WCR (VOL. 2)
BILLFISH - 1
(W1178)

Esso Australia Ltd.

WELL COMPLETION REPORT

BILLFISH - 1

VOLUME 2
INTERPRETATIVE DATA

GIPPSLAND BASIN
VICTORIA

ESSO AUSTRALIA LIMITED

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July 1997

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1. *SUMMARY OF WELL RESULTS*

Billfish-1 was spudded in VIC/P34 on January 21, 1997 with the water depth at the location being 499 metres. The well was designed to test a prospect defined at the Top of Latrobe Group as a northerly plunging erosional remnant with a southerly bounding fault. At the northern end of the feature an additional trapping mechanism was interpreted to exist defined by the combination of a southerly dipping near Base Paleocene marine shale subcropping the northerly dipping Top of Latrobe Group. Intra-Latrobe Group sandstones in fault bounded traps represented secondary objectives for the well, in particular shoreface sandstones near the Sap Green sequence boundary.

The Top of Latrobe Group was intersected at 2887.0 mKB, some 169.5 metres low to prognosis. No hydrocarbon shows were recorded during drilling and the well was drilled to a total depth of 3250 mKB. Log interpretation indicates that all target reservoirs are water saturated and no hydrocarbon pay is mapped.

The Latrobe Group reservoirs are as prognosed, consisting of Late Cretaceous shoreface sandstones. However, the overlying uppermost section of the Latrobe Group, which consists of 15.5 metres of Early Eocene Flounder Formation and 12 metres of a condensed Upper Cretaceous-Paleocene section, is thicker than prognosed. The overlying Lakes Entrance Formation provides an adequate top seal for the prospect although the absence of significant intra-Latrobe Group shales decreased the opportunity for secondary objectives to be successful.

Post-drill analysis suggests that the lack of a valid trap at the well location is the most likely reason for failure. Formation tops are summarised in Table 1 below.

Billfish-1 was plugged and abandoned on February 10, 1997.

Table 1 : Prognosed vs. Actual Formation Tops

Formation/Horizon	Predicted Depth (mss TVD)	Actual Depth (mss TVD)	
Gippsland Limestone	-497.0	-499.0	529.5.
Lakes Entrance Formation	-2517.0	-2674.0	2704.5.
Top of Latrobe Group	-2687.0	-2856.5	2887
Base of Eocene Flounder Formation	Not Prognosed	-2872	2902.5.
Near Base Paleocene Blue Shale	-2690.0	-2884	2914.5.
Sap Green Sequence Boundary Marker	-2935.0	-3102	3132.5.
Total Depth	-3100.0	-3219.5	3250.

KB = 30.5 metres

2. *INTRODUCTION*

Billfish-1 is a wildcat exploration well located in VIC/P34 some 12 km south of the Blackback Oil Field (Figure 1). Billfish-1 was drilled as the second well in the 1996/7 Sedco 703 program.

The well was designed to test a Top of Latrobe Group closure defined pre-drill as a northerly plunging erosional remnant with a southerly bounding fault. At the northern end of the feature an additional trapping mechanism was interpreted to exist, defined by the combination of a southerly dipping near Base Paleocene marine shale subcropping the northerly dipping Top of Latrobe Group. Intra-Latrobe Group sandstones in fault bounded traps represented secondary objectives for the well. The key risks identified pre-drill were time interpretation (due to the seismic data quality), depth conversion, top seal integrity of the subcropping shales and fault seal integrity.

3. *STRATIGRAPHY*

The Billfish-1 Well Completion Log is presented in Enclosure 1. Palynological analysis details are contained in Appendix 1.

A thick succession (2175 m) of Gippsland Limestone (Middle Miocene to Recent age, 529.5-2704.5 mKB) was penetrated by Billfish-1. No cuttings were collected down to 1317 mKB as this section was drilled without a riser. Below this depth the Gippsland Limestone comprises predominantly light to medium grey calcisiltite grading to calcilutite. Below 2497 metres the limestone changes to a marl with depth due to a progressive increase in clastic content.

The Lakes Entrance Formation (Oligocene to Middle Miocene age, 2704.5-2887 mKB) is 182.5 metres thick and comprises grey calcareous claystone with traces of carbonaceous detritus. An increase in siltstone content occurs over the lowermost part of this interval.

The pre-drill prognosis was that Eocene Flounder Formation channel fill, 57 metres thick in Angler-1 9.9 km to the west, would pinch out on the flanks of the Billfish feature and would not be present at the well location. However, a thin Early Eocene Flounder Formation section, comprising dark brown-grey siltstones and claystones containing abundant glauconite, was actually penetrated in the well at the top of the Latrobe Group and is now interpreted to cover the crestal area of the feature (2887 mKB-2902.5 mKB).

Beneath the Eocene channel fill, a thin and condensed Upper Cretaceous-Paleocene section was penetrated, consisting of dark green-grey siltstones and lithic greywackes containing abundant glauconite (2902.5 mKB-2914.5 mKB). The lowermost part of this interval is equivalent in age to the near Base Paleocene Blue Shale of which 3 metres was originally prognosed at the well location.

Upper Cretaceous Latrobe Group was penetrated from 2914.5 mKB to TD at 3250 mKB (335.5 metres). The total section belongs to the T.Longus spore-pollen zone. The section is interpreted to comprise predominantly shoreface and fluvial-estuarine sandstones, siltstones and minor claystones with traces of coal.

4. *STRUCTURE*

The Billfish trap was defined pre-drill at the Top of Latrobe Group as a northerly plunging erosional remnant with a southerly bounding fault. In the most likely case 41 metres of closure, with an areal extent of 69.5 sq km, were mapped at the Top of Latrobe Group, with the well testing the lower 24 metres of this closure. At the northern end of the feature an additional trapping mechanism was interpreted to exist, defined by the combination of a southerly dipping near Base Paleocene marine shale subcropping the northerly dipping Top of Latrobe Group. In the most likely case 54 metres of closure (22.5 sq km), defined by a fault leak point, were assessed and tested by the well on the subcrop trap. Overall, 160 metres of structural closure were mapped at this level with an areal extent of 105.2 sq km. The overall structural trend was interpreted to have been created by compressional uplift during the Lower Eocene to Oligocene compressional events, which structurally uplifted and arched the central Gippsland Basin. Intra-Latrobe Group sandstones in fault bounded traps with interbedded shales providing top seal represented secondary objectives for the well.

Post-drill mapping suggests the absence of a valid closure at the well location at the Top of Latrobe Group. Greater than anticipated post-Mid Miocene tilting to the east, resulting from the deposition of significant thicknesses of Miocene-Recent limestones along the shelf margin, appears to have opened up to the west most of the original closure on the erosional remnant. A closure of very limited areal extent (2.4 sq km) and vertical relief (10 metres) is now interpreted to be located to the west of the well location.

Significant relief has also been lost at the deeper near Base Paleocene subcrop trap level and the well is now interpreted to not have tested a valid closure. A closure of much smaller areal extent (18.6 sq km) and overall vertical relief (56 metres) than that mapped pre-drill is now interpreted to exist to the west of the well location. In addition to the lack of closure at the well location, the Upper Cretaceous-Paleocene condensed section penetrated in the well, the key top seal for the intra-Latrobe trap, consists of siltstones and lithic greywackes which are unlikely to form an effective seal. Although the distribution of this section is now interpreted to be wider than recognised pre-drill, and so making the trap less dependent on a sealing Top of Latrobe Group subcrop edge, the variation in lithology from the prognosed marine shales has probably led to a lack of a competent seal to form an effective trap . In addition, the unexpected presence of the Early Eocene Flounder Formation over the crest of the Billfish feature is also damaging to this trap as it is likely to act as a thief zone, should leakage occur from the subcrop trap to the Top of Latrobe Group surface, allowing migration of any hydrocarbons updip to the west of the structure. The secondary intra-Latrobe Group objectives have also lost

significant closure post-drill and when combined with the absence of competent sealing units this has resulted in the absence of hydrocarbon pools at these levels.

5. *HYDROCARBONS*

No significant hydrocarbon shows were encountered within the Gippsland Limestone or Lakes Entrance Formation in Billfish-1. Background gas levels within the Gippsland Limestone varied from 5-40 units, typically comprising 99.7 % methane, 0.3 % ethane and traces of propane. Over the interval 2350-2385 mKB up to 30 units of gas were encountered comprising 98.0% methane, 1.5% ethane and 0.5 % propane. Over the marl interval between 2497 mKB and 2704.5 mKB, 5-10 units of gas were encountered, with compositions in the range 95.0-99.0% methane and 1.0-5.0% ethane. Background gas levels within the Lakes Entrance Formation (2704.5 m KB-2887 m KB) varied from 2-9 units, typically comprising 100.0 % methane with only traces of ethane.

No significant hydrocarbon shows were encountered within the Latrobe Group (2887 m KB- 3250 m KB). Background gas levels varied from 0.5-8 units, typically comprising 100.0 % methane with only traces of ethane. No hydrocarbon fluorescence was recorded over this interval. Only very small variations were observed in gas levels and these variations are interpreted to be related to lithological changes.

Log interpretation indicated all reservoir sandstones are water saturated and no hydrocarbon pay is mapped (Appendix 2).

6. *GEOPHYSICAL DISCUSSION*

The Billfish feature is located under the present day shelf slope break. The steep and rugose slope, combined with local incision of deep seafloor canyons, degrades seismic data quality and introduces significant time distortions in this area. The Billfish feature was defined on a 500 x 500 metre grid using the G95B 2D seismic survey. The application of dynamic water replacement statics improved the data quality , although it remains only poor to fair by Gippsland Basin standards.

6.1 Time Interpretation

The pre-drill seismic interpretation was constrained by limited well penetrations in this area of the basin with the nearest well control being Angler-1, 9.9 km to the west. The Mid Miocene Marker surface and the Top of Latrobe Group are both readily identifiable over most of the area, with only minor uncertainty surrounding the exact position of the Top of Latrobe Group pick on the wavelet as the subcropping lithology varies. The Eocene and Upper Cretaceous-Paleocene sections penetrated in Angler-1 were recognised to be thinning towards the Billfish feature. The pre-drill prognosis for Billfish-1 was that the Eocene section

would have pinched out before the well location and that the Upper Cretaceous-Paleocene section would be only 3 metres thick.

Post-drill analysis demonstrates that the Mid Miocene Marker surface and the Top of Latrobe Group are both 6 msecs above the pre-drill prognoses. The Eocene section prognosed to have pinched out is actually present and is 10 msecs (15.5 metres) thick at the well location. The Upper Cretaceous-Paleocene section is also thicker than prognosed (8 msecs, 12 metres). These relatively minor variations from the pre-drill prognoses are due to the interpretation being constrained by the quality of the 2D seismic data and the lack of data density. The seismic event interpreted pre-drill as the Sap Green Sequence Boundary ties to the top of a set of dolomitic sandstones. The exact intra-Latrobe Group correlation between Angler-1 and Billfish-1 is not clear, with the interpretation being constrained by seismic data quality.

A comparison of the pre-drill prognosis versus the post-drill results is contained in Table 2. A synthetic seismogram for Billfish-1 is presented in Enclosure 4. Seismic lines through the well location illustrating the post-drill seismic interpretation are presented in Enclosures 2 and 3.

6.2 Depth Conversion

The steep and rugose water bottom topography combined with the progradational and severely channellised nature of the Miocene limestone section introduces significant time distortions in the seismic data over the Billfish feature. The Mid Miocene Marker surface at the top of the Lakes Entrance Formation is recognised across the Gippsland Basin as being relatively unstructured other than for local drape/compaction effects and a post-Mid Miocene regional tilt to the east, as limestones of the overlying Seaspray Group prograde seawards. This surface was interpreted across the dataset, tied to the well control and smoothed to remove obvious velocity artefacts. The amount of post-Mid Miocene easterly tilt is the greatest uncertainty in this depth conversion technique.

Depth conversion to the Top of Latrobe Group was achieved by isopaching down from the Mid Miocene Marker surface. Isopaching was also used to depth convert from the Top of Latrobe Group to the key intra-Latrobe Group surfaces. Interval velocities within the Lakes Entrance Formation and the Latrobe Group are relatively stable and so isopaching is generally a reliable depth conversion technique.

A comparison of the pre-drill prognosis versus the post-drill results is contained in Table 2. The total depth conversion error to the Top of Latrobe Group is 169.5 metres or 6.3%. The depth conversion error at the Top of Latrobe Group was a little more than that at the Mid Miocene Marker surface due to a faster than expected Lakes Entrance Formation. The depth conversion error at the near Base Paleocene Blue Shale level was a little more than that at the Top of Latrobe Group due to the additional thicknesses of the Eocene and Upper Cretaceous-Paleocene

sections penetrated. It is clear that the actual Mid Miocene Marker surface has a greater dip to the east than that displayed on the pre-drill depth map of the surface, implying a faster section between water bottom and the Mid Miocene Marker than prognosed.

A different depth conversion technique, incorporating the additional depth and velocity information provided by the well, was applied during the post-drill mapping process. Stacking velocity functions derived from the G95B 2D seismic data, which contain a high degree of variability, were used to generate a velocity-depth function by calibration to the existing well control. The function takes into account the impact of the significant water depth changes across the area and also the impact of the changing thicknesses of the overlying Gippsland Limestone section.

V(mmio) = 0.0005 x (V(start) - 1900) x (2200 - Dwb) + 1900

where,

V(mmio) is the average velocity from sea level to the Mid Miocene Marker

Dwb is the depth to the water bottom

and **V(start) = 0.700 x (1000 - Isoc(bhvcmmm)) + 2300 + Cvch**

where,

Isoc(bhvcmmm) is the isochron between the base of the high velocity Gippsland Limestone and the Mid Miocene Marker

Cvch is a well correction factor varying with the local velocity of the channel fill

This function was then used to depth convert to the Mid Miocene Marker surface. Depth conversion to the Top of Latrobe Group and to deeper levels was then achieved by isopaching as described above.

The post-drill maps for the Top of Latrobe Group and the composite near Base Paleocene Blue Shale/Top of Latrobe Group surface are presented in Enclosures 5 and 6. These maps demonstrate the absence of valid closure at the well location at the Top of Latrobe Group level. A closure at this level of very limited areal extent (2.4 sq km) and vertical relief (10 metres) is now interpreted to be located to the west of the location. Billfish-1 is also interpreted to not have tested a valid closure at the near Base Paleocene Blue Shale level.

Table 2 : Time Interpretation and Depth Conversion Analysis

	Water Bottom	Mid Miocene Marker	Top of Latrobe	Base Pal. Blue Shale
Pre-drill Seis. Time (sec,TWT)	0.474	1.969	2.096	2.100
Post-drill Seis. Time (sec,TWT)	0.474	1.963	2.090	2.108
Time Interpretation Error (sec)	0.000	-0.006	-0.006	0.008
Pre-drill Depth (m,ss)	497	2517	2687	2690
Post-drill Depth (m,ss)	499	2674	2856.5	2884
Total Depth Error (m)	2	157	169.5	194
Pre-drill Pseudo Interval Velocity (m/sec)	2702	2677		-
Post-drill Pseudo Interval Velocity (m/sec)	2921	2874		3056
Interval Velocity Error (m/sec)	219	197		-

Note : Seismic times are sourced from the G95B 2D survey with a 2100 m/sec water replacement static applied.

7. *GEOLOGICAL DISCUSSION*

As detailed in the earlier sections covering post-drill structural analysis, it is interpreted that Billfish-1 did not test a valid closure at either the Top of Latrobe Group or near Base Paleocene Blue Shale levels. An analysis of the key geological parameters of seal, reservoir and hydrocarbon migration demonstrates that possibly more than one play element may have failed at Billfish-1.

The Lakes Entrance Formation, 182.5 metres thick at the well location and comprised for the most part of calcareous claystone, would be an extremely effective seal for a Top of Latrobe Group closure. However, the Upper Cretaceous-Paleocene condensed section at the well location, 12 metres thick and comprised for the most part of siltstone and lithic greywackes, is less likely to act as a competent seal at the near Base Paleocene Blue Shale surface. This section decreases in thickness rapidly between Angler-1 and Billfish-1. If this section leaks, or has been breached by one of the small faults near the crest of the structure, the overlying Early Eocene Flounder Formation, comprising mostly siltstones with some claystones, is likely to act as thief zone and will lead to any hydrocarbons leaking from the trap to migrate along the Top of Latrobe Group surface back to the west towards Angler-1.

The reservoir quality of the Upper Cretaceous Latrobe Group interval penetrated by the well was within the range of the pre-drill prognosis. The pre-drill prognosis for the target shoreface sandstone reservoirs was for an average porosity in the range 19-25 % and a net/gross in the range 66-96%. The actual parameters for the Upper Cretaceous Latrobe Group section penetrated by the well between 2915.2 m KB and 3225.0 m KB are an average porosity of 20 % and an average net/gross of 79 %. The section is interpreted

to comprise shoreface and fluvial/estuarine sandstones, siltstones and minor claystones with traces of coal.

Pre-drill studies indicated that the presence of adequate hydrocarbon migration pathways was unlikely to be a key risk for the prospect. By analogy with the Blackback field 12 km to the north, source rock volumes and maturity levels are interpreted to be adequate to generate substantial hydrocarbon volumes within the drainage area of the prospect and as trap formation pre-dates hydrocarbon generation, the timing of generation and migration is not considered a major risk. However, significant lateral migration must be able to occur as Billfish is located well to the east of the area of mature source rock generation. Vitrinite reflectance data collected in the well indicate that maturation levels appear to be very low even in the deepest of the samples. In addition, in order for efficient vertical migration to occur, in the absence of faulting, significant facies changes within the Latrobe Group are required to enable cross-stratal migration. To further aid efficient vertical migration the individual sequences needed to be aggradationally stacked to allow individual shoreface belts to directly overlay each other. If this were the case then hydrocarbons generated in the deep lower coastal plain source rocks could laterally follow regional dip up to the east into the stacked shoreface sandstone belts whereby vertical migration into the trap would be possible. The seismic data quality is not adequate to map these individual facies belts in this area and as the well did not drill deep enough to penetrate this section, the occurrence of these facies changes remains conjectural.

FIGURE 1

Figure 1 follows

PE905147

This is an enclosure indicator page.
The enclosure PE905147 is enclosed within the container PE900820 at this location in this document.

The enclosure PE905147 has the following characteristics:

ITEM_BARCODE	= PE905147
CONTAINER_BARCODE	= PE900820
NAME	= Billfish-1 Locality Map
BASIN	= GIPPSLAND
PERMIT	= VIC/P34
TYPE	= GENERAL
SUBTYPE	= PROSPECT_MAP
DESCRIPTION	= Billfish-1 Locality Map. Figure 1 of WCR volume 2.
REMARKS	=
DATE_CREATED	= 31/07/1997
DATE_RECEIVED	= 06/08/1997
W_NO	= W1178
WELL_NAME	= Billfish-1
CONTRACTOR	=
CLIENT_OP_CO	= Esso Australia Limited

(Inserted by DNRE - Vic Govt Mines Dept)

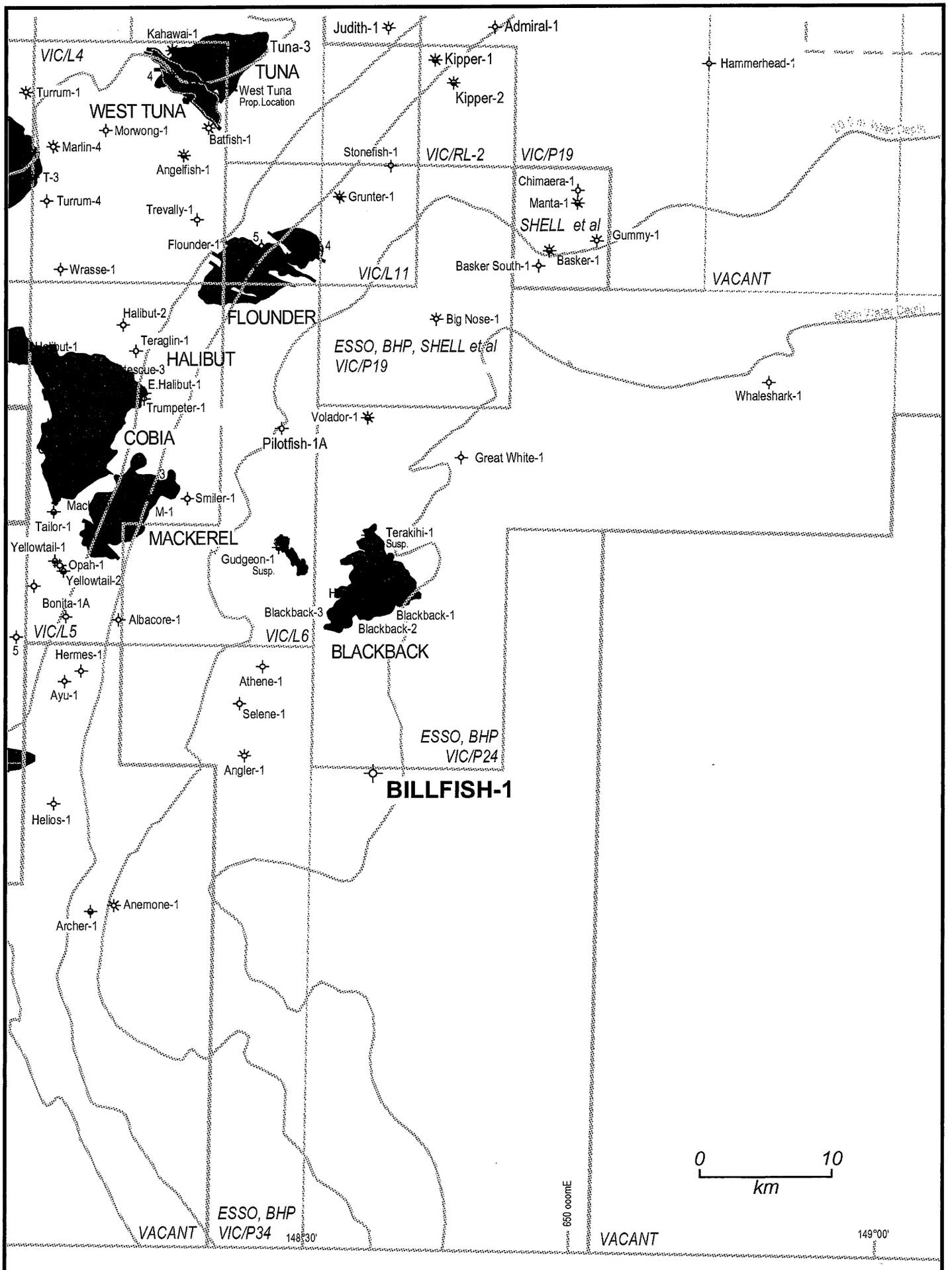

Figure 1

APPENDIX 1

Palynological analysis of Billfish–1, offshore Gippsland Basin.

by

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Biostrata Report 1997/9

31 March 1997

Palynological analysis of Billfish–1, offshore Gippsland Basin.

by Alan D. Partridge

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INTERPRETATIVE DATA

Introduction

Twenty-four samples between 2800m and 3245m from across the top of Latrobe in Billfish-1 have been analysed to determine the palynological zonation and age of the sequence. The following table summarises the results:

Palynological Summary of Billfish–1

AGE	UNIT/FACIES	SPORE-POLLEN ZONES (MICROPLANKTON ZONES)	DEPTHS mKB
EARLY MIOCENE to OLIGOCENE	SEASPRAY GROUP	*P. tuberculatus* (*Operculodinium* Superzone)	2800–2880 (2800–2880)
EARLY EOCENE	LATROBE GROUP Flounder Formation equivalent	Upper *M. diversus* (*H. tasmaniense*)	2894 (2894)
PALEOCENE	LATROBE GROUP "Hapuku Formation equivalent"	Upper *L. blamei* (*A. homomorphum*) *L. blamei* undifferentiated Lower *L. blamei* (*E. crassitabulata*)	2904 (2904) 2906–2908m 2910 (2910)
MAASTRICHTIAN	LATROBE GROUP K/T boundary shale	Upper *T. longus* (*M. druggii*)	2913–2914 (2913–2914)
MAASTRICHTIAN	LATROBE GROUP Undifferentiated sand, shales and coals	Undifferentiated *T. longus* Lower *T. longus*	2916–3245 3177

An average of 14.7 grams of sample from five cuttings and an average of 7.3 grams from 19 sidewall cores were split and forwarded to Laola Pty Ltd in Perth on 10 March 1997 for processing to prepare the palynological slides for analysis. The material was returned on 18 March and initial provisional results provided on 21 March. The interpretative data with zone identification and Confidence Ratings are recorded in Table 1 and basic data on residue yields, preservation and diversity are recorded on Tables 2.

The residue yields recovered from the samples were mostly very low to low from the Latrobe Group and moderate from the Seaspray Group. Palynomorph concentrations on the slides was largely dependant on the residue yields and varied from very low to high. Preservation of palynomorphs was generally poor to

fair with occasional well preserved specimens. Average spore-pollen diversity was 14+ species per sample and average microplankton diversity was ~11 species per sample in the glauconitic facies and Seaspray Group above 2915m. In contrast the underlying undifferentiated Latrobe Group below 2915m contained very low microplankton abundance and diversity. All species which have been identified with binomial names are tabulated on Table 3. The relinquishment list for palynological slides is provided at the end of the report. No palynological residues remained after preparation of the slides.

Geological Comments

1. The cuttings and sidewall cores analysed from Billfish-1 between 2800–3245m have provided confident age dating of the basal ~90 metres of the Seaspray Group and upper ~360 metres of the Latrobe Group notwithstanding the generally low residue yields and low to moderate diversity assemblages recorded.

2. The basal Seaspray Group is sampled between 2800-2880m by cuttings which gave assemblages that could only be assigned a broad Oligocene to Early Miocene age. In general the cuttings were of poor quality because relative to sidewall cores taken for the basal Seaspray Group in other wells the palynomorph assemblages are biased towards larger and/or more robust palynomorphs. This is considered to reflect the removal of finer and softer clays during the washing and drying of the cuttings. Also the three deeper cuttings contained common, fine to coarse, mica flakes which are believed to be mud additives. Upon processing these three samples the palynological residues were found to be dominated by coarse, fresh (not carbonised) organic matter which is atypical of Seaspray Group and is interpreted to have also been derived from a mud additive. No species were found in the assemblages recorded to confirm the presence of the Early Oligocene wedge documented in the Blackback wells and in Great White–1 (Partridge, 1994; Partridge 1997).

3. The top of the Latrobe Group is characterised by a ~27 metre thick section of glauconitic siltstones and sandstones (greensand facies) which represents a stack of condensed sections ranging in age from latest Maastrichtian to Early Eocene and which are separated by significant disconformities. Deposition was in a starved distal outer shelf marine environment. Younger Middle and Late Eocene section equivalent to the main development of the Gurnard Formation found over most of the Central Deep appears to be missing at the unconformity at the top of Latrobe.

4. The shallowest ~12 metres of the greensand facies is considered to be equivalent to the lower part of the Flounder Formation based on the recovery of a good Early Eocene assemblage belonging to the Upper *M. diversus* spore-pollen Zone and *Homotryblium tasmaniense* microplankton Zone from SWC–25 at 2894m. The other two sidewall cores from this interval at 2888m and 2899m are unfortunately both problematic.

   SWC–26 at 2888m contains unusual kerogen which is either biodegraded or partially oxidised. Only a very meagre amount of residue was recovered and this contained an unusual abundance of microforaminiferal liners but unfortunately very few specimens of the more age diagnostic spores, pollen and dinoflagellates. It is uncertain from the palynology whether the sample belongs to the Latrobe or overlying Seaspray Group. The calcareous lithology favours the latter. The unusual aspects of this sample undoubtedly relates to low depositional rates and missing section at the top of Latrobe at this location.

   SWC–24 at 2899m is considered to be out-of-place because both the calcareous claystone lithology and recovered assemblage are clearly derived from the Seaspray Group. The small size and irregular shape of the original sidewall core suggests that the bullet sampled a caved fragment within the well bore.

5. The next ~10 metres of the Latrobe Group is a richly glauconitic section which contains four good sidewall cores that are confidently assigned to the Paleocene *L. balmei* Zone. These assemblages represent a more condensed section of the informal "Hapuku Marine Sands" penetrated in Hapuku–1 and Blackback–2 (Partridge, 1993). The high glauconite content (30%-75%) at this locality is consistent with slower sediment accumulation rates in Billfish–1 based on recent studies of glauconite formation (Kelly & Webb, 1996).

6. The lower part of the Early Eocene representing the Lower and Middle *M. diversus* Zones may be missing at a disconformity or condensed between the reliable samples at 2894m and 2904m and similarly the *P. asperopolus* Zone and the three *N. asperus* Subzones are missing at disconformities or are very condensed above 2894m.

7. The bottom ~5 metres of the greensand facies is sampled by two sidewall cores which gave good assemblages belonging to the latest Maastrichtian portion of the *M. druggii* microplankton Zone based on the presence of *Manumiella seelandica*. This section represents only the lower part of the K/T boundary shale in the Gippsland Basin. On current correlations to the Haq

et al. (1987) time scale the three metre section between the *E. crassitabulata* Zone at 2910m and the top of the *M. druggii* Zone at 2913m represents a time interval of ~10 million years. The anomalous reworked occurrence of *Palaeoperidinium pyrophorum* associated with *Eisenackia crassitabulata* in the sample at 2910m suggests the time interval is highly condensed or missing through non-deposition rather than absent due to erosion.

8. All samples from the predominantly sandy undifferentiated Latrobe facies below ~2915m (with exception of SWC-2) gave low yields with few species recorded from each sample. However, when the species list is amalgamated for all samples the total assemblage favours a Lower rather than Upper *T. longus* Zone assignment. Only SWC–2 at 3177m gave a sufficiently diverse assemblage to be confident of its assignment to the Lower *T. longus* Zone. This interpretation is based on lack of any *Gambierina* abundance and absence of *Stereisporites* (*Tripunctisporis*) sp. Rare microplankton in these sands and lack of any coals suggest deposition of the section in a proximal inner shelf marine environment.

Biostratigraphy

Spore-pollen zone and age determinations are based on the scheme proposed by Stover & Partridge (1973) and modified by Helby, Morgan & Partridge (1987). The microplankton zones and ages are based on the still unpublished scheme by Partridge (1975, 1976) and the Otway Basin scheme of Harris (1985).

Author citations for most spore-pollen species can be sourced from Stover & Partridge (1973, 1982), Helby, Morgan & Partridge (1987) and Mildenhall & Pocknall (1989) or other references cited herein. Author citations for dinoflagellates can be found in the index of Lentin & Williams (1993) or other references cited herein. Species names followed by "ms" are unpublished manuscript names.

***Proteacidites tuberculatus* Spore-Pollen Zone:** **2800–2880 metres**
Oligocene to Early Miocene.

The four cuttings samples are assigned to this zone based on the presence of the key index species *Cyatheacidites annulatus*. Other index species where not recorded in the samples which were poor in spore-pollen. All the recovered assemblages are believed to be biased by the removal of the finer clays from the cuttings during washing and drying.

***Operculodinium* Microplankton Superzone:** **2800–2880 metres**
Oligocene-Miocene.

The four cuttings samples from the Seaspray Group are dominated by dinoflagellates characteristic of the *Operculodinium* Superzone which has a broad Oligocene to Miocene age range. As is typical in the superzone the assemblages contain common *Spiniferites* spp. and/or *Operculodinium centrocarpum* as well as the consistent presence of the long ranging species *Achomosphaera alcicornu, Apteodinium australiense, Dapsilidinium pseudocolligerum* and *Lingulodinium machaerophorum*. The assemblages also includes a number of key manuscript species including *Pyxidinopsis pontus* ms, *P. beta* ms, *Protoellipsodinium simplex* ms and *Tectatodinium scabroellipticus* ms which are widespread in the basin and relatively long-ranging. Of most stratigraphic significance is the occurrence in the deepest cuttings of *Protoellipsodinium mamilatus* ms. This species is found above the section identified as the "early Oligocene wedge" in both Blackback-3 and Great White-1 (Partridge, 1994; 1997). Its record here at the base of the Seaspray Group and absence of older index species such as *Fromea leos* ms suggests the "early Oligocene wedge" is not present in Billfish-1.

Upper *Malvacipollis diversus* Spore-Pollen Zone and
***Homotryblium tasmaniense* Microplankton Zone:** **2894 metres**
Early Eocene.

The dark brown-black siltstone with ~10% glauconite recovered at 2894m contains a diverse palynomorph assemblage dominated by microplankton (83%) amongst which *Homotryblium tasmaniense* was the most abundant at ~40% of the total count.

The sample is assigned to the Upper *M. diversus* Zone on the presence of *Myrtaceidites tenuis* and absence of younger index species. Although a high diversity spore-pollen assemblage was recorded the poor preservation and dominance of microplankton in the sample masked the presence of other key spore-pollen species. Compared to samples from this zone from coastal plain environments the abundance and diversity of *Proteacidites* pollen was unusually low. The most abundant groups in the assemblage were *Dilwynites* spp., *Podocarpidites* spp. and *Haloragacidites harrisii*.

The microplankton assemblage is assigned to the broad *H. tasmaniense* Zone of Harris (1985) on the dominant presence of the eponymous species. This zone was originally considered to be equivalent to only the *Kisselovia edwardsii* and *K. thompsonae* Zones by Harris (1985, fig.2) but the eponymous species is also typical and often abundant in the older *Wilsonidium ornatum* and *Rhombodinium waipawaense* Zones. Unfortunately the absence of all these index species

precludes a confident assignment of the sample to any of these "*Wetzeliella*" zones, although the presence of *Wetzeliella articulata* in the assemblage would favour assignment to the *W. ornatum* Zone based on the ranges recorded by Partridge (1975).

***Lygistepollenites balmei* Spore-Pollen Zone:** **2904–2910 metres**
Paleocene.

The four sidewall cores over this interval are assigned to the *L. balmei* Zone on the presence of the eponymous species and/or *Gambierina rudata* and absence of younger or older index species. The shallowest sample at 2904m is assigned to the Upper subzone on the presence of *Proteacidites annularis* and the deepest sample to the Lower subzone on the presence of *P. angulatus*. The two intermediate samples lack index species of either subzone and are best left as undifferentiated *L. blamei* Zone. The assemblages are dominated by *Dilwynites* spp. and *Podocarpidites* spp. suggesting the presence of a "Neves effect" (Traverse, 1988; p.413).

***Apectodinium homomorphum* Microplankton Zone:** **2904 metres**
Paleocene.

The presence of the short spined variety of *Apectodinium homomorphum* is considered diagnostic of this zone. Overall the assemblage is more diverse than usually recorded from the *A. homomorphum* Zone which in the coastal plains facies is often typified by a nearly monospecific assemblage of the eponymous species. In Billfish-1 other key species identified include *Diphyes colligerum, Glaphyrocysta retiintexta, Achomosphaera septata* and a variety of very small <30μm micro-dinoflagellates which except for *Tubulifera heterosolenia* have not been fully identified.

***Eisenackia crassitabulata* Microplankton Zone:** **2910 metres**
Paleocene.

The zone is identified by mostly fragmented specimens of the eponymous species (~5%) in a microplankton assemblage dominated by *Glaphyrocysta retiintexta* (~35%) and *Isabelidinium cingulatum* (~30%). Other significant species in the assemblage include *Deflandrea speciosus, Palaeocystiodinium golzowense Tubiosphaera filosa, Vozzhenikovia angulata* and *Palaeoperidinium pyrophorum*.

The two intermediate samples at 2906m and 2908m lack index species of the currently recognised microplankton zones and are not assigned to any zone. Their assemblages are consistent however with a Paleocene age.

All through the greensand facies there are anomalous occurrences of microplankton species relative to ranges established in other sections in the

Gippsland Basin. Typical examples are the anomalous old occurrence of the short spined variety of *Apectodinium homomorphum* and the anomalously young occurrence of *Palaeoperidinium pyrophorum* both with *Elsenackia crassitabulata* at 2910m. As well as the anomalously old occurrence of *Homotryblium tasmaniense* at 2904m in the highest Palaeocene sample and the occurrence of *Isabelidinium cingulatum* with abundant *M. druggii* at 2913m. All these anomalous occurrences are considered to reflect stratigraphic leakage or reworking associated with syndepositional bioturbation of the slowly accumulating greensand facies.

***Tricolpites longus* Spore-Pollen Zone:** **2913–3245 metres**
Maastrichtian.

The twelve sidewall cores and single cuttings sample over this interval gave mostly low to very low yields from which only limited spore pollen assemblages could be recorded. Amalgamating all the assemblages recorded the interval can be no younger than the *T. longus* Zone based on the youngest occurrences (LADs) of *Proteacidites reticuloconcavus* ms, *Tricolporites lilliei, Proteacidites otwayensis* ms and *Nothofagidites senectus* all recorded at 2913m and no older than this zone on the oldest occurrences (FADs) of *Forcipites* (al. *Tricolpites*) *longus*, *Tetracolporites verrucosus* and *P. reticuloconcavus* ms all recorded from the deepest sidewall core at 3177m. Another key index species for the zone is *Quadraplanus brossus* recorded in sidewall cores at 2916m and 3076m.

The samples at 2913m and 2914m are considered to belong to the Upper *T. longus* Zone based on the common occurrence of *Gambierina rudata* as well as the presence of *Stereisporites* (*Tripunctisporis*) sp. at 2913m. The lack of these features suggest all samples below 2914m probably belong to the Lower subzone but unfortunately most of the assemblages recorded are too limited to confidently assign them to the subzone. Only the deepest sidewall core at 3177m provided sufficient yield to obtain a good assemblage which can be assigned to the Lower subzone on a low *G. rudata* abundance of <2% and a high *Nothofagidites* spp. abundance of >7%.

***Manumiella druggii* Microplankton Zone:** **2913–2914 metres**
Late Maastrichtian.

The two sidewall cores from the bottom of the greensand facies are both overwhelmingly dominated by dinoflagellates cysts of the *Manumiella* species complex which comprises ~65% at 2913m and ~55% at 2914m of the total palynomorph assemblage counts. Because of fragmentation not all specimens can be identified to species level but it appears the *Manumiella conorata* is most abundant with *M. druggii* present in nearly equal abundance and *M. seelandica* relatively rare. The presence of the last species however is typical of the youngest

part of the zone where it is associated with the most consistent acme for the species complex. The presence of a single specimen of *Odontochitina* n.sp. at 2913m is considered to represent reworking (or laboratory contamination?) like the record of *Odontochitina indigena* at 2908m rather than an extension of the range of either species.

In the sandy Latrobe section below 2914m microplankton are both rare and generally non-diagnostic. The exception is *Isabelidinium greenense* recorded at 3008m which has been previously recorded at about the same stratigraphic level in Great White-1 (Partridge, 1997). Most other fragmented specimens also appear to belong to *Isabelidinium* rather than *Manumiella.*

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Table 1: Interpretative Palynological Data from Billfish-1						
Sample Type	**Depth metres**	**Spore-Pollen Zone**	***CR**	**Microplankton Zone**	***CR**	**Key Species and Comments**
Cuttings	2800	*P. tuberculatus*	D3	*Operculodinium* Superz.	D2	*Cyatheacidites annulatus* present.
Cuttings	2850	*P. tuberculatus*	D3	*Operculodinium* Superz.	D2	*Cyatheacidites annulatus* present in residue dominated by organic mud additive.
Cuttings	2870	*P. tuberculatus*	D3	*Operculodinium* Superz.	D1	*Cyatheacidites annulatus* present in residue dominated by organic mud additive.
Cuttings	2880	*P. tuberculatus*	D3	*Operculodinium* Superz.	D2	*Cyatheacidites annulatus* and *Protoellipsodinium mamillatus* ms present. Residue dominated by organic mud
SWC 26	2888	Indeterminate				Microforaminiferal liners dominate low yield sample.
SWC 25	2894	Upper *M. diversus*	B2	*H. tasmaniense*	B2	MP ~83%. *Homotryblium tasmaniense* ~42%. FADs for *Myrtaceidites tenuis* and *Wetzeltella articulata*.
SWC 24	2899	Indeterminate		*Operculodinium* Superz.	B2	MP >98% interpreted out-of-place sample diagnostic of Seaspray Group.
SWC 23	2904	Upper *L. balmei*	B2	*A. homomorphum*	B2	MP ~45%. *Dilwynites* spp. ~45% of SP count. FAD of *Proteacidites annularis* and LAD of *Lygistepollenites*
SWC 22	2906	*L. balmei*	B2			LAD of *Gambierina rudata*.
SWC 21	2908	*L. balmei*	B2			MP ~20%. *Dilwynites* spp. ~25% of SP count.
SWC 20	2910	Lower *L. balmei*	B2	*E. crassitabulata*	B2	MP ~55%. *Dilwynites* spp. ~26% of SP count. LADs of *Elsenackia crassitabulata* and *Proteacidites angulatus*.
SWC 19	2913	Upper *T. longus*	B2	*M. druggii*	B3	MP ~73% dominated by *Manumiella* spp. at ~90% of MP count. LADs of *Proteacidites reticuloconcavus* ms and *Tricolporites lilliei*.
SWC 18	2914	Upper *T. longus*	B2	*M. druggii*	B4	MP ~55% with *Manumiella* spp. >90% of MP.
SWC 17	2916	*T. longus*	B2			LAD for *Quadraplanus brossus*.
SWC 16	2919	Indeterminate				Virtually barren.
SWC 15	2922	Indeterminate				Very low yield sample.
SWC 14	2929	*T. longus*	B2			*Battenipollis sectilis* and *Tricolporites lilliei* present.
SWC 13	2944	*T. longus*	B2			*Battenipollis sectilis* present.
SWC 11	2960	Indeterminate				Virtually barren.
SWC 8	3008	Indeterminate				Single specimen of *Isabelidinium greenense* recorded.
SWC 7	3076	*T. longus*	B3			*Quadraplanus brossus* present.
SWC 6	3128	Indeterminate				Virtually barren.
SWC 2	3177	Lower *T. longus*	B1			FADs of *Forcipites longus* and *Tetracolporites verrucosus* with *Gambierina rudata* <2%.
Cuttings	3245	*T. longus*	D3			FAD of *Proteacidites reticuloconcavus* ms.
			***CR = Confidence Rating.**			**FAD/LAD = First/Last Appearance Datums**

Confidence Ratings

The concept of Confidence Ratings applied to palaeontological zone picks was originally proposed by Dr. L.E. Stover in 1971 to aid the compilation of micropalaeontological and palynological data and to expedite the revision of the then rapidly evolving zonation concepts in the Gippsland Basin. The original scheme which mixed confidence in fossil species assemblage with confidence due to sample type gradually proved to be rather limiting as additional refinements to existing zonations were made. With the development of the STRATDAT computer database as a replacement for the increasingly unwieldy paper based Palaeontological Data Sheet files a new format for the Confidence Ratings was proposed. These are given for individual zone assignments on Table 1, and their meanings are summarised below:

Alpha codes: Linked to sample type

- **A** Core
- **B** Sidewall core
- **C** Coal cuttings
- **D** Ditch cuttings
- **E** Junk basket
- **F** Miscellaneous/unknown
- **G** Outcrop

Numeric codes: Linked to fossil assemblage

1	**Excellent confidence:**	High diversity assemblage recorded with key zone species.
2	**Good confidence:**	Moderately diverse assemblage recorded with key zone species.
3	**Fair confidence:**	Low diversity assemblage recorded with key zone species.
4	**Poor confidence:**	Moderate to high diversity assemblage recorded without key zone species.
5	**Very low confidence:**	Low diversity assemblage recorded without key zone species.

Table 2: Basic Sample and Palynomorph data from Billfish-1												
Sample Type	Depth metres	Lithology Description Modified by A.D. Partridge	SWC Rec. cms	SWC Palyn cms	Wt. gms	Vom (cc)	O/Yield	Visual Yield	Palynomorph Concentration	Preservation	No. SP Spp.	No. MP Spp.
Cuttings	2800	CALCAREOUS CLAYSTONE to CALCILUTITE medium grey.			13.1	0.4	0.030	Moderate	Moderate	Poor-fair	17	15
Cuttings	2850	CALCISILTITE medium grey. Common fine to coarse mica mud additive?			14.3	0.4	0.027	Moderate	Low	Fair-good	8	12
Cuttings	2870	CALCISILTITE medium grey. Common fine to coarse mica mud additive?			14.5	0.9	0.062	Moderate	Low	Fair	7	9
Cuttings	2880	CALCISILTITE medium grey. Common fine to coarse mica mud additive?			16.5	0.4	0.024	Moderate	Moderate	Poor-fair	17	19
SWC 26	2888	CALCISILTITE light grey, argillaceous, negligible glauconite.	2.0	1.0	8.6	0.2	0.023	Very low	Very low	Very poor	3	1
SWC 25	2894	SILTSTONE dark brown to green black, with common pelletoidal glauconite ~10%	4.5	2.0	10.3	2.1	0.203	Moderate		Poor	26	17
SWC 24	2899	CLAYSTONE calcareous, medium grey, no obvious glauconite	1.7	0.8	5.4	0.2	0.037	Very low	High	Poor	3	10
SWC 23	2904	SILTSTONE dark grey to green black with common glauconite ~30%	2.0	1.2	7.7	0.3	0.038	Low	Moderate	Poor	26	16
SWC 22	2906	GLAUCONITIC SANDSTONE dark green grey to green black fine grained with >60% glauconite.	2.5	1.2	8.3	0.2	0.024	Very low	Low	Poor	14	3
SWC 21	2908	GLAUCONITIC SANDSTONE dark green grey to green black with >75% medium grained glauconite.	2.0	1.0	9.0	0.1	0.011	Low	Moderate	Poor-fair	28	6
SWC 20	2910	GLAUCONITIC SANDSTONE green black with >75% fine grained glauconite.	1.8	0.9	8.9	0.3	0.033	Low	High	Poor-fair	26	13
SWC 19	2913	GLAUCONITIC SANDSTONE dark green with >75% fine grained glauconite.	2.5	1.0	7.9	0.3	0.037	Moderate	Moderate	Poor-fair	19	8
SWC 18	2914	GLAUCONITIC SILTSTONE green black, with floating quartz and feldspar of coarse sand to pebble size.	1.7	0.9	6.0	0.1	0.016	Low	Moderate	Poor-fair	14	3
SWC 17	2916	SANDSTONE light grey, coarse to very coarse, with patches of medium grey argillaceous matrix.	1.7	0.8	5.0	0.01	0.002	Very low	Low	Fair-good	16	2
SWC 16	2929	SANDSTONE medium grey, predominantly medium grained with silty matrix.	2.0	1.2	8.2	0.01	0.001	Very low	Virtually Barren	Fair	2	NR
SWC 15	2922	SANDSTONE medium grey, fine to medium grained with argillaceous matrix	2.0	1.0	7.7	0.01	0.001	Very low	Very low	Poor-good	9	1

Table 2: Basic Sample and Palynomorph data from Billfish-1												
Sample Type	**Depth metres**	**Lithology Description Modified by A.D. Partridge**	**SWC Rec. cms**	**SWC Palyn cms**	**Wt. gms**	**Vom (cc)**	**O/Yield**	**Visual Yield**	**Palynomorph Concentration**	**Preservation**	**No. SP Spp.**	**No. MP Spp.**
SWC 14	2929	SANDSTONE med-light grey, fine to medium grained, minor agrillaceous matrix.	2.5	~1.0	4.6	0.1	0.021	Very low	Low	Fair-good	17	NR
SWC 13	2944	SANDSTONE med-light grey, fine to medium grained, minor agrillaceous/silty matrix.	1.8	0.7	6.1	0.05	0.008	Very low	Low	Poor-good	13	NR
SWC 12	2959.5	SANDSTONE light grey, fine to medium grained, with negligible matrix. **Not sampled for palynology.**	3.2	NA								
SWC 11	2960	SANDSTONE light grey, medium grained, well sorted with pyrite and tr. rock fragments.	2.8	1.0	9.4	0.01	0.001	Very low	Very low	Fair	4	NR
SWC 10	2961	CONGLOMERATE 60% with quartz pebbles 2-8mm and light grey, medium to coarse SANDSTONE 40%. **Not suitable for palynology.**	1.5	NA								
SWC 9	2962	SANDSTONE light grey,medium grained, well sorted with negligible matrix. **Not sampled for palynology.**	2.5	NA								
SWC 8	3008	SANDSTONE medium grey, fine to medium grained with abundant silty matrix.	<2.0	<1.0	6.7	0.1	0.014	Very low	Very low	Poor-fair	5	2
SWC 7	3076	SANDSTONE medium grey, fine to medium, common argillaceous/silty matrix.	2.0	1.0	4.7	0.05	0.010	Very low	Very low	Poor-fair	6	1
SWC 6	3128	SANDSTONE medium grey, fine to medium grained with abundant silty matrix.	1.8	0.8	5.7	0.01	0.001	Very low	Virtually Barren	Fair	1	NR
SWC 4	3143	SANDSTONE light grey, fine to medium grained with abundant silty matrix. **Not sampled for palynology.**	1.2	NA								
SWC 2	3177	Medium grey fine SANDSTONE with 0.5-2mm thick laminae of dark grey MUDSTONE.	<2.0	1.0	7.6	0.3	0.039	Moderate	Moderate	Poor-fair	42	2
Cuttings	3245	Clumped cuttings of SANDSTONE and MUDSTONE? light grey with white blotches.			15.2	0.3	0.019	Very low	Very low	Poor-fair	7	NR
										AVERAGES:	**13.8**	**5.8**

Table-3: Species List for Billfish-1, Gippsland Basin.

Sample Depths	2800 Cts	2850 Cts	2870 Cts	2880 Cts	2888 SWC	2894 SWC	2899 SWC	2904 SWC	2906 SWC	2908 SWC	2910 SWC	2913 SWC	2914 SWC	2916 SWC	2929 SWC	2922 SWC	2929 SWC	2944 SWC	2960 SWC	3008 SWC	3076 SWC	3128 SWC	3177 SWC	3245 Cts
SPORE-POLLEN SPECIES																								
Acaciapollenites myriosporites																						CV		
Aequitriradites verucosus																							X	
Aequitriradites spinulosus																							X	
Araucariacites australis	X	X	X	X		X	X	F		X	X			X				X	X				X	
Australopollis obscurus										X	X													
Baculatisporites spp.						X		X	X			X												
Battenipollis sectilis																		X					X	
Beaupreaidites orbiculatus																							X	
Camarozonosporites heskermensis												X											X	
Clavastephanocolporites meleosus				X																				
Clavifera triplex								X		X														
Corollina torosa **RW**								RW																
Crybelosporites striatus **RW**														X										
Cupanieidites orthoteichus						X																		
Cyatheacidites annulatus	F	X	X	X																				
Cyathidites australis												X		X								X	X	
Cyathidites minor																X	X						X	
Cyathidites paleospora	X			F		X		X					X											
Cyathidites splendens						X		X				X	X							X	X		X	
Dacrycarpites australiensis										X							X							
Densoisporites velatus																							X	
Dicotetradites clavatus											X													
Dictyophyllidites spp.			X																					
Dilwynites granulatus					X	A	X	A	X	A	A	X		X			X							
Dilwynites tuberculatus	X								X	X	X													
Forcipites longus																							X	
Gambierina edwardsii											X												X	
Gambierina rudata									X	X	C	C	C	X				X		X			X	
Gleicheniidites circinidites						C		C	X	C	X	X	X				X			X				
Haloragacidites harrisii	X	X	X	X		C		X		X	X											CV		
Herkosporites elliottii	X			X				X		X		X	X	X									X	
Ischyosporites gremius		X																						
Ischyosporites irregularis ms	X	X		X							X													

Table-3: Species List for Billfish-1, Gippsland Basin.

Sample Depths	2800	2850	2870	2880	2888	2894	2899	2904	2906	2908	2910	2913	2914	2916	2929	2922	2929	2944	2960	3008	3076	3128	3177	3245
	Cts	Cts	Cts	Cts	SWC	SWC	SWC	SWC	SWC	SWC	SWC	SWC	SWC	SWC	SWC	SWC	SWC	SWC	SWC	SWC	SWC	SWC	SWC	Cts
Laevigatosporites major	X	X								X													X	
Laevigatosporites ovatus	X			X		X	X	X		X	X	X		X		X	X				X		X	X
Latrobosporites amplus																	X						X	
Latrobosporites ohiensis																							X	
Leptolepidites verrucatus **RW**																							X	
Lygistepollenites balmei								X		F	F			X		X	X			X			X	
Lygistepollenites florinii		X	X	X	X	X		X	X	X	F		X	X				X			X		X	
Malvacipollis diversus						X																		
Malvacipollis subtilis						X																		
Matonisporites ornamentalis	X		X	X																				
Microcachryidites antacticus										F	F						X	X					X	
Myrtaceidites tenuis						X																		
Nothofagidites asperus				X				X																
Nothofagidites brachyspinulosus								X	X	X														
Nothofagidites emarcidus/heturus	X			X	X	X		X	X	X	X													
Nothofagidites endurus											X												X	
Nothofagidites falcatus				X																				
Nothofagidites flemingii						X		X		X													cf	
Nothofagidites senectus												X		X		X	X	X					X	X
Peninsulapollis gillii								X	X	X	X	X	X	X		X	X	X					X	
Periporopollenites demarcatus						X																		
Periporopollenites polyoratus												X												
Perotrilites papillatus																							X	
Phyllocladidites mawsonii	X		X	X				X	X	C	C	F	X	X		X	F	F					C	
Phyllocladidites verrucosus											X													
Pilosisporites notensis **RW**																							X	
Plicatipollenites spp. **RW**									X															
Podocarpidites exiguus														X				X						
Podocarpidites spp.				X		C		F	X	A		C	X		X	X	X		X				C	X
Podosporites microsaccatus						X		X	X	X	X												F	
Polypodiaceoisporites varus ms						X																		
Polypodiidites perverrucatus	X	X																						
Proteacidites adenanthoides						X																		
Proteacidites angulatus											X													
Proteacidites annularis								X																

Table-3: Species List for Billfish-1, Gippsland Basin.

Sample Depths	2800 Cts	2850 Cts	2870 Cts	2880 Cts	2888 SWC	2894 SWC	2899 SWC	2904 SWC	2906 SWC	2908 SWC	2910 SWC	2913 SWC	2914 SWC	2916 SWC	2929 SWC	2922 SWC	2929 SWC	2944 SWC	2960 SWC	3008 SWC	3076 SWC	3128 SWC	3177 SWC	3245 Cts
Proteacidites clinei ms																	X							
Proteacidites granoratus						X																		
Proteacidites otwayensis ms												X											X	
Proteacidites palisadus																							X	
Proteacidites recticuloconcavus ms												X	X										F	X
Proteacidites reticuloscabratus						X																		
Proteacidites retiformis																							X	
Proteacidites spp.						X		X	X	F	F	C	C	F	X	X	C	C	X				C	X
Proteacidites tenuiexinus										X														
Quadraplanus brossus														X							X			
Reticulosporis reticulata																							X	
Retitriletes nodosa **RW**																							X	
Retitriletes spp.								X		X		X	X					X		X			X	
Rudolphisporis rudolphi	X																							
Rugulatisporites mallatus						X																		
Rugulatisporites trophus	X																							
Stereisporites (Tripunctisporis) sp.												X												
Stereisporites antiquisporites	X			X		X		X		X	X	X	X	X		X	X	X					X	X
Tetracolporites verrucosus																							X	
Tetracolpotites multistrixus ms								X																
Tricolpites phillipsii								X																
Tricolpites waiparaensis													X						X				X	
Tricolporites lilliei												X					X						X	X
Tricolporites paenestriatus						X																		
Triporopollenites spp.										X	X			X				X			X			
MICROPLANKTON SPECIES																								
Achomosphaera alcicornu		X	X	X																				
Achomosphaera ramulifera							X																	
Achomosphaera septata								X																
Amosopollis cruciformis											X										X			
Apectodinium homomorphum (long sp.)						X																		
Apectodinium homomorphum (short sp.)								X			X													
Apteodinium australiense		X	X	X																				

Table-3: Species List for Billfish-1, Gippsland Basin.

Sample Depths	2800 Cts	2850 Cts	2870 Cts	2880 Cts	2888 SWC	2894 SWC	2899 SWC	2904 SWC	2906 SWC	2908 SWC	2910 SWC	2913 SWC	2914 SWC	2916 SWC	2929 SWC	2922 SWC	2929 SWC	2944 SWC	2960 SWC	3008 SWC	3076 SWC	3128 SWC	3177 SWC	3245 Cts
Cleistosphaeridium sp.													X											
Cordosphaeridium inodes						X		X																
Crassosphaera concinnia	X	X																						
Cribroperidinium sp.										X														
Cyclopsiella vieta	X			X																				
Dapsilidinium pseudocolligerum	X		X	X																				
Deflandrea flounderensis						X																		
Deflandrea medcalfii											X													
Deflandrea sp. indent.						X		X																
Deflandrea speciosus											X													
Diphyes colligerum								X																
Eisenackia crassitabulata											C													
Enneadocysta spp.							X																	
Glaphyrocysta retiintexta								X			A												CV	
Glaphyrocysta sp.						C																		
Holoroginella incurvata								X																
Homotryblium tasmaniense						A	X	CV															CV	
Hystiocysta sp.											X													
Hystrichokolpoma rigaudae				X			X																	
Hystrichosphaeridium tubiferum											X													
Impagidinium maculatum				X																				
Impagidinium spp.		X		X		X	X			X		X												
Isabelidinium cingulatum											A	CV												
Isabelidinium greenense																				X				
Isabelidinium spp.														X						X				
Kallosphaeridium sp.												X												
Kenleyia spp.						X																		
Lejeunecysta sp.	X																							
Lingulodinium machaerophorum	X	X		X	X	X	X																	
Lingulodinium solarum			X	X																				
Manumiella conoratum												A	A											
Manumiella druggii												A	F											
Manumiella seelandica												F	C											
Micrystridium sp.												X												
Nematosphaeropsis labrynthius							X																	

Table-3: Species List for Billfish-1, Gippsland Basin.

Sample Depths	Cts 2800	Cts 2850	Cts 2870	Cts 2880	SWC 2888	SWC 2894	SWC 2899	SWC 2904	SWC 2906	SWC 2908	SWC 2910	SWC 2913	SWC 2914	SWC 2916	SWC 2929	SWC 2922	SWC 2929	SWC 2944	SWC 2960	SWC 3008	SWC 3076	SWC 3128	SWC 3177	Cts 3245
Nematosphaeropsis rhizoma ms	X																							
Odontochitina indigena **RW**										RW														
Odontochitina n.sp.												X												
Operculodinium centrocarpum	X	X	X	C		X	A	F	X	X	X												cf	
Operculodinium tabulatum ms	X			X																				
Palaeocystodinium golzowense										X	X													
Palaeoperidinium pyrophorum											X													
Paralecaniella indentata								X																
Pentadinium laticinctum				X																				
Protoellipsodinium mamilatus ms.				X																				
Protoellipsodinium simplex ms.	X	X	X	F																				
Pyxidinopsis beta ms	X	X	X	X																				
Pyxidinopsis delicata						X																		
Pyxidinopsis pontus ms	X	C	X	X																				
Pyxidinopsis waipawaensis						X		X																
Senegelinium dilwynense									X	cf														
Sigmopollis carbonis																							X	
Spinidinium sp.										X														
Spiniferites spp.	X	X	X	F		X	A	X		X	X												X	
Systematophora placacantha	X			X																				
Systematophora variable						X																		
Tasmanites sp.	X											X												
Tectatodinium scabroellipticus ms	X	X		X																				
Tectatodinium sp.							X																	
Tubisphaera filosa						X					X													
Tubulifera heterosolenia						X		X	X															
Vozzhennikova angulata											X													
Wetzeliella articulata						X																		
Micro-dinoflagellates indeterminate						X		X	X	X	X													
OTHER PALYNOMORPHS																								
Botryococcus sp.				X				X															X	
Fungal fruiting bodies						X																		
Fungal spores & hyphae						X		X		X														
Microforaminiferal liners	C	C	F	C	C	X		X	X	X													X	
Scolecodonts				X				X																

ABBREVIATIONS

X	=	Present
F	=	Frequent
C	=	Common
A	=	Abundant
RW	=	Reworked
CV	=	Caved
cf	=	Compare with

RELINQUISHMENT LIST — PALYNOLOGY SLIDES

WELL NAME & NO: BILLFISH-1

PREPARED BY: A.D. Partridge

DATE: 21 March 1997 Sheet 1 of 1

Sample Type	Depth (m)	Catalogue Number	Description
Cuttings	2800	P197178	Kerogen slide filtered/unfiltered fractions
Cuttings	2800	P197179	Oxidised slide 2
Cuttings	2800	P197180	Oxidised slide 3 - 1/2 cover slip
Cuttings	2850	P197181	Kerogen slide filtered/unfiltered fractions
Cuttings	2850	P197182	Oxidised slide 2
Cuttings	2850	P197183	Oxidised slide 3
Cuttings	2870	P197184	Kerogen slide filtered/unfiltered fractions
Cuttings	2870	P197185	Oxidised slide 2
Cuttings	2870	P197186	Oxidised slide 3
Cuttings	2880	P197187	Kerogen slide filtered/unfiltered fractions
Cuttings	2880	P197188	Oxidised slide 2
Cuttings	2880	P197189	Oxidised slide 3 - 1/2 cover slip
SWC 26	2888	P197190	Kerogen slide filtered/unfiltered fractions
SWC 25	2894	P197191	Kerogen slide filtered/unfiltered fractions
SWC 25	2894	P197192	Oxidised slide 2
SWC 25	2894	P197193	Oxidised slide 3
SWC 24	2899	P197194	Kerogen slide filtered/unfiltered fractions
SWC 23	2904	P197195	Kerogen slide filtered/unfiltered fractions
SWC 23	2904	P197196	Oxidised slide 2
SWC 22	2906	P197197	Kerogen slide filtered/unfiltered fractions
SWC 21	2908	P197198	Kerogen slide filtered/unfiltered fractions
SWC 21	2908	P197199	Oxidised slide 2
SWC 20	2910	P197200	Kerogen slide filtered/unfiltered fractions
SWC 20	2910	P197201	Oxidised slide 2 - 18mm cover slip
SWC 19	2913	P197202	Kerogen slide filtered/unfiltered fractions
SWC 19	2913	P197203	Oxidised slide 2
SWC 19	2913	P197204	Oxidised slide 3 - 18mm cover slip
SWC 18	2914	P197205	Kerogen slide filtered/unfiltered fractions
SWC 18	2914	P197206	Oxidised slide 2 - 18mm cover slip
SWC 17	2916	P197207	Kerogen slide filtered - 15mm cover slip
SWC 16	2929	P197208	Kerogen slide filtered - 15mm cover slip
SWC 15	2922	P197209	Kerogen slide filtered - 15mm cover slip
SWC 14	2929	P197210	Kerogen slide filtered - 18mm cover slip
SWC 13	2944	P197211	Kerogen slide filtered - 18mm cover slip
SWC 11	2960	P197212	Kerogen slide filtered - 18mm cover slip
SWC 8	3008	P197213	Kerogen slide filtered/unfiltered fractions
SWC 7	3076	P197214	Kerogen slide filtered - 18mm cover slip
SWC 6	3128	P197215	Kerogen slide filtered - 15mm cover slip
SWC 2	3177	P197216	Kerogen slide filtered/unfiltered fractions
SWC 2	3177	P197217	Oxidised slide 2
SWC 2	3177	P197218	Oxidised slide 3
SWC 2	3177	P197219	Oxidised slide 4
Cuttings	3245	P197220	Kerogen slide filtered/unfiltered fractions

APPENDIX 2

Esso Australia Ltd

Exploration Department

BILLFISH 1

Formation Evaluation
Log Analysis Report

Petrophysicist: A. A. Mills

May 1997

Endorsed by: .....

FE Team Leader

Date: 9/5/97

BILLFISH 1 LOG ANALYSIS

Billfish 1 electric log data acquired at total depth have been analysed for effective porosity and water saturation over the interval 2900m to 3223m MDKB.

The 12¼" hole was drilled out of 13 3/8" casing from 1302m to a total depth of 3250 m (drillers depths). Note that all depths quoted below are logged MDKB unless specified otherwise.

A depth plot of the interpretation is included as Figure 1.

DATA

Logs Acquired

Schlumberger Wireline data:

GR-DLL-SP	(Supercombo)	3242m to 1289m
MSFL-CALS	(Supercombo)	3218m to 2394m
LDT-CNL	(Supercombo)	3225m to 1289m
SDT	(Supercombo)	3236m to 566m
CSAT	(Checkshot)	3245.5m to 600.1m

Mud Data

Mud type:	NaCl / KCl / PHPA / POLY
Mud weight:	10 ppg
API Filtrate:	5.6 (ml/30m)

Log Quality

- All of the logs used in this interpretation were acquired as a single (supercombo) run-in-the-hole. The hole condition was generally excellent, with no significant pulls experienced while logging, resulting in all logs being well depth-matched. The only significant exception to this occurred near top of Latrobe over the interval 2887-2915m MDKB, where washout has affected nuclear and micro resistivity data.

- Similarly the good hole condition resulted in all of the data being acceptable for use in the interpretation.

- Despite barite in the mudcake giving rise to a negative DRUO measurement throughout the Latrobe Formation, the density curve provides a reliable formation measurement as indicated by the overlay between the neutron and density curves on a sandstone compatible scale over the clean, quartzose sandstones.

Log Processing

- No depth alignment was necessary prior to the logs being used in the interpretation.
- The resistivity logs were environmentally corrected and invasion corrected to generate an Rt curve for use in the interpretation.

INTERPRETATION

Logs Used

GR, Rt, RHOB, TNPH.

Analysis Parameters

a	1
m	1.8
n	2
Apparent Shale Neutron Porosity	0.30
Apparent Shale Bulk Density	2.50 gm/cc
Input Hydrocarbon Density	0.7 gm/cc
Shale Resistivity	5 ohmm
Lower Grain Density Limit	2.645 gm/cc
Upper Grain Density Limit	2.675 gm/cc
Formation Water Salinity	40,000 ppm NaCleq
Bottom Hole Temperature	71 DegC
Measured Rmf	0.036 ohmm @ 71 Deg C
Fluid Density	1.08

Free Formation Water Resistivity

The free formation water salinity of 40,000 ppm was derived from Rwa calculations in clean, quartzose water sands. As a consequence, water saturation is slightly underestimated in feldspathic sands and overestimated in dolomitic sands as variable grain densities have led to small errors in porosity calculation.

Shale Volume, Total Porosity and Water Saturation

An initial Vsh was calculated from the GR and compared to a calculated neutron-density value to test for input into an iterative log analysis model. Initial neutron-density total porosity and dual-water total water saturation were then calculated and hydrocarbon and shale corrections applied to the neutron and density data using those values. The resulting calculated grain density was compared to a supplied grain density window and the initial Vsh increased or decreased until the calculated GD fell within the window.

Effective Porosity and Water Saturations

Effective porosity was calculated using the final values of total porosity and Vsh and the effective water saturation from the total water saturation using the following equations:

PHIE = (PHIT - (VSH * PHISH))
SWE = (1 - ((PHIT/PHIE) * (1 - SWT)))

DISCUSSION

1. Porosities calculated at Billfish 1 are generally 20-25 p.u., consistent with those calculated for surrounding wells. However, clear correlation of water saturations in excess of 110% with dolomitised zones, and water saturations of 80-90% with feldspathic zones is indicative of porosity errors related to the grain densities of dolomite and feldspar. Porosities have been overcalculated in feldspathic sands and undercalculated in dolomitic zones. (An error of +/- 10 s.u. equates to an error of about +/- 2.5 p.u.)

   This effect is clearly identifiable in sands at 2960m (32.5 p.u.), 3181m (29 p.u.), and 3195m (27 p.u.) which have high feldspar concentrations, and porosities. Three sidewall cores were shot in the sand at 2960m, as no mudlog shows were recorded throughout the well, but it was clear that logs would calculate significant hydrocarbon saturations here given the high apparent porosity. No shows were recorded in the SWCs.

   All sands were interpreted to be water saturated, and the well was plugged and abandoned.

Attached are the following presentations of results:

- Table 1 - Summary of Results
- Table 2 - Log Analysis Listing
- Figure 1 - Depth Plot of Interpretation
- Attachment 1 - Analysis Depth Plot

BILLFISH_1

PETROPHYSICS ANALYSIS SUMMARY

Net porosity cut-off: 0.120 volume per volume
Net water saturation cut-off: 0.500 volume per volume
Depth reference: MDKB

Net Porous Interval based on Porosity cut-off only.
Both Porosity and Sw cut-offs invoked when generating Hydrocarbon-Metres.

(metres) (top)	(base)	Gross Metres	NET POROUS INTERVAL Net Metres	Net to Gross (%)	Mean Porosity	Standard Deviation	Mode Porosity	Mean Vshale
2887	2915	28	0	0%	-	-	-	-
2915.2	3225	309.8	243.4	79%	0.2	0.042	0.22	0.12

BILLFISH_1
LOG ANALYSIS LISTING

DEPTH	GR	RT	RHOB	NPHI	PHIE	SWE
mRKB	api	ohmm	g/cc	frac	frac	frac
2875.00	67.00	1.30	2.43	0.34	0.00	1.00
2876.00	64.00	1.50	2.42	0.29	0.00	1.00
2877.00	70.00	1.30	2.42	0.31	0.00	1.00
2878.00	66.00	1.50	2.44	0.32	0.00	1.00
2879.00	61.00	1.60	2.45	0.32	0.00	1.00
2880.00	67.00	1.50	2.41	0.28	0.00	1.00
2881.00	67.00	1.80	2.46	0.26	0.00	1.00
2882.00	64.00	1.50	2.43	0.27	0.00	1.00
2883.00	61.00	1.80	2.50	0.23	0.00	1.00
2884.00	61.00	2.40	2.53	0.22	0.00	1.00
2885.00	69.00	2.60	2.53	0.24	0.00	1.00
2886.00	66.00	3.00	2.53	0.23	0.00	1.00
2887.00	94.00	2.60	2.42	0.26	0.00	1.00
2888.00	166.00	2.20	2.29	0.34	0.00	1.00
2889.00	151.00	2.40	2.31	0.37	0.00	1.00
2890.00	128.00	2.10	2.32	0.36	0.00	1.00
2891.00	132.00	2.30	2.36	0.35	0.00	1.00
2892.00	125.00	2.50	2.39	0.36	0.00	1.00
2893.00	130.00	2.60	2.39	0.35	0.00	1.00
2894.00	127.00	2.30	2.31	0.41	0.00	1.00
2895.00	129.00	2.30	2.34	0.41	0.00	1.00
2896.00	92.00	1.30	2.47	0.25	0.00	1.00
2897.00	121.00	2.10	2.14	0.35	0.00	1.00
2898.00	116.00	2.10	2.30	0.33	0.06	1.00
2899.00	113.00	2.20	2.47	0.36	0.00	1.00
2900.00	101.00	1.90	1.93	0.34	0.00	1.00
2901.00	106.00	2.10	2.48	0.33	0.00	1.00
2902.00	103.00	2.30	2.55	0.38	0.00	1.00
2903.00	97.00	2.30	2.37	0.29	0.00	1.00
2904.00	105.00	2.20	2.42	0.29	0.00	1.00
2905.00	99.00	2.20	2.28	0.29	0.00	1.00
2906.00	108.00	2.10	2.47	0.30	0.00	1.00
2907.00	117.00	1.80	2.47	0.32	0.00	1.00
2908.00	139.00	1.80	2.47	0.34	0.00	1.00
2909.00	90.00	2.10	2.54	0.33	0.00	1.00
2910.00	107.00	2.00	2.48	0.32	0.00	1.00
2911.00	127.00	2.00	2.45	0.28	0.00	1.00
2912.00	172.00	1.70	2.66	0.30	0.00	1.00
2913.00	148.00	1.90	2.61	0.28	0.00	1.00
2914.00	118.00	2.30	2.66	0.31	0.00	1.00
2915.00	117.00	3.00	2.53	0.12	0.05	1.00
2916.00	62.00	1.50	2.42	0.15	0.13	1.00
2917.00	66.00	1.80	2.40	0.17	0.14	1.00
2918.00	89.00	1.40	2.38	0.14	0.17	1.00
2919.00	110.00	1.00	2.28	0.24	0.22	1.00
2920.00	110.00	1.00	2.29	0.26	0.20	1.00

2921.00	139.00	0.80	2.21	0.27	0.28	1.00
2922.00	131.00	1.00	2.26	0.25	0.24	0.98
2923.00	89.00	1.40	2.34	0.25	0.16	1.00
2924.00	52.00	1.30	2.38	0.17	0.18	1.00
2925.00	51.00	1.20	2.36	0.16	0.18	1.00
2926.00	49.00	1.30	2.40	0.17	0.16	1.00
2927.00	46.00	1.20	2.44	0.15	0.13	1.00
2928.00	74.00	0.80	2.43	0.19	0.12	1.00
2929.00	101.00	0.80	2.23	0.23	0.28	1.00
2930.00	82.00	1.00	2.26	0.21	0.25	1.00
2931.00	110.00	0.80	2.24	0.24	0.26	1.00
2932.00	84.00	0.90	2.24	0.24	0.25	1.00
2933.00	106.00	0.80	2.22	0.26	0.27	1.00
2934.00	123.00	0.80	2.20	0.24	0.29	0.99
2935.00	108.00	0.80	2.22	0.25	0.28	1.00
2936.00	81.00	0.90	2.24	0.24	0.25	1.00
2937.00	85.00	0.90	2.28	0.24	0.22	1.00
2938.00	85.00	0.70	2.20	0.25	0.29	1.00
2939.00	94.00	0.80	2.24	0.25	0.26	1.00
2940.00	97.00	0.80	2.21	0.25	0.29	1.00
2941.00	109.00	0.80	2.24	0.22	0.27	1.00
2942.00	113.00	1.00	2.26	0.25	0.24	1.00
2943.00	120.00	0.90	2.25	0.23	0.25	1.00
2944.00	132.00	1.00	2.26	0.24	0.24	0.98
2945.00	130.00	1.00	2.25	0.24	0.25	0.98
2946.00	104.00	0.90	2.23	0.24	0.27	0.99
2947.00	91.00	1.10	2.33	0.21	0.19	1.00
2948.00	111.00	1.40	2.33	0.23	0.18	1.00
2949.00	113.00	1.70	2.39	0.22	0.13	1.00
2950.00	104.00	1.20	2.29	0.22	0.23	0.98
2951.00	76.00	1.00	2.26	0.23	0.23	1.00
2952.00	74.00	0.80	2.22	0.22	0.27	1.00
2953.00	73.00	0.80	2.24	0.22	0.27	1.00
2954.00	93.00	0.70	2.27	0.24	0.24	1.00
2955.00	103.00	1.50	2.37	0.21	0.16	1.00
2956.00	99.00	1.40	2.35	0.23	0.16	1.00
2957.00	113.00	2.60	2.42	0.21	0.10	0.93
2958.00	119.00	1.20	2.29	0.22	0.22	0.97
2959.00	121.00	1.40	2.25	0.21	0.26	0.85
2960.00	119.00	1.20	2.14	0.28	0.33	0.73
2961.00	108.00	1.10	2.22	0.28	0.26	0.89
2962.00	126.00	1.00	2.25	0.26	0.24	0.96
2963.00	87.00	1.00	2.33	0.22	0.18	1.00
2964.00	64.00	2.60	2.55	0.12	0.04	1.00
2965.00	70.00	2.00	2.40	0.13	0.16	1.00
2966.00	65.00	1.40	2.37	0.16	0.17	1.00
2967.00	60.00	32.40	2.61	0.02	0.01	1.00
2968.00	95.00	2.70	2.40	0.17	0.14	0.86
2969.00	116.00	1.10	2.28	0.25	0.22	0.99
2970.00	110.00	2.70	2.42	0.22	0.11	0.87
2971.00	63.00	4.90	2.56	0.05	0.05	1.00
2972.00	67.00	1.40	2.30	0.21	0.22	0.90

2973.00	57.00	2.90	2.42	0.13	0.14	0.92
2974.00	48.00	9.80	2.52	0.05	0.08	0.88
2975.00	48.00	26.00	2.64	0.03	0.00	1.00
2976.00	46.00	6.20	2.45	0.10	0.13	0.70
2977.00	128.00	4.90	2.49	0.10	0.09	0.98
2978.00	48.00	36.50	2.62	0.04	0.02	0.87
2979.00	60.00	1.90	2.53	0.05	0.07	1.00
2980.00	145.00	3.60	2.35	0.37	0.00	1.00
2981.00	102.00	2.30	2.47	0.22	0.02	1.00
2982.00	54.00	1.30	2.30	0.18	0.23	0.99
2983.00	48.00	3.50	2.51	0.11	0.09	1.00
2984.00	60.00	3.50	2.47	0.14	0.12	0.95
2985.00	61.00	2.10	2.36	0.16	0.18	0.89
2986.00	84.00	1.20	2.24	0.25	0.23	0.90
2987.00	81.00	1.60	2.32	0.20	0.20	0.93
2988.00	62.00	3.00	2.41	0.11	0.16	0.90
2989.00	62.00	1.80	2.34	0.17	0.20	0.93
2990.00	63.00	1.70	2.33	0.17	0.20	0.93
2991.00	64.00	1.30	2.33	0.17	0.20	1.00
2992.00	61.00	1.50	2.35	0.15	0.19	1.00
2993.00	55.00	3.20	2.49	0.12	0.10	1.00
2994.00	54.00	3.90	2.55	0.07	0.07	1.00
2995.00	134.00	3.40	2.44	0.34	0.00	1.00
2996.00	92.00	1.10	2.33	0.27	0.16	1.00
2997.00	68.00	0.90	2.24	0.22	0.26	1.00
2998.00	64.00	2.20	2.42	0.17	0.14	1.00
2999.00	52.00	2.40	2.37	0.13	0.18	0.90
3000.00	49.00	4.40	2.54	0.09	0.07	1.00
3001.00	49.00	6.20	2.60	0.05	0.03	1.00
3002.00	48.00	11.50	2.62	0.03	0.03	1.00
3003.00	55.00	2.40	2.39	0.13	0.16	0.95
3004.00	68.00	7.30	2.60	0.06	0.02	1.00
3005.00	96.00	1.50	2.38	0.22	0.13	1.00
3006.00	90.00	1.10	2.29	0.25	0.20	1.00
3007.00	86.00	0.80	2.23	0.22	0.27	1.00
3008.00	138.00	2.00	2.39	0.22	0.13	0.94
3009.00	119.00	1.40	2.30	0.22	0.21	0.92
3010.00	123.00	1.50	2.32	0.22	0.20	0.92
3011.00	113.00	1.50	2.32	0.25	0.18	0.90
3012.00	110.00	3.60	2.44	0.23	0.05	0.87
3013.00	102.00	2.50	2.46	0.25	0.00	1.00
3014.00	98.00	3.00	2.43	0.21	0.10	0.83
3015.00	73.00	1.20	2.29	0.23	0.21	0.98
3016.00	132.00	1.80	2.37	0.26	0.10	0.96
3017.00	67.00	1.10	2.29	0.23	0.21	1.00
3018.00	71.00	0.90	2.24	0.24	0.25	0.99
3019.00	69.00	1.00	2.28	0.23	0.22	1.00
3020.00	54.00	1.10	2.29	0.17	0.23	1.00
3021.00	62.00	1.30	2.30	0.16	0.22	1.00
3022.00	58.00	1.20	2.29	0.19	0.23	0.98
3023.00	61.00	1.00	2.30	0.19	0.22	1.00
3024.00	58.00	1.10	2.31	0.19	0.21	1.00

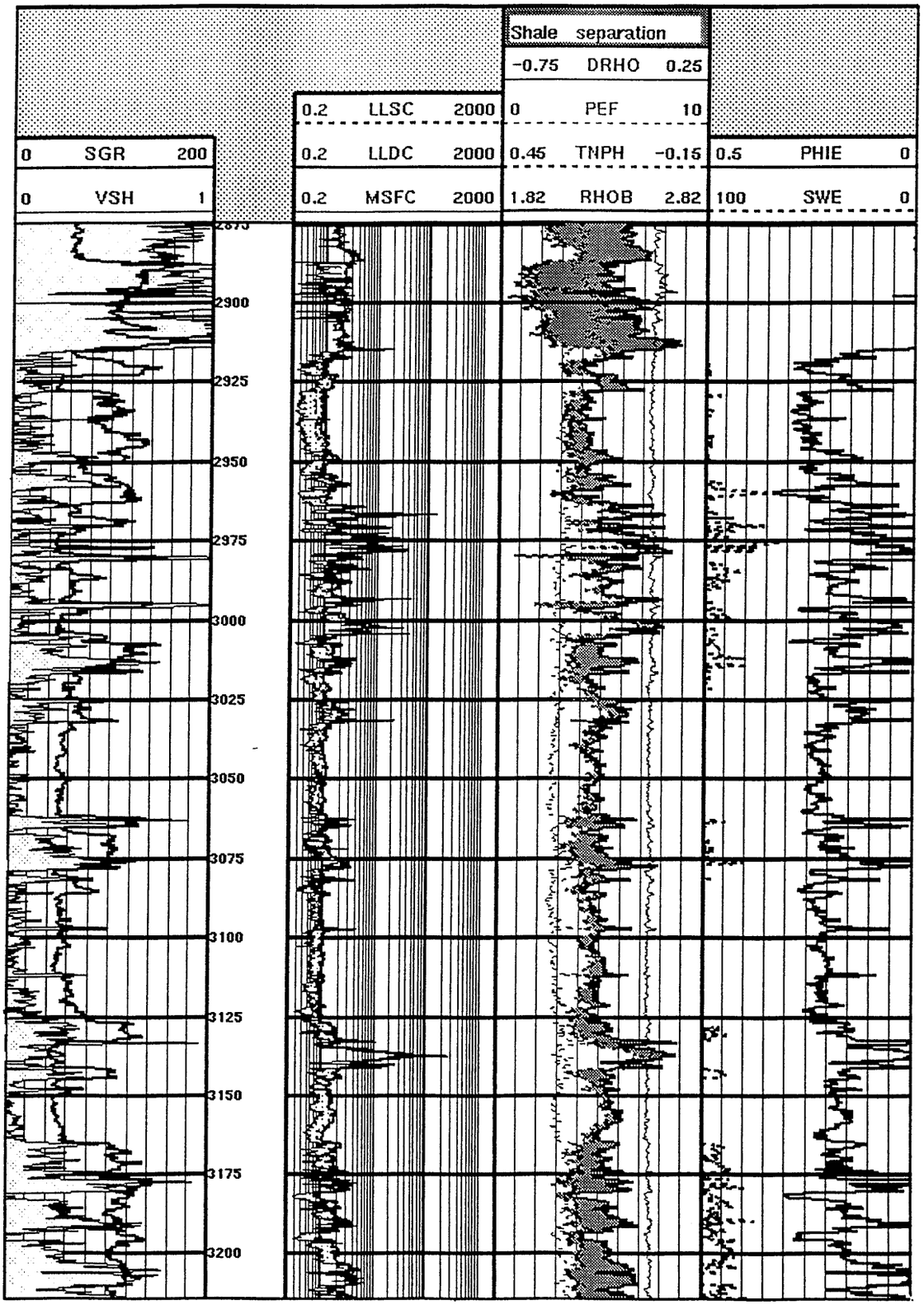
3025.00	122.00	2.50	2.48	0.23	0.00	1.00
3026.00	69.00	1.60	2.40	0.16	0.14	1.00
3027.00	65.00	1.50	2.37	0.18	0.16	1.00
3028.00	77.00	2.40	2.45	0.14	0.11	1.00
3029.00	67.00	2.20	2.44	0.12	0.12	1.00
3030.00	72.00	2.10	2.44	0.12	0.12	1.00
3031.00	83.00	1.80	2.41	0.15	0.14	1.00
3032.00	66.00	2.00	2.46	0.15	0.11	1.00
3033.00	63.00	1.00	2.29	0.18	0.23	1.00
3034.00	66.00	1.10	2.36	0.16	0.18	1.00
3035.00	58.00	1.20	2.31	0.20	0.21	1.00
3036.00	51.00	1.00	2.28	0.20	0.23	1.00
3037.00	57.00	1.10	2.34	0.18	0.19	1.00
3038.00	55.00	0.90	2.30	0.19	0.22	1.00
3039.00	54.00	0.80	2.25	0.23	0.24	1.00
3040.00	58.00	0.80	2.27	0.22	0.23	1.00
3041.00	60.00	0.90	2.33	0.20	0.19	1.00
3042.00	56.00	0.90	2.27	0.21	0.24	1.00
3043.00	48.00	1.00	2.28	0.19	0.24	1.00
3044.00	49.00	1.00	2.29	0.19	0.23	1.00
3045.00	48.00	1.10	2.31	0.18	0.22	1.00
3046.00	47.00	1.10	2.32	0.16	0.21	1.00
3047.00	48.00	1.10	2.33	0.16	0.21	1.00
3048.00	53.00	1.10	2.31	0.17	0.22	1.00
3049.00	53.00	1.10	2.34	0.18	0.19	1.00
3050.00	57.00	0.80	2.32	0.18	0.21	1.00
3051.00	58.00	1.10	2.29	0.18	0.23	1.00
3052.00	54.00	0.90	2.27	0.20	0.24	1.00
3053.00	55.00	0.90	2.26	0.21	0.25	1.00
3054.00	55.00	1.00	2.27	0.20	0.25	1.00
3055.00	50.00	1.00	2.30	0.19	0.22	1.00
3056.00	53.00	1.10	2.32	0.19	0.20	1.00
3057.00	50.00	1.00	2.29	0.16	0.22	1.00
3058.00	50.00	0.90	2.29	0.20	0.23	1.00
3059.00	52.00	0.90	2.30	0.19	0.22	1.00
3060.00	54.00	0.80	2.24	0.21	0.26	1.00
3061.00	49.00	1.10	2.33	0.18	0.21	1.00
3062.00	125.00	1.10	2.33	0.21	0.19	1.00
3063.00	130.00	2.40	2.42	0.22	0.10	0.94
3064.00	118.00	2.00	2.40	0.23	0.12	1.00
3065.00	90.00	1.80	2.41	0.22	0.11	1.00
3066.00	59.00	1.00	2.29	0.19	0.23	1.00
3067.00	72.00	0.80	2.24	0.22	0.26	1.00
3068.00	104.00	1.30	2.36	0.22	0.16	1.00
3069.00	105.00	1.30	2.34	0.21	0.18	1.00
3070.00	100.00	1.10	2.29	0.25	0.21	1.00
3071.00	103.00	1.10	2.27	0.26	0.22	0.98
3072.00	103.00	1.20	2.30	0.23	0.21	1.00
3073.00	98.00	1.20	2.31	0.23	0.20	1.00
3074.00	99.00	1.40	2.35	0.21	0.17	1.00
3075.00	109.00	1.90	2.39	0.22	0.13	0.96
3076.00	113.00	3.00	2.43	0.20	0.10	0.87

3077.00	73.00	2.60	2.58	0.14	0.01	1.00
3078.00	82.00	1.90	2.44	0.20	0.10	1.00
3079.00	48.00	0.90	2.29	0.21	0.24	1.00
3080.00	53.00	1.00	2.33	0.20	0.21	1.00
3081.00	76.00	1.70	2.37	0.20	0.15	1.00
3082.00	70.00	1.20	2.33	0.21	0.18	1.00
3083.00	68.00	0.90	2.26	0.20	0.25	1.00
3084.00	73.00	0.80	2.26	0.22	0.24	1.00
3085.00	91.00	0.80	2.23	0.23	0.27	1.00
3086.00	56.00	1.40	2.35	0.17	0.19	1.00
3087.00	52.00	0.90	2.31	0.18	0.22	1.00
3088.00	56.00	0.80	2.27	0.21	0.24	1.00
3089.00	53.00	1.00	2.28	0.17	0.23	1.00
3090.00	52.00	1.00	2.30	0.18	0.22	1.00
3091.00	54.00	0.90	2.26	0.20	0.25	1.00
3092.00	51.00	0.90	2.29	0.19	0.23	1.00
3093.00	53.00	0.90	2.31	0.18	0.22	1.00
3094.00	55.00	0.90	2.36	0.18	0.18	1.00
3095.00	50.00	1.00	2.31	0.20	0.22	1.00
3096.00	57.00	1.00	2.33	0.16	0.21	1.00
3097.00	101.00	2.00	2.48	0.19	0.06	1.00
3098.00	56.00	1.10	2.32	0.15	0.21	1.00
3099.00	57.00	1.00	2.31	0.18	0.22	1.00
3100.00	56.00	1.00	2.29	0.20	0.22	1.00
3101.00	59.00	1.00	2.30	0.20	0.22	1.00
3102.00	61.00	1.00	2.29	0.20	0.23	1.00
3103.00	56.00	0.90	2.28	0.21	0.22	1.00
3104.00	53.00	1.00	2.31	0.17	0.22	1.00
3105.00	55.00	1.00	2.32	0.16	0.21	1.00
3106.00	51.00	1.10	2.35	0.16	0.19	1.00
3107.00	50.00	1.00	2.33	0.16	0.21	1.00
3108.00	49.00	1.00	2.35	0.17	0.20	1.00
3109.00	48.00	1.00	2.35	0.19	0.20	1.00
3110.00	47.00	1.00	2.35	0.19	0.19	1.00
3111.00	52.00	0.90	2.35	0.19	0.20	1.00
3112.00	64.00	1.00	2.31	0.20	0.21	1.00
3113.00	58.00	1.10	2.33	0.18	0.20	1.00
3114.00	66.00	0.90	2.30	0.18	0.23	1.00
3115.00	61.00	0.90	2.32	0.17	0.21	1.00
3116.00	60.00	0.80	2.30	0.20	0.22	1.00
3117.00	65.00	0.80	2.29	0.20	0.22	1.00
3118.00	67.00	0.90	2.31	0.21	0.20	1.00
3119.00	60.00	0.90	2.32	0.21	0.20	1.00
3120.00	54.00	0.90	2.32	0.20	0.21	1.00
3121.00	64.00	1.00	2.37	0.17	0.16	1.00
3122.00	70.00	0.90	2.27	0.22	0.24	1.00
3123.00	70.00	0.70	2.26	0.22	0.24	1.00
3124.00	76.00	1.00	2.31	0.21	0.21	1.00
3125.00	77.00	1.00	2.28	0.21	0.24	1.00
3126.00	79.00	1.00	2.29	0.24	0.21	1.00
3127.00	125.00	1.60	2.38	0.21	0.14	1.00
3128.00	117.00	1.70	2.34	0.21	0.17	0.91

3129.00	115.00	1.80	2.36	0.22	0.16	0.91
3130.00	120.00	1.20	2.32	0.24	0.18	1.00
3131.00	133.00	1.80	2.38	0.21	0.15	0.98
3132.00	110.00	2.70	2.43	0.16	0.12	0.98
3133.00	54.00	1.70	2.70	0.16	0.00	1.00
3134.00	53.00	1.60	2.45	0.14	0.13	1.00
3135.00	45.00	5.90	2.57	0.08	0.04	1.00
3136.00	43.00	17.20	2.63	0.05	0.00	1.00
3137.00	47.00	61.00	2.69	0.03	0.00	1.00
3138.00	47.00	23.80	2.61	0.05	0.02	1.00
3139.00	54.00	5.30	2.39	0.10	0.16	1.00
3140.00	46.00	10.80	2.57	0.06	0.05	1.00
3141.00	82.00	2.60	2.44	0.06	0.12	1.00
3142.00	109.00	1.90	2.36	0.21	0.16	0.90
3143.00	102.00	1.90	2.36	0.20	0.16	0.87
3144.00	107.00	2.20	2.40	0.21	0.12	0.92
3145.00	50.00	1.30	2.33	0.18	0.20	1.00
3146.00	48.00	1.50	2.37	0.15	0.18	1.00
3147.00	55.00	1.20	2.34	0.18	0.19	1.00
3148.00	61.00	1.50	2.40	0.19	0.15	1.00
3149.00	60.00	1.50	2.37	0.15	0.18	1.00
3150.00	49.00	1.40	2.37	0.15	0.18	1.00
3151.00	48.00	1.60	2.37	0.13	0.18	1.00
3152.00	50.00	1.50	2.39	0.13	0.16	1.00
3153.00	49.00	1.40	2.38	0.13	0.17	1.00
3154.00	50.00	1.50	2.37	0.14	0.18	1.00
3155.00	49.00	1.90	2.40	0.12	0.16	1.00
3156.00	53.00	1.70	2.42	0.13	0.14	1.00
3157.00	50.00	1.70	2.43	0.13	0.14	1.00
3158.00	54.00	1.70	2.42	0.12	0.14	1.00
3159.00	54.00	1.30	2.36	0.16	0.18	1.00
3160.00	56.00	1.30	2.35	0.16	0.18	1.00
3161.00	57.00	1.10	2.32	0.17	0.21	1.00
3162.00	56.00	1.10	2.30	0.19	0.22	1.00
3163.00	60.00	1.00	2.29	0.19	0.23	1.00
3164.00	57.00	1.10	2.34	0.18	0.19	1.00
3165.00	104.00	2.30	2.41	0.21	0.11	0.94
3166.00	103.00	2.30	2.39	0.19	0.14	0.89
3167.00	119.00	1.80	2.35	0.20	0.17	0.91
3168.00	108.00	1.30	2.30	0.25	0.20	0.92
3169.00	110.00	1.80	2.35	0.20	0.18	0.90
3170.00	106.00	1.80	2.37	0.23	0.14	0.95
3171.00	132.00	1.80	2.35	0.22	0.16	0.91
3172.00	111.00	1.80	2.34	0.20	0.19	0.88
3173.00	107.00	1.40	2.28	0.23	0.23	0.87
3174.00	95.00	2.70	2.45	0.20	0.09	1.00
3175.00	93.00	1.10	2.29	0.25	0.21	0.98
3176.00	125.00	1.80	2.36	0.23	0.15	0.90
3177.00	140.00	3.10	2.48	0.26	0.00	1.00
3178.00	143.00	1.90	2.41	0.28	0.00	1.00
3179.00	129.00	3.40	2.44	0.22	0.06	0.84
3180.00	116.00	2.10	2.41	0.22	0.11	1.00

3181.00	127.00	0.80	2.18	0.26	0.30	0.95
3182.00	121.00	0.90	2.21	0.25	0.29	0.90
3183.00	107.00	1.50	2.35	0.23	0.16	1.00
3184.00	112.00	2.00	2.37	0.20	0.15	0.90
3185.00	122.00	2.30	2.41	0.21	0.12	0.91
3186.00	103.00	1.40	2.34	0.24	0.17	0.98
3187.00	98.00	1.70	2.36	0.23	0.16	0.94
3188.00	108.00	2.00	2.41	0.21	0.12	1.00
3189.00	115.00	2.90	2.46	0.20	0.07	1.00
3190.00	115.00	3.40	2.49	0.22	0.00	1.00
3191.00	107.00	3.90	2.49	0.23	0.00	1.00
3192.00	83.00	1.80	2.37	0.16	0.16	0.98
3193.00	111.00	1.40	2.31	0.21	0.21	0.92
3194.00	121.00	1.00	2.25	0.22	0.26	0.95
3195.00	132.00	0.90	2.22	0.23	0.28	0.98
3196.00	116.00	2.00	2.37	0.19	0.16	0.90
3197.00	122.00	1.70	2.34	0.21	0.18	0.90
3198.00	105.00	2.10	2.37	0.19	0.16	0.88
3199.00	101.00	2.20	2.38	0.20	0.15	0.86
3200.00	99.00	2.10	2.38	0.20	0.14	0.90
3201.00	104.00	2.00	2.35	0.22	0.17	0.84
3202.00	111.00	2.10	2.39	0.21	0.13	0.93
3203.00	116.00	2.70	2.43	0.22	0.07	0.92
3204.00	113.00	3.50	2.45	0.19	0.09	0.85
3205.00	123.00	5.40	2.50	0.24	0.00	1.00
3206.00	121.00	1.50	2.33	0.24	0.17	0.93
3207.00	119.00	4.50	2.48	0.22	0.01	1.00
3208.00	119.00	4.40	2.48	0.23	0.00	1.00
3209.00	119.00	5.30	2.50	0.20	0.02	1.00
3210.00	110.00	2.80	2.43	0.18	0.11	0.91
3211.00	102.00	1.60	2.33	0.23	0.18	0.89
3212.00	112.00	2.80	2.44	0.20	0.09	0.95
3213.00	105.00	3.00	2.46	0.21	0.05	0.98
3214.00	105.00	5.10	2.48	0.20	0.04	0.81
3215.00	115.00	5.50	2.50	0.21	0.00	1.00
3216.00	136.00	5.90	2.51	0.23	0.00	1.00
3217.00	136.00	2.00	2.34	0.21	0.18	0.81
3218.00	136.00	2.10	2.35	0.19	0.17	0.82
3219.00	136.00	5.90	2.50	0.18	0.03	1.00
3220.00	136.00	1.80	2.34	0.22	0.17	0.86
3221.00	136.00	1.50	2.36	0.23	0.15	1.00
3222.00	136.00	2.40	2.40	0.25	0.07	0.00
3223.00	136.00	2.60	2.42	0.24	0.06	0.00
3224.00	136.00	4.10	2.46	0.23	0.01	0.00
3225.00	107.00	3.10	2.46	0.28	0.00	0.00

BILLFISH 1 LOG ANALYSIS



PE600636

This is an enclosure indicator page.
The enclosure PE600636 is enclosed within the container PE900820 at this location in this document.

The enclosure PE600636 has the following characteristics:

ITEM_BARCODE	= PE600636
CONTAINER_BARCODE	= PE900820
NAME	= CPI - Formation Evaluation Log
BASIN	= GIPPSLAND
PERMIT	= VIC/P34
TYPE	= WELL
SUBTYPE	= WELL_LOG
DESCRIPTION	= CPI - Formation Evaluation Log. From appendix 2 of WCR volume 2.
REMARKS	=
DATE_CREATED	= 12/05/1997
DATE_RECEIVED	= 06/08/1997
W_NO	= W1178
WELL_NAME	= Billfish-1
CONTRACTOR	= Esso
CLIENT_OP_CO	= Esso Australia Limited

(Inserted by DNRE - Vic Govt Mines Dept)

ENCLOSURES

ENCLOSURES

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5th Cut
A4 Dividers
Re-order Code 97052

PE600637

This is an enclosure indicator page.
The enclosure PE600637 is enclosed within the container PE900820 at this location in this document.

The enclosure PE600637 has the following characteristics:

ITEM_BARCODE	= PE600637
CONTAINER_BARCODE	= PE900820
NAME	= Enclosure 1
BASIN	= GIPPSLAND
PERMIT	= VIC/P34
TYPE	= WELL
SUBTYPE	= COMPOSITE_LOG
DESCRIPTION	= Well Completion Log Billfish-1
REMARKS	=
DATE_CREATED	= 12/02/1997
DATE_RECEIVED	= 06/08/1997
W_NO	= W1178
WELL_NAME	= Billfish-1
CONTRACTOR	= Esso
CLIENT_OP_CO	= Esso

(Inserted by DNRE - Vic Govt Mines Dept)

PE600638

This is an enclosure indicator page.
The enclosure PE600638 is enclosed within the container PE900820 at this location in this document.

The enclosure PE600638 has the following characteristics:

ITEM_BARCODE	= PE600638
CONTAINER_BARCODE	= PE900820
NAME	= Enclosure 2
BASIN	= GIPPSLAND
PERMIT	= VIC/P34
TYPE	= WELL
SUBTYPE	= SYNTH_SEISMOGRAPH
DESCRIPTION	= Billfish-1 Synthetic Seismogram
REMARKS	=
DATE_CREATED	=
DATE_RECEIVED	= 06/08/1997
W_NO	= W1178
WELL_NAME	= Billfish-1
CONTRACTOR	= Esso
CLIENT_OP_CO	= Esso

(Inserted by DNRE - Vic Govt Mines Dept)

PE900821

This is an enclosure indicator page.
The enclosure PE900821 is enclosed within the container PE900820 at this location in this document.

The enclosure PE900821 has the following characteristics:

ITEM_BARCODE	= PE900821
CONTAINER_BARCODE	= PE900820
NAME	= Enclosure 3
BASIN	= GIPPSLAND
PERMIT	= VIC/P34
TYPE	= SEISMIC
SUBTYPE	= SECTION
DESCRIPTION	= Seismic Line G95B-5080 Billfish-1
REMARKS	=
DATE_CREATED	= 07/05/1997
DATE_RECEIVED	= 06/08/1997
W_NO	= W1178
WELL_NAME	= Billfish-1
CONTRACTOR	=
CLIENT_OP_CO	= Esso

(Inserted by DNRE - Vic Govt Mines Dept)

PE900822

This is an enclosure indicator page.
The enclosure PE900822 is enclosed within the container PE900820 at this location in this document.

The enclosure PE900822 has the following characteristics:

ITEM_BARCODE	= PE900822
CONTAINER_BARCODE	= PE900820
NAME	= Enclosure 4
BASIN	= GIPPSLAND
PERMIT	= VIC/P34
TYPE	= SEISMIC
SUBTYPE	= SECTION
DESCRIPTION	= Seismic Line G95B-5099/5014 Billfish-1
REMARKS	=
DATE_CREATED	= 07/05/1997
DATE_RECEIVED	= 06/08/1997
W_NO	= W1178
WELL_NAME	= Billfish-1
CONTRACTOR	=
CLIENT_OP_CO	= Esso

(Inserted by DNRE - Vic Govt Mines Dept)

PE900823

This is an enclosure indicator page.
The enclosure PE900823 is enclosed within the container PE900820 at this location in this document.

The enclosure PE900823 has the following characteristics:

ITEM_BARCODE	= PE900823
CONTAINER_BARCODE	= PE900820
NAME	= Depth Structure Map
BASIN	= GIPPSLAND
PERMIT	= VIC/P34
TYPE	= SEISMIC
SUBTYPE	= HRZN_CONTR_MAP
DESCRIPTION	= Depth Structure Map for Billfish-1: Top of Latrobe Group
REMARKS	=
DATE_CREATED	=
DATE_RECEIVED	= 06/08/1997
W_NO	= W1178
WELL_NAME	= Billfish-1
CONTRACTOR	= Esso Australia
CLIENT_OP_CO	= Esso Australia

(Inserted by DNRE - Vic Govt Mines Dept)

PE900824

This is an enclosure indicator page.
The enclosure PE900824 is enclosed within the container PE900820 at this location in this document.

The enclosure PE900824 has the following characteristics:

ITEM_BARCODE	= PE900824
CONTAINER_BARCODE	= PE900820
NAME	= Depth Structure Map
BASIN	= GIPPSLAND
PERMIT	= VIC/P34
TYPE	= SEISMIC
SUBTYPE	= HRZN_CONTR_MAP
DESCRIPTION	= Depth Structure Map for Billfish-1 : Composite Base of Blue Shale/ Top of Latrobe Group
REMARKS	=
DATE_CREATED	=
DATE_RECEIVED	= 06/08/1997
W_NO	= W1178
WELL_NAME	= Billfish-1
CONTRACTOR	= Esso Australia
CLIENT_OP_CO	= Esso Australia

(Inserted by DNRE - Vic Govt Mines Dept)