

APPENDIX

MICROPALAEONTOLOGICAL ANALYSIS, WEST FORTESCUE-1,
GIPPSLAND BASIN

by

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INTRODUCTION

Fifteen (15) sidewall core samples were examined for their foraminiferal content in West Fortescue-1 from 2366.2m to 2423.0m. Three samples were also checked for their calcareous nannoplankton content. Tables 1 and 2 provide a summary (Basic and Interpretative) of the palaeontological analysis in West Fortescue-1. A summary of the biostratigraphic breakdown of the stratigraphic units in the well is given below.

AGE	UNIT	ZONE	DEPTH (mKB)
E. Miocene or younger	Lakes Entrance Fm		(not studied)
-----log break at 2216m (*Mid-Miocene Marker)-----			
Early Miocene	Lakes Entrance Fm	H-1	2366.2 - 2419.2
-----log break at 2420m (30Ma)-----			
#1 Early Oligocene	Un-named hardground unit (time equivalent of the "Oligocene Wedge")	No younger than J-1	2420.2
-----log break at 2421m (40Ma)-----			
#2 latest Early-Middle Eocene Indeterm.	Top of Latrobe glauconitic sandstone unit	P9-P13 equiv. Indeterm.	2421.3 2423.0
-----lithological/faunal break at 2423m (49.5Ma)-----			
#3 Early Eocene	Latrobe Group (coarse clastics)		(not studied)

			TD 2671m

- * Based on correlation with other wells on the Fortescue Field which have biostratigraphic control.
- #1 age based on results of palynology (Macphail, 1984) and micropalaeontology.
- #2 age based on calcareous nannoplankton
- #3 age based on results of palynology (Macphail, 1984).

GEOLOGICAL COMMENTS

The top of the Latrobe Group in West Fortescue-1 consists of three closely spaced disconformity surfaces which equate with the 30Ma, 40Ma and 49.5Ma seismic sequence events of Vail et al. (1977). Close sidewall core spacing across the top of the Latrobe Group in the well has enabled these events to be recognized.

In West Fortescue-1 a thin top of Latrobe glauconitic sandstone unit disconformably overlies marginal marine Latrobe Group sediments. This disconformity is picked at 2423m and is based primarily on palaeontological and lithological data. The disconformity equates with the 49.5Ma event of Vail et al. (1977). The sidewall core sample shot immediately below the 53Ma event at 2424.2m consists of firm grey siltstone and has been assigned to the Early Eocene Upper M. diversus palynological Zone by Macphail (1984). The sidewall core sample immediately above the 49.5Ma event consists of fine grained, friable, whitish-grey, glauconitic sandstone but unfortunately is not age diagnostic. The sample is barren of palynomorphs (Macphail, 1984) and planktonic foraminifera, and contains only an impoverished non-age diagnostic calcareous nannoplankton assemblage. Fortunately an age diagnostic sample was shot in the upper part of the top of Latrobe glauconitic sandstone unit at 2421.2m. This sample is lithologically identical to the sample shot near the base of the unit and consists of fine grained, friable, white, glauconitic sandstone. The sample at 2421.2m is barren of palynomorphs (Macphail, 1984) but contains both planktonic foraminiferal and calcareous nannoplankton assemblages. The planktonic foraminiferal assemblage is not age diagnostic although the presence of rare specimens of Globigerina linaperta indicates the sample is Eocene in age. The calcareous nannoplankton assemblage provides a more refined biostratigraphic determination and indicates a likely age of latest Early Eocene - Middle Eocene. The foraminiferal assemblage at 2421.2m consists predominantly of planktonics and this indicates that the top of Latrobe glauconitic sandstone unit was probably deposited in an outer continental shelf or deeper palaeoenvironment.

The top of Latrobe glauconitic sandstone unit is disconformably overlain by a thin Early Oligocene hardground unit which is a time equivalent of the "Oligocene Wedge". The disconformity at 2421m equates with the 40Ma event of Vail et al. (1977). The hardground is characterized by a sonic/density log spike and is less than 1m thick. The hardground was penetrated by SWC 39 (2420.2m). This sample consists of a hard, compact, glauconitic,

recrystallized calcareous shale. The combined results of palynology and micropalaeontology indicate that the sample at 2420.2m is Early Oligocene in age. Planktonic foraminiferal evidence indicates an age no younger than Zone J-1 (Early Oligocene) while palynological evidence (Macphail, 1984) indicates an age no older than Early Oligocene. Macphail (1984) recorded dinoflagellates indicative of the Oligocene/Miocene P. tuberculatus Zone. The hardground horizon in West Fortescue-1 is also present in other wells drilled on the eastern flank of the Fortescue Field (near the western flank of the pre-existing Marlin Channel). The characteristic density/sonic spike log signature is also present in Fortescue-1, Fortescue-3 and Halibut-1. The hardground in all these wells is less than 2m in thickness. The hardground is a time-equivalent of the "Oligocene Wedge" which is well developed in wells on the western part of the Fortescue-Cobia Field e.g. Fortescue-2, Rockling-1 and Cobia-2.

The Early Oligocene hardground horizon is disconformably overlain by the Lakes Entrance Formation. The disconformity at 2420m equates with the 30Ma event of Vail et al. (1977). The lowest sample of Lakes Entrance Formation in West Fortescue-1 (SWC 40 at 2419.2m) consists of a planktonic foraminiferal ooze which is Early Miocene (Zone H-1) in age. The hiatus between the hardground and the Lakes Entrance Formation spans at least 7my. The 30Ma event is widespread in the Gippsland Basin and is mapped seismically as the "Top of Latrobe". In West Fortescue-1 and many other wells drilled in the deeper parts of the offshore Gippsland Basin, the 30Ma, 40Ma and 49.5Ma events are beyond seismic resolution and are all mapped as the "Top of Latrobe" seismic marker.

There is evidence of reworking in two basal samples of the Lakes Entrance Formation in West Fortescue-1. Minor reworked green calcareous shale (presumably the Early Oligocene hardground) was noted in sidewall core samples at 2418.6 and 2417.5m. Reworking of Early Oligocene and older sediments during the early stages (Zone H-1 time) of the deposition of the Lakes Entrance Formation has been recorded in numerous recently drilled Gippsland Basin wells.

The Mid Miocene Marker equates with the sonic log break at 2216m. The Mid Miocene Marker occurs at comparable depths in other Fortescue-Cobia Field wells. For example, in Fortescue-1, the Mid Miocene Marker occurs at 2214m and falls within Zone F.

DISCUSSION OF ZONES

Indeterminate Interval : 2423.0m

The interval is barren of planktonic foraminifera and only contains an impoverished, non-age diagnostic calcareous nannoplankton assemblage. The interval is also barren of palynomorphs (Macphail, 1984).

Zones P9 - P13 equivalent : 2421.3m

Sidewall core 38 at 2421.3m contains a planktonic foraminiferal assemblage which is not age diagnostic. The presence of rare specimens of Globigerina linaperta indicates a generalized Eocene age. A more refined age assignment is provided by the calcareous nannofossil species Cruciplacolithus staurion. Smith (1972) records the species range as P6-P13 in the western North Atlantic Ocean region. Edwards & Perch-Nielsen (1975) recorded the species in DSDP Site 277 (drilled on the southern Campbell Plateau, south of New Zealand) and noted its range as latest Early Eocene - Mid Eocene (interval from the first appearance of Reticulofenestra dictyoda to the first appearance of Cyclicargolithus reticulatus nannofossil events).

In addition Edwards & Perch-Nielsen (1975) recorded Discoaster sp. as being restricted to the interval Mid Early Eocene - Mid Eocene in DSDP Site 277 (interval from the last appearance of Discoaster multiradiatus to the first appearance of Cyclicargolithus reticulatus nannofossil events). The specimen of Discoaster sp. illustrated by Edwards & Perch-Nielsen is synonymous with specimens recorded in SWC 38 (2421.3m) in West Fortescue-1. The calcareous nannoplankton assemblage at 2421.3 is latest Early to Mid Eocene in age (P9-P13). This age assignment is based primarily on comparison with nannofossil assemblages recorded by Edwards & Perch-Nielsen in the southern Tasman Sea (DSDP Site 277). Palynological evidence indicates that the SWC at 2421.3m can be no older than the Upper M.diversus Zone (Macphail, 1984). The upper M.diversus Zone equates with Zones P7-P8.

No younger than Zone J-1 : 2420.2m

The presence of rare poorly preserved specimens of Globigerina angiporoides in the SWC at 2420.2 indicates an age no younger than Zone J-1. Macphail (1984) recorded dinoflagellates typically found in the P.tuberculatus palynological Zone in the same sample. The integration of palynological and micropalaeontological results support an Early Oligocene age for the sidewall core sample at 2420.2m.

Zone H-1 : 2366.2 - 2419.2

The presence of Globigerina woodi connecta without its descendant Globigerinoides trilobus indicates that the interval is Zone H-1 in age.

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TABLE 1

SUMMARY OF PALAEOLOGICAL ANALYSIS - WEST FORTESCUE-1, GIPPSLAND BASIN

INTERPRETATIVE DATA

NATURE OF SAMPLE	DEPTH (M)	YIELD		PRESERVATION		DIVERSITY			AGE	COMMENTS
		PLANK FORAMS	NANNOS	PLANK FORAMS	NANNOS	PLANK FORAMS	NANNOS	ZONE		
51	2366.2	Moderate	Not studied	Poor	-	Moderate	-	H-1	Early Miocene	
50	2374.0	High	Not studied	Moderate/Poor	-	Moderate	-	H-1	Early Miocene	
49	2396.6	Moderate	Not studied	Poor	-	Low	-	Indeterm.	-	
48	2400.0	Low	Not studied	Poor	-	Very low	-	Indeterm.	-	
47	2402.1	Very low	Not studied	Poor	-	Very low	-	H-1	Early Miocene	
46	2406.6	Low	Not studied	Poor	-	Very low	-	Indeterm.	-	
45	2411.1	Low	Not studied	Poor	-	Low	-	Indeterm.	-	
44	2413.5	Low	Not studied	Poor	-	Low	-	H-1	Early Miocene	
43	2416.4	Moderate	Not studied	Poor	-	Low	-	H-1	Early Miocene	
42	2417.5	Moderate	Not studied	Poor	-	Moderate	-	Indeterm.	-	contains minor reworked
41	2418.6	High	Not studied	Poor	-	Moderate	-	H-1	Early Miocene	Early Oligocene green calc. shale (hardground)
40	2419.2	High	Not studied	Moderate/Poor	-	Moderate	-	H-1	Early Miocene	
39	2420.2	Very low	Low	Very poor	Moderate	Very low	Low	No younger than J-1	No younger than Early Oligocene	
38	2421.3	Low	Low	Poor	Moderate	Very low	Very low	P9-P13 equiv.	Early/Middle Eocene	contains <u>Cruciplacolithus</u> <u>staurion</u>
37	2423.0	Barren	Very low	-	Moderate	-	Very low	Indeterm.	-	

BASIC DATA

TABLE 2: BASIC DATA, WEST FORTESCUE-1
RANGE CHART: CALCAREOUS PLANKTONIC MICROFOSSILS
AND OTHER SKELETAL MATERIAL

TABLE 2
SUMMARY OF PALAEOLOGICAL ANALYSIS - WEST FORTESCUE-1, GIPPSLAND BASIN
BASIC DATA

NATURE OF SAMPLE	DEPTH (M)	YIELD		PRESERVATION		DIVERSITY	
		PLANK FORAMS	NANNOS	PLANK FORAMS	NANNOS	PLANK FORAMS	NANNOS
51	2366.2	Moderate	Not studied	Poor	-	Moderate	-
50	2374.0	High	Not studied	Moderate/Poor	-	Moderate	-
49	2396.6	Moderate	Not studied	Poor	-	Low	-
48	2400.0	Low	Not studied	Poor	-	Very low	-
47	2402.1	Very low	Not studied	Poor	-	Very low	-
46	2406.6	Low	Not studied	Poor	-	Very low	-
45	2411.1	Low	Not studied	Poor	-	Low	-
44	2413.5	Low	Not studied	Poor	-	Low	-
43	2416.4	Moderate	Not studied	Poor	-	Low	-
42	2417.5	Moderate	Not studied	Poor	-	Moderate	-
41	2418.6	High	Not studied	Poor	-	Moderate	-
40	2419.2	High	Not studied	Moderate/Poor	-	Moderate	-
39	2420.2	Very low	Low	Very poor	Moderate	Very low	Low
38	2421.3	Low	Low	Poor	Moderate	Very low	Very low
37	2423.0	Barren	Very low	-	Moderate	-	Very low

MICROPALAEONTOLOGICAL DATA SHEET

BASIN: GIPPSLAND

ELEVATION: KB: 21.0m GL: -65.0m

WELL NAME: WEST FORTESCUE-1

TOTAL DEPTH: 2671.3m KB

AGE	FORAM. ZONULES	HIGHEST DATA					LOWEST DATA				
		Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time	Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time
PLEISTOCENE	A ₁										
	A ₂										
PLIOCENE	A ₃										
	A ₄										
MIOCENE	LATE	B ₁									
		B ₂									
		C									
	MIDDLE	D ₁									
		D ₂									
		E ₁									
		E ₂									
	EARLY	F									
		G									
		H ₁	2366.2	2				2419.2	1		
	OLIGOCENE	LATE	H ₂								
			I ₁								
I ₂											
EARLY		J ₁									
		J ₂									
EOCENE	K										
	Pre-K										

COMMENTS: Sidewall core 39 at 2420.2m contains rare *Globigerina angiporoides* and is considered to be no younger than Zone J-1. Sidewall core 38 at 2421.3m contains rare specimens of *Globigerina linaperta* and is considered to be no younger than Zone K.

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: J.P. Rexilius

DATE: 23/05/84

DATA REVISED BY: J.P. Rexilius

DATE: 10/09/84

SAMPLE TYPE OR NO. *	DEPTHS	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
		2423.0	2421.2	2420.2	2419.2	2418.6	2417.5	2416.4	2415.5	2414.1	2406.6	2402.1	2400.0	2396.6	2374.0	2366.2
PLANKTONIC FORAMINIFERA																
Globigerina linaperta																
indeterminate globigerinids						■	■						■	■		
indeterminate globorotalids																
indeterminate planktonics																
Globigerina angiporoides																
Globigerina woodi woodi																
G. woodi connecta																
G. machitaensis																
G. praebuloides																
Globoquadrina dehiscens																
Globorotalia aff. bella																
G. zealandica zealandica																
Catapsydrax dissimilis																
juvenile planktonics				■			■						■			
Globoquadrina advena																
Globorotalia nana																
G. continua																
G. obesa																
CALCAREOUS NANNOPLANKTON																
indeterminate coccoliths																
Discaster sp.																
Cruciplacolithus staurion																
Coccolithus spp.																
Coccolithus eupelagicus																
Peticulofenestra cf. scissura																
R. cf. alabamensis																
Cyclococcolithina sp.																
OTHER SKELETAL MATERIAL																
echinoid spines																
fish teeth																
ostracods																
bivalve fragments																

* C=CORE S=SIDEWALL CC T
T=CUTTINGS J=JUNK BASKET

--- RARE
- FEW

■ COMMON
■ ABUNDANT

PALAEO.CHART-2
DWG.I107/OP/287