T/18P, BASS BASIN, TASMANIA

SHEARWATER 2D AND 3D MARINE SEISMIC SURVEY AND 2D REPROCESSING

FINAL REPORT

(INTERPRETIVE)

origin

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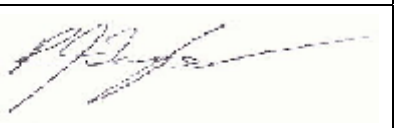
Randall Taylor	Chief Geophysicist	22/2/08	
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EXECUTIVE SUMMARY

The Shearwater 2D and 3D Marine Seismic Survey was acquired between 14 November and 10 December 2005 in the T/18P permit in the Bass Basin, Tasmania. The 3D survey covered a total of 250 km^2 with 208 km^2 of full-fold data being acquired. The 2D survey consisted of 202.5 sail kilometres of 2D lines. 1366km of vintage 2D data were reprocessed.

The primary objective of the Shearwater 3D was to detail the Trefoil-1 discovery and nearby prospects within T/18P. The objective of the Shearwater 2D survey and associated vintage seismic data reprocessing was to detail leads previously identified on existing 2D seismic in T/18P.

1.0 INTRODUCTION

The 208 km^2 Shearwater 3D Marine Seismic Survey (MSS) and the 202.5km Shearwater 2D MSS was acquired by the T/18P Joint Venture between 14th November and 10th December 2005. Data processing was conducted by Fugro Seismic Imaging (FSI) between December 2005 and July 2007. The acquisition and processing of the Shearwater 2D and 3D MSS and 2D reprocessing fulfilled the work commitment for Year 2 in accordance with the Work in Advance of Commitment work obligation variation.

1.1 Location

T/18P is an offshore permit located in Tasmanian State waters in the central part of the Bass Basin (Figure 1). The permit covers an area of 1055 km^2.

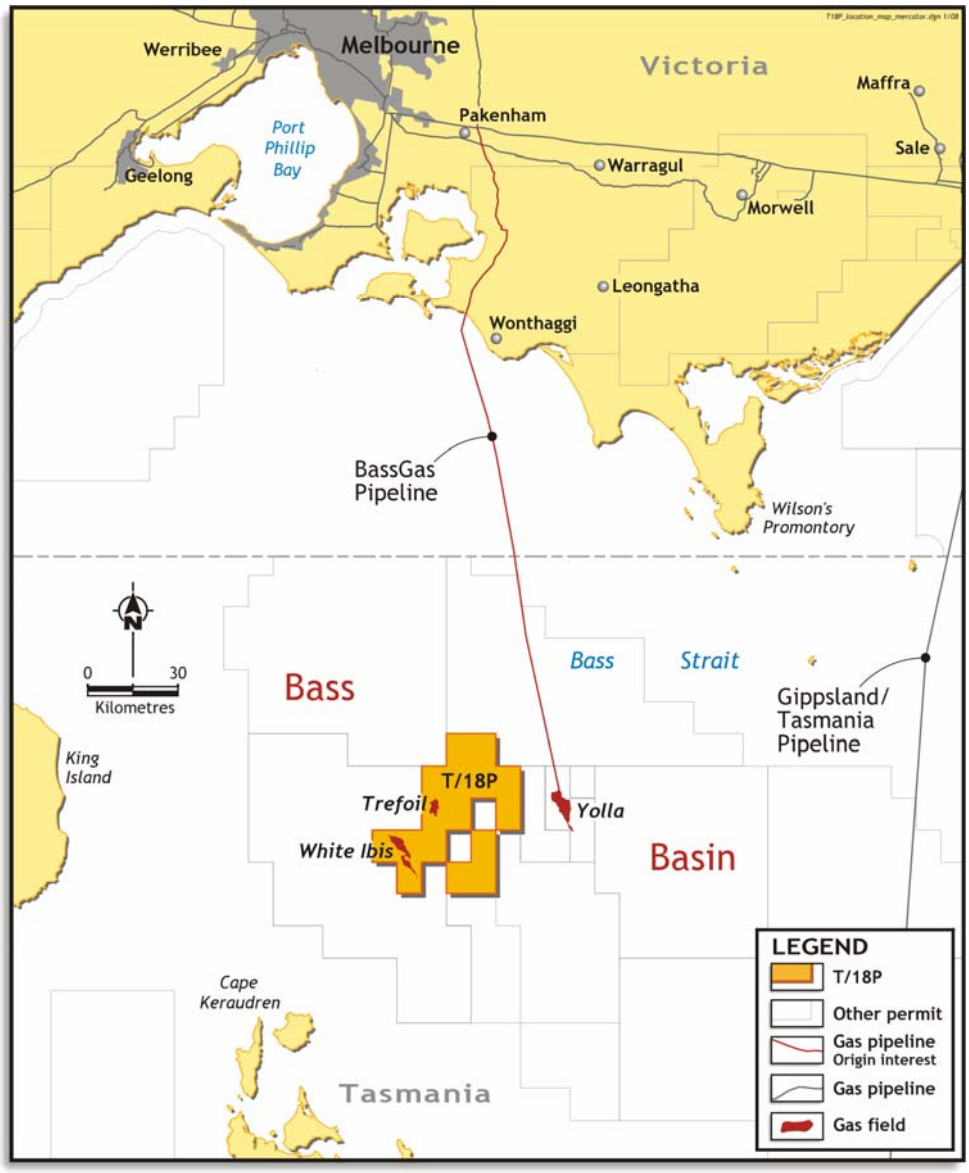


Figure 1. T/18P Location Map

Water depths across the block range from 65 to 85m and deepen toward the East. The Shearwater 3D Seismic Survey is located over the south-western half of T/18P in water depths ranging from approximately 65 to 79m and the Shearwater 2D MSS and reprocessing is located in the northeast and southwest parts of T/18P (Enclosure 1).

1.2 Permit Details

T/18P was renewed for a period of five years from 23 May 2005, based on an application submitted to the Designated Authority on 17 December 2004. The approved permit work programme is set out in Table 1.

Permit Year	Ending	Minimum Work Requirement
1	22/05/06	G&G Studies
2	22/05/07	165km^2 of 3D Seismic 260km of 2D Seismic 750km of 2D Seismic data reprocessing
3	22/05/08	G&G Studies
4	22/05/09	1 Well
5	22/05/10	G&G Studies

Table 1 T/18P work programme

Table 2 lists the Joint Venture Participants.

JV Participant	Equity %
Origin Energy Resources Limited (Operator)	39.0
AWE Petroleum Limited	30.0
CalEnergy Gas (Australia) Ltd	18.5
ARC (Bass Gass) Ltd	12.5

Table 2 T/18P Joint Venture Participants

2.0 EXPLORATION HISTORY

Exploration within the area of T/18P commenced in 1963 with the acquisition of regional 2D seismic data (Table 3). Many subsequent seismic surveys have been recorded within the permit with the latest in 2005, the Shearwater 2D MSS, bringing the total 2D seismic acquisition in the permit to 7,149.30 km. The Shearwater 3D MSS is the first 3D seismic survey to be conducted in T/18P.

Year	Survey Name	No Kilometres
1963	B	146.3
	B63	263.8
1965	EB	62.0
	EK	80.2
1966	ES	29.5
1969	B69B	100.0
1971	B71A	230.5
1972	B72A	582.5
1973	HB75A	440.5
1977	HB77A	318.75
1981	BBS81	419.75
	BCSS81	14.75
1982	82BMR	178.0
	BB82A	34.5
1984	TNK4	660.5
1985	TP05	304.25
	TQH5	1135.25
1990	BS90B	201.5
1994	SB94A(Rocky Cape)	541.0
1996	Hummock	569
2001	Shelduck	376
2005	Shearwater	202.5
	Shearwater 3D	208km^2
	TOTAL	**7,149.30**

Table 3 T/18P Seismic Exploration History

A total of 9 exploration wells have been drilled within the historical permit boundaries of T/18P (Table 4). An uneconomic oil accumulation was discovered at Cormorant 1 in 1970. A two-metre oil column was identified from logs and a Formation Interval Test (FIT). Subsequent production testing was not performed. The King 1 well confirmed

that the oil accumulation is uneconomic. White Ibis 1 discovered sub commercial quantities of gas. The nearest and most relevant wells to Trefoil 1 are Aroo 1, White Ibis 1 and Bass 3.

Year	Well Name	Operator	Well Type	Target	Total Depth (m)	Result	Flow Rate / Recovery
1967	Bass 3	ESSO	Expl	EVCM	2432	P&A	Gas Shows
1970	Cormorant	ESSO	Expl	Mid EVCM	3001	P&A	FIT Oil Recovery
1972	Tarook 1	ESSO	Expl	Top EVCM	2774	P&A	-
1974	Toolka 1A	ESSO	Expl	EVCM	2715	P&A	Shows Gas & Condensate
1974	Aroo 1	Hematite	Expl	Mid EVCM	3692	P&A	Shows Gas & Condensate
1985	Koorkah 1	AMOCO	Expl	Basal EVCM	3147	P&A	-
1992	King 1	SAGASCO	Expl	Upper EVCM	2223	P&A	Oil & Gas Shows
1998	White Ibis 1	BORAL (Premier)	Expl	Upper EVCM	2220	P&S	Sub comm. Gas disc
2004	Trefoil 1	Origin Energy	Expl	Upper EVCM	3545	P&S	Gas dsc.

Table 4 Key nearby Wells

The Trefoil gas field was discovered in November 2004 when Trefoil-1 intersected gas bearing sandstones within the Lower L. balmei, upper F.longus and T.lilliei spore pollen zones. Open hole log and mud log data indicate the potential for up to 21 gas pay zones with 12 of the zones confirmed by MDT sampling and optical fluid analysis. The Trefoil closure is a low relief relatively unfaulted anticline.

Aroo 1 was drilled in 1974 as an exploration well on a then interpreted four-way dip closure. The well encountered strong gas and oil shows in the Lower *L. balmei* with minor gas and water recovered on testing. The poor reservoir quality and minor hydrocarbon recovery resulted in the well being plugged and abandoned.

Bass 3 was drilled in 1967 as an exploration well on a fault-bounded closure on the south-western margin of the Yolla Trough. Primary targets were sands in the intra-Eastern View Coal Measures (EVCM). A moderate gas peak in the upper Palaeocene was tested with a recovery of gas, condensate and water. A minor gas peak and fluorescence was also noted in the Late Cretaceous but not tested. The well was

plugged and abandoned. The likely causes of failure are inadequate closure and/or fault seal breach.

White Ibis 1 was drilled in 1998 updip of Bass 3 in the adjacent fault block. Gas recoveries were made from sands in the Lower L. balmei and based on MDT and gas ratio data an oil leg is possible beneath the gas column. The well is currently suspended for possible future production.

3.0 REGIONAL GEOLOGY

The Bass Basin is located offshore in south-eastern Australia between Victoria and Tasmania. It is one of a series of sedimentary basins that were formed in response to rifting during the Late Jurassic to Early Cretaceous between Australia and Antarctica (Williamson et al, 1987). The Bass Basin covers approximately 65,000 km^2 and water depths range from 30 to 90 m.

3.1 Structure

The Bass Basin is a failed intra-cratonic rift basin with structural features which highlight three separate phases of evolution:

1) Initial northeast-southwest extension during the early Cretaceous,
2) Late Cretaceous to Pliocene thermal subsidence and
3) Miocene compression.

The rifting created a series of northwest-southeast oriented graben offset by associated east-west wrench movement. The Pelican, Yolla and Cormorant Troughs comprise the major depocentres in the Bass Basin (Figure 2). These depocentres are fault-bounded half-grabens that progressively developed via growth faulting during the active rifting and thermal subsidence phases of basin evolution. The Trefoil, Yolla and White Ibis structures are all located on the flanks of the Yolla Trough. The dominant structural trend in the basin is northwest-southeast, highlighted by the orientation of the major faults and troughs.

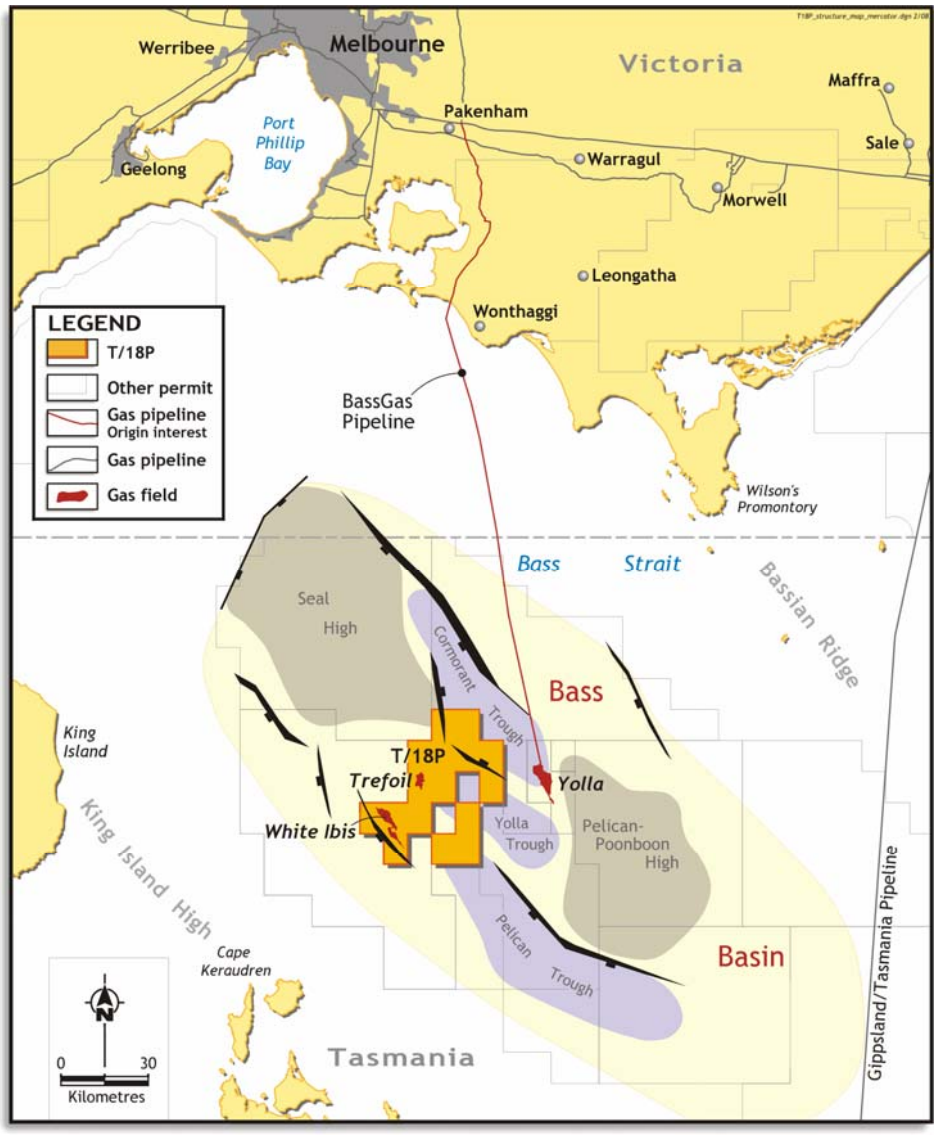


Figure 2. Western Bass Basin Structural Elements Map

3.2 Stratigraphy

The stratigraphic succession in the Bass Basin comprises sediments ranging in age from Early Cretaceous to Recent (Figure 3).

The Early Cretaceous Otway Group rests unconformably on pre-rift Palaeozoic black shales and quartzites and consists of clastic, volcaniclastic, fluvial and deltaic sediments ranging from coarse-grained sandstone to shale and coal. The Otway Group was deposited as a very thick sequence of sediments (*C. australiensis* to *C. paradoxus*) that have been intersected in the Bass Basin at only one locale, Durroon 1, in the extreme southeast.

Localised uplift and erosion then occurred on the basin margins as the initial rifting phase subsided (Middle Cretaceous). The Otway Drift phase then began along the southern margin of Australia, which was largely contemporaneous with the start of the Tasman Rifting event on the eastern edge of the southern margin. This recommenced rifting in the Bass Basin, which resulted in deposition of the prospective Early Cretaceous to Late Eocene Eastern View Coal Measures (EVCM) which comprise a thick succession of sandstone, siltstone, shale and coal, deposited primarily within fluvial, deltaic and lacustrine depositional environments. Seismic data suggests that the EVCM is over 4000m thick in the troughs. The EVCM thins markedly towards the basin margins and exhibits both onlap onto basement and erosional truncation. In a broad sense, the EVCM can be divided into three sequences separated by erosional unconformities. The middle sequence was penetrated in Bass 1 and Yolla 1 and 2 and contains the major gas accumulations in the Yolla Field. This sequence is bounded at the base by the *N. senectus* unconformity and at the top by the *upper M. diversus* unconformity.

The Lower Eastern View Coal Measures (EVCM) depositional sequence was deposited from Cenomanian to Santonian times (*A. distocrinatus* to *N. senectus*). These units have only been intersected in Durroon 1 in the southeast of the Bass Basin and are equivalent to the Golden Beach Group in the Gippsland Basin.

An angular unconformity is identified over localised highs on the basin margins at the top of the *N. senectus* zone. The boundary is marked in places by significant extrusive volcanism, similar to that observed in the Gippsland Basin. This event signals the termination of Tasman rifting, which was followed by sea floor spreading in conjunction with the already active drift in the Otway region. During this time, thermal subsidence dominated throughout the basin and thick, ubiquitous deposition of the Late Cretaceous to Palaeocene Lower EVCM occurred (*T. lilliei* to Lower *M. diversus*/*P. asperopolus*).

The Late Cretaceous sediments are restricted mainly to the basin depocentres (such as at Trefoil 1) and axial reaches where accommodation space was sufficient for deposition and subsequent preservation. The section is missing on the basin margins due to sediment bypass. The Palaeocene section is extensive throughout with the greatest thickness of sediments in the basin depocentres

and significant thinning towards the basin flanks, as a result of both condensing of the section and basement onlap.

The Late Cretaceous/Palaeocene Lower EVCM has been intersected in numerous wells in the basin, identifying it as a continuous sequence of late low stand sediments grading through a transgressive systems tract and finally capped by high stand sediments. Environments are gradational both laterally and temporally from alluvial through fluvio-deltaic and nearshore to deeper restricted lacustrine. Primary sediment input to the basin was from the southeast with minor localised input also deposited transversely from the flanks of the troughs. Extensive coal measures dominate the sedimentary sequence in the southeast of the basin (Pelican Trough) with increasingly thicker homogeneous shale units occurring through the Yolla and Cormorant Troughs.

The top of the Lower EVCM is identified by localised uplift and inversion of the pre-existing sedimentary sequence, caused by mild regional compression. The effects of this uplift are variable with the degree of erosion extending from the middle *M. diversus* through to the *P. asperopolus* in places.

The Eocene upper EVCM (middle *M. diversus*/*P. asperopolus* to middle *N. asperus*) was then deposited under a regime of slower subsidence, resulting in more widespread, highly variable facies development. Fluctuating conditions of alluvial, fluvio-deltaic and shallow marine processes resulted with more extensive deposition of coal measure sediments. A regional marine transgression then occurred, resulting in the basin-wide deposition of the Demons Bluff, the base of which is marked by a locally very thick transgressive sand.

Conformably overlying the EVCM is the Late Eocene Demon's Bluff Formation. Lithologically this unit consists of a basal sequence of fine-grained carbonaceous shale and siltstone deposited in an open marine environment. The unit has an average thickness over the basin of approximately 120 m, but thins toward the basin margins. The Demon's Bluff Formation provides a regional top seal to hydrocarbons reservoired in the top-most sandstone units of the EVCM as demonstrated in Yolla 1.

The Demon's Bluff Formation is overlain by the Late Eocene to Pliocene age Torquay Group which broadly consists of a basal sequence of marls and calcareous shales which grade upwards into a succession of bioclastic limestones. The Torquay Group signifies continual deposition under pervasive marine conditions. The Torquay Group is punctuated in places by episodes of minor uplift and/or erosion accompanied by varying effects of volcanism. Large-scale extrusives (volcanoes) are observable on the seismic data (as seen near Trefoil 1) with extensive sill and dyke networks also resulting from these events (as intersected in the Yolla Field wells, Cormorant 1 and Aroo 1).

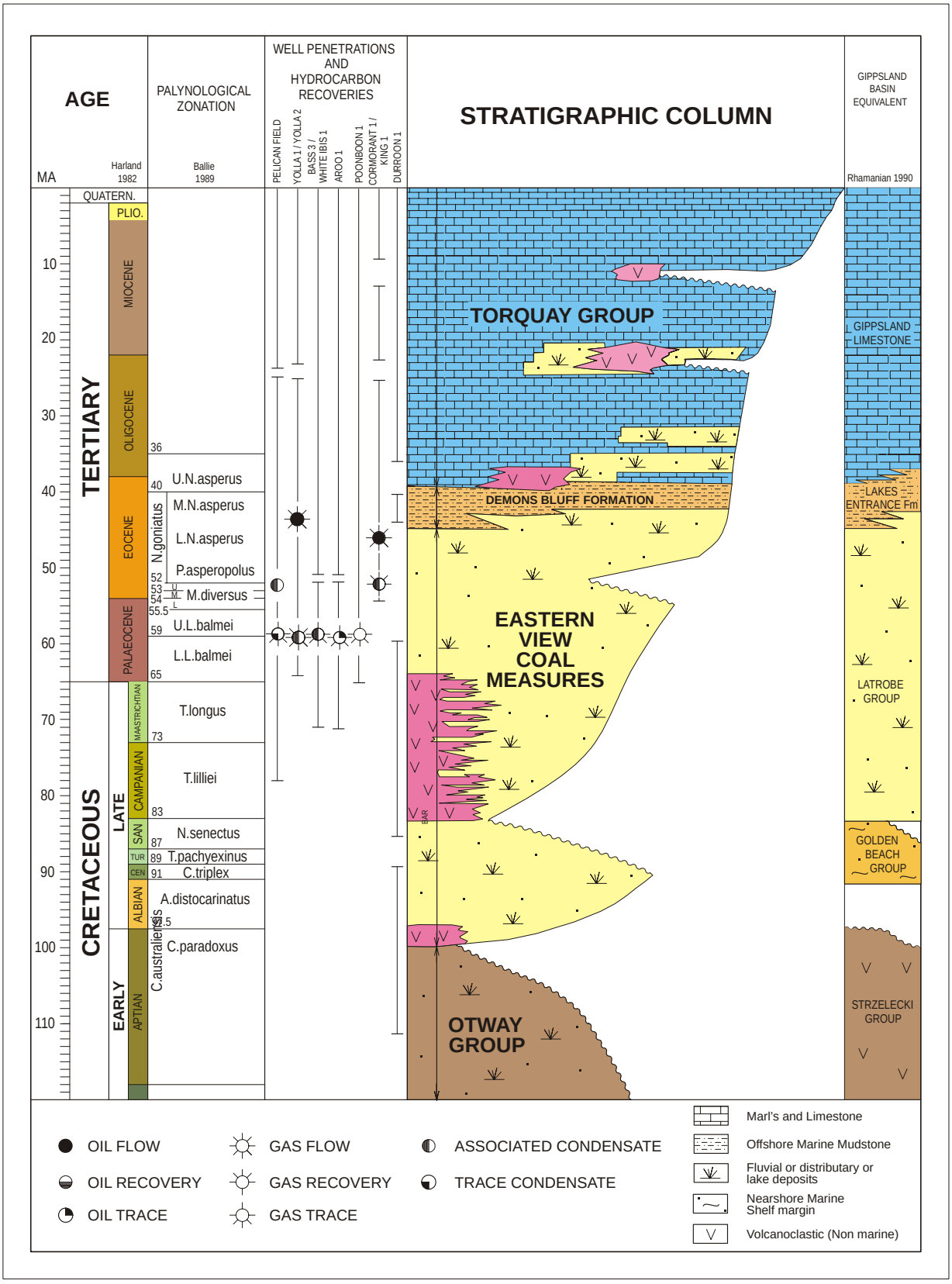


Figure 3. Generalised Stratigraphy of the Bass Basin

4.0 SHEARWATER 2D/3D MSS

4.1 Objectives

The 2005 Shearwater 2D and 3D MSS was recorded to provide detailed seismic coverage over the Trefoil-1 discovery and additional T/18P prospects and leads in fulfilment of the Year 2 work commitment for the permit.

4.2 Data Acquisition

The Shearwater 2D and 3D MSS was acquired between 14th November 2005 and 10th December 2005 using the PGS vessel *Orient Explorer*. A total of 208 km^2 of full fold 3D data was acquired and 202 km of 2D data. The key acquisition parameters are summarised in Table 5.

Group Interval	12.5m
Crossline Spacing	25m
Source	2x2500 in^3
Source Depth	6 m
Streamers	4 x 4350 m
Streamer Spacing	100 m
Streamer Depth	8 m
Near Trace Offset	96 m
Shot Interval	18.75m for 3D/25.0m for 2D
Sample Rate	2ms
Record Length	5120ms

Table 5 Shearwater MSS Key Acquisition Parameters

Further details on the acquisition activities are available in the final acquisition reports, submitted separately.

4.3 Data Processing

Processing of the Shearwater 3D seismic data was carried out by Fugro Seismic Imaging Pty Ltd (FSI) and completed in February 2006. In addition to the newly acquired data, a total of 1366 km of vintage 2D data were also reprocessed by FSI and completed in July 2007. Full details of seismic processing are available in the Seismic Data Processing Reports for a) the Shearwater 3D and b) the Shearwater 2D & Reprocessing, which were each submitted separately.

4.4 Data Quality

The overall data quality of the Shearwater 2D and 3D seismic data is very good, with well-imaged fault planes, a high signal-to-noise ratio, broad bandwidth, plus good event definition and continuity Figure 4. The polarity of the Shearwater 2D and 3D data as supplied by FSI was determined to be ASEG Normal (i.e. an increase in impedance is represented by a negative number or trough) and approximately zero phase. The convention used for all seismic line displays in this report is also ASEG Normal (black=trough, red=peak).

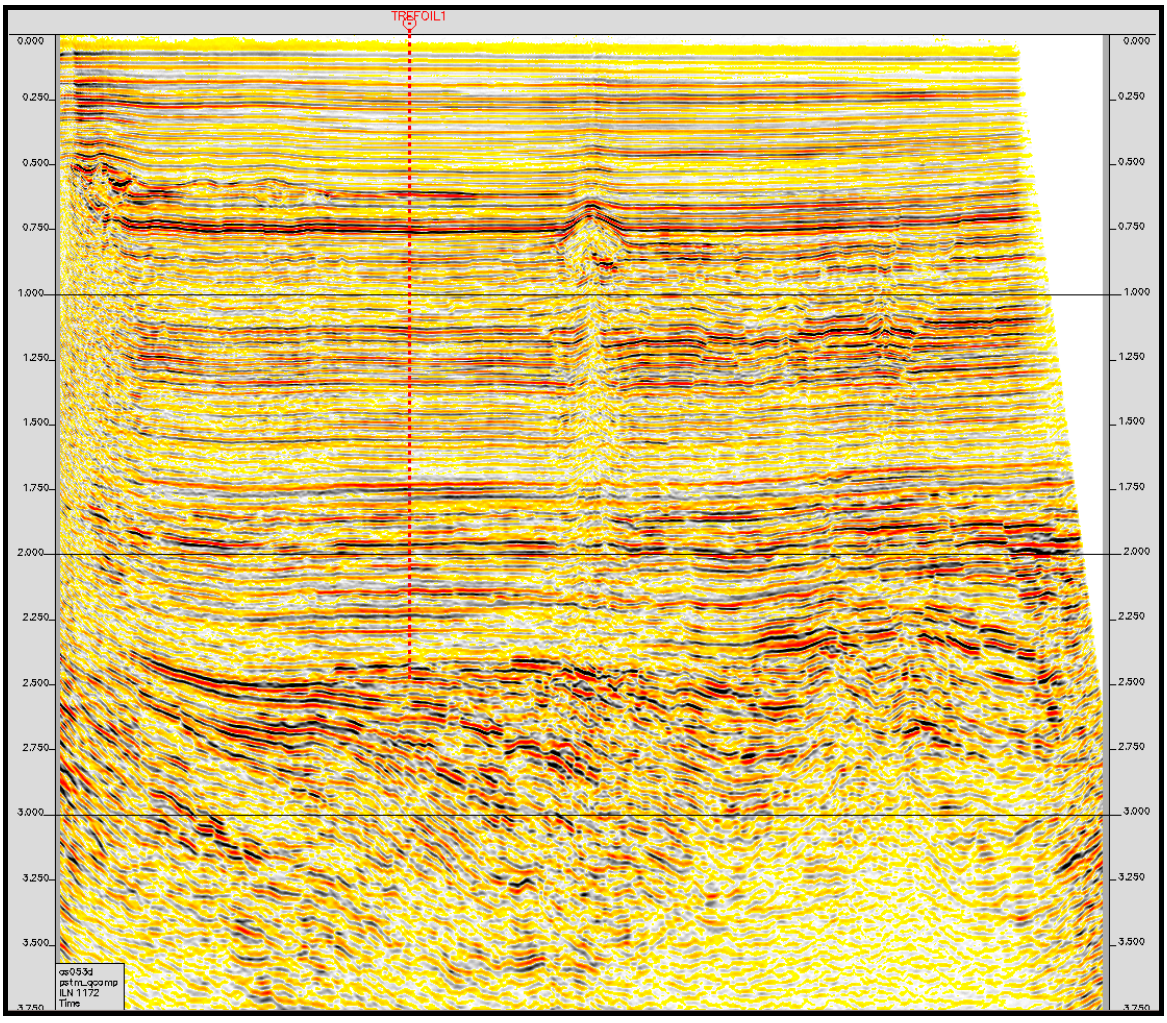


Figure 4. Shearwater 3D Example Seismic Line

The reprocessing provided an improvement in data quality of the vintage 2D seismic data, in particular the frequency content, fault definition and amplitude preservation Figure 5.

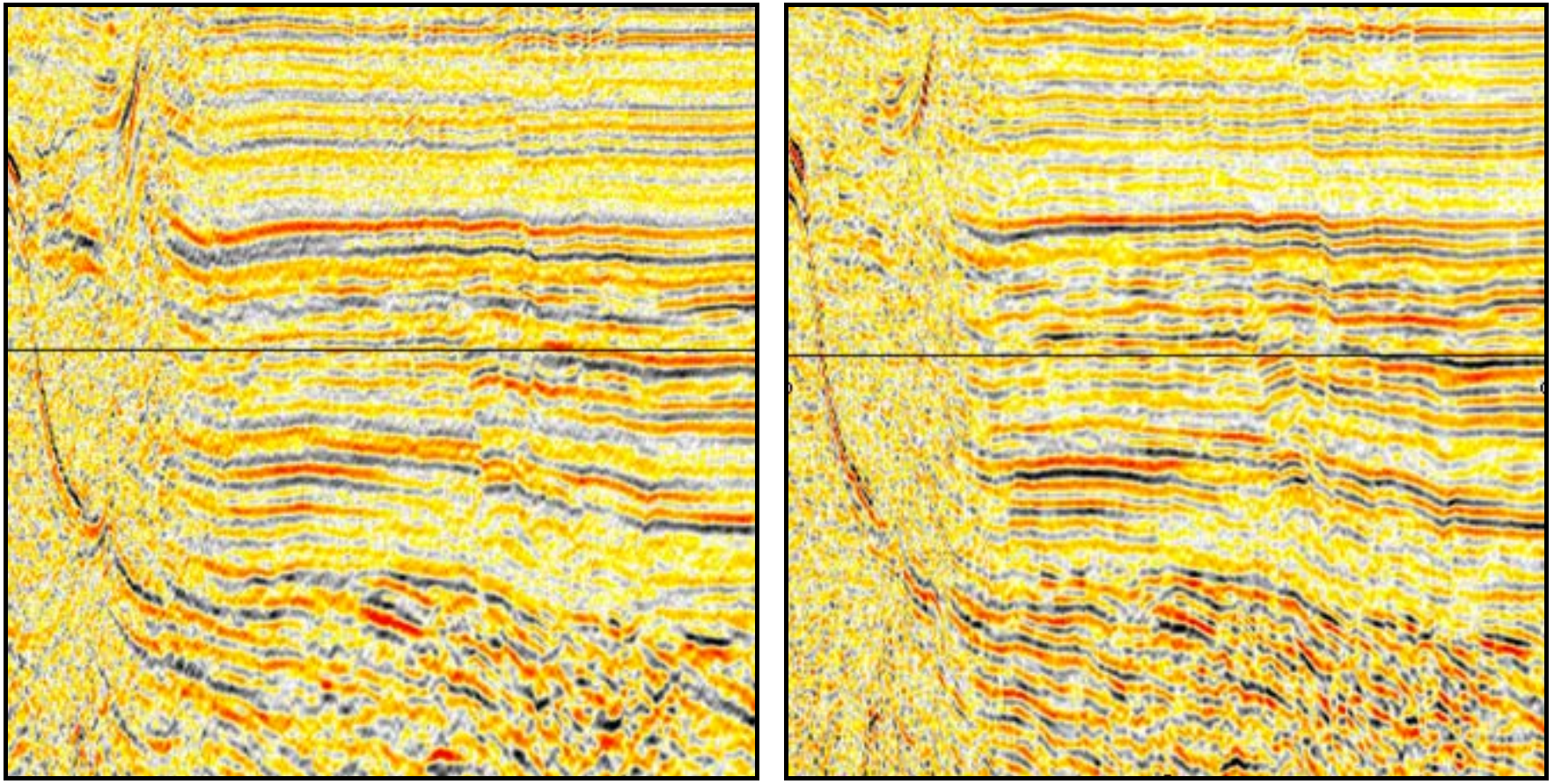


Figure 5. Original 2D vs Reprocessing data quality comparison

5.0 INTERPRETATION AND MAPPING

Interpretation and mapping of the 2005 Shearwater 2D and 3D MSS was undertaken in conjunction with the regional mapping of the 2D reprocessed data within T/18P. The aim of the mapping was to provide a more detailed understanding of the Trefoil discovery and to provide an updated inventory of prospects and leads, in particular the Rockhopper, Gentoo, Chappell, Aroo East and White Ibis/Bass 3 leads (Enclosure1). Interpretation was undertaken utilising Schlumberger's IESX software within Geoframe Version 4.3. Mapping was carried out using Petrosys Version 15.3 software.

5.1 Well Ties

The seismic interpretation of the Shearwater dataset is based on seismic character ties into key offshore wells (i.e. Aroo-1, Bass-3, Trefoil-1, White Ibis-1).

5.2 Time Mapping

Horizons interpreted within the Shearwater 2D and 3D seismic datasets are summarised in Table 6.

Seismic Event	Areal Extent	Reason for Picking	Character	Quality
Water Bottom	2D & 3D	Water bottom	Trough	Good
Top Trefoil Volcanics	2D & 3D	Regional seismic marker	Trough	Good
Lower Miocene Marker	2D & 3D	Regional seismic marker	Trough	Good
Near Top Angahook Fm	2D & 3D	Regional seismic marker	Trough	Good
Top Lower Angahook Fm	2D & 3D	Regional seismic marker	Trough	Fair
Top Demons Bluff Fm	2D & 3D	Regional Seal	Trough	Good
Top EVCM	2D & 3D	Secondary target	Trough	Fair
Top E1 Sst	2D & 3D	Secondary target	Peak	Fair
Top 2973m Sst	2D & 3D	Secondary target	Trough	Good
Base Low Acoustic Impedance Zone	3D	Primary target	Peak	Fair
Top TlLb60 Sst	2D & 3D	Primary target	Trough	Fair
Top TuFl60 Sst	2D & 3D	Primary target	Trough	Fair
Top Upper Cretaceous Unconformity	2D & 3D	Regional seismic marker	Peak	Poor
Basement	2D & 3D	Regional seismic marker	Trough	Poor

Table 6 Key Interpreted seismic horizons.

A composite seismic line across the T/18P permit showing key interpreted seismic markers is included as Figure 6.

The following key regional two-way time structure maps were produced:

- E1 Sand Time Structure (Enclosure 2) - provides current day structural control on a key unconformity within the EVCM. It is a main hydrocarbon producing reservoir in Yolla.

- 2973m Sand Time Structure (Enclosure 3) - provides the current day structural configuration for a prospective hydrocarbon zone in Yolla and White Ibis-1 and represents an important reservoir-seal interface with the T/18P permit.

- Upper Cretaceous Unconformity Time Structure (Enclosure 4) - provides structural configuration for the prospective Cretaceous reservoirs within the *F. longus* and *T.lilliei* palynological zones intersected in Aroo-1 and Trefoil-1.

The time structure maps are characterised by extensive northwest-southeast, basement-involved, normal faulting. These faults are interpreted to be early basin rift faults that have been reactivated in the Palaeocene/Eocene. The mapping suggests that with the exception of the Trefoil prospect, all structural plays are reliant on bounding faults for any significant closure. Fault linkages as mapped, outside of the Shearwater 3D are severely compromised due to the inherent pitfalls of 2D seismic.

All time maps are characterised by an apparent ring of volcanoes of Miocene age in the vicinity of T/18P.

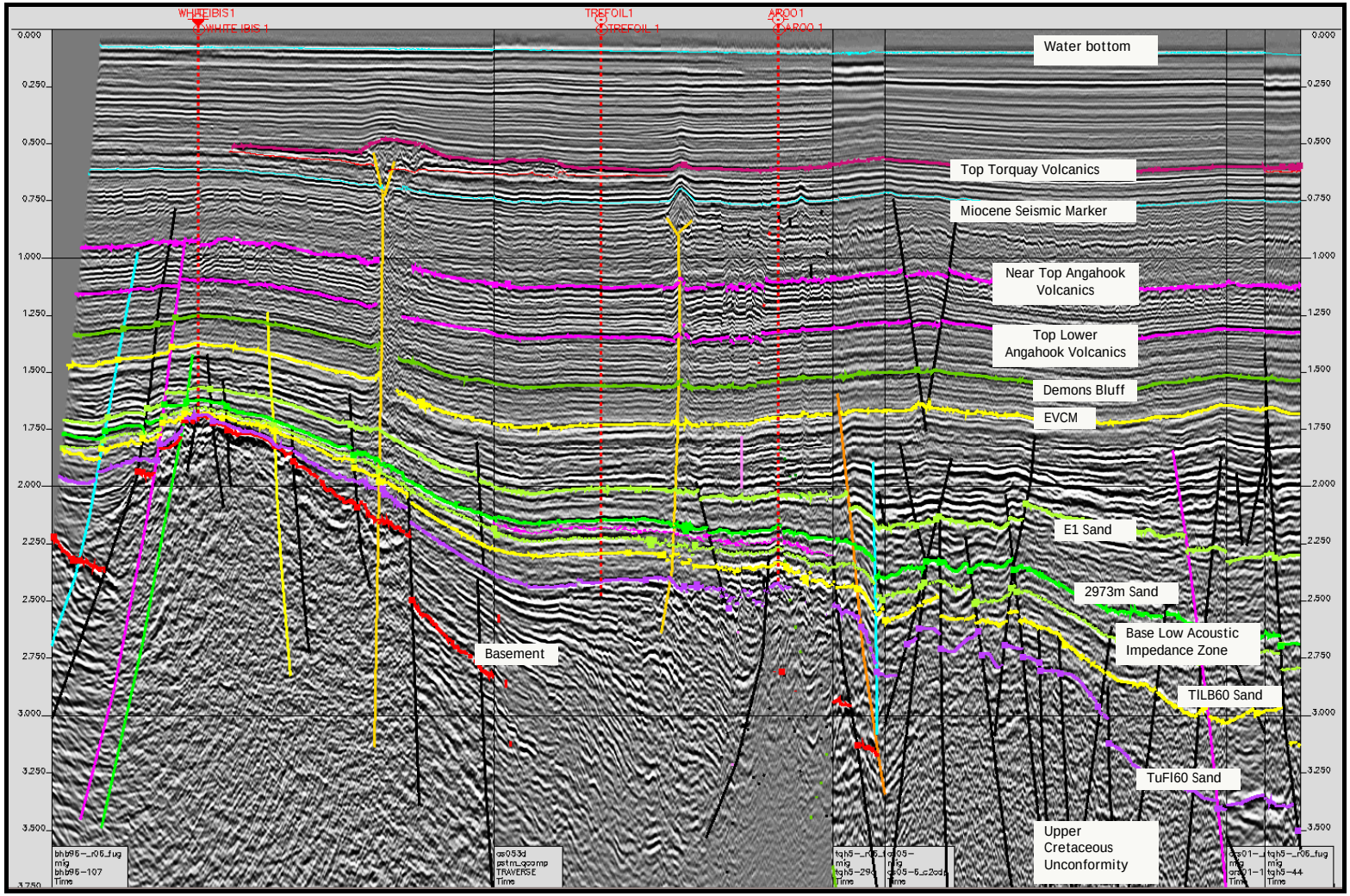


Figure 6. Key interpreted Seismic Horizons

6.0 PROSPECTS & LEADS

The Shearwater Seismic Survey addressed the following key prospects and leads:

Aroo East

The Aroo East Prospect is located approximately 28 km northwest of the Yolla Gas Field in water depths of approximately 76 m. The feature is immediately adjacent to Chappell and is interpreted at potential reservoir levels within the EVCM as an anticlinal closure associated with a narrow northwest-southeast trending half-graben. It is constrained by two northeast dipping normal faults on which the feature is reliant for the greater part of its closure.

The Shearwater 2D seismic data and reprocessing has better defined fault location and linkage for the Aroo East feature with enhanced confidence in fault mapping. A primary risk associated with Aroo East is the reliance on fault seal for trapping significant quantities of hydrocarbons.

Chappell

The Chappell Prospect is located approximately 15 km west of the Yolla Gas Field in water depths of approximately 78 m. The feature is structurally complex and is interpreted as a narrow horst created by the merging of two northwest-southeast trending normal faults at potential reservoir levels within the EVCM. Possible strike-slip movement and compression along the faults is also interpreted.

The Shearwater 2D seismic data and reprocessing has better defined fault location and linkage for the Chappell feature. Whilst the confidence of fault mapping is still limited by the 2D grid, the overall closure is considered robust. A primary risk associated with Chappell is the reliance on fault seal for trapping significant quantities of hydrocarbons.

Rockhopper

The Rockhopper Prospect is located approximately 33 km west northwest of the Yolla Gas Field in water depths of approximately 74 m. The feature is interpreted as a northwest-southeast trending, fault-controlled anticline at potential reservoir levels within the EVCM. The Shearwater 3D seismic data has better defined fault location and linkage for the Rockhopper feature with enhanced confidence in fault mapping.

Trefoil -1

Trefoil-1 is located approximately 37 km west of the Yolla Gas Field in water depths of approximately 68 m. The feature is mapped as a relatively simple fault-independent, four-way dip closure. The Shearwater 3D seismic data has better defined fault location and linkage for the Trefoil structure with enhanced confidence in fault and seismic amplitude mapping.

White Ibis/Bass-3 Leads

The lowside fault plays surrounding the White Ibis and Bass-3 highs are structurally robust but have a high potential for fault leakage along the en-echelon White Ibis/Bass 3 bounding faults. The Shearwater 2D seismic data and reprocessing has better defined fault location and linkage for these features.

7.0 CONCLUSIONS

- The Shearwater 2D and 3D MSS and vintage 2D reprocessing has provided good quality, detailed seismic control over T/18P, fulfilling the Year 2 work commitment for T/18P.

- The Chappell, Aroo East and White Ibis/Bass-3 leads are structurally robust, however their structural complexity warrants future 3D seismic coverage to further reduce structural and seal risks associated with the bounding faults on these plays.

- The Shearwater 3D has increased confidence and accuracy in the mapping of the Trefoil and Rockhopper structures.

8.0 REFERENCES

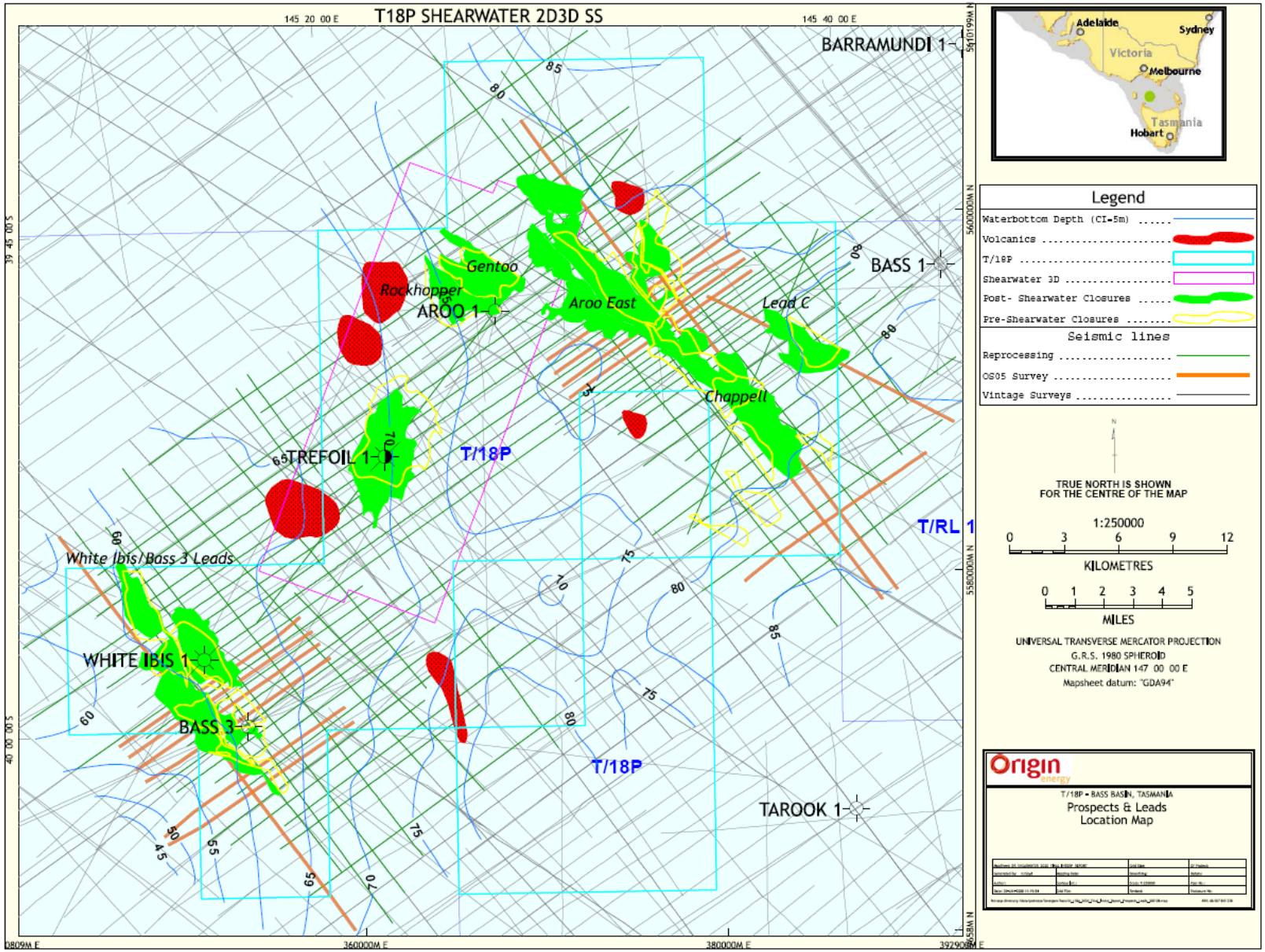
Williamson, P.E., Pigram, C.J., Colwell, J.B., Scherl, A.S., Lockwood, K.L. and Branson, J.C., 1987 – *Review of stratigraphy, structure and hydrocarbon potential of Bass Basin, Australia*. AAPG Bulletin V.71, No.3, 253-280.

WesternGeco, 2005 - *Acquisition Report, Shearwater 3D and 2D Survey*.

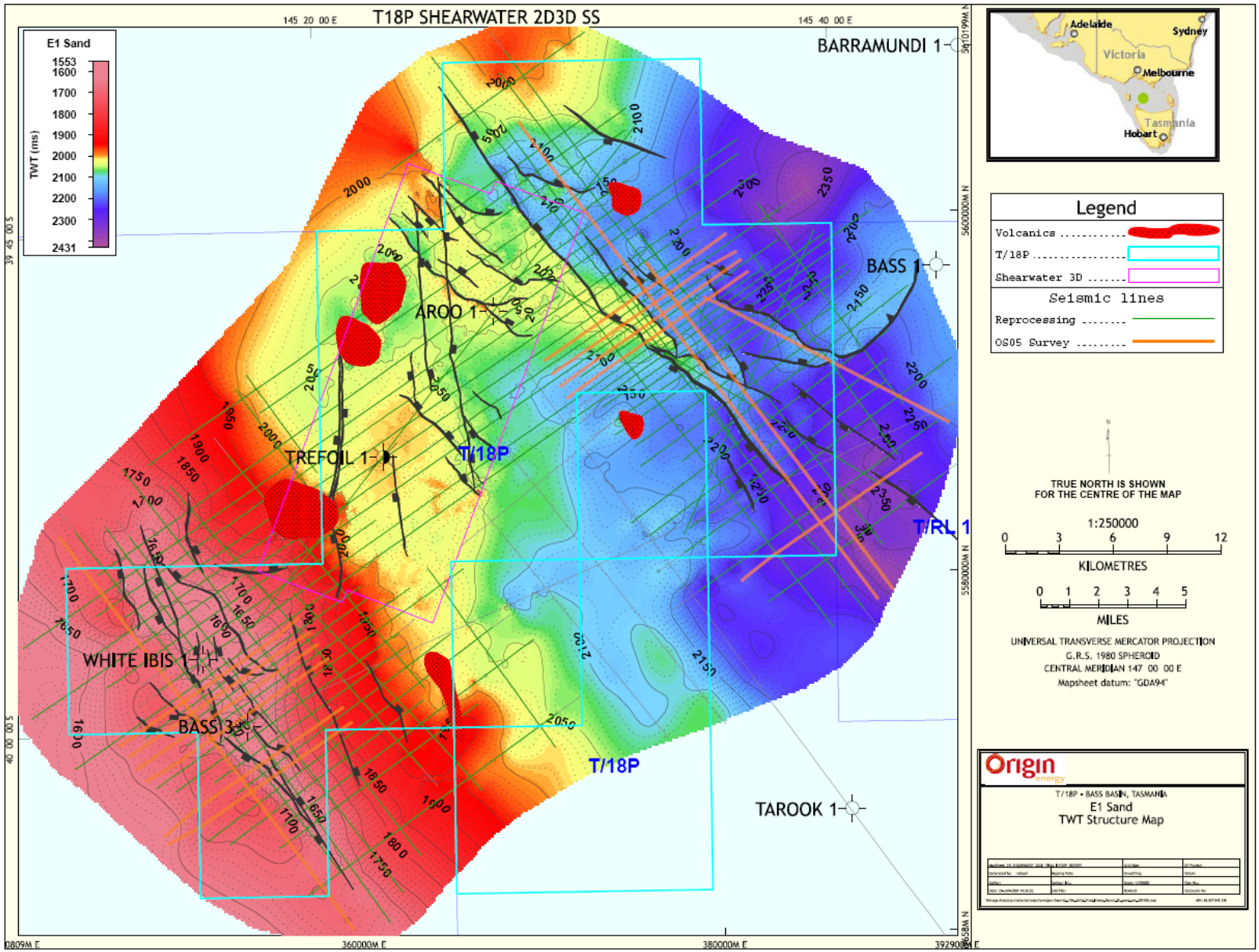
Fugro Seismic Imaging, 2006 – *Seismic Data Processing Report, Shearwater 2D and 3D*.

Fugro Seismic Imaging, 2007 – *Seismic Data Processing Report, 2005 Shearwater 2D Survey and Reprocessing*.

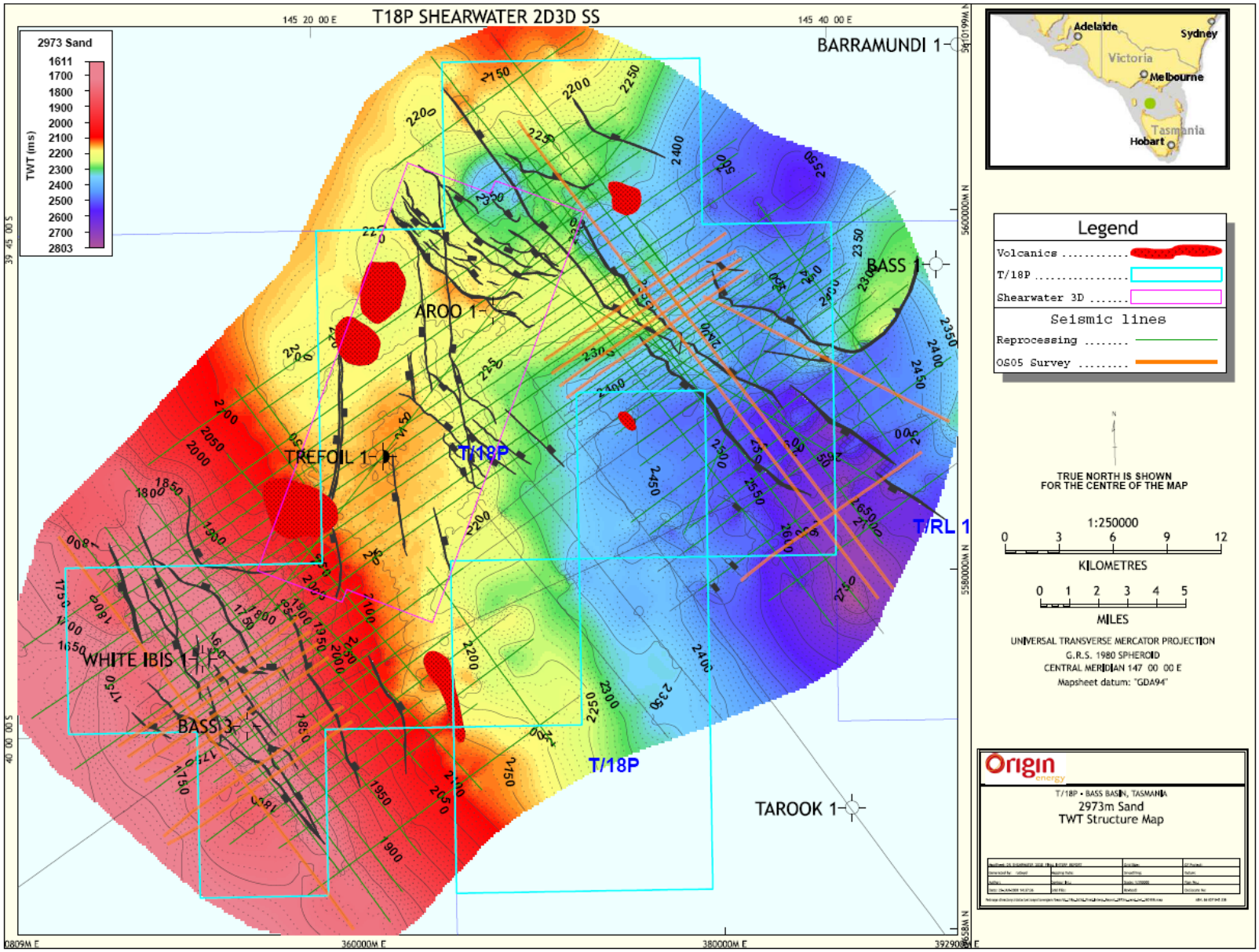
9.0 ENCLOSURES



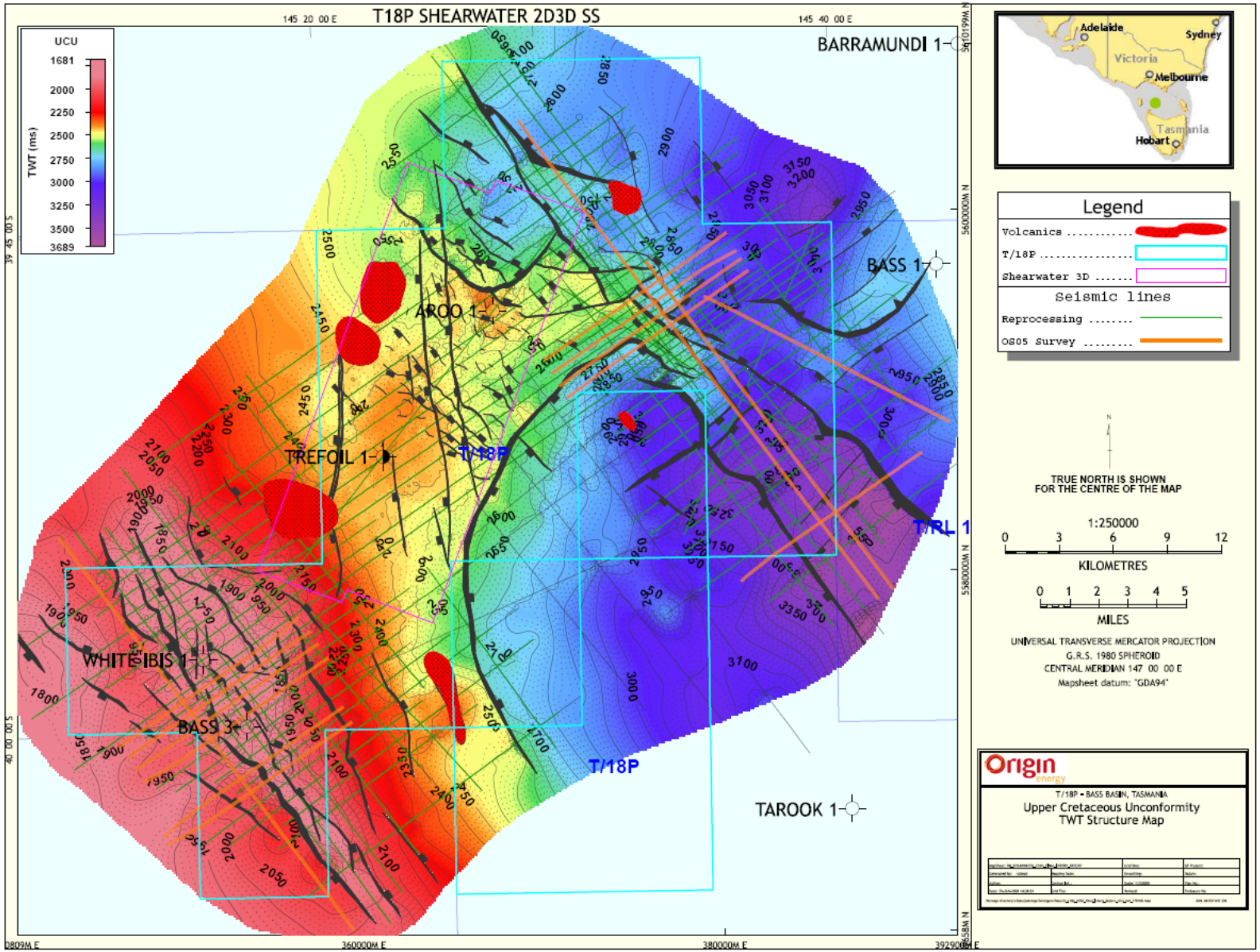
Enclosure 1: T/18P Prospects and Leads



Enclosure 2: T/18P E1 Sand TWT Structure Map



Enclosure 3: T/18P 2973m Sand TWT Structure Map



Enclosure 4: T/18P Upper Cretaceous Unconformity TWT Structure Map