

**PROSPECTIVITY OF  
STATE ACREAGE RELEASE AREA  
T10-1, PERTH BASIN**

**2010**



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## Introduction

Release Area T10-1 extends from 130 to 255 km north of Perth, and covers 1331 km<sup>2</sup> offshore in the 3-nautical-mile zone between Lancelin and Desperation Bay, north of Jurien (Figs 1, 2).

## Regional geology and stratigraphy

Perth Basin tectonic subdivisions are shown in Figure 2. The regional basin stratigraphy is summarized in Figure 3. T10-1 lies across the Beagle Ridge to the north, and passes through the Abrolhos Sub-basin, Beermullah Trough, and Vlaming Sub-basin to the south.

## Beagle Ridge

The Beagle Ridge is a horst block sandwiched between the Cadda Terrace to the east, and the Abrolhos Sub-basin and Turtle Dove Ridge to the west. It is covered by 1–3 km of early to late mature Permian, and immature to early mature Triassic strata. Thus, potential accumulations within the ridge mostly require migration from adjacent depocentres. Nevertheless, the structurally elevated position, and lack of deep burial compared to adjacent areas, indicates the presence of favourable structures to trap hydrocarbons. The only shows recorded on the ridge to date are poor gas and oil shows in Jurien 1, and a small gas show in the Green Head 1 coal bore, both from the Lower Permian Irwin River Coal Measures, the reservoir in the nearby Cliff Head oil discovery.

## Abrolhos Sub-basin

The Abrolhos Sub-basin is a deep trough, containing mostly Mesozoic aged sedimentary rocks, between the Beagle and Turtle Dove Ridges. Only a small part of this tectonic division is present in T10-1.

## Beermullah Trough

The Beermullah Trough is a Jurassic depocentre, which is separated from the Dandaragan Trough to the north by the Cervantes Transfer, and from the Vlaming Sub-basin to the south by the Turtle Dove Transfer. Convergence of these transfers to the northwest has produced a large number

of anticlines, of which only the Gingin–Bootine and Bullsbrook Anticlines have been tested for hydrocarbons (Crostella and Backhouse, 2000).

## Vlaming Sub-basin

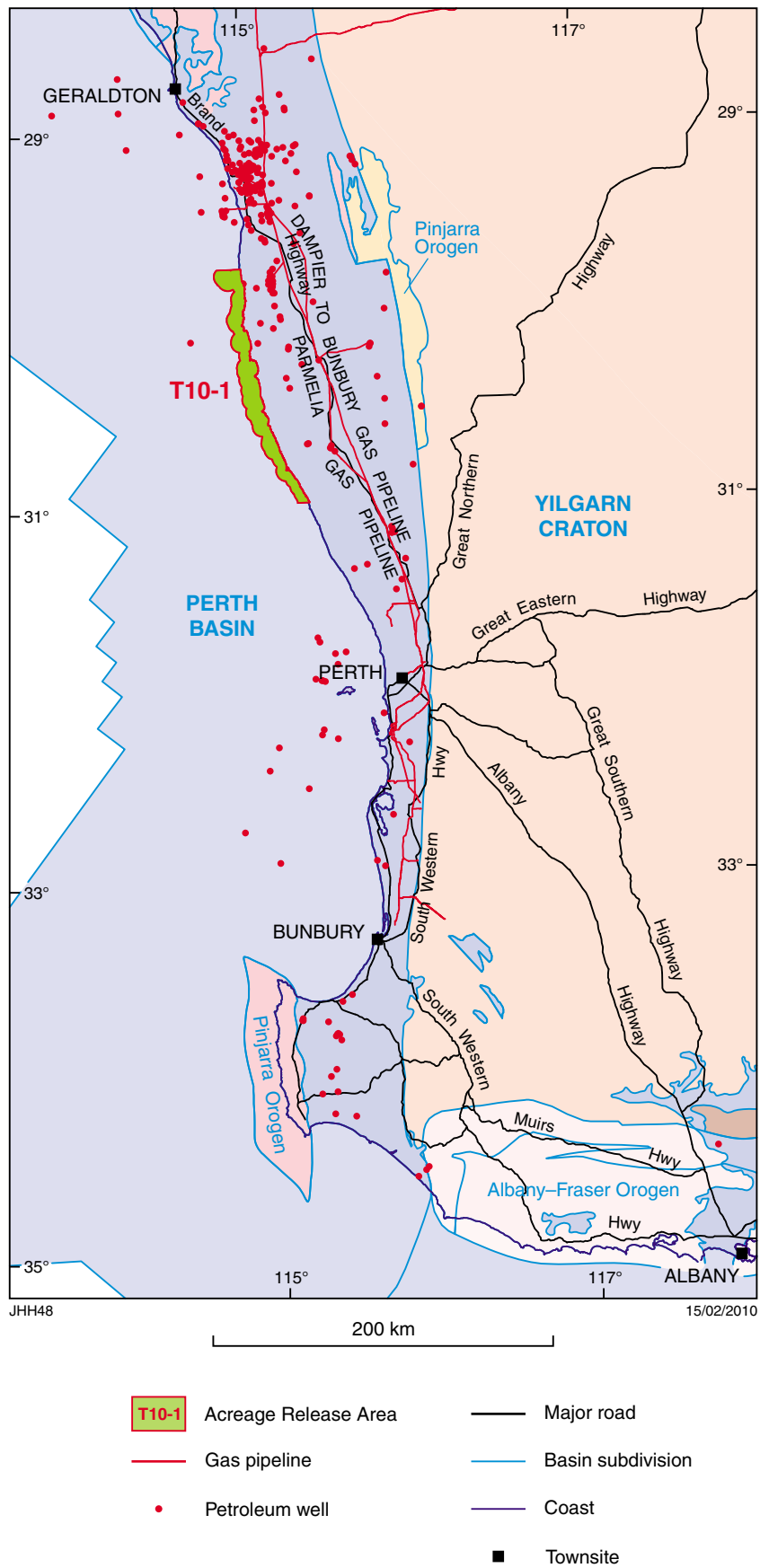
The Vlaming Sub-basin is a Jurassic–Cretaceous depocentre south of the Turtle Dove Transfer. The prevailing structures are mostly extensional; compressional anticlines are rare. In T10-1, the section is similar to that of the Houtman area as described by Gorter et al. (2004) and Crostella (2001), in which generation and entrapment within the Lower Jurassic Cattamarra Coal Measures are envisaged. Only a small part of this tectonic division is present in the southern portion of T10-1.

## Prospectivity

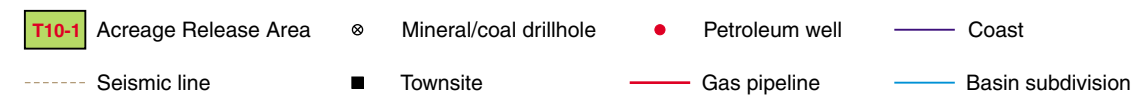
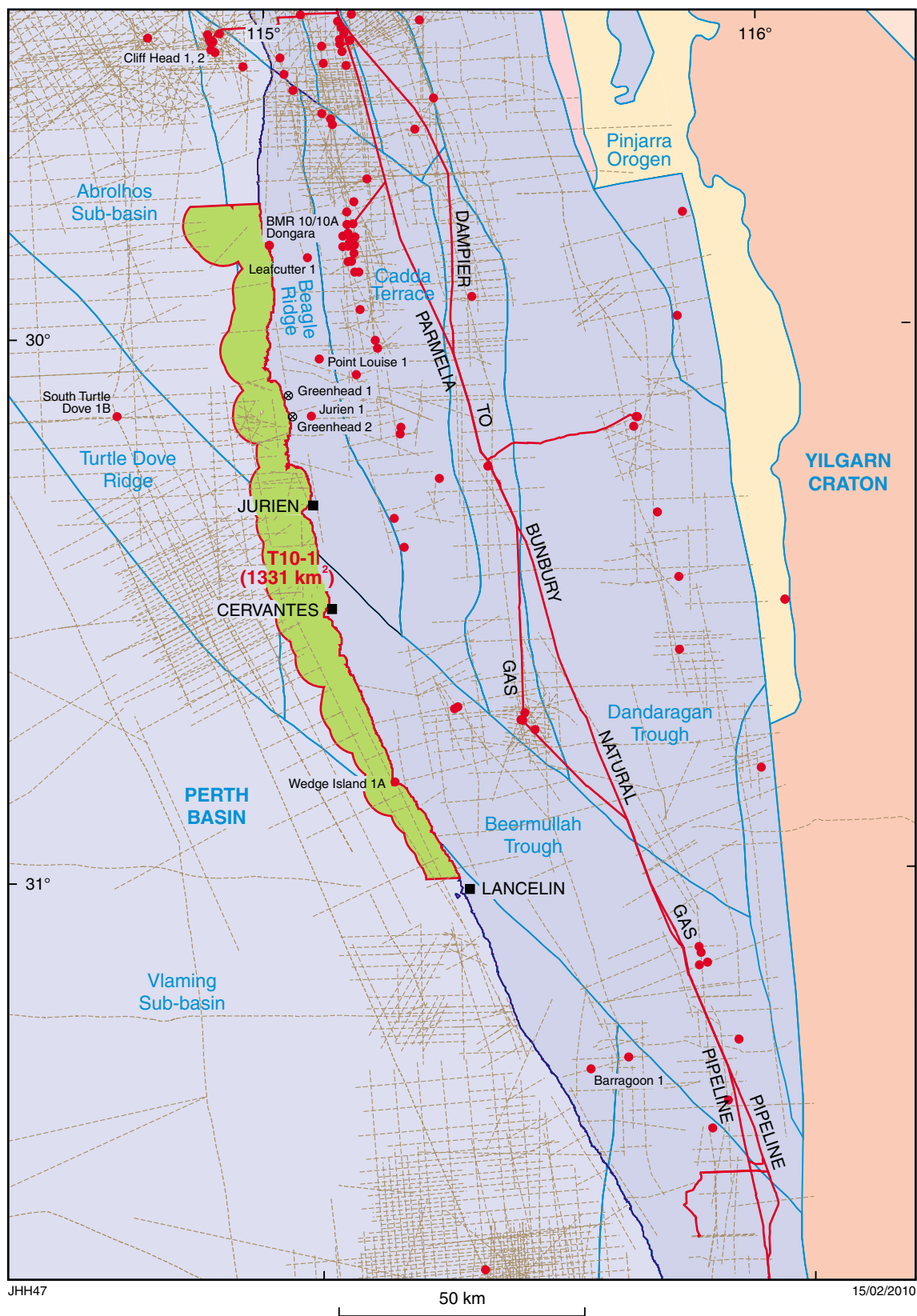
Release Area T10-1 extends south along the Beagle Ridge–Abrolhos Sub-basin transition, across the Beermullah Trough, and into the Vlaming Sub-basin. The corresponding depths to basement increases from 2 to 8 km across this area, and, as such, T10-1 extends from an area with shallow Permian–Triassic strata to an area with a thick Upper Jurassic section (Fig. 2). The region has a thick Lower Triassic source and seal interval, in addition to likely source intervals in the Lower Jurassic section. The source potential of the Permian to Lower Triassic has recently been re-evaluated by Thomas and Barber (2004), who showed that the principal source beds in the northern Perth Basin are within a sapropelic interval near the base of the Lower Triassic Kockatea Shale.

## Data

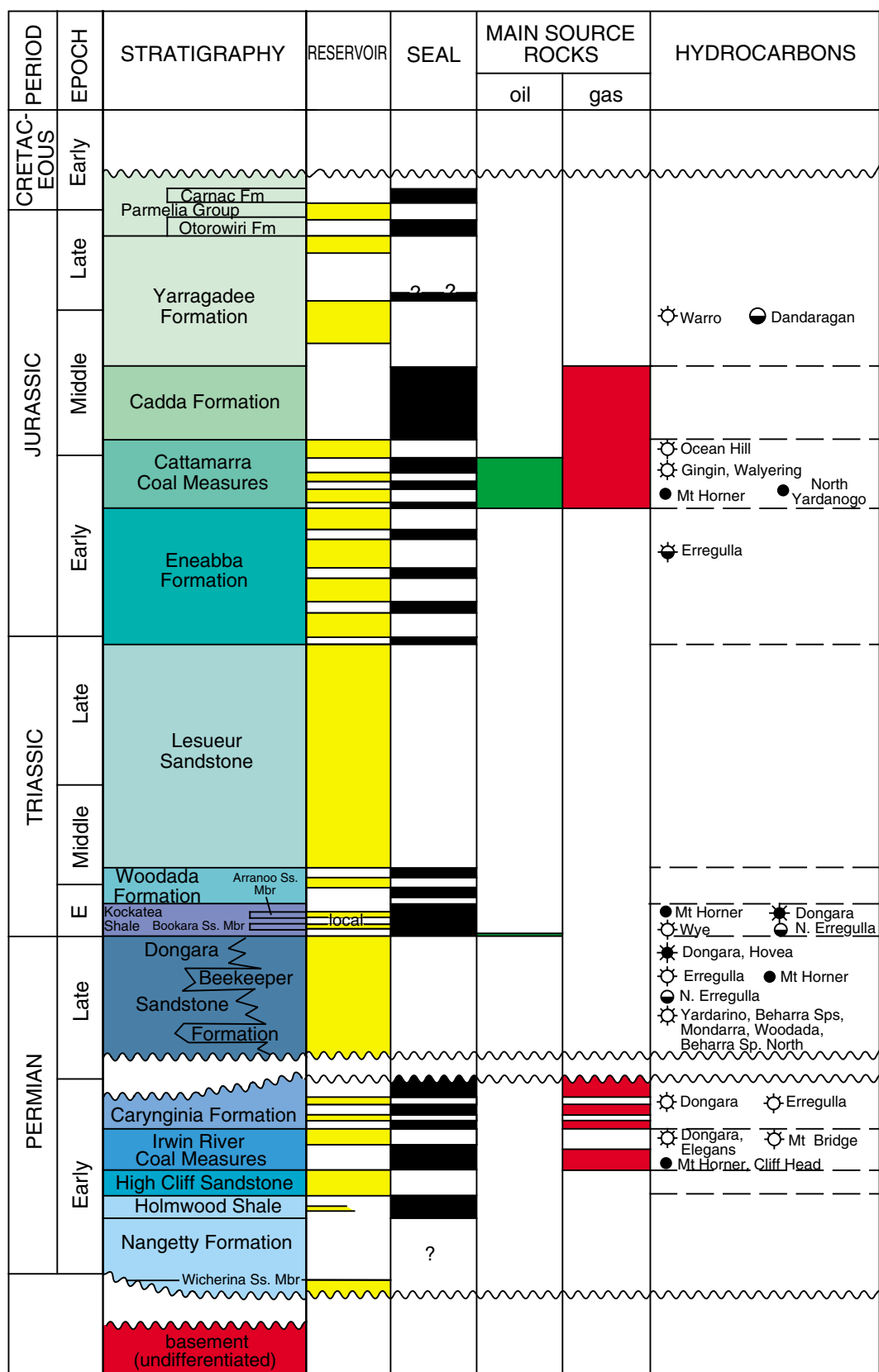
The release area is 32 km south of the Cliff Head oil discovery, and 15 km west of the Woodada gasfield; to date, no petroleum wells have been drilled within this region (Fig. 2). The nearest onshore wells are stratigraphic tests drilled close to the coast (BMR 10/10A and Wedge Island 1A), with the next closest wells (Barragoon 1, Jurien 1, Leafcutter 1, and Point Louise 1) up to 10 km east of the coast. South Turtle 1B, the nearest offshore well, is 24 km to the west (Table 1). About 1100 line-km of seismic data are available, dating mainly from the 1970s and early 1980s.



**Figure 1. Map of the Perth Basin, showing the location of May 2010 Acreage Release Areas.**



**Figure 2. Acreage Release Area T10-1, showing major basin subdivisions, and the location of seismic lines, petroleum exploration wells, and access roads.**



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- ☼ Gas well
- Oil well
- Oil show
- ☼ Gas show, abandoned
- ☼ Oil and gas well
- ☼ Oil and gas show, abandoned

**Figure 3. Generalized stratigraphy of the Perth Basin with major petroleum elements and occurrences indicated.**

**Table 1. Selected petroleum and coal exploration wells adjacent to T10-1. Data extracted from Western Australian Petroleum Information Management System (WAPIMS) and well completion reports**

| Well                 | Latitude<br>S | Longitude<br>E | Operator | Year | Class | Status | TD<br>(m) | Elevation<br>(m) | TD age | Oil shows <sup>(a)</sup> | Gas shows <sup>(a)</sup> |
|----------------------|---------------|----------------|----------|------|-------|--------|-----------|------------------|--------|--------------------------|--------------------------|
| Barragoon 1          | 31°21'35.6"   | 115°35'14.6"   | WAPET    | 1974 | NFW   | P&A    | 2 335     | 40               | RT     | Nil                      | Nil                      |
| BMR 10 Dongara       | 29°49'37.9"   | 114°58'30.0"   | BMR      | 1959 | STR   | P&A    | 1 192     | 4                | RT     | Nil                      | Nil                      |
| BMR 10A Dongara      | 29°49'36.1"   | 114°58'30.0"   | BMR      | 1960 | STR   | P&A    | 1 482     | 8                | RT     | Nil                      | Nil                      |
| Cliff Head 1         | 29°27'52.6"   | 114°52'10.9"   | Roc Oil  | 2001 | NFW   | P&A    | 1 499     | 25               | RT     | Excellent                | Fair                     |
| Cliff Head 2         | 29°27'52.6"   | 114°52'10.9"   | Roc Oil  | 2001 | EXT   | P&A    | 2 020     | 25               | RT     | Good                     | Fair                     |
| Green Head 1 (GHD-1) | 30°05'55.6"   | 115°00'05.2"   | Amax     | 1974 | COAL  | P&A    | 685       | 54               | GL     | Nil                      | Fair                     |
| Green Head 2 (GHD-2) | 30°08'15.6"   | 115°00'05.2"   | Amax     | 1974 | COAL  | P&A    | 328       | 2                | GL     | Nil                      | Fair                     |
| Jurien 1             | 30°08'44.2"   | 115°02'53.9"   | WAPET    | 1962 | NFW   | P&A    | 1 026     | 9                | DF     | Poor                     | Poor                     |
| Leafcutter 1         | 29°51'08.4"   | 115°03'15.3"   | Hardman  | 2003 | NFW   | P&A    | 1 330     | 25               | RT     | Nil                      | Poor                     |
| Point Louise 1       | 30°02'20.0"   | 115°04'13.4"   | Mesa     | 1981 | NFW   | P&A    | 950       | 43               | DF     | Nil                      | Nil                      |
| South Turtle Dove 1B | 30°07'41.9"   | 114°38'16.4"   | WAPET    | 1975 | NFW   | P&A    | 1 830     | 30               | RT     | Nil                      | Nil                      |
| Wedge Island 1A      | 30°49'09.5"   | 115°11'37.3"   | WAPET    | 1970 | STR   | P&A    | 486       | 6                | KB     | Nil                      | Nil                      |

**NOTES:** (a) Shows summarized from well completion reports

|      |     |                       |         |                                                     |
|------|-----|-----------------------|---------|-----------------------------------------------------|
| TD   | P&A | Plugged and abandoned | WAPET   | West Australian Petroleum Pty Ltd                   |
| NFW  | DF  | Drill floor           | BMR     | Bureau of Mineral Resources, Geology and Geophysics |
| STR  | KB  | Kelly bushing         | Roc Oil | Roc Oil Co. Ltd                                     |
| EXT  | RT  | Rotary table          | Amax    | Amax Pty Ltd                                        |
| COAL | GL  | Ground level          | Hardman | Hardman Resources                                   |
|      |     |                       | Mesa    | Mesa Australia Ltd                                  |

## References

- Crostella, A 2001, Geology and petroleum potential of the Abrolhos Sub-basin, Western Australia: Geological Survey of Western Australia, Report 75, 57p.
- Crostella, A and Backhouse, J 2000, Geology and petroleum exploration of the central and southern Perth Basin, Western Australia: Geological Survey of Western Australia, Report 57, 85p.
- Gorter, J D, Hearty, DJ and Bond, AJ 2004, Jurassic petroleum systems in the Houtman Sub-basin, northwestern offshore Perth Basin, Western Australia: a frontier petroleum province on the doorstep?: APPEA Journal, v. 44, no. 1, p. 13–57.
- Thomas, BM and Barber, CJ 2004, A re-evaluation of the hydrocarbon habitat of the northern Perth Basin: APPEA Journal, v. 44, no. 1, p. 59–92.