APPENDIX

FORAMINIFERAL ANALYSIS, PILOTFISH-1A GIPPSLAND BASIN

by

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PART 1

INTERPRETATIVE DATA

SUMMARY

The foraminiferal bearing sediments from Pilotfish-1A range in age from Late Eocene to Middle-Late Pliocene. Two disconformities/condensed sequences occur in the section.

TABLE 1 - GEOLOGICAL SUMMARY, PILOTFISH-1A.

AGE	FORMATION	LITHOLOGY*	ZONE
----------Sea floor KB 206m----------			
Late Pliocene/ Early Miocene	Gippsland Limestone/ Lakes Entrance Formation	Dominantly Recrystalised Carbonate	A 3 (490.0m - 945.0m)
			B 1 (960.0m - 1250.0m)
			B 2 (1420.0, - 1910.0m)
			C (1980.0m - 2330.0m)
			D 2 (2400.0m)
			F (2470.0m - 2750.0m)
			G (2770.0, - 2915.0m
2915.0m			
Late Eocene/ Early Oligocene	Un-named unit	Fine quartz sand with mica, rare glauconite at base.	J 2 1 K (2915.0m - 2925.0m) Reworked lower L. balmei Beds.
2925.0m			
Lower Paleocene	Latrobe Group	Fine quartz sand with glauconite.	Lower L. balmei (2925.0m - 2948.0m)
T.D. 3505.0m.			

* Generalised Lithologies from washed residues/SWC description sheets.

GEOLOGICAL COMMENTS

Top of Latrobe.

Three units have been identified across the Latrobe Group/Lakes Entrance Formation Boundary.

1. Intra Latrobe Greensand (2950.0m to 2925.0m)
   Washed residue from this unit consists of a fine grained angular quartz with occasional high glauconite levels. All unprocessed material from this unit showed the characteristic green colour of high Glauconite content. The unit is dated as Palaeocene (Lower L. balmei Zone - Macphail 1983).

2. Unnamed unit (2925.0m to 2915.0m)
   This interval consists of a similar fine grained quartz sand to the Intra Latrobe Greensand but can be distinguished by: a) the very small amount of glauconite in either the washed residues or unprocessed material and b) large amounts of mica in the sediment.
   They are further distinguished by their ages. Although the palynomorphs derived from the unnamed unit would indicate a lower L. balmei age for the unit, several samples also yielded reasonable foraminiferal assemblages which allow a fairly confident Late Eocene/Early Oligocene (Zones K/J2) age to be assigned to the unit. This implies: a) a major hiatus between the two sands and b) the reworking of an entire Lower L. balmei assemblage with no perceivable admixture of younger spore pollen.

3. Marine Carbonates of the basal Lakes Entrance Formation.
   These consist of recrystalised carbonates yielding poorly preserved foraminifera. The age of the sediments immediately above the Latrobe Group is Early Miocene (Zone G) in age indicating a second disconformity in the section.

Timing of Maximum Tertiary Progradation

The time of maximum accumulation of marine carbonates in most Gippsland basin wells occurs during the Middle Miocene (Zone D). The closer the wells are to the shelf edge the younger this time of maximum progradation becomes. In Hapuku-1 the maximum rate of sediment accumulation occurs in the Late Miocene/Pliocene (Zones B and A). Pilotfish-1A follows the same general pattern, however the maximum sedimentary rate occurs earlier than Hapuku-1; commencing late in the Middle Miocene (Zone C).

Early Miocene Thickening.

Zones F & G, (Early Miocene) which are thin or absent in Hapuku-1 thicken up considerably in Pilotfish-1A. This may be a result of either:

1. The more shoreward position of Pilotfish-1A,
2. The accumulation of the Early Miocene sediments as channel fill in the vicinity of Pilotfish-1A.

BIOSTRATIGRAPHY

Zone K, Late Eocene, 2923.0m to 2921.0m.

Sidewall cores 44 and 45 at 2923.0m and 2921.0m respectively yielded a sparse poorly preserved assemblage. Nevertheless the recognition of Globigerina linaperta, Globigerina angiporoides and Globorotalia postcretaea means that they can be assigned to Zone K with a fair degree of confidence.

Zone J2/K, Late Eocene-Early Oligocene, 2917.0m.

An assemblage consisting entirely of Globigerina brevis was recovered from SWC 47 at 2917.0m providing a fairly firm J2/K date for the sample.

Zone G, Middle Miocene, 2915.0m - 2770.0m.

A thick pile of Zone G age sediments sit immediately on top of the Latrobe Group. This zonal determination is based on the occurrence of Globigerinoides quadrilobatus trilobus without Globigerinoides sicanus. Samples from this interval yielded in general poorly preserved assemblages of limited diversity consisting mainly of Globigerinoides quadrilobatus trilobus, Globorotalia mayeri, Globigerina juvenilis and Globigerina woodi. A slight increase in planktonic diversity occurs around sidewall core 63 at 2867.0m, coincident with a brief appearance of Catapsiderax dissimilis. Samples in which Globigerinoides quadrilobatus trilobus was absent are listed in the summary tables as indeterminate.

Zone F, late Early Miocene, 2750.0m to 2470.0m.

The appearance of Globigerinoides sicanus in sidewall core 72 at 2750.0m without Praeorbulina glomerosa or either form of Orbulina marks the base of Zone F. This zone is well developed in Pilotfish-1A, being some 280m thick.

Unlike other Gippsland wells, the index species Globigerinoides sicanus is consistently present throughout the zone. One exception is sidewall core 73 at 2730.0m which is listed as indeterminate on the summary sheets. With the incoming of the Globoquadrina dehiscens group near the base of the zone planktonic diversity improves. In addition, the rapid increase in Globorotalid diversity, which occurs within Zone F in the Seahorse area (Hannah 1982 1983), is recorded between SWC's 78 and 79 (at 2628.0m and 2611.0m respectively) in Pilotfish-1A. This confirms the usefulness of this datum in recognising Zone F even when Zonal species are absent.

Zone D2, Mid Miocene, 2400.0m.

Sidewall core 82 at 2400.0m contains Orbulina universa and a moderate diversity of Globigerinoides suggesting a Zone D2 age. The absence of Globorotalia peripheroacuta is supportive of this assignment. The lack of Zones E and D1 from the section is probably due to sampling gaps.

Zone C, late Mid Miocene, 2330.0m to 1980.0m.

The presence of Globorotalia miotumida miotumida, Globorotalia mayeri and the absence of Globorotalia acostaensis in samples from this interval enables a fairly confident Zone C assignment to be made. Plankton diversity is low to moderate and preservation in general is poor. One problem species appearing during Zone C in Pilotfish-1A is referred to Globorotalia miotumida cf. conomiozea. This species looks nearly identical to Globorotalia miotumida conomiozea and if care is not taken to separate the two, a "too young" age may be assigned.

Zone B2, Late Miocene, 1910.0m to 1420.0m.

The base of this zone is marked by the replacement of Globorotalia mayeri by Globorotalia acostaensis. It is considered to extend up as far as the first appearance of Globorotalia miotumida conomiozea. Towards the top of this zone preservation is very poor due to high levels of recrystalisation making zonal determination difficult or in some cases, impossible.

Zone B1, Late Miocene-Early Pliocene, 1250.0m to 960.0m.

The remaining sidewall cores are assigned to Zone B1 on the basis of their containing Globorotalia miotumida conomiozea and Globorotalia acostaensis and the absence of either the Globorotalia inflata group and Globorotalia puncticulata. Preservation is poor and species diversity is low throughout this interval.

Zone B1-A4, Late Miocene-Pliocene, 955m - 960m (Cuttings).
A single cuttings sample is assigned to this zonal interval because a) it contains Globorotalia puncticulata and Globorotalia miotumida conomiozea (this later species becomes extinct within A4). and b) They do not contain Globorotalia miotumida miotumida. The assignment carries a low degree of confidence.

Zone A3, Late-mid Pliocene, 945.0m to 490.0m (Cuttings).
Three cuttings samples are assigned to this zone because they contain large numbers of Globorotalia puncticulata and no Globorotalia miotumida conomiozea. The occasional appearance of Globigerina woodi is also indicative of a pre-Pleistocene age. There is also an odd dearth of Globorotalia inflata in the samples. Again this zonal determination can only carry a low degree of confidence.

TABLE 2

INTERPRETATIVE DATA - PILOTFISH-1A

SWC No.	DEPTH (m)	MICROFOSSIL YIELD	MICROFOSSIL PRESERVATION	PLANKTON DIVERSITY	ZONE (conf.rate)	AGE
Cuttings	360-370	NFF				
Cuttings	490-500	High	Moderate	High	A3 (3)	Late/Middle Pliocene
Cuttings	670-680	High	Moderate	High	A3 (3)	Late/Middle Pliocene
Cuttings	940-945	Moderate	Poor	Moderate	A3 (3)	Late/Middle Pliocene
Cuttings	955-960	Very Low	Very Poor	Low	A4-B1	Late Miocene/Mid Pliocene
SWC 102	960.0	Moderate	Moderate	Low	B1 (1)	Late Miocene/Early Pliocene
SWC 101	1025.0	Moderate	Good	Low	B1 (1)	Late Miocene/Early Pliocene
SWC 100	1100.0	Very Low	Very Poor	Very Low	Indeterminate	
SWC 99	1175.0	Low	Very Poor	Moderate	B1 (1)	Late Miocene/Early Pliocene
SWC 98	1250.0	Moderate	Poor	High	B1 (1)	Late Miocene/Early Pliocene
SWC 97	1350.0	Low	Poor	Low	Indeterminate	
SWC 96	1420.0	Moderate	Very Poor	Moderate	B? (1)	Late Miocene
SWC 95	1490.0	Very Low	Very Poor	Very Low	Indeterminate	
SWC 94	1560.0	Moderate	Very Poor	Moderate	B2 (1)	Late Miocene
SWC 93	1630.0	Low	Very Poor	Moderate	B2 (1)	Late Miocene
SWC 92	1700.0	Very Low	Very Poor	Low	B2 (2)	Late Miocene
SWC 91	1770.0	Moderate	Poor	Moderate	B2 (1)	Late Miocene
SWC 90	1840.0	Low	Very Poor	Low	B2 (2)	Late Miocene
SWC 89	1910.0	Very Low	Poor	Moderate	B2 (1)	Late Miocene
SWC 88	1980.0	Low	Very Poor	Low	C (1)	Middle Miocene
SWC 87	2050.0	Very Low	Very Poor	Low	C (1)	Middle Miocene
SWC 86	2120.0	Low	Poor	Moderate	C (1)	Middle Miocene

TABLE 2

INTERPRETATIVE DATA - PILOTFISH-1A

SWC No.	DEPTH (m)	MICROFOSSIL YIELD	MICROFOSSIL PRESERVATION	PLANKTON DIVERSITY	ZONE (conf.rate)	AGE
SWC 85	2190.0	Moderate	Very Poor	Low	C (1)	Middle Miocene
SWC 84	2260.0	High	Moderate	Moderate	C (1)	Middle Miocene
SWC 83	2330.0	High	Moderate	Moderate	C (1)	Middle Miocene
SWC 82	2400.0	High	Moderate	High	D2 (1)	Early Middle Miocene
SWC 81	2470.0	Moderate	Moderate	High	F (1)	Late Early Miocene
SWC 80	2560.0	Moderate	Moderate	High	F (1)	Late Early Miocene
SWC 79	2611.0	Low	Poor	High	F (1)	Late Early Miocene
SWC 78	2628.0	Low	Poor	Moderate	F (1)	Late Early Miocene
SWC 77	2650.0	Low	Moderate	Low	F (2)	Late Early Miocene
SWC 76	2670.0	Moderate	Poor	Moderate	F (1)	Late Early Miocene
SWC 75	2690.0	Moderate	Very Poor	Low	F (2)	Late Early Miocene
SWC 74	2710.0	Moderate	Poor	Moderate	F (1)	Late Early Miocene
SWC 73	2730.0	Low	Poor	Low	Indeterminate	
SWC 72	2750.0	Moderate	Very Poor	Low	F (1)	Late Early Miocene
SWC 71	2770.0	Low	Very Poor	Low	G (2)	Early Miocene
SWC 70	2790.0	High	Moderate	High	G (1)	Early Miocene
SWC 69	2810.0	Low	Poor	Low	G (1)	Early Miocene
SWC 68	2830.0	High	Poor	Low	G (1)	Early Miocene
SWC 67	2847.0	Very Low	Poor	Very Low	Indeterminate	
SWC 66	2852.0	Low	Very Poor	Moderate	G (1)	Early Miocene
SWC 65	2857.0	Low	Poor	Low	G (1)	Early Miocene
SWC 64	2862.0	High	Moderate	Moderate	G (0)	Early Miocene

TABLE 2

INTERPRETATIVE DATA - PILOTFISH-1A

SWC No.	DEPTH (m)	MICROFOSSIL YIELD	MICROFOSSIL PRESERVATION	PLANKTON DIVERSITY	ZONE (conf.rate)	AGE
SWC 63	2867.0	Very Low	Very Poor	High	G (1)	Early Miocene
SWC 62	2872.0	High	Moderate	Moderate	G (1)	Early Miocene
SWC 61	2877.0	Low	Very Poor	Low	G (1)	Early Miocene
SWC 60	2882.0	Very Low	Very Poor	Low	Indeterminate	
SWC 59	2887.0	High	Very Poor	Low	G (1)	Early Miocene
SWC 58	2892.0	Moderate	Very Poor	Moderate	G (1)	Early Miocene
SWC 57	2897.0	Moderate	Poor	Low	G (1)	Early Miocene
SWC 56	2899.0	Moderate	Very Poor	Low	G (2)	Early Miocene
SWC 55	2901.0	Low	Poor	Low	G (2)	Early Miocene
SWC 54	2903.0	Moderate	Poor	Low	G (1)	Early Miocene
SWC 53	2905.0	Moderate	Poor	Low	G (2)	Early Miocene
SWC 52	2907.0	Low	Poor	Low	G (1)	Early Miocene
SWC 51	2909.0	Very Low	Very Poor	Low	G (2)	Early Miocene
SWC 50	2911.0	Low	Poor	Low	G (1)	Early Miocene
SWC 48	2915.0	Low	POor	Low	G (1)	Early Miocene
SWC 47	2917.0	Low	Poor	Very Low	J2/K (2)	Latest Eocene/Early Oligocene
SWC 46	2919	NFF				
SWC 45	2921.0	Low	Poor	Low	K (1)	Latest Eocene
SWC 44	2923.0	Low	Poor	Low	K (1)	Latest Eocene
SWC 41	2929.0	NFF				
SWC 39	2933.0	NFF				

NFF = No foraminifera found.

REFERENCES

HANNAH, M.J., 1982. Foraminiferal Analysis of Seahorse-2, Gippsland Basin, Victoria. Esso Australia Ltd. Palaeontology Report, 1982/40.

HANNAH, M.J., 1983. A Reassessment of the Planktonic Foraminiferal Content of Hudbay West Seahorse-1, Gippsland Basin, Esso Australia Ltd. Palaeontology Report, 1983/5.

MACPHAIL, M.K., 1983 Palynological Analysis of Pilotfish-1A, Gippsland Basin, Esso Australia Ltd. Palaeontology Report 1983/20.

PART 2

BASIC DATA

SUMMARY

RANGE CHART

TABLE 3

BASIC DATA - PILOTFISH-1A

SWC No.	DEPTH (m)	MICROFOSSIL YIELD	MICROFOSSIL PRESERVATION	PLANKTON DIVERSITY
Cuttings	360-370	NFF		
Cuttings	490-500	High	Moderate	High
Cuttings	670-680	High	Moderate	High
Cuttings	940-945	Moderate	Poor	Moderate
Cuttings	955-960	Very Low	Very Poor	Low
SWC 102	960.0	Moderate	Moderate	Low
SWC 101	1025.0	Moderate	Good	Low
SWC 100	1100.0	Very Low	Very Poor	Very Low
SWC 99	1175.0	Low	Very Poor	Moderate
SWC 98	1250.0	Moderate	Poor	High
SWC 97	1350.0	Low	Poor	Low
SWC 96	1420.0	Moderate	Very Poor	Moderate
SWC 95	1490.0	Very Low	Very Poor	Very Low
SWC 94	1560.0	Moderate	Very Poor	Moderate
SWC 93	1630.0	Low	Very Poor	Moderate
SWC 92	1700.0	Very Low	Very Poor	Low
SWC 91	1770.0	Moderate	Poor	Moderate
SWC 90	1840.0	Low	Very Poor	Low
SWC 89	1910.0	Very Low	Poor	Moderate
SWC 88	1980.0	Low	Very Poor	Low
SWC 87	2050.0	Very Low	Very Poor	Low
SWC 86	2120.0	Low	Poor	Moderate
SWC 85	2190.0	Moderate	Very Poor	Low
SWC 84	2260.0	High	Moderate	Moderate
SWC 83	2330.0	High	Moderate	Moderate
SWC 82	2400.0	High	Moderate	High
SWC 81	2470.0	Moderate	Moderate	High
SWC 80	2560.0	Moderate	Moderate	High
SWC 79	2611.0	Low	Poor	High
SWC 78	2628.0	Low	Poor	Moderate
SWC 77	2650.0	Low	Moderate	Low
SWC 76	2670.0	Moderate	Poor	Moderate
SWC 75	2690.0	Moderate	Very Poor	Low
SWC 74	2710.0	Moderate	Poor	Moderate
SWC 73	2730.0	Low	Poor	Low

TABLE 3

BASIC DATA - PILOTFISH-1A

SWC No.	DEPTH (m)	MICROFOSSIL YIELD	MICROFOSSIL PRESERVATION	PLANKTON DIVERSITY
SWC 72	2750.0	Moderate	Very Poor	Low
SWC 71	2770.0	Low	Very Poor	Low
SWC 70	2790.0	High	Moderate	High
SWC 69	2810.0	Low	Poor	Low
SWC 68	2830.0	High	Poor	Low
SWC 67	2847.0	Very Low	Poor	Very Low
SWC 66	2852.0	Low	Very Poor	Moderate
SWC 65	2857.0	Low	Poor	Low
SWC 64	2862.0	High	Moderate	Moderate
SWC 63	2867.0	Very Low	Very Poor	High
SWC 62	2872.0	High	Moderate	Moderate
SWC 61	2877.0	Low	Very Poor	Low
SWC 60	2882.0	Very Low	Very Poor	Low
SWC 59	2887.0	High	Very Poor	Low
SWC 58	2892.0	Moderate	Very Poor	Moderate
SWC 57	2897.0	Moderate	Poor	Low
SWC 56	2899.0	Moderate	Very Poor	Low
SWC 55	2901.0	Low	Poor	Low
SWC 54	2903.0	Moderate	Poor	Low
SWC 53	2905.0	Moderate	Poor	Low
SWC 52	2907.0	Low	Poor	Low
SWC 51	2909.0	Very Low	Very Poor	Low
SWC 50	2911.0	Low	Poor	Low
SWC 48	2915.0	Low	POor	Low
SWC 47	2917.0	Low	Poor	Very Lowcene
SWC 46	2919	NFF		
SWC 45	2921.0	Low	Poor	Low
SWC 44	2923.0	Low	Poor	Low
SWC 41	2929.0	NFF		
SWC 39	2933.0	NFF		

NFF = No foraminifera found.

MICROPALEONTOLOGICAL DATA SHEET

BASIN: GIPPSLAND ELEVATION: KB: 21.0 GL: -205.6

WELL NAME: PILOTFISH-1A TOTAL DEPTH: 3505

AGE		FORAM. ZONULES	HIGHEST DATA					LOWEST DATA				
			Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time	Preferred Depth	Rtg	Alternate Depth	Rtg	Two W Time
PLEISTOCENE		A_1										
		A_2										
PLIOCENE		A_3	490.0	3				945.0	3			
		A_4										
MIOCENE	LATE	B_1	960.0	1				1250.0	1			
		B_2	1420.0	1				1910.0	1			
		C	1980.0	1				2330.0	1			
	MIDDLE	D_1										
		D_2	2400.0	1				2400.0	1			
		E_1										
		E_2										
	EARLY	F	2470.0	1				2750.0	1			
		G	2770.0	2	2790.0	1		2915.0	1			
		H_1										
OLIGOCENE	LATE	H_2										
		I_1										
		I_2										
	EARLY	J_1										
		J_2	2921.0	1								
EOCENE		K						2925.0	1			
		Pre-K										

COMMENTS: Cuttings at 955.0 to 960.0 are dated as A4/B1 - Late Miocene to Early Pliocene. The absence of Zone E is probably a result of a sample gap. SWC 47 at 2917.0m is dated as J2/K latest Eocene, Early Oligocene.

CONFIDENCE RATING:

0: SWC or Core - Complete assemblage (very high confidence).
1: SWC or Core - Almost complete assemblage (high confidence).
2: SWC or Core - Close to zonule change but able to interpret (low confidence).
3: Cuttings - Complete assemblage (low confidence).
4: Cuttings - Incomplete assemblage, next to uninterpretable or SWC with depth suspicion (very low confidence).

NOTE: If an entry is given a 3 or 4 confidence rating, an alternative depth with a better confidence rating should be entered, if possible. If a sample cannot be assigned to one particular zone, then no entry should be made, unless a range of zones is given where the highest possible limit will appear in one zone and the lowest possible limit in another.

DATA RECORDED BY: M.J. Hannah. DATE: May 21, 1983.

DATA REVISED BY: _____ DATE: _____