PROSPECTIVITY OF STATE ACREAGE
RELEASE AREAS L06-1, L06-2, L06-3,
L06-4, AND L06-5, OFFSHORE
NORTHERN CARNARVON BASIN

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Prospectivity of State Acreage Release Areas
L06-1, L06-2, L06-3, L06-4 and L06-5,
offshore Northern Carnarvon Basin

Introduction
The Northern Carnarvon Basin, particularly the Barrow and Dampier Sub-basins, is one of the more intensively explored areas of Australia. Islands such as Barrow, Airlie, Varanus, and Thevenard provide excellent locations for production facilities and bases (Fig. 1).

Area L06-1 covers parts of the Dampier Sub-basin and the Lambert and Peedamullah Shelves (Fig. 2). It is only 10 km east of the Harriet Joint Venture production licences and 20 km southwest of the Stag (oil) production licence. Area L06-2 is immediately southwest of the Thevenard Production Facility, in the southern part of the Barrow Sub-basin. Areas L06-3 and L06-5 lie on the Peedamullah Shelf, south and southwest respectively of the Thevenard Production Facility (Fig. 3). Area L06-4 lies in the easternmost part of the Exmouth Sub-basin (Fig. 3).

Water depths are less than 50 m in the release areas, which is ideal for the use of jackup drilling rigs. There is good coverage of 2D seismic data (Figs 2 and 3) and partial coverage of 3D seismic data in the release areas (see also Available data section — Data listings on this CD).

Stratigraphy
Major depocentres in the basin are estimated to contain up to 15 km of Mesozoic sedimentary rocks (Fig. 4). In the Barrow, Dampier, and Exmouth Sub-basins, Mesozoic and Cenozoic successions overlie (commonly at considerable depth) Paleozoic sedimentary rocks.

Triassic, Jurassic to lowermost Cretaceous, and Lower to Upper Cretaceous (siliciclastic) successions reflect the development of the Northern Carnarvon Basin as a rift system related to breakup of Greater India and Australia. The Triassic succession is pre-rift trough infill, and the Jurassic succession represents rift-valley infill. Post-breakup trough-infill was formed by progradation of the continental shelf in the Upper Cretaceous and Cenozoic, and is characterized by carbonate-dominated, restricted-circulation trailing-edge deposition (Hocking, 1988).

Structure
The Northern Carnarvon Basin is dominated by southwest-trending troughs, the most prospective of which are the Barrow and Dampier Sub-basins. The Dampier Sub-basin may be regarded as a northeastern extension of the Barrow Sub-basin, the two distinguished from each other by a gradual change in structural style.

The Barrow Sub-basin contains more than 10 km of Jurassic–Cretaceous strata, and has been largely controlled by the east-trending Long Island Fault System and northeast-trending Flinders Fault System, which form the boundary between the sub-basin, and the Peedamullah Shelf to the southeast (Fig. 1). The Dampier Sub-basin is flanked to the southeast by the Lambert Shelf. A mid-basin high formed by the Alpha Arch and Rankin Platform bound the Barrow and Dampier Sub-basins to the west and northwest respectively.

The Exmouth Sub-basin forms part of the Exmouth–Barrow–Dampier intracratonic rift system of the Northern Carnarvon Basin. The Exmouth Sub-basin has been defined as the area immediately to the east of the Exmouth Plateau where Jurassic syn-rift sediments attain significant thickness (Tindale et al., 1998).

The Peedamullah Shelf is a northwest-dipping block of Paleozoic and Triassic strata downthrown by the Sholl Fault near its eastern margin (Fig. 1). The shelf extends both onshore and offshore, and is covered by an onlapping veneer of Cretaceous and Tertiary sedimentary rocks.

The Lambert Shelf lies to the north of the Precambrian Pilbara Craton. The western and northwestern boundaries of the shelf are defined by the down-to-the-west Sholl Fault and its connecting northeast-trending faults (West Australian Petroleum Ltd, 1979).

Petroleum geology
The petroleum potential of the region is demonstrated by its numerous oil and gas fields. The largest oilfield in Western Australia, Barrow Island oilfield, had in-place oil of 200 GL (1250 MMBBL; Ellis et al., 1999).
Prospectivity of State Acreage Release Areas L06-1, L06-2, L06-3, L06-4, and L06-5, offshore Northern Carnarvon Basin

Figure 1. Simplified tectonic subdivisions of Northern Carnarvon Basin and release areas
Prospectivity of State Acreage Release Areas L06-1, L06-2, L06-3, L06-4, and L06-5, offshore Northern Carnarvon Basin

Figure 2. Seismic lines, wells, and release area L06-1
The offshore Northern Carnarvon Basin is Australia’s leading producer of both liquid hydrocarbons and gas. To date, most oil production has come from the Barrow Sub-basin. Key factors leading to this success include: good Mesozoic source rocks, which have generated hydrocarbons over a long period of time; Lower Cretaceous reservoir rocks with excellent porosity and permeability; and a thick and effective regional seal (Muderong Shale; Baillie and Jacobson, 1997).

Most of the oil fields discovered in the Barrow Sub-basin rely on fault closure, where the Winning Group shales (Muderong Shale and Gearle Siltstone) provide a seal for accumulations in the Barrow Group, Windalia Sandstone Member, and Birdrong Sandstone (West Australian Petroleum Ltd, 1995).

The Exmouth Sub-basin and adjacent Kangaroo Trough have had numerous petroleum finds since 1998. These include oil at Coniston 1, Stybarrow 1, Stickle 1, and Harrison 1, as well as oil and gas at Vincent 1, Enfield 1, Laverda 1, and Ravensworth 1.

Table 1 lists a number of wells drilled in and around the Northern Carnarvon Basin release areas. Areas L06-2, L06-3, and L06-5 lie within 10 km of the Thevenard production area. Within area L06-1, Border 1 had excellent gas shows. Bordering area L06-2, Lightfoot 1 had good oil shows. Within 20 km of area L06-4, Leatherback 1 had excellent oil shows, Blencathra 1 had good oil and gas shows, and Careta 1 and Ridley 1 had good oil shows. Within L06-5, Longneck 1 had good oil shows and 3 km to the northeast of L06-5 Coaster 1 had excellent oil shows.
Figure 4. Stratigraphy and petroleum systems of the Northern Carnarvon Basin
### Table 1. Selected wells drilled in and around L06-1, L06-2, L06-3, L06-4, and L06-5

<table>
<thead>
<tr>
<th>Well name</th>
<th>Type</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Kelly bushing elevation (m AHD)</th>
<th>Total depth (m)</th>
<th>Bottomed in Year</th>
<th>Operator</th>
<th>Status 1</th>
<th>Status 2</th>
<th>Gas show</th>
<th>Oil show</th>
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<td>Arabella 1</td>
<td>NFW</td>
<td>20°28'07.66&quot;</td>
<td>116°01'56.61&quot;</td>
<td>35</td>
<td>2 200</td>
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<td>Dry</td>
<td>P&amp;A</td>
<td>Nil</td>
<td>Nil</td>
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<td>2 680</td>
<td>Triassic 1991</td>
<td>WAPET</td>
<td>Dry</td>
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<td>Poor</td>
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<td>Blencathra 1</td>
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<td>22</td>
<td>1 510</td>
<td>Jurassic 1995</td>
<td>BHP</td>
<td>Oil, gas</td>
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<td>Good</td>
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<td>115°52'23.25&quot;</td>
<td>37</td>
<td>935</td>
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<td>Gas</td>
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<td>Fair</td>
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<td>NFW</td>
<td>21°35'06.41&quot;</td>
<td>114°50'04.00&quot;</td>
<td>30</td>
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<td>Barrow Group 1998</td>
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<td>1 112</td>
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<td>1 840</td>
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<td>Fair</td>
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<td>Cretaceous 1993</td>
<td>WAPET</td>
<td>Oil</td>
<td>P&amp;A</td>
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<td>1 029</td>
<td>Jurassic 1996</td>
<td>Apache NW</td>
<td>Oil</td>
<td>P&amp;A</td>
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<td>STR</td>
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<td>115°54'01.79&quot;</td>
<td>9</td>
<td>1 272</td>
<td>Permian 1967</td>
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<td>Nil</td>
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<td>21°35'08.29&quot;</td>
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<td>2 134</td>
<td>Jurassic 1966</td>
<td>WAPET</td>
<td>Dry</td>
<td>P&amp;A</td>
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**NOTES:**
- Apache: Apache Energy Limited
- Apache NW: Apache Northwest Pty Ltd
- BHP: BHP Petroleum (Australia) Pty Ltd
- Hadson: Hadson Carnarvon Pty Ltd
- Lasmo: Lasmo Oil (Australia) Limited
- WAPET: West Australian Petroleum Pty Ltd
- NFW: new field wildcat
- STR: stratigraphic
- P&A: plugged and abandoned
- Occidental: Australian Occidental Oil Pty Ltd

**Prospectivity of State Acreage Release Areas L06-1, L06-2, L06-3, L06-4, and L06-5, offshore Northern Carnarvon Basin**
References


