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Bureau of Resource Sciences

Australian Petroleum Accumulations Report 8

Carnarvon Basin, W.A.

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Cover: Two Biggadas (the Euro *Macropus robustus*) at the flowlines in the L block separator station, Barrow Island, May 1986. Photograph: Barry West

The Bureau of Resource Sciences is a professionally independent bureau within the Department of Primary Industries and Energy. It was established in October 1992 and was formed from the former Bureau of Rural Resources and the resource assessment branches of the former Bureau of Mineral Resources, Geology and Geophysics.

Its role is to provide professionally independent and timely scientific and technical analyses, assessments, advice and information to government, industry and the community, and to facilitate the formulation and implementation of policies and programs directly relevant to Australia's agricultural, minerals, petroleum, forestry and fishing industries.

FOREWORD

This report on the Carnarvon Basin, Western Australia, is the eighth in the Australian Petroleum Accumulations (APA) series. The series presents data on Australia's identified petroleum resources, and an appraisal of the geological setting and characteristics of those resources, their size and, in the case of developed accumulations, details of their development and production history.

The APA database, on which this publication series is based, was developed in cooperation with petroleum companies and State and Northern Territory mines departments. It was released in digital format in 1991, and is available as ASCII files or Oracle tables. It is linked to PEDIN, the petroleum publicly available exploration information database maintained by the Bureau of Resource Sciences (BRS) and the Australian Geological Survey Organisation (AGSO).

The offshore part of the Carnarvon Basin contains the largest number of known petroleum accumulations of any offshore Australian basin and the basin presents excellent prospects for further discoveries. The information contained in this report is essential to petroleum explorers and developers alike.

Paul E. Williamson
Director
Petroleum Resource Branch
Bureau of Resource Sciences

In the Australian Petroleum Accumulations series:

Report 1 Amadeus Basin (Northern Territory) (1986)
Report 2 Bass Basin (Victoria and Tasmania) (1987)
Report 3 Gippsland Basin (Victoria) (1987)
Report 4 Adavale Basin (Queensland) (1988)
Report 5 Bonaparte Basin (Northern Territory and Western Australia) (1989)
Report 6 Otway Basin (Victoria and South Australia) (1990)
Report 7 Browse Basin (Western Australia) (1991)
Report 8 Carnarvon Basin (Western Australia) (1993)
Report 9 Canning Basin (Western Australia) (in preparation)
Report 10 Perth Basin (Western Australia) (in preparation)

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The digital version of the Australian Petroleum Accumulations database, previously maintained as hard copy, was developed and implemented in late 1991 with assistance from Robert De Nardi.

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PETROLEUM ACCUMULATIONS SUMMARIES

ABSTRACT

Seventy three petroleum accumulations have been found to 30 June 1992 in the Carnarvon Basin. Most accumulations occur offshore in the northern part of the basin, in Triassic to Cretaceous sedimentary rocks. This Mesozoic sequence was deposited in a series of sub-basins associated with the rifting of the Australian and Indian plates. Petroleum accumulations are found in the Barrow, Dampier and Exmouth Sub-basins, the Exmouth Plateau, and the Peedamullah/Onslow Shelf.

Trapping mechanisms include structural and stratigraphic traps at several levels in the Mesozoic sequence. The largest known gas and oil fields in the basin are reservoired in pre-rift Triassic fluvio-deltaic sands and post-rift Cretaceous marginal marine sandstones. Several significant accumulations, including the Wanaea and Cossack oil accumulations, occur in the Jurassic syn-rift sequence, which includes marine shelf, slope and basin floor sandstones.

Source and seal for many accumulations are provided by marine prodelta shales and by restricted occurrences of deep marine shales, both of Jurassic age. Cretaceous marine claystones also act as seals, often by juxtaposition of these impermeable sediments against reservoirs across faults.

Thirteen developments were in place, as at 30 June 1992, to produce petroleum from the Carnarvon Basin and a further nine were planned, not including the planned Wandoo production test. Development infrastructure offshore consists of manned and unmanned platforms and monopods, seapoles and pipelines, while onshore facilities include the gas processing facilities and LNG plant at Karratha, the Tubridgi gas plant, the Harriet gas gathering facility on Varanus Island, oil processing or storage plants on Varanus, Thevenard, Airlie and Barrow Islands and offloading facilities at these islands. The Talisman development using a floating production facility ceased production in August 1992 and was decommisioned in October 1992.

1. INTRODUCTION

This report contains technical data on the 73 petroleum accumulations found in the Carnarvon Basin up to 30 June 1992. It summarises the petroleum geology and gives an overview of the development and production aspects of the basin.

A discrete, measured recovery of petroleum from a well (other than gas dissolved in aquifer water) qualifies an accumulation for inclusion in the Australian Petroleum Accumulations (APA) digital database, a copy of which accompanies this report (see Chapter 4 for accumulations data). Petroleum interpreted only from wireline log data or recognised from core fluorescence is, thus, excluded. Test results from the discovery well, where available on open file, are listed in the database and Chapter 4. Petroleum accumulations are classed as 'commercial' if production has occurred or if development plans have been announced by the operator. Petroleum accumulations are classed as 'non-commercial' if a reserve has been estimated or a retention lease has been applied for. In a few instances, (such as Tanami), accumulations listed here as non-commercial are now commercial and in production. The classification of other discovery is used for other fields, where discrete recovery of petroleum has been achieved, and is often an indicator of petroleum exploration potential where little other information is available.

The petroleum accumulations found in the Carnarvon Basin have made a significant contribution to Australia's oil and gas reserves and production. The Carnarvon Basin is Australia's second largest basin in terms of oil production and is by far the largest in terms of gas production.

2. BASIN SUMMARY

2.1. Basin Setting

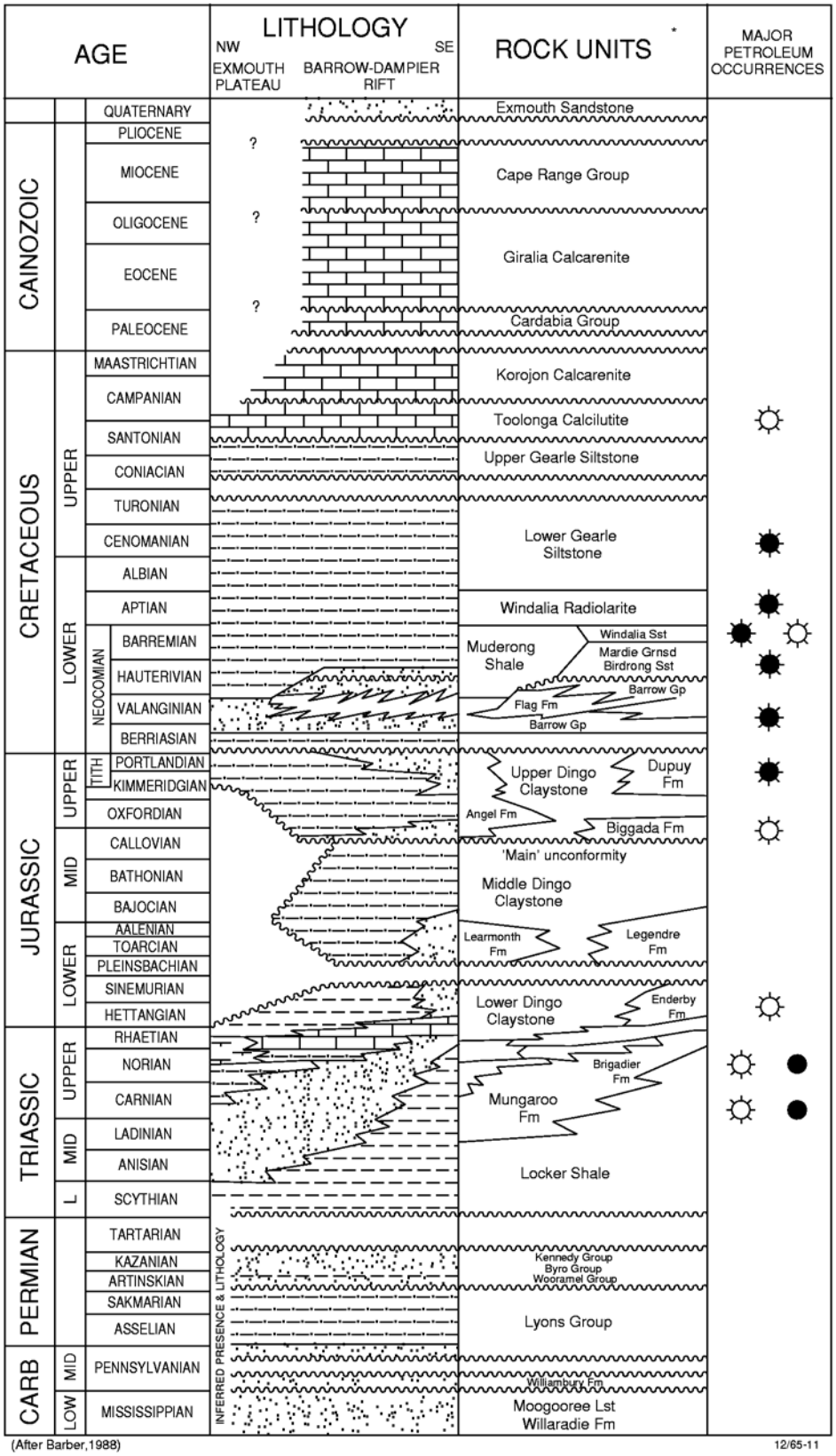
The Carnarvon Basin extends for over 1000 kilometres onshore and offshore along the western margin of the Australian mainland in the State of Western Australia, in water depths to 3500 metres (Figure 1). With the Browse Basin and the offshore parts of the Canning, and Bonaparte Basins to its north, the Carnarvon Basin constitutes the petroleum province known as the North West Shelf.

The arcuate Carnarvon Basin has an onshore area of about 115 000 square kilometres and an offshore area of about 535 000 square kilometres. Offshore, the basin extends to the continental plate boundary. From the eastern basin margin (Pilbara Craton) to the western edge of the Exmouth Plateau, the basin is over 400 kilometres wide.

Major structural elements in the Carnarvon Basin are: an outer platform area (the Exmouth Plateau), centrally located northeast-trending graben structures, (including, from northeast to southwest; the Beagle, Dampier, Barrow, Exmouth and Gascoyne Sub-basins); and shallow basement areas near and onshore (the Peedamullah/Onslow Shelf) (Figure1). The Rankin Trend flanks the Barrow and Dampier Sub-basins on the northwest boundaries, and consists of a series of horst blocks composed of Triassic sedimentary rocks, over which the Jurassic and Cretaceous sequences are draped. The northeast structural trend in the central and outer parts of the continental margin is related to the Mesozoic, (mainly Jurassic), rifting and continental separation. The Beagle, Dampier and Barrow Sub-basins constitute the axis of the Jurassic rift. The southern part of the basin consists of the Gascoyne, Merlinleigh and Byro Sub-basins (no discoveries to date).

The sedimentary fill of the onshore part of the basin consists mainly of Palaeozoic rocks, overlain by a thin Mesozoic sequence in the west. Up to 7 kilometres thickness of sedimentary rocks are present onshore. Offshore, the 15 kilometre thick sequence consists mainly of Mesozoic sedimentary rocks. Underlying Palaeozoic rocks are poorly known but are regarded as basement to the prospective Mesozoic rift-related sedimentary sequence (Figure 2).

FIGURE-1



(After Barber,1988) 12/65-11

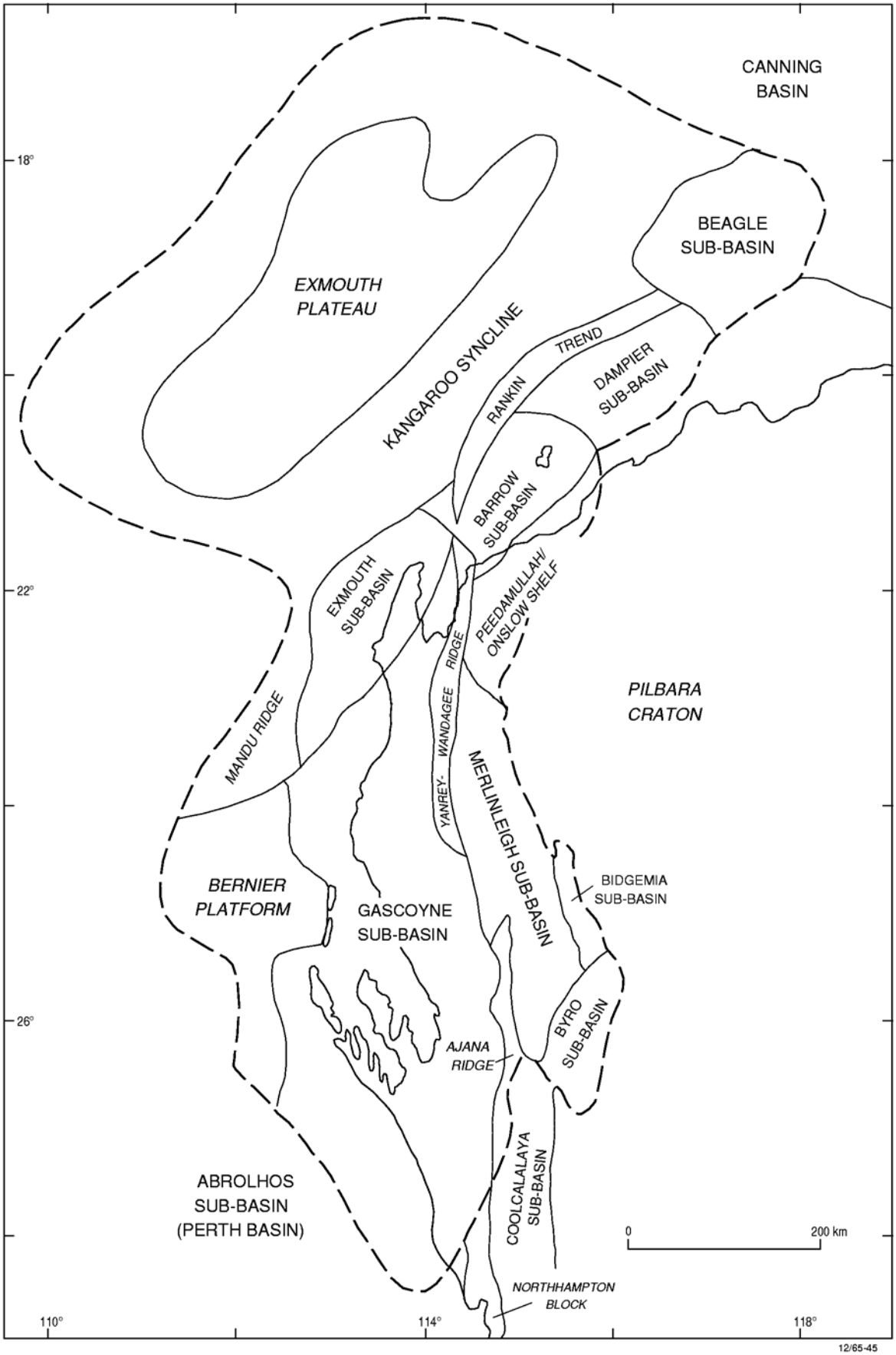
Nannyarra Sandstone is lower Devonian in age.

Barrow Group consists of Flacourt and Malouet Formations.

* Correct time relationships are shown for rock units but not all units are present in each sub-basin.

● *Oil* ☼ *Gas* ✹ *Oil,gas*

FIGURE-2


CANNING
BASIN
18°
BEAGLE
SUB-BASIN
EXMOUTH
PLATEAU
KANGAROO SYNCLINE
TREND
RANKIN
DAMPIER
SUB-BASIN
BARROW
SUB-BASIN
22°
EXMOUTH
SUB-BASIN
PEEDAMULLAH/
ONSLOW SHELF
PILBARA
CRATON
MANDU RIDGE
YANREY-
WANDAGEE
RIDGE
MERLINLEIGH SUB-BASIN
BIDGEMIA
SUB-BASIN
BERNIER
PLATFORM
GASCOYNE
SUB-BASIN
26°
BYRO
SUB-BASIN
AJANA
RIDGE
COOLCALALAYA
SUB-BASIN
ABROLHOS
SUB-BASIN
(PERTH BASIN)
0
200 km
NORTHHAMPTON
BLOCK
110°
114°
118°
12/65-45

2.2. Exploration history

The modern history of exploration in the Carnarvon Basin commenced with surveys by the newly-formed Commonwealth Bureau of Mineral Resources, Geology and Geophysics in the late 1940s under the recommendation of Dr. Harold Raggatt, the Bureau's Director, to William Walkley, co-founder of Ampol, to explore in the Exmouth Gulf area of the basin (Wilkinson, 1988). In 1956, the first well drilled, (Rough Range-1), struck oil at 1100 metres depth. The accumulation was later found to be relatively small. This discovery was the first oil in Australia to flow from an exploration well.

Despite intensive exploration, the next significant discovery in the Carnarvon Basin was not until 1964, when Barrow Island-1, drilled on Barrow Island on a structural crest intersected oil in the Jurassic sequence. Other oil and gas pools were later discovered on Barrow Island at several horizons in the Cretaceous sequence. High-pressure gas was discovered in the Jurassic at depth beneath Barrow Island in 1975 (Biggada-1). The Barrow Island accumulation has been the basin's largest oil producer to date.

During the 1960s, exploration in the Basin moved offshore after the first offshore seismic survey was carried out in Exmouth Gulf in 1961 (Parry and Smith, 1988). Soon after this, the Woodside Petroleum group was granted permits over a large area of the North West Shelf, including basins north of the Carnarvon Basin. Extensive reconnaissance marine seismic surveys were carried out during the 1960s, with more detailed seismic work commencing in 1967 (Doyle, 1988). The Rankin Trend was first recognised during a 1968 survey by the Bureau of Mineral Resources, Geology and Geophysics (BMR) (Parry and Smith, 1988). The North Rankin and Goodwyn accumulations were discovered on the Rankin Trend in 1971, and the Angel gas accumulation was discovered to the east in 1972. Several other gas discoveries were subsequently made along the Rankin Trend, including the large accumulation at Gorgon in 1981. On the Exmouth Plateau, the very large Scarborough gas field was discovered in 1979.

Further commercial oil was not discovered until the early 1980s, following mandatory relinquishments of offshore acreage. A string of discoveries was made in the central Barrow Sub-basin, (several along the extension of the Barrow Island Anticline). The discoveries in the 1980s included South Pepper, North Herald, Chervil and Harriet. The Saladin/Yammaderry accumulation was discovered in 1985 in the southern Barrow Sub-basin, followed by the Cowle and Roller discoveries nearby.

In 1989 and 1990, the Chinook/Scindian and Griffin wells discovered oil in the Mardie and Barrow sandstone.

The first commercial oil find in the Dampier Sub-basin was the Talisman discovery (1984), although non-commercial oil had been encountered in the 1970s in a number of wells drilled on the Rankin Trend. The Wanaea and Cossack commercial oil accumulations were discovered in 1989 and 1990 respectively. These accumulations lie on the same regional structural trend as the Angel gas accumulation.

In the onshore Carnarvon Basin, a commercial gas discovery was made at Tubridgi, near the town of Onslow. Production of gas from Tubridgi for the domestic market commenced in 1991. A potentially large undeveloped heavy oil resource identified in several wells, (including Mardie-1), is located 65 kilometres northeast of Onslow in the vicinity of Thringa. This accumulation is currently being evaluated for its suitability for enhanced oil recovery.

2.3. Reservoir summary

A summary of all the known producing and non-producing petroleum-bearing reservoirs in the basin, ordered by sub-basin, is given in Table 1.

3. HYDROCARBON-BEARING AREAS OF THE CARNARVON BASIN

3.1. Dampier Sub-Basin

3.1.1. *Geological summary*

The Dampier Sub-basin is one of several Mesozoic depositional downwarps of the northern Carnarvon Basin, and lies offshore from the Precambrian Pilbara Block (Crostella and Chaney, 1978; Kopsen and McGann, 1985). To the southwest, the sub-basin connects to the Barrow Sub-basin, but the boundary between them is not clearly defined. The sub-basin boundary used in this report is derived from McClure and others (1988).

The Kendrew Trough, Madeleine Trend, Lewis Trough, Legendre Trend and Enderby Trend in the Dampier Sub-basin proper trend northeasterly, and lie parallel to the Rankin Trend. To the northeast the De Grey Nose separates the sub-basin from the Beagle Sub-basin (Figure 4).

The Rankin Trend is the fault-segmented, southeastern border-zone of the Exmouth Plateau/Rankin Platform megacrustal block (Woodside, 1988). The Trend coincides with a positive regional gravity anomaly and lies between the Victoria Syncline to the northwest and the Dampier Sub-basin proper to the southeast, forming a prominent horst-and-graben structural trend.

The Dampier Sub-basin originated as a pull-apart basin by rifting of Gondwanaland in the Carboniferous or Permian, and has evolved into a marginal basin characterised by carbonate sedimentation (Crostella and Chaney, 1978).

The Mesozoic evolution commenced with a widespread transgression, which resulted in the deposition of the Locker Shale over much of the sub-basin in Early to Middle Triassic times (Crostella and Barter, 1980; Kopsen and McGann, 1985; Veenstra, 1985). During the Late Triassic, the sub-basin became a site of thick fluvio-deltaic deposits comprising the Mungaroo Formation. Sedimentation continued without a major break until the Middle Jurassic, with increasing marine influence (Dingo Claystone) (Figure 2).

The Rankin Trend area was uplifted during a period of major tectonic activity associated with continental break-up in the Middle Jurassic. Subsequent Late Jurassic sub-aerial erosion removed large amounts of sediment from upthrown horsts on the Rankin Trend, peneplanating the

erosion surface. Meanwhile, the Dampier Sub-basin remained a depocentre for marine sediments during the Late Jurassic.

FIGURE-3

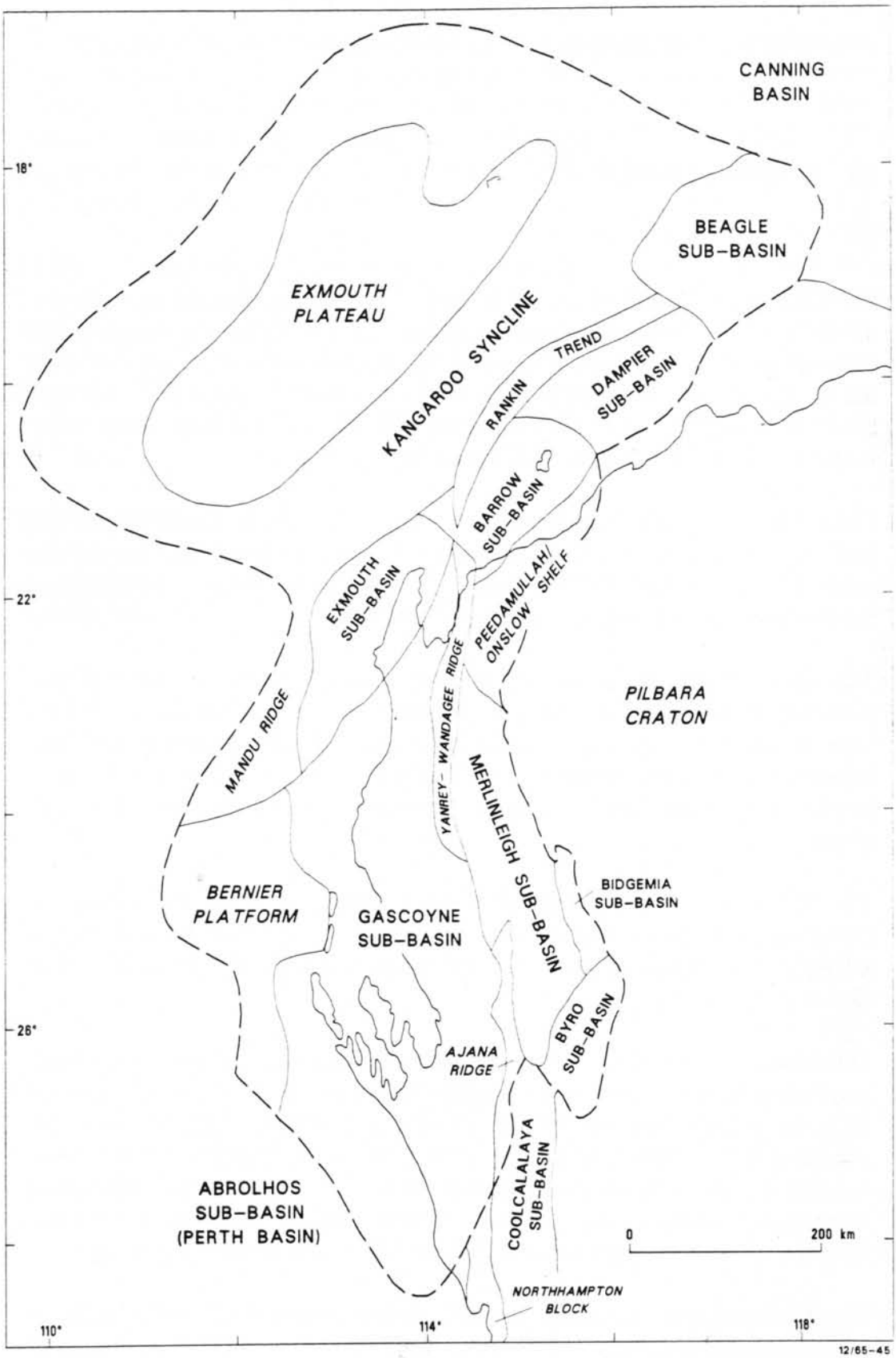
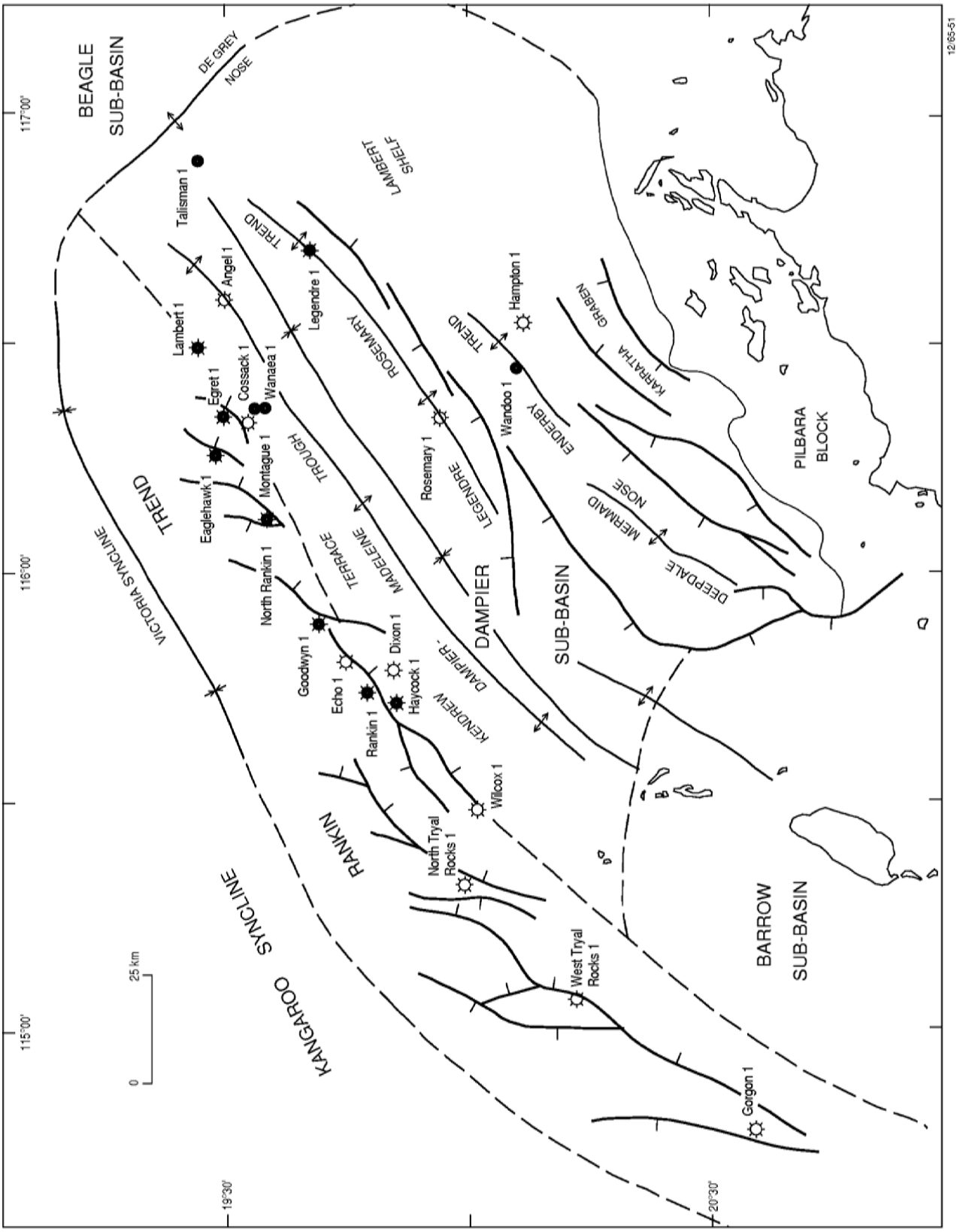

CANNING
BASIN
18°
BEAGLE
SUB-BASIN
EXMOUTH
PLATEAU
KANGAROO SYNCLINE
RANKIN TREND
DAMPIER
SUB-BASIN
BARROW
SUB-BASIN
EXMOUTH
SUB-BASIN
PEEDAMULLAH/
ONSLOW SHELF
22°
MANDU RIDGE
YANREY-WANDAGEE RIDGE
MERLINLEIGH SUB-BASIN
PILBARA
CRATON
BERNIER
PLATFORM
GASCOYNE
SUB-BASIN
BIDGEMIA
SUB-BASIN
BYRO
SUB-BASIN
26°
AJANA
RIDGE
COOLCALALAYA
SUB-BASIN
ABROLHOS
SUB-BASIN
(PERTH BASIN)
0
200 km
NORTHHAMPTON
BLOCK
110°
114°
118°
12/65-45

FIGURE-4


BEAGLE SUB-BASIN
DE GREY NOSE
LAMBERT SHELF
TREND
ROSEMARY
TROUGH
MADELEINE TERRACE
LEGENDRE
ENDERBY
DAMPIER SUB-BASIN
KENDREW
DAMPIER
VICTORIA SYNCLINE
RANKIN
KANGAROO SYNCLINE
MERMAID NOSE
DEEPDALE
KARRATHA
GRABEN
PILBARA BLOCK
BARROW SUB-BASIN
Talisman 1
Angel 1
Lambert 1
Egret 1
Cossack 1
Wanaea 1
Legendre 1
Montague 1
Eaglehawk 1
North Rankin 1
Goodwyn 1
Echo 1
Dixon 1
Rankin 1
Haycock 1
Wilcox 1
North Tryal Rocks 1
West Tryal Rocks 1
Gorgon 1
Rosemary 1
Hampton 1
Wandoo 1
117°00'
116°00'
115°00'
19°30'
20°30'
0
25 km
12/65-51

While the Rankin Trend was gradually subsiding in the Early Cretaceous, the fluvio-deltaic Barrow Group and the transgressive marine Muderong Shale were deposited in the sub-basin. Claystones of the Muderong Shale have provided an effective regional seal.

The deposition of claystones, marls and calcilutites continued in the sub-basin through the Cretaceous and Early Tertiary. Sediments in the sub-basin were tilted to the northwest during tectonism in the Oligocene and Miocene (Hann and Paterson, 1991). Since the Miocene, the continental shelf has remained stable, and deposition has been dominated by thick sequences of clastic carbonates.

3.1.2. *Hydrocarbon habitat*

3.1.2.1 *Reservoir geology*

Sandstones of the Mungaroo Formation (Figure 2) form the major reservoir rocks on the Rankin Trend. The Mungaroo Formation, comprising sandstones, claystones and thin interbeds of coal, was deposited during the slow transgression from a fluvial sequence to a barrier bar and lagoon coastline sequence in the Late Triassic (Harris, 1981). The fluvial sequence is dominated by alternating cycles of braided and meandering stream deposits. Oriented core samples taken from North Rankin wells have established the source of detrital materials to be from the east, and the formation prograded probably from an eastern source area (Forrest and Horstman, 1986). The Jurassic sequence is absent, and claystones of the Early Cretaceous Muderong Shale unconformably overlie the Mungaroo Formation.

In the North Rankin and Goodwyn areas on the Rankin Trend, the reservoir sandstones have a high quartz content and lack primary clay matrix. Local leaching of carbonate cement has taken place with little subsequent infilling of the pore spaces, resulting in the present situation in which some of the sandstones have porosities far higher than would be expected for the depth of burial. However, quartz overgrowths have had some adverse effects on reservoir quality (Harris, 1981; Beston, 1986).

Around the Gorgon and West Tryal Rocks areas on the Rankin Trend (Figure 4), the Mungaroo Formation is dominated by siltstone with interbeds of claystone and sandstone and minor interbeds of coal (Campbell and Smith, 1982). The sandstones consist of a rigid component (quartz grains), a mobile component (allogenic clays and lithic fragments) and an authigenic component (silica, kaolinite and carbonates). The authigenic kaolinite comprises 10 to 20 per cent of the sandstones and appears to have been

precipitated from circulating low-salinity aquifers. In contrast to the remainder of the Rankin Trend, the Jurassic Dingo Claystone and the Cretaceous Barrow Group have been preserved in the Gorgon-West Tryal area. The Barrow Group is hydrocarbon-bearing at Gorgon.

In the Kendrew Trough, the major reservoir rocks are either Jurassic sandstones or the Triassic Mungaroo Formation. Petroleum accumulations are aligned along the Rankin Trend escarpment, and some of the accumulations occur within remnant blocks detached from the Rankin Trend.

In the Wanaea, Cossack and Angel areas on the Madeleine Trend, the main reservoir sequence is sandstones of the Late Jurassic Angel Formation (Bint, 1991; Winterhalder and Hann, 1991). The Angel Formation is a stratigraphic equivalent of the Dupuy Formation, and of the Dingo Claystone, in the Barrow Sub-basin. The sandstones are mass-flow deposits in a pro-delta environment.

The Legendre Trend contains Late Jurassic mass-flow sandstones, which are a stratigraphic equivalent of the Angel Formation and of the Dupuy Formation. Early Cretaceous sandstones are shaly and glauconitic, and have been subjected to diagenetic cementation.

On the Enderby Terrace in the inshore part of the Dampier Sub-basin proper, Hampton-1 and Wandoo-1 were drilled to test the Triassic Mungaroo Formation, but discovered gas and oil accumulations, respectively, in the Early Cretaceous Windalia Sandstone Member of the Muderong Shale. This glauconitic sandstone was deposited on a storm-generated shelf during a minor regressive phase (Kopsen and McGann, 1985) and is overlain by the Early Cretaceous Windalia Radiolarite and Gearle Siltstone.

3.1.2.2 *Source rocks and maturation*

The Triassic Locker Shale comprises a thick, entirely marine sequence of interbedded claystones and siltstones (Crostella and Barter, 1980). This organic-rich shale is a source rock for hydrocarbons in the sub-basin. A geochemical interpretation of crude oil and condensate samples from the North Rankin and Goodwyn areas suggested that these hydrocarbons are derived from the Locker Shale. This source rock reached the oil generation threshold in the Late Triassic to Early Jurassic (prior to the Late Jurassic, when a regional sub-aerial erosion took place), and is now in an advanced stage of gas generation (Brikke, 1982).

The Jurassic Dingo Claystone, comprising a thick sequence of dark grey claystones and siltstones, is probably the most significant source rock for

hydrocarbon generation in the sub-basin (Crostella and Barter, 1980). The depositional environment is restricted marine, receiving large amounts of terrestrial matter. Paraffinic crude oils were generated from the claystones, which are also likely to be a source for gas.

A crude oil sample from Legendre-1 shows strong evidence of terrestrial input, although the reservoir rocks and probable source rocks lie within marine or deltaic sequences (Thomas, 1982). Claystones of the Dingo Claystone, penetrated in Dampier-1 and Madeleine-1, contain source rocks whose organic extract character correlates closely with Carnarvon Basin oils.

The Early Cretaceous Muderong Shale exceeds 1000 metres in thickness in the Lewis Trough. Crude oils found in Eaglehawk-1 (sandstones of the Mungaroo Formation) and North Rankin-1 (Late Cretaceous Toolonga Calcilutite) may have been derived from the Early Cretaceous Muderong Shale (Crostella and Chaney, 1978). These crude oils are naphthenic and aromatic, and the Eaglehawk-1 oil (30 °API) may be biodegraded (Alexander and others, 1983).

Reservoir rocks have been charged with hydrocarbons at various times and depths of burial, and some oil accumulations have been subjected to varying degrees of biodegradation. The nature of the hydrocarbons thus varies widely (Woodside, 1988). The last and main period of oil migration took place in the Miocene when a tectonic episode reactivated faults and provided conduits for oil migration.

3.1.3. *Hydrocarbon accumulations*

Discoveries to date in the Dampier Sub-basin include five commercial accumulations, thirteen non-commercial accumulations and four other discoveries (Plates 1-3)

3.1.3.1 Commercial accumulations

North Rankin (Plate 1, Accumulation 2)

The North Rankin gas field was discovered on the Rankin Trend in 1971 in a water depth of 125 metres. The Rankin structure is a truncated horst of Late Triassic to Early Jurassic fluvial and marginal marine sediments unconformably overlain by Cretaceous claystones and marls (Beston, 1986). In addition, gas and condensate flowed from the Enderby Formation (Middle Jurassic) in the North Rankin-4 exploration well.

The 34-slot North Rankin 'A' platform was installed in 1982, and production commenced in 1984 (Posaner and Goldthorpe, 1986). Gas and condensate are piped from the platform to the onshore plant complex through a 135 kilometres submarine pipeline. Part of the gas is sent to Perth via a 1500 kilometres onshore pipeline. The bulk of the methane is liquefied for export in a two train LNG plant.

North Rankin is part of the North West Shelf Project, which is one of the largest natural resource development projects undertaken in Australia. The third LNG processing train commenced production in 1992, and a fourth is being considered by the joint venture partners.

By the end of 1991, 49 million barrels of condensate had been produced from the North Rankin field. Currently condensate production is running at rates of up to 35 000 barrels per day. After commissioning of the Goodwyn 'A' platform (scheduled in 1994), condensate production will rise to more than 90 000 barrels a day.

Talisman (Plate 1, Accumulation 1)

The Talisman oil field was discovered on the Legendre Trend in 78 metres of water in 1984. The reservoirs consist of locally developed Early Cretaceous glauconitic shelf sandstone (Talisman Sandstone) and a Late Jurassic mass-flow sandstone (Angel Formation) (Ellis, 1988). The reservoirs in the Talisman Sandstone and Angel Formation are under different pressure regimes. The Talisman structure is a faulted anticline on the northeastern extremity of the Legendre Trend (Figure 4).

Crude oil production from Talisman commenced in 1989. Oil flowed from Talisman-1 and Talisman-7 (which is the sidetrack of Talisman-6) to a floating production storage and off loading facility. These wells were the first subsea completions undertaken in Western Australia. The Talisman production facilities were decommissioned in October 1992.

Goodwyn (Plate 1, Accumulation 3)

The Goodwyn gas and oil accumulation is situated in 130 metres of water. The main reservoirs are fluvial sandstones of the Mungaroo Formation, sealed by claystones of the Muderong Shale, intra-formational claystones and bounding faults (Tilbury and Smith, 1988). Because the reservoir sequence dips to the north at a steeper angle than the unconformity surface, younger reservoir units progressively subcrop to the north beneath the overlying unconformity. .

A fault escarpment separates the upthrown Goodwyn Main (Goodwyn-1, -2, -4, -5, -6, -7, -8 and -9) block from the Goodwyn South (Goodwyn-3 and Pueblo-1) and Tidepole blocks. The Goodwyn South block is upthrown in relation to the Tidepole block to the east (Vincent and Tilbury, 1988).

The stacked, gas reservoirs in the Goodwyn Main block are in several different pressure regimes. One isolated crude oil pool was discovered in the Mungaroo Formation in Goodwyn-3 (which intersected only oil, but may have a gas cap). Another pool was discovered in Goodwyn-6. In contrast, the two gas columns and the one gas-capped oil column intersected in Tidepole-1 appear to be in one pressure regime.

The Goodwyn 'A' platform is under construction and due to commence production in 1994. The platform will be connected to the North Rankin 'A' platform by a 22 kilometre submarine pipeline.

3.1.3.2 *Non-commercial accumulations (Rankin Trend)*

Eaglehawk (Plate 1, Accumulation 8)

The Eaglehawk oil accumulation, situated on the northeastern extremity of the Rankin Trend, was discovered in 1972 in 120 metres of water. A horst block of the Triassic Brigadier Formation is overlain by the Cretaceous Muderong Shale (Vincent and Tilbury, 1988; Figure 2).

Rankin (includes Echo/Yodel and Dockrell) (Plate 2, Accumulation 14)

The Rankin oil and gas accumulation was discovered in 1971 in 93 metres of water. The gas and oil column lies within sandstones of the tilted Mungaroo Formation and is sealed by a boundary fault, intra-formational claystones and the unconformably overlying Muderong Shale (Vincent and Tilbury, 1988). The Rankin, Echo/Yodel and Dockrell accumulations may possibly form an integrated accumulation under several different pressure regimes.

The Echo/Yodel gas and condensate accumulation was discovered by Echo-1 in 1988 in 175 metres of water. The Yodel-1 appraisal well was drilled in 1990. The tilted, gas-bearing sandstone units are in the Mungaroo Formation, which is overlain unconformably by Late Jurassic to Early Cretaceous claystones.

The Dockrell oil and gas accumulation was discovered in 1973. Dockrell-1 intersected an oil and gas column and two separate gas columns in the tilted Mungaroo Formation (Vincent and Tilbury, 1988). Water-bearing sandstones, as well as claystones separate these three hydrocarbon columns.

Wilcox (Plate 2, Accumulation 11)

The Wilcox gas accumulation was discovered in 1983 in 72 metres of water. The gas-bearing sandstones of the Mungaroo Formation are sealed by a combination of a boundary fault, inter-formational claystones, the conformably overlying Brigadier Formation (claystones and water-bearing sandstones) and the unconformably overlying Cretaceous claystones. Sandstones within the Brigadier Formation are water-bearing.

West Tryal Rocks (Plate 2, Accumulation 13)

The West Tryal Rocks gas accumulation, discovered in 1973 in 138 metres of water, is in a tilted horst of the Triassic Mungaroo Formation overlain by the Barrow Group. The Mungaroo Formation contains several gas-bearing sandstone units.

North Tryal Rocks (Plate 3, Accumulation 22)

The North Tryal Rocks gas accumulation was discovered in a horst block in 1972 in 107 metres of water. The Mungaroo Formation reservoir subcrops beneath a drape closure of the Muderong Shale.

Gorgon (Plate 2, Accumulation 12)

The Gorgon (Gorgon-1, Central Gorgon-1 and North Gorgon-1) gas accumulation was discovered on the southeastern end of the Rankin Trend in 1980 in 259 metres of water. The elongated Gorgon horst of the Triassic Mungaroo Formation contains several stacked gas-bearing sandstone units, although siltstones dominate in the Mungaroo Formation in the Gorgon area (Campbell and Smith, 1982). In addition to the Triassic gas columns, a gas-bearing sandstone unit was intersected in the Malouet Formation (Barrow Group).

3.1.3.3 *Non-commercial accumulations in the Kendrew Trough*

Lambert (Plate 1, Accumulation 9)

The Lambert oil accumulation was discovered in 1974 in 125 metres of water (Vincent and Tilbury, 1988). The Lambert structure is a domal rollover feature. Oil-bearing sandstones of the Angel Formation are overlain by siltstones and claystones of the Barrow Group.

Egret (Plate 1, Accumulation 6)

The Egret oil accumulation, discovered in 1973 in 118 metres of water, is a Triassic horst, draped with Angel Formation sandstones (Vincent and Tilbury, 1988). The faulted closure is sealed by claystones of the Barrow Group.

Montague (Plate 2, Accumulation 10)

The Montague gas accumulation was discovered in 1985, in 115 metres of water. The main gas reservoir is Mungaroo Formation sandstone. A secondary reservoir is present in Upper Jurassic sandstones. The Montague structure is an anticlinal rollover on the downthrown side of the Egret/Montague fault.

Dixon (Plate 2, Accumulation 16)

The Dixon gas accumulation was discovered in 1984 in 85 metres of water. Gas is reservoired in sandstones of the Mungaroo Formation, in a Triassic tilted-fault block and in draped Jurassic sandstones (Angel Formation) (Vincent and Tilbury, 1988). The stacked, Triassic gas reservoirs are in separate pressure regimes.

Haycock (Plate 3, Accumulation 21)

The Haycock gas accumulation, discovered in 1977 in 93 metres of water, is situated on the edge of the Kendrew Trough. A bounding normal fault separates it from the Rankin accumulation. The gas is reservoired in sandstones of the Mungaroo Formation (Crostella and Chaney, 1978).

3.1.3.4 *Commercial accumulations (Madeleine Trend)*

Wanaea (Plate 1, Accumulation 4)

The Wanaea oil accumulation was discovered in 1989 in 81 metres of water. Although several small oil accumulations were previously known in the Dampier Sub-basin, the Wanaea oil discovery was significant enough to change the general perception at that time that the sub-basin is a gas province. The Wanaea structure is an elongated anticline on the Madeleine Trend. The reservoir section, similar to that of the nearby Cossack oil accumulation, consists of mass-flow sandstones of the Angel Formation, overlain by Early Cretaceous claystones (Bint, 1991). The net-to-gross of the oil-bearing section is 70 per cent in the Wanaea wells, and 90 per cent in the Cossack wells.

Cossack (Plate 1, Accumulation 5)

The Cossack oil accumulation, discovered in 1990, is situated in 80 metres of water. Oil-bearing mass-flow sandstones of the Angel Formation are unconformably overlain by Lower Cretaceous claystones (Bint, 1991). The

Cossack oil-water contact, at a depth of 2918 metres subsea, appears to be deeper than that of Wanaea (2895 to 2905 metres subsea).

3.1.3.5 *Non-commercial accumulations (Madeleine Trend)*

Angel (Plate 1, Accumulation 7)

The Angel gas accumulation was discovered in 1971 in a water depth of 80 metres. Thick mass-flow deposits of coarse-grained sandstone of the Angel Formation constitute the reservoir section, which is overlain by Early Cretaceous claystones (Hann and Paterson, 1991). Although the reservoir sandstones are clean, a significant reduction in porosity, (identified locally in Angel-2), is related to dolomite cementation.

3.1.3.6 *Non-commercial accumulations (Legendre Trend)*

Legendre (Plate 2, Accumulation 17)

The Legendre oil accumulation was discovered in 1968 in 52 metres of water by Legendre-1. This was the first well drilled in the Dampier Sub-basin (Vincent and Tilbury, 1988). The structure is a faulted anticline. Reservoirs comprise sandstones of the Barrow Group which are sealed by intraformational claystones.

Rosemary (Plate 3, Accumulation 20)

The Rosemary gas accumulation was discovered in 1973 in 65 metres of water. The structure is a fault-controlled closure. A formation interval test, run in a Jurassic sandstone unit, (the Legendre Formation), recovered a small quantity of gas.

3.1.3.7 *Non-commercial accumulations (Enderby Terrace)*

Wandoo (Plate 3, Accumulation 18)

The Wandoo oil and gas accumulation was discovered in 1991 in 56 metres of water. This is the first discovery of oil in the inshore part of the Dampier Sub-basin. An oil pool exists in the Cretaceous Windalia Sandstone Member, (which is extremely friable, at about 600 metres subsea). During a production test for Wandoo-1, a substantial amount of sand was also produced. The low gas-oil ratio (83 cubic feet per barrel) suggests that the oil is not capped with gas (although a thin gas cap is thought to be present at Wandoo). In addition to the Cretaceous oil pool, a small gas pool was identified in the Jurassic Legendre Formation.

Hampton (Plate 3, Accumulation 19)

The Hampton gas accumulation was discovered in 1974 in 53 metres of water. It has one gas reservoir unit in the Cretaceous Windalia Sandstone Member at 500 metres subsea. Cretaceous sequences drape over a fault block.

3.1.4 Hydrocarbon types

Petroleum accumulations in the Dampier Sub-basin contain a variety of petroleum types: from high API gravity crude oils to biodegraded medium gravity crude oils, and from gas, extremely rich in condensate to relatively dry gas. Some gases contain a high percentage of carbon dioxide. Table 2 lists the molecular composition of reservoir fluids.

The Echo/Yodel accumulation has a high condensate-gas ratio of 235 barrels per million standard cubic feet of gas, the highest known in Australia. In the Goodwyn Main block of the Goodwyn accumulation, condensate yield and nitrogen content tend to increase in younger reservoir units of the Mungaroo Formation. The GD sandstone intersected in Goodwyn-9 (which is the youngest, proven reservoir unit in the Goodwyn accumulation) also has a high condensate-gas ratio of 143 barrels per million standard cubic feet.

The gas reservoirs of the Gorgon and West Tryal Rocks accumulations contain high proportions of carbon dioxide (17 per cent in Central Gorgon-1 and 11 per cent in West Tryal Rocks-2 (Table 2)). In addition, both accumulations are lean in condensate (condensate/gas ratios of 2.4 and 13.7 barrels per million cubic feet respectively).

The Cossack oil accumulation (gas/oil ratio 98 standard cubic feet per barrel) is situated between the Wanaea oil accumulation, (gas/oil ratio 1082 standard cubic feet per barrel), and the Angel gas accumulation. Oil from these accumulations has a gravity of about 55 °API. The Angel gas has a condensate yield of 56 barrels per million standard cubic feet and a condensate gravity of 55 °API.

The biodegraded Wandoo oil has a gravity of 19 °API. The oil, flowed from a Cretaceous zone between 581 and 593 metres subsea, has a low pour point, but was able to flow at a wellhead temperature of 15 °C.

3.2. Barrow Sub-Basin

3.2.1 *Geological summary*

The Barrow Sub-basin lies mainly offshore and is bounded to the east and south-east by the Peedamullah/Onslow Shelf and to the west by the Exmouth Plateau and Rankin Trend (Figures 5 and 6). To the south, the boundary is generally taken to be the east-trending Long Island Fault system, which forms a junction between the Barrow Sub-basin and the Exmouth Sub-basin. This boundary is also marked by the truncation of the Early Neocomian sequence, absent in the Exmouth Sub-basin. In the north the sub-basin merges with the Dampier Sub-basin. McClure and others (1988) consider that the boundary between the Barrow and Dampier Sub-basins is marked by a change in orientation of the major structures in the vicinity of Campbell and West Tryal Rocks.

The Barrow Sub-basin Permian and Mesozoic sedimentary fill exceeds 7000 metres in thickness over most of its area. Kopsen and McGann (1985) recognised three major depositional cycles in the sub-basin: Triassic, Jurassic to Early Cretaceous, and Late Cretaceous to Recent. The sedimentary packages represent the pre-rift phase, syn-rift and post-rift phases of basin development.

The Barrow Sub-basin began to develop during the earliest stage of rifting on the northwestern margin of Australia. Uplift and erosion of Palaeozoic sedimentary rocks at the end of the Permian were followed by downwarping of the sub-basin area and marine incursion during the earliest Triassic. The fluvio-deltaic Mungaroo Formation prograded into the sub-basin from the east, to be succeeded by a thick sequence of marine claystone (Dingo Claystone) (Figure 2) deposited during a marine transgression in the Middle and Late Jurassic.

The rift basin assumed much of its present structural configuration during this time. Fault movements at the basin margins were accompanied by erosion of adjacent platform areas and deposition of sandstones in deep water settings, as fans (Biggada Sandstone) and slope deposits (Dupuy Formation).

The complex sedimentary sequence comprising the Barrow Group disconformably overlies the Dupuy Formation and is best developed at the southern end of the Barrow Sub-basin. Four lithofacies have been recognised: coastal plain and upper shoreface, marine slope, outer turbidite facies and deepwater basinal shale. Northeast of Barrow Island, the Barrow Group consists only of marine shelf and deep water turbidites. Lateral equivalents of the Barrow Group to the west consist of deep marine

claystones. The Muderong Shale blankets the Barrow Group and equivalents

FIGURE-5

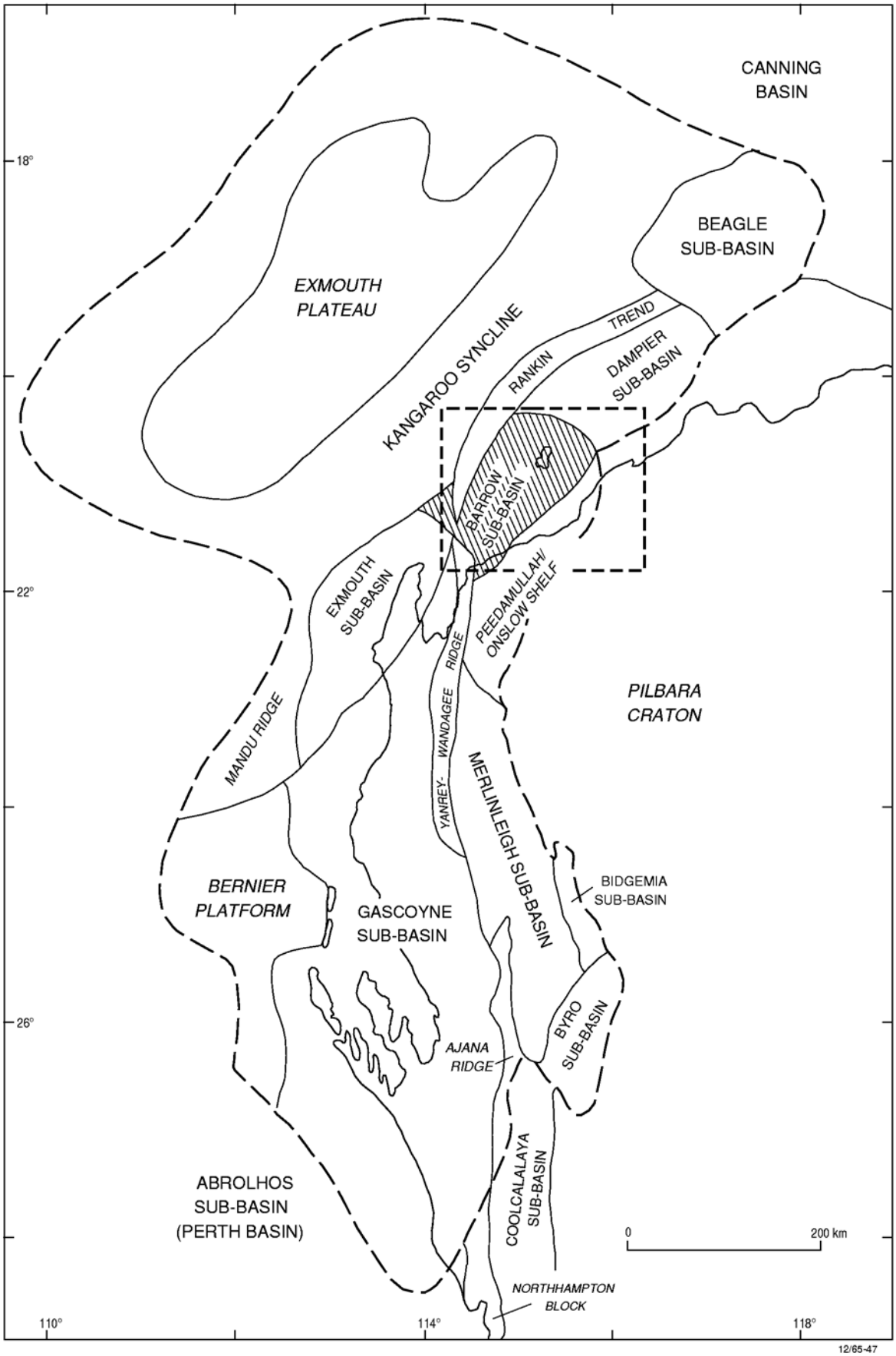
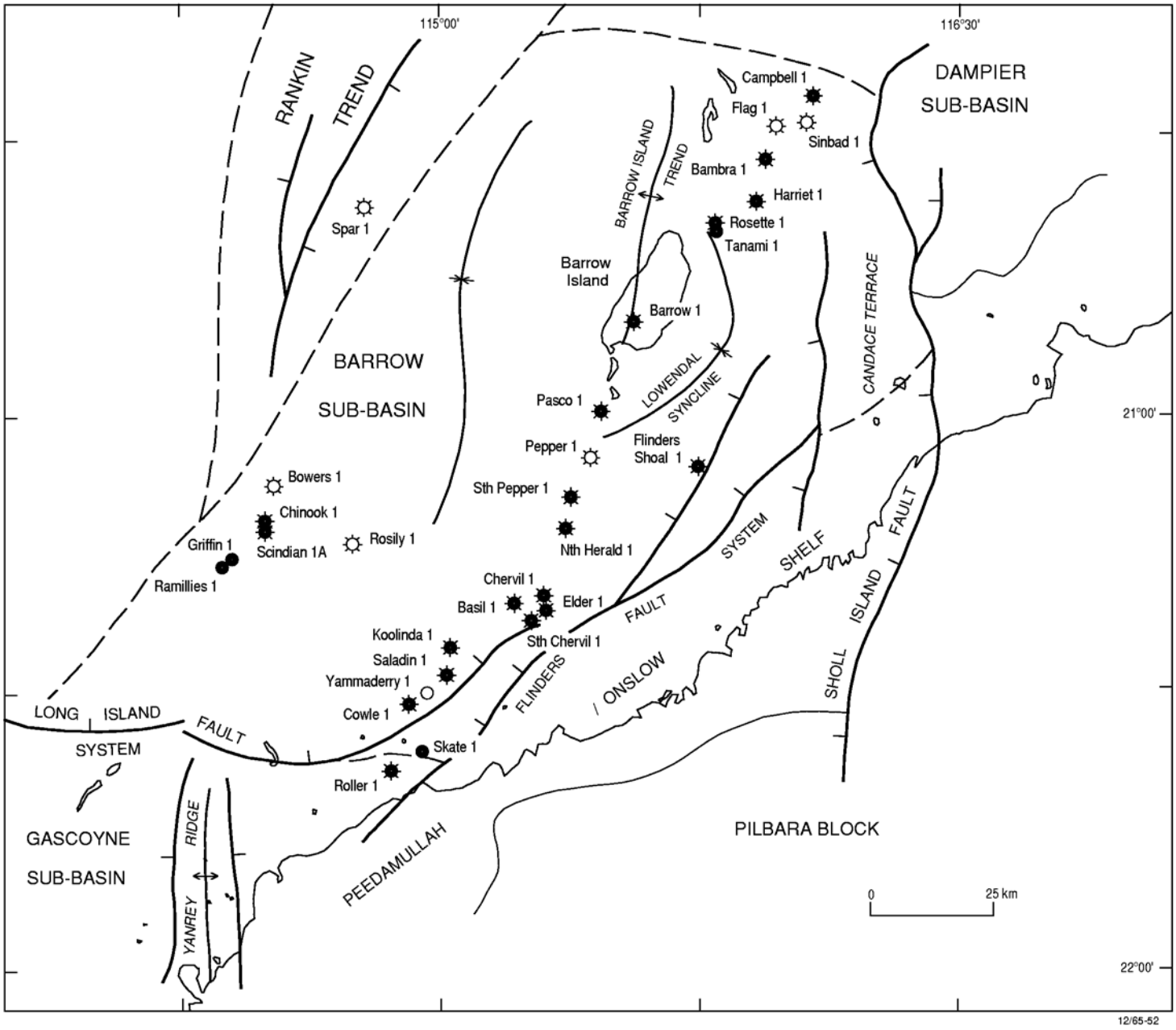

CANNING
BASIN
BEAGLE
SUB-BASIN
EXMOUTH
PLATEAU
KANGAROO SYNCLINE
RANKIN
TREND
DAMPIER
SUB-BASIN
BARROW
SUB-BASIN
EXMOUTH
SUB-BASIN
PEEDAMULLAH/
ONSLOW SHELF
MANDU RIDGE
YANREY-
WANDAGEE
RIDGE
PILBARA
CRATON
MERLINLEIGH SUB-BASIN
BIDGEMIA
SUB-BASIN
BERNIER
PLATFORM
GASCOYNE
SUB-BASIN
BYRO
SUB-BASIN
AJANA
RIDGE
ABROLHOS
SUB-BASIN
(PERTH BASIN)
COOLCALALAYA
SUB-BASIN
0
200 km
NORTHHAMPTON
BLOCK
18°
22°
26°
110°
114°
118°
12/65-47

FIGURE-6


115°00'
116°30'
21°00'
22°00'
RANKIN
TREND
DAMPIER
SUB-BASIN
Campbell 1
Flag 1
Sinbad 1
BARROW ISLAND
TREND
Bambra 1
Harriet 1
Rosette 1
Tanami 1
Spar 1
Barrow
Island
Barrow 1
CANDACE TERRACE
BARROW
SUB-BASIN
LOWENDAL
SYNCLINE
Pasco 1
Pepper 1
Flinders
Shoal 1
Bowers 1
Sth Pepper 1
Chinook 1
Griffin 1
Scindian 1A
Rosily 1
Nth Herald 1
Ramillies 1
Chervil 1
Basil 1
Elder 1
SYSTEM
SHELF
FAULT
Koolinda 1
Sth Chervil 1
Saladin 1
FAULT
Yammaderry 1
FLINDERS
ONSLOW
SHOLL
ISLAND
FAULT
Cowle 1
LONG
ISLAND
SYSTEM
FAULT
Skate 1
Roller 1
GASCOYNE
SUB-BASIN
RIDGE
YANREY
PEEDAMULLAH
PILBARA BLOCK
0
25 km
12/65-52

and is of regional extent following a marine transgression in the Late Valanginian. The Birdrong Sandstone at the base of the Muderong Shale is a shelf to shoreface sand well developed on the Peedamullah/Onslow Shelf. The Mardie Greensand Member, further west, is a deeper water equivalent of the Birdrong Sandstone.

The Windalia Sandstone Member of the Muderong Shale is a marine shelf sandstone and may indicate a minor regression in the basin. Open marine conditions were established with the opening of the Indian Ocean from the end of the Aptian.

3.2.2. *Hydrocarbon habita*t

3.2.2.1 *Structure and hydrocarbon traps*

A large number of accumulations in the Barrow Sub-basin are lie along major rift-related fault systems, relying on either fault seal or juxtaposition of impermeable shales against porous reservoirs for trap integrity.

Major basin-bounding fault systems (Long Island and Flinders Fault Systems), developed as a result of Jurassic rifting. Intrabasinal faults are generally parallel to the bounding fault systems, but reactivation of old faults has influenced structure. Cretaceous and Tertiary structural movements enhanced or subdued earlier structures.

The easterly-trending Long Island Fault system consists of several parallel down-to-basin normal faults, with a single antithetic fault at the basinward margin of the fault system. The Flinders Fault system, between the Barrow Sub-basin and Peedamullah/Onslow Shelf is more complex. The northeasterly trend developed as a result of Jurassic rifting, but overprints a reactivated north-northeasterly Palaeozoic/Precambrian trend. The Lowendal Fault lies basinward of the northern end of the Flinders Fault system. It is a down-to-basin fault.

The Roller, Cowle, and Saladin/Yammaderry accumulations lie close to the margins of the sub-basin near the intersection of the Long Island and Flinders Fault Systems. All three accumulations lie on the upthrown side of faults and are sealed by the Muderong Shale. The Chervil and South Chervil accumulations also lie near this intersection, and their structures are partly four-way dip-closed anticlines between the Airlie and Chervil faults.

North of Chervil and South Chervil, the North Herald and South Pepper accumulations occur in faulted segments of an anticline, (part of a regional structural high extending through Barrow Island to the north). Faults which

transect the anticline have an east-northeast trend and are associated with wrenching during the Cretaceous. The Barrow Island oil and gas field also occurs on the regional anticlinal trend and is further discussed in section 3.3.

Low relief four-way dip closures at the top of the Flag Sandstone are a consequence of the mounded topography of the top of this reservoir unit. The mounding is reflected in the multi-crested form of the structures (Rosette, Bambra, Campbell).

3.2.2.2 *Reservoir geology*

Barrow Group

The Barrow Group delta extends northwards from the Long Island Fault hingeline to the latitude of the present Barrow Island and west to the Exmouth Plateau.

The Flacourt Formation comprises the sandstone topsets and claystone foresets of the Barrow Group delta. The underlying Malouet Formation consists of sandstone bottomsets. The bottomsets were deposited as submarine fans onlapping the Dingo Claystone in the central and eastern parts of the Barrow Sub-basin depocentre. The topsets were deposited in shallow marine to fluvial environments. Sandstones of both units are excellent reservoirs, hosting accumulations at Harriet, South Pepper, North Herald, Saladin and Chervil.

The Flag Sandstone (Figure 2) is a submarine fan system in the distal part of the Barrow Group (a deepwater facies equivalent of the Flacourt Formation). The Flag Sandstone is thought to have been sourced mainly from east of the Lowendal Fault, which acted as a depositional hinge for the unit. The unit is a maximum of 265 metres thick in the vicinity of Harriet and Bambra, shaling out close to the Rankin Trend, interfingering with the Flacourt Formation to the south and pinching out to the north about 50 kilometres north of Harriet. Upward-coarsening depositional cycles in the Flag Sandstone are attributed to tectonism accompanied by an overall sea level fall. Widespread transgression then deposited the Muderong Shale, which seals the Barrow Group over most of its area. In composition, the Flag Sandstone is quartz-rich and lithic-poor, making it an excellent reservoir.

The Flag Sandstone is host to commercial accumulations in the south-central part of the Barrow Sub-basin, including Harriet, Rosette, Sinbad and Tanami.

Muderong Shale

The Mardie Greensand Member of the Muderong Shale is a reservoir at Griffin and other fields located along the Barrow Anticline. Slow marine transgression during the Neocomian resulted in deposition of a thin sheet of glauconitic sandstone over the Barrow Group. The unit is extensively bioturbated and contains patchy siderite cement developed during early diagenesis. Reservoir quality of the Mardie Greensand Member is generally poor, but lenses of reservoir quality sandstones are present mainly in the relatively coarser grained and quartz-rich basal part of the unit. At Barrow Island, porosity in the Mardie Greensand Member is about 28 per cent and permeability 4 millidarcies. The Windalia Sandstone and Tunney members of the Muderong Shale are discussed in Section 3.3.

Birdrong Sandstone

The Birdrong Sandstone is widely distributed in the southern part of the Carnarvon Basin, extending from its southern margin to the northern edge of the Peedamullah/Onslow Shelf and into the western part of the Barrow Sub-basin (Hocking and others, 1988). The only accumulation in the Barrow Sub-basin known to be reservoired in the Birdrong Sandstone is an oil and gas accumulation intersected in Finders Shoal-1. The Birdrong Sandstone is also discussed in Section 3.4 which describes the Exmouth Sub-basin.

Windalia Radiolarite

The Windalia Radiolarite, in the Barrow Sub-basin, is a light to dark grey radiolarite grading to radiolarian siltstone and claystone in deeper basinal areas, where it is similar in composition to the overlying Gearle Siltstone. Deposited widely over the Carnarvon Basin, it reflects a marine transgression at the end of the Aptian (Woodside, 1988). Although normally a seal for the underlying Windalia Sandstone Member, in the vicinity of Barrow Island, the unit is occasionally petroleum-bearing (Chervil).

Gearle Siltstone

See Section 3.3.2.2

3.2.2.3 *Source rocks and maturation*

Generation of hydrocarbons from the Dingo Claystone is thought to have commenced during the Late Neocomian in the Barrow Sub-basin. Petroleum in Cretaceous reservoirs was subjected to biodegradation due to groundwater circulation. Subsequent burial beneath marine shales and carbonates ended biodegradation and preserved the accumulations.

Both naphthenic-aromatic and paraffinic oils are sourced from the Jurassic Dingo Claystone, the variations in oil composition arising from different degrees of water washing, biodegradation and maturation of oil in the reservoir. Volkman and others (1983) identified four phases of accumulation of a light paraffinic oil. The Cretaceous sedimentary rocks at Barrow Island are immature for oil generation, while the Dingo Claystone is mature. Organic matter in the Dingo Claystone is mixed terrigenous and marine in origin, and hydrogen-poor. Generation and migration began during the Late Jurassic at high levels of thermal maturity and continued through the Early Cretaceous, with hydrocarbons charging the Cretaceous reservoirs during the Aptian. Oil generation is thought to have continued into the Tertiary. Late generated oils have generally undergone less degradation.

3.2.3. *Hydrocarbon accumulations*

Discoveries to date in the Barrow Sub-basin include eleven commercial accumulations (including Barrow Island), 12 non-commercial accumulations and 11 other discoveries (Plates 4-7). Barrow Island, described in Section 3.3 in this chapter, is the largest known oil accumulation in the Carnarvon Basin and the largest onshore oil accumulation in Australia. Other commercial oil accumulations are the Harriet and Saladin/Yammaderry fields with smaller fields at South Pepper, North Herald and Chervil. Commercial gas accumulations include Sinbad, Campbell and the gas cap at Harriet.

Most accumulations are associated with the Flinders Fault Zone. This zone is characterised by normally-faulted, down to the northwest fault blocks on the south-eastern edge of the Barrow Sub-basin which provides a combination of suitable structural style with the presence of prospective reservoirs. Most of the oil fields so far discovered in the sub-basin rely on fault closure, where the downthrown Muderong shale provides a seal for accumulations in the upthrown Barrow Group and Birdrong Sandstone.

3.2.3.1 Commercial accumulations

Barrow Island (Plate 4, Accumulation 23)

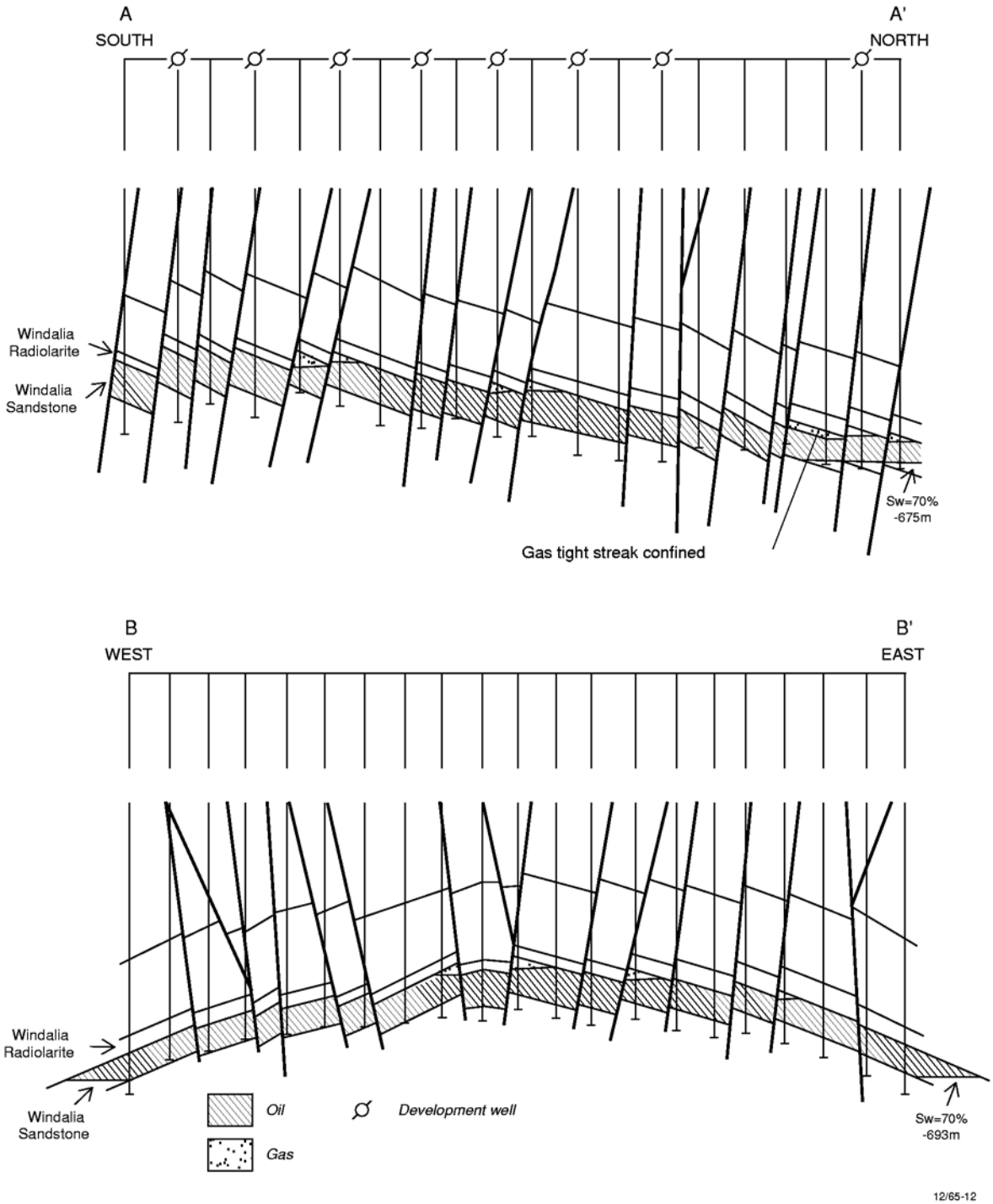
The Barrow Island accumulation was discovered in 1964. Further details are given in Section 3.3 of this chapter.

Saladin/Yammaderry (Plate 4, Accumulation 24)

The Saladin/Yammaderry oil accumulation was discovered in 1985 in 16 metres of water. The nearby Cowle and Roller discoveries are of the same

play type. These accumulations are located in shallow water adjacent to Thevenard Island, about 22 kilometres northwest of Onslow. The Saladin/Yammaderry and Cowle structures are *en echelon*, fault-controlled elongate rollovers. Barrow Group reservoirs are juxtaposed against the Muderong Shale seal across the faults. The Barrow Group is overlain by the

FIGURE-7


A
SOUTH
A'
NORTH
Windalia
Radiolarite
Windalia
Sandstone
Sw=70%
-675m
Gas tight streak confined
B
WEST
B'
EAST
Windalia
Radiolarite
Windalia
Sandstone
Oil
Gas
Development well
Sw=70%
-693m
12/65-12

Mardie Greensand Member, the basal unit of the Muderong Shale, which is also oil-bearing.

Saladin-1 discovered a 17 metre gross oil column in the Flacourt Formation reservoir. The reservoir is subdivided into upper and lower sands separated by a bioturbated sand which is a partial barrier to vertical fluid flow. The discovery was followed by seven Saladin and two Yammaderry wells. Of these, Saladin-4, -5 and -6 were deviated from Thevenard Island into the reservoir. Saladin-1, -2, -4, -5, -6, -7 and -8, and Yammaderry-2 are oil producing wells.

Saladin wells commenced production in November 1989, and peaked in February 1990 at 62 000 stock tank barrels per day. The ultimate oil recovery is expected to be 45 million barrels.

Cowle (Plate 4, Accumulation 25)

Cowle-1 is located 20 kilometres northwest of Onslow in 13 metres of water. This well flowed oil from Flacourt Formation sandstones at unstabilised rates ranging from 114 to 253 kilolitres (720 to 1590 barrels) of oil per day. Although Cowle is a relatively small accumulation, it is sufficiently close to the existing facilities on Thevenard Island to justify development.

Roller, Skate (Plate 6, Accumulations 38 and 39)

Roller-1 was drilled to the southwest of Cowle in June 1990. The well flowed oil at a maximum stabilised rate of 856 kilolitres (5381 barrels) per day. Roller, with the nearby Skate accumulation, is presently under development.

Skate-1 is located east of the Roller accumulation and was suspended as a future oil producer in November 1991.

Harriet (Plate 5, Accumulation 29)

The Harriet oil field was discovered in 1983 in 23 metres of water, when Harriet-1 encountered a gross hydrocarbon column of 23 metres in the Flag Sandstone at the top of the Barrow Group. Unlike the mildly biodegraded oils of most other fields on the Barrow Island Anticline, the Harriet crude oil is relatively unaltered and paraffinic. This oil composition is consistent with a source in the Jurassic age Dingo Claystone at moderate to high levels of thermal maturity.

Ten wells were drilled on the field between 1983 and 1985, with nine completed as producers and the other (Harriet-2) plugged and abandoned.

Production commenced from five wells in January 1986 at a rate of about 8500 barrels of oil per day.

South Pepper, North Herald, Chervil (Plate 4, Accumulations 26, 27 and 28)

The South Pepper and North Herald fields are located on east-west faults on the Barrow Island Anticline south of Harriet. With the nearby Chervil field, total oil reserves are 2.4 million kilolitres (15 million barrels), which ranks these among the smallest offshore fields to be developed independently of other existing facilities.

The South Pepper field, discovered in 1982, is reservoired in the uppermost sands of the Barrow Group and the overlying low permeability Mardie Greensand Member of the Muderong Shale. South Pepper-1 intersected a 9 metre oil column and a 14 metre gas cap, but South Pepper-2 and -3 failed to intersect the oil leg. North Herald was drilled 5 kilometres south of South Pepper in 1983 and intersected a 12 metre oil column, also in upper Barrow Group sands. The Chervil field was discovered in the same year. Two extension/appraisal wells (Chervil-2 and -3) failed to intersect the oil column, but Chervil-4 and -5 have been successfully completed.

3.2.3.2 *Non-commercial accumulations*

Chinook/Scindian, Griffin/Hilda/Ramillies (Plate 6, Accumulations 36 and 37)

The Chinook/Scindian and Griffin/Hilda/Ramillies accumulations are associated with the Alpha Arch, a Triassic high trend. The Chinook/Scindian structure is a drape anticline over a downthrown tilted fault block to the east of the Alpha Arch. Chinook-1, drilled in 124 metres of water, intersected a gross hydrocarbon column of 64 metres within the Mardie Greensand Member and the upper Barrow Group. The reservoir is sealed by the Muderong Shale, and the source is believed to be the Dingo Claystone, in the eastern part of the Exmouth Sub-basin.

Griffin-1, drilled in 136 metres of water, encountered a 97 metre gross oil column in the Barrow Group and Mardie Greensand Member. The Ramillies structure is a fault-bounded block downthrown to the south of the Griffin/Hilda accumulation. The oil column is contained within the Mardie Greensand Member, which has moderate to poor reservoir properties. Griffin-1 was cased and suspended as a future oil producer in 1990 after flowing 4000 barrels per day of 54.7 °API oil. Ramillies-1 is also suspended as a potential oil producer.

The above accumulations are presently under development.

Spar (Plate 5, Accumulation 35)

Gas was discovered in 1976 by the Spar-1 well, which was drilled in 116 metres of water basinward of the Rankin Trend and its associated gas fields, Gorgon and West Tryal Rocks. The structure is a domal closure in the top Barrow Group (Flacourt Formation), with the massive, permeable and porous sands of the Barrow Group sealed by the Muderong Shale.

Elder (Plate 6, Accumulation 41)

The Elder accumulation has the oldest reservoir in the Barrow Sub-basin. Elder-1, drilled in 1985 in 15 metres of water, was the first well in the area to be directed at a Triassic target rather than the Barrow Group. The reservoir is the Triassic age Mungaroo Formation sealed by the Dingo Claystone. The accumulation contains a small quantity of dry gas (93 per cent methane).

Bambra, Campbell (Plate 5, Accumulation 34)

The Bambra and Campbell accumulations both occur in low relief four-way dip closed structures within a Flag Sandstone reservoir. Both accumulations are predominantly gas with minor oil legs. Bambra-1 was drilled in 1982 in 24 metres of water and discovered a 3.5 metre gas zone at the top of the Flag Sandstone.

Campbell-1, drilled in 39 metres of water, discovered a 21 metre gas pay overlying a 1.5 metre oil leg. A drill stem test in the gas zone flowed a maximum of 9.5 million cubic feet of gas per day and 140 barrels per day of condensate through a 5/8 inch choke. A repeat formation test sample from the oil leg recovered 17 litres of 35 °API oil. The Campbell accumulation has been developed as part of the Harriet gas gathering project, by means of a monopod.

Rosette, Tanami (Plate 5, Accumulations 30 and 34)

The Rosette accumulation occurs in a low relief four-way dip closed structure with mounded geometry at the top of the Barrow Group level (Williams, 1988). The Flag Sandstone contains a 24 metre gas pay overlying a 4 metre oil leg. On testing, Rosette-1 flowed 152 barrels per day of 39 °API oil and 18.3 million cubic feet of gas per day.

Tanami-1 was drilled in July 1991 from Varanus Island , 3 kilometres east of Rosette, and has been suspended as a future Flag Sandstone oil producer. Both accumulations occur in part of the same submarine fan complex that

hosts the Harriet oil reservoirs. Rosette-1 and Tanami-1 were drilled as deviated wells from Varanus Island, which houses production facilities. Rosette-1 produced oil as an extended production test, and will be produced with the Tanami, Sinbad and Campbell accumulations.

South Chervil (Plate 6, Accumulation 40)

South Chervil-1 is located midway between Barrow Island and Onslow. The well was drilled in 1983 in 16 metres of water on the southern culmination of the Chervil structure to test potential reservoirs in Early Cretaceous and Triassic formations. Hydrocarbons were encountered in the porous, permeable sands in the Mardie Greensand Member with a 9 metre gas column and a 3.8 metre oil leg.

Sinbad (Plate 5, Accumulation 32)

Discovered in March 1990, Sinbad-1 is located 16 kilometres northeast of the Harriet field in 37 metres of water. Sinbad-1 was cased and suspended as future Flag Sandstone gas producer.

Bowers (Plate 6, Accumulation 42)

Bowers 1, located northeast of Hilda 1A in 133 m of water, discovered gas in a tilted fault block sturcture in the Mungaroo formation in 1982.

Flinders Shoal (Plate 7, Accumulation 43)

Flinders Shoal 1 was drilled in 1969 in 15 m water depth into the Flinders Shoal anticline southeast of Pasco Island. It discovered heavy oil (23ºAPI) at 792 m in the Birdrong sandstone.

Pepper (Plate 7, Accumulation 44)

Pepper 1 was drilled in 1970 in 9 metres of water 10 km south of Pasco. It discovered gas in the Flacourt formation in a large, low relief structure extending southeast of the Barrow Island complex.

Pasco (Plate 7, Accumulation 45)

Pasco 1 well drilled in 1967 on Boodie Island, south of Pasco Island, encountered oil and gas in three separate sands in the upper Jurassic . Production tests produced oil at 449 barrels per day and gas at 3 million cubic feet per day from the 5700 foot sand. Further long term production tests were conducted in 1973.

Basil (Plate 7, Accumulation 46)

Basil 1, 4 km north of the South Chervil field in 16 m water depth, discovered oil and gas in 1983 in the Mardie and Flacourt formations at 1226 m.

Koolinda (Plate 7, Accumulation 47)

Koolinda 1 drilled in 1978 8 km north of Thevenard Island discovered gas in the upper Dingo claystone at 2193 m.

Flag (Plate 7, Accumulation 48)

Flag 1 drilled in 1970 30 km north of Barrow Island in 37 m of water discovered gas in the Windalia sandstone at 1270 m.

Rosily (Plate 7, Accumulation 49)

Rosily 1, drilled in 1982 60 km southeast of Barrow Island in 100 m water depth, discovered gas in the Malouet formation at 2948 m.

3.2.4 Hydrocarbon types

Petroleum accumulations in the Barrow Sub-basin consist of several petroleum types. With the exception of the Barrow Island crude oil (36 °API), the oils are light crudes (over 45° API), and the gas fields have low condensate yields.

Table 2 lists the molecular compositions of reservoir fluids.

3.3. Barrow Island

3.3.1 *Geological summary*

The Barrow Island oil field is located in the central part of the Barrow Sub-basin. A summary of the geology of the Barrow Sub-basin is given in Section 3.2 of this chapter.

3.3.2 *Hydrocarbon habitat*

3.3.2.1 *Structure and hydrocarbon traps*

The Barrow Island Anticline, in the central Barrow Sub-basin, is the structure which contains the multiple pools comprising the Barrow Island oil field (Parry, 1967; Crank, 1973). The anticline is segmented into numerous fault blocks with small throws, arranged in a down-to-axis manner, with a central down-dropped keystone graben (Figure 7). Overall vertical structural closure of the Barrow Island Anticline is approximately 330 metres.

Trapping at all stratigraphic levels within the Barrow Island structure is by juxtaposition of impermeable fine-grained sedimentary rocks against porous and permeable reservoir sandstones. The Barrow Fault is a seal for major reservoirs on the field, and other faults may also act as seals. Stratigraphic trapping of petroleum within reservoir sandstones is commonly controlled by variation in the permeability of the sandstone: the Windalia Radiolarite is known to be petroleum-bearing in some areas, but is a seal for the Windalia Sandstone Member.

Discontinuities in the Windalia Sandstone Member reservoir control the way in which the field is developed. Discontinuities arise from extensive faulting on the field and from variable quality (tight streaks) in the reservoir.

The Barrow Island Anticline and Barrow Fault Zone may have been initiated in the Middle Jurassic (Woodside, 1988); the fault zone has been intermittently active since that time, particularly in the Late Cretaceous and Tertiary. Faulting associated with the zone penetrates to the surface at the southern end of Barrow Island; the lower part of the zone probably intersects the Triassic sequence. Migration of oil along the Barrow Fault Zone has been suggested as a charging mechanism for the Windalia Sandstone Member; the fault now acts as a seal to the Windalia reservoir. Oil staining in Tertiary carbonates in some Barrow Island wells may indicate the leaky nature of the fault, although some oil was generated in the Tertiary.

3.3.2.2 *Reservoir geology*

There are over 20 known reservoir units in the Mesozoic sequence underlying Barrow Island. The Cretaceous Windalia Sandstone Member of the Muderong Shale is the main reservoir for the Barrow Island field, accounting for over 95 per cent of production (Burdette, 1970). Oil accumulations are also known to be present in a number of fine-grained sandstone reservoirs in the Early Cretaceous Muderong Shale and Barrow Group and in the predominantly sandy Dupuy Formation. Gas is associated with a number of oil accumulations.

The Gearle Siltstone at Barrow Island contains carbonate concretionary nodules in which oil is present in fractures. The distribution of these single or coalesced septarian nodules in the Gearle Siltstone is variable. Campbell and others (1984) reported that to August 1983, 32 000 kilolitres of oil had been produced from six wells intersecting oil-bearing nodules.

The Windalia Sandstone Member oil reservoir was intersected in the discovery well at only 595 metres depth subsea. The Windalia reservoir has a gross thickness of 30 to 35 metres and is sealed by the Windalia Radiolarite and Gearle Siltstone. Porosities in the reservoir range from 20 to 32 per cent with permeabilities up to 70 millidarcys. The low permeability and extensive faulting of the Windalia reservoir requires a large number of production wells to develop the field.

The Windalia Sandstone Member is a fine-grained kaolinitic silty quartzofeldspathic arenite, extensively bioturbated and deposited on a shallow marine shelf in low energy conditions. Variations in grain size, clay content and authigenic mineralogy affect reservoir quality. The unit represents the last significant influx of sandy sediment into the Barrow Sub-basin and is restricted in its distribution to Barrow Island and areas shorewards.

Barrow Deep-1, at 4650 metres is the deepest well on the field, was drilled to test reservoir potential in the Triassic section. High pressure gas was encountered at three levels in sands of the Middle Jurassic Biggada Formation within marine shales and siltstones of the Dingo Claystone (Plate 4), but the Triassic section was not penetrated. Biggada-1 and Perentie-1 also penetrated deep gas reservoirs.

3.3.2.3 *Source rocks and maturation*

Both the naphthenic-aromatic and paraffinic oils are sourced from the Jurassic Dingo Claystone. The variations in oil composition arise from

different degrees of water washing, biodegradation and maturation of oil in the reservoir. Organic matter in the Dingo Claystone is mixed terrigenous and marine in origin, and hydrogen-poor. However, the unit is the source of much of the oil throughout the Barrow Sub-basin.

Detailed oil-source correlation studies of Barrow Island oils (Volkman and others, 1983) identified four phases of accumulation of a light paraffinic oil. Cretaceous sedimentary rocks underlying Barrow Island are immature for oil generation, while the Dingo Claystone is mature. Generation and migration are thought to have begun during the Late Jurassic at high levels of thermal maturity and to have continued through the Early Cretaceous, beginning to charge the Cretaceous reservoirs during the Aptian. Oil generation is thought to have continued until the Tertiary. Oil generated later has generally undergone less degradation than earlier generated oils.

3.3.2.4 *Hydrocarbon types*

Oils from the Windalia Sandstone and Mardie Greensand Members are naphthenic-aromatic in composition, while oils in other Lower Cretaceous and Upper Jurassic sandstone reservoirs are paraffinic. In addition, gas and condensate have been recovered from Middle, Upper Jurassic and Cretaceous reservoirs.

The Barrow Island Windalia crude oil at 36 °API is one of the heaviest crudes produced in Australia, (although it is lighter than the average gravity of crude oil produced worldwide).

The deep gas accumulations on Barrow Island have a low condensate yield and low hydrogen sulphide (H_2S) concentration.

3.4. Exmouth Sub-basin

3.4.1 *Geological summary*

The Exmouth Sub-basin lies south of the Long Island Fault System, which forms the boundary between the Exmouth and Barrow Sub-basins (Figure 9). It is bounded by the Cape Range Fracture zone to the south. While the sub-basin's eastern margin is generally agreed to be the Rough Range Fault, the the western boundary is less apparent. The sub-basin has been described both as a rift (similar to the Barrow Dampier Rift) and as a half-graben bounded by detachment faults. A large part of the Exmouth Sub-basin is onshore.

The stratigraphy of the Exmouth Sub-basin is in many respects similar to that of the adjacent Barrow Sub-basin. The Triassic Locker Shale and Mungaroo Formation are truncated by an unconformity bounded, syn-rift to trough fill sedimentary sequence, consisting of a thick basal sequence of marine sedimentary rocks, (mainly shale), with alluvial to shoreline equivalents near the eastern margin of the sub-basin. A number of unconformities in this sequence mark rift phases.

The Early Cretaceous Barrow Group fluvio-deltaic complex is confined to the north and northwestern parts of the Exmouth Sub-basin. The Long Island Fault System acted as a depositional hingeline during development of the Barrow Group delta, which was not deposited south of the fault. Nearshore and marginal marine equivalents of the Barrow Group delta are locally present in the east. Elsewhere in the Sub-basin, Barrow Group equivalent transgressive sandstones are overlain by restricted to open marine siltstone and shale (Gearle Siltstone). Late Cretaceous to Tertiary marine pelagic carbonate rocks blanket the area.

3.4.2 *Hydrocarbon habitat*

North-northeasterly structural trends associated with Jurassic rifting overprint the northerly trends of the underlying Palaeozoic Gascoyne Sub-basin. Malcolm and others (1991) have modelled a series of east-southeast-trending transform faults within the Exmouth Sub-basin. Structure beneath the Early Cretaceous unconformity is dominated by tilted fault blocks, downthrown to the west. Late Miocene compression related to subduction of the northern Australian plate boundary has resulted in structural inversion along the basin margins, with reactivation of earlier structures.

3.4.2.1 *Reservoir geology*

Primary reservoir targets occur in the Triassic Mungaroo Formation, in sandstones within the Jurassic Dingo Claystone, in the Cretaceous Barrow

FIGURE-8

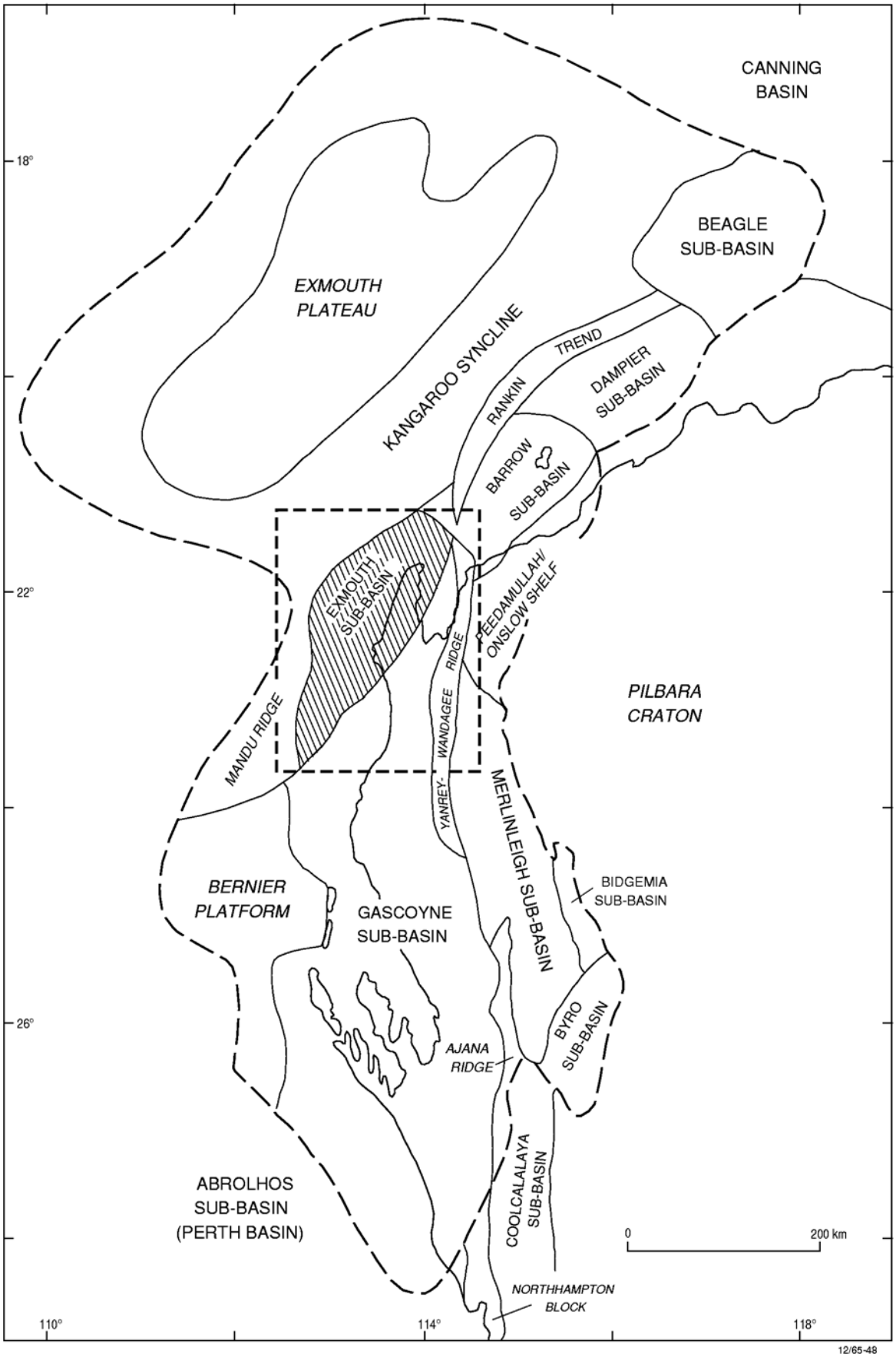
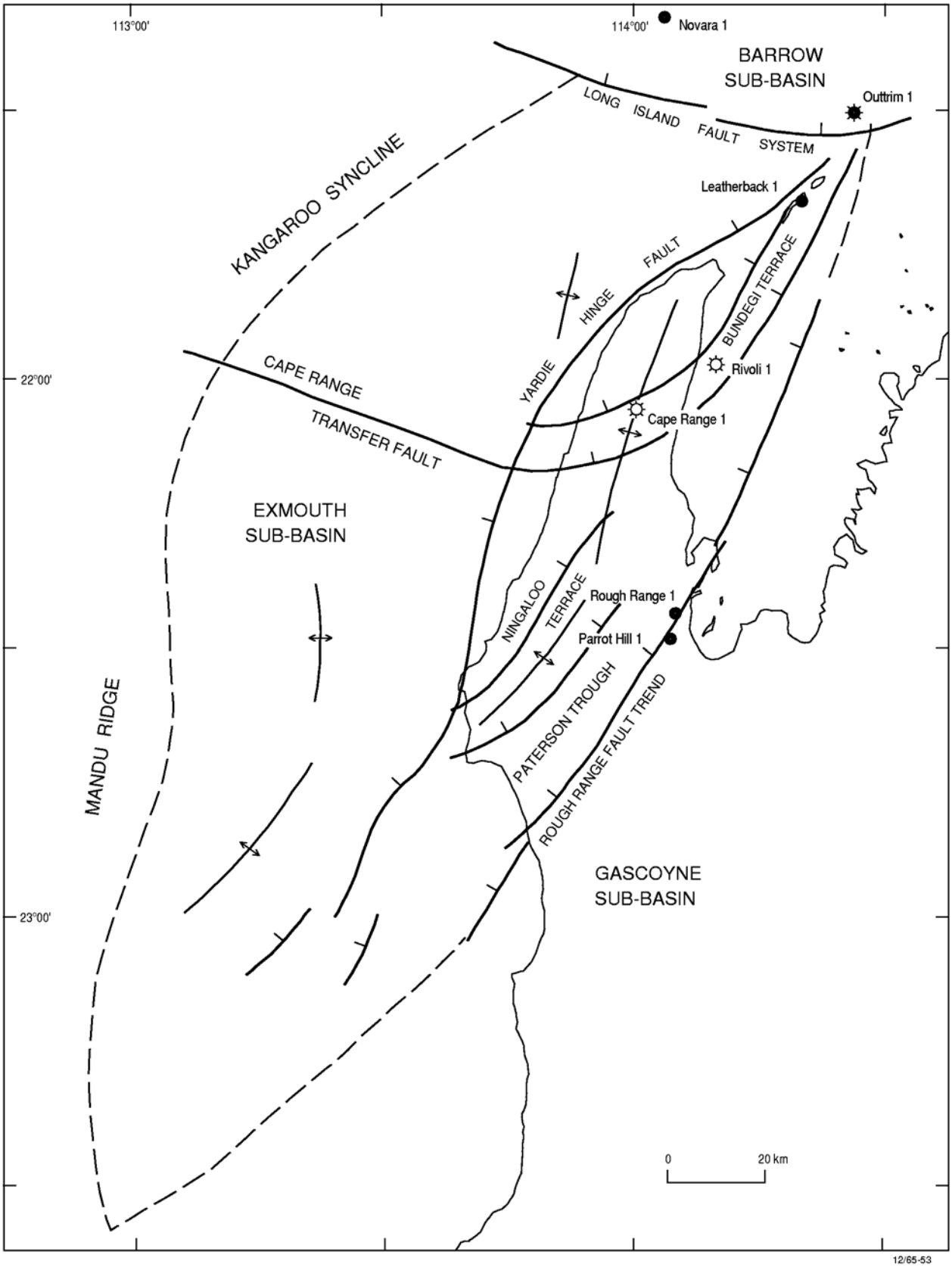

CANNING
BASIN
18°
BEAGLE
SUB-BASIN
EXMOUTH
PLATEAU
KANGAROO SYNCLINE
RANKIN
TREND
DAMPIER
SUB-BASIN
BARROW
SUB-BASIN
EXMOUTH
SUB-BASIN
FEEDAMULLAH/
ONSLOW SHELF
22°
PILBARA
CRATON
MANDU RIDGE
WANDAGEE
RIDGE
YANREY-
MERLINLEIGH SUB-BASIN
BIDGEMIA
SUB-BASIN
BERNIER
PLATFORM
GASCOYNE
SUB-BASIN
BYRO
SUB-BASIN
26°
AJANA
RIDGE
ABROLHOS
SUB-BASIN
(PERTH BASIN)
COOLCALALAYA
SUB-BASIN
0
200 km
NORTHHAMPTON
BLOCK
110°
114°
118°
12/65-48

FIGURE-9


113°00'
114°00'
Novara 1
BARROW
SUB-BASIN
Outtrim 1
LONG ISLAND FAULT SYSTEM
KANGAROO SYNCLINE
Leatherback 1
FAULT
HINGE
BUNDEGI TERRACE
YARDIE
Rivoli 1
22°00'
CAPE RANGE
TRANSFER FAULT
Cape Range 1
EXMOUTH
SUB-BASIN
NINGALOO
TERRACE
Rough Range 1
Parrot Hill 1
PATERSON TROUGH
ROUGH RANGE FAULT TREND
MANDU RIDGE
GASCOYNE
SUB-BASIN
23°00'
0
20 km
12/65-53

Group equivalent sandstones, and in post-rift transgressive sandstones (Birdrong Sandstone and Mardie Greensand Member) within the Muderong Formation and Gearle Siltstone regional seals.

The Barrow Group, host to major accumulations in the Barrow Sub-basin to the north, is restricted to the northern and northwestern parts of the Exmouth Sub-basin, where it hosts the Novara and Outtrim oil accumulations. The transgressive Birdrong Sandstone hosts most other oil and gas accumulations in the southeastern part of the sub-basin.

The Birdrong Sandstone consists of several facies including coarse-grained fluvial sandstone which outcrops onshore, and glauconitic sandstones in the subsurface in the Rough Range area (Hocking and others, 1988). The glauconitic sandstone is fine- to medium-grained, with good porosity. It is regarded as a lower shoreface sand, deposited at the onset of marine transgression in the Neocomian.

Oil and gas in Cape Range-1 occur in sandstones within the Dingo Claystone, while oil in the Mungaroo Formation at Leatherback-1 represents the only accumulation presently known in the Triassic in the Exmouth Sub-basin.

3.4.2.2 *Source rocks and maturation*

Triassic and Jurassic shales (Locker Shale and Dingo Claystone) are thick and widespread throughout the Exmouth Sub-basin. Both units contain mostly mixed marine and terrestrial organic matter, capable of generating both oil and gas. While most oil in the adjacent Barrow Sub-basin has been generated from the Jurassic Dingo Claystone, Middle Permian shales of the Byro Group may have sourced the oil at Rough Range-1. The biodegraded oil at Novara-1 in the western part of the Exmouth Sub-basin is thought to have a similar origin to biodegraded oils in the Barrow Sub-basin: (generation from the Dingo Claystone during the Late Neocomian, and biodegradation either during migration or *in situ* in Cretaceous reservoirs subjected to groundwater circulation). Subsequent burial beneath marine shales and carbonates ended biodegradation and preserved the altered accumulations.

The depth to the top of the zones of peak oil generation at the present day ranges from 2500 metres on the Cape Range Anticline and the structural ridge along the western margin of the Barrow Sub-basin to over 3500 metres in the flanking troughs. The Permo-Triassic to mid-Jurassic section in the deeper parts of the Exmouth Sub-basin is probably mature at the present day.

3.4.3. *Hydrocarbon accumulations*

3.4.3.1 *Commercial accumulations*

Rough Range (Plate 8, Accumulation 50)

Australia's first flowing oil was discovered in the Exmouth Sub-basin in 1953 when oil was recovered during the drilling of the onshore well Rough Range-1. A drill stem test flowed 87 kilolitres of oil per day from the Early Cretaceous Birdrong Sandstone. After a 48 day production test, the well was shut-in. In 1986, Rough Range-1 produced 1440 kilolitres of oil during an extended production test. The oil was trucked to the Kwinana refinery near Perth.

3.4.3.2 *Non-commercial accumulations*

Novara (Plate 8, Accumulation 52)

In 1982, Novara-1 drilled in 372 metres of water, encountered an 8 metre column of highly biodegraded oil (13.9 °API) at the top of the Barrow Group in the western Exmouth Sub-basin (Parry and Smith, 1988). Although non-commercial, the discovery was significant in demonstrating the oil potential of the western, offshore part of the Exmouth Sub-basin.

Leatherback (Plate 8, Accumulation 53)

In 1991, Leatherback-1, drilled in 13 metres of water with a Mungaroo Formation objective, was suspended as an oil producer after it flowed 2377 barrels per day of 41 °API oil from a 7 metre column.

Parrot Hill (Plate 8, Accumulation 51)

In 1987, Parrot Hill-1 was suspended as an onshore oil producer.

3.4.3.3 *Other discoveries*

Cape Range (Plate 8, Accumulation 54)

Cape Range 1 drilled in 1954 discovered gas at Cape Range, 34 km north of Rough Range-1, in an anticlinal test in the late Jurassic upper Dingo claystone over the interval 9734 to 10098 feet. During a nine day production test rates declined rapidly.

Outtrim (Plate 8, Accumulation 55)

In 1984, Outtrim-1, drilled in 91 m of water, encountered a gross oil column of 14 metres in a rotated fault block target on the Southern flank of the Barrow sub-basin at the top of the Barrow Group. The oil recovered was 40-45 degree API. The well was plugged and abandoned because the oil accumulation was mapped as too small to produce commercially.

Rivoli (Plate 8, Accumulation 56)

Rivoli 1, located 6 km southeast of Exmouth, in 1989 discovered gas in an anticlinal structure at 1915.5 m in the Birdrong sandstone.

3.4.4 *Hydrocarbon types*

Table 2 shows the compositions of crudes in the Exmouth Sub-basin.

The Rough Range crude has a high API gravity (40 degree API), but has a high wax content, (which led to production difficulties). Similarly, Outtrim and Leatherback crudes are light. Prior to the discovery of the Wandoo accumulation, Novara was the most significant heavy (13.9 degree API) crude discovery in Australia.

3.5. Peedamullah/Onslow Shelf

3.5.1 *Geological summary*

The Peedamullah/Onslow Shelf lies southeast of the Barrow Sub-basin, from which it is separated by the Jurassic Flinders Fault System. In the south, the shelf and its extension, the Onslow Embayment, abut complex faulting which separates the shelf from the Exmouth Sub-basin. To the east, the Peedamullah/Onslow Shelf onlaps or is faulted against the Archaean Pilbara Block. To the north, it merges with the Candace Terrace, which in turn is truncated by the Sholl Island Fault. The Candace Terrace is not known to be hydrocarbon-bearing, and is excluded from further discussion. The Peedamullah/Onslow Shelf straddles the present day coastline.

The Mesozoic sequence, well developed in the offshore part of the shelf, thins rapidly to the east. Triassic deposition on the Peedamullah/Onslow Shelf was dominated by sandy facies derived from the Archaean Pilbara Block to the east. The main depocentre during the Jurassic was the Barrow Sub-basin (sedimentation largely bypassed the shelf). However, the Late Jurassic Dupuy Formation, which prograded into the Barrow Sub-basin from the east, was deposited over the western half of the shelf area. No Jurassic section is present on the eastern half of the shelf, due to non-deposition.

The post-Jurassic sequence is thin and consists largely of Cretaceous and Tertiary marine clastics and carbonates. The Early Cretaceous Barrow Group deltaic sequence onlaps the Dupuy Formation in the offshore part of the shelf, but does not extend onshore, where equivalent shallow marine sandy and conglomeratic lithofacies were deposited in littoral and fluvial environments near the basin margin.

3.5.2. *Hydrocarbon habitat*

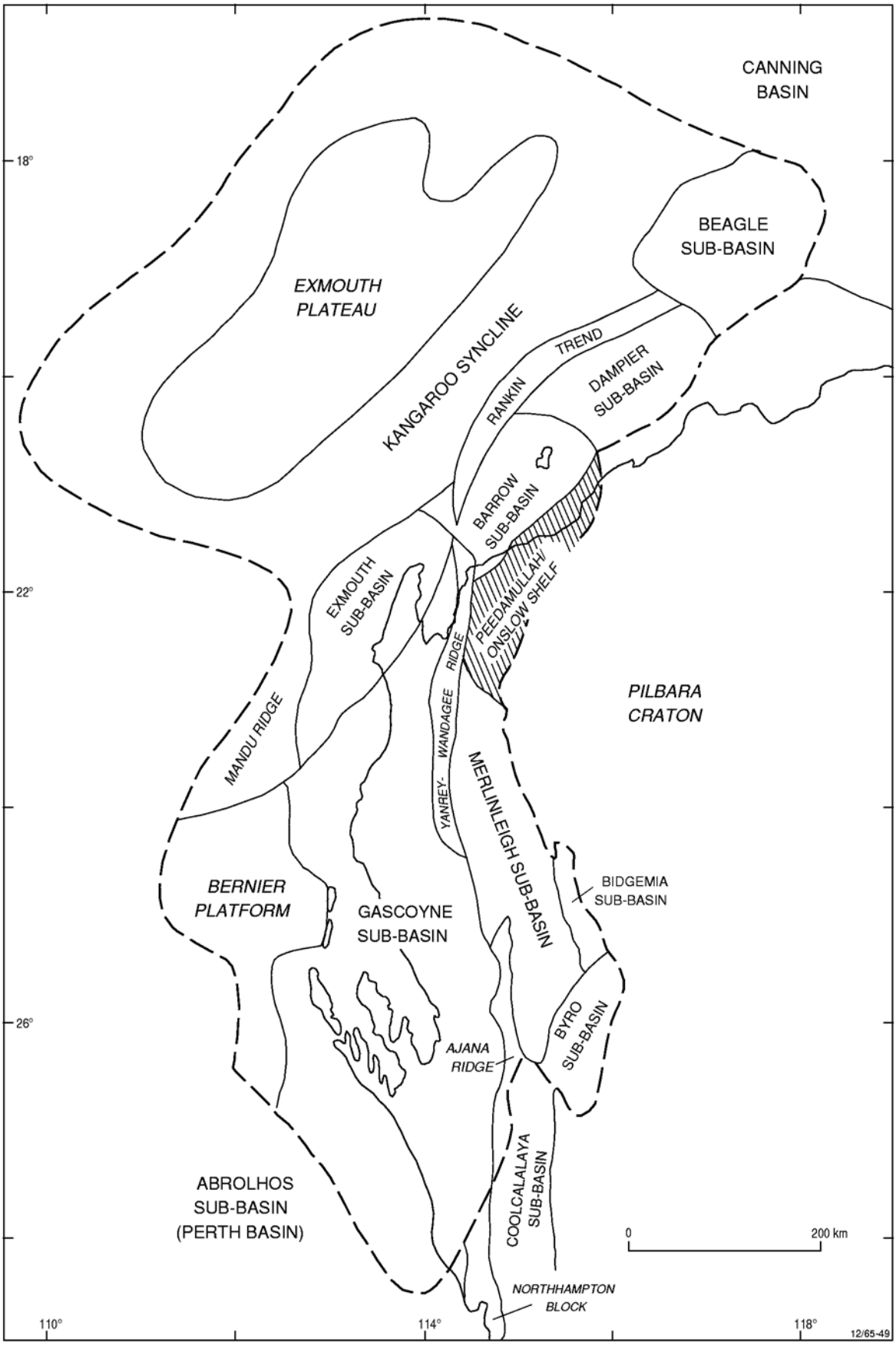
3.5.2.1 *Structure and hydrocarbon traps*

The Peedamullah/Onslow Shelf area underwent most of its structuring during the Palaeozoic, when marine, shelf and basin conditions prevailed. The Sholl Island Fault and related faults have been intermittently active since the Silurian, and have exerted a strong control on sedimentation from that time onwards. Numerous potential hydrocarbon traps are associated with these faults, including rollovers, tilted fault blocks and steep angular unconformities.

By the time of continental break-up in the Mesozoic, the locus of tectonic activity had moved to the west, movement being largely taken up by the

Flinders Fault Zone. Uplift and tilting of the shelf at the end of the Triassic

FIGURE-10


CANNING
BASIN
18°
BEAGLE
SUB-BASIN
EXMOUTH
PLATEAU
KANGAROO SYNCLINE
TREND
RANKIN
DAMPIER
SUB-BASIN
BARROW
SUB-BASIN
22°
EXMOUTH
SUB-BASIN
PEEDAMULLAH/
ONSLOW SHELF
RIDGE
WANDAGEE
YANREY-
MANDU RIDGE
PILBARA
CRATON
MERLINLEIGH SUB-BASIN
BIDGEMIA
SUB-BASIN
BERNIER
PLATFORM
GASCOYNE
SUB-BASIN
26°
AJANA
RIDGE
BYRO
SUB-BASIN
ABROLHOS
SUB-BASIN
(PERTH BASIN)
COOLCALALAYA
SUB-BASIN
0
200 km
NORTHHAMPTON
BLOCK
110°
114°
118°
12/65-49

was associated with this rifting phase, but no major structuring has affected the Cretaceous and Tertiary sequences which were deposited in stable tectonic conditions. Minor tilting and warping of these sequences as a result of subsidence to the west may have resulted in subtle closures, particularly at Cretaceous level.

Sediment drape and differential compaction over tilted fault blocks of pre-Cretaceous sedimentary sequences have resulted in the development of four-way, dip-closed anticlines in the southern part of the shelf, where tectonic effects were greatest (for example, at Tubridgi).

Basinward flow of meteoric waters from the Robe River Embayment during the Tertiary created a hydrodynamic trap for the oil migrating updip from its source. Hydrodynamic effects could enhance the trapping potential of low relief structural traps.

The gas reservoired in the Windalia Sandstone Member in North Sandy-1 appears to have a stratigraphic trapping mechanism.

3.5.2.2 *Reservoir geology*

Mesozoic reservoirs include Cretaceous sandstones: the Flacourt Formation of the Barrow Group, the Windalia Sandstone Member of the Muderong Shale Member, sandy beds within the Gearle Siltstone and the Mardie Greensand Member. Sandstones of the Triassic Mungaroo Formation are also hydrocarbon-bearing in the southern part of the shelf. All of these have excellent reservoir characteristics due mainly to their shallow depth of burial. These Cretaceous sequences are deposited unconformably onto Permian sedimentary sequences over much of the shelf (the Mungaroo Formation being confined to its western edge).

Most of the accumulations on the Peedamullah/Onslow Shelf are located in the Robe River Embayment, a structural depression northeast of Onslow. The embayment contains Late Palaeozoic and Cretaceous sedimentary rocks. The Cretaceous sequence is host to the accumulations in the area. The gas recovered from all accumulations is associated with the Mardie Greensand Member of the Muderong Formation which contains a potentially large oil resource. Low pressures in the shallow (90 to 170 metres depth) Mardie Greensand Member reservoir and the heavy biodegraded character of the oil inhibit recovery of oil to the surface. Application of thermal techniques for enhanced recovery of oil in the area is currently under investigation. East Somelim-1 was drilled as part of an appraisal program for the area.

The Mardie Greensand Member, a reservoir in the Robe River Embayment, is underlain by the highly porous and permeable Yarraloola Conglomerate, a

stratigraphic equivalent of the Birdrong Sandstone. The Yarraloola aquifer is thought to be responsible for the water-washing and biodegradation of the oil in the Mardie Greensand Member. Long-range migration by the oil generated from a Gearle Siltstone or Muderong Shale source in the Barrow Sub-basin to the west may also account for the loss of the lighter hydrocarbon fraction.

The non-glauconitic sandstone facies of the Birdrong Sandstone occurs mainly on the Peedamullah/Onslow Shelf and was deposited nearer the shoreline than the glauconitic facies (Hocking and others, 1988). Depositional environments, sedimentary character and distribution of the Birdrong Sandstone are discussed in Section 3.4 of this chapter.

3.5.2.3 *Source rocks and maturation*

The Dingo Claystone, a major source of oil in the Barrow Sub-basin to the east, is absent on the shelf, but long-range migration from mature Dingo Claystone within the Barrow Sub-basin has probably occurred. Some of the presently known oil accumulations on the eastern edge of the shelf, in the Robe River Embayment, have been linked to similar sources of oils on Barrow Island. The Gearle Siltstone and Muderong Shale in the Barrow Sub-basin have also been suggested as possible sources of Robe River oil. Migration pathways via the Flinders Fault System and/or permeable Cretaceous sandstones (Birdrong Sandstone and its equivalent, the Yarraloola Conglomerate) are considered likely. Basinward meteoric water flow probably introduced oleophilic bacteria into the reservoir, resulting in further degradation of the oil after its entrapment.

As much of the oil generation in the Barrow Sub-basin is considered to have taken place during the Miocene, trapping of hydrocarbons is possible at all stratigraphic levels on the Peedamullah/Onslow Shelf.

Other potential sources, the Triassic Locker Shale and Permian Kennedy Group, are immature on the Peedamullah/Onslow Shelf, although the deeper untested Palaeozoic section may contain mature source rocks.

3.5.3 *Hydrocarbon accumulations*

After limited success on the Peedamullah/Onslow Shelf in the initial exploration of the late 1960s, the world oil crisis led to renewed interest in the early 1980s. Discoveries are located onshore near the coast, towards the northern and southern ends of the shelf, where most exploration drilling has taken place. There are one commercial accumulation, two non-commercial accumulations and five other discoveries.

Northeast of Onslow, gas was recovered from several wells drilled in the Robe River Embayment, but the principal interest in this area is in the potentially large resource of low gravity crude oil trapped at shallow depths.

3.5.3.1 *Commercial accumulations*

Tubridgi (Plate 10, Accumulation 66)

The Birdrong Sandstone, the Flacourt Formation of the Barrow Group and the Mungaroo Formation contain the reservoirs for the main Tubridgi gas pool. The average bed thickness of each main reservoir unit is generally less than 10 metres, inhibiting resolution of the reservoir on seismic sections. The gas within the overlying Gearle Siltstone further inhibits seismic interpretation of the main reservoir.

The gas at Tubridgi is trapped in a four-way dip-closed anticline formed by drape and differential compaction of the Cretaceous sequence over Triassic tilted fault blocks. The Wyloo and Onslow wells intersected the Tubridgi accumulation. Onslow-1, drilled in 1966, was the discovery well for the accumulation, intersecting its edge. A thin oil leg in the Birdrong Sandstone remains undeveloped. Tubridgi gas contributes to the domestic gas supply via an 85 km pipeline to the main SECWA pipeline.

3.5.3.2 *Non-commercial accumulations*

Thringa (Plate 10, Accumulation 67)
East Somelim (Plate 10, Accumulation 68)

These two accumulations, located in Robe River Embayment in the northern part of the Peedamullah/Onslow Shelf, tested gas from Winning Group reservoirs. Thomas, B.M. (1978) reported that oil blew out from a seismic shothole in the area. Oil is present in cores in exploration wells taken from the Mardie Greensand Member reservoir, but does not flow to the surface. The area near the Thringa accumulation is regarded by the current operator as a potential oil resource. An appraisal program commenced in 1988 with a new seismic survey over the area, followed by drilling of Mardie-1B and East Somelim-1 appraisal wells.

3.5.3.3 *Other discoveries*

Carnie (Plate 10, Accumulation 69)
Windoo (Plate 10, Accumulation 70)
Mardie (Plate 10, Accumulation 71)
Mulyery (Plate 10, Accumulation 72)
Myanore (Plate 10, Accumulation 73)

These five wells are located in the Robe River Embayment in the vicinity of Thringa. Although all recovered gas from the Muderong Shale, mainly from the Mardie Greensand Member, their principal interest is in the heavy oil intersected in the Mardie Greensand Member reservoir. See comments on Thringa above.

3.5.4 *Hydrocarbon types*

Tubridgi gas contains approximately 93 per cent methane, with less than 1 per cent ethane, propane and carbon dioxide. Nitrogen averages 6 per cent.

Oil samples from the Mardie Greensand Member of the Muderong Shale were sampled from Mardie-1 and from a seismic shot hole (Thomas, 1978). Analysis of the sample from the seismic shot hole showed a low gravity (19.5 °API), highly aromatic crude, with a sulphur content of 0.39 per cent, and marked depletion in paraffins. Oil retorted from Mardie-1 cores had gravities ranging from 14 to 20 °API.

3.6. Exmouth Plateau

3.6.1 *Geological summary*

The Exmouth Plateau is a submerged continental block which separated from the Australian mainland during continental break-up in the middle Jurassic. The plateau lies between 150 and 500 kilometres from the Western Australian coast, in water depths ranging from 900 to 3500 metres (Figure 11).The Kangaroo Syncline forms the southeastern boundary of the Exmouth Plateau.

The Exmouth Plateau evolved from a continental downwarp, which underwent three main stages of rifting and faulting: rifting on the northern margin took place during the Callovian; rifting in the south took place 20 million years later, where continental separation took place in the Neocomian; and separation from India of the western region too place in the Late Neocomian.

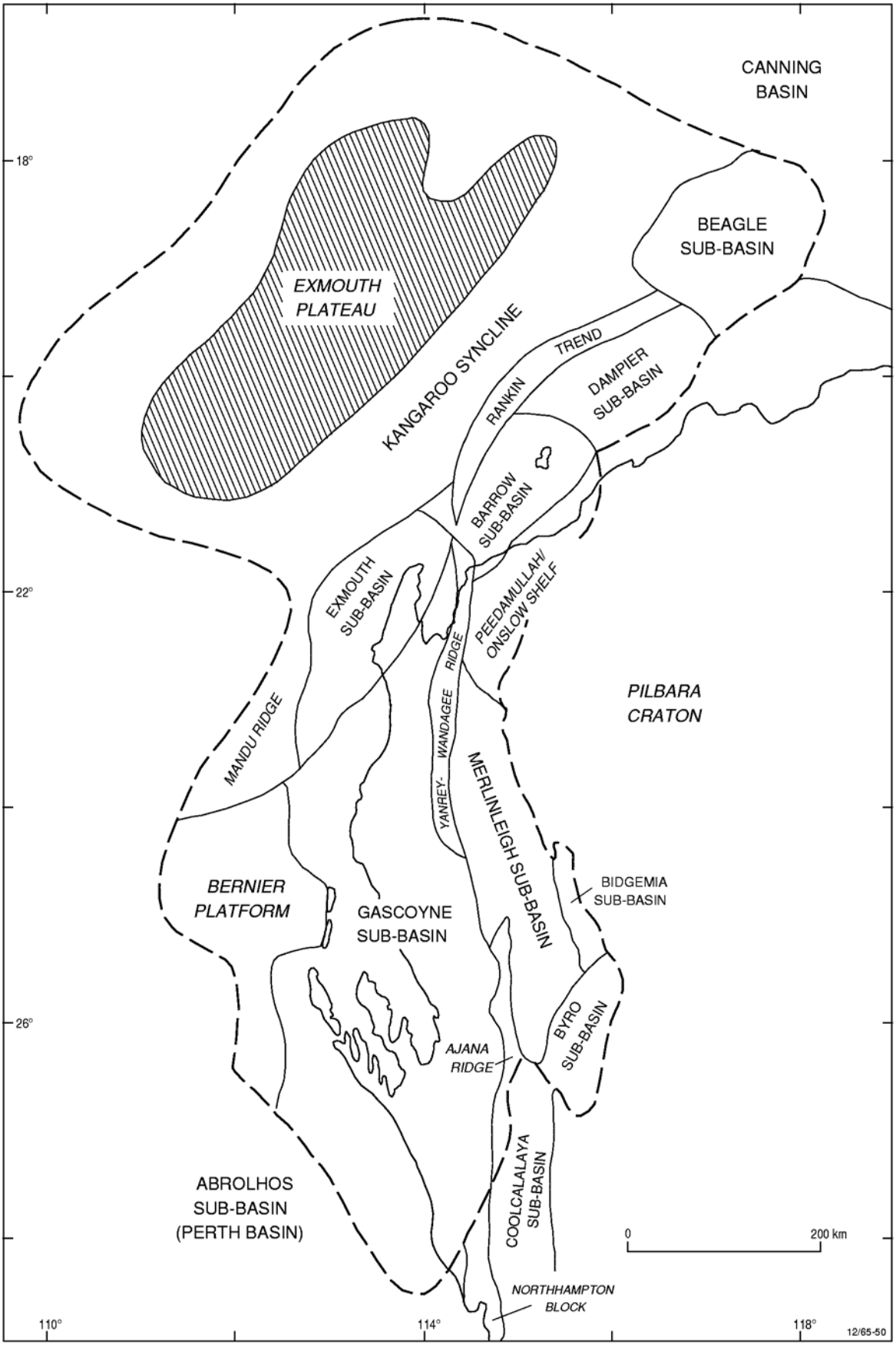
Prior to continental break-up, more than 5000 metres of Palaeozoic sediments were deposited over the area now occupied by the Exmouth Plateau. The Mesozoic sequence consists of a thick (up to 5500 metres) Triassic fluvio-deltaic to marine sedimentary sequence (Mungaroo Formation) followed by a thin Late Jurassic marine sequence, a Dingo Claystone equivalent). Breaks in sedimentation in the Early and Middle Jurassic and also in the Early Cretaceous indicate that much of the Exmouth Plateau was elevated during these times. However, between 1000 and 2000 metres of Barrow Group deltaic sediments were deposited over the plateau's southern half. Sedimentation on the northern Exmouth Plateau resumed in the Middle Cretaceous with deposition of a thin sequence of fine-grained marine clastics, succeeded by Late Cretaceous and Cainozoic marine carbonates. Up to 2000 metres of Late Mesozoic and Cainozoic sediments have accumulated since the final stage of break-up.

3.6.2 *Hydrocarbon habitat*

3.6.2.1 *Structure and petroleum traps*

Protracted tectonism affecting the Exmouth Plateau resulted in development of structural traps at several levels in the Mesozoic sequence. Elevated fault and wrench blocks developed on and flanking the Exmouth Plateau during rifting are composed of Triassic to Jurassic sedimentary rocks and are petroleum-bearing on the west (Vinck-1, Eendracht-1) and north (Jupiter-1), and in the Kangaroo Trough (Zeepaard-1, Zeewulf-1 and Resolution-1). Seals are provided across faults by younger fine-grained sediments downthrown against the reservoirs (Barber, 1988).

FIGURE-11


CANNING
BASIN
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SUB-BASIN
EXMOUTH
PLATEAU
KANGAROO SYNCLINE
RANKIN
TREND
DAMPIER
SUB-BASIN
BARROW
SUB-BASIN
22°
EXMOUTH
SUB-BASIN
PEEDAMULLAH/
ONSLOW SHELF
RIDGE
YANREY-
WANDAGEE
MANDU RIDGE
PILBARA
CRATON
MERLINLEIGH SUB-BASIN
BIDGEMIA
SUB-BASIN
BERNIER
PLATFORM
GASCOYNE
SUB-BASIN
BYRO
SUB-BASIN
26°
AJANA
RIDGE
COOLCALALAYA
SUB-BASIN
ABROLHOS
SUB-BASIN
(PERTH BASIN)
0
200 km
NORTHHAMPTON
BLOCK
110°
114°
118°
12/65-50

Where the Early Cretaceous Barrow Group delta has prograded over the southern and central parts of the Exmouth Plateau, large four-way dip closures are developed near the top of the delta as a result of post-break-up isostatic arching and depositional dip in the delta (Barber, 1988). Gas accumulations discovered in Scarborough-1, Investigator-1 and Sirius-1 are reservoired in sandstones at the top of the Barrow Group, sealed by prodelta muds and Muderong Shale equivalents.

3.6.2.2 *Reservoir geology*

The hydrocarbon-bearing reservoirs on the Exmouth Plateau are fluvio-deltaic and marine sandstones of the Triassic Mungaroo Formation, marine sandstones of the Late Triassic Brigadier Formation and fluvio-deltaic and mass flow sandstones of the Neocomian Barrow Group delta (Barber, 1988).

The Mungaroo Formation delta prograded northwest over the plateau during the Late Triassic. Delta plain sandstones are up to 30 metres thick with porosities ranging from 15 to 34 per cent and permeabilities of up to 1000 millidarcies.

A marine Mungaroo Formation equivalent sequence was intersected on the western edge of the plateau in Eendracht-1. Here, gas is reservoired in clean reworked marginal marine sandstones, where the porosity is reduced by carbonate cementation. Sandstones in this sequence range in thickness from 6 to 17 metres.

3.6.3. *Hydrocarbon accumulations*

Exploration of the Exmouth Plateau, the main phase of which occurred between 1979 and 1980, discovered several dry gas accumulations, including the very large, currently non-commercial, Scarborough accumulation.

3.6.3.1 *Non-commercial accumulations*

Scarborough (Plate 9, Accumulation 57)

Scarborough-1 was drilled on a large closure near the top of the Barrow Group delta. A thick sequence of very good quality Barrow Group reservoir sands contained reserves of very dry gas estimated at 350 billion cubic metres. This is the largest Australian gas discovery to date.

3.6.3.2 *Other discoveries*

Jupiter
(Plate 9, Accumulation 60)
Eendracht (Plate 9, Accumulation 58)
Vinck (Plate 9, Accumulation 62)

Jupiter-1, Eendracht-1 and Vinck-1 were drilled into large, north-northeast trending, wrench fault blocks of Triassic to Jurassic age on, or peripheral to, the Exmouth Plateau, beyond the depositional limits of the Barrow Group. Each well intersected a number of thin gas sands in the Triassic Mungaroo Formation.

Eendracht-1 intersected four gas-bearing sands in the upper part of the Mungaroo Formation. Very dry gas was recovered from Eendracht-1, with 96 per cent methane and only minor amounts of ethane and propane.

Investigator
(Plate 9, Accumulation 59)
Sirius (Plate 9, Accumulation 61)

Like Scarborough-1, Investigator-1 and Sirius-1 were drilled on large four-way dip closures which contain a thick Neocomian Barrow Group section. There were no hydrocarbon indications in the Barrow Group, gas being recovered only from the Mungaroo Formation.

Zeepaard (Plate 9, Accumulation 63)
Zeewulf (Plate 9, Accumulation 64)
Resolution (Plate 9, Accumulation 65)

Zeepaard-1, Zeewulf-1, and Resolution-1, located in the Kangaroo Trough, were tests of rotated or elevated Triassic fault blocks. No significant discoveries were made. This is probably due to the lack of fault seals, caused by lateral juxtaposition of thick lower delta plain sands across the fault.

Resolution-1 recovered a small quantity of gas (by formation interval test) from a 4 metre gas column. Thin gas-bearing sands were intersected in the Brigadier Formation in Zeepaard-1, and Zeewulf-1, where a Neocomian shale seal occurs across the main bounding faults.

3.6.4 *Hydrocarbon types*

Table 2 presents an analysis of the Scarborough-1 gas. All gases recovered from wells on the plateau are very dry.

TABLE 1: SUMMARY OF PETROLEUM-BEARING RESERVOIRS

Sub-basin	Dampier	Dampier	Dampier	Dampier	Dampier
Accumulation	**Talisman**	**North Rankin**	**Goodwyn**	**Goodwyn South/Pueblo**	**Tidepole**
Accumulation Number (see Plates)	**1**	**2**	**3**	**3**	**3**
Development status	Developed	Developed			
Well locations	Offshore	Offshore	Offshore	Offshore	Offshore
Petroleum pools					
Cretaceous					
Toolonga Calcilutite					
Gearle Siltstone					
Windalia Radiolarite					
Muderong Shale					
Windalia Sandstone					
Birdrong Sandstone					
Mardie Greensand					
Barrow Group					
Flacourt Formation					
Flag Sandstone					
(unnamed sandstone)					
Malouet Formation					
Jurassic					
Angel Formation	O,O				
Upper Dingo Claystone					
Depuy Sandstone					
(unnamed formation)					
Biggada Sandstone					
Lower Dingo Claystone					
Legendre Formation					
Enderby Formation		G			
Triassic					
Brigadier Formation					
Mungaroo Formation		G,G,G,G,G	G,G,Og,G	G,O	G,G,Og
Devonian					
Nannyarra Greywacke					
O: Oil	Abandoned				
Og: Oil with gas cap	Aug-92				
G: Gas or gas/condensate					
Pool - producing					
Pool - undeveloped					

TABLE 1: SUMMARY OF PETROLEUM-BEARING RESERVOIRS (cont.)

Sub-basin	Dampier	Dampier	Dampier	Dampier	Dampier
Accumulation	**Wanaea**	**Cossack**	**Egret**	**Angel**	**Eaglehawk**
Accumulation Number (see Plates)	**4**	**5**	**6**	**7**	**8**
Development status Well locations Petroleum pools	Offshore	Offshore	Offshore	Offshore	Offshore
Cretaceous					
Toolonga Calcilutite					
Gearle Siltstone					
Windalia Radiolarite					
Muderong Shale					
Windalia Sandstone					
Birdrong Sandstone					
Mardie Greensand					
Barrow Group					
Flacourt Formation					
Flag Sandstone					
(unnamed sandstone)					
Malouet Formation					
Jurassic					
Angel Formation	O	O	O	G	
Upper Dingo Claystone					
Depuy Sandstone					
(unnamed formation)					
Biggada Sandstone					
Lower Dingo Claystone					
Legendre Formation					
Enderby Formation					
Triassic					
Brigadier Formation					O
Mungaroo Formation					
Devonian					
Nannyarra Greywacke					

O: Oil

Og: Oil with gas cap

G: Gas or gas/condensate

Pool - producing

Pool - undeveloped

TABLE 1: SUMMARY OF PETROLEUM-BEARING RESERVOIRS (cont.)

Sub-basin	Dampier	Dampier	Dampier	Dampier	Dampier
Accumulation	**Lambert**	**Montague**	**Wilcox**	**Gorgon**	**West Tryal Rocks**
Accumulation Number (see Plates)	**9**	**10**	**11**	**12**	**13**
Development status Well locations Petroleum pools	Offshore	Offshore	Offshore	Offshore	Offshore
Cretaceous					
Toolonga Calcilutite					
Gearle Siltstone					
Windalia Radiolarite					
Muderong Shale					
Windalia Sandstone					
Birdrong Sandstone					
Mardie Greensand					
Barrow Group					
Flacourt Formation					
Flag Sandstone					
(unnamed sandstone)					
Malouet Formation				G	
Jurassic					
Angel Formation	O	G			
Upper Dingo Claystone					
Depuy Sandstone					
(unnamed formation)					
Biggada Sandstone					
Lower Dingo Claystone					
Legendre Formation					
Enderby Formation					
Triassic					
Brigadier Formation					
Mungaroo Formation		G	G,G	G,G,G,G,G	G,G,G,G,G
Devonian					
Nannyarra Greywacke					

O: Oil

Og: Oil with gas cap

G: Gas or gas/condensate

Pool - producing

Pool - undeveloped

TABLE 1: SUMMARY OF PETROLEUM-BEARING RESERVOIRS (cont.)

Sub-basin	Dampier	Dampier	Dampier	Dampier	Dampier
Accumulation	**Dockrell**	**Rankin**	**Echo/Yodel**	**Dixon**	**Legendre**
Accumulation Number (see Plates)	**14**	**14**	**15**	**16**	**17**
Development status Well locations Petroleum pools	Offshore	Offshore	Offshore	Offshore	Offshore
Cretaceous					
Toolonga Calcilutite					
Gearle Siltstone					
Windalia Radiolarite					
Muderong Shale					
Windalia Sandstone					
Birdrong Sandstone					
Mardie Greensand					
Barrow Group					
Flacourt Formation					
Flag Sandstone					
(unnamed sandstone)					
Malouet Formation					O
Jurassic					
Angel Formation				G	
Upper Dingo Claystone					
Depuy Sandstone					
(unnamed formation)					
Biggada Sandstone					
Lower Dingo Claystone					
Legendre Formation					
Enderby Formation					
Triassic					
Brigadier Formation					
Mungaroo Formation	Og,G,G	Og	G,G	G,G,G,G	
Devonian					
Nannyarra Greywacke					

O: Oil

Og: Oil with gas cap

G: Gas or gas/condensate

Pool - producing

Pool - undeveloped

TABLE 1: SUMMARY OF PETROLEUM-BEARING RESERVOIRS (cont.)

Sub-basin	Dampier	Dampier	Dampier	Dampier	Dampier
Accumulation	**Wandoo**	**Hampton**	**Rosemary**	**Haycock**	**North Tryal Rocks**
Accumulation Number (see Plates)	**18**	**19**	**20**	**21**	**22**
Development status Well locations Petroleum pools	Offshore	Offshore	Offshore	Offshore	Offshore
Cretaceous					
Toolonga Calcilutite					
Gearle Siltstone					
Windalia Radiolarite					
Muderong Shale					
Windalia Sandstone	O	G			
Birdrong Sandstone					
Mardie Greensand					
Barrow Group					
Flacourt Formation					
Flag Sandstone					
(unnamed sandstone)					
Malouet Formation					
Jurassic					
Angel Formation					
Upper Dingo Claystone					
Depuy Sandstone					
(unnamed formation)					
Biggada Sandstone					
Lower Dingo Claystone					
Legendre Formation	G		G		
Enderby Formation					
Triassic					
Brigadier Formation					
Mungaroo Formation				G	G
Devonian					
Nannyarra Greywacke					

O: Oil

Og: Oil with gas cap

G: Gas or gas/condensate

Pool - producing

Pool - undeveloped

TABLE 1: SUMMARY OF PETROLEUM-BEARING RESERVOIRS (cont.)

Sub-basin	Barrow	Barrow	Barrow	Barrow	Barrow
Accumulation	**Barrow Island**	**Saladin/ Yammaderry**	**Cowle**	**South Pepper**	**North Herald**
Accumulation Number (see Plates)	**23**	**24**	**25**	**26**	**27**
Development status	Developed	Developed	Develped	Developed	Developed
Well locations	Onshore	Off/onshore	Offshore	Offshore	Offshore
Petroleum pools					
Cretaceous					
Toolonga Calcilutite					
Gearle Siltstone	Og, O, O				
Windalia Radiolarite					
Muderong Shale					
Windalia Sandstone	Og,O				
Birdrong Sandstone					
Mardie Greensand	O,O				
Barrow Group					
Flacourt Formation	O	Og	Og	Og	O
Flag Sandstone					
(unnamed sandstone)					
Malouet Formation	G,O,G,G,G,O			O	
Jurassic					
Angel Formation					
Upper Dingo Claystone					
Depuy Sandstone	O, Og			G	
(unnamed formation)					
Biggada Sandstone	G,G,G				
Lower Dingo Claystone					
Legendre Formation					
Enderby Formation					
Triassic					
Brigadier Formation					
Mungaroo Formation					
Devonian					
Nannyarra Greywacke					

O: Oil

Og: Oil with gas cap

G: Gas or gas/condensate

Pool - producing

Pool - undeveloped

TABLE 1: SUMMARY OF PETROLEUM-BEARING RESERVOIRS (cont.)

Sub-basin	Barrow	Barrow	Barrow	Barrow	Barrow
Accumulation	**Chervil**	**Harriet**	**Rosette**	**Campbell**	**Sinbad**
Accumulation Number (see Plates)	**28**	**29**	**30**	**31**	**32**
Development status	Developed	Developed	Developed	Developed (gas	Developed
Well locations	Offshore	Offshore	Onshore	Offshore	Offshore
Petroleum pools					
Cretaceous					
Toolonga Calcilutite					
Gearle Siltstone					
Windalia Radiolarite					
Muderong Shale					
Windalia Sandstone					
Birdrong Sandstone					
Mardie Greensand					
Barrow Group					
Flacourt Formation	Og				
Flag Sandstone		Og	Og	Og	G
(unnamed sandstone)					
Malouet Formation					
Jurassic					
Angel Formation					
Upper Dingo Claystone					
Depuy Sandstone					
(unnamed formation)					
Biggada Sandstone					
Lower Dingo Claystone					
Legendre Formation					
Enderby Formation					
Triassic					
Brigadier Formation					
Mungaroo Formation					
Devonian					
Nannyarra Greywacke					

O: Oil

Og: Oil with gas cap

G: Gas or gas/condensate

Pool - producing

Pool - undeveloped

Oil leg undeveloped

TABLE 1: SUMMARY OF PETROLEUM-BEARING RESERVOIRS (cont.)

Sub-basin	Barrow	Barrow	Barrow	Barrow	Barrow
Accumulation	**Tanami**	**Bambra**	**Spar**	**Griffin/ Hilda**	**Ramillies**
Accumulation Number (see Plates)	**33**	**34**	**35**	**36**	**36**
Development status					
Well locations	Onshore	Offshore	Offshore	Offshore	Offshore
Petroleum pools					
Cretaceous					
Toolonga Calcilutite					
Gearle Siltstone					
Windalia Radiolarite					
Muderong Shale					
Windalia Sandstone					
Birdrong Sandstone					
Mardie Greensand					O
Barrow Group					
Flacourt Formation			G	O	
Flag Sandstone	O	Og			
(unnamed sandstone)					
Malouet Formation					
Jurassic					
Angel Formation					
Upper Dingo Claystone					
Depuy Sandstone					
(unnamed formation)					
Biggada Sandstone					
Lower Dingo Claystone					
Legendre Formation					
Enderby Formation					
Triassic					
Brigadier Formation					
Mungaroo Formation					
Devonian					
Nannyarra Greywacke					

O: Oil

Og: Oil with gas cap

G: Gas or gas/condensate

Pool - producing

Pool - undeveloped

TABLE 1: SUMMARY OF PETROLEUM-BEARING RESERVOIRS (cont.)

Sub-basin	Barrow	Barrow	Barrow	Barrow	Barrow
Accumulation	**Chinook/ Scindian**	**Roller**	**Skate**	**South Chervil**	**Elder**
Accumulation Number (see Plates)	**37**	**38**	**39**	**40**	**41**
Development status				Developed	
Well locations	Offshore	Offshore	Offshore	Offshore	Offshore
Petroleum pools					
Cretaceous					
Toolonga Calcilutite					
Gearle Siltstone					
Windalia Radiolarite					
Muderong Shale					
Windalia Sandstone					
Birdrong Sandstone					
Mardie Greensand					
Barrow Group					
Flacourt Formation	Og	Og	Og	Og	
Flag Sandstone					
(unnamed sandstone)					
Malouet Formation					
Jurassic					
Angel Formation					
Upper Dingo Claystone					
Depuy Sandstone					
(unnamed formation)					
Biggada Sandstone					
Lower Dingo Claystone					
Legendre Formation					
Enderby Formation					
Triassic					
Brigadier Formation					
Mungaroo Formation					G
Devonian					
Nannyarra Greywacke					

O: Oil

Og: Oil with gas cap

G: Gas or gas/condensate

Pool - producing

Pool - undeveloped

TABLE 1: SUMMARY OF PETROLEUM-BEARING RESERVOIRS (cont.)

Sub-basin	Barrow	Barrow	Barrow	Exmouth	Exmouth
Accumulation	**Koolinda**	**Flag**	**Rosily**	**Rough Range**	**Parrot Hill**
Accumulation Number (see Plates)	**47**	**48**	**49**	**50**	**51**
Development status Well locations Petroleum pools	Offshore	Offshore	Offshore	Onshore	Onshore
Cretaceous					
Toolonga Calcilutite					
Gearle Siltstone					
Windalia Radiolarite					
Muderong Shale					
Windalia Sandstone		G			
Birdrong Sandstone				O	O
Mardie Greensand					
Barrow Group					
Flacourt Formation					
Flag Sandstone					
(unnamed sandstone)					
Malouet Formation			G		
Jurassic					
Angel Formation					
Upper Dingo Claystone					
Depuy Sandstone	G				
(unnamed formation)					
Biggada Sandstone					
Lower Dingo Claystone					
Legendre Formation					
Enderby Formation					
Triassic					
Brigadier Formation					
Mungaroo Formation					
Devonian					
Nannyarra Greywacke					

O: Oil

Og: Oil with gas cap

G: Gas or gas/condensate

Pool - producing

Pool - undeveloped

TABLE 1: SUMMARY OF PETROLEUM-BEARING RESERVOIRS (cont.)

Sub-basin	Barrow	Barrow	Barrow	Barrow	Barrow
Accumulation	**Bowers**	**Flinders Shoal**	**Pepper**	**Pasco**	**Basil**
Accumulation Number (see Plates)	**42**	**43**	**44**	**45**	**46**
Development status Well locations Petroleum pools	Offshore	Offshore	Offshore	Onshore	Offshore
Cretaceous					
Toolonga Calcilutite					
Gearle Siltstone					
Windalia Radiolarite					
Muderong Shale					
Windalia Sandstone					
Birdrong Sandstone		G			
Mardie Greensand					
Barrow Group					
Flacourt Formation			G		Og
Flag Sandstone					
(unnamed sandstone)					
Malouet Formation				G,Og,Og,Og,G	
Jurassic					
Angel Formation					
Upper Dingo Claystone					
Depuy Sandstone					
(unnamed formation)					
Biggada Sandstone					
Lower Dingo Claystone					
Legendre Formation					
Enderby Formation					
Triassic					
Brigadier Formation					
Mungaroo Formation	G				
Devonian					
Nannyarra Greywacke					

O: Oil

Og: Oil with gas cap

G: Gas or gas/condensate

Pool - producing

Pool - undeveloped

TABLE 1: SUMMARY OF PETROLEUM-BEARING RESERVOIRS (cont.)

Sub-basin	Exmouth	Exmouth	Exmouth	Exmouth	Exmouth
Accumulation	**Novara**	**Leatherback**	**Cape Range**	**Outtrim**	**Rivoli**
Accumulation Number (see Plates)	**52**	**53**	**54**	**55**	**56**
Development status Well locations Petroleum pools	Offshore	Onshore	Onshore	Offshore	Onshore
Cretaceous					
Toolonga Calcilutite					
Gearle Siltstone					
Windalia Radiolarite					
Muderong Shale					
Windalia Sandstone					
Birdrong Sandstone					G
Mardie Greensand					
Barrow Group					
Flacourt Formation					
Flag Sandstone					
(unnamed sandstone)	O			O	
Malouet Formation					
Jurassic					
Angel Formation					
Upper Dingo Claystone					
Depuy Sandstone			G		
(unnamed formation)					
Biggada Sandstone					
Lower Dingo Claystone					
Legendre Formation					
Enderby Formation					
Triassic					
Brigadier Formation					
Mungaroo Formation		O			
Devonian					
Nannyarra Greywacke					

O: Oil

Og: Oil with gas cap

G: Gas or gas/condensate

Pool - producing

Pool - undeveloped

TABLE 1: SUMMARY OF PETROLEUM-BEARING RESERVOIRS (cont.)

Sub-basin	Exmouth Plateau	Exmouth Plateau	Exmouth Plateau	Exmouth Plateau	Exmouth Plateau
Accumulation	**Scarborough**	**Eendracht**	**Investigator**	**Jupiter**	**Sirius**
Accumulation Number (see Plates)	**57**	**58**	**59**	**60**	**61**
Development status Well locations Petroleum pools	Offshore	Offshore	Offshore	Offshore	Offshore
Cretaceous					
Toolonga Calcilutite					
Gearle Siltstone					
Windalia Radiolarite					
Muderong Shale					
Windalia Sandstone					
Birdrong Sandstone					
Mardie Greensand					
Barrow Group					
Flacourt Formation					
Flag Sandstone					
(unnamed sandstone)	G				
Malouet Formation					
Jurassic					
Angel Formation					
Upper Dingo Claystone					
Depuy Sandstone					
(unnamed formation)					
Biggada Sandstone					
Lower Dingo Claystone					
Legendre Formation					
Enderby Formation					
Triassic					
Brigadier Formation		G		G	
Mungaroo Formation			G		G
Devonian					
Nannyarra Greywacke					

O: Oil

Og: Oil with gas cap

G: Gas or gas/condensate

Pool - producing

Pool - undeveloped

TABLE 1: SUMMARY OF PETROLEUM-BEARING RESERVOIRS (cont.)

Sub-basin	Exmouth Plateau	Exmouth Plateau	Exmouth Plateau	Exmouth Plateau	Peedamullah/ Onslow
Accumulation	**Vinck**	**Zeepaard**	**Zeewulf**	**Resolution**	**Tubridgi**
Accumulation Number (see Plates)	**62**	**63**	**64**	**65**	**66**
Development status					Developed (gas)
Well locations	Offshore	Offshore	Offshore	Offshore	Onshore
Petroleum pools					
Cretaceous					
Toolonga Calcilutite					
Gearle Siltstone					G
Windalia Radiolarite					
Muderong Shale					
Windalia Sandstone					
Birdrong Sandstone					Og
Mardie Greensand					G
Barrow Group					
Flacourt Formation					
Flag Sandstone					
(unnamed sandstone)					
Malouet Formation					
Jurassic					
Angel Formation					
Upper Dingo Claystone					
Depuy Sandstone					
(unnamed formation)					
Biggada Sandstone					
Lower Dingo Claystone					
Legendre Formation					
Enderby Formation					
Triassic					
Brigadier Formation		G	G		
Mungaroo Formation	G,G,G			G	
Devonian					
Nannyarra Greywacke					

O: Oil

Og: Oil with gas cap

G: Gas or gas/condensate

Pool - producing

Pool - undeveloped

Oil leg un-developed

TABLE 1: SUMMARY OF PETROLEUM-BEARING RESERVOIRS (cont.)

Sub-basin	Peedamullah/ Onslow	Peedamullah/ Onslow	Peedamullah/ Onslow	Peedamullah/ Onslow
Accumulation	**Thringa**	**East Somelim**	**Carnie**	**Windoo**
Accumulation Number (see Plates)	**67**	**68**	**69**	**70**
Development status	Developed			
Well locations	Onshore	Onshore	Onshore	Onshore
Petroleum pools				
Cretaceous				
Toolonga Calcilutite				
Gearle Siltstone				
Windalia Radiolarite				
Muderong Shale				
Windalia Sandstone	G			
Birdrong Sandstone	G		G	
Mardie Greensand	O	G		G
Barrow Group				
Flacourt Formation				
Flag Sandstone				
(unnamed sandstone)				
Malouet Formation				
Jurassic				
Angel Formation				
Upper Dingo Claystone				
Depuy Sandstone				
(unnamed formation)				
Biggada Sandstone				
Lower Dingo Claystone				
Legendre Formation				
Enderby Formation				
Triassic				
Brigadier Formation				
Mungaroo Formation				
Devonian				
Nannyarra Greywacke				

O: Oil

Og: Oil with gas cap

G: Gas or gas/condensate

Pool - producing

Pool - undeveloped

TABLE 1: SUMMARY OF PETROLEUM-BEARING RESERVOIRS (cont.)

Sub-basin	Peedamullah/ Onslow	Peedamullah/ Onslow	Peedamullah/ Onslow
Accumulation	**Mardie**	**Mulyery**	**Myanore**
Accumulation Number (see Plates)	**71**	**72**	**73**
Development status Well locations Petroleum pools	Onshore	Onshore	Onshore
Cretaceous			
Toolonga Calcilutite			
Gearle Siltstone			
Windalia Radiolarite	G		
Muderong Shale			
Windalia Sandstone			
Birdrong Sandstone			
Mardie Greensand		G	G
Barrow Group			
Flacourt Formation			
Flag Sandstone			
(unnamed sandstone)			
Malouet Formation			
Jurassic			
Angel Formation			
Upper Dingo Claystone			
Depuy Sandstone			
(unnamed formation)			
Biggada Sandstone			
Lower Dingo Claystone			
Legendre Formation			
Enderby Formation			
Triassic			
Brigadier Formation			
Mungaroo Formation			
Devonian			
Nannyarra Greywacke			

O: Oil

Og: Oil with gas cap and oil?

G: Gas or gas/condensate

Pool - producing

Pool - undeveloped

TABLE 2
COMPOSITION OF RESERVOIR FLUIDS
(Recombined well stream)

ACCUMULATION NO.	1	2	3	3	3	3
Well	**Talisman-1**	**North Rankin-2**	**Goodwyn-3**	**Goodwyn-6**	**Goodwyn-9**	**Tidepole-1**
Sub-basin	Dampier	Dampier	Dampier	Dampier	Dampier	Dampier
Formation	Angel	Mungaroo	Mungaroo	Mungaroo	Mungaroo	Mungaroo
Geologic age	Jurassic	Triassic	Triassic	Triassic	Triassic	Triassic
Test	DST-2 (cased hole)	DST-1 (cased hole)	DST-1 (cased hole)	PT-2	PT-1	DST-1 (cased hole)
Perforations	1927 -1938 mKB	3168 -3197 mRT	3015 -3026 mRT	3022 -3032 mRT	2845 -2856 mRT	3335 -3343 mRT
	KB = 18.2 m	RT = 12.5 m	RT = 30 m	RT = 8 m	RT = 25 m	RT = 30 m
Flow period (hr)	11.0	9.0		3.5	17.0	7.0
Reservoir fluid	Oil	Gas	Oil	Oil	Gas	Oil
Crude oil (bbl/d)	**4060**		**2730**	**3522**		**3317**
GOR (scf/bbl)	41		1013	946		857
Gas (million scf/d)	**0.17**	**19.04**	**2.77**	**3.33**	**32.70**	**2.84**
Condensate (bbl/d)		**521**			**4676**	
CGR (bbl/million scf)		27.36			143.00	
Liquid gravity (oAPI)	42.5	53.5	41.5	36.0	64.0	36.0
Water (bbl/d)	0	0	0	trace	42	
Mol %						
Methane	2.99	84.75	49.33	47.09	66.29	
Ethane	0.67	5.68	5.90	6.97	7.18	
Propane	0.95	2.04	4.71	3.90	5.92	
i-Butane	0.56	0.32	0.99	0.72	1.54	
n-Butane	1.05	0.57	2.48	1.36	3.01	
i-Pentane	1.45	0.21	1.18	0.62	1.39	
n-Pentane	2.52	0.19	1.42	0.73	1.50	
Hexanes	5.91	0.28	2.13	1.79	1.88	
Heptanes +	82.75	1.75	30.61	34.65	6.75	
Hydrogen sulphide	0.00	0.00	0.00	0.00	0.00	
Carbon dioxide	0.91	3.51	0.69	1.52	1.90	
Nitrogen	0.24	0.70	0.56	0.65	2.64	
Oxygen						
Helium						
Hydrogen						
Total	100.00	100.00	100.00	100.00	100.00	
Remarks						

TABLE 2
COMPOSITION OF RESERVOIR FLUIDS
(Recombined well stream)

ACCUMULATION NO.	4	5	6	7	8	9
Well	**Wanaea-1**	**Cossack-1**	**Egret-1**	**Angel-1**	**Eaglehawk-1**	**Lambert-1**
Sub-basin	Dampier	Dampier	Dampier	Dampier	Dampier	Dampier
Formation	Angel	Angel	Angel	Angel	Mungaroo	Angel
Geologic age	Jurassic	Jurassic	Jurassic	Jurassic	Triassic	Jurassic
Test	PT-1	PT-1	DST-1 (cased hole)	DST-1 (cased hole)	DST-2 (cased hole)	DST-1A (cased hole)
Perforations	2901 -2910 mRT	2890 -2900 mRT	3119 -3128 mRT	2734 -2737 mRT	2750 -2766 mRT	3101 -3106 mRT
	RT = 25 m	RT = 25 m	RT = 12.5 m	RT = 9.4 m	RT = 12.5 m	RT = 9.4 m
Flow period (hr)	23.0	13.0		11.0	5.0	9.0
Reservoir fluid	Oil	Oil	Oil	Gas	Oil	Oil
Crude oil (bbl/d)	**5856**	**7200**	**2752**		**1645**	**375**
GOR (scf/bbl)	1036	98	1025		86	243
Gas (million scf/d)	**3.80**	**0.71**	**2.83**	**13.00**	**0.14**	0.09
Condensate (bbl/d)				**725**		
CGR (bbl/million scf)				56.00		
Liquid gravity (oAPI)	49.5	49.0	37.0	55.0	29.3	45.0
Water (bbl/d)			30		0	368
Mol %						
Methane	35.15	4.70		81.01	13.32	
Ethane	7.05	2.39		6.61	2.30	
Propane	8.28	5.14		3.39	2.02	
i-Butane	1.52	2.47		0.68	0.36	
n-Butane	5.28	5.98		1.19	0.51	
i-Pentane	2.01	3.66		0.44	0.27	
n-Pentane	2.84	4.75		0.50	0.15	
Hexanes	3.64	11.38		0.61	0.49	
Heptanes +	31.82	58.26		3.04	78.77	
Hydrogen sulphide	0.00	0.00		0.00	0.00	
Carbon dioxide	1.72	1.10		1.78	1.32	
Nitrogen	0.69	0.17		0.75	0.49	
Oxygen						
Helium						
Hydrogen						
Total	100.00	100.00		100.00	100.00	
Remarks						

TABLE 2
COMPOSITION OF RESERVOIR FLUIDS
(Recombined well stream)

ACCUMULATION NO.	10	11	12	13	14	14
Well	**Montague-1 (ST-2)**	**Wilcox-1**	**Central Gorgon-1**	**West Tryal Rocks-2**	**Dockrell-1**	**Rankin-1**
Sub-basin	Dampier	Dampier	Dampier	Dampier	Dampier	Dampier
Formation	Mungaroo	Mungaroo	Mungaroo	Mungaroo	Mungaroo	Mungaroo
Geologic age	Triassic	Triassic	Triassic	Triassic	Triassic	Triassic
Test	PT-2	PT-1	DST-3 (cased hole)	DST-3 (cased hole)	DST-2 (cased hole)	DST-2 (cased hole)
Perforations	4174 -4180 mRT	3846 -3864 mRT	4015 -4033 mRT	3295 -3305 mRT	3004 -3009 mRT	2932 -2938 mRT
	RT = 17 m	RT = 17 m	RT = 25 m	RT = 12 m	RT = 30 m	RT = 9.4 m
Flow period (hr)	27.0	19.0	17.0	7.8	4.0	6.0
Reservoir fluid	Oil	Gas	Gas	Gas	Oil	Gas
Crude oil (bbl/d)	**35**				**1869**	
GOR (scf/bbl)	13				1035	
Gas (million scf/d)	**2.60**	**20.55**	**37.41**	**14.50**	**1.93**	**15.96**
Condensate (bbl/d)		**1241**	**90**	**220**		**564**
CGR (bbl/million scf)		60.40	2.41	13.70		35.00
Liquid gravity (oAPI)	41.0	45.0	35.6		39.5	38.1(oil-FIT 8)
Water (bbl/d)			44	trace	0	trace
Mol %						
Methane	85.10	76.77	75.79	66.33	52.77	
Ethane	4.51	7.54	3.17	3.56	6.12	
Propane	1.92	3.25	0.87	1.24	3.61	
i-Butane	0.33	0.58	0.14	0.19	0.75	
n-Butane	0.51	1.43	0.17	0.35	1.39	
i-Pentane	0.22	0.40	0.07	0.12	0.78	
n-Pentane	0.20	0.52	0.04	0.11	0.79	
Hexanes	0.32	0.51	0.06	0.19	1.36	
Heptanes +	2.66	3.52	0.35	1.06	30.84	
Hydrogen sulphide	0.00	0.00	0.00	0.00	0.00	
Carbon dioxide	3.11	4.60	16.86	11.28	0.68	
Nitrogen	1.12	0.88	2.48	15.50	0.91	
Oxygen						
Helium				0.01		
Hydrogen				0.06		
Total	100.00	100.00	100.00	100.00	100.00	
Remarks						

TABLE 2
COMPOSITION OF RESERVOIR FLUIDS
(Recombined well stream)

ACCUMULATION NO.	15	17	18	19	21	23
Well	**Echo-1**	**Legendre-1**	**Wandoo-1**	**Hampton-1**	**Haycock-1**	**Barrow-1**
Sub-basin	Dampier	Dampier	Dampier	Dampier	Dampier	Barrow
Formation	Mungaroo	Malouet	Windalia Sandstone	Windalia	Mungaroo	Windalia Sandstone
Geologic age	Triassic	Neocomian	Cretaceous	Cretaceous	Triassic	Cretaceous
Test	PT-1	DST-3	PT-1A (cased hole)	DST-1A (cased hole)	FIT-4	DST-4
Perforations	2987 -2993 mRT	1893.1 -1897.9 mKB	602 -614 mRT	535 -565 mRT	3315 mRT	1882.4 -1891.6 mRT
	RT = 25 m	RT=9.1 m	RT = 21 m	RT = 30 m	RT = 8 m	RT = 55.2 m
Flow period (hr)	18.0	7.1	12.0			
Reservoir fluid	Gas	Oil	Oil	Gas	Gas	Oil
Crude oil (bbl/d)		**442-1014**	**2850**			**985**
GOR (scf/bbl)		892-1320	83			
Gas (million scf/d)	**16.45**		**0.24**	**0.10**		
Condensate (bbl/d)	**3873**			**0**		
CGR (bbl/million scf)	235.00			0.00		
Liquid gravity (oAPI)	58.2	44.7	18.7			38.1
Water (bbl/d)	trace		0	52		
Mol %						
Methane	64.55		19.70	98.10	91.00	
Ethane	6.72		0.03	0.04	9.00	
Propane	4.74		0.00	0.00		
i-Butane	1.43		0.00	0.00		
n-Butane	2.42		0.00	0.00		
i-Pentane	1.36		0.00	0.00		
n-Pentane	1.42		0.00	0.00		
Hexanes	2.34		0.00	0.00		
Heptanes +	10.55		79.97	0.00		
			(all C10+)			
Hydrogen sulphide	0.00		0.00	0.00		
Carbon dioxide	2.11		0.24	0.00		
Nitrogen	2.36		0.06	1.83		
Oxygen				0.03		
Helium						
Hydrogen						
Total	100.00		100.00	100.00	100.00	
Remarks			Sand was produced.		No DST	Mardie 32-36 API Dupuy 38-44 API

TABLE 2
COMPOSITION OF RESERVOIR FLUIDS
(Recombined well stream)

24	ACCUMULATION NO.	25	26	27	29	31	35
Saladin-2	**Well**	**Cowle-1**	**South Pepper-1**	**North Herald-1**	**Harriet-1**	**Campbell-2**	**Spar-1**
Barrow	Sub-basin	Barrow	Barrow	Barrow	Barrow	Barrow	Barrow
Barrow	Formation	Flacourt Formation	Barrow	Barrow	Flag Formation	Flag Formation	Malouet
Cretaceous	Geologic age	Early Cretaceous	Cretaceous	Early Cretaceous	Early Cretaceous	Early Cretaceous	Cretaceous
DST-1 (cased hole)	Test	DST-1 (cased hole)	DST-7 (cased hole)	DST-1	DST-2 (cased hole)	DST-1 (cased hole)	DST-4 (cased hole)
1110.5 -1117.0 mRT	Perforations	1098 -1100 mRT	1232 -1238 mRT	1197 -1203.5 mKB	1942 -1945 mKB	2212 -2214 mKB	2621 -2630 mRT
RT = 36.4 m		RT = 32 m	RT = 32.7 m	KB = 29.9m	KB = 34.7	KB = 34 m	RT = 30 m
17.0	Flow period (hr)	4.0	36.0			4.0	6.0
Oil	Reservoir fluid	Oil	Oil	Oil	Oil	Gas	Gas
11011	**Crude oil (bbl/d)**	**6384**	**1515**		**3990**		
316	GOR (scf/bbl)	304	677		500		
3.48	**Gas (million scf/d)**	**1.92**	**1.03**		**2.00**	**9.50**	**11.29**
	Condensate (bbl/d)					**140**	**266**
	CGR (bbl/million scf)						23.60
48.2	Liquid gravity (oAPI)	45.1	44.1	44.4	38.5	53.0	53.0
0	Water (bbl/d)		4			0	0
	Mol %						
28.10	Methane	26.75			39.28	86.86	87.80
4.74	Ethane	4.40			5.84	5.30	5.05
4.51	Propane	4.57			4.16	2.28	1.91
1.18	i-Butane	1.37			1.15	0.27	0.22
2.88	n-Butane	3.24			1.58	0.60	0.37
1.52	i-Pentane	1.88			0.58	0.17	0.11
1.90	n-Pentane	2.31			0.43	0.22	0.10
4.38	Hexanes	4.43			1.76	0.25	0.10
48.86	Heptanes +	49.04			43.46	1.40	0.07
0.00	Hydrogen sulphide	0.00				0.00	
0.81	Carbon dioxide	1.00			1.54	2.65	3.00
1.12	Nitrogen	1.01			0.22	0.00	1.25
	Oxygen						
	Helium						
	Hydrogen						
100.00	Total	100.00			100.00	100.00	99.98
	Remarks						

TABLE 2
COMPOSITION OF RESERVOIR FLUIDS
(Recombined well stream)

ACCUMULATION NO.	36	36	36	50	52	57
Well	**Griffin-1**	**Ramillies-1**	**Chinook-1**	**Rough Range-1**	**Novara-1**	**Scarborough-1**
Sub-basin	Barrow	Barrow	Barrow	Exmouth	Exmouth	Exmouth Plateau
Formation	Mardie Greensand	Mardie Greensand	Mardie Greensand	Birdrong Sandstone	Barrow	Barrow
Geologic age	Early Cretaceous	Early Cretaceous	Early Cretaceous	Early Cretaceous	Neocomian	Cretaceous
Test	DST-2 (cased hole)	DST-1 (cased hole)	DST-1 (cased hole)	DST 1	PT-1	FIT-1 (open hole)
Perforations	2628 -2643 mKB	2686 -2708 mKB	2659 -2664 mKB	1098.8 -1101.8 mKB	1271 -1278.5 mKB	1899 mKB
	KB = 17.7	KB = 17.7 m	KB = 17.7 m	KB = 60.7 m	KB= 8m	KB = 10.4 m
Flow period (hr)	26.4					
Reservoir fluid	Oil	Oil	Oil	Oil	Oil	Gas
Crude oil (bbl/d)	**1850**	**4036**	**6416**	**555**	**33**	
GOR (scf/bbl)	542	52				
Gas (million scf/d)		**0.21**	**4.20**			
Condensate (bbl/d)						
CGR (bbl/million scf)						
Liquid gravity (oAPI)	55.3	55.4	52.3	39.6	16.7	
Water (bbl/d)						
Mol %						
Methane	28.58	7.36	36.26		1.46	95.53
Ethane	3.50	1.81	4.91		0.02	0.12
Propane	5.08	3.51	4.15		tr	0.01
i-Butane	1.84	2.07	1.90		0.01	
n-Butane	3.08	3.77	3.41		tr	
i-Pentane	2.00	3.09	2.46		tr	
n-Pentane	2.06	3.36	2.33		tr	
Hexanes	5.05	11.79	4.67		0.31	
Heptanes +	45.99	62.14	33.98		97.25	
Hydrogen sulphide	0.00	0.00				0.00
Carbon dioxide	1.07	0.76	1.22		tr	(trace)
Nitrogen	1.75	0.22	4.71		0.95	4.34
Oxygen						
Helium						
Hydrogen						
Total	100.00	100.00	100.00		100.00	100.00
Remarks					65% C20+	No DST or PT

ACCUMULATION	REMAINING RECOVERABLE RESERVES (50% Prob)			CUMULATIVE PRODUCTION			INITIAL RECOVERABLE RESERVES (50% Prob)		
	Oil	**Cond**	**Gas**	**Oil**	**Cond**	**Gas**	**Oil**	**Cond**	**Gas**
Barrow Island	15.514		0.164	37.880		3.631	53.394		3.795
Chervil	0.478		0.129	0.152		0.033	0.6300		0.162
Harriet	3.617		0.741	2.670		0.471	6.287		1.212
North Herald	0.404		0.035	0.503		0.051	0.907		0.086
North Rankin		22.150	204.45		5.001	34.143		27.151	238.59
Rosette	0.080	0.098	0.730	0.001		0.005	0.081	0.098	0.735
Saladin	2.492		0.010	1.492		0.120	3.984		0.130
South Pepper	0.335		0.192	0.675		0.245	1.010		0.437
Talisman	0.720		0.005	0.552		0.006	1.272		0.011
Campbelll		0.162	1.408					0.162	1.408
Cowle	0.045						0.045		
Goodwyn (Main)	1.800	16.700	82.700				1.800	16.700	82.700
Goodwyn (North)		23.400	45.800					23.400	45.800
Goodwyn (South)	2.500						2.500		
North Rankin (West)		0.800	7.400					0.800	7.400
Tubridgi			2.160						2.160
Yammaderry	0.082						0.082		
Angel		11.000	35.900					11.000	35.900
Bambra	0.130	0.019	0.380				0.130	0.019	0.380
Central Gorgon		0.400	45.570					0.400	45.570
Dockrell	0.800						0.800		
Eaglehawk	0.200						0.200		
Egret	1.100						1.100		
Gorgon		0.160	57.190					0.160	57.190
North Gorgon		1.660	130.89					1.660	130.89
Rankin			5.500						5.500
Scarborough			350.00						350.00
Spar		0.790	7.040					0.790	7.040
Tidepole	1.100	1.700	14.800				1.100	1.700	14.800
Wilcox		3.400	9.500					3.400	9.500
West Tryal Rocks		3.940	80.770					3.940	80.770

Liquids in millions of kilolitres
Gas in billions of cubic metres (includes C_1-C_4)

Table 3. Hydrocarbon reserve estimates, Carnarvon Basin, as at 30 June 1990 (WADME).

4. PETROLEUM ACCUMULATIONS SUMMARIES

ACCUMULATION:	TALISMAN
PRESENT OPERATOR:	Marathon Petroleum Aust Ltd
TYPE:	Oil
COMMERCIAL STATUS:	Commercial, abandoned
LOCATION:	130 km north of Dampier
STATE:	WA
PETROLEUM TITLES:	WA-8-L
SUB-BASIN:	Dampier Sub-basin
DISCOVERY WELL:	Talisman 1
Longitude (E):	116.9399
Latitude (S):	-19.4954
Date total depth reached:	24 AUG 84
Water depth/ground level:	-78 m
Operator:	Marathon Petroleum Australia Ltd.
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 4; Development: 2
STRUCTURE:	Faulted anticline
RESERVOIR UNITS:	A total of 3 petroleum-bearing unit(s)
PRODUCING UNITS:	A total of 3 petroleum producing unit(s)
DRIVE MECHANISM:	Water Drive
PRODUCTION:	Oil: commenced in JUL 89
INFRASTRUCTURE:	Well streams from subsea wells flowed to the production facility FPSO Acqua Blu through flexible flowlines, then a CALM. Now abandoned.
PETROLEUM-BEARING UNIT No 1:	"A" Sand
CONTENTS:	Oil
AGE:	Valanginian-Hauterivian
LITHOLOGY:	Sandstone: argillaceous; glauconitic; arenaceous claystone
DEPTH (mSS):	1905 (OWC)
POROSITY:	15-24 %
PERMEABILITY:	Average 127 mD
TEMPERATURE (C):	67
RESERVOIR PRESSURE:	2870 psia
PRODUCTION STATUS:	Developed, abandoned.
PETROLEUM-BEARING UNIT No 2:	"B" Sand
CONTENTS:	Oil
AGE:	Berriasian-Tithonian

LITHOLOGY:	Sandstone: glauconitic with minor pyrite
DEPTH (mSS):	1953 (OWC)
POROSITY:	17-25 %
PERMEABILITY:	Maximum of 1534 mD
TEMPERATURE (C):	68
RESERVOIR PRESSURE:	2885 psia
PRODUCTION STATUS:	Developed and abandoned.
REMARKS:	This is the upper unit of the Angel Fm pool.

PETROLEUM-BEARING UNIT No 3:	"C" Sand
CONTENTS:	Oil
AGE:	Berriasian-Tithonian
LITHOLOGY:	Sandstone: glauconitic with minor pyrite
DEPTH (mSS):	953 (OWC)
POROSITY:	16-23 %
PERMEABILITY:	Maximum 3027 mD
TEMPERATURE (C):	
RESERVOIR PRESSURE:	2885 psia
PRODUCTION STATUS:	Developed and abandoned.
REMARKS:	This is the lower unit of the Angel Fm pool.

TEST DATA FROM THE DISCOVERY WELL (Talisman 1):
DST 3, 1 917 m, oil at 1 893 bbls/d and gas at RTSTM and water at 811 bbls/d
Repeat WT, 1 921 m, 5 runs
Repeat WT 2, 1 921.5 m, recovered 2 500 ml oil, ° 62.4 and 0.2 m3 gas and 200 ml mud filtrate
DST 2, 1 945.5 m, oil at 4 020-4 658 bbls/d and gas at (RTSTM)
DST 1B, 1961 m, oil at 3861-4778 bbls/d and gas at rate too small to measure (RTSTM)
DST 1A, 1961 m, test aborted due to detection of H_2S
Repeat WT 5(11), 1962 m, recovered 9500 ml oil (API 41.4 deg) and .02 m3 gas
Repeat WT 5(1), 1963.5 m, recovered 3600 ml oil (API 41.4 deg). and trace gas
Repeat WT 4, 1971 m, recovered 3600 ml oil (API 41.3 deg.).

Repeat WT 1, 1975.5 m, recovered 10410 ml water
Repeat WT 3, 2589 m, recovered slight oil scum and 3785 ml water

ACCUMULATION:	NORTH RANKIN
PRESENT OPERATOR:	Woodside Offshore Petroleum
TYPE:	Gas and oil
COMMERCIAL STATUS:	Commercial
LOCATION:	130 km north-northwest of Karratha
STATE:	WA
PETROLEUM TITLES:	WA-28-P; WA-1-L, WA-2-L
SUB-BASIN:	Dampier Sub-basin
DISCOVERY WELL:	North Rankin 1
Longitude (E):	116.1250
Latitude (S):	-19.5986
Date total depth reached:	25 JUN 71
Water depth/ground level:	-122 m
Operator:	Burmah Oil Co of Aust Ltd
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 6; Development: 23
STRUCTURE:	Tilted horst block
AREAL CLOSURE:	
RESERVOIR UNITS:	A total of 8 petroleum-bearing unit(s)
PRODUCING UNITS:	A total of 8 petroleum producing unit(s)
PRODUCTION:	Gas: commenced in JUL 84
INFRASTRUCTURE:	Gas brought onshore to Burrup Peninsula. Domestic gas supply reaches Perth via SECWA Dampier to Perth pipeline. LNG plant on Burrup Peninsula for LNG exports via refrigerated tankers.
PETROLEUM-BEARING UNIT No 1:	Toolonga Calcilutite
CONTENTS:	Oil and gas
FORMATION:	Toolonga Calcilutite
AGE:	Santonian-Turonian
LITHOLOGY:	Calcilutite and marls; foraminifera abundant
DEPTH (mSS):	2505 (Top)
POROSITY:	11-20 %
PERMEABILITY:	Low
PETROLEUM-BEARING UNIT No 2:	Enderby Fm
CONTENTS:	Gas
FORMATION:	Enderby Fm
AGE:	Mid Jurassic
LITHOLOGY:	Stratigraphic/structural

DEPTH (mSS):	2945 (Top)
PETROLEUM-BEARING UNIT No 3:	"NC"
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Triassic
LITHOLOGY:	Sandstone: fluvio-estuarine and shoreline; laterally extensive
DEPTH (mSS):	3187 (GWC)
POROSITY:	13- 21 %
PERMEABILITY:	100 - 2200 mD
PETROLEUM-BEARING UNIT No 4:	"D"
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Jurassic/Triassic
LITHOLOGY:	Sandstone:marginal marine and coastal; discontinuous
DEPTH (mSS):	2710 (Top)
POROSITY:	14-22 %
PERMEABILITY:	5 - 800 mD
PETROLEUM-BEARING UNIT No 5:	"E"
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Triassic
LITHOLOGY:	Sandstone: fluvio-estuarine and braided; laterally extensive
DEPTH (mSS):	2656 (Top)
POROSITY:	13-24 %
PERMEABILITY:	75-2500
PETROLEUM-BEARING UNIT No 6:	"F"
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Triassic
LITHOLOGY:	Sandstone: fluvial and floodplain; channel sands
POROSITY:	10-24 %
PERMEABILITY:	10-600 mD
PETROLEUM-BEARING UNIT No 7:	"NG"
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Triassic

LITHOLOGY:	Sandstone: braided fluvial; laterally extensive
DEPTH (mSS):	3225 (GWC)
POROSITY:	9-19 %
PERMEABILITY:	15-1500 mD
PETROLEUM-BEARING UNIT No 8:	"H"
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Triassic
LITHOLOGY:	Sandstone: fluvial; channel sands
POROSITY:	11-16 %
PERMEABILITY:	10-250 mD

TEST DATA FROM THE DISCOVERY WELL (North Rankin 1):	
DST 6, 2573 m, recovered 762 m water and 30 m gas and oil cut mud	Toolonga Calcilutite
FIT 1, 2697 m, recovered 2700 cc mud-sand-cement and 200 cc condensate. 19300 cc void (assumed to be gas)	Winning Gp
FIT 2, 2762 m, recovered 1.95 m3 gas, 90 cc condensate (42 °API) and 100 cc mud-sand-cement	Mungaroo Fm
DST 5, 2836 m, cushion to surface, gas to surface reversed out	Mungaroo Fm
FIT 9, 2838 m, recovered 5.1 m3 gas, 560 cc condensate (48 °API) and 75 cc mud with of trace sand.	Mungaroo Fm
FIT 8, 2893 m, recovered 5.1 m3 gas, 500 cc condensate (49 °API) and 50 cc mud.	Mungaroo Fm
FIT 7, 2989 m, recovered 5.1 m3 gas, 600 cc condensate (50 °API) and 100 cc mud.	Mungaroo Fm
DST 4, 3010 m, cushion to surface, gas-water-condensate to surface reversed out	Mungaroo Fm
FIT 6, 3014 m, recovered 4.8 m3 gas, 600 cc condensate (48.2 °API) and 800 cc mud with trace of sand.	Mungaroo Fm
DST 3, 3103 m, cushion to surface, gas and water flowed reversed out	Mungaroo Fm
FIT 5, 3109 m, recovered 0.06 m3 gas and 18000 cc mud.	Mungaroo Fm
FIT 4, 3152 m, recovered 4.8 m3 gas, 600 cc condensate (49 deg. API) and 300 cc mud with a trace of sand.	Mungaroo Fm

DST 2, 3206 m, cushion to surface, gas and water to surface reversed out	Mungaroo Fm
FIT 3, 3208 m, recovered 4.5 m3 gas, 200 cc condensate, 500 cc water (22 000 ppm NaCl) and 3500 cc mud and cement.	Mungaroo Fm
DST 1, 3251 m, gas to surface, flow rate 212 thousand m3/d reversed out	Mungaroo Fm

ACCUMULATION:	GOODWYN
PRESENT OPERATOR:	Woodside Offshore Petroleum
TYPE:	Gas and oil
COMMERCIAL STATUS:	Commercial
LOCATION:	140 km northwest of Dampier, 25 km southwest of the North
STATE:	WA
PETROLEUM TITLES:	WA-5-L; WA-6-L
SUB-BASIN:	Dampier Sub-basin
DISCOVERY WELL:	Goodwyn 1
Longitude (E):	115.8954
Latitude (S):	-19.6936
Date total depth reached:	25 NOV 71
Water depth/ground level:	-126 m
Operator:	Burmah Oil Co of Aust Ltd
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 10
STRUCTURE:	Large tilted fault block open to the north. Reservoirs dip northwards and are truncated by the Main unconformity. "Goodwyn South", is part of the Goodwyn field.
AREAL CLOSURE:	163.0 sq km
VERTICAL CLOSURE:	370.0 m
RESERVOIR UNITS:	A total of 6 petroleum-bearing unit(s)
INFRASTRUCTURE:	Goodwyn A platform under construction. Gas and condensate to be piped to North Rankin A platform.
PETROLEUM-BEARING UNIT No 1:	"GD"
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Triassic
LITHOLOGY:	Sandstone: fluvial
DEPTH (mSS):	2874 (GWC)
POROSITY:	20.1 % average
PERMEABILITY:	400 mD
TEMPERATURE (C):	109 at 2874 mSS
RESERVOIR PRESSURE: 4	303 psia at 2874 mSS
PRODUCTION STATUS:	Developing
REMARKS:	condensate/gas ratio = 140 bbl/million scf

PETROLEUM-BEARING UNIT No 2:	Toolonga Calcilutite
CONTENTS:	Gas
FORMATION:	Toolonga Calcilutite
AGE:	Late Cretaceous
LITHOLOGY:	Foraminiferal limestone: fine grained
POROSITY:	17.2-19.2 %
PERMEABILITY:	.4-.1 mD
PRODUCTION STATUS:	Undeveloped

PETROLEUM-BEARING UNIT No 3:	"GE" and "GFA"
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Triassic
LITHOLOGY:	Sandstone: fluvial
DEPTH (mSS):	2878 (GWC)
POROSITY:	20 %
PERMEABILITY:	700 mD
TEMPERATURE (C):	108 at 2878 mSS
RESERVOIR PRESSURE:	4303 psia at 2878 mSS
PRODUCTION STATUS:	Developing

PETROLEUM-BEARING UNIT No 4:	"GFB" and "GG"
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Triassic
LITHOLOGY:	Sandstone
DEPTH (mSS):	2943 (GWC)
POROSITY:	17 %
PERMEABILITY:	3500 mD
TEMPERATURE (C):	105 at 2879 mSS
RESERVOIR PRESSURE:	4434 psia at 2943 mSS
PRODUCTION STATUS:	Developing

PETROLEUM-BEARING UNIT No 5:	"GHA" and "GHB"
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Triassic
LITHOLOGY:	Sandstone: fluvial channel
DEPTH (mSS):	3130 (GWC)
POROSITY:	19 %
TEMPERATURE (C):	110 at 3125 mSS
RESERVOIR PRESSURE:	4707 psi at 3120 mSS
PRODUCTION STATUS:	Undeveloped

REMARKS:	This pool may not be accessible from Goodwyn A platform. This pool is structurally lower than GHC.
PETROLEUM-BEARING UNIT No 6:	"GHC"
CONTENTS:	Oil with gas cap
FORMATION:	Mungaroo Fm
AGE:	Triassic
LITHOLOGY:	Sandstone: floodplain/fluvial channel
DEPTH (mSS):	3034 (OWC)
POROSITY:	15 %
PERMEABILITY:	100 mD
TEMPERATURE (C):	105
RESERVOIR PRESSURE:	4516 psia
PRODUCTION STATUS:	Undeveloped
REMARKS:	This pool may not be accessible from Goodwyn "A"

TEST DATA FROM THE DISCOVERY WELL (Goodwyn 1):
DST 1, 2842 m, flowed gas at 11.4 million scf/d, condensate at 490 bbls/d (API 57 deg.), and water at 10 bbls/d.
FIT 7, 2921 m, recovered 1590 cc condensate (API 42 deg.), 3.4 m3 gas, 100 cc mud, and 100 cc sand.
FIT 6, 2929 m, recovered 1400 cc condensate (API 42 deg), 4.8 m3 gas and trace of sand.
FIT 5, 3126 m, recovered 200 cc condensate (API 44 deg.), 3.1 m3 gas and 7900 cc mud with a trace of sand.
FIT 4, 3131 m, recovered 200 cc condensate/mud emulsion, 4 m3 gas, 5000 cc mud and a trace of sand.
DST 2, 3146 m, flowed gas at 7.6 million scf/d, condensate at 361 bbls/d (API 52 deg.) and 7 bbls/d of water.
FIT 3, 3149 m, recovered 750 cc mud/condensate emulsion, 3 m3 gas, 7500 cc mud and a trace of sand.
FIT 1, 3190 m, recovered 21000 cc water (21,000 ppm NaCl), 0.21 m3 gas and a trace of sand

ACCUMULATION:	WANAEA
PRESENT OPERATOR:	Woodside Offshore Petroleum
TYPE:	Oil
COMMERCIAL STATUS:	Commercial
LOCATION:	30 km east of North Rankin
STATE:	WA
PETROLEUM TITLES:	WA-28-P
SUB-BASIN:	Dampier Sub-basin
DISCOVERY WELL:	Wanaea 1
Longitude (E):	116.4341
Latitude (S):	-19.5931
Date total depth reached:	26 MAY 89
Water depth/ground level:	-80 m
Operator:	Woodside Offshore Petroleum
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 5
STRUCTURE:	Elongate anticline, dip closed
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)

PETROLEUM-BEARING UNIT No 1:	Angel Fm
CONTENTS:	Oil
FORMATION:	Angel Fm
AGE:	Tithonian
LITHOLOGY:	Sandstone: mass flow deposit
DEPTH (mSS):	2900 (OWC)
POROSITY:	16-17 %
PERMEABILITY:	300 mD average; maximum 1000 mD

TEST DATA FROM THE DISCOVERY WELL (Wanaea 1):	
RFT, 2773 m, recovered 0.1 m3 (0.2 cu ft) gas, 0.1 L oil, and 10 L water.	Angel Fm
DST 1, 2902 m, flowed oil at 871 m3/d (5479 bbls/d, GOR of 666).	Angel Fm
DST 2, failed due to mechanical problems	Angel Fm

ACCUMULATION:	COSSACK
PRESENT OPERATOR:	Woodside Offshore Petroleum
TYPE:	Oil
COMMERCIAL STATUS:	Commercial
LOCATION:	125 km north of Dampier, 37 km northeast of North Rankin Facility and 7 km northeast of the Wanaea accumulation
STATE:	WA
PETROLEUM TITLES:	WA-28-P
SUB-BASIN:	Dampier Sub-basin
DISCOVERY WELL:	Cossack 1
Longitude (E):	116.4960
Latitude (S):	-19.5560
Date total depth reached:	08 JAN 90
Water depth/ground level:	-82 m
Operator:	Woodside Offshore Petroleum
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 3
STRUCTURE:	Drape closure associated with listric faulting
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Angel Fm
CONTENTS:	Oil
FORMATION:	Angel Fm
AGE:	Tithonian
LITHOLOGY:	Sandstones: mass flow deposits
DEPTH (mSS):	2918 (OWC)
POROSITY:	17 %
PERMEABILITY:	500 mD average; 1300 mD maximum

TEST DATA FROM THE DISCOVERY WELL (Cossack 1):	
Production test flowed 1144.71 m3/d (7200 bbls/d) oil, through a 1 inch choke.	Angel Fm

ACCUMULATION:	EGRET
PRESENT OPERATOR:	Woodside Offshore Petroleum
TYPE:	Oil
COMMERCIAL STATUS:	Non commercial
LOCATION:	8 km southeast of Eaglehawk and 25 km east northeast of North Rankin
STATE:	WA
PETROLEUM TITLES:	WA-28-P
SUB-BASIN:	Dampier Sub-basin
DISCOVERY WELL:	Egret 1
Longitude (E):	116.3471
Latitude (S):	-19.5065
Date total depth reached:	12 MAY 73
Water depth/ground level:	-118 m
Operator:	Woodside/Burmah Oil NL
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	Narrow, northeast trending Tithonian horst block capped by Neocomian claystones
AREAL CLOSURE:	0.5 sq km
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Angel Fm
CONTENTS:	Oil
FORMATION:	Angel Fm
AGE:	Tithonian
LITHOLOGY:	Sandstone: marine; claystone; and siltstone
DEPTH (mSS):	3110 (OWC)
POROSITY:	19 %
PERMEABILITY:	100-200 mD

TEST DATA FROM THE DISCOVERY WELL (Egret 1):	
DST 1, 3119 m, flowed oil at 2976 bbls/d and gas at 80 thousand m3/d. Recovered 610m of sea water cushion.	Barrow Gp
Production test 1, 3119 m, flowed gas at 80 thousand m3/d, oil at 2729 bbls/d (API 39 deg.) and water at 20-30 bbls/d.	Barrow Gp
FIT 2, 3208 m, recovered 24 cc water and a trace of mud	Barrow Gp
FIT 1, 3587 m, recovered 21500 cc water, 0.02 m3 gas and a trace of mud.	Mungaroo Fm

ACCUMULATION:	ANGEL
PRESENT OPERATOR:	Woodside Offshore Petroleum
TYPE:	Gas
COMMERCIAL STATUS:	Non commercial
LOCATION:	Approximately 130 km north of Dampier and 50 km northeast of the North Rankin Facility
STATE:	WA
PETROLEUM TITLES:	WA-3-L; WA-4-L
SUB-BASIN:	Dampier Sub-basin
DISCOVERY WELL:	Angel 1A
Longitude (E):	116.5966
Latitude (S):	-19.5056
Date total depth reached:	11 JAN 72
Water depth/ground level:	-89 m
Operator:	Burmah Oil Co of Aust Ltd
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 4
STRUCTURE:	Anticline, with minor faulting; drape over an eroded high
AREAL CLOSURE:	114.0 sq km
VERTICAL CLOSURE:	140.0 m
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
DRIVE MECHANISM:	Water drive
PETROLEUM-BEARING UNIT No 1:	Angel Fm
CONTENTS:	Gas
FORMATION:	Angel Fm
AGE:	Late Jurassic
LITHOLOGY:	Sandstone: marine; grading to siltstone; with minor claystone
DEPTH (mSS):	2737 (GWC)
POROSITY:	14-20 %
PERMEABILITY:	150-727 mD

TEST DATA FROM THE DISCOVERY WELL (Angel 1A):	
DST 2, 2685 m, flowed gas at 13.2 million scf/d and condensate at 686 bbls/d (API 56 deg.) with a trace of water.	Angel Fm
FIT 1, 2707 m, recovered 4.5 m3 gas, 1095 cc condensate and 15 cc mud.	Angel Fm
DST 1, 2734 m, flowed gas at 12.85 million scf/d and condensate at 720 bbls/d (API 61 deg.) with a trace of water.	Angel Fm

FIT 2, recovered 4.2 m3, gas and 1103 cc condensate with 15 cc of mud.	Angel Fm

ACCUMULATION:	EAGLEHAWK
PRESENT OPERATOR:	Woodside Offshore Petroleum
TYPE:	Oil
COMMERCIAL STATUS:	Non commercial
LOCATION:	138 km north of Dampier and 11 km east-northeast of the Rankin accumulation WA.
STATE:	WA
PETROLEUM TITLES:	WA-28-P
SUB-BASIN:	Dampier Sub-basin
DISCOVERY WELL:	Eaglehawk 1
Longitude (E):	116.2769
Latitude (S):	-19.5083
Date total depth reached:	13 DEC 72
Water depth/ground level:	-120 m
Operator:	Woodside/Burmah Oil NL
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	Horst block: unconformity surface with a domal form
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	D Unit
CONTENTS:	Oil
FORMATION:	Brigadier Fm
AGE:	Late Triassic
LITHOLOGY:	Sandstone: claystone; siltstone and minor coal
DEPTH (mSS):	2758 (OWC)
POROSITY:	15-22 %
PERMEABILITY:	510 mD

TEST DATA FROM THE DISCOVERY WELL (Eaglehawk 1):	
DST 3, 2708 m, no flow to surface	Winning Gp
DST 2, 2750 m, flowed oil at 1645 bbls/d (API 29.3 deg.) and gas at 0.141 million scf/d	Winning Gp
FIT 4, 2751 m, recovered 16530 cc water, 2080 cc of oil/condensate, 465 cc mud, and 0.01 m3 gas.	Winning Gp
FIT 3, 2764 m, recovered mud only.	Winning Gp
FIT 3A, 2765 m, recovered 22000 cc mud.	Winning Gp

DST 1, 2777 m, flowed oil at 233 bbls/d (API 30 deg.) and 571 bbls/d water with a trace of gas	Winning Gp
FIT 2, 2797 m, recovered 13500 cc mud	
FIT 2A, 2800 m, recovered 13100 cc water (33,000 ppm NaCl).	Winning Gp
FIT 1, 3040 m, recovered 15250 cc water (29700 ppm NaCl).	Winning Gp

ACCUMULATION:	LAMBERT
PRESENT OPERATOR:	Woodside Offshore Petroleum
TYPE:	Oil
COMMERCIAL STATUS:	Non commercial
LOCATION:	150 km north-northeast of Karratha and 40 km east-northeast of North Rankin A Platform
STATE:	WA
PETROLEUM TITLES:	WA-28-P
SUB-BASIN:	Dampier Sub-basin
DISCOVERY WELL:	Lambert 1
Longitude (E):	116.4897
Latitude (S):	-19.4564
Date total depth reached:	23 NOV 73
Water depth/ground level:	-125 m
Operator:	
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	Rollover feature located on the downthrown side of a major southeast hading listric fault
AREAL CLOSURE:	4.0 sq km
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Angel Fm
CONTENTS:	Oil
FORMATION:	Angel Fm
AGE:	Late Jurassic
LITHOLOGY:	Sandstone: shallow marine
DEPTH (mSS):	3101 (OWC)
POROSITY:	17 % average

TEST DATA FROM THE DISCOVERY WELL (Lambert 1):	
DST 1A, 3101 m, flowed 0.002581 million std m3/d gas, 59.55 m3/d of oil and 60.85 m3/d water	Angel Fm
DST 1, 3101 m, misrun	Angel Fm
WFT 2, 3105 m, recovered 19890 cc water, 1310 cc oil and 0.0227 m3 gas with a trace of mud and sand	Angel Fm
WFT 3, 3141 m, recovered 215000 cc water and 0.0255 m3 gas.	Angel Fm

WFT 1, 3435.5 m, recovered 21200 cc of water.	Angel Fm	

ACCUMULATION:	MONTAGUE
PRESENT OPERATOR:	Woodside Offshore Petroleum
TYPE:	Gas
COMMERCIAL STATUS:	Non commercial
LOCATION:	Northeastern end of the Rankin Platform
STATE:	WA
PETROLEUM TITLES:	WA-28-P
SUB-BASIN:	Dampier Sub-basin
DISCOVERY WELL:	Montague 1
Longitude (E):	116.3513
Latitude (S):	-20.4653
Date total depth reached:	07 MAR 85
Water depth/ground level:	-115 m
Operator:	Woodside Offshore Petroleum
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	Fault controlled rollover
RESERVOIR UNITS:	A total of 2 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 2:	Jurassic
CONTENTS:	Gas
AGE:	Kimmeridgian to Oxfordian
DEPTH (mSS):	3931 (Top)
PETROLEUM-BEARING UNIT No 1:	Triassic
CONTENTS:	Gas
AGE:	Norian
DEPTH (mSS):	4123 (Top)

TEST DATA FROM THE DISCOVERY WELL (Montague 1):	
Production Test 3, 4006 m, flowed 4813.86 m3/d (0.017 million cfd) of gas through a 1 1/4 inch choke.	Unnamed Fm
Production Test 2, 4174 m, flowed 73623.68 m3/d (2.6 million cu ft/d) gas through a 1 1/2 inch choke.	Unnamed Fm
Production Test 1, 4252 m, flowed 1047.57 m3/d (6589 bbls/d) of water through a 5/8 inch choke.	Unnamed Fm

ACCUMULATION:	WILCOX
PRESENT OPERATOR:	Woodside Offshore Petroleum
TYPE:	Gas
COMMERCIAL STATUS:	Non-commercial
LOCATION:	165 km northwest of Karratha, 85 km southwest of the North Rankin A platform
STATE:	WA
PETROLEUM TITLES:	WA-28-P
SUB-BASIN:	Dampier Sub-basin
DISCOVERY WELL:	Wilcox 1
Longitude (E):	115.4837
Latitude (S):	-20.0089
Date total depth reached:	17 FEB 83
Water depth/ground level:	-72 m
Operator:	Woodside Petroleum Ltd
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 2
STRUCTURE:	Fault block: northeast-southwest on the southwestern extension of the Rankin Trend
AREAL CLOSURE:	7.0 sq km
RESERVOIR UNITS:	A total of 4 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Unit "E"
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Late Triassic
LITHOLOGY:	Sandstone: interbedded siltstone; shale and claystone
DEPTH (mSS):	3539 (GWC)
POROSITY:	Average 21 %
PETROLEUM-BEARING UNIT No 2:	Unit "F"
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Late Triassic
LITHOLOGY:	Sandstone
WELLS DRILLED:	3684 (GWC)
POROSITY:	17-21 %
PETROLEUM-BEARING UNIT No 3:	Unit "F"
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Late Triassic

LITHOLOGY:	Sandstone
DEPTH (mSS):	3766 (GWC)
POROSITY:	17-21 %
PETROLEUM-BEARING UNIT No 4:	Unit "G"
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Late Triassic
LITHOLOGY:	Sandstone
DEPTH (mSS):	3878 (GWC)
POROSITY:	17 %

TEST DATA FROM THE DISCOVERY WELL (Wilcox 1):	
Repeat WT, 3396.5 m, 5 runs	Mungaroo Fm
Repeat WT 1, 3424 m, recovered 28 L gas, scum of condensate and 10 L filtrate.	Mungaroo Fm
Production Test 3, 3492 m, flowed gas at 1.1 million m3/d and condensate at 350 m3/d	Mungaroo Fm
Repeat WT 2, 3495 m, recovered 142 L gas, 600 ml of condensate and 600 ml of filtrate.	Mungaroo Fm
Repeat WT 3, 3612 m, recovered 1184 L of gas, 200 ml condensate and 4 L filtrate.	Mungaroo Fm
Production Test 2, 3625 m, flowed gas at 0.806 million m3/d and condensate at 240 m3/d.	Mungaroo Fm
Production Test 1, 3841 m, flowed gas at 0.668 million m3/d and condensate at 200m3/d.	Mungaroo Fm
Repeat WT 4, 3890.5 m, recovered 235 L gas, 700 ml condensate and 900 ml of filtrate.	Mungaroo Fm

ACCUMULATION:	GORGON
PRESENT OPERATOR:	WAPET
TYPE:	Gas
COMMERCIAL STATUS:	Non commercial
LOCATION:	72 km west-northwest of Barrow Island
STATE:	WA
PETROLEUM TITLES:	WA-25-P
SUB-BASIN:	Dampier Sub-basin
DISCOVERY WELL:	Gorgon 1
Longitude (E):	114.7728
Latitude (S):	-20.5787
Date total depth reached:	11 JAN 81
Water depth/ground level:	-259 m
Operator:	WAPET
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 3
STRUCTURE:	Elongate, uplifted fault block
RESERVOIR UNITS:	A total of 10 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Malouet Fm
CONTENTS:	Gas
FORMATION:	Barrow Group
AGE:	Cretaceous
DEPTH (mSS):	3365 (Top)
PETROLEUM-BEARING UNIT No 2:	"E" sand
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Late Triassic
LITHOLOGY:	Sandstone
DEPTH (mSS):	3450
POROSITY:	19 %
PETROLEUM-BEARING UNIT No 3:	"F" sand
CONTENTS:	Gas
DEPTH (mSS):	3550
POROSITY:	20
PETROLEUM-BEARING UNIT No 4:	"H" sand
CONTENTS:	Gas
DEPTH (mSS):	3750
POROSITY:	18
PETROLEUM-BEARING UNIT No 5:	"I" sand

CONTENTS:	Gas
DEPTH (mSS):	3600
POROSITY:	15
PETROLEUM-BEARING UNIT No 6:	"M" sand
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Late Triassic
LITHOLOGY:	Sandstone: massive; fluvio-deltaic
DEPTH (mSS):	3952
POROSITY:	15 %
PERMEABILITY:	0.1-527 mD
PETROLEUM-BEARING UNIT No 7:	"N" sand
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Late Triassic
LITHOLOGY:	Sandstone: massive; fluvio-deltaic
DEPTH (mSS):	4013
POROSITY:	17 %
PERMEABILITY:	0.1-527 mD
REMARKS:	CO_2 = 17 %, N_2 = 2.5 %; This unit is the main reservoir unit in Gorgon.
PETROLEUM-BEARING UNIT No 8:	"O" sand
CONTENTS:	Gas
DEPTH (mSS):	4200
POROSITY:	16
PETROLEUM-BEARING UNIT No 9:	"S" sand
CONTENTS:	Gas
DEPTH (mSS):	4000
POROSITY:	12
PETROLEUM-BEARING UNIT No 10	"T"
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Late Triassic
LITHOLOGY:	Sandstone: fluvial
DEPTH (mSS):	4150 (GWC)
POROSITY:	12
RESERVOIR PRESSURE: 6590 psi	
REMARKS:	"T" is the stratigraphically deepest unit.

TEST DATA FROM THE DISCOVERY WELL (Gorgon 1):

DST 7, 3365 m, gas flowed at 267.8 thousand m3/d, water at 2010 bbls/d and oil at 145 bbls/d.	Malouet Fm
Repeat WT, 3 367 m.	Malouet Fm
DST 5, 3729 m, gas flowed at 382.4 thousand m3/d, water at 83 bbls/d and oil at 29 bbls/d.	Mungaroo Fm
DST 6, 3729 m, gas flowed at 643.6 thousand m3/d, water at 84 bbls/d and oil at 36 bbls/d.	Mungaroo Fm
DST 4, 3973 m, gas flowed at 769.1 thousand m3/d, water at 90 bbls/d and condensate at 19 bbls/d.	Mungaroo Fm
DST 2, 4034 m, water flowed at 899 bbls/d and gas at 5.15 thousand m3/d.	Mungaroo Fm
DST 2D, 4034 m, gas flowed at 93.6 thousand m3/d with traces of condensate	Mungaroo Fm
DST 3, 4034 m, gas flowed at 524.6 thousand m3/d, water at 44 bbls/d and condensate at 18 bbls/d	Mungaroo Fm
DST 1, 4148 m, flowed water at 761 bbls/d with solution gas	Mungaroo Fm

ACCUMULATION:	WEST TRYAL ROCKS
PRESENT OPERATOR:	WAPET
TYPE:	Gas
COMMERCIAL STATUS:	Non commercial
LOCATION:	65 km northwest of Barrow Island
STATE:	WA
PETROLEUM TITLES:	WA-25-P
SUB-BASIN:	Dampier Sub-basin
DISCOVERY WELL:	West Tryal Rocks 1
Longitude (E):	115.0345
Latitude (S):	-20.2292
Date total depth reached:	03 MAR 73
Water depth/ground level:	-138 m
Operator:	WAPET
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 3
STRUCTURE:	Uplifted, elongate fault block
RESERVOIR UNITS:	A total of 5 petroleum-bearing unit(s)

PETROLEUM-BEARING UNIT No 1:	Muderong Shale
CONTENTS:	Gas
FORMATION:	Muderong Shale
AGE:	Early Cretaceous
LITHOLOGY:	Basal sandstone
DEPTH (mSS):	3204 (Top)

PETROLEUM-BEARING UNIT No 2:	"K" sand
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Late Triassic
LITHOLOGY:	Sandstone: fluvial
DEPTH (mSS):	3212
POROSITY:	18-22 %
PERMEABILITY:	25-500 mD

PETROLEUM-BEARING UNIT No 3:	"L" sand
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Late Triassic
LITHOLOGY:	Sandstone: fluvial
DEPTH (mSS):	3261

PETROLEUM-BEARING UNIT No 4:	"M" sand
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Late Triassic
LITHOLOGY:	Sandstone: fluvial
DEPTH (mSS):	3329 (GWC)
RESERVOIR PRESSURE:	3255 psig

PETROLEUM-BEARING UNIT No 5:	"N" sand
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Late Triassic
LITHOLOGY:	Sandstone: fluvial
DEPTH (mSS);	3398

TEST DATA FROM THE DISCOVERY WELL (West Tryal Rocks 2):	
DST 3, 3295-3305 m, flowed gas.	Mungaroo Fm
DST 2, 3435-3450 m, flowed gas.	Mungaroo Fm

West Tryal Rocks-1 was not tested due to cyclonic activity and engineering problems.

ACCUMULATION:	RANKIN
PRESENT OPERATOR:	Woodside Offshore Petroleum
TYPE:	Oil with gas cap
COMMERCIAL STATUS:	Non commercial
LOCATION:	50 km southwest of North Rankin platform
STATE:	WA
PETROLEUM TITLES:	WA-28-P
SUB-BASIN:	Dampier Sub-basin
DISCOVERY WELL:	Rankin 1
Longitude (E):	115.7421
Latitude (S):	-19.7989
Date total depth reached:	23 SEP 71
Water depth/ground level:	93 m
Operator:	Burmah Oil Co of Aust Lt
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	Tilted fault block
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
DRIVE MECHANISM:	Water drive
PETROLEUM-BEARING UNIT No 1:	Mungaroo Fm
CONTENTS:	Oil with gas cap
FORMATION:	Mungaroo Fm
AGE:	Middle-Late Triassic
LITHOLOGY:	Sandstone: interbedded; siltstone and shale
DEPTH (mSS):	2945 (OWC)
POROSITY:	16-21 %
PERMEABILITY:	1-40 mD
REMARKS:	GOC = 2942 mSS; 48 metres of net gas.

TEST DATA FROM THE DISCOVERY WELL (Rankin 1):	
FIT 2, 2892 m, recovered 8500 cc mud filtrate and 0.014 m3 gas.	Mungaroo Fm
FIT 1, 2 900 m, recovered 27 L mud.	Mungaroo Fm
DST 2, 2 932 m, flowed gas at 15.96 million scf/d, 564 bbls/d condensate and 610 m of sea water cushion.	Mungaroo Fm
FIT 9, 2934 m, recovered 750 cc condensate (API 53 deg.), 420 cc mud and 4.8 m3 of gas.	Mungaroo Fm

FIT 12, 2947 m, recovered 950 cc condensate (API 50 deg.) and 5 m3 of gas.	Mungaroo Fm
FIT 11, 2949 m, recovered 22000 cc of gas cut mud and 0.0085 m3 of gas.	Mungaroo Fm
DST 1, 2952 m.	Mungaroo Fm
FIT 8, 2954 m, recovered 15650 cc oil (API 45 deg.), 150 cc water and 5.7 m3 of gas.	Mungaroo Fm
FIT 7, 2969 m, recovered 21500 cc water and 0.014 m3 of gas.	Mungaroo Fm
FIT 5, 3174 m, recovered 27 L of mud.	Mungaroo Fm
FIT 6, 3174 m, No. 1 flowline blocked	Mungaroo Fm
FIT 3, 3 250 m, recovered 27 L of mud.	Mungaroo Fm
FIT 4, 3250 m, No recovery - flow line blocked.	Mungaroo Fm
FIT 10, 3251 m, recovered 27 L of mud.	Mungaroo Fm

ACCUMULATION:	ECHO/YODEL
PRESENT OPERATOR:	Woodside Offshore Petroleum
TYPE:	Gas
COMMERCIAL STATUS:	Non commercial
LOCATION:	
STATE:	WA
PETROLEUM TITLES:	WA-28-P
SUB-BASIN:	Dampier Sub-basin
DISCOVERY WELL:	Echo 1
Longitude (E):	115.7227
Latitude (S):	-19.7118
Date total depth reached:	16 OCT 88 (Echo-1) 1 SEP 90 (Yodel-1).
Water depth/ground level:	-175 m
Operator:	Woodside Offshore Petroleum
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 2
RESERVOIR UNITS:	A total of 2 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Lower 'E' Unit (Yodel-1)
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Norian
LITHOLOGY:	Sandstone: minor claystone
DEPTH (mSS):	2959 (Top)
PETROLEUM-BEARING UNIT No 2:	Upper 'E' Unit (Echo-1)
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Late Triassic
LITHOLOGY:	Sandstone
DEPTH (mSS):	2977 (Top)
TEST DATA FROM THE DISCOVERY WELL (Echo 1):	
RFTs, 2983.5 m, maximum of 0.95 m3 (25.6 cu ft) of gas, 1 L mud filtrate and 2 L condensate. 24 pressure tests and 3 fluid samples taken. All contained gas/condensate	Mungaroo Fm
DST 1, 2987 m, flowed 144 416 m3/d (5.1 million cu ft/d) of gas, 214 m3/d (1344 bbls/d) of cond. through a ½ inch choke.	Mungaroo Fm

DST 1, 2987 m, flowed 317148 m3/d (11.2 million cu ft/d) of gas and 443 m3/d (2786 bbls/d) of cond. (5/8 inch choke).	Mungaroo Fm
DST 1, 2987 m, flowed 438910 m3/d of gas, 613 m3/d of condensate through a 7/8" choke.	Mungaroo Fm

ACCUMULATION:	DIXON
PRESENT OPERATOR:	Woodside Offshore Petroleum
TYPE:	Gas
COMMERCIAL STATUS:	Non commercial
LOCATION:	132 km northwest of Dampier and 47 km southwest of North Rankin A platform
STATE:	WA
PETROLEUM TITLES:	WA-28-P
SUB-BASIN:	Dampier Sub-basin
DISCOVERY WELL:	Dixon 1
Longitude (E):	115.7866 Latitude (S): -19.8499
Date total depth reached:	26 MAY 84
Water depth/ground level:	-85 m
Operator:	Woodside Offshore Petroleum
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	Base Cretaceous drape structure underlain by Triassic tilted fault block
AREAL CLOSURE:	13.0 sq km
VERTICAL CLOSURE:	65.0 m
RESERVOIR UNITS:	A total of 7 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Angel Fm
CONTENTS:	Gas
FORMATION:	Angel Fm
AGE:	Tithonian
LITHOLOGY:	Sandstone: marine; silty in part, slightly glauconitic; with minor claystone
DEPTH (mSS):	3474 (GWC)
POROSITY:	11-17 %
PETROLEUM-BEARING UNIT No 2:	F
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Late Triassic
LITHOLOGY:	Sandstone: fluvial with claystone interbeds
DEPTH (mSS):	3791 (Top)
POROSITY:	10-17 %

PETROLEUM-BEARING UNIT No 3:	H1
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Late Triassic
LITHOLOGY:	Sandstone

PETROLEUM-BEARING UNIT No 4:	H2
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Late Triassic

PETROLEUM-BEARING UNIT No 5:	H3
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Late Triassic

PETROLEUM-BEARING UNIT No 6:	H4
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Late Triassic

PETROLEUM-BEARING UNIT No 7:	H5
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Late Triassic
DEPTH (mSS):	4206 (GWC)

TEST DATA FROM THE DISCOVERY WELL (Dixon 1): .
No production tests were performed

ACCUMULATION:	LEGENDRE
PRESENT OPERATOR:	Woodside Offshore Petroleum
TYPE:	Oil and Gas
COMMERCIAL STATUS:	Non-commercial
LOCATION:	110 km north of Dampier
STATE:	WA
PETROLEUM TITLES:	WA-1P
SUB-BASIN:	Dampier Sub-basin
DISCOVERY WELL:	Legendre 1
Longitude (E):	116.7321
Latitude (S):	-19.6719
Date total depth reached:	31 OCT 68
Water depth/ground level:	-52 m
Operator:	Burmah Oil Co of Aust Ltd
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 2
STRUCTURE:	Anticline closure
AREAL CLOSURE:	5.7 sq km
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
DRIVE MECHANISM:	Water drive

PETROLEUM-BEARING UNIT No 1:	Barrow Group
CONTENTS:	Oil
FORMATION:	Malouet Fm
AGE:	Neocomian
LITHOLOGY:	Sandstone: glauconitic
DEPTH (mSS):	1897 (GWC)
POROSITY:	14 % average; 23 % maximum
PERMEABILITY:	64-28 mD

TEST DATA FROM THE DISCOVERY WELL (Legendre 1):	
DST 2, 1893 m, flowed gas to surface, reversed out water and 12 bbls of oil.	Barrow Gp
DST 3, 1893 m, flowed gas and oil to surface, produced 44.7 deg. API oil at 442-1014 bbls/d (GOR 892-1320).	Barrow Gp
DST 1, 1912 m, recovered trace oil, 1067 m cloudy water, 637 m clear water and 152 m muddy water.	Barrow Gp

ACCUMULATION:	WANDOO
PRESENT OPERATOR:	Ampolex (PPL) P/L
TYPE:	Oil
COMMERCIAL STATUS:	Commercial
LOCATION:	65 km northwest of Dampier on the Enderby Trend
STATE:	WA
PETROLEUM TITLES:	WA-202-P
SUB-BASIN:	Dampier Sub-basin
DISCOVERY WELL:	Wandoo 1
Longitude (E):	116.4221
Latitude (S):	-20.1390
Date total depth reached:	15 JUN 91
Water depth/ground level:	-56 m
Operator:	Ampolex (PPL) P/L
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 3 Development: 2
RESERVOIR UNITS:	A total of 2 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Unknown
CONTENTS:	Oil
FORMATION:	Windalia Sandstone
AGE:	Cretaceous
LITHOLOGY:	Sandstone: glauconitic, extremely friable
DEPTH (mSS):	598 (OWC)
TEMPERATURE (C):	50 at 598 mSS
PETROLEUM-BEARING UNIT No 2:	Legendre Fm
CONTENTS:	Gas
FORMATION:	Lower Dingo Claystone
AGE:	Middle Jurassic
LITHOLOGY:	Sandstone
DEPTH (mSS):	894 (Top)

TEST DATA FROM THE DISCOVERY WELL (Wandoo 1):
RFT 4, 593.3 m, recovered 0.41 m3 gas, 4 cc oil and 270 cc of filtrate.
RFT 3, 605 m, recovered 0.08 m3 gas, 18 L of oil and 6.75 L of filtrate.
RFT 1, 912 m, recovered 0.23 m3 gas and 144 cc of filtrate.

ACCUMULATION:	HAMPTON
PRESENT OPERATOR:	Woodside Offshore Petroleum
TYPE:	Gas
COMMERCIAL STATUS:	Other discoveries
LOCATION:	60 km northwest of Dampier
STATE:	WA
PETROLEUM TITLES:	WA-1-P
SUB-BASIN:	Dampier Sub-basin
DISCOVERY WELL:	Hampton 1
Longitude (E):	116.5465
Latitude (S):	-20.1179
Date total depth reached:	17 APR 74
Water depth/ground level:	-53 m
Operator:	Woodside/Burmah Oil NL
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	ENE-WSW trending, tilted horst block
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Early Cretaceous
CONTENTS:	Gas
FORMATION:	Windalia Sandstone
AGE:	Early Cretaceous
LITHOLOGY:	Sandstone; glauconitic; interbedded with claystone, siltstone
DEPTH (mSS):	463 (Top)

TEST DATA FROM THE DISCOVERY WELL (Hampton 1):
DST 1A, 535 m, flowed gas at 2905.3 std. m3/d and water at 8.2 m3/d.
WFT 1, 597 m, recovered 0.00708 m3 of gas.

ACCUMULATION:	ROSEMARY
PRESENT OPERATOR:	Woodside Offshore Petroleum
TYPE:	Gas
COMMERCIAL STATUS:	Other discoveries
LOCATION:	
STATE:	WA
PETROLEUM TITLES:	WA-1-P
SUB-BASIN:	Dampier Sub-basin
DISCOVERY WELL:	Rosemary 1
Longitude (E):	116.3448
Latitude (S):	-19.9545
Date total depth reached:	26 MAR 73
Water depth/ground level:	-65 m
Operator:	Woodside/Burmah Oil NL
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
RESERVOIR UNITS:	A total of 3 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Lower Dingo Claystone
CONTENTS:	Gas
FORMATION:	Legendre Fm
AGE:	Jurassic
DEPTH (mSS):	2151 (Top)
PETROLEUM-BEARING UNIT No 2:	Legendre Fm
CONTENTS:	Gas
AGE:	Jurassic
DEPTH (mSS):	2602 (Top)
PETROLEUM-BEARING UNIT No 3:	Enderby Fm
CONTENTS:	Gas
AGE:	Jurassic
DEPTH (mSS):	3133 (Top)

TEST DATA FROM THE DISCOVERY WELL (Rosemary 1):
FIT 5, 2210 m, recovered 22000 cc water and 0.02 m3 gas
FIT 4, 2778 m, recovered 0.3 m3 gas and 21250 cc mud.
FIT 3, 3178 m, recovered 5400 cc water and filter cake and 0.011 m3 of gas.
FIT 2, 3784 m, recovered trace of mud and 0.003 m3 of gas. Fm tight.

FIT 1, 3894 m, recovered 16800 cc water,
3500 cc mud and 0.0085 m3 of gas.

ACCUMULATION:	HAYCOCK
PRESENT OPERATOR:	Woodside Offshore Petroleum
TYPE:	Gas
COMMERCIAL STATUS:	Other discoveries
LOCATION:	130 km northwest of Dampier
STATE:	WA
PETROLEUM TITLES:	WA-28-P
SUB-BASIN:	Dampier Sub-basin
DISCOVERY WELL:	Haycock 1
Longitude (E):	115.7214
Latitude (S):	-19.8495
Date total depth reached:	07 APR 77
Water depth/ground level:	-93 m
Operator:	Woodside Petroleum Ltd
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	Fault: north trending fault block
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Mungaroo Fm
CONTENTS:	Gas
AGE:	Late Triassic
LITHOLOGY:	Sandstone: with claystone, siltstone and coal
DEPTH (mSS):	3240 (Top)
POROSITY:	6.5-26.5 %
PERMEABILITY:	.1-264 mD

TEST DATA FROM THE DISCOVERY WELL (Haycock 1):
WFT 5, 3301 m, recovered 750 cc water, 250 cc condensate and 5.0 m3 gas with a trace of mud.
WFT 4, 3315 m, recovered 1100 cc water, 270 cc condensate and 4.8 m3 gas with a trace of mud.
WFT 3, 3352 m, recovered 12300 cc water, 70 cc condensate and 2.2 m3 gas.
WFT 6, 3387 m, recovered 0.03 m3 gas and 9500 cc mud.
WFT 2, 3390.5 m, recovered 0.15 m3 gas and 9700 cc mud.
WFT 7, 3575 m, recovered 2500 cc water, trace of condensate and 0.03 m3 gas

WFT 1, 3600 m, recovered 9600 cc water,
0.2 m3 gas and a trace of mud.

ACCUMULATION:	NORTH TRYAL ROCKS
PRESENT OPERATOR:	WAPET
TYPE:	Gas
COMMERCIAL STATUS:	Other discoveries
LOCATION:	80 km north of Barrow Island
STATE:	WA
PETROLEUM TITLES:	WA-25-P
SUB-BASIN:	Dampier Sub-basin
DISCOVERY WELL:	North Tryal Rocks 1
Longitude (E):	115.3197
Latitude (S):	-19.9883
Date total depth reached:	28 JUL 72
Water depth/ground level:	-107 m
Operator:	WAPET
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	Horst block: cap of shales form a drape closure
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)

PETROLEUM-BEARING UNIT No 1:	Mungaroo Fm equivalent
CONTENTS:	Gas
FORMATION:	Mungaroo Fm equivalent
AGE:	Late Triassic
DEPTH (mSS):	3129 (Top)
POROSITY:	1-2 mD

TEST DATA FROM THE DISCOVERY WELL (North Tryal Rocks 1):	
FIT 4, 3142 m, recovered 17200 cc muddy water with a scum of condensate and 0.36 m3 of gas.	Mungaroo Fm
FIT 3, 3232 m, tool plugged, no test.	Mungaroo Fm
FIT 5, 3232 m, recovered 10700 cc of muddy water and 11000 cc of water.	Mungaroo Fm
FIT 2, 3367 m, recovered 13000 cc of muddy water, 8000 cc mud and 0.04 m3 of gas	Mungaroo Fm
FIT 1, 3542 m, recovered 22000 cc of gas cut muddy water.	Mungaroo Fm

ACCUMULATION:	BARROW ISLAND
PRESENT OPERATOR:	WAPET
TYPE:	Oil and gas
COMMERCIAL STATUS:	Commercial
LOCATION:	55 km off the northwest coast of Australia,1300 km north of Perth
STATE:	WA
PETROLEUM TITLES:	WA-L1^{H}, L10, TL3, WA-7-L
SUB-BASIN:	Barrow Sub-Basin
DISCOVERY WELL:	Barrow 1
Longitude (E):	115.3939
Latitude (S):	-20.8183
Date total depth reached:	04 AUG 64
Ground level:	52 m
Operator:	WAPET
NUMBER OF WELLS DRILLED:	Exploration, appraisal and development: 786
STRUCTURE:	Anticline
RESERVOIR UNITS:	A total of 10 petroleum-bearing units
PETROLEUM-BEARING UNIT No 1:	Gearle Siltstone
CONTENTS:	Oil
FORMATION:	Gearle Siltstone
AGE:	Middle-Late Cretaceous
DEPTH (mSS):	Several sands, 280-335 (approx)
PETROLEUM-BEARING UNIT No 2:	Windalia Sandstone
CONTENTS:	Oil and gas
FORMATION:	Windalia Sandstone
AGE:	Middle Cretaceous
LITHOLOGY:	Sandstone: glauconitic; shale and silt; beds of dolomite and calcareous sandstone
POROSITY:	28%
PERMEABILITY:	Average 5.7 mD
DEPTH (mSS):	Several sands, 630-730 (approx)
PETROLEUM-BEARING UNIT No 3:	Muderong Shale [M3]
CONTENTS:	Oil
FORMATION:	Muderong Shale
AGE:	Early-Middle Cretaceous
LITHOLOGY:	Siltstone: interbedded limestones and shales
DEPTH (mSS):	810 (approx)

PETROLEUM-BEARING UNIT No 4:	Muderong Shale [M4]
CONTENTS:	Oil
FORMATION:	Muderong Shale
AGE:	Early-Middle Cretaceous
LITHOLOGY:	Siltstone: interbedded limestone and shale
DEPTH (mSS):	910 (approx)
PETROLEUM-BEARING UNIT No 5:	Mardie Greensand
CONTENTS:	Oil
FORMATION:	Muderong Shale
AGE:	Early Cretaceous
LITHOLOGY:	Sandstone: glauconic; silty,argillaceous
DEPTH (mSS):	820 (approx)
PETROLEUM-BEARING UNIT No 6:	Tunney Member
CONTENTS:	Oil
FORMATION:	Muderong Shale
AGE:	Early Cretaceous
DEPTH (mSS):	1120 (approx)
PETROLEUM-BEARING UNIT No 7:	Flacourt Formation
CONTENTS:	Oil
FORMATION:	Barrow Group
AGE:	Early Cretaceous
DEPTH (mSS):	Several sands, 830 -850 (approx)
PETROLEUM-BEARING UNIT No 8:	Malouet Formation
CONTENTS:	Oil and gas
FORMATION:	Barrow Group
AGE:	Early Cretaceous
DEPTH (mSS):	Several, 1680-1850 (approx)
PETROLEUM-BEARING UNIT No 9:	Dupuy Formation
CONTENTS:	Oil and gas
FORMATION:	Dingo Claystone
AGE:	Late Jurassic
LITHOLOGY:	Sandstone: argillaceous; bioturbated; interbedded sandstone, claystone and conglomerate
DEPTH (mSS):	Several, 1680-1850 (approx)
PETROLEUM-BEARING UNIT No 10:	Biggada Formation
CONTENTS:	Gas

FORMATION:	Dingo Formation
AGE:	Middle-Late Jurassic
LITHOLOGY:	Sandstone: argillaceous; bioturbated; interbedded sandstone claystone and conglomerate
DEPTH (mSS):	Several, 3200-3390 (approx)
POROSITY:	20%
PERMEABILITY:	18 mD

TEST DATA FROM THE DISCOVERY WELL (Barrow 1)

DST 7, 1984-1993 m, flowed 1 million cfd of gas.
DST 4, 1888.5-1898.9 m, flowed 1 million cfd of gas and 15.2 m of 50.1 deg. API condensate
DST 8 , 2029.1-2036.4 m, flowed 3 million cfd gas and 15.2 m of 53.9 deg. API condensate
DST 10, 2054.4-2060.1 m, flowed 985 bbls/d oil (38.1 deg. API) through a 1/2 inch choke (GOR= 1910 cf/bbl).
DST 16, 2057.4-2067.5 m, flowed 985 bbls/d oil (38.1 deg. API) through a 1/2 inch choke (GOR= 1910 cf/bbl).

ACCUMULATION:	SALADIN/YAMMADERRY
PRESENT OPERATOR:	WAPET
TYPE:	Oil and gas-cap gas
COMMERCIAL STATUS:	Commercial
LOCATION:	25 km northwest of Onslow and 70 km southwest of Barrow Island
STATE:	WA
PETROLEUM TITLES:	WA-24-P; TP/3 PART 1
SUB-BASIN:	Barrow Sub-basin
DISCOVERY WELL:	Saladin 1
Longitude (E):	115.0532
Latitude (S):	-21.4416
Date total depth reached:	19 JUN 85
Water depth/ground level:	-16 m
Operator:	WAPET
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 9 Development: 1
STRUCTURE:	Fault closed northeast trending tilted structure
AREAL CLOSURE:	150.0 sq km
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PRODUCING UNITS:	A total of 1 petroleum producing unit(s)
PRODUCTION:	Oil: commenced in DEC 89
INFRASTRUCTURE:	Oil is transported through 150 mm and 200 mm diameter pipelines to separation facilities on Thevenard Island

PETROLEUM-BEARING UNIT No 1:	Flacourt Formation
CONTENTS:	Oil with gas cap
FORMATION:	Barrow Group
AGE:	Early Cretaceous
LITHOLOGY:	Sandstone; claystone
DEPTH (mSS):	1102 (OWC)
POROSITY:	18-27 %; average 24 %
PERMEABILITY:	400-10 darcies; average 6 darcies
TEMPERATURE (C):	84
RESERVOIR PRESSURE:	1661 psia at 1102 mSS
PRODUCTION STATUS:	Developed

TEST DATA FROM THE DISCOVERY WELL (Saladin 1):

DST 1, 1116 m, flowed 5504 bbls/d of oil and 41 500 m3/d of gas through a 1 1/4 inch choke.	Flacourt Fm
RFTs, 1116.5 m, 13 pressure measurements and 4 fluid samples, (2 runs).	Flacourt Fm

ACCUMULATION:	COWLE
PRESENT OPERATOR:	WAPET
TYPE:	Oil and gas-cap gas
COMMERCIAL STATUS:	Commercial
LOCATION:	75 km southwest of Barrow Island and 8 km south-southwest of the Saladin oil production facility
STATE:	WA
PETROLEUM TITLES:	TL/4
SUB-BASIN:	Barrow Sub-basin
DISCOVERY WELL:	Cowle 1
Longitude (E):	114.9682
Latitude (S):	-21.5235
Date total depth reached:	22 DEC 89
Water depth/ground level:	-18 m
Operator:	WAPET
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1; Development: 1
STRUCTURE:	Elongate structure trending northeast-southwest, fault bounded to southeast with dip closure in other directions
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PRODUCING UNITS:	A total of 1 petroleum producing unit(s)
PRODUCTION:	Oil: commenced in MAY 91
INFRASTRUCTURE:	A monopod platform with a helideck. Flowline connects to Thevenard Island production facilities
PETROLEUM-BEARING UNIT No 1:	Flacourt Formation
CONTENTS:	Oil with gas cap
FORMATION:	Barrow Group
AGE:	Early Cretaceous
LITHOLOGY:	Deltaic sands
DEPTH (mSS):	1072 (OWC)
POROSITY:	18 %
PRODUCTION STATUS:	Developed
TEST DATA FROM THE DISCOVERY WELL (Cowle 1):	

DST, 1098 m, stabilised flow of 1016 m3/d (6390 bbls/d) of oil, 55200 m3/d (1.95 thousand cu ft/d) of gas through a 60/64 inch choke (600 psig).	Flacourt Fm

ACCUMULATION:	SOUTH PEPPER
PRESENT OPERATOR:	Wesminco Oil P/L
TYPE:	Oil with gas-cap gas
COMMERCIAL STATUS:	Commercial
LOCATION:	59 km north of Onslow and 30 km southwest of Barrow Island
STATE:	WA
PETROLEUM TITLES:	TL-2
SUB-BASIN:	Barrow Sub-basin
DISCOVERY WELL:	South Pepper 1
Longitude (E):	115.2748
Latitude (S):	-21.1249
Date total depth reached:	12 DEC 82
Water depth/ground level:	-17 m
Operator:	Mesa Aust Ltd
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 6; Development: 9
STRUCTURE:	Truncated anticline located on a northeast-southwest trending regional high
AREAL CLOSURE:	6.2 sq km
VERTICAL CLOSURE:	23.0 m
RESERVOIR UNITS:	A total of 5 petroleum-bearing unit(s)
PRODUCTION:	Oil: commenced in JAN 88
INFRASTRUCTURE:	Remote subsea well and monopod, jack-up rig converted to a manned production facility. Processed oil is stored at Airlie Island which also has tanker loading
PETROLEUM-BEARING UNIT No 1:	Mardie Greensand Mbr
CONTENTS:	Gas-cap gas
FORMATION:	Muderong shale
AGE:	Early Cretaceous
LITHOLOGY:	Sandstone: glauconitic, silty and argillaceous, part of transgressive shallow marine sequence
DEPTH (mSS):	1197 (GOC)
POROSITY:	Maximum 30 %
PERMEABILITY:	Maximum 55 mD
REMARKS:	This unit is the upper part of the Mardie/Flacourt pool.
PETROLEUM-BEARING UNIT No 2:	Dupuy Fm

CONTENTS:	Gas/condensate, and oil
FORMATION:	Dingo Claystone
AGE:	Late Jurassic
LITHOLOGY:	Sandstone: grained, well sorted, subrounded
DEPTH (mSS):	2497 (Top)
PETROLEUM-BEARING UNIT No 3:	Flacourt Fm
CONTENTS:	Oil and gas-cap gas
FORMATION:	Upper Barrow Group
AGE:	Early Cretaceous
LITHOLOGY:	Sandstone: fine-coarse grained, poorly sorted; within a sequence of coarsening upward cycles
DEPTH (mSS):	1207 (OWC)
POROSITY:	24-27 %
PRODUCTION STATUS:	Developed
REMARKS:	This unit is the lower part of the Mardie/Flacourt pool.
PETROLEUM-BEARING UNIT No 4:	Unit "C" Shale Sub-Unit
CONTENTS:	Oil and gas
FORMATION:	Lower Barrow Group
AGE:	Early Cretaceous
LITHOLOGY:	Sandstone: thin, lenticular beds; fine grained and poorly sorted
DEPTH (mSS):	2182 (Top)
PERMEABILITY:	Maximum of 1000 mD
PRODUCTION STATUS:	Developed
PETROLEUM-BEARING UNIT No 5:	Unit "C" Shale Sub-Unit
CONTENTS:	Oil and gas
FORMATION:	Lower Barrow Group
AGE:	Late Jurassic - E. Cretaceous
LITHOLOGY:	Sandstone: finegrained, poorly sorted, subangular
DEPTH (mSS):	2443 (Top)

TEST DATA FROM THE DISCOVERY WELL (South Pepper 1):	
DST 11, 940 m, no flow. Reversed out 1 bbl muddy water, trace gas. Formation very tight.	Muderong Sh
DST 10, 1178 m, no flow, formation very tight.	Muderong Sh
DST 10A, 1178 m, no flow, tool failed.	Muderong Sh

DST 10B, 1178 m, no flow, recovered 1 bbl muddy water, formation very tight.	Muderong Sh
DST 1, 1197.3 m, gas flowed at approx. 0.14 million m3/d.	Muderong Sh
DST 9, 1205 m, flowed gas at approx .025 million m3/d.	Muderong Sh
DST 8, 1219 m, flowed gas at 0.30 million m3/d with 5.3 bbls condensate per million cu ft of gas (API 60.8 deg.).	Barrow Gp
DST 7, 1232 m, flowed oil at 1515 bbls/d, gas at .02 thousand m3/d and water at 498 bbls/d.	Barrow Gp
DST 6, 1245 m. flowed water at 1100 bbls/d.	Barrow Gp
DST 2, 1994 m, recovered 90 bbls water.	Barrow Gp
DST 5, 2160 m, flowed gas at rate too small to measure. 45 bbls formation water reversed out.	Barrow Gp
DST 4, 2214 m, flowed oil at 502 bbls/d, (35.6 deg. API) and gas at 6.7 thousand m3/d.	Barrow Gp
DST 3A, 2475 m, flowed gas at 0.03 million m3/d and water at 42 bbls/d.	Dupuy Fm
DST 3, 2528 m, flowed gas at 0.5 thousand m3/d with trace of 34.6 deg. API oil.	Dupuy Fm

ACCUMULATION:	NORTH HERALD
PRESENT OPERATOR:	Wesminco Oil P/L
TYPE:	Oil
COMMERCIAL STATUS:	Commercial
LOCATION:	60 km north-northeast Onslow
STATE:	WA
PETROLEUM TITLES:	TP/7
SUB-BASIN:	Barrow Sub-basin
DISCOVERY WELL:	North Herald 1
Longitude (E):	115.2674
Latitude (S):	-21.1763
Date total depth reached:	19 JUN 83
Water depth/ground level:	-19 m
Operator:	Mesa Aust Ltd
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 4; Development: 1
STRUCTURE:	Fault truncated anticline; east-west oriented
AREAL CLOSURE:	5.0 sq km
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PRODUCING UNITS:	A total of 1 petroleum producing unit(s)
PRODUCTION:	Oil: commenced in DEC 87
PETROLEUM-BEARING UNIT No 1:	Flacourt Fm
CONTENTS:	Oil
FORMATION:	Barrow Group
AGE:	Valanginian - E. Hauterivian
LITHOLOGY:	Deltaic sequence, predominantly sandstone with thin discontinuous shale intervals
DEPTH (mSS):	1176 (OWC)
POROSITY:	<5 - 25 %
PERMEABILITY:	10-500 mD
PRODUCTION STATUS:	Developed
TEST DATA FROM THE DISCOVERY WELL (North Herald 1):	
DST 2, 1197 m, flowed 79.5 m3/d (500 bbls/d) of oil and 480 thousand m3/d (160 thousand cf/d) of gas through a 1/4 inch choke at 611 psig.	Barrow Gp

DST 1, 2502 m, produced minor gas at a RTSTM. Pressure data indicated a very tight formation.	Dupuy Fm

ACCUMULATION:	CHERVIL
PRESENT OPERATOR:	Wesminco Oil P/L
TYPE:	Oil with gas cap
COMMERCIAL STATUS:	Commercial
LOCATION:	40 km north-northeast of Onslow, and 50 km south-southwest of Barrow Island
STATE:	WA
PETROLEUM TITLES:	TP/7
SUB-BASIN:	Barrow Sub-basin
DISCOVERY WELL:	Chervil 1
Longitude (E):	115.2258
Latitude (S):	-21.3036
Date total depth reached:	02 AUG 83
Water depth/ground level:	-15 m
Operator:	Mesa Aust Ltd
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 4; Development: 1
STRUCTURE:	Faulted anticline
AREAL CLOSURE:	4.0 sq km
RESERVOIR UNITS:	A total of 2 petroleum-bearing unit(s)
PRODUCING UNITS:	A total of 2 petroleum producing unit(s)
PRODUCTION:	Oil: commenced in AUG 89
INFRASTRUCTURE:	Piped 7.5 km by a 200 mm pipeline facility on Airlie Island
PETROLEUM-BEARING UNIT No 1:	Mardie Greensand
CONTENTS:	Gas
FORMATION:	Muderong Shale
AGE:	Early Cretaceous
DEPTH (mSS):	996 (Top)
PETROLEUM-BEARING UNIT No 2:	Flacourt Fm
CONTENTS:	Oil with gas cap
FORMATION:	Barrow Group
AGE:	Early Cretaceous
LITHOLOGY:	Sandstone: deltaic, in part bioturbated; with minor shale and siltstone
DEPTH (mSS):	1018 (Top)
POROSITY:	27 %
PERMEABILITY:	0-1600 mD
PRODUCTION STATUS:	Developed

REMARKS:	This is the lower part of the Mardie/Flacourt pool
TEST DATA FROM THE DISCOVERY WELL (Chervil 1):	
DST 3, 1024-1030 m and 1034.5-1036.5 m, flowed 68 m3/d of gas on a 3/8" choke.	Mardie Greensand
DST 2, 1049.0-1052.5 m, flowed 2053 bbls/d of 46 deg. API oil and 688 m3/d of gas through a 3/4" choke.	Barrow Group
DST 1, 1780-1792 m, flowed dry gas at a rate too small to measure.	Barrow Group

ACCUMULATION:	HARRIET
PRESENT OPERATOR:	Hadson Aust Dev Pty Ltd
TYPE:	Oil with gas cap
COMMERCIAL STATUS:	Commercial
LOCATION:	17 km northeast of Barrow Island
STATE:	WA
PETROLEUM TITLES:	TL/1
SUB-BASIN:	Barrow Sub-basin
DISCOVERY WELL:	Harriet 1
Longitude (E):	115.6129
Latitude (S):	-20.6035
Date total depth reached:	22 NOV 83
Water depth/ground level:	-23 m
Operator:	Aust Occidental Petroleum
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 8 Development: 3
STRUCTURE:	Anticline fault bounded northeast-southwest trending
AREAL CLOSURE:	7.0 sq km
VERTICAL CLOSURE:	20.5 m
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PRODUCING UNITS:	A total of 1 petroleum producing unit(s)
PRODUCTION:	Oil: commenced in JAN 86; Gas: commenced in JUL 92
INFRASTRUCTURE:	First commercial oil development offshore WA brought onstream from the main A platform in JAN 1986. Production from the C and B platforms commenced in SEPT 1986 and JAN 1987

PETROLEUM-BEARING UNIT No 1:	Flag Formation
CONTENTS:	Oil with gas cap
FORMATION:	Barrow Group
AGE:	Early Cretaceous
LITHOLOGY:	Sandstone: massive; fine-coarse grained with interbedded claystone
DEPTH (mSS):	1922 (OWC)
POROSITY:	23.6 % average
PERMEABILITY:	800-2000 mD
TEMPERATURE (C):	91
RESERVOIR PRESSURE:	2800 psia
PRODUCTION STATUS:	Developed

REMARKS: GOC = 1902 mSS

TEST DATA FROM THE DISCOVERY WELL (Harriet 1):
Repeat WT, 1 935 m.
Repeat WT 20, 1935.5 m, recovered 10.5 L of water.
Repeat WT 22, 1938 m, recovered 0.34 m3 gas, 3 L oil and 5.5 L of water.
DST 2, 1942 m, flowed oil at 2487 bbls/d and gas at 32.5 thousand m3/d.
Repeat WT 10, 1944 m, recovered 0.36 m3 gas, 2 L light oil and 5 L of emulsion.
DST 1, 1950 m, flowed oil (38.5 deg. API) at 1465 bbls/d and gas at 21.6 thousand m3/d.
Repeat WT 21, 1952 m, recovered .08 m3 of gas, 3 L of oil/water emulsion and 6 L of water.

ACCUMULATION:	ROSETTE
PRESENT OPERATOR:	Hadson Aust Dev Pty Ltd
TYPE:	Oil with gas cap
COMMERCIAL STATUS:	Commercial
LOCATION:	Varanus Island
STATE:	WA
PETROLEUM TITLES:	TL/6
SUB-BASIN:	Barrow Sub-basin
DISCOVERY WELL:	Rosette 1
Longitude (E):	115.5739
Latitude (S):	-20.6566
Date total depth reached:	16 OCT 87
Ground level:	5 m
Operator:	Bond Petroleum
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1 Development: 1
STRUCTURE:	Low relief anticlinal closure
AREAL CLOSURE:	5.0 sq km
VERTICAL CLOSURE:	28.0 m
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PRODUCING UNITS:	A total of 1 petroleum producing unit(s)
PRODUCTION:	Oil: commenced in JUL 92
PETROLEUM-BEARING UNIT No 1:	Flag Fm
CONTENTS:	Oil with gas cap
FORMATION:	Barrow Group
AGE:	Early Cretaceous
LITHOLOGY:	Sandstone: quartz arenites interbedded with siltstone and claystone
DEPTH (mSS):	1830 (GOC)
POROSITY:	Maximum of 20 %
PERMEABILITY:	Maximum of 1500 mD for gas zone and 1290 mD for oil zone
PRODUCTION STATUS:	Developed
REMARKS:	Mainly, gas producer. Part of the oil in the 4 m oil leg is also produced from the same well (Rosette-1).
TEST DATA FROM THE DISCOVERY WELL (Rosette 1):	
RFT 1, 2363 m, recovered 0.014 m3 of gas and 10.5 L of mud.	Unknown Fm

DST 5, 2385.5 m, flowed gas at 521033 m3/d (18.4 million cu ft/d) and recovered 82.4 m3 (518 bbls) of condensate.	Unknown Fm
DST 4, 2395 m, flowed 27 m3/d (170 bbls/d) of clean 41 deg. API oil through a 1/8 inch choke. Associated wet solution gas flowed at 1274 m3/d (45 thousand cf/d).	Unknown Fm
DST 3, 2396 m, recovered 14.6 m3 (92 bbls) of 40 deg. API oil and 26.9 m3 (169 bbls) of water.	Unknown Fm
FIT 1, 2396 m, recovered 0.47 m3 (16.6 cu ft) of gas, 8.5 L of oil and 1.5 L of mud filtrate.	Unknown Fm
RFT 2, 2396 m, recovered 0.358 m3 of gas, 6 L of oil and 1.5 L of water.	Unknown Fm
DST 1, 3021 m, failed to produce due to tight formation.	Unknown Fm
DST 2, 3060 m, failed to produce due to tight formation	Unknown Fm

ACCUMULATION:	CAMPBELL
PRESENT OPERATOR:	Hadson Aust Dev Pty Ltd
TYPE:	Oil with gas cap
COMMERCIAL STATUS:	Commercial
LOCATION:	40 km northeast of Barrow Island
STATE:	WA
PETROLEUM TITLES:	TL/5
SUB-BASIN:	Barrow Sub-basin
DISCOVERY WELL:	Campbell 2
Longitude (E):	115.7289
Latitude (S):	-20.4154
Date total depth reached:	01 MAR 86
Water depth/ground level:	-39 m
Operator:	Bond Corp Holdings Ltd
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 4
STRUCTURE:	mounding, fault at southeastern margin anticline, several culminations due to submarine fan
AREAL CLOSURE:	11.0 sq km
VERTICAL CLOSURE:	24.0 m
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PRODUCING UNITS:	A total of 1 petroleum producing unit(s)
PRODUCTION:	Gas: commenced in JUL 92
INFRASTRUCTURE:	Gas is piped to Varanus Island as part of the Harriet gas gathering project
PETROLEUM-BEARING UNIT No 1:	Flag Fm
CONTENTS:	Oil with gas cap
FORMATION:	Barrow Group
AGE:	Early Cretaceous
LITHOLOGY:	Sandstone
DEPTH (mSS):	2160 (GWC)
POROSITY:	Average 21% in gas zone and 20% in oil zone
PERMEABILITY:	Average 670 mD in gas zone and 980 mD in oil zone
PRODUCTION STATUS:	Developed
REMARKS:	The 1.5 m oil leg is undeveloped.

TEST DATA FROM THE DISCOVERY WELL (Campbell 2):

RFT, 2195 m, 6 pressure readings at 2195 m, 2205 m, 2214 m, 2219 m, 2222 m, and 2235 m.	Flag Sand Mbr
DST 1, 2212 m, flowed 161406 m3/d (5.7 million cfd) of gas (3/8 inch choke), 220 872 m3/d (7.8 million cfd) of gas and 25.4 m3/d (160 bbls/d) of condensate (1/2 inch choke) and 269011 m3/d gas and 22.3 m3/d of condensate (5/8 inch).	Flag Sand Mbr
RFT sample, 2216.5 m, recovered 1.359 m3 (48 cu ft) of gas, 15 L of oil (35 deg. API) and 3 L water (6 gallon chamber).	Flag Sand Mbr
RFT sample, 2216.5 m, recovered 0.538 m3 (19 cu ft) of gas, 2.1 L of oil and 0.7 L of water (1 gallon chamber).	Flag Sand Mbr

ACCUMULATION:	SINBAD
PRESENT OPERATOR:	Hadson Aust Dev Pty Ltd
TYPE:	Gas
COMMERCIAL STATUS:	Commercial
LOCATION:	30 km northeast of Barrow Island
STATE:	WA
PETROLEUM TITLES:	TL/5, TL/1
SUB-BASIN:	Barrow Sub-basin
DISCOVERY WELL:	Sinbad 1
Longitude (E):	115.7103
Latitude (S):	-20.4840
Date total depth reached:	25 MAR 90
Water depth/ground level:	-37 m
Operator:	Hadson Aust Dev Pty Ltd
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 2
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PRODUCING UNITS:	A total of 1 petroleum producing unit(s)
PRODUCTION:	Gas: commenced in JUL 92
INFRASTRUCTURE:	Gas is piped to Varanus Island as part of the Harriet gas gathering project.

PETROLEUM-BEARING UNIT No 1:	Flag Fm
CONTENTS:	Gas
FORMATION:	Barrow Group
AGE:	Early Cretaceous
LITHOLOGY:	Sandstone
DEPTH (mSS):	1991 (GWC)
PRODUCTION STATUS:	Developed

TEST DATA FROM THE DISCOVERY WELL (Sinbad 1):
Production test flowed gas at 416000 m3/d (14.7 million cu ft/d) with 40 m3/d (250 bbls) of condensate.

Flag Sand Mbr

ACCUMULATION:	TANAMI
PRESENT OPERATOR:	Hadson Aust Dev Pty Ltd
TYPE:	Oil
COMMERCIAL STATUS:	Non commercial (note: on October 11 1991 a long term production test commenced. Permanent facilities being completed in 1993)
LOCATION:	Varanus Island
STATE:	WA
PETROLEUM TITLES:	WA-EP-307
SUB-BASIN:	Barrow Sub-basin
DISCOVERY WELL:	Tanami 1
Longitude (E):	115.5798
Latitude (S):	-20.6549
Date total depth reached:	08 JUL 91
Ground level:	5 m
Operator:	Hadson Aust Dev Pty Ltd
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 2
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Flag Fm
CONTENTS:	Oil
FORMATION:	Barrow Group
AGE:	Early Cretaceous
LITHOLOGY:	Sandstone
DEPTH (mSS):	1732 (Top)
REMARKS:	The oil may be gas-capped.
TEST DATA FROM THE DISCOVERY WELL (Tanami 1):	
RFT 1, 2180.5 m, recovered 2.1 L of oil and 7.7 L of filtrate.	Flag Sandstone.

ACCUMULATION:	BAMBRA
PRESENT OPERATOR:	Hadson Aust Dev Pty Ltd
TYPE:	Oil with gas cap
COMMERCIAL STATUS:	Non-commercial
LOCATION:	Approximately 115 km west northwest of Dampier and 25 km northeast of Barrow Island
STATE:	WA
PETROLEUM TITLES:	WA-192-P; TL/1
SUB-BASIN:	Barrow Sub-basin
DISCOVERY WELL:	Bambra 2
Longitude (E):	115.6008
Latitude (S):	-20.5456
Date total depth reached:	27 AUG 83
Water depth/ground level:	-26.3 m
Operator:	Aust Occidental Petroleum
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 3
STRUCTURE:	submarine fan mounding
AREAL CLOSURE:	11.0 sq km
VERTICAL CLOSURE:	24.0 m
RESERVOIR UNITS:	A total of 3 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Flag Fm
CONTENTS:	Oil with gas cap
FORMATION:	Barrow Group
AGE:	Early Cretaceous
LITHOLOGY:	Sandstone; massive, marine fan
DEPTH (mSS):	2000 (GOC)
POROSITY:	21 % in gas zone; 20 % in oil zone
PERMEABILITY:	850 mD in gas zone; 1650 mD in oil zone
PRODUCTION STATUS:	Undeveloped
REMARKS:	Only part of 4.5 m oil leg would be developed.

PETROLEUM-BEARING UNIT No 2:	Dingo Claystone
CONTENTS:	Gas
FORMATION:	Upper Dingo Claystone
AGE:	Middle Jurassic
LITHOLOGY:	Sandstone: deep marine
DEPTH (mSS):	3100 (Top)
POROSITY:	up to 21%
PERMEABILITY:	47-87 mD
PRODUCTION STATUS:	Undeveloped

PETROLEUM-BEARING UNIT No 3:	Dingo Claystone
CONTENTS:	Gas
FORMATION:	Upper Dingo Claystone
AGE:	Middle Jurassic
LITHOLOGY:	Sandstone: deep marine
DEPTH (mSS):	3607 (Top)
POROSITY:	Up to 21 %
PERMEABILITY:	47-87 mD
PRODUCTION STATUS:	Undeveloped

TEST DATA FROM THE DISCOVERY WELL (Bambra 2):	
DST 1, 2041.00-2049.00 m, Reverse circulation recovered 50bbls fm water/water cushion.	Flag Fm
DST 2, 2037.0-2038.5 m, flowed water/oil emulsion at 880 bbls/d and water at 1720 bbls/d.	Flag Fm
DST 3, 2032.0-2033.5 m, flowed oil at 262bbls/d and gas at .05 million m3/d.	Flag Fm
Repeat WT, 2030-2396 m.	Flag Fm
Repeat WT 1, 2032.5 m, recovered 10500cc of water.	Flag Fm
Repeat WT 2, 2030 m, recovered 0.38 m3 of gas and 1900cc of water with a trace of oil scum.	Flag Fm

Repeat WT 3, 2337 m, recovered .04 m3 of gas and 10300cc of water. Flag Fm

ACCUMULATION:	SPAR
PRESENT OPERATOR:	WAPET and Western Mining Corp
TYPE:	Gas
COMMERCIAL STATUS:	Non commercial
LOCATION:	50 km north-northwest of Barrow Island
STATE:	WA
PETROLEUM TITLES:	WA-4-R and WA 214-P
SUB-BASIN:	Barrow Sub-basin
DISCOVERY WELL:	Spar 1
Longitude (E):	114.8850
Latitude (S):	-20.6150
Date total depth reached:	02 SEP 76
Water depth/ground level:	-116 m
Operator:	WAPET
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	Anticline: large domal structure at top of Barrow Group
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Flacourt Fm
CONTENTS:	Gas
FORMATION:	Barrow Group
AGE:	Early Cretaceous
LITHOLOGY:	Sandstone
DEPTH (mSS):	2601 (Top)
POROSITY:	5-26 % with an average of 15 %
PERMEABILITY:	0.01-120 mD

TEST DATA FROM THE DISCOVERY WELL (Spar 1):	
WFT 4, 2615.5 m, unsuccessful test, recovered 0.425 L of muddy water.	Flacourt Fm
DST 4, 2621 m, flowed gas at 318000 m3/d and condensate at 42.26 m3/d with water.	Flacourt Fm
WFT 3, 2623 m, recovered 2.5 m3 of gas and 0.3 L of condensate/emulsion/muddy water.	Flacourt Fm
WFT 2, 2635 m, recovered 3.17 m3 of gas and 0.2 L of light straw condensate in 3.25l of condensate/emulsion.	Flacourt Fm
WFT 1, 2686.5 m, recovered 22 L of dark brown water	Flacourt Fm

WFT 15, 3273 m, recovered 0.22 m3 of gas and 9 L of mud.	Malouet Fm
DST 2A, 3289 m, misrun.	Malouet Fm
DST 2, 3289 m, misrun.	Malouet Fm
DST 3, 3289 m, flowed gas at 1690 m3/d with water	Malouet Fm
WFT 14, 3306 m, recovered 0.02 m3 of gas and 9.1 L of mud.	Malouet Fm
WFT 13, 3307 m, unsuccessful test, recovered 4.0 L of mud.	Malouet Fm
WFT 12, 3311 m, recovered 1.13 m3 of gas and 5.4 L of mud.	Malouet Fm
DST 1, 3402 m, unsuccessful test.	Malouet Fm
WFT 11, 3422 m, recovered 1.04 m3 of gas and 3.1 L of cloudy water.	Malouet Fm
WFT 9, 3527 m, seal failure, recovered 10.25 L of mud.	Malouet Fm
WFT 8, 3534.5 m, unsuccessful test, recovered 0.75 L of mud.	Malouet Fm
WFT 6, 3539 m, seal failed, recovered 10.25 L of mud.	Malouet Fm
WFT 7, 3540 m, seal failure, recovered 10.25 L of mud.	Malouet Fm
WFT 5, 3 668 m, seal failure, recovered 10.3 L mud	Malouet Fm

ACCUMULATION:	GRIFFIN/HILDA/RAMILLIES
PRESENT OPERATOR:	BHP Petroleum
TYPE:	Oil
COMMERCIAL STATUS:	Commercial
LOCATION:	96 km northeast of Exmouth
STATE:	WA
PETROLEUM TITLES:	WA-210-P
SUB-BASIN:	Barrow Sub-basin
DISCOVERY WELL:	Griffin 1
Longitude (E):	114.6200
Latitude (S):	-21.2356
Date total depth reached:	14 FEB 90
Water depth/ground level:	-136 m
Operator:	BHP Petroleum
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 7 Development: 2
STRUCTURE:	Anticlinal
RESERVOIR UNITS:	A total of 2 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Unknown Fm
FORMATION:	Top of Barrow Group
AGE:	Cretaceous
DEPTH (mSS):	2696 (OWC)
REMARKS:	This unit is the lower part of the Mardie/Barrow pool.
PETROLEUM-BEARING UNIT No 2:	Mardie Greensand Mbr
CONTENTS:	Oil
FORMATION:	Mardie Greensand
AGE:	Early Cretaceous
LITHOLOGY:	Sandstone
REMARKS:	This is the upper part of the Mardie/Barrow pool. Hilda-1A is the actual, original discovery well.

TEST DATA FROM THE DISCOVERY WELL (Griffin 1):	
RFT 4, 601.3 m, recovered a trace of gas, 0.005 L of oil and 9.6 L of water (2.75 gallon chamber).	Mardie Greensand
RFT 1, 2606 m, recovered 757.47 L (26.75 cu ft) of gas, 1.75 L of oil (53.8 deg. API) and 12.5 L of water (6.00 gallon chamber).	Mardie Greensand

RFT 4, 2624.3 m, recovered 42.47 L (1.5 cu ft) of gas, 0.6 L of oil (48.5 deg. API) and 21 L of water (6.00 gallon chamber, 8 m in the Mardie Greensand and 10 m in the Barrow Gp).	Barrow Gp/Mardie Greensand
RFT 3, 2636.9 m, recovered 67.96 L (2.4 cu ft) of gas, 0.8 L of oil (52 deg. API) and 8.6 L of water (2.75 gallon chamber).	Barrow Gp
RFT 2, 2639.8 m, recovered 376.61 L (13.3 cu ft) of gas, 5 L of oil (54.7 deg. API) and 3.85 L of water (2.75 gallon chamber).	Barrow Gp
DST 1, 2656.5 m, flowed 881.43 m3/d (5544 bbls) of oil through a 3/4 inch choke (55.2 deg. API).	Barrow Gp
RFT 1, 2686.8 m, recovered 379.45 L (13.4 cu ft) of gas, 6.9 L of oil (54 deg. API) and 0.9 L of water (2.75 gallon chamber).	Barrow Gp
RFT 7, 2700.4 m, recovered 23.7 L (0.84 cu ft) of gas and 22 L of water (6 gallon chamber).	Barrow Gp
RFT 7, 2700.4 m, recovered 3.96 L (0.14 cu ft) of gas, a trace of oil and 9 L of water (2.75 gallon chamber).	Barrow Gp
RFT 6, 2749.3 m, recovered 2.55 L (0.09 cu ft) of gas and 22 L of water (6 gallon chamber).	Barrow Gp
DST 2, flowed 294 m3/d (1 850 bbls) of oil (55.3 deg. API) through a 40/64 inch choke.	Barrow Gp

ACCUMULATION:	CHINOOK/SCINDIAN
PRESENT OPERATOR:	BHP Petroleum
TYPE:	Oil with gas cap
COMMERCIAL STATUS:	Commercial
LOCATION:	90 km southwest of Barrow Island, and 78 km northwest of Onslow
STATE:	WA
PETROLEUM TITLES:	WA-210-P
SUB-BASIN:	Barrow Sub-basin
DISCOVERY WELL:	Chinook 1
Longitude (E):	114.6966
Latitude (S):	-21.1701
Date total depth reached:	27 JUN 89
Water depth/ground level	-125 m
Operator:	BHP Petroleum
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 4
STRUCTURE:	Anticlinal
RESERVOIR UNITS:	A total of 2 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Mardie Greensand Mbr
CONTENTS:	Gas-capped gas
FORMATION:	Mardie Greensand
AGE:	Cretaceous
REMARKS:	This unit is the upper part of the Mardie/Flacourt pool.
PETROLEUM-BEARING UNIT No 2:	Flacourt Fm
CONTENTS:	Oil with gas cap
FORMATION:	Flacourt Fm
AGE:	Early Cretaceous
LITHOLOGY:	Sandstones
REMARKS:	This unit is the lower part of the Mardie/Flacourt pool

TEST DATA FROM THE DISCOVERY WELL (Chinook 1):	
RFT 2, 2560.5 m, recovered 1.34 m3 gas, 1.65 L oil (52.3 deg. API) and 11.1 L water (6 gallon chamber).	Barrow Gp
RFT 3, 2614.3 m, recovered 2.19 m3 gas, 0.9 L cond, and 8 L water.	Barrow Gp

DST 2A, 2627 m, flowed 274 bbls/d of condensate (61 deg. API) and 121762 m3/d(4.3 million scf/d) of gas through a 56/64 in choke.	Barrow Gp
DST 2B, 2627 m, inconclusive due to mechanical problems.	Barrow Gp
RFT 2, 2653.5 m, recovered 0.23 m3 gas, 0.6 L oil (52.3 deg. API) and 1.60 L water (1 gallon chamber).	Barrow Gp
DST 1, 2659 m, flowed 6416 bbls/d oil (52.3 deg. API) and 118930 m3/d (4.2 million scf/d) of gas through a 56/64 in choke.	Barrow Gp
RFT 1, 2668 m, recovered 1.24 m3 gas, 10.15 L oil (52.3 deg. API)and 6.35 L of water (6 gallon chamber).	Barrow Gp

ACCUMULATION:	ROLLER
PRESENT OPERATOR:	WAPET
TYPE:	Oil with gas cap
COMMERCIAL STATUS:	Non commercial
LOCATION:	6 km offshore of the Ashburton River and 20 km south of the Saladin field
STATE:	WA
PETROLEUM TITLES:	WA-TP-3
SUB-BASIN:	Barrow Sub-basin
DISCOVERY WELL:	Roller 1
Longitude (E):	114.9260
Latitude (S):	-21.6350
Date total depth reached:	19 JAN 90
Water depth/ground level:	-11 m
Operator:	WAPET
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 4
STRUCTURE:	Large faulted anticline
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)

PETROLEUM-BEARING UNIT No 1:	Barrow Group
CONTENTS:	Oil with gas cap
FORMATION:	Flacourt Fm
AGE:	Early Cretaceous
LITHOLOGY:	Deltaic sandstones with some carbonate cementation
DEPTH (mSS):	891 (OWC)
POROSITY:	27 %
REMARKS:	GOC = 874 mSS

TEST DATA FROM THE DISCOVERY WELL (Roller 1):	
SFT, 904.6 m, recovered 0.56 m3 (19.95 cu ft) gas with 0.15 L of filtrate.	Flacourt Fm
DST 1, 910.5 m, flowed 866.48 m3/d (5 450 bbls) of oil and 29300 m3/d (1.04 million cu ft/d) of gas through a 80/64 inch choke.	Flacourt Fm

ACCUMULATION:	SKATE
PRESENT OPERATOR:	WAPET
TYPE:	Oil with gas cap
COMMERCIAL STATUS:	Non commercial
LOCATION:	6 km to the northeast of Roller 1
STATE:	WA
PETROLEUM TITLES:	WA-TP/3
SUB-BASIN:	Barrow Sub-basin
DISCOVERY WELL:	Skate 1
Longitude (E):	114.9788
Latitude (S):	-21.5983
Date total depth reached:	18 NOV 91
Water depth/ground level:	-9 m
Operator:	WAPET
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	Faulted anticline
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)

PETROLEUM-BEARING UNIT No 1:	Flacourt Fm
CONTENTS:	Oil and gas
FORMATION:	Barrow Group
AGE:	Early Cretaceous
LITHOLOGY:	Sandstones: fine to coarse interbedded with shales and carbonate cemented sands
DEPTH (mSS):	898 (OWC)
POROSITY:	27 %
REMARKS:	GOC = 890 mSS

TEST DATA FROM THE DISCOVERY WELL (Skate 1):	
DST, flowed 172 m3/d of gas and 1082 bbls/d of 31 deg. API oil	Flacourt Fm
RFT, 915.3 m, recovered 4.5 L mud filtrate with a trace of gas and oil.	Flacourt Fm
RFT, 917 m, recovered 0.8 cf of gas, 2.75 L of mud/mud filtrate and a trace of oil.	Flacourt Fm
RFT, 920 m, recovered 8 L of 31.4 deg. API oil	Flacourt Fm

ACCUMULATION:	SOUTH CHERVIL
PRESENT OPERATOR:	Wesminco Oil P/L
TYPE:	Oil and gas
COMMERCIAL STATUS:	Commercial
LOCATION:	Mid-way between Barrow Island and Onslow
STATE:	WA
PETROLEUM TITLES:	WA-149-P
SUB-BASIN:	Barrow Sub-basin
DISCOVERY WELL:	South Chervil 1
Longitude (E):	115.2033
Latitude (S):	-21.3444
Date total depth reached:	20 NOV 83
Water depth/ground level:	-16 m
Operator:	Wesminco Oil P/L
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	Crest of dome on the Chervil structure
RESERVOIR UNITS:	A total of 2 petroleum-bearing unit(s)
PRODUCING UNITS:	A total of 2 petroleum producing unit(s)
PETROLEUM-BEARING UNIT No 1:	Mardie Greensand Mbr
CONTENTS:	
FORMATION:	Muderong Shale
AGE:	Early Cretaceous
LITHOLOGY:	Sandstone: claystone and glauconitic sandstone
DEPTH (mSS):	986 (Top)
PERMEABILITY:	0.1-30 mD
REMARKS:	This unit is the upper part of the Mardie/Flacourt pool.
PETROLEUM-BEARING UNIT No 2:	Flacourt Formation Unit 'A'
CONTENTS:	Oil with gas cap
FORMATION:	Barrow Group
AGE:	Early Cretaceous
LITHOLOGY:	Sandstone with some siltstone and silty coal
DEPTH (mSS):	1013 (Top)
POROSITY:	29-22 %
PERMEABILITY:	Maximum of 10,000 mD
REMARKS:	This unit is the lower part of the Mardie/Flacourt pool.

TEST DATA FROM THE DISCOVERY WELL (South Chervil 1):

Repeat WT, 1016.5 m.	Flacourt Fm
DST 4, 1025 m, flowed gas at 4.2 M m3/d.	Flacourt Fm
DST 3, 1030.5 m, recovered 1.5 bbls mud.	Flacourt Fm
Repeat WT 2, 1050.3 m, recovered 7900 cc oil, (44 deg. API at 76 °F) 0.26 m3 of gas and 2600 cc water.	Flacourt Fm
DST 2, 1050.5 m, flowed oil at 1493 bbls/d and gas at 0.034 million m3/d.	Flacourt Fm
DST 1, 1053.5 m, flowed water at a max. rate of 58 bbls/d.	Flacourt Fm

ACCUMULATION:	ELDER
PRESENT OPERATOR:	Wesminco Oil P/L
TYPE:	Gas
COMMERCIAL STATUS:	Non-commercial
LOCATION:	60 km northeast of Onslow, and 1 km south-southeast of Chervil
STATE:	WA
PETROLEUM TITLES:	WA-149-P
SUB-BASIN:	Barrow Sub-basin
DISCOVERY WELL:	Elder 1
Longitude (E):	115.2314
Latitude (S):	-21.3121
Date total depth reached:	29 MAY 85
Water depth/ground level:	-15 m
Operator:	Wesminco Oil P/L
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1 Development: 1
STRUCTURE:	Tilted Triassic fault block bounded by the north-northeast to south-southwest trending down-to-the-basin Chervil Fault, on the basinward edge of the Flinders Fault zone
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PETROLEUM-BEARING UNI No 1:	Mungaroo Fm
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Anisian-Norian
LITHOLOGY:	Sandstone: minor siltstone, claystone and shale
DEPTH (mSS):	1729 (Top)
POROSITY:	11 %
TEST DATA FROM THE DISCOVERY WELL (Elder 1):	
RFT, 1719.5 m, 3 samples 44 pressure measurements.	Unknown Fm
DST 1, 1779 m, flowed gas at 243526 m3/d (8.77 million cfd) through a 1/2 inch choke at 1833 psi. The condensate/gas ratio was 18.9 bbls/million cfd.	Mungaroo Fm

ACCUMULATION:	BOWERS
PRESENT OPERATOR:	BHP Petroleum
TYPE:	Gas
COMMERCIAL STATUS:	Other discoveries
LOCATION:	14 km northeast of Hilda 1A
STATE:	WA
PETROLEUM TITLES:	WA-210-P
SUB-BASIN:	Barrow Sub-basin
DISCOVERY WELL:	Bowers 1
Longitude (E):	114.7150
Latitude (S):	-21.1039
Date total depth reached:	14 AUG 82
Water depth/ground level:	-133 m
Operator:	WAPET
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	Elongate, tilted Triassic fault block on the eastern flank of the Alpha Arch
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Mungaroo Fm
CONTENTS:	
FORMATION:	Mungaroo Fm
AGE:	Triassic
LITHOLOGY:	Sandstone: fluvial with shale, claystone, siltstone and thin beds of coal
DEPTH (mSS):	3905 (Top)
POROSITY:	14 % average
TEMPERATURE (C):	3.8 C/100 m

TEST DATA FROM THE DISCOVERY WELL (Bowers 1):	
RFT, 3952.5 m, recovered 0.82 m3 (29 cu ft) gas and 300 m3 filtrate with a film of condensate.	Mungaroo Fm
RFT, 4032.5 m, recovered 1.98 m3 (70 cu ft) of gas and 1900 m3 of filtrate with a film of condensate.	Mungaroo Fm
RFT, 3 runs, 57 attempted pressure measurements, 2 samples (3 952.5 m, 4 032.5 m).	Mungaroo Fm

ACCUMULATION:	FLINDERS SHOAL
PRESENT OPERATOR:	WAPET
TYPE:	Gas
COMMERCIAL STATUS:	Other discoveries
LOCATION:	Offshore, southeast of Pasco Island
STATE:	WA
PETROLEUM TITLES:	WA-23-P
SUB-BASIN:	Barrow Sub-basin
DISCOVERY WELL:	Flinders Shoal 1
Longitude (E):	115.5217
Latitude (S):	-21.0711
Date total depth reached:	09 JUL 69
Water depth/ground level:	-15 m
Operator:	WAPET
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	Flinders Shoal anticline
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)

PETROLEUM-BEARING UNIT No 1:	Birdrong Sandstone
CONTENTS:	Gas
FORMATION:	Birdrong Sandstone
AGE:	Early Cretaceous
LITHOLOGY:	Sandstone
DEPTH (mSS):	761 (Top)

TEST DATA FROM THE DISCOVERY WELL (Flinders Shoal 1):	
DST 1, 792 m, misrun.	Birdrong Sst
DST 1A, 792 m, flowed gas at 2.38 million cu ft/d and recovered 0.5 bbl oil (23 deg. API) and no water.	Birdrong Sst

ACCUMULATION:	PEPPER
PRESENT OPERATOR:	WAPET
TYPE:	Gas
COMMERCIAL STATUS:	Other discoveries
LOCATION:	10 km south of the Pasco accumulation, 50 km offshore
STATE:	WA
PETROLEUM TITLES:	WA-23-P
SUB-BASIN:	Barrow Sub-basin
DISCOVERY WELL:	Pepper 1
Longitude (E):	115.3011
Latitude (S):	-21.0578
Date total depth reached:	03 MAY 70
Water depth/ground level:	-9 m
Operator:	WAPET
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	Large, low relief structural culmination along the southeast extension of the large Barrow Island structural complex
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Flacourt Fm
CONTENTS:	Gas
FORMATION:	Barrow Group
AGE:	Neocomian
LITHOLOGY:	Sandstone
DEPTH (mSS):	317 (Top)

TEST DATA FROM THE DISCOVERY WELL (Pepper 1):	
WFT 8, 1259 m, misrun.	
WFT 9, 1259 m, recovered 1.90 m3 of gas and 36 cc of condensate.	Flacourt Fm
WFT 4, 2504 m, no seal	
WFT 7, 2506 m, tight test	
WFT 3, 2506 m, tool failed	
WFT 2, 2570 m, no seal	
WFT 5, 2571 m, no seal	
WFT 1, 2572 m, no seal	
WFT 6, 2573 m, no seal	

ACCUMULATION:	PASCO
PRESENT OPERATOR:	WAPET
TYPE:	Oil and gas
COMMERCIAL STATUS:	Non-commercial
LOCATION:	Boodie Island,approximately 10km west south of Barrow Island
STATE:	WA
PETROLEUM TITLES:	EP-61
SUB-BASIN:	Barrow Sub-basin
DISCOVERY WELL:	Pasco 1
Longitude (E):	115.3250
Latitude (S):	-20.9719
Date total depth reached:	25 MAY 67
Water depth/ground level:	7.6 m
Operator:	WAPET
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 4
STRUCTURE:	Anticline
RESERVOIR UNITS:	A total of 5 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	5200 ft sand
CONTENTS:	Gas
FORMATION:	Malouet Fm
AGE:	Early Cretaceous
LITHOLOGY:	Sandstone; massive, marine fan
DEPTH (mSS):	1575.2 (top)
REMARKS:	Gas reservoir, produced at 1.75 million cfd from interval 1575.2-1585.5m in Pasco 1.
PETROLEUM-BEARING UNIT No 2:	5700 ft sand
CONTENTS:	Oil and gas
FORMATION:	Malouet Fm
AGE:	Early Cretaceous
LITHOLOGY:	Sandstone; massive, marine fan
DEPTH (mSS):	1734 (GOC)
REMARKS:	Four drill stem tests in Pasco 1 produced oil at 449 bbls/d and gas at 3 million cfd.

PETROLEUM-BEARING UNIT No 3:	5980 ft sand
CONTENTS:	Oil
FORMATION:	Malouet Fm
AGE:	Early Cretaceous
LITHOLOGY:	Sandstone; massive, marine fan
DEPTH (mSS):	1820 (top)
REMARKS:	Drill stem test in Pasco 3 produced oil at 90 bbls/d
PETROLEUM-BEARING UNIT No 4:	6000 ft sand
CONTENTS:	Oil
FORMATION:	Malouet Fm
AGE:	Early Cretaceous
LITHOLOGY:	Sandstone; massive, marine fan
DEPTH (mSS):	1826 (top)
REMARKS:	Oil produced at 615 bbls/d from Pasco 1.
PETROLEUM-BEARING UNIT No 5:	7300 ft sand
CONTENTS:	Gas
FORMATION:	Malouet Fm
AGE:	Early Cretaceous
LITHOLOGY:	Sandstone; massive, marine fan
DEPTH (mSS):	2240 (GWC)
REMARKS:	Gas produced at 1.8 million cfd from Pasco 3.

TEST DATA FROM THE DISCOVERY WELL (Pasco 1):	
Produced gas at 1.75 million cfd from the interval 1575.2-1585.5 m (5200 ft sand).	Malouet Fm
Four DSTs produced oil at 449 bbls/d and gas at 3 million cfd from the 5700 ft sand	Malouet Fm
Oil produced at 615 bbls/d from the 6000 ft sand.	Malouet Fm

ACCUMULATION:	BASIL
PRESENT OPERATOR:	Western Mining Corp
TYPE:	Oil with gas cap
COMMERCIAL STATUS:	Other discoveries
LOCATION:	35 km north-northeast of Onslow and 4 km north of the South Chervil accumulation
STATE:	WA
PETROLEUM TITLES:	WA-149-P
SUB-BASIN:	Barrow Sub-basin
DISCOVERY WELL:	Basil 1
Longitude (E):	115.1933
Latitude (S):	-21.3103
Date total depth reached:	23 DEC 83
Water depth/ground level:	-16 m
Operator:	Western Mining Corp Ltd
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	Downthrown side of Airlie Fault
RESERVOIR UNITS:	A total of 2 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Mardie Greensand Mbr
CONTENTS:	Oil with gas cap
FORMATION:	Muderong Shale
AGE:	Early Cretaceous
LITHOLOGY:	Sandstone: greensand
DEPTH (mSS):	1195 (Top)
REMARKS:	This is the upper part of the Mardie/Flacourt pool.
PETROLEUM-BEARING UNIT No 2:	Flacourt Fm
CONTENTS:	Oil with gas cap
FORMATION:	Barrow Group
AGE:	Early Cretaceous
LITHOLOGY:	Sandstone
DEPTH (mSS):	1196 (Top)
REMARKS:	This is the lower part of the Mardie/Flacourt pool.
TEST DATA FROM THE DISCOVERY WELL (Basil 1):	
Repeat WT, 1203.5 m.	Flacourt Fm
Repeat WT, 6/2, 1217 m, recovered 10 300 cc of water	Flacourt Fm

Repeat WT, 1/2, 1226.3 m, recovered trace of oil and 2100 cc of water.	Flacourt Fm
Repeat WT, 5/2, 1226.4 m, recovered 80 cc of oil, 7000 cc of water and trace of gas	Flacourt Fm
Repeat WT, 2/2, 1227.6 m, recovered 200 cc of water and 0.39 m3 gas.	Flacourt Fm
Repeat WT, 4/2, 1229 m, recovered 9500 cc of water and of trace gas.	Flacourt Fm
Repeat WT, 3/2, 1230.5 m, recovered 500 cc of water and trace of gas.	Flacourt Fm

ACCUMULATION:	KOOLINDA
PRESENT OPERATOR:	WAPET
TYPE:	Gas
COMMERCIAL STATUS:	Other discoveries
LOCATION:	8 km north of Thevenard Island
STATE:	WA
PETROLEUM TITLES:	WA-24-P; TP/7
SUB-BASIN:	Barrow Sub-basin
DISCOVERY WELL:	Koolinda 1
Longitude (E):	115.0537
Latitude (S):	-21.3960
Date total depth reached:	02 APR 78
Water depth/ground level:	-18 m
Operator:	WAPET
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	Flinders Fault System; rollover on downthrown side has closure
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)

PETROLEUM-BEARING UNIT No 1:	Dupuy Sandstone
CONTENTS:	Gas
FORMATION:	Upper Dingo Claystone
AGE:	Late Jurassic
LITHOLOGY:	Sandstone
DEPTH (mSS):	1826 (Top)
PERMEABILITY:	Low

TEST DATA FROM THE DISCOVERY WELL (Koolinda 1):	
DST 4A, 2098 m, no formation fluids recovered.	Dupuy Sandstone
DST 4, 2098 m, no formation fluids recovered.	Dupuy Sandstone
DST 3, 2155 m, recovered 7 bbls of mud, slightly gas cut at the top.	Dupuy Sandstone
WFT 3, 2193 m, recovered 9900 cc of water and 0.092 m3 of gas with a scum of condensate.	Dupuy Sandstone
DST 2A, 2198 m, recovered 300 m of slightly gas cut mud.	Dupuy Sandstone
DST 2, 2201 m, no formation fluids recovered.	Dupuy Sandstone

WFT 2, 2252 m, recovered 7000 cc of water, 0.314 m3 of gas and 200 cc of condensate/oil	Dupuy Sandstone
DST 1B, 2258.5 m, recovered 190 m mud.	Dupuy Sandstone
DST 1A, 2258.5 m, no formation fluids recovered.	Dupuy Sandstone
DST 1, 2 259.5 m, no formation fluids recovered	Dupuy Sandstone
WFT 1A, 2284 m, recovered shot gas only, dry test.	Dupuy Sandstone
WFT 1, 2297 m, recovered 9400 cc of water and 0.092 m3 of gas with a scum of condensate.	Dupuy Sandstone

ACCUMULATION:	FLAG
PRESENT OPERATOR:	WAPET
TYPE:	Gas
COMMERCIAL STATUS:	Other discoveries
LOCATION:	30 km north of Barrow Island
STATE:	WA
PETROLEUM TITLES:	WA-23-P
SUB-BASIN:	Barrow Sub-basin
DISCOVERY WELL:	Flag 1
Longitude (E):	115.6456
Latitude (S):	-20.4653
Date total depth reached:	30 JAN 70
Water depth/ground level:	-37 m
Operator:	WAPET
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Windalia Sandstone
CONTENTS:	Gas
FORMATION:	Upper Muderong Shale
AGE:	Early Cretaceous
DEPTH (mSS):	1225 (Top)

TEST DATA FROM THE DISCOVERY WELL (Flag 1):	
DST 1, 1270 m, recovered dry gas (approx. 1 thousand cu ft) and gas cut mud with a slight trace of distillate.	Windalia Sandstone
DST 5A, 2734 m, recovered 137 m of salt water.	
DST 5, 2734 m, misrun.	
DST 4, 2871 m, recovered 44 m of salt water.	
DST 3, 2871 m, recovered 9 m of salt water.	
DST 2, 2902 m, recovered 18 m very salty salt water.	

ACCUMULATION:	ROSILY
PRESENT OPERATOR:	WAPET
TYPE:	Gas
COMMERCIAL STATUS:	Other discoveries
LOCATION:	60 km southwest of Barrow Island oil field
STATE:	WA
PETROLEUM TITLES:	
SUB-BASIN:	Barrow Sub-basin
DISCOVERY WELL:	Rosily 1A
Longitude (E):	114.8669
Latitude (S):	-21.2022
Date total depth reached:	03 MAY 82
Water depth/ground level:	-100 m
Operator:	WAPET
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Malouet Fm
CONTENTS:	Gas
FORMATION:	Malouet Fm
AGE:	Early Cretaceous
LITHOLOGY:	Sandstone
DEPTH (mSS):	2923.5 (Top)
TEST DATA FROM THE DISCOVERY WELL (Rosily 1A):	
RFT, 2068 m, recovered 400 cc of mud filtrate.	Flacourt Fm
RFT, 2945.5 m, recovered 400 mls mud filtrate and 0.9 cu ft of gas.	Malouet Fm

ACCUMULATION:	ROUGH RANGE
PRESENT OPERATOR:	Ampolex (PPL) P/L
TYPE:	Oil
COMMERCIAL STATUS:	Non commercial
LOCATION:	117 km southwest of Barrow Island
STATE:	WA
PETROLEUM TITLES:	WA-EP-41
SUB-BASIN:	Exmouth Sub-basin
DISCOVERY WELL:	Rough Range 1
Longitude (E):	114.0833
Latitude (S):	-22.4200
Date total depth reached:	08 MAY 56
Water depth/ground level:	57.9 m
Operator:	WAPET
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 11
STRUCTURE:	Anticline: enechelon folds
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PRODUCTION:	Oil: commenced in JAN 55
INFRASTRUCTURE:	Rough Range 1A produced oil again in 1986 over a short period. The oil was trucked to the Kwinana refinery south of Perth

PETROLEUM-BEARING UNIT No 1:	Birdrong Sandstone
CONTENTS:	Oil
FORMATION:	Birdrong Sandstone
AGE:	Early Cretaceous
LITHOLOGY:	Sandstone: quartzose; greensand
DEPTH (mSS):	1098 (Top)
POROSITY:	28 %
REMARKS:	Carried out an extended production test.

TEST DATA FROM THE DISCOVERY WELL (Rough Range 1):	
DST 1, 1098.8-1101.8m, flowed 555 bbls/d of 39.6 deg. API oil on a 1/4 inch choke.	Birdrong Sandstone

ACCUMULATION:	PARROT HILL
PRESENT OPERATOR:	Ampol Explor Ltd
TYPE:	Oil
COMMERCIAL STATUS:	Non commercial
LOCATION:	9 km southwest of the Rough Range accumulation
STATE:	WA
PETROLEUM TITLES:	WA-EP-41
SUB-BASIN:	Exmouth Sub-basin
DISCOVERY WELL:	Parrot Hill 1
Longitude (E):	114.0461
Latitude (S):	-22.4889
Date total depth reached:	30 AUG 87
Ground level:	82 m
Operator:	Ampol Explor Ltd
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	Elongated anticline
AREAL CLOSURE:	0.5 sq km
VERTICAL CLOSURE:	31.0 m
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)

PETROLEUM-BEARING UNIT No 1:	Birdrong Sandstone
CONTENTS:	Oil
FORMATION:	Birdrong Sandstone
AGE:	Cretaceous
LITHOLOGY:	Sandstone: glauconitic
DEPTH (mSS):	1053 (Top)
POROSITY:	10-26 %; average 17 %
PERMEABILITY:	< 50 mD

TEST DATA FROM THE DISCOVERY WELL (Parrot Hill 1):	
DST 2, 1128-1135 m, recovered 16.84 bbls of water and 0.28 bbls of oil.	Muderong Shale.
DST 1, 1139-1142 m, recovered 8.46 bbls of oil and water.	Birdrong Sandstone.
DST 3, 1139-1143.5 m, recovered 11.6 bbls of oil and water.	Birdrong Sandstone.

ACCUMULATION:	NOVARA
PRESENT OPERATOR:	BHP Petroleum
TYPE:	Oil
COMMERCIAL STATUS:	Non commercial
LOCATION:	50 km north-northwest of North West Cape
STATE:	WA
PETROLEUM TITLES:	WA-155-P
SUB-BASIN:	Exmouth Sub-basin
DISCOVERY WELL:	Novara 1
Longitude (E):	114.0751
Latitude (S):	-21.3572
Date total depth reached:	25 OCT 82
Water depth/ground level:	-372 m
Operator:	Esso Explor and Prod Aus
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	Domal anticline: low relief, faulted
AREAL CLOSURE:	11.5 sq km
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Upper Barrow Group
CONTENTS:	Oil
FORMATION:	Barrow Group
AGE:	Neocomian
LITHOLOGY:	Sandstone interbedded with siltstone
DEPTH (mSS):	1270 (OWC)
POROSITY:	29 %; maximum 33 %
PERMEABILITY:	Maximum 318 mD
REMARKS:	14 °API crude

TEST DATA FROM THE DISCOVERY WELL (Novara 1):	
Repeat WT, 1246 m, 5 runs.	Barrow Gp
Production test 1, 1271 m, oil flowed at 33 bbls/d (16.7 deg. API at 60 °F).	Barrow Gp
Repeat WT 22, 1278 m, recovered film of oil, 0.0014 m3 of gas and 0.75 L filtrate.	Barrow Gp
Repeat WT 1, 1290.5 m, recovered film of oil and 22.0 L of filtrate.	Barrow Gp
Repeat WT 11, 1301.5 m, recovered 0.0008 m3 of gas and 10 L of filtrate.	Barrow Gp
Repeat WT 3, 1305.5 m, recovered film of oil, 0.0008 m3 of gas and 22 L of filtrate.	Barrow Gp

ACCUMULATION:	LEATHERBACK
PRESENT OPERATOR:	Lasmo Oil Co Aust Ltd
TYPE:	Oil
COMMERCIAL STATUS:	Non commercial
LOCATION:	30 km north-east of the town of Exmouth
STATE:	WA
PETROLEUM TITLES:	WA-EP-342
SUB-BASIN:	Exmouth Sub-basin
DISCOVERY WELL:	Leatherback 1
Longitude (E):	114.3652
Latitude (S):	-21.6855
Date total depth reached:	21 JUN 91
Water depth/ground level:	-13 m
Operator:	Lasmo Oil Co Aust Ltd
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Mungaroo Fm
CONTENTS:	Oil
FORMATION:	Mungaroo Fm
AGE:	Late Triassic
LITHOLOGY:	Sandstone
TEST DATA FROM THE DISCOVERY WELL (Leatherback 1):	
DST 1, 1751.3-1752.5 m, flowed gas at a rate of 377 m3/d and 41 deg. API oil at a rate of 2377 bbls/d through a variable choke.	Mungaroo Fm

ACCUMULATION:	CAPE RANGE
PRESENT OPERATOR:	Ampolex (PPL) P/L
TYPE:	Gas
COMMERCIAL STATUS:	Other discoveries
LOCATION:	23 km southwest of Exmouth
STATE:	WA
PETROLEUM TITLES:	EP-41
SUB-BASIN:	Exmouth Sub-basin
DISCOVERY WELL:	Cape Range 2
Longitude (E):	113.9947
Latitude (S):	-22.0972
Date total depth reached:	14 APR 56
Water depth/ground level:	0 m
Operator:	WAPET
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 2
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)

PETROLEUM-BEARING UNIT No 1:	Upper Dingo Claystone
CONTENTS:	Gas
FORMATION:	Dingo Claystone
AGE:	Jurassic
DEPTH (mSS):	2967 (Top)

TEST DATA FROM THE DISCOVERY WELL (Cape Range 2):	
DST 10, 2967-3078m, flowed gas at 34 million scf/d.	Dingo Claystone

ACCUMULATION:	RIVOLI
PRESENT OPERATOR:	Minora Resources
TYPE:	Gas
COMMERCIAL STATUS:	Other discoveries
LOCATION:	6 km southeast of Exmouth
STATE:	WA
PETROLEUM TITLES:	WA-EP-325
SUB-BASIN:	Exmouth Sub-basin
DISCOVERY WELL:	Rivoli 1
Longitude (E):	114.1802
Latitude (S):	-21.9827
Date total depth reached:	06 SEP 89
Water depth/ground level:	-19 m
Operator:	Minora Resources
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	Anticlinal closure
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Birdrong Sandstone
CONTENTS:	Gas
FORMATION:	Birdrong Sandstone
AGE:	Early Cretaceous
LITHOLOGY:	Sandstone: channel sands with fining upward sequences
DEPTH (mSS):	1880 (Top)
POROSITY:	19 % average
PERMEABILITY:	824 mD average

TEST DATA FROM THE DISCOVERY WELL (Rivoli 1):	
DST 1, 1915.5 m, flowed 0.6 m3/d (20.7 cu ft) of gas and 17 L mud filtrate.	Birdrong Sst
DST 2, 1919.3 m, recovered 20 L of mud filtrate and scum of possible condensate.	Birdrong Sst

ACCUMULATION:	SCARBOROUGH
PRESENT OPERATOR:	Esso Explor and Prod Aust Ltd
TYPE:	Gas
COMMERCIAL STATUS:	Non commercial
LOCATION:	Exmouth Plateau 55 km northeast of Investigator 1
STATE:	WA
PETROLEUM TITLES:	WA-1-R
SUB-BASIN:	Exmouth Plateau
DISCOVERY WELL:	Scarborough 1
Longitude (E):	113.1457
Latitude (S):	-19.8850
Date total depth reached:	13 DEC 79
Water depth/ground level:	-949 m
Operator:	Esso Explor and Prod Aus
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	Simple, low relief anticline
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Barrow Group
CONTENTS:	Gas
FORMATION:	Barrow Group
AGE:	Berriasian
LITHOLOGY:	Sandstone: thick, mass flow sand sequence
DEPTH (mSS):	1857 (Top)
POROSITY:	6-31 % with average of 23 %
REMARKS:	The gas is dry.

TEST DATA FROM THE DISCOVERY WELL (Scarborough 1):	
Repeat WT, 1844 m, 2 runs.	Barrow Group
Repeat WT 20, 1904.5 m, run 2, recovered 5219.2 L of gas and 250 cc of mud.	Barrow Group

ACCUMULATION:	OUTTRIM
PRESENT OPERATOR:	BHP Petroleum
TYPE:	Oil
COMMERCIAL STATUS:	Other discoveries
LOCATION:	50 km northwest of Onslow
STATE:	WA
PETROLEUM TITLES:	WA-155-P
SUB-BASIN:	Exmouth Sub-basin
DISCOVERY WELL:	Outtrim 1
Longitude (E):	114.4507
Latitude (S):	-21.5313
Date total depth reached:	02 JUL 84
Water depth/ground level:	-91 m
Operator:	Esso Explor and Prod Aus
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	Rotated fault block
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)

PETROLEUM-BEARING UNIT No 1:	Upper Barrow Group
CONTENTS:	Oil
FORMATION:	Barrow Group
AGE:	Neocomian
LITHOLOGY:	Sandstone interbedded with siltstone
DEPTH (mSS):	1258 (Top)
POROSITY:	19 % maximum
PERMEABILITY:	100 mD maximum
REMARKS:	40 to 45 °API crude

TEST DATA FROM THE DISCOVERY WELL (Outtrim 1):	
Repeat WT, 1287 m, 4 runs.	Barrow Gp
Repeat WT 15, 1291 m, run 2, recovered 0.75 L of oil, 0.12 m3 gas and 8 L of filtrate.	Barrow Gp
Repeat WT 25, 1293 m. run 3, recovered 11.65 L of oil, 0.31 m3 gas and 7.6 L of filtrate.	Barrow Gp
Repeat WT 1, 1299.5 m, Run 1 recovered 17.9 L of oil, 1.45 m3 of gas and 10.8 L of filtrate.	Barrow Gp

ACCUMULATION:	INVESTIGATOR
TYPE:	Gas
COMMERCIAL STATUS:	Other discoveries
LOCATION:	191 km west-northwest of Muiron 2 on the Exmouth Plateau
STATE:	WA
PETROLEUM TITLES:	(Vacant)
SUB-BASIN:	Exmouth Plateau
DISCOVERY WELL:	Investigator 1
Longitude (E):	112.9710
Latitude (S):	-20.3520
Date total depth reached:	12 JUL 79
Water depth/ground level:	-841 m
Operator:	Esso Explor and Prod Aus
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	Broad, north-northeast trending anticline
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Mungaroo Fm
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Norian
LITHOLOGY:	Sandstone
DEPTH (mSS):	3353 (Top)

TEST DATA FROM THE DISCOVERY WELL (Investigator 1):	
Repeat WT, 1375.5 m, 6 runs.	Mungaroo Fm
WFT 2, 3407.5 m, recovered .014 m3 of gas and 11000 cc of filtrate.	Mungaroo Fm
WFT 4, 3407.5 m, recovered .03 m3 of gas and 6500 cc of filtrate.	Mungaroo Fm
Repeat WT 38, 3417.3 m, run 2, recovered 0.04 m3 of gas and 13000 cc of filtrate.	Mungaroo Fm
WFT 3, 3 591.5 m, recovered .014 m3 gas and 3800 cc filtrate	Mungaroo Fm
WFT 1, 3711.6 m, recovered 200 cc of filtrate.	Mungaroo Fm

ACCUMULATION:	JUPITER
TYPE:	Gas
COMMERCIAL STATUS:	Other discoveries
LOCATION:	Central Exmouth Plateau
STATE:	WA
PETROLEUM TITLES:	(Vacant)
SUB-BASIN:	Exmouth Plateau
DISCOVERY WELL:	Jupiter 1 (Phillips)
Longitude (E):	113.5328
Latitude (S):	-19.5814
Date total depth reached:	14 OCT 79
Water depth/ground level:	-961 m
Operator:	Phillips Aust Oil Co
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	Large rotated fault block
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)

PETROLEUM-BEARING UNIT No 1:	Brigadier Fm
CONTENTS:	Gas
FORMATION:	Brigadier Fm
AGE:	Carnian-Norian
LITHOLOGY:	Sandstone: calcareous; siltstone; and minor limestone
DEPTH (mSS):	1885 (Top)

TEST DATA FROM THE DISCOVERY WELL (Jupiter 1 (Phillips)):	
WFT 2, 1918.5 m, recovered 3.39 m3 of gas.	Brigadier Fm
WFT 4, 1923 m, recovered 3.56 m3 of gas.	Brigadier Fm
WFT 3, 1932.5 m, recovered 22000 cc of water and 0.03 m3 of gas.	Brigadier Fm
WFT 1, 1979.5 m, recovered 20500 cc of water and 1500 cc of sand.	Brigadier Fm

ACCUMULATION:	SIRIUS
TYPE:	Gas
COMMERCIAL STATUS:	Other discoveries
LOCATION:	
STATE:	WA
PETROLEUM TITLES:	(Vacant)
SUB-BASIN:	Exmouth Plateau
DISCOVERY WELL:	Sirius 1 (Esso)
Longitude (E):	112.6893
Latitude (S):	-20.8846
Date total depth reached:	02 DEC 80
Water depth/ground level:	-1174 m
Operator:	Esso Explor and Prod Aus
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	Large, low relief simple anticline
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)

PETROLEUM-BEARING UNIT No 1:	Mungaroo Fm
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Late Triassic
DEPTH (mSS):	3005 (Top)

TEST DATA FROM THE DISCOVERY WELL	(Sirius 1 (Esso)):
Repeat WT, 2896 m, 4 runs.	Mungaroo Fm
Repeat WT 14, 3019.5 m, run 3, recovered 0.1 L of condensate, 2.01 m3 of gas and 2.9 L of formation water.	Mungaroo Fm
Repeat WT 1, 3174 m, run 1, recovered 0.1 L of condensate, 4.9 m3 of gas and 1.5 L of formation water.	Mungaroo Fm
Repeat WT 13, 3238 m, run 2, recovered 0.1 L of condensate,2.09 m3 of gas and 3.9 L of formation water.	Mungaroo Fm

ACCUMULATION:	VINCK
TYPE:	Gas
COMMERCIAL STATUS:	Other discoveries
LOCATION:	Northwest of North West Cape, 85 km west-southwest of Investigator
STATE:	WA
PETROLEUM TITLES:	(Vacant)
SUB-BASIN:	Exmouth Plateau
DISCOVERY WELL:	Vinck 1
Longitude (E):	112.1928
Latitude (S):	-20.5846
Date total depth reached:	16 MAR 80
Water depth/ground level:	-1373 m
Operator:	Esso Explor and Prod Aus
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	North-northwest trending faulted anticline
RESERVOIR UNITS:	A total of 3 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Mungaroo Fm
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Triassic
LITHOLOGY:	Sandstone fluvio-deltaic over bank deposits
DEPTH (mSS):	3199 (Top)
PETROLEUM-BEARING UNIT No 2:	Mungaroo Fm
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Triassic
DEPTH (mSS):	3597 (Top)
PETROLEUM-BEARING UNIT No 3:	Mungaroo Fm
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Triassic
DEPTH (mSS):	3701 (Top)
TEST DATA FROM THE DISCOVERY WELL (Vinck 1):	
Repeat WT 1, 3205 m, run 1, recovered 0.5 L of condensate, 4.446 m3 of gas and 0.5 L of filtrate.	Mungaroo Fm

ACCUMULATION:	ZEEPAARD
TYPE:	Gas
COMMERCIAL STATUS:	Other discoveries
LOCATION:	90 km west of Barrow Island
STATE:	WA
PETROLEUM TITLES:	(Vacant)
SUB-BASIN:	Exmouth Plateau
DISCOVERY WELL:	Zeepaard 1
Longitude (E):	114.4228
Latitude (S):	-20.7372
Date total depth reached:	16 OCT 80
Water depth/ground level:	-740 m
Operator:	Esso Explor and Prod Aus
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	Narrow northeast trending, faulted horst
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Brigadier Fm
CONTENTS:	Gas
FORMATION:	Brigadier Fm
AGE:	
LITHOLOGY:	Sandstone
DEPTH (mSS):	3098 (Top)

TEST DATA FROM THE DISCOVERY WELL (Zeepaard 1):	
Repeat WT, 2817 m, 5 runs.	Brigadier Fm
Repeat WT 14, 3437.5 m, run 2, recovered 2.04 L of formation water.	Brigadier Fm
Repeat WT 43, 4014.5 m, run 5, recovered 0.979 m3 of gas and 7.0 L of filtrate.	Brigadier Fm

ACCUMULATION:	ZEEWULF
TYPE:	Gas
COMMERCIAL STATUS:	Other discoveries
LOCATION:	150 km northwest of Onslow in the southern Kangaroo Trough
STATE:	WA
PETROLEUM TITLES:	(Vacant)
SUB-BASIN:	Exmouth Plateau
DISCOVERY WELL:	Zeewulf 1
Longitude (E):	113.6167
Latitude (S):	-21.1090
Date total depth reached:	03 MAY 79
Water depth/ground level:	-1194 m
Operator:	Esso Explor and Prod Aus
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	Northeast trending tilted horst feature
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Brigadier Fm
CONTENTS:	Gas
AGE:	Late Triassic
LITHOLOGY:	Sandstones: thin, marine
DEPTH (mSS):	3081 (Top)

TEST DATA FROM THE DISCOVERY WELL (Zeewulf 1):	
Repeat WT, 2350 m, 5 runs.	Brigadier Fm
Repeat WT 33, 3094.5 m, run 5, recovered 0.1 L of condensate and 4401 L of gas.	Brigadier Fm
Repeat WT 28, 3094.5 m, run 3, recovered 0.02 L of condensate and 1313 L of gas.	Brigadier Fm

ACCUMULATION:	RESOLUTION
TYPE:	Gas
COMMERCIAL STATUS:	Other discoveries
LOCATION:	78 km northeast of Exmouth and 22 km south-southeast of Zeewulf accumulation
STATE:	WA
PETROLEUM TITLES:	(Vacant)
SUB-BASIN:	Exmouth Plateau
DISCOVERY WELL:	Resolution 1
Longitude (E):	113.6903
Latitude (S):	-21.2993
Date total depth reached:	08 NOV 79
Water depth/ground level:	-1086 m
Operator:	Esso Explor and Prod Aus
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	Southern culmination of a narrow northeast trending, faulted horst
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Mungaroo Fm
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
LITHOLOGY:	Sandstone
DEPTH (mSS):	3767 (Top)
TEST DATA FROM THE DISCOVERY WELL (Resolution 1):	
Repeat WT, 3758.5 m, 1 run.	Mungaroo Fm
Repeat WT 4, 3777.5 m, recovered 11.33 L of gas and 23.3 L of filtrate.	Mungaroo Fm

ACCUMULATION:	TUBRIDGI/ONSLOW/WYLOO
PRESENT OPERATOR:	Pan Pacific Petroleum NL
TYPE:	Gas and oil
COMMERCIAL STATUS:	Commercial
LOCATION:	Onshore, near the town of Onslow
STATE:	WA
PETROLEUM TITLES:	LTP 174H
SUB-BASIN:	Peedamullah/Onslow Shelf
DISCOVERY WELL:	Onslow 1
Longitude (E):	114.8714
Latitude (S):	-21.7656
Date total depth reached:	08 NOV 66
Water depth/ground level:	0 m
Operator:	WAPET
NUMBER OF WELLS DRILLED	Exploration and appraisal: 1; Development: 6
STRUCTURE:	Broad, low-relief anticlinal closure
RESERVOIR UNITS:	A total of 4 petroleum-bearing unit(s)
PRODUCING UNITS:	A total of 4 petroleum producing unit(s)
PRODUCTION:	Gas: commenced in SEP 91
INFRASTRUCTURE:	Pipeline 85 km from field to the main SECWA pipeline in the vicinity of the No 2 compressor station

PETROLEUM-BEARING UNIT No 1:	Lower Gearle Siltstone
CONTENTS:	Gas
FORMATION:	Gearle Siltstone
AGE:	Aptian to Late Albian
DEPTH (mSS):	173 (Top)
PRODUCTION STATUS:	Undeveloped
REMARKS:	Gearle Siltstone 0.05 mmcfd

PETROLEUM-BEARING UNIT No 2:	Birdrong Sandstone
CONTENTS:	Oil with gas cap
FORMATION:	Birdrong Sandstone
AGE:	Barremian
DEPTH (mSS):	503 (Top)
POROSITY:	26-35 %
PRODUCTION STATUS:	Developed
REMARKS:	The 3.5 m oil leg is undeveloped. The gas-cap gas is developed.

PETROLEUM-BEARING UNIT No 3:	Flacourt Fm

ACCUMULATION:	EENDRACHT
TYPE:	Gas
COMMERCIAL STATUS:	Other discoveries
LOCATION:	300 km from the mainland, the most westerly on the Exmouth Plateau
STATE:	WA
PETROLEUM TITLES:	(Vacant)
SUB-BASIN:	Exmouth Plateau
DISCOVERY WELL:	Eendracht 1
Longitude (E):	112.2431
Latitude (S):	-19.9080
Date total depth reached:	29 MAY 80
Water depth/ground level:	-1354 m
Operator:	Esso Explor and Prod Aus
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1; Development: 1
STRUCTURE:	Large north-northeast trending rotated fault block of Triassic and Jurassic age
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Brigadier Fm
CONTENTS:	Gas
FORMATION:	Marine eqivalent of Mungaroo Fm
AGE:	Norian
LITHOLOGY:	Sandstone
DEPTH (mSS):	2457 (Top)
POROSITY:	10-28 %
PERMEABILITY:	20-100 mD

TEST DATA FROM THE DISCOVERY WELL (Eendracht 1):	
Repeat WT, 2264 m, 3 runs.	Brigadier Fm
Repeat WT 2, 2535.5 m, run 1, recovered 1.6 m3 of gas and 1 L of formation water.	Brigadier Fm
Repeat WT 1, 2651 m, run 2, recovered 60 ml of condensate, 3.5 m3 gas and 0.5 L of formation water.	Brigadier Fm
Repeat WT 4, 2655.5 m, run 3, recovered 1.66 L of formation water.	Brigadier Fm

CONTENTS:	Gas
FORMATION:	Flacourt Fm
AGE:	Early Cretaceous
DEPTH (mSS):	508 (Top)
PRODUCTION STATUS:	Undeveloped

PETROLEUM-BEARING UNIT No 4:	Mungaroo Fm
CONTENTS:	Gas
FORMATION:	Mungaroo Fm
AGE:	Triassic
PRODUCTION STATUS:	Undeveloped

TEST DATA FROM THE DISCOVERY WELL (Onslow 1):	
DST 1, 513 m, flowed salt water at 200 bbls/d with heads of gas chlorides (17500 ppm).	Birdrong Sst
DST 2, 525 m, flowed salt water at 150-160 bbls/d and gas at 2.8-5.7 thousand m3/d.	Birdrong Sst

ACCUMULATION:	THRINGA
PRESENT OPERATOR:	Metana Energy NL
TYPE:	Gas and oil
COMMERCIAL STATUS:	Non-commercial
LOCATION:	Onshore, 66 km northeast of Onslow
STATE:	WA
PETROLEUM TITLES:	EP-137
SUB-BASIN:	Peedamullah/Onslow Shelf
DISCOVERY WELL:	Thringa 1
Longitude (E):	115.6833
Latitude (S):	-21.3542
Date total depth reached:	09 JUL 82
Water depth/ground level:	6 m
Operator:	Cape Range Oil NL, Avon Engineering Pty Ltd
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
RESERVOIR UNITS:	A total of 3 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Windalia Sandstone
CONTENTS:	Gas
PETROLEUM-BEARING UNIT No 2:	Muderong Shale
CONTENTS:	Gas
PETROLEUM-BEARING UNIT No 3:	Mardie Greensand Mbr
CONTENTS:	Oil
TEST DATA FROM THE DISCOVERY WELL (Thringa 1):	
Production Test 3, 163.7-165.0 m, flowed gas at 1132 m^3/d through a 1/8" choke.	Mardie Greensand/Muderong Shale
Production Test 2, 165.5-166.5 m, immediate gas flow with minor water and a trace of oil.	Mardie Greensand
Production Test 1, 168.5-171.4 m, flowed 9 bbls of water/d with traces of oil.	Mardie Greensand.

ACCUMULATION:	EAST SOMELIM
PRESENT OPERATOR:	Metana Energy NL
TYPE:	
COMMERCIAL STATUS:	Other discoveries
LOCATION:	Onshore, northeast of Thringa
STATE:	WA
PETROLEUM TITLES:	
SUB-BASIN:	Peedamullah/Onslow Shelf
DISCOVERY WELL:	East Somelim 1
Longitude (E):	115.8225
Latitude (S):	-21.3144
Date total depth reached:	31 OCT 91
Ground level:	7 m
Operator:	Lennard Oil NL
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Mardie Greensand
FORMATION:	Muderong Shale
AGE:	Cretaceous
REMARKS:	Total depth of East Somelim-1 is 144 m.

TEST DATA FROM THE DISCOVERY WELL (East Somelim 1):

ACCUMULATION:	CARNIE
PRESENT OPERATOR:	Metana Energy NL
TYPE:	Gas
COMMERCIAL STATUS:	Other discoveries
LOCATION:	65 km northeast of Onslow
STATE:	WA
PETROLEUM TITLES:	EP-137
SUB-BASIN:	Peedamullah/Onslow Shelf
DISCOVERY WELL:	Carnie 1
Longitude (E):	115.6847
Latitude (S):	-21.4083
Date total depth reached:	17 JUL 82
Water depth/ground level:	7 m
Operator:	Cape Range Oil NL, Avon Engineering Pty Ltd
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Birdrong Sandstone
CONTENTS:	Gas
FORMATION:	Muderong Shale
AGE:	Cretaceous
LITHOLOGY:	Sandstone: fine, light green/grey; calcareous in part
DEPTH (mSS):	20 (Top)
TEST DATA FROM THE DISCOVERY WELL (Carnie 1):	
DST-1, 150.2-154.0 m, flowed gas at an initial rate of 850 m^3/d through a 1/8" choke, slowly decreasing.	Muderong Shale.

ACCUMULATION:	WINDOO
TYPE:	Gas
COMMERCIAL STATUS:	Other discoveries
LOCATION:	Onshore
STATE:	WA
PETROLEUM TITLES:	EP-40
SUB-BASIN:	Peedamullah/Onslow Shelf
DISCOVERY WELL:	Windoo 1A
Longitude (E):	115.7819
Latitude (S):	-21.3550
Date total depth reached:	22 NOV 72
Water depth/ground level:	2 m
Operator:	BHP Petroleum
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1; Development: 1
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PRODUCING UNITS:	A total of 1 petroleum producing unit(s)
PETROLEUM-BEARING UNIT No 1:	Mardie Greensand
Equivalent CONTENTS:	Gas
FORMATION:	Muderong Shale
AGE:	Mid Cretaceous

TEST DATA FROM THE DISCOVERY WELL (Windoo 1A):

ACCUMULATION:	MARDIE
PRESENT OPERATOR:	(none)
TYPE:	Gas
COMMERCIAL STATUS:	Other discoveries
LOCATION:	Onshore, 70 km northeast of Onslow
STATE:	WA
PETROLEUM TITLES:	(vacant)
SUB-BASIN:	Peedamullah/Onslow Shelf
DISCOVERY WELL:	Mardie 1 (WAPET)
Longitude (E):	115.7064
Latitude (S):	-21.3539
Date total depth reached:	09 AUG 67
Water depth/ground level:	5 m
Operator:	WAPET
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 4
STRUCTURE:	?Anticline
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)

PETROLEUM-BEARING UNIT No 1:	Muderong Shale
CONTENTS:	Gas
FORMATION:	Muderong Shale
AGE:	Aptian-Albian
LITHOLOGY:	Sandstone: silty; glauconitic
DEPTH (mSS):	154 (Top)

TEST DATA FROM THE DISCOVERY WELL (Mardie 1 (WAPET)):	
FIT-1, 160-164 m, flowed gas at 1415 m^3/d with a trace of watery cement.	Mardie Greensand.

ACCUMULATION:	MULYERY
PRESENT OPERATOR:	(none)
TYPE:	Gas
COMMERCIAL STATUS:	Other discoveries
LOCATION:	Onshore, 50 km northeast of Onslow
STATE:	WA
PETROLEUM TITLES:	(vacant)
SUB-BASIN:	Peedamullah/Onslow Shelf
DISCOVERY WELL:	Mulyery 1
Longitude (E):	115.7967
Latitude (S):	-21.3072
Date total depth reached:	18 JAN 68
Water depth/ground level:	0 m
Operator:	WAPET
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	Unknown
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Mardie Greensand
CONTENTS:	Gas
FORMATION:	Muderong Shale
AGE:	Neocomian
LITHOLOGY:	Sandstone: glauconitic with shale and siltstone
DEPTH (mSS):	118 (Top)
POROSITY:	17-46 %
PERMEABILITY:	28-1218 md
TEST DATA FROM THE DISCOVERY WELL (Mulyery 1):	
A flow test through perforations over the interval 123.7-128.0 m flowed gas at the rate of 0.04 million cfd.	Mardie Greensand

ACCUMULATION:	MYANORE
PRESENT OPERATOR:	Metana Energy NL
TYPE:	Gas
COMMERCIAL STATUS:	Other discoveries
LOCATION:	Onshore, 65 km northeast of Onslow
STATE:	WA
PETROLEUM TITLES:	EP-137
SUB-BASIN:	Peedamullah/Onslow Shelf
DISCOVERY WELL:	Myanore 1
Longitude (E):	115.6944
Latitude (S):	-21.3442
Date total depth reached:	05 MAY 83
Water depth/ground level:	5 m
Operator:	Cape Range Oil NL, Avon Engineering Pty Ltd
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	Anticline; culmination of Myanore Structure
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Mardie Greensand
CONTENTS:	Gas
FORMATION:	Muderong Shale
AGE:	Cretaceous
LITHOLOGY:	Sandstone
DEPTH (mSS):	140 (Top)
TEST DATA FROM THE DISCOVERY WELL (Myanore 1):	
DST 1, 46.0-109.0 m, flowed gas at a rate of 0.36 million m^3/d through a 1/8" choke.	Gearle Siltstone/Muderong Shale.

ACCUMULATION:	NEBO
PRESENT OPERATOR:	Kufpec Australia Pty Ltd
TYPE:	Oil
COMMERCIAL STATUS:	Other discovery
LOCATION:	12 km northwest of Depuch 1, 30 km northeast of Picard 1.
STATE:	WA
PETROLEUM TITLES:	WA-225-P
SUB-BASIN:	Beagle Sub-basin
DISCOVERY WELL:	Nebo 1
Longitude (E):	117.8274
Latitude (S):	-18.7808
Date total depth reached:	19 MAY 93
Water depth:	171 m
Operator:	Kufpec Australia Pty Ltd
NUMBER OF WELLS DRILLED:	Exploration and appraisal: 1
STRUCTURE:	Fault dependent closure
RESERVOIR UNITS:	A total of 1 petroleum-bearing unit(s)
PETROLEUM-BEARING UNIT No 1:	Calypso Formation
CONTENTS:	Oil
FORMATION:	Calypso Formation
AGE:	Middle to Late Jurassic
LITHOLOGY:	Sandstone, interbedded with claystone and coal.
DEPTH (mSS):	
TEST DATA FROM THE DISCOVERY WELL (Nebo 1):	
DST 1, 2664.5-2668 m, Flowed 1840 bbls/d of 42 deg. API oil through a 1/2" choke.	Calypso Formation

5 PETROLEUM DEVELOPMENTS

5.1. Developments in The Dampier Sub-Basin

5.1.1. *Development: Talisman*

Operator:	Marathon Petroleum Australia Ltd
Location:	127 kilometres north of Dampier, water depth 89 metres
Discovered:	January 1984 - Talisman-1
Production started:	April 1991
Production ceased:	August 1992
Product:	Oil

No. of wells :	
Oil producers	2
Gas producers	0
Shut in	0
Plugged and abandoned	5
Injection	0
Suspended	0
Total	7

Initially the field was developed by one subsea well (discovery well Talisman-1) producing into a floating production and offloading facility (FPSO). In 1990, a second well, Talisman-7, was connected and put into production.

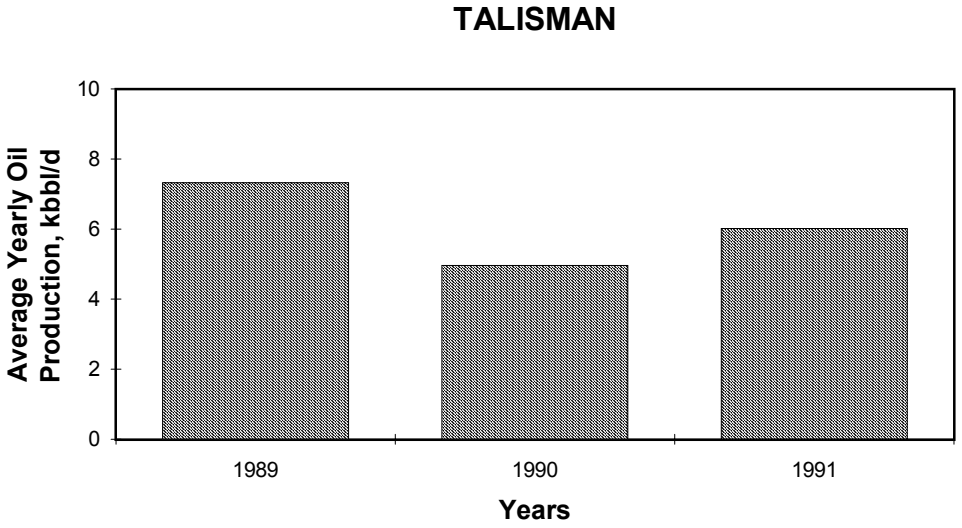
Bluewater Offshore Production Systems NV was contracted to provide the FPSO, the *Acqua Blu*, a 70 000 tonne tanker which had been converted to FPSO service in 1985. Oil storage capacity was approximately 360 000 barrels, while production facilities could handle 20 000 barrels per day of oil and 16 000 barrels per day of water. A flare situated on the main deck could accommodate up to 9 million cubic feet per day of solution gas.

The mooring system consisted of a 12 metre square-shaped buoy, which was anchored to the sea bed by four 450 metre long chains at 90 degree spacing. The buoy was equipped with umbilical and production line swivels which allowed the vessel to rotate around the buoy at 360 degrees as a result of shifts in winds and currents. The vessel could disconnect quickly when required. A 6 inch diameter flexible flowline and an eight-path hydraulic control umbilical were laid from the buoy across a buoyancy tank/clump weight arrangement to the Talisman wellheads.

Fluids produced through the subsea wellheads flowed through flexible subsea lines to the onboard process plant where they were separated in a two-stage, three-phase separator train into gas, oil and water. Gas was

flared, while separated oil and water were routed into settling tanks, where final dewatering of oil and de-oiling of water was achieved. The produced water was discharged overboard, while stabilised crude oil was shipped by shuttle tankers to refineries.

Figure 12 Annual production, Talisman accumulation.



5.1.2 *Development: North Rankin*

Operator:	Woodside Petroleum Development Pty Ltd	
Location:	134 kilometres northwest of Dampier, water depth 125 metres	
Discovered:	July 1971 - North Rankin-1	
Production started:	July 1984	
Product:	Gas and condensate	
No. of wells:	Oil producers	0
	Gas producers	13
	Shut in	0
	Plugged and abandoned	0
	Injection	6
	Suspended	5
	Total	24

The North Rankin field was developed by a conventional fixed steel offshore platform with production wells drilled directionally into the reservoir from the platform. On the platform, streams from the producing wells are gathered, condensate and gas are separated, gas is dehydrated and both phases are shipped to shore in a two-phase, 40 inch diameter, 134 kilometre long pipeline for further processing and distribution of sales products in the onshore gas plant and shipping facilities at Burrup Peninsula, 30 kilometres from the town of Karratha. Produced gas is partly reinjected into the reservoir for accelerated condensate recovery.

The platform jacket has an eight leg, 32 piles design, with a separate three leg, six piles flare support jacket, and a bridge between platform and flare. The platform weight, including piles, is 54,000 tonnes. The flare support weighs 3130 tonnes. Piles are driven 120 metres into the sea bed. Twenty modules were installed on the platform. The average weight of each module is 800 tonnes. The platform is equipped with a drilling rig which allows concurrent production and drilling or workover. The top of the derrick is 90 metres above sea level. The platform dimensions are 83 x 67 metres at the sea bed and 60 x 38 metres at the top. Accommodation capacity is 118 permanent and 96 temporary living quarters.

Three parallel separation and gas glycol dehydration trains on the platform are each capable of processing 15.6 million cubic metres of gas per day. The separators operating pressure is 1722 psia and operating temperature is 42 degrees Celsius. The vapour phase from the separators, after passing through the scrubber to remove any entrained liquids, is dehydrated by counter current contact with triethylene glycol in the trayed glycol contractor column. The liquid phase from the separators is cooled in the condensate cooler to 30 degrees Celsius and then separated in the primary

water/condensate separator into wet condensate and water. The produced water flows to the drain sump caisson for final removal of entrained hydrocarbons and disposal to the sea. The wet condensate flows through filter for fines removal and then through a condensate coalescer which removes entrained water droplets. The treated condensate is then reinjected into the dehydrated gas stream for transmission to the onshore plant.

Excess dehydrated gas from each of the production trains is combined and fed through a single line to the compressor suction scrubber for reinjection into the reservoir.

Gas for reinjection is compressed in the gas turbine-driven, six-stage, two-section centrifugal compressor. Compressed gas is discharged from the first section at 2900 psi and 87 degrees Celsius and is cooled in the intercooler before it enters the second section. Gas is discharged from the second section of the compressor at 4370 psi and 70 degrees Celsius and is piped to the dedicated injection wells. Gas recycling was introduced in 1987 and recycling capacity is 14.2 million cubic metres of gas per day.

The two-phase pipeline to shore has a maximum capacity of 46.7 million cubic metres per day. Pipeline maximum design pressure is 1900 psig.

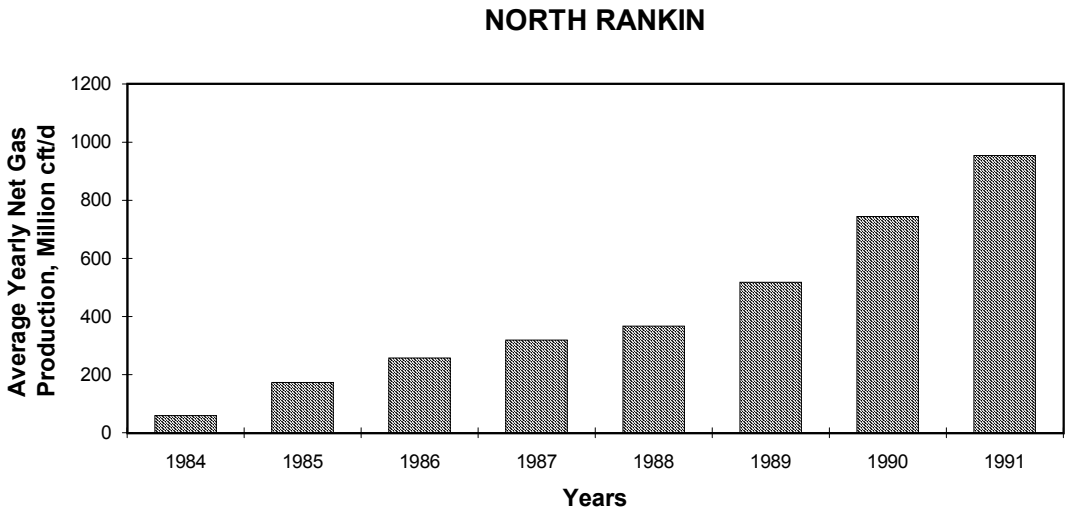
Wells are completed with 7 inch diameter tubing. The wells are deviated by up to 60 degrees while the maximum hole length is 5000 metres.

Onshore facilities at Burrup Peninsula consist of a domestic gas plant, an LNG plant, storage and shipping facilities. The domestic gas plant supplies natural gas to the State Energy Commission of Western Australia (SECWA), which distributes the gas to industrial, commercial and residential customers in Western Australia. The plant has two trains consisting of a dehydration unit, which removes water from gas, and an extraction unit, which removes heavy hydrocarbons from gas. It also has three condensate stabilisation units which remove lighter hydrocarbons from condensate. The two parallel trains have a capacity of processing 11.3 million cubic metres of gas per day each. Gas inlet into the gas plant is at 900 psig and ambient temperature, while the gas outlet is at 1244 psig and 55 degrees Celsius. The condensate storage consists of two 72,000 cubic metre capacity tanks. Stabilised condensate is loaded into tankers and shipped to refineries.

The LNG plant consists of two LNG processing trains. A third train is under construction and will come on stream in the first half of 1993. Each train has process capacity of 2 million tonnes of LNG per year. The natural gas is processed by removing carbon dioxide, water and heavy hydrocarbons. The purified natural gas is then chilled to minus 161 degrees Celsius, at which temperature it condenses into a liquid. Each LNG processing train consists

of a sulphinol unit which removes carbon dioxide, a dehydration unit which removes water, and a liquefaction unit. Two fractionation trains process refrigerant for the liquefaction process. The LNG plant inlet conditions are 900 psig and ambient temperature. LNG is stored in four 65,000 cubic metre capacity tanks prior to loading into LNG carriers and shipment to Japan.

Figure 13 Annual production, North Rankin accumulation



5.1.3 *Development: Goodwyn*

Development:	Goodwyn	
Operator:	Woodside Petroleum Development Pty Ltd	
Location:	145 kilometres northwest of Dampier and 23 kilometres south.west of the North Rankin platform , water depth 126 metres	
Discovered:	December 1971, Goodwyn 1	
Production started:	Anticipated late 1993 or early 1994	
Product:	Gas & condensate	
No. of wells:	Oil producers	0
	Gas producers	0
	Shut in	0
	Plugged and abandoned	0
	Injection	0
	Suspended	10
	Total	10

The Goodwyn field is being developed by a conventional fixed steel offshore platform and production wells drilled directionally into the reservoir from the platform. The platform has been built with a capacity for 26 wells and the initial development drilling program calls for between 12 and 14 production wells to be drilled. A drilling and workover derrick will be permanently positioned on the platform. The Goodwyn platform will be connected by a subsea pipeline with the North Rankin A platform. The produced gas and condensate will be shipped from the Goodwyn platform to the onshore processing and storage facilities at Burrup Peninsula, via the North Rankin A platform and the existing North Rankin A platform to shore pipeline .

The flare at Goodwyn will be a vertical structure incorporated within the platform complex. To keep the flare tip safely away from the rest of the facilities, the flare tower has to be 120 m tall.

The production is expected to peak at up to 25.4 million cubic metres of gas a day and up to 80 000 barrels of condensate. In the early phase of Goodwyn production the emphasis will be on condensate recovery. The produced gas will be stripped of condensate and mostly reinjected back into the reservoir to be reproduced later in the project production life. The reminder of the dry gas produced in the early phase will be used to augment the supply from North Rankin and maintain the gas conctracts with the State Energy Commission of Western Australia and the LNG customers in Japan.

The 18 000 tonnes, eight leg, platform jacket was launched in October 1992. After the jacket was .positioned on the sea bed 20 primary piles were inserted

through slots in the jacket's feet and driven to depth of 116 m.The initial operation was to drill out the earth from the primary piles and drive secondary piles to the final foundation depth of 181 m. When drilling out the primary piles, a number were found to have buckled, making it impossible to drive all the insert piles through them and down into the deeper sediments. There have been consequent delays to the program while remedies were sought and put into effect.

5.2 Developments in The Barrow Sub-Basin

5.2.1 *Development: Barrow Island*

Operator:	West Australian Petroleum Pty Ltd	
Location:	Barrow Island, 100 kilometres northeast of Onslow	
Discovered:	1964 - Barrow Island	
Production started:	January 1967	
Product:	Oil and gas	
No. of wells January 1989:	Oil producers	417
	Gas producers	1
	Shut in	143
	Plugged and abandoned	11
	Injection and water source	214
	Suspended	0
	Total	786

Oil production is processed through the ten separator stations consisting of manifolds, bulk three-phase separators, test three-phase separators and separator station storage tanks. The producing wells are connected by 2 and 3 inch diameter individual pipelines and up to three flowline manifolds to the separator stations. Separated oil is stored in the 160,000 cubic metre capacity tank farm terminal. Oil is further pumped to the sea terminal for shipment to refineries by a 10 inch diameter, 9 kilometre long pipeline.

Low pressure gas from the four separator stations is gathered to the compressor station where it is compressed to 4150 kilopascals. From the compressor station, the gas is passed through a low temperature separation unit where LPG and condensate are removed. Gas is further distributed through the field for gas lift operation and as fuel for pumping units, while LPG is spiked into the crude oil. LPG is also used on the island as a fuel for some of the company's vehicles. A small quantity of ethane is used to fuel compressor motors and the balance is flared. Water separated in the separators flows to water disposal tanks and is then injected into water disposal wells.

There are four water injection pumping stations at the Barrow Island field. Water is supplied from four water source wells drilled into the water productive Flacourt Formation. At the water injection pumping station, water is degassed, filtered to 10 microns and delivered to injection wells by pump.

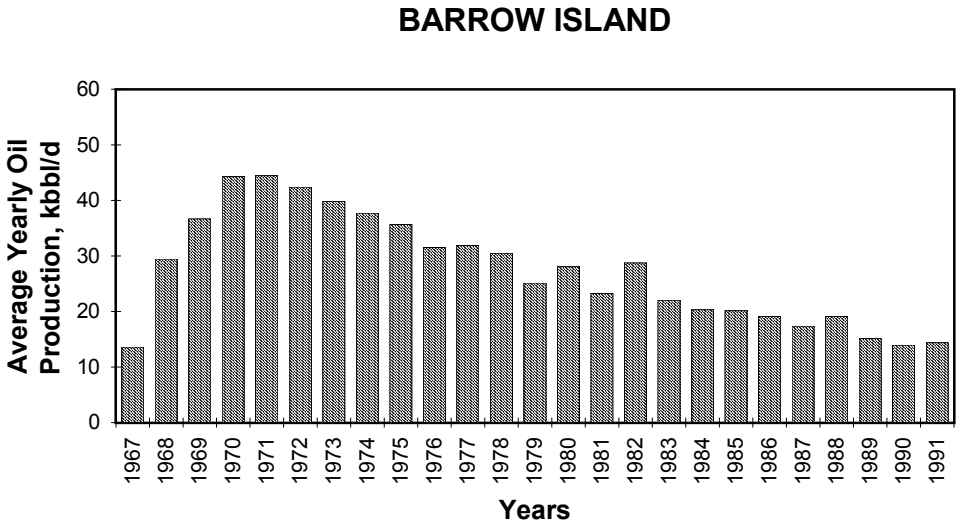
Waterflood was introduced during 1968 with a 40 acre, five spot pattern at the southwestern end of the field. The flood was expanded throughout the

field by 1970, essentially to 40 acre inverted nine spot patterns. As the result of an early water breakthrough at some producing wells, a conversion of high water cut wells to injection wells was carried out in 1972 resulting in line drive pattern.

In 1978, a 20 acre infill drilling program commenced. This program is continuing with the recent Windalia pilot infill drilling program coming to an end in July 1991. Additional drilling began again in second half of 1992.

Development wells were drilled to the surface casing point at about 250 metres with an air-foam mist to avoid lost circulation in near surface limestones. Drilling through Gearle Siltstone requires careful management of mud properties to control swelling. Because of low permeability, all producing wells have to be fractured.

Figure 14 Annual production, Barrow Island accumulation



5.2.2 *Development: Saladin*

Operator:	West Australian Petroleum Pty Ltd	
Location:	70 kilometres southwest of Barrow Island, water depth 16 metres	
Discovered:	June, 1985 - Saladin-1	
Production started:	November 1989	
Product:	Oil	
No. of wells :	Oil producers	6
	Gas producers	0
	Shut in	1
	Plugged and abandoned	0
	Injection	0
	Suspended	1
	Total	8

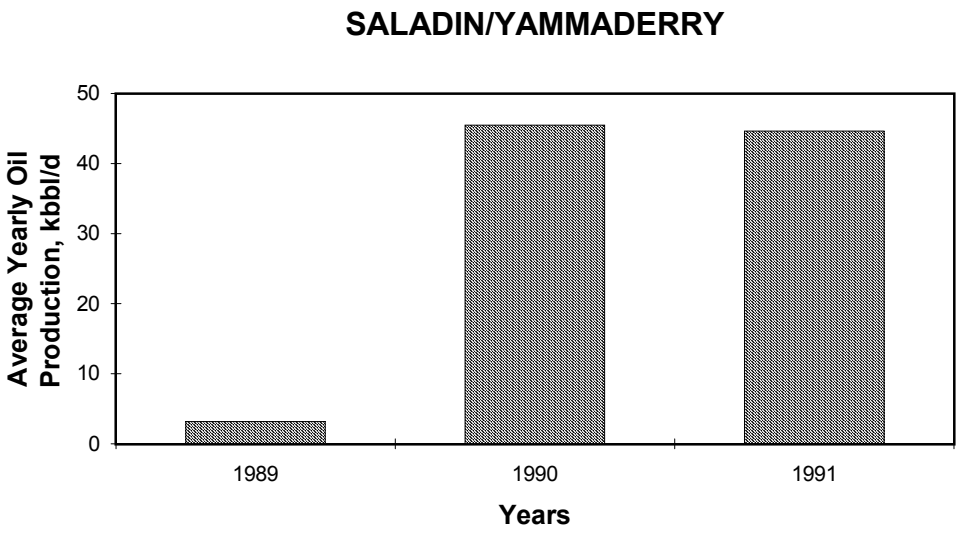
The Saladin development consists of three unmanned platforms: A, B and C. Each of the platforms is a three leg, three well slots steel structure with a double deck topside. Bi-level boat landings and a helicopter deck are installed on each platform. The platforms have been positioned over the Saladin-1, -2 and -7 wells which were previously drilled. In addition, one directional well, Saladin-8, was drilled from the Saladin A platform. Three wells, Saladin-4, -5 and -6, were also drilled from Thevenard Island and deviated into the reservoir area that lay beneath the environmentally sensitive Thevenard Island shoal.

Production from each offshore platform and onshore well is transported by pipeline to separation and stabilisation facilities on Thevenard Island. Separation and stabilisation of the crude oil are achieved in three stages through a system of three-phase separators and fixed roof tanks. The system is capable of handling 60 000 barrels of crude oil per day.

Stabilised crude oil is stored in three floating roof tanks with a capacity of 350,000 barrels each. Tankers are loaded via a 24 inch diameter pipeline. Tanker mooring facilities are located 7 kilometres offshore Thevenard Island.

Produced solution gas is used as fuel and instrument supply, and the excess gas is flared. As the wells begin to produce water, this excess gas will be eventually used for gas lift. The produced water and water from the onshore drainage system are treated and discharged to the sea beyond the shoals area.

Figure 15 Annual production, Saladin/Yammaderry accumulations



5.2.3 *Development: Yammaderry*

Operator:	West Australian Petroleum Pty Ltd	
Location:	70 kilometres southwest of Barrow Island, water depth 9 metres	
Discovered:	July 1988 - Yammaderry-1	
Production started:	March 1991	
Product:	Oil	
No. of wells:	Oil producers	1
	Gas producers	0
	Shut in	0
	Plugged and abandoned	0
	Injection	0
	Suspended	1
	Total	2

Yammaderry was developed by a single horizontal well (Yammaderry-2) drilled to a horizontal length of 704 metres to the southwest. The well was completed with a tree above the water level and an unmanned offshore monopod which protects and supports the well. A jack-up drilling rig was used to drill the caisson hole, lift the monopod substructure from the transportation vessel and grout the monopod substructure in place. The production well was then drilled and completed through the substructure. The monopod topside was then installed over the completed well.

Yammaderry is producing via a 2 kilometre, 6 inch line to Saladin C platform, where production is mixed with that of the Saladin-7 well and fed into the 8 inch diameter production line running to the Thevenard Island processing facility. As gas lift will be required as future water cut increases, the gas lift lines were laid in paired bundles with the production lines from the Thevenard Island facilities.

5.2.4. *Development: Cowle*

Operator:	West Australian Petroleum Pty Ltd	
Location:	70 kilometres southwest of Barrow Island, water depth 12 metres	
Discovered:	December 1989 - Cowle-1	
Production started:	April 1991	
Product:	Oil	
No. of wells	Oil producers	1
	Gas producers	0
	Shut in	0
	Plugged and abandoned	0
	Injection	0
	Suspended	1
	Total	2

The Cowle accumulation was developed by two production wells and a unmanned offshore monopod structure. The discovery well, Cowle-1, was re-entered and completed as a vertical production well. The production well, Cowle-2, was drilled 1054 metres horizontally into the reservoir in a southwest direction. The installation method for the structure was similar to the method utilised for the Yammaderry monopod.

Cowle wells are producing directly to the Thevenard Island processing facilities through a single 8 inch diameter product line which is bypassing the Saladin C platform. The 3 inch diameter gas lift line was laid, together with the production line for possible future gas lift.

5.2.5. *Development: Harriet*

Operator:	Hadson Australia Development Pty Ltd	
Location:	20 kilometres northeast of Barrow Island and 120 kilometres west of Dampier, water depth 23 metres	
Discovered:	November 1983 - Harriet-1	
Production started:	18 January 1986	
Product:	Oil and gas	
No. of wells :	Oil producers	12
	Gas producers	0
	Shut in	0
	Plugged and abandoned	2
	Injection	0
	Suspended	0
	Total	14

The Harriet field was developed by one conventional eight leg platform with the processing plant on deck (Harriet A) and two satellite monopods (Harriet B and C) feeding back via the A platform to storage facilities on nearby Varanus Island (Varanus Island belongs to Lowendal group of Islands). The Harriet A platform is totally self contained, with all power generation, production facilities, oil shipping facilities, helideck and emergency personnel amenities on board. The platform is manned only during daylight hours.

Prior to Harriet A platform installation, five deviated appraisal wells were drilled from a template located over the Harriet-1 discovery well. The Harriet A platform was installed over the template and four successful appraisal wells and the discovery well Harriet-1 were completed for production. The platform jacket contains nine well conductor guides situated outboard, so that the conductors could be accessed by a slot type jack-up rig. The additional production well was drilled after the platform was installed, giving a total of six Harriet A producing wells.

The production facilities on the Harriet A platform consist of well manifolds, a three-stage production separation train and a three-phase test separator. Produced gas is used for fuel. The first stage separator gas is used for gas lift which includes three stages of compression and cooling. Gas not used for fuel or gas lift until 1992. The water produced is released into the ocean after being treated. The facilities on the Harriet A platform are capable of handling 48 million standard cubic feet per day of gas, 23,000 barrels per day of oil and 48,000 barrels per day of water. Gas compression capacity is 20 million standard cubic feet per day.

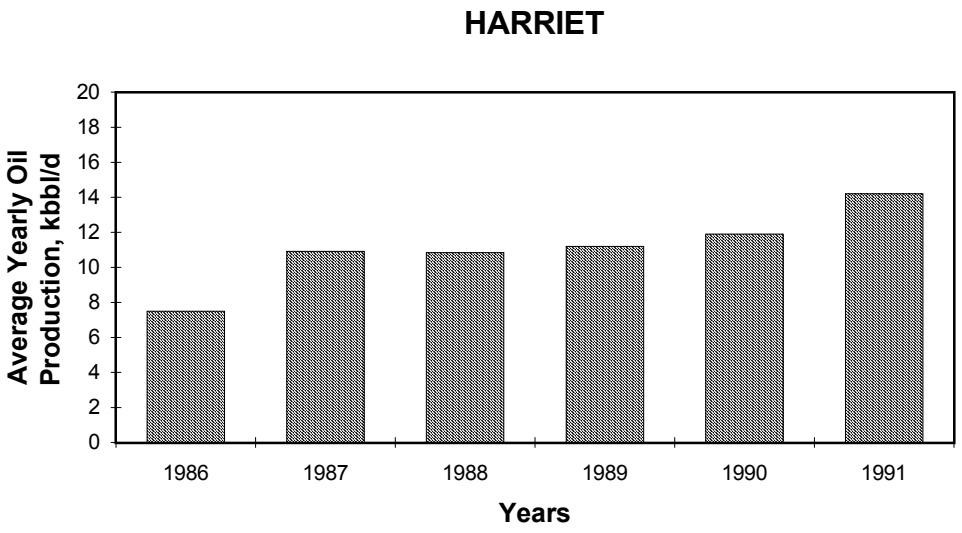
Facilities on Varanus Island consist of three storage tanks (750,000 barrels total storage capacity), crude oil loading pumps and associated controls, accommodation for up to 100 operating personnel, and support facilities such as workshop/warehouse, control and communications, laboratory, power generation, helicopter pad, hanger and jet fuel storage.

From the storage facilities, the oil is transported by a 762 millimetre diameter pipeline to the offshore tanker loading facility 4 kilometres northeast of the island.

In 1992, a gas gathering system was constructed for Harriet solution gas and nearby Sinbad, Campbell and Rosette gas fields which feeds into the Dampier-Perth gas pipeline. Low temperature gas separation and compression facilities have been constructed on Varanus Island for delivery of gas via Compressor Station 1 on SECWA's Dampier-Perth gas transmission line. Export quality gas from Varanus Island is transmitted to Compressor Station 1 through a 324 millimetre diameter, 100 kilometre long pipeline (70 km offshore; 30 km onshore) which was also constructed in 1992.

While the Harriet A platform and Varanus Island facilities were under construction, further drilling proved a northern extension to the field, and two satellite unmanned monopods (B and C), supporting three production wells each, were subsequently constructed and installed.

Figure 16 Annual production, Harriet accumulation



5.2.6. *Development: Bambra* (see under Harriet)

Operator:	Hadson Australia Development Pty Ltd	
Location	7 kilometres north of Harriet A platform, water depth 35 metres	
Discovered:	February 1983 - Bambra-1	
Production started:	Not yet in production	
Product:	Gas	
No. of wells :	Oil producers	0
	Gas producers	0
	Shut in	0
	Plugged and abandoned	1
	Injection	0
	Suspended	1
	Total	2

A seapole has been installed at Bambra-3, but this is not currently connected for production.

5.2.7 *Development: Tanami* (see under Harriet)

Development:	Tanami	
Operator:	Hadson Australia Development Pty Ltd	
Location:	Varanus Island, onshore	
Discovered:	July-1991, Tanami 1	
Production started:	11 October, 1991 (long term production test)	
Product:	Oil	
No. of wells:	Oil producers	1
	Gas producers	0
	Shut in	0
	Plugged and abandoned	1
	Injection	0
	Suspended	0
	Total	2

The Tanami 1 well is produced into facilities on Varanus Island.

5.2.8 *Development: Rosette* (see under Harriet)

Operator:	Hadson Australia Development Pty Ltd	
Location	Varanus Island, onshore	
Discovered:	November, 1987 - Rosette-1	
Production started:	Mid 1992	
No. of wells :	Oil producers	1
	Gas producers	0
	Shut in	0
	Plugged and abandoned	0
	Injection	0
	Suspended	0
	Total	1

The Rosette-1 well is produced into facilities on Varanus Island. Its associated gas is produced to the Harriet gas gathering facilities on Varanus Island.

5.2.9 *Development: Campbell* (see under Harriet)

Operator:	Hadson Australia Development Pty Ltd	
Location:	40 kilometres northeast of Barrow Island, water depth 39 metres	
Discovered:	March 1967 - Campbell-2	
Production started:	October 1992	
Product:	Gas and condensate	
No. of wells:	Oil producers	0
	Gas producers	1
	Shut in	0
	Plugged and abandoned	1
	Injection	0
	Suspended	2
	Total	4

The Campbell field is produced via a monopod facility to the Harriet gas gathering facilities on Varanus Island.

5.2.10 *Development: Sinbad* (see under Harriet)

Operator:	Hadson Australia Development Pty Ltd	
Location:	30 kilometres northeast of Barrow Island, water depth 37 metres	
Discovered:	March-1990, Sinbad 1	
Production started:	October, 1992	
Product:	Gas and condensate	
No. of wells:	Oil producers	0
	Gas producers	2
	Shut in	0
	Plugged and abandoned	0
	Injection	0
	Suspended	0
	Total	2

The Sinbad field is produced via monopod facility to the Harriet gas gathering facilities on Varanus Island.

5.2.11 *Development: North Herald*

Operator:	Western Mining Corporation	
Location:	53 kilometres north of Onslow and 30 kilometres south of Barrow Island, water depth 16 metres	
Discovered:	June 1983 - North Herald-1	
Production started:	December 1987	
Product:	Oil	
No. of wells :	Oil producers	1
	Gas producers	0
	Shut in	0
	Plugged and abandoned	0
	Injection	0
	Suspended	2
	Total	3

The North Herald field was developed by a single well monopod and one production well drilled horizontally into the reservoir. The well is connected by a 6 inch diameter flowline and 3 inch diameter gas lift line via the South Pepper platform to the production facility on board the jack-up rig *Vicksburg* situated over the South Pepper structure. The distance between South Pepper and North Herald fields is 6 kilometres.

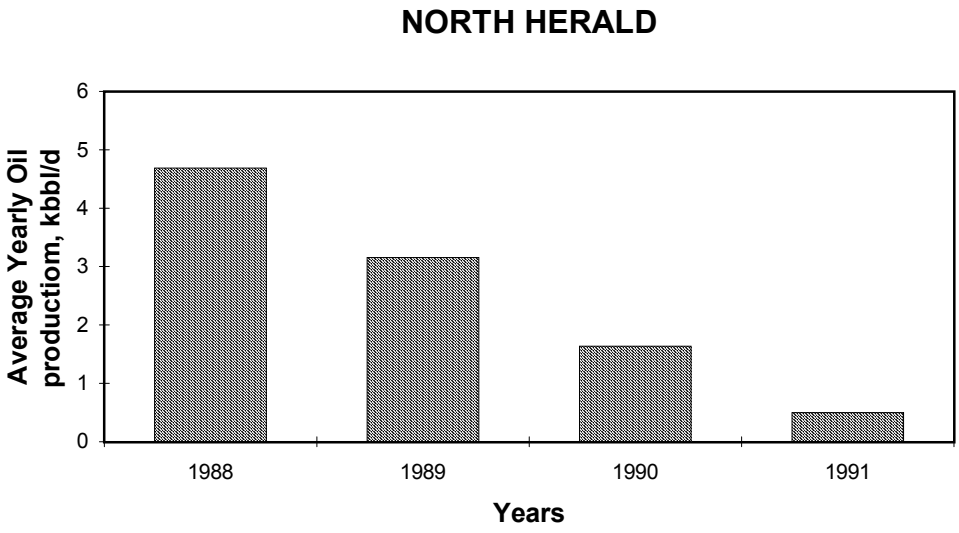
The production facilities on *Vicksburg* consist of flowlines, inlet manifolds, two three-phase separators, each capable of processing 17,000 barrels of fluid per day, downstream centrifugal pumps, positive displacement export pumps, flare system and corrugated plate interceptor (CPI) vessel. The facility design allows for installation of gas lift when required and an additional CPI vessel. Gas lift facilities were installed and commissioned for use in the South Pepper field in 1991. Crude oil from the North Herald field is commingled on the jack up, processed and then pumped via a 6 inch diameter trunk line to Airlie Island some 25 kilometres to the south where it is stored in two 150 000 barrel tanks. Tanker loading facilities consist of a 20 inch diameter, 2 kilometre line to the tanker mooring terminal located north of Airlie Island.

Some of the produced gas on the *Vicksburg* is used for fuel and the excess is flared. The produced water is treated in the CPI vessel and then discharged overboard. The drilling rig *Vicksburg* is a slotted type jack up, which was able to locate above the North Herald and South Pepper jacket structures, as the structures were specifically designed to accommodate the rig slot configuration. The rig was used to install the North Herald monopod and to drill the production well. The North Herald structure supports only one conductor and wellhead. The 80 tonne jacket supports the 5 x 4 metre

wellhead access deck. Personnel access to the platform is by inflatable dinghy and ladder. The upper level of the deck structure allows wireline equipment to be delivered by helicopter sling drop.

The production well, North Herald-3, was drilled sub-horizontally through the reservoir at an angle of 89 degrees to the vertical. The length of the sub-horizontal section through the reservoir was 305 metres. This was the first horizontal well in Australia.

Figure 17 Annual production, North Herald accumulation



5.2.12 *Development: South Pepper*

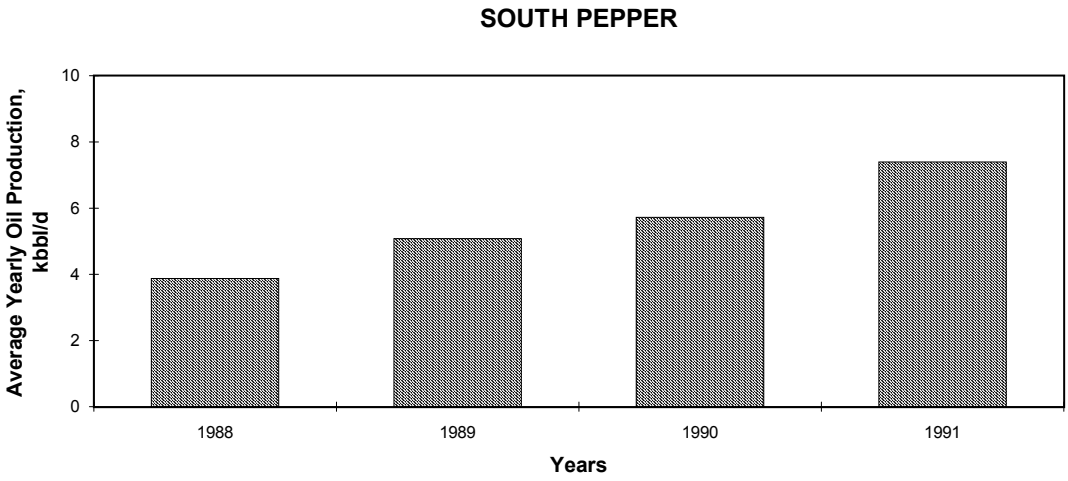
Operator:	Western Mining Corporation	
Location:	53 kilometres north of Onslow and 30 kilometres south of Barrow Island, water depth 17 metres	
Discovered:	December 1982 - South Pepper-1	
Production started:	May 1988	
Product:	Oil	
No. of wells :	Oil producers	8
	Gas producers	0
	Shut in	0
	Plugged and abandoned	5
	Injection	0
	Suspended	0
	Total	13

The South Pepper accumulation was developed jointly with North Herald as a single project and the development concept was similar to that of North Herald. The field was developed by a small unmanned offshore structure supporting four production wells and four subsea completed wells producing into production facilities on board the jack-up rig *Vicksburg*.

The 115 tonne South Pepper jacket consists of a tripod structure containing a central column which extends below the mudline to act as a pile. Three external pin piles are attached to the jacket through grouted sleeve connections. One conductor and all pipeline risers are contained within the central pile. A deck structure provides access to the wellheads from the jack-up rig *Vicksburg* which was positioned over the structure. South Pepper crude oil is commingled on the platform with North Herald crude oil and is then piped to the processing facilities on board the *Vicksburg* jack up for separation and shipment to Airlie Island for storage and distribution to refineries.

Four production wells were drilled horizontally through the reservoir section to maximise recovery.

Figure 18 Annual production, South Pepper accumulation



5.2.13 *Development: Chervil*

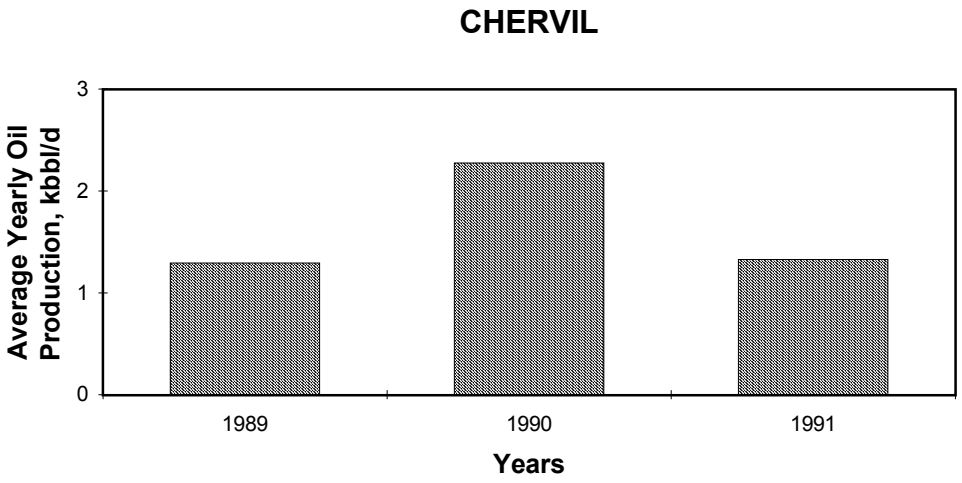
Operator:	Western Mining Corporation	
Location:	50 kilometres north of Onslow and 30 kilometres south of Barrow Island, water depth 15 metres	
Discovered:	August 1983 - Chervil-1	
Production started:	August 1989	
Product:	Oil	
No. of wells :	Oil producers	2
	Gas producers	0
	Shut in	0
	Plugged and abandoned	3
	Injection	0
	Suspended	0
	Total	5

As Chervil field was in close proximity to Airlie Island (7 kilometres), it was developed by utilising the existing North Herald/South Pepper storage and loading facilities on the island. The field was developed by setting a small caisson type platform next to the existing Chervil-4 well. The platform supports two production wells, header manifolds, remotely operated well control equipment, gas lift lines, flowline risers and helideck. The produced fluids from the wells are commingled on the platform and shipped to the Airlie Island processing facilities via a 200 millimetre diameter pipeline.

Chervil processing facilities on the island consist of flowlines, manifolds, one 17,000 barrels per day liquid capacity three-phase separator, gas conditioning vessel, gas flare, metering facilities, water treatment facilities and power generation. The incoming oil is heated from 22 degrees Celsius to a separator operating temperature in two heat exchangers located at the base of the shielded flare. After separation, oil is stored in the tanks and exported in conjunction with the South Pepper and North Herald oil. The produced gas is flared, while the produced water is treated prior to disposal on Airlie Island. In 1991, gas lift equipment for Chervil wells was installed and commissioned on Airlie Island.

Two production wells were drilled horizontally through the reservoir. The appraisal well, Chervil-4, was initially drilled as a conventional deviated hole to test the southern extent of accessible reserves. Subsequently, the well was redrilled 227 metres horizontally through the reservoir section and completed for production. After the Chervil platform was installed using the jack-up rig *Maersk Valiant*, the second production well Chervil-5 was drilled and completed for production using the same rig. The well was drilled 601 metres horizontally through the reservoir.

Figure 19 Annual production, Chervil accumulation



5.2.14 *Development: Tubridgi*

Operator:	Doral Resources NL	
Location:	25 kilometres southwest of Onslow.	
Discovered:	1980	
Production started:	26 September, 1991	
Product:	Gas	
No. of wells:	Oil producers	0
	Gas producers	6
	Shut in	0
	Plugged and abandoned	0
	Injection	0
	Suspended	0
	Total	6

Gas is gathered from six producing wels through some 24 km of flowlines into the central gas processing plant. The gas processing plant consists of liquids separator, glycol type gas dehydration plant, mercury scrubber, three 1250 HP reciprocating compressors, power generator, water suply and communication facilities. The facility is manned on a 24 hour basis with living quarters located close to the gas processing plant. From the gas processing plant the compressed gas flows via a 150 mm diameter, 92 km long pipeline to compressor station CS2 on the SECWA's main pipeline to Perth. Before injection into the main pipeline the gas is metered in facilities owned by the Tubridgi Joint Venture.

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GLOSSARY

°API Oil gravity, American Petroleum Institute

$$°API = \frac{141.5}{\text{specific gravity of oil at } 60^{o}F \text{ referred to water at } 60^{o}F} - 131.5$$

bbls	barrels. One barrel= 0.15898 cubic metres
bbls/d	barrels per day
C	degree Celsius
°F	degree Fahrenheit
cc	cubic centimetre = 10^{-6} cubic metres = millilitre
cfd	cubic feet per day
CO_2	carbon dioxide
cu ft	cubic feet
cu ft/d	cubic feet per day
d	day
DST	drill stem test
E	east
FIT	formation interval test
Fm	formation
GOC	gas-oil contact
GOR	gas-oil ratio
H_2S	hydrogen sulphide
GWC	gas-water contact
kL	kilolitre = 1 cubic metre
km	kilometre
L	litre
m	metre
m3	cubic metre
Mbr	member
m3/d	cubic metres per day
m/d	metres per day
mD	millidarcy (unit of permeability). One darcy = 0.986 micrometre squared
ml	millilitre=cubic centimetre
mm	millimetre
mSS	metres subsea

N_2	nitrogen
NaCl	sodium chloride (salt)
OWC	oil-water contact
ppm	parts per million
psi	pounds per square inch
psig	pounds per square inch gauge (above atmospheric)
RFT	Repeat formation test
RL	Retention Lease
RTSTM	rate too small to measure
Rw	water resistivity, ohm metre
S	south
scf/stb	standard cubic feet of gas per stock tank barrel of oil
SECWA	State Electricity Commission of Western Australia
SFT	Sidewall formation test (equivalent to RFT)
Sh	shale
sq	square
Sst	sandstone
stb	stock tank barrel
std. cu. m/day	standard cubic metres per day
TL	Territorial licence (Western Australia)
TP	Territorial permit (Western Australia)
WA	Western Australia
WFT	Wireline formation test (equivalent to RFT and SFT)
WGR	Water-gas ratio
WT	Wireline test (equivalent to RFT and SFT)

AUSTRALIAN PETROLEUM ACCUMULATIONS

DEPARTMENT OF PRIMARY INDUSTRIES AND ENERGY

COMPILED BY DOWLING L., PAIN L. & FELTON E.A.

BIBLIOGRAPHIC CITATION : DOWLING L., PAIN L. & FELTON E.A., 1992-
Carnarvon Basin, Western Australia
Bureau of Resource Sciences, Australia,
Australian Petroleum Accumulations Report 8.

CARNARVON BASIN

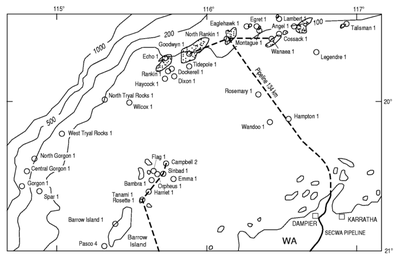
DAMPIER SUB-BASIN

STATUS	COMMERCIAL					NON COMMERCIAL			
LOCALITY MAP NUMBER	1	2	3	4	5	6	7	8	9
ACCUMULATION	TALISMAN	NORTH RANKIN	GOODWYN +	WANAEA	COSSACK	EGRET	ANGEL	EAGLEHAWK	LAMBERT
TRAP	Angel Fm	Toolonga Calcilutite Enderby Fm Mungaroo Fm	? Toolonga Calcilutite Mungaroo Fm	Angel Fm	Angel Fm	Angel Fm	Angel Fm	Brigadier Fm	Angel Fm
PETROLEUM - BEARING UNIT CRETACEOUS	'A' Sand	Toolonga Calcilutite	? Toolonga Calcilutite						
JURASSIC	'B' Sand 'C' Sand	Enderby Fm		Angel Fm	Angel Fm	Angel Fm	Angel Fm		Angel Fm
TRIASSIC		C to H	D E F G H					D	
PETROLEUM CONTENT	●	●	●	●	●	●	●	●	●

FIG 1 + *Includes Pueblo,Tidepole, Goodwyn South*

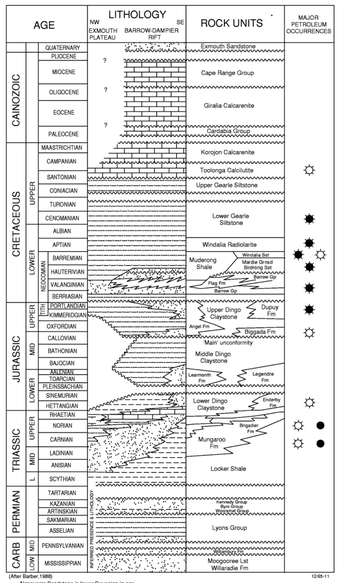
● *Oil* ✹ *Gas* ✹ *Oil,gas*

LOCALITY MAP



CARNARVON BASIN

STRATIGRAPHY

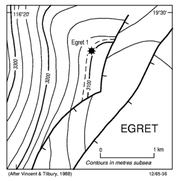


(After Barber, 1988)

Nannyarra Sandstone is lower Devonian in age.
Barrow Group consists of Flacourt and Malouet Formations.
* Correct time relationships are shown for rock units but not all units are present in each sub-basin.

● *Oil* ✹ *Gas* ✹ *Oil,gas*

STRUCTURE TOP ANGEL 'B' SAND

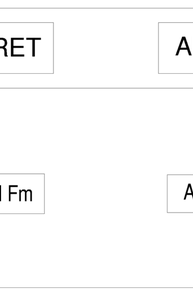


STRUCTURE AT BASE CRETACEOUS LEVEL (K)

STRUCTURE

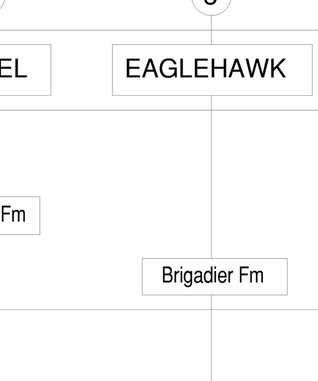
STRUCTURE AT TOP TITHONIAN

STRUCTURE AT MAIN UNCONFORMITY



STRUCTURE AT TOP F UNIT

STRUCTURE AT TOP H UNIT



STRUCTURE AT BASE NE UNIT

STRUCTURE AT MAIN UNCONFORMITY

DAMPIER SUB-BASIN

(Plate 1 of 3)

PETROLEUM RESERVES AND PRODUCTION

(The estimates listed below are for the whole of the Carnarvon Basin)

REMAINING RECOVERABLE RESERVES as at	31	12	90
Oil	86.73 Gl		
Condensate	91.59 Gl		
Sales Gas & LPG	972.45 Bcm		

CUMULATIVE PRODUCTION as at	30	6	90
Oil	43.893 Gl		
Condensate	5.001 Gl		
Sales Gas & LPG	35.705 Bcm		

Comments

Includes commercial and non-commercial, proved and probable reserves

DEPARTMENT OF PRIMARY INDUSTRIES AND ENERGY

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AUSTRALIAN PETROLEUM ACCUMULATIONS

CARNARVON BASIN

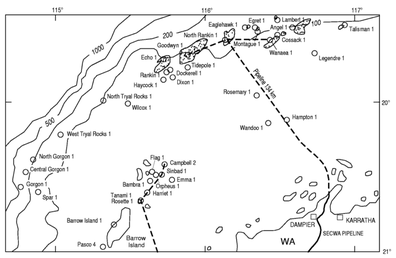
DAMPIER SUB-BASIN

STATUS: NON COMMERCIAL

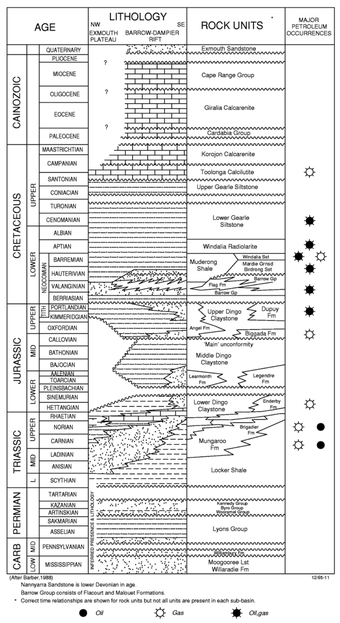
LOCALITY MAP NUMBER	ACCUMULATION	TRAP	PETROLEUM - BEARING UNIT	PETROLEUM CONTENT
10	MONTAGUE	Angel Fm; Triassic	CRETACEOUS: Angel Fm JURASSIC: Angel Fm TRIASSIC: Upper Triassic	Gas
11	WILCOX	Mungaroo Fm	TRIASSIC: E; F (3684m); F (3766m); G	Gas
12	GORGON	Barrow Group; Mungaroo Fm	CRETACEOUS: Malouet Fm TRIASSIC: Middle Mungaroo; Lower Mungaroo	Gas
13	WRYAL ROCKS	Mungaroo Fm	TRIASSIC: Mungaroo Fm	Oil,gas
14	RANKIN +	Mungaroo Fm	TRIASSIC: Mungaroo Fm	Includes Dockrell
15	ECHO #	Mungaroo Fm	TRIASSIC: E	Includes Yodel
16	DIXON	Angel Fm; Mungaroo Fm	JURASSIC: Angel Fm TRIASSIC: F; H	Gas; Multiple sands
17	LEGENDRE	Barrow Group	CRETACEOUS: Barrow Group	Oil,gas

FIG 1

LOCALITY MAP



STRATIGRAPHY



(After Barber 1988)

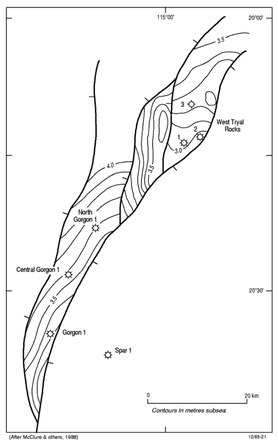
Nannyarra Sandstone is lower Devonian in age.
Barrow Group consists of Flacourt and Malouet Formations.
* Correct time relationships are shown for rock units but not all units are present in each sub-basin.

● Oil ☼ Gas ✸ Oil,gas

12/65-11

STRUCTURE

GORGON-WEST TRYAL ROCKS

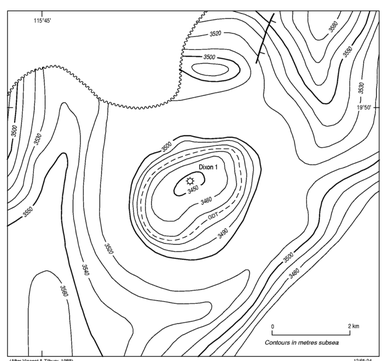


(After McClure & others, 1988)

12/65-21

STRUCTURE WITHIN UPPER TRIASSIC MUNGAROO FORMATION

DIXON

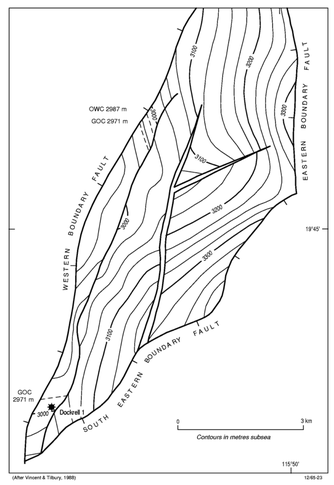


(After Vincent & Tilbury, 1988)

12/65-24

STRUCTURE AT BASE CRETACEOUS LEVEL

DOCKRELL



(After Vincent & Tilbury, 1988)

12/65-23

STRUCTURE AT TOP E UNIT

DAMPIER SUB-BASIN

(Plate 2 of 3)

PETROLEUM RESERVES AND PRODUCTION

(The estimates listed below are for the whole of the Carnarvon Basin)

REMAINING RECOVERABLE RESERVES as at	31	12	90
Oil	86.73 Gl		
Condensate	91.59 Gl		
Sales Gas & LPG	972.45 Bcm		
CUMULATIVE PRODUCTION as at	30	6	90
Oil	43.893 Gl		
Condensate	5.001 Gl		
Sales Gas & LPG	35.705 Bcm		

Comments

Includes commercial and non-commercial, proved and probable reserves

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AUSTRALIAN PETROLEUM ACCUMULATIONS

CARNARVON BASIN

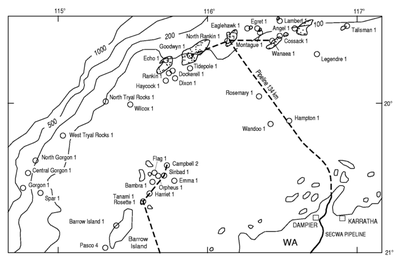
DAMPIER SUB-BASIN

STATUS	NON COMMERCIAL	OTHER DISCOVERIES			
LOCALITY MAP NUMBER	18	19	20	21	22
ACCUMULATION	WANDOO	HAMPTON	ROSEMARY	HAYCOCK	NORTH TRYAL ROCKS
TRAP	Muderong Shale	Early Cretaceous	Barrow Group Legendre Fm Enderby Fm	Mungaroo Fm	Mungaroo Fm Equivalent
PETROLEUM - BEARING UNIT — CRETACEOUS	M.australis Sst	Windalia Sst	Barrow Gp		
JURASSIC			Legendre Fm	Enderby Fm	
TRIASSIC				Mungaroo Fm *	Mungaroo Fm equivalent
PETROLEUM CONTENT					

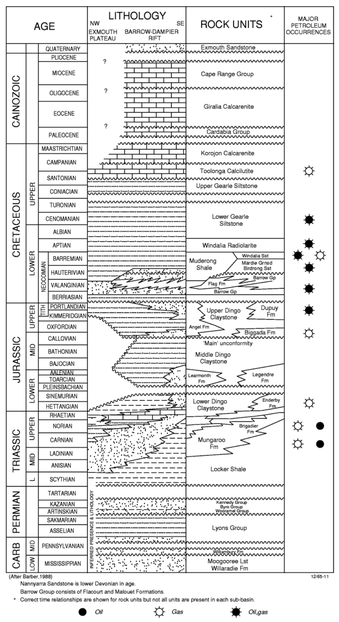
FIG 1

Gas Oil,gas * Multiple sands

LOCALITY MAP



STRATIGRAPHY



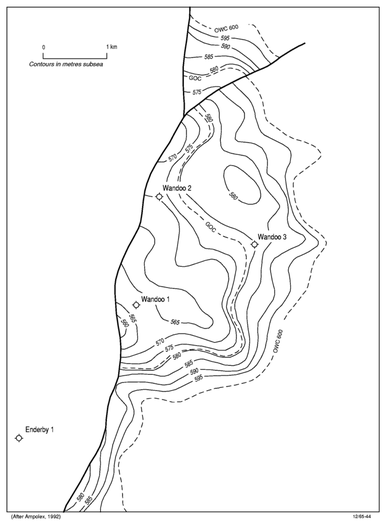
(After Barber 1988)
Nannyarra Sandstone is lower Devonian in age.
Barrow Group consists of Flacourt and Malcuet Formations.
* Correct time relationships are shown for rock units but not all units are present in each sub-basin.

● Oil ☼ Gas ✹ Oil,gas

12/65-11

STRUCTURE

WANDOO



(After Ampolex, 1992)

12/65-44

STRUCTURE AT TOP UNIT A

DAMPIER SUB-BASIN

(Plate 3 of 3)

PETROLEUM RESERVES AND PRODUCTION

(The estimates listed below are for the whole of the Carnarvon Basin)

REMAINING RECOVERABLE RESERVES as at		31	12	90
	Oil	86.73 Gl		
	Condensate	91.59 Gl		
	Sales Gas & LPG	972.45 Bcm		
CUMULATIVE PRODUCTION as at		30	6	90
	Oil	43.893 Gl		
	Condensate	5.001 Gl		
	Sales Gas & LPG	35.705 Bcm		

Comments

Includes commercial and non-commercial, proved and probable reserves

DEPARTMENT OF PRIMARY INDUSTRIES AND ENERGY

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AUSTRALIAN PETROLEUM ACCUMULATIONS

CARNARVON BASIN

BARROW SUB-BASIN

	23	24	25	26	27	28
STATUS	COMMERCIAL					
ACCUMULATION	BARROW ISLAND	SALADIN +	COWLE	SOUTH PEPPER	NORTH HERALD	CHERVIL
TRAP	Gearle Siltstone; Windalia Radiolarite; Muderong Shale; Barrow Group; Dingo Claystone	Muderong Shale Barrow Group	Barrow Group	Muderong Shale Barrow Group; Dupuy Fm	Barrow Group	Muderong Shale Barrow Group
PETROLEUM - BEARING UNIT: CRETACEOUS	Gearle Siltstone; Windalia Sandstone; M3; M4; Mardie Grn; Tunney Mbr; Flacourt Fm; Malouet Fm *	Mardie Greensand & Flacourt Fm	Flacourt Fm	Mardie Greensand & Flacourt Fm; Malouet Fm	Flacourt Fm	Mardie Greensand & Flacourt Fm
JURASSIC	Dupuy Fm *; Biggada Fm *			Dupuy Fm		
TRIASSIC						
PETROLEUM CONTENT	◎	◎	◎	◎	◎	◎

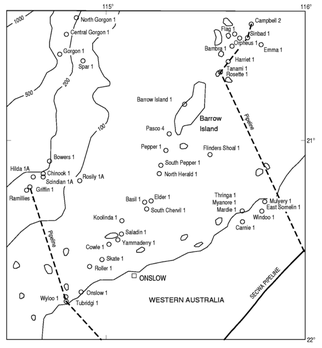
+ *Includes Yammaderry*

* *Multiple sands*

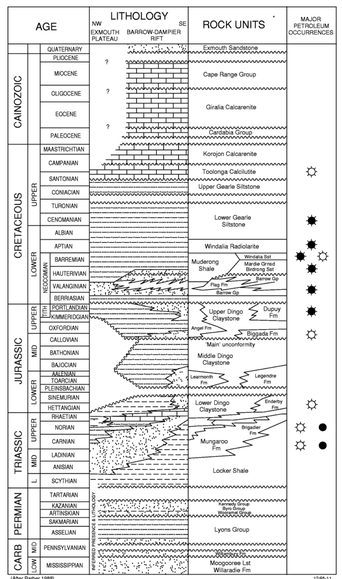
◎ *Oil* ☼ *Gas* ✹ *Oil,gas*

FIG 1

LOCALITY MAP



STRATIGRAPHY



(After Barber, 1988)
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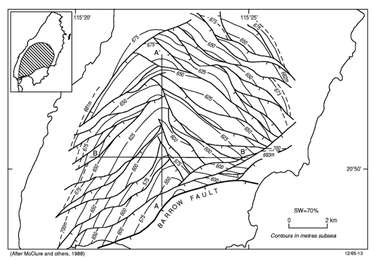
Barrow Group consists of Flacourt and Malouet Formations.
* Correct time relationships are shown for rock units but not all units are present in each sub-basin.

12/65-11

STRUCTURE

BARROW ISLAND

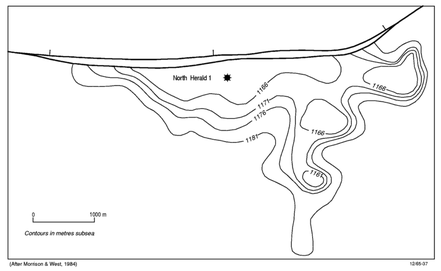


(After McClure and others, 1988)

12/65-13

STRUCTURE AT TOP WINDALIA SANDSTONE

NORTH HERALD

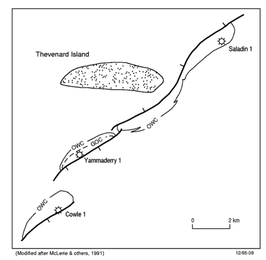


(After Morrison & West, 1984)

12/65-37

STRUCTURE FOR TOP BARROW GROUP

SALADIN



(Modified after McLerie & others, 1991)

12/65-09

BARROW SUB-BASIN

(Plate 1 of 4)

PETROLEUM RESERVES AND PRODUCTION

(The estimates listed below are for the whole of the Carnarvon Basin)

REMAINING RECOVERABLE RESERVES as at	31	12	90
Oil	86.73 Gl		
Condensate	91.59 Gl		
Sales Gas & LPG	972.45 Bcm		

CUMULATIVE PRODUCTION as at	30	6	90
Oil	43.893 Gl		
Condensate	5.001 Gl		
Sales Gas & LPG	35.705 Bcm		

Comments

Includes commercial and non-commercial, proved and probable reserves

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AUSTRALIAN PETROLEUM ACCUMULATIONS

CARNARVON BASIN

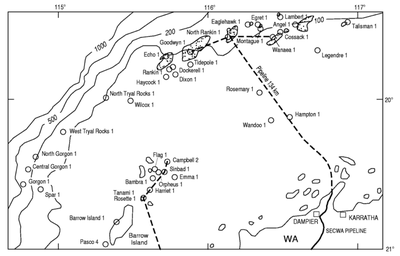
BARROW SUB-BASIN

STATUS	COMMERCIAL					NON COMMERCIAL		
LOCALITY MAP NUMBER	29	30	31	32	33	34	35	
ACCUMULATION	HARRIET	ROSETTE	CAMPBELL	SINBAD	TANAMI	BAMBRA	SPAR	
TRAP	Barrow Group	Barrow Group	Barrow Group	Barrow Group	Barrow Group	Barrow NE / Barrow SW / Dingo Claystone	Barrow Group	
PETROLEUM - BEARING UNIT: CRETACEOUS	Flag Fm	Flag Fm	Flacourt Fm	Flag Fm	Flag Fm	Barrow NE / SW	Flacourt Fm	
PETROLEUM - BEARING UNIT: JURASSIC						Dingo Claystone		
PETROLEUM - BEARING UNIT: TRIASSIC								
PETROLEUM CONTENT								

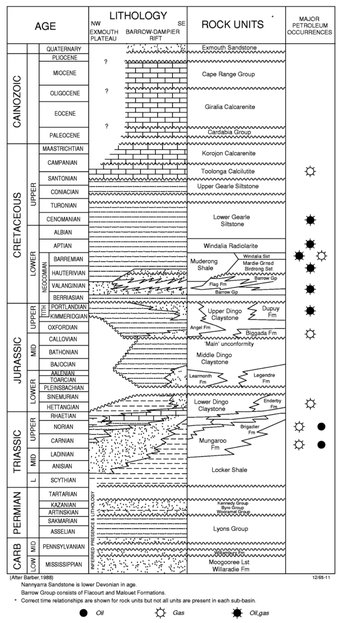
FIG 1

Oil Gas Oil,gas

LOCALITY MAP



STRATIGRAPHY



(After Barber 1988)

Nannyarra Sandstone is lower Devonian in age.

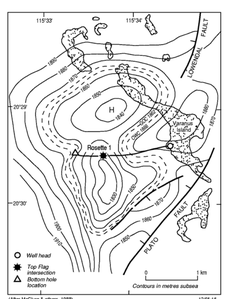
Barrow Group consists of Flacourt and Malcuet Formations.

* Correct time relationships are shown for rock units but not all units are present in each sub-basin.

Oil Gas Oil,gas

STRUCTURE

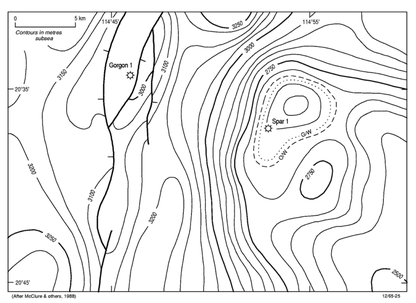
ROSETTE



(After McClure & others, 1988) 12/65-15

STRUCTURE AT TOP FLAG SANDSTONE LEVEL

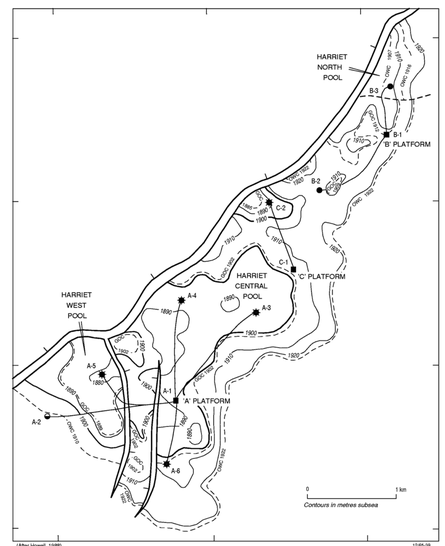
SPAR



(After McClure & others, 1988) 12/65-25

STRUCTURE AT TOP BARROW GROUP

HARRIET



(After Howell, 1988) 12/65-38

STRUCTURE AT TOP FLAG FORMATION

BARROW SUB-BASIN

(Plate 2 of 4)

PETROLEUM RESERVES AND PRODUCTION

(The estimates listed below are for the whole of the Carnarvon Basin)

REMAINING RECOVERABLE RESERVES as at	31	12	90
Oil	86.73 Gl		
Condensate	91.59 Gl		
Sales Gas & LPG	972.45 Bcm		

CUMULATIVE PRODUCTION as at	30	6	90
Oil	43.893 Gl		
Condensate	5.001 Gl		
Sales Gas & LPG	35.705 Bcm		

Comments

Includes commercial and non-commercial, proved and probable reserves

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AUSTRALIAN PETROLEUM ACCUMULATIONS

CARNARVON BASIN

BARROW SUB-BASIN

STATUS	COMMERCIAL				NON COMMERCIAL		OTHER DISCOVERIES
LOCALITY MAP NUMBER	36	37	38	39	40	41	42
ACCUMULATION	GRIFFIN +	CHINOOK #	ROLLER	SKATE	SOUTH CHERVIL	ELDER	BOWERS
TRAP	Muderong Shale; Barrow Group	Mardie Greensand; Barrow Group	Barrow Group	Barrow Group	Muderong Shale Barrow Group	Mungaroo Fm	Mungaroo Fm
PETROLEUM - BEARING UNIT: CRETACEOUS	Mardie Greensand; *	Mardie Greensand; Barrow Group	Flacourt Fm	Barrow Group	Mardie Greensand & Flacourt Fm		
PETROLEUM - BEARING UNIT: JURASSIC							
PETROLEUM - BEARING UNIT: TRIASSIC						Mungaroo Fm	Mungaroo Fm
PETROLEUM CONTENT	Oil; Oil	Gas; Oil	Oil,gas	Oil	Oil,gas	Oil,gas	Gas

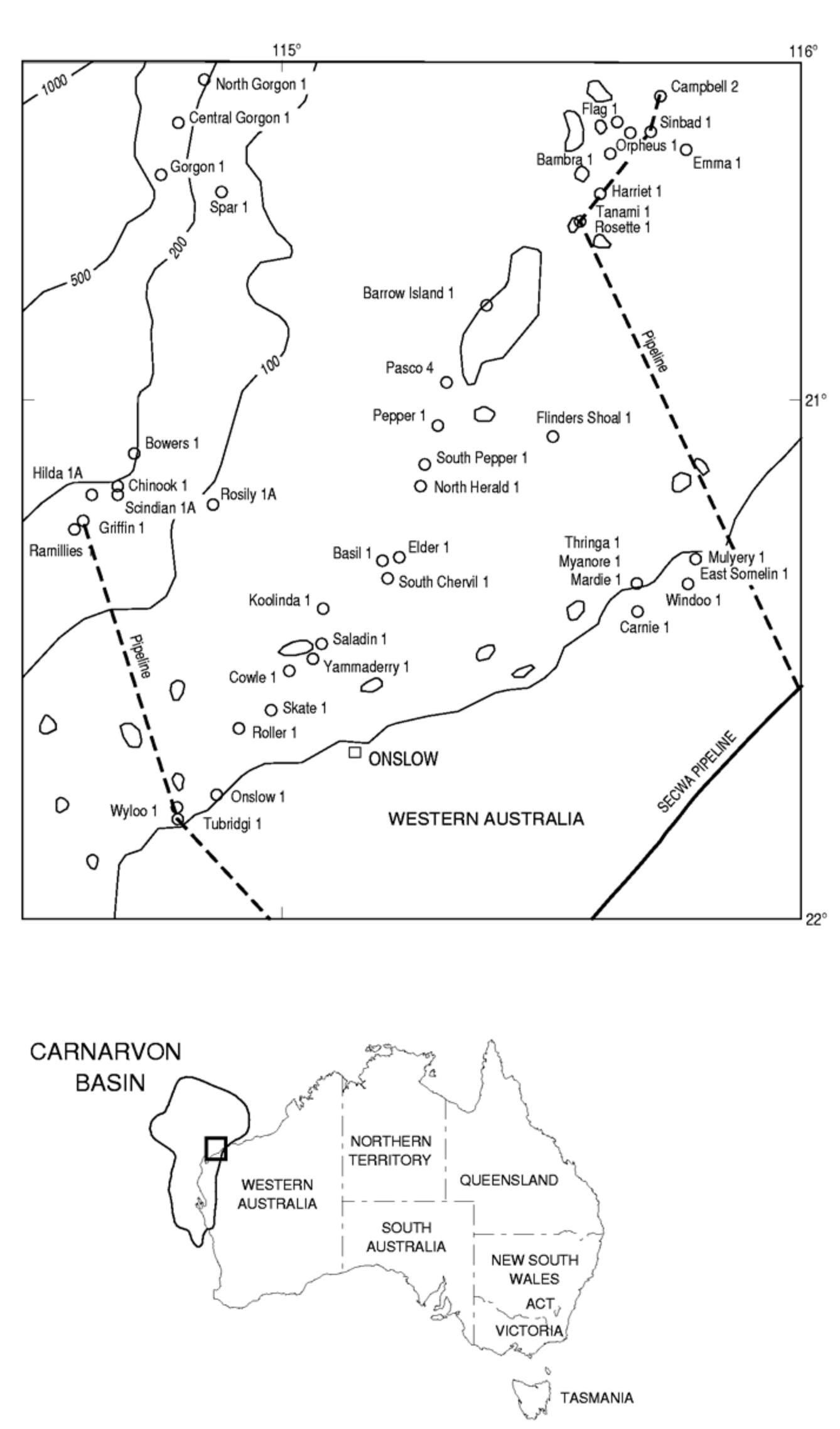
+ *Includes Hilda & Ramillies*
# *Includes Scindian*

Legend: Oil; Gas; Oil,gas

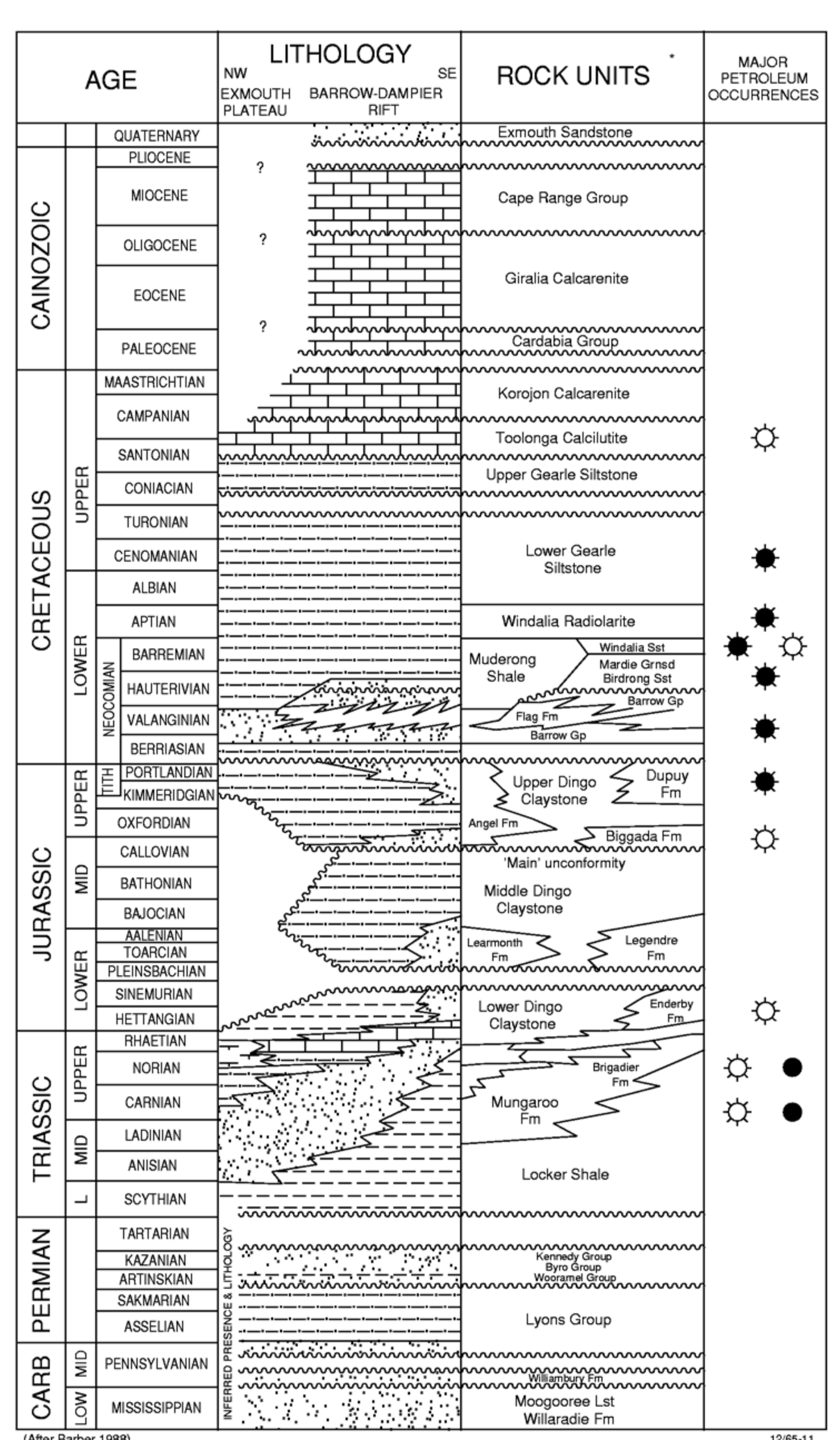
* *Multiple sands*

FIG 1

LOCALITY MAP



STRATIGRAPHY

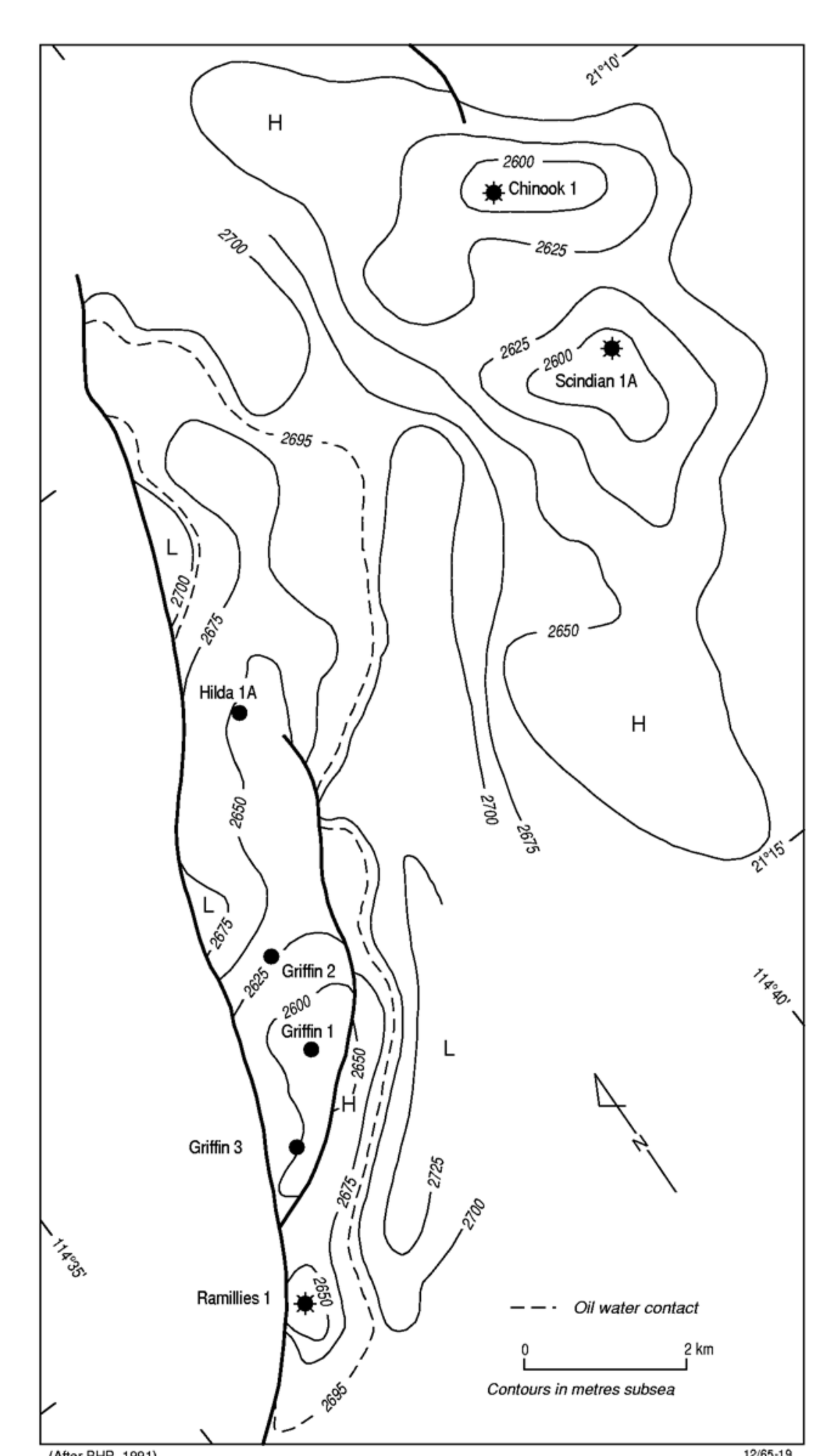


(After Barber,1988)
Nannyarra Sandstone is lower Devonian in age.
Barrow Group consists of Flacourt and Malouet Formations.
* Correct time relationships are shown for rock units but not all units are present in each sub-basin.

Legend: Oil; Gas; Oil,gas

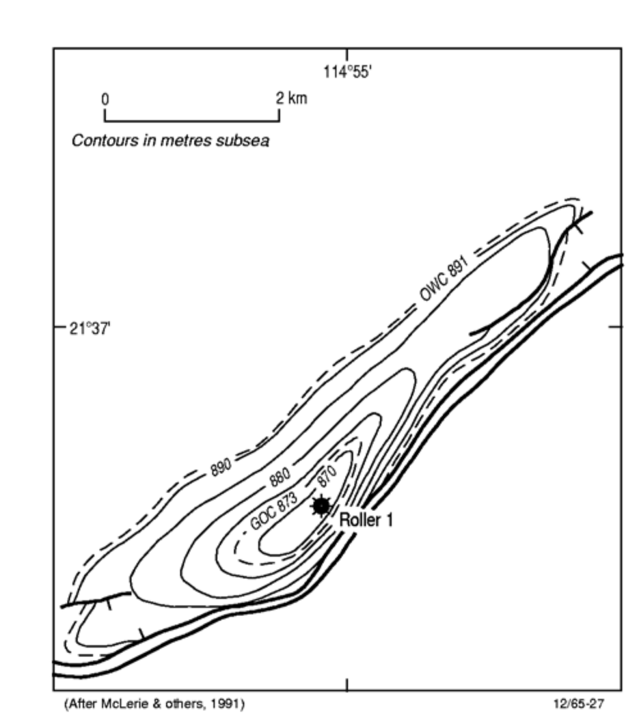
STRUCTURE

GRIFFIN - CHINOOK



STRUCTURE AT TOP MARDIE GREENSAND

ROLLER



STRUCTURE AT TOP BARROW GROUP

BARROW SUB-BASIN

(Plate 3 of 4)

PETROLEUM RESERVES AND PRODUCTION

(The estimates listed below are for the whole of the Carnarvon Basin)

REMAINING RECOVERABLE RESERVES as at	31	12	90
Oil	86.73 Gl		
Condensate	91.59 Gl		
Sales Gas & LPG	972.45 Bcm		
CUMULATIVE PRODUCTION as at	30	6	90
Oil	43.893 Gl		
Condensate	5.001 Gl		
Sales Gas & LPG	35.705 Bcm		

Comments

Includes commercial and non-commercial, proved and probable reserves

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CARNARVON BASIN

BARROW SUB-BASIN

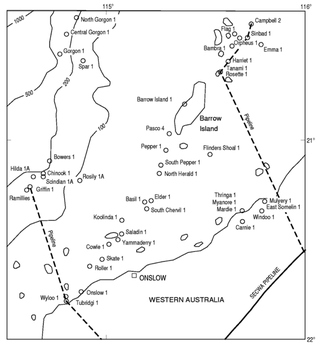
OTHER DISCOVERIES

	43	44	45	46	47	48	49
LOCALITY MAP NUMBER							
ACCUMULATION	FLINDERS SHOAL	PEPPER	PASCO	BASIL	KOOLINDA	FLAG	ROSILY
TRAP	Birdrong Sst	Barrow Group	Malouet Fm	Muderong Shale	Dupuy Fm	Muderong Shale	Malouet Fm
PETROLEUM - BEARING UNIT: CRETACEOUS	Birdrong Sst	Upper Barrow Group	5200' Sand 5700' Sand 5980' Sand 6000' Sand 7300' Sand	Mardie Greensand		Muderong Shale	Malouet Fm
JURASSIC					Dupuy Fm		
TRIASSIC							
PETROLEUM CONTENT							

FIG 1

Oil *Gas* *Oil,gas*

LOCALITY MAP



STRATIGRAPHY

AGE			LITHOLOGY NW EXMOUTH PLATEAU	LITHOLOGY BARROW-DAMPIER RIFT SE	ROCK UNITS *	MAJOR PETROLEUM OCCURRENCES
CAINOZOIC		QUATERNARY			Exmouth Sandstone	
		PLIOCENE				
		MIOCENE	?		Cape Range Group	
		OLIGOCENE	?		Giralia Calcarenite	
		EOCENE				
		PALEOCENE	?		Gandalla Group	
CRETACEOUS	UPPER	MAASTRICHTIAN			Korojon Calcarenite	
		CAMPANIAN				
		SANTONIAN			Toolonga Calcilutite	
		CONACIAN			Upper Gearle Siltstone	
		TURONIAN				
		CENOMANIAN			Lower Gearle Siltstone	
		ALBIAN				
	LOWER	APTIAN			Windalia Radiolarite	
		BARREMIAN			Muderong Shale / Windalia Sst / Mardie Grnsd / Birdrong Sst	
		HAUTERIVIAN				
		VALANGINIAN			Flag Fm / Barrow Gp	
		BERRIASIAN				
JURASSIC	UPPER	PORTLANDIAN			Upper Dingo Claystone / Dupuy Fm	
		KIMMERIDGIAN				
		OXFORDIAN			Angel Fm / Brigadia Fm	
	MID	CALLOVIAN			'Main' unconformity	
		BATHONIAN			Middle Dingo Claystone	
		BAJOCIAN				
		AALENIAN			Learmonth Fm / Legendre Fm	
	LOWER	TOARCIAN				
		PLIENSBACHIAN				
		SINEMURIAN			Lower Dingo Claystone / Enderby Fm	
		HETTANGIAN				
TRIASSIC	UPPER	RHAETIAN			Brigadier Fm	
		NORIAN				
		CARNIAN			Mungaroo Fm	
	MID	LADINIAN				
		ANISIAN			Locker Shale	
	L	SCYTHIAN				
PERMIAN		TARTARIAN				
		KAZANIAN			Byro Group / Wooramel Group	
		ARTINSKIAN				
		SAKMARIAN				
		ASSELIAN			Lyons Group	
CARB	LOW MID	PENNSYLVANIAN				
		MISSISSIPPIAN			Moogooree Ltst / Willaradie Fm	

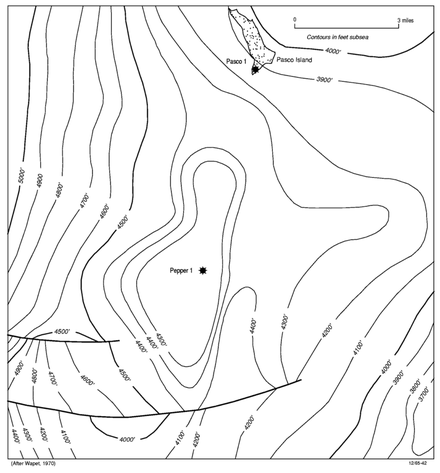
(After Barber 1988)
Nannyarra Sandstone is lower Devonian in age.
Barrow Group consists of Flacourt and Malouet Formations.
* Correct time relationships are shown for rock units but not all units are present in each sub-basin.

1249-11

Oil *Gas* *Oil,gas*

STRUCTURE

PEPPER



(After Wapet, 1970)

1249-42

STRUCTURE NEAR TOP BARROW GROUP

BARROW SUB-BASIN

(Plate 4 of 4)

PETROLEUM RESERVES AND PRODUCTION

(The estimates listed below are for the whole of the Carnarvon Basin)

REMAINING RECOVERABLE RESERVES as at	31	12	90
Oil	86.73 Gl		
Condensate	91.59 Gl		
Sales Gas & LPG	972.45 Bcm		
CUMULATIVE PRODUCTION as at	30	6	90
Oil	43.893 Gl		
Condensate	5.001 Gl		
Sales Gas & LPG	35.705 Bcm		

Comments

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CARNARVON BASIN

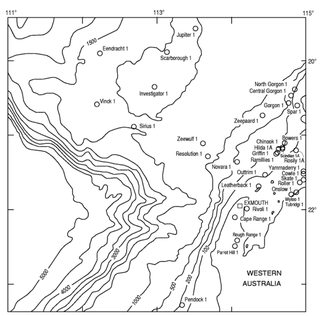
EXMOUTH SUB-BASIN

STATUS	COMMERCIAL	OTHER DISCOVERIES					
LOCALITY MAP NUMBER	50	51	52	53	54	55	56
ACCUMULATION	ROUGH RANGE	PARROT HILL	NOVARA	LEATHERBACK	CAPE RANGE	OUTTRIM	RIVOLI
TRAP	Birdrong Sandstone	Birdrong Sandstone	Barrow Group	Mungaroo Fm	Dingo Claystone	Barrow Group	Birdrong Sandstone
PETROLEUM - BEARING UNIT: CRETACEOUS	Birdrong Sandstone	Birdrong Sandstone	Barrow Group		Dingo Claystone	Barrow Group	Birdrong Sandstone
JURASSIC				Mungaroo Fm			
TRIASSIC							
PETROLEUM CONTENT	●	●	●	●	☼	☼	☼

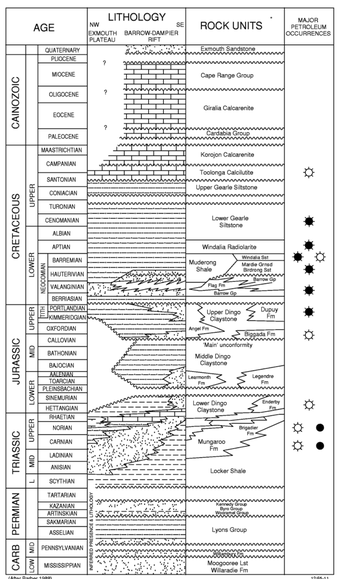
● Oil ☼ Gas ☼ Oil, gas

FIG 1

LOCALITY MAP



STRATIGRAPHY



(After Barber,1988)
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Barrow Group consists of Flacourt and Malouet Formations.
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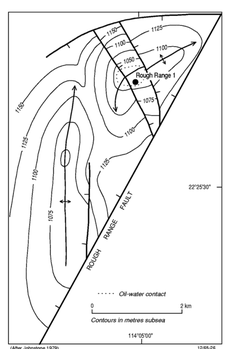
● Oil ☼ Gas ✸ Oil,gas

STRUCTURE

ROUGH RANGE



STRUCTURE AT BIRDRONG SANDSTONE

EXMOUTH SUB-BASIN & GASCOYNE SUB-BASIN

PETROLEUM RESERVES AND PRODUCTION

(The estimates listed below are for the whole of the Carnarvon Basin)

REMAINING RECOVERABLE RESERVES	as at	31	12	90
Oil		86.73 Gl		
Condensate		91.59 Gl		
Sales Gas & LPG		972.45 Bcm		
CUMULATIVE PRODUCTION	as at	30	6	90
Oil		43.893 Gl		
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Comments

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AUSTRALIAN PETROLEUM ACCUMULATIONS

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CARNARVON BASIN

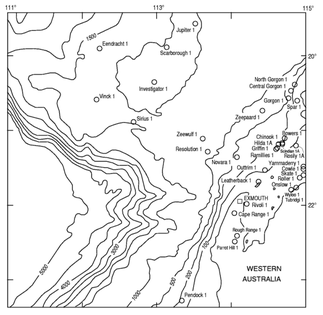
EXMOUTH PLATEAU

STATUS	NON COMMERCIAL	OTHER DISCOVERIES							
LOCALITY MAP NUMBER	57	58	59	60	61	62	63	64	65
ACCUMULATION	SCARBOROUGH	EENDRACHT	INVESTIGATOR	JUPITER	SIRIUS	VINCK	ZEEPAARD	ZEEWULF	RESOLUTION
TRAP	Barrow Group	Brigadier Fm	Mungaroo Fm	Brigadier Fm	Mungaroo Fm	Mungaroo Fm	Brigadier Fm	Brigadier Fm	Mungaroo Fm
PETROLEUM - BEARING UNIT: CRETACEOUS	Barrow Group								
PETROLEUM - BEARING UNIT: JURASSIC									
PETROLEUM - BEARING UNIT: TRIASSIC		Brigadier Fm	Mungaroo Fm	Brigadier Fm	Mungaroo Fm	Mungaroo Fm	Brigadier Fm	Brigadier Fm	Mungaroo Fm
PETROLEUM CONTENT	●	☼	☼	☼	☼	☼	☼	☼	☼

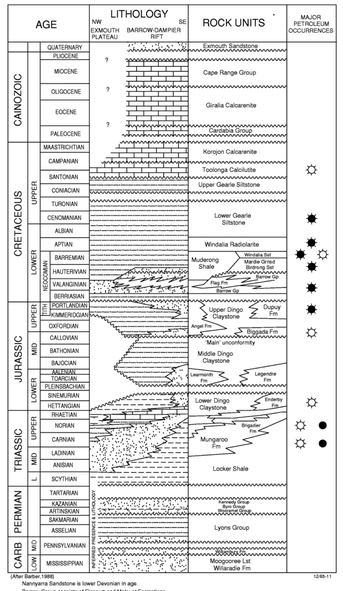
Gas

FIG 1

LOCALITY MAP

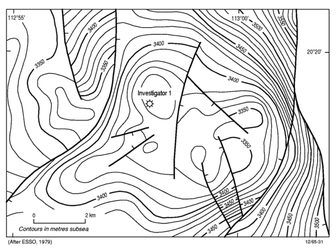


STRATIGRAPHY



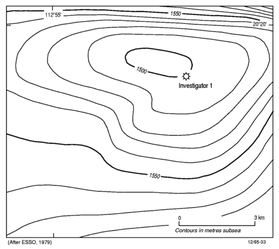
STRUCTURE

INVESTIGATOR



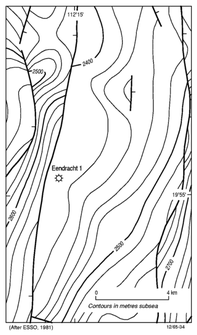
STRUCTURE AT RHAETIAN UNCONFORMITY

INVESTIGATOR



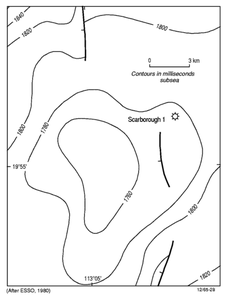
STRUCTURE AT DELTA TOP IN BARROW GROUP

EENDRACHT



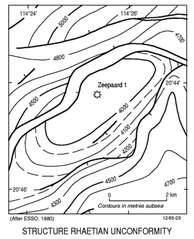
STRUCTURE AT RHAETIAN UNCONFORMITY

SCARBOROUGH



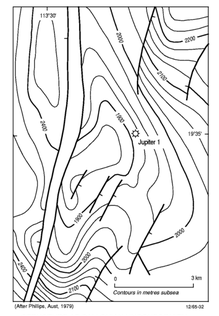
STRUCTURE DELTA TOP IN BARROW GROUP (TWT)

ZEEPAARD



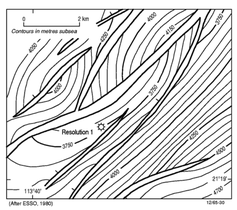
STRUCTURE RHAETIAN UNCONFORMITY

JUPITER



STRUCTURE AT CALLOVIAN UNCONFORMITY

RESOLUTION



STRUCTURE AT RHAETIAN UNCONFORMITY

EXMOUTH PLATEAU

PETROLEUM RESERVES AND PRODUCTION

(The estimates listed below are for the whole of the Carnarvon Basin)

	as at		
REMAINING RECOVERABLE RESERVES	31	12	90
Oil	86.73 Gl		
Condensate	91.59 Gl		
Sales Gas & LPG	972.45 Bcm		
CUMULATIVE PRODUCTION	as at 30	6	90
Oil)	43.893 Gl		
Condensate	5.001 Gl		
Sales Gas & LPG	35.705 Bcm		

Comments

Includes commercial and non-commercial, proved and probable reserves

AUSTRALIAN PETROLEUM ACCUMULATIONS

DEPARTMENT OF PRIMARY INDUSTRIES AND ENERGY

COMPILED BY DOWLING L., PAIN L. & FELTON E.A.

BIBLIOGRAPHIC CITATION : DOWLING L., PAIN L. & FELTON E.A., 1992-
Carnarvon Basin, Western Australia
Bureau of Resource Sciences, Australia,
Australian Petroleum Accumulations Report 8.

CARNARVON BASIN

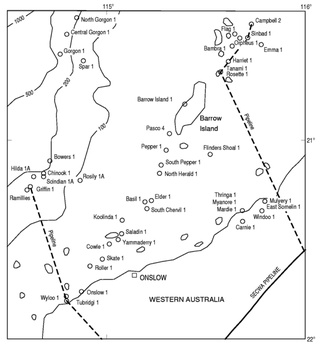
PEEDAMULLAH / ONSLOW SHELF

STATUS	COMMERCIAL	NON COMMERCIAL		OTHER DISCOVERIES				
LOCALITY MAP NUMBER	66	67	68	69	70	71	72	73
ACCUMULATION	TUBRIDGI	THRINGA	EAST SOMELIM	CARNIE	WINDOO	MARDIE	MULYERY	MYANORE
TRAP	Gearle Siltstone Birdrong Sandstone Barrow Group Mungaroo Fm	Windalia Sandstone Muderong Shale Mardie Greensand		Muderong Shale	Muderong Shale	Muderong Shale	Muderong Shale	Muderong Shale
PETROLEUM - BEARING UNIT: CRETACEOUS	Lower Gearle Siltstone * Birdrong Sandstone Flacourt Formation	Windalia Sandstone Muderong Shale Mardie Greensand		Muderong Shale	Mardie Greensand	Mardie Greensand	Mardie Greensand	Mardie Greensand
JURASSIC	*JURASSIC THIN OR ABSENT ON PEEDAMULLAH / ONSLOW SHELF*							
TRIASSIC	Mungaroo Formation							
PETROLEUM CONTENT	☼ ☼ ☼ ☼	☼ ☼ ◉	◉	☼	☼	☼	☼	☼ *

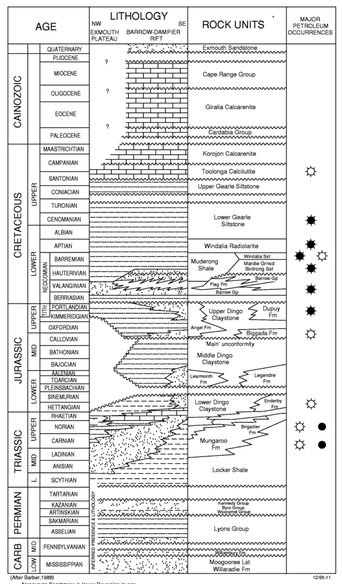
◉ Oil ☼ Gas ✸ Oil, gas * Multiple sands

FIG 1

LOCALITY MAP



STRATIGRAPHY



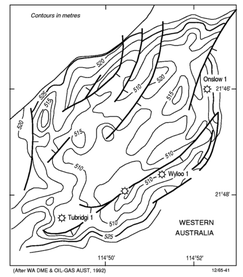
(After Barber,1988)
Nannyarra Sandstone is lower Devonian in age.
Barrow Group consists of Flacourt and Malouet Formations.
• Correct time relationships are shown for rock units but not all units are present in each sub-basin.

12/48-11

● Oil ☼ Gas ✸ Oil,gas

STRUCTURE

TUBRIDGI



(After WA DME & OIL/GAS AUST., 1992) 12/65-41

STRUCTURE AT TOP BARROW GROUP

PEEDAMULLAH/ONSLOW SHELF

PETROLEUM RESERVES AND PRODUCTION

(The estimates listed below are for the whole of the Carnarvon Basin)

REMAINING RECOVERABLE RESERVES	as at	31	12	90
Oil		86.73 Gl		
Condensate		91.59 Gl		
Sales Gas & LPG		972.45 Bcm		
CUMULATIVE PRODUCTION	as at	30	6	90
Oil		43.893 Gl		
Condensate		5.001 Gl		
Sales Gas & LPG		35.705 Bcm		

Comments

Includes commercial and non-commercial, proved and probable reserves