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**SUMMARY OF OIL SEARCH ACTIVITIES IN AUSTRALIA  
AND PAPUA NEW GUINEA DURING 1971**

by

**Evelyn Nicholas**

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Table 2. Geophysical operations during 1971.

## INTRODUCTION

The sources of information for this Record are mainly the final reports of drilling and geophysical operations carried out under the Commonwealth Petroleum Search Subsidy Act (PSSA 1959-1969), but other information from Press Reports, commercial scouting services, the Petroleum Newsletter issued quarterly by BMR, and publications in various journals, has been used. It is not always possible to verify the accuracy of some of this information.

The final reports of operations conducted under the Petroleum Search Subsidy Act deserve special mention. Those for 1971 are unpublished at present, and are referred to in this Record by their Bureau of Mineral Resources (BMR) file numbers (Tables 1 and 2). The reader should bear in mind that the interpretations in some final reports may be changed slightly when they are published by the Bureau, because author and publisher sometimes have the opportunity to revise an interpretation in the light of later knowledge.

This Record contains the results of all subsidized operations completed in 1971 plus the results of operations carried out in the latter half of 1970. Plate 2 shows only subsidized geophysical surveys: although numerous unsubsidized surveys were reported during the year, their locations are not always available and their titles are sometimes confusing with regard to the Bureau's nomenclature of subsidized surveys.

## ADAVALE BASIN

The results of the East Lynne seismic survey (BMR file, 70/758) and the subsequently drilled Allandale No. 1 well were released during 1971. The survey was carried out in the Tambo 1:250 000 Sheet area, which lies in the southern part of the Galilee Basin. The area is outside that presently defined as the Adavale Basin but the intersection of a Devonian section correlated with the Adavale Basin sequence makes the inclusion of the results in this section appropriate.

The survey resulted in the mapping of two horizons on good quality data. Horizon A was correlated with the top of the Permian and Horizon B with an horizon believed to be Middle Devonian. A few small closed anticlines were contoured, on one of which Allandale No. 1 was drilled.

The well penetrated an Eromanga Basin sequence to 744 m and the Permo-Triassic sequence of the Galilee Basin to 2149 m. The pre-Permian sequence consists of sediments identified on palynological evidence as

Middle Devonian Etonvale Formation (622 m thick) lying unconformably on tuff with minor interbedded sandstone and shale of the ?Lower Devonian Gumbardo Formation. The underlying basement rock of possible Silurian age is a tuff of similar composition and texture but much tougher.

There were no hydrocarbon shows. The well proved the existence of porous and permeable sandstone reservoirs in the Jurassic to Cretaceous section. The gas-bearing Log Creek Formation, which underlies the Etonvale Formation in the Adavale Basin to the southwest, is absent in this well.

The Cootabynia seismic survey was carried out in the northeastern part of the basin during 1971 about 10 m east of Etonvale No. 1. In addition to investigating previously indicated seismic anomalies the survey was designed to assess the relative merit of the geoflex technique and shallow shot compositing in obtaining data from deep horizons at an economic rate.

The shallow shot compositing was the more satisfactory technique from the point of view of both data quality and economy. It was estimated that four-fold data could be recorded at a cost of approximately \$700 per mile.

It was found that digital processing of the original analogue records gave greatly improved results and it seems that continuous data below the Bury Limestone will be obtained only if surface input digital techniques are used. In the Cootabynia survey continuous data was obtained on one traverse from three horizons identified as Blythesdale, Permian, and Bury Limestone Member of the Middle Devonian Log Creek Formation.

### AMADEUS BASIN

The Seymour Range seismic survey was carried out near the southern margin of the basin, southwest of the Seymour Range and north-east of the Liddle Hills, an area with little previous geophysical coverage. The nearest seismic work was by BMR about 160 km east of the survey area where about 3350 m of sediments was indicated. One of the objectives of the Seymour Range survey was to provide information on the thickness of the stratigraphic sequence. In addition it was designed to delineate possible prospective structures and locate possible wedge-outs of the

Ordovician Pacoota and Stairway Sandstones which have yielded hydrocarbons in the Palm Valley and Mereenie areas to the northwest. Data quality was poor. The only useable data were at the southern end of the main northwest trending traverse. Two horizons, A and B, were mapped. The B horizon which was the upper one, was identified as an unconformity near or at the top of the Proterozoic. The A horizon was interpreted as a reflecting horizon, deep within the Proterozoic sedimentary sequence. A narrow easterly trending syncline containing about 3700 m of sediments was delineated. The failure to obtain useable data in the northern half of the survey area was attributed to the presence of shallow Precambrian basement. The report recommends that any future seismic exploration should be preceded by a program of shallow stratigraphic test drilling, particularly in the northern half of the area, and that the seismic program should be planned according to the results.

#### ARCKARINGA BASIN

The final report of the Peak Creek seismic and gravity survey (BMR file 70/605) was released during the year. It was carried out in the northwestern part of the basin, and the seismic data integrated with that from the Lake Conway seismic and gravity survey (BMR file 69/3088) immediately to the south. The gravity survey incorporated all previous gravity data for the area.

Two horizons were mapped; Horizon B, top of Unit 1 of the Lower Permian, and Horizon D, top of the Devonian, or economic basement where the Devonian section is absent. The maps indicate a relatively thin flat-lying sedimentary sequence in the northwestern part of the basin, making it a less attractive area for petroleum exploration. The new gravity data did not alter the existing gravity maps for the area. In general, the Bouguer gravity anomalies do not correspond with the subsurface structures revealed by seismic work in the basin.

#### BONAPARTE GULF BASIN

The results of two onshore seismic surveys, Pincombe Range (BMR file 70/675) and Burt Range (BMR file 70/647), were released during the year. They covered areas of the Carlton and Burt Range Sub-basin in the Medusa Banks, Cambridge Gulf, and Auvergne 1:250 000 Sheet areas.

Poor quality data were obtained from previous seismic work in the area, using explosives as an energy source. In an attempt to overcome the problem the Thumper method with 6-fold CDP was used for the Pincombe Range survey, but the results obtained were very poor, and the survey yielded almost no reliable information. Explosives were used in the Burt Range survey and data ranging in quality from poor to fair were obtained. Three horizons were mapped; Horizon A, near the top of the Upper Devonian Buttons Beds, Horizon B, top of the Upper Devonian Cockatoo Formation, and Horizon C, Lower Cambrian or Precambrian basement. The horizons were tied to Keep River No. 1 (BMR file 68/2029), and Spirit Hill No. 1 wells. The maps show a northeasterly trending high running for about 24 km a few kilometres to the northwest of the Cockatoo Fault, which forms the southeastern boundary of the basin. A deep trough containing about 4500 m of sediments is indicated to the northwest of the high. A small high in the extreme west of the survey area, not noted in the Company report, is considered (C. Robertson, BMR, pers. comm.) to be worth further investigation.

The Sahul-Ashmore marine seismic survey was carried out over the Ashmore-Sahul Block which lies adjacent to the Browse Basin. The survey was designed to evaluate earlier seismic leads and provide seismic ties to Ashmore Reef No. 1 (BMR file 67/4264) and Sahul Shoals No 1 (BMR file 69/2042). The horizons mapped were: Horizon E - approximate base Miocene; Horizon M - near base Tertiary; Horizon P - near base Cretaceous, and Horizon Z - near top Permian. One interesting structure was described (Anomaly 71-15) located northeast of Ashmore Reef and coincident with North Hibernia and Fantome Shoals and extending eastward. Closure was mapped at all levels. The isochron map E-M indicates substantial thinning of this interval over Anomaly 71-15 suggesting structural growth during the early Tertiary. Isochron map M-P indicates thin relatively undisturbed section over all the area mapped.

The offshore wells Petrel No. 2 and Tern No. 1 both encountered gas. In drill stem tests, gas flowed at a rate of 9.2 MMcfD from a depth of about 3660 m in Petrel No. 2 and 7 MMcfD from a depth of about 2530 m in Tern No. 1.

The Tryal Evans (BMR file 70/245) and Trimouille-Dillon marine seismic surveys included projects in the Bonaparte Gulf Basin (See - Offshore North and Northwest Australia).

## BROWSE BASIN

Final reports of the first three wells drilled in the basin were released in 1971.

In each well, the age of the rock units is supported by micropalaeontological and palynological evidence.

Leveque No. 1 (BMR file 70/670), the first well drilled, was located on the Leveque Platform and penetrated 900 m of sedimentary rocks before entering Precambrian basement (gabbro). The sequence ranged in age from Quaternary to Upper Jurassic. The Tertiary section consisted of 284 m of carbonate rocks. The Cretaceous was 510 m and the Upper Jurassic 52 m thick. The Mesozoic section consisted of marine clastic sedimentary rocks and claystone with abundant glauconite. There was an unconformity between the base of the Miocene and the Upper Cretaceous and one within the Upper Cretaceous. The mid-Upper Cretaceous unconformity is also recognized in Lacepede No. 1A, to the south in the offshore Canning Basin, and in Ashmore Reef No. 1 to the north in the offshore Bonaparte Gulf Basin.

Lynher No. 1 was drilled on the margin of the Leveque Platform about 108 km west of Leveque No. 1. The sequence penetrated ranged in age from Upper Tertiary to Upper Permian and contained the base Tertiary and mid-Cretaceous unconformities identified in the earlier well. The upper one cutting out the lower Palaeocene and possibly the upper Maastrichtian, and the lower one the Coniacian and possibly part of the Turonian and Cenomanian. The possibility of a base Miocene unconformity cutting out the upper Eocene and Oligocene was also indicated.

The sequence contained 200 m of Upper Triassic sediments unconformable on Upper Permian sediments. Faunal evidence indicates a marine origin for the bottom 60 m of Permian sediments penetrated and for all sediments younger than mid-Upper Jurassic.

Gas was discovered in Scott Reef No. 1 drilled in a large north-east-trending anticline located near the western margin of the basin. The sequence ranged in age from Recent to Upper Triassic. The well penetrated the thickest Tertiary section (3368 m) yet encountered in drilling on the Northwest Shelf, and the thickest reef, which extended from the seabed to 1411 m. There was an unconformity between the middle Palaeocene and the Upper Cretaceous.

The Cretaceous sequence was 763 m and the Jurassic 96 m thick, and the Upper Triassic was penetrated for 375 m.

The Cretaceous section is the most complete so far recognized on the Northwest Shelf. An unconformity was recognized between the Turonian and Cenomanian and between the lower Neocomian and the Upper Jurassic.

An unconformity separates the Upper and Middle to Lower Jurassic and an angular unconformity separates the Jurassic and Upper Triassic. Mafic volcanics, similar to volcanics in the Upper Jurassic in Ashmore Reef No. 1 occur above the first unconformity.

The hydrocarbons were produced from reservoirs in the Lower to Middle Jurassic and the Triassic sediments. Palynological evidence suggests deposition of the Lower to Middle Jurassic sediments in a deltaic environment with weak marine influences. In the Upper Triassic, the evidence for marine deposition at this time is stronger than in any previous well drilled on the Northwest Shelf. In drill stem tests on 1" surface choke the highest gas flow was 18.2 MMcfD, with 20bl/MMcf condensate.

Following the successful outcome of the drilling of the Scott Reef No. 1 well, the Scott Reef seismic survey was carried out to provide better definition of the structure at pre-Cretaceous level. Only a limited amount of reliable data had resulted from earlier seismic work. The survey included a reconnaissance line extending northwest from Scott Reef. The horizons mapped were: Horizon II - approximate base Miocene; Horizon III - Upper Cretaceous, and Horizon T - approximate top Triassic.

Horizon II is identified at Scott Reef No. 1 as near to the base of the Oligocene, but off the reef it is identified as near the base of the Miocene according to a tie with Ashmore Reef No. 1 well (Project 71 - H of the Trimouille - Dillon seismic survey). In the vicinity of the Scott Reef well the lack of a distinct reflection from the base of the Miocene, and the thinness of the Oligocene interval (88 m) supports the validity of the correlation of Horizon II from on-reef to off-reef. Horizon III was a good continuous reflection from an unconformity within the Upper Cretaceous. Horizon T was mapped on poor data and was not mapped in earlier surveys. There was more evidence of structure on this horizon than on Horizons II and III. It appears to be a major angular unconformity over a large part of the survey area.

The results generally confirmed the earlier structural picture at Scott Reef, and provided confirmation of the major unconformity below Horizon T interpreted in Scott Reef No. 1. South of Scott Reef, a long anticlinal nose, believed to be a continuation of the Buccaneer Nose, was

mapped on Horizon T, and northwest of this structure a large closed anticline was contoured on both Horizons T and III.

A large structure (anomaly 71-14) was interpreted on Horizon T adjacent to the northeast end of North Reef. The isochron map III - T indicates considerable thinning over the structure, the apex of which is in approximately 440 m of water. The company considers the feature worthy of further evaluation.

See also section on offshore north and northwest Australia for reference to geophysical projects.

### CANNING BASIN

This section contains the results of twenty nine subsidized operations - twenty one of which were geophysical. Of the eight drilling operations, two were offshore. Seismic projects in the Canning Basin are also referred to in the section on offshore north and northwest Australia.

Lacepede No. 1 A (BMR file 70/426) was the first well drilled offshore in the Fitzroy Trough. It penetrated sediments ranging in age from Quaternary to Upper Permian (based on micropalaeontological evidence). There was no Triassic section, but the well contained the most complete Jurassic sequence, including the only Lower Jurassic sediments, drilled in the Canning Basin. The well contained the base Tertiary and the mid-Cretaceous unconformities recorded in the Browse Basin wells as evidenced by the absence of the Palaeocene, Eocene, and Oligocene, and the Albian, Cenomanian, and Turonian respectively. The faunal evidence indicates a marine origin for all sediments younger than mid-Upper Jurassic.

Bedout No. 1 was located 257 km southwest of Lacepede No. 1A on the offshore extension of the Broome Platform which separates the Bedout Sub-basin to the south from the Rowley Sub-basin to the north. It penetrated sediments ranging in age from Quaternary to Upper Triassic, overlying volcanic rocks of undetermined age. The Upper Triassic sequence in this well was 110 m thick. The well contained a base Miocene unconformity which cuts out the Aquitanian and Oligocene but no unconformity was detected at the base of the Tertiary. The 23 m of greensand conformably overlying the Upper Cretaceous was interpreted as Danian in age and was the second occurrence of sediments of this age in wells on the Northwest Shelf,

the first being in Sahul Shoals No. 1 (BMR file 69/2042) drilled in the Bonaparte Gulf Basin. Within the Cretaceous the Santonian to Turonian sequence was condensed, and a time break was indicated between it and the underlying basal Cenomanian. A hiatus was also indicated between the Albian and the Aptian. The Lower Cretaceous contains an unconformity between the upper and lower Neocomian. A sandstone unit (61 m thick) within the Upper Neocomian was correlated with the Broome Sandstone in Lacepede No. 1A (305 m thick). In the Jurassic section, marine Tithonian claystone is unconformable on the underlying deltaic sequence. This break was found in Lacepede No. 1A and also in wells in the Dampier Sub-basin. The Jurassic was conformable on Upper Triassic sediments of marine origin, comprising a sequence of fine to medium-grained sandstone and multicoloured claystone. The upper part of the volcanic sequence consisted of volcanic conglomerate overlying weathered basalt which was underlain by fairly fresh basalt.

Three of the operations - the Alexander II seismic survey (BMR file 70/449) and the Napier Nos 4 and 5 wells, were located near the northern margin of the Lennard Shelf. They have provided valuable information in an area where the subsurface geology is not well known.

Napier No. 4 was drilled in the Yampi 1:250 000 Sheet area on a large positive Bouguer gravity anomaly and Napier No. 5 in the Derby 1:250 000 Sheet area on a closed anticline defined by the Alexander II seismic survey. The survey was a detailed one, designed to confirm the presence of this structure which had previously been indicated by the Alexander seismic survey (BMR file 69/3057). In addition it confirmed a regional thinning of the sedimentary section to the north and northwest.

Both wells reached total depth in Proterozoic basement rocks. Napier No. 4 in orthoquartzite correlated with the King Leopold Beds which crop out 13 km to the northwest, and Napier No. 5 in granitic gneiss of the Lamboo Complex. The overlying sequence has been subdivided into rock units, assigned formation names on the basis of lithological, micro-faunal, and palynological correlation with the nearest wells. Part of an upper Devonian reef complex is recognized in each well; represented in Napier No. 4 by the Pillara Limestone (back-reef facies) and in Napier No. 5 by the Napier Formation (fore and inter-reef facies). The underlying unit is the Upper Devonian Van Emmerick Conglomerate (deltaic) in Napier No. 5 which is correlated with a thick sandstone unit in No. 4. This unit overlies basement in Napier No. 4, but in Napier No. 5 a thick dominantly sandstone unit of probably Middle Devonian age, for which the name 'Station Creek Formation' is proposed, overlies basement.

The reef facies is overlain by the Upper Devonian to Lower Carboniferous Fairfield Formation and the Lower Carboniferous Laurel Formation in both wells and, in Napier No. 4, the Permian Grant Formation and Quaternary aeolian sand.

In addition to the operations carried out by Lennard Oil N.L., five seismic surveys were carried out, and one subsidized well drilled by WAPET in the King Sound area of the Lennard Shelf.

The Gogo Trig seismic survey (BMR file 70/718) was carried out on the Lennard Shelf in the Noonkanbah 1:250 000 Sheet area. It was designed to extend the reconnaissance coverage of the Lennard Shelf, and to provide a sufficiently detailed coverage of the Gogo Anticline (discovered by earlier geophysical work) for a well to be sited. Two horizons were mapped; Horizon A - ?Lower Carboniferous Laurel Formation, and Horizon B - ?Ordovician basement. The Gogo Anticline trends in a north-northwesterly direction and is traversed by northwest trending normal faults with downthrow to the southwest. The faults are involved in four local closures along the crest of the anticline. The one which crosses the southwest flank of the structure is tentatively identified as the Pinnacle Fault.

The Laurel seismic survey (BMR file 70/763) was carried out in the Lennard River 1:250 000 Sheet area as the first seismic investigation of the Laurel Terrace. The Terrace was interpreted from Bouguer gravity data and from aeromagnetic data as a downfaulted block bounded by the Pinnacle Fault and the Lennard Shelf to the northeast and the Fitzroy Trough to the southwest, with estimated depth to magnetic basement of up to 4500 m.

Two horizons were mapped; Horizon A - tentatively correlated with the Lower Carboniferous Laurel Formation, and Horizon B - a deeper phantom horizon, not identified. The most significant result from the survey is the repositioning of the Pinnacle Fault farther to the southwest, with consequent reduction in width of the Laurel Terrace.

The Pender seismic survey (BMR file 70/817) covered the northeast Dampier Peninsula in the Pender and Derby 1:250 000 Sheet areas. It followed the King Sound marine seismic survey (BMR file 70/218), which indicated that the Lennard Shelf extends offshore through King Sound and the Dampier Peninsula. The Pender survey consisted of three widely spaced (35 km) southwest-trending lines. Three horizons were mapped: Horizon A - near the base of the lower Triassic Blina Shale, Horizon B - near the top of the Lower Permian Grant Formation, and

Horizon C - near the base of the Lower Carboniferous Laurel Formation. The westerly extension of the Lennard Shelf was confirmed. The three lines, appear from north to south (1) to be entirely on the Lennard Shelf, (2) to cross the Pinnacle Fault into the Fitzroy Trough, and (3) to be in the Fitzroy Trough.

The survey indicated southward thickening of the sediments on the shelf. Possible Devonian reef development associated with minor basement faults is interpreted on Horizon C at the southern end of the Lennard Shelf traverse. The major Pinnacle Fault system and the minor faults are indicated only on the Lower Carboniferous horizon. The northern flank of the Fraser River Anticline is indicated on the Fitzroy Trough traverse.

Prospective hydrocarbon traps were not defined, but could occur between the widely spaced traverses.

The westerly extension of the Lennard Shelf was tested by Tappers Inlet No. 1, drilled on the coast about 130 m northwest of Derby. It was located on a seismically defined culmination on a northwest trending anticline which extends offshore. The well was primarily a test of the hydrocarbon potential of Devonian carbonates, the Carboniferous Laurel Formation, and a possible Ordovician section. It also provided an invaluable extension of stratigraphic control for onshore and offshore seismic sections, located as it was 193 km west-northwest of the nearest wells on the Lennard Shelf. The sequence penetrated was interpreted on lithological and palaeontological evidence. It comprised the Upper Jurassic Alexander Formation (approximately 414.5 m thick) and Wallal Sandstone (226.5 m thick) unconformably overlying the Permian Noonkanbah (389.2 m thick) and Upper Grant Formations (501.4 m thick). An angular unconformity was detected below the Grant Formation, separating it from the Upper and Middle Devonian Pillara Formation (431.6 m thick). The well reached total depth in Precambrian mafic igneous rocks. The only indications of hydrocarbons in the well were minor oil traces in cores of stromatoporoid limestone from the Pillara Formation. The best reservoir characteristics were found in sandstone in the Poulton Formation which had an average porosity of 13.7 percent and permeability up to 66 millidarcies. Other points of interest are the absence of Carboniferous sediments and the presence of a basal shale unit, a potential cap rock 30.5 m thick, in the Grant Formation which was otherwise predominantly composed of fine to medium-grained sandstone.

The Oscar seismic survey (BMR file 70/765) was carried out at the northwestern end of the Lennard Shelf near Derby, over a basement high called the 'Oscar Ridge' that extends about 100 km to the southeast

from the coast at King Sound. Exploration activity in this area has centred around the possibility of Devonian reef development around the basement high and the survey was designed to complete a broad reconnaissance grid over the Oscar Ridge and also to extend a tie line from the shelf across the Fitzroy Trough and onto the Jurgurra Terrace.

Two horizons were mapped; Horizon A - within the Permian Grant Formation, and Horizon B - base of the lower Carboniferous Laurel Formation. Data quality was too poor for the structure to be delineated across the Oscar Ridge, but the Lennard Shelf, Fitzroy Trough, and Jurgurra Terrace were well defined. The Lennard Shelf appears to be largely devoid of structure suitable for hydrocarbon accumulation, but a number of promising anticlines are indicated in the transitional zone between the Fitzroy Trough and the Jurgurra Terrace.

The Poulton seismic survey covered parts of the Oscar Ridge, Laurel Terrace, and Gogo Anticline. The survey was a combination of reconnaissance and semi-detailed coverage. The interpretation incorporated about 72 km of previous data. The survey was done by two contractors, Digicon and G.S.I., who were responsible for the northwestern and southwestern areas respectively with some overlap between the two. The horizons mapped in the northwestern area were: Horizon A - within the Permian upper Grant Formation; Horizon C - a reflecting horizon in the Lower Carboniferous Laurel Formation, and Horizon E - near the top of the Ordovician. In the southeastern area the horizons mapped were; Horizon C - as above; Horizon B - pre-Permian unconformity, and Horizon D - Lower Devonian. Horizon C, the only one countoured in both areas, shows the northwest trending Pinnacle Fault system separating the Oscar Ridge from the Laurel Terrace to the southwest. Other significant results include the discovery of three new structures, named the Warrawada, the Mount Hardman, and the Jubilee Downs, in the southeastern area. The first two are individual closures on a northwest trending anticline to the south of the Pinnacle Fault. Minimum vertical closure on the Warrawada structure was calculated as 0.110 seconds, limited to the north by the Pinnacle Fault. The areal extent is at least  $30 \text{ km}^2$ . A minimum vertical closure of 0.50 seconds, and an areal extent of approximately  $50 \text{ km}^2$  was calculated on the Mount Hardman structure. The Jubilee Downs structure lies within the Pinnacle Fault system and control on it was insufficient for a reliable estimate of closure to be made. Two new prospective anticlines were indicated in the northwestern area, one on Horizon C and the other on Horizon A. Additional seismic control was considered necessary on all the structures indicated by the survey.

Five seismic and two aeromagnetic surveys were carried out in the eastern part of the basin.

The Lake Betty seismic survey (BMR file 70/657) was carried out in the Lake Bannerman 1:250 000 Sheet area over the Gregory Sub-basin and the adjacent Lake Betty Terrace. Previous geophysical work has indicated a northwest trending trough divided by a basement high (Jones Arch) into the Fitzroy Trough in the northwest, and the Gregory Sub-basin in the southeast. The Betty Terrace lies between the Precambrian Kimberley Block and the Gregory Sub-basin, both boundaries being faults downthrown to the southwest. An anticline, the Lake Betty Structure, has been defined southwest of the fault separating the Terrace from the sub-basin. The Lake Betty survey was primarily designed to confirm northeast closure on the anticline at pre-Permian level.

Two horizons were mapped; Horizon A - near the base of the Permian and Horizon B - near the base of the Carboniferous. The Lake Betty Structure was found to be a northwest-trending anticline dipping to the northwest, southeast, and southwest, but with no substantial dip to the northeast. The anticline is traversed by three major northwest-trending normal faults, downthrown to the southwest, that provide fault closure on the northeast side of three culminations along the axis. The culmination adjacent to the southwesterly fault was recommended as a drill site. The survey provided improved velocity control in the area and increased knowledge of the structural relationships between the Gregory Sub-basin, Betty Terrace, and Lake Betty Structure.

Lake Betty No. 1 was drilled on the Lake Betty Structure to test the hydrocarbon potential of the predicted Devonian and Ordovician carbonate section. The sequence penetrated was interpreted on lithological and palaeontological evidence as: Upper Permian Liveringa Formation (373.4 m thick); Lower Permian (Artinskian) Noonkanbah Formation (300.2 m thick) and ?Poole Sandstone (86.3 m thick); Sakmarian to Upper Carboniferous Grant Formation (922.6 m thick); Upper Devonian (Famennian) Luluigui Formation, and Middle Devonian Poulton Formation (67.4 m penetrated). The well appeared to intersect a fault plane at 3078 m, which cut out the Upper Devonian Pillara Formation, so that the Middle Devonian section was encountered about 762 m higher than predicted. The lower 91 m of the Grant Formation was dated as Upper Carboniferous on palynological evidence. The only significant hydrocarbon shows were gas shows in a medium-grained sandstone in the Laurel Formation which proved to be impermeable on testing.

The Helena, Crossland, and Crossland Platform seismic surveys were carried out over the southeastern end of the Mid-Basin Platform which separates the Fitzroy Trough and Gregory Sub-basin to the northeast from the Willara and Kidson Sub-basins to the southwest. The Mid-basin Platform, an area of comparatively shallow depth to magnetic basement, has been subdivided in the survey area into the Crossland and Helena Platforms, lying northeast and southwest respectively of a steep gravity gradient known as the Tina Springs Hingeline. There had been no previous seismic work and no wells drilled in the area.

The Helena seismic survey (BMR file 70/504) produced generally poor quality data, and only two horizons, interpreted as the top and bottom of the Devonian Carribuddy Formation, were mapped. The interpretation showed that the Crossland Platform is downfaulted to the northeast and dips steeply into the Gregory Sub-basin. Downfaulting to the northeast was also interpreted on the Tina Springs Hingeline on the southwestern side of the platform. The strata dip gently from the Tina Springs Hingeline towards the Kidson Sub-basin. The survey provided no confirmation of a faulted boundary (Tobin Hingeline) between the Helena Platform and the Kidson Sub-basin. Possible anticlines worthy of further investigation were indicated on the Crossland Platform.

The Crossland and Crossland Platform seismic surveys (BMR file 70/687 and 71/150) added to the definition of the Crossland Platform and adjacent areas. Three horizons were mapped; Horizon A - pre-Permian unconformity, Horizon B - near the top of the Devonian, and Horizon C - near the top of the Ordovician. A shelf area (now Barbwire Terrace) was defined intermediate in depth between the Crossland Platform and the Fitzroy Trough and separated from them by the Dummer Range and Fenton Faults respectively. The Fenton Fault was mapped as a system of southeasterly-trending faults with throws decreasing in that direction and replaced by steep dips. The throw on the Dummer Range Fault also decreases to the southeast. A number of possibly prospective anticlines were indicated on the southern flank of the Fitzroy Trough, on the shelf (including one previously identified as the Barbwire Range Structure) and on the Crossland Platform. Additional seismic work was recommended for their definition.

Three stratigraphic coreholes - Crossland Nos. 1, 2, and 3 were drilled on the Crossland Platform about 160 km south of Fitzroy Crossing. The objectives were to obtain lithological and velocity data in an area devoid of well control. The lithological units were identified on the basis of their lithology and palaeontology. Crossland No. 1 was located on the Barbwire Terrace, Crossland No. 2 on the Crossland Platform, and Crossland No. 3 on a large fault block within the Dummer Range Fault system.

All three wells spudded in Recent aeolian sand (6.4, 6.4, and 3.4 m thick). Crossland No. 1 then penetrated approximately 292 m of interbedded siltstone, claystone, and fine-grained sandstone interpreted as Lower Permian Grant Formation equivalent and subdivided into two members the Dora Shale and the Cuncudgerie Sandstone (143 and 149 m thick). The Permian was unconformable on an unnamed Devonian(?) carbonate sequence (dolomite) in which the well reached total depth. Crossland No. 2 penetrated approximately 134.7 m of interbedded sandstone and siltstone interpreted as Tertiary and Lower Permian in age. The Permian part of the sequence was correlated with the Noonkanbah Formation. The underlying sequence was equated to the Lower Permian Poole Sandstone (64 m thick), and the Grant Formation (451.8 m thick). In this well the Dora Shale Member was 327.4 m thick and the Cuncudgerie Sandstone Member was 124.4 m thick. The Permian was underlain by a sequence of red continental claystone, limestone, and dolomite, with minor sandstone, identified as the Silurian to Devonian? Carribuddy Formation. Crossland No. 3 penetrated about 134.7 m of alternating white and ironstained sandstone and kaolinitic claystone, correlated with the Noonkanbah Formation and Poole Sandstone. It was underlain by the Grant Formation equivalent (374.9 m thick) subdivided into the Dora Shale Member (229.8 m thick) and the Cuncudgerie Sandstone Member (144.8 m thick). This was underlain by a carbonate sequence consisting of limestone that becomes increasingly dolomitic with depth. Two cores, one in the limestone and one in the dolomite, were tentatively dated as Lower Carboniferous (Tournaisian) and Upper Devonian, respectively, on the basis of their conodont fauna. There were no indications of hydrocarbons in the three coreholes.

The Stretch Range seismic and gravity survey (BMR file 70/600), carried out in the Lucas and Stansmore 1:250 000 Sheet areas, was the most easterly of the five seismic surveys. It confirmed the extension of the Fitzroy Trough (Gregory Sub-basin) into the area and showed that the Point Moody No. 1 well (BMR file 65/4174) was drilled on the southeastern flank of a large anticline extending to great depth, and not on a surface structure as had been thought. It also indicated the presence of an unconformity within the sedimentary sequence with the possibility of 'pinch-out' traps below it.

The Billiluna - Helena aeromagnetic survey was a high sensitivity survey covering a large part of the east Canning Basin and designed to provide a basis for future geophysical exploration. Previously only one subsidized regional aeromagnetic survey (BMR file 62/1728), a small subsidized seismic survey (BMR file 63/1533), and a low density regional gravity survey by BMR (BMR Rec. 1962/105) had been carried out in the

area. The Billiluna - Helena Survey was flown on an approximate 3 km by 18 km grid. The results indicated that basement structure is controlled by two fault sets - a dominant northwest trending series and a subordinate series trending northeasterly, which have produced large fault blocks, and, where the two fault sets intersect, a complex structural picture. Eleven 'zones of interest' for future exploration are discussed in the report and are related to the better known structure to the west. A deep trough containing up to 9000 m of sediments occurs in the northern and central parts of the survey area. It was interpreted as the southeastern extension of the Fitzroy Trough (i.e. Gregory Sub-basin). The trough is flanked to the south by an area of shallow magnetic basement, 1500 m to 4000 m below sea level. This area was interpreted as the southeastern extension of the Crossland and Helena Platforms. A similar area to the north of the trough was interpreted as the southeastern extension of the Betty Terrace and Billiluna Shelf.

The White Hills aeromagnetic survey covered the Stretch Range area of the east Canning Basin. The survey was flown on a very close grid using a high sensitivity magnetometer to delineate the deep magnetic basement and provide a basis for locating future seismic surveys.

The interpretation broadly outlines the southeastern extensions of the Broome Platform and the Fitzroy Trough into the survey area. Magnetic basement lies at depths of up to 6000 m on the Broome Platform and from 6000 m to 12 200 m in the Fitzroy Trough.

Features of interest included two prominent ridges extending from the Platform into the Trough, and a large northwest trending magnetic high, with an amplitude of about 30 gammas, within the Fitzroy Trough in the northwestern part of the survey area.

Four seismic surveys were carried out south of Broome in the western part of the basin.

Geophysics and drilling had suggested a structural subdivision of the area into a northwest trending shelf, the Broome Platform, separated from the Willara Sub-basin to the south by a major fault zone, called the Admiral Bay Hingeline. An area of complex folding, the Munro Arch, lies on the eastern flank of the Willara Sub-basin, and a north-northwest-trending basement high, the Anketell Ridge, to the southwest. A north-trending structural shelf, the Wallal Platform, bounds the sub-basin to the south.

The Broome-Samphire seismic survey (BMR file 70/857) provided regional reconnaissance control over an area extending from the Wallal Platform to the northern part of the Broome Platform. Three horizons were mapped over the northern Broome Platform - the Precambrian basement, and two horizons interpreted as being near the top of the Ordovician Goldwyer Formation and the Permian Grant Formation. Only the Ordovician horizon was picked on reliable data. The existence of a large northwest-trending anticline was indicated. This was further investigated by the North Broome seismic survey. Two horizons were mapped, interpreted from a tie to Thangoo No. 1A well (BMR file 62/1054) to be the base of the Permian unconformity, and near the top of the Thangoo Limestone. The anticline, a large Ordovician structure, in faulted and eroded strata, has several smaller associated anticlines. Two of these, near the crest of the major structure 5.6 km and 13 km southwest of the Thangoo wells Nos 1 and 1A, were regarded as the most prospective. Further detailing was recommended.

In the Broome-Samphire seismic survey four horizons were mapped over the rest of the survey area, which extended across the southern part of the Broome Platform, the Willara Sub-basin, the Anketell Ridge, and onto the Wallal Platform. They were interpreted as being near the tops of the Permian Cuncudgerie Sandstone (member of Grant Formation), the Goldwyer Formation, the Ordovician Thangoo Limestone, and the Ordovician Nambet Formation. All were picked on fair to good quality data.

The remaining survey released in 1971 was carried out in the southeastern part of the basin over the Kidson Sub-basin and adjacent areas. The northwesterly trending Kidson Sub-basin is estimated from aeromagnetic data to contain up to 6000 m of sediments. The Munro Arch area separates it from the Willara Sub-basin on the northwest.

The Lake Auld (BMR file 70/933) seismic survey investigated the southern flank of the sub-basin. It extended seismic control over the southern flank of the Kidson Sub-basin and adjoining Tabletop Shelf. Three horizons were mapped; the Siluro-Devonian Tandalgo Red Beds, the Ordovician-Silurian Carribuddy Formation, and the top of the Thangoo Limestone. The survey provided further definition of the southwest flank of the sub-basin and confirmed faulting indicated by gravity and aeromagnetic data. A northeast-trending anticline was interpreted west of Lake Auld.

The Munro Detail and the Munro D-2 seismic surveys were carried out in the southeastern part of the Willara Sub-basin. The first survey was programed to delineate the Munro Structural Trend (Munro

Arch) and the Munro Fault. The three horizons mapped were identified as near the tops of the Cuncudgerie Sandstone (Permian), the Goldwyer Formation (Ordovician), and the Thangoo Limestone (Ordovician). The best quality reflection data was obtained from the Goldwyer Formation. The data from this survey was integrated with approximately 480 line km of data from earlier surveys.

The two structures under investigation were delineated on the Ordovician horizons. The Munro Fault is a northwest trending normal fault downthrown to the southwest, and the Munro Arch is an elongated northwest trending anticline with a number of postulated separate culminations on the upthrown side of the fault. Minimum closure calculated on the Thangoo Limestone horizon was approximately 130 milliseconds. Depth conversion was not made because of the lack of well control and velocity data. The displacement on the fault ranges from nil to 140 milliseconds on the Goldwyer Formation horizon. Movement on the fault appears to have stopped at about the same time that deposition of this interval ceased. The contour map on the Cuncudgerie Sandstone has a different pattern from that on the underlying Ordovician horizons, demonstrating the unconformable relationship. The structure of the Cuncudgerie Sandstone is partly due to the removal of salt from the underlying Carribuddy Formation (Silurian). The report recommended additional seismic work to mature a well site with the result that the Munro D-2 survey was carried out to confirm closure on the Munro Arch, and to investigate a gravity high to the east of it. Four separate culminations were defined along the anticline and two of these were recommended as well locations. The structure as a whole is closed to the northeast by the regional dip and to the southwest by the Munro Fault. It has minimum vertical closure of approximately 150 milliseconds and an areal extent of about 260 km<sup>2</sup> at the level of the Thangoo Limestone horizon. The gravity maximum was not associated with a significant structure.

Munda No. 1 was sited on one of the culminations, mainly to obtain velocity and stratigraphic data as an aid to interpretation of a wider area of the sub-basin and secondarily to investigate the hydrocarbon potential of the Permian sequence.

The well spudded in the Broome Sandstone. It penetrated the following Mesozoic sequence: 110 m of marginal coarse-grained Neocomian Broome Sandstone; 133.8 m of marine clastic sediments correlated with the Upper Jurassic Jarlemai Siltstone and Alexander Formation, and 167 m of unconsolidated Middle to Upper Jurassic Wallal Sandstone. The Mesozoic sequence is unconformable on the Permian Grant Formation

(389.5 m thick) which comprised an upper member, the Dora Shale (178 m thick) and a lower member, the Cuncudgerie Sandstone, which contained sandstone units in beds from 1.2 to 48.8 m thick with good reservoir characteristics. The well reached total depth in an evaporite sequence in the Silurian to Devonian Carribuddy Formation. There were no indications of hydrocarbons.

### CARNARVON BASIN

During 1971 large gas/condensate reserves were discovered in the Dampier Sub-basin of the Carnarvon Basin, offshore from the Pilbara Block.

The discoveries were made in the North Rankin, Rankin, and Goodwyn wells drilled on three separate structures along the Rankin Trend, a trend of positive Bouguer gravity anomalies lying along the northwestern side of the sub-basin. The trend consists of block-faulted Triassic reservoir sediments unconformably overlain by Cretaceous cap rocks and Tertiary sediments.

The final reports of two wells drilled in the Dampier Sub-basin in 1970 were released in 1971. The age of the sediments was determined from palaeontological and palynological studies.

Enderby No. 1 (BMR file 70/737) was drilled at the southern end of the Enderby fault zone which lies along the southeastern margin of the sub-basin. It was located on a seismically defined anticline and penetrated rock of Quaternary to Miocene (198 m), Cretaceous (492 m), Jurassic (712 m), Triassic (512 m), and (?) Permo-Triassic (68 m penetrated) age to total depth. Although there were no significant shows of hydrocarbons the well provided valuable stratigraphic information in a previously untested part of the sub-basin.

The well contained the base Tertiary and mid-Cretaceous unconformities recorded elsewhere in wells on the Northwest Shelf. At the upper unconformity, rocks of Miocene age rested on Upper Cretaceous strata. The Coniacian and Santonian are absent at the mid-Cretaceous unconformity. There is also palynological evidence for a basal Cretaceous unconformity at which most of the Tithonian and much of the Neocomian are missing. The underlying Jurassic sequence was apparently deposited without any major time breaks. The well was the first in the Dampier Sub-basin to penetrate sediments dated as Lower Jurassic. The Triassic sequence was also penetrated in the Dampier Sub-basin for the first time. Good potential sandstone reservoir beds occurred in both the Jurassic and

Triassic. Felsic volcanic rocks underlie the Triassic sedimentary rocks at 2081 m. They were tentatively dated as Lower Triassic to late Permian.

Legendre No. 2 (BMR file 70/769) was sited on a closed anticline at the northeastern end of the northeast-trending Rosemary-Legendre Anticlinal Trend - a large complex horst structure. The well was a crestal test of a Jurassic sequence stratigraphically equivalent to one which gave significant indications of hydrocarbons in Legendre No. 1 (BMR file 68/2116) drilled downdip and about 8 km to the southwest.

The age and thickness of the sequence penetrated was Quaternary and Tertiary (1055 m), Cretaceous (960 m), and Jurassic (1546 m) to total depth.

In this well a base Tertiary unconformity eliminates lower Paleocene sediments, and an intra-Cretaceous unconformity cuts out most of the Aptian. In addition, there is an unconformity which cuts out all lower Miocene and Oligocene sediments, and evidence for an unconformity within the Upper Jurassic.

The Lower Neocomian sandstone which flowed oil in Legendre No. 1 was absent. The absence was attributed either to a probable unconformity between the Neocomian and Upper Tithonian or to a facies change between the two wells.

Sandstone with good reservoir characteristics was encountered in the Jurassic section, but all horizons were 100 percent water-bearing.

North Rankin No. 1 was the first well drilled on the Rankin Trend, followed by Rankin No. 1 and Goodwyn No. 1. The drilling followed a long program of seismic work in the Dampier Sub-basin culminating in a project included in the Trimouille-Dillon seismic survey (BMR file 71/976). The Rankin Trend lies along the northwestern side of the sub-basin where it coincides with a linear belt of positive Bouguer gravity anomalies. The seismic interpretation showed that it is a series of en/echelon fault blocks in Triassic sediments unconformably overlain by sediments of Cretaceous and Tertiary age. The drilling of North Rankin No. 1, Rankin No. 1, and Goodwyn No. 1 confirmed the absence of a Jurassic section. All three wells penetrated sedimentary sequences ranging in age from Quaternary to Triassic, based on their lithology and palaeontology. The presence of a very thick sequence (about 2440 m) of Tertiary marine sediments was established.

North Rankin No. 1 penetrated 1925 m of limestone, sandstone, and dolomite ranging in age from Quaternary to middle Eocene, and 345 m of middle Eocene to upper Paleocene claystone and marl. A very fine-grained sandstone at the base of the Palaeocene rested unconformably on the Cretaceous sediments which comprised 240 m of claystone, marl, and calcilutite. 847 m of Upper and Middle Triassic sandstone with interbedded claystone and thin coal horizons were penetrated to total depth.

In Rankin No. 1 the Cainozoic section was 7823 m thick and ranged in age from Pleistocene to middle Paleocene. The upper 1525 m consisted of calcarenite and the lower part consisted of calcilutite, calcisiltite, marl, and calcareous claystone. The middle Paleocene was unconformable on the Cretaceous, but the basal Tertiary sandstone encountered in North Rankin No. 1 was absent. The Cretaceous section comprised 376 m of claystone, marl, and calcilutite unconformable on a Triassic sequence (1248 m penetrated) of coarse-grained sandstone with interbedded claystone similar to that encountered in North Rankin No. 1.

Goodwyn No. 1 also penetrated a Cainozoic section ranging in age from Pleistocene to middle Paleocene (2311 m thick) and containing an upper calcarenite sequence (about 1495 m thick) and a lower sequence of calcisiltite, calcilutite, marl, and calcareous claystone. Again the basal sandstone encountered in North Rankin No. 1 was absent. The underlying Cretaceous (333 m thick) and Triassic (739 m thick) section was lithologically similar to that encountered in North Rankin and Goodwyn except that there was a much higher proportion of claystone in the Triassic.

The results of the drilling contributed to the understanding of the geology of the area in a number of ways. The drilling proved the existence of a major unconformity which eliminates the entire Jurassic. The base Tertiary unconformity which has been seen in earlier wells drilled in the Dampier Sub-basin and elsewhere on the Northwest Shelf was also present in all three wells. It eliminates the lower part of the middle Paleocene, the entire lower Paleocene, and probably the top part of the Cretaceous. There is also a base middle Eocene unconformity which cuts out part of the lower Eocene and probably the lower part of the middle Eocene. The lower Cretaceous section is very thin, only 5 m in North Rankin No. 1, 23 m of Goodwyn No. 1, and 41 m in Rankin No. 1, by comparison with about 427 m in Madeleine No. 1 (BMR file 69/2006). The drilling also established the presence of porous and permeable Middle to Upper Triassic sediments on the Rankin Trend and confirmed the existence of a major fault zone with a considerable downthrow to the southeast between the Rankin Trend and the Madeleine - Dampier Trend.

The gas/condensate discoveries were made in Upper Triassic reservoirs (Mungaroo Formation) and oil also was encountered in this section in Rankin No. 1. Oil was present in the Upper Cretaceous Toolonga Calcilitite and probably the basal Tertiary sediments in North Rankin No. 1, but permeability was low.

In five drill stem tests taken in North Rankin No. 1, gas flowed at a rate between 7.02 MMcfD and 11.42 MMcfD through  $\frac{1}{2}$ " bottom and  $\frac{3}{4}$ " top chokes accompanied by condensate at rates between 95.5 and 317 bpd. A drill stem test in the Toolonga Calcilitite flowed gas at the rate of 5.75 MMcfD plus a trace of oil. A net pay thickness of 1020 m of reservoir sandstone was proven in the Upper Triassic.

D.S.T. No. 1 produced gas at the rate of 10.91 MMcfD plus 1062 bpd of 34° A.P.I. gravity oil through a  $\frac{1}{2}$ " top and a  $\frac{5}{8}$ " bottom choke and D.S.T. No. 2 produced gas at a rate of 15.96 MMcfD plus 41 b/MMcfD of condensate from the Mungaroo Formation in Rankin No. 1.

Two drill stem tests of the Mungaroo Formation in Goodwyn No. 1 yielded gas at a rate of 11.4 and 7.6 MMcfD plus 43 and 45 b/MMcf of condensate respectively through  $\frac{3}{8}$ " bottom hole choke and  $\frac{5}{8}$ " and  $\frac{1}{2}$ " top hole chokes.

Three subsidized seismic surveys were completed offshore during 1971. See also section on Offshore North and Northwest Australia for reference to geophysical projects.

Two of the surveys, the Ronsard and the Bernier, were located in the offshore extension of the Gascoyne Sub-basin where geological control was limited to one well, Pendock I.D. No. 1 (BMR file 68/2020), at the northern end and one well, Gun Island No. 1 (BMR file 68/2015), to the south in the Abrolhos Trough of the Perth Basin.

The Ronsard survey was designed to detail two large anticlines in the northeastern part of the survey area (Pendock I.D. No. 1, about 70 km to the north, intersected a Devonian reef complex and it was thought that the structures under investigation might lie over the reef). The horizons mapped were: Horizon A - near base of Tertiary; Horizon B - near base of Cretaceous, and Horizon C - Palaeozoic (Devonian or Silurian). The quality of the data obtained from Horizon C, although poor, was better than that obtained in earlier surveys. Data from the West Carnarvon and the Gnarraloo marine seismic surveys (BMR files 66/11089 and 67/11158) were incorporated in the maps of Horizons A and B. The results indicated that the large simple anticlines, interpreted previously,

were in fact a large number of smaller fault controlled structures. The presence of a reef was not established.

The Bernier seismic survey was a much more extensive operation designed to provide regional reconnaissance coverage, and to delineate structures indicated by earlier surveys. The use of the Maxipulse system as an energy source was expected to give better results than had been obtained previously.

Thirty six potential structural hydrocarbon traps were delineated and the report contains a detailed discussion of each. One large anticline, considered to be of major importance was located at the southern end of the survey area where three horizons were mapped. Horizon A - ? base Lower Cretaceous unconformity; Horizon D - possible Mesozoic, and Horizon E - at or near basement. The large anticline was mapped on each horizon. A vertical closure of about 686 m over an area of about 130 km<sup>2</sup> was indicated on Horizon E.

The Rankin Trend marine seismic survey consisted of two projects, one on the Rankin Trend and one in the outer part of the Beagle Trough.

#### Project 71-Q, Rankin Trend

The project followed the drilling of North Rankin No. 1 and Rankin No. 1 and was designed to provide more detail on the structure of the section below the Cretaceous unconformity. Previous seismic work in the area had yielded generally poor quality results below this horizon. The project was expected to aid the planning of future drilling of the North Rankin structure.

The horizons mapped were: Horizon Tw-Lower Miocene; Horizon E-Middle Eocene; Horizon A-Upper Cretaceous, and Horizon Y-Lower Cretaceous/Upper Triassic. The drilling on the Rankin Trend provided well control for the identification of the upper two horizons. In earlier surveys Horizon-Tw was identified as 'Top Trealla Limestone' and Horizon E as 'Base Miocene'. Horizon A represents the Upper Cretaceous Toolonga Calcilutite. Horizon Y is close to the top of the Barrow Group at the Dampier No. 1 and Madeleine No. 1 wells drilled on the Madeleine-Dampier Trend, but related to the Upper Triassic sands at Rankin No. 1 and North Rankin No. 1 drilled on the Rankin Trend.

The survey confirmed the form of the Rankin and Goodwyn structures and indicated minor changes to the form of the North Rankin structure. Greater structural control was obtained on two other unnamed anomalies (71-9 and 71-10).

Project 71-Q Extension, outer Beagle Trough

The project was generally aimed at a closer investigation of previously mapped structures and in particular at provision of closer control on their seaward (i.e. northwest) flanks. The horizons mapped were: Horizon A-Upper Cretaceous Toolonga Calcilutite; Horizon Hw-approximate top Jurassic, and Horizon D-unidentified (Horizon D is a dip phantom and probably does not represent one particular geological horizon).

The isochron maps of the interval Hw-D show considerable thinning over the major structures. Further control was obtained on seven structures.

Cane River Nos 1 to 5 were drilled in the northeastern part of the basin to investigate the hydrocarbon potential of the Mesozoic section. In this area, Lower Cretaceous marine sediments are unconformable on older block faulted sediments and on Proterozoic metasediments. The basal Cretaceous unconformity has a gentle uniform dip to the northwest. Hydrocarbon shows from Cretaceous sediments have been reported in wells in the surrounding areas. Cane River No. 1, the only subsidized well in the group, was located 60 m south-southwest of Barrow Island. It penetrated: Quarternary Coastal Limestone (100 m); a carbonate sequence 31 m thick of probable Tertiary age; 150 m of Lower Cretaceous Gearle Siltstone; 76 m of Windalia Radiolarite; 104 m of Muderong Shale, and 21 m of Yanaloola Conglomerate. 280 m of generally fine-grained clastic sediments containing a late Lower Carboniferous spore assemblage were penetrated beneath the basal Cretaceous unconformity. No hydrocarbons were reported from any of the five wells, but in Cane River No. 1 potential reservoirs were present in the Lower Cretaceous and in the Lower Carboniferous sections. In all cases they were completely saturated with brackish water.

COOPER BASIN

The final report of the Tallalia No. 1 well (BMR file 70/305), the Coopers Creek Central seismic survey, the Yanpurra No. 1 well (BMR file 70/758), and the Tilparee seismic survey were released during 1971.

The first three operations were located in the part of the basin that straddles the South Australian and Queensland border. There are four major anticlines in this area trending in a northeasterly direction along the Gidgealpa Innamincka Structural Trend. They are from southwest to northeast; the Gidgealpa; Merrimelia; Packsaddle, and Innamincka Anticlines.

Tallalia No. 1 was drilled in Queensland in the Durham Downs 1:250 000 Sheet area. It was sited on a seismically defined anticlinal nose plunging west-southwest off the southern flank of the Innamicka Anticline. Seismic evidence indicated the Permian Gidgealpa Formation pinching out on the flanks of the structure. It was anticipated that the lower member and possibly the middle member of the formation would be encountered in the well.

A normal Eromanga Basin sequence was penetrated to the base of the Triassic Nappamerri Formation. The well encountered 789 m of Permian Gidgealpa Formation, the thickest drilled so far in the basin, and 103 m of Permian Merrimelia Formation to total depth. The Gidgealpa Formation penetrated was thought to be the lower member. There were good gas shows, but the permeability of the formation was low, and the gas was not commercially significant.

The Coopers Creek Central seismic survey was carried out in the Innamincka 1:250 000 Sheet area to provide seismic control in an area with very little previous coverage. Three horizons were mapped; Horizon C - the top of the Lower Cretaceous Transition Beds (i.e. top Hooray Sandstone on current nomenclature); Horizon P - the base of the Mesozoic, and the base of the Gidgealpa Formation. The contours on the last horizon were considered unreliable.

Two northeasterly-trending troughs were indicated with several small anticlines on the flanks. Two of these were drilled during the year: one by the unsubsidized Coonatie No. 1 well which struck oil and gas in the Permian Gidgealpa Formation, and the other by the subsidized well - Yanpurra No. 1 (BMR file 70/758).

Yanpurra No. 1 was sited on a northeasterly extension of the Packsaddle Anticline. The seismic interpretation indicated pinching out of the Permian over the structure. After penetrating a normal Eromanga Basin sequence the well encountered 174 m of Gidgealpa Formation, which was thinner than expected, 20 m of Merrimelia Formation, and 28 m of Devonian red-beds to total depth.

The Gidgealpa Formation intersected was identified by lithology and palynology with the upper and lower members. The section was tight with non-commercial shows of oil and gas. An oil-bearing basal sandstone was of particular interest.

The subsidized part of the Tilparee seismic survey was sited south of the other two seismic surveys and separated from them by an area excluded from subsidy because of its proximity to the Moomba and Roseneath gas fields. The greater part of the survey lay within this area.

The same horizons were mapped as in the Coopers Creek Central survey. An anticline<sub>2</sub> was indicated which could have closure over an area of about 60 km<sup>2</sup> at the base of the Gidgealpa Formation.

The Sandy Creek seismic survey was carried out in 1971 to provide additional control over one of the structures indicated in the Coopers Creek Central survey. Digital Vibroseis recording was used which resulted in a very great improvement in data quality over that obtained in the earlier survey using Geoflex and analogue recording. The horizons mapped were: C - top Hooray Sandstone; top of Permian, and base of Permian. All three horizons show a gentle northerly dip, a north trending nose and general thickening towards the north. The structure under investigation was not confirmed and further work was not recommended for the immediate future. It was pointed out however that the conclusions were based on time contours and could be altered by more accurate velocity information.

All other wells drilled in the basin during 1971 were unsubsidized. The status of each at the end of the year is shown in Table 1.

### EROMANGA BASIN

The results of the drilling of Belmore No. 1 well (BMR file 70/555) were released during the year. It was sited in the Maneroo 1:250 000 Sheet area Queensland as a crestal test of a large closed anticline delineated by the Thomson River seismic survey. The structure trends northeasterly and has closure over an area of about 26 km x 6 km. The northwestern flank is truncated by the Thomson River Fault with a downthrow to the west of about 600 m.

The well penetrated Lower Cretaceous sediments (Allaru Mudstone, Toolebuc Limestone, Wallumbilla Formation) to 523 m, Lower Cretaceous to Jurassic sediments (Hooray Sandstone, Westbourne Formation, Adori Sandstone, Birkhead Formation) to 926 m, Lower Jurassic Hutton Sandstone to 1051 m, and ?Palaeozoic sediments to total depth.

The Hooray, Adori, and Hutton Sandstones had good porosity and permeability but were freshwater flushed. There were minor indications of hydrocarbons in the Adori Sandstone.

The Williams Creek seismic survey was carried out in the northern Eromanga Basin to the east of the Diamantina River, about 65 km southwest of Winton, during 1971. The main structures are the northeast trending Cork Fault and the related, subparallel, Wetherby and Holberton Structures. The latter two are faults at depth, but probably only monoclines at the surface. The Cork Fault is downthrown about 305 m to the northwest where up to 600 m of Triassic and/or Permian sediments were indicated by an earlier seismic survey (BMR file 67/11198). This survey and an earlier one (BMR file 66/11105) confirmed that Jurassic sediments were draped in a monoclinal fold over a probable fault (the Cork Fault) in older sediments. The Williams Creek survey was carried out to investigate the thickness of the Permian/Triassic(?) sequence and to detail possible structural traps along the upthrown side of the Cork Fault. Three horizons were mapped. The shallowest was identified as the top of the Lower Cretaceous Transition Beds (i.e. top of the Hooray Sandstone on current nomenclature\*). The underlying horizons were tentatively identified as basal Jurassic and basal Permian. The upper horizon was a reliable event continuous over the whole area. The basal Jurassic horizon varies in character and reliability and the possibility of mild pre-Jurassic erosion was indicated. The basal Permian horizon, although generally based on a strong reliable event, was also variable in character. The structure contour maps and the isopach map between the two lower horizons delineated a broad northeast trending anticline on the upthrown side of the Cork Fault. Many small culminations occur along the crest of the large structure. The Permian/Triassic(?) section is about 90-150 m thick and the top of the culmination is about 110 m below surface. Drilling was recommended.

### EUCLA BASIN

The results of the Offshore Eyre seismic survey were released in 1971. It was a follow-up of the Twilight Cove marine seismic survey (BMR file 70/440) which indicated the existence of two north-east-trending channels in the basement containing about 2200 m of ?Permian or pre-Permian sediments. The Offshore Eyre seismic survey was carried out shorewards of the earlier survey, as close to the shoreline as possible, in order to determine the likelihood of the channels extending onshore so that a stratigraphic test well could be drilled. It comprised a single east-west traverse, and only fair to poor quality data

\* Exon, N.F., 1966 - Revised Jurassic to Lower Cretaceous stratigraphy in the south-east Eromanga Basin, Queensland.

were obtained. The strongest and most persistent reflection came from a very irregular surface interpreted as basement. The two channels were again indicated, one about 8 km wide, and a smaller one to be east of it. They contain an estimated maximum thickness of 2000 m of ?Permian or pre-Permian sediments, overlain unconformably by about 1000 m of sediment, inferred from well data onshore to be of Cretaceous age, overlain unconformably by Lower Tertiary. Outside the channels this section overlies basement.

### GIPPSLAND BASIN

The final report of the Bemm River and Sailfish seismic surveys were released in 1971.

The Bemm River survey (BMR file 70/768) was an onshore survey consisting of a single refraction line along the beach between Sydenham Inlet and Petrel Point in the Mallacoota 1:250 000 Sheet area. It was designed to test a hypothesis, based on gravity interpretation, that a trough of Tertiary sediments exists immediately west of Timboon Inlet. However, the results indicated only a shallow (180 m) Tertiary section. Three other refractors tentatively identified as Ordovician sediments, Ordovician metamorphics, and Devonian granite were recorded below the Tertiary. The presence of Cretaceous sediments was considered unlikely.

The Sailfish seismic survey (BMR file 70/884) was carried out offshore in the eastern part of the basin about 80 km northeast of Flinders Island. Previous interpretation of marine and airborne magnetic data indicated two basement highs; a northerly one which rises to about 1200 m below sea level, and one farther south (the Sailfish structure) which rises to about 600 m below sea level. The two highs were separated by a trough with estimated depth to magnetic basement of about 2400 m. Seismic data has confirmed the general basement structure and indicated about 75 m of closure on the Sailfish Anticline but with depth to basement of about 1800 m below sea level. Reef structures were postulated in association with the northern high. The Sailfish survey was carried out to detail the closure on the Sailfish Anticline and investigate the possible reef structures using a close-grid reflector program.

The results modified the earlier picture in that they revealed a large possible reef complex in conjunction with isolated bioherms at about 1500 m below sea level in water depths of about 60-110 m. The three

horizons mapped were; Horizon A - within the Miocene, Horizon B - near the base of the Miocene, and Horizon C - the base of the Oligocene.

Three drill sites were recommended, one of which was tested by the subsidized Sailfish No. 1 well. The drilling proved that the seismic anomaly was due to the presence of mafic pyroclastic rocks (180 m thick) and there were no indications of hydrocarbons. Hydrocarbon shows were reported in the unsubsidized offshore Flying Fish No. 1 well in rocks correlated with the Eocene Latrobe Valley Coal Measures immediately under the unconformity with the Oligocene Lakes Entrance Formation.

### LAKE FROME EMBAYMENT (of Eromanga Basin)

The results of the Frome Downs seismic and gravity survey (BMR file 69/3071) were released during 1971. An horizon interpreted as the top of the Cambrian Wirrealpa Limestone was mapped over most of the survey area. A shallower horizon, thought to be the Mesozoic/Palaeozoic unconformity, was mapped in the northern and central part of the area, becoming too shallow to map in the south.

The Wirrealpa Limestone dips gently northwards in the north of the area, the dip direction changing to westerly farther south. There was very little evidence of faulting or folding in the Cambrian section and no large anticlines were located.

The Mesozoic sediments (Eromanga Basin) lie in a northerly trending depression which deepens northwards from about 60 m to about 1000 m below sea level. There was good correlation between the Bouguer anomalies and the major structural features outlined by the seismic survey. There was no evidence of diapiric structures.

### LAURA BASIN

Final reports for Breeza Plains No. 1 and Lakefield No. 1 were released during 1971.

The Breeza Plains seismic survey (BMR file 69/3059) and earlier geophysical work had delineated a northerly-trending anticline on the western side of the Mesozoic Laura Basin. The wells tested two closed culminations along this structure.

It was expected that porous and permeable sandstone of the Jurassic Dalrymple and Cretaceous Battle Camp Formations would be overlain by Cretaceous marine shale and Cainozoic sediments. Basement was expected to be at about 700 m.

Breeza Plains No. 1 penetrated 79 m of Cainozoic sand and gravel, 201 m of Cretaceous shale tentatively subdivided into Wolena Claystone (60 m thick) and Battle Camp Formation shale (141 m thick), 212 m of Battle Camp Formation sandstone, and 432 m of Jurassic Dalrymple Formation. The Mesozoic section rests unconformably on clastic sediments of probable Permian age (813 m thick) which constitute economic basement.

A similar stratigraphic sequence was encountered in Lakefield No. 1 but the Mesozoic sediments rest with angular unconformity on (?) Permian granite.

The sediments had higher average velocities than anticipated from the seismic work and the depth to basement was consequently greater than expected i.e. 906 m in Breeza Plains No. 1 and 890 m in Lakefield No. 1.

There was no indication of hydrocarbons. Sandstone units with good reservoir potential were encountered in the Dalrymple and Battle Camp Formations but they proved to be water-bearing.

### NGALIA BASIN

The results of the Ngalia Basin 2 gravity survey (BMR file 70 704) were released in 1971. The survey was designed to extend regional gravity coverage of the area - the results to be integrated with those from earlier geophysical work.

The interpreted results provided a clearer picture of the general structure than previously obtained. The residual anomaly map showed four east-west structural trends interpreted as being due to faulting, or a combination of faulting and basement ridges.

Four fairly large gravity highs were mapped and recommended for further investigation in addition to numerous small gravity anomalies.

The Ngalia Basin seismic survey was carried out in the western part of the basin in 1971 to investigate seismic, gravity, and magnetic anomalies indicated by earlier geophysical work.

The data quality was fair except in faulted zones. Two horizons were mapped. They were: Horizon A - base of Carboniferous Mount Eclipse Sandstone, and Horizon B - top of Proterozoic Vaughan Springs Quartzite (acoustic basement). The survey confirmed the general picture obtained in other surveys and indicated a number of closures associated with two east-southeast trending thrust-fault zones.

### OTWAY BASIN

In 1971 the results of the McArthur Portland seismic survey (BMR file 69/3080) and the Portland - Geelong aeromagnetic survey (BMR file 70/373) were released. Three seismic surveys and a gravity survey were completed during the year, and one seismic survey was in progress at the end of the year.

The McArthur Portland seismic survey and the Portland - Geelong aeromagnetic survey were carried out in the Otway Basin in Victoria - the first survey being entirely onshore, and the aeromagnetic extending offshore.

The seismic survey covered two areas: Braxholme-Hawkesdale and Port Campbell-Eumeralla.

The first area is characterized by complex faulting. The fault trend is generally northwest and the regional dip to the south. Three horizons were mapped: basement; Cretaceous Eumeralla Unit 2, and Cretaceous Pretty Hill Sandstone. Six fault-bounded basement highs were mapped. Further work would be needed to prove closure.

Poor quality data and the prevalence of faulting detracted from the value of the results in the second area. Four horizons were mapped, interpreted as: Horizon A - Tertiary Heytesbury Group; Horizon B - Tertiary/Upper Cretaceous unconformity at the base of the Wangerrip Group; Horizon C - top of the Otway Group, and Horizon D - ?basement. The Port Campbell anticline was the only structure of interest mapped. This has previously been drilled without success by Port Campbell Nos 3 and 4 (BMR file 64/4063 - No. 4).

The aeromagnetic survey distinguished three significantly different anomaly patterns. The first is a zone of narrow intense anomalies in the north and northwest of the area due to outcropping or near-surface Pliocene to Recent volcanics. The second consists of wide relatively large anomalies arising from metasediments of the Palaeozoic basement, which was shown to deepen southwards to a maximum depth of 3900 m in the western half of the area. Offshore extension of the Dartmoor Ridge, the Tyrendarra Embayment, and the Colac Trough was indicated in addition to a trough southwest of Port Phillip Bay. The third zone consists of anomalies of medium amplitude which arise from an unidentified magnetic marker probably at the top of the Mesozoic. These are mainly in the south and southeast. A gentle dip to the southwest and a maximum depth of 2010 m are indicated.

The Nelson - Koroit seismic survey was carried out in two separate areas referred to as the Nelson, a small area lying near the South Australia/Victoria border in the Gambier Sub-basin, and the Koroit, a large area to the east covering part of the Tyrendarra Embayment and the Warrnambool High. The objectives were to provide detailed seismic control on potentially prospective structures indicated by earlier seismic work i.e. the Port Fairy - Nelson seismic survey (BMR file 66/11062), the Hawkesdale seismic survey (BMR 68/3053), and the MacArthur-Portland seismic survey (see above) and to extend regional reconnaissance coverage. Two horizons, B and G, within the Upper Cretaceous Sherbrook Group were mapped in the Nelson area. Closure was not proved on the anticline previously indicated by the Port Fairy - Nelson seismic survey. Two horizons, identified as the top of the Lower Cretaceous Eumeralla Formation and basement, were mapped in the Koroit area. The maps show that the sedimentary section thickens rapidly towards the coast with a steep regional dip to the south and southeast. Useful additional control was obtained in the area south and southeast of Hawkesdale and over the Pretty Hills structure on which Pretty Hills No. 1 was drilled (BMR file 62/1115). Complex faulting was indicated in the area between Koroit and Hawkesdale.

The Colac - Geelong gravity survey was carried out in the eastern part of the Otway Basin with ties to the eastern end of the Terang - Portland gravity survey (BMR file 69/3054). The same area was covered by the Portland - Geelong aeromagnetic survey. The program was designed to delineate basement structure as a guide for future seismic work. The regional gravity picture resulting from the survey was discussed with reference to a Bouguer anomaly map which included the results of the eastern part of the Terang - Portland survey. The regional trends in the Colac - Geelong area are predominantly northeasterly or east-northeasterly

in contrast to the predominantly northwest trends in the central and western part of the basin. A broad gravity minimum, considered to represent the eastern part of the Port Campbell Embayment, overlies the survey area and a north trending gravity high (Stoneyford Maximum Zone) may reflect a basement high separating it from the central part of the embayment. The survey area is bounded on the south by the northeast trending Otway Ridge. A major regional fault zone with down-throw to the north of about 1800 m is interpreted along the northwest flank of the Otway Ridge. A maximum sedimentary thickness of about 3500 m is indicated southeast of the Colac - Gellibrand area on a basement contour map (prepared by computer analysis).

The Warrnambool - Pomborneit seismic survey covered the eastern part of the Warrnambool High and the Port Campbell Embayment. The survey area can be divided into a coastal strip, where depth to the Lower Cretaceous Pretty Hills Sandstone was estimated to range from 2450 m to 3650 m and the overlying Upper Cretaceous Sherbrook Group is well developed, and an area to the north, where the Sherbrook Group has wedged out and depth to the Pretty Hill Sandstone was estimated to be between 1200 m and 2450 m. Previous drilling in the area (e.g. Flaxmans No. 1, BMR file 62/1074) indicated the existence of potential hydrocarbon reservoirs in the Pretty Hill Sandstone and the Sherbrook Group and gravity and seismic work the possibility of promising structural traps. The quality of the earlier seismic data was too poor for the structure to be reliably defined. Good quality data was obtained with both dynamite and Vibroseis energy sources during the Warrnambool - Pomborneit survey, although Vibroseis was superior to all levels. Three horizons were mapped: basement; unconformity at base of Sherbrook Formation, and unconformity at base of Paleocene Wangerrip Group. The basement contours indicate a complex fault pattern with three main trends - southeast, east, and northeast. There was less evidence of faulting on the two shallower horizons. Two small closed anticlines were mapped on the upper horizon. An isopach map of the Sherbrook Group, i.e. between the base of the Wangerrip Group and the base of the Sherbrook Group, showed that the sediments wedge out along an easterly trending zero isopach in the north of the basin. Seven northeast trending basement highs were interpreted on the basement horizon; two of which may warrant future seismic investigation, using the Vibroseis system and shorter spreads to improve the quality of the data in the vicinity of faults.

The Otway 071A seismic survey was carried out in the western end of the basin in South Australia, in an area extending eastwards from the coast at Beachport, to approximately 39 km north of Millicent. The objectives of the survey were to provide good seismic data over the Diamond Swamp gravity and magnetic anomaly and additional seismic

data over two other gravity and magnetic anomalies, the Beachport and Mount Hope. Two horizons, the top of the Lower Cretaceous Pretty Hill Sandstone and the top of economic basement were mapped. The upper horizon was mapped on good to fair quality data, but the lower was mapped on poor to very poor quality data. The results were integrated with those from the 069A seismic survey (BMR file 69/3003). The survey showed that the Diamond Swamp, Beachport, and Mount Hope anomalies are fault controlled basement highs, and that the Pretty Hill Sandstone onlaps them.

### OXLEY BASIN

The results of the Bundalla seismic survey (BMR file 70/493) were released in 1971. It was carried out in the Tamworth 1:250 000 Sheet area and followed the Blackville seismic survey (BMR file 69/3007) as a further investigation of a gravity high. The Blackville survey indicated an anticlinal trend coincident with the gravity high, but the quality of the data was poor. Despite the use of the Thumper energy source in the Bundalla survey the data obtained were still of rather poor quality and considered reliable on only one horizon within the Upper Permian. The structure contour map of this horizon shows three anticlines, one of which corresponds to the gravity high.

### PEDIRKA BASIN

The results of the Mount Daer gravity survey (BMR file 70/487) were released in 1971. This detailed gravity survey was carried out on the western side of the Simpson Desert in the Eringa Sub-basin, which lies to the east of the Precambrian Musgrave Block. The Permian sediments of the Eringa Sub-basin are overlain by a relatively thin Eromanga Basin sequence, and underlain by lower Palaeozoic sediments of the Warburton Basin.

The Bouguer anomaly map contours show a general decrease in value to the south from the Andado Platform. The Mount Daer gravity low is the most prominent anomaly mapped. It extends from the southern edge of the survey area in a northeasterly direction to link with the Casuarina Trough on the eastern edge of the Andado Platform. Two positive residual anomalies - the Maryfields and Bottom Well highs - were mapped to the northwest of the Mount Daer low. The first one is coincident with a magnetic high. The depth to magnetic basement is estimated at about 4500 m. The second one has no magnetic counterpart and is interpreted as a Permian anticline of possible diapiric origin.

The three Corners seismic and gravity survey was carried out in the eastern Pedirka Basin in 1971. The survey aimed to provide semi-detailed gravity and seismic coverage of the area and in particular to define possible prospective structures indicated by earlier seismic work. The data obtained was of fairly good quality over the whole area. Three horizons were mapped: Horizon C - top of Lower Cretaceous Transition Beds (Hooray Sandstone on current nomenclature); Horizon P - top of Permian, and Horizon P1 - a unit within the Permian. The three horizons show a similar structural pattern. The major trends run northerly. The survey area is bounded on the east and west by fault controlled anticlines about 80 km apart, designated the East Border Anticline and the Border Anticline respectively. The area between contains narrow northerly-trending folds, on one of which (the Colson Anticline), structural closure in the Permian was estimated to be 60 m over 39 km<sup>2</sup>. The Permian sediments are 460 to 550 m thick. The isochron map C - P shows that sediments thin locally over the anticlines. The upper part of the Permian section thickens eastwards and the lower part appears to thin although further work will be necessary to confirm this. The East Border Anticline requires further definition. It appears to be the northern end of an anticline, more than 78 km long, on the eastern border of the permit area.

There is good correlation between the anticlines defined by the seismic work and the principal gravity maxima shown on the Bouguer anomaly map. The same general trends were also indicated on the compensated Bouguer anomaly map, on which the gravitational effect of sediments above the P horizon was removed, but the anomalies were weakened to varying degrees. The differences are attributed to basement structure. The gravity maxima overlying the Border Anticline and the Colson Anticline were considerably weakened, but the Crocker Gravity Maximum overlying the southern extension of the East Border Anticline remained a major anomaly suggesting that the basement is shallower on the eastern side of the survey area.

### PERTH BASIN

The results of seven geophysical and six drilling operations are summarized in this section.

The wells were drilled in the central and southern parts of the basin, five of them offshore. There were no significant hydrocarbon shows in the offshore wells but the onshore well, Walyering No. 1, was a gas discovery.

Sugarloaf No. 1 (BMR file 70/1020) the most southerly of the offshore wells, was sited 72 km northwest of Bunbury offshore in the Bunbury Trough. There has been extensive seismic surveying in the area, but the well provided the first stratigraphic control. It was a test of a closed anticline which developed during the Lower Cretaceous forming a ridge in the centre of the basin. The primary objectives were the Upper Jurassic Yarragadee and the Lower Jurassic Cockleshell Gully Formations which have produced hydrocarbons in wells drilled both offshore and onshore in the central part of the basin.

The well penetrated a Miocene carbonate section to 253 m underlain by 280 m of Upper Cretaceous Osborne Formation, 177 m of the Lower Cretaceous Leederville Sandstone Member, and 27 m of the Quinns Shale Member, both of the South Perth Formation, and 1536 m of Upper Jurassic Yarragadee Formation to total depth.

The section penetrated differed from that predicted in several ways. The Quinns Shale Member, identified by its electric log characteristics and fossils, was over 1200 m deeper than expected, and the sandstone beneath it was identified by its fauna as Upper Jurassic Yarragadee Formation and not the expected Cockleshell Gully Formation.

The remaining four offshore wells were sited in the central part of the basin to the west of Perth and Fremantle. They were drilled on seismically defined closed structures developed during major uplift in the Neocomian. After erosion a thick sequence of marine sediments was deposited over the irregular underlying topography. The primary targets were sandstone in the Lower Cretaceous part of the Yarragadee Formation below the Neocomian unconformity, and the basal sandstone of the South Perth Formation above it. The upper unit had good oil shows in Gage Roads No. 1 (BMR file 68/2039), drilled previously in the area, which proved non-commercial after production testing. Hydrocarbon shows were also reported from the lower unit.

Charlotte No. 1, Gage Roads No. 2, and Roe No. 1 all penetrated Tertiary sediments unconformably overlying part of the South Perth Formation: in Roe No. 1 only the top member, the Leederville Sandstone (257 m), was present; in Gage Roads No. 2 all of the formation was present (798 m thick) except the siltstone - shale unit which underlies the Leederville Sandstone; in Charlotte No. 1 the formation was 1037 m thick and contained all members. Gage Roads No. 2 reached total depth in the Upper Jurassic part of the Yarragadee Formation; the other two wells bottomed in the Lower Cretaceous part of the Yarragadee Formation.

Warnbo No. 1 also bottomed in the Upper Jurassic part of the Yarragadee Formation after penetrating a complete sequence of South Perth Formation (1048 m thick). Unlike the other wells it encountered correlatives of the Upper Cretaceous Gingin Chalk, Molecap Greensand, and Poison Hill Greensand for the first time in an offshore well. The Upper Cretaceous Osborne Formation, also penetrated for the first time offshore, was unconformable beneath these sediments, and a possible unconformity separated it from the underlying South Perth Formation.

The only hydrocarbons recorded were in Gage Roads No. 2, where there were non-commercial oil shows in the basal sandstone of the South Perth Formation.

Four seismic surveys were carried out in the Dandaragan Trough. The Walyering detail seismic survey (BMR file 70/717) was designed to confirm structural closure and seismic correlation before drilling Walyering No. 1. It followed earlier seismic work in the area which had outlined the Walyering Anticline - a north-northeast-trending faulted anticline in the northwest part of the trough.

A primary target in the area is the Lower Jurassic Cockleshell Gully Formation, which contains gas in commercial quantities in the Cattamarra Coal Measures Member in the Gingin area 61 km to the south-southeast. The coal measures contain sandstone, siltstone, shale, and coal deposited in continental and marginal environments.

Two horizons were mapped: Horizon A - within Upper Jurassic Yarragadee Formation, and Horizon B - Lower Jurassic, probably Cattamarra Coal Measures Member of the Cockleshell Gully Formation. The Walyering Anticline covers an area of about 3 km by 10 km. A vertical closure of about 305 m at a depth of about 2590 m was mapped on Horizon B, which Walyering No. 1 tested. The well penetrated the Lower Cretaceous to Upper Jurassic Yarragadee Formation to 2685 m, then the Middle Jurassic Cadda Formation (186 m thick), and reached total depth in the Cattamarra Coal Measures Member of the Cockleshell Gully Formation after penetrating it for 757 m. There were three hydrocarbon-bearing sandstone units in the coal measures. The upper unit gave an average production of 2.07 MMcfD of gas with 4 bbls/MMcf condensate and 9 bbls/MMcf of water on a ten day test. The middle unit gave an average production of 8.1 MMcfD of gas with 6.6 bbls condensate and 1.7 bbls of water per MMcf. No production data are available for the lower unit.

The Barragoon seismic survey was designed to provide regional reconnaissance control in the Dandaragan Trough, to investigate the northern extension of the Walyering anticlinal trend, and to test the hypothesis that the Cattamarra Coal Measures Member of the Lower

Jurassic Cockleshell Gully Formation may be present at drillable depths. The Gingin No. 1 gas discovery well lies within the survey area, which is bounded to the north by the Yardarino Gas Field.

The quality of the data ranged from good to very poor. The results were integrated with those from previous surveys, and the areas north and south of the Gingin subsidy exclusion circle were interpreted separately. The Cattamarra Coal Measures Member was mapped in both areas.

In addition, two horizons, one in the Cockleshell Gully Formation (the 'Donkey Creek') below the Cattamarra Coal Measures Member and the other within the Upper Jurassic Yarragadee Formation, were mapped in the northern area. The Upper Triassic Lesueur Sandstone and the Lower Cretaceous unconformity were mapped in the southern area. In the north seven fault-controlled anticlines were indicated along the east and west flanks of the Trough. A more complex structural picture is indicated in the south.

The West Walyering seismic survey was carried out to obtain more detailed structural control to the west, south, and north of the Walyering Anticline. The work to the north included about 13 km of experimental shooting to establish the most suitable methods for future work in that area. This experimental work was shot along one of the same lines shot during the Barragoon seismic survey. In general the quality of the data deteriorated towards the areas of Coastal Limestone in the west. The results were integrated with all the data from earlier surveys. Three horizons were mapped: A - within the Upper Jurassic Yarragadee Formation; B - Cattamarra Coal Measures Member of the Cockleshell Gully Formation, and C - the 'Donkey Creek' horizon of the Cockleshell Gully Formation. Horizons A and B were tied to the Walyering wells. The area is complexly faulted and all three maps show a similar structure - a graben containing the Walyering Anticline, separating the Beagle Ridge on the west from the Dandaragan Trough on the east. The graben is limited on the east by a series of faults downthrown to the west, and on the west by a series of faults downthrown to the east. Three fault controlled closures were mapped on the Walyering Anticline in addition to the one tested by Walyering Nos 1 & 2 and four others were mapped on the upthrown sides of the faults bounding the Walyering Graben. Another faulted anticline was mapped on poor quality data to the west of the graben on the east flank of the Beagle Ridge. The experimental work showed that a sixteen hole diamond shot pattern, with the sides of the diamond about 46 m long, seems the most suitable, although further comparison with a thirty six hole diamond pattern was recommended. A tapered geophone array of 76.2 m to 91.4 m overall length gave the best results.

The Moore River seismic survey was designed to check closure at the southern ends of two anticlines indicated by the Moore River - Lancelin seismic survey (70/194). Poor quality reflection data have been previously obtained in this area due largely to the presence of the Pleistocene Coastal Limestone. The data in this survey were also very poor and added virtually nothing to the control over the two anticlines obtained by the previous survey.

The Preston detail seismic survey (BMR file 70/858) was a follow-up of the Harvey D-1 survey (BMR file 69/3074), which delineated the northwest trending Harvey Ridge separating the Dandaragan and Bunbury Troughs and indicated several promising fault-controlled structural highs on the ridge. The Preston survey was designed to prove closure on two of the structures located to the north and south of Lake Preston. The shallow-water traverses on Lake Preston and Lake Clifden were an attempt to obtain data better in quality than that previously obtained on land.

The resulting data varied in quality, the better results coming from the water and beach traverses. The three horizons mapped were Lower Jurassic (top of Eneabba Member of the Cockleshell Gully Formation), Upper Triassic (near top of Lesueur Sandstone), and an horizon near the top of the Permian. The data on the top horizon was considered fairly reliable, but the reflections from the lower two were intermittent. The maps indicated complex faulting, thinning of the Jurassic and Triassic over the Harvey Ridge, and four fault-controlled structural highs along the ridge. Two structures were indicated to the south and southeast of Lake Preston, with about 600 m and 300 m of vertical closure respectively on the Upper Triassic. In the north of the survey area there were two highs that together formed one large structure with a vertical closure of up to 1200 m over an area 16 km by 30 km in the Upper Triassic. Top of the Permian was estimated at 2400 m below sea level.

The Preston D-1 detail seismic survey was programmed to provide further control on the Harvey Ridge and on the Myalup structure at the southern end of Lake Preston. The Myalup structure was previously called the Lake Preston Anomaly. The resulting poor quality data was integrated with that from earlier work, and the same three horizons were mapped. The Myalup Structure was shown to be a simple anticline closed over about 8 km<sup>2</sup> at the Permian horizon and limited by faults on the north, east, and west. East-west closure was confirmed and the structure was recommended as a well location for a deep test of the Harvey Ridge. Isochron maps of the intervals between the mapped horizons indicate only slight thinning over the ridge. The major structural growth is thought to have occurred in the Upper Permian and the early Triassic.

The Geelvink Channel D-1 seismic survey located near Geraldton was the only geophysical work carried out offshore in 1971. The nearest well to the survey area, Gun Island No. 1 (BMR file 68/2015), established the presence of a thick Quaternary to Lower Jurassic sedimentary sequence and the survey was designed to detail two anticlines located by the Geelvink Channel seismic survey (BMR file 70/241). The three horizons mapped were tentatively identified as: A - Upper Jurassic; C - Middle Jurassic, and D - Lower Jurassic. Closure, dependent on a fault across the northeast, was proved on only one of the anticlines. Plans to drill this structure (the Zeewyk) have been announced.

### POLDA BASIN

The Poldas Basin 2 marine seismic survey was designed to detail structure located by the Poldas Basin marine seismic survey (BMR file 70/163). The results of the two operations were integrated. The quality of the reflection data varied from poor to good and only one unidentified horizon - Horizon A just above a very irregular erosional surface - was sufficiently continuous to be mapped. The reflections from above Horizon A were mostly horizontal. The most prominent structure detailed was a large anticline in the eastern part of the Elliston Trough. The anticline has up to about 150 m of closure over an area of about 52 km<sup>2</sup> and the crest lies about 670 m below sea level. The northern and western flanks are probably faulted. Three smaller closed anticlines were detailed to the west of the major structure. Good quality refraction data showed a velocity of about 4570 m/sec at Horizon A level and high velocities (5490 and 6700 m/sec) within the sedimentary sequence beneath. Reconnaissance traversing to the west of the Elliston Trough confirmed that basement is generally shallow. A maximum thickness of about 900 m of sediments was indicated in the region of 130°00'E latitude. Elsewhere basement was generally less than 300 m below sea level.

### SURAT BASIN

Four subsidized and fourteen unsubsidized wells were drilled during 1971.

The available information for the unsubsidized wells is summarized in Table 1. Kincora No. 6, a step-out well on the Kincora anticline north of the Alton Field, was completed as a triple zone gas well with a total flow of 6 MMcfD.

The four subsidized wells were drilled as one subsidized operation - the Foyleview Project. They were located on the Walgett Shelf about 96 km southwest of Roma and 100 km northwest of St George. The siting of the wells was based mainly on the results of the Maranoa seismic survey (BMR file 67/1152). Possible hydrocarbon traps were predicted in Jurassic sandstone draped over, or wedging out on basement highs. The wells all penetrated the same stratigraphic sequence, comprising Cretaceous Wallumbilla Formation and Mooga Sandstone (426 m and 86 m thick), Jurassic Orallo Formation (196 m thick), an undifferentiated Jurassic sequence correlated with the Gabberamunda, Westborne, and Springbok Formations (231 m thick), Jurassic Walloon Formation (73 m thick), and Hutton Sandstone (98 m thick), and reached total depth in metamorphosed rocks of the Devonian Timbury Hills Formation. Thicknesses given are for the Neabul Creek No. 1 well. Although there were no hydrocarbon shows the operation provided closely spaced stratigraphic information in an area of sparse well control.

### SYDNEY BASIN

The results of three 1970 seismic surveys, two offshore and one onshore, were released in 1971.

The South Broken Bay marine seismic survey (70/803) was designed to provide further information on structures indicated by the Broken Bay marine seismic survey (69/3070). Good quality data were obtained from horizons interpreted as within the Tertiary and Triassic sequence, but reflection quality was very poor from deeper, i.e. Permian, levels. A contour map was presented on an horizon interpreted as the approximate base of the Kulnura Marine Tongue (within the Permian Illawarra Coal Measures). The contours indicated closure on the northern and southern end of a structure named the Sealion Anticline, which was investigated further by the Sealion marine seismic survey carried out during 1971.

The Charlotte Head seismic survey (70/828) was carried out offshore in a previously unexplored area between Wallabi Point in the north and Port Stephens in the south. Permian rocks of the northern Sydney basin and Carboniferous rocks of the New England area with Permian outliers (Myall Syncline, Stroud-Gloucester Trough) crop out in the adjacent onshore area.

Three unidentified horizons were mapped, plus basement. Basement was shallow near the shore (maximum 300 m), deepening to about 1200 m on the continental shelf 32 km offshore, and then more rapidly on the continental slope. Low amplitude southeasterly-trending folds including a possible offshore extension of the Myall Syncline were indicated in the overlying sedimentary sequence. The petroleum prospects of this area are downgraded by this indication of a thin sedimentary sequence on the continental shelf in water depths suitable for drilling.

The onshore Stockton seismic survey (BMR file 70/482) covered part of the northeastern corner of the Sydney Basin, about 20 km northwest of Newcastle. It was designed to investigate the structure of the Permian marine sediments and the Greta Coal Measures which separates them in this area.

The quality of the reflection data obtained varied from fair to good, and one horizon, interpreted on the basis of a tie to East Maitland No. 1 well as the top of the Greta Coal Measures was mapped. The horizon is shown to deepen generally to the south and west and a closed anticline is indicated in the centre of the survey area with its culmination at about 600 m below sea level and with a vertical closure of about 60 m.

The Sealion marine seismic survey carried out in 1971 was a follow up of the Broken Bay and South Broken Bay surveys and the results were interpreted in conjunction with the earlier work. The quality of the data obtained in the Sealion Survey was an improvement over that recorded in the earlier operations although still only poor to fair. Two horizons were mapped. One was interpreted as an intra-Permian event (Horizon H), and the other as an event at or near the base of the Permian (Horizon L). Phantom correlation was necessary on both horizons because of the lack of continuity of the reflection data. Detailed structural control was not achieved. A north-trending anticline with two separate culminations, Sealion and Sealion North was outlined. The first culmination lies about 5.6 km offshore from Sydney and the second lies about 12.9 km offshore from Broken Bay. The sedimentary rocks lying between horizons H and L thin over the anticline. Exploratory drilling of either of the two culminations was recommended before any further seismic work is undertaken.

#### OFFSHORE NORTH AND NORTHWEST AUSTRALIA

The Tryal-Evans (BMR file 70/245) marine seismic survey consisted of twelve separate projects carried out in an area extending from Barrow Island in the south to the northeastern offshore extension of the Bonaparte Gulf Basin in the north covering parts of all the permit

areas held by the group for which B.O.C. of Australia Ltd is the operator. The survey was designed to provide detailed coverage in areas previously surveyed, and reconnaissance coverage of areas with sparse or no previous coverage.

Two projects were carried out within the Dampier Sub-basin and on its northwest flank on the Rankin Platform. Two projects were located in the offshore Canning Basin marginal to the Pilbara Block, and one in the offshore extension of the Fitzroy Trough. There were three projects in the Bonaparte Gulf Basin, and four in the area of the Leveque Platform (offshore Canning Basin) and the Browse Basin.

The report provides a detailed discussion of the results of each project which are too numerous to be fully summarized here. Only the horizons mapped and the broader conclusions will be given.

### Carnarvon Basin

#### Dampier Sub-basin: Project 70-A

The project was carried out to the south and southwest of Legendre No. 1 (BMR file 68/2016) which, together with Madeleine No. 1 (BMR file 69/2006) and Dampier No. 1 (BMR file 68/2052), provided stratigraphic control for the project. The horizons mapped were interpreted as: Horizon A - top of the Upper Cretaceous Toolonga Calcilutite; Horizon Y - approximate top of the Lower Cretaceous Barrow Formation; Horizon Hw - top of Jurassic unconformity; Horizon R, R1 - within the Middle Jurassic (interpreted across a fault), and two deeper unidentified horizons. The isochron map A-Y shows thinning near the major structural anomalies indicating structural growth in the Upper Cretaceous.

#### Rankin Bank: Project 70-L

Three horizons were mapped, interpreted as: Horizon Tw - top of the Miocene Trealla Limestone, Horizon E - base of the Miocene, and Horizon A - top of the Toolonga Calcilutite. The only significant structural features indicated were on Horizon A, suggesting that there has been little or no structural growth since the Upper Cretaceous.

### Offshore Canning Basin

#### Pilbara Block Margin - Projects 70-B and 70-C

Legendre No. 1 provides the closest stratigraphic control for the projects.

Project 70-B was carried out at the southern end of the offshore Canning Basin in the vicinity of the De Grey Nose - a structurally complex area where prospective hydrocarbon traps are predominantly fault closures. The horizons mapped were interpreted as: Horizon A - top of Toolonga Calcilutite, Horizon Hw - top of the Jurassic unconformity (tentative in some areas), and Horizon D - unidentified. The isochron map A - Hw indicates structural growth during post-unconformity deposition, and also that Horizon A is very close to the unconformity over a large part of the survey area.

Project 70-C was carried out farther north where structural deformation has been less intense, and faulting is not the most significant feature in the structural closures. Generally speaking the project area contains a thick sedimentary sequence deposited in a depression between the Broome Platform and the North Turtle Arch (not named at time of survey). Three horizons were mapped: Horizon A - identified as an extension of Horizon A in Project 70-B; Horizon B - unidentified and not tied to 70-B, and Horizon D - also unidentified and not tied to 70-B. The isochron map B-D indicates substantial growth of the major structural features during deposition.

#### Offshore Fitzroy Graben, Project 70-D

The project was designed to provide closer control on an anticline (Anomaly 70-14) mapped in 1969 and a structurally high trend north of this, and also to provide information on the structures that exist below the major unconformity (interpreted as top of the Palaeozoic). The horizons mapped were: Horizon I - considered to be the possible equivalent of Horizon A in Project 70-C; Horizon S - top of the Palaeozoic, and two deeper unidentified horizons F and B. The isochron map I-S indicates post-unconformity westward tilting. It also indicates that there was movement of the structures being investigated during the Mesozoic. On Anomaly 70-14 closure was confirmed on Horizons I and S on the upthrown side of a fault cutting a westward plunging nose. Below the unconformity, there is a zone of large scale structural deformation, and it is considered that Anomaly 70-14 was produced during renewed movement on these older structures during the Mesozoic.

#### Leveque Platform - Projects 70-E and 70-F

Project 70-E investigated the structure along the offshore margin of the Leveque Platform in addition to detailing a seismic anomaly - Anomaly 69-5 mapped previously. Three horizons were mapped: Horizon I - extended from Project 70-D and tentatively identified as Upper Cretaceous; Horizon B - not identified, and Horizon D, D1 - representing the top of

seismic basement. Horizon D was carried from the Leveque Platform and extends over most of the project area. It appears to deepen rapidly to the northeast, where D1, a shallower event, was mapped.

The isochron maps I-B and B-D, D1 show northwestward thickening and local thinning over some of the folds. The Anomaly 69-5 renamed 70-15 was detailed sufficiently for a well site to be established.

Project 70-F was carried out on the Leveque Platform, primarily to investigate a series of palaeotopographic highs on a reflecting horizon which constituted seismic basement i.e. Horizon D, which extends from Project 70-E. Faulting and erosion have produced a very irregular surface at this level. In addition a shallower horizon, Horizon B, was mapped which also tied to Project 70-E. Although the maps indicated draping of sediments over the basement highs, no significant closure was mapped, and there was no clear evidence of reefs.

#### Browse Basin Margin, Project 70-G

The project was carried out south of the Londonderry Arch, near the northwest edge of the Kimberley Block.

The horizons mapped were: Horizon D, which again constituted seismic basement, and two shallower unidentified horizons I 1 I 0, and B 1. The intermediate horizon B 1 appears to be absent at the eastern side of the project area probably due to onlapping. Horizon D presents an irregularly eroded surface broken by numerous small, and several large faults.

#### Browse Basin, Project 70-K

The project covered a large area which included the Scott Reef structure. The horizons mapped in the southern part of the project area were tied to Project 70-E, and those mapped in previous surveys around Scott Reef were continued in the northern part.

The horizons extended from Project 70-E were: Horizon I - Upper Cretaceous, and the unidentified horizons B and D1. Horizon I was the only one based on good quality data. A northeast-plunging nose was seen on all the horizons and growth of this structure indicated on the B-D1 isochron map. The lowest of the three horizons mapped in the rest of the project area was shown to lie slightly below the level of Horizon I when projected into Project 70-E. The only significant closure mapped was on Scott Reef. The isochron maps show it to be a complex structure. Progressive subsidence of the outer edge of the basin margin has resulted in a easterly migration of the anticlinal axis.

Bonaparte Gulf Basin, Projects 70-H, 70-I, and 70-J

Project 70-H was carried out in the northeast part of the offshore Bonaparte Gulf Basin with the primary object of investigating a large anticline - the Calder Anomaly - indicated by earlier seismic surveys. Three horizons were mapped: Horizon S - ?near the base of the Tertiary, Horizon A - unidentified poor reflector, Horizon B - unidentified, but the strongest and deepest reflecting horizon in the area. Structural growth is indicated on the S-B isochron map. On the anticline known as the Calder Anomaly (Anomaly 70-18), closure was established on all three horizons.

Project 70-I adjoins Project 70-H on its northwestern side. It was carried out to provide control on a large anticline revealed by earlier surveys. The horizons mapped were: Horizon S - ? near the base of the Tertiary, and extended from Project 70-H, Horizon A - believed to be within the Upper Cretaceous and also extended from Project 70-H, Horizon B - ?Lower Cretaceous, and the most prominent reflector in the area, and Horizon C - ? near the top of the Permian. The isochron map S-A shows a thin sedimentary sequence in the northwest sector from where it thickens considerably in a southeasterly direction. The isochron map A-B also shows thickening of the sediments in a southeasterly direction across the project area. On the anticline under investigation, closure was mapped on each horizon. The anticline is faulted on the pre-Tertiary horizons. The most prominent fault parallels the northern flank.

Project 70-J was carried out in the northern part of the Bonaparte Gulf Basin, on the eastern side of the Cartier Trough. Good reflection data were obtained on three horizons A, B, and C, which were mapped but not identified. Horizon B appears to represent an unconformity. There is local truncation of deeper horizons against it and overlapping of shallower horizons. The isochron map A-B shows a southeasterly (basinward) thickening, and that for B-C a westward thickening. The project provided additional control on two anticlines indicated by previous seismic work.

The Trimouille-Dillon marine seismic survey which followed the Tryal Evans Survey also covered an extensive area of the northwest continental shelf and comprised eleven separate projects. About two thirds of the work was concerned with the evaluation and detailing of structures indicated by previous surveys, and the remainder, with reconnaissance coverage of areas with little or no previous coverage. Reconnaissance work was carried out along the northwest side of the Rankin Platform and along the outer continental shelf from the Rankin Platform to Scott Reef. Detailed work was done on the Rankin, North Rankin, and Angel structures in the Dampier Sub-basin, and on possible structural traps around the margin of

the Leveque Platform and the De Grey Nose, in the outer part of the Beagle Trough, and in the Browse Basin. A reconnaissance line tied to Sahul Shoals No. 1 well investigated the structure of the Sahul Ridge in the Bonaparte Gulf Basin.

The results of the survey contributed to the drilling of North Rank n No. 1, Rankin No. 1, De Grey No. 1, Angel No. 1, and Goodwin No. 1. The horizons mapped and the broader conclusions will be given for each project.

### Canning Basin

#### Offshore Broome Swell and Jurgurra Terrace, Project 71-A

The project consisted of the reprocessing of 908.5 km of data recorded in 1968 with the object of improving the quality of data from deeper levels. Three horizons were mapped, interpreted as: Horizon A - top Jurassic unconformity, Horizon T - ?Lower Jurassic unconformity, Horizon Ze - ? base Permian unconformity. Horizon A is interpreted as a near Tithonian unconformity carried from Lacepede No. 1A. This is at variance with the well completion report (see section on Canning Basin) in which an unconformity was not interpreted at this level. The map of this horizon shows a regional westward tilt, but little or no relief. Horizon T was also tied to Lacepede No. 1A and represents the major unconformity near the top of the Permian. Horizon Ze is highly faulted over most of the project area, particularly on the flank of the Fitzroy Trough. Although the horizon was related to the base of the Grant Formation in the onshore Canning Basin well Samphire Marsh No. 1 (BMR file 62/1002), it was actually phantomned over much of the project area. The maps showed Permian highs along the axis of the Jurgurra Terrace, but there was no clear indication of Devonian reefs. The isochron map H-T shows the area to have been relatively stable during this period of deposition, and that for T-Ze marked thinning over the Permian highs.

### Carnarvon Basin

#### Rankin Bank - Angel, Preston, Project 71-B

Project 71-B was carried out over the Rankin Bank (Rank n Trend) with the primary object of confirming and detailing two previously discovered structures - North Rankin and Angel (Anomalies 70-6 and 70-3, Tryal-Evans seismic survey). The horizons mapped were: Horizon E - base Miocene; Horizon A - top Upper Cretaceous Toolonga Calcilutite or equivalent, and Horizon Y - approximate top of the Lower Cretaceous Barrow Formation. A regional westerly dip is shown on the upper two horizons. Large-scale

structural movement is indicated on Horizon A, mainly on the Rankin and Madeleine - Dampier Trends. Horizon Y is an extension of the Y horizon mapped in the Tryal-Evans Project 70-A. It represents the top of the productive sand unit i.e. the 'Y' sand in Legendre No. 1 well (BMR file 68/2116). However, since the sand does not appear to be a consistent reflecting horizon, the map is a dip phantom. Because of the deterioration of the data over the Rankin Trend due to faulting, the horizon mapped in this area may not be the one mapped in the Tryal-Evans survey. The isochron maps indicate structural growth during the Cretaceous and stable conditions in the Miocene. A small area of closure was mapped on Horizon Y on the Angel structure and the North Rankin structure was confirmed as a northeasterly trending anticline with an areal extent of nearly 52 km<sup>2</sup>. Closure was mapped on Horizon A. The project provided additional control on another structure (Tryal-Evans Anomaly 70-5), an anticline at the southwestern end of the Rankin Trend with closure of about 260 km<sup>2</sup> mapped on Horizon A.

#### Outer Beagle Trough, Project 71-C

The project was designed primarily to investigate the possibility, suggested by earlier work, that the Madeleine - Dampier anticlinal trend extends from the Dampier Sub-basin into the Beagle Trough. The horizons mapped were: Horizon A - Upper Cretaceous Toolonga Calcilutite, Horizon Hw - top Jurassic unconformity, Horizon D - unidentified. Horizon A was extended from the Tryal-Evans survey Project 70-B and is continuous with the 'A' horizon mapped in Project 71-K to the south (see below) and Project 71-B to the west. Horizon Hw is extended from the Tryal-Evans Project 70-B. Near the western edge of the map it is somewhat higher than the horizon mapped as Hw in Project 70-A. In general, the quality of the data obtained on this horizon was poor. Horizon D was tied on the west to Horizon R of Tryal-Evans Project 70-A, tentatively identified as Middle Jurassic. The isochron map Hw - D indicates movement on the major structures during the Jurassic.

Horizon A was the only one also mapped in the Dampier Sub-basin (Project 71-B). The two maps together indicate that the outer Beagle anticlinal trend is a continuation of the Rankin Trend and not of the Madeleine - Dampier Trend as previously suspected. The De Grey Nose does not appear to continue across the project area.

#### Offshore Canning Basin, Project 71-D

This project was carried out to the northeast of Project 71-C in the Bedout Sub-basin to provide detailed control of previously mapped structural features; in particular, of one designated Anomaly 70-13. The horizons mapped were: Horizon A - ?Upper Cretaceous; Horizon Hw -

approximate top of Jurassic (at or near the top of the Jurassic unconformity); Horizon B - unidentified (? Jurassic?), and Horizon D - unidentified (mapping confined to area around Anomaly 70-13)). The isochron map A-Hw shows Anomaly 70-13 as a northwest-trending anticline plunging to the southeast. Growth of the structure is indicated on the isochron map Hw-B. Horizon D was shown to have been removed by erosion over most of the anticline. Truncation of the steeply dipping underlying beds was seen on all except three of the lines traversing the structure.

#### North Fitzroy, Project 71-E

The project was carried out to further investigate previously mapped structures near the margin of the Leveque Platform. The horizons mapped were: Horizon I - Upper Cretaceous (tied to an Upper Cretaceous horizon in Lynher No. 1 well), and Horizon D - unidentified (a strongly reflecting horizon, both on and off the Leveque Platform). There is very little indication of faulting at Horizon I level. Dips are steeper and more faults were indicated on Horizon B. On the Leveque Platform, Horizon D appears to be seismic basement. This is a very irregular surface, the irregularities being due to faulting and/or erosion. Off the Leveque Platform, Horizon D was considered to be younger than the horizon mapped on it. Discontinuous reflections were obtained from deeper horizons which appear to be strongly faulted.

#### De Grey Nose, Project 71-K

Three horizons, tied into those mapped in Project 71-C and Projects 70-A and 70-B of the Tryal-Evans Survey were mapped. The horizons were: Horizon A - top Upper Cretaceous Toolonga Calcilutite; Horizon Hw - approximate top Jurassic unconformity, and Horizon D - ? Middle Jurassic. No closure was mapped on Horizon A. Although Horizon Hw is based on poor quality data, it is tied to adjacent projects, so that the structure contour map gives a broad general picture at this level over a large area. Horizon D, which ties to Horizon R of Project 70-A, is based on fair to good quality data. It appears to be largely absent over the southern part of the area. In the western (Dampier Sub-basin) sector the map shows a severely faulted zone with some small closures.

#### Rankin - Rowley Shoals, Project 71-L

The project comprised one strike line running from Project 71-B (Rankin Bank) to the Scott Reef area, and five dip lines joining this line to existing seismic control. The horizons mapped were: Horizon E - near base of Miocene; Horizon A - top Upper Cretaceous, Toolonga Calcilutite, and Horizon B - unidentified.

Horizon A ties exactly to the 'A' horizons mapped in Project 71-C, 71-D, and 70-C and it was shown to be the equivalent of Horizon 1 in Project 71-E (North Fitzroy). The map indicates only slight structural deformation. Horizon B could not be traced along the entire strike line because no data were obtained in one area which coincided with a very irregular ocean floor. The horizon could not be identified with certainty but it was concluded that it probably represents a Jurassic horizon in the northeastern part of the area and a Triassic horizon in the southwest. The isochron map E indicates westward thickening in this interval and consequently subsidence of the shelf area in post Miocene time.

### Offshore Canning Basin, Browse Basin

#### Lombardina/Buccaneer, Project 71-F

The main objective of the project was a detailed coverage of the Lombardina structure mapped in the Tryal-Evans survey (Anomaly 70-16). In addition it was hoped that the project would provide better control on the lower-most Mesozoic seismic events, and that a line shot in the eastern part of the area would clarify the relationship between the Buccaneer Nose and the Scott Reef structural trend. As in Tryal-Evans Project 70-K, the horizons mapped in the southern part of the project area were tied to Tryal-Evans Project 70-E and a different set of horizons mapped around Scott Reef. In the southern part, the horizons were: Horizon I - ?Upper Cretaceous, and two unidentified horizons B and D, D1. Horizon D, D1 was regarded as seismic basement in that the quality of the data below this level was too poor for horizons to be mapped. The isochron map D, D1 shows local thinning over the Buccaneer Nose, and there is also evidence of movement during the deposition of this interval on a traverse across the Lombardina Structure. Clarification of the relationship between the Buccaneer Nose and the Scott Reef Structure trend was not achieved.

#### Browse Basin Margin, Project 71-G

The project was carried out in an area near the northwest edge of the Kimberly Block, bounded by the Londonderry Arch to the north and the Leveque Platform to the south. It was designed to provide detailed control on previously mapped structures. Three horizons were mapped - I1, B, B1 and D, all unidentified. The maps on Horizons I1 and B, B1 indicate a low angle regional northwesterly dip and minor faulting. The map on Horizon D is an attempt to illustrate the structural configuration of the regional unconformity from the Browse Shelf to the northeast edge of the Browse Basin. On the shelf, the horizon is broken by numerous small faults, and several apparently erosional residual highs were indicated. A system of large northeast-trending faults downthrown to the west was mapped in a zone which may be transitional between the shelf area and the basin.

## Browse Basin

### Scott - Ashmore, Project 71-H

The project was designed to use the information gained from the drilling of the Ashmore Reef No. 1 well (BMR file 67/4264) to identify seismic horizons in the Scott Reef area, and also in the area of Project 71-G described above. Three horizons were mapped, all based on good reflection data and identified by tie with Ashmore Reef No. 1. They were: Horizon E - approximate base of Miocene; Horizon M - near the Tertiary, and Horizon B - near base Cretaceous. Horizon E ties into an horizon (Horizon 2) mapped in the Seringapatam Reef area (BMR file 68/3027) which also extends over the Scott Reef area. The horizon is well above Horizon I, the shallower level mapped in Project 71-G. There is evidence of faulting on Horizon E in the vicinity of Ashmore Reef which does not affect the deeper horizons. Horizon M ties into Project 71-G a little above Horizon I providing a tentative correlation of that horizon as near the top of the Cretaceous. It could not be carried into the Seringapatam Reef area. Horizon B was tied to the unconformity at the base of the 'Woodbine Beds' in Ashmore Reef No. 1, and the tie into Project 71-G indicates a tentative Middle or Upper Jurassic age for Horizon B in that area.

The isochron map E-M indicates some structural growth during pre-Miocene Tertiary deposition in the Ashmore Reef and Woodbine Banks area. The Cretaceous thickness map (M-B) indicates movement throughout the deposition of the interval and, along one traverse line, northwesterly thinning of the section and onlapping of the M on the B horizon is indicated.

## Bonaparte Gulf Basin

### Sahul - Laminaria, Project 71-M

The project was carried out in the area of the northeast Londonderry Ridge. The four horizons mapped were tied to Sahul Shoals No. 1 well (BMR file 69/2042). They were: Horizon E - near base of Miocene; Horizon M - approximate base of Tertiary; Horizon P - approximate of Cretaceous, and Horizon Z - approximate top of Permian. The value of the isochron maps produced was limited by the highly faulted nature of the area. In general the project confirmed the previous picture of the area as strongly folded and faulted during two major periods of movement, one pre-Cretaceous (probably late Triassic) and the other post-Miocene.

## PAPUAN BASIN

The results of three 1970 geophysical operations carried out in the northwestern part of the basin were released in 1971. They all investigated the subsurface structure of large low-amplitude anticlines, in lower to middle Miocene limestone, which form a belt trending south-easterly across this part of the basin.

The Kanau Gravity Survey (70/719) investigated the relationship between the large northwest trending Kanau Anticline, and a basement high culminating at about 1800 m below sea level (Fly-Turama aeromagnetic survey, BMR file 68/3028).

Interpretation of the resulting data indicated that the Kanau Anticline results from basement thrusting and forms the front of an elevated area - the Darai Plateau. The limestone is overthrust to the southwest and thickens to about 4000 m near the centre of the Darai Plateau. The underlying Mesozoic sediments thin to less than 1500 m over the anticline.

The Cecilia seismic and gravity survey (BMR file 70/569) investigated the subsurface structure of the exposed Cecilia Anticline, and also the structure of the Mesozoic southwest of the anticline. The quality of the seismic reflection data was fair to poor and no useful data were obtained over the Cecilia Anticline. Elsewhere two horizons tentatively identified as Tertiary and Mesozoic were contoured. The maps indicate a number of broad north-trending folds in the central part of the survey area. The Bouguer gravity anomaly map contours support these indications and indicate a maximum zone over the Cecilia Anticline. There was a decrease in gravity value readings of 10 milligals on the southern flank.

The Libano seismic survey (BMR file 70/676) investigated the Libano Anticline. Three horizons were mapped: Horizon A - top of Miocene limestone; Horizon B - base of Miocene Limestone, and Horizon C - basement. The maps indicate that the anticline is overthrust, with a downthrow to the south of about 900 m at the limestone horizons. No major involvement of basement was indicated in the survey area.

The Fly Strickland-Aramia River seismic survey (BMR file 70/899) was carried out in the area to the south of those just described. Quaternary deposits cover the area, and the only subsurface information comes from Aramia No. 1 well drilled within the survey area, Morehead No. 1 drilled 70 km to the south, and seismic surveys. The sequence predicted is Tertiary to about 1000 m, Cretaceous to about 2000 m, Jurassic to about 2500 m, and then ?granite basement.

The survey extended regional seismic coverage and assessed the reliability of depth to magnetic basement calculations. Two horizons, the top of the Lower Cretaceous Albian grey shale and basement, were mapped. Basement depths ranged from about 2000 m to 2700 m. Local draping of the Mesozoic over basement highs was indicated. The most promising structural traps for petroleum were in the area of the upper Fly and the lower Strickland Rivers.

The Magobu Island No. 1 well (BMR file 70/581) was drilled on the northeast coast of Magobu Island in the Fly River Delta to test a large seismically defined anticline in Mesozoic strata.

The well intersected 125 m of Quaternary and ? Pliocene deltaic and shallow marine clastic sediments, 815 m of lower to middle Miocene shelf carbonates, 1634 m of Jurassic to Lower Cretaceous shallow marine, marginal, and non-marine clastic sediments (delta complex), and 60 m of (? Carboniferous) basement volcanics. There were no significant hydrocarbon shows, but beds with good porosity and permeability occurred in both the Tertiary and Mesozoic. The non-reefal Tertiary limestone has been flushed by fresh water, but connate water with salinities up to 67 000 ppm NaCl was recovered from the Mesozoic sandstones during drill stem testing.

Three subsidized seismic surveys were carried out and two subsidized wells were drilled in 1971.

The Balimo seismic survey was carried out in the southwestern part of the basin north of the Fly River. Previous seismic work indicated sediments thickening from 1220 m in the southwest to 4880 m in the northeast. The Kaweto seismic survey (BMR file 69/3033) indicated several north-northwest trending anticlines in presumed Mesozoic sediments. This interpretation was based on widely spaced reconnaissance lines and the Balimo survey was designed to provide closer structural control in the area. The quality of the resulting data ranged from fair to poor, the better quality being recorded on the shallowest of the mapped horizons, Horizon A at the base of Miocene. Horizon B, near the middle of the Lower Cretaceous, and Horizon C, within the Lower to Middle Jurassic, were also mapped. The horizons were tied to the Magobu Island No. 1 well (BMR file 70/581) 26 km southeast of the survey area. The survey provided confirmation and further detailing of the anticlines outlined in the Kaweto survey and also established the presence of hitherto unmapped structures. Further detailing was recommended before siting a well.

The Kaim-Strickland seismic and gravity survey was carried out in the western Papuan Basin, in the area traversed by the Kaim and Strickland Rivers. It was the first seismic work in the area. The horizons mapped were: A - (?) near top of Miocene limestone or base of Pliocene; B - (?) near top of Mesozoic or base of Miocene, and C - (?) pre-Jurassic basement. The C horizon increases in depth from about 2440 m in the south to about 3800 m in the northern part of the survey area. A complex easterly trending fault system was mapped in the north. A large anticline dominates the centre of the survey area. It is interpreted as a topographic high on which there has been later movement as evidenced by the loss of section from the base of the ?Jurassic sequence immediately overlying Horizon C. A number of smaller local highs were also mapped. The maps of the A and B horizons show the same structure but with decreasing relief and the A horizon appears to post-date most of the faulting. The contours on the Bouguer anomaly map bear a general resemblance to the seismic contours. There is a downward gradient to the north, and the structural features can be correlated with positive Bouguer anomalies.

The Tovala-Lesi seismic survey was carried out in the vicinity of Malalaua at the southeastern end of the Papuan Basin. Previous seismic work (BMR files 64/4513, 65/4580, 69/3069) had indicated two anticlines - the Tovala and Lesi. The Tovala anticline is masked by an alluvial cover within the survey area but it crops out to the northwest where it has been mapped. One objective of the survey was to determine closure on the two anticlines. The other objective was to determine whether not reefs are present in the area. This possibility was suggested by earlier seismic work and the lithologies penetrated in Tovala No. 1A. The only horizon mapped in the Tovala area was identified as being near the top of the middle Miocene at the well. The record quality was poor in parts of this area. The Tovala anticline was interpreted to have an areal extent of about 26 km<sup>2</sup> and a vertical closure in excess of 240 m. The presence of reefs was not confirmed. The same horizon was tentatively identified in the Lesi area. The quality of the data was not sufficiently good for vertical closure to be established with any certainty and there was no indication of a reef.

Cecilia No. 1 and Mananda No. 1 were drilled in 1971 in the Southern Highlands district some 600 km northwest of Port Moresby. The area lies on the southwestern margin of the northwest trending Papuan fold belt. The Mananda Anticline is exposed as a limestone ridge, about 40 km long and 11 km wide, and the Cecilia Anticline is exposed farther west over a length in excess of 88 km and a width varying from 5 to 8 km.

The drilling of Mananda No. 1 proved the Mananda Anticline to be a complex overthrust fold with a horizontal displacement to the southwest of about 2.5 km. The target horizons for petroleum exploration, sandstones of the Cretaceous Toro Formation and the Jurassic Koi-Iangi Formation, were not penetrated so that the petroleum potential of the area was not downgraded by the lack of hydrocarbon shows. The section penetrated comprised the Pleistocene Hagen Volcanics (9 m thick), underlain unconformably by middle Oligocene to early Miocene Darai Limestone (832 m thick), which was in turn unconformable on the Cretaceous Ieru Formation (1219 m thick). The well then intersected the thrust fault (at 2441 m) and penetrated a sequence of late Oligocene to early Miocene Darai Limestone (155 m thick) to total depth. The thicknesses given are true vertical. The lower 72 m of the Ieru Formation are possibly repeated in an overturn. Palaeontological evidence was used to date the sequence. The youngest Cretaceous sediments were interpreted as Senonian.

Cecilia No. 1 was drilled in a near-crestal position on the northwest flank of the Cecilia Anticline to test the hydrocarbon potential of Jurassic and Cretaceous sandstone, with the lower Miocene (Kaban Formation) limestone as a secondary target. The prospective units were thought to occur on the upthrown side of a northeast dipping reverse fault. However, the fault was intersected at 1622 m after which the well penetrated sediments on the downthrown side of the fault. The well penetrated 1305 m of lower Miocene limestone (undifferentiated Cecilia and Kaban Formations) unconformably overlying Upper Cretaceous (lower Turonian to Cenomanian) Narin Formation which was predominantly mudstone above the fault. This sequence was repeated below the fault. The sediments were dated on fossils. There were no indications of hydrocarbons and the Mesozoic section had generally poor reservoir characteristics.

#### NORTHERN NEW GUINEA BASIN

The results of one seismic survey carried out in 1970, were released, and one aeromagnetic survey was completed in 1971. The surveys were located in the area north of the Sepik River and southwest of Wewak. The basin contains Miocene to Pleistocene sediments resting unconformably on basement metamorphic and igneous rocks. Previous aeromagnetic surveys indicated that the surface anticlines were offset surface expressions of basement structures. The Mai-Mai seismic survey (BMR file 70/491) was designed to determine the structure of one of the surface anticlines - the Mai-Mai - and the depth to basement, before siting a wildcat well. The quality of both reflection and refraction data was poor, but a southeasterly dip was indicated on two horizons

tentatively identified as the top of the lower Miocene 'Barkop Marl Member' of the Keang Mudstone and Conglomeratic Formation and either the top of the 'Barkop Limestone' or basement. No well site was recommended. The Yimi aeromagnetic survey indicated that the Namblo, Bongos, and Yabanakuor Anticlines correspond to magnetic basement highs. The Mai-Mai Anticline was not associated with a magnetic anomaly. The Amogu (or Screw) Basin, outlined by the Mapik seismic survey (BMR file 69/3043), appears to extend westerly into the northern part of the survey area.

### OFFSHORE PAPUA NEW GUINEA

The Louisaide Archipelago aeromagnetic survey was carried out off the eastern tip of the Papuan mainland in the area south-southwest of the Calvados Chain as the first phase in exploration of the permit by Hematite Petroleum Pty Ltd. Previously Amoco Australia had carried out some unsubsidized seismic work and BMR measured gravity on the islands of the Archipelago and carried out a shipborne seismic, gravity, and magnetic survey along traverses outside the fringing barrier reef. Two magnetic horizons were interpreted. The deeper one, regarded as magnetic basement, follows the southeast-trending core of the archipelago at about 2130 m below sea level and deepens to about 2250 m to the north and south. The shallow horizon corresponds to the top of the metamorphosed Cretaceous sediments that crop out in the Calvados Chain and it constitutes economic basement. As it is nowhere deeper than 609 m below sea level the thin sedimentary sequence overlying it is considered unprospective.

The Bougainville seismic and magnetic survey was carried out off the southwest coast of Bougainville Island. It was designed to extend seismic coverage on the shelf, indicate the thickness and distribution of sediments, and to locate structures. Good quality seismic data was produced and two horizons were mapped; Horizon B, interpreted as the base of upper Miocene? to Pliocene sediments, and Horizon D interpreted as a reflecting horizon within an Oligocene to lower Miocene sedimentary section. The results indicated a small basin covering about 1300 km<sup>2</sup> in the middle of the permit area offshore from Empress Augusta Bay. The basin, which is rimmed by areas of thinner sediments, contains approximately 6100 m of block faulted lower Tertiary strata and flat lying upper Miocene? to Pliocene sediments. The only significant structure was a northwest trending horst. A shallow horizon interpreted as Eocene? basement was mapped to the west, north, and south of the deep basin. The magnetic survey was curtailed by the loss of the proton magnetometer on the reef.

ACKNOWLEDGMENT

The author is grateful to L.K. Rixon for his assistance in the preparation of the tables.

TABLE 1. WELLS DRILLING IN 1971

<u>BASIN</u> <u>COMPANY</u> Well Name BMR file no. if subsidized	Latitude South Longitude East	1:250 000 Sheet Area	Elevations (metres) GL/WD DF/KB/RT	Date spudded  T.D. reached	T.D. (metres)	Status as at 31/12/71
<u>ADAVALE</u>						
BEAVER EXPLORATION AUSTRALIA N.L.						
Allandale No. 1	24 25 00	G55/2	GL 374.6	3/11/70	3004.1	PA
BMR file 70/823	145 54 15		KB 379.2	2/1/71		
<u>ARAFURA</u>						
SHELL DEVELOPMENT (AUSTRALIA) PTY LTD						
Money Shoal No. 1	10 18 57	G53/9	WD 68.6	15/6/71	2590.2	PA
	132 44 11		RT 9.4	19/7/71		
<u>ARCKARINGA</u>						
S.A. DEPARTMENT OF MINES						
Wallira West No. 1	29 29 45	H53/5	GL 223.1	14/3/71	358.7	PA
	132 16 00		KB 224.0	24/3/71		
<u>BONAPARTE GULF</u>						
ARCO AUSTRALIA LIMITED						
Flamingo No. 1	11 01 34	C52/13	WD 96.0	4/8/71	3700.0	PA
	126 28 55		KB 34.4	1/12/71		
Gull No. 1	11 56 29	C52/14	WD 134.4	5/6/70	3421.4	PA
	127 54 37		DF 13.1	15/1/71		

<u>BASIN</u> COMPANY Well Name BMR file no. if subsidized	Latitude South Longitude East			1:250 000 sheet Area	Elevations (metres) GL/WD DF/KB/RT	Date spudded  T.D. reached	T.D. (metres)	Status as at 31/12/71
	0	'	"					
Heron No. 1	10 26	26.9		C52/10	WD 35.1 KB 12.2	13/9/71 -	3867.9	Drilling ahead
	128 57	04.6						
Osprey No. 1	12 13	-		D51/4	WD 100.6 KB 34.1	13/12/71 -	1079.0	Drilling ahead
	125 13	-						
Petrel No. 2	12 51	14		D52/2	WD 97.2 KB 34.4	20/12/70 24/5/71	4724.7	PA
	128 30	50						
Sandpiper No. 1	13 18	53		D52/6	WD 86.6 KB 11.9	7/8/71 8/9/71	1891.6	PA
	127 58	35						
Tern No. 1	13 13	15		D52/6	WD 93.9 DF 11.9	26/1/71 5/7/71	4351.9	PA
	128 03	53						
<u>BROWSE</u>								
B.O.C. OF AUSTRALIA LTD								
Lynher No. 1	15 56	24		D51/13	WD 57.9 RT 9.5	25/12/70 11/2/71	2724.9	PA
BMR file 70/948	121 04	59						
Scott Reef No. 1	14 04	33.99		D51/10	WD 49.7 RT 9.5	18/2/71 26/5/71	4730.5	Completed as a capped off- shore wet gas well
BMR file 71/82	121 49	28.76						
<u>CANNING</u>								
B.O.C. OF AUSTRALIA LTD								
Bedout No. 1	18 14	40		E50/15	WD 141.7 KB 29.0	31/7/71 4/9/71	3073.0	PA
BMR file 71/435	119 23	22.6						

<u>BASIN</u> COMPANY Well Name BMR file no. if subsidized	Latitude South Longitude East	1:250 000 sheet Area	Elevations (metres) GL/WD DF/KB/RT	Date spudded T.D. reached	T.D. (metres)	Status as at 31/12/71
<b>WEST AUSTRALIAN PETROLEUM PTY LTD</b>						
Crossland No. 1 BMR file 71/465	19 43 10 125 14 50	E51/16	GL 181.1 RT 183.8	31/7/71 16/8/71	9132	PA
No. 2 BMR file 71/465	20 00 45 124 59 36	F51/3	GL 175.0 RT 177.7	22/8/71 3/9/71	914.4	PA
No. 3 BMR file 71/465	20 12 12 125 45 39	E51/4	GL 230.7 RT 233.5	24/6/71 14/10/71	915.3	PA
Lake Betty No. 1 BMR file 71/441	19 34 08 126 19 45	E52/13	GL 273.7 RT 278.3	1/9/71 2/12/71	3145.8	PA
Munda No. 1 BMR file 71/475	19 28 27 122 17 32	E51/14	GL 94.5 RT 97.2	5/11/71 17/11/71	1066.8	PA
Tappers Inlet No. 1 BMR file 71/301	16 15 33 122 35 20	E51/2	GL 18.9 RT 22.3	16/6/71 5/8/71	2856.3	PA
<b>CARNARVON</b>						
<b>B.O.C. OF AUSTRALIA LTD</b>						
Angel No. 1 BMR file 71/617	19 30 20.1 116 35 47.8	E50/14	WD 79.9 RT 9.5	12/10/71 -	3240.0	Drilling ahead
De Grey No. 1 BMR file 71/616	19 29 20.4 117 05 08	E50/15	WD 94.5 RT 29.0	10/9/71 16/10/71	2087.9	PA
Goodwyn No. 1 BMR file 71/732	19 41 36.8 115 53 43.6	E50/14	WD 125.6 RT 29.0	22/10/71 25/11/71	3535.7	Suspended gas and condensate well

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<u>BASIN</u>	Latitude South			1:250 000 Sheet Area	Elevations (metres) GL/WD DF/KB/RT	Date spudded	T.D. (metres)	Status as at 31/12/71
COMPANY	Longitude East					T.D. reached		
Well Name	0	'	"					
BMR file no. if subsidized								
North Rankin No. 1	19	35	55	E50/14	WD 122.2	3/5/71	3533.5	Suspended gas producer
BMR file 71/254	116	07	30		RT 30.2	25/6/71		
Rankin No. 1	19	47	56	E50/14	WD 93.0	31/7/71	4110.5	Suspended gas well
BMR file 71/495	115	44	31		RT 9.5	23/9/71		
<b>HEMATITE PETROLEUM PTY LTD</b>								
Cane River No. 1	21	40	51	F50/5	GL 7.7	29/11/71	694.0	PA
BMR file 71/751	115	05	54		RT 10.3	9/12/71		
Cane River No. 2	21	38	13	F50/5	GL 4.5	17/12/71	413.0	PA
	115	15	51		RT 7.3	23/12/71		
Cane River No. 3	21	42	28	F50/5	GL 14.9	29/12/71	69.2	Drilling ahead
	115	19	29		RT 17.7	-		
<b>WEST AUSTRALIAN PETROLEUM PTY LTD</b>								
Ningaloo No. 1	22	34	25	F49/12	GL 114.3	18/3/71	1228.3	PA
	113	46	40		RT 107.9	5/4/71		
Sandy Point No. 2	22	22	18	F49/12	GL 100.9	17/4/71	1676.4	PA
	113	50	42		RT 104.9	6/5/71		
<b>COOPER</b>								
<b>ALLIANCE OIL DEVELOPMENT AUSTRALIA N.L.</b>								
Coopers Creek No. 1	27	48	22	G54/14	GL 33.5	5/6/71	3205.6	PA
	140	01	38		KB 38.7	23/7/71		

<u>BASIN</u>	Latitude South			1:250 000 Sheet Area	Elevations (metres)		Date spudded	T.D. (metres)	Status as at 31/12/71
<u>COMPANY</u>	Longitude East				GL/WD	DF/KB/RT	T.D. reached		
Well Name	0	'	"						
BMR file no. if subsidized	0								
Mudrangie No. 1	27	37	46	G54/14	GL 39.3	KB 44.5	21/9/70	3185.8	Gas producer
	140	16	45				1/1/71		
BRIDGE OIL N.L.									
Moorari No. 1	27	34	19	G54/14	GL 40.8	KB 47.5	1/1/71	3023.0	Gas and condensate producer
	140	07	43				28/2/71		
No. 2	27	33	09	G54/14	GL 35.7	KB 41.5	8/9/71	3136.4	PA
	140	07	49				19/10/71		
Tirrawarra No. 2	27	41	21	G54/14	GL 31.7	KB 37.5	5/7/71	3037.3	Oil and gas producer
	140	05	48				12/8/71		
DELHI INTERNATIONAL OIL CORPORATION									
Big Lake No. 1	28	12	36	H54/2	GL 37.5	KB 42.7	10/11/71	3058.7	Gas producer
	140	20	07				29/12/71		
Burley No. 1	27	48	16	G54/14	GL 47.9	KB 52.7	23/6/71	2231.1	PA
	140	39	40				21/10/71		
Epsilon No. 1	28	07	45	H54/3	GL 126.3	KB 130.5	15/12/71	2094.0	Drilling ahead
	141	09	24				-		
Fly Lake No. 1	27	38	13	G54/14	GL 29.3	KB 34.8	2/9/71	2949.0	Oil and gas well
	139	56	48				15/10/71		
No. 2	27	37	24	G54/14	GL 35.1	KB 40.5	16/12/71	2599.6	Drilling ahead
	139	58	50				-		

<u>BASIN</u> COMPANY Well Name BMR file no. if subsidized	Latitude South Longitude East	1:250 000 Sheet Area	Elevations (metres) GL/WD DF/KB/RT	Date spudded T.D. reached	T.D. (metres)	Status as at 31/12/71
	0 ' "					
Kudrieke No. 1	27 28 56 140 10 50	G54/14	GL 37.5 KB 43.0	31/10/71 4/12/71	3220.8	PA
Tilpatee 'A' No. 1	28 30 10 140 38 20	H54/2	GL 42.4 KB 43.0	30/8/71 14/9/71	2140.3	PA
Tirrawarra No. 3	27 37 24 140 06 54	G54/14	GL 33.5 KB 38.7	1/11/71 7/12/71	3017.5	Shut in gas and conden- sate producer
No. 4	27 39 15 140 08 51	G54/14	GL 33.8 KB 39.3	22/12/71 -	2156.8	Drilling ahead
Toolachee No. 3	28 27 52 140 46 46	H54/2	GL 63.4 KB 69.3	5/8/71 31/8/71	2312.2	Shut in gas producer
No. 4	28 22 09 140 48 44	H54/2	GL 58.5 KB 63.4	9/9/71 29/9/71	2262.8	Gas/conden- sate producer
<b>FLINDERS PETROLEUM N.L.</b>						
Coonatie No. 1	27 29 06 140 20 15	G54/14	GL 41.8 KB 47.2	18/2/71 5/7/71	3171.4	Gas conden- sate producer
<b>MURUMBA OIL N.L.</b>						
Lake Hope No. 1	28 07 22 139 38 10	H54/2	GL 11.7 KB 16.0	17/8/71 13/9/71	2500.0	PA

<u>BASIN</u> COMPANY Well Name BMR file no. if subsidized	Latitude South Longitude East			1:250 000 Sheet Area	Elevations (metres) GL/WD DF/KB/RT	Date spudded  T.D. reached	T.D. (metres)	Status as at 31/12/71
	0	'	"					
<u>PURSUIT OIL N.L.</u>								
Strzelecki No. 2	28	17	27	H54/2	GL 56.7 KB 60.4	5/11/71 24/11/71	2148.8	PA
Della No. 3	28	03	54	H54/2	GL 64.0 KB 67.7	30/9/71 23/10/71	2292.1	PA
No. 4	28	04	00	H54/2	GL 61.3 KB 64.9	5/12/71 23/12/71	2168.7	Gas producer
<u>GIPPSLAND</u>								
<u>HALLIDAY ENTERPRISES PTY LTD</u>								
Crossroads No. 1	38	19	39	J55/11		19/5/71 3/6/71	1040.0	PA
East Reeve No. 1	38	05	50	J55/11		19/9/71 -	31.1	Drilling ahead
West Seacombe No. 1	38	08	08.4	J55/11		31/12/71 -	61.0	Drilling ahead
<u>N.S.W. OIL AND GAS CO N.L.</u>								
Sailfish No. 1	39	27	24	J55/16	WD 84.7 KB 95.4	12/10/71 2/11/71	1421.9	PA
BMR file 71/472	148	37	54.4					
Flying Fish No. 1	38	20	51	J55/11	KB 9.5	7/11/71 29/11/71	1987.3	PA

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<u>BASIN</u>	Latitude South			1:250 000	Elevations	Date spudded	T.D. (metres)	Status
COMPANY	Longitude East			Sheet	(metres)	T.D. reached		as at
Well Name				Area	GL/WD			31/12/71
BMR file no. if subsidized	0	'	"		DF/KB/RT			

PERTH

WEST AUSTRALIAN PETROLEUM PTY LTD

Charlotte No. 1	31	48	36	H50/13	WD 42	19/12/70	2435.4	PA
BMR file 70/761	115	26	56		RT 30.3	7/1/71		
Gage Roads No. 2	31	57	05	H50/13	WD 73.2	14/1/71	2971.8	PA
BMR file 71/21	115	21	45		RT 30.2	8/2/71		
Sugarloaf No. 1	32	54	54.9	I50/1	WD 46.0	14/2/71	3657.6	PA
BMR file 70/1020	115	03	09		RT 30.2	6/4/71		
Walyering No. 1	30	42	57	H50/9	GL 94.5	31/1/71	3643.3	Gas producer
BMR file 71/48	115	27	55		RT 99.1	10/4/71		
No. 2	30	42	08	H50/9	GL 100.3	24/6/71	4115.1	PA
	115	28	20		RT 104.9	28/10/71		
Warnbro No. 1	32	14	20	I50/1	WD 47.2	26/11/70	3660.3	PA
	115	20	45		RT 25.0	1/1/71		
West White Point No. 1	29	20	42	H50/5	GL 76.2	1/2/71	2248.2	PA
	115	02	23		RT 80.2	25/2/71		
No. 2	29	22	44	H50/5	GL 32.3	27/11/71	2350.0	PA
	115	02	24		RT 36.3	28/12/71		

SURAT

BRIDGE OIL N.L.

Meribah No. 1	27	41	20	G55/16		1/4/71	2583.8	PA
	149	26	14			24/4/71		

<u>BASIN</u> COMPANY Well Name BMR file no. if subsidized	Latitude South Longitude East	1:250 000 Sheet Area	Elevations (metres) GL/WD DF/KB/RT	Date spudded T.D. reached	T.D. (metres)	Status as at 31/12/71
<b>DAMSON OIL (AUST) LTD</b>						
Foyleview Project						
Hoolah No. 1	27 11 18	G55/15	GL 288.5	11/10/71	1225.3	PA
BMR file 71/627	148 08 49		KB 292.0	17/10/71		
Hoolah Creek No. 1	27 17 18	G55/15	GL 268.0	25/10/71	1249.7	PA
BMR file 71/627	148 08 52		KB 271.6	6/11/71		
Neabul Creek No. 1	27 15 07	G55/15	GL 288.9	11/11/71	1234.7	Completed as
BMR file 71/627	147 57 42		KB 292.4	17/11/71		water well
Noogilla No. 1	27 16 53	G55/15	GL 284.7	27/9/71	1202.1	PA
BMR file 71/627	148 03 21		KB 288.3	4/10/71		
<b>ENDEAVOUR OIL CO N.L.</b>						
Glenarden No. 1	26 17 03.6	G55/12	GL 406.9	24/3/71	1208.2	PA
	149 08 27.2		KB 410.0	29/3/71		
Glenavon No. 1	26 23 00	G55/12	GL 385.6	18/4/71	1196.3	PA
	149 10 07		KB 388.6	27/4/71		
Glenora No. 1	26 19 19	G55/12	GL 392.6	14/3/71	1009.2	PA
	149 07 43		KB 395.9	23/3/71		
Jenavale No. 1	26 16 19.8	G55/12	GL 393.8	7/4/71	969.0	PA
	149 05 25.7		KB 396.9	14/4/71		
Javel No. 1	26 25 25	G55/12	GL 318.2	28/2/71	1160.4	PA
	149 09 05		KB 321.6	9/3/71		

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<u>BASIN</u> COMPANY Well Name BMR file no. if subsidized	Latitude South Longitude East	1:250 000 Sheet Area	Elevations (metres) GL/WD DF/KB/RT	Date spudded T.D. reached	T.D. (metres)	Status as at 31/12/71
	0 ' "					
Muggleton No. 1	26 24 20 149 18 09	G55/12	GL 397.5 KB 401.1	9/3/71 5/4/71	2423.8	PA
N.S.W. OIL AND GAS CO N.L.						
Echo Hill No. 1	27 21 53 149 03 24	G55/16	GL 310.6 KB 314.3	19/2/71 3/3/71	1891.0	PA
Norindoo No. 2	27 03 17 149 14 29	G55/16	GL 243.5 KB 247.8	14/1/71 11/2/71	2208.3	PA
No. 3	27 07 58 149 12 05	G55/16	GL 265.2 KB 268.8	1/5/71 16/5/71	2139.7	PA
PEXA OIL N.L.						
Kincora No. 6	27 01 54 148 48 20	G55/16	GL 322.2 KB 326.1	5/7/71 16/7/71	1541.7	Gas producer (triple zone)
SOUTHERN UNION ENERGY						
Niella North West No. 1	26 18 36 148 55 54	G55/12	GL 307.5 KB 432.8	15/8/71 21/8/71	1145.7	PA
Wangary North No. 1	26 31 34 148 41 36	G55/12	GL 304.8 KB 308.2	5/8/71 11/8/71	1076.9	PA
WOODS PETROLEUM OF AUSTRALIA LTD						
Thompson No. 1	28 14 15 150 24 50	H56/1	GL 288.3 KB 292.5	10/3/71 17/3/71	1158.2	Completed as a water well

<u>BASIN</u>	Latitude South	1:250 000	Elevations	Date spudded	T.D. (metres)	Status
COMPANY	Longitude East	Sheet	(metres)	T.D. reached		as at
Well Name		Area	GL/WD			31/12/71
BMR file no. if subsidized	0 ' "		DF/KB/RT			

SYDNEY

HARTOGEN EXPLORATIONS PTY LTD

Crookhaven Stratigraphic Holes	SE of Nowra	I59/9		8/11/70 28/1/71	1462.4	PA
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OFFSHORE NORTH AND NORTHWEST AUSTRALIA

FLINDERS PETROLEUM N.L.

Tinganoo Bay No. 1	11 23 42 131 29 02	C52/16		18/12/70 19/4/71	583.4	PA
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PAPUAN

AUSTRALASIAN PETROLEUM CO PTY LTD

Mananda No. 1	6 10 10.6	B54/12	GL 1873.9	12/9/71	2808.7	PA
BMR file 71/501	142 49 31		KB 1877.6	1/12/71		

TEXACO OVERSEAS PETROLEUM COMPANY

Cecilia No. 1	6 05 30	B54/11	GL 363.3	22/4/71	3765.8	PA
BMR file 71/237	142 25 25		KB 366.7	4/7/71		

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**TABLE 2. GEOPHYSICAL OPERATIONS DURING 1971**

BASIN OPERATING COMPANY Survey Name BMR file no.	Permit 1:250 000 Sheet area	Duration	Extent
<b><u>ADAVALE BASIN</u></b>			
<b>HARTOGEN EXPLORATIONS PTY LTD</b>			
Cootabynia seismic BMR file 71/626	ATP 183 P G.55-6	27/9/71-7/10/71	19.9 km sub- surface coverage analog CDP
<b><u>AMADEUS BASIN</u></b>			
<b>MAGELLAN PETROLEUM (N.T.) PTY LTD</b>			
Seymour Range seismic BMR file 71/406	OP 175 G.53-1	24/11/71-13/11/71	40 km 6-fold CDP. 10 km conventional, subsurface coverage
<b><u>BONAPARTE GULF BASIN</u></b>			
<b>B.O.C. OF AUSTRALIA LTD</b>			
Sahul-Ashmore marine seismic BMR file 71/667	P7,P10,P13, P14,P15 C.51-15/16 D.51-3	14/10/71-21/10/71	602.3 km "Maxipulse"
<b><u>BROWSE BASIN</u></b>			
<b>B.O.C. OF AUSTRALIA LTD</b>			
Scott Reef seismic BMR file 71/481	WA-33-P D.51-5/6	27/7/71-17/8/71	786.6 km 2400% digital data
<b><u>CANNING BASIN</u></b>			
<b>ASSOCIATED AUSTRALIAN OILFIELDS N.L.</b>			
Billiluna-Helena aeromagnetic BMR file 71/422	EP 58, 59 E.52-13/14 F.52-1/2/5/9	6/10/71-5/11/71	11918.8 km
<b>AUSTRALIAN AQUITAINE PETROLEUM PTY LTD</b>			
White Hills aeromagnetic BMR file 71/508	EP 31 F.52-1/2/5/6	6/11/71-16/11/71	4388.7 km

<u>BASIN</u> OPERATING COMPANY Survey Name BMR file no.	Permit 1:250 000 Sheet area	Duration	Extent
<b>WEST AUSTRALIA</b>			
<b>PETROLEUM PTY LTD</b>			
Anketell seismic BMR file 70/896	EP 3, 16, 53 E.51-14 F.51-2	16/11/70-18/1/71	232.98 km 600% reflection
Lake Auld seismic BMR file 70/933	EP 15 F.51-11	22/1/71-1/2/71	40.32 km 600% CDP reflection
Munro Detail seismic BMR file 70/1000	EP 3 E.51-14	6/7/71-16/3/71	175.6 km 600% reflection
Crossland Platform seismic BMR file 71/150	EP 13,18,19,43 E.51-12/15/16 E.52-13 F.51-4 F.52-1	21/3/71-30/6/71	395.9 km 600% 177 km 400% coverage
North Broome seismic BMR file 71/252	EP 6,14,38 E.51-10/11	24/4/71-24/5/71	174.15 km 400% reflection
Poulton seismic BMR file 71/326	EP 7,42,44 E.51-7/8/11/12	27/5/71-16/8/71	379.8 km 600 CDP 259.3 km of 400% and 600% reflection
Munro D-2 seismic BMR file 71/478	EP 3,37,38 E.51-14/15 F.51-2/3	24/7/71-20/8/71	168.84 km 600% reflection
<b>CARNARVON BASIN</b>			
<b>B.O.C. OF AUSTRALIA LTD</b>			
Rankin Trend seismic BMR file 71/538	WA-28-P WA-29-P, WA-1-P E.50-11/13/14/ 15/12 F.50-1/2	4/9/71-16/9/71	706.9 km "Maxipulse" continuous reflec- tion
<b>ENDEAVOUR OIL COMPANY</b>			
<b>N.L.</b>			
Ronsard seismic BMR file 71/79	WA-26-P F.49-16 G.49-4	5/3/71-14/3/71	342.5 km 24-fold reflection

<u>BASIN</u> OPERATING COMPANY Survey Name BMR file no.	Permit 1:250 000 Sheet area	Duration	Extent
<u>OCEANIA PETROLEUM PTY LTD</u> Murchison-Gascoyne D-1 gravity BMR file 71/555	EP 45,46,47,48 G.49-8/12 G.50-5/6/13	31/8/71-	in progress
<u>OCEAN VENTURES PTY LTD</u> Bernier seismic and magnetic survey BMR file 71/722	WA-26-P F.49-15/16 G.49-3/4/7/8/12/ 16	24/10/71-9/12/71	1451.6 km 24- fold reflection 1414.6 km magnetic
<u>COOPER BASIN</u> <u>DELHI INTERNATIONAL OIL CORP</u> Tilpatee seismic BMR file 71/157	PEL 5,6 H.54-2	30/4/71-8/7/71	37.8 km conven- tional reflection
Dunjeroo seismic BMR file 71/696	PEL 5,6 ATP66/67 P. H.54-2/3	6/11/71-	in progress
<u>FLINDERS PETROLEUM N.L.</u> Coopers Creek Central seismic BMR file 70/668	PEL 5,6 ATP 166, 167P G.54-14/15	8/8/70-15/2/71	858.1 km
Sandy Creek seismic BMR file 71/553	ATP 66/67P G.54-15	30/10/71-12/11/71	51.5 km digital 'Vibroseis'
<u>EROMANGA BASIN</u> <u>U.S. NATIONAL RESOURCES AUSTRALIA LTD</u> Williams Creek seismic BMR file 71/336	ATP 166P F.54-11/12	28/5/71-20/6/71	165.36 km single 19.71 km 6 fold conventional analog

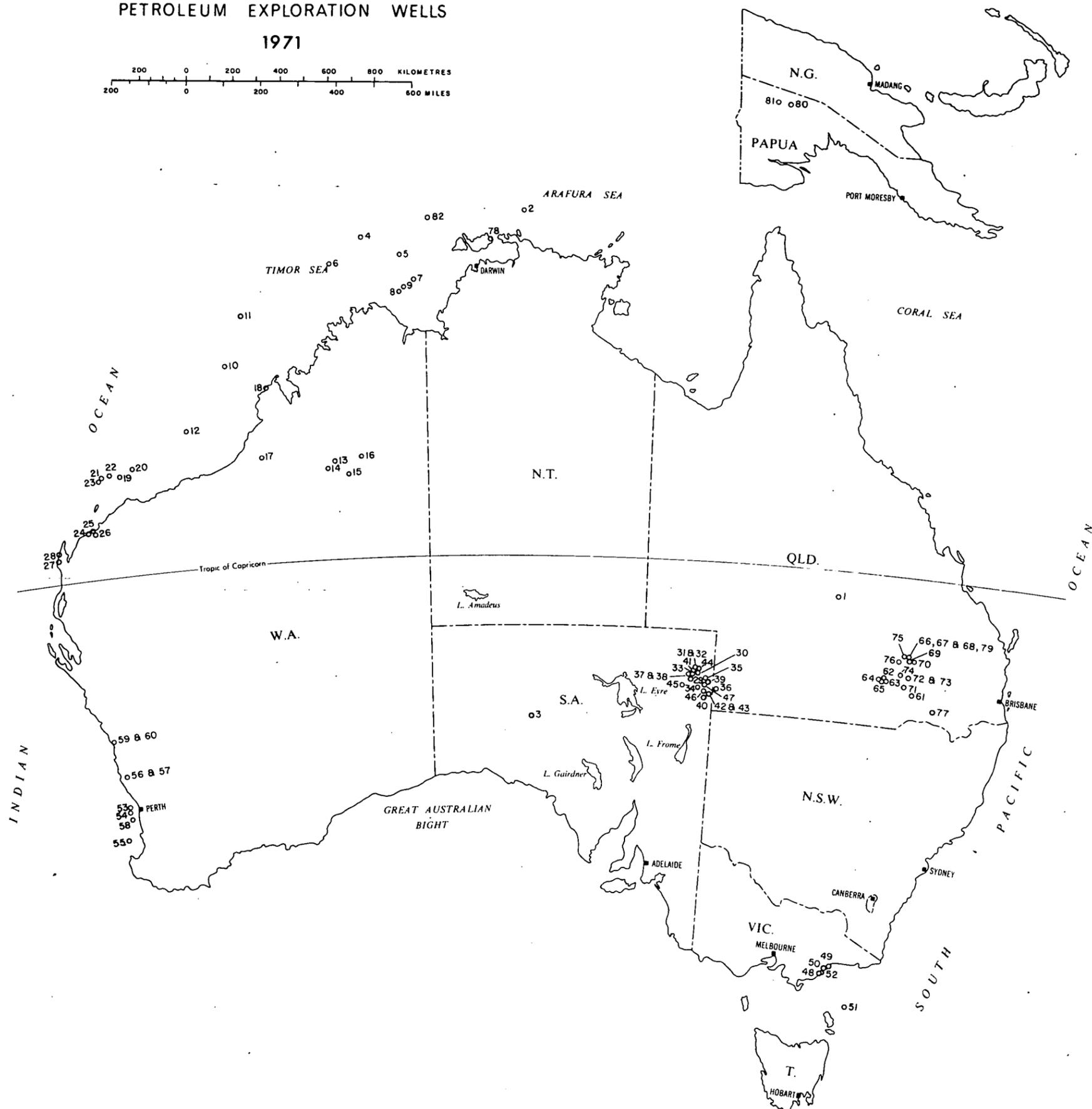
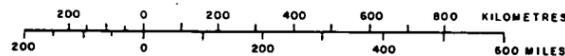
<u>BASIN</u> OPERATING COMPANY Survey Name BMR file no.	Permit 1:250 000 Sheet area	Duration	Extent
<u>EUCLA BASIN</u> HARTOGEN EXPLORATIONS PTY LTD Offshore Eyre seismic BMR file 71/34	WA-8,9,10, 41-P 1.52-1 000	10/2/71	55.6 km 24-fold reflection
<u>NGALIA BASIN</u> MAGELLAN PETROLEUM AUSTRALIA LTD Ngalia Basin seismic BMR file 71/387	O.P. 165 F.52-12	28/6/71-18/10/71	109.4 km 6-fold CDP 331.5 km single coverage
<u>OTWAY BASIN</u> ESSO EXPLORATION & PRODUCTION AUSTRALIA INC. Otway 071A seismic BMR file 71/74	PEL 8 J.54-6	2/2/71-16/5/71	69.95 km 6-fold 71.425 km 12- fold 17.050 km tapered 6 or 12 fold 8.33 km experimental
HEMATITE PETROLEUM PTY LTD Torquay Embayment marine seismic and magnetic BMR file 71/883	P/6 J.55-9	26/12/71	in progress
SHELL DEVELOPMENT (AUSTRALIA) PTY LTD Warrnambool-Pomborneit seismic BMR file 70/962	PEP 5,6 J.54-12	14/12/70-1/8/71	78.6 km dynamite 600% CDP, 345 km Vibroseis 1200% CDP
Nelson-Koroit seismic BMR file 70/963	PEP 5 J.54-6/7/10/11	14/12/70-6/6/71	194 km 12-fold CDP
Colac-Geelong gravity BMR file 71/560	PEP 6 J.54-12 J.55-9	19/8/71-11/11/71	2134 field stations & 23 base stations

<u>BASIN</u>	Permit	Duration	Extent
OPERATING COMPANY	1:250 000		
Survey Name	Sheet area		
BMR file no.			
<u>PEDIRKA BASIN</u>			
BEACH PETROLEUM N.L.			
Three Corners seismic & gravity	O.P. 57 G.53-8	17/8/71-20/10/71	257.6 km single fold analog 552 gravity stations along lines
BMR file 71/526			
<u>PERTH BASIN</u>			
BP PETROLEUM DEVELOPMENT AUSTRALIA PTY LTD			
Geelvink Channel D-1 marine seismic	WA-40-P H.49-4 H.50-1	13/1/71-23/1/71	301.8 km 2400% coverage
BMR file 71/35			
<u>WEST AUSTRALIAN PETROLEUM PTY LTD</u>			
Barragoon seismic	EP 23,24,21 H.50-5/6/9/10/14	11/1/71-26/3/71	1048.6 km 6- fold CDP
BMR file 70/999			
Moore River seismic	EP 24 H.50-14	2/1/71-11/1/71	34.3 km 600% coverage
BMR file 70/1001			
West Walyering seismic	EP 24 H.50-9/10	24/8/71-29/9/71	130.4 km 600% CDP
BMR file 71/565			
Preston D-1 Detail seismic	EP 25 I.50-2/6	23/11/71-1/12/71	5.9 km conven- tional dynamite 600% cover, 23.6 km geoflex
BMR file 71/678			
Dandaragan East Flank seismic	EP 23,25 H.50-6/10	10/12/71-	in progress
BMR file 71/850			
Coomallo seismic	EP 21,24 H.50-9/10	29/12/71-	in progress
BMR file 71/928			
<u>POLDA BASIN</u>			
Polda Basin 2 marine seismic	EPP 13 I.52-3/4/7/8 I.53-1/2/5/6	12/6/71-23/6/71	540.6 km 24- fold CDP, 618.3 km single fold sparker 3 refraction profiles
BMR file 71/355			

<u>BASIN</u> OPERATING COMPANY Survey Name BMR file no.	Permit 1:250 000 Sheet area	Duration	Extent
<u>SYDNEY BASIN</u>			
ENDEAVOUR OIL CO LTD N.L. Sealion marine seismic BMR file 71/398	PEP 2,3 I.56-5/6/9/10	2/7/71-9/7/71	378.2 km 2400% CDP magneto- meter
<u>OFFSHORE NORTH &amp; NORTHWEST AUSTRALIA</u>			
B.O.C. OF AUSTRALIA LTD Trimouille-Dillon marine seismic BMR file 70/976	WA-1/28,29,30,31, 32,33,34,35,36, 37P, N.T. P/5,8, 10,13,15,9 F.50-1/2/3 E.50-4/7/8/10/11/ 12/13/14/15/16 D.51-2/3/4/5/6/7/ 8/9/10/11/12/13/ 14/15 C.51-12/15/16 C.52-9		20/12/70-2/5/71
<u>PAPUAN BASIN</u>			
CONTINENTAL OIL CO. OF AUSTRALIA LTD Fly, Strickland & Aramia Rivers seismic BMR file 70/899	OP 43 B.54-11/15/16 C.54-3/4	5/12/70-25/1/71	62.6 km refraction 801 km multiple cover- age, 57.9 km single coverage
<u>MARATHON PETROLEUM AUSTRALIA LTD</u>			
Tovala-Lesi seismic BMR file 71/356	L9 C.55-2	8/6/71-2/10/71	120.7 km 600% CDP
<u>TEXACO OVERSEAS PETROLEUM CO</u>			
Balimo seismic BMR file 71/399	PEP 55 C.54-3/4	20/7/71-4/11/71	168.9 km multiple cover- age CDP

<u>BASIN</u> OPERATING COMPANY Survey Name BMR file no.	Permit 1:250 000 Sheet area	Duration	Extent
Elevala seismic BMR file 71/764	O.P. 27 B.54-7/11	8/11/71-	in progress
UNION OIL DEVELOPMENT CORP. Kaim-Strickland seismic and gravity BMR file 70/1018	P51 B.54-7/11/12/16	10/3/71-31/12/71	446.04 km sub- surface cover- age 6-fold CDP
<u>NORTHERN NEW GUINEA</u> <u>BASIN</u> AUSTRALIAN AQUITAINE PETROLEUM PTY LTD Yimi aeromagnetic BMR file 71/323	P45 A.54-15/16 B.54-3/4	20/5/71-23/5/71	2137.5 km
<u>OFFSHORE PAPUA</u> <u>NEW GUINEA</u> HEMATITE PETROLEUM PTY LTD Louisiade Archipelago aeromagnetic BMR file 71/659	18P C.56-10/11/14/15	21/10/71-25/10/71	1554.6 km
SHELL DEVELOPMENT (AUSTRALIA) PTY LTD Bougainville seismic & magnetic BMR file 71/880	19P	19/12/71-28/12/71	611.6 km 'Airgun'

AUSTRALIA AND PAPUA NEW GUINEA  
 PETROLEUM EXPLORATION WELLS  
 1971



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

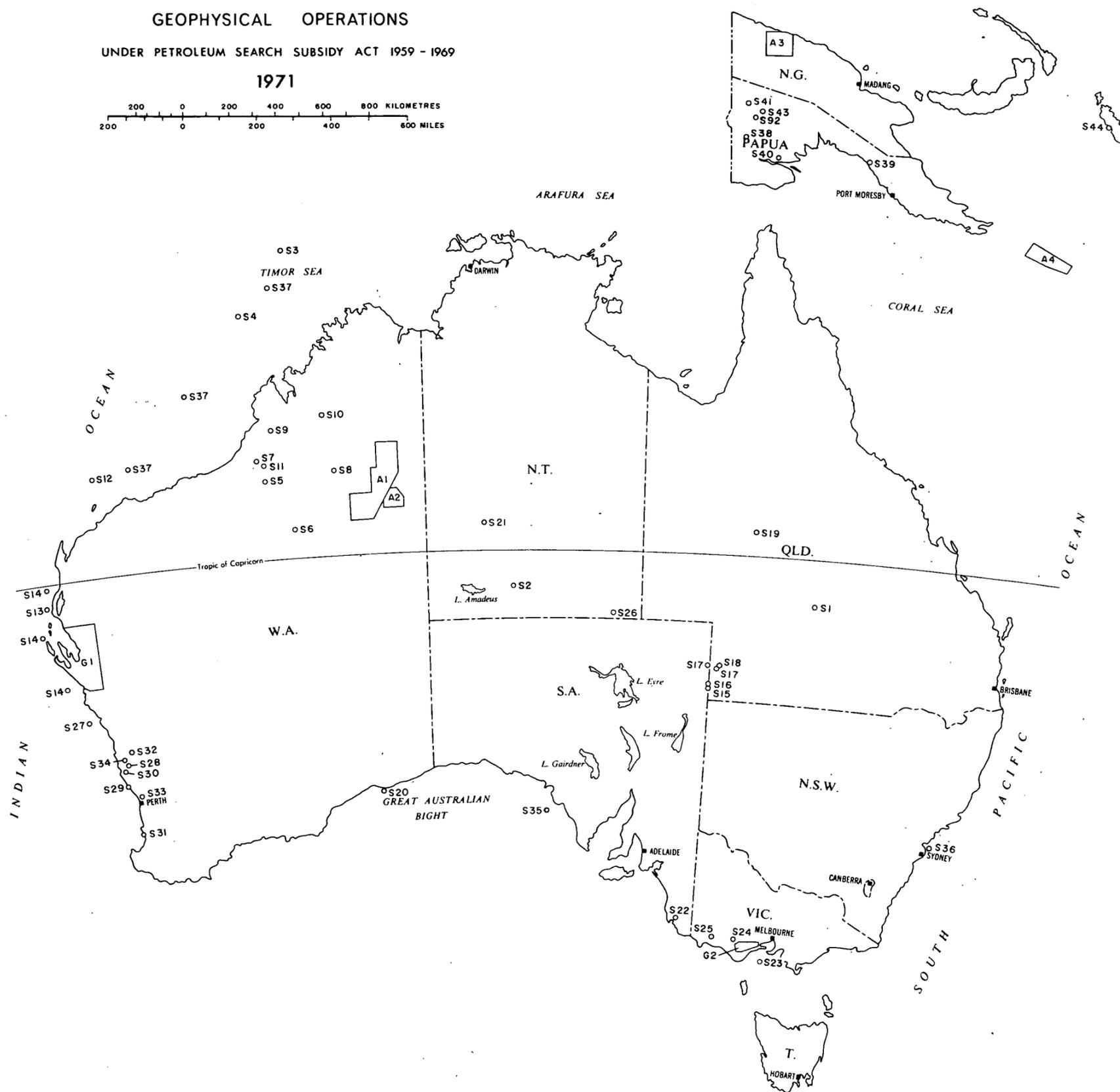
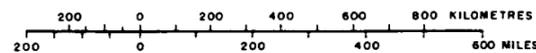
- |                        |                             |
|------------------------|-----------------------------|
| 1 Allandale, Old.      | 41 Tirrawarra 3 & 4, S.A.   |
| 2 Money Shoal, N.T.    | 42 Toolachee 3, S.A.        |
| 3 Wallira West, S.A.   | 43 Toolachee 4, S.A.        |
| 4 Flamingo, W.A.       | 44 Coonatie, S.A.           |
| 5 Gull, W.A.           | 45 Lake Hope, S.A.          |
| 6 Osprey, W.A.         | 46 Strzelecki 2, S.A.       |
| 7 Petrel 2, W.A.       | 47 Della 3 & 4, S.A.        |
| 8 Sandpiper, W.A.      | 48 Crossroads, Vic.         |
| 9 Tern, W.A.           | 49 East Reeve, Vic.         |
| 10 Lynher, W.A.        | 50 West Seacombe, Vic.      |
| 11 Scott Reef, W.A.    | 51 Sailfish, T.A.S.         |
| 12 Bedout, W.A.        | 52 Flying Fish, Vic.        |
| 13 Crossland, W.A.     | 53 Charlotte, W.A.          |
| 14 Crossland 2, W.A.   | 54 Gage Roads, W.A.         |
| 15 Crossland 3, W.A.   | 55 Sugarloaf, W.A.          |
| 16 Lake Betty, W.A.    | 56 Walyering, W.A.          |
| 17 Munda, W.A.         | 57 Walyering 2, W.A.        |
| 18 Tappers Inlet, W.A. | 58 Warnbro, W.A.            |
| 19 Angel, W.A.         | 59 West White Point, W.A.   |
| 20 De Grey, W.A.       | 60 West White Point 2, W.A. |
| 21 Goodwyn, W.A.       | 61 Meribah, Old.            |
| 22 North Rankin, W.A.  | 62 Hoolah, Old.             |
| 23 Rankin, W.A.        | 63 Hoolah Creek, Old.       |
| 24 Cane River, W.A.    | 64 Neabul Creek, Old.       |
| 25 Cane River 2, W.A.  | 65 Noogilla, Old.           |
| 26 Cane River 3, W.A.  | 66 Glenarden, Old.          |
| 27 Ningaloo, W.A.      | 67 Glenora, Old.            |
| 28 Sandy Point 2, W.A. | 68 Jenavale, Old.           |
| 29 Coopers Creek, S.A. | 69 Javel, Old.              |
| 30 Mudrangie, S.A.     | 70 Muggleton, Old.          |
| 31 Moorari, S.A.       | 71 Echo Hill, Old.          |
| 32 Moorari 2, S.A.     | 72 Norindoo 2, Old.         |
| 33 Tirrawarra 2, S.A.  | 73 Norindoo 3, Old.         |
| 34 Big Lake, S.A.      | 74 Kincola 6, Old.          |
| 35 Burley, S.A.        | 75 Niella North West, Old.  |
| 36 Epsilon, Old.       | 76 Wangary North, Old.      |
| 37 Fly Lake, S.A.      | 77 Thompson, Old.           |
| 38 Fly Lake 2, S.A.    | 78 Tinganoo Bay, N.T.       |
| 39 Kudrieke, S.A.      | 79 Glenavon, Old.           |
| 40 Tilpatee A, S.A.    | 80 Mananda, P.N.G.          |
|                        | 81 Cecilia, P.N.G.          |
|                        | 82 Heron, N.T.              |

AUSTRALIA AND PAPUA NEW GUINEA

GEOPHYSICAL OPERATIONS

UNDER PETROLEUM SEARCH SUBSIDY ACT 1959 - 1969

1971



S SEISMIC

- S1 Cootabynia, Qld.
- S2 Seymour Range, N.T.
- S3 Sahul - Ashmore Marine, N.T.
- S4 Scott Reef Marine, W.A.
- S5 Anketell, W.A.
- S6 Lake Auld, W.A.
- S7 Munro Detail, W.A.
- S8 Crossland Platform, W.A.
- S9 North Broome, W.A.
- S10 Poulton, W.A.
- S11 Munro D-2, W.A.
- S12 Rankin Trend Marine, W.A.
- S13 Ronsard Marine, W.A.
- S14 Bernier Marine, W.A. (& Magnetic)
- S15 Tilpatee, S.A.
- S16 Dunjereo, Qld. & S.A.
- S17 Coopers Creek Central, Qld. & S.A.
- S18 Sandy Creek, Qld.
- S19 Williams Creek, Qld.
- S20 Offshore Eyre Marine, W.A.
- S21 Ngalia Basin, N.T.
- S22 Otway 071A, S.A.
- S23 Torquay Embayment Marine, Vic. (& Magnetic)
- S24 Warrnambool - Pomborneit, Vic.
- S25 Nelson-Koroit, Vic.
- S26 Three Corners, N.T. (& Gravity)
- S27 Geelvink Channel, D-1, Marine, W.A.
- S28 Barragoon, W.A.

- S29 Moore River, W.A.
- S30 West Walyering, W.A.
- S31 Preston D-1, Detail W.A.
- S32 Dandaragan East Flank, W.A.
- S33 Gingin-Bullsbrook D-1, W.A.
- S34 Coomallo, W.A.
- S35 Polda Basin 2 Marine, S.A.
- S36 Sealion Marine, N.S.W.
- S37 Trimouille-Dillon Marine, W.A. & N.T.
- S38 Fly, Strickland & Aramia Rivers, P.N.G.
- S39 Tovala-Lesi, P.N.G.
- S40 Balimo, P.N.G.
- S41 Elevala, P.N.G.
- S42 Kaim-Strickland, P.N.G. (& Gravity)
- S43 Tomu River, P.N.G. (& Gravity)
- S44 Bougainville Marine, P.N.G. (& Magnetic)

A AEROMAGNETIC

- A1 Billiluna-Helena, W.A.
- A2 White Hills, W.A.
- A3 Yimi, P.N.G.
- A4 Louisiade Archipelago, P.N.G.

G GRAVITY

- G1 Murchison-Gascoyne, D-1, W.A.
- G2 Colac-Geelong, Vic.