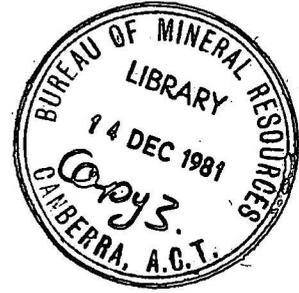


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# BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

## RECORD

RECORD 1981/67

PETROLEUM EXPLORATION BRANCH

SUMMARY OF ACTIVITIES

1981

RECORD 1981/67

PETROLEUM EXPLORATION BRANCH

SUMMARY OF ACTIVITIES

1981

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- Figure 1: Offshore Exploration Drilling Operations Completed 1.11.80 to 31.10.81.

## PETROLEUM TECHNOLOGY SECTION

During the year, all groups in the section but one carried out their normal functions. Several staff positions remained unfilled, and for this reason, the reservoir fluid analysis (PVT) group in the laboratories was again inactive throughout the year.

The Chief Petroleum Technologist (CPT) Mr J.A.W. White spent the major portion of his time in examining applications for new oil pricing and on matters related to the Oil Advisory Committee. The increasing amount of work in examining new oil pricing applications, reflecting the rising activity in domestic exploration drilling, also required the expertise and substantial assistance of several other officers in the branch.

As Secretary of the Oil Advisory Committee, the CPT convened a number of meetings during the year with other (BMR) committee members, and prepared extensive correspondence and other details related to the meetings. Activities under the Oil Advisory Committee also involved the CPT in two visits to the Davis No. 1 oil drilling operation in the Ngalia Basin during March and April.

In other activities, the CPT attended several presentations by industry groups on their exploration philosophy, attended various meetings in the Department including discussions on selection of a consultant for advising the Federal Government on Bass Strait crude oil production operations for excise levy purposes. The latter also involved the CPT in a week's visit to Bass Strait with consultants in October to inspect the operation.

During the absence of the branch head on several occasions the CPT acted for him; Mr McKay, OIC in the Petroleum Technology Laboratory in turn acted for Mr White as CPT on several occasions.

### Petroleum Technology Laboratory

Continued development and use of new equipment and techniques as well as expanding research into new petrophysical areas occupied the main efforts during the year. The laboratory continued to be understaffed with the Science 2 (geochemist) position (formerly occupied by Dr Jackson) remaining unfilled. A vacancy also occurred in the petrophysical group with the promotion of Mr Bresnehan to the Reservoir Engineering Group; however this position was filled later in the year by Mr De Nardi from Basin Assessment. The Reservoir fluid analysis (PVT) equipment continued to be unused because of staff limits.

With regard to equipment and techniques, further development took place in the head space method for geochemical source character and maturation studies of canned cuttings samples; this was greatly aided by addition and programming of a direct automatic data processor and subsequent evaluation of samples from widespread areas of the country. The high pressure liquid chromatograph for rapid identification and separation of hydrocarbon liquids was also put into service and is now being used by

both Baas Becking and our laboratories. In petrophysics, further work was conducted in formation damage studies in particular conjunction with a major industry drilling project in the Surat Basin; a study on the petrophysics of some coal samples was also carried out in connection with investigations on gas recovery from coal in Queensland and NSW.

Several large groups of students visited the laboratory during the year, including geology students from the Canberra College of Advanced Education and Syracuse University in New York, USA.

### Petrophysics

In formation damage studies, cores from the Alton field and surrounding areas in the Surat Basin, Queensland were tested. These tests included the use of the scanning electron microscope and X-ray diffraction of fine clay fractions to identify authogenic clays in the pore spaces and measure their effect on fluid flow in the samples under various flowing conditions. Formation damage, restricting and sometimes completely cutting off hydrocarbon flow, is a severe problem in the Surat Basin where clay content is known to be high; comparisons were made with a few samples from the Pacoota hydrocarbon productive reservoir in the Amadeus Basin where the reservoir is much less argillaceous. Work in this area to identify and restrict formation damage problems during exploration and production operations is continuing.

Petrophysical tests on coals using whole cores and drilled plugs from bores drilled into coal seams in the Leichhardt area of Queensland and Appin, NSW, were also carried out. The bore holes were drilled to evaluate the prospects of economically producing gas from the coals in these areas, also to effect methane drainage from the coal seams in advance of mining. It was hoped the petrophysical tests would give further details on the character of the pore volume and flow capacity of the coals; however through various difficulties such as fracturing, coal drying problems, entrained methane in the samples, it was not possible to obtain consistent and reliable data by normal petrophysical techniques, and the project was terminated.

Various conventional core tests involving either porosity, permeability or fluid saturation measurements were conducted for the Geological, Geophysical and Petroleum Exploration Branches of BMR, the Baas Becking Laboratory and the Queensland Mines Department. These consisted of samples from the Gilbert Islands, Norfolk Island, stratigraphic bore holes in Queensland and mineral exploration core hole samples from Queensland which had intersected bitumen staining. Whole core samples were also analysed from a fractured sandstone and carbonate gas reservoir in the Perth Basin; this work was conducted because BMR had the only whole core equipment for use in the country. A total of 247 conventional and whole core samples were analysed in these tests.

In drilling fluid analysis, tests on additives for possible use by industry in high temperature, high pressure drilling conditions were conducted. Tests were also carried out on bentonitic muds with potassium chloride additives for control of sloughing shales in BMR field drilling programs; instructions were prepared for the field crews in their use.

Extensive discussions and instructions were given to staff from Australian Mineral Development Laboratories in the design and operation of petrophysical laboratory equipment; this was done as a prelude to the probability of AMDEL setting up a routine and special core analysis laboratory in Adelaide to service industry requirements. Additional future contact and assistance in this field is expected.

During overseas recreational leave in December, the laboratory supervisor, Mr McKay, paid visits to four organisations conducting research in enhanced oil recovery and gas from coal. He also gave a lecture on enhanced oil recovery to the ANZAAS conference in Brisbane in May. The petrophysical laboratory group leader, Mr Duff, attended a distinguished lecture series on formation damage conducted by Dr Alman through the Petroleum Exploration Society of Australia.

#### Petroleum Source Rock Geochemistry Group

The principal work of the group involved completion of source rock studies on the Taroom Trough, commencement of a geochemical study for the Basin Assessment section on the Gippsland Basin, and the major work being carried out in canned cuttings analysis including co-operative work in the multidisciplinary Eromanga Basin project. The latter (continuing) studies are being conducted on canned cuttings samples which have been obtained by considerable support from industry drilling in the Eromanga and other domestic basins. This work will be followed up with pyrolysis (thermal) tests on the Eromanga samples when the necessary "Rock Eval" equipment is obtained in the next financial year.

Additional geochemical source rock analysis comprised studies on some bituminous and carbonaceous cores obtained in a mineral exploration program in the Georgina Basin; analysis of cuttings from a well drilled in the Ngalia Basin (Davis No. 1); study of three carbonaceous and petroliferous core samples from coal bores in Victoria; and core samples from a BMR stratigraphic hole (Duchess No. 15) in Queensland.

In other work by the section, oil shale samples from wells drilled in the NERDDC Toolebuc oil shale project were examined, specifically for the characteristics of the free bitumens contained in the samples; an Eaglehawk (Canning Basin) oil sample was analysed for saturate-aromatic content for the Baas-Becking enhanced oil recovery project; oil samples extracted from cores in the Woodada gas reservoir (Perth Basin) were compared to free oil produced from the well on test; gas, condensate, and water samples from the Gorgon gas reservoir in the offshore Canning Basin were analysed; and an oil sample from the Blina oil discovery in the Canning Basin was analysed. Further work was conducted on a sample of petrol from a bore hole drilled in conjunction with the Centre Cinema 1977/78 groundwater contamination project, and analysis was commenced on possible gas content of water samples collected by BMR (Dr Habermehl) in the Eromanga Basin. The latter work has been delayed due to the need for a major overhaul or new purchase of a thermal conductivity chromatograph.

Industry and Economics GroupPetroleum Economics and Statistics

Material prepared in response to questions from Government Departments, industry, the public, and Parliamentary enquiries has continued to be updated and revised. In addition, quarterly assessments of the recoverable reserves of crude oil, condensate, plant products, liquefied petroleum gas (LPG), and natural gas, together with cumulative production and remaining recoverable reserves were prepared and published in the relevant Petroleum Newsletters Nos. 81, 82, 83, and 84 (currently in printing). There have been numerous requests for comment from the Department in respect of Foreign Investment applications where these concern petroleum exploration and development companies, titles, etc.

Petroleum and drilling engineering comments were prepared on several drilling projects in the Northern Territory offshore and onshore areas and assistance was given with matters concerning royalty payments and production measurement with respect to Bass Strait offshore production.

During the latter half of 1981 good progress was made with the implementation of the BMR computer based "PETIN" petroleum data storage and retrieval program for petroleum exploration activity (geology, geophysics and exploration drilling) and for development well data. A proving trial is currently in progress using a trial sample input of 1980 offshore seismic data from private enterprise and a trial batch of data from 50 wells in various categories. This trial is being conducted as a joint project involving officers from the Petroleum Technology Section, the Offshore Group (PEB) and the ADP Section.

The annual collection of petroleum exploration, development, and production expenditures and geological and geophysical activities was undertaken, and the results will be published in Petroleum Newsletter No. 86. They are being further analysed and will be published in detail in the Petroleum chapter of the Australian Mineral Industry Annual Review, 1980. The increase in requests for information and/or statistics from the various Divisions of the Department and industry noted in 1980 has continued throughout 1981 and reflects the increasing tempo of petroleum exploration and development activity in Australia. Indications are that this increasing tempo is expected to continue at least into 1983 and is indicative of work loads to be expected.

In summary, the results of the 1980 activity and expenditure survey show that there was an increase of 24% in exploration drilling expenditure in 1980 over 1979; this was mainly due to the increase in onshore exploration drilling activity more than doubling the expenditure on this item in 1979. Overall seventy-seven onshore exploration wells were drilled, twenty-two more than in 1979; metres drilled increased significantly from 58 700 in 1979 to 137 296 in 1980. In offshore exploration drilling the number of wells fell from 21 in 1979 to 17 in 1980 with a corresponding decrease in the metres drilled from 77 440 in 1979 to 62 012 in 1980. This decrease mainly occurred through the termination for the time being of deep water drilling operations on the Exmouth Plateau.

Geological and geophysical exploration activity in 1980 in terms of crew months of work together with a comparison with 1978 and 1979 are given in Table 3. The increase in these activities in 1979 over 1978 is reflected in the increases in 1980 over 1979 because of a further rise in petroleum exploration tempo.

During the latter part of 1981 a map showing 1981 petroleum exploration and development drilling activity has been placed on display adjacent to the office of the Assistant Director, Petroleum Exploration. This map (updated monthly) shows the location of wells and their status (oil or gas discovery, drilling or plugged and abandoned). A key maintained in conjunction with the map gives the name and co-ordinates of the wells involved.

Table 1

Level of Geological and Geophysical Activity, 1980  
(with 1978 & 79 for comparison)

Survey	Unit of Work	1978	1979	1980
Land Seismic	Crew months	35.66	55.04	114.6
Marine Seismic	Crew months	21.11	15.79	26.1
Gravity Surveys	Crew months	2.41	5.05	8.25
Geological Surveys	Crew months	3.5	130.3	63.0
Magnetic Land	Line km	nil	nil	nil
Aero	Line km	5048	nil	4403
Shipborne	Line km	3053	8540	16332

Total petroleum exploration expenditure in Australia in 1980 was \$290.16 million; reflecting an increase in exploration expenditure of 28.2 percent over 1979 when the expenditure was \$226.3 million.

The Section prepared for publication and distribution the following documents:-

- (i) The Petroleum Newsletter (Quarterly) Nos. 81, 82, 83, and 84 (in preparation) including monthly drilling rig activity and quarterly statistics.
- (ii) A breakdown of petroleum exploration, development, and production in Petroleum Newsletter No. 82 and in the Petroleum Chapter of the AMI Annual Review.
- (iii) Statistics, and information on petroleum exploration, production, and resources, etc. in Australia for various publications such as World Oil, Oil and Gas Journal, Offshore magazine, year books, and pamphlets.
- (iv) The Petroleum Exploration and Development Titles Map and Key showing the position as at 1 January 1981 was published. The map showing the position as at 1 July 1981 is in preparation.

A library of index cards containing details on each well drilled is maintained for quick reference, as is reference material on the corporate structure of individual companies engaged in petroleum activities. An index to articles of interest in the various industry and professional journals is maintained on a subject and author basis.

### Drilling Engineering Subsection

#### Plant and Equipment

On completion of the 1980 Georgina and Amadeus Basin surveys all Mayhew drilling units and tankers were returned to Canberra, drill pipe and consumable drilling equipment were stored in Alice Springs (NT) and Quilpie (Qld) for the 1981 field surveys.

The "Gemco" 210 B drilling unit, support vehicles, camping and drilling equipment were stored in Darwin at the Winnelli BMR compound.

#### Workshop (Fyshwick) A.C.T.

The work bench, power saw and hydraulic press are still to be relocated plus the installation of power points for the welding unit.

The Department of Housing and Construction carried out the necessary machining of parts for repairs and modifications to plant and equipment, private enterprise carried out work for minor repairs and overhaul.

#### Vehicles & Plant

The current vehicle and plant strength is:-

- 5 - Mayhew 1000 Drilling Rigs mounted on Mack R. 685 - 8 x 6 chassis.
- 5 - 8645 litre water tanks mounted on Mack 6 x 6 RM 6866 RS chassis.
- 1 - 2730 litre water tank mounted on International 1600 chassis.
- 1 - "Gemco" 210 B "Tandem Trailer" mounted auger/diamond Drill Rig.
- 3 - 6 tonne - 4 wheel drill trailers.
- 1 - 4 tonne - 4 wheel drill drailer.

#### Drilling Operations

In the year ending 31 October 1981, the Drilling Subsection provided eleven drilling parties in support of various BMR field activities. Drilling and diamond coring operations took place in the A.C.T. and NSW, diamond coring for stress-measurements in Victoria, drilling and diamond coring in the Amadeus Basin (NT), Darwin/Pine Creek (NT), Cunnamulla/Charleville (Qld) and seismic shot holes in the Eromanga Basin (Qld).

Personnel were also provided for the Barrier Reef drilling using a Geological Branch drill rig.

The five Mayhew 1000 drills, one Gemco 210 B and a portable drilling unit were used to carry out these operations.

Table 1 summarises the drilling and coring activities during the period 1 November 1980 to 31 October 1981.

#### Technical Services

During the year a number of drilling and coring contracts were edited for various branches in BMR.

Period contracts were prepared or revised and submitted to the Contract Board for the supply of replacement parts, drilling bits, diamond core-heads and other consumable stores.

Inspection, modifications and acceptance of a drilling unit and equipment was carried out on behalf of the Department of Foreign Affairs (ADAB) and estimates for drilling projects for other branches were prepared.

Table 2. Summary of BMR Drilling Operations, 1 Nov. 1980 to 31 Oct. 1981

BRANCH AND SECTION	PROJECT AREA OF OPERATION	FROM	TO	NO. OF HOLES	DRILLED	METRES CORED	DRILLED & CORED
<u>GEOLOGICAL METALLIFEROUS</u>	DARWIN PINE CREEK	15. 7.81	7.10.81	30	260.00	265.50	525.50
<u>SEDIMENTARY</u>	LAKE CARGELLICO NSW	11. 5.81	3. 6.81	1	4.00	111.00	115.00
	BUNYAN (NSW)	23. 2.81	17. 3.81	2	110.85	96.10	206.95
	CUNNAMULLA/ CHARLEVILLE (QLD)	13. 5.81	18. 6.81	6	341.40	75.30	416.70
<u>ENGINEERING HYDROLOGY</u>	ACT/NSW	12. 3.81	27. 5.81	11	290.90	249.79	540.69
<u>GEOPHYSICAL REGIONAL</u>	STRESS MEASUREMENTS (VIC)	11. 2.81	1. 4.81	15	246.95	17.80	264.75
<u>SEISMIC</u>	EROMANGA BASIN (QLD)	4.11.80	21.11.80	215	8370.00	-	8370.00
		2. 7.81	7.10.81	1068	40793.00	-	40793.00
<u>PETROLEUM EXPLORATION BASIN ASSESSMENT</u>	AMADEUS BASIN (NT)	29.10.80	12.11.80	3	14.50	95.40	109.90
		20. 7.81	18. 9.81	4	261.85	427.15	689.00
<b>TOTALS</b>				1355	50693.45	1338.04	52031.49

Total metres drilled	= 50693.45
Total metres cored	= 1338.04
Total metres drilled & cored	= 52031.49
Total no. of holes	= 1355
Total no. of cores cut	= 696
Average core recovery	= 83.67

NO. OF CORES	AVERAGE CORE RECOVERY %	TIME SPENT. (HRS) OPERATING			AVERAGE PENETRATION RATE METRES HR		AVERAGE DEPTH OF HOLE (METRES)	TRAVELLING TIME (HOURS)
		DRILLING	CORING	TOTAL	DRILLING	CORING		
170	84.5	118	203	321	2.20	1.31	17.52	-
40	70.0	.50	66.5	67	8.00	1.67	115.00	4.0
51	95.0	23.5	67.0	90.5	4.71	1.43	103.47	19.5
30	92.1	89.0	56.0	145.0	3.83	1.34	69.45	-
151	66.3	111.0	161.0	272.0	2.62	1.55	49.15	105.0
25	100.0	105.0	45.5	150.5	2.35	.39	17.65	45.00
-	-	217.00	-	217.00	36.58	-	38.93	74.00
-	-	1205.00	-	1205.00	33.85	-	38.19	352.00
74	76.2	4.50	39.5	44.00	3.22	2.41	36.63	-
155	85.3	42.50	147.5	190.00	6.16	2.89	172.25	-
696	83.67	1916	786.0	2702	26.45	1.62	38.39	599.50

Reservoir Engineering Subsection

The government's "new oil" pricing policy continued to involve the subsection in considerable effort throughout the year. Technical appraisals were required for Barrow Island wells which included assessing the oil-water contacts in the main pool and comparing them with the off-setting wells. "Substantial new development" applications for Barrow Island were also reviewed. Engineering and Geological assessments were also made on wells in the Cooper and Bowen-Surat Basins relative to "new oil" applications. As before all of the available information is examined in the course of these assessments.

A format guide to authors of Reservoir Engineering records and reports was prepared. Pursuant to this guide sectional BMR records on the Hapuka, Pelican, and Petrel fields were extensively revised; in addition the Brecknock Field Study was prepared in accordance with this format.

Mathematical developments in reservoir descriptions are being monitored from technical journals and other publications. In particular the conformal mapping technique which purports to replace numerical reservoir simulation by an analytical approach is being studied closely. The Department of Mathematics and Statistics (CSIRO) developed an analytical program as an alternate to the conformed mapping approach but this has not yet been converted to a usable oil-field units program.

Quarterly assessments of Australia's initially recoverable, produced, and remaining reserves of crude oil, condensate (and plant products), liquified petroleum gas (LPG) and natural gas were prepared and published in the relevant Petroleum Newsletter Nos. 83, 84 and 85 (currently in preparation). Summaries of the reserves were also released as 'News Releases'. Australia's estimated economic petroleum reserves as at 30 June 1981 are given in Table 4. This will be published in Petroleum Newsletter No. 86.

Table 3

Economic Petroleum Reserves as at 30.6.81

	Initial Reserves	Cumulative Production	Remaining Reserves
Crude Oil	$518.07 \times 10^6 \text{ m}^3$	$251.54 \times 10^6 \text{ m}^3$	$266.53 \times 10^6 \text{ m}^3$
Condensate	$70.03 \times 10^6 \text{ m}^3$	$5.77 \times 10^6 \text{ m}^3$	$64.26 \times 10^6 \text{ m}^3$
LPG	$126.84 \times 10^6 \text{ m}^3$	$26.39 \times 10^6 \text{ m}^3$	$100.45 \times 10^6 \text{ m}^3$
Natural Gas	$569.42 \times 10^9 \text{ m}^3$	$68.24 \times 10^9 \text{ m}^3$	$501.18 \times 10^9 \text{ m}^3$

The apparent increase in gas (and LPG and condensate) is due mainly to classifying the North Rankin Gas Field (North West Shelf, W.A.) as economic. Some recent oil discoveries are not included in these reserves as they have not been assessed and reported yet.

The Scarborough Field was assessed using only the limited amount of data available on an ad hoc basis. No record was prepared. Ad hoc studies were carried out in the Woodada, Mt Horner and Strzelecki reservoirs based on information from various sources.

The monitoring of oil production from Gippsland Basin and Barrow Island fields has been enhanced by the computer plotting of monthly statistics on a routine basis.

Detailed reservoir engineering studies were carried out on the Gorgon, Scott Reef, Brecknock, Tubridgi, Wyloo, and Blina fields. Parameters defined in the comprehensive studies were:

- effective pay thickness
- areal extent
- porosity
- hydrocarbon saturation
- shaliness
- permeability

A detailed study of the Mackerel Field, Bass Strait, is currently in progress. The study is, in effect, an on-the-job training program for D.G. Bennett and R.M. Bresnehan and has included:

- (1) Wire-line logs were interpreted for determination of porosity and water saturation.
- (2) The company's interpretation of the structure and net pay was reviewed.
- (3) Volumes of crude oil initially in place have been determined.
- (4) Production wire-line logs (TDT) were evaluated to determine the present level of the oil-water contact. The water encroachment compared to oil production gives an estimate of oil recovery to be expected.
- (5) Pressure build-up and pulse-testing data were examined and analysed for permeability-thickness estimates, well damage, and possible communication between wells.
- (6) Facies analysis was also attempted but was discontinued because of insufficient core and cuttings data.

A lecture was given at the BMR by Mr L.E. Kurylowicz on the methodology used to evaluate "new oil" pricing applications for the Fortescue Oil Field (Bass Strait) and the Barrow Island F-72 well.

Mr L.E. Kurylowicz visited various organisations in Perth, Adelaide and Sydney to ascertain the current state-of-the-art in reservoir engineering. He also attended a lecture on "Challenge of the North Sea Oil" given by Dr Paul Eisenklam at the University of New South Wales.

Mr D.G. Bennett attended a 3-day course on Geological and Geophysical Applications of Wireline Techniques given by Schlumberger. He also attended a 5-day course on Applied Reservoir Engineering at AMF given by Dr H.K. van Poolen from the USA.

Mr D.G. Bennett visited oil and gas operations in Roma, Queensland area. He witnessed field operations which included drilling, production, metering and pipeline operations. The purpose of the trip was to acquaint himself with field activities and how basic data needed for engineering purposes are gathered.

Mr M.H. Ellis left the subsection for the month of September to work on higher duties in the Petroleum Technology Laboratory.

Dr S. Ozimic had vacated the Petroleum Technologist Class 2 position in February 1980 and was temporarily replaced by Mr D.G. Bennett. Mr Bennett now occupies another Class 2 position within the subsection and Dr Ozimic's position is again vacant.

Mr L.E. Kurylowicz resigned on 16 October and Mr R.M. Bresnehan gave notice of his resignation to take effect 6 November.

PETROLEUM ASSESSMENT SECTION

The Petroleum Assessment Section continued its usual functions, of providing the technical advice necessary for the administration of the Petroleum (Submerged Lands) Act and of assessing the petroleum potential of Australia's sedimentary basins, during 1981.

Staff numbers remained fairly steady, at about eleven professional and nine sub-professional, and good progress was made with most of the programmed activities. In particular, the Basin Assessment Subsection continued to expand its petroleum source rock data bank, using this as a basis for a number of publications on the petroleum prospects of sedimentary basins. Stratigraphic drilling was again undertaken in the Amadeus Basin and samples of Precambrian black shales were obtained for geochemical analysis and sedimentological study. One well, sited on a magnetic anomaly to the east of Ayers Rock, penetrated a previously unknown Precambrian or Cambrian basalt and evaporites, concealed beneath 90 m of Cainozoic sediments. The scientific highlight of the year was the recognition and delineation of Lower Cambrian reefal sediments in the Todd River Dolomite of the Amadeus Basin.

The acting head of the Section, Dr D.J. Forman, completed his work on the Canning Basin Bulletin and this was forwarded to the printer in June. Some time was spent editing material for the National Energy Advisory Committee's report entitled 'Australia's Energy resources : 1980.' The report was published during the year. A talk was given on the Minimum Economic Reservoir Size Project at the BMR symposium and part of a course on economics of petroleum exploration and production was given at the University of New South Wales. Material was supplied for two articles in BMR 80.

BASIN ASSESSMENT SUBSECTIONAssessment of sedimentary basins

Sampling and analysis of potential petroleum source rocks continued throughout the year. These data and data from company reports continue to be incorporated into the petroleum source rock data base of the IMAGE computer reference system. Approximately 1700 new entries were made, bringing the total number of entries in the data bank to about 6500. Revised instructions for operating the system are contained in a BMR Record (De Nardi, 1981). The data base is currently being prepared for publication.

Some of the data were incorporated into regional studies of petroleum prospectivity. A paper on the petroleum potential of the Bass Basin, which was presented at a Petroleum Exploration Society of Australia symposium in 1980, was completed for publication (Nicholas and others, 1981). The contents of this paper were reviewed in the 1980 summary of activities (BMR Record 1980/73).

The petroleum prospects of the Galilee Basin were assessed in a paper presented at the 1981 APEA conference (Jackson and others, 1981). The results of this study were reported in the 1980 summary of activities (BMR Record 1980/73) and, although the data on which this study was based were doubled in 1981, the conclusions remain the same.

The petroleum potential of the Darling Basin was assessed and a paper was prepared for publication (Brown and others, in prep.). Part of this material, mainly the geological history of the basin, was presented to the Fifth Geological Society of Australia convention by V. Passmore. The interpretation of geochemical data derived by analysis of potential source rocks supports earlier conclusions that the basin has low prospectivity. The Lower Devonian Amphitheatre Formation, considered the only potential source rock, proves to be generally low in organic matter, probably gas prone (if anything), and presently mature to overmature for oil generation. The optimum location for mature source rocks and reservoir rocks in juxtaposition is likely to be along the flanks of the Lake Wintlow High-Wilcannia High where the rocks are comparatively shallow.

The results of and conclusions from a study of the petroleum source potential of Upper and Lower Cretaceous rocks in the offshore Otway Basin were presented in March at the BMR lecture series. The work, combined with onshore data held on open file at BMR, is being prepared for publication (Jackson & Felton, in prep.). A total of 62 cores were analysed with fair quality source rocks being recognised throughout the Otway Basin sequence. Total organic carbon content ranges from 0.15 percent to 15.9 percent, averaging around 1.5 percent. However, the samples are generally immature for oil generation, and are rated as sources for gas and oil generation would be enhanced considerably. A geochemical study of source richness and organic maturity, using head space gas analyses from canned cuttings (supplied by Beach Petroleum N.L.) from the Paaratte gas field, indicates that the most likely source rocks occur in the Otway Group.

The results of petroleum exploration drilling on the Exmouth Plateau were reviewed during the year (Nicholas, 1981). Drilling began in March 1979 when Zeewolf No. 1 was spudded in by Esso Australia Ltd in water 1194 m deep. By December 1980, Esso had completed eight wells and Phillips Australia Oil Company two, all in the three permit areas covering the southern half of the plateau. Gas was discovered in Jupiter No. 1 (Phillips) and Scarborough No. 1 (Esso) and gas/condensate was discovered in Vinck No. 1 (Esso). No significant indications of oil were recorded in any wells. Because of the cost and technological difficulty of either pipelining the gas to shore or of using it as a feedstock in floating plants, these discoveries are uneconomic.

The subsection continued to provide geological and geophysical input to the Central Eromanga Basin project. Intra-Devonian horizons have been mapped by K. Lockwood using company seismic data. A paper discussing the geological and geophysical parameters in fourteen key wells in the project area is in preparation; the paper will relate changes in lithology to wireline log response and to synthetic seismograms. A study of the source rock potential and thermal history of the Adavale Basin began, the available data indicate that the Log Creek and Etonvale Formations have low source potential. In fact, of the 90 samples analysed from 19 wells, most rate as lean source rocks.

Preparation of contributions on Australian basins for the ESCAP Atlas of stratigraphy continued, but at a much reduced level. Cross-sections of the Darling Basin are being drafted and explanatory notes are being prepared. Cross-sections of the Adavale Basin are still at a preliminary stage.

The Canning Basin Bulletin is in press. During the year text, figures, and plates were checked and amended by V.L. Passmore, D.J. Forman, and other authors.

Several officers contributed to a paper prepared by the Department (Department of National Development and Energy, 1981).

The well data system and a system of reference on a number of topics relating to petroleum exploration in Australia were maintained.

K. Lockwood participated in the initial phase of the Bass Strait project, particularly the location of new marine geophysical traverses.

#### Central Australian Proterozoic and Cambrian petroleum studies

##### Organic geochemistry:

Twenty-nine core samples were submitted to AMDEL for source rock analysis and determination of vitrinite reflectance. Most of these samples came from wells drilled in the Amadeus Basin during 1980: 13 samples were from BMR Rodinga No. 1A and four were from BMR Illogwa Creek Nos. 4 and 5. The remaining 12 samples were of Cambrian sediments of the Daly Basin of the Northern Territory and were provided by the Northern Territory Department of Mines and Energy.

Of 13 core samples taken from BMR Rodinga No. 1A, three contained significant carbon: 0.7, 0.75, and 3 percent. Individual carbonate beds had good porosity and permeability, but were too thin to be significant reservoirs. The red-brown silty mudstone within the Chandler Limestone is considered to be an effective seal for any underlying reservoirs.

The results of geochemical analyses of samples taken from the upper part of the Gillen Member, intersected in BMR Illogwa Creek Nos. 4 and 5, indicate that this part of the unit is lean to barren as a source rock.

Twelve samples from the Middle Cambrian to Lower Ordovician (?) Jinduckin Formation and the Middle Cambrian Tindall Limestone of the Daly Basin were analysed; all are rated as lean source rocks.

In 1981, two fully cored holes were drilled in the Proterozoic sequence of the Amadeus Basin. BMR Illogwa Creek No. 6, in the Aralka Formation, penetrated 230 m of black calcareous pyritic siltstone with occasional pyritic calcareous grainstone (?) and boundstone (?) in the top 55 m. BMR Rodinga No. 4, in the Pertatataka Formation, intersected 170 m of dark greenish grey to greenish black pyritic mudstone with a small proportion of dolomitic siltstone laminae. Eighteen samples have been selected for analysis of organic carbon content.

The petroleum potential of the Toko Syncline in the Georgina Basin was evaluated (Jackson, in prep.). This study represents the first systematic examination of the source potential of the Cambrian and Ordovician sediments of the Toko Syncline and incorporates chemical data from the BMR Petroleum Technology Laboratory, including head space gas analyses from canned cuttings from Mirrica No. 1, and data from company reports held on open file at BMR. The best prospects for hydrocarbon discoveries lie within the Cambrian sequence where source, reservoir, and cap rocks may occur. Good quality source rocks are identified in the Cambrian, particularly the Middle Cambrian Marqua Beds. The overlying Ordovician rates as a secondary target with good reservoir rocks, but no source rocks have been identified.

A gas show at Ethabuka No. 1 and several reports of bitumen and oil stains are evidence that hydrocarbons have been generated in the syncline. It is possible that oil was generated before faulting and folding occurred along the Toomba Fault, because the Middle Cambrian beds are now overmature for oil, but still in the gas generation phase. A possible lack of porosity and permeability within the Cambrian rocks and of seal adjacent to the Toomba Fault adds to the exploration risk.

#### Sedimentology of the Todd River Dolomite, Amadeus Basin:

A detailed sedimentological study of the Todd River Dolomite is being undertaken to determine the lithofacies, depositional environment, and diagenetic history of a 'reefal' archaeocyathid-rich build-up. Two distinct archaeocyathid-rich lithologies are recognised; thrombolitic algal-archaeocyathid boundstone, and archaeocyathid wackestone.

Thrombolitic algal-archaeocyathid boundstones form irregular domed bioherms (1-9 m long, 0.3-3 m thick) which stood up to 50 cm above the sandy carbonate substrate. The bioherms are infilled and buried by thick sheets of carbonate sand (peloid-intraclast-skeletal grainstone) derived from the abrasion and erosion of the bioherms. The bioherms make up approximately 30 percent of an extensive, 20 to 45 m thick, boundstone-grainstone 'reefal' facies, but it is doubtful that this build-up ever had the relief of a truly wave-resistant reef structure. However, the build-up was, at least in part, a rigid structure and also possibly emergent because irregular cavities (caves) 2 m or more in length and 50 cm across were developed locally at the top of the build-up and infilled by archaeocyathid coquinas prior to the widespread development of fenestral algal mats.

Archaeocyathid wackestones comprise complete and near complete skeletons of Archaeocyathids in a matrix of lime and terrigenous red mud. The wackestone forms isolated or closely packed dome-shaped mounds (0.5-2.5 m long and 0.35-0.7 m thick) buried by planar stratified skeletal-peloid-intraclast grainstone. The mounds were formed by the entrapment and accumulation of mud within growth clusters ('colonies') of archaeocyathids in a generally tranquil shallow marine environment. The skeletal sand accumulations surrounding the mounds most probably result from the rapid break-down of the archaeocyathid skeletons on death to sand-size particles, and the grain size is thought to have little energy connotations. At least some of the mounds were lithified whilst exposed on the sediment substrate (?sea-floor cementation) and were eroded to form sand and granule-size peloids and intraclasts.

The two archaeocyathid-rich lithofacies occur in two separate areas of exposed Palaeozoic units in the northeastern portion of the basin (algal-archaeocyathid boundstone in the Ross River-Fergusson Range-Gaylad Synclines; archaeocyathid wackestone in the Phillipson Pound-Ooraminna Anticline) and their depositional relationship is not known.

Sedimentology of the Chandler Limestone, Amadeus Basin:

Three stratigraphic sections were measured in the Ooraminna Anticline.

Stratigraphy and sedimentology of black shales, Amadeus Basin:

Four lithological sections were measured in the Julie Formation; one in the southeastern corner of Phillipson Pound, immediately above BMR Rodinga No. 4, and three widely spaced along the northern margin of the Ross River Syncline. The formation showed a cyclic sequence of calcareous siltstones, peloidal and ooid grainstones, lime mud, and algal mat.

Magnetic anomaly survey and drilling:

Several prominent magnetic anomalies within the southwestern portion of the Amadeus Basin were investigated in June by single-line ground magnetic surveys along existing roads; one was selected for further investigation by drilling in September. The anomalies, originally identified in the regional aeromagnetic survey of the Amadeus Basin (Young & Shelley, 1966 and 1977), appear to be sourced by rocks within the Proterozoic to Palaeozoic sedimentary sequence where they are concealed beneath an extensive cover of Cainozoic sediments including alluvium and sand. The anomalies arise from rocks concealed at shallow depths ( 300 m) and some appear to be linear or curved. Another type of magnetic anomaly in the same area arises from deep magnetic basement, probably metamorphic and igneous rocks, at depths of 5000-6000 m.

Geophysical interpretation of two prominent anomalies suggests that they are sourced by thin tabular bodies 100-200 m deep; the source of one may be a single body, the other may be sourced by a complex of three closely spaced bodies. BMR Ayers Rock Nos. 1 & 2 were drilled 25 m apart to intersect the single-body sourced anomaly 25 km northwest of Curtin Springs, and basalt was intersected at depths of 99 m and 90 m respectively. The magnetic susceptibility of the basalt ranges from 48 110 to 66 924 SI x 10<sup>6</sup> (average 58 265 SI x 10<sup>6</sup>) and, when modelled as a 70 m thick sheet dipping 45° to the southeast at a depth of 120 m, generates a computed anomaly in close agreement with the observed anomaly.

The age of the basalt is uncertain; it is moderately steeply dipping most probably extrusive. It is overlain unconformably by Tertiary sediments and is underlain by poorly indurated dark grey silty mudstone, a sequence of contorted and brecciated gypsum interbedded with light to dark grey dolostone of unknown age.

Spilites in the Proterozoic Bitter Springs Formation in the north-east and mafic igneous rocks in the Pinyinna Beds to the west are the only known occurrences of mafic igneous rocks in the Amadeus Basin. Bedded gypsum and other evaporite deposits are known from both the Bitter Springs Formation and the Lower Cambrian Chandler Limestone. In the Officer Basin of Western Australia, Cambrian basalt rests unconformably on Cambrian or late Precambrian evaporites. The basalt, gypsum and dolostone intersected in BMR Ayers Rock Nos. 1 & 2 is probably correlative with the Bitter Springs Formation, but a lower Cambrian age can not be ruled out at this stage.

Shallow magnetic bodies are also known to occur within the sedimentary sequence in the Lake Amadeus and Bloods Range Sheet areas of the Northern Territory and the Rawlinson and MacDonald Sheet areas of Western Australia (Young & Shelley, 1966 and 1967 and Geophysical Associates Pty Ltd, 1965). In Western Australia the bodies are interpreted to be 15-25 m thick sheet-like bodies of probable volcanic origin at depths of 300-450 m; the interpreted depth to magnetic crystalline basement in the same area ranges from 4000 m to 9000 m. It is likely that some of these shallow magnetic anomalies are sourced by basalt similar to that intersected in BMR Ayers Rock Nos. 1 & 2.

#### OFFSHORE SUBSECTION

##### Petroleum (Submerged Lands) Act

The receipt, examination, indexing, and storage of data and reports received under the Act continued during the year. Applications to carry out operations and final reports on drilling and geophysical operations were examined and technical comments were prepared. A register of current offshore permits was maintained and quarterly and annual reports for these permits were studied and commented on as necessary.

Technical comments and recommendations on applications for new permits were prepared for Oil and Gas Division and the Department of Mines and Energy, Northern Territory. Comments were also prepared on applications for renewal of offshore permits and for variation of conditions.

During the 12 months ended 31 October 1981, 13 exploratory wells were drilled in offshore Australia: ten of these wells were new-field wildcats (two were plugged and abandoned at a shallow depth) and three were appraisal wells of previous discoveries (see Table 2 and Fig. 2). Ten of these wells were drilled in water adjacent to Western Australia and three (Bream No. 4, Bream No. 4A, and Palmer No. 1) in waters adjacent to Victoria. The average depth of wells off Western Australia was 3328 m and the average depth of wells off Victoria was 1448 m. In total 37 629 m of drilling was completed with an average depth of 2895 m for the wells drilled.

Six development wells were completed on the Tuna 'A' platform and five development wells were completed on the Snapper 'A' platform; both platforms are in the Gippsland Basin, Victoria.

Three wells, Bream No. 4, Bream No. 4A, and Palmer No. 1, were drilled by Esso Exploration and Production Australia, Inc. in the Gippsland Basin, Victoria. Bream No. 4 was plugged and abandoned at a shallow depth because of mechanical difficulties. Bream No. 4A confirmed the western extent of the Bream oil and gas accumulation discovered in earlier wells. Palmer No. 1, located on a small anticline adjacent to the Perch oil discovery, was a disappointment and was plugged and abandoned as a dry hole.

West Australian Petroleum Pty Ltd drilled one well, Gorgon No. 1, on the southern extension of the Rankin Trend, 50 kilometres southwest of West Tryal Rocks gas field and 60 kilometres west-northwest of Barros Island oil field. The water depth at the location is 248 m, twice the depth at the North Rankin field. Two main gas pay zones were encountered and the well was suspended at a total depth of 4401 m.

Three wells, Saturn No. 1, Sirius No. 1, and Delambre No. 1, were drilled within the Exmouth Plateau permits. Saturn No. 1, drilled by Phillips Australian Oil Co., was located on a tilted fault block, within the Kangaroo Syncline in a water depth of 1177.5 m. The well was plugged and abandoned at a total depth of 4000 m after having encountered only minor gas shows.

Delambre No. 1 was drilled by Woodside Petroleum Development Pty Ltd in the outer part of the Beagle Sub-basin in 890 m of water. No hydrocarbons were encountered in the Triassic target zone and the well was plugged and abandoned at a total depth of 5496 m. (This is the deepest offshore well drilled in Australia to date).

Sirius No. 1 was drilled by Esso Exploration and Production Australia Inc in 1174 m of water on the Exmouth Plateau. Although all three Mesozoic objectives were encountered and excellent reservoir sections were penetrated, no hydrocarbons were noted and the well was plugged and abandoned.

Fisher No. 1, drilled by Woodside Petroleum Development 4.5 kilometres southwest of Rankin No. 1, and Lawley No. 1, drilled 27 kilometres southwest of Hauy No. 1 by Highbay Oil (Australia) Ltd, were plugged and abandoned without encountering any hydrocarbons. North Rankin No. 6 was drilled to resolve the structural and sedimentological uncertainties in the northwestern area of the North Rankin field and to provide information needed to finalise the location of Platform 'B' and its slot requirements, and to plan well paths. The well was suspended at a total depth of 3900 m after completing two production tests. Gas was produced at a variety of controlled rates, up to 1 586 000 cubic metres per day (56 million cubic feet per day).

Woodside Petroleum Development Pty Ltd drilled Brewster No. 1 and Brewster No. 1A in the Browse Basin. Brewster No. 1 was plugged and abandoned at a shallow depth because of mechanical difficulties. Brewster No. 1A was cut for later re-entry, testing, and evaluation after encountering hydrocarbon shows.

Parmelia No. 1 was drilled by Phillips Australian Oil Co in a farm-in arrangement with West Australian Petroleum Pty Ltd. It was drilled in the Vlaming Sub-basin 60 kilometres west-southwest of Kwinana. No shows of hydrocarbons were encountered and the well was plugged and abandoned.

During the year 68 seismic surveys were carried out in waters adjacent to Western Australia, Northern Territory, Victoria, Queensland, New South Wales, and Tasmania. Seven of these surveys involved magnetic and gravity readings in addition to seismic recording and one survey involved only seismic and magnetic surveying. An experimental airborne gamma radiation spectrometer system was treated along traverses between selected Gippsland Basin wells for Magnet Petroleum Pty Ltd. Shoreline Exploration Co. carried out a shipborne geochemical investigation of 1634 km in the South Australian portion of the offshore Otway Basin. Total survey coverage was approximately 55 106 km of seismic, 8873 km of magnetic, and 6550 km of gravity traverse.

The Subsection continued to provide technical advice on petroleum exploration to the Papua New Guinea Government and in July C.S. Robertson inspected onshore seismic surveys on behalf of the PNG authorities. Late in September, C.S. Robertson left for a three month visit to Fiji to provide advice on the storage and retrieval of petroleum exploration data.

#### Petroleum Search Subsidy Act

The Subsection met requests by visitors and BMR officers for information on and access to PSSA reports and other material. PSSA material was supplied on request to the Australian Government Publishing Service to satisfy customers requests for copies.

#### Core and Cuttings Laboratory

During the year 1736 metres of core and 12 753 cuttings samples were received from a total of 99 company wells and BMR drill holes. At the same time, 4461 metres of core, 26 797 cuttings samples, and 405 geo-chemical samples were registered and added to the collection. The laboratory now contains a total of 1 300 877 registered samples from 2490 km of drilling.

BMR personnel made 90 visits to the laboratory. Representatives from 41 consulting organisations and oil and mining companies made 62 visits. Officers from 15 universities, government authorities, and State government departments made 30 visits. 10 087 metres of core and 38 393 cuttings samples from 228 company wells and 181 BMR drill holes were provided for examination. 354 metres of core and 4 343 bags of cuttings were sampled for destructive analysis. Thirty-seven reports on the results of destructive analysis were received and indexed.

New compactus units were provided in portion of the 1974 extension to the laboratory in June and had been one third filled by the end of the year.

28 000 prelabelled cuttings bags were sent to companies engaged in offshore drilling. Many thousands of cuttings bags, core bags, and boxes were supplied to BMR drilling parties. 112 thin sections were made for BMR officers and 100 core plugs were drilled on request. 130 man days were spent slabbing core from BMR drilling. Information was supplied for an article in BMR 80.

TABLE 4

Offshore Exploration Drilling Operations.  
Completed 1 November 1980 to 31 October 1981.

Operator	Well	Total Depth(m)	Status
	Brewster No. 1	633 m	P & A
Woodside Petroleum Development Pty Ltd	Brewster No. 1A	4703 m	Suspended
	Delambre No. 1	5495 m	P & A
	North Rankin No. 6	3900 m	Suspended
	Fisher No. 1	3762 m	P & A
West Australian Petroleum Pty Ltd	Gorgon No. 1	4401	Suspended
Phillips Australian Oil Co	Saturn No. 1	4000 m	P & A
	Parmelia No. 1	1770 m	P & A
Esso Exploration and Production Australia Inc	Sirius No. 1	3500 m	P & A
	Bream No. 4	222 m	P & A
	Bream No. 4A	2400 m	Suspended
	Palmer No. 1	1723 m	P & A
Hudbay Oil (Australia) Ltd	Lawley No. 1	1120 m	P & A

## APPENDIX

### RECORDS AND PUBLICATIONS

#### Petroleum Technology Section

##### Records (issued)

- DONALD, I.M., 1981 - The computer program "OYSHL". Bureau of Mineral Resources, Australia, Record 1981/37.
- HORVATH, Z., JACKSON, K.S., 1981 - Procedure for the isolation of herogen from sedimentary rocks. Bureau of Mineral Resources, Australia, Record 1981/62.

##### Records (in preparation)

- DONALD, I.M., 1981 - A user's guide to the data-base "REFIL" on the Hewlett Packard data-base Image system. Bureau of Mineral Resources, Australia, Record.
- DUFF, P.G., MCKAY, B.A., - Waroon No. 1 well, Queensland. Special petrophysical tests on core samples from a gas reservoir in the showgrounds sandstone and rewan formation. Bureau of Mineral Resources, Australia, Record.
- KURYLOWICZ, L.E., BENNETT, D.G., & ELLIS, M.H., 1980 - Petrel Field, Bonaparte Gulf Basin, W.A. & N.T.: Estimated recoverable petroleum reserves as at 31 October 1980. Bureau of Mineral Resources, Australia, Record.
- KURYLOWICZ, L.E., & ELLIS, M.H., 1980 - Hapuka Field, Gippsland Basin, Victoria: Estimated recoverable petroleum reserves as at 31 October 1980. Bureau of Mineral Resources, Australia, Record.
- KURYLOWICZ, L.E., & ELLIS, M.H., 1981 - Brecknock Field, Browse Basin Western Australia: Estimated Recoverable petroleum reserves as at 31 July 1981. Bureau of Mineral Resources, Australia, Record.
- KURYLOWICZ, L.E., OZIMIC, S., & ELLIS, M.H., 1980 - Pelican Field, Bass Basin, Tasmania: Estimated recoverable petroleum reserves as at 30 June 1980. Bureau of Mineral Resources, Australia, Record.

Records (issued)

- DE NARDI, R., 1981 - A user's guide to the source rock data-base (WILDAT) (Program IMFN) on the Hewlett-Packard data-base IMAGE system. Bureau of Mineral Resources, Australia, Record 1981/58.
- HORVATH, Z., & JACKSON, K.S., 1981 - Procedure for the isolation of kerogen from sedimentary rocks. Bureau of Mineral Resources, Australia, Record 1981/62.
- NICHOLAS, E., 1981 - Summary of petroleum exploration drilling, Exmouth Plateau, to 31 December 1980. Bureau of Mineral Resources, Australia, Record 1981/40 (In confidence).
- NICHOLAS, E., RIXON, K., & HAUPT, A., 1980 - Uncorrected geothermal map of Australia. Bureau of Mineral Resources, Australia, Record 1980/66.
- PASSMORE, V.L., 1981 - BMR Ivanhoe No. 1 well completion report. Bureau of Mineral Resources, Australia, Record 1981/28.

Professional Opinions (issued)

- ROBERTSON, C.S., BRANSON, J.C., and LOCKWOOD, K.L., 1980 - Preliminary appraisal GSI Coral Sea Scientific Survey. Professional Opinion PEB 80.005.
- TEMPLE, P.R., and McAVOY, W.J., 1981 - Devonian carbonate plays in the Canning Basin, W.A., Professional Opinion PEB 81.001.

Records (in preparation)

- BLADON, G.H. (in prep.) - Ground magnetic survey and drilling, southern Amadeus Basin, Ayers Rock region, Northern Territory, 1981. Bureau of Mineral Resources, Australia, Record.
- FELTON, E.A. (in prep.) - Well completion report, BMR Rodinga Nos. 1, 1A, 2, 2A, 3, Amadeus Basin, Northern Territory. Bureau of Mineral Resources, Australia, Record.
- FELTON, E.A., & WEST, B.G., (in prep.) - Well completion reports for Proterozoic drilling, 1980-1981, Amadeus Basin, Northern Territory. Bureau of Mineral Resources, Australia, Record.

LOCKWOOD, K., (in prep.) - Marine geophysical results from the Capricorn Basin. Bureau of Mineral Resources, Australia, Record

PASSMORE, V.L. (in prep.) - Adavale Basin explanatory notes and stratigraphic correlations. Bureau of Mineral Resources, Australia, Record

PASSMORE, V.L. (in prep.) - Darling Basin explanatory notes and stratigraphic correlations. Bureau of Mineral Resources, Australia, Record

SMITH, E.L. (in prep.) - DELPHI: a computer program for the summation of hydrocarbon resources using Monte Carlo simulation. Bureau of Mineral Resources, Australia, Record 1981/65.

SMITH, E.L. (in prep.) - WILDAT: a computer program for the prospect-by-prospect method of estimating hydrocarbon resources using Monte Carlo simulation. Bureau of Mineral Resources, Australia, Record

SMITH, E.L. (in prep.) - MERS: a computer system and user manual for the economic evaluation of petroleum prospects. Bureau of Mineral Resources, Australia, Record

#### Publications

DEPARTMENT OF NATIONAL DEVELOPMENT AND ENERGY, 1981 - Petroleum exploration and development in Australia - an outline. Department of National Development and Energy, Canberra, Australia, October 1981.

JACKSON, K.S., HORVATH, Z., & HAWKINS, P.J., 1981 - An assessment of the petroleum prospects for the Galilee Basin, Queensland. The APEA Journal 21, 172-186.

NATIONAL ENERGY ADVISORY COMMITTEE, 1981 - Australia's energy resources 1980. December 1980. NEAC Report No. 14.

NICHOLAS, E., LOCKWOOD, K.L., MARTIN, A.R., & JACKSON, K.S., 1981 -  
Petroleum potential of the Bass Basin. BMR Journal of Australian  
Geology and Geophysics, 6(3), 199-212.

PASSMORE, V.L., 1981 - Depositional environments of the Devonian rocks  
of the Darling Basin - prospects for petroleum. In Sediments  
through the ages. Geological Society of Australia, Fifth Australian  
Geological Convention, Perth 1981, Abstracts, 25.

PASSMORE, V.L., 1980 - Carnarvon Basin. In ESCAP Atlas of Stratigraphy II.  
United Nations Mineral Resources Development Series 46.

PASSMORE, V.L., 1980 - Carpentaria and Karumba Basins. In ESCAP Atlas of  
Stratigraphy II. United Nations Mineral Resources Development Series  
46.

PASSMORE, V.L., 1980 - Sydney Basin. In ESCAP Atlas of Stratigraphy II.  
United Nations Mineral Resources Development Series 46.

PASSMORE, V.L., 1980 - Laura Basin. In ESCAP Atlas of Stratigraphy II.  
United Nations Mineral Resources Development Series 46.

Publications (in preparation or in press)

BROWN, C.M., JACKSON, K.S., LOCKWOOD, K.L., & PASSMORE, V.L. (in prep.) -  
Source rock potential and hydrocarbon prospectivity of the Darling  
Basin. BMR Journal of Australian Geology and Geophysics.

FORMAN, D.J., & WALES, D.W., (in press) - Geological evolution of the  
Canning Basin, Western Australia. Bureau of Mineral Resources,  
Australia, Bulletin 210.

JACKSON, K.S. (in prep.) - Geochemical evaluation of the petroleum  
potential of the Toko Syncline, Georgina Basin, Queensland. BMR Journal of  
Australian Geology and Geophysics.

JACKSON, K.S., & FELTON, E.A. (in prep.) - Petroleum source rock  
potential of the Otway Basin, Victoria.

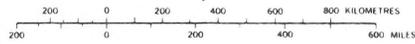
JACKSON, K.S., NICHOLAS, E., & FORMAN, D.J., (in prep.) - Australian petroleum source rock analyses. BMR Microfiche report.

PASSMORE, V.L. (in prep.) - Assessment of the hydrocarbon prospects of the Adavale Basin, Queensland.

PASSMORE, V.L. (in press) - Browse Basin. In ESCAP Atlas of Stratigraphy. United Nations Mineral Resources Development Series.

OFFSHORE EXPLORATION DRILLING OPERATIONS

Completed 1-11-80 - 31-10-81



1. Brewster 1 WA
2. Brewster 1A WA
3. Delambre 1 WA
4. North Rankin 6 WA
5. Fisher 1 WA
6. Gorgon 1 WA
7. Saturn 1 WA
8. Parmelia 1 WA
9. Sirius 1 WA
10. Lawley 1 WA
11. Bream 4 Vic.
12. Bream 4A Vic.
13. Palmer 1 Vic.