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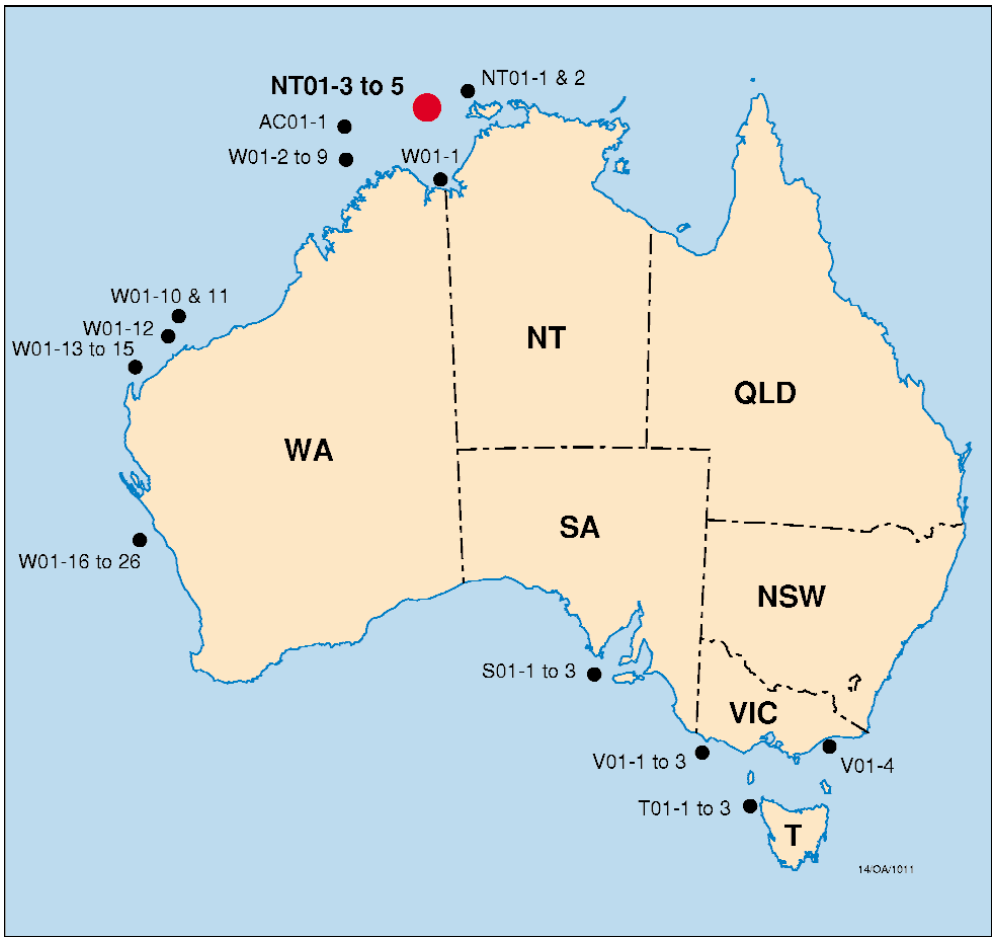
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NT01-1 & 2
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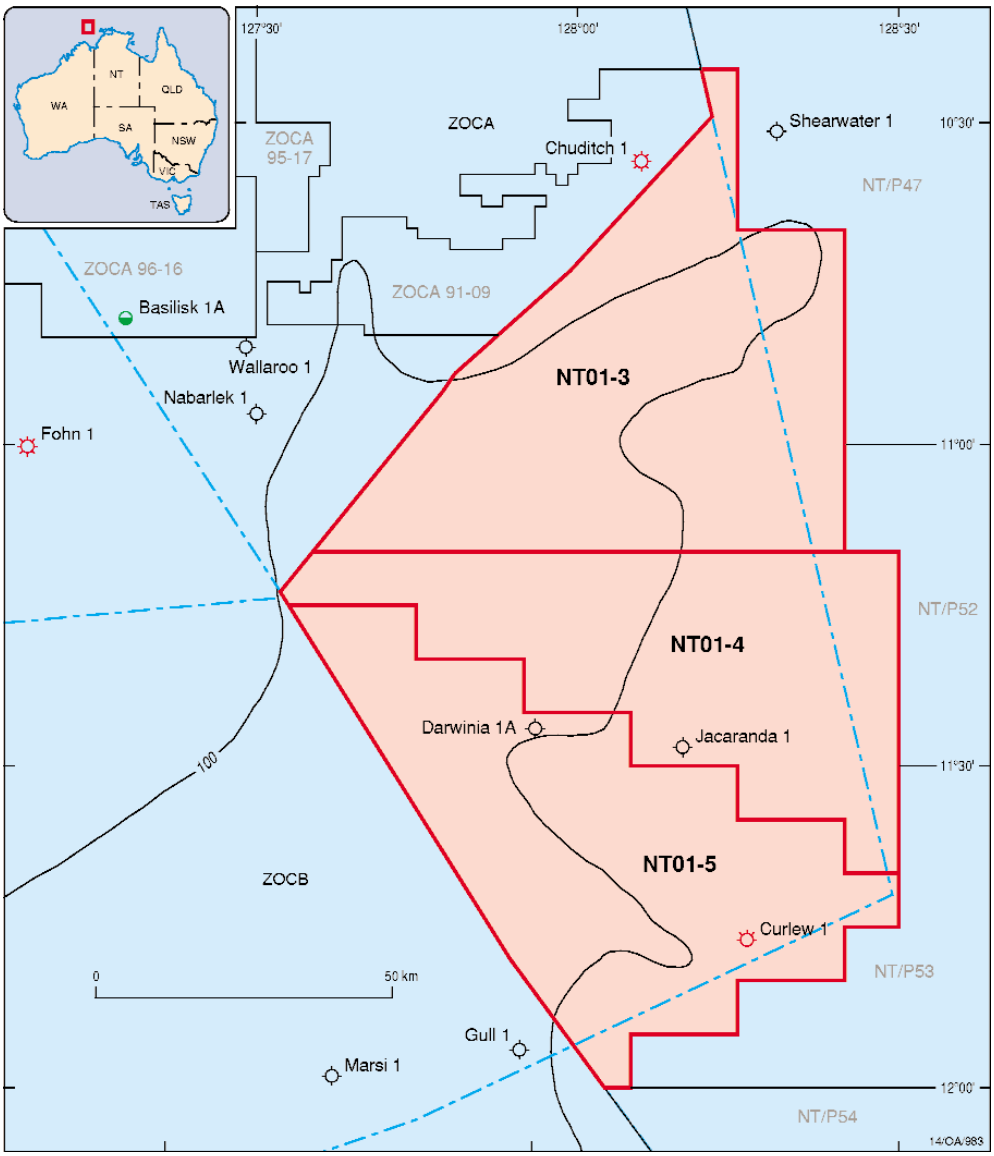
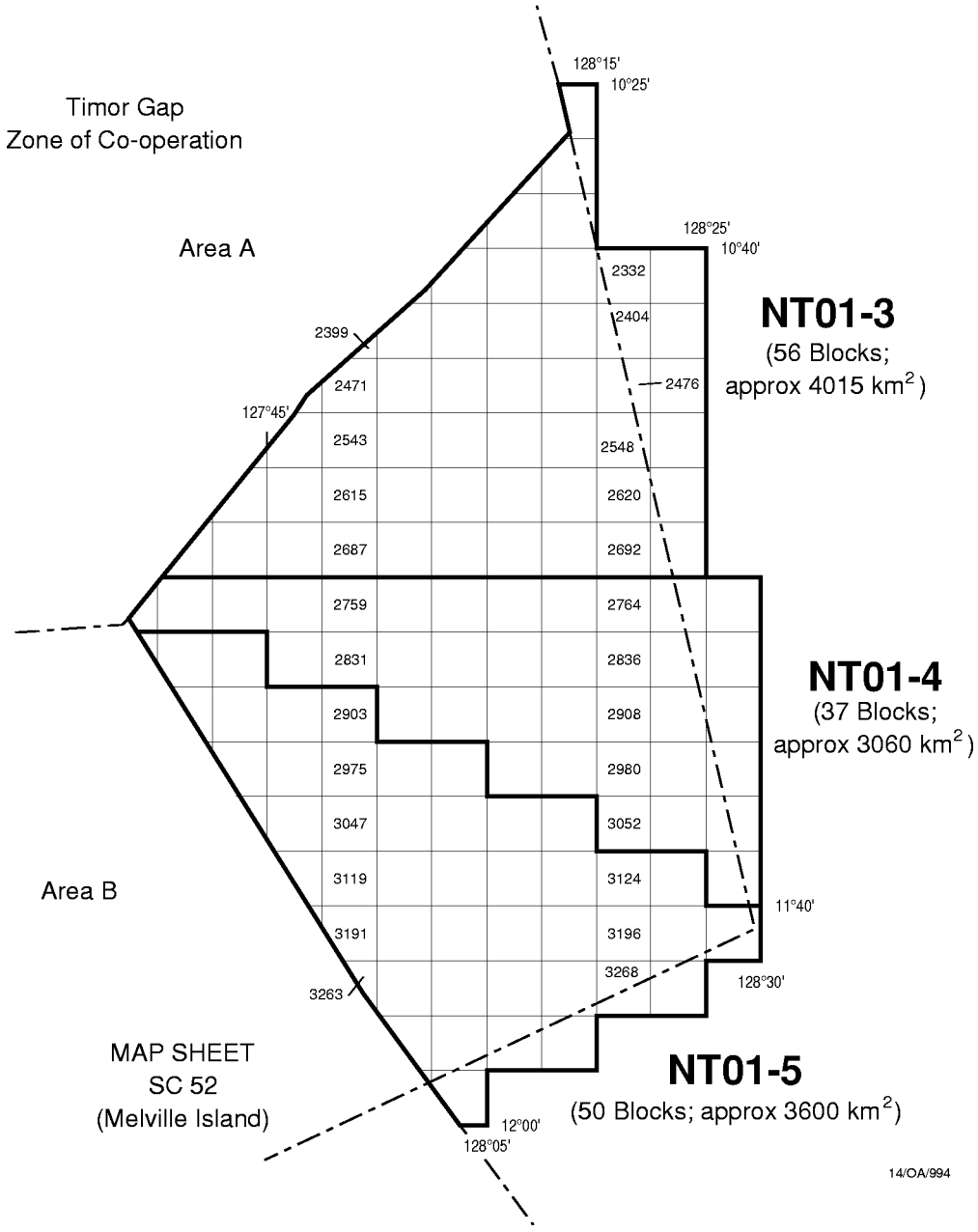
Areas NT01-3 to 5
Malita Graben, Bonaparte Basin, Northern Territory

(Bids Close 11 October 2001)



- Lightly explored areas, 300 km from Darwin
- Close to proposed gas developments in the ZOCA and to the north
- Water depths predominantly < 100 m
- Major Malita Graben Mesozoic kitchen
- Graben and flank plays
- Special requirements apply to these areas - refer to Guidance Notes for Applicants

2001 Release Areas
Malita Graben, Bonaparte Basin, Northern Territory/ZOC



Area NT01-3

Map Sheet SC 52 (Melville Island)

2115(part)	2186(part)	2187(part)	2257(part)	2258(part)	2259
2328(part)	2329(part)	2330	2331	2332	2333
2399(part)	2400(part)	2401	2402	2403	2404
2405	2470(part)	2471(part)	2472	2473	2474
2475	2476	2477	2541(part)	2542(part)	2543
2544	2545	2546	2547	2548	2549
2612(part)	2613(part)	2614	2615	2616	2617
2618	2619	2620	2621	2684(part)	2685
2686	2687	2688	2689	2690	2691
2692	2693				

Assessed to contain 56 graticular blocks

Area NT01-4

Map Sheet SC 52 (Melville Island)

2755(part)	2756(part)	2757	2758	2759	2760
2761	2762	2763	2764	2765	2766
2830	2831	2832	2833	2834	2835
2836	2837	2838	2904	2905	2906
2907	2908	2909	2910	2978	2979
2980	2981	2982	3052	3053	3054
3126					

Assessed to contain 37 graticular blocks

Area NT01-5

Map Sheet SC 52 (Melville Island)

2827(part)	2828(part)	2829(part)	2900(part)	2901	2902
2903	2972(part)	2973(part)	2974	2975	2976
2977	3045(part)	3046(part)	3047	3048	3049
3050	3051	3118(part)	3119	3120	3121
3122	3123	3124	3125	3190(part)	3191(part)
3192	3193	3194	3195	3196	3197
3198	3263(part)	3264(part)	3265	3266	3267
3268	3269	3336(part)	3337	3338	3339
3408(part)	3409(part)				

Assessed to contain 50 graticular blocks

Areas NT01-3 to 5
Malita Graben, Bonaparte Basin, Northern Territory

(Bids Close 11 October 2001)

Location

Areas NT01-3, NT01-4 and NT01-5, comprising 56, 37 and 50 graticular blocks respectively, are located in the central portion of the offshore Bonaparte Basin about 300 km northwest of Darwin. The areas cover the eastern half of Area B of the Timor Gap Zone of Co-operation (ZOCB) (Figure 1). Water depths are generally less than 100 m.

Regional Geology

Areas NT01-3, NT01-4 and NT01-5 straddle the Malita Graben, a northeast-trending depositional trough that contains a thick Mesozoic to Recent section. Two of the areas (Areas NT01-4 and 5) extend across the southern flank of the graben to the northern edge of the northwest-trending Petrel Sub-basin (Figure 2).

At depth, the Malita Graben is probably underlain by a thick Palaeozoic section, where total sediment thickness may exceed 8 km. The graben is characterised by northeast-trending tilted fault blocks of Mesozoic age. The Mesozoic sediments may contain effective petroleum source-to-trap systems (Figure 3).

The Sahul Platform, which forms the northern flank of the Malita Graben, is a region of elevated Mesozoic and Palaeozoic sediments which exhibit northeast-trending Mesozoic fault displacements parallel with and down-towards the margin of the Malita Graben (Figure 2).

South of the Malita Graben, the Petrel Sub-basin comprises a northwest-trending rift of Devonian-Carboniferous origin, containing Palaeozoic and Mesozoic sediments estimated to have a total thickness exceeding 15 km (Colwell and Kennard, 1996). The southern margin of the Malita Graben is marked by a northeast-trending, faulted hinge line, down-faulted to the northwest. Salt migration and salt structuring are developed in parts of the Petrel Sub-basin. Two salt diapirs are present near the Malita Graben boundary at Gull-1 and Curlew-1 (Figure 4).

Previous Exploration

Exploration activity in the region commenced in the mid-1960s and can be divided into 3 phases. Three wells have been drilled in the release areas (Curlew-1, Jacaranda-1, Darwinia-1/1A), with another three wells drilled close by (Gull-1, Shearwater-1 and Chuditch-1). Other wells have been drilled in the Malita Graben further to the northeast (Heron-1, Evans Shoal-1&2 and Beluga-1) and more recently on the northern flank of the Malita Graben in Area A of the Timor Gap Zone of Co-operation (ZOCA) (eg Narbalek-1 and Wallaroo-1).

The initial phase of exploration (1964-1974) focused on regional aeromagnetic and reconnaissance seismic surveying as well as detailed seismic surveying over leads and prospects. During this period, several wells were drilled in the region, the Petrel gas field was discovered and the Shearwater-1 well recorded residual oil.

Gull-1 was the first well to be drilled in the region in 1970. This well was designed to test a large, tectonically complex, salt induced feature. Minor hydrocarbon shows were recorded over several intervals, however reservoir targets (Cretaceous Bathurst Island Group sands, Jurassic Laminaria Formation and Plover Formation) exhibit destruction of primary porosity through diagenesis. This

play was not fully tested by Gull-1, as the well was not located in an optimal structural position due to poor quality seismic at the time (Botten and Wulff, 1990).

Curlew-1 was drilled in 1975. This well, like Gull-1, was drilled to test a complex, salt-induced anticline (Figure 5). The well encountered minor oil and gas shows in Upper Cretaceous sandstones of the Bathurst Island Group and Upper Jurassic sandstones of the Flamingo Group, but these reservoirs were water saturated. This well appears to have been a valid test, but there may be additional deep flank plays.

The second phase of exploration (1975-1980) concentrated on analysis of data obtained by the earlier phase. This included regional study of palynology, diagenesis of sandstone reservoir units and subsurface temperature gradients from wells drilled in the region.

In 1980, Tricentrol was awarded exploration permit NT/P33 and commenced seismic work over the area, delineating the Jacaranda and Darwinia prospects with subsequent seismic in 1983 and 1984.

Jacaranda-1 was drilled in 1984 and tested a hanging wall fault play on the down-thrown side of a major growth fault marking the edge of the Malita Graben (Figure 5). Minor gas shows were encountered in the Bathurst Island and Flamingo Groups but no tests were undertaken. Objective reservoir sands show porosity reduction through diagenesis. Late Cretaceous sandstones with good reservoir characteristics were encountered but outside of mapped closure. The Jacaranda feature is interpreted to have formed primarily in the Tertiary and post-dated major hydrocarbon expulsion from the Malita Graben (Botten and Wulff, 1990).

Darwinia-1A was drilled in 1985 to test a small four-way dip closure at the level of the Upper Cretaceous sands within the Malita Graben, which were expected to have good porosity and permeability characteristics. Good reservoir quality sands were encountered but were found to be water wet. The well did not test any deeper objectives and was plugged and abandoned in Upper Cretaceous claystones. There is some doubt as to whether this well tested a valid trap.

In 1997, Area NT01-5 was granted as exploration permit NT/P51 to a joint venture of Woodside and BHP Petroleum. A subsequent farmin to the permit by Shell in 1999 resulted in equal equity for all permit joint venture partners. As part of the work program for this permit, 1217 km of 2D seismic data were acquired in January 1999 before the permit was relinquished.

In 1998, approximately 2000 km of non-exclusive seismic data were acquired over Areas NT01-3 and NT01-4. Also in that year, Chuditch-1 was drilled by Shell in ZOCA91-09, directly adjacent to Area NT01-5 (then NT/P51). This well was drilled on the fault-terraced northern margin of the Malita Graben and discovered gas in the Jurassic Plover Formation.

Petroleum Potential

Of particular interest to petroleum explorationists in the region are the Jurassic Plover and Laminaria Formations, the Jurassic to Cretaceous Flamingo Group and the Cretaceous Bathurst Island Group. These units constitute the main potential reservoir, source and seal horizons.

Results from drilling in the region are encouraging with gas/condensate (Bayu-Undan) and oil (Elang / Kakatua) discoveries in the ZOCA, gas/condensate discoveries on the eastern Sahul Platform (Sunrise, Troubadour, Loxton Shoals, Sunset and Evans Shoals) and gas discoveries in the Petrel Sub-basin (Petrel and Tern). Some corollaries may be drawn between the Malita Graben and the hydrocarbon producing Vulcan Graben in the Ashmore-Cartier region to the west.

With relatively poor seismic coverage in parts of the region, and much of the older seismic data being of inferior quality, many structures and potential stratigraphic traps are yet to be fully delineated.

Reservoirs

Many potential sandstone reservoir units have been identified in the region, including the Plover and Laminaria Formations and also the Jurassic to Cretaceous Flamingo Group (Figure 3). The Bathurst Island Group also includes sands with good reservoir characteristics (Figures 5 and 6). The Plover Formation has a wide distribution in the region but, in much of the area, may be too deep to be a primary reservoir target due to increased diagenetic alteration with depth (Figure 6). This unit probably occurs at depths below 5000 m in the deeper parts of the Malita Graben. Fracture porosity may be developed in the more deeply buried areas. Also, early migration of hydrocarbons into the Plover sands may have inhibited reservoir diagenesis.

Core data from the Plover Formation in Gull-1 shows porosities of 10-15% (Figure 7). The overlying Laminaria Formation sands are more thinly bedded but retain higher porosity.

Jurassic turbidite sandstones within the Flamingo Group, shed from the Sahul Platform in the north and the Darwin Platform in the east, provide excellent potential reservoir targets in Areas NT01-3, NT01-4 and NT01-5. Drill stem test (DST) recoveries and log-derived porosities in Curlew-1 support this view.

Cretaceous marine sandstones within the Bathurst Island Group are also potentially excellent reservoir targets, as do sandstone units in the overlying Paleocene section. These sands may be best developed and provide a thicker section within the bounds of the Malita Graben. Where the sands were intersected in Darwinia-1/1A, porosities ranged from 20-28% over an interval in excess of 150 m (Figure 6).

Seals

The major regional seal in the area is the massive claystone and siltstone interval at the base of the Bathurst Island Group. Many of the petroleum accumulations in the surrounding regions occur immediately below this formation which forms the seal for the underlying Jurassic and Triassic reservoirs. The thickness of the Bathurst Island Group increases toward the basin depocentres, such as the Malita Graben, where the risk of seal-breaching is reduced. Intraformational shales and claystones are also potential seals within the Flamingo Group and Plover Formation.

Source

Three potential oil prone source rock intervals exist within Areas NT01-3, NT01-4 and NT01-5.

Regionally, the Plover Formation contains intervals with fair to good oil source potential, as does the Laminaria Formation.

Flamingo Group shales and siltstones exhibit good to excellent source potential. To the northeast, at Heron-1, the average TOC value is 2.5% (78 samples). At Jacaranda-1, the combined average TOC over both the Flamingo Group and Laminaria Formation is about 0.7%. In the vicinity of Curlew-1, average TOC values within the Flamingo Group are in excess of 1%.

The Bathurst Island Group exhibits good source potential, with TOC values as high as 1.3% in Flamingo-1, 3.4% in Lynedoch-1 and 1.8% in Heron-1. In the Petrel Sub-basin, cuttings samples in some wells recorded up to 5.5% TOC from the Wangarlu Formation, a micaceous mudstone and glauconitic siltstone unit near the base of the Bathurst Island Group.

Maturity

Poor well control makes regional maturity trends difficult to establish. It can be expected that most potential source rocks in the region have reached at least marginal maturity for oil generation. The Plover Formation, however, is expected to be over-mature within the Malita Graben (Figure 7).

Maturation modelling of Plover Formation source rocks in the central Malita Graben indicates hydrocarbon generation from Early to Middle Cretaceous times. Bathurst Island Group shales and Flamingo Group shales began generating hydrocarbons from the Late Cretaceous to the Palaeogene (Figure 8).

Play Types

Most plays are associated with horst blocks within the Malita Graben or on its southeastern flank. Stratigraphic plays are also targets on the margins of the Malita Graben, where Jurassic turbidite sands of the Flamingo Group may be expected. There may be a stratigraphic component to Late Cretaceous sand traps. Maastrichtian fans similar to those found further east in the Malita Graben at Evans Shoal-1 well are thought to occur in Areas NT01-3, NT01-4 and NT01-5 (Figure 9). Salt related plays might be a target in the region south of the Malita Graben, where the northwest trending Petrel Sub-basin intersects the northeast-trending Malita Graben (Figure 4).

Previous drilling in the region has identified targets that could be re-evaluated using higher resolution seismic data that is now available. It has been suggested that poor seismic data at the time resulted in wells not being drilled in optimal structural positions (Gull-1, Curlew-1 and possibly Jacaranda-1). Darwinia-1A drilled the Cretaceous section in the Malita Graben, but did not test any deeper reservoir objectives, possibly due to preconceived ideas regarding reservoir quality.

With only three wells and limited and dated seismic data, Areas NT01-3, NT01-4 and NT01-5 are under-explored and, considering that the region has known hydrocarbon occurrences, are considered to have significant prospectivity.

Data Availability

Information on wells, seismic surveys and other open file data relevant to Areas NT01-3 to 5 are available from the Northern Territory Department of Mines and Energy (NTDME), Darwin and the Australian Geological Survey Organisation (AGSO), Canberra.

A full listing of relevant open file data held in AGSO's Repositories is available. AGSO's geological databases provide detailed biostratigraphic (STRATDAT), geochemical (ORGCHEM) and reservoir, hydrocarbon shows and interpreted depositional environment information (RESFACS) from exploration wells.

Wells and seismic data within and adjacent to the two release areas are tabulated below.

Wells :

Well	*Year*	*Well Status*	*NTDME Ref No.*
Petrel-1/1A	1969	Gas Discovery	**PR** 69-1, **PR** 70/6
Gull-1	1971	P&A Dry	
Heron-1	1972	P&A Dry	**PR** 72/7, 85/33, 85/43
Shearwater-1	1974	P&A Dry	**PR** 74/27, 85/33, 85/43
Curlew-1	1975	Gas Show	**PR** 74/29, 85/33, 85/43
Jacaranda-1	1984	P&A Dry	**PR** 85/9
Darwinia-1/1A	1985	P&A Dry	**PR** 85/75
Evans Shoal-1	1988	Gas Discovery	**PR** 88/50
Fohn-1	1994	Gas Discovery	
Narbalek-1	1994	P&A Dry	
Wallaroo-1	1996	P&A Dry	
Marsi-1	1996	P&A Dry	
Evans Shoal-2	1998	Appraisal	
Chuditch-1	1998	Gas Discovery	

Seismic Surveys :

Survey	*Operator*	*Year*	*NTDME Ref No.*
Marine seismic Survey 1964	Woodside	1964	
Sahul Shelf Marine Seismic	Arco	1966	
Survey 3	BMR	1967	
Sahul Rise (SR lines)	Arco	1967	
Londonderry Rise Marine Seismic	Arco	1968	
Legendre-Marie Marine Seismic	Woodside	1969	
Van Dieman Rise Marine Seismic	Arco	1969	
Holothuria Marine Seismic	Arco	1970	
Tryal-Evans Marine Seismic	Woodside	1970	
Baldwin Bank Marine Seismic	Arco	1972	
Pago Marine Seismic	Arco	1972	
Cartier Marine Seismic	Arco	1973	
Cape Talbot Marine Seismic	Arco	1974	
Van Cloon Marine Seismic	Arco	1976	
York Sound Marine Seismic	Arco	1977	
Bellona Marine Seismic	Aquitaine	1979	
Cape Bernier (1-10)/Petrel (11-1)	Lennard	1979	
Bonaparte Gulf 1981 Marine Seismic	Shell	1981	
NT/P33 1981 Marine Seismic	Tricentrol	1981	**PR** 82/31
Jacaranda Marine Seismic	Tricentrol	1983	**PR** 84/23
Darwinia Marine Seismic	Tricentrol	1985	**PR** 85/28
Marie Marine Seismic	Western Mining	1985	**PR** 87/50
Gloria Marine Seismic		1986	**PR** 01993
Timor Sea Tie	AGSO	1993	
Fourcroy Marine Seismic	MIM	1993	
Caladi Marine Seismic	Petroz	1993	
Marabar Marine Seismic	Marathon	1993	
93-SA-09-ZA Marine Seismic	Enterprise	1993	
94-SA-09-ZA Marine Seismic	Enterprise	1994	
Kununga Marine Seismic	MIM	1995	
PC95 Marine Seismic	Petroz	1995	
SPA 1SL/94-95 Timor Marine	Geco-Prakla	1995	
Bonaparte-Browse 2D 1996 SPA	Western Geophysical	1996	
Donder Marine Seismic	Mobil	1996	
HZ196 2D Marine Seismic	BHP	1996	
Timor Sea Spec Marine Seismic	Aust Seismic Brokers	1996	
NT/P47 and NT/P48 Marine Seismic	Shell	1997	
SPA Jacaranda 98 Marine Seismic	Nopec	1998	
99NT/P51 Marine Seismic		1999	**PR** 99/55

Further Information

For a more detailed review of the petroleum prospectivity, five publications, which cover the region in detail, are given below.

Botten, P.R. and Wulff, K., 1990 - Exploration potential of the Timor Gap Zone of Cooperation. *The APEA Journal* 30(1), 68-90.

Colwell, J.B. and Kennard, J.M., 1996 - Petrel Sub-basin study 1995-1996. *AGSO Record* 1996/40.

Northern Territory Geological Survey, 1990 - Petroleum Basin Study - Bonaparte Basin. Prepared by Petroconsultants Australasia Pty. Ltd. *Northern Territory Government Printer.*

West, B.G. and Miyazaki, S., 1994 - Evans Shoal Area. *Bureau of Resource Sciences, Petroleum Prospectivity Bulletin and Data Package.*

West, B.G. and Passmore, V.L., 1994 - Hydrocarbon potential of the Bathurst Island Group, Northeast Bonaparte Basin: Implications for future exploration. *The APEA Journal* 34(1), 626-643.

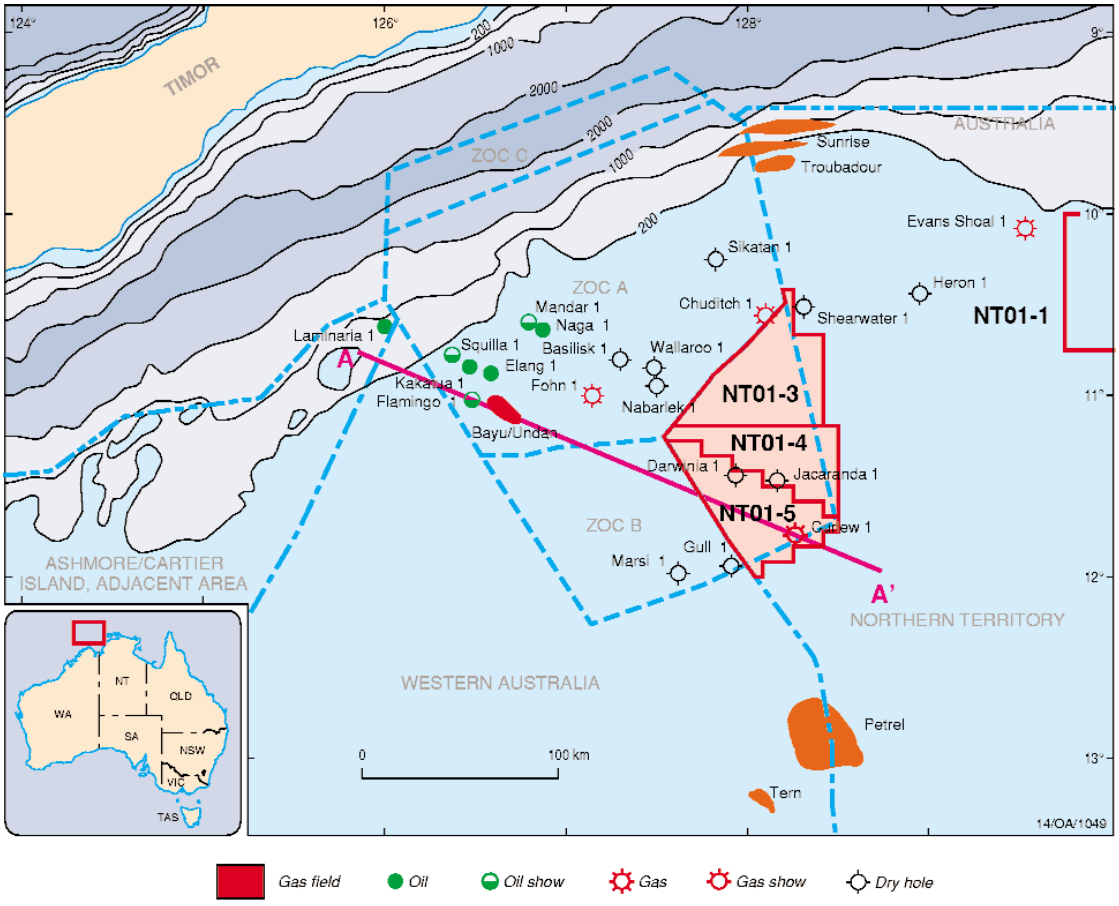


Figure 1. Location map and adjacent discoveries.

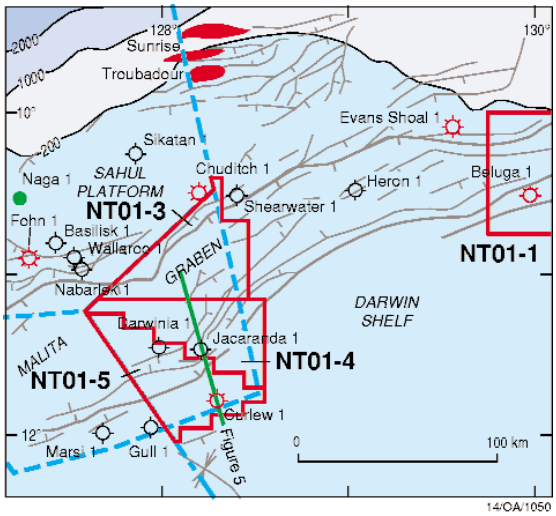


Figure 2. Generalised structure map.

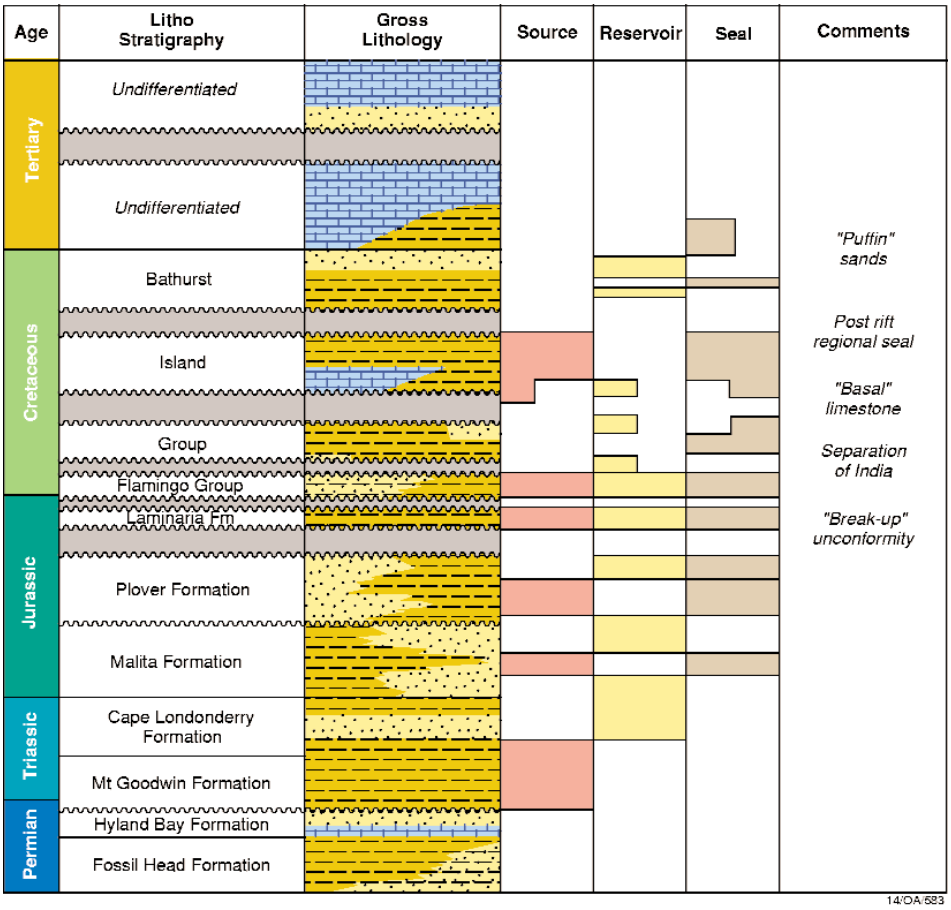


Figure 3. Stratigraphy, Eastern Bonaparte Basin.

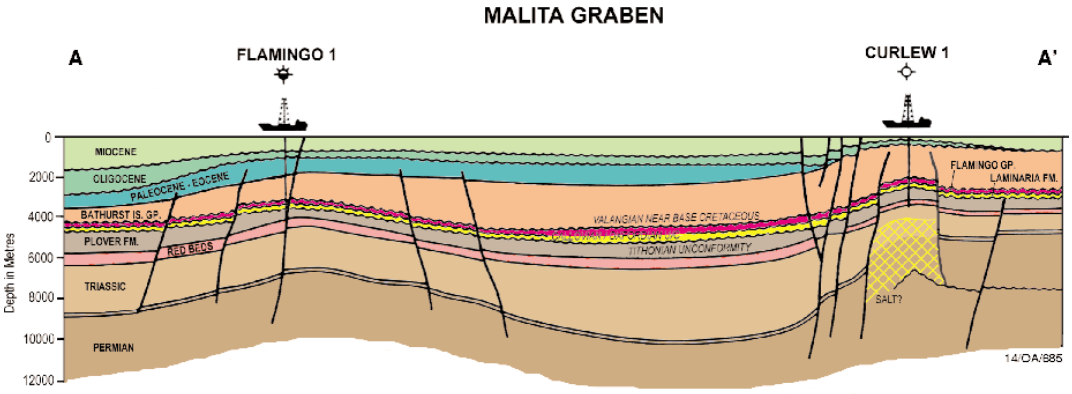
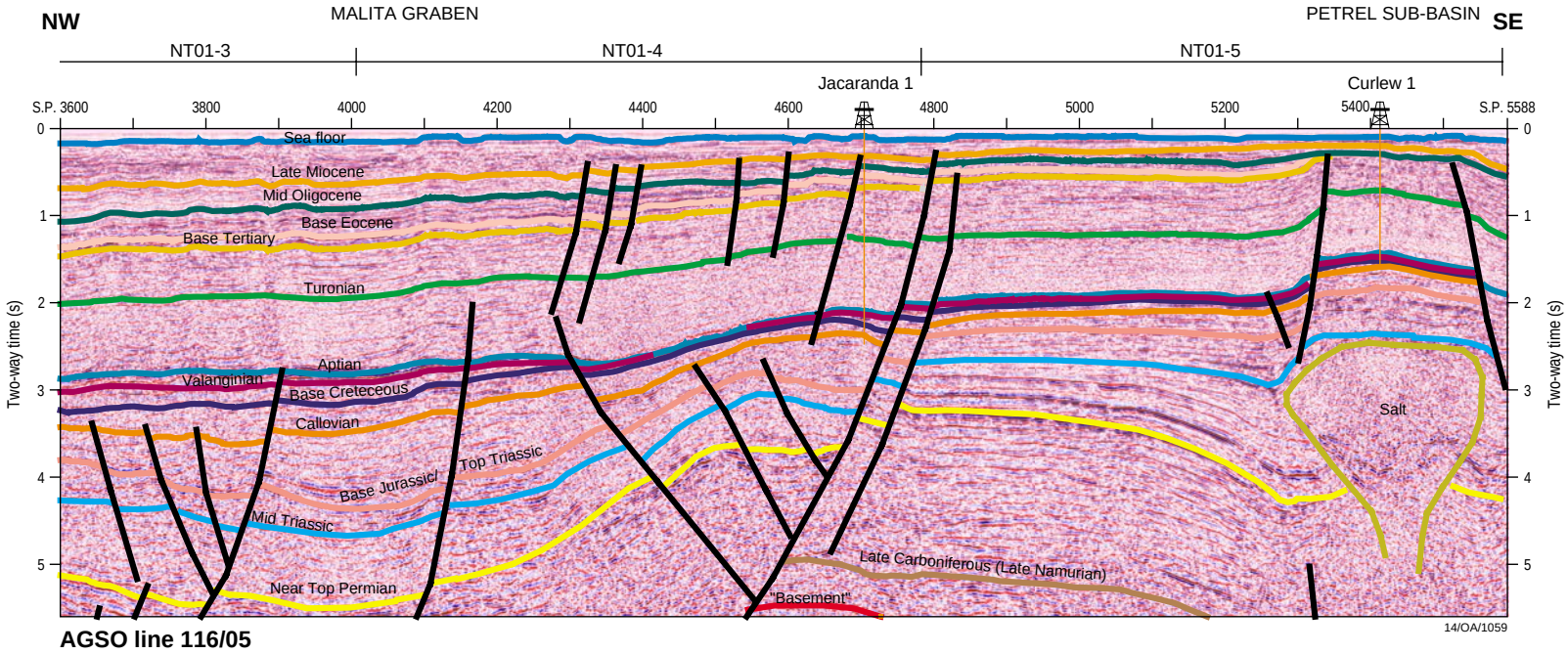


Figure 4. Schematic cross section between Flamingo 1 and Curlew 1 displaying tectonic framework of the Malita Graben.



AGSO line 116/05

Figure 5. AGSO seismic line 116/05 through the southern flank of the Malita Graben. Location of line is shown in Figure 2.

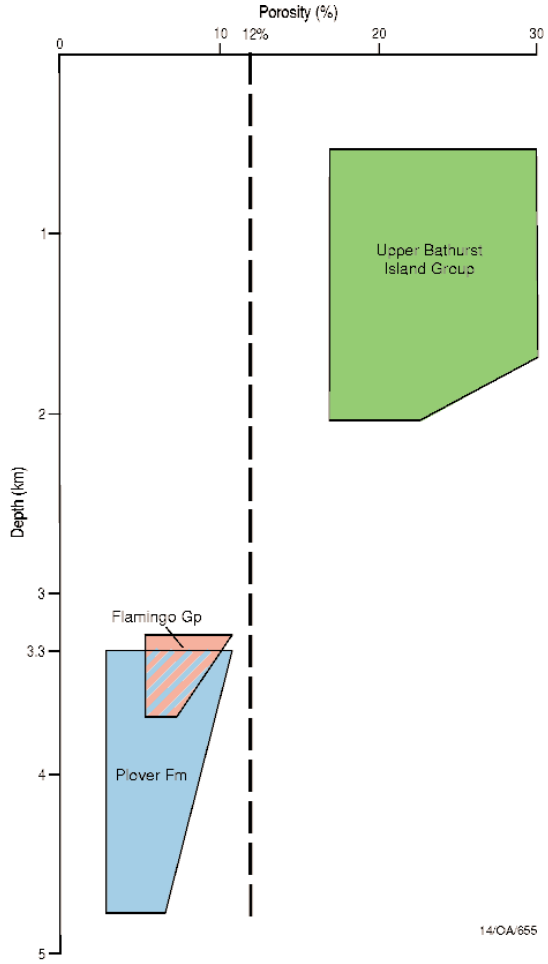


Figure 6. Porosity plot for wells in the Malita Graben.

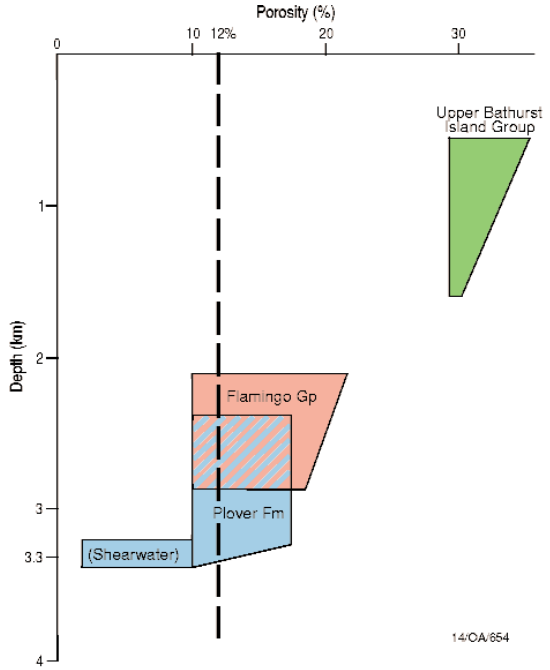


Figure 7. Porosity plot for wells on the flanks of the Malita Graben and adjacent shelves.

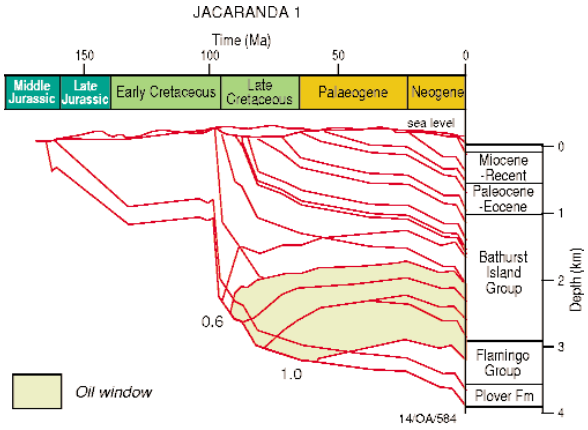


Figure 8. Jacaranda 1 geohistory plot.

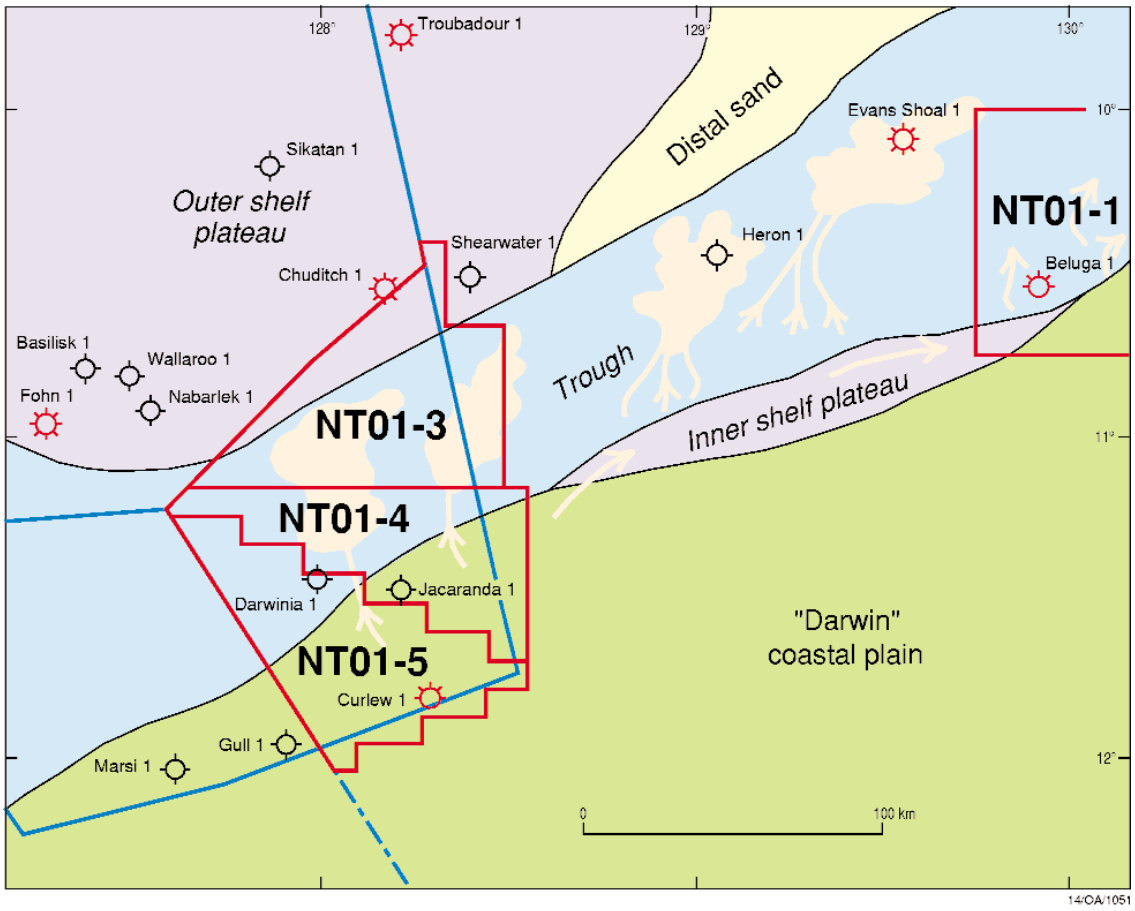


Figure 9. Maastrichian fan play in the Malita Graben.