This is the sixth report in a series prepared by the Petroleum Resource Assessment Branch of the Bureau of Mineral Resources, Geology and Geophysics (BMR) that outlines the locations, character and general quality of Australia's identified petroleum resources in particular sedimentary basins. The series is a product of continuing BMR effort to develop and maintain an inventory of the petroleum resources identified by exploration and development. Each report is intended as a reference for use by petroleum explorationists, government policy makers, researchers, resource analysts and the public, to assist in understanding the nature and extent of Australia's identified petroleum resources.

This report covers the identified petroleum and non-petroleum gas resources in the Otway Basin which, although not large, are strategically located near major population centres along the southeast margin of the Australian mainland. Previous reports in the series cover the petroleum resources of the Amadeus, Bass, Gippsland, Adavale and Bonaparte Basins. Reports on the Browse, Bowen-Surat, Cooper-Eromanga, Carnarvon and Perth Basins are in preparation.

The Australian Petroleum Accumulations Report series is a major product of the work coordinated by the BMR Reservoir Geology Group, established under the leadership of the late Dr Stanley Ozimic. The APA series was initiated by Dr Ozimic and is a tribute to his efforts and foresight.

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5 April 1990
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ABSTRACT

As at 31 December 1989 the Otway Basin, which is located along the southeast margin of the Australian mainland, was known to contain a total of seven economic and six subeconomic petroleum and non-petroleum gas accumulations. All have been discovered since the late 1950s as a result of petroleum exploration drilling.

Three accumulations have been or could be used as a source of petroleum natural gas or carbon dioxide: the North Paaratte gas accumulation in Victoria and the Caroline carbon dioxide accumulation in South Australia, both of which are currently being exploited, and the Wallaby Creek gas accumulation in Victoria, which has been identified by permit holders as an accumulation likely to be developed in the future (1992-1994). In addition, the Katnook and Ladbroke Grove gas accumulations in South Australia are being considered for development in the near future.

The initial petroleum reserves of the Otway Basin as at 31 December 1988 are estimated to be 0.483 billion cubic metres of sales gas and 0.002 million kilolitres of condensate (not including the reserves of the Katnook and Ladbroke Grove accumulations). Production from the Caroline carbon dioxide accumulation commenced in 1968, and this field continues to supply this commodity much of the South Australian and Victorian markets. Production of natural gas from the North Paaratte accumulation commenced in August 1986. This field supplies domestic and industrial users in Warrnambool, Victoria.
INTRODUCTION

This report summarises technical information on the petroleum and non-petroleum accumulations found in the Otway Basin up to 31 December 1989. The report contains a brief overview of the geology of the Otway Basin and describes the location and significance of all known petroleum and other strategic non-petroleum gas accumulations.

The nature of the Otway Basin sequence, and the petroleum accumulations found to date, indicate that additional petroleum resources are likely to be discovered. An unusual feature of the known accumulations is that several comprise carbon dioxide, while some of the petroleum accumulations have significant concentrations of nitrogen and helium, in addition to carbon dioxide. The petroleum and non-petroleum gas found to date highlight the potential of the basin to satisfy some of the energy and industrial resource needs of regional population centres in southeastern Australia.

BASIN SUMMARY

Basin setting

The Otway Basin extends west-northwestwards for over 500 kilometres along the southern Australian mainland coast, and is one of several extensional and transitional basins along this margin of the Australian continent.

The limits of the Otway Basin (Fig. 1) are taken as the 4500 metre isobath in the southwest, and King Island in the southeast (Exon & Lee, 1987; Robertson & others, 1978). In the north and northwest, the boundary of the Otway basin is taken as the limit of Cretaceous sedimentation.

In the east, the Otway Basin is separated from the Bass Basin by the King Island-Mornington Peninsula basement ridge. Between this ridge and the Cape Otway-King Island High lies the Torquay Basin, which has a similar early rifting history to that of the Otway Basin, but which developed separately in the Late Cretaceous (Robertson & others, 1978). In the southeast, the Otway Basin grades into the Sorell Basin, which extends down
the west coast of Tasmania for 500 kilometres and averages 100 kilometres in width.

**Basin development and stratigraphy**

The Otway Basin was formed by both rift and wrench-related tectonics (Williamson & others, 1988) (Fig. 1) but is largely interpreted to be a rifted margin whose structural grain is dominated by west-northwest-trending down-to-basin faults. This fault pattern appears to have been initiated in the Early Cretaceous, but was far more evident in the Late Cretaceous to early Tertiary as sea floor spreading occurred (Weissel & Hayes, 1972). Following the initiation of sea floor spreading, north-northeast-trending horst and graben structures developed in the Late Cretaceous and the outer part of the continental shelf was the site of subsidence.

Four major sedimentary sequences have been recognised in the Otway Basin (Felton & Jackson, 1987) (Fig. 2). The Upper Jurassic to Lower Cretaceous Otway Group (Fig. 2), consists of up to 4500 metres of continental sandstone, siltstone, shale and coal with some volcanoclastic sediments and volcanics. Much of the sequence was deposited by fluvio-lacustrine (Eumeralla Formation) to fluvial (Pretty Hill Sandstone) sedimentation in troughs formed during initial rifting of the basin. By the Late Cretaceous, rifting was followed by spreading and subsidence, so that the basin began to take its present shape (Exon & Lee, 1987). South and west of the Mussel Platform, rapid subsidence occurred during the deposition of the Sherbrook Group, forming the northwest-trending Voluta Trough which is filled with up to 5000 m of clastic sediments. The Upper Cretaceous sequence was deposited during a major transgressive-regressive cycle. Holdgate and others (1986) suggested that the Sherbrook Group was deposited as a thick deltaic sequence, sourced from the north and west of the basin with its major depocentre in the Voluta Trough (Fig. 3).

At the end of the Cretaceous the Sherbrook Group was truncated by local erosion. A rise in sea level in the Paleocene resulted in transgression over the other sequences where they were exposed around major basement highs. Some of the material eroded from older sequences is preserved in restricted shallow marine deposits of the Pebble Point Formation, which is one of the earliest Tertiary units (Fig. 2). Overlying sediments comprise the clastic-dominated deltaic Dilwyn Formation and Pember Mudstone Member, which were deposited in rapidly subsiding areas
Figure 1. Location map of the Otway Basin showing simplified onshore structural elements and petroleum accumulations. See Plates 1 and 2 for details of each accumulation and Figure 3 for a detailed structural elements map.
Figure 3. Location and structural elements of the Otway Basin, southeastern Australia.
around Portland Trough where the early Tertiary sequence reaches a thickness of 500 metres (Holdgate & others, 1986). The clastic sequences of the Wangerrip Group are succeeded by extensive carbonate sequences comprising the Niranda and Heytesbury Groups. Open marine conditions prevailed during deposition of these sequences, as is indicated by the prolific growth of filter-feeding invertebrates (Holdgate & others, 1986). Since the Pliocene regression, karst has formed in coastal regions while characteristic red soils have developed in inland areas.

Petroleum exploration

A total of over 120 petroleum exploration wells have been drilled in the Otway Basin since the 19th century (Sprigg, 1986), but the majority of exploration drilling has been undertaken since the late 1950s (Appendix 1). Many of the petroleum exploration wells were located by a combination of surface geology and sparse seismic survey traverses; few have apparently tested valid structural traps (Laing & others, 1989). Only 19 wells have been drilled in the offshore part of the basin. Numerous minor hydrocarbon 'shows' and indications have been noted during drilling (Smith, 1988), yet few wells have identified economically significant accumulations (Fig. 2).

The results of exploration in the Otway Basin have been discussed in detail by many authors and has been summarised by Sprigg (1986). More recent developments have been outlined by Felton & Jackson (1987), Williamson & others (1987, 1988), Smith (1988), Buffin (1989) and Laing and others (1989). Previous exploration, both seismic and drilling activity, has largely been aimed at determining the extent and content of potential reservoirs within the Waarre and Pretty Hill Sandstones and the Eumeralla Formation.

The initial major discovery of petroleum occurred in 1959 when the Port Campbell 1 well intersected gas in the Upper Cretaceous Waarre Sandstone (Fig. 2). Subsequently, the Port Campbell 4 (1962) well recovered waxy paraffinic oil (28-35°API gravity) from the upper part of the Eumeralla Formation. Additional drilling in the Port Campbell area in the late 1970s and early 1980s resulted in the discovery of several gas (and some condensate or carbon dioxide) accumulations including North Paaratte, Wallaby Creek and Grumby. All of these accumulations are reservoired in the Waarre Sandstone.
The Lower Cretaceous sequence (Eumeralla Formation) has provided some encouragement as it contains recently-discovered and undeveloped accumulations. Windermere 1 well, drilled in 1987, recovered oil from the sandy upper part of this sequence. Testing indicated that the oil-bearing unit had low productivity and exhibited pressure decline in the reservoir section but the well was significant in that it increased the basin's onshore oil prospectiveness (Smith, 1988). The Windermere 2 well, drilled in 1989, encountered minor gas shows. The Katnook 1 well, drilled in 1987, and the Katnook 2 well, drilled in 1989, apparently intersected gas and condensate reservoir(s) in the Eumeralla Formation, as did the Ladbroke Grove 1 well, which was drilled in 1989.

The recovery of several barrels of oil from the Pebble Point Formation in the Lindon 1 well in 1983 highlighted the possibility of long-range vertical migration of petroleum from a deep, mature sequence into shallow, immature parts of the Tertiary sequence (Tabassi & Davey, 1986).

Petroleum and non-petroleum gas accumulations

The petroleum and other accumulations discovered to date are, or are potentially, strategic sources of supply for natural carbon dioxide and petroleum gas (and some condensate) for the Victorian and South Australian markets.

One gas accumulation and one carbon dioxide accumulation have been identified by companies as economic accumulations and have been developed for use. These are as follows:

<table>
<thead>
<tr>
<th>Accumulation</th>
<th>Discovery well</th>
<th>Year drilled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caroline (carbon dioxide)</td>
<td>Caroline 1</td>
<td>1967</td>
</tr>
<tr>
<td>North Paaratte (gas/condensate)</td>
<td>North Paaratte 1</td>
<td>1979</td>
</tr>
</tbody>
</table>

These accumulations have been brought on-stream and their products are used by domestic or industrial users in parts of Victoria and South Australia. A number of other accumulations have been identified as potentially economic but as yet have not been developed for use. They include the following:
Economic and undeveloped accumulations

<table>
<thead>
<tr>
<th>Accumulation</th>
<th>Discovery well</th>
<th>Year drilled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wallaby Creek (gas)</td>
<td>Wallaby Creek 1</td>
<td>1981</td>
</tr>
<tr>
<td>Katnook (gas/condensate)</td>
<td>Katnook 1 &amp; 2</td>
<td>1987, 1988</td>
</tr>
<tr>
<td>Ladbroke Grove (gas/carbon dioxide)</td>
<td>Ladbroke Grove 1</td>
<td>1989</td>
</tr>
<tr>
<td>Iona (gas)</td>
<td>Iona 1</td>
<td>1988</td>
</tr>
<tr>
<td>Grumby (gas/carbon dioxide)</td>
<td>Grumby 1</td>
<td>1981</td>
</tr>
</tbody>
</table>

Several other accumulations comprise smaller or less extensive resources which currently are considered subeconmic and remain undeveloped. They include:

Subeconomic and undeveloped accumulations

<table>
<thead>
<tr>
<th>Accumulation</th>
<th>Discovery well</th>
<th>Year drilled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lindon (oil)</td>
<td>Lindon 1</td>
<td>1983</td>
</tr>
<tr>
<td>Windermere (oil)</td>
<td>Windermere 1</td>
<td>1987</td>
</tr>
<tr>
<td>Kalangadoo (carbon dioxide)</td>
<td>Kalangadoo 1</td>
<td>1965</td>
</tr>
<tr>
<td>Flaxmans (gas/condensate)</td>
<td>Flaxmans 1</td>
<td>1961</td>
</tr>
<tr>
<td>Port Campbell 1 ) (oil/</td>
<td>Port Campbell 1</td>
<td>1959</td>
</tr>
<tr>
<td>Port Campbell 3 ) gas/</td>
<td>Port Campbell 3</td>
<td>1963</td>
</tr>
<tr>
<td>Port Campbell 4 ) condensate)</td>
<td>Port Campbell 4</td>
<td>1965</td>
</tr>
<tr>
<td>Pecten (gas)</td>
<td>Pecten 1A</td>
<td>1967</td>
</tr>
</tbody>
</table>

The number of traps and the petroleum-bearing units in which these accumulations from the three categories outlined above are shown in Plates 1 and 2. Detailed technical data on each accumulation are tabulated in the 'Petroleum and non-petroleum gas accumulations summaries' section of this report. The stratigraphic position of each accumulation is shown in Figure 2.

Structure and petroleum traps

The Otway Basin was developed in the Late Jurassic as a northwest-trending trough which formed as a result of rifting between Australia and Antarctica (Williamson & others, 1988). As a result, tensional and wrench fault planes dip both towards the continent (northeast) and towards the open ocean (southwest), and the dips on these normal faults vary from one part of the basin to another. On the continental slope, rotational normal faults dip more consistently towards the ocean; these faults and some associated wrench-related 'flower structures' appear to be somewhat younger than the faults on the shelf (Fig. 3).
Rapid subsidence of the basin during the Late Cretaceous resulted in extensive synsedimentary deformation of some sequences, forming slumps and gravitational slides (Gravestock & others, 1986). By the end of the Cretaceous, reactivation of the earlier rift-faults resulted in the development of numerous fault-related closures in younger sequences, after which major faulting ceased (Robertson & others, 1978; Felton & Jackson, 1987). The tensional faulting and slumping which characterise the continental slope sequence probably continued to occur, although by about 45 Ma (million years before the present) blocks of continental crust ceased sliding to abyssal depths and the basin reached its present configuration (Robertson & others, 1978; Felton & Jackson, 1987).

The potential traps in the basin which have not yet been drilled consist of tilted-fault blocks, four-way dip closures on the upthrown side of normal faults, horsts, and folded structures associated with wrenching (Megallaa, 1986). On the other hand, the majority of structures tested by drilling are associated with syndepositional down-to-basin normal faults and include simple fault traps where reservoir rock is faulted against cap-rock seal or sealed by impermeable fault zones, and four-way dip-closed traps ('rollovers'). Both stratigraphic pinchout and unconformity traps are potential plays throughout the basin (Felton & Jackson, 1987).

Coastal bitumen strandings of oil indicate that some as yet unknown offshore accumulations may have been breached allowing hydrocarbons to escape (McKirdy & Horvath, 1976; McKirdy & others, 1986; Felton & Jackson, 1987).

**Reservoir sequences**

Potential reservoir rocks have been identified throughout the Otway Basin sequence from the Early Cretaceous to Paleocene, and in some cases weathered and fractured Palaeozoic basement (the Kalangadoo 1 well) (Sprigg, 1986). The Pretty Hill Sandstone, Eumeralla Formation and Waarre Sandstone have, however, been the major petroleum exploration drilling targets.

Figure 4 shows the variation in permeability and porosity readings from core material (over 150 core plugs) tested by the BMR Petrophysical Laboratory (from over 20 wells drilled between 1964 and 1986) in a variety of lithologies. BMR will release the results of all testing undertaken in this laboratory in a comprehensive data set for sale to industry and the public. It is evident from the data that, while many of the samples have
porosities in excess of 10 percent, less than a third exhibit permeability in excess of 100 millidarcys. This is a common trend in many of the potential reservoir rocks; permeability is generally unrelated to porosity and is a major limiting factor affecting the quality of potential reservoir rocks in the Otway Basin sequence.

Pretty Hill Sandstone

The Cretaceous Pretty Hill Sandstone exhibits features typical of most major reservoir units in the Otway Basin sequence (Fig. 5). The core plugs tested by BMR (Petrophysical Laboratory) reveal a range of core porosity readings, many as high as 35 percent. However, permeability readings from the same plugs were less than 100 millidarcys in at least half of the plugs, indicating that permeability does not correlate well with porosity even when the latter is high. Where the Pretty Hill Sandstone has been buried, its porosity and permeability are generally markedly reduced. However the patchy nature of permeability is clearly illustrated by the data in Crayfish 1 between 2000-3000 m and Woolsthorpe 1 between 100-2000 m.

According to Smith (1988), the Pretty Hill Sandstone is a major potential reservoir of interest for petroleum exploration and consists of fine to coarse-grained, relatively clean sandstone, but mineralogy varies widely, depending on local provenance. Plutonic-sourced sandstones (subarkose and sublitharenite) are generally more porous, whereas sandstones containing metasedimentary and volcanic-sourced clasts are prone to significant loss of permeability and porosity due to diagenetic changes.

Eumeralla Formation

Porosity and permeability changes similar to that evident in the Pretty Hill Sandstone are also evident in the Eumeralla Formation. The lower part of the Eumeralla Formation contains fine-grained sandstone deposited in lacustrine and floodplain environments but the upper part contains braided-stream sandstone which has a high proportion of clean, coarse-grained channel units. According to Smith (1988), sandstones throughout the formation are feldspathic litharenites, with a matrix comprising clay, zeolite, carbonate, silica, and broken framework grains. The reservoir potential of the Eumeralla Formation is, however, severely reduced by diagenesis. One exception is the Heathfield Sandstone Member
Figure 4. Plot of porosity and permeability from over 150 core plugs obtained from 20 wells drilled in the Otway Basin. Data obtained from material tested by the BMR Petrophysical Laboratory.
Figure 5. Porosity and permeability in the Pretty Hill Sandstone, measured from core plugs obtained from 10 Otway Basin wells by the BMR Petrophysical Laboratory.
which can display excellent porosity with good permeability but this unit is apparently restricted to the northeastern margin of the basin and trough areas (Laing & others, 1989).

The results evident during drilling of the Katnook 1 and 2 wells in South Australia suggest that additional gas accumulations could be discovered in the Eumeralla Formation. The flow rates measured during the tests of these wells suggest that the reservoir quality of the formation and the Pretty Hill Sandstone is higher than could have been expected from information available prior to drilling of these wells.

Waarre Sandstone

The Upper Cretaceous Waarre Sandstone has good reservoir properties in some areas and contains a large number of the basin's known petroleum accumulations (Appendix 1; Plates 1 and 2). It is commonly non-marine at its base and passes into marginal marine at the top (Smith, 1988) with accompanying change in sandstone composition from lithic to quartzose and a corresponding improvement in reservoir quality.

The Caroline carbon dioxide accumulation is reservoired in a sequence that Mulready (1977) considers to be a lateral equivalent of the Waarre Sandstone. Three carbon dioxide-bearing intervals were identified on wireline log data within deltaic or reworked deltaic sandstone reservoirs (Fig. 6). The sandstone, interbedded with siltstone and shale, is very poorly-sorted, friable, angular and fine to coarse-grained. Cement in the sandstone consists of silica with some kaolinite and rare siderite. Log-derived porosity readings in the reservoirs range from 13 to 21 percent. Most carbon dioxide production is obtained from the uppermost 'reworked' sand in the sequence (Mulready, 1977).

The Waarre Sandstone in the Port Campbell area has been subdivided into four units by Buffin (1989): a basal fining-upward sequence; a medial siltstone with interbedded calcareous sandstone; a coarse-grained porous, beach-barrier sandstone with good permeability (the primary gas reservoir); and the 'Flaxman Formation' - a ferruginous siltstone/sandstone sequence. The two upper units comprise a beach barrier island complex with associated tidal inlet delta channel complexes, deposited in an elongate linear fashion (Buffin, 1989).
Figure 6. Carbon dioxide-bearing reservoirs in the Caroline 1 well, after Mulready (1977).
Other potential reservoir units

The Paaratte Formation is typically a clean orthoquartzite to sublitharenite, with some chlorite and glauconite. The formation contains evidences of progradation by several deltaic systems, as well as offshore, shoreface, estuarine and lagoonal sediments (Smith, 1988). Landward parts of the sequence consist of distributary channel, coastal-plain and alluvial sequences. While onshore reservoirs of the Paaratte Formation appear to be flushed by meteoric water they may be a viable exploration target in the offshore part of the basin (Laing & others, 1989).

The Paleocene Pebble Point Formation consists of conglomeratic sandstone with a clay matrix of limonite and chamosite as well with minor goethite and hematite. In the eastern part of the basin, this unit is a potential reservoir as it is more arenaceous (Laing & others, 1989).

Source rocks and maturation

The petroleum source potential of the Otway Basin sequence has been examined by Felton and Jackson (1987), and their analytical results for total organic carbon (TOC) are shown in Table 1. Most stratigraphic units sampled contained an average of more than 0.5 percent of TOC, which is generally considered the minimum for sourcing a significant quantity of hydrocarbons. Most units had more than necessary to source hydrocarbons, the Dilwyn and Paaratte Formations being the richest. The Eumeralla Formation and Pretty Hill Sandstone, although not rich in organic material, have some rich intervals in the Crayfish 1A well (Felton & Jackson, 1987).

More detailed qualitative information is revealed by saturated and aromatic hydrocarbon contents of each unit compared to the amount of organic carbon. The Dilwyn Formation is potentially a fair to very good source for both oil and gas. Both the Upper and Lower Cretaceous sequences are identified as fair hydrocarbon sources, largely for gas, as the organic matter is dominated by vitrinite and inertinite macerals. The Eumeralla Formation has a significantly higher vitrinite-to-exinite ratio than any other unit. Overall, the exinite content of the Cretaceous sequence is generally low (3%) and highest concentrations are found in the Paaratte Formation. Felton and Jackson (1987) concluded that the Paaratte Formation and Belfast Mudstone have the best hydrocarbon source potential, where
these units are mature, but that they are likely to generate gas, owing to the vitrinite-rich nature of the preserved organic matter.

**Table 1. Organic richness of Otway Basin stratigraphic units.**

<table>
<thead>
<tr>
<th>Formation</th>
<th>TOC % range</th>
<th>Average TOC %</th>
<th>No. of samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dilwyn Formation</td>
<td>1.87 - 3.00</td>
<td>2.23</td>
<td>4</td>
</tr>
<tr>
<td>Pebble Point Formation</td>
<td>1.65 - 2.23</td>
<td>1.89</td>
<td>2</td>
</tr>
<tr>
<td>Paaratte Formation</td>
<td>1.49 - 3.10</td>
<td>2.26</td>
<td>-</td>
</tr>
<tr>
<td>Belfast Mudstone</td>
<td>0.86 - 2.59</td>
<td>1.50</td>
<td>13</td>
</tr>
<tr>
<td>Waarre Sandstone</td>
<td>1.14</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Eumeralla Formation</td>
<td>0.25 - 7.75</td>
<td>0.62</td>
<td>10</td>
</tr>
<tr>
<td>Pretty Hill Sandstone</td>
<td>0.26 - 15-9</td>
<td>0.83</td>
<td>-</td>
</tr>
</tbody>
</table>

(After Felton & Jackson, 1987).

Available vitrinite reflectance data for the entire basin, collected from analytical results submitted by exploration companies to BMR's Core and Cuttings Laboratory (Fig. 7), indicate that much of the sequence drilled is immature. Less than half of the available readings are in the range of 0.7 to 1.2 percent (the oil window). Most samples which exceed 0.7 percent are from well depths in excess of 2000 metres (Fig. 7), mainly in the Cretaceous section. The results indicate that the top of the oil window is not likely to be encountered at depths shallower than 2500 metres. The present subsurface temperature data for the basin, derived from the bottom hole measurement of exploration wells, show a gradient of 2.8°C/100 metres (Fig. 7) which is in accord with the likely depth-oil-maturity trends evident from the vitrinite reflectance data.

A geohistory analysis of the Voluta 1, Crayfish 1A and Prawn 1A wells by Williamson and others (1988) provides additional indication of the history, maturity and prospectivity of the Otway Basin sequence. Subsidence data presented by Williamson and others (1987 & 1988) indicate that major rifting from 144 Ma through to the point of continental break-up at 94 Ma, was the major influence on structuring and maturation.
Figure 7. Temperature (A) and vitrinite reflectance (B) profiles from over 50 wells drilled in the Otway Basin. Based on data submitted to the BMR Core and Cuttings Laboratory.
However, Holdgate and others (1986) suggested that rapid Tertiary subsidence in the Portland region has buried the Belfast Mudstone and Paaratte Formation into the oil generation zone. They considered the Portland area to be one of the most prospective areas in the basin, as its depositional history is similar to that of the Gippsland Basin.

Coastal bitumens

Eight occurrences of coastal bitumen have been described in detail (McKirdy & Horvath, 1976) from coastal locations in the Otway Basin (Fig. 8). The bitumen samples have been found in the form of lumps, blocks and sheets, ranging from black, semi-liquid crude to light brown weathered flakes. As a result of exposure the bitumen is heavier (< 29°API) than most Australian crude oils (generally > 35°API). Pour points are high (> 10°C) indicating a high wax content characteristic of crude oil derived from debris of non-marine plants (Hedberg, 1968; McKirdy & Horvath, 1976). The samples have a high wax and low sulphur content; this feature is consistent with a terrestrial organic source (McKirdy & Horvath, 1976).

A comparison of analytical data from the bitumen samples and paraffinic crude oil from the Port Campbell 4 well, shows a close resemblance between the stranded bitumens and the crude oil. The composition of the bitumens shows that they are abnormally rich in asphaltenes, and to a lesser extent, ONS compounds. McKirdy and Horvath (1976) considered that the composition of the bitumen samples are within the limits which could be expected from biodegradation and weathering of oil of similar composition to the Port Campbell oil.

Petroleum types

Gas

Otway Basin natural gas accumulations vary in composition, as shown in Table 2, from gas rich in methane (96%) with a small content of carbon dioxide (as little as 0.15%) to gas with much lower methane content (63-70%) and a high proportion of carbon dioxide (15-23%).
Figure 8. Principal sites of bitumen stranding along the Otway Basin coast (after McKirdy & Horvath, 1976).
Table 2. Analysis of natural gases in Otway Basin accumulations.

<table>
<thead>
<tr>
<th></th>
<th>Caroline-1 Waarre Sst</th>
<th>Flaxmans-1 Otway Gp</th>
<th>Pecten-1A Waarre Sst</th>
<th>Port Campbell-l Waarre Sst</th>
<th>Port Campbell-4 Otway Gp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth (m)</td>
<td>2516 2624 2790</td>
<td>3305 to</td>
<td>1771 to</td>
<td>1813 to</td>
<td></td>
</tr>
<tr>
<td>to (m)</td>
<td>2570 2661 2799</td>
<td>3514 to</td>
<td>1775 to</td>
<td>1820 to</td>
<td></td>
</tr>
<tr>
<td>C1</td>
<td>1.31 0.74 0.93</td>
<td>76.9 1.85</td>
<td>63.2 0.41</td>
<td>86.5 0.24</td>
<td></td>
</tr>
<tr>
<td>C2</td>
<td>0.03 0.039 0.006</td>
<td>13.2 0.41</td>
<td>5.4 0.14</td>
<td>7.3 0.66</td>
<td></td>
</tr>
<tr>
<td>C3</td>
<td>0.01 0.022 0.001</td>
<td>6.9 0.064</td>
<td>2.7 0.2</td>
<td>3.8 0.66</td>
<td></td>
</tr>
<tr>
<td>C4</td>
<td>0.001 0.003 0.001</td>
<td>1.5 0.024</td>
<td>1.7 0.2</td>
<td>1.9 0.66</td>
<td></td>
</tr>
<tr>
<td>C5</td>
<td>0.001 0.004 0.001</td>
<td>-</td>
<td>0.2 0.02</td>
<td>1.05</td>
<td></td>
</tr>
<tr>
<td>N2</td>
<td>0.42 0.094 -</td>
<td>*</td>
<td>3.3 2.33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H2</td>
<td>0.04 0.054 0.0023</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>He</td>
<td>0.008 0.0026 0.0071</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>97.5 99.1 99.8</td>
<td>-</td>
<td>23.0 15.6</td>
<td>0.15</td>
<td></td>
</tr>
</tbody>
</table>

* Oxygen + nitrogen = 3.9%  
(After Konecki and Blair, 1970).

The presence of wet-gas fractions, in addition to carbon dioxide, in some petroleum accumulations indicates that the accompanying carbon dioxide is not a product of thermal cracking of in-place natural gas. The carbon dioxide is considered to be derived from a separate, possibly volcanic source, and that it has migrated into the petroleum traps and mixed with hydrocarbon gas. In some instances, carbon dioxide may have flushed hydrocarbons out of traps.

Oil-cut mud samples from Lindon 1 indicate that the oil intersected by this well is a mature crude generated from terrigeneous organic matter, possibly of algal origin (Tabassi & Davey, 1986). Water-washing of the crude is evident from a high wax content, as well as the depletion of benzene and toluene. The crude has a high pour point (33°C) and a relatively low gravity (28°API). Oil samples recovered from the Port Campbell 4 well (1789-1799 m RT) have a similar high wax content but a higher gravity (35°API). The Port Campbell crude comprises 83.1 percent saturates and 9.5 percent aromatic compounds, and has a high gasoline content (38 vol %) (McKirdy & Horvath, 1976). According to McKirdy and Heggie (1987) the Lindon-1 oil (Pebble Point Formation), Port Campbell-4 oil (Eumeralla Formation) and North Paaratte-l condensate (Waarre Sandstone) were probably all sourced from the Eumeralla Formation.
Gas which flowed during testing of the Katnook 2 well was accompanied by a flow of 109 barrels per day of condensate from a thick 69 metres depth interval (Milne, 1988).

**Non-petroleum gas accumulations**

Gas and liquid hydrocarbons containing measurable quantities of carbon dioxide, nitrogen and helium, have been recovered from several accumulations. These compounds have economic significance as well as contributing to an understanding of petroleum genesis and accumulation (Fig. 9; Table 3).

**Table 3. Molecular percentages of carbon dioxide, nitrogen and helium in Otway Basin gas samples.**

<table>
<thead>
<tr>
<th>Ref No.</th>
<th>Well or Accumulation</th>
<th>Type</th>
<th>Carbon dioxide</th>
<th>Nitrogen</th>
<th>Helium</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wangoom</td>
<td>carbon dioxide</td>
<td>95.00</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Port Campbell</td>
<td>oil</td>
<td>0.5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2A</td>
<td>Port Campbell</td>
<td>oil</td>
<td>23.00</td>
<td>6.80</td>
<td>0.05</td>
</tr>
<tr>
<td>3</td>
<td>Caroline</td>
<td>carbon dioxide</td>
<td>98.6</td>
<td>-</td>
<td>0.07</td>
</tr>
<tr>
<td>4</td>
<td>North Paaratte</td>
<td>natural gas</td>
<td>0.28</td>
<td>1.45</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>Pecten</td>
<td>natural gas</td>
<td>0.04</td>
<td>1.6</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>Tullich (Eumeralla Fm)</td>
<td>natural gas</td>
<td>-</td>
<td>18.5</td>
<td>-</td>
</tr>
<tr>
<td>6A</td>
<td>Tullich (Pretty Hill Sst)</td>
<td>natural gas</td>
<td>-</td>
<td>32.62</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>Ferguson Hill</td>
<td>natural gas</td>
<td>-</td>
<td>12.0</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>Garvoc</td>
<td>carbon dioxide</td>
<td>96.7</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>Kalangadoo</td>
<td>carbon dioxide</td>
<td>88.0</td>
<td>12.60</td>
<td>0.029</td>
</tr>
</tbody>
</table>

(The locations of the accumulations are shown in Figure 9.)
[After Konecki & Blair (1970) and Ozimic (1986).]
Figure 9. Regional distribution of non-petroleum gas accumulations. (Reference numbers 1 to 9 inclusive are listed in Table 3.)
Carbon dioxide

A significant accumulation of carbon dioxide was discovered in 1967 during drilling of the Caroline 1 well in South Australia (Mulready, 1977; Sprigg, 1986). The carbon dioxide in this accumulation is 98.9 percent pure. Since 1968, when production from the accumulation commenced, a total of over 250,000 tonnes of carbon dioxide has been produced for the South Australian and Victorian markets.

Apart from the Caroline accumulation, a number of other accumulations have been identified with concentrations of carbon dioxide ranging from less than 1.0 percent to over 99.0 percent.

Wopfner and Thornton (1971) concluded from their study of carbon dioxide in the Caroline 1 and Kalangadoo 1 wells that it was derived from sources below the Otway Group, rather than in-situ decay of organic matter. The migration of the carbon dioxide into present-day traps probably took place during the Cainozoic. In contrast, sources of carbon dioxide in the Bass and Gippsland Basins are likely to be organic, but with some contribution from igneous sources (Stainforth, 1984; Ozimic, 1986). The Caroline-1 'volcanic' carbon dioxide is accompanied by a small amount of aromatic petroleum (150 API with 0.2% sulphur) apparently stripped from poor-quality inertinitic organic matter dispersed throughout the Waarre Sandstone reservoir (McKirdy & Heggie, 1987).

The genesis of carbon dioxide in petroleum basins has been discussed in detail by Farmer (1965), Hunt (1969) and Bray and Foster (1980) who consider that potential sources include the thermocatalytic decomposition of organic matter, hydrocarbons, or thermal decomposition of carbonates, as well as the action of some anaerobic bacteria on hydrocarbons (Ozimic, 1986).

Nitrogen

Nitrogen is present in a number of Otway Basin accumulations in concentrations ranging from 1.0 to 33.0 percent (Table 3). Thermal alteration of organic matter is a common source of nitrogen (Lutz & others, 1975). A possible source is the degassing of basement rocks, a view supported by the observation that gases included in igneous rocks have a high nitrogen content, and that the nitrogen concentration in some natural gas accumulations increases towards basement (Beebe & Curtis, 1986).
Ozimic (1986) considered that the nitrogen recorded in the Otway Basin may have originated by degassing of basement.

**Helium**

Low concentrations of helium have been recorded in several accumulations (Table 3); any accumulations containing over 0.5 percent helium may have commercial potential (Ozimic, 1986). Terrestrially-derived helium is generally a by-product of the disintegration of radioactive elements. While the concentration of such elements may be low in plutonic and volcanic rocks, they are the most likely source of helium in petroleum accumulations (Hunt, 1979). Ozimic (1986) suggested an igneous source for helium in the Otway Basin.

**Petroleum and carbon dioxide reserves and developments**

The initial total commercial and non-commercial reserves (as at 31 December 1988) for all gas accumulations in the Otway Basin are estimated at 0.483 billion cubic metres of sales gas and 0.002 million kilolitres of condensate (BMR, 1989). This does not include the Katnook and Ladbroke Grove reserves, which are currently being assessed by the permit holders. Of these reserves approximately 0.025 billion cubic metres of gas have been extracted.

**North Paaratte/Wallaby Creek**

In mid-1984 an agreement was reached between Beach Petroleum and the Gas and Fuel Corporation of Victoria for the supply of natural gas to Warrnambool from the North Paaratte and Wallaby Creek gas accumulations, via a production facility and pipeline (Figs. 10 & 11). The agreement required that 14 billion cubic feet (0.4 billion cubic metres) of gas be supplied over a 20 year period at flow rates up to a maximum of 8 million cubic feet per day (VDITR, 1988).

Beach Petroleum (1986) estimated the initial gas reserves in the North Paaratte accumulation to be 0.207 billion cubic metres; Wallaby Creek, 0.228 billion cubic metres; and Grumby, 0.048 billion cubic metres. Included in these accumulations are small quantities of condensate.
Figure 10. Location map of the North Paaratte gas production facility, surrounding wells and petroleum accumulations, after Beach Petroleum (1986).
Figure 11. Wireline log data and extent of gas accumulation in part of the sequence intersected in the North Paaratte 1 well, after McPhee & others (1981).
Development of the North Paaratte gas accumulation(s) involved two stages. The initial stage, completed in August 1986 (VDITR, 1988), coupled the North Paaratte 1 and 2 wells, and an associated processing and production facility, into a 34 km-long and 168 mm-diameter pipeline to Warrnambool. The second stage involves development of the Wallaby Creek accumulation and is expected to be completed by 1992 to 1994 (Beach Petroleum, 1986).

The North Paaratte gas processing plant was commissioned in April 1986, and full conversion of the Warrnambool gas market to natural gas was completed in August 1986. Water and condensate are removed at the processing plant; the water is disposed of in an evaporation pit and the condensate stored for use (Beach Petroleum, 1986).

Caroline

The Caroline carbon dioxide accumulation in South Australia has been producing since 1968 at a rate of around 15 000 tonnes per annum of liquefied carbon dioxide. The maximum daily production rate is approximately 79 tonnes of raw gas. The raw gas is purified at a processing plant to remove small quantities of methane, water and hydrogen sulphide and the refined product is shipped to Melbourne and Adelaide in pressurised road tankers (Mulready, 1977). Reservoir conditions (pressure and temperature) in the accumulation are well above the critical point for carbon dioxide; some liquid carbon dioxide does, however, form as the gas passes through the well column to the surface. As a result both liquid and gaseous carbon dioxide are produced at the well head.

Resource potential

The quality of Otway Basin reservoirs and the size of potential traps have been highlighted by Smith (1988) and Williamson and others (1988) as major constraints on the resource potential of the sequence. The Pretty Hill Sandstone remains a major potential target in onshore areas, particularly for fault-dependent closures (Smith, 1988). The Eumeralla Formation generally lacks good-quality reservoir, due to the presence of a high proportion of labile constituents which are susceptible to diagenetic change. The formation has reservoir potential for gas accumulations in areas where immature or unstable constituents are absent.
According to Smith (1988), the Waarre Sandstone represents the best reservoir target for future exploration, for marine transgressive sandstones in particular, less so in the case of fluvial sandstones which have reduced porosity and permeability. In the Port Campbell area the marine sandstones have good porosity at depths of up to 1500 metres, as well as the advantage of good water drive. The Paaratte Formation is considered to have its best reservoir potential in the top of prograding shoreface units, and which could be good potential targets in offshore locations (Smith, 1988).

The Late Cretaceous and older parts of the Otway Basin sequence (pre-Belfast Mudstone) are possibly the most prospective because of favourable burial history and source rock maturity (Smith, 1988). In addition, any hydrocarbons present above the Belfast Mudstone are likely to be in small accumulations rather than large discrete ones (Smith, 1988). While potential reservoirs and traps are present in the Tertiary sequence the development of a freshwater aquifer system in this sequence could cause rapid biodegradation of any oil which has migrated from deeper mature sediments (for example, the Lindon 1 well).

More detailed modern seismic coverage and well control will be required before the basin's resource potential can be assessed with greater certainty (Smith, 1988). Many of the offshore wells failed to reach their target, or were off-structure, and no detailed modern seismic coverage exists over much of the offshore parts of the basin (Williamson & others, 1988; Smith, 1988). All of these factors suggest that considerable scope exists for further and more detailed exploration, as well as possible successful development of additional resources.
PETROLEUM AND NON-PETROLEUM GAS ACCUMULATIONS SUMMARIES
**PETROLEUM ACCUMULATIONS SUMMARY SHEET**

<table>
<thead>
<tr>
<th>ACCUMULATION: North Paaratte</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPILATION DATE: 01/11/89</td>
</tr>
<tr>
<td>TYPE: gas/condensate</td>
</tr>
<tr>
<td>COMMERCIAL STATUS: economic and developed</td>
</tr>
<tr>
<td>LOCATION: 200 km WSW of Melbourne; 34 km SE of Warrnambool</td>
</tr>
<tr>
<td>STATE: Victoria</td>
</tr>
<tr>
<td>PETROLEUM TITLE(S): PPL 1</td>
</tr>
<tr>
<td>OPERATOR: Gas and Fuel Corp of Victoria</td>
</tr>
</tbody>
</table>

**FIRST DISCOVERY WELL:** North Paaratte 1  
- latitude: 38°33'10" - longitude: 142°57'15"  
- discovery: gas/condensate  
- total depth: 1545 m  
- date total depth reached: 21/11/79

**NUMBER OF WELLS DRILLED:**  
- exploration & appraisal: 3, including one producer  
- development: nil

**STRUCTURE:** a discrete fault block within a faulted high  
- areal closure: 2.3 sq. km  
- vertical closure: 13.4 m

**SUBDIVISION OF PETROLEUM ACCUMULATION:**  
- number of traps: 1  
- number of petroleum-bearing units: 1

**NUMBER AND TYPE OF PRODUCING ZONES:**  
- gas: nil  
- gas/condensate: 1  
- gas/oil: nil  
- oil: nil

**DRIVE MECHANISM:** water drive

**PRODUCTION COMMENCED:** April 1986

**PRODUCTION INFRASTRUCTURE:** the gas is piped 34 km to Warrnambool

**REFERENCE(S):** McPhee & others, 1981; Beach Petroleum, 1986
TRAP

TRAP 1: Waarre Sandstone
DISCOVERY WELL(S): North Paaratte 1
CONTENTS: gas/condensate

PETROLEUM-BEARING UNIT(S)

PETROLEUM-BEARING UNIT 1: top of Waarre Sandstone
PETROLEUM CONTENTS: gas with a small amount of condensate
PRODUCTION STATUS: producing
FORMATION: Waarre Sandstone
AGE: Late Cretaceous
LITHOLOGY: sandstone: white to very light grey; medium to coarse grained; subrounded to subangular; moderately sorted; loosely consolidated; fluvial channel and point-bar
TRAPPING MECHANISM: structural
DEPTH TO TOP OF PETROLEUM-BEARING UNIT: 1449 m KB (1353 m SS)
POROSITY: 23%
PERMEABILITY: 2000 md
RESERVOIR TEMPERATURE: not available
RESERVOIR PRESSURE: 13 618 kPa at 1454 m KB
ACCUMULATION: Caroline

COMPILATION DATE: 01/11/89

TYPE: carbon dioxide

COMMERCIAL STATUS: economic and developed

LOCATION: 400 km SE of Adelaide

STATE: South Australia

PETROLEUM TITLE(S): PPL 21

OPERATOR: Liquid Air Australia Ltd

FIRST DISCOVERY WELL: Caroline 1
  - latitude: 37°56'30" - longitude: 140°54'30"
  - discovery: carbon dioxide
  - total depth: 3371 m
  - date total depth reached: 29/1/67

NUMBER OF WELLS DRILLED:
  - exploration & appraisal: 1 (producer)
  - development: nil

STRUCTURE: a tilted fault block
  - areal closure: not available
  - vertical closure: 365 m

SUBDIVISION OF ACCUMULATION:
  - number of traps: 1
  - number of petroleum-bearing units: 3

NUMBER AND TYPE OF PRODUCING ZONES:
  - gas: 3
  - gas/condensate: nil
  - gas/oil: nil
  - oil: nil

DRIVE MECHANISM: water drive (?)

PRODUCTION COMMENCED: November 1968

PRODUCTION INFRASTRUCTURE: Raw gas is purified at the treatment plant adjacent to the wellhead. The purified gas is transported in liquid form in pressured road tankers.

REFERENCE(S): Wopfner & Douglas, 1971; Mulready, 1977
TRAP

TRAP 1: Waarre Sandstone
DISCOVERY WELL(S): Caroline 1
CONTENTS: carbon dioxide

CARBON DIOXIDE-BEARING UNIT(S)

CARBON DIOXIDE-BEARING UNIT 1: "A" sand

CONTENTS: carbon dioxide
PRODUCTION STATUS: producing
FORMATION: Waarre Sandstone
AGE: Late Cretaceous
LITHOLOGY: sandstone: poorly sorted, friable, angular and very fine to very coarse; slightly cemented
TRAPPING MECHANISM: structural
DEPTH TO TOP OF CARBON DIOXIDE-BEARING UNIT: 2499 m KB (2462 m SS)
POROSITY: 14-17%
PERMEABILITY: not available
RESERVOIR TEMPERATURE: not available
RESERVOIR PRESSURE: not available

CARBON DIOXIDE-BEARING UNIT 2: "B" sand

CONTENTS: carbon dioxide
PRODUCTION STATUS: producing
FORMATION: Waarre Sandstone
AGE: Late Cretaceous
LITHOLOGY: sandstone: poorly sorted, friable, angular and very fine to very coarse; slightly cemented
TRAPPING MECHANISM: structural
DEPTH TO TOP OF CARBON DIOXIDE-BEARING UNIT: 2789 m KB (2751 m SS)
POROSITY: 18-21%
PERMEABILITY: not available
RESERVOIR TEMPERATURE: not available
RESERVOIR PRESSURE: 28 435 kPa at 2790 m KB
CARBON DIOXIDE-BEARING UNIT 3: "C" sand

CONTENTS: carbon dioxide
PRODUCTION STATUS: producing
FORMATION: Waarre Sandstone
AGE: Late Cretaceous
LITHOLOGY: sandstone: poorly sorted, friable, angular and very fine to very coarse; slightly cemented
TRAPPING MECHANISM: structural
DEPTH TO TOP OF CARBON DIOXIDE-BEARING UNIT: 2835 m KB (2798 m SS)
POROSITY: 11%
PERMEABILITY: not available
RESERVOIR TEMPERATURE: 86°C
RESERVOIR PRESSURE: not available
ACCUMULATION: Wallaby Creek

COMPILATION DATE: 1/11/89

TYPE: gas/condensate

COMMERCIAL STATUS: economic and undeveloped

LOCATION: 200 km WSW of Melbourne; 30 km SE of Warrnambool

STATE: Victoria

PETROLEUM TITLE(S): PPL 1

OPERATOR: Gas and Fuel Corp of Victoria

FIRST DISCOVERY WELL: Wallaby Creek 1
- latitude: 38°34'18" - longitude: 142°54'19"
- discovery: gas/condensate
- total depth: 1763 m
- date total depth reached: 29/3/81

NUMBER OF WELLS DRILLED: - exploration & appraisal: 1
- development: nil

STRUCTURE:
- areal closure: 3.0 sq. km
- vertical closure: not available

SUBDIVISION OF PETROLEUM ACCUMULATION:
- number of traps: 1
- number of petroleum-bearing units: 1

NUMBER AND TYPE OF PRODUCING ZONES:
- gas: nil
- gas/condensate: nil
- gas/oil: nil
- oil: nil

DRIVE MECHANISM: not known

PRODUCTION COMMENCED:

PRODUCTION INFRASTRUCTURE: 4 km distant from the North Paaratte-Warrnambool gas pipeline

REFERENCE(S): Beach Petroleum, 1986
TRAP

TRAP 1: Waarre Sandstone
DISCOVERY WELL(S): Wallaby Creek 1
CONTENTS: gas/condensate

PETROLEUM-BEARING UNIT(S)

PETROLEUM-BEARING UNIT 1: top of Waarre Sandstone
PETROLEUM CONTENTS: gas with a small amount of condensate
PRODUCTION STATUS: nil (suspended)
FORMATION: Waarre Sandstone
AGE: Late Cretaceous
LITHOLOGY: sandstone
TRAPPING MECHANISM: structural
DEPTH TO TOP OF PETROLEUM-BEARING UNIT: 1516 m KB (1472 m SS)
POROSITY: not available
PERMEABILITY: not available
RESERVOIR TEMPERATURE: not available
RESERVOIR PRESSURE: not available
ACCUMULATION: Katnook

COMPILATION DATE: 12/12/89

TYPE: gas/condensate

COMMERCIAL STATUS: economic and undeveloped

LOCATION: 300 km SE of Adelaide; 40 km north of Mount Gambier

STATE: South Australia

PETROLEUM TITLE(S): PEL 32

OPERATOR: Ultramar Australia Ltd

FIRST DISCOVERY WELL: Katnook 1
- latitude: 37°27'11" - longitude: 140°46'53"
- discovery: gas/condensate
- total depth: 2520 m
- date total depth reached: 31/12/87

SECOND DISCOVERY WELL: Katnook 2
- latitude: 37°27'02" - longitude: 140°47'19"
- discovery: gas/condensate
- total depth: 3478.2 m KB
- date total depth reached: 8/2/89

NUMBER OF WELLS DRILLED: - exploration & appraisal: 2
- development: nil

STRUCTURE: a faulted anticline
- areal closure: not available
- vertical closure: not available

SUBDIVISION OF PETROLEUM ACCUMULATION:
- number of traps: 3
- number of petroleum-bearing units: 3

NUMBER AND TYPE OF PRODUCING ZONES:
- gas: nil
- gas/condensate: nil
- gas/oil: nil
- oil: nil

DRIVE MECHANISM: water drive

PRODUCTION COMMENCED:

PRODUCTION INFRASTRUCTURE: nil

REFERENCE(S):
TRAP

TRAP 1: Eumeralla Formation
DISCOVERY WELL(S): Katnook 1
CONTENTS: gas/condensate

PETROLEUM-BEARING UNIT(S)

PETROLEUM-BEARING UNIT 1: basal sand of Eumeralla Formation
PETROLEUM CONTENTS: gas/condensate
PRODUCTION STATUS: completed as potential producing interval
FORMATION: Eumeralla Formation
AGE: Early Cretaceous
LITHOLOGY: sandstone
TRAPPING MECHANISM: structural
DEPTH TO TOP OF PETROLEUM-BEARING UNIT: 1882 m KB (-1814 m SS)
POROSITY: 20%
PERMEABILITY: 2000 m.d.
RESERVOIR TEMPERATURE: 85°C
RESERVOIR PRESSURE: 2684 psia
TRAP 2: Pretty Hill Sandstone
DISCOVERY WELL(S): Katnook 2
CONTENTS: gas/condensate

PETROLEUM-BEARING UNIT(S)

PETROLEUM-BEARING UNIT 1: Pretty Hill Sandstone
PETROLEUM CONTENTS: gas/condensate
PRODUCTION STATUS: completed
FORMATION: Pretty Hill Sandstone
AGE: Early Cretaceous
LITHOLOGY: sandstone
TRAPPING MECHANISM: structural
DEPTH TO TOP OF PETROLEUM-BEARING UNIT: 2863.5 m KB (-2794.7 m SS)
POROSITY: not available
PERMEABILITY: not available
RESERVOIR TEMPERATURE: not available
RESERVOIR PRESSURE: not available
ACCUMULATION: Ladbroke Grove

COMPILATION DATE: 1/11/89

TYPE: gas

COMMERCIAL STATUS: economic and undeveloped

LOCATION: 300 km southeast of Adelaide; 40 km north of Mount Gambier

STATE: South Australia

PETROLEUM TITLE(S): PEL 32

OPERATOR: Ultramar Australia Ltd

FIRST DISCOVERY WELL: Ladbroke Grove 1
- latitude: 37°28'06" - longitude: 140°46'52"
- discovery: gas
- total depth: 3442 m
- date total depth reached: 24/4/89

NUMBER OF WELLS DRILLED: - exploration & appraisal: 1
- development: nil

STRUCTURE:
- areal closure: not available
- vertical closure: not available

SUBDIVISION OF PETROLEUM ACCUMULATION:
- number of traps: 1
- number of petroleum-bearing units: 1

NUMBER AND TYPE OF PRODUCING ZONES: - gas: nil - gas/condensate: nil
- gas/oil: nil - oil: nil

DRIVE MECHANISM: water drive

PRODUCTION COMMENCED:

PRODUCTION INFRASTRUCTURE: nil

REFERENCE(S):
TRAP

TRAP 1: Pretty Hill Sandstone
DISCOVERY WELL(S): Ladbroke Grove 1
CONTENTS: gas

PETROLEUM-BEARING UNIT(S)

PETROLEUM-BEARING UNIT 1: Pretty Hill Sandstone
PETROLEUM CONTENTS: gas (high CO₂ content)
PRODUCTION STATUS:
FORMATION: Pretty Hill Sandstone
AGE: Early Cretaceous
LITHOLOGY: sandstone
TRAPPING MECHANISM: structural
DEPTH TO TOP OF PETROLEUM-BEARING UNIT: not available
POROSITY: not available
PERMEABILITY: not available
RESERVOIR TEMPERATURE: not available
RESERVOIR PRESSURE: not available
ACCUMULATION: Iona

COMPILATION DATE: 1/11/89

TYPE: gas

COMMERCIAL STATUS: economic and undeveloped

LOCATION: 200 km WSW of Melbourne; 40 km SE of Warrnambool

STATE: Victoria

PETROLEUM TITLE(S): PEP 108

OPERATOR: Gas and Fuel Corporation of Victoria

FIRST DISCOVERY WELL: Iona 1
- latitude: 38°34'30" - longitude: 143°01'57"
- discovery: gas
- total depth: 1487 m
- date total depth reached: 17/3/88

NUMBER OF WELLS DRILLED: - exploration & appraisal: 1 (suspended)
- development: nil

STRUCTURE:
- areal closure: 2.86 sq. km
- vertical closure: 30 m

SUBDIVISION OF PETROLEUM ACCUMULATION:
- number of traps: 1
- number of petroleum-bearing units: 1

NUMBER AND TYPE OF PRODUCING ZONES:
- gas: nil
- gas/condensate: nil
- gas/oil: nil
- oil: nil

DRIVE MECHANISM: bottom water or edge water drive

PRODUCTION COMMENCED:

PRODUCTION INFRASTRUCTURE: 6 km east of the North Paaratte gas plant

REFERENCE(S): Buffin, 1989; Laing & others, 1989
TRAP 1: Waarre Sandstone
DISCOVERY WELL(S): Iona 1
CONTENTS: gas

PETROLEUM-BEARING UNIT(S)

PETROLEUM-BEARING UNIT 1: Waarre Sandstone
PETROLEUM CONTENTS: Waarre Sandstone
PRODUCTION STATUS: nil (suspended)
FORMATION: Waarre Sandstone
AGE: Late Cretaceous
LITHOLOGY: sandstone
TRAPPING MECHANISM: structural
DEPTH TO TOP OF PETROLEUM-BEARING UNIT: 1293 m KB
POROSITY: 27%
PERMEABILITY: in excess of 8000 md
TEMPERATURE: 56°C @ 1487 m KB
RESERVOIR PRESSURE:
ACCUMULATION: Grumby

COMPILATION DATE: 1/11/89

TYPE: gas

COMMERCIAL STATUS: economic and undeveloped

LOCATION: 200 km WSW of Melbourne; 35 km SE of Warrnambool

STATE: Victoria

PETROLEUM TITLE(S): PPL 1

OPERATOR: Gas and Fuel Corp of Victoria

FIRST DISCOVERY WELL: Iona 1
  - latitude: 38°35'08" - longitude: 142°57'11"
  - discovery: gas
  - total depth: 1811 m
  - date total depth reached: 10/3/81

NUMBER OF WELLS DRILLED:
  - exploration & appraisal: 1
  - development: nil

STRUCTURE:
  - areal closure: 0.9 sq. km
  - vertical closure: not available

SUBDIVISION OF PETROLEUM ACCUMULATION:
  - number of traps: 1
  - number of petroleum-bearing units: 1

NUMBER AND TYPE OF PRODUCING ZONES:
  - gas: nil
  - gas/condensate: nil
  - gas/oil: nil
  - oil: nil

DRIVE MECHANISM: not available

PRODUCTION COMMENCED:

PRODUCTION INFRASTRUCTURE: 3 km south of the North Paaratte gas plant

REFERENCE(S): Beach Petroleum, 1986
TRAP

TRAP 1: Waarre Sandstone
DISCOVERY WELL(S): Grumby 1
CONTENTS: gas

PETROLEUM-BEARING UNIT(S)

PETROLEUM-BEARING UNIT 1: Waarre Sandstone
PETROLEUM CONTENTS: gas containing 50% of carbon dioxide
PRODUCTION STATUS: nil (suspended)
FORMATION: Waarre Sandstone
AGE: Late Cretaceous
LITHOLOGY: sandstone
TRAPPING MECHANISM: structural
DEPTH TO TOP OF PETROLEUM-BEARING UNIT: 1665 m KB (1574 m SS)
POROSITY: not available
PERMEABILITY: not available
RESERVOIR TEMPERATURE: not available
RESERVOIR PRESSURE: not available
ACCUMULATION: Lindon

COMPILATION DATE: 1/11/89

TYPE: oil show

COMMERCIAL STATUS: uneconomic

LOCATION: 370 km west of Melbourne; 30 km north of Portland

STATE: Victoria

PETROLEUM TITLE(S): PEP 105

OPERATOR: Beach Petroleum NL

FIRST DISCOVERY WELL: Lindon 1
- latitude: 38°04'05" - longitude: 141°30'55"
- discovery: oil show
- total depth: 
- date total depth reached: 

NUMBER OF WELLS DRILLED:
- exploration & appraisal: 1
- development: nil

STRUCTURE: a NW-trending horst block
- areal closure: 3.1 sq. km
- vertical closure: not available

SUBDIVISION OF PETROLEUM ACCUMULATION:
- number of traps: 1
- number of petroleum-bearing units: 1

NUMBER AND TYPE OF PRODUCING ZONES:
- gas: nil
- gas/condensate: nil
- gas/oil: nil
- oil: nil

DRIVE MECHANISM: (show only)

PRODUCTION COMMENCED:

PRODUCTION INFRASTRUCTURE: nil (plugged and abandoned)

REFERENCE(S): Tabbasi & Davey, 1986
TRAP 1: Pebble Point Formation
DISCOVERY WELL(S): Lindon 1
CONTENTS: (oil show)

PETROLEUM-BEARING UNIT(S)

PETROLEUM-BEARING UNIT 1: top of Pebble Point Formation
PETROLEUM CONTENTS: (oil show)
PRODUCTION STATUS: nil (plugged and abandoned)
FORMATION: Pebble Point Formation
AGE: Tertiary
LITHOLOGY: sandstone: medium to dark green-grey, friable to firm, very fine to very coarse grained, rounded and poorly sorted; inter bedded with silty claystone; lateritic
TRAPPING MECHANISM: structural
DEPTH TO TOP OF PETROLEUM-BEARING UNIT: 910 m KB
POROSITY: up to 20%; average 5%
PERMEABILITY: low
RESERVOIR TEMPERATURE: not available
RESERVOIR PRESSURE: not available
ACCUMULATION: Windermere

COMPILATION DATE: 1/11/89

TYPE: oil

COMMERCIAL STATUS: subeconomic

LOCATION: 250 km west of Melbourne; 30 km NW of Port Fairy

STATE: Victoria

PETROLEUM TITLE(S): PEP 111

OPERATOR: Minora Resources NL

FIRST DISCOVERY WELL: Windermere 1
- latitude: 38°13'45" - longitude: 142°10'52"
- discovery: oil
- total depth: 1852 m
- date total depth reached: 8/4/87

NUMBER OF WELLS DRILLED:
- exploration & appraisal: 2
- development: nil

STRUCTURE: a faulted anticline
- areal closure: not available
- vertical closure: not available

SUBDIVISION OF PETROLEUM ACCUMULATION:
- number of traps:
- number of petroleum-bearing units:

NUMBER AND TYPE OF PRODUCING ZONES:
- gas: nil
- gas/condensate: nil
- gas/oil: nil
- oil: nil

DRIVE MECHANISM: not available

PRODUCTION COMMENCED:

PRODUCTION INFRASTRUCTURE: nil

REFERENCE(S):
TRAP

TRAP 1: Eumeralla Formation
DISCOVERY WELL(S): Windermere 1
CONTENTS: oil

PETROLEUM-BEARING UNIT(S)

PETROLEUM-BEARING UNIT 1: Heathfield Member
PETROLEUM CONTENTS: oil
PRODUCTION STATUS: nil (suspended)
FORMATION: Eumeralla Formation
AGE: Early Cretaceous
LITHOLOGY: sandstone
TRAPPING MECHANISM: structural
DEPTH TO TOP OF PETROLEUM-BEARING UNIT: 1790 m KB (1739 m SS)
POROSITY: not available
PERMEABILITY: not available
RESERVOIR TEMPERATURE: not available
RESERVOIR PRESSURE: not available
ACCUMULATION: Kalangadoo

COMPILATION DATE: 1/11/89

TYPE: carbon dioxide

COMMERCIAL STATUS: uneconomic

LOCATION: 120 km SE of Adelaide; 30 km north of Mount Gambier

STATE: South Australia

PETROLEUM TITLE(S): PEL 32

OPERATOR: Ultramar Australia Ltd

FIRST DISCOVERY WELL: Kalangadoo 1
- latitude: 37°34'32" - longitude: 140°42'10"
- discovery: carbon dioxide
- total depth: 2755 m
- date total depth reached: 31/8/65

NUMBER OF WELLS DRILLED: - exploration & appraisal: 1
- development: nil

STRUCTURE: an upthrust block of Palaeozoic basement
- areal closure: not known
- vertical closure: not known

SUBDIVISION OF PETROLEUM ACCUMULATION:
- number of traps: 1
- number of petroleum-bearing units: 1

NUMBER AND TYPE OF PRODUCING ZONES: - gas: nil
- gas/condensate: nil
- gas/oil: nil
- oil: nil

DRIVE MECHANISM: not known

PRODUCTION COMMENCED: nil (plugged and abandoned)

REFERENCE(S):
TRAP

TRAP 1: Palaeozoic basement
DISCOVERY WELL(S): Kalangadoo 1
CONTENTS: carbon dioxide

CARBON DIOXIDE-BEARING UNIT(S)

CARBON DIOXIDE-BEARING UNIT 1: Palaeozoic basement
PETROLEUM CONTENTS: carbon dioxide
PRODUCTION STATUS: nil (plugged and abandoned)
FORMATION: basement
AGE: Palaeozoic (? Devonian)
LITHOLOGY: sandstone: dolomitic with shale; sheared and fractured; weathered
TRAPPING MECHANISM: structural
DEPTH TO TOP OF CARBON DIOXIDE-BEARING UNIT: 2059 m RT (1986 m SS)
POROSITY: low
PERMEABILITY: not available
RESERVOIR TEMPERATURE: not available
RESERVOIR PRESSURE: not available
PETROLEUM ACCUMULATIONS SUMMARY SHEET

ACCUMULATION: Flaxmans

COMPILATION DATE: 1/11/89

TYPE: gas/condensate show

COMMERCIAL STATUS: uneconomic

LOCATION: 200 km WSW of Melbourne; 30 km SE of Warrnambool

STATE: Victoria

PETROLEUM TITLE(S): PEP 104

OPERATOR: Beach Petroleum NL

FIRST DISCOVERY WELL: Flaxmans 1
  - latitude: 38°33' - longitude: 142°46'
  - discovery: (gas/condensate show)
  - total depth: 3514 m
  - date total depth reached: 25/8/61

NUMBER OF WELLS DRILLED: - exploration & appraisal: 1
  - development: nil

STRUCTURE: a faulted NE-trending high
  - areal closure: not available
  - vertical closure: not available

SUBDIVISION OF PETROLEUM ACCUMULATION:
  - number of traps: 1
  - number of petroleum-bearing units: 1

NUMBER AND TYPE OF PRODUCING ZONES:
  - gas: nil
  - gas/condensate: nil
  - gas/oil: nil
  - oil: nil

DRIVE MECHANISM:

PRODUCTION COMMENCED:

PRODUCTION INFRASTRUCTURE: nil (plugged and abandoned)

REFERENCE(S): BMR, 1965
TRAP 1: Eumeralla Formation

DISCOVERY WELL(S): Flaxmans 1

CONTENTS: (gas/condensate show)

PETROLEUM-BEARING UNIT(S)

PETROLEUM-BEARING UNIT 1: Eumeralla Formation

PETROLEUM CONTENTS: (gas/condensate show)

PRODUCTION STATUS: nil (plugged and abandoned)

FORMATION: Eumeralla Formation

AGE: Early Cretaceous

LITHOLOGY: sandstone: grey, very fine grained and cross-bedded; grading into siltstone and mudstone

TRAPPING MECHANISM: structural

DEPTH TO TOP OF PETROLEUM-BEARING UNIT: 3305 m RT (3237 m SS)

POROSITY: low

PERMEABILITY: low

RESERVOIR TEMPERATURE: 103°C

RESERVOIR PRESSURE: not available
ACCUMULATION: Port Campbell 1

COMPILATION DATE: 1/11/89

TYPE: gas/condensate

COMMERCIAL STATUS: uneconomic

LOCATION: 200 km WSW of Melbourne; 36 km SE of Warrnambool

STATE: Victoria

PETROLEUM TITLE(S): PPL 1

OPERATOR: Gas and Fuel Corp of Victoria

FIRST DISCOVERY WELL: Port Campbell 1
- latitude: 38°34'57" - longitude: 142°57'50"
- discovery: gas/condensate
- total depth: 1818 m
- date total depth reached: 9/12/59

NUMBER OF WELLS DRILLED: - exploration & appraisal: 1
- development: nil

STRUCTURE: a faulted block on the downthrown side of a fault
- areal closure: not available
- vertical closure: not available

SUBDIVISION OF PETROLEUM ACCUMULATION:
- number of traps: 1
- number of petroleum-bearing units: 1

NUMBER AND TYPE OF PRODUCING ZONES: - gas: nil
- gas/condensate: nil
- gas/oil: nil
- oil: nil

DRIVE MECHANISM:

PRODUCTION COMMENCED:

PRODUCTION INFRASTRUCTURE: (plugged and abandoned); 3km east of the North Paaratte gas production station

REFERENCE(S): BMR, 1964
TRAP

TRAP 1: Waarre Sandstone
DISCOVERY WELL(S): Port Campbell No. 1
CONTENTS: gas/condensate

PETROLEUM-BEARING UNIT(S)

PETROLEUM-BEARING UNIT 1: top of Waarre Sandstone
PETROLEUM CONTENTS: gas/condensate
PRODUCTION STATUS: nil (plugged and abandoned)
FORMATION: Waarre Sandstone
AGE: Late Cretaceous
LITHOLOGY: sandstone: light grey to white; clean and friable; pebble conglomerate at the top; pyrite and coal lenses; slightly calcareous in parts
TRAPPING MECHANISM: structural
DEPTH TO TOP OF PETROLEUM-BEARING UNIT: 1724 m RT (1618 m SS)
POROSITY: 24-26.5%
PERMEABILITY: 170-2990 md
RESERVOIR TEMPERATURE: 79°C
RESERVOIR PRESSURE: 14 500 kPa at 1739 m RT (DST 4)
PETROLEUM ACCUMULATIONS SUMMARY SHEET

ACCUMULATION: Port Campbell 3

COMPILATION DATE: 1/11/89

TYPE: gas show

COMMERCIAL STATUS: uneconomic

LOCATION: 200 km WSW of Melbourne; 32 km SE of Warrnambool

STATE: Victoria

PETROLEUM TITLE(S): PPL 1

OPERATOR: Gas and Fuel Corp of Victoria

FIRST DISCOVERY WELL: Port Campbell 3
- latitude: 38°33' - longitude: 142°55'
- discovery: (gas show)
- total depth: 1686 m
- date total depth reached:

NUMBER OF WELLS DRILLED: - exploration & appraisal: 1
- development: nil

STRUCTURE:
- areal closure: not available
- vertical closure: not available

SUBDIVISION OF PETROLEUM ACCUMULATION:
- number of traps: 1
- number of petroleum-bearing units: 1

NUMBER AND TYPE OF PRODUCING ZONES: - gas: nil
- gas/condensate: nil
- gas/oil: nil
- oil: nil

DRIVE MECHANISM: not available

PRODUCTION COMMENCED:

PRODUCTION INFRASTRUCTURE: (plugged and abandoned); 3km distant from the North Paaratte gas production station

REFERENCE(S):
TRAP

**TRAP 1**: Eumeralla Formation

**DISCOVERY WELL(S)**: Port Campbell No. 3

**CONTENTS**: (gas show)

---

**PETROLEUM-BEARING UNIT(S)**

**PETROLEUM-BEARING UNIT 1**: Eumeralla Formation

**PETROLEUM CONTENTS**: (gas show)

**PRODUCTION STATUS**: (plugged and abandoned)

**FORMATION**: Eumeralla Formation

**AGE**: Early Cretaceous

**LITHOLOGY**: sandstone

**TRAPPING MECHANISM**: structural

**DEPTH TO TOP OF PETROLEUM-BEARING UNIT**: 1511 m RT

**POROSITY**: not available

**PERMEABILITY**: not available

**RESERVOIR TEMPERATURE**: not available

**RESERVOIR PRESSURE**: not available
ACCUMULATION: Port Campbell 4

COMPILATION DATE: 1/11/89

TYPE: oil and gas

COMMERCIAL STATUS: uneconomic

LOCATION: 200 km WSW of Melbourne; 34 km SE of Warrnambool

STATE: Victoria

PETROLEUM TITLE(S): PPL 1

OPERATOR: Gas and Fuel Corp of Victoria

FIRST DISCOVERY WELL: Port Campbell 4
- latitude: 38°32'30" - longitude: 142°58'30"
- discovery: oil and gas
- total depth: 2597 m
- date total depth reached: 12/7/64

NUMBER OF WELLS DRILLED: - exploration & appraisal: 1
- development: nil

STRUCTURE:
- areal closure: not available
- vertical closure: not available

SUBDIVISION OF PETROLEUM ACCUMULATION:
- number of traps: 1
- number of petroleum-bearing units: 1

NUMBER AND TYPE OF PRODUCING ZONES:
- gas: nil
- gas/condensate: nil
- gas/oil: nil
- oil: nil

DRIVE MECHANISM: not available

PRODUCTION COMMENCED:

PRODUCTION INFRASTRUCTURE: (plugged and abandoned); 3km distant from the North Paaratte gas production station

REFERENCE(S):
**TRAP 1: Eumeralla Formation**

**DISCOVERY WELL(S):** Port Campbell 4

**CONTENTS:** oil and gas

---

**PETROLEUM-BEARING UNIT(S)**

**PETROLEUM-BEARING UNIT 1: intra-unit 2**

**PETROLEUM CONTENTS:** oil and gas

**PRODUCTION STATUS:** (plugged and abandoned)

**FORMATION:** Eumeralla Formation

**AGE:** Early Cretaceous

**LITHOLOGY:** sandstone: light grey to green-grey; mottled; feldspathic with dark rock grains and minor quartz; interbedded with siltstone and mudstone

**TRAPPING MECHANISM:** structural

**DEPTH TO TOP OF PETROLEUM-BEARING UNIT:** 1789 m RT (1655 m SS)

**POROSITY:** 10.4-14.3%

**PERMEABILITY:** very low

**RESERVOIR TEMPERATURE:** 62°C

**RESERVOIR PRESSURE:** 16,410 kPa at 1783 m RT
ACCUMULATION: Pecten

COMPILATION DATE: 1/11/89

TYPE: gas

COMMERCIAL STATUS: uneconomic

LOCATION: 215 km WSW of Melbourne; 15 km offshore

STATE: Victoria

PETROLEUM TITLE(S): vacant

OPERATOR:

FIRST DISCOVERY WELL: Pecten 1A
- latitude: 38°40'41" - longitude: 142°39'56"
- discovery: gas
- total depth: 2850 m
- date total depth reached: 3/6/67

NUMBER OF WELLS DRILLED:
- exploration & appraisal: 1
- development: nil

STRUCTURE: ANE-trending anticline
- areal closure: 73 sq. km
- vertical closure: 107 m

SUBDIVISION OF PETROLEUM ACCUMULATION:
- number of traps: 1
- number of petroleum-bearing units: 1

NUMBER AND TYPE OF PRODUCING ZONES:
- gas: nil
- gas/condensate: nil
- gas/oil: nil
- oil: nil

DRIVE MECHANISM: not available

PRODUCTION COMMENCED:

PRODUCTION INFRASTRUCTURE: nil (plugged and abandoned)

REFERENCE(S):
TRAP 1: Waarre Sandstone

DISCOVERY WELL(S): Pecten No. 1A

CONTENTS: gas

PETROLEUM-BEARING UNIT(S)

PETROLEUM-BEARING UNIT 1: top of Waarre Sandstone

PETROLEUM CONTENTS: gas

PRODUCTION STATUS: nil (plugged and abandoned)

FORMATION: Waarre Sandstone

AGE: Late Cretaceous

LITHOLOGY: sandstone: well sorted; interbedded with mudstone

TRAPPING MECHANISM: structural

DEPTH TO TOP OF PETROLEUM-BEARING UNIT: 1771 m RT (1737 m SS)

POROSITY: 17-25%

PERMEABILITY: 19-30 md

RESERVOIR TEMPERATURE: 63°C

RESERVOIR PRESSURE: 16 740 kPa at 1722 m DF
ACKNOWLEDGEMENTS

The technical data contained in this report has been assembled with the assistance of relevant petroleum exploration companies and the State Departments responsible for petroleum exploration and development in South Australia, Victoria and Tasmania. BMR is able to compile reports of this type as a result of its efforts in maintaining a strategic inventory of Australia's identified petroleum (and other) resources.

This report was typed by Penny Wilkins, re-typed by Annette Barker, and the figures were drafted by Richard Larson. E. Anne Felton, Evelyn Nicholas, Geoff O'Brien and Denis Wright reviewed the report.

The authors and all members of Petroleum Resource Assessment Branch, BMR, gratefully acknowledge the efforts of the late Dr Stanley Ozimic who coordinated and developed the 'Australian Petroleum Accumulations Report' series as the primary source of information on Australia's identified petroleum resources. Dr Ozimic's work in this area and that of natural gas storage will remain as major hallmarks of his talent and perseverance.

Technical data on the petroleum accumulations have been collated with the assistance of Beach Petroleum NL, Bridge Oil Ltd and Ultramar Australia Ltd.

REFERENCES


SPRIGG, R.C. & WOOLLEY, J.B., 1963 - Coastal bitumen in South Australia, with special reference to observations at Geltwood Beach, south-east South Australia. Transactions of Royal Society of South Australia, 86, 67-103.


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<th>WELL NAME</th>
<th>OPERATOR</th>
<th>LATITUDE (S)</th>
<th>LONGITUDE (E)</th>
<th>STAT</th>
<th>TD DATE</th>
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<th>GL WD (m)</th>
<th>DATUM (m)</th>
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## AUSTRALIAN PETROLEUM ACCUMULATIONS
### OTWAY BASIN

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### Petroleum Bearing Unit

- **Paaritte Fm**
- **Waarre Sst**
- **Eumeralla Fm**

### Petroleum Content

- Oil show
- Gas Cap/Producing show
- Gas Cap/Non-producing show
- Gas Cap/Drill show

### Structures

- **PORT CAMPBELL 1**
- **PORT CAMPBELL 3**
- **PORT CAMPBELL 4**

### Petroleum Production Systems

- **Port Campbell 3**
- **Port Campbell 1**

### Petroleum Reserves and Production

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### Comments

- Structure map not available