Areas NT04-1, NT04-2 & NT04-3
Northern Bonaparte Basin
Northern Territory

Bids close 31st March 2005

Location

Release areas NT04-1, NT04-2 and NT04-3 comprise 56 blocks (4745 km^2), 84 blocks (6775 km^2) and 95 blocks (7370 km^2) respectively and are located in the eastern Timor Sea about 300 km north of Darwin and 250 km northeast of the proposed Darwin to Bayu/Undan gas pipeline (Figure 1). The Greater Sunrise and Evans Shoal gas accumulations are located to the west and south of the release areas, and the Abadi gas accumulation is located to the north in Indonesian waters.

Regional Geology

The following discussion of regional geology and hydrocarbon potential draws largely on regional studies by West and Passmore (1993, 1994), West and Miyazaki (1994) and Longley et al. (2002). More recent studies in the area can be found in the Timor Sea Petroleum Geoscience Symposium Volume; for example, Ambrose (2003), Barber et al. (2003), George et al. (2003) and Lowe-Young et al. (2003).

The release areas NT04-1, NT04-2 and NT04-3 extend west to east over the northeastern part of the Bonaparte Basin, across the basin bounding Lynedoch Bank Fault System, into the western Arafura/Money Shoals Basins (Figure 2). The target stratigraphy in this area ranges from the Permian to the Tertiary and is summarised in Figure 3.

The Sahul Platform (westernmost part of NT04-1) is a region of elevated Mesozoic and upper Palaeozoic sediments with its southern boundary denoted by northeast trending Mesozoic normal faults showing displacement down towards the Calder and Malita grabens which were major Mesozoic/Tertiary depocentres. Total sediment thickness, including the underlying Palaeozoic, may exceed 8 km in the grabens.

The Lynedoch Bank Fault System is a large transfer zone which acted as a major depositional hinge and may connect with the Halls Creek Mobile Zone to the south (McLennan et al., 1990). This fault zone has an associated structural high area developed in the western hanging wall, and drape and compaction of Jurassic and Cretaceous units occurs over this basement controlled feature. There are commonalities between the Mesozoic stratigraphy on either side of the fault, but the stratigraphy in the Malita and Calder grabens remains

speculative given the lack of well control. Figure 4 is a regional composite seismic line transecting the Sahul Platform, Malita Graben and Darwin Shelf.

West of the Lynedoch Bank Fault System are two important depocentres bound by faulted terraces. The larger, the Malita Graben, forms a southwesterly trending, symmetrical depocentre bounded on both sides by large displacement normal faults which show some evidence of wrenching (Figure 6). This depocentre may represent a flexural depression that developed on the inboard part of an upper plate rift margin (O'Brien et al., 1993). The similar age Calder Graben is a more northerly trending depocentre in alignment with the Lynedoch Bank Fault System (Figure 2) and from Early Cretaceous times has plunged to the north towards the Masela Deep in Indonesian waters.

Seismic mapping suggests the Cretaceous structural history varies greatly from the Malita Graben to the Calder Graben as reflected by variable isopachs of the upper and lower Bathurst Island Formation. This suggests an important structural impasse between the Calder and Malita grabens, at least during the Cretaceous (West and Passmore, 1994).

In both the Calder and Malita grabens, very few wells have intersected the pre-rift Plover Formation. This formation is expected to thicken slightly from the adjacent faulted terraces, as should the main syn-rift sequence in this area (the Tithonian/Berriasian section of the Flamingo Formation). The intervening Oxfordian/Kimmeridgian syn-rift section depicts a starved basin setting over most of the area but a substantial sequence could be localised, given that such an interpretation is made from seismic to the west in the Malita Graben (Longley et al., 2002; Figure 6). Also 60 m of Oxfordian silty shale (Cleia Formation) occurs in the Evans Shoal area and this section could thicken into the adjacent Malita Graben. The post-rift Cretaceous to Tertiary sequences thicken into the Malita and Calder grabens facilitating hydrocarbon generation from older Jurassic source rocks. Sparse well control is concentrated in the Evans Shoal gas accumulation (two wells) and Lynedoch horst structure (two wells).

In the western Money Shoal Basin, relatively undeformed Mesozoic to Cainozoic sediments overlie Precambrian basement and folded/faulted Palaeozoic to Early Mesozoic rocks of the western Arafura Basin (Figure 5). The nearest well control east of the Lynedoch Bank Fault System is Tuatara 1 in the Money Shoal Basin (Figure 5). This well intersected over 3500 m of Mesozoic/Tertiary sediments, unconformably overlying Arafura Basin sediments which comprised tight siliceous sandstones. In Tuatara 1 the pre-rift Early-Middle Jurassic Plover Formation is 450 m thick but the overlying early syn-rift section (Elang/Cleia Formations) comprises less than 10 m of limestone which is consistent with thin condensed sequences of this age seen to the west in Lynedoch 1 and Evans Shoal 1 drilled in the Bonaparte Basin.

The later syn-rift sequence (Flamingo Formation) is 413 m thick in Tuatara 1, comprising Tithonian sandstone fans at the base (Sandpiper Sandstone), overlain by thick silty shales, in turn succeeded by similar lithologies in the Echuca Shoals Formation (292 m thick). The overlying Cretaceous-Tertiary section is about 2500 m thick.

In this general area two wells have intersected complete Plover Formation sections; Troubadour 1 (343 m) on the Sahul Platform and Tuatara 1 (450 m) in the Money Shoal Basin. The thickest intersections of the Plover Formation occur to the west in the Greater Sunrise gas-bearing structure. The base of the section comprises Early Jurassic braidplain/alluvial sediments overlain by open marine mudstone which in turn grade to brackish siltstone/mudstone enclosing a medial shoreface/fluvial sandstone. This unit grades upwards into shoreface/deltaic sandstones at the top (Seggie et al., 2000). Figure 7 summarises the Plover Formation in the Evans Shoal gas accumulation, where the productive reservoirs are shoreface and fluvial/estuarine sandstones (Lowe-Young et al., 2003).

The Oxfordian early syn-rift sequences in the main depocentres are poorly understood but this section is condensed and quite thin elsewhere. The younger Flamingo Formation syn-rift sequence thickens markedly into the main depocentres and is 867 m thick in Heron 1 in the Malita Graben. This unit pinches out laterally onto the Bathurst Terrace to the southeast, and the Sahul Platform to the west. Overall the northward tilt established during the Cretaceous was maintained throughout the Cainozoic.

Exploration History

Lynedoch 1 (1973), Lynedoch-2 (1998) and Tyche 1 (2000) have been drilled in NT04-2. Exploration commenced in this general area in 1965 and has continued through to the present day with the exception of an exploration hiatus between 1978 and 1985 due to a border dispute between Australia and Indonesia. The study area was first explored on a regional basis in the 1960s and early 1970s when Shell, BOC and ARCO acquired regional aeromagnetic surveys providing a regional grid of 10-20 km, and a semi detailed grid of 3-10 km. Shell drilled Lynedoch 1 in 1973 and gas shows were encountered in the Bathurst Island Group and also the Plover Formation but were not tested.

A second phase of exploration took place in the late 1980s to early 1990s when there was acquisition of more detailed seismic data and two wells were drilled in the general area (Evans Shoal 1 and Beluga 1). Between 1985 and 1987, WMC acquired 2500 km of regional and semi detailed 2D seismic, prior to an aeromagnetic survey carried out by BHP in 1988. Later BHP recorded over 5000 km of 2D seismic data, largely over the Malita and Calder grabens, with a grid spacing of between 1x3 km and 1x5 km. This resulted in the drilling of Evans Shoal 1 (BHP, 1988) which tested a tilted horst block and was a Plover Formation gas discovery proving gas charge from the graben. BP conducted an airborne laser fluorescence survey (ALF) over part of the area in 1989. Beluga 1 (BHP, 1991) tested a stratigraphic play on the southern margin of the Malita Graben but, despite some minor gas shows, the well was plugged and abandoned.

The most recent exploration phase occurred in the late 1990s and early 2000s. Acquisition of new seismic, and reprocessing of existing seismic data, preceded the drilling of Evans Shoal 2 (1998) which was a successful gas appraisal well proving favourable deliverability from the Plover Formation reservoirs. Lynedoch 2, which was drilled in 1998 by Shell, encountered a tight gas column in the Plover Formation which had originally been suspected from the results of Lynedoch 1. The most recent well in the area was Tyche 1 drilled by Shell in 2000, which tested a shallow stratigraphic play, but the well was plugged and abandoned without encountering significant shows. In Indonesian waters, three Abadi wells were drilled, resulting in the discovery of a large-scale gas accumulation.

Petroleum Potential

By far the most important hydrocarbon source rocks in the area are contained in the Plover Formation, which is also the most important reservoir interval. This source/reservoir sequence was most recently discussed by Longley et al. (2002) and Ambrose (2003). In the northern Bonaparte Basin the dominant source of oils reservoired in the Laminaria/Corallina fields is believed to be the Plover Formation (George et al., 2003) but the Elang Formation has also made some contribution and is recognised as the dominant source at Bayu/Undan. Also, recent geochemical studies indicate the Greater Sunrise gas-condensate field was sourced locally from the Plover Formation on the Troubadour Terrace (Longley et al., 2002). Overall, the Plover Formation contains fair to good oil and gas prone source rocks with oil and gas liquids being generated to the west in the Joint Petroleum Development Area (JPDA) and on the Troubadour Terrace.

Farther east, dry gas has been discovered in the Plover Formation at Evans Shoal, with tight gas being recorded at Lynedoch 1 and 2, and more recently gas was discovered in the Plover Formation in three Abadi wells drilled in Indonesian waters. The Plover Formation is also the most likely source of gas in these accumulations. There is no source rock data relevant to the Plover Formation in the Calder Graben but limited data from Evans Shoal 1 and Heron 1 indicate viable oil and gas prone source rocks in these wells. Additional source rocks may occur in Early-Middle Jurassic (*C.turbatus* biozone) shales in the deeper Plover Formation section (Ambrose, 2003), as indicated by deeper wells in the JPDA area, but depocentres to the east have not been penetrated by the drill.

In the Malita Graben the Plover Formation, based on modelling from Heron 1 (Figure 8), probably entered the oil window in the mid Cretaceous and today is through the dry gas window. On the Evans Shoal Terrace the Plover Formation is in the wet gas window. Modelling of Evans Shoal 1 (Figure 9) suggests possible oil generation in the late Cretaceous followed by gas generation in the mid-late Tertiary. Any oil possibly trapped in the Evans Shoal or Lynedoch areas required an early formed structural trap. A similar proposition is probably true for hydrocarbons sourced from the Calder Graben.

The highly faulted Greater Sunrise trapping structure was formed in the Miocene or Pleistocene and was filled to spill at about 10 Ma or less (Seggie et al., 2000). The structuring at Evans Shoal appears to be much older (pre-Turonian) and modelling by West and Miyazaki (1994) suggests gas generation from the Plover Formation probably commenced in the Middle Cretaceous in the Malita Graben and continued to the present day with contributions from the surrounding faulted terraces.

The Plover Formation is a viable reservoir away from the main depocentres. Excellent gas flow rates of up to 25 mmcfd have been recorded from the Evans Shoal accumulation and also from the Abadi accumulation to the north.

Depth of burial has a significant impact on the degree of diagenesis and reservoir quality will be most favourable where the depth of burial has been less

than 3000 m and present day porosities are between 15 and 30% (NTGS, 1990). Botten and Wulff (1990) consider the Plover Formation may also provide potential plays at depths greater than 3300 m, where early hydrocarbon emplacement has inhibited diagenesis.

Evans Shoal 2 encountered more than 360 m of Plover Formation sandstone containing high-permeabity streaks (Lowe-Young et al., 2003); Figure 7). Pressure data indicates the Evans Shoal structure is filled to spill, with a closure height of 300 m. Estimated reserves are 6.6 tcf sales gas. Depositional facies interpretation indicates the presence of marine shoreface sandstones in the upper Plover Formation which form the primary reservoir zone. The lower Plover Formation section is mainly a fluvial/estuarine facies with different reservoir properties. Production tests over two zones resulted in gas flows of 25.5 and 5.5 mmscfd with the larger flow largely sourced from the upper shoreface zone. Natural fractures observed in core samples have probably enhanced reservoir performance.

The second important source rocks are contained in the Late Jurassic-Early Cretaceous Flamingo Formation. The best intersection occurs in Heron 1, which tested an inversion structure in the Malita Graben, and which intersected 885 m of Flamingo Formation shales. Total organic carbon (TOC) ranges between 0.2 and 10% but hydrogen indices (HI) indicate the sequence is gas prone. The overlying Bathurst Island Group shows fair TOC values ranging from 0.12 to 2.86 % and with the exception of the basal unit, the Echuca Shoals Formation, appears to be gas prone although there is some potential for mixed oil/gas sourcing (West and Passmore, 1994).

Not only source rocks but the Flamingo Formation is also the secondary target reservoir in this area. Core derived porosities range from 9% in the basin centre to 30% in basin margin locations (Botten and Wulff, 1990).

Oil-prone source rocks of the lower Bathurst Island Group are in the oil window or have passed through it since the Eocene (West and Passmore, 1994). Opportunities for oil retention exist in migration shadow zones on the faulted margins of the Malita and Calder grabens. This would allow the possibility of later oil charge to complement possible early oil charge from the Plover Formation. It is significant that liquid petroleum related fluorecence anomalies (ALF detected) occur south and east of the Calder Graben hinting at the generation of hydrocarbon liquids in this depocentre (Martin and Cawley, 1991).

A regional limestone unit of Aptian/Albian age, near the base of the Bathurst Island Group, is recognised at Heron 1, Evans Shoal 1 and Lynedoch 1. Significant gas shows were reported from fractures in Lynedoch 1 and minor shows were reported in Heron 1 and Evans Shoal 1 from the same interval. The play is speculative, however if fracture porosity is widespread this interval will become prospective.

The regional seal for the Plover/Flamingo Formation reservoirs is the thick claystone interval of the lower Bathurst Island Group. This group also contains high-quality reservoirs, such as Santonian and Maastrichtian sandstones, which

were deposited regionally. The thickness of the Maastrichtian sandstones ranges from 158 m in Heron 1 to 583 m in Lynedoch 1; these are the equivalent of the oil-bearing Puffin Formation sandstones tested in the Vulcan Sub-basin further to the west.

West and Passmore (1994) consider Maastrichtian sandstones in Heron 1 and Evans Shoal 1 represent turbidite flows deposited as basin floor fans tapping updip coastal plain and shelfal sands during a low sea level stand. On seismic lines these sandstones appear as widespread, hummocky clinoform reflections with possible mounding and foresetting (West and Miyazaki, 1994). Reservoir quality, which ranges from 10 to 33%, can be excellent but the presence of seal and hydrocarbon charge remain to be proved.

Tilted fault blocks, faulted anticlines and broad, low relief anticlinal drape over tilted fault blocks provide the main structural plays in this area. Tilted horst blocks are attractive targets on faulted terraces adjacent to the Malita and Calder grabens. The possibility of hanging wall fault traps on the downthrown side of the bounding faults provides a secondary play.

In summary the release areas NT04-1, NT04-2 and NT04-3 offer excellent prospectivity for gas, with giant gas accumulations occurring immediately to the north, south and west. Liquids contents are likely to be low but should be higher than in Evans Shoal and should range between 10 and 30 bbls/mmcf. There is some chance for higher liquids contents but the prospects for oil are low.

Further west at the west end of the Sahul Platform, the condensate recovery project will be commissioned later this year at the Bayu/Undan gas field. Construction of a single train LNG plant is underway near Darwin with the feedstock being recycled dry gas from the field (Figure 2). A number of other giant gas accumulations occur in the general area of the northern Bonaparte Basin. These include Greater Sunrise (8.4 tcf), Evans Shoal (6.6 tcf) and Abadi (5 tcf; in Indonesian waters) accumulations. This prolific gas province will host additional discoveries in the next decade as commercial gas projects emerge and future drilling programs should discover new wet gas fields with a likelihood of subordinate oil fields.

Data Availability

Open-file reports, data and down-hole samples (wells, geophysical surveys and other petroleum exploration and production data submitted by the petroleum industry) are available from both the Northern Territory Department of Business, Industry and Resource Development (DBIRD), Darwin and Geoscience Australia (GA), Canberra.

Digital wireline logs from wells are available from Crocker Data Processing, Perth, and Wiltshire Geological Services, Adelaide.

Table 1. Relevant Wells

Well	Operator	Year	Total Depth (m)	Hydrocarbons
Bard 1	Woodside Petroleum (Timor Sea 19) Pty Ltd	1998	2164	Gas indications
Chuditch 1	Shell Dev (PSC 9) P/L	1998	3035	Gas accumulation with oil indications
Cobra 1A	BHP Petroleum	1993	2542	Oil indications
Evans Shoal 1	BHP Petroleum	1988	3712	Gas accumulation with oil indications
Evans Shoal 2	Shell Dev (Aust) P/L	1998	3940	Gas accumulation
Heron 1	Arco Australia Ltd	1972	4209	Gas indications
Kulka 1	Diamond Shamrock Oil Co (Aust)	1984	3998	Gas and oil indications
Loxton Shoals 1	Woodside Offshore Petroleum	1995	2330	Gas accumulation
Lynedoch 1	Shell Dev (Aust) P/L	1973	3967	Gas indications
Lynedoch 2	Shell Dev (Aust) P/L	1998	4225	Gas and oil indications
Melville 1 (BHP Petroleum)	BHP Petroleum			
Shearwater 1	Arco Australia Ltd	1974	3177	Gas and oil indications
Sunrise 1	Woodside/Burmah Oil NL	1975	2341	Gas accumulation with oil indications
Sunrise 2	Woodside Offshore Petroleum	1998	2350	Gas accumulation
Sunset 1 (Shell)	Shell Dev (PSC 19) P/L	1997	2420	Gas show with oil indications
Sunset West 1	Woodside Petroleum (Timor Sea) Pty Ltd	1998	2505	Gas show with oil indications
Troubadour 1	Woodside/Burmah Oil NL	1974	3459	Gas accumulation with oil indications
Tuatara 1	BHP Petroleum	1990	3875	Oil and gas indications
Tyche 1	Woodside Energy Ltd	2000	1475	

Wonarah 1	Shell Dev (Aust) P/L	1998	2800	

Geoscience Australia's geological databases provide detailed biostratigraphic (STRATDAT), geochemical (ORGCHEM) and less-detailed reservoir, hydrocarbon shows and interpreted depositional environment information (RESFACS) from open file exploration wells (attached Bonaparte Data File). These data can also be obtained via the Geoscience Australia Petroleum Well Database interface, www.ga.gov.au/oracle/apcrc.

Table 2. Relevant Wells – Cores & Cuttings Availability

Well	Type	Top (m)	Bottom (m)	Remark
Bard 1	Cuttings	1465	2165	
Chuditch 1	Core	2921.4	2947	
Chuditch 1	Cuttings	1540	3035	
Cobra 1A	Cuttings	360	2542	
Evans Shoal 1	Core	3709	3711.55	Continuous core
Evans Shoal 1	Cuttings	460	3708	Washed and dried samples
Evans Shoal 2	Cuttings	730	3940	
Heron 1	Core	2838.41	4201.06	Continuous core.Junk basket sample between C2 & C3 @ 9903 - 9904 feet.
Heron 1	Cuttings	198.17	4185.97	
Heron 1	Cuttings	3064.02	4182.92	
Kulka 1	Cuttings	460	3999	
Loxton Shoals 1	Cuttings	1310	2330	
Lynedoch 1	Cuttings	518.16	3966.97	Original depths in feet
Lynedoch 2	Cuttings	515	4224	No samples at 690-810, 2630-2645, 3230-3255, 3845-3855.
Shearwater 1	Cuttings	231.65	3297.94	Original depths in feet
Sunrise 1	Cuttings	502	2241	
Sunrise 2	Core	2097	2186.57	
Sunrise 2	Cuttings	1691	2350	
Sunset 1 (Shell)	Core	2094	2248.21	
Sunset 1 (Shell)	Cuttings	1775	2420	
Sunset West 1	Core	2187	2309.22	
Sunset West 1	Cuttings	1685	2505	
Troubadour 1	Core	2203	3456	Continuous core
Troubadour 1	Cuttings	430	3459	
Tuatara 1	Cuttings	720	3862	Washed and dried samples
Tyche 1	Cuttings	1160	1475	
Wonarah 1	Cuttings	1070	2800	

Contact Geoscience Australia's Repository for more information or to arranging access to core and cuttings, phone 61 (0)2 6249 9222, e-mail ausgeodata@ga.gov.au.

Table 3. Relevant Wells – Available Analysis Reports

Well	Report No.	Title	Company	Year
Heron 1	DAR0077	Source rock potential and max palaeotemp study of 10 wells, offshore WA.	Robertson Research (Aust) Pty	1974
Heron 1	DAR0291	Geochemical Review, N.W. Australian shelf.	Texaco Petroleum Co	1978
Heron 1	DAR0340	Geochemistry and significance of coastal bitumen from Sth and Nth Aust.	Dept of Nat Dev	1976
Heron 1	DAR0475	Diagenesis of sandstones from the Bonaparte Basin Nth Aust - a pilot study	Shell Co of Aust Ltd	1982
Heron 1	DAR0632	Palynology report AP 21. Northern Territory.	BP Australia Ltd	1983
Heron 1	DAR0640	Petroleum Geochemistry of the Australian NW shelf. Progress report No.5	Robertson Research (Aust) Pty	1985
Heron 1	DAR0650	Petroleum Geology & Geochem - NW shelf WA - Phase 2 Vol 3 Part 6c.	Robertson Research (Aust) Pty	1986
Heron 1	DAR0715	Biostratigraphic (micropaleo) analysis of the Bathurst Island group, WA.	BHP Petroleum	1988
Heron 1	DAR0719	Organic geochemical analyses of seven Arafura and Bonaparte basin wells.	BHP Petroleum	1989
Heron 1	DAR0738	Visual Kerogen analysis of 10 samples of cores & cuttings - Matilda Graben	Western Mining Corp Ltd	1988
Heron 1	DAR0747	Petrography, mineralogy of samples from North West shelf wells, Aust.	IEDS, London	1990
Heron 1	DAR0754	Source rock Geochemistry data on eleven Bonaparte basin wells.	Geological Survey of NT	1984
Heron 1	DAR0858	New Palynology from Heron 1 well.	BP Australia Ltd	1991
Kulka 1	DAR0715	Biostratigraphic (micropaleo) analysis of the Bathurst Island group, WA.	BHP Petroleum	1988
Kulka 1	DAR0717	Biostratigraphic (Palynology) analysis of three NT offshore wells.	BHP Petroleum	1989

Kulka 1	DAR0719	Organic geochemical analyses of seven Arafura and Bonaparte basin wells.	BHP Petroleum	1989
Kulka 1	DAR0724	Palynological Analysis of Kulka -1, Money Shoals -1 and Tasman -1	BHP Petroleum	1989
Lynedoch 1	DAR0340	Geochemistry and significance of coastal bitumen from Sth and Nth Aust.	Dept of Nat Dev	1976
Lynedoch 1	DAR0475	Diagenesis of sandstones from the Bonaparte Basin Nth Aust - a pilot study	Shell Co of Aust Ltd	1982
Lynedoch 1	DAR0715	Biostratigraphic (micropaleo) analysis of the Bathurst Island group, WA.	BHP Petroleum	1988
Lynedoch 1	DAR0719	Organic geochemical analyses of seven Arafura and Bonaparte basin wells.	BHP Petroleum	1989
Lynedoch 1	DAR0754	Source rock Geochemistry data on eleven Bonaparte basin wells.	Geological Survey of NT	1984
Lynedoch 1	DAR0825	New palynology on cuttings for Lynedock 1 well.	BMR	1991
Shearwater 1	DAR0475	Diagenesis of sandstones from the Bonaparte Basin Nth Aust - a pilot study	Shell Co of Aust Ltd	1982
Shearwater 1	DAR0715	Biostratigraphic (micropaleo) analysis of the Bathurst Island group, WA.	BHP Petroleum	1988
Shearwater 1	DAR0719	Organic geochemical analyses of seven Arafura and Bonaparte basin wells.	BHP Petroleum	1989
Shearwater 1	DAR0738	Visual Kerogen analysis of 10 samples of cores & cuttings - Matilda Graben	Western Mining Corp Ltd	1988
Shearwater 1	DAR0754	Source rock Geochemistry data on eleven Bonaparte basin wells.	Geological Survey of NT	1984
Shearwater 1	DAR0788	Bulk Fluid Inclusion Mass Spectrometry on samples from Shearwater 1	Amoco Aust Pet Co	1991
Shearwater 1	DAR0863	New Palynology from Shearwater 1	BP Australia Ltd	1991
Sunrise 1	DAR0417	Source rock data from the Perth, Carnarvon, Canning, Browse & Bonaparte basin	CSIRO	1980

Sunrise 1	DAR0789	Bulk Fluid Inclusion Mass Spectrometry on samples from Sunrise 1.	Amoco Aust Pet Co	1991
Troubadour 1	DAR0417	Source rock data from the Perth, Carnarvon, Canning, Browse & Bonaparte basin	CSIRO	1980
Troubadour 1	DAR0529	The Permian sediments of the NW shelf of Australia and Timor Indonesia.	University of London	1985
Troubadour 1	DAR0639	Petroleum Geochemistry of the Australian NW shelf. Preliminary report 1564	Robertson Research (Aust) Pty	1985
Troubadour 1	DAR0650	Petroleum Geology & Geochem - NW shelf WA - Phase 2 Vol 3 Part 6c.	Robertson Research (Aust) Pty	1986
Troubadour 1	DAR0661	Geochemical data for Northwest shelf wells, offshore WA/NT.	BP Australia Ltd	1987
Troubadour 1	DAR0715	Biostratigraphic (micropaleo) analysis of the Bathurst Island Gp, WA.	BHP Petroleum	1988
Troubadour 1	DAR0719	Organic geochemical analyses of seven Arafura and Bonaparte basin wells.	BHP Petroleum	1989
Troubadour 1	DAR0747	Petrography, mineralogy of samples from North West shelf wells, Aust.	IEDS, London	1990
Troubadour 1	DAR0754	Source rock Geochemistry data on eleven Bonaparte basin wells.	Geological Survey of NT	1984
Troubadour 1	DAR0791	Bulk Fluid Inclusion Mass Spectrometry on samples from Troubadour 1	Amoco Aust Pet Co	1991
Troubadour 1	DAR0866	New Palynology data from Troubadour 1.	BP Australia Ltd	1991
Troubadour 1	DAR1022	Fluorescence alteration and Vitrinite reflectance data for Troubadour 1.	CSIRO	1993
Troubadour 1	DAR1076	Late Triassic Conodont & Palynomorph Biostratigraphy	AGSO	1994

Contact Geoscience Australia's Repository for more information regarding access to analysis reports, phone 61 (0)2 6249 9222, e-mail ausgeodata@ga.gov.au.

Table 4. Relevant Seismic Surveys

Uno	Survey	Year	Operator
S0660096	Sahul Shelf Seismic	1966	Arco Australia Ltd
S0670082	Sahul Rise Seismic	1967	Arco Australia Ltd
S0690097	Van Diemen Rise Seismic	1969	Arco Australia Ltd
S0720001	Baldwin Bank Marine Seismic	1972	Arco Australia Ltd
S6730010	Kendrew-Cootamundra Marine Seismic	1973	Barkley Oil Co P/L
S8930003	AGSO Survey 116B;Malita Graben Marine Seismic	1993	AGSO
S0930001	AGSO Survey 118A;Malita Graben Marine Seismic	1993	AGSO

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Table 5. Initial Reserves

Field	Oil Reserves MMBBLS	Condensate MMBBLS	Gas Reserves TCF	Source
Abadi	NA	NA	NA	No data available
Evans Shoal	28.8		8	NT DBIRD
Sunrise/ Troubadour/ Loxton Shoals (Greater Sunrise)	321		9.56	NT DBIRD

NT DBIRD – Northern Territory Department of Business, Industry and Resource Development

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Figures

Graticular Block Listings and Map

Bids close 31st March 2005

Area NT04-1
Malita Graben, Bonaparte Basin, Northern Territory

Map Sheet SC 52 (Melville Island)

1259 1260 1261 1262 1263 1264 1265 1266 1267 1268 1269 1331
1332 1333 1334 1335 1336 1337 1338 1339 1340 1341 1403 1404
1405 1406 1407 1408 1409 1410 1411 1412 1413 1475 1476 1477
1478 1479 1480 1481 1482 1547 1548 1549 1550 1551 1619 1620
1621 1622 1623 1691 1692 1693 1694 1695

Assessed to contain 56 blocks

Area NT04-2
Malita/Calder Graben, Bonaparte Basin, Northern Territory

Map Sheet SC 52 (Melville Island)

1136(part) 1203(part) 1204(part) 1205(part) 1206(part) 1207(part)
1208(part) 1270 1271 1272 1273 1274 1275 1276 1277 1278 1279
1280 1342 1343 1344 1345 1346 1347 1348 1349 1350 1351 1352
1414 1415 1416 1417 1418 1419 1420 1421 1422 1423 1424 1486
1487 1488 1489 1490 1491 1492 1493 1494 1495 1496 1558 1559
1560 1561 1562 1563 1564 1565 1566 1567 1568 1630 1631 1632
1633 1634 1635 1636 1637 1638 1639 1640 1702 1703 1704 1705
1706 1707 1708 1709 1710 1711 1712

Assessed to contain 84 blocks

Area NT04-3
Calder Graben, Bonaparte Basin, Northern Territory

Map Sheet SC 52 (Melville Island)

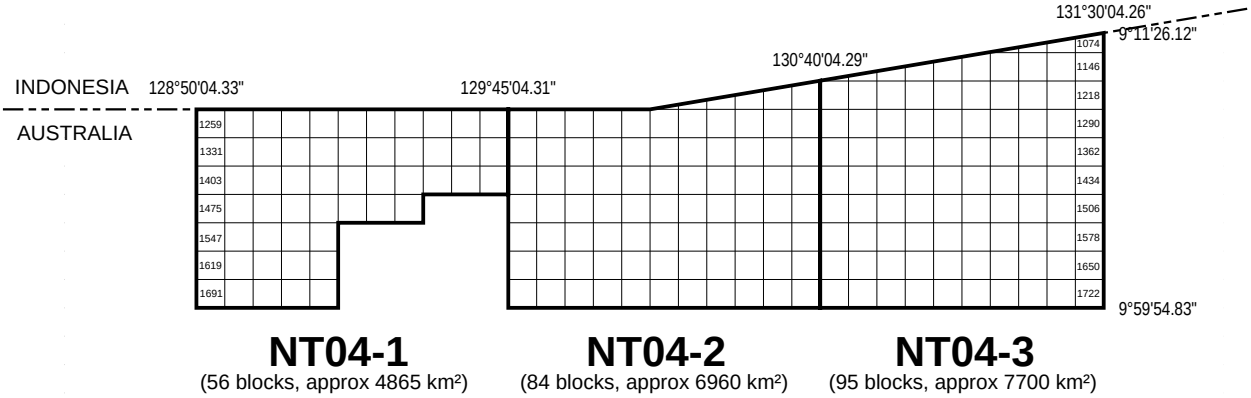
1070(part) 1071(part) 1072(part) 1073(part) 1074(part) 1137(part)
1138(part) 1139(part) 1140(part) 1141(part) 1142(part) 1143 1144
1145 1146 1209 1210 1211 1212 1213 1214 1215 1216 1217 1218
1281 1282 1283 1284 1285 1286 1287 1288 1289 1290 1353 1354
1355 1356 1357 1358 1359 1360 1361 1362 1425 1426 1427 1428
1429 1430 1431 1432 1433 1434 1497 1498 1499 1500 1501 1502
1503 1504 1505 1506 1569 1570 1571 1572 1573 1574 1575 1576
1577 1578 1641 1642 1643 1644 1645 1646 1647 1648 1649 1650
1713 1714 1715 1716 1717 1718 1719 1720 1721 1722

Assesses to contain 95 blocks

2004 Release Areas
Northern Bonaparte Basin,
Northern Territory

MAP SHEET

SC 52 (Melville Island)



Grid coordinates on this map are presented with reference to the Geocentric Datum of Australia (GDA94). Permit areas are based on the same grid, Australian Geodetic Datum (AGD66), that has defined areas since the Petroleum (Submerged Lands) Act was proclaimed in 1967. However, with the adoption of GDA94, the gridlines are no longer referred to in whole multiples of 5 minutes as they were under AGD66.

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