

# WHITE IBIS 1 WELL PROPOSAL T/18P



**T/18P  
BASS BASIN  
TASMANIA**



## SUMMARY

The proposed White Ibis 1 exploration well is to be drilled at SP 1139 on seismic line BHB96-107 in permit T/18P in the Bass Basin, Tasmania. The primary objective is to test a series of Late Cretaceous to Palaeocene intra-EVCM stacked shoreline and delta plain reservoir/seal couplets in a fault-dependent closure situated over a basement high west of the Yolla Trough.

White Ibis 1 is situated crestally at the primary objective level. It is to be drilled approximately 45 metres updip and approximately 4300 metres northwest along strike from Bass 3, an exploration well drilled by Esso in 1967. Bass 3 was plugged and abandoned after a Formation Integrity Test recovered 29cf of gas, 800cc of condensate and 12259cc of discoloured water. Improved seismic data acquired over the White Ibis structure subsequent to the drilling of Bass 3 have revealed distinct amplitude, amplitude versus offset (AVO) and acoustic impedance anomalies at an equivalent stratigraphic level to the FIT in Bass 3. The AVO anomaly appears to conform with structure and may represent a direct hydrocarbon indicator (DHI). Fault-seal analysis work on the major bounding fault at White Ibis suggests a high probability that this fault is sealing. White Ibis 1 will test a series of shoreface and channel sandstones sealed by interbedded intraformational lacustrine and delta plain shales. Reservoir risk is considered to be low based on core data and the FIT recovery of hydrocarbons from Bass 3.

The most likely hydrocarbon charge for the White Ibis prospect is from gas mature source rocks within the *M.diversus* and *L.balmei* zones in the Yolla Trough. Migration of gas is likely to have occurred along laterally continuous sandstone conduit beds from the source kitchen, migrating updip to the west into the White Ibis structure.

White Ibis 1 is also located optimally to test a secondary, fault independent structural closure at the Top EVCM, topsealed by the Demons Bluff formation shales.

It is prognosed that White Ibis 1 will intersect the Top EVCM secondary objective at 1582 mSS, the Top Palaeocene primary objective at 1924 mSS and will reach total depth at 2150 mSS within metamorphosed basement rocks.

Deterministic reserve calculations for both the primary and secondary targets show that potential gas-in-place volumes at the primary objective range from 134 BCF (P90 case) to 753 BCF (P10 case). At the secondary objective in-place gas-only and in-place oil-only deterministic reserve calculations range from 8 MMSTB (P90 case) to 32 MMSTB (P10 case) for oil and 9 BCF (P90 case) to 40 BCF (P10 case) for gas.

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**TABLE 1 PROSPECT SUMMARY**

<b>WELL NAME</b>	White Ibis 1	
<b>LOCATION</b>	Seismic	SP 1139 on line BHB96-107
	Latitude	: 39° 57' 49.61"S
	Longitude	: 145° 15' 17.28"E
	Northing	: 5 574 789
	Easting	: 350 947
<b>PERMIT</b>	T/18P, Offshore Bass Basin	
<b>INTEREST HOLDERS</b>	Boral Energy Resources Ltd	57.6%
	Premier Petroleum (Aust) Ltd	42.4%
<b>TYPE OF WELL</b>	Exploration	
<b>ANTICIPATED SPUD</b>	May 1998	
<b>ELEVATION</b>	Water Depth :	60m
	Kelly Bushing :	12.5m
<b>PROPOSED TD</b>	2150mSS	
<b>PRIMARY OBJECTIVE</b>	Intra-Eastern View Coal Measures sandstones of Late Cretaceous to Palaeocene age	
<b>SECONDARY OBJECTIVE</b>	Uppermost sandstones of the Eastern View Coal Measures	

# 1 INTRODUCTION

## 1.1 Geographical Location

The proposed well, White Ibis 1, is to be drilled in the offshore Bass Basin in permit T/18P approximately 220 km south of Melbourne and 130 km north of Tasmania (Figure 1). White Ibis 1 will be located approximately 4300 metres northwest of the Bass 3 exploration well. The proposed pre-spud geographical coordinates are presented in Table 1.

## 1.2 Permit Details

White Ibis 1 will be located in permit T/18P which was granted on 22 December 1993 with Boral Energy Resources Ltd as Operator. The current interest holders are shown in Table 1. Although Boral Energy Resources Ltd is the Joint Venture Operator, Premier Petroleum (Australia) Ltd will operate the drilling of White Ibis 1. The commitment work program and actual activities for the current term are shown below:

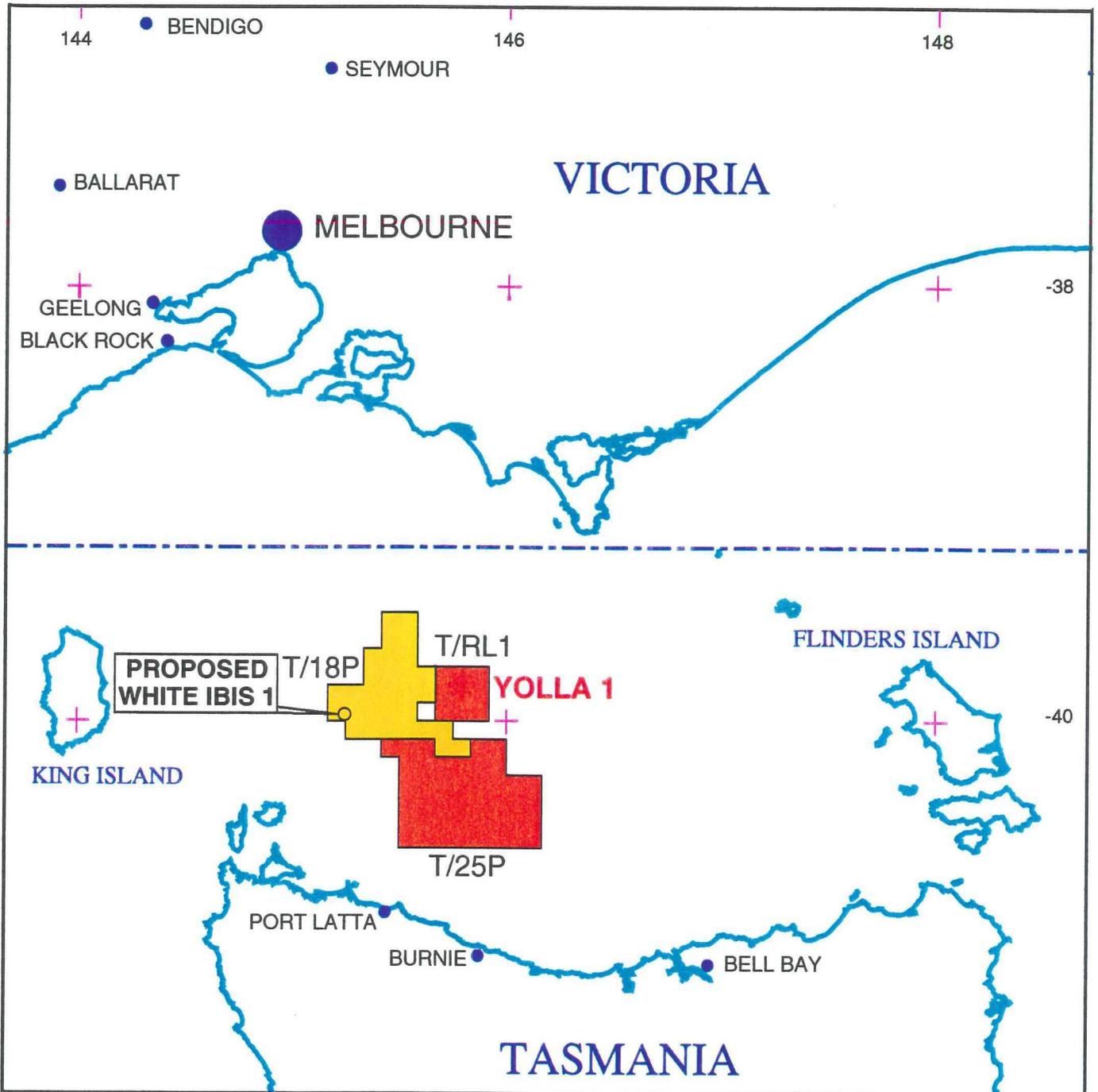
Table 2 Permit Obligations

YEAR	ENDING	COMMITMENT	ACTUAL
1	21/12/94	G & G review	541km seismic
2	21/12/95	500km seismic	G & G; 565km reprocessing
3	21/12/96	500km seismic	569km seismic
4	21/12/97	G & G review	G & G review
5	21/12/98	1 well	

The drilling of White Ibis 1 will fulfill the Year 5 permit obligation. If renewal is sought beyond 1998, 50% relinquishment is applicable. The area relinquished may depend on the results of White Ibis 1.

## 1.3 Previous Exploration

Exploration within the current permit boundaries commenced in 1963 with the acquisition of 410.1km of 2D seismic data. The first well in T/18P, Bass 3, was drilled by Esso in 1967. Bass 3 was drilled to a total depth of 2422 mSS on an adjacent fault block approximately 4.3km southeast along strike and approximately 45m downdip of the proposed White Ibis 1 well. The well was plugged and abandoned after a Formation Integrity Test recovered 29cf of gas, 800cc of condensate and 12259cc of discoloured water.



**BASS BASIN TASMANIA  
LOCATION OF T/18P**

Including Bass 3, seven petroleum exploration wells have been drilled in T/18P. Five of these wells have encountered hydrocarbon shows but no commercial discoveries have been made to date. Table 3 summarises the results of wells drilled in T/18P.

Table 3 Well History: Permit T/18P

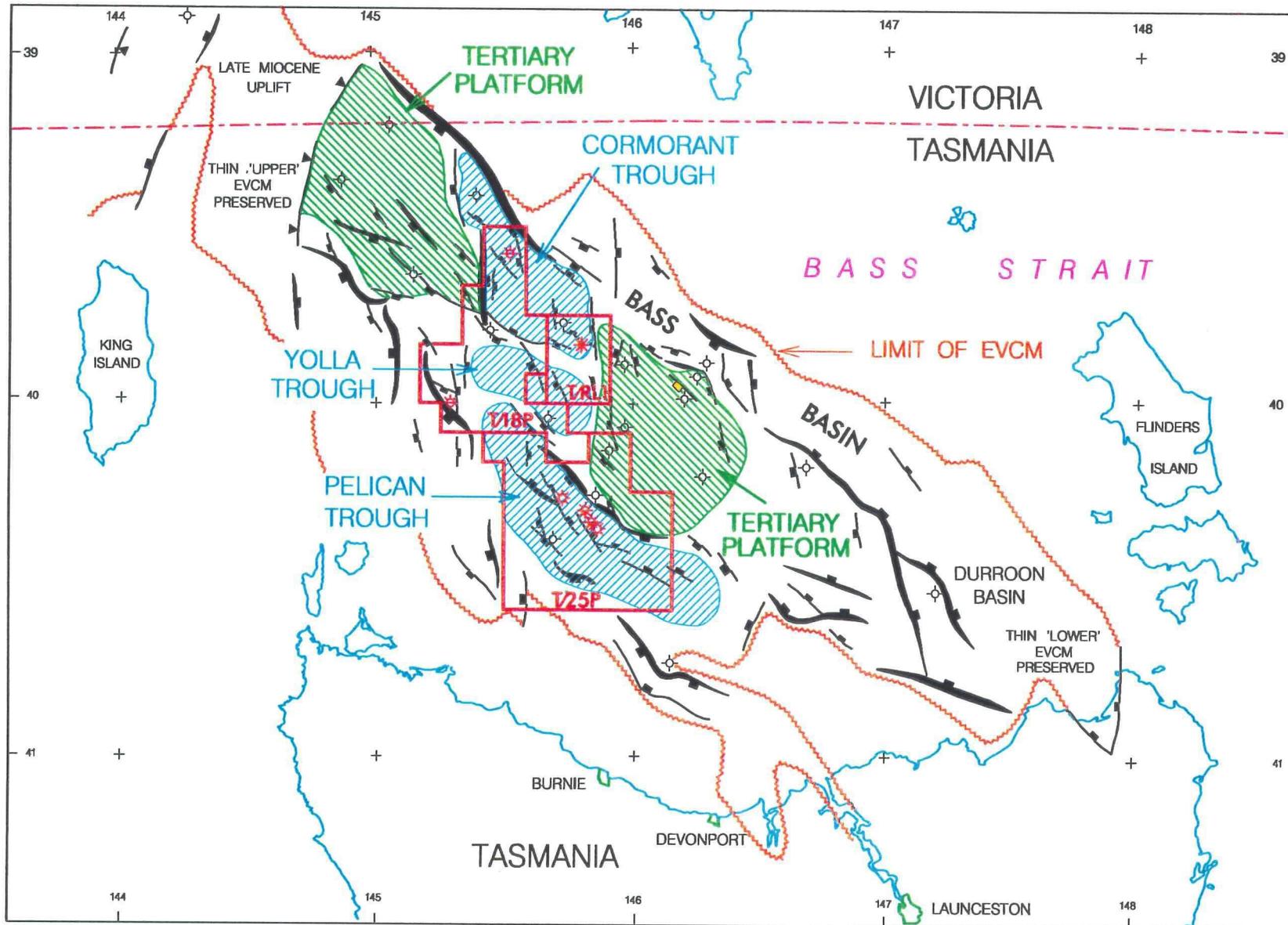
YEAR	WELL	OPERATOR	TARGET	RESULT	SHOWS
1967	Bass 3	Esso	EVCM	P & A	FIT gas/condensate recoveries
1970	Cormorant 1	Esso	Mid EVCM	P & A	FIT oil/gas recoveries
1972	Tarook 1	Esso	Top EVCM	P & A	No shows
1974	Toolka 1A	Esso	EVCM	P & A	Gas/Condensate shows
1974	Aroo 1	Hematite	Mid EVCM	P & A	Gas/Condensate shows
1985	Koorkah 1	AMOCO	Basal EVCM	P & A	No shows
1992	King 1	SAGASCO	Top EVCM	P & A	Oil/Gas shows

Subsequent to the drilling of King 1, over 1000km of modern 2D seismic data were acquired. Interpretation of these data has led to the identification of several drillable prospects in T/18P including White Ibis situated updip of Bass 3.

#### 1.4 Regional Geology

The Bass Basin is located offshore in southeastern Australia between Victoria and Tasmania (Figure 2). It is one of a series of basins along the southern margin of Australia that evolved as a result of Cretaceous – Early Tertiary rifting between Australia and Antarctica and, to a lesser extent, Tasman Sea rifting.

The Bass Basin is a failed intracratonic 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 Pelican, Yolla and Cormorant Troughs comprise the major depocentres in the Bass Basin (Figure 2). These are fault bounded half-grabens that progressively developed via growth faulting during the active rifting and thermal subsidence



BASS BASIN - TASMANIA  
TECTONIC ELEMENTS  
MAP

phases of basin evolution. The dominant structural trend in the basin is northwest – southeast, highlighted by the orientation of the major faults and troughs (Figure 2).

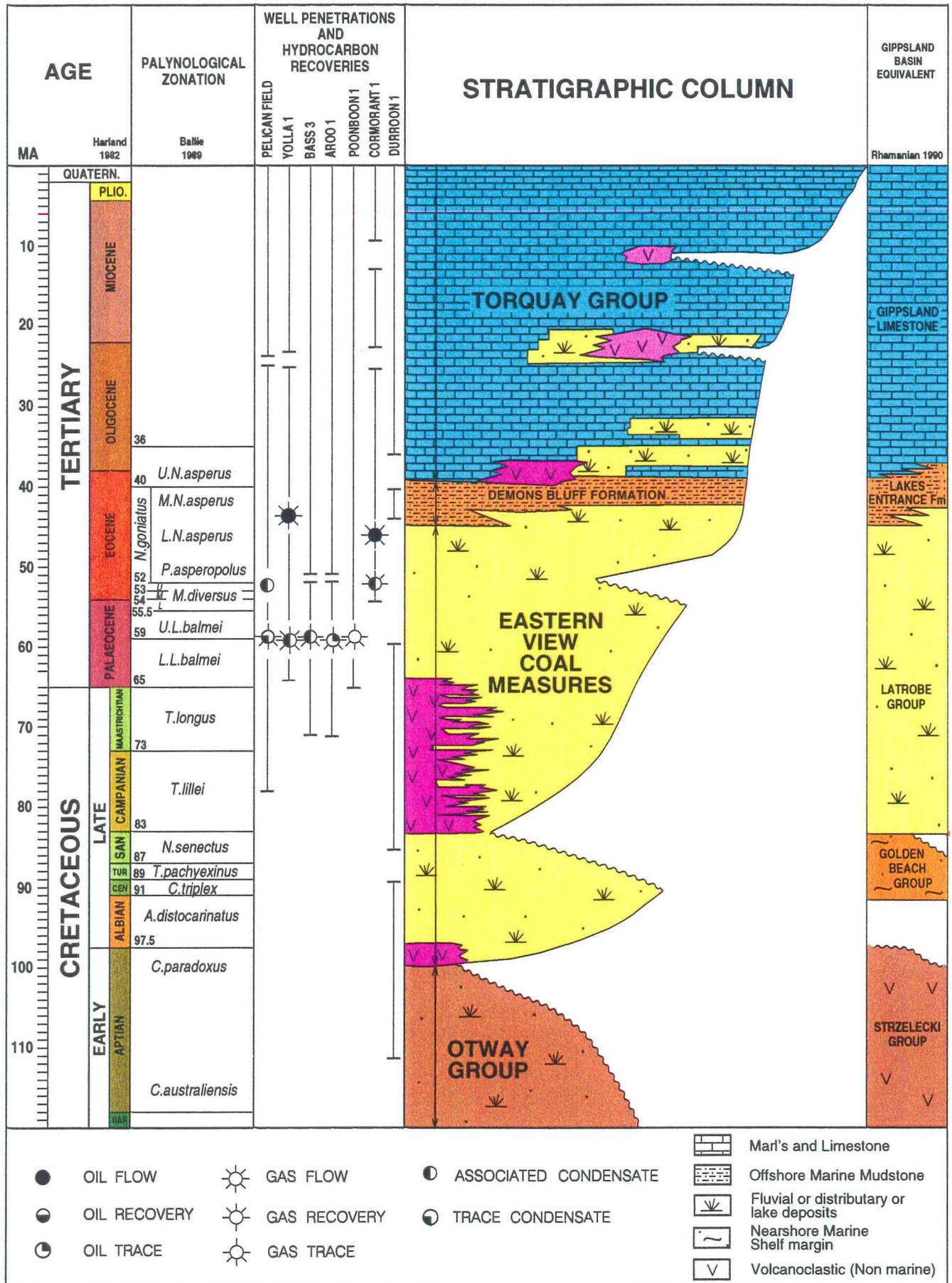
The stratigraphic succession in the Bass Basin comprises sediments ranging in age from Lower Cretaceous to Recent (Figure 3). The Lower Cretaceous Otway Group rests unconformably on pre-rift Palaeozoic black shales and quartzites and consists of clastic, volcanoclastic, fluvial and deltaic sediments ranging from coarse sands through to shales and coals. The Otway Group has not been penetrated in T/18P and the nearest well control is provided by Duroon 1 located approximately 170km to the southeast which intersected some 1500m of sequence. The Otway Group is viewed as being less prospective than the overlying Eastern View Coal Measures (EVCN) within T/18P.

Overlying the Otway Group are the prospective Lower Cretaceous to Upper Eocene Eastern View Coal Measures which comprise a thick sequence of sandstones, siltstones, shales and coals deposited in predominantly fluvial, deltaic and lacustrine environments occasionally subject to marine incursions. Seismic data suggests that the EVCN are over 4000m thick in the troughs. The EVCN thins markedly towards the basin margins and exhibits both onlap onto basement and erosional truncation following uplift.

In a broad sense, the EVCN can be subdivided into three sequences separated by intraformational unconformities. The lowermost sequence of EVCN sediments is largely unexplored due to its depth of burial. This sequence is bounded by mappable unconformities which occur at the base of the EVCN and within the *N.senectus* zone suggesting that this sequence is, in part, the stratigraphic equivalent of the Golden Beach Group in the Gippsland Basin. Seismic data indicate that in some areas the lower EVCN sequence is top-sealed by volcanics which provide the possibility of play styles similar to the Kipper oil and gas field in the Gippsland Basin.

The middle sequence of EVCN sediments is bounded by the basal *N.senectus* unconformity and an unconformity at the base of the upper *M.diversus* zone. Deposition during the *T.longus* and *L.balmei* zones was controlled by compaction-induced tectonic subsidence with associated growth faulting. The upper part of this sequence has been penetrated by the Bass 3 and Aroo 1 wells in T/18P, and contains the major gas accumulation encountered by the Yolla 1

# BASS BASIN - TASMANIA STRATIGRAPHIC COLUMN



well in T/RL1. The middle EVCM sequence is now the major focus for play identification in the block and forms the primary target for White Ibis 1.

The uppermost sequence of EVCM sediments lie between the unconformity at the base of the upper *M.diversus* zone and the top of the formation. Mapping has highlighted a change in the tectonic regime to that of a simple sag basin characterised by only minor faulting. The lack of structure diminishes the probability of suitable plays at this level, although an oil and gas accumulation is present at Yolla 1 in T/RL1 and significant oil and gas shows were recorded in Cormorant 1. This is in contrast with the Gippsland Basin where most oil and gas fields are trapped in the upper Latrobe Group, the stratigraphic equivalent of the middle and upper sequences of the EVCM.

Conformably overlying the EVCM is the Late Eocene Demons Bluff Formation. Lithologically this unit consists of a transgressive sequence of fine grained carbonaceous shales and silts deposited in an open marine environment. The unit has an average thickness of approximately 120m, but thins toward the basin margins. The Demons Bluff Formation provides a regional top seal to hydrocarbons reservoired in the topmost sands of the EVCM as demonstrated at Yolla 1.

The Demons Bluff Formation is overlain by the Oligocene to Pliocene age Torquay Group which broadly consists of a basal sequence of marls and calcareous shales which grade upwards into a sequence of bioclastic limestones. The Torquay Group ranges in thickness from approximately 450m around the basin margins to about 1000m in the Cormorant area.

The Angahook Formation, deposited from the Lower Oligocene to Lower Pliocene, forms a distinct but geographically localised basal unit of the Torquay Group. Angahook Formation sediments have not been identified in all wells drilled in the Bass Basin and appear to represent reworked volcanoclastics and terrigenous sediments proximal to Miocene volcanoes. Deposits consist of a mix of interbedded volcanoclastics, sandstones, claystones and dolostones. Sediments belonging to this formation have been identified in outcrop along the Torquay Embayment in southern Victoria and have been identified at Yolla 1 where it has been resolved into four separate seismically mappable units. The Angahook Formation is not likely to be developed at White Ibis 1.

The Bass Basin displays evidence of geographically widespread igneous activity. Volcanic lavas and pyroclastics are associated with the basal and intra-EVCM unconformities, and intrusives and extrusives of Oligocene to Miocene age, relating to the change from tensional to a compressional tectonic regime in the Late Tertiary, have been intersected in a number of wells in the basin. Seismic data allow the mapping of shallow volcanic rocks with a high degree of confidence, in contrast with the intrusives and deeper extrusives which are difficult to image.

## **2. PROSPECT DESCRIPTION**

### **2.1 Introduction**

The White Ibis structure at the primary objective level comprises a large tilted fault block situated over a Lower Cretaceous ridge west of the Yolla Trough. White Ibis 1 will test stacked Late Cretaceous and Palaeocene shoreline and fluvial facies reservoir sands sealed by intraformational shales within the Eastern View Coal Measures.

### **2.2 Structure**

The basement high over which the White Ibis prospect lies formed during Early Cretaceous rifting between the Australian and Antarctic plates. During and post deposition of the overlying EVCM sediments, drape, compaction and growth faulting comprised the major mechanisms forming the positive structural feature at White Ibis.

Seismic data acquired since the drilling of Bass 3 has produced improved images at depth. These data have revealed that Bass 3 was drilled “off structure” leaving approximately 45 metres of updip potential at White Ibis.

In the Palaeocene primary target, seismic reflection data over the White Ibis structure has revealed distinct amplitude, AVO and acoustic impedance anomalies at an equivalent stratigraphic level to the FIT in Bass 3. Additionally, the AVO anomaly appears to conform with the structure suggesting that the anomaly could be a DHI.

Fault – seal analysis on the major bounding fault has been undertaken at White Ibis. Calibration with data from Yolla suggests a high probability that the White Ibis fault is sealing.

The smaller, secondary target at White Ibis has been mapped as a fault-independent four way dip closure at the Top EVCM. Hydrocarbons have been encountered at this level in both Cormorant 1 in T/18P and Yolla 1 in the adjoining T/RL1 permit.

### 2.3 Reservoir

The primary reservoir targets at White Ibis 1 are the shoreface and fluvial sandstone beds of the Palaeocene and Late Cretaceous Eastern View Coal Measures.

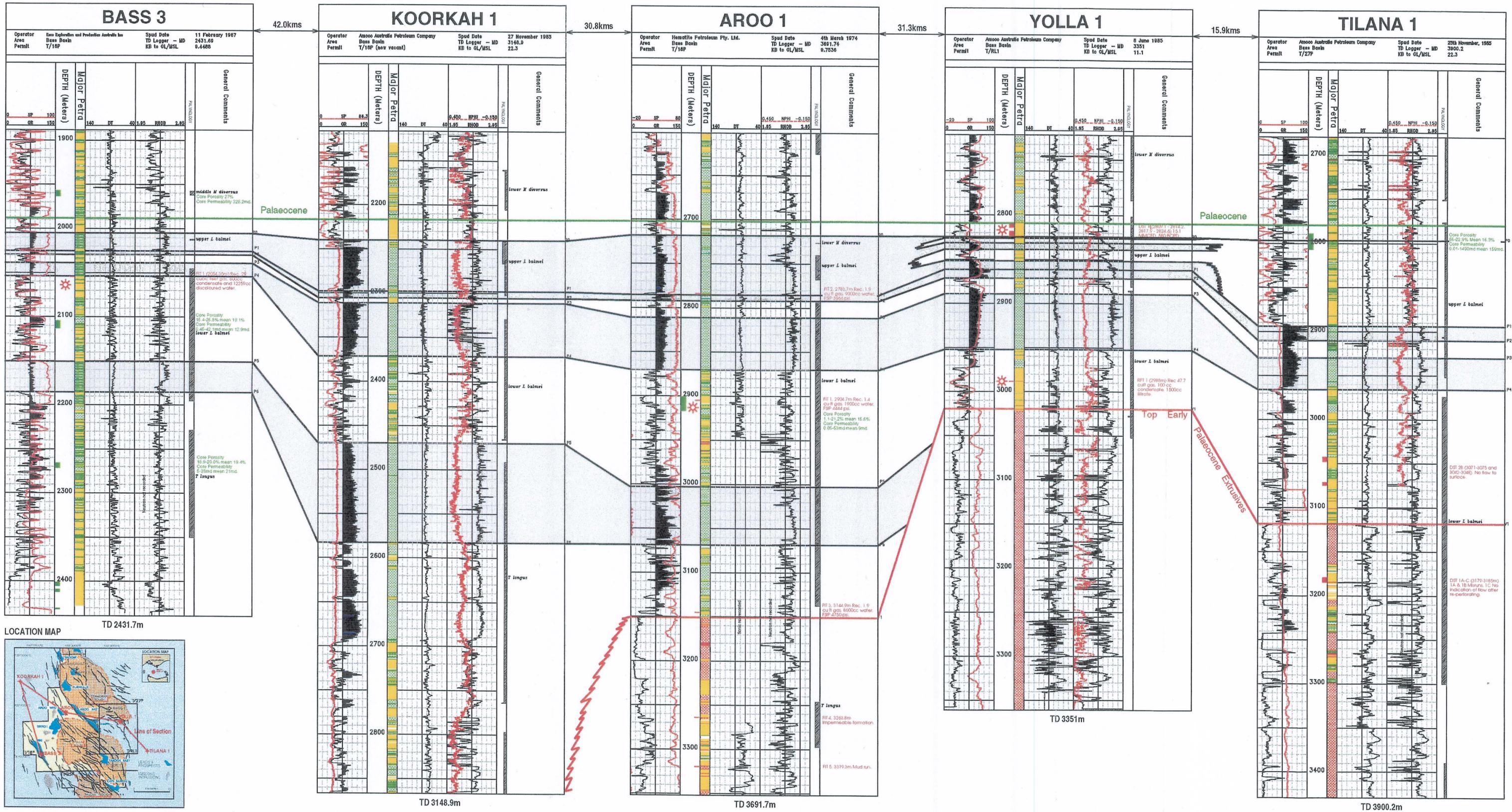
The intra-EVCM sands were deposited in a combination of terrestrial and shoreface subaqueous/subaerial environments. Therefore, sand development and reservoir quality and continuity constitute significant risks in the Bass Basin as shown in Figure 4 and Enclosure 2. While it is possible to correlate regional sand trends within a gross sequence at the objective level, poor well control and the depositional history of individual sand packages makes correlation difficult at smaller scales.

In a 1987 report by AMOCO on the prospectivity of the Bass Basin, the logs and core from the Late Cretaceous and Palaeocene reservoir sands at Bass 3 were interpreted to represent interbedded lacustrine or estuarine silts, shales and channel sands overlain by stacked shoreface, delta plain channels, crevasse splay and marsh sequences. These interbedded channel and shoreface sands and shales have an average porosity of 20% and measured permeabilities ranging from <1 md to >300 md and represent a series of stacked reservoir/seal couplets analogous to the stacked reservoirs found at Yolla 1 (Figure 4 and Enclosure 2).

The sediments present at the Top EVCM in Bass 3 were interpreted to have been deposited in a lower to upper shoreface setting. Porosity and permeability measured from core at this level in Bass 3 shows an average porosity of 25% and permeability ranging from <1 md to > 250 md.

Reservoir risk is considered to be low at White Ibis 1 based on core data and the FIT recovery of hydrocarbons at Bass 3. Evidence of the lateral continuity of major sand and shale packages, albeit showing variances in thickness and reservoir quality across the basin, is demonstrated by correlation between Bass 3, Koorkah 1, Aroo 1, Yolla 1 and Tilana 1 (Figure 4 and Enclosure 2).

# T/18P BASS BASIN STRATIGRAPHIC SECTION DATUM : TOP PALAEOCENE



## 2.4 Seals

The stacked reservoir sands at the White Ibis structure are individually topsealed by intraformational lacustrine and delta plain shales of varying thicknesses as indicated at Bass 3. Although igneous intrusives and extrusives have been encountered throughout the basin, none were encountered at Bass 3 nor are expected to be intersected at White Ibis 1 and hence play no part in forming possible hydrocarbon seals.

Lateral sealing along the major bounding fault at White Ibis is provided by juxtaposition of reservoir sands against intra-EVCM shales on the downthrown side of the fault and generation of fault plane seals by shale gouge.

## 2.5 Source Rocks, Maturation and Migration

The existence of hydrocarbons at Bass 3 proves the existence of source, maturation and effective charge of hydrocarbons into the White Ibis structure. The Yolla trough to the east of White Ibis is considered to be the source rock kitchen for hydrocarbons in the White Ibis structure. Source rocks in the Yolla trough are mature enough for gas generation. Migration of such gas will have occurred along laterally continuous sandstone conduit beds from the source kitchen, migrating updip to the west into the White Ibis structure.

The best EVCM source potential occurs within the *M.diversus* and *L.balmei* zones which are believed to source the hydrocarbons at Bass 3, Yolla 1 and Cormorant 1. Geochemical studies of selected shales within the above-mentioned zones at Yolla 1 show that all samples have TOC contents ranging from 2 – 6% with 2 – 3% TOC representing a good source rock, 3 – 4% TOC representing a very good source rock and TOC values > 4% defining an excellent source. Additional source rocks are likely to be developed in the Late Cretaceous part of the EVCM but have not been penetrated by drilling.

Maturity studies of wells within the Pelican and Cormorant Troughs indicate that the shales within the pre-middle *M.diversus* zone are mature for hydrocarbon generation as shown by the vitrinite reflectance profile (Figure 5). Vitrinite reflectance data are not available for the Yolla Trough with the shallow and only well Tarook 1 providing insufficient data. However, given the fairly uniform nature of the EVCM over the Bass Basin (Figure 4) and the

absence of insignificant variations in regional heat flow, maturity data from Cormorant 1 (Figure 5) can be applied with confidence to the Yolla Trough.

### 3. SEISMIC INTERPRETATION

#### 3.1 Data Quality

The White Ibis structure is well defined by a 1 kilometre grid of modern seismic data. The 1996 Hummock seismic survey provided approximately 180 kilometres of control to mature the structure to drillable status.

There is an additional 350 kilometres of pre-1996 data, with all data post-1970 being reprocessed. These data were loaded onto a Geoquest workstation for interpretation and mistie analysis. The Petrosys mapping package was used for depth conversion and map production.

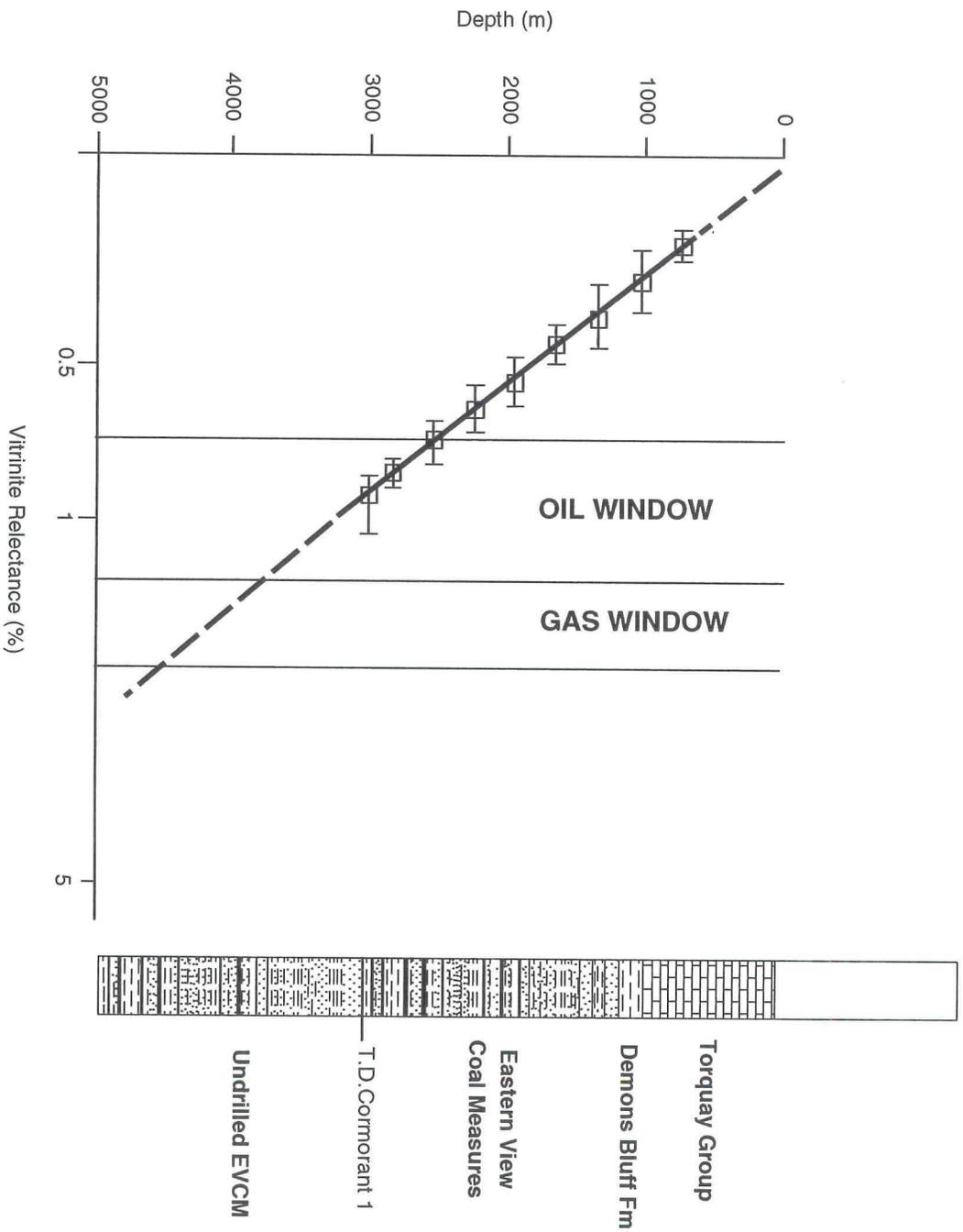
#### 3.2 Misties

Prior to interpretation, a large effort went into identifying vintage consistent bulk shifts which were applied to bring all data in line with the basin wide TQH5 seismic data. This step aided subsequent interpretation and marker recognition by reducing misties. Following interpretation, a three step mistie correction was applied:

1. Bulk shifts were applied to pre-1992 data on a line-by-line basis, to correct to the more modern data.
2. Bulk shifts were calculated and applied to all data.
3. Residual shifts were applied to reduce all misties to zero.

Internally within each vintage of seismic data, the misties were generally small, although greater variability did exist in the pre-1980's data. Busts on these lines were handled by individual adjustment on a line-by-line basis.

With the predominance of one vintage of data (1996 Hummock survey) over the White Ibis prospect, the misties were generally insignificant.



**BASS BASIN - TASMANIA**  
**T/18P**  
**MATURITY PLOT**  
**CORMORANT 1**

### 3.3 Synthetic Seismic-to-Well-Tie

A synthetic seismogram was produced for the Bass 3 well using the LogM software. Check shot corrected sonic and density data were used to generate the reflection coefficients. These were convolved with four Ricker wavelets of different frequencies, being either 20, 30, 40, or 50 Hz. The synthetic is included here as Enclosure 1.

A very good character tie was made with seismic line BHB96-100 at shotpoint 1595, using the 40 Hz reversed polarity display. This confirms the conclusion of the AVO Study report which achieved a good phase match between well and seismic using SEG negative polarity.

To achieve the character match with the seismic line, a 25 millisecond adjustment was added to the synthetic seismogram.

### 3.4 Structural Mapping

The seismic mapping of the White Ibis Prospect was undertaken as part of a basin-wide structural mapping project. Three events were correlated regionally, namely the Top Eastern View Coal Measures, Top Middle *M.diversus*, and Near Top Palaeocene (Top Upper *L.balmei*). A further six seismic events within the EVCM were correlated locally over and around the White Ibis structure. These are shown on the depth prognosis of Table 4, along with the depth tie to the Bass 3 well.

The White Ibis structure is developed as drape over a prominent basement high on the western flank of the Yolla Trough. (Figure 6). The Basement is represented by high amplitude, low frequency seismic events with a heavily eroded topography. The latter causes some ambiguity for seismic interpretation with respect to diffractions and tuning effects, but this is generally resolved in most areas.

The Top Palaeocene is a good continuous seismic marker in this area. Structure at this level, as shown by Figure 7, is a northwesterly trending interlocking fault system. Closure at this level is entirely fault-dependent, with a potential to come 45 metres updip from the Bass 3 well location.

The Top EVCM structure at White Ibis (Figure 8) is developed as a fault independent four-way-dip closure updip of the Bass 3 well.

## WHITE IBIS DEPTH PROGNOSIS

STRATIGRAPHIC LEVEL	BASS 3						WHITE IBIS 1	
	Depth KB (metres)	Depth S/S (metres)	Two-way-Time (msecs)	Synthetic Time (msecs)	Synthetic time ADJUSTED	Interval Velocity (metres/sec)	Two-way-Time (msecs)	Depth S/S (metres)
SEAFLOOR	69.0	-59.5						60
						2202		
*NEAR TOP DEMONS BLUFF FM	1443.8	-1434.4	1303	1265	1290	3224	1297	1428
*TOP EVCM	1619.5	-1610.1	1412	1386	1411	3300	1393	1582
*TOP LOWER N.ASPERUS	1655.8	-1646.4	1434	1410	1435	3188	1424	1634
*N.ASPERUS UNCONFORMITY	1842.3	-1832.9	1551	1525	1550	3276	1532	1806
*MIDDLE M.DIVERSUS	1945.5	-1936.1	1614	1587	1612	3904	1584	1891
*TOP PALAEOCENE	1998.2	-1988.8	1641	1617	1642	3506	1601	1924
*INTRA-PALAEOCENE	2054.3	-2044.9	1673	1648	1673	3672	1630	1975
*LATE CRETACEOUS	2197.5	-2188.1	1751	1727	1752	4074	1668	2045
*NEAR TOP BASEMENT	2395.1	-2385.7	1848	1836	1861	4074	1695	2100
TD	2431.69	-2422.2						2150

### \*MAPPED EVENTS

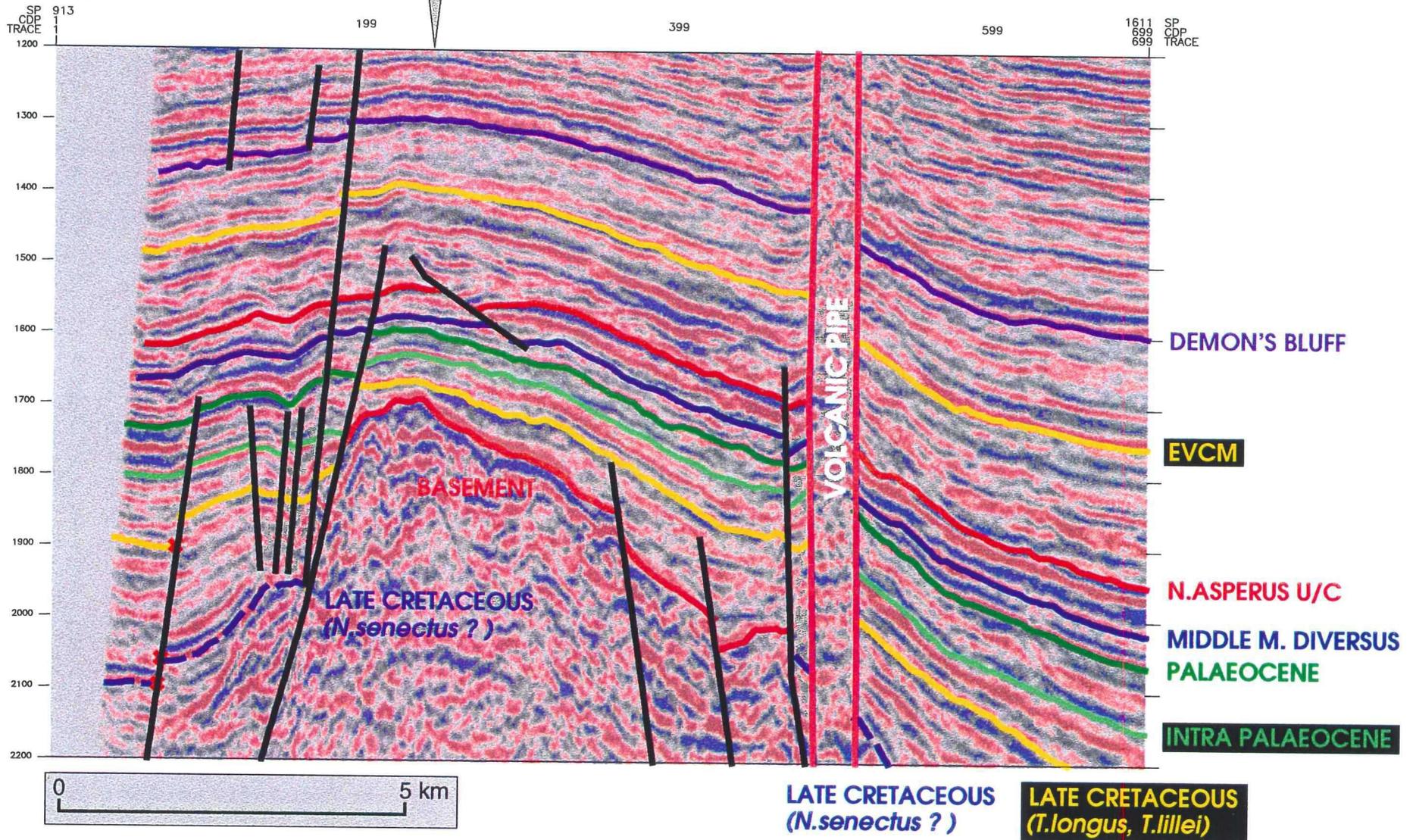
Notes: Synthetic Time based on check-shot corrected sonic and density data  
 Synthetic Time ADJUSTED from comparison of reversed polarity synthetic to seismic line BHB96-100, indicating a 25 msec shift to tie

### LOCATION DATA:

White Ibis 1	Seismic Line BHB96-107 sp 1139	Easting	350947	Latitude	39 57 49.61 S
		Northing	5574789	Longitude	145 15 17.28 E

# White Ibis Dip Line BHB96-107

## WHITE IBIS PROSPECT



Bass 3 has no fault independent closure at this level. The structure is elongated northwest-southeast with approximately 20 metres of vertical closure.

### **3.5 Depth Conversion**

The depth structure maps of Figures 7 and 8 were produced by using an average velocity down to each level, based on the Bass 3 well velocity data as follows:

- 2414 metres/second to Top Palaeocene
- 2271 metres/second to Top EVCM

For the detailed depth prognosis, the additional mapped seismic markers were used in the depth conversion process. An interval velocity for each mapped level was determined from the Bass 3 well, and the depth prognosis calculated by summation of intervals. These are listed in Table 4.

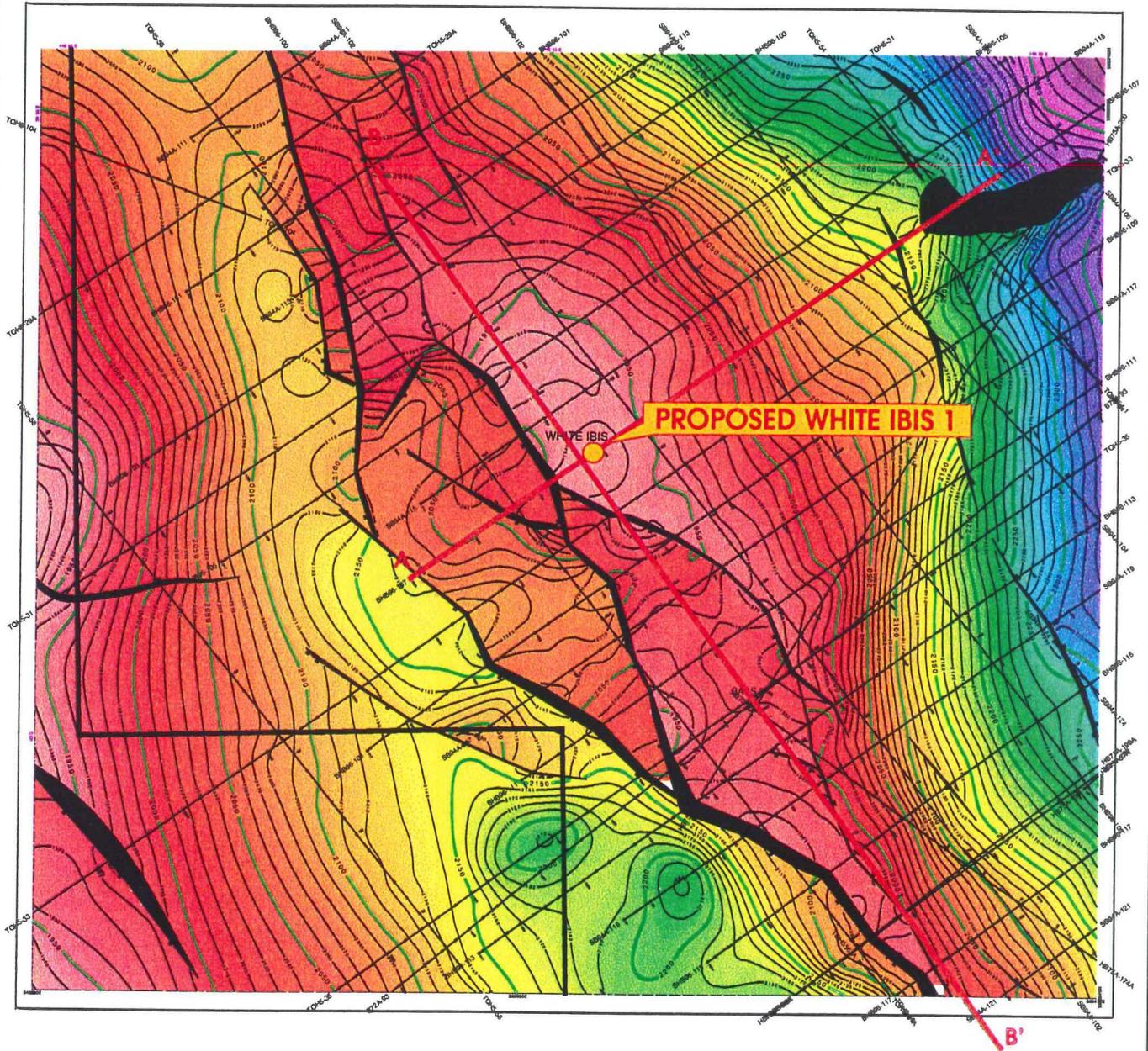
### **3.6 Amplitude verses Offset Study**

An amplitude verses offset (AVO) study and inversion processing was carried out by Robertson Research on line BHB96-100. The Bass 3 well was phase matched to the seismic line, with the conclusion that a 180<sup>0</sup> phase shift be applied to the seismic data to tie the synthetic seismogram at Bass 3 using SEG positive polarity. Three final displays were generated from this study:

1. Intercept times Gradient (Figure 9)
2. Delta Rp (Figure 10)
3. Acoustic Impedance (Figure 11)

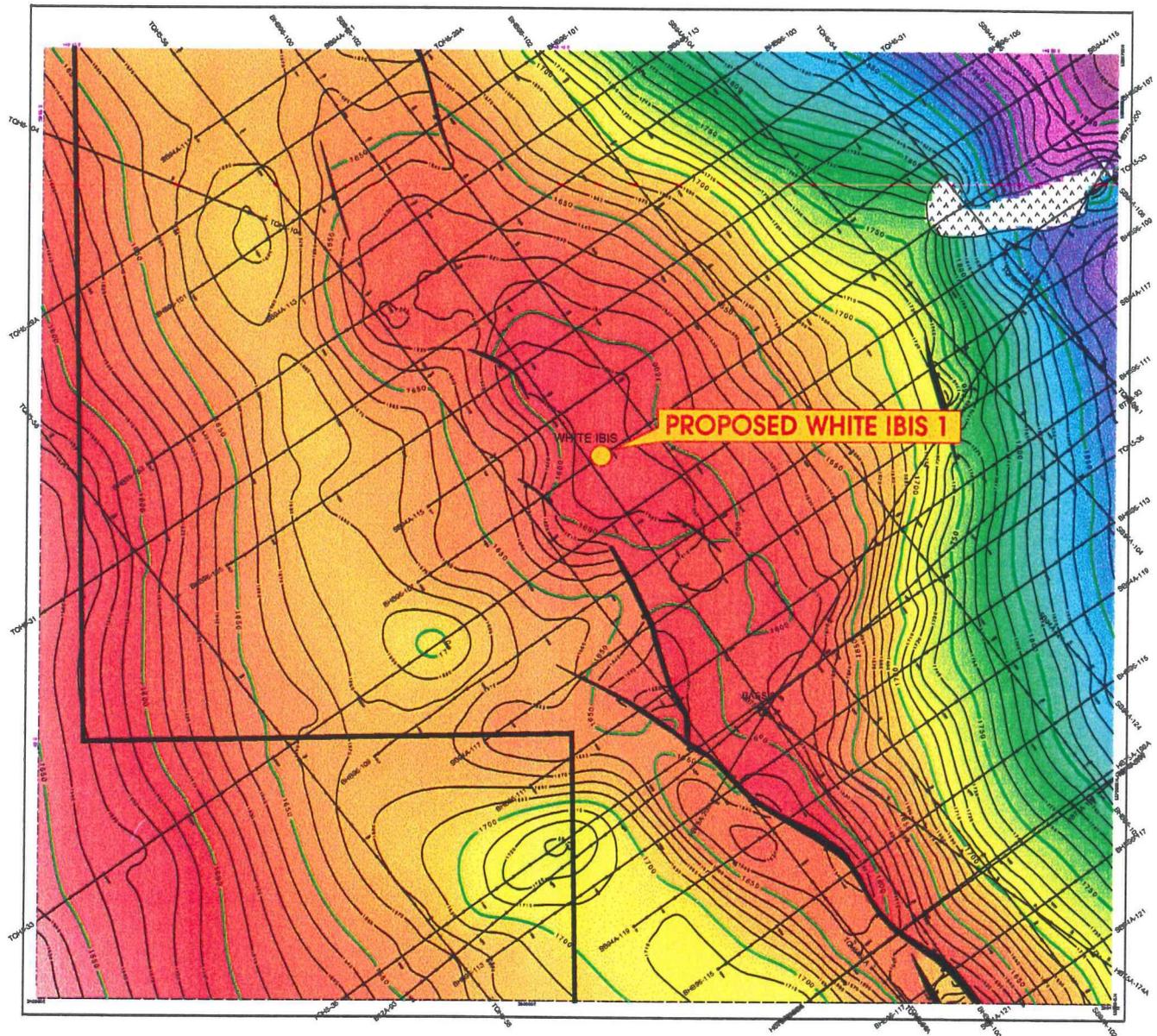
The intercept is the zero offset reflection coefficient, and gradient refers to the change in amplitude with offset. On the display of Figure 9, a red colour indicates increasing amplitude with offset. The Delta Rp results from a technique where a lithological trend is established from the intercept and gradient data. This trend represents the average response of brine-filled rocks. Any deviation from the wet-trend will be displayed as an anomaly on the Delta Rp display (Figure 10). The top of a hydrocarbon sand will be displayed as a blue anomaly, whereas the base is a red anomaly.

WHITE IBIS PROSPECT



**BASS BASIN TASMANIA**  
**T/18P - WHITE IBIS PROSPECT**  
**PALAEOCENE DEPTH STRUCTURE**

WHITE IBIS PROSPECT



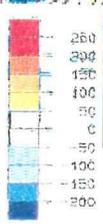
**BASS BASIN TASMANIA**  
**T/18P - WHITE IBIS PROSPECT**  
**EVCM DEPTH STRUCTURE**

WHITE IBIS 1

1.5

1.6

1.7



**BORAL  
ENERGY**

LINE BHB96 - 100  
INTERCEPT TIMES GRADIENT

FIG. 9

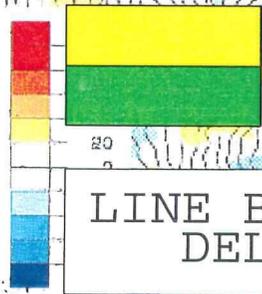
WHITE IBIS 1

1.5

1.6

1.7

**BORAL ENERGY**



20  
5

LINE BHB96-100  
DELTA Rp

FIG. 10

WHITE IBIS 1

BASS 3

1.5

1.6

1.7



LINE BHB96-100  
ACOUSTIC IMPEDANCE

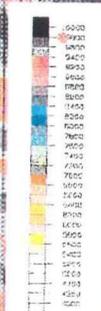


FIG. 11

The acoustic impedance data will show a lower value for hydrocarbon filled sands when compared to the equivalent sands in the Bass 3 well. Lower acoustic impedance could also represent sands of a higher porosity.

The following observations can be made at the White Ibis location:

- The Delta Rp plot shows a continuous blue trough at 1610 milliseconds.
- The Intercept times Gradient has a corresponding red colour, indicating increasing amplitude with offset.
- The Acoustic Impedance plot indicates this section to have a lower acoustic impedance, than the equivalent sands in Bass 3.
- 1610 milliseconds corresponds in depth to the thin sand developed at 2025 m KB in the Bass 3 well. This equates to approximately 1940 metres S/S at White Ibis 1.
- Sands immediately below this interval recovered gas on FIT at the Bass 3 location.
- A similar AVO study over the Trefoil Prospect, showed that igneous intrusives have a Delta Rp and Intercept times Gradient response of opposite polarity to the response seen at White Ibis.

Figure 12 shows the original migrated section for seismic line BHB96-100.

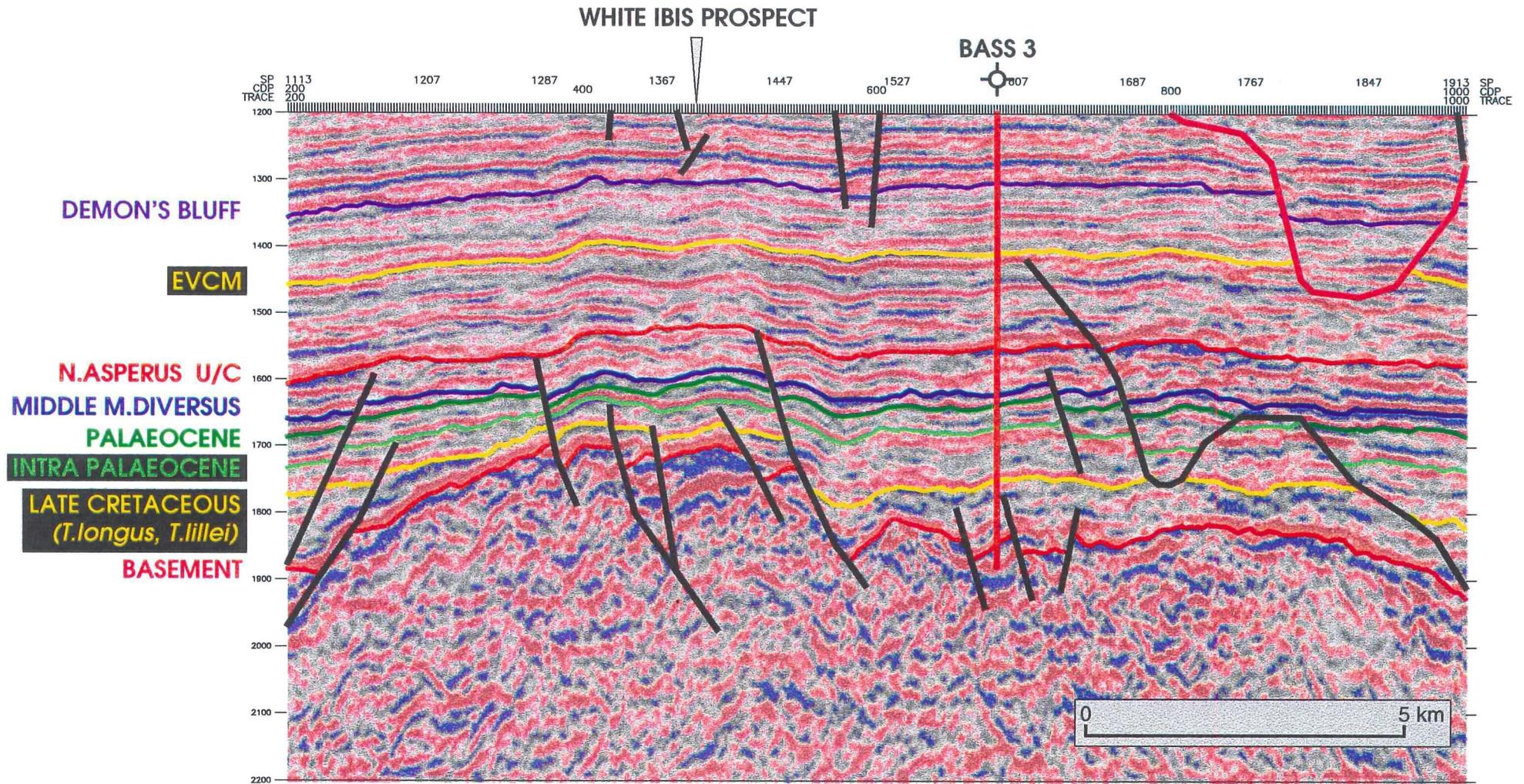
### 3.7 Amplitude Anomaly

There is a seismic amplitude anomaly associated with the Intra-Palaeocene marker. This marker ties at the Bass 3 well at 2054 metres KB, which is the level of FIT 1, that recovered 29 cubic feet of gas. As seen on the map of Figure 13, the amplitude response is structurally conformable. White Ibis 1 is ideally located to test this anomaly.

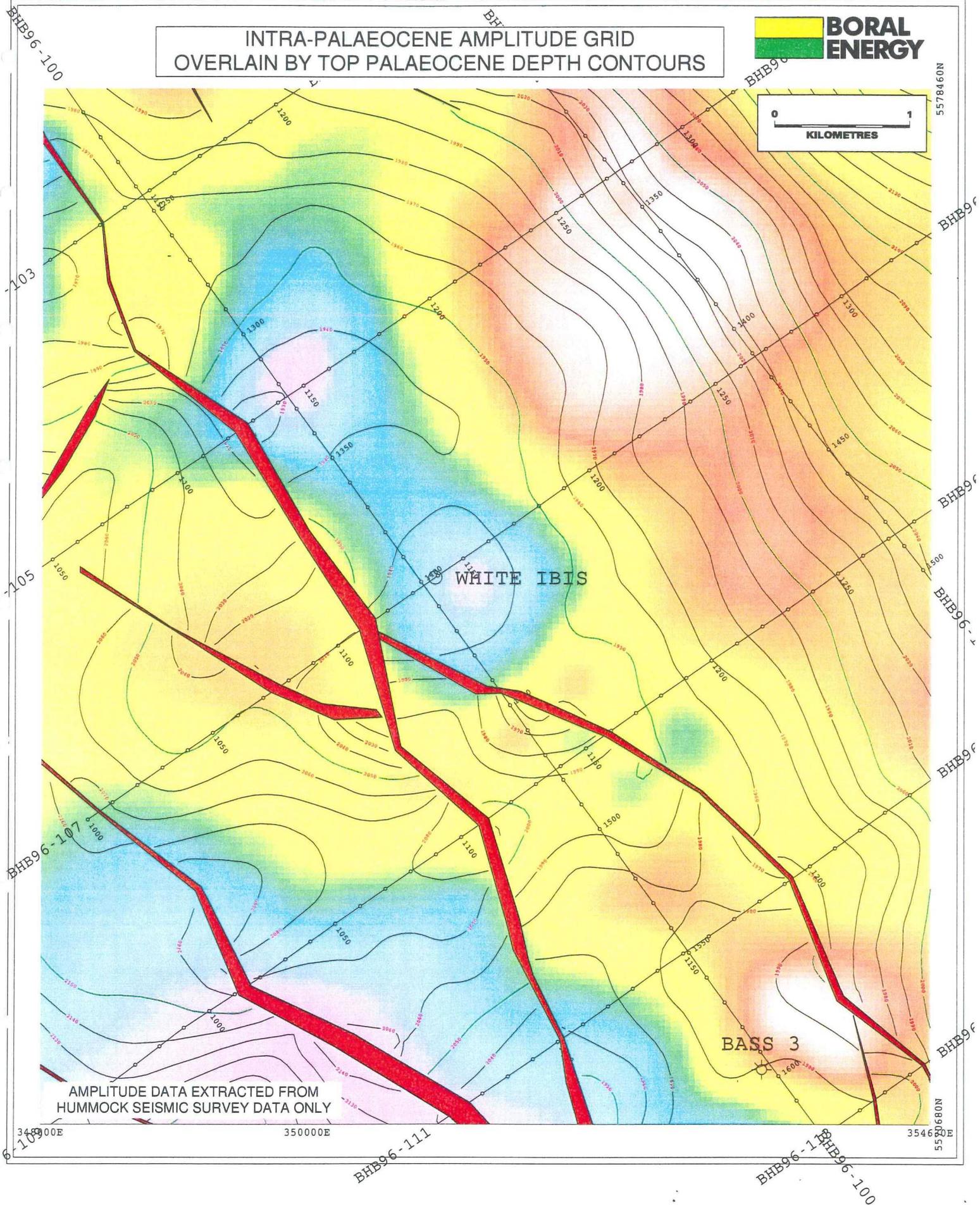
## 4. WELL LOCATION

The White Ibis 1 well location will be at shot point 1139 on seismic line BHB96-107. This is an optimum location for testing the White Ibis structure at the primary and secondary objective levels. White Ibis 1 will be located approximately 45m updip of Bass 3 at the Top Palaeocene level.

# White Ibis Strike Line BHB96-100



INTRA-PALAEOCENE AMPLITUDE GRID  
OVERLAIN BY TOP PALAEOCENE DEPTH CONTOURS



AMPLITUDE DATA EXTRACTED FROM  
HUMMOCK SEISMIC SURVEY DATA ONLY

FIG. 13

#### 4.1 Primary Objective

The primary objective of White Ibis 1 are stacked Late Cretaceous to Palaeocene shoreline and delta plain sandstone reservoirs of the intra-Eastern View Coal Measures. These objectives are characterised by a prominent AVO anomaly. An FIT recovery from the nearby Bass 3 well indicates that the probability of hydrocarbon charge is high. White Ibis 1 will test the primary objective at its crestal location thereby allowing a full evaluation.

#### 4.2 Secondary Objective

The well is also optimally located to test a fault independent structural closure at the Top Eastern View Coal Measures top-sealed by the Demons Bluff Formation shales.

#### 4.3 Predicted Stratigraphy

The following lithological descriptions of the anticipated stratigraphic section are based on data from Bass 3. Note that depths referring to Bass 3 are in metres KB whilst the prognosed depths for White Ibis 1 are in metres subsea (mSS).

##### *Torquay Group (60 – 1428mSS)*

The Torquay Group is composed of an upper bioclastic limestone section and a lower claystone section with the change in rock-type being transitional at around 700 metres. The upper section is expected to comprise grey to light brown coarse to fine grained calcarenite and calcirudite composed of friable and loosely cemented skeletal debris consisting of pelecypods, bryozoans, foraminifera and gastropods. Lesser amounts of rounded, medium to coarse sand and glauconite is also present within this interval. At around 400 metres, grain size may become finer with the micrite content of the rock increasing and clays present in trace amounts. The section will grade from calcirudites and calcarenites to calcilutites with micrite content increasing with depth where below approximately 700 metres the clay content will increase and the rock may grade to a grey to green-brown fossiliferous marl with varying amounts of calcilutite and lesser glauconite.

At around 1150 metres the calcilutites may become interbedded with more argillaceous siltstone. Additionally, very fine grained glauconitic sandstones

(up to 20%) may be intersected up to around 1200 meters, below which the rock may then become dominated by fossiliferous calcimicrite and lesser amounts of calcilutite and glauconite.

The Torquay Group was deposited on a shallow continental shelf (30 – 100 metres of water) in high energy conditions.

#### ***Angahook Formation (- mSS)***

The Angahook Formation is not expected to be intersected in White Ibis 1.

#### ***Demons Bluff Formation (1428 – 1582mSS)***

The Demons Bluff Formation, of Late Eocene age, is predominantly an argillaceous claystone section with thin interbeds of sandstone and dolomitic limestone. The claystones range from dark grey to dark brown, are dominantly argillaceous with a minor calcareous or fossiliferous component. The sandstones are medium brown, very fine grained with minor glauconite and dolomite cement. The sandstones have poor visual porosity.

The Demons Bluff Formation was deposited in a barred basin, marginal marine environment in up to 30 metres of water.

#### ***Eastern View Coal Measures (1582 – 2100mSS)***

The Eastern View Coal Measures penetrated in Bass 3 ranged from Late Eocene to Palaeocene. The contact between the EVCM and the overlying Demons Bluff Formation is gradational with shales becoming more silty and sandy eventually grading into the very fine grained moderately to well sorted and sub rounded quartz sandstones of the EVCM.

The first major sand package was intersected at an approximate depth of 1630 metres in Bass 3. The upper sands at Bass 3 comprise 10% to 100% of sample, are quartzose and predominantly unconsolidated and range in colour from light green to white. The sands are very fine to fine grained with minor medium to very coarse grained intervals, are glauconitic with an argillaceous matrix and show very minor cementation by micrite or dolomite cements. Two cores were cut in the upper section of the EVCM in Bass 3 (Cores 6 and 7). Haskell (1987) described these cores as being heavily bioturbated, argillaceous, very fine grained to fine grained lower to middle shoreface sands

characterised by horizontal and low angle hummocky cross-stratification. Suttill *et. al.* (1987) interpret these to represent lower to middle shoreface and beach to beach ridge depositional settings.

The next thick section of interbedded sandstones, siltstones and shales at Bass 3 coincided with the intersection of the first clean consolidated sandstone and a series of interbedded coals from 1767 to 1898 metres. The sandstone, possibly a channel sand, has coarse to granule sized, milky to clear, sub rounded to rounded quartz grains with minor associated pyrite. However the dominant sandstones within this interval are micaceous and very fine to fine grained with a white clay (kaolinite?) matrix. These sandstones are typically interbedded with brown to black carbonaceous shales. The coals tend to be black in colour with a brilliant lustre, brittle and exhibiting a conchoidal fracture. A 4.3 metre core cut within this zone (Core 8) penetrated a very fine grained to silt-sized interval exhibiting wavy ripple bedding, bioturbation and load casts. Suttill *et. al.* (1987) and Haskell (1987) interpret these sediments to be either back barrier lagoonal, coastal embayment or lake deposits.

From about 1900 metres until the next major sandy interval at 2054 metres the section at Bass 3 comprises a series of coal-dominated terrestrial deposits with lesser amounts of shale and minor sands interfingering with interbedded pyritic calcareous claystones, fossiliferous shale, and glauconitic, very fine grained sandstone with a clay matrix. Between 2054 and 2158 metres, a series of well sorted medium to coarse grained sandstones and friable quartz sands interbedded with brown to grey micaceous and silty shales were intersected. The sandstones at 2054 metres, from which hydrocarbons were recovered via an FIT, exhibited a slight odour but did not fluoresce. A 9.1 metre core (Core 10) cut from 2103.9 to 2113 metres was interpreted by Haskell (1987) to represent a series of bedded medium to coarse grained stacked channel sands overlain by crevasse splay and marsh sequences. The marsh deposits show evidence of abundant carbonaceous root structures.

Between 2158 and the base of the EVCM at 2375 metres in Bass 3, the sedimentary package comprises an interbedded sequence of sandstone, siltstone and shale. Individual bed thickness is variable with no particular rock-type showing overall dominance. The sandstones are typically light grey, matrix supported and show a range in grain size from fine grained to granule sized. Weathered feldspar content is higher compared with sands higher up in the EVCM. The grains are typically sub-angular to rounded and poorly sorted. Matrix may also include minor amounts of mica and carbonaceous shale. The

siltstones are generally light brown to light grey, argillaceous in part, micaceous and pyritic. The shale is light to mid-grey, occasionally silty and micaceous. Coal may be present, but usually only in trace amounts. Core 11 from Bass 3, cut from 2265.5 to 2271.5 was interpreted to consist of a series of debris flow deposits characterised by convolute bedding, associated with grey lake shales and upward fining cross stratified channel sandstones. Suttill *et. al.* (1987) interpret this to represent channel sandstones and debris flow deposits of a lacustrine fan delta.

#### ***Basement (2100 – 2150 (TD) mSS)***

Overlying crystalline basement rock is a pre-rift sequence of metamorphosed black shales and quartzites. These rocks are commonly referred to as “economic basement”. At Bass 3 approximately 45 metres of economic basement was penetrated from 2386 to 2431 metres. The rocks comprised an interbedded sequence of quartzite, recrystallised siltstone and fine grained sandstone and black metamorphosed shales. White Ibis 1 is expected to penetrate up to 50 metres of economic basement.

### **5. RESERVES**

Reserve calculations for the White Ibis prospect have been calculated using a deterministic method for both primary and secondary targets. Both oil only and gas only cases have been calculated for the secondary Top EVCM target.

Calculated gas in place volumes at the primary objective range from 134 BCF (P90) (94 BCF recoverable) to an upside of 753 BCF (P10) (527 BCF recoverable) with a mean of 406 BCF (284 BCF recoverable). The risk weighted Chance of Success for the discovery of hydrocarbons at the primary objective has been calculated at 26%.

Deterministic volumetric calculations at the secondary objective level demonstrate that White Ibis could have in-place volumes of oil ranging from 8 MMSTB (P90) (2 MMSTB recoverable) to a high case of 32 MMSTB (P10) (8 MMSTB recoverable) with a mean of 18 MMSTB (5 MMSTB recoverable). Calculations of gas in place volumes range from a lowside case of 9 BCF (P90) (7 BCF recoverable) to an upside case of 40 BCF (P10) (28 BCF recoverable) with a mean of 22 BCF (16 BCF recoverable). The Chance of Success of discovering either oil or gas at this level has been calculated at 20%.

6. **REFERENCES**

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Haskell N L. 1987. Core facies data – volume one. In: Amoco Australia Petroleum Company – *The Prospectivity of the Bass Basin, Australia, Appendix B.*

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Suttill R J, Williams B P J & Wild E K. 1987. Sedimentological analysis of Bass Basin cores – final project report. Unpublished Boral Energy report.

"1996 Hummock Seismic Survey, Final Report Part B, Seismic Interpretation, T/18P and T/14P, Bass Basin". 1997. Unpublished Boral Energy report.

**GMA LOGM**  
KB ELEVATION=9.4 M

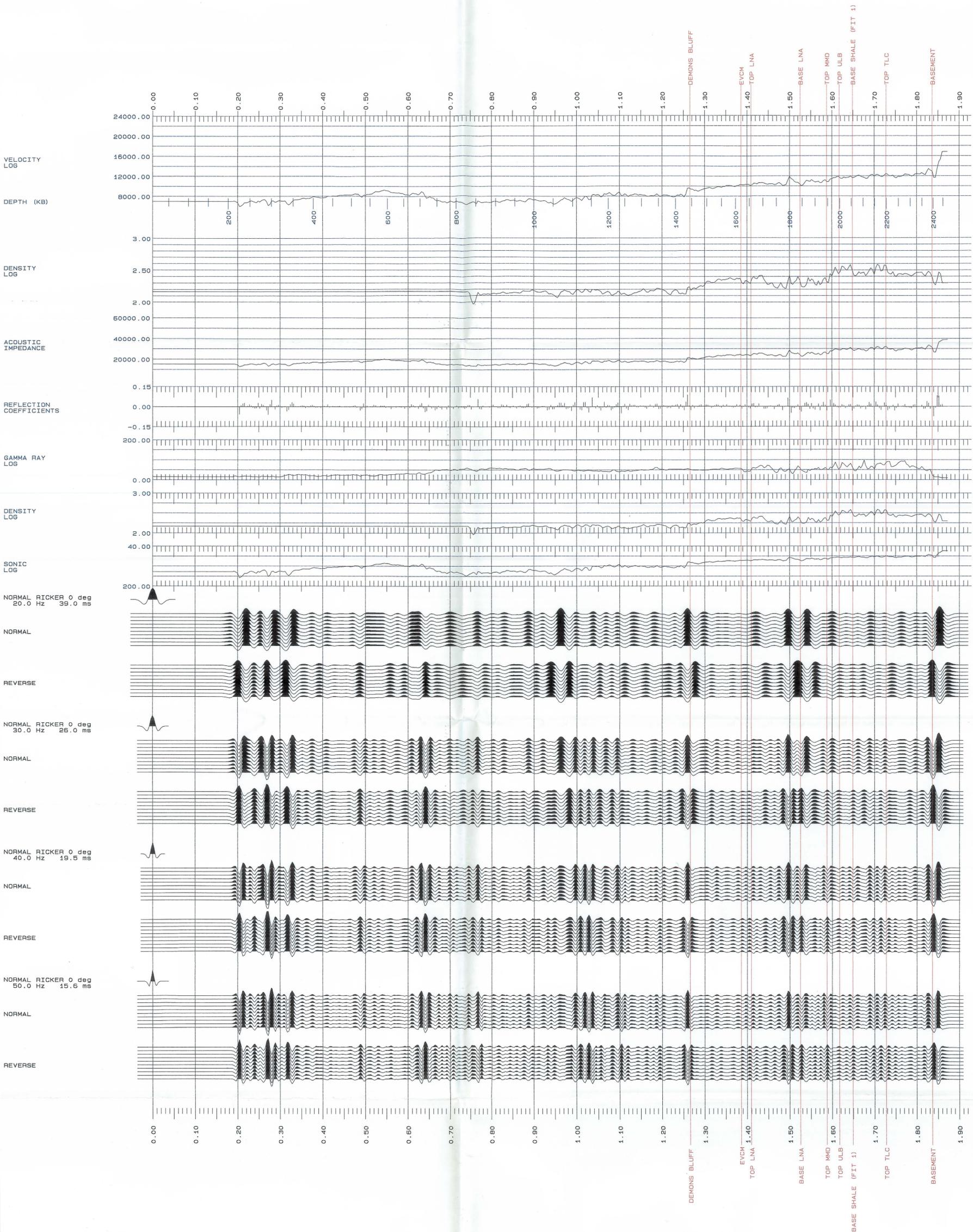
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# OF TRACES	=10	INCHES PER SEC	=7.87
CHECK SHOT APPLIED	=Y		
TRAVEL TIME CURVE	=SONIC		
MULTIPLES	=NONE		

WAVELET # 1 RICKER :	WAVELET # 2 RICKER :
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FREQUENCY	FREQUENCY
=20.0 Hz	=30.0 Hz
PHASE	PHASE
=0 deg	=0 deg

WAVELET # 3 RICKER :	WAVELET # 4 RICKER :
PERIOD	PERIOD
=19.5 MS	=15.6 MS
FREQUENCY	FREQUENCY
=40.0 Hz	=50.0 Hz
PHASE	PHASE
=0 deg	=0 deg



**ENCLOSURE 1**

BASS 3								
FORMATION	DEPTH m (KB)	DEPTH m (ASL)	TIME Seconds	AVG VEL m/s	RMS VEL m/s	INT VEL m/s	INT TIME Seconds	INT DEN kg/mm
DEMONS BLUFF	1443.8	-1434.4	1.265	2267	2281	2915	0.124	2313.5
EVCM	1613.5	-1610.0	1.386	2324	2344	3053	0.024	2305.1
TOP LNA	1655.8	-1646.4	1.410	2336	2358	3236	0.115	2319.6
BASE LNA	1842.3	-1832.8	1.525	2404	2436	3312	0.062	2309.8
TOP MMD	1945.5	-1935.0	1.587	2440	2477	3524	0.030	2433.4
TOP ULB	1998.2	-1988.8	1.617	2460	2500	3587	0.031	2529.8
BASE SHALE (FIT 1)	2054.3	-2044.9	1.648	2481	2525	3622	0.079	2483.7
TOP TLC	2197.5	-2188.1	1.727	2533	2586	3633	0.109	2442.8
BASEMENT	2395.1	-2385.7	1.836	2599	2660			

CHECK SHOTS					
DEPTH (m)	CHECK SHOT TIME (ms)	CHECK SHOT INT VEL (m/s)	SONIC TIME (ms)	SONIC INT VEL (m/s)	TIME DIFF (ms)
216.4	96.3	2150.0	96.3	2359.3	0.0
620.0	284.0	2472.2	267.4	2226.5	16.6
1076.0	485.0	2499.8	472.2	2474.5	12.8
1442.0	632.0	2977.3	620.1	3028.3	11.9
1704.0	720.0	3419.8	706.6	3399.5	13.4
2152.0	851.0	3532.4	838.4	3746.0	12.6
2399.0	919.0		904.4		14.6

Thu Mar 19 11:08:30 CST 1998  
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