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COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Record No. 1971/115



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Petroleum Exploration Branch

Summary of Activities 1971

(Period from 1 November, 1970 to 31 October, 1971)

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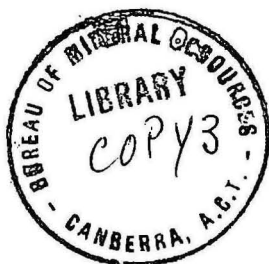


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PETROLEUM EXPLORATION BRANCH

SUMMARY OF ACTIVITIES



1971

(Period from 1.11.70 to 31.10.71)

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SUBSURFACE SECTION

SEDIMENTARY BASINS STUDY GROUP

The Sedimentary Basins Study Group continued its reviews of the Sydney Basin and the Canning Basin. Six bibliographies were submitted for publication. Report No. 134 - "Review of the Otway Basin" was checked in proof and returned to the printer. An assessment of oil search activities in Australia and Papua New Guinea was maintained. The Core and Cuttings Laboratory received core and cuttings and made its facilities available to B.M.R. and company personnel. I.K. Kraitsowits spent six months in France studying a semantic system of geological data processing. Progress was made in assessing the requirements of a B.M.R. well data storage and retrieval system.

Sydney Basin

Following the correlation of rock units throughout the Sydney Basin (Summary of Activities, 1970), fourteen basin-wide subdivisions of the Permian and Triassic rocks were made. As the sedimentary rocks are about 4,800 metres thick and were deposited over a period of about 80 million years the average basin-wide sub-division is about 340 metres thick, deposited in 6 million years. Scarcity of accurate palaeontological dating means that interpretations of the isopach and lithofacies maps are not reliable in basin-wide reconstructions of environments and palaeogeography. Within these limitations the study provides a comprehensive synthesis of old and new data.

Interpretation of seismic sections is complete but structure contour maps and thickness maps derived from them are still being compiled. The seismic sections show interfingering of the Branxton Formation and the Greta Coal Measures near Singleton. Two unconformities have been recognized in the northeastern part of the Sydney Basin, one at, or near, the base of the Permian sediments, and the other within the lowermost Permian sediments. The seismic sections also show thinning and abutment unconformity of the Permian sedimentary rocks over the northern part of the Lochinvar Anticline. These relationships suggest the possibility of structural growth during deposition and also the possibility of finding off-structure stratigraphic traps where previously untested formations abut against the anticline.

Canning Basin

Preliminary rock-unit correlations were made on a basin-wide network of columnar sections at 1":1000'. A total of 32 wells with a locality map and legend, were drawn on six sheets. The correlations used

existing company interpretations and have been forwarded to West Australian Petroleum Pty Ltd for criticism and comment.

Station cards were completed for 187 localities including petroleum exploration wells, water bores, measured sections, and other sites of importance. These localities were drafted on a "Cronaflex" base map of the onshore and offshore basin at 1:1,500,000 scale. The localities on the base map are identified by cross-index sheets.

Final rock-unit correlations of the Permian have been made by examination of cores and cuttings from key wells deduced from the preliminary correlations. The key wells are Willara No. 1; Parda No. 1; McLarty No. 1; Sahara No. 1; and Kidson No. 1. The electric, gamma, and sonic log characteristics of the rock units were noted and were then used to obtain the basin-wide correlation.

The Permian sequence has been divided into five lithological units informally named P1 to P5 (older to younger) and two of the units have been further subdivided. Figure 1 shows the relationship of these units to defined formations. The final correlation is essentially the same as the preliminary correlation except in Sahara No. 1 well. Seismic correlation (Tabletop Seismic Survey) shows that the "Dora Shale Member" and the "Cuncudgerie Sandstone Member" (Fig. 1) identified by WAPET in Sahara No. 1 cannot be the same units as the outcrop "Formations" and are in fact correlative with part of the Grant Formation.

Microflora are the only consistent means of dating the Permian strata basin-wide. A chart of microfloral zones used by different palynologists has been drawn up and compared with the lithological units (Fig. 2). The microflora suggest that the base of unit P1, the base of unit P3a, and the top of unit P2 are diachronous.

Petroleum Exploration in Australia and Papua New Guinea

A card index of drilling and geophysical operations was kept. Progress maps were maintained of drilling operations in the Dongara-Yardarino-Mondarra oil and gas fields in Western Australia, the Pleasant Hills-Grafton Range-Mooga gas fields in Queensland, the Cooper Basin of Queensland and South Australia, and the Surat Basin of Queensland and New South Wales. Maps showing all subsidized drilling operations and geophysical operations to 30 June 1971 were prepared. A draft summary of oil search activities in 1970 was prepared.

Publications 1970/1971

- FORMAN, D.J., 1971 - The Arltunga Nappe Complex, Macdonnell Ranges, Northern Territory, Australia. Jour. Geol. Soc Aust, 18(2) 173-182.
- FORMAN, D.J., and SHAW R.D., 1971 - Relationship between metamorphism, structure, and Bouguer gravity anomalies in Central Australia. in Abstracts 43rd congress, Australian and New Zealand Association for the Advancement of Science, Brisbane Section 3, p.36.
- MAYNE, S.J., NICHOLAS Evelyn, OZIMIC S., 1970 - Revised stratigraphy of part of the Sydney Basin. Letters to the Editor. Search, 1(3), 130.
- MAYNE, S.J., and NICHOLAS, Evelyn, 1971 - Contributions to the stratigraphy of the Sydney Basin. in Programme and abstracts for the sixth symposium on "Advances in the Study of the Sydney Basin". Department of Geology, University of Newcastle, 21-2.

Publications in press

- Bibliography of the Perth Basin, Western Australia. Bur. Miner. Resour. Aust. Rep. 157.
- Bibliography of the Canning Basin, Western Australia. Bur. Miner. Resour. Aust. Rep. 155.
- Bibliography of the Sydney Basin, New South Wales. Bur. Miner. Resour. Aust. Rep. 158.
- Bibliography of the Bonaparte Gulf Basin, W.A. & N.T. Bur. Miner. Resour. Aust. Rep. 156.
- Bibliography of the Clarence-Moreton Basin of New South Wales and Queensland. Bur. Miner. Resour. Aust. Rep. 151.
- Bibliography of the Carnarvon Basin, Western Australia. Bur. Miner. Resour. Aust. Rep. 161.

Unpublished Records

- OZIMIC, S., 1971 - Well completion report Wollongong (B.M.R.) Nos. 1, 2 and 2A wells, Sydney Basin, N.S.W.

Unpublished compilations

- Summary of oil exploration in Australia and Papua New Guinea in 1970.

CORE AND CUTTINGS LABORATORYVisitors

221 Bureau personnel and 110 company personnel representing 45 outside organisations visited the Laboratory. The full facilities offered in the Laboratory for the petrological, chemical and visual

4.

examinations of sub-surface samples stored in the Laboratory were used by Bureau personnel for the total of 398 man/days and by Company personnel for 106 whole working days.

Store activities

Receivals

During the above period 75,738 samples were received from 195 petroleum exploration and development wells and 81 B.M.R. stratigraphic holes:

Subsidized operations

- Cores : 4,456 samples, representing 5,102 ft of coring (2,576 ft actual length)
- Cuttings: 23,236 samples, representing 342,746 ft of drilling.

B.M.R. Drilling

- Cores : 16,681 samples, representing 8,542 ft of coring (7,288 ft actual length)
- Cuttings: 5,736 samples, representing 35,541 ft of drilling.

Donations (including unsubsidized offshore operations: Petroleum

- (Submerged Lands) Act)
- Cores : 3901 samples, representing 4,418 ft of coring (2,068 ft actual length)
- Cuttings: 18,555 samples, representing 145,952 ft of drilling.

Registrations

During the year 65,394 samples were registered (measured, marked with depth-intervals, repacked into standard containers and documented).

Store totals

599,271 registered samples are stored in the Laboratory in 17,357 core boxes, occupying 4,680 sq. ft of the available 6,600 sq. ft of storage area.

Approximately 40,000 seismic samples occupy 396 square ft of storage area, and miscellaneous sundries, consumable and field party materials occupy about 500 sq. ft of storage area.

Major activities within the Laboratory

- Materials from 201 wells were tested for phosphate by company personnel, representing 1,027,497 ft of drilling.
- 759 samples from 50 wells were tested by B.M.R. Petroleum Technology Section.
- B.M.R. Geological Branch borrowed materials from 44 wells for palaeontological, palynological, and grain size analyses.

- Samples from 35 wells were examined by the Basin Study Group.
- 29,506 cutting envelopes were prepared for 107 wells, to facilitate the submission of cuttings.
- 11 Bureau Field Parties were equipped with materials to pack, document and transport subsurface samples (submission forms, wooden core boxes, cartons, sample bags, polythene tubing etc.). Trials carried out with new containers, made according to Laboratory design, were successful according to Party Leaders' reports.
- 354 thin-sections were made. Total number of thin sections in the Laboratory is now 4,675.
- Work continued in the update of the Laboratory's well data storage and retrieval system. Data from 3,230 wells are now fully documented, while approximately 2,000 old wells, bores shafts, etc. (from which material is stored outside of the Laboratory) are awaiting registration and documentation.
- Several proposals were prepared and submitted to National Development Methods section concerning the computerisation of the Laboratory's well data and sample documentation systems.
- A lecture was given at the B.M.R. by I.K. Kraitsowits on the semantic approach to data processing.

Overseas Trip - I.K. Kraitsowits (8.2.71 - 8.8.71)

I.K. Kraitsowits was granted a scholarship by the French Government in conjunction with the Australian Department of Education and Science (Technical and Cultural Exchange Scheme) to study geological data processing in France. At the same time the opportunity was taken to visit several organisations in England. The following organisations were visited on the dates indicated.

- | | |
|-------------------|--|
| 8.2.71 - 27.2.71 | <u>Centre International des Stages, Paris.</u>
(Organisation of tour, subject introduction, language). |
| 1.3.71 - 30.4.71 | <u>Bureau de Recherches Geologiques et Minieres</u>
- Direction du Service Geologique National in Paris.
- Centre Scientifique in Orleans.
- Regional Centres |
| 15.3.71 - 17.3.71 | - Nord - Pas de Calais Service Geologique Regional in Lille. |
| 13.4.71 - 17.4.71 | - Aquitaine Service Geologique Regional in Bordeaux. |
| 19.4.71 - 24.4.71 | - Pyrannees Service Geologique Regional in Pan.
Visit gas field in Lacq, and ESSO-ERAP drilling sites in Came. |

- 18.5.71 - 23.5.71 Great Britain
- Geological Sciences Institute.
 - Royal College of Art (experimental cartography)
 - Royal Albert Museum (processing of sample data).
 - Imperial College (geosemantica).
 - Graham Lee Publications (Geocom bulletin),
- 31.5.71 - 5.6.71 Societe Nationale des Petroles d'Aquitaine, Pan.
- 7.6.71 - 12.6.71 Centre de Recherches Petrographiques et Geochimiques, Vandoeuvre Les Nancy.
- 14.6.71 - 26.6.71 Institute Francais du Petrole, Rueil - Malmaison.
- FRANLAB (data processing affiliate).
 - B.E.I.C.I.P. (Bureau d'Etudes Industrielles et de Coop. de L'I.F.P.) -
- DURIX (Service de conservation des Gisements).
- 28.6.71 - 29.6.71 Universite de Paris, Faculte des Sciences - Statistique mathematique en geologie.
- 30.6.71 Ministerede Developpement National
- D.I.C.A. (Direction des Carburants).
- 1.7.71 - 13.7.71 Ecole Nationale Superieure des Mines de Paris.
- Centre de Recherche: Fontainebleau,
- 14.7.71 - 28.7.71 Centre International des Stages, Paris.

SUBSIDY SECTION

The processing of applications and the examination and assessment of final reports and cost statements continued.

Applications

During the year 1 November 1970 to 31 October 1971, the Subsidy Section received 69 applications for approval of operations under the Petroleum Search Subsidy Act 1959-1969. These consisted of 23 for exploration drilling operations, 39 for seismic surveys (including 2 for seismic and gravity surveys and 1 for a seismic and magnetic survey), 3 for gravity surveys and 4 for aeromagnetic surveys.

Twenty-seven applications were also received for approval of extensions to the programme of approved operations; nine of these were for extensions to the approved target depths of wells, including one which was also for production testing, and 18 were for extensions to the approved programmes of seismic surveys.

Approvals

The Minister approved 68 applications under the Petroleum Search Subsidy Act 1959-1969 during the year ended 31 October 1971. Twenty-five of these were for exploration drilling operations and 43 were for geophysical surveys (see Plates 1 and 2). One of the drilling operations, Gage Roads No. 2, was approved to the depth of 6800 feet only; one application for approval of a drilling operation was withdrawn, and at 31 October 1971, the Minister had not given a decision on 12 applications. In addition, 17 extensions to approved programmes were approved, 7 to drilling operations and 10 to geophysical surveys. As a result of these approvals, the amount of \$8,970,209 was committed by way of subsidies under the Petroleum Search Subsidy Act.

The approved geophysical operations consisted of 38 seismic surveys (including 2 seismic and gravity surveys and 11 marine surveys), two gravity surveys, and 3 aeromagnetic surveys. Twelve of the approved drilling operations were for offshore wells.

Expenditure

In the 12 months to 31 October 1971, a total of \$8,759,403 was paid by the Commonwealth in subsidies to petroleum exploration companies under the Petroleum Search Subsidy Act 1959-1969. A breakdown of this expenditure by States and type of operation is given in Table I.

TABLE I
Petroleum Search Subsidy Expenditure
1 November 1970 - 31 October 1971

	Drilling Operations		Geophysical Operations		Total
	Onshore	Offshore	Onshore	Offshore	
Queensland	386,939	-	163,998	46,137	597,074
New South Wales	62,915	-	119,366	28,677	210,958
Victoria	104,115	-	204,444	20,976	329,535
Tasmania	-	-	-	22,437	22,437
South Australia	262,002	-	253,276	76,220	591,498
Western Australia	559,242	2,214,089	1,034,677	610,017	4,418,025
Northern Territory	-	278,443	133,860	225,954	638,257
Papua New Guinea	1,149,801	-	801,818	-	1,951,619
Total	2,525,014	2,492,532	2,711,439	1,030,418	8,759,403

The expenditure under the Petroleum Search Subsidy Act during the financial year ended 30 June 1971 was \$9,642,531. Of this amount, \$5,711,304 was paid for onshore operations and \$3,931,227 for offshore operations.

At 31 October 1971, the total expenditure by the Commonwealth in petroleum search subsidies was \$109,565,996 and the total commitment was \$115,817,139.

Areas excluded from Subsidy

No additional areas were excluded from subsidy during the period under review.

Visits to Subsidized Operations

Officers of the Subsidy Section inspected 19 drilling operations, including 9 offshore wells, and 11 geophysical operations during the year ended 31 October 1971.

Features of Subsidized Exploration

The subsidy programme for the period under review showed a considerable decrease in the number of drilling operations over that for the previous 12 months (25 compared with 37); the reduction was in onshore operations (13 compared with 33). The number of offshore operations increased from 4 in the previous year to 12 in the current period. All subsidized offshore wells were drilled in waters adjacent to Western Australia; Scott Reef No. 1 (T.D. 15,520 ft) is the deepest well drilled to date offshore Australia.

One onshore and 3 offshore wells have had major gas flows. Walyering No. 1 (T.D. 11,953 ft), drilled by West Australian Petroleum Pty Limited in the onshore Perth Basin, tested gas at rates of more than 10 MMcf/d. Scott Reef No. 1, drilled by B.O.C. of Australia Ltd in the offshore Browse Basin, tested several intervals with flows of gas at rates up to 18.2 MMcf/d accompanied by condensate with condensate/gas ratios of about 20 bbl/MMcf. North Rankin No. 1 (T.D. 11,593 ft), drilled by B.O.C. of Australia Ltd in the offshore Dampier Basin, was completed as a gas well; several intervals in the Triassic section were tested with gas flows at rates up to 14.1 MMcf/d and a condensate/gas ratio of up to 28 bbl/MMcf. Rankin No. 1 (T.D. 13,486 ft), another B.O.C. well drilled in the Dampier Basin, tested gas at a rate of 15 MMcf/d accompanied by

condensate with a condensate/gas ratio of 35 bbl/MMcf. Testing also established the presence of a thin oil column which was tested at the rate of more than 1000 bbl/day accompanied by gas at 10.5 MMcf/d and 350 bbl/day of water.

Compared with the previous year, the number of subsidized seismic surveys both onshore and offshore decreased markedly during the 12 months ended 31 October 1971 (38 against 72). Most of the geophysical activity was in the Northwest Shelf area, the onshore Canning Basin, the onshore Otway Basin, and in Papua New Guinea. Currently, an unusually large gravity survey involving some 6000 stations with precise optical surveying is in progress in the southern part of the Carnarvon Basin. The outstanding marine seismic survey completed during the year was B.O.C. of Australia's Trimouille-Dillon off the northwest coast of Western Australia; this survey covered 4082 miles.

The most significant developments in geophysical techniques during the year were the re-introduction into Australia of the "Vibroseis" energy source for a land seismic survey (Warrnambool-Pomborneit Seismic) and the first use in Australian waters of Western Geophysical Company's "Maxipulse" marine seismic energy source. The "Vibroseis" survey was the first in this country using a digital recording and processing system. The "Maxipulse" system represents a significant advance on the highly successful "Aquapulse" system. It provides excellent depth penetration and reflection quality.

Publications

One report was published during the year:

No. 81 - Summary of data and results: Sue No. 1
Well, Perth Basin, Western Australia.

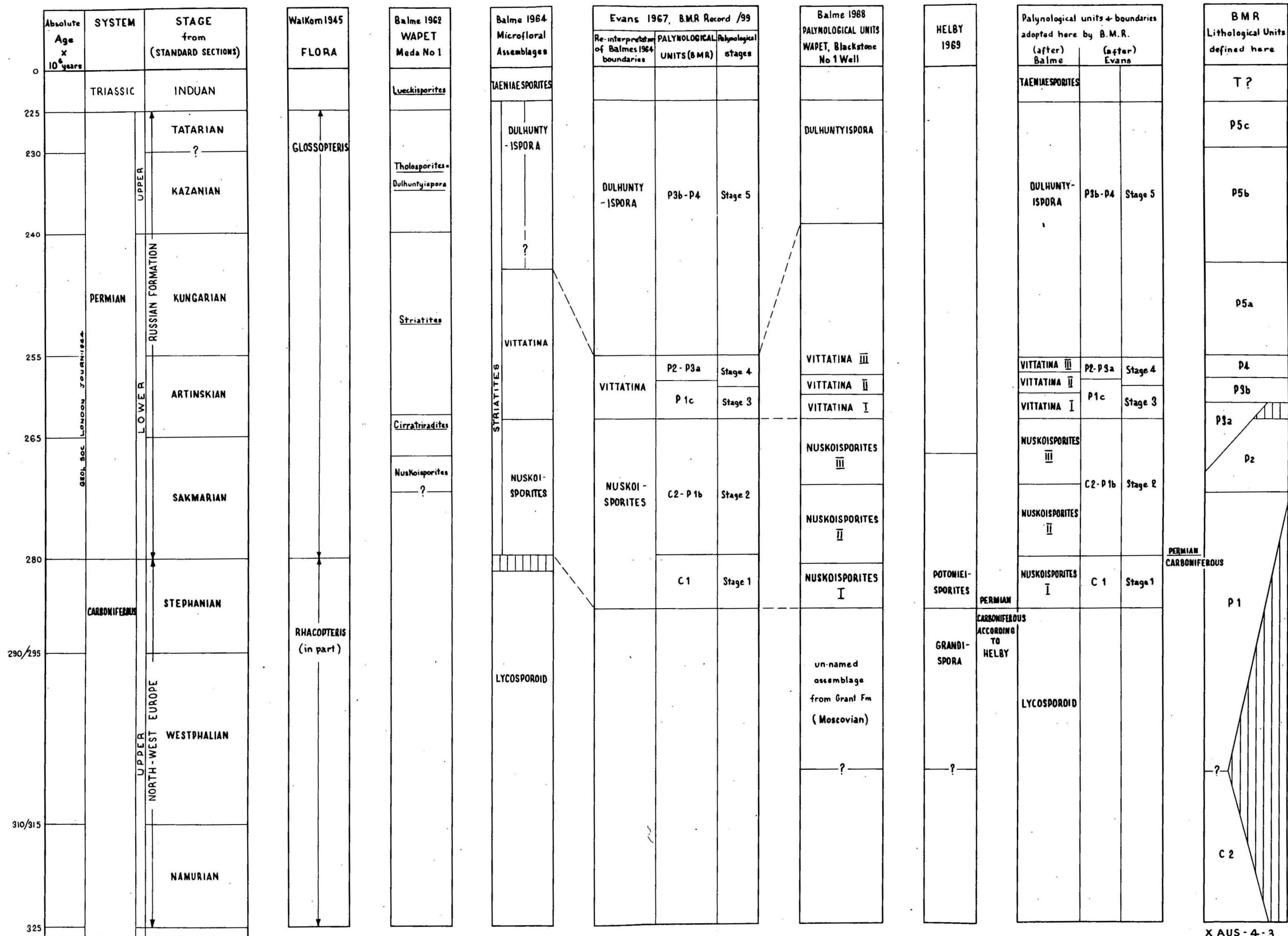
Five more reports were prepared for publication.

LITHOLOGICAL CORRELATION OF PERMIAN
AND UPPERMOST CARBONIFEROUS ROCKS
OF THE CANNING BASIN

Interval	Fitzroy Trough After Guppy & al., 1958		Canning Basin SW Subsurface After WAPET various well completion reports		Canning Basin SW Outcrop After Veevers & Wells 1961		Canning Basin NE After Casey & Wells 1964			
P5c	Livinga Formation									
		Mt Hardman Beds							Livinga Formation	Hardman Member
		plant bearing beds								Condren Member
P5b		basal marine beds		Livinga Formation			Lightjack Member and Balgo Member			
P5a				Triwhite Sandstone			Noonkanbah Formation			
P4	Noonkanbah Formation		Dora Shale Member							
P3b	Poole Sandstone		Cuncudgerie Sandstone	Poole Sandstone						
P3a		Nurra Nurra Member			Nurra Nurra Member					
P2	Grant Formation	Shale Siltstone unit, top of Grant Formation	Dora Shale Member	Braeside Tillite	Paterson Formation					
			Cuncudgerie Sandstone Member							
Glacial Member		Braeside Tillite Member				Grant Formation				
P1										
		?				?				
	Anderson Formation						Anderson Formation			

COMPARISON OF PERMIAN MICROFLORAL ASSEMBLAGE ZONES - CANNING BASIN

Figure 2

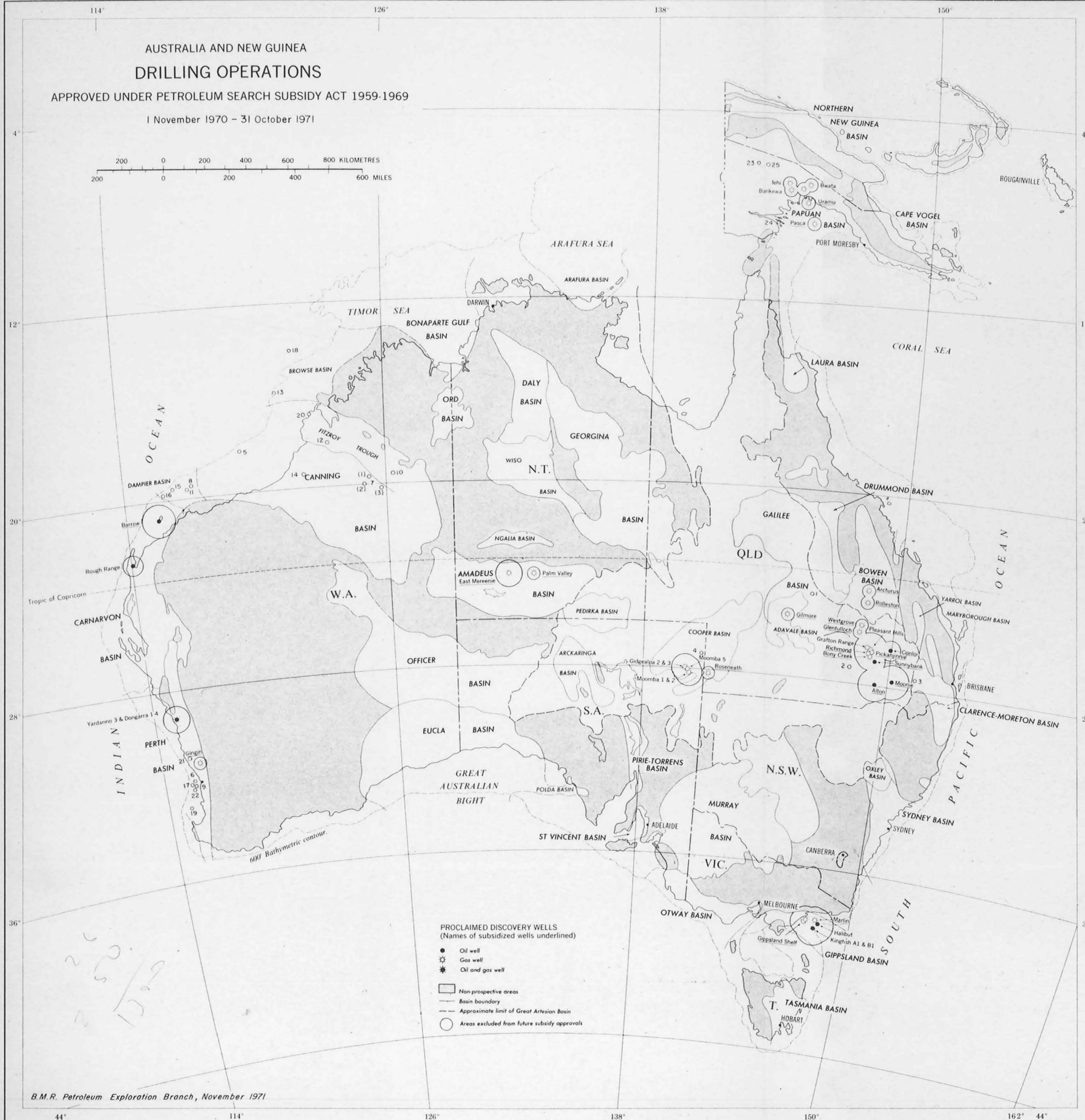


AUSTRALIA AND NEW GUINEA DRILLING OPERATIONS

APPROVED UNDER PETROLEUM SEARCH SUBSIDY ACT 1959-1969

1 November 1970 - 31 October 1971

200 0 200 400 600 800 KILOMETRES
200 0 200 400 600 MILES



Note: Unless otherwise stated, well location refers to No. 1 well.

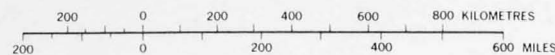
* Offshore operations under terms of Petroleum (Submerged Lands) Act 1967-1968.

1	Allandale, Qld	(Beaver)
2	Foyleview Project, Qld	(Damson)
"	A. Hoolah	
"	B. Hoolah Creek	
"	C. Neabul Creek	
"	D. Noogilla	
3	Horrane, Qld	(Amalgamated)
4	Yanpurra, S.A.	(Flinders)
5*	Bedout, W.A.	(B.O.C.)
6*	Charlotte, W.A.	(WAPET)
7	Crossland Nos. 1-3, W.A.	(WAPET)
8*	De Grey, W.A.	(B.O.C.)
9*	Gage Roads No. 2, W.A.	(WAPET)
10	Lake Betty, W.A.	(WAPET)
11*	Legendre No. 2, W.A.	(B.O.C.)
12	Logue, W.A.	(WAPET)
13*	Lynher, W.A.	(B.O.C.)
14	Munda, W.A.	(WAPET)
15*	North Rankin, W.A.	(B.O.C.)
16*	Rankin, W.A.	(B.O.C.)
17*	Roe, W.A.	(WAPET)
18*	Scott Reef, W.A.	(B.O.C.)
19*	Sugarloaf, W.A.	(WAPET)
20	Tappers Inlet, W.A.	(WAPET)
21	Walpyring, W.A.	(WAPET)
22*	Warnbro, W.A.	(WAPET)
23	Cecilia, PNG	(Texaco)
24	Magobu Island, PNG	(Endeavour)
25	Mananda, PNG	(A.P.C.)

AUSTRALIA AND NEW GUINEA GEOPHYSICAL SURVEYS

APPROVED UNDER PETROLEUM SEARCH SUBSIDY ACT 1959-1969

1 November 1970 - 31 October 1971



B.M.R. Petroleum Exploration Branch, November 1971

* Offshore operations under terms of Petroleum (Submerged Lands) Act 1967-1968.

Seismic Surveys

S1	Sandy Creek, Qld	(Flinders)
S2	Williams Creek, Qld	(U.S. Nat. Res.)
S3*	Charlotte Head, N.S.W.	(N.S.W.O.G.)
S4*	Sealion, N.S.W.	(Longreach)
S5*	South Broken Bay, N.S.W.	(Longreach)
S6	Bemm River, Vic.	(WYP)
S7	Nelson - Koroit, Vic.	(Shell)
S8	Warrnambool - Pomorneit, Vic.	(Shell)
S9*	Sailfish, Tas.	(N.S.W.O.G.)
S10	Otway 071A, S.A.	(Esso)
S11*	Polda Basin 2, S.A.	(Target)
S12	Tilpatee, S.A.	(Delhi)
S13	Anketell, W.A.	(WAPET)
S14	Barragoon, W.A.	(WAPET)
S15	Broome - Samphire, W.A.	(WAPET)
S16	Crossland Platform, W.A.	(WAPET)
S17*	Geelvink Channel D-1, W.A.	(BP)
S18	Lake Auld, W.A.	(WAPET)
S19	Moore River, W.A.	(WAPET)
S20	Munro Detail, W.A.	(WAPET)
S21	Munro D-2, W.A.	(WAPET)
S22	North Broome, W.A.	(WAPET)
S23*	Offshore Eyre, W.A.	(Hartogen)
S24	Pender, W.A.	(WAPET)
S25	Poulton, W.A.	(WAPET)
S26	Preston Detail, W.A.	(WAPET)
S27*	Rankin Trend, W.A.	(B.O.C.)
S28*	Ronsard, W.A.	(Endeavour)
S29*	Scott Reef, W.A.	(B.O.C.)
S30*	Trimouille - Dillon, W.A. & N.T.	(B.O.C.)
S31	West Wyalering, W.A.	(WAPET)
S32	Ngalia Basin, N.T.	(Magellan)
S33	Seymour Range, N.T.	(Magellan)
S34	Three Corners, N.T. (& Gravity)	(Beach)
S35	Balimo, PNG	(Texaco)
S36	Fly, Strickland & Aramia Rivers, PNG	(Continental)
S37	Kaim-Strickland, PNG (& Gravity)	(Union)
S38	Tovala - Lesi, PNG	(Marathon)

Gravity Surveys

G1	Colac - Geelong, Vic.	(Shell)
G2	Murchison - Gascoyne D-1, W.A.	(Oceania)

Aeromagnetic Surveys

A1	Billiluna - Helena, W.A.	(A.A.O.)
A2	White Hills, W.A.	(Aquitaine)
A3	Yimi, PNG	(Aquitaine)