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Record 1973/216

SUMMARY OF OIL SEARCH ACTIVITIES IN AUSTRALIA AND PAPUA NEW GUINEA DURING 1972

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CONTENTS

INTRODUCTION

This Record is largely a summary of the results of subsidized drilling and geophysical operations carried out under the Commonwealth Petroleum Search Subsidy Act (1959 - 1969 (PSSA)) during 1972. It also contains brief details of unsubsidized drilling operations.

Because the results of subsidized operations are kept confidential for at least six months, the results of those completed late in 1972 are not included - the cut off date being 31 July 1973. The Record contains the results of a small number of subsidized operations completed in 1971 and released too late for inclusion in the previous record in this series (Bur. Miner. Resour. Aust. Rec. 1973/27).

Except where indicated, the interpretation of the data is that of the author or authors of the Final Reports. Stratigraphic nomenclature has been altered where necessary to fit in with current useage.

The Bureau of Mineral Resources (BMR) file numbers of the Final Reports of the 1972 subsidized operations are included in Tables 3 and 4. File numbers of earlier subsidized operations are given in the text.

Unsubsidized geophysical surveys are not included in this Record because details of these operations are not consistently reported in the press. The locations of those which are reported are not always available, and their titles are sometimes confusing with regard to the Bureau's nomenclature of subsidized surveys.

ADAVALE BASIN

One subsidized well was drilled and one subsidized seismic survey was carried out in 1972.

SUBSIDIZED DRILLING

Alva No. 1 was drilled in the eastern part of the basin on a northeast-trending anticline mapped during the Listowell seismic survey (BMR file 65/11024). The primary target was sandstone in the Middle Devonian Log Creek Formation which produced gas at Gilmore about 80 km to the west.

The well penetrated 1506 m of sediments in the Eromanga Basin and 344 m of Triassic and Permian sandstone, shale, and coal of the Galilee Basin before intersecting sediments of the Adavale Basin at 1856 m (below Kelly Bushing). Upper Devonian to Lower Carboniferous sandstone and shale of the Buckabie Formation are underlain by 671 m

of Middle Devonian sediments correlated with the Etonvale D1, Etonvale D2, and Boree Salt Members of the Etonvale Formation and the Bury Limestone. These are underlain by 70 m+ of sandstone of presumed Middle Devonian age in which the well bottomed. These correlations, given in the final report, are questionable. The Company geologist, G. Auchincloss, considers that the dolomitic limestone correlated with the Bury Limestone is better correlated with the Cooladdi Limestone Member of the Etonvale Formation, found in several wells drilled to the west of Alva No. 1, and that the underlying sandstone is the correlative of the sandstone member of the Log Creek Formation which is gas bearing at Gilmore. Galloway (1970)* on the other hand correlates the Cooladdi Limestone of the central Adavale Basin with the Boree Salt Member in the east and he correlates the shale member of the Log Creek Formation with the Bury Limestone.

The unnamed sandstone below the Bury Limestone is a prominent seismic horizon and was the primary drilling target. However, it proved to have low porosity and permeability owing to secondary silicification and there were no indications of hydrocarbons. The overlying Bury Limestone was dense and tight hydrocarbons. The overlying Bury Limestone was dense and tight, but was shown to be a possible source rock - giving a bituminous residue when dissolved in acid.

SUBSIDIZED GEOPHYSICS

The Gallipoli seismic survey was carried out in two parts; one a detailed survey in the Grey Range area about 50 km northwest of the Gilmore Gas field and the other a reconnaissance survey carried out west of the Adavale Basin. The detailed survey was designed to investigate the Grey Range Prospect - a southeast-plunging anticline - mapped by earlier geophysical work over part of the northeast margin of the Cooper Basin. The shallow hole CDP analogue technique employed, produced generally poor quality data in both areas and no significant new information was produced.

BASS BASIN

No subsidized geophysical operations were carried out in 1972. Four unsubsidized wells were drilled. They were all plugged and abandoned as dry holes.

* GALLOWAY, M.C., 1970 - Adavale, Queensland - 1:250 000 Geological Series. Bur. Miner. Resour. Aust. explan. Notes SG/55-5.

BONAPARTE GULF BASIN

Eight unsubsidized and two subsidized wells were completed in 1972. Three subsidized seismic surveys were completed.

SUBSIDIZED DRILLING

Onshore

Heron No. 1 was drilled on a seismically defined northeast-trending anticline about 300 km northwest of Darwin on the Van Diemen Rise in the northeastern part of the basin. The Tertiary to Upper Jurassic sediments penetrated were dated by marine and non-marine microfossils. The Tertiary section is a carbonate sequence with interbedded claystone, significantly more argillaceous and considerably thinner than the equivalent sequence in Flamingo No. 1 280 km to the west. Fifty five metres of upper Miocene and 281 m of lower to middle Miocene sediments rest unconformably on 495 m of Paleocene to Eocene sediments. The top 198 m was not sampled. Although there is faunal evidence for a considerable hiatus at the base of the Miocene, there is no evidence on the seismic records of an angular unconformity.

The Tertiary sediments are apparently conformable on the Lower to Upper Cretaceous Bathurst Island Formation (2126 m thick) which ranges in age from Maastrichtian to Albian or Aptian. The formation consists of interbedded outer neritic marine sandstone and shale which becomes successively more argillaceous and calcareous with depth.

The underlying Petrel Formation ranges in age from Aptian to Oxfordian. It contains slightly silty generally calcareous shale, except in the bottom 30 m where a fine-grained tight sandstone is present. The well reached total depth in this formation after penetrating it for 1054 m.

The Bathurst Island Formation is thicker in this well than in any of the previous seven wells drilled by Arco Australia Ltd in the Bonaparte Gulf Basin, which suggests that at this locality it was deposited near the centre of the northeast-trending Malita Graben. The apparent conformity between the Bathurst Island Formation and the underlying Petrel Formation contrasts with the unconformity in other wells, drilled near the palaeo basin margin. Several gas shows were recorded in the Upper Cretaceous and the Upper Jurassic sediments, but the zones were not tested.

Offshore

Pelican Island No. 1 was drilled on an island in the southern Bonaparte Gulf, about 5 km from the coast and 100 km northeast of Wyndham. The Upper Carboniferous Border Creek Formation crops out on the island. The well penetrated Carboniferous sediments dated by marine and non-marine microfossils.

The 151 m of Border Creek Formation penetrated consisted of continental quartz sandstone with rare interbedded claystone.

Two unnamed lithological units, both of Upper Carboniferous age underlie the Border Creek Formation. The upper unit (189 m thick) consists of marginal quartz sandstone and minor interbedded shale ranging in age from Namurian to Westphalian. The lower unit (41 m thick) consists of thinly interbedded marginal sandstone and shale of lower Namurian and possibly upper Visean age.

A fairly sharp change in microflora suggests a possible disconformity between the Upper and Lower Carboniferous sediments. The Lower Carboniferous section consists of the Tanmurra Formation (466 m thick) above and the Bonaparte Beds (935 m thick) below. The Tanmurra Formation, of Visean age, consists of sandstone, limestone, and very minor shale deposited in a shallow marine environment. The Bonaparte Beds of Visean and possibly Upper Tournasian age, consist of shallow marine siltstone and shale with minor sandstone and limestone. The well intersected intrusive salt at 1791 m and penetrated it to 1981 m where drilling terminated. The salt may have originated from Middle or Upper Devonian sediments.

Several oil shows were recorded in the Upper Carboniferous sediments, and gas shows were recorded in several zones in the Lower Carboniferous. Examination of electric logs and sidewall cores indicated that the various zones of interest were either too tight or too thin to warrant testing.

The results of two of the three seismic surveys had been released by the cut-off date.

SUBSIDIZED GEOPHYSICS

Onshore

The Border Creek seismic survey was carried out in the area south of Keep River No. 1, (BMR file 68/2029). Gas was produced at Keep River No. 1 from the Lower Carboniferous Milligan Formation during a drill-stem test.

Poor quality reflection data were obtained and only one horizon, identified as the upper member of the Milligan Formation by tie with Keep River No. 1, was mapped. The formation dips gradually to the northeast where it is folded into a small northeast-trending anticline. As the conventional six-fold common depth point technique employed in this survey produced poor data the Vibroseis technique was recommended for future work in the area.

Offshore

The Prudhoe-Hibernia seismic survey was carried out in two parts; one, 72-D, in the Bonaparte Gulf Basin and the other, 72-G, in the Browse Basin.

Project 72-D was a detailed survey carried out on the Sahul-Ashmore Block near Cartier Island and Hibernia Reef. Five horizons were mapped on fair quality data: horizon E - near base Miocene; horizon M - near base Tertiary; horizon T - major unconformity (?early Jurassic); horizon Q - intra Triassic event, and horizon S - tentative top Permian.

Two sets of faults were mapped; a younger easterly-trending set north of Hibernia Reef and an older northeasterly-trending set of Lower Triassic to early Jurassic age. Three main structures were mapped: the North Hibernia - a large anticline with vertical closure on all horizons; the East Hibernia - an anticline with closure at all levels except on the intra-Triassic Q horizon which showed severe faulting and tilting, and the Cartier Island - an uplifted fault block in the southeast of the survey area mapped only on Horizon S. There is sufficient seismic control on the North Hibernia anticline and the Cartier Island fault block for well sites to be selected.

BOWEN BASIN

No wells were drilled in 1972. The Burton Downs seismic, gravity, and magnetic survey was carried out in 1972 but the results had not been released by 31 July 1973.

BROWSE BASIN

Two subsidized seismic surveys, in addition to Project 72-G of the Prudhoe-Hibernia seismic survey, were carried out and one subsidized well was drilled in 1972.

SUBSIDIZED DRILLING

Rob Roy No. 1 was sited 37 km east of Scott Reef No. 1 (BMR file 71/82) on the eastern side of the basin. The section penetrated was dated by marine and non-marine microfossils. Cainozoic and Mesozoic sediments were penetrated and then Permian to Carboniferous? sediments, preserved in a graben, were penetrated before the well bottomed in quartzite of probable Proterozoic age. No significant indications of hydrocarbons were encountered, but formation waters in Cretaceous to Triassic sandstone beds were interpreted from wire-line logs to have high salinity, suggesting that the sediments have not been flushed and, perhaps, indicating the presence of an evaporite sequence downdip.

The Cainozoic sediments, 588 m thick, are predominantly carbonates except for 133 m of Palaeocene sandstone with minor interbedded claystone and coal at the base. The Eocene, Oligocene, and an unknown amount of the lower Miocene are absent.

The Tertiary appears to be conformable on the Cretaceous. The Cretaceous consisted of 783 m of clastic sediments with a higher proportion of sandstone than encountered previously on the North-West Shelf. Maastrichtian/Cenamanian, and Neocomian/Lower Jurassic disconformities or unconformities were detected. Lower Jurassic sandstone, minor claystone, and coal, 93 m thick, rest unconformably on Sakmarian and possibly Upper Carboniferous claystone and sandstone with minor limestone. In addition to the major disconformities or unconformities referred to above, hiati were detected between the Albian and the Aptian, the Aptian and the Neocomian, and within the Neocomian.

SUBSIDIZED GEOPHYSICS

The Browse Basin seismic survey was designed to detail structures mapped previously in Triassic and Jurassic sediments. Four horizons were mapped on generally good quality data: horizon X - near base Tertiary; horizon D - intra Upper Cretaceous unconformity; horizon Hf - intra-Neocomian, and horizon T - near top Triassic unconformity. The seismic horizons were tied to Scott Reef No. 1 (BMR file 71/82), Rob Roy No. 1, Leveque No. 1 (BMR file No. 67/670), and Lynher No. 1 (BMR file 71/948). The structure contour maps confirm the presence of a rapidly seaward thickening wedge of undisturbed Tertiary and Mesozoic sediments overlying faulted Triassic and older

rocks. The isochron maps X - D, D - Hf, and Hf - T show numerous structural anomalies towards the present shoreline although no closures were mapped. It is considered that data quality below Horizon T was sufficiently good to permit structures below this horizon to be mapped.

The North Reef seismic survey was a detailed survey carried out in the northern part of Scott Reef.

There had been no previous seismic work over the North Reef because of the difficulty of access with a conventional seismic ship and streamer cable. The problem was overcome with a shallow draught vessel and a floating cable. A tie line was extended from inside North Reef, through the southern opening, to the vicinity of Scott Reef No. 1. This tie line intersected six seismic lines shot previously in the South Reef. The horizons mapped were: horizon X - near base Tertiary; horizon D - intra Upper Cretaceous unconformity; horizon Hf - Lower Cretaceous intra Necomian; horizon Jb - near top Jurassic, and horizon T - near top Triassic unconformity. The data quality was fair to good on the upper two horizons, but deteriorated with depth. A northeasterly-trending anticline closed on all horizons was mapped within North Reef. The northwest side of the structure was faulted down to the northwest in the late Jurassic and the interval Jb - T thins towards the crest.

Project 72-G of the Prudhoe-Hibernia seismic survey was carried out in the east of the Browse Basin to detail the Prudhoe Prospect and to explore for additional closures along the same anticline. Four horizons were mapped on fair quality data: horizon X - near base Tertiary; horizon D - intra-Upper Cretaceous unconformity; horizon Hf - intra Neocomian (Lower Cretaceous), and horizon T - near top Triassic. The area is structurally rather featureless. No closures and no pronounced faults were mapped.

CLARENCE - MORETON BASIN

The unsubsidized well, Toora No. 1, was drilled 48 km west of Dalby. There were no indications of hydrocarbons.

CANNING BASIN

Nine subsidized geophysical operations were carried out and five subsidized wells were drilled in 1972. Two of the wells, Pender No. 1 and Palm Spring No. 1, were stratigraphic tests.

SUBSIDIZED DRILLING

Onshore

Pender No. 1 was sited on a small seismically defined anticline, one of a series of structures mapped along a 160 km-long trend, at the western end of the Lennard Shelf. The primary objective of the well was to establish the presence or absence of Ordovician or Devonian carbonates in the area. The well penetrated 62 m of unconsolidated sandstone, 120 m of Lower Cretaceous Broome Sandstone, 40 m of Upper Jurassic Jarlemai Siltstone, 51 m of Alexander Formation, and 169 m of Upper Jurassic Wallal Sandstone resting unconformably on 463 m of fine to coarse-grained sandstone of Permian and Carboniferous age (Grant Formation). The Permian/Carboniferous boundary occurs between 597 m and 625 m. The well passed from Grant Formation into Precambrian mica schist at 907 m.

Palm Spring No. 1 was drilled on the Lennard Shelf 85 km northwest of Fitzroy Crossing to determine the stratigraphy of the Lower Carboniferous to Upper Devonian section and to provide velocity information in this area of poor quality seismic data. After a thin Quaternary section the well penetrated 137 m of shale and claystone of the Permian Noonkanbah Formation, 30 m of Permian Poole Sandstone, and 289 m of unconsolidated Permian sandstone of the Grant Formation. At 462 m it entered limestone assigned to the Upper Devonian (Upper Famennian) Luluigui Formation. The top 300 m of the formation is predominantly massive tight limestone and this rests on a predominantly shale sequence which persisted to total depth. There were no indications of hydrocarbons.

The lack of good quality seismic data in the area was partly attributed to the lack of velocity contrast in the thick shale section of the Luluigui Formation. The company correlates the Luluigui Formation in Palm Spring No. 1 with a platform carbonate, the Nullara Limestone (WAPET new name = Famennian Pillara Limestone of Playford & Lowry, 1967*), which was found in Blackstone No. 1, drilled about 60 km to the west-northwest.

Munro No. 1 was drilled in the southeastern part of the basin on the Munro Structure - a northwest-trending anticline separating the Kidson and Willara Sub-basins. The structure was detailed by the Munro D-1 (BMR file 71/1000) and the Munro D-2 (BMR file 71/478) seismic surveys. The nearest deep well control is from Willara No. 1 (BMR file 65/4158) 90 km to the northwest.

* PLAYFORD, P.E., & LOWRY, D.C., 1967 - Devonian reef complexes of the Canning Basin, Western Australia. Bull. geol. Surv. W. Aust. 118.

The well was drilled to test the hydrocarbon potential of the carbonate rocks of the Ordovician Nita, Goldwyer, and Willara Formations. It penetrated about 27 m of Jurassic siltstone overlying approximately 402 m of Jurassic Wallal Sandstone. The Wallal Sandstone rests unconformably on the Grant Formation (Dora Shale Member, 550 m thick, and Cuncudgerie Sandstone Member, 131 m thick) which in turn is unconformable on the Silurian to Devonian Carribuddy Formation (324 m thick). The Carribuddy Formation overlies the Nita Formation (88 m thick), possibly disconformably. The Ordovician Nita Formation, Goldwyer Formation (219 m thick), and Willara Formation (304 m thick) are conformable. The Ordovician sediments are underlain by Precambrian granite which the well penetrated to total depth. No significant hydrocarbons were found.

Logue No. 1 was drilled on a seismically defined northeast-trending anticline on the Jurgurra Terrace. The primary objective was to test the hydrocarbon potential of the Devonian Mellingerie Formation which is a porous and permeable carbonate sequence at Matches Springs No. 1 (BMR file 69/2023) and Mowla No. 1 (BMR file 69/2039) some 80 km along the terrace to the southeast. The Middle Devonian Tandalgoo Sandstone and overlying Permian sediments were secondary objectives. The well penetrated Upper Jurassic Wallal Sandstone to approximately 165 m before entering Lower Permian siltstone and claystone of the Noonkanbah Formation (240 m thick), the Poole Sandstone (107 m thick), and unconsolidated sandstone of the upper Grant Formation (415 m thick). The lower part of the Grant Formation is Carboniferous in age. It contains 133 m of shale underlain by 300 m of sandstone. The Grant Formation is unconformable on Carboniferous(?) claystone and shale of the Laurel Formation (204 m thick) which in turn is unconformable on an Upper Devonian sequence consisting of the Clanmeyer Formation (1067 m thick) and the 'Babrongan Beds' (69 m thick) in which the well reached total depth. The 'Babrongan Beds', first noted in Babrongan No. 1 (BMR file 62/1090), were identified on the basis of a change from grey to red-brown siltstone and a change in wireline log characteristics. The Palaeozoic lithological units were dated by marine and non-marine microfossils. Although no significant hydrocarbons were found the well provided useful geological information. The Grant Formation was thicker than predicted and part of it is Carboniferous. The Carboniferous claystone and shale identified as Laurel Formation by the company is preferably identified as Fairfield Formation (P.J. Hawkins BMR pers. comm.) on the basis of its lithology and age. The principal drilling target, the Mellinjerie Formation, was not intersected as predicted. Seismic correlation between Logue No. 1 and other wells suggests that the formation may lie at a depth of approximately 1981 m near Doran No. 1 (BMR file 68/2033) drilled on the Jurgurra Terrace to the southeast, and that this area should be explored in the future.

Barbwire No. 1 was drilled to determine the stratigraphy in an area where only poor quality seismic data had been obtained. It was sited on a poorly defined anticline separating the Jurgurra Terrace to the northwest from the Barbwire Terrace to the southeast. The well spudded in the Grant Formation and penetrated 143 m of sandstone, claystone, and siltstone before passing through an unconformity into dolomitic limestone of the Upper Devonian Pillara Formation. Two hundred and twenty metres of limestone, dolomitic sandstone, siltstone, and calcitic dolomite of the Pillara Formation were underlain by 220 m of claystone, sandstone, and siltstone correlated with the Middle Devonian Tandalgoo Formation and 273 m predominantly of siltstone correlated with the Silurian to Devonian(?) Carribuddy Formation. The Carribuddy Formation is unconformable on Ordovician dolomite of the Nita Formation (52 m thick). Beneath the Nita Formation, 289 m of the Goldwyer Formation were drilled to total depth. The formation consists of shale and siltstone containing a 91 m-thick unit of dolomite and limestone. There were no significant hydrocarbon shows, but the porosities of the sandstone in the Tandalgoo and Carribuddy Formations improved over that recorded in Matches Springs No. 1 (BMR file 69/2023). The drilling demonstrated the presence of Devonian carbonates in the Barbwire area. Previous interpretation had suggested that they had been eroded from over a basement high.

SUBSIDIZED GEOPHYSICS

The results of seven of the nine geophysical surveys carried out in 1972 were released before 31 July 1973.

Onshore

The East Canning seismic survey included detailed and semi-detailed coverage of previously mapped structures and reconnaissance coverage to provide tie-lines between earlier traverses on the Lennard Shelf, the Fitzroy Trough/Gregory Sub-basin, the Barbwire Terrace, and the Crossland Platform. Approximately 860 km of existing data were reprocessed and incorporated with the new data in the mapping of three horizons: horizon A - pre-Permian unconformity; horizon B - near top Devonian Pillara Formation, and horizon C - near top Ordovician. Data quality varied from good to very poor.

Two fault controlled anticlines, the Arundel and Bruten structures, were mapped in the Arundel-Christmas Creek area of the Lennard Shelf and the Fitzroy Trough. Poor quality data resulting from complex faulting prevented good definition of the two structures. Three small closures, which need further confirmation, were mapped on the Crossland Platform. A number of closures were mapped on the Barbwire Terrace. A well site was recommended on one of them, the Jones Range structure, which is a large faulted anticline with 500 milliseconds of vertical closure. One of the smaller closures was tested by Barbwire No. 1.

The Lennard Shelf survey provided detailed coverage of previously mapped structures near Blackstone No. 1 (BMR file 67/4262) on the Lennard Shelf southeast of Derby and also tied modern CDP lines to the well. Further regional control was obtained by extending seismic lines farther south. Three horizons were mapped: horizon B - pre-Permian unconformity; horizon C - near top of Devonian reflector, and horizon D - top Pillara Formation (intra Devonian unconformity). Isochron maps of the intervals B-C and C-D were presented. Fifteen structures were intervals B-C and C-D were presented. Fifteen structures were mapped, eleven of them in detail. The best prospect, the Warrawadee Structure, is a closed anticline on the downthrown, i.e. southern, side of the Pinnacle Fault, which provides closure to the northeast. Vertical closure of up to approximately 580 m extends over an area of 78 km^2. The Pillara Formation is estimated to occur at depths between 3300 m and 4000 m.

Two seismic surveys, the Dampier Downs Collins and the North Broome D-2, were carried out in the central part of the basin, east-southeast of Broome.

The Dampier Downs Collins survey provided regional coverage over about 57 000 km of the Broome Platform, the Fitzroy Trough, and the Jurgurra Terrace. The pre-Permian unconformity and an horizon near the top of the Ordovician were mapped; the lower horizon on unreliable data and the upper horizon on unreliable to good data. The upper horizon shows the major northwest-trending Broome Platform, Jurgurra Terrace, and Fitzroy Trough. Sixteen structures were mapped, eight of which are closed anticlines which have already been drilled. Further seismic work is recommended to detail seven of the remainder. The interval between the two mapped horizons thickens from the Broome Platform into the Fitzroy Trough and is absent near Thangoo No. 1 (BMR file 62/1054) and Thangoo No. 2 (unsubsidized - 1973) on the Broome Platform in the northwestern part of the survey area.

The Hickey Hills seismic survey was carried out in two permit areas, EP 20 and EP 33, in the eastern part of the Canning Basin.

EP 20 lies in the southeastern part of the Kidson Sub-basin where previous seismic work had indicated that Ordovician sediments may pinchout on the southeastern margin. The two wells drilled in the sub-basin, Wilson Cliffs No. 1 (BMR file 68/2011) and Kidson No. 1 (BMR file 65/4177), obtained shows of wet gas from the Ordovician sediments. Data quality was fair and the two traverses, one north and one northwest trending, demonstrated the northerly thickening of the sediments into the basin over a series of terraces bounded by northwest-trending down to the basin faults. Three unidentified horizons were mapped. Additional seismic work and some stratigraphic drilling were recommended.

EP 33 lies to the east of EP 20 where aeromagnetic and gravity work had indicated the possibility of a sedimentary sequence lying between the Helena Pollock Hills ridge and scattered Proterozoic outcrops to the east. The quality of the data obtained in EP 33 was too poor to yield any reliable information.

The North Broome D-2 seismic survey detailed a northwest-trending anticline with several separate culminations revealed by earlier seismic work in the northwestern part of the Broome Platform. The Ordovician Thangoo Limestone and Nita Formation are the prospective units in the area. Seismic horizons from near the top of the Thangoo Limestone and from the unconformity at the base of the Permian were mapped.

The reflections from the top of the Thangoo Limestone were of fair to good quality and five possible domes were further defined, only one in sufficient detail for a well to be sited. A maximum 50 m of vertical closure is estimated over an area of 50 km^2. Thangoo No. 1 (BMR file 62/1054) which lies to the north had oil shows in the Thangoo Limestone whereas Thangoo No. 1A had no indications of hydrocarbons. An explanation for this was found during the survey as one of the many faults mapped passes between Thangoo No. 1 and Thangoo No. 1A, demonstrating that the wells were sited on separate fault blocks.

The reflections from the unconformity at the base of the Permian were generally of poorer quality than those from the Thangoo Limestone. The isochron map between the two horizons indicates substantial erosion of the Goldwyer Formation, particularly in the area northwest of the Thangoo wells. A thicker section, with an estimated minimum of about 150 m is estimated on the prospective structure to the south of the wells.

Offshore

The Naringla seismic survey was carried out offshore over the southern margin of the Fitzroy Trough. Good quality data were obtained and three horizons were mapped: horizon D - Cretaceous Toolonga Calcilutite; horizon H - top of Jurassic sand section; horizon T - major regional unconformity of late Triassic age, and horizon Ze - probable base Permian. The upper three horizons were tied to Lacepede No. 1A (BMR file 70/426) and horizon Ze to Tappers Inlet No. 1 (BMR file 71/301). The sediments above the Triassic unconformity dip uniformly to the northwest. A series of horsts parallel to the margin of the Broome Platform were mapped on horizon Ze. A number of closures were mapped on the fault blocks, the most notable being the Naringla structure.

The Bedout-Broome Swell seismic and magnetic survey was carried out offshore over the eastern half of the Bedout Sub-basin and over the Broome Swell, (the offshore extension of the Broome Platform). The survey was designed to investigate previously mapped structure and to extend reconnaissance coverage. Reflecting horizons from the top of the Jurassic, top of the Triassic, and the top of the Permian were contoured in depth. Two prominent structures in the Bedout Sub-basin were defined as fault blocks containing lower Mesozoic sediments overlain by a thick sequence of upper Mesozoic and Tertiary sediments. There is no evidence of fault movement after the Upper Triassic. The Bedout Sub-basin is estimated to contain over 6000 m of Mesozoic and Tertiary sediments. The magnetic survey was shelved owing to malfunction of the magnetometer.

CARNARVON BASIN

SUBSIDIZED DRILLING

Onshore

Two subsidized wells were completed onshore in 1972.

Cunaloo No. 1 was located southwest of Onslow in the northern Ashburton Sub-basin. The well was drilled primarily to test the hydrocarbon potential of a structural trap in the basal Cretaceous Birdrong Sandstone and, in addition, to confirm the presence of Triassic sediments beneath the Lower Cretaceous unconformity and, if present, to assess the hydrocarbon potential of the Upper Triassic Mungaroo Formation.

The well penetrated: 15 m of undifferentiated Quaternary and Tertiary sediments; 6 m of Miocene Trealla Limestone; 9 m of Upper Cretaceous (Albian) Gearle Siltstone; 236? m of Lower Cretaceous (Aptian) Gearle Siltstone; 84? m of Muderong Shale; 7 m of Birdrong Sandstone; 235 m of Middle to Lower Triassic Locker Shale, and 57 m of Upper Permian Kennedy Group.

The Cretaceous Windalia Radiolarite was absent and the Muderong Shale and Birdrong Sandstone were thinner than expected; 46 m of the sandstone were predicted. The sandstone beds within the Locker Shale were water saturated. The Upper Triassic Mungaroo Formation and the upper part of the Locker Shale appear to have been eroded away beneath the unconformity diminishing the potential for stratigraphic traps. However, sandstone beds within the Kennedy Group are porous and the Locker Shale above is a potential caprock.

East Marilla No. 1 was drilled southeast of Exmouth on a structural high that separates the Ashburton Sub-basin in the north from the Merlinleigh Sub-basin in the south. It tested the East Marilla anticline (Mia Mia seismic survey, BMR file 67/11179), a northerly-trending structure in pre-Permian strata with up to 244 m of closure over about 47 km^2. Geological control for the seismic survey was limited to Wandagee No. 1 (BMR file 62/1215) and Quail No. 1 (BMR file 63/1010), both 112 km to the south, and Marilla No. 1 (BMR file 63/1200), only 11 km west of East Marilla No. 1 but shallow (548 m) and separated from it by the major Wandagee Fault. The well penetrated 27 m of undifferentiated Quaternary and Tertiary ? sediments unconformable on 282 m of Lower Cretaceous claystone and 64 m of Birdrong Sandstone. The Cretaceous sequence is unconformable on the basal part of the Upper Carboniferous Lyons Group (31 m thick) and this in turn rests unconformably on 233 m of Lower Carboniferous Moogooree Limestone.

The drilling demonstrated that Permian sediments are absent on the structural high and that the major angular unconformity tentatively identified as base Permian (Mia Mia seismic survey, BMR file 67/11179) actually separates the Upper and Lower Carboniferous sediments in this area.

There were no significant hydrocarbon shows in the well and the Birdrong Sandstone, the only part of the sequence with good reservoir characteristics, was 100 percent water saturated.

Offshore

Dampier Sub-basin

The highlight of petroleum exploration in Australia during 1972 was the discovery of heavy grade oil (29.3° A.P.I. gravity) offshore in Eaglehawk No. 1 drilled on the Rankin Trend in the Dampier Sub-basin of the Carnarvon Basin. Previous significant oil discoveries in Australia have been of lighter grade, between 37° and 43° A.P.I. gravity crude oil. The well completion report had not been released at 31 July 1973, but the results of three drill-stem tests had been released to the press. During D.S.T. No. 1, between 2779 m and 2790 m, 30° A.P.I. gravity oil flowed at a rate of 571 b.p.d. through a 5/8" bottom hole choke. During D.S.T. No. 2, between 2752 m and 2766 m, 29.3° A.P.I. gravity oil flowed at a rate of 1645 b.p.d. and gas flowed at a rate of 0.41 MMcfD. No fluid was recovered during D.S.T. No. 3 of a tight zone between 2710 m and 2719 m above the main reservoir.

Angel Nos. 1 and 2 wells were drilled in the Dampier Sub-basin on the Angel structure, a culmination at the northeastern end of the northeast-trending Madeleine-Dampier Trend (see Project 72-A above). The trend was formed by the differential compaction and drape of Jurassic and Lower Cretaceous sediments over block faulted pre-Jurassic strata. The wells were the first to encounter hydrocarbons in commercial quantities on it; only shows of oil and gas were noted in the two earlier wells, Madeleine No. 1 and Dampier No. 1 (BMR file 69/2006, 68/2052).

Angel No. 1 penetrated Pleistocene to Upper Jurassic sediments and Angel No. 2 penetrated Pleistocene to Lower Jurassic sediments. The rock units were dated by fossils. Gas/condensate was discovered in sandstone in the lower part of the Upper Jurassic Barrow Formation (Table 1).

Angel No. 1, penetrated 1810 m of Cainozoic sediments; the drilling of this part of the sequence at Angel No. 2 was not subsidized. The Pleistocene to middle Miocene sediments in Angel No. 1 (711 m thick) consisted of coarse-grained calcarenite, and medium- to coarse-grained sandstone; the sandstone becoming the dominant lithology in the bottom two thirds of the section. The middle to lower Miocene sequence (497 m thick) consisted mainly of calcarenite grading into calcirudite in the lower part. The lower Miocene to Oligocene sediments (186 m thick) consisted of calcarenite and calcilutite, becoming dominantly marl in the bottom 50 m. Upper to middle Eocene calcilutite, 100 m thick, overlies lower Eocene to middle Paleocene marl (316 m thick).

TABLE 1 - DRILL STEM TESTS ANGEL NOS. 1 & 2

Well Name	bottom hole choke	surface choke	interval (m)	gas flow MMcfD	condensate barrels/day
Angel No. 1	5/8"	5/8"	2734 - 2737	12.85	720
" " "	5/8"	5/8"	2685 - 2688	13.2	686
Angel No. 2	5/8"	5/8"	2742 - 2751	11.16	586
	5/8"	½"	2718 - 2722	7.4	377
	5/8"	5/8"	2698 - 2705	12.1	632

The Mesozoic sequence was 1513 m thick. It comprised 431 m of Upper Cretaceous calcilutite, marl, and calcareous claystone unconformably overlying 304 m of Lower Cretaceous claystone and siltstone which in turn rested conformably on Upper Jurassic sandstone, siltstone, and claystone (778 m penetrated).

Angel No. 2, located 8 km northeast of Angel No. 1, tested the Jurassic section below the total depth of the first well. At 314 m the well intersected the plane of a major northeast-trending fault, upthrown on the southeast side. A throw of at least 250 m is indicated by correlation between the two wells. Upper Jurassic lower Tithonian sandstone was encountered on the down-thrown side of the fault and 1258 m of Upper to Lower Jurassic sandstone, claystone, siltstone, and coal was penetrated on the upthrown side to total depth.

The age ranges of the sediments and of time breaks within them were established using microfossils. Time breaks occur in Angel No. 1 at the base of the middle Eocene and at the base of the Tertiary. The upper one is three to four million years long and the lower one, which extends from the lower Palaeocene and probably part of the middle Palaeocene to the upper Maastrichtian, is five to seven million years long. Breaks occur at the Albian/Aptian boundary, within the Neocomian, and possibly within the Tithonian.

The Tithonian sequence in Angel No. 2 contained assemblages of pollen, spores, and microplankton similar to those found in Angel No. 1. The underlying Jurassic sequence (below the fault) ranged without break from possible Callovian to Lower Jurassic.

The gas/condensate reservoir in Angel No. 1 has a gross pay of approximately 85 m, which is the thickest hydrocarbon column encountered in the Barrow Formation.

The thick porous and permeable sandstone of the lower Barrow Formation encountered in Angel Nos 1 and 2 does not extend southeast to Madeleine No. 1 and Dampier No. 1. Potential reservoirs of porous and permeable sandstone were also present in Callovian to Lower Jurassic strata beneath the reservoir in Angel No. 2.

Wells were drilled on the Malus, Rosemary and Egret structures in 1972 (see Project 72-A above). Rosemary No. 1 and Egret No. 1 were in progress at the end of the year. Malus No. 1 was a subsidized well drilled at the southwest end of the Rankin Trend. The Malus structure is a large wedge-shaped fault block in Jurassic to Cretaceous sediments bounded on the east by a northeast-trending fault downthrown to the east and on the west by a north-trending

fault downthrown to the west; the two faults converge southwest of the well location. Cretaceous and Tertiary sediments are draped over the structure. The well penetrated sediments dated as Pliocene to Upper Triassic on the basis of marine and non-marine microfossils. It was the first well to penetrate Upper Jurassic sediments on the Rankin Trend. A Pliocene to middle Paleocene carbonate sequence was intersected to 2596 m. Breaks were detected between Burdigalian and basal Aquitanian, Oligocene and upper to middle Eocene, and upper to middle Eocene and lower Eocene. The Paleocene sediments are disconformable on Upper Cretaceous sediments of Maastrichtian to Campanian age.

The Cretaceous sediments are composed of 320 m of Maastrichtian to Albian marl, calcilutite, and claystone disconformable on 41 m of Aptian and Neocomian calcilutite and marl.

Upper Tithonian (Jurassic) marl, calcilutite, and claystone, 16 m thick, lies conformably beneath the Cretaceous sediments and rests unconformably on 20 m of Oxfordian sandstone and claystone. Below the Upper Jurassic the well penetrated 549 m of Upper Triassic silty claystone and sandstone to total depth. There were no indications of significant hydrocarbons. Log evaluation and testing indicated that all intervals were water bearing.

Barrow Sub-basin

North Tryal Rocks No. 1 was located 80 km north of Barrow Island and 48 km southwest of Rankin No. 1 on a large seismically defined fault block in Triassic sediments with drape closure provided by Cretaceous and Tertiary sediments. The Cainozoic to Upper Triassic sequence penetrated was dated by marine and non-marine microfossils.

Quaternary limestone was penetrated to 177? m and Tertiary carbonates to 2602 m. Breaks were detected at the upper Miocene/middle Miocene, Oligocene/upper Eocene, and mid Eocene/lower Eocene boundaries.

The Tertiary carbonates rest disconformably on Upper Cretaceous sediments. Maastrichtian to Campanian Miria Marl equivalent, 68 m thick, conformably overlies Santonian Toolonga Calcilutite, 101 m thick, which in turn overlies Lower Cretaceous (Albian to Turonian) Gearle Siltstone (98 m thick), Albian Windalia Radiolarite equivalent (18 m thick), and 93 m of Aptian and 80 m of Neocomian Muderong Shale.

Jurassic sediments, three metres thick, were identified below the base Cretaceous disconformity, and these are conformable on the Upper Triassic Mungaroo Formation equivalent which was penetrated for 580 m to total depth.

Non-commercial quantities of gas were discovered in the Mungaroo Formation. The gas bearing sands were thin - only 3 m of potential pay was estimated and thick porous and permeable sands which occurred in the bottom 300 m of the well are water-wet.

The drilling provided new stratigraphic information. The lower Miocene to Pliocene sediments contain less terrigenous detritus than sediments of the same age drilled to the north and south along the North Tryal Rocks - Rankin Trend. The terrigenous content of the mid to upper Eocene sediments increases from south to north. The base Tertiary sandstone was absent. The age equivalent of the Miria Marl was predominantly shale and the age equivalent of the Windalia Radiolarite was a limestone. The Windalia Sand Member of the Muderong Shale, which underlies the Windalia Radiolarite on Barrow Island and forms the major oil reservoir, was absent.

The Aptian and Neocomian shales are distinguished on fossil evidence only, and for this reason have been grouped together as the Muderong Shale. The Neocomian shale may be regarded as the correlative of the Neocomian Barrow Group as defined on Barrow Island.

Beagle Sub-basin

The first two wells were drilled in the Beagle Sub-basin in 1972. The Beagle Sub-basin comprises a large Mesozoic downwarp, the Beagle Trough, separated from the Dampier Sub-basin by the structurally high De Grey Nose. It is bounded on the north by the northeast-trending Jarman-Picard anticlinal trend and in the northeast by the structurally high block-faulted North Turtle Arch. Geophysical evidence suggests the sub-basin has a similar tectonic and depositional history to the Dampier Sub-basin.

The first well drilled, Picard No. 1, was located on the Jarman-Picard Trend, and the second well drilled, Sable No. 1, was located on an apparent northeasterly extension from the Dampier Sub-basin of the Rankin Trend. The lithological units penetrated in the two wells were dated by marine and non-marine microfossils.

Picard No. 1 penetrated predominantly carbonate Cainozoic sediments, 1741 m thick, ranging in age from Pliocene or younger to middle Palaeocene. No Oligocene sediments were found, and a break occurs between the middle and lower Eocene. The upper to middle Eocene sediments are thicker (272 m) than in the Dampier Sub-basin (89 m and 73 m in Angel Nos. 1 and 2).

The Cainozoic sequence rests unconformably on Upper Cretaceous, lower Maastrichtian, sediments. The Cretaceous section (434 m thick) consisted mainly of claystone and marl, except between 2020 m and 2012 m where

the Toolonga Calcilutite of Santonian age was penetrated. Breaks were detected at the Albian/Aptian boundary and at the base of the Cretaceous sequence, where Neocomian sediments rest on Middle Jurassic sediments.

Middle and Lower Jurassic (?Toanian) sediments, mainly sandstone with interbedded claystone, were penetrated for 1891 m to total depth.

The only indications of hydrocarbons were increased gas readings during the drilling of the Lower Jurassic. All the sands in the section were water saturated.

Sable No. 1 penetrated sediments ranging in age from Pliocene or younger to Triassic. No significant hydrocarbons were found.

The Cainozoic carbonate sequence, 2152 m thick, ranges in age from Pliocene or younger to Lower Paleocene and contains a break between the middle Eocene and the Oligocene. The Tertiary/Upper Cretaceous boundary appears unconformable on wireline log evidence, although micropalaeontological evidence indicates a more complete sequence than seen in wells drilled previously on the Northwest Shelf. Danian and Maastrichtian sediments were recognized.

Cretaceous sediments, 199 m thick, range in age from Maastrichtian to Cenomanian and consist of: an upper unit of marl and minor calcilutite; a middle unit (2444 m to 2488 m) of calcilutite (Toolonga Calcilutite), and a lower unit of calcareous claystone.

The Upper Cretaceous sediments rest on Lower Jurassic sediments. Conformable Lower Jurassic (Toarcian) and Upper Triassic claystone and fine-grained sandstone were drilled to total depth.

Gascoyne Sub-basin

Edel No. 1 was drilled in the offshore extension of the Gascoyne Sub-basin on a large anticline which was delineated by the Bernier seismic survey (BMR file 71/722).

It was expected to penetrate Tertiary, Mesozoic, and lower Palaeozoic sediments equivalent to those in either the Carnarvon and/or Perth Basins. Rock units correlated with the Tertiary Tulku Limestone, Mandu Calcilutite, and Giralia Calcarenite of the Carnarvon Basin were penetrated to 364 m. Below 364 m the well entered interbedded sandstone and volcanics which persisted to total depth at 2749.6 m. Rare bryozoan fragments between 857 m and 885 m were identified as younger than Cretaceous and an Upper Triassic spore assemblage was found below 1482 m. On the

basis of this evidence the sequence was subdivided by the company into an upper part (above 930 m) of Cretaceous age, interpreted as equivalent to the Winning Group of the Carnarvon Basin, and a lower part from 930 m to total depth of Triassic age, informally named the 'Edel Formation'. The volcanics were a mixture of nosean phonolites and lamprophyres and trachytes. The sandstone in the Mesozoic section was tight, and there were no traces of hydrocarbons in the well. Because of the unexpected nature of the Mesozoic rocks the drilling threw no light on the problem of the offshore boundaries of the Perth and Carnarvon Basins in this area.

UNSUBSIDIZED DRILLING

Offshore

Dampier Sub-basin

The gas/condensate fields discovered on the Rankin Trend in 1971 by the subsidized wells North Rankin No. 1, Rankin No. 1, and Goodwyn No. 1 were successfully extended by the unsubsidized wells Goodwyn No. 2 and North Rankin Nos 2, 3, and 4. Comprehensive testing of North Rankin No. 2 (Table 2) confirmed a net hydrocarbon pay of 383 m of porous and permeable sands with a gas reservoir section of 1649 m.

According to a press release Goodwyn No. 2 contains a net 21 m of porous and permeable reservoir sands. During testing the gas/condensate ratios were between 72 and 90 barrels of condensate per MMcf of gas; the highest recorded so far in the area.

Goodwyn No. 3 was spudded in December 1972 and was declared an oil and gas discovery in February 1973 (Table 2).

SUBSIDIZED GEOPHYSICS

Onshore

Gascoyne Sub-basin

The Lyndon Quobba seismic survey was carried out north of Carnarvon in the Gascoyne Sub-basin, east and west of Lake Macleod. Previous well and seismic control is sparse and the survey was designed to provide reconnaissance seismic control of improved quality (using modern techniques including CDP recording) and to map any pre-Cretaceous structures. Two east-west lines were shot, 72 km apart. The quality of the data was fair in the west but deteriorated to the east. Two horizons were

TABLE 2 - DRILL-STEM TESTS GOODWYN NO. 3 AND NORTH RANKIN NOS 2, 3, & 4

Well Name	bottom hole choke	surface choke	interval (m)	gas flow MMcfD	condensate barrels/MMcf	oil flow barrels/day	A.P.I. gravity
North Rankin No. 2	½"	5/8"	3168-3197	18.28	28.3		
	3/4"	7/8"	" "	21.3			
	3/4"	7/8"	2842-2863	20.4	25.1		
North Rankin No. 3		3/4"	3092-3138	28.2*			
	3/4"	5/8"	2758-2763	10.9	25.5		
	3/4"	7/8"	2719-2736	18.73	28.8		
North Rankin No. 4		3/4"	2977-2998	7.5	27		
Goodwyn No. 3	½"	3/4"	3015-3026	2.7		2730	41.7

*Best for B.O.C. Consortium to date.

mapped: horizon A - basal Cretaceous unconformity, and horizon B - top of Middle Palaeozoic Tumblagooda Sandstone. An isochron map of the A to B interval was also presented. Four anticlines were mapped on horizon A. Two of these trend southwesterly through the Wandagee wells. The other two were drilled by the Griesson and Cape Cuvier No. 1 core holes. Numerous north-trending faults and four anticlines were mapped on horizon B. Wandagee No. 1 (BMR file 62/1215) and Quail No. 1 (BMR file 63/1010) tested two of the anticlines without encountering hydrocarbons. The other two anticlines had not been mapped previously and more work will be required to establish closure.

The Murchison D-1 gravity survey was carried out in the Gascoyne Sub-basin south of Carnarvon to indicate areas suitable for seismic investigation. Earlier regional gravity surveys had indicated that high Bouguer anomalies occur over basement ridges. The Murchison D-1 survey used half mile (0.8 km) station spacing to detect more localized anomalies. The survey confirmed the presence of the Ajana-Wandagee Gravity Ridge between the southern Gascoyne and Coolcalalaya Basins and located twelve, more localized, positive gravity anomalies along it. The structural significance of these gravity anomalies was investigated by the Hamelin seismic survey. Although three unidentified horizons were mapped the data quality was too poor for any conclusions to be drawn.

Offshore

Dampier Sub-basin and Beagle Trough

The Montebello-Turtle marine seismic survey was carried out in two parts, 72-A in the Dampier Sub-basin and 72-B in the Beagle Trough.

Project 72-A, Montebello-Angel: An extensive program of detailed and semi-detailed work was carried out over structures outlined in previous surveys, and the areas between the Madeleine-Dampier Trend and the Rankin Trend, and the Rankin Trend and the northwest limit of the permit area were explored. The horizons mapped were: horizon X - near base Tertiary; horizon D - near base Upper Cretaceous Toolonga Calcilutite; horizon Y - intra Neocomian unconformity; horizon W - approximate top Neocomian and horizon Jc - intra Upper Jurassic unconformity. The X-D isochrons show slight thinning over the North Rankin structure and slight thickening on the northwestern side of the Rankin Trend in what appears to be a previously unmapped trough. A zone of rapid thickening near the southwestern end of the project area corresponds to pronounced southeasterly dip on horizon D on the flank of a well defined structural nose together with a northwesterly dip on Horizon X on the slope of a prograding delta front.

The report discusses the North Rankin, Goodwyn, Rankin, Angel, Malus, Steamboat, Bank, Regnard-Preston, Rosemary, and Eaglehawk structures and names four, previously unnamed, ones; Egret, Lambert, Nickol, and Finucane. The Eaglehawk structure, on the Rankin Trend northeast of the North Rankin structure, was shown to be an attractive drilling prospect.

The Eaglehawk structure is a narrow northeast-trending fault block flanked by major faults on the southeast and northwest. The block contains three culminations, controlled by cross-faults, and an additional high area lies to the east of the main Eaglehawk structure. The major faulting was interpreted to have occurred up to middle or late Jurassic time with little movement since. Jurassic sediments, which are absent on the North Rankin, Goodwyn, and Rankin structures, are expected to be present at Eaglehawk. The Jc horizon is closed for approximately 20 km in a northeasterly direction and 2 km in a southeasterly direction. The closing contour also encompasses the Egret structure.

Project 72-B, Angel-Turtle: Previous seismic work indicated that the Madeleine-Dampier Trend extends from the Dampier Sub-basin into the Beagle Trough and that a number of prospective closed structures owing to drape over large fault blocks are present in the Trough. Project 72-B was designed to further detail these structures, to investigate the extension of the Rankin Trend into the Trough, and to establish the relationship of both the Rankin and Madeleine-Dampier trends with the North Turtle Arch and the western side of the Bedout-Sub-basin.

The horizons mapped in this project were the same as those mapped in 72-A, i.e. horizons X, D, Y, and Jc. The isochron map X-D shows a regional thinning to the northeast and local thinning over the Sable and Picard structures and to the north of the North Turtle Arch. Isochron map D-Y indicates thinning over all the recognized structures, minor in the case of Picard.

Horizon Jc is a discontinuous event broken by block faulting over the whole area. Although the reliability of the isochron map Y-Jc is limited by the discontinuous nature of the Jc horizon, it does indicate a regional thickening of the interval to the north and marked thinning over most of the fault blocks. The interval is absent north of the North Turtle Arch.

The Malus-Hedland marine seismic survey was designed to detail structures in the Beagle Trough and Dampier Sub-basin. It comprised three separate projects.

Project 72-J, Lambert - Jarman: During the project a series of previously mapped fault blocks were detailed in the Beagle Trough. The fault blocks lie along an interpreted northeasterly extension of the Rankin Trend. Sufficient detail was obtained over the Nickol, Finucane, Sable, Ronsard, and Jarman structures for wells to be sited. Sable No. 1 was drilled in 1972 and the company has announced that it intends drilling the Ronsard and Jarman structures. The Lambert structure will require further detailing. Four horizons were mapped; horizon X - near base Tertiary; horizon D - near top Cretaceous Toolonga Calcilutite; horizon Y - intra Neocomian unconformity, and horizon Jc - ?intra Upper Jurassic unconformity.

Project 72-K, Hauy - Bruguieres: The project was located on the southeastern margin of the Dampier Sub-basin to better delineate stratigraphic pinchouts indicated by previous surveys. The horizons mapped were: horizon X - near base Tertiary; horizon F - near Albian/Aptian boundary; horizon W - near top Neocomian; horizon Jc - near top Callovian; horizon T - near top Triassic, and horizon S - possible top Permian. Horizons W, Jc, and T were mapped only in the southern, Bruguieres part of the project area and horizon F only in the northern, Hauy region. The Hauy prospect is a pinchout of Lower Cretaceous sediments towards the southeastern edge of the Dampier Sub-basin. The subsidized well, Hauy No. 1, was drilled in 1972 without discovering hydrocarbons. Details of the drilling were not released at 30 July 1973. The Bruguieres prospect is a Lower Cretaceous to Upper Jurassic pinchout located to the east of Enderby No. 1 (BMR file 70/737). It will require further detailing.

Project 72-L, Malus - Bank: During this project the Malus and Bank prospects were detailed on the Rankin Trend in the Dampier Sub-basin. The horizons mapped were: horizon X - near base Tertiary; horizon D - near top Cretaceous Toolonga Calcilutite, and horizon Y - intra Neocomian unconformity. The Malus prospect was detailed sufficiently for the subsidized well Malus No. 1 to be drilled in 1972, but the Bank prospect will require further detailing.

COOPER BASIN

SUBSIDIZED DRILLING

During 1972 seven subsidized wells were either completed or in progress in contrast to the situation in 1971 when no subsidized wells were drilled. This resulted from a change in Government policy in March 1972 to allow subsidy for operations in formerly 'excluded areas' i.e. defined areas around discovery wells and fields. Of the

subsidized wells drilled in 1972, Brumby No. 1 and Burke No. 1 were both gas discoveries and Brolga No. 1 was a gas/condensate discovery.

Brumby No. 1 was drilled close to the crest of the anticline defined by the Dunjeroo seismic survey. It penetrated a normal Eromanga Basin sequence before entering the Lower Triassic Nappamerri Formation at 1742 m. This formation, 80.5 m thick, rests conformably on the Gidgealpa Group (formerly the Gidgealpa Formation). A new stratigraphic nomenclature (Gatehouse, 1972) was used for the Permian sequence, (see Fig. 1).

The top of the Patchawarra Formation was encountered 78.7 m lower than expected. The sandstone in the top 38 m was impermeable, but below this level there was about 11 m of net effective pay which yielded 5.42 MMcfD in a preliminary production test.

Brolga No. 1 penetrated a normal Eromanga Basin sequence to 2411 m before intersecting the Lower Triassic Nappamerri Formation of the Cooper Basin. The following sequence was penetrated to total depth:-

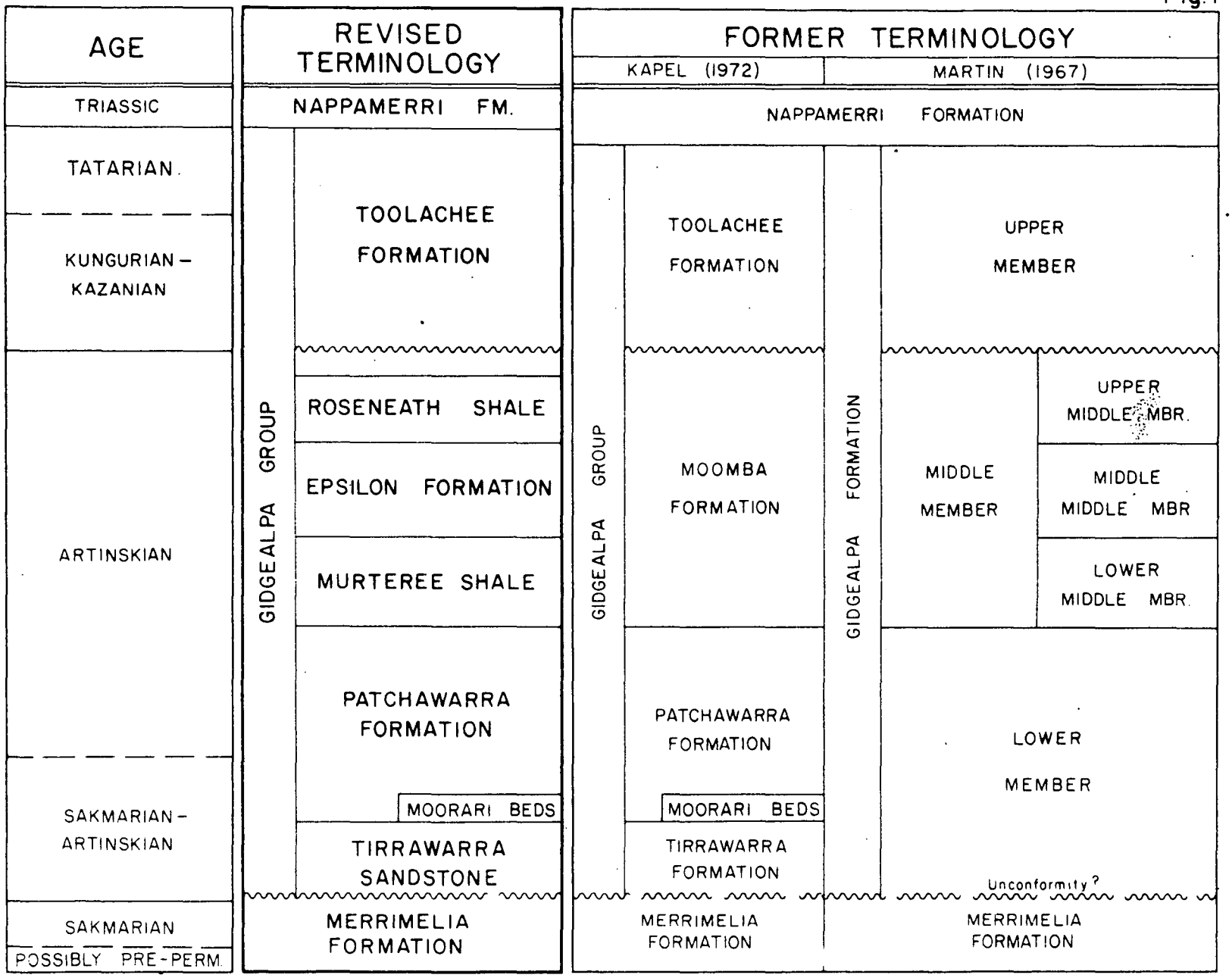
Age	Stratigraphic Name	Depth (m)	Thickness (m)
Lower Triassic	Nappamerri Formation	2409.4	238.6
	GIDGEALPA GROUP		
Upper Permian	Toolachee Formation	2648.0	31.8
Lower Permian	Epsilon Formation	2679.8	11.0
" "	Murteree Shale	2690.8	9.4
" "	Patchawarra Formation	2700.2	218.0
" "	Coal Marker	2774.3	
" "	Tirrawarra Sandstone	2918.2	19.8
" "	Merrimelia Formation	2938.0	18.6
		2956.6 TD	

MARTIN, C.A., 1967 - The Gidgealpa and Merrimelia Formations in the Cooper's Creek Basin. Aust. Oil Gas J., 14(2), 29, 32, 35.

KAPEL, A.J., 1972 - The geology of the Patchawarra Area Cooper Basin. APEA J., 12(1), 53-7.

GATEHOUSE, C.G., 1972 - Formations of the Gidgealpa Group in the Cooper Basin. Aust. Oil Gas Rev., 18(12), 10-15.

Fig. 1



THE GIDGEALPA GROUP – COOPER BASIN (After Gatehouse 1972)

Numerous hydrocarbon shows were obtained in the Gidgealpa Group, but only those in the Patchawarra Formation were of commercial significance. During one drill-stem test gas was produced at the rate of 3.26 MMcfD. Two hundred and seventy feet of condensate, 325 feet of mud and gas cut condensate and 180 feet of water were recovered. The Toolachee Formation yielded salt water on drill-stem testing. The Tirrawarra Sandstone, which had good oil shows, was atypically shaly and contained no sandstone beds with good reservoir characteristics as in Fly Lake No. 2 about 5.6 km to the southwest. The company reports that comparison of the levels of the various reservoirs in the Patchawarra Formation between Brolga No. 1 and the Fly Lake wells to the southwest and the Moorari wells to the northeast makes connection between the reservoirs unlikely. The pattern of hydrocarbon-bearing and water-bearing sands in the wells can be explained on the assumption that they are channel and point-bar sandstones with a northerly orientation across the Fly Lake - Moorari trend. East-trending closure is provided by the impermeable sediments enclosing the sandstone bodies, and north-trending close is provided by drape across the structurally high trend.

Toolachee East No. 1 was drilled in the northeastern part of the basin about 6 km northeast of the Toolachee gas field. It was primarily a test of the Patchawarra Formation of the Gidgealpa Group on the downthrown side of a large north-trending fault. The well penetrated approximately 1800 m of sediment in the Eromanga Basin before passing through an unconformity into the Lower Triassic Nappamerri Formation (109 m thick) and the Permian Gidgealpa Group (634 m thick) of the Cooper Basin. The Tirrawarra Sandstone was absent and the Patchawarra Formation rested directly on pre-Permian phyllite in which the well reached total depth. The Patchawarra Formation was encountered 30 m higher than predicted. Sandstone beds within it are impermeable. Sandstone in the Toolachee Formation yielded only water on testing.

Burke No. 1 was located about 32 km north of Brumby No. 1 near the crest of a seismically defined culmination of an easterly-trending anticline that runs between Dullingari in South Australia and Epsilon/Roseneath in Queensland. Beneath the 1754 m thick sequence in the Eromanga Basin the well penetrated 195 m of Lower Triassic Nappamerri Formation, which was over 30 m thicker than predicted, and 420 m of the Permian Gidgealpa Group. The Gidgealpa Group was intersected at 2110 m. The Patchawarra Formation rests unconformably on slightly metamorphosed Ordovician shale, siltstone, and sandstone in which the well reached total depth. Gas was discovered in the Toolachee and Patchawarra Formations. An open hole drill-stem test of the Toolachee Formation produced gas at a rate of 10.4 MMcfD

from 20 m of net effective pay. The Patchawarra Formation produced gas at a rate of 8.7 MMcfD from 26 m of net effective pay.

Murteree A No. 1 and Murteree C No. 1 were drilled in the southeastern part of the Cooper Basin about 50 km southeast of the Moomba gas field. The wells tested closures on the large northeast-trending Murteree horst, against which Permian sediments were predicted to wedge out. Murteree A No. 1 was located near the crest of the structure to test the hydrocarbon potential of the Jurassic Hutton sandstone draped over the horst. Murteree C No. 1 tested the Gidgealpa Group on the downfaulted northwest flank.

The two wells penetrated sediments of the Eromanga Basin, 1552 m and 1792 m thick respectively, before entering sediments of the Cooper Basin. Murteree A No. 1 then encountered 7 m of the Lower Permian Merrimelia Formation overlying andesitic rock in which the well reached total depth. Murteree C No. 1 penetrated 36 m of the Lower Triassic Nappamerri Formation, 411 m of the Gidgealpa Group, and 11 m of the Merrimelia Formation. The well reached total depth in pre-Permian phyllite. All the formations in Murteree A No. 1 were intersected 30 m to 60 m higher than expected, and the presence of the Merrimelia Formation was unexpected. The Hutton Sandstone gave no indication of hydrocarbons. Murteree C No. 1 intersected 157 m of Tirrawarra Sandstone; the first discovery of this unit in the southeastern part of the basin. There was no indication of hydrocarbons in the Gidgealpa Group.

UNSUBSIDIZED DRILLING

With one exception, the unsubsidized wells drilled in 1972 (see Table 1) were all step-outs and therefore not eligible for subsidy. The exception was the exploration well, Epsilon No. 1, which was drilled before the removal of the exclusion circles.

SUBSIDIZED GEOPHYSICS

The Dunjeroo seismic survey was carried out in the area to the east of the Toolachee gas and condensate field near the South Australian-Queensland border. The Tilparee seismic survey (BMR file 71/157) had indicated the presence of an anticline with possible closure over an area of 60 km^2 at the base of the Gidgealpa Group. The Dunjeroo seismic survey was designed to confirm the existence of the structure and to detail the Gidgealpa Group on and around it. Two horizons were mapped. The upper one, horizon P,

arises from a coal horizon near the top of the Gidgealpa Group and is taken to represent the top of the Permian. The lower horizon is the base of the Gidgealpa Group. Two isopach maps were presented; an isopach map of the Gidgealpa Group, and the C-P isopach of the interval from the base of the Cretaceous to the top of the Permian. The base of the Gidgealpa Group is folded into a large northeasterly-trending anticline with over 240 m of relief on this horizon. On horizon P the relief is only about 36 m.

The Andree seismic survey was carried out in the western part of the Cooper Basin in South Australia, immediately to the west of the Gidgealpa, Fly Lake, and Tirrawarra fields. The horizons mapped were: horizon C - top of Lower Cretaceous Transition Beds; horizon P - top of the Permian Gidgealpa Group, and the Permian Patchawarra Coal horizon (a reflection obtained from a thick coal seam in the lower part of the Gidgealpa Group and considered more reliable than the reflection obtained from the base of the Group). All horizons have regional dip to the east and northeast and although no major structures were indicated a number of anticlinal noses or ridges with small closures were outlined. The P-Patchawarra Coal isopach map shows regional thinning to the northwest from a thick section along the western side of the Gidgealpa gas field suggesting the possibility of stratigraphic traps.

The Embarka seismic survey was also carried out in the western part of the Cooper Basin in South Australia in the area where commercially significant flows of oil and gas have already been obtained from the Tirrawarra, Fly Lake, and Moorari fields. The survey was designed to provide more control on the known structures and also to confirm and detail a number of small structures in the same area. It was also designed to investigate the area north and northwest of Fly Lake, towards the basin margin, for possible structural or stratigraphic traps or both. Three horizons were mapped; horizon C - top Lower Cretaceous Transition Beds; horizon P - top Permian Gidgealpa Group; and Patchawarra Coal Horizon - thick coal seam in the lower part of the Gidgealpa Group. Two isopach maps, C-P, and P-Patchawarra Coal Horizon, were presented. The same general structure occurs at all horizons; the dominant structures are the Tirrawarra anticline and the anticlinal ridge running from Fly Lake to Moorari. Closure increases with depth. The interval C-P thins regionally to the northeast whereas the P-Patchawarra Coal Horizon interval thickens to the south. All horizons showed a steady rise towards the basin margin to the north and northwest of Fly Lake, indicating the possibility of stratigraphic traps; but none were mapped. The Brolga anticline, between the Fly Lake and Moorari anticlines, was defined and Brolga No. 1 was later drilled on it. The anticline has vertical closure of about 15 m over about 6.5 km^2 at the P horizon.

The Tickerna seismic survey was designed to give increased seismic control over an area containing the Darlingie, Moomba, and Big Lake structures. The data quality was fair to good and three horizons were mapped: horizon C - top Lower Cretaceous Transition Beds; horizon P - top Permian Gidgealpa Group, and base Gidgealpa Group. Improved control was obtained on the base of the Gidgealpa Group and on the Daralingie and Big Lake structures. The new information led to the successful drilling of Daralingie No. 3. Good quality data, obtained in the vicinity of Moomba No. 6, will aid in the siting of future wells.

GALILEE BASIN

One subsidized seismic survey was carried out and three subsidized wells were drilled in 1972.

SUBSIDIZED DRILLING

Lovelle Downs No. 1, Goleburra No. 1, and Clyde No. 1 were drilled as a three well program in an interpreted western extension of the Galilee Basin. Lovelle Downs No. 1 was located on the western side of the Cork Fault and the other two wells were located on the eastern side.

Lovelle Downs No. 1 spudded in the Cretaceous and penetrated 1381 m of Eromanga Basin sediments and 626 m of Permian-Triassic sediments of the Galilee Basin before reaching total depth in pre-Permian quartzite. Minor gas shows were obtained from coal measures in the Permian sequence. The well confirmed that a Permian to Triassic sub-basin exists on the western downthrown side of the Cork Fault. Non-marine microfossils from the base of the sequence are dated as Permian Stage 3 (Sakmarian to Artinskian) i.e. younger than in the main basin.

Goleburra No. 1, sited 24 km southeast of Lovelle Downs, penetrated 1242 m of Cretaceous to Jurassic sediments of the Eromanga Basin unconformable on 278 m of Lower Permian sediments correlated with the Murteree Shale, the Patchawarra Formation, and the Tirrawarra Sandstone in the Cooper Basin. These two wells provided the first subsurface stratigraphic control across the Cork Fault.

Clyde No. 1 was drilled approximately 100 km southeast of the other two wells. It penetrated 1096 m of Eromanga Basin sediments unconformable on pre-Permian basement. The predicted Permian and Triassic sediments were absent indicating that there is a northeasterly indentation in the southern margin of the western Galilee Basin. The

well appears to be located on a north-northeasterly-trending basement high about 30 km south of the limit of Permo-Triassic sediments. Apparently good correlation between the Jurassic to Cretaceous Longsight Sandstone and the Hooray Sandstone suggests that the Hooray Sandstone extends farther west than previously thought.

SUBSIDIZED GEOPHYSICS

The Hexham seismic survey was carried out in an area approximately 112 km northeast of Barcaldine to detail a possible closed anticline indicated by the Yarrowglen seismic survey (BMR file 66/11133). The anticline lies up-dip from Lake Galilee No. 1 which produced 3 m of 43° A.P.I. oil from the Upper Carboniferous Joe Joe Formation. In this area Galilee Basin sediments are thought to be draped over folded and faulted strata of the underlying Drummond Basin. Only one horizon, the top Permian, could be mapped as a result of the survey and the resultant map shows a north-northwest plunging nose and not a closed anticline.

GIPPSLAND BASIN

No subsidized geophysical operations were carried out in the Gippsland Basin in 1972.

SUBSIDIZED DRILLING

Two subsidized wells were drilled offshore in the area formerly excluded from subsidy. Morwong - 1 was located 8 km east of the Marlin Platform, and Cobia - 1 was located 6 km southwest of Halibut - 1. The well completion reports were not released by 31 July 1973, but some information was released to the press. Minor oil shows were recorded in Cobia - 1 in shale in a core of interbedded sandstone and shale recovered between 2391 m and 2417 m. Further oil shows were recorded in sandstone below 2391 m. The well was plugged and abandoned. Morwong - 1 was also plugged and abandoned as a dry hole.

The well completion report for Sailfish No. 1 (BMR file 71/472), completed late in 1971, was released in 1972. The well was drilled in Tasmanian waters in the eastern part of the Gippsland Basin about 80 km northeast of Flinders Island. It was designed to test a possible reef complex revealed by the Sailfish seismic survey (BMR file 70/784). However, the well intersected pyroclastics demonstrating that the structure was caused by them and not by a reef.

The well penetrated 3208 m + of Recent to Miocene sediments and 185 m + of volcanics before reaching total depth. The age of the volcanics is unknown.

UNSUBSIDIZED DRILLING

Three unsubsidized wells were drilled onshore. No hydrocarbon shows were reported from Keystone No. 1 and West Seacombe No. 1. Only minor gas shows were reported from East Reeve No. 1. The unsubsidized offshore wells Moray No.1 and Nannygai No. 1 were also unsuccessful in finding hydrocarbons.

Esso drilled two appraisal wells on the Mackeral structure. Mackerel - 2 was reported to have confirmed a westward extension of the oil reservoir encountered in Mackerel - 1. After the drilling of Mackerel - 3 the company announced that the field has commercial significance, the extent of which remains to be evaluated.

OTWAY BASIN

Two subsidized wells and six seismic surveys were completed in 1972. The results of the Torquay Embayment survey which started in 1971 were released.

SUBSIDIZED DRILLING

Onshore

Rowans No. 1 was drilled in the Port Campbell Embayment, 25 km east-southeast of Warrnambool. The well was sited on the seismically defined Rowans horst and the target horizon was the Waare Sandstone, the basal sandstone of the early Tertiary to Upper Cretaceous section. The Tertiary sediments consisted of 597 m of Oligocene to Miocene limestone and marl of the Heytesbury Group and 405 m of Paleocene to Eocene clastic sediments. The Upper Cretaceous sediments comprised 367 m of alternating sandstone, argillaceous siltstone, and claystone, 155 m of chloritic sandstone, 64 m of claystone and siltstone, and 33 m of Waare Sandstone. The Waare Sandstone was intersected at 1588 m, about 110 m deeper than predicted. It consisted of interbedded sandstone and claystone in beds 3 m to 9 m thick. Porosities in the sandstone ranged from 15 percent to 26 percent, but there was no indication of hydrocarbons. The well reached total depth in the underlying Lower Cretaceous Eumeralla Formation which consisted of interbedded water-bearing sandstone and siltstone.

Offshore

Snail No. 1 was drilled in 1972, on the Snail structure, primarily as a test of the hydrocarbon potential of the Eastern View Coal Measures. It penetrated: 810 m of Miocene to Upper Eocene marine carbonate, marl, and claystone of the Torquay group group; 136 m of Eocene silty claystone of the Demons Bluff Formation; 101 m of Eocene to middle Paleocene glauconitic sandstone, claystone, minor shale, dolomite, and minor coal, of the Eastern View Coal Measures and 350 m of Lower Cretaceous Otway Group, unconformably beneath, to total depth.

The small quantity of coal in the Eastern View Coal Measures reflected a greater proportion of marine sediments than in the equivalent sequence in Nerita No. 1, drilled about 50 km to the northwest, and in the onshore wells drilled in the Torquay Embayment. The Jan Juc Formation at the base of the Torquay group is older than in Nerita No. 1 and onshore, suggesting that the sea which occupied the southern part of the embayment in the upper Eocene transgressed northwards during the upper Eocene and Oligocene.

SUBSIDIZED GEOPHYSICS

Onshore

The Paraparap seismic survey was carried out southwest of Geelong in the Torquay Embayment at the eastern end of the Otway Basin. Earlier work indicated that sediments of the Lower Cretaceous Otway Group rest directly on shallow basement in this area and the survey was designed to confirm the presence of the basal sandstone of the Otway Group which has good reservoir characteristics elsewhere. Neither Angelsea No. 1 (BMR file 62/1217) nor Hindhaugh Creek No. 1 (BMR file 69/2026) which had been drilled in the area fully penetrated the Otway Group.

Fair quality data was obtained in some areas, but data was not recorded in others. The two shallowest seismic horizons mapped, A and B, were tied with Hindhaugh Creek No. 1 where they are identified as within the Otway Group. The two deeper horizons, D and E, were not penetrated by the well and are tentatively identified as 'top basal Cretaceous' and 'basement'. Time contours on horizons B,D, and E outline a large south-plunging anticline faulted on its west flank and with possible east-trending fault closure. The isochron maps A-B, B-D, and D-E show thinning over the anticline, and indicate that the faults on the western flank were active from at least early Cretaceous to Horizon B time.

The Dartmoor seismic survey was carried out, in the western part of the basin near the Victoria/South Australian border. It was the first survey over the Dartmoor Ridge - a northerly-trending area of elevated Bouguer anomalies separating the Gambier Sub-basin on the west from the Tyrendarra Embayment on the east. Data quality was generally poor and, coupled with the wide spacing of the seismic lines and the complexly faulted nature of the area, the lateral correlation of seismic horizons is rather unreliable. Three horizons were mapped: horizon A - Tertiary/Upper Cretaceous boundary in the north and possibly base Cretaceous in the south; horizon B - unidentified, and horizon C - at or near Palaeozoic basement. The Dartmoor Ridge was interpreted as a southerly trending nose intersected by several major northwesterly-trending faults. Further seismic work was recommended to detail possible closed structures.

The Colac-Geelong seismic survey was the first survey carried out in the northeastern part of the Port Campbell Embayment. Interpretation of previous gravity and magnetic surveys suggested that the area was underlain by a northeast-trending trough (Colac Trough) of thick sediments. The Colac-Geelong gravity survey revealed a northeast-trending series of positive gravity anomalies, lying along the central part of the trough, that probably were caused by local basement highs. The reflection data quality was good except in areas of outcropping unconsolidated sand and high topographic relief. Two horizons were mapped: basement, and a reflection from within the Eumeralla Formation of the Lower Cretaceous Otway Group. Both horizons show unconformable relationships with a flat lying reflection identified as the base of the Tertiary. The structure contours on the two mapped horizons show that the area is a south-easterly dipping monocline intersected by two major southwest-trending normal faults, downthrown to the north with throws of 900 m to 1500 m. One anticline, closed by a fault, and a small south-plunging nose were mapped. Neither structure was considered worth further detailing.

Offshore

The Port Macdonnell marine seismic survey was carried out to investigate earlier seismic indication of a structural high extending offshore from Port Macdonnell. Only fair to poor quality data were produced and the presence of the structure was not confirmed.

The Portland-King Island seismic survey was carried out in the eastern part of the Otway Basin. Only very poor quality seismic data had previously been obtained below the Upper Cretaceous/Tertiary unconformity and

confirmation of the 'structures' on which Mussel - 1 (BMR file 69/2021), Prawn - 1 (1968 - unsubsidized), and Whelk - 1 (1970 - unsubsidized) were drilled had not been possible. It was hoped that the Portland-King Island survey would establish a tie of good quality data between the wells and generally clarify the structural relationships in the area. These objectives were achieved during the survey and 373 km of older data, slightly improved by reprocessing, were incorporated in the interpretation. Two horizons were mapped: horizon B, a reflection from the base of the Wangerrip Group i.e., the Tertiary/Upper Cretaceous unconformity, and horizon C, a reflection from the unconformity between the Upper Cretaceous Sherbrook Group and the Lower Cretaceous Otway Group. The survey confirmed that Whelk - 1 was drilled on a basement high. Prawn - 1 was drilled low on the west flank of a northerly-trending and structurally complicated high which could not be clearly defined on the available data. Mussel - 1 was drilled virtually off-structure on the eastern side of a large high.

The Torquay Embayment seismic and magnetic survey was carried out in the offshore part of the Torquay Embayment. Previous seismic work had suggested that the Upper Cretaceous to Paleocene Eastern View Coal Measures thin out over and probably drape across Palaeozoic basement highs located to the south and east of the northeast-trending post mid-Cretaceous depositional axis. The survey was designed to investigate these structures. Depth contours were prepared for two horizons: horizon A - within the mid-Miocene to mid-Oligocene Torquay Group, and horizon B - top of the Eastern View Coal Measures. The horizons were identified by tie with Nerita No. 1 (BMR file 67/4258) the only well in the area. An isopach map of the interval A-B was also prepared. The Eastern View Coal Measures were shown to range in depth from about 600 m around the edges of the embayment to about 1300 m in the centre. In addition to the Snail structure which was already mapped, and the Nerita structure which was mapped and drilled, the survey outlined four new structures which will require further detailing.

PERTH BASIN

One unsubsidized and five subsidized wells were drilled in 1972. Four subsidized seismic surveys were completed and one was in progress at the end of the year.

SUBSIDIZED DRILLING

ONSHORE

Dandaragon Trough

Bullsbrook No. 1 penetrated 88 m of Quaternary and Recent sand, 71 m of early Cretaceous Leederville Sandstone, 2633 m of Jurassic Yarragadee Formation, 130 m of Jurassic

Cadda Formation, and 1319 m of Jurassic Cockleshell Gully Formation to total depth. There were no significant hydrocarbon shows although the Cattamarra Coal Measures Member of the Cockleshell Gully Formation had good reservoir characteristics.

Narlingue No. 1 penetrated: 4 m of Quaternary sediments; 367 m of Lower Cretaceous South Perth Formation unconformably on 576 m of Lower Cretaceous to Upper Jurassic Yarragadee Formation; 10 m of Middle Jurassic Cadda Formation; 317 m of Lower Jurassic to Upper Triassic Cattamarra Coal Measures Member; 58 m of the Eneabba Member of the Cockleshell Gully Formation; 17 m of Lower to Middle Triassic Woodada Formation; 209 m of Lower Triassic Kockatea Shale unconformable on 52 m of coarse to very coarse-grained well sorted sandstone of uncertain age with good reservoir characteristics provisionally identified as the Yardarino or Wagina Sandstone or both. The sandstone is unconformable on a Lower Permian sequence comprising the Carynginia Formation (79 m thick), the Irwin River Coal Measures and High Cliff Sandstone (377 m thick), and the Holmwood Shale (104 m penetrated to total depth).

Heaton No. 1 penetrated a similar section down to the Kockatea Shale. The well then penetrated 50 m of unnamed basal Triassic sandstone unconformably overlying Upper Permian Wagina Sandstone (145 m thick), which was in turn unconformable on Lower Permian Carynginia Formation (113 m penetrated).

Both sandstone units have good reservoir characteristics. It is assumed from the lack of hydrocarbons in the two wells that in this area the hydrocarbons migrated before the major structural movement in the Cretaceous.

Bunbury Trough

Wonnerup No. 1 was drilled in the Bunbury Trough on the crest of the seismically defined Wonnerup structure. Target horizons included Jurassic and Permian sandstone, the latter having produced gas at Whicher Range No. 1 (BMR file 68/2005) 39 km to the north.

The well penetrated sediments of Lower Cretaceous to Upper Jurassic (Yarragadee Formation, 818 m thick) Jurassic (Cockleshell Gully Formation, 1271 m thick), Triassic (Lesueur Sandstone, 1460 m thick; Kockatea Shale, 518 m thick) and late Permian (Irwin River Coal Measures, 624 m penetrated) age. Gas shows were recorded in the Irwin River Coal Measures, but the two drill-stem tests carried out were technically unsuccessful. Palynological studies of samples from the interval 924 m to 4452 m established that strata within it are entirely non-marine and are of early Jurassic, middle or late Triassic, early Triassic, and late Permian age.

The well reached a total depth of 4727 m; the deepest to date in Western Australia.

SUBSIDIZED GEOPHYSICS

Onshore

Dandaragon Trough

The Coomallo survey was carried out over the western flank of the trough about 160 km north of Perth. Earlier seismic work indicated a number of fault closures on the northern extension of the Walyering fold trend. The primary object of the Coomallo survey was to detail one of these - the Coomallo Prospect. The two horizons mapped were: horizon B - near the top of the AZ member of the Yarragadee Formation, and horizon C - Cattamarra Coal Measures Member of the Lower Jurassic Cockleshell Gully Formation. Data quality on both horizons was poor, being somewhat better on the shallower horizon than on the deeper horizon. Three structures were mapped. mapped. Two of them, along the Coomallo anticlinal trend, are postulated to be closed to the east by regional dip and to the west by a northerly-trending normal fault downthrown to the west. Both require further detailing. The third structure lies to the west of the trend. It appears to be a fault-bound structural high which will also require further detailing.

The Dandaragan East Flank seismic survey was designed to detail structures mapped previously, in particular by the Barragoon seismic survey (BMR file 70/999), and to increase seismic coverage in the area adjacent to the Darling Fault. Three horizons were mapped on generally fair quality data: horizon A - shallow horizon, Yarragadee Formation, and horizons B and C - as in the Coomallo survey.

Numerous north and northwest-trending faults were mapped and four possibly prospective structures are associated with one of them; a north-trending fault, downthrown to the west, that traverses the whole survey area. Three are fault closed anticlines on the upthrown side of the fault with vertical closure in the range of 533 m to 747 m and areal extent of 100 km^2 to 180 km^2 on the Cattamarra Coal Measures Member horizon. The other structure is a culmination on an anticline located along the downthrown side of the fault. This structure has a vertical closure of up to 420 m over an area of about 80 km^2 on the same horizon.

The Gingin-Bullsbrook seismic survey extended from the edge of the Perth metropolitan area northwards to Gingin. The objectives were to provide additional C.D.P. coverage over a structural high trending southwards from the Gingin wells and reconnaissance coverage along the eastern margin of the Dandaragan Trough.

The data produced ranged in quality from good to unusable. All previously shot reasonable quality data were incorporated in the interpretation.

The four horizons mapped were: horizon A - basal Cretaceous unconformity; horizon B - within Upper Jurassic Yarragadee Formation; horizon C - near top Lower Jurassic Cattamarra Coal Measures Member, and horizon D - near top Triassic. A structurally high area, the Gingin Anticline, was confirmed trending north through the project area. A drill site, Bullsbrook No. 1, was selected on the Gingin Anticline. Two other prospective drill sites, requiring further seismic coverage, were mapped on the same structure.

The area is traversed by mainly northerly-trending faults which were mapped on all horizons. Along the eastern margin of the Dandaragan Trough the sediments are step faulted down to the west along the Darling and Muchea faults and show regional westerly dip between the two faults.

The shallower of the two prospective drill sites on the Gingin Anticline was detailed during the Barberton seismic survey. Two horizons were mapped; horizon A - within the Upper Jurassic Yarragadee Formation, and horizon B - near the top of the Cattamarra Coal Measures Member of the Lower Jurassic Cockleshell Gully Formation. The data quality was fair to poor, being mainly poor near faults. The horizons were identified by tie to Gingin No. 1 (BMR file 64/4121) and Gingin No. 2 (unsubsidized 1965-6).

The Barberton and Dandaragan anticlines were mapped. The Barberton anticline trends north and is faulted. It contains the Cattamarra Coal Measures Member at an estimated depth of 5800 m. A test well is recommended to confirm the stratigraphy and to test the hydrocarbon potential of the unit. The Dandaragan anticline is interpreted as a simple anticline but drilling is not recommended at this stage.

ST VINCENT BASIN

SUBSIDIZED GEOPHYSICS

Offshore

One seismic survey, the Marsden marine seismic survey, was the only subsidized geophysical operation carried out in 1972. It was designed to establish closure

over a structural high mapped during the St Vincent Gulf marine seismic survey (BMR file 67/11192). The record quality was poor, although better than obtained previously.

Two horizons, the base of the Permian and an horizon referred to in one part of the report as 'Middle Cambrian unconformity surface' and another as 'Lower Cambrian unconformity', were mapped. The report states that the survey confirmed closure of up to 45 m over an area of 20 km^2, but W.J. McAvoy (BMR pers. comm.) considers that a southwest dip has not been established and the structure may be a nose.

SURAT BASIN

The removal of the 'exclusion circles' in March 1972 stimulated exploration activity in the areas around the previously discovered oil and gas fields. Seven subsidized wells were drilled and three subsidized seismic surveys were carried out. The results of two of the seismic surveys were released in 1972 but the results of the remaining operation will not be released until after 31 July 1973. One other subsidized well, Moree No. 1, was drilled at the southern end of the basin, but the results were still confidential at 31 July 1973.

SUBSIDIZED DRILLING

Of the wells drilled in the formerly 'excluded' areas, Rockwood No. 1 was the only one to encounter hydrocarbons. According to a press release the well was completed as a shut in gas well pending possible stimulation. Gas flowed at a rate of 704 McfD through a 7/16" surface choke, and 112 feet of oil and gas cut mud were recovered from the drill pipe.

Moree No. 1 was reported to have bottomed in basement without intersecting the Middle to Lower Jurassic Hutton Sandstone.

UNSUBSIDIZED DRILLING

No significant indications of hydrocarbons were reported from any of the unsubsidized drilling (see Table 3).

SUBSIDIZED GEOPHYSICS

The Rockybank seismic survey was carried out in an area about 40 km south of Roma covering the western side of the Roma Shelf and the whole of the Arbroath Trough. It was programed to investigate the possible anticlines indicated by earlier seismic work. The horizons mapped were the top of the Jurassic Evergreen Shale and basement(?) and an isopach map was presented of the interval between the two. Both horizons were relatively flat lying and the predicted anticlines were not confirmed.

The Marmadua seismic survey was carried out in two areas, a southern one located about 20 km southeast of Tara and a northern one about 24 km east-southeast of Condamine. The exploration program in the permit area (191P) was designed to test the hydrocarbon potential of the '58-0' sand (basal sand of the Jurassic Precipice Sandstone) close to the zero isopach which has been defined by drilling. The eleven wells previously drilled in the survey area intersected generally flushed Precipice Sandstone. Studies of formation water salinities and water saturation in the '58-0' sand have enabled non-flushed areas to be defined. The specific object of the Marmadua seismic survey was to provide accurate definition of structural traps in these areas.

The horizons mapped in the southern area were: the top of the Precipice Sandstone, and the top of the 'Kuttung Formation'. An isopach map of the interval between the two was also prepared. Fair to poor quality reflection data were obtained from the top horizon and mainly poor data were obtained from the bottom horizon. Two areas of thinning over elevated basement were interpreted. One of the elevated areas was drilled by Marmadua No. 1 (BMR file 64/4094), but the report quotes a personal communication by G. Stephen (G.J. Stephens and Associates Pty Ltd) that the '58-0' sand was not actually tested for its hydrocarbon potential in this well.

The top of the Evergreen Shale and the top of the Permian Back Creek Formation were mapped in the northern area. An isopach map between the two horizons was also presented. The reflection data on both horizons was of only fair to poor quality. The survey confirmed the presence of a basement high, the Undulla Nose mapped by earlier surveys, and showed that it extended farther to the north and south than previously thought. The isopach map shows a thick section to the west of the Undulla Nose.

Two of the subsidized wells drilled in 1972, Sawpit Gully No. 1 and Rockwood No. 1, were located in this area; Rockwood No. 1 on data obtained by the Marmadua survey.

TROBRIAND BASIN

SUBSIDIZED GEOPHYSICS

The Trobriand Island marine seismic survey was located between the D'Entrecasteaux and Trobriand Islands offshore from eastern Papua. It was designed to confirm the existence of a sedimentary basin indicated by previous aeromagnetic work in the area. Fairly good quality reflection data were obtained. Gaps in the coverage were due to faulting and near surface reefs. Two unidentified horizons were mapped, and the existence of a deep east-trending sedimentary basin was confirmed. Numerous small structures were mapped associated with major anticlinal trends running parallel to the northern and southern margins. These were further investigated by the Trobriand Island detail seismic survey and data from the two surveys were integrated. Several of the structures were mapped in sufficient detail for drilling, the most promising was tested in 1973 by Goodenough No. 1, without success.

PAPUAN BASIN

Seven subsidized geophysical surveys were carried out and one unsubsidized well was drilled offshore in 1972. The results of four of the geophysical operations have been released.

SUBSIDIZED GEOPHYSICS

Onshore

The Tomu River seismic and gravity survey followed the Kaim-Strickland seismic and gravity survey (BMR file 70/1018, see BMR Record 1973/27) in the western Papuan Basin. The objectives were further investigation of seismic anomalies indicated by the earlier work, and extension of reconnaissance coverage. Three horizons were mapped on poor to fair quality data; horizon A - near top Miocene limestone or base of Pliocene, horizon B - near top of Mesozoic or base of Miocene, and horizon C - pre-Jurassic basement. An additional horizon between B and C tentatively identified as the top of prospective Jurassic sandstone was mapped by the operator. The survey confirmed that the area contains a thick sedimentary section increasing northwards, and that its northern part is traversed by a complex east-trending fault system. No large anticlines were definitely located, but a number of medium sized anticlines and other possible traps within the faulted zone were indicated. The Bouguer anomaly map showed a regional gradient from about + 10 milligals in the southwest to -20 milligals in the northwest corresponding to an increase

in section to the northeast. About half the gravity 'highs' appear to correlate with seismic 'highs'. The gravity work extended to the southwest beyond the seismic coverage where a large positive anomaly was mapped centred on Lake Murray.

The Elevala seismic survey was located east of Kiunga on the southwestern margin of the folded and faulted Mesozoic and Tertiary rocks of the Central Highlands. It was designed to extend seismic coverage with the hope of discovering prospective structures in the Mesozoic section. Generally good quality data was obtained, and three horizons were mapped; horizon A - top Miocene, horizon B - top Mesozoic, and horizon C - basement. The same three horizons were mapped in the Cecilia seismic survey (BMR file 70/569), but a significant improvement in data quality on horizon C was obtained by the technique employed in the Elevala survey (i.e. 12-fold C.D.P.). All three horizons showed similar structural trends. Many anticlines and fault controlled structures were mapped, one of which, the Palmer anticline was the most prominent.

The Kiunga seismic survey was a semi-detailed investigation of the structures mapped in the Elevala survey. The Palmer gravity survey was designed to assist in the evaluation of the seismic data obtained across the Palmer Anticline. The Kiunga survey obtained generally good quality data except over the Palmer Anticline where it was fair. The contour maps (horizons as above) show gentle northwest-trending folds except along the northern border of the survey area where deformation is more severe. In addition to confirming and further defining the main structure mapped by the Elevala survey the Kiunga survey discovered several new features which will require further definition. The seismic sections over the Palmer Anticline show a definite dip on the northern flank and a probable west-northwest-trending fault downthrown to the south on the southern flank. The reduction in quality of the seismic data over and to the north of the anticline is probably due to the presence of near surface lower Miocene limestone which crops out sporadically in the area.

The limestone was interpreted as the remnant of a large thrust sheet originating to the north of the survey area or alternatively as the eroded core of a block faulted horst. The Palmer gravity survey was carried out to assist in resolving the problems of the seismic interpretion. The results suggested that the first explanation is the most likely and that the limestone is less than about 600 m thick.

OFFSHORE PAPUA NEW GUINEA

SUBSIDIZED GEOPHYSICS

The Bougainville D-1 seismic survey was carried out offshore from Bougainville. It was a follow up of unsubsidized (1970) and subsidized (BMR file 71/880) seismic work which had indicated the presence of a small basin offshore from Empress Augusta Bay. Elsewhere in the permit area a thin cover of sediments was shown to overlie igneous basement. Fair quality data were obtained on two horizons; horizon 1 - upper Miocene, and horizon 2 - Paleocene/lower Miocene. The presence of a basin was confirmed. An approximate thickness of 6100 m of Tertiary sediments and an areal extent of about 1300 km^2 was estimated. The sequence can be divided into a faulted lower and a relatively undisturbed upper section. A major north-trending fault separates the basin from the shallow platform area in the west. A number of anomalies, variously interpreted as structural, intrusive, or reefal in origin, were mapped.

ACKNOWLEDGMENT

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

TABLE 3 WELLS DRILLING IN 1972

BASIN COMPANY Well Name BMR file no. if subsidized	Latitude South Longitude East o ' "	1:250,000 Sheet Area	Elevation (Metres) GL/WD DF/KB/RT	Date Spudded TD reached	TD (Metres)	Status
ADAVALE						
HARTOGEN EXPLORATIONS PTY LTD						
Alva No. 1 BMR file 72/2633	25 12 31 145 23 14	G55/5	GL 377.6 KB 372.5	16 8 72 29 11 72	3586.8	Plugged and completed as a water well
BASS						
ESSO EXPLORATION AND PRODUCTION INC.						
Durroon No. 1	40 32 03 147 12 47	K55/2	WD 68.6 DF 9.8	22 10 72 24 11 72	3024.2	PA
Pelican No. 3	40 15 45 145 51 51	K55/1	WD 80.2 DF 9.8	1 5 72 13 6 72	2906.9	PA
Poonboon No. 1	40 08 15 145 55 01	K55/1	WD 78.9 DF 9.8	29 8 72 30 9 72	3265.9	PA
Tarook No. 1	40 02 37 145 40 29	K55/1	WD 79.6 DF 9.8	3 10 72 21 10 72	2773.7	PA

BONAPARTE GULF

AUSTRALIAN AQUITAINE PETROLEUM PTY LTD												
Bougainville No. 1	13	46	25	D52/7	WD	35.9	8	2	72	2676.1		PA
	129	02	31		KB	12.8	24	3	72			
ARCO AUSTRALIA LTD												
Brown Gannet No. 1	12	06	29	D51/3	WD	109.7	3	10	72	2743.2		PA
	123	51	22		KB	12.2	1	11	72			
Eider No. 1	11	23	29	C51/16	WD	100.0	6	8	72	2834.6		PA
	125	44	44		KB	34.1	16	9	72			
Heron No. 1	10	26	27	C52/10	WD	38.4	13	9	71	4208.7		PA
BMR file 71/623	128	57	05		KB	11.9	27	1	72			
Osprey No. 1	12	13	09	D51/4	WD	100.6	13	12	71	3185.5		PA
	125	15	15		KB	34.1	25	3	72			
Pelican Island No. 1	14	46	19	D52/10	GL	7.9	29	5	72	1981.2		PA
BMR file 72/868	128	46	27		KB	12.2	27	7	72			H.C. Show
Penguin No. 1	13	36	28	D52/6	WD	62.5	22	6	72	2756.9		PA
	128	28	06		KB	34.4	23	7	72			
Plover No. 1	12	42	45	D52/1	WD	57.9	10	11	72	2438.1		PA
	126	22	07		RT	34.1	14	12	72			

Puffin No. 1	12	18	30	D51/3	WD	102.4	9	4	72	2961.1	PA
	124	20	00		KB	34.1	8	6	72		
Swan No. 1	12	11	17	D51/3	WD	108.8	20	12	72	346.6	In progress
	124	29	34		KB	34.1					
BROWSE											
B.O.C. OF AUSTRALIA LTD											
Rob Roy No. 1	13	58	16	D51/7	WD	102.1	27	1	72	2286.0	PA
BMR file 71/853	124	11	57		RT	9.5	25	2	72		
CANNING											
WEST AUSTRALIAN PETROLEUM PTY LTD											
Barbwire No. 1	19	10	38	E51/16	GL	215.5	18	6	72	1071.4	PA
BMR file 72/2001	125	00	59		RT	218.5	5	7	72		
Logue No. 1	18	07	33	E51/11	GL	53.9	17	7	72	2698.7	PA
BMR file 71/479	123	23	25		RT	58.5	31	8	72		
Munro No. 1	19	51	55	E51/14	GL	51.2	4	6	72	2115.6	PA
BMR file 72/846	122	28	28		RT	55.8	30	6	72		
Palm Spring No. 1	17	48	56	E51/8	GL	118.0	31	5	72	1066.8	PA
BMR file 72/2002	124	53	08		RT	121.0	11	6	72		

Pender No. 1	16	40	48	E51/2	GL 20.9	15	5	72	911.7	PA
BMR file 72/2000	122	50	06		RT 24.0	21	5	72		
CARNARVON										
B.O.C. OF AUSTRALIA LTD										
Angel No. 1	19	30	20	E50/14	WD 79.8	12	10	71	3410.7	Suspended gas and condensate discovery
BMR file 71/617	116	35	48		RT 9.5	12	1	72		
Angel No. 2	19	27	57	E50/14	WD 86.6	7	3	72	4396.7	Suspended gas condensate well
BMR file 72/857	116	39	25		RT 9.5	21	5	72		
Cossigny No. 1	19	19	53	E50/15	WD 112.8	15	10	72	3203.5	PA
BMR file 72/3063	117	17	26		RT 12.5	5	11	72		
Eaglehawk No. 1	19	30	30	E50/14	WD 120.4	10	11	72	3505.2	Suspended oil well
BMR file 73/3177	116	16	37		RT 12.5	14	12	72		
Egret No. 1	19	30	23	E50/14	WD 118.3	24	12	72	1292.4	In progress
BMR file 72/3357	116	20	50		RT 12.5					
Goodwyn No. 3	19	44	09	E50/14	WD 118.9	16	12	72	2590.8	In progress
	115	52	43		RT 30.2					

Hauy No. 1	19	47	39	E50/15	WD	65.5	25	11	72	825.4	PA
BMR file 72/3186	117	15	15		RT	30.2	8	12	72		
Malus No. 1	19	45	16	E50/14	WD	85.4	7	10	72	3657.6	PA
BMR file 72/3058	115	32	02		RT	9.8	5	11	72		
Picard No. 1	18	58	60	E50/11	WD	140.8	28	7	72	4216.0	PA
BMR file 72/2710	117	37	20		RT	9.5	23	9	72		
Rosemary No. 1	19	57	16	E50/14	WD	64.9	13	11	72	2845.0	In progress
BMR file 72/3172	116	20	41		RT	9.5					
Sable No. 1	19	14	04	E50/14	WD	150.9	21	8	72	3971.5	PA
BMR file 72/2770	116	54	59		RT	12.5	12	10	72		
Goodwyn No. 2	19	39	53	E50/14	WD	133.5	27	3	72	3750.0	Suspended gas/ condensate producer
	115	51	53		KB	9.5	28	5	72		
N. Rankin No. 2	19	33	54	E50/14	WD	126.5	9	6	72		Suspended gas/ condensate producer
	116	08	46		RT	12.5	1	8	72		
N. Rankin No. 3	19	31	41	E50/14	WD	127.1	4	8	72	4062.5	Suspended gas/ condensate producer
	116	10	14		RT	29.3	14	9	72		

N. Rankin No. 4	19	35	07	E50/14	WD	127.1	30	9	72	4062.4	Suspended gas/ condensate producer	
	116	06	42		RT	30.2	11	11	72			
HARTOGEN EXPLORATION PTY LTD												
Bidgemia No. 1	25	16	00	G50/5	GL	201.8	6	11	72	227.7	PA	
	115	20	20		RT	203.3	23	11	72			
Moogooree No. 1	24	15	20	G50/1	GL	271.9	8	10	72	137.8	PA	
	115	15	30		RT	272.4	15	10	72			
Moogooree No. 2	24	16	50	G50/1	GL	276.5	18	10	72	205.7	PA	
	115	12	40		RT	277.1	27	10	72			
Coonga No. 1	21	03	08	F50/6	GL	5.8	14	12	72	176.5	PA	
	116	01	48		RT	7.9	19	12	72			
HEMATITE PETROLEUM PTY LTD												
Cane River No. 3	21	42	28	F50/5	GL	14.9	29	12	72	185.6	PA	
	115	19	29		RT	17.7	2	1	72			
No. 4	21	35	54	F50/6	GL	13.1	16	1	72	172.8	PA	
	115	33	45		RT	15.9	21	1	72			
No. 5	21	47	22	F50/5	GL	34.1	8	1	72	200.9	PA	
	115	28	48		RT	36.9	10	1	72			

Mardie West No. 1	21	11	56	F50/6	GL	6.4	5	12	72	135.3	PA
	115	55	24		RT	8.5	8	12	72		
Surprise No. 1	21	17	58	F50/6	GL	9.8	14	11	72	216.4	PA
	115	49	27		RT	12.8	28	11	72		Gas Show
Windoo No. 1	21	21	18	F50/6	GL	2.1	17	10	72	218.9	PA
	115	46	55		RT	4.3	22	11	72		Hydrocarbon Show
Woorawa No. 1	21	21	55	F50/6	GL	13.4	14	9	72	202.4	PA
	115	47	33		RT	15.9	27	9	72		Gas Show
OCEAN VENTURES PTY LIMITED											
Edel No. 1	27	06	48	G49/16	WD	92.9	23	5	72	2749.6	PA
BMR file 72/2074	113	23	23		KB	29.6	21	7	72		
WEST AUSTRALIAN PETROLEUM PTY LTD											
Barrow Deep No. 1	20	50	07	F50/1	GL	38.4	16	9	72	3128.8	In progress
BMR file 72/2862	115	22	58		KB	46.6					
Cunaloo No. 1	22	00	48	F50/9	GL	12.2	22	3	72	797.4	PA
BMR file 72/53	114	53	47		RT	15.2	31	3	72		

East Marilla No. 1	22	54	48	F50/9	GL	59.1	15	4	72	638.3	PA
BMR file 72/960	114	36	58		RT	62.2	25	4	72		
North Tryal Rocks No. 1	19	59	18	E50/13	WD	106.7	3	6	72	365.6	PA
BMR file 72/2069	115	19	11		RT	12.2	28	7	72		
West Muiron No. 1	21	34	34	F50/5	WD	140.2	16	8	72	780.9	Abandoned
BMR file 72/2738	114	14	40		RT	6.1	29	9	72		
West Muiron No. 1A	21	34	44	F50/5	WD	63.1	5	10	72	345.3	Abandoned
BMR file 72/2738	114	14	45		RT	12.2	19	10	72		
West Tryal Rocks No. 1	20	13	45	F50/1	WD	137.8	23	10	72	3436.3	In progress
BMR file 72/3108	115	02	04		RT	12.2					
CLARENCE-MORETON											
AMALGAMATED PETROLEUM N.L.											
Toora No. 1	27	20	28	G56/13	GL	375.2	8	1	72	1227.4	PA
	150	51	46		KB	378.6	30	1	72		
COOPER											
DELHI INTERNATIONAL OIL CORPORATION											
Big Lake No. 2	28	13	47	H54/2	GL	32.0	13	2	72	2499.4	Shut in gas producer
	140	17	17		KB	37.2	19	5	72		

Brolga No. 1	27	35	36	G54/14	GL	34.1	19	4	72	2967.2	Gas condensate producer
BMR file 72/1018	140	01	28		KB	39.6	24	5	72		
Brumby No. 1	28	24	37	H54/2	GL	79.4	15	3	72	2350.9	Shut in gas well
BMR file 72/939	140	59	35		KB	83.5	6	4	72		
Burke No. 1	28	07	43	H54/2	GL	83.2	13	7	72	2555.8	Dual gas producer
BMR file 72/2728	140	57	19		KB	87.2	9	8	72		
Daralingie No. 3	28	21	32	H54/2	GL	26.5	9	6	72	2296.1	Shut in gas producer
	139	54	36		KB	31.1	26	6	72		
Dullingari No. 2	28	08	16	H54/2	GL	91.1	9	9	72	2700.5	Shut in gas producer
	140	53	27		KB	95.1	6	10	72		
Dullingari No. 3	28	05	20	H54/2	GL	74.4	12	10	72	2777.0	PA Hydrocarbon Show
	140	51	55		KB	78.3	10	11	72		
Epsilon No. 1	28	08	45	H54/3	GL	126.3	16	12	71	2209.8	Shut in gas producer
	141	09	24		KB	130.5	3	1	72		
Epsilon No. 2	28	08	38	H54/3	GL	117.6	23	4	72	2194.6	Shut in gas producer
	141	08	03		KB	121.9	8	5	72		

Fly Lake No. 2	27	37	24	G54/14	GL	40.5	16	12	71	2948.9	Gas condensate and oil well
	139	58	50		KB	35.0	21	1	72		
Fly Lake No. 3	27	39	45	G54/14	GL	31.1	1	2	72	2971.8	PA
	139	56	21		KB	36.6	7	3	72		
Mudrangie No. 2	27	40	03	G54/14	GL	41.8	1	7	72	3182.1	PA
	140	13	46		KB	47.2	5	7	72		Hydrocarbon show
Murteree A No. 1	25	29	47	H54/2	GL	58.8	11	8	72	1573.7	PA
BMR file 72/2868	140	19	39		KB	63.1	17	8	72		
Murteree C No. 1	28	25	01	H54/2	GL	320	23	8	72	2266.8	PA
BMR file 72/2921	140	23	14		KB	40	4	9	72		
Toolachee East No. 1	28	21	44	H54/2	GL	32.0	28	6	72	2566	PA
BMR file 72/2643	140	51	56		KB	36.0	1	8	72		
VAMGAS N.L.											
Kanowana No. 1	27	47	57	G54/14	GL	30.5	12	12	72	2831.3	In progress
BMR file 72/3282	139	58	42		KB	35.7					
DUNTROON											
SHELL DEVELOPMENT (AUSTRALIA) PTY LTD											
Echidna No. 1	35	36	15	I53/15	WD	139.0	16	1	72	3831.9	PA
	135	37	12		KB	30.2	12	3	72		

Platypus No. 1	35	25	07	I53/14	WD	157.9	21	3	72	3892.9	PA	
	134	49	25		KB	30.2	29	4	72			
GALILEE												
HEMATITE PETROLEUM PTY LTD												
Clyde No. 1	22	48	26	F54/12	GL	228.6	11	10	72	1116.5	PA	
BMR file 72/2760	143	29	00		KB	233.5	17	10	72			
Goleburra No. 1	22	25	06	F54/12	GL	172.8	23	9	72	1371.6	PA	
BMR file 72/2659	142	36	35		KB	179.0	4	10	72			
Lovelle Downs No. 1	22	12	43	F54/12	GL	167.6	26	8	72	2027.5	PA	
BMR file 72/2669	142	33	21		KB	182.3	14	9	72			
GIPPSLAND												
ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC.												
Cobia-1	38	27	27	J55/11	WD	72.9	4	8	72	1771.2	PA	
BMR file 72/2703	148	17	01		KB	9.8	24	8	72			
Flounder-4	38	18	25	J55/11	WD	119.5	28	12	72	890.0	In progress	
	148	29	45		DF	9.8						
Mackerel-2	38	29	14	J55/11	WD	92.7	14	2	72	2592.3	PA	
	148	20	18		KB	9.8	18	3	72			

Mackerel-3	38	28	28	J55/11	WD	98.8	1	4	72	2632.6	PA	
	148	21	45		KB	8.9	18	4	72			
Moray-1	38	51	48	J55/11	WD	75.6	15	6	72	2669.7	PA	
	148	03	21		KB	9.8	9	7	72			
Morwong-1	38	13	43	J55/11	WD	63.4	10	12	72	2439.3	PA	
BMR file 72/3225	148	18	45		DF	9.8	25	12	72			
Nannygai-1	38	33	10	J55/11	WD	68.6	9	7	72	3019.0	PA	
	147	59	43		KB	9.8	31	7	72			
HALLIDAY ENTERPRISES PTY LTD												
East Reeve No. 1	38	05	50	J55/11	GL	1.5	18	1	72	1524.0	PA	
	147	32	51		KB	5.5	25	1	72			
Keystone No. 1	38	19	39	J55/11	GL	29.6	8	2	72	1960.0	PA	
	147	09	21		KB	34.8	18	2	72			
West Seacombe No. 1	38	08	08	J55/11	GL	6.1	31	1	71	1765.7	PA	
	147	25	18		KB	11.0	1	1	72			
OTWAY												
HEMATITE PETROLEUM PTY LTD												
Snail No. 1	38	53	52	J55/9	WD	81.1	26	11	72	1234.8	PA	
BMR file 72/3159	144	18	10		DF	9.8	6	12	72			

Rowans No. 1	38	27	35	J54/12	GL	66.4	18	4	72	1798.3	PA	
BMR file 72/896	142	47	19		RT	70.7	2	5	72			
PERTH												
ABROLHOS OIL N.L.												
Heaton No. 1	29	07	18	H50/5	GL	185.6	3	5	72	2438.4	PA	
BMR file 72/979	115	12	45		RT	190.5	24	6	72			
Narlingue No. 1	29	04	14	H50/5	GL	192.9	27	3	72	2130.3	PA	
BMR file 72/790	115	06	10		RT	196.6	24	4	72			
UNION OIL DEVELOPMENT CORPORATION												
Wonnerup No. 1	33	37	55	I50/5	GL	15.8	18	4	72	4727.5	PA	
BMR file 71/929	115	28	16		KB	24.4	1	8	72		Gas show	
WEST AUSTRALIAN PETROLEUM PTY LTD												
Bullsbrook No. 1	31	28	42	H50/14	GL	86.3	1	10	72	4256.8	PA	
BMR file 72/3026	115	50	28		RT	90.8	28	11	72			
Lake Preston No. 1	32	55	12	I50/2	GL	10.1	20	12	72	1383.8	In progress	
BMR file 72/3302	115	39	39		RT	14.6						
Walyering No. 3	30	44	01	H50/9	GL	91.4	16	1	72	4187.3	PA	
	115	29	33		RT	96.0	28	4	72		Gas show	

SURAT										
ASSOCIATED AUSTRALIAN OILFIELDS N.L.										
Minmi No. 1	26	30	41	G55/12	GL 344.1	16	11	72	1147.9	Plugged and completed as water well
BMR file 72/3064	148	49	50		KB 347.5	21	11	72		
Pleasant Hills No. 17	26	23	53	G55/12	GL 363.3	24	9	72	1149.7	Plugged and completed as water well
BMR file 72/3019	149	03	00		KB 366.7	2	10	72		
DAMSON OIL (AUSTRALIA) LTD										
Noorindoo No. 4	27	07	27	G55/16	GL 252.4	17	2	72	2365.6	Plugged and completed as a water well
	149	09	00		KB 256.0	4	4	72		
Noorindoo No. 5	27	05	01	G55/16	GL 242.0	26	1	72	2147.6	PA
	149	07	45		KB 245.7	18	3	72		
LSG AUSTRALIA INC.										
Rockwood No. 1	26	58	47	G56/9	GL 303.2	5	10	72	1206.1	Shut in gas well
BMR file 72/3013	150	21	40		KB 307.5	19	10	72		
Rockwood No. 2	26	59	29	G56/9	GL 312.1	10	11	72	1254.3	Plugged and completed as a water well
	150	22	18		KB 316.4	28	11	72		
Sawpit Gully No. 1	27	28	00	G56/13	GL 335.3	3	9	72	1463.3	PA
BMR file 72/2912	150	36	30		KB 338.9	28	9	72		

MAYFAIR MINERALS INC										
Moree No. 1	29	17	26	H55/8	GL 198.5	4	12	72	1146.0	PA
BMR file 72/3223	149	47	45		KB 202.1	10	12	72		
TARGET EXPLORATION PTY LTD										
Jandowae South No. 1	26	49	35	G56/9	GL 328.0	30	6	72	469.7	PA
BMR file 72/937	150	59	15		KB 330.4	10	7	72		
Jandowae West No. 1	26	43	20	G56/9	GL 342.3	4	6	72	616.0	PA
BMR file 72/937	151	01	00		KB 344.7	12	6	72		
Stockyard Creek No. 1	26	22	30	G56/9	GL 346.9	19	5	72	415.1	Plugged and completed as a water well
BMR file 72/937	150	47	30		KB 349.3	29	5	72		
WOODS PETROLEUM OF AUSTRALIA LTD										
Coomoron No. 1	28	29	00	H56/1	GL 224.0	11	2	72	852.8	Plugged and completed as a water well
	150	27	20		KB 228.6	17	2	72		
Moogoon No. 1	28	21	45	H56/1	GL 239.3	28	1	72	989.1	Plugged and completed as a water well
	150	32	50		KB 243.8	5	2	72		
PAPUAN										
PHILLIPS AUSTRALIAN OIL CO.	07	48	-	B55/13	WD 7.3	1	7	72	2194.6	PA
Mira No. 1	144	44	-			1	8	72		

TABLE 4: GEOPHYSICAL OPERATIONS DURING 1972

BASIN	Permit	Duration	Extent
OPERATING COMPANY	1:250,000		
Survey name	Sheet area		
BMR file no.			
ADAVALE BASIN			
HARTOGEN EXPLORATIONS PTY LTD			
Gallipoli seismic	ATP183P	16.7.72	168.98 km
BMR file 72/2666	G.54-4/8	29.9.72	CDP analog
	G.55-1/5		
BONAPARTE GULF BASIN			
AUSTRALIAN AQUITAINE PETROLEUM PTY LTD			
Border Creek seismic	OP162 D52-15	16.8.72 12.9.72	108 km 6-fold reflection (digital)
BMR file 72/2794			
B.O.C. OF AUSTRALIA LTD			
Calder Evans marine seismic	NT/P6,P12,P4, P19.	20.9.72 30.9.72	605.11 km
BMR file 72/3038	C.52-6/7/10/11		24-fold CDP digital
Prudhoe-Hibernia marine seismic Project 72D	NT/P7,13,14,5. WA-35-P C51-15 D51-3	1.5.72 27.5.72	843.2 km
BMR file 72/2530			
BOWEN BASIN			
TARGET PETROLEUM N.L.			
Burton Downs seismic gravity and magnetic	ATP167P F55-7	27.8.72 21.9.72	57.9 km 600% CDP reflection. Magnetic reading every station and gravity every sixth.
BMR file 72/2924			

BROWSE BASIN

B.O.C. OF AUSTRALIA LTD

Browse Basin seismic	WA-32,33,34, 35-P	18.2.72 23.3.72	23 5.34 km 48 fold CDP
BMR file 72/791	D51-7/10/11/14		
North Reef marine seismic	WA-33-P D.51/6/10	20.3.72 26.3.72	65.50 km 12 fold and 6 fold
BMR file 72/1017			
Prudhoe - Hibernia marine seismic			
Project 72G	WA-35,37-P	1.5.72	459.1 km
BMR file 72/2530	D51-7/8/11	27.5.72	

CANNING BASIN

AUSTRALIAN AQUITAINE PETROLEUM PTY LTD

Hickey Hills seismic	WA-20,33-P F.51-16 F.52-13/14	14.10.72 8.12.72	210 km 6 fold CDP
BMR file 72/2761			

B.O.C. OF AUSTRALIA LTD

Naringla seismic	WA-31-P	16.7.72	397.0 km
BMR file 72/2716	E.51/5/6/9/10	27.7.72	2400%

HEMATITE PETROLEUM PTY LTD

Bedout Broome Swell seismic and magnetic	WA-29,30,31-P E.50-12/16 E.51-9/13	13.7.72 13.8.72	898.7 km 2400%
BMR file 72/2616			

WEST AUSTRALIAN PETROLEUM PTY LTD

Dampier Downs-Collins seismic	EP7,42,43,37,38 E.51/10/12/14/15/16	8.6.72 12.8.72	430.12 km 600%
BMR file 72/2545			
East Canning seismic	EP13,17,18,19,42, 43,44	9.4.72 22.8.72	904.9 km
BMR file 72/975	E.51-12/15/16 F.51-4 F.52-1		

Lennard Shelf aeromagnetic	EP5,7,17,42,44,51, 52,67.	21.6.72 4.9.72	31,571 km
BMR file 72/1019	E.51-3/4/7/8/11/12 E.52-5/9		
Lennard Shelf seismic	EP5,7,17,42,44, 51,52,67.	3.5.72 3.9.72	342.79 km 6 fold CDP
BMR file 72/1065	E.51-7/8/11/12		
Liveringa Ridge seismic	EP5,6,7 E.51-10/11	6.9.72 25.9.72	151.3 km 600% CDP
BMR file 72/2938			
North Broome D-2 seismic project	EP6,14 E.51-10/11	15.4.72 19.8.72	107.34 km 6 fold CDP
BMR file 72/961			
CARNARVON BASIN			
B.O.C. OF AUSTRALIA LTD			
Malus-Hedland marine seismic	WA-1, 28-P E.50-10/11/14/15/13 F.50-2/3	30.6.72 15.7.72	571.92 km 24-fold maxi-pulse
BMR file 72/2701			
Montebello-Turtle marine seismic	WA-1,28,29-P E.50-10/11/12/14/15 F.50-2	10.2.72 15.3.72	2874.49 km
BMR file 72/509			
Steamboat-Spit seismic	WA-1,29-P	23.11.72	In progress
BMR file 72/3253			
OCEANIA PETROLEUM PTY LTD			
Hamelin seismic	EP37,48	29.5.72	15 km 1200%
BMR file 72/2075	G.49-12 G.50-9	19.7.72	64 km 600% CDP
Murchison Gascoyne D-1 Gravity	EP45,46,47,48 G49-8/12 G.50-5/9/13	31.8.71 17.7.72	6576 gravity stations
BMR file 71/555			
WEST AUSTRALIAN PETROLEUM PTY LTD			
Lyndon-Quobba seismic	EP55,12	12.3.72 8.4.72	2221 km 600% CDP
BMR file 72/891	F.49-16 F.50-13, G.49-4 G.50-1		

COOPER BASIN

DELHI INTERNATIONAL OIL CORPORATION			
Andree seismic	PEL5&6	16.3.72 1.4.72	24.14 km 6 fold
BMR file 72/753	G.54-14		67.59 km 6 fold CDP
Dunjeroo seismic	PEL5,6	6.11.72	28.2 km 1-fold
BMR file 71/696	ATP66,67P H.54-2/3	26.1.72	23.3 km 6-fold
Embarka seismic	PEL5&6	23.11.72 12.4.72	78 km 100% 16.1 km
BMR file 72/956	G.54-14		300% 72.9 km 400% 7.4 km 600%
Omicron seismic	ATP 66,67P	22.5.72	210.8 km of 100% to 600%
BMR file 72/2065	H54-2/3 G54-14/15	17.8.72	CDP
Tickerna seismic	PEL 5&6	13.4.72	114.3 km 100% to 400% CDP
BMR file 72/1003	H.54-2	17.5.72	
XLX N.L. Windorah East Gravity	ATP 197P		no stations recorded
BMR file 72/3039			

GALILEE BASIN

AMERICAN AUSTRALIAN ENERGY LTD			
Belyando seismic	ATP 194P	12.9.72	72.4 km
BMR file 72/2935	F.55-10	17.10.72	6 fold CDP
Hexham seismic	ATP 76P	29.8.72	25.75 km
BMR file 72/2920	F.55-10	9.9.72	single fold

OTWAY BASIN

ALLIANCE OIL DEVELOPMENT PTY LTD			
Port Macdonnell marine seismic	SA8 J.54-6	10.5.72 14.5.72	44 km 6-fold
BMR file 72/1089			

HEMATITE PETROLEUM PTY LTD			
Portland-King Island seismic	Vic/P6,7 T/P3	26.10.72 29.10.72	268.2 km 48 fold CDP
BMR file 72/3020	J.54-11/12/16		
Torquay Embayment seismic and magnetic	Vic/P6 J.55-9	26.12.71 9.1.72	225.3 km 24-fold reflection
BMR file 71/883			
PURSUIT OIL N.L.			
Paraparap seismic	PEP 68	6.3.72 28.3.72	54.07 km 6-fold coverage
BMR file 72/831	J.55-9		
SHELL DEVELOPMENT (AUSTRALIA) PTY LTD			
Colac-Geelong seismic	PEP 6	9.2.72 11.6.72	265.7 km 1200% CDP
BMR file 72/805	J.54-12		
Dartmoor seismic	PEP5	15.2.72	216 km 1200%
BMR file 72/757	J.54-7/11	25.5.72	
PEDIRKA BASIN			
REEF OIL N.L.			
Poeppel Corner seismic	OP172	9.7.72 31.10.72	29 km 1200%
BMR file 72/2645	G.53-8		392.7 km 600%
PERTH BASIN			
WEST AUSTRALIAN PETROLEUM PTY LTD			
Barberton seismic	EP 24	7.12.72 19.12.72	59 km 600% CDP
BMR file 72/3277	H.50-10		
Coomallo seismic	EP 21,24	29.12.71	145.78 km
BMR file 71/928	H.50-9/10	31.1.72	600%
Dandaragon East Flank seismic	EP 23,25	10.12.71	323.8 km
BMR file 71/850	H.50-6/10	2.3.72	600%

Gingin-Bullsbrook D-1 seismic	EP25,24 H.50-14	11.1.72 6.3.72	211.9 km
BMR file 71/855			
Rockingham seismic	EP 25	17.11.72	in progress
BMR file 72/3179	I50-2		

ST VINCENT BASIN

BEACH PETROLEUM N.L.

Marsden marine seismic	SA 9 I.53-16	26.5.72 31.5.72	36.2 km
BMR file 72/2523			

SURAT BASIN

ASSOCIATED AUSTRALIAN OILFIELDS N.L.

Lorelle seismic	ATP 119P	1.8.72 18.12.72	305.9 km 6 fold CDP 7.8 km 3 fold 6.2 km 12 fold
BMR file 72/2593	G.55-12		

L.S.G. AUSTRALIA INC.

Marmadua seismic	ATP 191P	26.4.72 14.5.72	38.6 km single-fold coverage
BMR file 72/2003	G.56-9/13		

SOUTHERN UNION ENERGY PTY LTD

Rockybank seismic	ATP 119P	14.6.72 28.6.72	40.2 km single fold coverage
BMR file 72/2561	G.55-12		

PAPUAN BASIN

CONTINENTAL OIL COMPANY OF AUSTRALIA

Upper Fly River-Lake Murray seismic and gravity	P43 B.54-11/15	11.7.72	in progress
BMR file 72/2422			

ENDEAVOUR OIL COMPANY N.L.

Kiwai land and marine seismic	L6,7	15.9.72	in progress
BMR file 72/2783	C.54-4		

GENERAL EXPLORATION COMPANY OF AUSTRALIA PTY LTD			
Popondetta seismic	P49	24.5.72	51.5 km
BMR file 72/2389	C.55-3	12.9.72	2 fold CDP 136.8 km 3 fold CDP
TEXACO OVERSEAS PETROLEUM CO.			
Elevala seismic	OP 27	9.11.71	399.1 km 12-fold
BMR file 71/764	B.54-7/11	31.5.72	71.6 km 9-fold
Kiunga seismic	P 27	1.6.72	412 km 12 fold CDP
BMR file 72/2423	B.54-7/11	9.12.72	25.7 km 24 fold CDP
Palmer Gravity	P 27	8.9.72	175 new stations
BMR file 72/2952	B.54-7	20.9.72	
UNION OIL DEVELOPMENT CORPORATION			
Tomu River seismic & Gravity	P 51 B.54-11	1.1.72 30.6.72	441.24 km
BMR file 71/924			
<u>TROBRIAND BASIN</u>			
AMOCO AUSTRALIA EXPLORATION COMPANY			
Trobriand Islands marine seismic	PNG/15P	4.4.72 22.4.72	1195.7 km 24-fold 331.5 km 6-fold
BMR file 72/822	C.56-1/5		
Trobriand Islands detail marine seismic	PNG/15P	9.12.72 17.12.72	688 km aquapulse 24 km maxipulse
BMR file 72/3268	C.56-1/5		24 fold CDP
<u>OFFSHORE PAPUA NEW GUINEA</u>			
SHELL DEVELOPMENT (AUSTRALIA) PTY LTD			
Bougainville D-1 seismic	PNG/19P B.56-8/12	17.12.72 26.12.72	802 km 2400% digital
BMR file 72/3301			

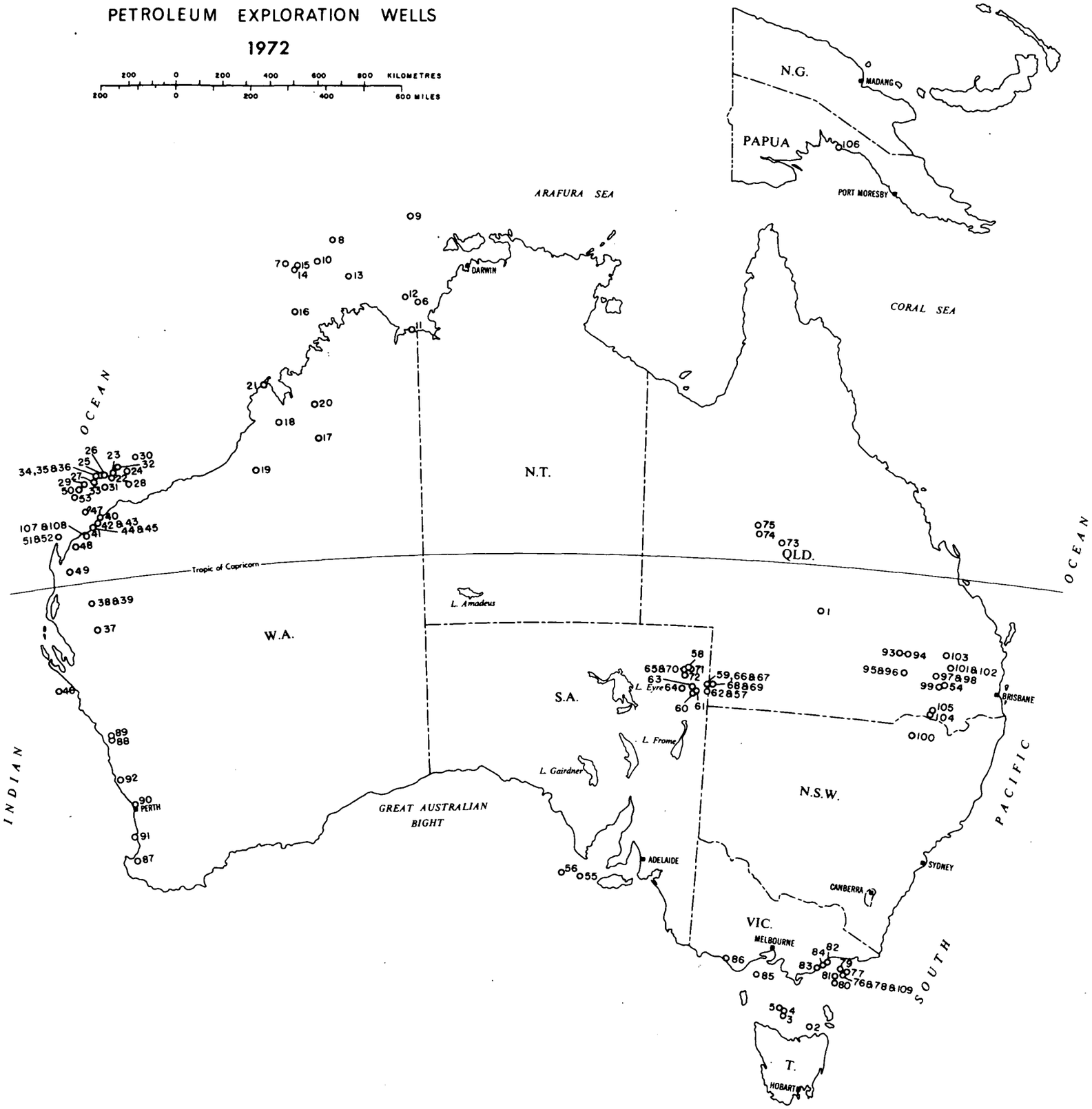
AUSTRALIA AND PAPUA NEW GUINEA

PETROLEUM EXPLORATION WELLS

1972

200 0 200 400 600 800 KILOMETRES

200 0 200 400 600 MILES



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

1	Alva, Qld	55	Echidna, S.A.
2	Durroon, Tas.	56	Platypus, S.A.
3	Pelican 3, Tas.	57	Brumby, S.A.
4	Poonboon, Tas.	58	Brolga, S.A.
5	Tarook, Tas.	59	Burke, S.A.
6	Bougainville, N.T.	60	Murteree A, S.A.
7	Brown Gannet, N.T.	61	Murteree C, S.A.
8	Eider, W.A.	62	Toolachee East, S.A.
9	Heron, N.T.	63	Big Lake 2, S.A.
10	Osprey, N.T.	64	Daralingie 3, S.A.
11	Pelican Island, W.A.	65	Fly Lake 2, S.A.
12	Penguin, W.A.	66	Dullingari 2, S.A.
13	Plover, W.A.	67	Dullingari 3, S.A.
14	Puffin, N.T.	68	Epsilon, Qld
15	Swan, N.T.	69	Epsilon 2, Qld
16	Rob Roy, W.A.	70	Fly Lake 3, S.A.
17	Barbwire, W.A.	71	Mudrangie 2, S.A.
18	Logue, W.A.	72	Kanowana, S.A.
19	Munro, W.A.	73	Clyde, Qld
20	Palm Spring, W.A.	74	Goleburra, Qld
21	Pender, W.A.	75	Lovelle Downs, Qld
22	Angel, W.A.	76	Cobia, Vic.
23	Angel 2, W.A.	77	Flounder 4, Vic.
24	Cossigny, W.A.	78	Mackerel 3, Vic.
25	Eaglehawk, W.A.	79	Morwong, Vic.
26	Egret, W.A.	80	Moray, Vic.
27	Goodwyn 3, W.A.	81	Nannygai, Vic.
28	Hauy, W.A.	82	East Reeve, Vic.
29	Malus, W.A.	83	Keystone, Vic.
30	Picard, W.A.	84	West Seacombe, Vic.
31	Rosemary, W.A.	85	Snail, Vic.
32	Sable, W.A.	86	Rowans, Vic.
33	Goodwyn 2, W.A.	87	Wonnerup, W.A.
34	North Rankin 2, W.A.	88	Heaton, W.A.
35	North Rankin 3, W.A.	89	Narlingue, W.A.
36	North Rankin 4, W.A.	90	Bullsbrook, W.A.
37	Bidgemia, W.A.	91	Lake Preston, W.A.
38	Moogooree, W.A.	92	Walyering 3, W.A.
39	Moogooree 2, W.A.	93	Minmi, Qld
40	Coonga, W.A.	94	Pleasant Hills 17, Qld
41	Cane River 3, W.A.	95	Noorindoo 4, Qld
42	Mardie West, W.A.	96	Noorindoo 5, Qld
43	Surprise, W.A.	97	Rockwood, Qld
44	Windoo, W.A.	98	Rockwood 2, Qld
45	Woorawa, W.A.	99	Sawpit Gully, Qld
46	Edel, W.A.	100	Moree, N.S.W.
47	Barrow Deep, W.A.	101	Jandowae South, Qld
48	Cunaloo, W.A.	102	Jandowae West, Qld
49	East Marilla, W.A.	103	Stockyard Creek, Qld
50	North Tryal Rocks, W.A.	104	Coomoron, Qld
51	West Muiron, W.A.	105	Moogoon, Qld
52	West Muiron 1A, W.A.	106	Mira, PNG
53	West Tryal Rocks, W.A.	107	Cane River 4, W.A.
54	Toora, Qld	108	Cane River 5, W.A.
		109	Mackerel 2, Vic.

B.M.R Petroleum Exploration Branch, 1973 *To accompany Record No 1973/216*

X AUS-1-15N

AUSTRALIA AND PAPUA NEW GUINEA

GEOPHYSICAL OPERATIONS

UNDER PETROLEUM SEARCH SUBSIDY ACT 1959 - 1969

1972

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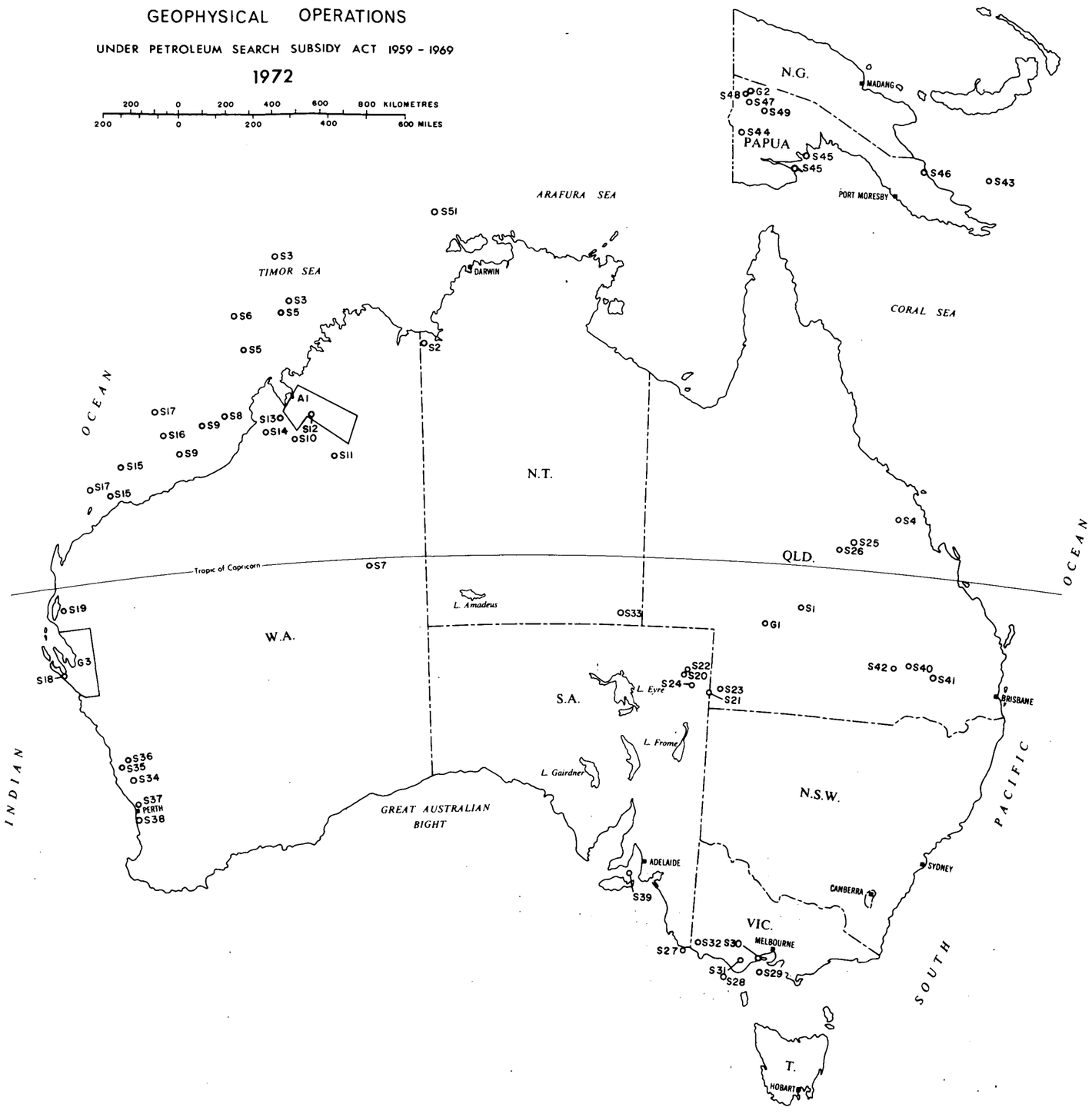
200 0 200 400 600 MILES



S	SEISMIC		
S1	Gallipoli, Qld	S32	Dartmoor, Vic.
S2	Border Creek, N.T.	S33	Poeppel Corner, N.T.
S3	Prudhoe - Hibernia, W.A.	S34	Barberton, W.A.
S4	Burton Downs, Qld (& Gravity & Magnetic)	S35	Coomallo, W.A.
S5	Browse Basin, W.A.	S36	Dandaragan East Flank, W.A.
S6	North Reef, W.A.	S37	Gingin - Bullsbrook D-1, W.A.
S7	Hickey Hills, W.A.	S38	Rockingham, W.A.
S8	Naringla, W.A.	S39	Marsden, S.A.
S9	Bedout Broome Swell, W.A. (& Magnetic)	S40	Lorelle, Qld
S10	Dampier Downs - Collins, W.A.	S41	Marmadua, Qld
S11	East Canning, W.A.	S42	Rockybank, Qld
S12	Lennard Shelf, W.A.	S43	Trobriand Islands, PNG
S13	Liveringa Ridge, W.A.	S44	Upper Fly River - Lake Murray, PNG (& Gravity)
S14	North Broome D-2, W.A.	S45	Kiwai, PNG
S15	Malus - Hedland, W.A.	S46	Popondetta, PNG
S16	Montebello - Turtle, W.A.	S47	Elevala, PNG
S17	Steamboat-Spit, W.A.	S48	Kiunga, PNG
S18	Hamelin, W.A.	S49	Tomu River, PNG (& Gravity)
S19	Lyndon - Quobba, W.A.	S50	Bougainville D-1, PNG
S20	Andree, S.A.	S51	Calder Evans, N.T.
S21	Dunjeroo, Qld & S.A.	S52	Trobriand Islands Detail, PNG
S22	Embarka, S.A.		
S23	Omicron, Qld		
S24	Tickerna, S.A.	A	AEROMAGNETIC
S25	Belyando, Qld	A1	Lennard Shelf, W.A.
S26	Hexham, Qld		
S27	Port Macdonnell, S.A.		
S28	Portland - King Island, Vic. & Tas.		
S29	Torquay Embayment, Vic. (& Magnetic)	G	GRAVITY
S30	Paraparap, Vic.	G1	Windorah East, Qld
S31	Colac - Geelong, Vic.	G2	Palmer, PNG
		G3	Murchison-Gascoyne D-1, W.A.

B.M.R. Petroleum Exploration Branch, 1973 To accompany Record No 1973/216