



APPENDIX

PALYNOLOGICAL ANALYSIS
WEST FORTESCUE-1, GIPPSLAND BASIN

by

M.K. Macphail

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INTRODUCTION

Twenty two (22) sidewall core samples were processed and examined for spore-pollen and dinoflagellates. Recovery and preservation was fair to good only in siltstone or shaley intervals. Palynological zones and lithofacies subdivisions from the base of the Lakes Entrance Formation to the lowest sidewall core shot (2569.2m) 102m above total depth are given below. The occurrence of spore-pollen and dinoflagellate species are given in the accompanying range chart. Anomalous and unusual occurrences of taxa are listed in Table 2.

SUMMARY

AGE	UNIT/FACIES	ZONE	DEPTH (m)
Early Miocene	Lakes Entrance Formation log break at 2420m (30 Ma)*	<u>P. tuberculatus</u>	2419.2
Early Oligocene	Unnamed hardground unit (time equivalent of the "Oligocene wedge") log break at 2421m (40.5 Ma)*	<u>P. tuberculatus</u>	2420.2
* latest Early - Middle Eocene	Intra-Latrobe Group glauconitic sandstone unit lithological boundary at 2423m (53 Ma) *	Indeterminate	2421.3-2423.0
Early Eocene	Latrobe Group (coarse clastics) ▽	Upper <u>M.diversus</u> Middle <u>M.diversus</u>	2425.2 2427.5-2569.2

TD 2671

* ages based on micropalaeontological analyses (Rexilius 1984)

GEOLOGICAL COMMENTS

1. Like the Fortescue-1 well, West Fortescue-1 contains an unusually thick (minimum 122m) section of Middle M. diversus Zone sediments. The overlying unit of Upper M. diversus Zone shales and siltstones (the FM-1.0 seal) is markedly thinner (approximately 1m vs 28m in Fortescue-1), reflecting deeper erosion at the West Fortescue-1 well site during the formation of the Marlin Channel.
2. The unit defined by the gamma log peak between 2430-2421m comprises middle and Upper M. diversus Zone shales and siltstones and the overlying but undatable 4m interval of glauconitic sandstones. Resistivity data confirm the upward coarsening nature of this sequence.
3. The unnamed hardground unit (Rexilius 1984), represented by the sonic kick at 2420-2421m contains dinoflagellate species typical of the Oligocene/Miocene P. tuberculatus Zone in age. The equivalent facies in Fortescue-1, between approximately 2413-2415m, contains the P. tuberculatus Zone indicator species, Cyatheacidites annulatus (Stacy & Partridge, 1978).
4. The FM-1.1 sand is Middle M. diversus Zone in age. Fossiliferous samples within this sand contained dinoflagellates, occasionally in considerable abundance, e.g. at 2447.1m, but never diverse populations. This indicates the unit was deposited in a marginal marine environment, probably shoreface in view of the well-sorted texture of the sands.
5. The highest coal, at 2506m, occurs above samples containing abundant dinoflagellates, e.g. at 2508.0m, 2512.0m and 2520.0m. This unit of coals interbedded with sands and shales showing various degrees of marine influence occurs to at least 2560.2m and represents a deltaic environment. The small-scale oscillations in sea level are younger than the Early Eocene Apectodinium (Wetzeliella) hyperacantha marine transgression recognized by Partridge (1976, revised by Stacy & Partridge, 1978)

6. Log analysis shows that the Middle M. diversus Zone coals between 2506.0 and 2569.2m in West Fortescue-1 are correlated with coals of both Middle and Lower M. diversus Zone age in Fortescue-1 (Stacy & Partridge ibid). The excellent match between individual coal seams in these wells indicates that the section down to at least 2573m and probably 2588m in Fortescue-1 is Middle not Lower M. diversus Zone in age (based on the first occurrences of Proteacidites tuberculiformis and P. tuberculo - tumulatus respectively in West Fortescue-1)

7. The basal 100m were not sampled. Biostratigraphic data from the Fortescue-1 well indicates West Fortescue-1 is likely to have bottomed close to, possibly just below, the Lower M. diversus/Upper L. balmei Zone boundary.

BIOSTRATIGRAPHY

Zone boundaries have been established using criteria proposed by Stover & Evans (1973), Stover & Partridge (1973) and subsequent proprietary revisions. The well contains an unusually thick, well-sampled M. diversus Zone interval and will prove important in any subsequent revision of the Early Eocene biostratigraphy in the Gippsland Basin.

Middle Malvacipollis diversus Zone 2569.2 to 2427.5m

The lower boundary is defined by the occurrence of Proteacidites tuberculotumulatus at 2569.2m (the basal sidewall core). This species is extremely rare in offshore wells, and although the majority of associated species, e.g. Tricolporites adelaidensis, Polycolpites esobalteus, Banksiaeidites arcuatus are also typically first recorded in this zone, the Middle M. diversus Zone age is of low confidence. An alternative, more confident pick for the lower boundary is at 2549.09m, based on the first occurrence of Proteacidites tuberculiformis. Similar uncertainties exist with the upper boundary. This is provisionally placed at 2427.5m, the highest occurrence of an M. diversus Zone assemblage lacking indicates species of the Upper M. diversus Zone. This sample contains Proteacidites tuberculiformis and is no older than Middle M. diversus Zone in age. The sample at 2428.1m contains Anacolosidites rotundus and Proteacidites ornatus, species which first appear in this zone.

Upper Malvacipollis diversus Zone 2425.2m

One sample is assigned to this zone, based on occurrences of Proteacidites pachypolus and Myrtaceidites tenuis. The sample lacks species first appearing in the P. asperopolus Zone but is certainly no younger than P. asperopolus Zone# in age. The sample contains abundant Haloragacidites harrisii and Proteacidites spp. relative to Nothofagidites. Malvacipollis diversus and Deflandrea flounderensis suggest the sample at 2424.2m may also be (Upper) M. diversus Zone in age.

Proteacidites tuberculatus zone 2419.2 to 2420.2

Two samples are assigned to this zone. The lower, at 2420.2m, contains Pyxidinospis pontus and probable Protoellipsodinium simplex, dinoflagellates typically found only in this zone. The occurrence of Cyatheacidites annulatus with these dinoflagellate species at 2419.2m confirms a P. tuberculatus zone age for the upper sample.

REFERENCES

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TABLE 1: SUMMARY OF PALYNOLOGICAL ANALYSIS - WEST FORTESCUE-1
INTERPRETATIVE DATA

SAMPLE NO.	DEPTH (m)	YIELD	DIVERSITY		LITHOLOGY	ZONE	AGE	CONFIDENCE	COMMENTS
			SPORE	POLLEN				RATING	
SWC 40	2419.2	V. good	Low		Clyst., calc.	<u>P. tuberculatus</u>	Early Miocene	0	<u>C. annulatus</u> , <u>P. pontus</u>
SWC 39	2420.2	V. low	V. Low		Clyst., glau., calc.	<u>P. tuberculatus</u>	Oligocene/Miocene	2	<u>P. simplex</u> , <u>P. pontus</u>
SWC 38	2421.3	Barren	-		Ss., glau.	-	-	-	
SWC 37	2423.0	Negligible	-		Ss., glau.	Indeterminate	-	-	
SWC 36	2424.2	V. low	Low		Slst.	<u>M. diversus</u>	Early Eocene	-	<u>D. flounderensis</u>
SWC 35	2425.2	Fair	Good		Sh., carb.	<u>Upper M. diversus</u>	Early Eocene	1	<u>M. tenuis</u> , <u>P. pachypolus</u> , <u>D. flounderensis</u> , <u>H. tasmaniense</u>
SWC 34	2427.5	Good	Fair		Slst., carb.	Middle <u>M. diversus</u>	Early Eocene	1	<u>P. tuberculiformis</u> , <u>T. moultonii</u>
SWC 33	2428.1	Fair	Fair		Sh., carb.	Middle <u>M. diversus</u>	Early Eocene	1	<u>A. rotundus</u> , <u>P. ornatus</u> , Frequent <u>W. longispina</u>
SWC 32	2429.7	V. low	V. low		Slst.			-	<u>M. diversus</u>
SWC 29	2436.7	V. low	V. low		Slst.			-	<u>M. diversus</u>
SWC 25	2447.1	V. good	Good		Sh., carb., coaly	Middle <u>M. diversus</u>	Early Eocene	2	<u>T. adalaidensis</u> , Freq <u>M. diversus</u> , <u>W. longispina</u>
SWC 24	2454.3	V. low	Fair		Slst.	<u>M. diversus</u>	Early Eocene	-	<u>C. orthoteichus</u>
SWC 11	2508.1	Good	Fair		Slst., carb.	Middle <u>M. diversus</u>	Early Eocene	2	<u>T. moultoni</u> , <u>T. paenestriatus</u>
SWC 9	2512.0	V. low	Low		Ss.	<u>M. diversus</u>	Early Eocene	-	<u>C. orthoteichus</u>
SWC 8	2133.7	Barren	-		Slst.	-	-	-	
SWC 7	2516.1	Barren	-		Ss.	-	-	-	
SWC 6	2520.0	Fair	Fair		Sh.	Middle <u>M. diversus</u>	Early Eocene	1	<u>P. tuberculiformis</u> , <u>B. emaciatus</u>
SWC 5	2531.0	Low	Low		Sh.	<u>M. diversus</u>	Early Eocene	-	Frequent <u>M. diversus</u>
SWC 4	2549.0	V. good	Good		Sh., carb.	Middle <u>M. diversus</u>	Early Eocene	1	<u>P. tuberculiformis</u> , <u>T. adalaidensis</u>
SWC 3	2560.2	Good	Fair		Slst.	No older than Lower <u>M. diversus</u>		-	<u>C. orthoteichus</u>
SWC 2	2565.6	Low	Low		Slst., carb.	Indeterminate		-	<u>M. diversus</u> ,
SWC 1	2569.2	Good	V. good		Sh.	Middle <u>M. diversus</u>	Early Eocene	2	<u>P. tuberculotumulatus</u> , <u>T. adalaidensis</u> <u>B. arcuatus</u> , <u>P. esobulteus</u>

TABLE
ANOMALOUS AND UNUSUAL OCCURRENCES OF SPORE-POLLEN TAXA IN WEST FORTESCUE-1

SAMPLE NO.	DEPTH (m)	ZONE	TAXON	COMMENTS
SWC 36	2424.2	?Upper M. <u>diversus</u>	<u>Deflandrea flounderensis</u>	Uncommon species
SWC 35	2425.2	Upper M. <u>diversus</u> (1)	<u>Deflandrea flounderensis</u>	as above
SWC35	2425.2	Upper M. <u>diversus</u> (1)	<u>Rugulatisporites</u> sp.	New var. cf <u>R. trophus</u>
SWC 34	2427.5	Middle M. <u>diversus</u> (1)	<u>Tricolpites reticulatus</u> Cookson	Rare sp.
SWC 34	2427.5	Middle M. <u>diversus</u> (1)	<u>Kuylisporites waterbolkii</u>	Rare sp.
SWC 3	2560.2	Middle M. <u>diversus</u> (3)	<u>Droseridites tholus</u>	Earliest record to date in Gippsland
SWC 1	2569.2	Middle M. <u>diversus</u> (2)	<u>Retistephanocolpites nixonii</u>	Rare sp.
SWC 1	2569.2	Middle M. <u>diversus</u> (2)	<u>Proteacidites tuberculotumulatus</u>	Very rare sp.
SWC 1	2569.2	Middle M. <u>diversus</u> (2)	<u>Camazonosporites australiensis</u>	Rare in sediments this young

P A L Y N O L O G Y D A T A S H E E T

B A S I N : GIPPSLAND

ELEVATION: KB: + 21.0m GL: _____

WELL NAME: WEST FORTESCUE-1

TOTAL DEPTH: 2671m

A G E	PALYNOLOGICAL ZONES	H I G H E S T D A T A					L O W E S T D A T A				
		Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time	Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time
NEOGENE	<i>T. pleistocenicus</i>										
	<i>M. lipsis</i>										
	<i>C. bifurcatus</i>										
	<i>T. bellus</i>										
PALEOGENE	<i>P. tuberculatus</i>	2419.2	0				2420.2	2			
	Upper <i>N. asperus</i>										
	Mid <i>N. asperus</i>										
	Lower <i>N. asperus</i>										
	<i>P. asperopolus</i>										
	Upper <i>M. diversus</i>	2425.2	1				2425.2	1			
	Mid <i>M. diversus</i>	2427.5	2	2437.5	1		2569.2	2	2549.0	1	
	Lower <i>M. diversus</i>										
	Upper <i>L. balmei</i>										
	Lower <i>L. balmei</i>										
LATE CRETACEOUS	<i>T. longus</i>										
	<i>T. lilliei</i>										
	<i>N. senectus</i>										
	U. <i>T. pachyexinus</i>										
	L. <i>T. pachyexinus</i>										
	<i>C. triplex</i>										
EARLY CRET.	<i>A. distocarinatus</i>										
	<i>C. paradoxus</i>										
	<i>C. striatus</i>										
	<i>F. asymmetricus</i>										
	<i>F. wonthaggiensis</i>										
	<i>C. australiensis</i>										
	PRE-CRETACEOUS										

COMMENTS: Dinoflagellates occur in all samples, often in abundance although diversity is usually low. It is not clear from these data whether marginal marine or fully marine environments are represented.

- CONFIDENCE RATING:
- 0: SWC or Core, Excellent Confidence, assemblage with zone species of spores, pollen and microplankton.
 - 1: SWC or Core, Good Confidence, assemblage with zone species of spores and pollen or microplankton.
 - 2: SWC or Core, Poor Confidence, assemblage with non-diagnostic spores, pollen and/or microplankton.
 - 3: Cuttings, Fair Confidence, assemblage with zone species of either spores and pollen or microplankton, or both.
 - 4: Cuttings, No Confidence, assemblage with non-diagnostic spores, pollen and/or microplankton.

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.K. Macphail

DATE: 20 June 1984

DATA REVISED BY: _____

DATE: _____

FOSSIL TYPE : CALCAREOUS PLANKTONIC MICROFOSSILS
& OTHER SKELETAL MATERIAL

Well Name WEST FORTESCUE-1

Basin GIPPSLAND

Sheet No. 1 of 1

SAMPLE TYPE OR NO. *	DEPTHS										
	37	38	39	40	41	42	43	44	45	46	47
PLANKTONIC FORAMINIFERA	2423.0	2421.2	2420.2	2419.2	2418.6	2417.5	2416.4	2413.5	2411.1	2406.6	2402.1
Globigerina linaperta											
indeterminate globigerinids					■	■				■	
indeterminate globorotalids											
indeterminate planktonics											
Globigerina angiporoides											
Globigerina woodi woodi											
G. woodi connecta											
G. ouachitaensis											
G. praebulloides											
Globoquadrina dehiscens											
Globorotalia aff. bella											
G. zealandica zealandica											
Catapsydrax dissimilis											
juvenile planktonics				■	■					■	
Globoquadrina advena											
Globorotalia nana											
G. continua											
G. obesa											
CALCAREOUS NANNOPLANKTON											
indeterminate coccoliths											
Discoaster sp.											
Cruciplacolithus staurion											
Coccolithus spp.											
Coccolithus eupelagicus											
Reticulofenestra cf. scissura											
R. cf. alabamensis											
Cyclococcolithina sp.											
OTHER SKELETAL MATERIAL											
echinoid spines											
fish teeth											
ostracods											
bivalve fragments											

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

--- RARE
— FEW

■ COMMON
■ ABUNDANT

PALAEO.CHART-2
DWG.1107/OP/287