMR aircraft, data for the North Queensland (Hann River), Lachlan (Bathurst, Ballarat), Canning Basin (Crossland, Dummer, Joanna Spring, Percival, Helena), Eastern Goldfields (Edjudina, Leonora, Laverton), Kimberley–Arunta (Dixon Range, Gordon Downs) and Gawler Craton (Murloocoppie) NGMA projects.

Improve methods of gamma-ray data acquisition and processing and magnetic data processing .

Upgrade databases as necessary.

Clients

Exploration companies

State and Territory mines departments

Tertiary educational institutions

Other government agencies (e.g. CSIRO)

Cooperating Organisations

State and territory mines departments

Exploration companies

Project 221.02 National Gravity Database

Project Leader	Michael Morse (06) 249 9251
Program Responsibility	Geophysical Mapping and Observatories Program
Timeframe	1965–ongoing

Objectives

Maintain and develop the Australian National Gravity Database and ensure that the information is readily accessible.

Relevance

A high quality Australia wide gravity database is vital for minerals and petroleum exploration, resource assessment and land use issues.

The regional gravity survey of onshore Australia is being improved using data from industry, state, and BMR surveys at closer station spacing. We propose collecting data at three to four km station spacing in areas where airborne geophysical data have been acquired for the Mapping Accord, and in a joint project with the Queensland Department of Resource Industries.

Expected Outcomes

National Gravity Database enhanced and generation of products given below.

Activities

Carry out surveys as part of the NGMA and in joint projects with States.

Investigate, develop and implement improvements in acquisition, processing, analysis, enhancements and presentations of gravity data.

Maintain a register of Isogal Stations, repair stations, install new stations as necessary.

Check, maintain, and install calibration ranges.

Acquire, check and incorporate data into the database from State Mines Departments and companies.

Expected Products

1:1 M and 1:250 k Bouguer anomaly maps.

1:1 M and 1:5 M gravity pixel maps using various enhancements.

Computer generated datasets on tapes and disks containing gravity information for sale.

Highlights for 1990/91

Completed the Townsville–Ayr–Bowen region gravity survey; results processed and released.

Checked, repaired and installed Isogal stations and calibration ranges in association with absolute gravity measurements made by the Geodetic Mapping Agency of the US Department of Defence.

Began Australia wide data checking.

Updated register of Isogal stations needing repair.

Goals for 1991/92

Undertake gravity surveys in north east Queensland in co-operation with the Queensland Department of Resource Industries (Buchanan, Mt Coolon) in the Eastern Goldfields (Edjudina, Laverton), in Cape York and in the southern and central Lachlan Fold Belt (Dubbo and central Victoria).

Clients

Exploration companies

State and Territory mines departments

Tertiary educational Institutions

Other government agencies

Cooperating Organisations

State and Territory mines departments

AUSLIG

Exploration companies

Leeds University

Project 221.05 Digital Magnetic Map of Australia

Project Leader	Chris Tarlowski (06) 249 9265
Program Responsibility	Geophysical Observatories and Mapping
Timeframe	1990–1993

Objectives

Create a consistent database of magnetic data across the whole continent levelled to the Australian Geomagnetic Reference Field.

Relevance

The Digital Magnetic Map of Australia will provide a regional framework for interpretation of the magnetic field of the upper crust.

Expected Outcomes

Databases of consistent point located and gridded magnetic values Australia wide generation of products given below.

Activities

Compute and amalgamate grids of geomagnetic field values over entire continent.

Expected Products

A database of position located and gridded data which will be available as a whole or for nominated areas.

Maps at 1:2.5 M, 1:5 M scales including contour, pixel and other presentations which best represent the data.

Highlights for 1990/91

Developed the levelling technique for simultaneous adjustment of survey lines on a rectangular area.

Developed sub-routines for reduction to the pole of magnetic data together with a set of sub-routines for linear transformations of data, namely, upward and downward continuation, first and second vertical derivatives.

Goals for 1991/92

Upgrade levelling algorithms and computer programs to provide for errors in the locations of line–tie intersections.

Develop a levelling technique to enable simultaneous adjustment of all survey lines and tie lines for irregularly shaped surveys and test a computer program implementing this technique.

Test software and procedures of levelling gridded and line data.

Produce a map and gridded dataset at 1:5 M scale covering more than half of the continent.

Clients

Exploration companies

State and Territory mines departments

Tertiary educational institutions

Other government organisations

Cooperating Organisations

Not yet determined

231: MINERALS RESOURCE ASSESSMENT

Objectives

Provide technical advice, submissions and information to government, the public and industry on the quantity, quality distribution, geological characteristics and availability of Australia's mineral resources and on the environmental impact of their development.

Relevance

Knowledge of Australia's mineral resources, their distribution, geological characteristics and capacity for sustainable development with minimal environmental impact is needed to provide technical advice for the formulation and implementation of policies related to land use planning, conservation of the environment, development of Australia's mineral resources and various international obligations and responsibilities.

Activities

Compile inventories of identified mineral deposits together with their characteristics.

Assess the availability of minerals from identified mineral deposits.

Assess undiscovered resources, through studies of regional geology, geological concepts and geological models.

Develop and maintain mineral deposit databases and functional computer programs for assessing the value and availability of identified mineral resources and the analysis of trends in resource levels.

Provide accurate, timely technical advice relating to the mineral industry.

Provide an overview of Australian exploration activity and its outcomes for resource assessments.

Highlights for 1990/91

Provided an assessment of the resources and value of the Coronation Hill gold deposit and of the mineral potential of the rest of the Kakadu Conservation Zone to the Resource Assessment Commission.

Submitted a paper on land access for geoscientific research to the Industry Commission.

Achieved 30% coverage of Australia's mineral deposits and occurrences in BMR's mineral location database (MINLOC).

Prepared papers for the Mining Working Group on Ecologically Sustainable Development.

Goals for 1991/92

Publish resource reports on coal and minor metals.

Prepare a resource report and MINDEP data file for Northern Territory gold deposits.

Progressively integrate those portions of datasets relating to areas being investigated under the National Geoscience Mapping Accord into MINDEP.

Further expand the MINDEP and MINLOC Australian mineral deposits and mineral occurrence databases.

Publish databases of Australian Mineral Deposits.

Prepare resource reports on Australian resources of gold and iron ore.

Complete an assessment of the mineral potential of Cape York Peninsula by end 1992.

MINERALS RESOURCE ASSESSMENT

Component Leader Gordon Battey (06) 249 9819

231.01 Mineral databases

231.02 Inventory and analysis of identified resources and exploration activity

231.03 Appraisal of resource potential

231.04 Mineral deposit evaluation and minerals availability

Component Resources

Project	Average staffing levels				Finances $k		
No	Research	Technical	Other	**Total**	Salary	Operations	**Total**
231.01	2.1	1.0	0.1	3.3			
231.02	5.2		0.3	5.4			
232.01	4.5		0.3	4.7			
233.01	2.2		0.3	2.6			
Total	**14.0**	**1.0**	**1.0**	**16.0**			**941**
Engineering support staff							
Cartographic support staff				0.9			43
TOTAL							**984**

Project 231.01 Mineral databases

Project Leader	Brian Elliott (06) 249 9502
Program Responsibility	Minerals Resource Assessment
Timeframe	1983–ongoing

Objectives

Establish, maintain and improve databases of mineral deposits and occurrences.

Relevance

These databases are required for mineral resource assessment, National Geoscience Mapping Accord Projects, BMR environmental and land use studies and geoscience research, and for use by the mineral industry in mineral exploration.

Expected Outcomes

Development and distribution of widely accepted mineral deposit data standards.

Activities

Compile mineral occurrence location data for BMR's MINLOC database; sales of MINLOC data to industry are continuing.

Apply Relational Database Management System (RDBMS) and allied computer technology to the capture, presentation and supply of useful mineral deposit and occurrence data.

Develop and market database designs and database products.

Provide mineral database products compatible with changing market needs.

Expected Products

Mineral occurrence and mineral deposit databases for BMR access including on line use.

BMR Resource Reports.

MINDEP (mineral deposits) and MINLOC (mineral occurrence/deposit location) data files in hard copy and computer formats, for sale.

Goals for 1991/92

Prepare and maintain mineral occurrence or deposit databases for all NGMA project areas and for Cape York and Kimberley resource assessment areas.

Expand MINLOC to cover 50% of all mineral occurrences and deposits in Australia.

Publish Resource Report and MINDEP data file on major Northern Territory gold deposits.

Encourage, with the States and industry, the development of data standards, exchange and joint projects in data capture and mineral database development.

Clients

Australian mining and exploration companies
Government agencies including other BMR programs.

Cooperating Organisations

State geological surveys.

University of Western Australia.

Project 231.02 Inventory and analysis of identified resources and exploration activity

Project Leader	Bill McKay (06) 249 9553
Program Responsibility	Minerals Resource Assessment
Timeframe	1989–ongoing

Objectives

Provide advice on the nation's identified resources.

Relevance

Technical advice and information about the nation's mineral resources and exploration activity are required for effective formulation and administration of government policies related to exploration, land use planning and development and processing of mineral resources.

Activities

Compile and maintain an inventory of Australia's identified mineral resources including geological characteristics and trends in resource levels and discovery.

Assess the mineralogical and geological characteristics of mineral resources including coal.

Utilise computerised systems for organising data and reporting.

Expected Products

Reports and publications on Australia's identified mineral resources.

Developing a database containing information on the size and classification of identified resources with emphasis on regions being investigated under the National Geoscience Mapping Accord.

Highlights for 1990/91

Resource Report on Australian Black Coals is in press.

Mike Huleatt led an Australian delegation to China for detailed discussions on mineral resource classification systems; this will facilitate comparison of each country's resource data.

Participated in a cooperative project between various State Governments, BMR and the gemstone industry to produce the first national assessment of gemstone resources

- the assessment provides a basis for future exploration and investment planning decisions concerning, among other things, the potential for increasing export income through expansion of Australia's gemstone processing industry.

Published a reconnaissance assay survey of minor metals and rare earth elements in Australian base metal ores as BMR Report 1990/92.

Goals for 1991/92

Complete draft resource report on Australia's resources of iron ore.

Continue preparation of report on gold.

Publish estimates of Australia's inventory of identified mineral resources as at the end of 1991 and analyse trends in the resource base.

Compile an Identified Resources database as a component of BMR's Oracle database.

Respond in a timely way to ad hoc requests on identified mineral resources.

Clients

Resource Assessment Commission

Policy divisions, DPIE

Cooperating Organisations

State Mines Departments

ABARE

Government mineral agencies in USA, Canada, Germany, UK, South Africa

Project 231.03 Appraisal of resource potential

Project Leader Gordon Battey (06) 249 9819

Program Responsibility Mineral Resource Assessment

Timeframe Ongoing

Objectives

Provide technical advice and information to government on mineral resource potential in specific areas or regions.

Provide advice on, and prepare assessments of, Australia's uranium resources for the government and the OECD/NEA, IAEA.

Relevance

The Government requires high quality impartial advice for the formulation and implementation of policies related to land use planning.

The Government has international obligations to provide data on uranium resources to the OECD Nuclear Energy Agency and the International Atomic Energy Agency(IAEA).

Expected Outcomes

Assessments of undiscovered mineral resource potential for specific areas on request.

Review and development of mineral deposit models.

Assessment of methodologies for evaluation of undiscovered mineral resources.

Assessment of individual uranium deposits.

Activities

The assessment of the mineral potential of a region involves an evaluation process which combines:

- the knowledge of its geology and mineral deposits and occurrences with mineral deposit models
- current theories of mineral deposit genesis
- the results of mineral exploration by exploration companies.

Provide timely responses to ad hoc requests on undiscovered mineral resources.

Prepare assessments of mineral resource potential of regions as requested by the Government.

Respond in timely fashion to ad hoc requests on undiscovered mineral resources.

Highlights for 1990/91

Submitted an assessment of the mineral resource of the Kakadu Conservation Zone to the Resource Assessment Commission.

Completed a reassessment of Australia's uranium resources as at 31 December 1990 and a survey of uranium exploration activity in Australia during 1989

- data on Australia's uranium resources were provided as input to OECD's publication 'Uranium–Resources, Production and Demand'.

Hosted the September 1990 Meeting of the OECD/NEA and IAEA Uranium Group in Australia.

Resumed the assessment of the mineral potential of Cape York Peninsula after the completion of work in the Kakadu Conservation Zone.

Collected data for assessment of mineral potential of areas of the Kimberley Region was commenced.

Hosted a delegation from the China National Non Ferrous Corporation (CNNC) on a visit to the tin and gold mines of north east Queensland under the cooperative program in non-ferrous metals mineral resources geology research between China and Australia.

Presented a paper and a poster at the 8th International Association on the Genesis of Ore Deposits (in conjunction with the International Conference on Mineral Deposit Modelling).

Completed a compendium of Australia's mineral deposit types.

Goals for 1991/92

Prepare an assessment of mineral potential of Cape York Peninsula.

Prepare datasets for assessments of the mineral potential of areas in the Kimberley Region, Western Australia.

Prepare an estimate of Australia's uranium resource at end of 1991.

Continue preparation of manuscript on genesis of Australian uranium, tin/tungsten and lead/zinc deposits.

Review and update models on mineral deposit types in Australia.

Publish the compendium of Australian mineral deposit types as a BMR Record.

Complete the manuscript of 'The geology and origin of Australia's mineral deposits' (Oxford University Press).

Clients

Coal and Minerals Division, DPIE

Corporate Policy Division, DPIE

OECD, Nuclear Energy Agency (NEA)

International Atomic Energy Agency

Resource Assessment Commission

Cooperating Organisations

State Mines Departments

OECD/NEA

IAEA

Project 231.04 Mineral deposit evaluation and minerals availability

Project Leader	Roland Curtis (06) 249 9817
Program Responsibility	Minerals Resource Assessment
Timeframe	1983–ongoing

Objectives

Provide technical advice and information to Government on:

- the value of mineral deposits
- the availability over time of minerals from identified deposits
- the environmental impact of mineral projects
- mining industry regulations
- various other mining matters.

Relevance

Technical advice is required for the formulation of policies related to land use planning, conservation of the environment, development of Australia's mineral resources and various international obligations and responsibilities.

Activities

Application of sound engineering principles.

Expected Products

Minutes, memoranda, reports and briefs.

Highlights for 1990/91

Provided advice to Government including an assessment of the value of the Coronation Hill gold deposit as consultant to the Resource Assessment Commission.

Installed and commissioned SURPAC mining systems software and a suite of programs for estimating spatial point and ore block distributions.

Prepared a submission on land access for the purposes of geoscientific research for the Industry Commission.

Prepared papers for the Mining Working Group on Ecologically Sustainable Development.

Submitted reports on the proceedings of the Conference of Chief Inspectors of Mines to the Australian and New Zealand Minerals and Energy Council.

Goals for 1991/92

Respond in a timely fashion to ad hoc requests from Government for technical advice.

Ensure that ANZMEC's goals for its sub-committee, Chief Inspectors of Mines Conference, are met to the satisfaction of ANZMEC.

Clients

Australian and New Zealand Minerals and Energy Council

Corporate Policy Division, DPIE

Sea Law Policy Branch, DFAT

Resource Assessment Commission

State and Northern Territory mines departments

Australian International Development Assistance Bureau

Cooperating Organisations

State and Northern Territory mines departments

241: GROUNDWATER

Objectives

Enable 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 multi-disciplinary 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.

BMR'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 1990/91

The Program underwent a major evaluation under the BMR Advisory Council Evaluation Program. Input was received from all major stakeholders and the report, which was endorsed by Council at its meeting on 27 February 1991, is being progressively implemented.

The Murray–Darling Basin Project received the inaugural BMR Advisory Council Project Award for scientific excellence. The Award was given to the Murray–Darling Basin Project on the basis of its orientation towards national priorities, on the efficiencies of its management, on the delivery of its objectives and the publication of its results.

Goals for 1991/92

Developing as part of the portfolio priority, national perspectives on water quality in association with State water and land management agencies.

Developing programs on groundwater aspects of land management in association with BMR's Environmental Geoscience Unit.

GROUNDWATER

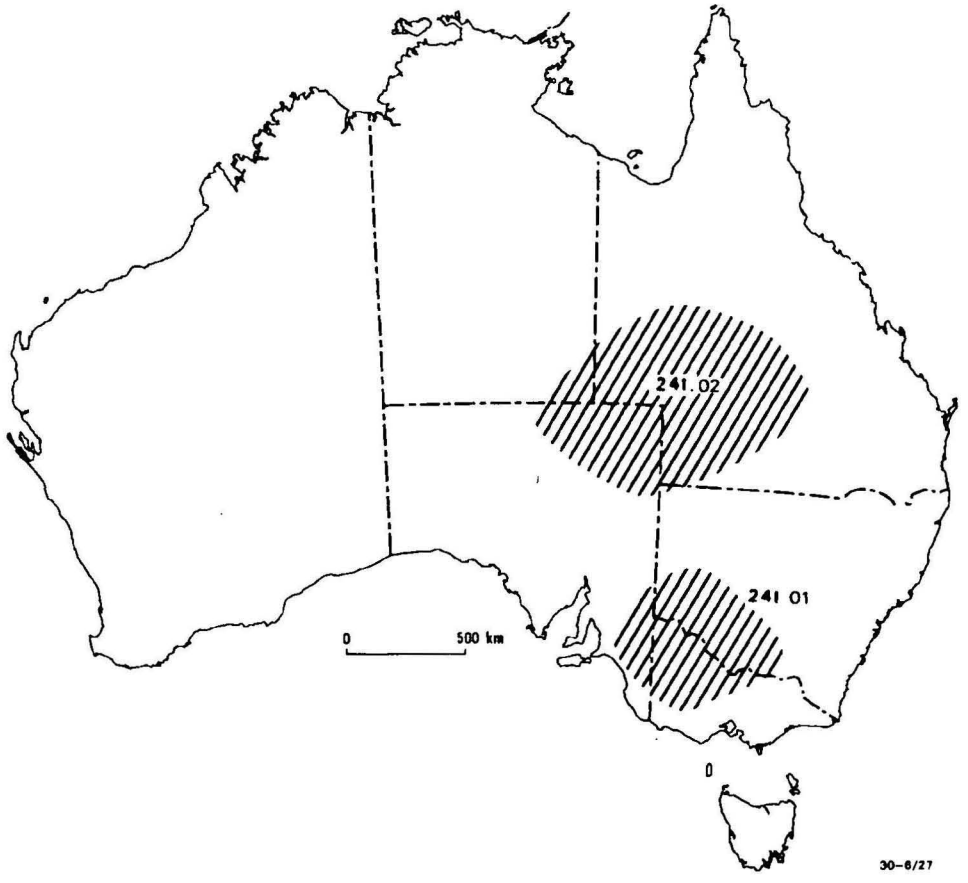
Component Leader Ray Evans (06) 249 9579

241.01 Murray–Darling Basin

241.02 Great Artesian Basin

Component Resources

Project	Average staffing levels				Finances $k		
No	Research	Technical	Other	**Total**	Salary	Operations	**Total**
241.01	8.7	5.5	0.7	14.9	622	334	956
241.02	2.3	1.5	0.3	4.1	171	153	324
Total	**11.0**	**7.0**	**1.0**	**19.0**	**793**	**486**	**1279**
Engineering support staff				1.0			33
Cartographic support staff				3.5			167
TOTAL				**23.5**			**1480**



Project 241.01 Murray–Darling Basin

Project Leader	Ray Evans (06) 249 9738
Program Responsibility	Groundwater
Timeframe	1979–1996

Objectives

Provide high level technical and scientific advice relating to groundwater issues in the Murray–Darling Basin to enable 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 between 30 and 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 M 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 regarding 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 therefore for managing the natural resources of the Basin is an understanding of the groundwater process. This understanding will provide the natural resource managers not only with an interpretation of the groundwater process upon which they can make immediate natural resource management decisions but will also provide them with a predictive capability.

Expected Outcomes

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 k scale and a Basin-wide database.

Produce numerical simulation models of regional groundwater flow systems in the Murray Basin.

Analyse and interpret regional hydrogeochemical and isotopic patterns to identify recharge and discharge processes; this may feed into the Quaternary climates study (242.02).

Assess contamination of groundwaters underlying irrigated agriculture by agro-chemicals and microbes of public health significance.

Assess the role of indigenous microbial processes in determining the quality and nature of groundwaters.

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 1990/91

The Rice Growers' Association of Australia underwent strategic planning for where their industry would be in the Year 2000; their assessments are based on BMR's model of the groundwater processes in the Basin.

Releasing the Pooncarie hydrogeological map; the first of the Murray Basin hydrogeological map series.

Setting the pace with numerical groundwater modelling of the Lachlan Fan area of the Murray Basin.

Water quality sampling in the Shepparton and Berriquin irrigation areas in association with the United States Geological Survey.

A number of presentations to key client groups on different aspects of the groundwater system of the Basin, as input to management decisions.

Goals for 1991/92

Pinnaroo, Ouyen, Bendigo, Hay, Barker, Adelaide, Deniliquin, Jerilderie map sheets printed as part of Hydrogeological Map Series.

Lachlan Fan/Ivanhoe Block numerical groundwater simulation model completed and management scenarios predicted.

Comprehensive report detailing baseline conditions for pesticide, nutrient and microbe status in groundwaters underlying a key irrigation area.

An estimate of the time scales for the build up and length scales for the distribution of concentrated brines under groundwater discharge zones and below salina waste water disposal basins.

A reconnaissance hydrogeological map of the Darling River Drainage Basin.

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 Organisations

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 241.02 Great Artesian Basin

Project Leader	Rien Habermehl (06) 249 9426
Program Responsibility	Groundwater
Timeframe	1984–1995

Objectives

Provide high level technical and scientific advice relating to groundwater issues in the Great Artesian Basin to enable ecologically sustainable development of the Basin's natural resources.

Relevance

The Project is for the most part a response to a strong demand expressed by Commonwealth and State Organisations through the Australian Water Resources Council and the Interstate Committee on the Great Artesian Basin (GAB).

The GAB is Australia's largest groundwater basin and contains some of the nation's most important groundwater resources.

BMR 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.

The study involves defining problems and remedial measures in the Basin in relation to the better management of artesian groundwater resources through the rehabilitation of uncontrolled bores and the establishment of a rational monitoring network.

Expected Outcomes

An information set will be available to allow water managers to sustainably manage the natural resource of the GAB.

Activities

Produce a hydrogeological database of the GAB.

Numerically simulate the GAB groundwater flow system.

Expected Products

Publications and reports showing detailed data and results of hydrogeological studies.

Hydrogeological Map of the GAB at scale 1:2.5 M.

GAB database with Basin wide hydrogeological data.

GABMOD model, a regional, Basin wide model of the Great Artesian, and several regional, small scale computer simulation models.

Digital data set of the BMR collection of wire line logs from the GAB.

Highlights for 1990/91

The GAB regional hydrogeological synthesis has been used as a basis for the States' GAB flowing bore rehabilitation program.

Goals for 1991/92

Make available a digital package of geophysical wireline logs.

A quantitative understanding of, and predictive capability for, the groundwater flow systems of the GAB.

Clients

Water Branch, Department of Primary Industries and Energy

State Water and Geological Authorities in Queensland, New South Wales, South Australia, Northern Territory

Petroleum and mining industry

Pastoral industry

Scientific institutions, including CSIRO and Universities

General public

Cooperating Organisations

Australian Nuclear Science and Technology Organisation

AL Herczeg, CSIRO Division of Water Resources

LK Fifield and GL Allan, Department of Nuclear Physics, Australian National University

State Water and Geological Authorities in Queensland, New South Wales, South Australia, Northern Territory

222: EARTHQUAKE SEISMOLOGY

Project 222.01 Earthquake seismology

Project Leader Kevin McCue (06) 249 9675

Program Responsibility Geophysical Observatories and Mapping

Timeframe 1950–ongoing

Project Resources

Project No	Average staffing levels Research	Technical	Other	**Total**	Finances $k Salary	Operations	**Total**
222.01	6.7	1.7	1.1	9.5	331	340	671

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 December 1989, a magnitude 5.6 earthquake close to Newcastle (NSW) resulted in 13 deaths and at least $1500 m damage.

Earthquakes are therefore quite clearly of major importance to Australians, and the risk 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.

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.

Activities

Continue to monitor and improve the monitoring of earthquakes in Australia.

Store data from BMR's seismic monitoring networks on an earthquake data file; 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 permanent seismographs and accelerographs (for strong ground motion) throughout the Australian continent and the AAT (225.01).

Continue joint BMR operation of networks in South Australia, Tasmania, New South Wales and Queensland with respective State and Commonwealth cooperating agencies.

Upgrade data file at monthly intervals.

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.

Maintain the Australian earthquake data file.

Provide a 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.

Highlights for 1990/91

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 that the lack of adequate monitoring is the greatest impediment to establishing models to explain the occurrence, frequency and location of Australian earthquakes.

Projects on Strong Ground Motion, Earthquake Hazard Assessment and the Exchange of Seismic Waveform Data were developed under a Memorandum of Understanding (MOU) signed on 26 April 1990 between BMR and the State Seismological Bureau, Peoples Republic of China.

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
- an analogue, low dynamic range seismograph installed at Quilpie (QLD)
- a broadband Guralp tri-axial seismograph was installed at Stephens Creek near Broken Hill (NSW) along with a new BMR designed data logger; data are telemetered to Canberra where they are recorded digitally
- bore holes were drilled at Stephens Creek, Broken Hill and Cobar for the siting of new broadband seismometers
- at Macquarie Island, the short period vertical seismometer was replaced with a broadband Guralp seismometer to increase the dynamic range from 65 db to 110 db and substantially widen the frequency band; the digital data are telemetered to Hobart (TAS) via the Antarctic Division's satellite link (ANARESAT) and then on to the BMR in Canberra
- a new seismograph was installed at Mt Morgan (QLD) in a cooperative project with the University College of Central Queensland
- in November 1990, a new seismograph was installed at Casey, Australia's second seismograph in the AAT.

Goals for 1991/92

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.

Move the seismographs at Armidale and Cobar (NSW) to quieter sites; mining activities have produced unacceptably high background noise levels.

Install downhole broadband seismographs at Broken Hill (NSW) and Coolgardie and Fitzroy Crossing (WA).

Publish the 1986, 1987 and 1988 ASC Reports and Part III of the Isoseismal Atlas.

Continue research into Australian seismicity including study of widely felt historical earthquakes.

Visit the State Seismological Bureau in the PRC under the MOU signed in 1990 to develop co-operative projects of mutual interest.

Finalise and publish the results of the micro-zonation of the Perth Basin which commenced in 1989/1990.

Commence micro-zonation studies of Newcastle (NSW).

Continue crustal stress mapping of the Australian continent using fault plane solutions of the larger earthquakes.

Installed, with the University of Queensland, two strain meters near Dalton (NSW) to continuously monitor crustal strain in this active intra-plate seismic zone.

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 Organisations

Australia

Antarctic Division, DASETT

Australian National University

Australian Nuclear Science and Technology Organisation

Queensland Department of Resource Industries

Seismology Research Centre, Phillip Institute of Technology

South Australian Department of Mines and Energy

St Ignatius College, Riverview

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

223: NUCLEAR EXPLOSION SEISMOLOGY

Project 223.01 Monitoring of nuclear explosions

Project Leader Ken Muirhead (06) 249 9481

Program Responsibility Geophysical Observatories and Mapping

Timeframe 1984–ongoing

Project Resources

Project No	Average staffing levels Research	Technical	Other	Total	Finances $k Salary	Operations	Total
223.01	5.6	3.7	1.5	10.7	344	420	764

Objectives

Establish and operate a national facility to detect and provide information on underground nuclear explosions, and an international seismological data centre, as a contribution 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 facility to monitor underground nuclear tests.

Detection and reporting of all underground nuclear explosions.

A national facility to monitor underground nuclear explosions.

An international data centre to monitor a CTBT.

A test of Australian and international monitoring capabilities through participation in the Group of Scientific Experts Technical Test–2 (GSETT2) experiment to transmit and analyse seismic data for developing systems to monitor a CTBT.

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 BMR'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 1990/91

Participated in the Group of Scientific Experts (GSE) warm up tests in preparation for the second major international experiment.

Participated in the 30th and 31st Session of the GSE in Geneva.

Successfully developed the system to process and analyse seismic data in the April/June international experiment.

Advised Government, media and the public on underground nuclear explosions.

Goals for 1991/92

Analyse data acquired during the large scale six week international experiment in order to obtain improved methods of defining and categorising events recorded by an international network of seismographs.

Further develop automatic algorithms for the detection, location and categorising 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.

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 Defence Advanced Research Projects Agency (exchange of software)

National Agencies participating in the Group of Scientific Experts within the Conference on Disarmament

224: GEOMAGNETISM

Objectives

Satisfy Australia's needs for accurate information about the temporal and spatial variations of the geomagnetic field.

Fulfil our international obligations for maintaining a global capability for monitoring the geomagnetic field.

Develop an understanding of the nature and origins of internal contributions to the field (core, crustal and induced).

Apply palaeomagnetic and rockmagnetic techniques to help solve geological problems associated with continental reconstructions, tectonic history, evolution of sedimentary basins, as a dating and stratigraphic tool, and for investigating past environmental (climatic) changes.

Provide national geomagnetic and palaeomagnetic services and facilities.

Relevance

Work covered by this component is undertaken to help develop and exploit applications of geomagnetic, palaeomagnetic and rockmagnetic phenomena. It also contributes to the databases essential for fundamental research in geomagnetism and palaeomagnetism, both on a regional (Australian) and a global scale.

Characterisation of the present-day and past behaviour of the geomagnetic field leads to an understanding of its origins—internal, crustal and external. This provide the basis for predicting the behaviour of the field, developing applications, and is 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 for monitoring natural magnetic disturbances and associated hazards. Information is required in the form of digital datasets, 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 academia.

Transient fluctuations of the geomagnetic field pose a serious 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, these natural variations of the geomagnetic field can be used to derive useful information about the geological structure of the crust via its 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 crucial 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.

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.

The observatory group has the necessary 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. Palaeomagnetic investigations focus essentially on main BMR program objectives. The palaeomagnetic laboratory is supported not only to satisfy BMR's needs, but also as a national facility.

Activities

Operate a national network of magnetic observatories in Australia, and in the Australian Antarctic Territory.

Modernize 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.

Three important new data sets are now available: the Project Magnetic vector aeromagnetic traverses over Australia, the BMR low-level scalar traverses, and the POGS satellite scalar data.

Contribute towards producing global field models, particularly IGRF, and improve their accuracy over the Australian region.

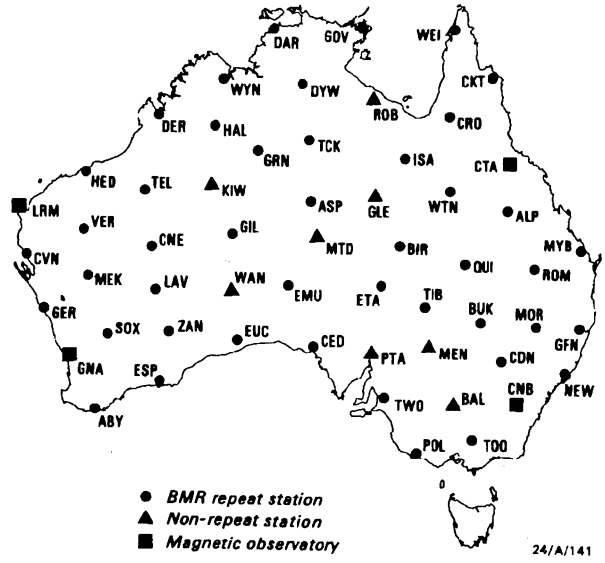
Collaborate with neighbouring countries to develop a better regional picture of the field.

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), with particular regard to the needs of Government and industry.

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 and facilities.



GEOMAGNETISM

Component Leader Phil McFadden (06) 249 9612

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

225.01: Antarctic Geophysical Observatories

Component Resources

Project	Average staffing levels				Finances $k		
No	Research	Technical	Other	**Total**	Salary	Operations	**Total**
224.01	4.6		0.2	4.8	227	155	382
224.02	1.2		0.1	1.3	50	5	55
224.03	4.1	1.0	0.2	5.3	210	170	380
225.01	3.6		0.2	3.7	90	10	100
Total	**13.5**	**1.0**	**0.6**	**15.1**	**577**	**340**	**917**

Project 224.01 Monitoring, analysis and modelling of the geomagnetic field

Project Leaders	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, for delineating and modelling long–wavelength magnetic anomalies, and for studies of the solid earth and solar-terrestrial relationships.

Expected Outcomes

Information about the behaviour and origin of the geomagnetic field.

A more accurate IGRF model for 1990–1995.

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 services—calibrations, training and advice.

Expected Products

A database of geomagnetic data.

Supply of data to the World Data Centres and other clients.

Magnetic field charts for AGRF1990.

A numerical model for the wider Australian region.

Highlights for 1990/91

Magnetic observatories were operated at Canberra, Gnangara, Charters Towers and Learmonth, Mawson and Macquarie Island.

Assistance was provided to Papua New Guinea to process data from the Port Moresby Observatory.

Improved data acquisition equipment was installed at Charters Towers observatory.

Routine data telemetry links were setup from Gnangara to Mundaring, and from Macquarie Island and Mawson to BMR.

Equipment for Alice Springs observatory is ready for installation.

The 1990 revision of AGRF was prepared (including several improvements over the 1985 model).

Improved techniques for regional field modelling have been developed.

Several important datasets were obtained and processed ready for regional field modelling: the Third-order survey (1967–1975), MAGSAT data (1980), Project Magnet data (1982–86, and 1990), BMR long scalar aeromagnetic traverse data (1975–76 and 1990 surveys), and scalar marine data from the *Rig Seismic*.

Collaboration was started with New Zealand to combine efforts to produce regional field coverage for the whole Australia–New Zealand–SW Pacific sector.

Our scheme for reporting and classifying repeat station data is being implemented internationally through the International Association of Geomagnetism and Aeronomy (IAGA), and is being welcomed by global modellers.

A fundamental advance has been achieved in identifying classes of core processes that account for the long-term behaviour of the geomagnetic field.

Publication of Australian Geomagnetism Report monthly and research papers on field modelling, and the nature and origin of the geomagnetic field.

Goals for 1991/92

Streamline the magnetic observatory network, processing methods and data dissemination.

Commence the repeat station survey for AGRF1995.

Commission the Alice Springs magnetic observatory.

Investigate a site for the Darwin Observatory.

Encourage Port Moresby to upgrade to digital acquisition.

Commence transmission from Canberra observatory into INTERMAGNET (global interchange of geomagnetic observatory data in real time by satellite).

Start producing computer-generated indices of magnetic disturbance.

Distribute AGRF1990 (model and charts) and produce a new regional field model for epoch 1990.0 to cover the whole Australia–New Zealand–SW Pacific–Papua New Guinea–Indonesia region.

Develop the new datasets (see above) for AGRF1995.

Commence analysis of the POGS satellite data.

Continue efforts through IAGA to improve the accuracy of global field models (IGRF) over Australia.

Continue fundamental research in geomagnetism.

Maintain databases.

Clients

Mineral exploration and petroleum industries

World Data Centres and the international scientific community

Civil Aviation Authority and commercial airlines

AUSLIG

Department of Defence

Ionospheric Prediction Service

Other users: surveyors, mariners, electronics industry

Cooperating Organisations

Australian

Physics Department, University of Queensland

Physics Department, La Trobe University

Division of Wildlife and Rangelands Research, CSIRO

Ionospheric Prediction Service (Solar Observatory at Learmonth)

Research School of Earth Sciences, Australian National University

Mathematics Department, University of Sydney

International

DSIR Geomagnetic Observatory, New Zealand

Meteorological and Geophysical Agency, Indonesia

Geological Survey, Papua New Guinea

SW Pacific Island nations

US Navy (Project Magnet)

US 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

Project 224.02 Spatial and diurnal variations of the geomagnetic field

Project Leader Charles Barton (06) 249 9611

Program Responsibility Geophysical Observatories and Mapping

Timeframe 1986–1993

Objectives

Understand 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.

Relevance

This project is directed specifically 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.

A scientific 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.

Expected Products

A preliminary "Aeromagnetic Risk Map" of Australia depicting the expected accuracy of

magnetic survey base-station data for different parts of the country.

Highlights for 1990/91

The main AWAGS magnetometer array ran successfully from November 1989 to July 1990; a line of stations from Darwin to Portland was kept running for the full 12 months.

Initial data processing of about half of the AWAGS data has been completed.

The first induction picture of the whole continent has been obtained and a 5000 km "Intercratonic Conductor" has been identified—the longest crustal induction feature ever mapped.

Goals for 1991/92

Initial processing of the AWAGS data to get a homogeneous dataset.

A more complete analysis of the electromagnetic induction properties of the crust.

More accurate determination of the path of the Intercratonic Conductor and a better understanding of its origin and correlation with geological features.

A preliminary draft of the Aeromagnetic Risk Map of Australia.

Analysis of the quiet (solar) daily variation, Sq, and its seasonal variation.

Information about coastal induction effects and their influence on our observatory data.

Use the AWAGS data for making diurnal corrections to the high-altitude Project Magnet vector data and the low-level scalar traverses over Australia, and as ground truth for the US Navy's POGS satellite.

Clients

Exploration industry

Geophysical Mapping, BMR

US Navy

Cooperating Organisations

Flinders University of South Australia

Research School of Earth Sciences, Australian National University

Project 224.03 Palaeomagnetism

Project Leader	Chris Klootwijk (06) 249 9324
Program responsibility	Geophysical Observatories and Mapping
Time Frame	1976–ongoing

Objectives

Help solve geoscientific problems.

Improve our understanding of the tectonic evolution of the Australian and Antarctic plates within a global plate tectonic framework.

Develop a chrono-stratigraphic framework for Australian sedimentary sequences, and other rock units including the regolith.

Identify and date major environmental (hence climatic) changes both onshore and offshore.

Maintain the Black Mountain palaeomagnetic laboratory as a national facility.

Relevance

BMR runs the only major strategic palaeomagnetic program in the country. Palaeomagnetism and rockmagnetism can provide a unique contribution to the resolution of a wide range of geological problems, e.g. palinspastic reconstructions, evolution of sedimentary basins (stratigraphic correlation and dating), deformation processes (magnetic fabric analysis), tracing mineral plumbing

phases (from palaeomagnetic overprints), and the rapid identification and dating of major environmental changes in the Quaternary record. The palaeomagnetic laboratory also serves as a national facility.

Expected Outcomes

Establishment of the palaeoenvironmental (climatic/sealevel) implications of palaeomagnetic records for ODP Site 820, offshore north east Australia (part of project 121.11).

Holocene secular variation data and a possible timescale for sediment records from Lake Johnson, Tasmania (part of project 242.02).

Improvement of the palaeomagnetic reference database through project-oriented and framework studies, targeted at crucial Tertiary, Palaeozoic and middle Proterozoic segments of the Australian and Antarctic apparent polar wander paths (APWP's).

A better understanding of the tectonic evolution of the Australian and Antarctic plates through interpretation of the global palaeomagnetic database.

Activities

Carry out palaeomagnetic, rock magnetic and magnetic fabric investigations in support of BMR programs.

Undertake palaeomagnetic framework studies to provide the basis for reliable palaeomagnetic interpretations.

Provide a palaeomagnetic information and training service.

Maintain the Black Mountain palaeomagnetic laboratory as a national facility.

Expected Products

Publication of palaeomagnetic results on:

- the correlation and APWP's for the east and west McArthur Basin;
- the tectonic evolution of the New Guinea Highlands and Sepik region;
- the tectonic evolution of the Bird's Head, Irian Jaya;
- the late Palaeozoic APWP and evolution of the Ngalia Basin;
- the tectonic evolution of northeast Queensland (Bulgonunna Volcanics, Featherbed Volcanics, Newcastle Range Volcanics, and part of the Drummond Basin);
- a magnetic fabric analysis to identify oroclinal bending of the southern New England Fold belt;
- age of sinters and associated deposits in the Mt. Painter area, Adelaide geosyncline.

Publication of papers related to ODP Leg 121 concerning:

- the evolution of the India–Asia collision;
- effects of the uplift of the Himalayan–Tibetan region on global climate;
- the Kerguelen hotspot origin of the Ninetyeast Ridge;
- the breaking-up mechanism of Broken Ridge and Kerguelen Plateau.

Highlights for 1990/91

Publication of keynote papers in the Scientific Results Volume of ODP Leg 121 on Broken Ridge and Ninetyeast Ridge delineating the evolution of the India–Asia collision, its possible effects on global climate, the origin of Ninetyeast Ridge, and the break-up mechanism of Broken Ridge/Kerguelen-Heard Plateau.

Review of palaeomagnetic data from New Guinea and SE Asia for the Palaeogeographic Mapping Project.

Oroclinal bending of the southern New England Fold Belt has been qualified and quantified through a study of the magnetic fabric of the orocline and remanence of its Permian inliers.

The late-Palaeozoic APWP has been upgraded through a study of the northeast Queensland Volcanic Province (Bulgonunna Volcanics, Featherbed Volcanics and part of the Drummond Basin sequence); the palaeomagnetic results suggest that zircon ages obtained from the SHRIMP of around 285–295 Ma in the Bulgonunna and pre-Bulgonunna volcanics may not be of primary

magmatic origin in the pre-Bulgonunna volcanics.

Preliminary poles for the East McArthur Basin, published in 1988, have been updated to give a revised segment for the Australian pole path that spans the Early–Middle Proterozoic boundary. A revised magnetostratigraphic column has been constructed for parts of the Tawallah and McArthur Groups to allow correlation of these sequences with those in other parts of the basin and elsewhere in Australia. Analysis of samples from the West McArthur Basin and interpretation have been completed.

Analysis of Proterozoic dyke samples collected from the Vestfold Hills in 1989 indicates the presence of two dominant overprint components that appear to be consistent with the 1100 Ma and 500 Ma segments of the Australian pole path. Components predating these two overprints appear to be present in mafic units of the northern part of the Vestfold Hills.

Measurements and analysis were completed on the Mount Painter sinters, uraniferous hematitic breccias and associated deposits. A tentative Permo-Carboniferous age, reported last year, was confirmed. The additional data and analysis extend the earlier results by indicating a sequence of development for the deposits.

Preliminary work on ODP Leg 133, Site 820 near the Great Barrier Reef has produced an excellent susceptibility record that appears to reflect sealevel fluctuations.

A new fold test and reversal test have been developed to test the reliability of palaeomagnetic data.

The PALSYS software package was implemented on the Data General mainframe and the PALDAS data acquisition software was adapted to run on PC's.

Goals for 1991/92

Minerals Program

Detail the 1.9–1.6 Ma segment of the Early Proterozoic APWP for the Pine Creek Inlier and compare this with time-equivalent APWPs for other cratonic units.

Determine pole positions for Middle to Late Proterozoic dyke sequences from the Musgrave Block and provide palaeomagnetic dating control where radiometric dating is problematic.

Detail Late Carboniferous–Early Permian palaeomagnetic overprinting in the Bulgonunna Volcanics and Drummond Basin sequence, and establish the relationship of this overprint to the origin of the U-Pb zircon ages in the 300–280 Ma interval.

Petroleum Program

Provide assistance to the Palaeogeographic Mapping Project on matters of palaeolatitude evolution and reconstructions of the Australian and adjacent plates.

Constrain the evolution of the southern New England Fold Belt from detailed study of Carboniferous ignimbrite sequences in the Tamworth Belt.

Environmental Geosciences Program

Determine Quaternary climatic changes from variations in magnetic minerals in ODP Leg 133 cores.

Determine a timescale for Holocene postglacial environmental changes from magnetic secular variation studies of cores from Lake Johnson (Tasmania).

Reconstruct the Antarctica–Australia relationship in Eastern Gondwana from studies of Proterozoic dyke sequences of the Vestfold Hills.

Framework studies

Improve the usefulness of Australia's Late Mesozoic–Cainozoic APWP as a dating tool through detailed study of the Early Cretaceous Strezlecki Group.

Laboratory development

Instal and test the BMR-designed high field AF demagnetizer and a high capacity furnace.

Implement LAN-type operation for the laboratory data acquisition system, PALDAS.

Upgrade the ORACLE-based palaeomagnetic processing system, PALSYS, installed on BMR's Data General computer, through addition of interactive graphic routines, contouring of density distributions on a sphere, semi-automatic determination of linear component directions, and grouping of directions.

Clients

BMR projects

Cooperating Organisations

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 Engel and Prof. E Colhoun, Newcastle University

Prof P Rochette and Dr C Aubourg, Gren-oble University

Dr E Scheibner, Geological Survey of New South Wales

Dr K Orth, Geological Survey of Victoria

Dr C Murray, Geological Survey of Queensland

Project 225.01 Antarctic Geophysical Observatories

Project Leader	Andrew McEwin (06) 249 9392
Program Responsibility	Geophysical Observatories and Mapping
Timeframe	1950–ongoing

Objectives

Monitor the morphology and variations of the magnetic field in the Australian Antarctic Territory 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 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 and Macquarie Island.

Support a regular program of absolute observations at Casey and Davis.

Conduct field surveys when opportunities arise.

Expected Products

Data from magnetic and seismic observatories at Mawson and Macquarie Island, and twice-weekly magnetic absolute observations at Casey and Davis. Data from Mawson and Macquarie Island to be telemetered to Canberra on a continuous basis.

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 1990/91

Observatories were operated at Mawson and Macquarie Island; support was provided for Casey and Davis.

Data telemetry links to Canberra produced a major improvement in availability and quality of data.

Bulletins of seismological data, K-indices and preliminary monthly mean values of the geomagnetic field were distributed regularly.

Data were lodged at the World Data Centres and made publicly available.

A magnetic repeat station survey was conducted in the Larseman Hills near Davis.

A new remote reference station was installed at Davis to replace contaminated station D.

A single component vertical seismometer was installed at Casey and linked to Canberra via ANARESAT.

Goals for 1991/92

Operate magnetic and seismic observatories at Mawson and Macquarie Island, and supervise regular magnetic observations at Casey and Davis.

Maintain telemetry to Canberra of seismic and geomagnetic data from Mawson and Macquarie Islands, and seismic data from the new seismograph at Casey

Determine errors in secular variation estimates derived from different observation sequences and averaging methods—with a view to rationalizing observations at Casey and Davis.

Clients

Australian Antarctic Division

AUSLIG, expedition parties

World Data Centres and the international scientific community

Polar Research Institute, Japan

Cooperating Organisations

Australian Antarctic Division

242: ENVIRONMENTAL GEOSCIENCE

Objectives

Develop programs to acquire the baseline geoscientific information necessary to understand Australia's natural environment, including its landscapes, soils, climates and sealevels.

Use this information to manage the impacts of environmental change.

Relevance

BMR's strategic plan, developed in response to the Woods Review, lists among the purposes of the organization "*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 (issued in July 1989) which focussed on the need for accurate information on environmental issues.

The 1991 ASTEC Review of Environmental Science in Australia stresses 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 BMR and establish a range of new clients; other activities, including the Cape York Peninsula Land Use Study, and the Antarctic Co-operative Research Centre, complement the projects identified.

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 Study; projects in Environmental Geoscience (including an overview of coastal environments, an enhancement of regolith mapping and an overview of groundwater resources) and Mineral Resource Assessment (digitise bedrock geology and levelling geophysical data) and costed at around $1m, have been approved for funding by the Joint Commonwealth–Queensland Steering Committee.

Develop a work program in environmental history for a Cooperative Research Centre on the Antarctic and Southern Ocean Environment; argued BMR's input into the successful bid for the CRC.

Highlights for 1990/91

Established communication with a range of clients/collaborators involved with aspects of Australian Coastal Zone; established the concern to develop a national accessible information base.

Facilitated communication between interested groups and provided expert advice to several inquiries into coastal zone issues; in these fora, we were able to focus on the need for information sources at a national level.

Established a role for BMR as an integrating agency in the compilation of palaeoclimatic data as well as a generator of primary data of value in defining natural climatic variability.

Explained the potential role of BMR in providing geological input to soils survey programs; identified potential cooperative projects with CSIRO, BRR, and forestry agencies.

Established a role for BMR in the production of educational material relating to National Parks; provided input into the Shark Bay World Heritage nomination; provided geological material of value in aspects of park management; produced educational posters and video.

Presented summaries in map and volume form, drawing together aspects of the geology of Antarctica; these help to maintain the scientific basis of Australia's presence in that continent.

Goals for 1991/92

Develop the 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 Study.

Implement a database to bring together palaeoclimatic information from a range of disciplines in the Australian Quaternary; use this information to test current climatic models in predicting the cause of future changes in climate.

Develop and instigate a program of surficial mapping in BMR that will provide the baseline data essential to understand and mitigate land degradational processes.

Lift the public profile of the 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, including the Bunger Hills, 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.

Cooperative Research Centre on the Antarctic and Southern Ocean Environment

BMR is one of five agencies who mounted a successful bid to establish this CRC at the University of Tasmania in Hobart. Other participants include *CSIRO Division of Oceanography, Bureau of Meteorology, Antarctic Division and University of Tasmania.* BMR is participating in the sub-program 'Natural Variability', and will be developing research projects focussing on the climatic history of the Antarctic icecap and of the Southern Ocean. This work will complement work on the icecore research of climate change undertaken by Antarctic Division scientists. Coordination of BMR inputs into the the Centre's activities rests with Environmental Geoscience, but contributions of staff time and resources (which will be matched by CRC contributions) will come as well from BMR's Continental Margins, Onshore Basins and Geophysical Observatories and Mapping Programs.

ENVIRONMENTAL GEOSCIENCE

Component Leader Liz Truswell (06) 249 9427

Component Projects

124.01	AAT Continental Margin
241.03	Lakes Monitoring
242.01	Coastal Zone
242.02	Quaternary Climates
242.03	Land Degradation
242.04	National Parks
242.05	Antarctic Onshore Geoscience
242.06	Natural hazards mapping in the Australian region

Component Resources

Project	Average staffing levels				Finances $k		
No	Research	Technical	Other	**Total**	Salary	Operations	**Total**
124.01	0.3	0.2	0.2	0.6	19	56	75
241.03	0.1	0.2		0.3	8	1	9
242.01	1.7	0.4	1.0	2.2	117	59	176
242.02	0.7	0.2	0.1	1.0	36	34	70
242.03	0.9	0.1	0.1	1.1	54	23	77
242.04	0.2	0.2	0.2	0.6	24	47	71
242.05	2.4	0.1	0.1	2.6	145	49	194
242.06	0.1			0.1	5	2	7
Total	**6.3**	**1.4**	**0.6**	**8.3**	**407**	**271**	**678**
Engineering support staff							
Cartographic support staff				1.0			48
TOTAL				**9.3**			**726**

Project 124.01 AAT continental margin

Project Leader	Howard Stagg (06) 249 9343
Program Responsibility	Marine Geoscience and Petroleum Geology
Timeframe	1982–ongoing

Objectives

Develop models of geological processes which have operated or are operating in the offshore AAT, which are relevant to resource assessment and environmental management.

Provide geoscientific advice in support of the resource and environmental management of the offshore AAT.

Relevance

While current activities in Antarctic marine geoscience are principally directed towards cooperation in international projects such as ODP drilling, preliminary work has been done towards initiating an Antarctic marine field program. This program will be implemented under the auspices of the Cooperative Research Centre for Antarctica and the Southern Ocean (Environment) and will focus on deciphering the record of past environmental changes such as carbon dioxide changes, the onset and periodicity of Antarctic glaciations, and Southern Ocean circulation patterns.

Expected Outcomes

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 (AAT), in particular the eastern sector of the AAT, which forms the conjugate feature to Australia's southern and south eastern margin.

Expected Products

Collaborative scientific papers with Australian and overseas co-workers.

Highlights for 1990/91

Contribution to papers on results of ODP drilling in Prydz Bay.

Data exchange with the USGS.

Initiation of the Cooperative Research Centre.

Goals for 1991/92

Continue involvement in international projects, i.e. follow up to ODP drilling and Antarctic Offshore Seismic Stratigraphy Project (ANTOSTRAT).

Develop and inplement projects under the auspices of the CRC.

Cooperating Agencies

Antarctic Division, DASETT

USGS

Bureau of Meteorology

CSIRO

University of Tasmania

Project 241.03 Lakes monitoring

Project Leader	Bob Abell (06) 249 9622
Program Responsibility	Groundwater
Timeframe	Ongoing

Objectives

Detect climate change in the southern highlands.

Relevance

Scientific evidence to support the public debate on climate change and global warming is scarce. Monitoring of Lake George has been continuously undertaken since the early nineteenth century and is thus one of, if not the most complete record of change in an environmental parameter in South Eastern Australia. The record provides a benchmark for tying in other environmental monitoring projects in South Eastern Australia.

Expected Outcomes

A long term hydrologic database for use related to a growing awareness of environmental change in South Eastern Australia.

Activities

Monthly monitoring of lake and groundwater levels in the Lake George and Lake Bathurst drainage basins.

Prepare a geo-environmental map of the Jervis Bay Territory.

Maintain the HYDSYS database of lake levels.

Provide advice on hydrologic conditions in the Lakes

Expected Outcomes

A continuous record of lake and groundwater levels in the Lake George and Lake Bathurst drainage basins.

A geo-environmental map of the Jervis Bay Territory.

A paper entitled "Fluctuating lake levels in South East Australia: indicators of climatic change" for the SLEADS Conference.

HYDSYS database of lake levels

Goals for 1991/92

Monthly monitoring of lake levels undertaken; HYDSYS database maintained.

Draft Jervis Bay map (October 1991); edit and peer review of draft Jervis Bay map (November 1991); submit Jervis Bay map for publication (December 1991).

Submit SLEADS paper abstract (November 1991); prepare SLEADS talk and paper (December 1991); submit SLEADS paper for publication (January 1992).

Clients

Environmental and climate change researchers

NSW and ACT authorities

Local interest groups including farmers, bird watching societies, etc

Project 242.01 Geological environment and resources of the coastal zone

Project Leader	Bob Burne (06) 249 9291
Program Responsibility	Environmental Geoscience
Timeframe	1990–Ongoing

Objectives

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 West Australian Minister for Regional Development to develop cooperative coastal mapping programs between BMR 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 Land Use Study.

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 BMR 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 1:1M scale National GIS being developed at NRIC.

Activities

With the cooperation of NRIC, compile existing information on coastal zone geology into a national coastal information system. Identify areas where existing information or understanding is inadequate for management needs and design and implement programs of geological mapping to fill information gaps.

Bring together the extensive body of existing data held by Commonwealth, state and

academic organisations, and to 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 BMR 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 40m in clear water, suspended sediment transport, and organic material in the water column. The 30 metre pixel resolution of Landsat TM will enable information to be displayed to a maximum scale of 1:50 k. 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).

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 Australian coastal zone and key areas of topical interest.

Maps, datasets and scientific papers on specific areas.

Advice to policy-making sections of Government.

Highlights for 1990/91

Established the Project within BMR, DPIE, as the logical source of national geoscientific coastal zone information and expertise.

Established pilot projects in using data from WA, SA and QLD in order to develop suitable techniques and systems.

Provided advice to DASETT and the WADCALM on the establishment and management of the proposed Shark Bay World Heritage area.

Goals for 1991/92

Complete pilot projects to establish feasibility.

Develop research techniques for Image Processing of remotely sensed coastal zone data.

Initiate study of the coastal zone of the Cape York Peninsula (in collaboration with QLDGS and other State and Commonwealth agencies).

Explore feasibility of mapping the coastal zone between Perth and Geraldton, WA (in collaboration with the WADPUD and GSWA).

Develop geoscientific guidelines for management strategies for the Shark Bay World Heritage area (in collaboration with WADCALM).

Provide research publications and educational and information materials for the general public.

Clients

NRIC

CSIRO

DASETT

Resource Assessment Commission

Western Australian government agencies

- Department of Conservation and Land Management (WADCALM)
- Department of Planning and Urban Development (WADPUD)
- Geological Survey
- Marine and Harbours

- Environmental Protection Authority

South Australian government agencies
- Department of Environment and Planning
- Department of 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 Organisations

NRIC

RAC

CSIRO

Western Australian government agencies

South Australian government agencies

Geological Survey of New South Wales

Queensland Department of Resource Industries

Project 242.02 Climatic variation in the Australian Quaternary

Project Leader	Liz Truswell (06) 249 9427
Program Responsibility	Environmental Geoscience
Timeframe	1990–2000

Objectives

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; BMR input has been sought in an integrating role by this consortium.

Expected Outcomes

An enhanced understanding of the range of national 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 a relational database to integrate chronological, palaeoclimatic, palaeobiological and palaeohydrological data for a number of time intervals in the Quaternary; translate this information into time slice climatic maps to synthesise boundary data to test climate models.

Expected Products

Database of past climate change, bibliography, and palaeoclimatic maps for selected time intervals.

Highlights for 1990/91

Presented a pilot database generated interest among the research community; it focussed

on BMR's potential role as an integrating agency in compiling data useful in testing climate models and attracted sufficient outside funding to progress the development further.

Successfully recovered cores from Lake Johnson (TAS)

- they are being analysed for a range of palaeoclimatic parameters Compiled and marketed a bibliography of Australian Quaternary climatic data.

Goals for 1991/92

Establish methodology and set up database to provide a focus for integrating diverse data and putting it into a form usable by modellers.

Clients

Policy makers within DPIE and other government departments including DASETT and DEET

Climatic modellers within academic institutions

Cooperating Organisations

Dr A Chivas, Research School of Earth Science, ANU

Prof J Chappell, Department of Biogeography and Geomorphology, ANU

Dr P deDeckker, Department of Geology, ANU

Dr R Wasson, Division of Water Resources, CSIRO

Project 242.03 Morphostratigraphic mapping in support of land degradation studies

Project Leader	Liz Truswell (06) 249 9427
Program Responsibility	Environmental Geoscience
Timeframe	1990–Ongoing

Objectives

Provide baseline data essential to understanding land degradation processes.

Relevance

Losses due to soil degradation are estimated at around $600 m 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 Outcomes

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 BMR, emphasizing 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, BRR) and scales

- initial areas of focus will probably be in the Murray–Darling Basin.

Expected Products

Geomorphic maps, including GIS format, at scales to be determined.

Highlights for 1990/91

Recognition by a number of agencies of a potential BMR role in providing geological data in support of soils survey and land evaluation.

Possible cooperative projects were identified with CSIRO Division of Soils, Bureau of Rural Resources and NSW Forestry Commission.

Goals for 1991/92

Implement a mapping program based on the outcome of multi-agency discussions in 1990/1991.

Clients

Soil Conservation Commission of NSW

Commonwealth departments (DPIE, DASETT) concerned with strategic planning in land use

CSIRO Division of Soils

Educational institutions with research programs requiring geomorphic information

NSW Forestry Commission

Cooperating Organisations

Division of Soils, CSIRO

Bureau of Rural Resources, DPIE

State agencies, such as QDPI, NSW Soil Conservation Commission,

NSW Forestry Commission

Project 242.04 Geology of Australian National Parks

Project Leader	Liz Truswell (06) 249 9427
Program Responsibility	Environmental Geoscience
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.

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

Highlights for 1990/91

Publication of the Kosciusko National Park geological map.

Publication of educational posters on Kakadu, Antarctica, and Shark Bay.

Preparation of a video and display material on Shark Bay.

Major input into the nomination for World Heritage listing of Shark Bay.

Goals for 1991/92

Complete compilation of maps and brochures for Uluru, Kakadu and the Warrumbungles.

Investigate the need for geological input into the Nullarbor Plain World Heritage listing.

Assess needs for information on National Parks in Cape York Peninsula.

Produce popular material on Jervis Bay, Molonglo Gorge.

Clients

The public

Tourist industry

Educational institutions

ANPWS

Environmental organisations

World Heritage Unit, DASETT

Cooperating Organisations

ANPWS

NSW National Parks

ACT Forestry

Project 242.05 Antarctic onshore geoscience

Project Leader	Bob Tingey (06) 249 9608
Program Responsibility	Environmental Geoscience
Timeframe	1954–Ongoing

Objectives

Develop and document a comprehensive geoscientific understanding of areas of bedrock exposure in the Australian Antarctic Territory.

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.

Note that this project only refers to regional geological and geophysical studies on the Antarctic continent. Antarctic geophysical observatories are accounted for in Project 225.01, and investigations of the continental margins in Project 124.01.

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, as evident in landforms onshore, will occur through the Cooperative Research Centre for the Antarctic and Southern Ocean Environment, currently being established in Hobart. Other aspects of Antarctic geoscientific research are taken up by University scientists.

Expected Outcomes

An understanding of the geological framework of Australian Antarctic Territory, commensurate with Australian territorial claims for that region.

The provision of baseline information necessary to monitor changes in the environment of Antarctica.

Expected Products

Regional geological maps and appraisals of outcrop areas in the AAT published as BMR Bulletins, and drawing together the results of BMR 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 1990/91

Completed and published a revised 1:10 M scale geological map of Antarctica together with an explanatory BMR Bulletin

- this is an up to date summary of the geology of the continent and is intended to replace previous maps.

Published the monograph 'Geology of Antarctica' by Oxford University Press, drawing together the diverse strands of Antarctic geology

- this has been edited by the Project Leader outside office hours and BMR scientists have contributed five of the nineteen review chapters.

Completed a regional geological appraisal of the Bunger Hills—Denman Glacier area; this rounds off the regional investigation of this area, commenced in 1986

- the fieldwork demonstrated Australia's ability to mount significant field operations in areas remote from permanent Stations and was a tangible contribution to the national presence in the Antarctic.

Acquired and digitised geophysical maps of the Enderby Land—Prince Charles Mountains region produced by the Soviet Antarctic Expedition (SAE) as a result of aerogeophysical surveys in the late 1980s

- the SAE has the capability to acquire geophysical data over large areas of Antarctica whereas Australia does not; however, BMR has better computing facilities than the SAE and should be able to produce a more sophisticated interpretation of the data.

Goals for 1991/92

Complete the Prydz Bay—Gamburtsev Mountains geoscience transect as a contribution to the work of the SCAR Group of Specialists on the structure and evolution of the Antarctic Lithosphere, and the IUGS Global Geoscience Transects Program.

Publication of a regional geological map and appraisal of the Bunger Hills—Denman Glacier area.

Substantial progress in geochemical and geochronological studies of samples collected early in 1991 from the northern Prince Charles Mountains.

Reinterpret Soviet airborne geophysical data over the Enderby Land—Prince Charles Mountains region in co-operation with geoscientists of the SAE.

Contribute 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.

Provide geoscientific advice on Antarctic matters as required; this may become necessary as negotiations proceed for a comprehensive treaty on the protection of the Antarctic environment.

Clients

Australian National Antarctic Research Expeditions

Australian Antarctic Division (DASETT)

Cooperating Organisations

Australian Antarctic Division

Australian National University

University of Adelaide

Edinburgh University

Macquarie University

Melbourne University

University of New England

University of New South Wales

Sydney University

University of Tasmania

Project 242.06 Natural hazards mapping in the Australian region

Project Leader	Wally Johnson (06) 249 9377
Program Responsibility	Minerals and Land Use
Timeframe	1991–1994

Objectives

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 HAZMAP Working Group 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, wave heights, sea ice 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 multi-disciplinary 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 Outcomes

Improved hazard awareness, assessment and preparedness.

Activities

Produce a 1:10 M scale (and possibly 1:2 M scale) map, with accompanying Explanatory Notes, of the geological and climatological hazards of the Australian region.

Coordinate regional input to map production as Chair of the Australian IDNDR Working Group (HAZMAP) 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 who will take responsibility for the costs of map production and publish through the US Geological Survey.

Collect multi-discipiniary data sets on natural hazards and compile them in map form.

Highlights for 1990/91

This is a new BMR project, starting in 1991/92. The main achievement so far has been the establishment of the multi-disciplinary HAZMAP Working Group which held its inaugural meeting on 18–20 March 1991 at the Australian Counter Disaster College (Department of Defence), Mount Macedon, Victoria. Wally Johnson of BMR chairs the Working Group.

Goals for 1991/92

Determine the best ways of portraying the wide range of natural hazards in map form at 1:10 M and other scales.

Collect the relevant data required for, and begin compilation of, the hazard map(s).

Report preliminary results to the Circum-Pacific Map project at the CPCEMR meeting being held in Bangkok in November.

252: NATIONAL RESOURCE INFORMATION CENTRE (NRIC)

Objectives

Improve the information base for policy formulation and decision-making processes relating to natural-resource management issues.

Relevance

The National Resource Information Centre is a joint facility of the Bureau of Mineral Resources, Geology and Geophysics and the Bureau of Rural Resources. The Centre is managed by the Executive Directors of the two bureaus together with a representative from policy divisions in the Department of Primary Industries and Energy. An Advisory Committee comprising representatives from State/Territory governments and Commonwealth departments assists in guiding the work of the Centre. The development of the Centre, since its establishment in May 1988, has been undertaken jointly by officers from the two bureaus.

Data held by the bureaus will need to be augmented substantially by accessing information supplied by Commonwealth and State/Territory agencies as well as other organisations. Much of the information relating to the management of Australia's natural resources is held and captured by the States and Territories. The State/Territory governments and relevant Commonwealth departments have agreed to cooperate in the development of the Centre and procedures are underway to develop formal data exchange agreements. The principle of data custodianship, in which the custodial agency controls access to and use of the data, forms an important part of these agreements.

The major products from this component will be the provision of services by the Centre to the portfolio and to external agencies including the directory of sources of resource information in Australia.

Resources

As mentioned before, NRIC is a facility jointly funded by the Bureau and the Bureau of Rural Resources.

Resources provided by the Bureau in 1991/92 will be seven staff and $864 k which includes both salary and operational costs.

Project 252.8.1 National Directory of Natural Resources Data

Project Leader	Paul Shelley (06) 272 4643
Program Responsibility	National Resource Information Centre
Timeframe	Ongoing

Objectives

Develop, maintain and make available a computerised directory of Australian natural resources data sets

Relevance

A key role of NRIC is to provide for the rapid identification and location of natural resources data required for policy and land use decision making. To this end, NRIC has developed a sophisticated software package, FINDAR, which provides facilities for the storage and retrieval of comprehensive descriptions of datasets including their spatial extents. The software is now relatively stable and priority is being given to capturing information on datasets managed or held within the DPIE portfolio.

Six directory nodes using FINDAR already exist—national, DPIE and Victoria (all at NRIC) and ERIN, WA (integrated land information program) and SA (Department of Mines and Energy). Interest in using FINDAR to develop data directories has been expressed by other states. Dataset descriptions held in subordinate nodes will be uploaded regularly to the national node which will be the major point of public enquiry.

Because the FINDAR software has wider applications in information management, a commercialisation agreement with an industry partner for the maintenance of the software and its marketing in Australia and overseas is in the final stages of negotiation.

Expected Outcomes

Enhanced awareness of the existence of natural resources data in Australia and its use in policy and land use decision making.

Activities

Maintain and support the FINDAR software which has been developed as the platform for the directory.

Develop a network of data directories using FINDAR in State/Territory and other Commonwealth agencies.

Provide enquiry facilities for departmental and external clients including on line access to the national and departmental directory nodes.

Expected Outputs

A publicly available national directory of datasets covering all major disciplines in the natural resources.

A departmentally available node directory containing information on all natural resources and related data managed or held in DPIE.

Printed subsets of the directory for particular subjects, areas or projects as appropriate.

Highlights for 1990/91

Installed version 2.1 of FINDAR at NRIC, ERIN, WALIS and SADME.

Agreed MOU in principle with States/Territories for transfer of data and directory information.

Arranged agreement for the marketing and maintenace of FINDAR with Wizard Information Services P/L.

Goals for 1991/92

Instal FINDAR in all States/Territories datasets which will help maximise the

availability of information relating to Australia's natural resources and enhance the quality of land use decisions.

Performance Information

The performance of this project will be measured against milestones specified in its project plan which is being developed using the project monitoring software recently installed in NRIC.

The performance of the project is assessed by:

- the level of use of the directory
- the currency of dataset descriptions in the directory
- the extent of subject and region coverages of dataset descriptions in the directory
- the level of acceptance of FINDAR by other agencies as a platform for directory development
- the level of commercial sales of the FINDAR software.

Clients

Commonwealth

States

Resource industries

Special interest groups

Project 252.8.4 Technology transfer (non-DPIE agencies)

Project Leaders	Graham Yapp (06) 272 3011 Rob Moore (06) 272 4607
Program Responsibility	National Resource Information Centre
Timeframe	Existing and Ongoing

Objectives

Enable technology transfer to external agencies in the Commonwealth, the States and Territories and industry via cooperative projects consistent with the overall function of NRIC.

Relevance

Support for cooperative pilot projects will be provided by a team of specialist technical and project staff from NRIC. Projects will normally only be carried out if there is a technology transfer return to NRIC as well as to the client. The notable exception to this rule is in public relations exercises.

Expected Outcomes

A professional level of support to be provided to NRIC clients.

An involvement of NRIC staff and facilities in cooperative pilot projects

Activities

Plan, develop, coordinate and monitor cooperative pilot projects with NRIC clients outside the DPIE portfolio.

Educate clients on the functionality and applicability of technologies such as those resident in NRIC for their specific work areas.

Expected Outputs

The development of a technology transfer education and training program.

Highlights for 1990/91

Completed collaborative projects with the Murray Darling Basin Commission, the Resource Assessment Commission and the Environmental Resource Information Network (ERIN/ANPWS).

Non-DPIE staff attended NRIC education and training programs in spatial information systems.

Goals for 1991/92

Develop and implement a technology transfer and education program for clients that will enhance their understanding of the functionality and applicability of NRIC technologies to their specific work areas; this will help to improve the quality and timeliness of land use decisions.

Performance Information

The performance of NRIC in respect to minor cooperative projects with external agencies will be subject to the following scrutiny:

- internal evaluation as a part of the Department's program evaluation plan
- review of achievements by the NRIC Executive Committee
- review of achievements by the NRIC Advisory Committee.

The performance of the project is assessed by:

- quality and timeliness of products produced in support of the above mentioned projects
- high level of involvement of NRIC in external cooperative projects
- the degree to which clients begin to adopt and use these technologies
- client satisfaction/dissatisfaction with support and responsiveness of NRIC to their needs.

Clients

Various

Project 252.8.5 Australian national GIS

Project Leader	Ian Musto (06) 272 4503
Program Responsibility	National Resource Information Centre
Timeframe	Ongoing

Objectives

Provide a nationwide GIS of biophysical data appropriate to decision making at the continental scale.

Relevance

The Department has a requirement for access to key datasets at a continental scale. This project addresses this requirement for a number of critical biophysical datasets.

Expected Outcomes

A GIS containing geology, soils, elevation and climate datasets.

Activities

Convert the Australian mapping data for geology, soils and elevation to GIS format.

Obtain descriptive data appropriate for resource assessment and evaluation and include these datasets in the national GIS.

Determine the limitations of each dataset and provide a facility and plan for upgrading their utility.

Expected Outputs

Procedures for upgrading the utility of these datasets.

A GIS database containing geology, soils, elevation and climate

Highlights for 1990/91

Released low cost geology and soil digital datasets in collaboration with BMR and CSIRO; the geology dataset comprises five layers scanned from the 1976 1:2.5M Geology of Australia map; the soils dataset is compiled from the 1:2M Atlas of Australian Soils.

Goals for 1991/92

Further develop a national digital elevation dataset to meet portfolio requirements.

Compile descriptive data to augment the digital data and increase their value for decision making.

Performance Information

The timely delivery of the datasets described

Providing and facility appropriate to user needs

Number of sales (at cost) of datasets

Measures of achievement

Widespread adoption of NRIC GIS standards.

Internal evaluation as part of BMR, BRR and NRIC procedures

Feedback from clients and collaborators.

Clients

Commonwealth

State and Territory agencies and statutory authorities

Other users of geo-referenced resource data

Project 252.8.6 Murray–Darling Basin GIS

Project Leader	Ian Musto (06) 272 4503
Program Responsibility	National Resource Information Centre
Timeframe	Ongoing

Objectives

Provide a structured GIS database for the Murray Darling Basin at a regional scale of 1:1 M including the following baseline data:

- vegetation/forest cover
- topography/cultural features
- terrain model and evaluation
- surface geology/hydrogeology
- soils
- climate.

Relevance

As a part of its normal operations the MDBC draws on detailed data prepared by State and Commonwealth agencies. This data are normally in a GIS format. The MDBC will analyse this information utilising limited in-house facilities to satisfy information requirements. NRIC will assist in this process by the provision and synthesis of data from other agencies.

The first stage of the database has been delivered to the MDBC and current work is concerned with refining the database and adding further data layers.

NRIC has been engaged identifying, retrieving and as appropriate reformatting data necessary for the construction of the regional scale GIS of the basin. This work has involved extensive consultation with data custodians and the examination and verification of various data necessary for the project. Much of the data was not available at the level of precision necessary in a digital form and in some cases it was necessary to arrange for digitising of the data.

Expected Outcomes

The provision of a comprehensive and timely support service to underpin the MDBC's further development and implementation of appropriate computer systems in support of its role.

Activities

Plan, coordinate and acquire necessary data to build the regional scale GIS.

Where primary data is unavailable at the required scale, undertake necessary work on existing data to allow them to be integrated into the regional GIS.

Provide an advanced data synthesis and modelling capability on major MDBC data.

Expected Outputs

A structured ARC/INFO library containing one theme per layer of the Murray–Darling Basin using a common coordinate system and geographic projection.

Highlights for 1990/91

Completed the first stage of project and delivered a portfolio of maps of geology, soil, vegetation, topographic and cultural features and climatic attributes of the Basin to the Murray Darling Basin Commission.

Goals for 1991/92

Produce a regional scale GIS database of the Murray Darling Basin for the Murray–Darling Basin Commission in support of its role to promote and coordinate effective planning and management of the Basin.

Performance Information

The performance of this project will be measured against the project plan being developed for its prosecution. This plan will be developed on the new project monitoring software that is currently being implemented by NRIC.

The performance of the project is assessed by:

- client satisfaction/dissatisfaction with the regional scale GIS of the Murray–Darling Basin
- the quality and precision of any manipulation undertaken by NRIC in support of the project objectives
- compatibility of systems adopted by MDBC with NRIC systems.

Clients

Murray–Darling Basin Commission

Project 252.8.7 Cape York Peninsula

Project Leader	Ian McNaught (06) 272 3019
Program Responsibility	National Resource Information Centre
Timeframe	August 1990–August 1992

Objectives

Manage two proposed programs of the Cape York Peninsula Land Use Study (CYPLUS).

Provide assistance with BMR's involvement in the National Geoscience Mapping Accord (NGMA).

Relevance

NRIC has two projects approved by the joint steering committee of CYPLUS:

- the GIS for CYPLUS will be coordinated and managed by NRIC with data contributions from both Commonwealth and Queensland agencies
- the directory will be a node of FINDAR and will describe all datasets (digital or otherwise) which are relevant to CYPLUS area and will also contain entries for datasets still being collected.

BMR's involvement in the NGMA is separately funded and administered. It is recognised that there will be a two way interchange of some of the outputs from the NGMA and CYPLUS.

The GIS will be derived from integration of existing and yet to be collected data of resources (both cultural and natural) and will comprise regional, point and modelled views of data and its products.

Progress with the project has been delayed as funding participation has not yet been finalised. The Project is due to finish two years after this issue is resolved.

Expected Outcomes

Joint creation of a GIS hosting basic natural, economic and social attributes of the study area for use as a data host and for land use planning.

Activities

Manage a proposed project which will create, coordinate and maintain on behalf of data custodians, the primary spatial information system for CYPLUS.

Manage a proposed project which will enable the listing of relevant datasets in the NRIC directory (FINDAR) and encourage dataset custodians to list their datasets on their local FINDAR node.

Establish and maintain an awareness of dataset generation and disseminate that awareness to the participants of CYPLUS.

Cooperate with and provide practical support to BMR's programs associated with the National Geoscience Mapping Accord North Queensland Project.

Expected Outputs

NRIC will provide GIS support to the BMR part of the North Queensland NGMA.

The primary GIS of CYPLUS containing the principal natural resource datasets will be created and made available to participating agencies.

The FINDAR directory for CYPLUS will contain entries describing all relevant identified datasets used or created under CYPLUS.

Highlights for 1990/91

Provided substantial support to departmental colleagues in support of Cape York initiatives.

Goals for 1991/92

Develop a primary GIS of Cape York containing the principal natural resource datasets to support the joint Commonwealth/Queensland Cape York Peninsula Land Use Study.

Performance Information

The performance of the project is assessed by:

- significant involvement in project formulation at levels from the GIS and natural resources working groups through to the joint steering committee of CYPLUS
- ability to meet the deadlines set by the various levels of CYPLUS management in the dynamic project environment
- successful application of FINDAR as the CYPLUS directory and in terms of dataset identification and data acquisition; the existing MOU process by NRIC will be complemented by CYPLUS joint steering committee efforts
- successful creation and maintenance of the CYPLUS GIS for and on behalf of the CYPLUS agencies; this will demonstrate NRIC's abilities at negotiation, data conversion and GIS creation and maintenance at both inter-departmental and inter-governmental levels.

The progress of the project will be assessed against deadlines set by external agencies and NRIC's ability to deliver within those deadlines. This will require NRIC to accurately estimate both delivery time for external data and creation/conversion for data resident within DPIE. The projects overall will be both inter-departmental and inter-state. While the CYPLUS is still in its informal (unfunded) state, NRIC will need to ensure that its capacity/capabilities are not misunderstood by the various clients.

Additionally, NRIC appreciates the possible complications which would arise if data contributors chose to price data beyond the expectations of CYPLUS or delivery dates for contributions are not met.

Clients

BMR

BRR

DPIE Land Resources Division

DASETT

Queensland government agencies

Other researchers and research organisations

Project 252.8.8 National Forest Inventory (NFI)

Project Leader	Rob Moore (06) 272 4607
Program Responsibility	National Resource Information Centre
Timeframe	Continuation beyond November 1991 in doubt

Objectives

Maximise the availability of information relating to Australia's forest resources by provision of appropriate technical support to NFI.

Relevance

Technical support is provided by a team of specialists headed by a Senior Professional Officer Grade A. NFI relies exclusively on this team for support of their systems due to the specialist nature of both the hardware and software.

Because NFI is acutely concerned with data security, staff have had to establish their integrity in a professional sense very quickly to facilitate the pursuit of NFI objectives.

Expected Outcomes

A professional level of technical support to NFI.

Activities

Plan, coordinate and monitor the provision of technical support to NFI.

Oversee the development and/or improvement of appropriate procedures and hardware and software systems to facilitate provision of support to NFI.

Provide appropriate technical advice to NFI.

Develop and implement appropriate computer and accommodation strategies to provide data security commensurate with custodianship agreements with the States and Territories in respect to NFI related data.

Continually monitor computer system performance and undertake necessary fine tuning to ensure optimum performance and availability to NFI.

Provide assistance and advice to NFI personnel to avoid duplication of effort between NRIC and NFI activities.

Provide staff resources until completion of existing commitment in November 1991.

Expected Outputs

The further development and implementation of appropriate procedures/computer systems in support of sub-objective 2.

The further development of security aspects to ensure that undertakings given to NFI clients are both honoured and seen to be honoured.

Highlights for 1990/91

Developed the Continental Forest Cover Geographic Information System.

High level of support for the NFI and its objectives throughout the year.

NFI/NRIC has consolidated its relationship and are jointly producing many useful products in support of the NFI's objectives.

Goals for 1991/92

Produce a continental database of forest types and a regional database/GIS coverage for the north east NSW and south east QLD forests to support the National Forest Inventory.

Performance Information

The performance of the project is assessed by:

- NFI satisfaction/dissatisfaction with technical support
- NFI satisfaction/dissatisfaction with level of security provided to data supplied by clients

- the percentage availability of computing systems to NFI staff
- compatibility of systems adopted by NFI with NRIC systems
- down time of computing systems to be kept to an absolute minimum
- assessment milestones
- continued NRIC involvement will be negotiated at completion of the current arrangement in November 1991
- internal evaluation as a part of the Department's program evaluation plan
- review of achievements by the NRIC Executive Committee
- completion and follow up of issues arising from a recent internal audit
- review of achievements by the NRIC Advisory Committee.

In addition, the performance of NRIC on this project will also be subject to scrutiny by the NFI Executive Committee.

Clients

Commonwealth

States and Territories

Portfolio clients

Project 252.8.9 Forest resources

Project Leader	Ian Musto (06) 272 4503
Program Responsibility	National Resource Information Centre
Timeframe	Completion of Stage 1 Spring/Summer 1991

Objectives

Provide a database of the results of the forest resources survey and an analytical capability to respond to requirements of the RAC.

Relevance

The forest resources survey was distributed by the RAC to all state forestry and conservation agencies and seeks to establish the current status and use of forest resources in Australia. The analysis of the data forms a major part of the draft report of the forest inquiry.

Activities

Develop a relational database in ORACLE to store and manipulate the forest resource survey data compatible with GIS analysis.

Provide data analysis to meet RAC's requirements for the forest inquiry report.

Provide limited GIS derived mapping of data from the survey.

Expected Outputs

A set of summary and analytical data provided to RAC for the draft report.

A further data compendium of the survey results to form an appendix to the final report.

Highlights for 1990/91

RAC forest resource survey project proceeding satisfactorily; RAC staff are impressed with the application and potential of the technology to assist their task.

Goals for 1991/92

Complete Stage 1 of contract to provide relational database and analyses of Forest Resource Survey data.

Negotiate and complete Stage 2 of contract to provide augmented and revised database and further analyses for inclusion in the final report of the RAC Forest and Timber Inquiry.

Performance Information

The performance of the project is assessed by:

- RAC satisfaction with technical support
- ability to meet deadlines
- flexibility in approach to emerging RAC needs for data analysis
- satisfactorily meeting the terms of the RAC contract.

Clients

Resource Assessment Commission (RAC)

Project 252.8.10 National geoscientific database

Project Leader	Simon Veitch (06) 272 4643
Program Responsibility	National Resource Information Centre
Timeframe	Ongoing

Objectives

Maximise the availability of information relating to Australia's geoscientific resources; minimise the time and cost of information retrieval; and respond to requests for information to satisfy strategic needs.

Liaise with agencies collecting and maintain geoscientific data to ensure efficiency, compatibility and standards are achieved.

Relevance

The geoscience resource database has two main components:

- a FINDAR directory of geoscience data
- geographic information in digital form.

The first component is supported routinely as a part of the FINDAR operational plan. It is supplemented in detail for specific projects under geoscience database operational plan.

The second component is substantially project driven. Projects are initiated by NRIC where new techniques for data analysis and representation are required in order to fulfil or anticipate management needs. NRIC also cooperates with, or conducts projects which are initiated by, the bureaux within DPIE.

Expected Outcomes

An ability to identify potential and existing natural resource issues indicated by geoscientific data.

Activities

Establish and maintain a FINDAR directory of geoscience data.

Establish and maintain geographic information system coverages appropriate to projects involving geoscience data.

Analyse and model geoscience data in response to policy and strategic needs.

Identify regions/areas where geoscience data is absent, lacking or is required for effective management.

Support liaison and workshops between geoscientists to facilitate communication, research and development.

Expected Outputs

A national directory of geoscientific data with up to date information of the status and spatial extent of geoscientific operations.

Ongoing geoscientific research compatible with natural resource management.

Digital geoscientific data suitable for analysis, modelling and comparison with other natural resource data.

Highlights for 1990/91

Release of the digital version of the 1:2.5 M scale map of the Geology of Australia (1976).

Release of the digital version of the 1:2 M scale Atlas of Australian Soils.

Goals for 1991/92

Continue to promote the use of computing techniques in the management and analysis of geoscientific information.

Apply new computing tools to geoscientific analysis.

Performance Information

The performance of the project is assessed by:

- ability to respond to enquiries/requests pertaining to geoscience issues
- involvement in effective communication with geoscientists nationwide
- the utility of the FINDAR geoscientific data entries
- products stemming from research (and modelling) which provide a better understanding of geoscientific processes
- NRIC's ability to report and supply information in response to client needs.

Clients

Commonwealth

States and Territories

Portfolio clients including Ministers

BMR and BRR

Project 252.8.11 Coastal zone

Project Leader	Simon Veitch (06) 272 4643
Program Responsibility	National Resource Information Centre
Timeframe	Ongoing

Objectives

Maximise the availability of information relating to Australia's coastal resources.

Minimise the time and cost of information retrieval.

Respond to requests for information to satisfy client needs.

Establish a FINDAR database of coastal resources.

Relevance

There are two principle projects covered by this plan:

- the Resource Assessment Commission (RAC) coastal resource enquiry
- the environmental geoscience unit of BMR's national geoscientific coastal database.

The RAC will commission NRIC's operations with regard to specific aspects of their enquiry. It is anticipated that these will relate to aspects of natural resources including vegetation, geology, geomorphology, soils and hydrology.

The national coastal geoscientific database consists of a pilot project to assess the feasibility of capturing geoscientific data into a GIS. It also incorporates specific projects relating to areas of impact such as Hamelin Pool and the south west coast of Western Australia; Cape York, QLD.

Expected Outcomes

Incorporation of geoscientific coastal data into a GIS so that analysis, modelling and research will be facilitated for specific project areas.

Activities

Establish contact with data custodians and researchers into coastal natural resources.

Incorporate directory information of coastal data into FINDAR.

Access and assemble digital information suitable for use in comparison and modelling and research of coastal management issues.

Respond to enquiries for specific client driven projects.

Expected Outputs

Reports to the RAC coastal enquiry to assist coastal resource assessment; data to be included are 1:100 k scale digital coastline of Australia, geomorphology, geology, data and hydrology data at 1:100 k scale or larger for coastal areas.

Highlights for 1990/91

Displayed the Shark Bay—Hamelin Pool GIS at the ASEG/GSA Conference (Sydney) and the IUCN Conference (Perth).

Completed a pilot study to assess methods for incorporating coastal geomorphological data into a GIS.

Goals for 1991/92

Apply image processing, GIS and database management systems to assist with the description and management of the coastal region.

Supply input to the RAC's coastal resource inquiry.

Performance Information

The performance of the project is assessed by:

- the utility of data stemming from projects to the management of coastal means
- the fulfilment of requirements for commissioned projects
- NRIC's ability to report and supply data within its deadlines on commissioned projects.

Clients

Department of Prime Minister and Cabinet

Resource Assessment Commission

BMR, Environmental Geoscience Unit

261: DATABASE COORDINATION AND RESEARCH

Objectives

Coordinate BMR 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 BMR's research and resource assessment projects must be readily available in a usable 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 BMR'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 NGMA.

Proper coordination of BMR's data also assists in maximising cost recovery through the sale of databases and related products.

Highlights for 1990/91

BMR was represented at several national and international geoscience database/computing meetings and contributed to committee work.

Four issues of "Database News" were produced.

Staff contributed to the design, enhancement and documentation of several national scientific databases.

Goals for 1991/92

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 transfer of image, GIS and mapping data between systems.

Develop draft data standards for geoscience data items, in conjunction with States/industry.

Represent the BMR at relevant national forums and conferences relating to database coordination and research.

DATABASE COORDINATION AND RESEARCH

Component Leader David Berman (06) 249 9602

Component Projects

261.01 Database Coordination and Liaison

261.02 Integration of Geoscientific Datasets

Component Resources

Project	Average staffing levels				Finances $k		
No	Research	Technical	Other	**Total**	Salary	Operations	**Total**
261.01	2.2		0.3	2.5	125	80	205
261.02	1.0	0.5		1.5	75	10	85
Total	**3.2**	**0.5**	**0.3**	**4.0**	**200**	**90**	**290**
Engineering support staff							
Cartographic support staff							
TOTAL				**4.0**			**290**

Project 261.01 Database coordination and liaison

Project Leader	David Berman (06) 249 9602
Project Responsibility	Information Systems
Timeframe	1984–Ongoing

Objectives

Promote geoscience database development, coordination and liaison at three levels:

- within BMR, so as to maximise the usefulness of BMR's geoscience and resources data and to facilitate the integration of different types of data by BMR 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, a Commonwealth/State Ministerial Council. BMR 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.

The project also contributes to BMR's national and international standing in geoscience database and related computer applications.

Highlights for 1990/91

Major staff changes and a cutback in staff resources during the year restricted activity in the project.

BMR continued to be represented on the GEOPAC Advisory Council, its Executive Committee, and on the AESIS Advisory Committee. BMR also maintained its substantial financial support of the Australian Earth Sciences Information System (AESIS), managed by the AMF, and contributed to the financial sponsorship of AMIRA's new AMDEX project.

BMR chaired the activity of the Government Geoscience Database Policy Advisory Committee. This committee gained acceptance by Chief Government Geologists for its draft standards on company exploration report formats. Four issues of the GGDPAC's "Database News" were published, with a circulation of over 130 within governmnent and industry.

BMR was also represented in 1990 at an international IUGS steering committee meeting for the Sub-commission on Global Data Management and Information Systems (SGDMIS), as well as two meetings of the International Consortium of Geological Surveys for Earth and Computer Sciences (ICGSECS).

Staff contributed to the design, enhancement and documentation of several national scientific databases, including Regolith, OzChron, Gravity, Earthquake & Nuclear Explosions, and PetChem.

Goals for 1991/92

Produce quarterly issues of "Geoscience Database News" (GGDPAC Newsletter).

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).

Develop a draft standard for statutory company exploration report technical content (GGDPAC).

Complete the sedimentary rock terms file as Australia's contribution to a Multilingual Thesaurus (COGEODOC project).

Update the national geoscience database directory, through NRIC's FINDAR system.

Foster the development of national computer-based geoscientific databases, particularly those supporting the NGMA and environmental geoscience initiatives.

Hold a national workshop on geoscience data standards and related GIS and cartographic issues.

Promote standards for geoscience data items required to support the integration of NGMA data sets and maps.

Promote support for the industry AMDEX project (mining data exchange standards), and forthcoming Australian spatial data transfer standards.

Develop a plan for the introduction of GIS technology to BMR programs, integrated with other BMR 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

Coordinating Committee on Science and Technology—working party on Resource and Environmental Databases

State Geological Surveys Mines Departments

BMR projects.

Cooperating Organisations

National Resource Information Centre (NRIC)

State Geological Surveys Mines Departments

Australian Mineral Foundation (AMF)

Australian Mineral Industry Research Association (AMIRA)

Australian Geoscience Information Association (AGIA)

IUGS 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 datasets

Project Leader	Prame N Chopra (06) 249 9602
Program Responsibility	Information Systems
Timeframe	1988–Ongoing

Objectives

Develop software links between the principal information technologies used in BMR for the processing, display, interpretation and sale of spatially referenced geoscience data.

Develop software tools and program interfaces to facilitate the use of BMR's information technologies from remote PC workstations and by this means, assist in the integration of the various data types (point, vector and raster).

Relevance

The integration and consequent interpretation of geoscientific data sets 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 BMR 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

Improved software links between the main BMR information technologies.

A personal computer interface to data held on the Image Processing, GIS and Digital Cartography systems.

Activities

The project uses the main BMR Image Processing, Geographic Information Systems, and Digital Cartographic Relational Database systems in addition to PC graphics, image and GIS packages together with communications software.

Highlights for 1990/91

The first overlaying of GIS–derived vector data onto imagery in the Image Processing Centre.

Routine transfer, processing and printing of images from the IPC on remote PCs.

Development of preliminary software for display of vector data over images on remote PCs.

Goals for 1991/92

Routine transfers of single-band images from the Image Processing Centre to the ARC/INFO Geographic Information System.

Routine overlaying of GIS vector data onto images in the IPC.

Routine transfer of scanned images from the Optronics plotter/scanner to the IPC and the GIS.

Refinements to the PC interface to the IPC and the development of links to the GIS.

Clients

BMR programs, components and projects

State and Federal land use organisations

Mineral and petroleum exploration companies

Educational and research institutions

Cooperating Organisations

National Resource Information Centre (NRIC)

Proposed Cooperative Research Centre for Integrated Resource Management and Environmental Science (NRIC/ CRES/ CSIRO)

State geological surveys mines departments

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, BMR 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 BMR's main functions in Australia. BMR'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

BMR, 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 bi- and multilateral projects initiated through Commonwealth agencies such as the Department of Foreign Affairs and Trade.

BMRs 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 BMRs specialist knowledge of the Australian and Antarctic regions
- regional cooperation in projects which, although development assistance oriented and funded, bring substantial benefit to BMR programs
- development assistance projects funded by development assistance agencies, mainly the Australian International Development Assistance Bureau
- support of Australias foreign policy or commercial objectives.
- where appropriate involvement of BMR and other Australian organisations in international cost-recovery projects and consultancies.

Arrangements are in place for cooperation with several countries/international organisations, and include:

- the Australia–New Zealand–USA tripartite program represents BMRs major contribution to development of offshore mineral and petroleum resources in the Asia–Pacific region under its membership of SOPAC
- development of geoscientific knowledge and mineral and petroleum resources in the Asia–Pacific region through:
  - cooperation with New Zealand and the USA under the Tripartite program—BMRs major contribution under its membership of SOPAC
  - bilateral cooperation with China under Memoranda of Understanding with the Ministry of Geology and Mineral Resources, the Chinese National Nonferrous Metals Industry Corporation, and the State Seismological Bureau 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

- 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.

BMR has established an International Programs Unit responsible for coordinating BMRs international program and investigating the establishment of an autonomous Australian Geoscience Services Project Office to coordinate Australian involvement in international commercial geoscience projects.

INTERNATIONAL DEVELOPMENT ASSISTANCE AND COOPERATION

Component Leader David Falvey (06) 249 9328

Component Projects

123.01 Tripartite geoscience projects—petroleum and mineral resource framework of south-west Pacific island arcs and basins

123.02 Rabaul harbour heatflow

123.03 Philippines offshore seismic project—regional petroleum explorations and evaluation of basin potential

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

Component Resources

Project	Average staffing levels				Finances $k		
No	Research	Technical	Other	**Total**	Salary	Operations	**Total**
(a)123.01							
(a)123.02							
(a)123.03							
(b)317.02			1.0	1.0	45	52	97
(c)317.03							
(a)317.04							
(c)317.05							
TOTAL			**1.0**	**1.0**	**45**	**52**	**97**

Notes:

(a) Externally funded

(b) Staffing support included in Corporate Relations, Information and Planning

(c) Budgets for these two projects are small and are sourced from the Onshore Sedimentary and Petroleum Geology Program (317.03) and the Minerals and Land Use Program (317.05)

Project 123.01 Tripartite geoscience projects: petroleum and mineral resource framework of south west Pacific island arcs and basins

Project Leader	Neville Exon (06) 249 9347
Program Responsibility	Marine Geoscience and Petroleum Geology
Timeframe	1982–1992

Objectives

Assist in exploration and development of petroleum and mineral resources of the region.

Advise on coastal problems.

Relevance

The south west Pacific Island Nations are island arcs where petroleum and seabed mineral potential are poorly known. The Tripartite geoscience project is an initiative of the governments of the United States of America, New Zealand and Australia to assist the Pacific Island Nations assess their petroleum and mineral seabed potential.

Activities

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 and Kiribati.

Reconstruct the Highlands and Sepik terranes of Papua New Guinea.

Provide advice on 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 southwest Pacific data tapes, in conjunction with Australian Archives.

Continue source rock and other studies on Pacific island cores, as appropriate.

Publish further results of Tripartite program and Papua New Guinea palaeomagnetic studies.

Help implement the work program agreed at the 1987 CCOP/SOPAC IOC Coastal Processes Workshop.

Expected Outcomes

Enhanced economic potential for, and resource knowledge of, the south west Pacific Island Nations.

Expected Products

Summary volumes and papers on manganese nodules, cobalt–rich crusts and petroleum prospects of the region.

Highlights for 1990/91

Data storage and retrieval facilities upgraded, and considerable new island country data accumulated and organised.

Publication of two further volumes of results of the Tripartite cruises.

Publication of various papers on results of the RV *SP Lee*, RV *Moana Wave* and HMNZS *Tui* minerals–orientated cruises.

Publication of the Tonga petroleum brochure.

Goals for 1991/92

Publish results from 1987, 1989 and 1990 cruises of the RV *Moana Wave*, *HMAS Cook* and RV *Sonne*.

Publish results of the Papua New Guinea palaeomagnetic study.

Prepare proposals and reports dealing with coastal processes on Pacific islands.

Clients

Island nations of the south west Pacific

AIDAB

CCOP/SOPAC IOC

Cooperating Organisations

United States Geological Survey (USGS)

Hawaiian Institute of Geophysics (HIG)

New Zealand Oceanographic Institute (NZOI)

New Zealand Geological Survey (NZGS)

Commitee for Coordination of Joint Propsecting for Mineral Resources in South Pacific Offshore Areas (CCOP/SOPAC)

Australian Defence Force Academy (ADFA, Duntroon)

Pacific Island Nation geological surveys

Australian Universities

Inter-governmental Oceanographic Commission (IOC)

Project 123.02 Rabaul Harbour heatflow survey

Project Leader	Trevor Graham (06) 249 9341
Program Responsibility	Marine Geoscience and Petroleum Geology
Timeframe	1989–1991

Objectives

Constrain the geological and geophysical models for the region that are essential to monitoring the volcanic hazards in the region.

Relevance

The determination of the thermal conditions within the Rabaul Caldera will further constrain the geological and geophysical models for the region that are essential to monitoring the volcanic hazards in the region.

The sediment cores will provide a recent geological history of eruptions, and will aid in the evaluation of any geological hazard associated with a major eruption, i.e. slumping.

Specifically, the heat flow survey will provide a base level by which changes in heat flow can be monitored, it will also delineate areas of high heat flow and consequently the areas of major volcanological and geothermal activity. The temperature data will identify any areas of pore fluid upwelling.

Expected Outcomes

Improved monitoring of volcanic hazards in the region.

Activities

Interpret and model the thermal data in an attempt to determine the location and extent of magma bodies, and to better understand the thermal processes of the Rabaul Caldera.

Obtain a base level heat flow map for the Rabaul Harbour region.

Conduct the main heat flow survey in December 1991.

Determine the temperature distribution, thermal gradient distribution and thermal conductivity within the near surface sea floor sediments.

Train relevant personnel of the Papua New Guinea Geological Survey and Rabaul Volcanological Observatory in geological hazard evaluation.

Complete cruise report.

Expected Products

Heatflow map of Rabaul Harbour and accompanying report.

Training will be given to geologists and geophysicists of the Papua New Guinea Geological Survey in marine heatflow and vibro-coring techniques.

Geologists from the RVO will be given training in possible monitoring procedures in relation to their earthquake prediction, i.e. especially in the area of sea floor water sampling, sea floor temperature monitoring.

Goals for 1991/92

Complete heat flow survey.

Prepare a base level heat flow map of the Rabaul Harbour region.

Clients

Papua New Guinea Geological Survey

Cooperating Organisations

AIDAB

CCOP/SOPAC

Papua New Guinea Geological Survey

Rabaul Volcanological Observatory

Project 123.03 Philippines offshore seismic project—regional petroleum exploration and evaluation of basin potential

Project Leader	Chao-Shing Lee (06) 249 9439
Program Responsibility	Marine Geoscience and Petroleum Geology
Timeframe	1990–1995

Objectives

Assess the petroleum prospectivity of selected offshore survey areas of the Philippines in an attempt to attract further exploration and drilling activities in these areas

Relevance

This is an Australian development assistance program to the Government of the Philippines designed to assist in the promotion of petroleum exploration activities in the Philippines. The funds of this project will be provided by the Australian International Development Assistance Bureau (AIDAB).

In September 1988, the Philippines Government formally requested the Australian Government to provide an exploration assistance program. In 1989 and 1990, BMR was requested by AIDAB to review the proposal and to design a sustainable program.

This project has now been designed in accordance with the following five stages

- Stage 1 Finalise the Project Design Document.
- Stage 2 Produce an Implementation Document.
- Stage 3 Mobilisation, data acquisition and demobilisation.

- Stage 4 Processing of data gathered on the cruise.
- Stage 5 Data interpretation, evaluation and recommendations.

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.

Pre-survey studies planned for September 1991, including processing of LANDSAT data.

Reprocessing of existing seismic data and interpreting of regional seismic and well data.

Marine Survey planned for April 1992, primarily using MCS and underway geochemistry aboard *Rig Seismic*.

Reprocess 500 kms of existing seismic data and process seven scenes of LANDSAT image data from the potential survey areas.

Produce 2500 kms of new processed seismic data as public geoscientific information on Philippines natural resources.

Publish the results of the project in the 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 kms of new processed seismic data as public geoscientific information on Philippines natural resources.

Highlights for 1990/91

Visited Manila to communicate with Australian aid officer, OEA, Philippines oil companies and local logistic support companies.

Completed Stage 1 including a Design Document submitted to AIDAB.

Provided technical advice in regard to the draft of a Memorandum of Understanding between the two governments.

Conducted budget negotiations with AIDAB.

Goals for 1991/92

Finalise an agreement with AIDAB and initiate program activities.

Reprocess 500 kms of previously collected oil company seismic data in the potential survey areas in order to better understand the geological structures and help to design the field program.

Process LANDSAT TM data in the potential survey areas in order to reduce the risk of encountering shallow water during the field operation.

Negotiate the navigation and logistic service contracts with AUSLIG and logistic support companies.

Prepare a 1992 *Rig Seismic* cruise in the selected survey areas of Philippines.

Clients

The Philippines

BHP

Philodrill

Alcorn Oil

Oriental Petroleum

Transasia Oil Company

Cooperating Organisations

Office of Energy Affairs (OEA), Republic of Philippines

AIDAB

Project 317.02 China—MOU cooperation

Project Leader	Professor Roye Rutland	(06) 249 9600
Project Coordinator	David Newham	(06) 249 9571
Program Responsibility	International Programs Unit	
Timeframe	1983–Ongoing	

Objectives

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

BMR 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)
- Geoscientific basis for exploration for tintungsten deposits in fold belts (CNNC)
- Exchange visits have also taken place in seismology to establish an MOU and identify topics for cooperative research (SSB).

Joint reports will be published on completion of the above programs.

The Report for the Palaeozoic basins and tin tungsten studies is in a final stage of completion. Further cooperative exchanges will be undertaken in the above and other identified programs with MGMR and CNNC.

Highlights for 1990/91

Completed the Indonesia–Australia Geological Mapping Project.

Exchange visits in the tin-tungsten program by the Director of the Bureau of International Cooperation, MGMR, to review the cooperative program and identify new areas for cooperation.

Goals for 1991/92

Completion of final reports on the Palaeozoic basins and the tin-tungsten studies.

Continuation of exchange visits in other programs and initiation of exchanges in new programs.

Establishment of a BMR international programs unit.

Clients

Peoples Republic of China

Exploration and mining industry

State geological surveys

Commonwealth agencies

Cooperating Organisations

International

Peoples Republic of China

China Ministry of Geology and Mineral Resources (MGMR)

China National Non-ferrous Metals Industry Corporation (CNNC)

PRC State Seismological Bureau (SSB)

Australia

Relevant Commonwealth, State and tertiary organisations and industry

Dr R Day, Dr P Playford, P Commander, Queensland and WA Geological Surveys

M Williams, NSW Water Board

G Gibson, Phillip Institute of Technology, Melbourne

Project 317.03 International geoscience mapping

ProjectLeader David Palfreyman (06) 249 9465

Program Responsibility Onshore Sedimentary and Petroleum Geology

Timeframe 1950s–Ongoing

Objectives

Contribute to international projects concerned with regional geoscience mapping, particularly in the South East Asian and the South West Pacific region.

Relevance

The project is part of Australia's contribution to international geoscience cooperation. This project will improve understanding of the geology in the south western Pacific quadrant 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 relationships with neighbouring countries in the South East Asian and the South West Pacific region.

BMR 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 Outcomes

Improved appreciation of the regional context of Australian geology, mineral and petroleum resources.

Activities

Compile 1:10 M 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 BMR's program.

Expected Outputs

BMR meets its obligations in international geoscience mapping.

South West Quadrant full colour maps and explanatory notes all published through the CPMP by the USGS.

Highlights for 1990/91

Published CPMP Mineral Resources map and notes; and Commission for the Geological Map of the World Geology map.

Goals for 1991/92

Complete data compilation for the CPMP Energy Resources map (South West Quadrant).

Complete Explanatory Notes for the Energy Resources Map.

Commence compilation of data for the CPMP Natural Hazards map (South West Quadrant); this activity is a contribution to the IDNDR (see 242.06).

Prepare a paper on Pacific geoscience for the conference on "Sustainable development: energy and mineral resources in the Circum Pacific region and the environmental impact of their utilisation" sponsored by CPCEMR to be held in Bangkok in March 1992.

Clients

Mineral and petroleum industries, both in Australia and overseas.

Governments and geoscientific organisations in neighbouring countries.

Cooperating Organisations

Circum-Pacific Council for Energy and Mineral Resources (CPCEMR)

USGS

Overseas geological surveys

Project 317.04 Geoscience program in the Sultanate of Oman

Project Leaders	David Denham (06) 249 9267 Lynton Jaques (06) 249 9745	(Geophysics) (Geology)
Project Coordinator	David Newham (06) 249 9571	
Program Responsibility	Geophysical Observatories and Mapping Minerals and Land Use International Programs Unit	(Geophysics) (Geology) (Coordination)
Timeframe	1990–1992	

Objectives

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 BMR 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 in 1990/91

Successful completion of a contract to the Omani Government for the preparation of the specifications for the above project.

Winning the contract to supervise implementation of this project.

Goals for 1991/92

Complete the contract to the satisfaction of the Omani Government.

Clients

Omani Ministry of Petroleum and Minerals.

Aerodata Australia.

Cooperating Organisations

Geological Survey of Oman

Al Bassim Enterprises, Muscat

Aerodata Australia

Project 317.05 Volcanism, tectonics and metallogeny of western Melanesia

Project Leader Dr Wally Johnson (06) 249 9377

Program responsibility Minerals and Land Use

Timeframe 1991–1996

Objectives

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.

BMR has had a long associations 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 BMR'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 Organisations

Australian National University

Rabaul Volcanological Observatory (PNG)

University of New England

PROGRAM DELIVERY

Engineering Services

Program Leader Geoff Feasey (06) 249 9243

Key Managers

Neville Esau	(Electronics Design and Development)
Lou Zeitlhofer	(Electronics Technical and Unit Resource Manager)
Mike Burns	(Mechanical Engineering)

Resources Table

Corporate Unit	Average staffing levels	Finances $k
Engineering Services	51.6	1613

Objectives

Contribute to the BMR's program by applying engineering expertise in a responsive, effective and efficient manner.

Expected Outcomes

Favourable direct comparisons, when available, of the unit's costs and those of the private sector.

Clients' recognition that the unit offers a more responsive and economic service than they could obtain from private sector contractors.

Low turnover of staff with highly marketable engineering skills.

Highlights for 1990/91

The replacement aircraft's new system, designed in the unit, was installed and became operational.

The Marine seismic system was updated to 192 channels, pre-amplifiers were designed and produced for the new charge coupled streamer cable, and a new 240 channel system was progressed.

The prototype of the new telemetry system for earthquake seismic and nuclear monitoring successfully completed an international data exchange experiment.

Productivity in mechanical engineering virtually doubled following investment in new technology and workforce rejuvenation.

Electronics productivity was increased through the initial introduction of automated electronic testing.

Service to all programs maintained with less staff through measures including:

- use of 10% temporary and contract staff to fill gaps and increase flexibility
- adoption of an interim flatter management structure while awaiting outcome of review of staff classifications.

Goals for 1991/92

Complete the reshaping of the unit, including the introduction of 'more commercial methods', taking advantage of the rejuvenation process begun with the redundancies of 1990/91, by rebalancing program aspirations and the unit's capacity to deliver.

Increase productivity by:

- extending the automation of testing of equipment, enabling staff to work more effectively
- extending the use of computer aided design and drafting, circuit simulation etc
- applying information technology to minimise the time required for functions such as purchasing and cost control

- negotiating quicker recruiting, promotion and purchasing procedures.

Compare the cost effectiveness of the unit with that of the private sector whenever possible.

Improve the working environment by updating the ESU accommodation on the Ground and Basement Floors following the introduction of modern techniques and processes, e.g. replacing manual drafting by CAD, etc.

Find a way to introduce a Technical Trainee Scheme in 1992/93.

Introduce measures to recognise and reward merit.

Clients

The program areas which contribute to the National Geoscience Mapping Accord, the Continental Margins Program and the Observatories and Nuclear Monitoring functions provide the unit's base workload and share the available ESU effort according to their needs.

Other programs can obtain services, and the key programs can get extra services, by providing salary funding for the hiring of additional effort.

Planned allocation of ESU resources to program areas

Component	Staff Years	Total $k
Onshore Sedimentary Basins	5.6	187
Continental Margins	25.1	839
Minerals and Land Use	0.5	17
Geophysical Observatories and Mapping	12.1	405
Groundwater	1.0	33
Business Management	0.7	23
ESU (not attributed)	6.6	108
TOTAL	**51.6**	**1613**

Cartographic Services

Program Leader John Hillier (06) 245 1295

Key Managers

Ian O'Donnell	(Resources)
Chris Carter	(Production)
Phil Ryan	(Information Technology)

Resources Table

Corporate Unit	Average staffing levels	Finances $k
Cartographic Services	49.0	2380

Objectives

Provide cartographic products and related services in support of BMR objectives.

Activities

Manage and operate BMR "Intergraph" computer assisted cartographic facility.

Collect, store and integrate data.

Produce digital datasets, geoscientific maps, and related graphic products:

- 35 mm colour slides, colour monochrome overhead films
  - scientific presentations (conferences, symposiums, briefings)
  - scientific publications (drawings, diagrams, illustrations).

Provide general graphic design services:

- colour poster displays (poster, design and layout)
- colour artwork (books, covers, brochures)
- miscellaneous colour products.
  Provide general still photographic services
- publicity
- promotions.

Provide reprographic services:

- lithographic printing
- copy service.

Undertake experimental development of leading edge technological applications.

Highlights for 1990/91

Devolution of management of BMR "Intergraph" computer assisted cartographic facility to CSU from Information Systems Branch.

Devolution of a range of functional responsibilities from BMR Business Management Branch.

Release of "Symbols on Geological Maps" in digital form.

Introduction of provision of customised electrostatic printer colour maps on demand from digital databases:

- Minerals
- Petroleum Tenements and Titles (Australia)

Provision of digital version of 1:2.5 M map of Geology of Australia to NRIC for public release.

Completion of contemporary multi-colour 1:250 k geological maps of Western portion of Irian Jaya and release of geoscientific data packages of West, Central Kalimantan.

Publication of multi-colour geological map of Kalimantan.

Visits by Minister Griffiths, Secretary Geoff Miller, Local Member John Langmore, Chairman, and a member of BMR Advisory Council.

Completion of Structural Efficiency Principles review of Technical Officer classifications.

Span of hours of operation enlarged from 6am–midnight, Monday–Friday.

Modest achievement in provision of BMR services in support of cost recovery objectives.

Achievement of Government Guaranteed Training Program objectives and targets.

Recipient of Printing Industry Craftsmanship Award for maps up to five colours. (Schematic Geological Map of Antarctica).

Eighth National Print Awards for Specialty or Special Printing Category (Geology and Mineralisation of the Alligator River's Uranium Field).

Rejuvenation of Staff Profile by voluntary redundancy program.

Introduction of CSU Achievement Award.

Publication of first maps in new series—ORMS 1:1 M, Murray Basin 1:250 k, folio of Amadeus Basin maps.

Publication of the book "Australia–Evolution of a Continent" for school students.

Goals for 1991/92

Sustained application of advanced CADD techniques to the continued provision of comprehensive and timely delivery of service to the broad spectrum of BMR programs, specifically those projects identified under the National Geoscience Mapping Accord.

Modernise production processess, particularly the installation of Intergraph technology for map production.

Introduce measures to rejuvenate the skills profile of the unit.

Participate in cost recovery through active marketing of CSU services.

Implement Preliminary Disaster Recovery Plan (DRP) options.

Establish Cost Recovery Committee.

Conduct Open Day for industry. Conduct BMR/states workshop on GIS Applications emphasising higher quality cartography.

Information brochure produced, printed and distributed. Continue to conduct "induction" for new BMR staff. Conduct occasional presentations (calendar). Foster social, recreational and sporting activities. Undertake client survey.

Ongoing market study and consultation with vendors and other users. Information exchange and collaboration. Recommendations made.

Undertake skills analysis survey and commence job analysis audit to develop strategic training program. Allocate GGT Legislation training component accordingly.

Provide opportunity for all project managment staff to participate in Middle Management Program.

Enhance digital Cartographic Symbols Library and associated standards. Participate in appropriate standards committees.

Allocate resources funding equivalent to 2% of CSU resource allocation per annum for experimental development.

Establish team for standard project documentation.

Complete trial of FINDAR as a solution to an automated file storage recording system.

Planned allocation of CSU resources to program areas

Program	Staff Years	Total $k
Onshore Sedimentary Basins	7.8	
Continental Margins	4.7	224
Petroleum Resource Assessment	1.7	81
Minerals and Land Use	9.7	463
Geophysical Observatories and Mapping	3.9	186
Minerals Resources Assessment	0.9	43
Groundwater	3.5	167
Environmental Geoscience	1.0	48
Corporate Relations Information and Planning	4.6	220
CSU (not attributed)	11.2	535
TOTAL	**49.0**	**2341**

Corporate Relations, Information and Planning

Program Leader Michael Lee (06) 249 9572

Key Managers

Gillian Tidey	(Marketing and Information)
Ian Hodgson	(Corporate Publications)
Anne Franklin	(Library)
David Bailey	(Planning, Evaluation and Reporting)

Resources Table

Corporate Unit	Average staffing levels	Finances $k
Corporate Relations, Information and Planning	30.7	*1935
Executive	6.0	560

* Includes program operation funds currently managed centrally.

Objectives

To promote and support BMR and its programs.

To help BMR adapt to change.

Highlights for 1990/91

Devolution to program areas, responsibility for, and funding of, publications.

Implementation and support for program evaluations.

Improvements in planning documents.

Reorganisation and amalgamation of the bookshop and copy service into a sales centre.

Client survey and client database development.

Production and distribution of a new marketing newsletter AUS.GEO News.

Extensive promotional effort at industry and scientific conferences.

Development of the BMR Record series.

BMR Journal in regular production.

Computerisation of library services.

Support for new Advisory Council initiatives; Project Award scheme, member interaction with specific program areas, Council involvement in program evaluations, Advisory Council Update.

Formation of an International Programs Unit external to the Branch.

Goals for 1991/92

Provide a higher level of support for the BMR Executive.

Assist the BMR Advisory Council to develop further its role in providing advice on the Bureau's programs.

Further develop the Bureau's planning, evaluation and reporting processes including better integration of project and corporate level planning.

Fully implement the 'Bookscan' computer based sales, accounting and client database system.

Prepare and implement a coordinated marketing and public relations strategy.

Develop and market more effectively the BMR Journal of Australian Geology and Geophysics.

Develop a new map library facility.

Develop an International Programs Unit located outside the Branch.

Business Management

Program Leader John Cahill (06) 249 9473

Key Managers Karl Ovijach (Finance and Services)
Mike Hedley (Personnel Management)

Resources Table

Corporate Unit	Average staffing levels	Finances $k
Business Management	59.0	*5537

* Includes program operation funds currently managed centrally.

Objectives

Manage BMR's business operations to provide services which promote and support the BMR Program and its people through:

- recruiting and developing BMR's people
- acquiring and assisting with the cost effective management of BMR's financial resources
- acquiring and managing BMR's property and related facilities
- providing management information and a broad range of corporate services.

Highlights for 1990/91

There have been several important achievements involving the Business Management Branch during the last financial year. Some of these included:

- introducing a new program based organisational structure for BMR and filling the senior management positions
- finalising the implementation of relevant recommendations from the Woods Review
- streamlining existing merit advancement promotion processes

- extending merit advancement promotion arrangements to BMR science grade Professional Officers
- negotiating a new structure for Research Scientists through the Industrial Relations Commission, including significant salary increases based on work value
- managing a BMR-wide redundancy program affecting almost ten percent of BMR's permanent officers
- launching the BMR People Development Program
- undertaking major repairs, maintenance and renovations to BMR's existing premises
- acquiring funds, and undertaking initial design studies, for new purpose-built accommodation for BMR
- reducing the size of BMR's vehicle fleet
- managing BMR's budget to within 0.05% of allocations.

Goals for 1991/92

The goals for the Branch during the next financial year are based principally on improving the quality of life for BMR staff through providing support services which better equip individuals and program groups to achieve research program objectives. These goals include:

- acquiring a new financial management information system
- generally improving the management of human and financial resources and accountability arrangements
- accelerating BMR's cultural change through further organisational development activites, people development programs and contemporary human resource management policies and practices
- further devolution of program funds to program managers
- streamlining support services and reducing red tape
- boosting funding and design activites for a new building for BMR.

Information Systems

Program Leader David Berman (06) 249 9602

Key Managers David Downie
Mirek Kucka
John Creasey
Geoff Wood
Rod Ryburn

Resources Table

Corporate Unit	Average staffing levels	Finances $k
Information Systems	18.0	1909

Objectives

Operate and develop corporate computing systems. Instal and support appropriate communications technology in order to promote connectivity between program and corporate level systems.

Promote communication between program managers to assist them in identifying their corporate computing needs, and to encourage effective and efficient resource and information sharing across BMR, and within the Department.

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 the BMR's Information Technology Strategy, in consultation with program managers, and Departmental interests.

Goals for 1991/92

Continue to support and improve existing corporate computing platforms:

- Manage the Data General MV/20000 computer; including the provision of operator services, user assistance, file system maintenance, magnetic tape management, system development, and general technical consulting services.
- Manage the BMR corporate Oracle Relational Database; including planning, advice and problem resolution, as well as routine support functions such as backup, recovery, security, integrity, software upgrades and day–to–day operational support of the database environment.
- Manage and upgrade the BMR corporate Image Processing Centre, and support the introduction of corporate GIS planning, in conjunction with systems expertise from NRIC.

Support the implementation of the recommendations of the 1990 Information Systems Study. Provide support for the Information Resources Management Committee.

Acquire a Unix based corporate Oracle database server. Plan for the relocation of applications currently using the Data General, prior to its decommissioning. Organise a more secure and formal Test and Production database administration environment.

Progressively instal and manage a corporate Ethernet network (BMRnet) to provide access to and efficient use of both corporate and program managed computing facilities, for document and data handling. Promote the rationalisation and integration of communications technologies, including data, voice (PABX and ISDN), and field radio and GPS positioning systems.

Organise training in and access to major corporate computing products including; operating systems, programming languages, database systems, image processing, office automation products and DPIE electronic mail.

Participate in program computing management meetings, to promote corporate computing principles, custodianship, data management and cross-program data-sharing opportunities. Provide senior BMR 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 database and computer applications, according to corporate priorities.

Provide supplimentary technical, administrative and financial support for the BMR's Database Coordination and Liaison projects.

Appendix A

BMR Advisory Council

The BMR Advisory Council 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 BMR, Professor Roye Rutland, on:

- the objectives and priorities of the BMR's research programs;
- the initiation, performance and termination of aspects of the program;
- industrial and economic policies which impinge on BMR's activities;
- community interests in relation to BMR activities.

The membership of the Advisory Council is as follows:

Gerry Gleeson
(nominated by the Minister for Resources, the Hon Alan Griffiths, MP)

John Cramsie
Director, Geological Survey of New South Wales, Department of Minerals and Energy
(nominated by the Chief Government Geologists' Conference)

Peter Core
Executive Director, Minerals and Fisheries Group, DPIE
(nominated by the Secretary, DPIE)

Hugh Skey
General Manager, Exploration Division, Aberfoyle Resources Ltd
(nominated by the Australian Mining Industry Council)

Phil Playford
Director, Geological Survey of Western Australia
(nominated by the Chief Government Geologists' Conference)

Ron Vernon
School of Earth Sciences, Macquarie University
(nominated by the Australian Academy of Science)

Jim Bowler
Deputy Director, Museum of Victoria
(nominated by the Australian Geoscience Council)

Bob Smith
Chief Geophysicist, CRA Exploration Pty Ltd
(nominated by the Australian Society of Exploration Geophysicists)

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

Roye Rutland
Executive Director, Bureau of Mineral Resources, Geology and Geophysics (ex officio)

Tony Stephenson
Staff representative, (elected by BMR staff)

Appendix B

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
AIDAB	Australian International Development Assistance Bureau
AMEC	Australian Minerals and Energy Council
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 Seismic Stratigraphy Project
ANU	Australian National University
APA	Australian Petroleum Accumulations [Report]
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
ASEG	Australian Society of Exploration Geophysicists
ASTEC	Australian Science and Technology Council
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
BRR	Bureau of Rural Resources
CAD	computer assisted design

CCOP . . . . . Committee for the Coordination of Joint Prospecting for Mineral Resources in Asian Offshore Areas

COSOP . . . . . Committee on Safety in the Offshore Petroleum Industry

CMP . . . . . Continental Margins Program

CPCEMR . . . . . Circum-Pacific Council for Energy and Mineral Resources

CRC . . . . . Cooperative Research Centre

CSIRO . . . . . Commonwealth Scientific and Industrial Research Organisation

CTBT . . . . . Comprehensive [Nuclear] Test Ban Treaty

CYPLUS . . . . . Cape York Peninsula Land Use Study

DASETT . . . . . Commonwealth Department of the Arts, Sport, the Environment, Tourism 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

EOR . . . . . Enhanced Oil Recovery

ERDC . . . . . Energy Research and Development Corporation

ERIN . . . . . Earth Resources Information Network (CSIRO)

GAB . . . . . Great Artesian Basin

GEBCO . . . . . General Bathymetric Chart of the Oceans

GGDPAC . . . . . Government Geologists Data Processing Advisory Committee

GIS . . . . . geographic information system

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

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
IGBP	International Geosphere Biosphere 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
LANDSAT	Land satellite
LOS	Law of the Sea [see UNCLOS]
LPG	liquid petroleum gas
MCS	multi-channel seismic
MLA	Member of the Legislative Assembly
MOU	Memorandum of Understanding
MP	Member of Parliament
NERDDC	National Energy Research, Development and Demonstration Council
NFI	National Forest Inventory
NGMA	National Geoscience Mapping Accord
NRIC	National Resource Information Centre (BMR/BRR)
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
PGE	Platinum Group Elements
PNG	Papua New Guinea
POGS	Polar Orbiting Geomagnetic Survey
PRC	Peoples' Republic of China
P(SL)A	Petroleum (Submerged Lands) Act

QLD . . . . . Queensland

QDPI . . . . . Queensland Department of Primary Industry

RAC . . . . . Resource Assessment Commission

RAN . . . . . Royal Australian Navy

RH&BNC . . . . . Royal Holloway and Bedford New College; Egham, Surrey, United Kingdom

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

SHRIMP . . . . . An ion microprobe facility at the Australian National University

SLEADS . . . . . Salt Lake, Evaporites and Aeolian Deposits

SOPAC . . . . . South Pacific

TAS . . . . . Tasmania

TM . . . . . Thematic Mapper

TMI . . . . . total magnetic intensity

UNCLOS . . . . . United Nations Convention on Law of the Sea

UNEP . . . . . United Nations Environment Program

USGS . . . . . United States Geological Survey

VIC . . . . . Victoria

VICGS . . . . . Victorian Geological Survey

WA . . . . . Western Australia

WALIS . . . . . Western Australian Land Information System

Appendix C

GLOSSARY OF DATABASES AND COMPUTING APPLICATIONS

APA:
A comprehensive database of oil, gas and condensate accumulations found so far in seven of Australia's sedimentary basins (Amadeus, Bass, Gippsland, Adavale, Bonaparte, Otway, Browse) including location, discovery details, reservoir characteristics, type of trap, production status and production infrastructure. [Contact: Anne Felton (06) 249 9754]

AUSTPLAY:
A menu driven program for assessing the petroleum potential of prospects, plays and basins [Contact: David Forman (06) 249 9756, Alan Hinde (06) 249 9259]

AUSTRES:
A subset of PEDIN used for assessment of petroleum potential and estimation of future production; data extracted from AUSTRES is analysed by the PC-based AUSTPLAY [Contact: David Forman (06) 249 9756]

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]

FINDAR:
A sophisticated software package, developed by NRIC, which provides facilities for the storage and retrieval of comprehensive descriptions of datasets including their spatial extents. [Contact: Paul Shelley (06) 272 4643]

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]

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]

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]

PORPERM:
Database containing porosity, permeability, lithology and grainsize data from petroleum exploration, development and stratigraphic wells drilled in Australia and Papua New Guinea. [Contact: Shige Miyazaki (06) 249 9715]

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]

RESERVES:

A confidential database of Australia's oil and gas reserves by field; a public summary is generated from the database every six months. [Contact: Steve Le Poidevin (06) 249 9753)]

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]