APPENDIX

PALYNOLOGICAL ANALYSIS OF GRUNTER-1, GIPPSLAND BASIN

by

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INTERPRETATIVE DATA

INTRODUCTION

SUMMARY TABLE

GEOLOGICAL COMMENTS

DISCUSSION OF AGE ZONES

TABLE-1: INTERPRETATIVE DATA

TABLE-2: ANOMALOUS AND UNUSUAL OCCURRENCES OF SPORE POLLEN

PALYNOLOGY DATA SHEET

TABLE-3: BASIC DATA

INTRODUCTION

Eighty eight sidewall core and six conventional core samples were processed and analysed for spore-pollen and dinoflagellates. Recovery and preservation were adequate to make confident age determinations in all sections of the well. Close sampling in the Late Cretaceous section has revealed several marine incursions predating the Maastrichtian *I. druggii* Zone transgression.

Lithological units and palynological zones from the base of the Lakes Entrance Formation to T.D. are summarized below. Anomalous and unusual occurrences of taxa are listed in Table 2. Basic data is given in Table 3.

SUMMARY

AGE	UNIT	ZONE	DEPTH (m)
Early Miocene	Lakes Entrance Fm.	*P. tuberculatus*	1850.1-1851.9
	log break at 1853m		
Middle Eocene	Gurnard Fm.	Lower *N. asperus*	1854.0-1858.0
	log break at 1858m		
Early Eocene	Flounder Fm.	*P. asperopolus*	1860.0-1887.0
	log break at 1888m		
Paleocene		Upper *L. balmei*	1889.6-2213.0
Paleocene	Latrobe Group	Lower *L. balmei*	2244.6-2590.1
Maastrichtian	coarse clastics	Upper *T. longus*	2645.0-2961.0
Late Cretaceous		Lower *T. longus*	2975.0-3403.0
Late Cretaceous		*T. lilliei*	3423.9-3797.0

GEOLOGICAL COMMENTS

1. The Grunter-1 well contains a continuous sequence of sediments from the Late Cretaceous T. lilliei Zone to the Paleocene Upper L. balmei Zone. These are unconformably overlain by the Early Eocene, P. asperopolus Zone Flounder Formation which in turn is disconformably overlain by the Middle Eocene, Lower N. asperus Zone Gurnard Formation.

2. The greensand unit at the top of the Latrobe Group in Flounder-4 contains P. tuberculatus Zone spore-pollen and dinoflagellates. The confident Lower N. asperus Zone age for the Gurnard Formation in Grunter-1 supports Partridge's (1973) suggestion that the greensand unit in Flounder-4 was originally deposited in the Middle Eocene and later reworked during the Oligocene.

3. Whilst the upper section of the Flounder Formation [1870.0-1875.0m] in Grunter-1 is certainly P. asperopolus/K. edwardsii Zone in age, it is not clear whether the lower section [1875.0-1887.0m] which was sampled by only one sidewall core is Upper M. diversus or P. asperopolus Zone in age. Sediments of both ages are present in Flounder-4 where the Upper M. diversus Zone section is found associated with W. ornata Zone dinoflagellates (see Partridge 1973, 1976). In contrast, Flounder Formation sediments in Stonefish-1 are dated as wholly P. asperopolus Zone in age. Indicator dinoflagellate species are absent and this date is wholly based on spore-pollen evidence.

4. In Flounder-4, a unit dated as Lower M. diversus Zone is present between the Upper L. balmei/A. homomorpha Zone section and the base of the Tuna-Flounder Channel. This unit, assumed to also be a channel fill, is not present in Grunter-1 or Stonefish-1.

5. At least 8 distinct marine incursions can be recognized in the Late Cretaceous-Paleocene section in Grunter-1. Incursions which can be associated with named dinoflagellate zones are A. homomorpha Zone [1889.6-2213.0m], the T. evittii Zone [2554.0m]? and the I. druggii Zone [2774.0m, 2961.0m]. It appears likely that the I. druggii Zone incursion occurred in two separate 'pulses'. Incursions older than the Maastrichtian I. druggii Zone are represented at 3007.1m and 3125.0m in Lower T. longus Zone sediments, and 3446.0m and 3770.0m in T. lilliei Zone sediments.

6. All the Paleocene-Late Cretaceous marine-influenced sediments appear to have been deposited in marginal marine situations within a coastal plain environment, e.g. in fluvial/tidal channels or coastal lagoons analogous to those along the present-day Gippsland coast. This includes the 535m thick section of A. homomorpha Zone sediments [1889.6-2425.0m], interpreted seismically as Paleocene channel fill units.

7. The Grunter-1 well is likely to have bottomed in T. lilliei rather than, as predicted, N. senectus Zone sediments. The basal sidewall case sample in Stonefish-1 (10,424 ft) would, on present criteria, be dated as T. lilliei Zone [confidence rtg 2] due to occurrences of Gambierina rudata. Both
wells demonstrate rapid sedimentation [1152m, 693m respectively] and therefore a period of major subsidence during the Late Cretaceous. The thinner total thickness of T. longus-T. lilliei Zone sediments at Sunfish-1 relative to Grunter-1 reflects its closer position relative to the northern margin of the basin.

BIOSTRATIGRAPHY

Zone boundaries have been established using criteria proposed by Stover & Partridge (1973) and subsequent proprietary reports, including Macphail (1983). Close sampling has revealed a number of discrepancies which are likely to lead to further modification of these criteria:

1. The I. druggii Zone appears to be coeval with the full, rather than merely the upper part of the Upper T. longus Zone. In Grunter-1, Isabelidinium druggii appears in two samples separated in part by coastal plain sediments. The first occurrence precedes the first appearance of the Upper T. longus Zone indicator species, Stereisporities punctatus, i.e. the dinoflagellate first appears in a typically Lower T. longus Zone spore-pollen assemblage.

2. Lower T. longus Zone palynofloras as defined by either the first appearance of Tricolpites longus or Quadraplanus brossus are initially dominated by Nothofagidites pollen. This dominance is more typical of T. lilliei or upper N. senectus Zone palynofloras. Dominance of Gambierina rudata first appears within the Lower T. longus Zone.

3. Proteacidites gemmatus extends from within the Lower T. longus to within the Upper L. balmei Zone, not, as previous data indicated, from the Upper T. longus to Lower L. balmei Zone.

4. The Grunter-1 data confirm previous suspicions that both Verrucosisporities kopukuensis and Apectodinium homomorpha first appear in Lower L. balmei Zone sediments [based on correlation with other wells]. It is still premature to define the lower boundary of the Upper L. balmei Zone by the first appearance of Proteacidites incurvatus and/or Cyathidites

gigantis since both are relatively uncommon. Other taxa which first appear within the Upper L. balmei Zone as defined by the first occurrence of V. kopukuensis are (relative frequency of occurrence in parentheses): Proteacidites annularis and Malvacipollis subtilis (frequent) and, Banksieacidites lunatus [ms sp.nov.], Cupanieidites orthoteichus and Triporopollenites ambiguus (infrequent to very rare). The first appearance of P. annularis and M. subtilis are used in this well to provisionally define the Upper/Lower L. balmei Zone boundary.

Tricolporites lilliei Zone: 3423.9 to 3797.0m

This section comprises palynofloras dominated by Nothofagidites and Proteacidites spp, less frequently by gymnosperms and Gambierina rudata. Although the first appearance of the zone indicator T. lilliei is at 3785.0m, the basal sidewall core at 3797.0m is provisionally assigned to this zone on the basis of a possible specimen of Gambierina rudata and the overall similarity of this to other T. lilliei Zone palynofloras. The upper boundary of the zone is defined by the highest occurrence of Tricolporites lilliei in an assemblage lacking T. longus Zone indicators.

Lower Tricolpites longus Zone: 2975.0 to 3403.0m

The base of this zone is picked at the first appearance of Tricolpites longus at 3403.0m. These are however two reasons for suspecting that this solitary record is anomolous and that the section may prove to be correlated with T. lilliei Zone sediments in adjacent wells. Firstly, the single specimen recorded is some 200m below the next lowest Lower T. longus Zone indicator species, (Quadraplanus brossus at 3204.0m). The specimen was recovered from a closely sampled core taken in carbonaceous siltstones. It would be extremely fortuitous for an equivalent occurrence to be found in sidewall cores. Secondly, the general appearance of palynofloras in this and adjacent samples is T. lilliei Zone in character, i.e. frequent to abundant Nothofagidites,

Tricolporites lilliei and Triporopollenites sectilis. The first appearance of Quadraplanus brossus at 3204.0m provides an alternative pick for the lower boundary. Gambierina rudata dominates the palynofloras above 3007.1m and the upper boundary is picked at 2975.0m. This sample contains the highest occurrence of Tricolpites labrum. The sample at 3125.0m contains at least four dinoflagellate species, one of which (Apectodinium sp. cf. A. homomorpha) is frequent in occurrence.

Upper Tricolpites longus Zone: 2645.0 to 2961.0m

This section is characterized by Gambierina-Proteacidites dominated palynofloras, many of which also contain Tricolpites longus and Stereisporites punctatus. The lower boundary is provisionally picked on the first appearance of Isabelidinium druggii at 2961.0m. S. punctatus first occurs at 2877.0m but I. druggii does not reappear until 2774.1m Apparently non-marine environments are represented within the intervening section, at 2949.0m and 2836.0m. The upper boundary is defined by the last appearance of Tricolpites longus and abundant Gambierina at 2645.0m.

Lower Lygistepollenites balmei Zone: 2244.6 to 2590.1m

The lower boundary is placed at 2590.1m, the first occurrence of a gymnosperm - Proteacidites palynoflora lacking in species restricted to the Late Cretaceous. Trithyrodinium evittii at 2554.0m confirms a Lower L. balmei Zone age for this sample. The same sample also contains the typically Late Cretaceous species Proteacidites otwayensis, apparently in situ. The upper boundary is provisionally picked at 2244.6m, the sample immediately below the first appearance of Proteacidites annularis and Malvacipollis subtilis. This sample is 180m above the first (simultaneous) appearance of Verrucosisporites kopukuensis and Apectodinium homomorpha.

Upper Lygistepollenites balmei: 1889.6 to 2213.0m

Samples within this section contain frequent to abundant Lygistepollenites balmei, Podocarpidites, Proteacidites and Apectodinium homomorpha. Gambierina spp. and Polycolpites langstonii are usually present. For reasons given above, the lower boundary is placed at 2213.0m Other first appearances within this zone are: Haloragacidites harrisii and Proteacidites incurvatus at 2103.0m, Banksieaeidites lunatus at 1975.6m, Cupanieidites orthoteichus at 1912.0m and Cyathidites gigantis at 1895.0m. The upper boundary at 1889.6m tightly defined by a L. balmei - dominated palynoflora containing P. incurvatus and C. gigantis as well as species which last appear in this zone e.g. Gambierina rudata and Polycolpites langstonii.

Proteacidites asperopolus Zone: 1860.0 to 1887.0m

Five samples are assigned to this zone, the upper one [1860.0m] provisionally so. The lower four, between 1865.1 and 1887.0m, contain Proteacidites pachypolus and Myrtaceidites tenuis, species which first appear in the Upper M. diversus Zone but which extend into the P. asperopolus Zone (M. tenuis) or higher (P. asperopolus). The only positive evidence of a P. asperopolus Zone age for the section is the occurrence of the dinoflagellate Kisselovia (Wetzeliella) edwardsii at 1875.0m. The sample at 1870.0 contains frequent occurrences of a Wetzeliella-group dinoflagellate closely resembling an Upper M. diversus Zone indicator species, Rhombodinium waipawaense. This species, provisionally identified as Wilsonidium (al. Wetzeliella) lineidentatum (Cookson & Eisenack 1961), has not been previously recorded in the Gippsland Basin.

Lower Nothofagidites asperus Zone: 1854.0 to 1858.0m

Occurrences of the dinoflagellates Areosphaeridium diktyoplokus at 1856.0 and 1858.0m, and Deflandrea heterophylcta at 1854.0m demonstrate this interval

is Lower N. asperus Zone in age.

Proteacidites tuberculatus Zone: 1850 to 1851.9m

Occurrences of Cyatheacidites annulatus and Protoellipsodinium simplex at 1850.0 and 1851.9m demonstrate a P. tuberculatus Zone age from this section. Although the spore-pollen yield is very low and dominated by wind-dispersed types, one member of a taxon that is generally poorly dispersed was present - Proteacidites rectomarginis at 1851.9m. This sample also contains the first record in Gippsland of the Western Australian dinoflagellate, Rottnestia borussia.

REFERENCES

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PALYNOLOGY DATA SHEET

BASIN: Gippsland ELEVATION: KB: +21.0m GL: _____

WELL NAME: Grunter-1 TOTAL DEPTH: 3809m KB

AGE	PALYNOLOGICAL ZONES	HIGHEST DATA					LOWEST DATA				
		Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time	Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time
NEOGENE	*T. pleistocenicus*										
	M. lipsis										
	C. bifurcatus										
	T. bellus										
	P. tuberculatus	1850.0	0				1851.9	0			
PALEOGENE	Upper *N. asperus*										
	Mid *N. asperus*										
	Lower *N. asperus*	1854.0	2	1856.0	1		1858.0	1			
	P. asperopolus	1865.1	2	1875.0	0		1887.0	2	1875.0	0	
	Upper *M. diversus*										
	Mid *M. diversus*										
	Lower *M. diversus*										
	Upper *L. balmei*	1889.6	0				2213.0	1			
	Lower *L. balmei*	2244.6	2				2590.1	2			
LATE CRETACEOUS	Upper *R. longus*	2645.0	0				2961.0	2	2877.0	0	
	Lower *R. longus*	3007.1	1				3403.0	2	3204.0	1	
	T. lilliei	3423.9	1				3797.0	2	3770.0	0	
	N. senectus										
	T. apoxyexinus										
	P. mawsonii										
	A. distocarinatus										
EARLY CRET.	*P. pannosus*										
	C. paradoxa										
	C. striatus										
	C. hughesi										
	F. wonthaggiensis										
	C. australiensis										

COMMENTS: Kisselovia (Wetzeliella) edwardsii Zone 1875.0m

A. homomorpha Zone 1889.6-2425.0m;

?T. evittii Zone 2554.0m; I. druggii Zone 2774.1m, 2961.0m

Campanian marginal marine environments 3007.1m, 3125.0m, 3446.0m, 3770.0m.

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: 12 May 1985

DATA REVIEWED BY: _____ DATE: _____

TABLE 1: SUMMARY OF INTERPRETATIVE PALYNOLOGICAL DATA

GRUNTER-1

SAMPLE NO.	DEPTH (m)	SPORE-POLLEN ZONE	DINOFLAGELLATE ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 142	1850.0	P. tuberculatus	-	Early Miocene	0	C. annulatus, P. simplex
SWC 141	1851.9	P. tuberculatus	-	Early Miocene	0	C. annulatus, P. simplex, P. rectomarginis
SWC 140	1854.0	Lower N. asperus	D. heterophylcta	Middle Eocene	1	N. falcatus, D. heterophylcta
SWC 139	1856.0	Lower N. asperus	A. dikytoplokus	Middle Eocene	1	A. diktyoplokus
SWC 138	1858.0	Lower N. asperus	A. dikytoplokus	Middle Eocene	1	A. diktyoplokus, D. flounderensis
SWC 137	1860.0	P. aspercpolus	-	Early Eocene	2	P. pachypolus
SWC 136	1865.1	P. aspercpolus	-	Early Eocene	2	P. pachypolus, M. tenuis
SWC 135	1870.0	P. aspercpolus	-	Early Eocene	2	P. pachypolus, M. tenuis
SWC 134	1875.0	P. aspercpolus	K. edwardsii	Early Eocene	0	K. edwardsii, P. pachypolus, M. tenuis
SWC 131	1887.0	Upper M. diversus	-	Early Eocene	2	P. pachypolus, M. tenuis
SWC 130	1889.6	Upper L. balmei	A. homomorpha	Paleocene	0	L. balmei common, C. gigantis, P. incurvatus, A. homomorpha
SWC 129	1895.0	Upper L. balmei	A. homomorpha	Paleocene	0	L. balmei common, C. gigantis, P. annularis
SWC 127	1911.0	Indet.	-	-	-	Caved Eocene spore-pollen
SWC 126	1912.0	Upper L. balmei	-	Paleocene	1	P. annularis, V. kopukuensis
SWC 125	1919.1	Upper L. balmei	A. homomorpha	Paleocene	1	P langstonii, P. annularis, abund. A. homomorpha
SWC 123	1940.0	Upper L. balmei	A. homomorpha	Paleocene	1	P langstonii, P. incurvatus, V. kopukuensis
SWC 122	1975.6	Upper L. balmei	A. homomorpha	Paleocene	2	M. subtilis, B. lunatus, A. homomorpha
SWC 121	1981.0	Upper L. balmei	-	Paleocene	2	L. balmei common, P. langstonii

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GRUNTER-1

SAMPLE NO.	DEPTH (m)	SPORE-POLLEN ZONE	DINOFLAGELLATE ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 120	2009.0	Upper L. balmei	A. homomorpha	Paleocene	2	A. homomorpha
SWC 119	2011.1	Upper L. balmei	A. homomorpha	Paleocene	1	A. homomorpha
SWC 115	2052.0	Indet.	-	-	-	
SWC 113	2103.0	Upper L. balmei	A. homomorpha	Paleocene	0	L. balmei freq., P. incurvatus, M. subtilis
SWC 110	2128.0	Upper L. balmei	A. homomorpha	Paleocene	2	
SWC 105	2176.0	Upper L. balmei	-	Paleocene	2	P. langstonii
SWC 102	2213.0	Upper L. balmei	-	Paleocene	1	P. langstonii, P. annularis, M. subtilis
SWC 179	2244.6	Lower L. balmei	A. homomorpha	Paleocene	2	A. homomorpha
SWC 175	2306.5	L. balmei	-	Paleocene	-	
SWC 96	2340.1	L. balmei	-	Paleocene	-	L. balmei common
SWC 91	2411.0	Lower L. balmei	A. homomorpha	Paleocene	2	A. homomorpha, D. medcalfii
SWC 90	2425.0	Lower L. balmei	A. homomorpha	Paleocene	2	L. balmei common, V. kopukuensis
SWC 84	2536.0	Lower L. balmei	-	Paleocene	2	Trithyrodinium
SWC 169	2539.1	Lower L. balmei	-	Paleocene	2	
SWC 82	2554.0	Lower L. balmei	? T. evittii	Paleocene	1	T. evittii
SWC 81	2570.1	L. balmei	-	Paleocene	-	D. medcalfii
SWC 80	2581.0	Indet.	-	-	-	C. inodes
SWC 79	2590.1	Lower L. balmei	-	Paleocene	2	G. retiintexta, C. inodes
SWC 78	2645.0	Upper T. longus	-	Maastrichtian	0	G. rudata abund., S. punctatus, T. longus
SWC 166	2649.0	Upper T. longus	-	Maastrichtian	2	T. longus, T. illilei

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GRUNTER-1

SAMPLE NO.	DEPTH (m)	SPORE-POLLEN ZONE	DINOFLAGELLATE ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 76	2673.1	Indet.	-	-	-	
SWC 75	2678.0	Indet.	-	-	-	
SWC 74	2683.1	Upper *T. longus*	-	Maastrichtian	0	*S. punctatus*; *T. longus*; abund. *G. rudata*
SWC 71	2751.1	Upper *T. longus*	-	Maastrichtian	0	*S. punctatus*; *T. longus*; abund. *G. rudata*
SWC 162	2774.1	Upper *T. longus*	? *I. druggii*	Maastrichtian	0	*S. punctatus*, *I.* cf *druggii*
SWC 69	2801.0	Upper *T. longus*	-	Maastrichtian	1	*S. punctatus*
SWC 68	2836.0	Upper *T. longus*	-	Maastrichtian	2	Spore-dominated palynoflora
SWC 67	2865.0	Upper *T. longus*	-	Maastrichtian	2	*T. longus*
SWC 160	2877.0	Upper *T. longus*	-	Maastrichtian	0	*S. punctatus*; *T. longus*; common *G. rudata*
SWC 65	2914.0	Upper *T. longus*	-	Late Cretaceous	2	*G. rudata* common, marginal marine?
SWC 64	2929.0	Upper *T. longus*	-	Late Cretaceous	2	*G. rudata* common, *S. meridianus*
SWC 63	2949.0	Upper *T. longus*	-	Late Cretaceous	2	*G. rudata* common, *T. longus*
SWC 159	2961.0	Upper *T. longus*	-	Late Cretaceous	2	*G. rudata* abund., *T. longus*, *I. druggii*
SWC 62	2975.0	No older than *T. lilliei* Zone		Late Cretaceous	-	*T. lilliei*, *T. labrum*
SWC 61	2993.0	Indet.	-	-	-	
SWC 60	3007.1	Lower *T. longus*	-	Late Cretaceous	1	*G. rudata* common, *T. longus*
SWC 58	3038.5	*T. longus*	-	Late Cretaceous	-	*P gemmatus*
SWC 57	3057.0	Lower *T. longus*	-	Late Cretaceous	-	*G. rudata* abund., *Q. brossus*
SWC 52	3112.0	No older than *T. lilliei* Zone		Late Cretaceous	-	*T. lilliei*
SWC 30	3125.0	No older than *T. lilliei* Zone		Late Cretaceous	-	*Nothofagidites* common, *T. lilliei*
SWC 27	3174.9	*T. longus*	-	Late Cretaceous	-	*P. gemmatus*, *T. lilliei*
SWC 24	3204.0	Lower *T. longus*	-	Late Cretaceous	1	*Q. brossus*

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GRUNTER-1

SAMPLE NO.	DEPTH (m)	SPORE-POLLEN ZONE	DINOFLAGELLATE ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 22	3233.0	No older than T. lilliei Zone		Late Cretaceous	-	T. lilliei, common Nothofagidites
SWC 21	3250.0	No older than T. lilliei Zone		Late Cretaceous	-	T. lilliei, common Nothofagidites, T. verrucosus
SWC 20	3267.1					
SWC 19	3282.0	No older than T. lilliei Zone		Late Cretaceous	-	T. sectilis, G. rudata
SWC 18	3300.0					
SWC 17	3317.5					
SWC 16	3330.1	Indet.	-	-	-	L. amplus
SWC 15	3344.8	No older than T. lilliei Zone		Late Cretaceous	-	T. lilliei, T. sectilis
SWC 14	3396.0	No older than T. lilliei Zone		Late Cretaceous	-	T. lilliei
Core 1	3397.0	Indet.				
Core 1	3400	No older than T. lilliei Zone		Late Cretaceous	-	T. lilliei, abund. Nothofagidites
Core 1	3403.0	Lower T. longus	-	Late Cretaceous	2	T. longus, common Nothofagidites
SWC 10	3423.9	T. lilliei	-	Late Cretaceous	1	T. lilliei, N. flemingii
Core 2	3434.0	T. lilliei	-	Late Cretaceous	1	T. lilliei
Core 2	3446.0	T. lilliei	-	Late Cretaceous	2	
Core 2	3450.8	T. lilliei	-	Late Cretaceous	1	T. lilliei, common Nothofagidites
SWC 5	3500.5	T. lilliei	-	Late Cretaceous	1	T. lilliei, N. flemingii
SWC 4	3527.0	T. lilliei	-	Late Cretaceous	1	T. sectilis, G. rudata, common Nothofagidites
SWC 243	3550.0	No older than N. senectus Zone		Late Cretaceous	-	Nothfagidites spp.
SWC 1	3559.5	Indet.	-	-	-	

TABLE 1: SUMMARY OF INTERPRETATIVE PALYNOLOGICAL DATA

GRUNTER-1

SAMPLE NO.	DEPTH (m)	SPORE-POLLEN ZONE	DINOFLAGELLATE ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 213	3567.5	Indet.	-	-	-	
SWC 212	3571.0	Indet.	-	-	-	
SWC 210	3578.5	Indet.	-	-	-	
SWC 208	3604.0	Indet.	-	-	-	
SWC 207	3614.5	No older than *N. senectus* Zone		Late Cretaceous	-	*N. waipawaensis*
SWC 237	3618.5	Indet.	-	-	-	
SWC 235	3630.0	No older than *N. senectus* Zone		Late Cretaceous	-	*N. waipawaensis*
SWC 229	3676.0	*T. lilliei*	-	Late Cretaceous	1	*N. flemingii*
SWC 228	3679.0	*T. lilliei*	-	Late Cretaceous	1	*G. rudata*
SWC 192	3746.0	*T. lilliei*	-	Late Cretaceous	1	*G. rudata* frequent
SWC 219	3761.0	*T. lilliei*	-	Late Cretaceous	0	*T. lilliei*, *G. rudata*, common *Nothofagidites*
SWC 189	3770.0	*T. lilliei*	-	Late Cretaceous	0	*T. lilliei*, *T. sectilis*, *G. rudata*; marginal marine
SWC 187	3785.0	*T. lilliei*	-	Late Cretaceous	1	*T. lilliei*, *F. verrucatus*
SWC 185	3797.0	No older than *N. senectus* Zone		Late Cretaceous	-	Possible *G. rudata*

TABLE 2

ANOMALOUS AND UNUSUAL OCCURRENCES OF SPORE-POLLEN TAXA IN GRUNTER-1

SAMPLE NO.	DEPTH(m)	ZONE	TAXON	COMMENTS
SWC 141	1851.9	P. tuberculatus (0)	Rottnestia borussica	First record of this West. Aust. dinoflagellate in Gippsland
SWC 141	1851.9	P. tuberculatus (0)	Proteacidites rectomarginis	Uncommon sp.
SWC 137	1860.0	Lower N. asperus (2)	Cupressaceae-Taxodiaceae	Modern taxon
SWC 137	1860.0	Lower N. asperus	Proteacidites callosus	Uncommon sp.
SWC 136	1865.1		Triporopollenites sectilis	Reworked Late Cretaceous sp.
SWC 136	1865.1	(P. asperopolus)	Dryptopollenites semilunatus	Rare sp.
SWC 136	1865.1	(P. asperopolus)	Peromonolites bacculatus	Rare sp.
SWC 135	1870.0	(P. asperopolus)	Wetzelielia lineidentata	West. Aust. dinoflagellate resembling R. walpawaense
SWC 135	1870.0	(P. asperopolus)	Cunoniaceae 3-p	Modern taxon
SWC 135	1870.0	(P. asperopolus)	Ornamentifera apiculatus	Rare ms sp. (M.K.M.)
SWC 134	1875.0	P. asperopolus (0)	Kisselovia edwardsii	Very rare dinoflagellate sp.
SWC 131	1887.0	(P. asperopolus)	Elphredripites notensis	Uncommon sp.
SWC 131	1887.0	Upper M. diversus (2)	Proteacidites xestoformis	Uncommon sp.
SWC 131	1887.0	Upper M. diversus (2)	Peromonolites baculatus	Rare sp.
SWC 130	1889.6	Upper L. balmei (0)	Liliacidites sernatus	Rare sp.
SWC 129	1895.0	Upper L. balmei (0)	Cupanieidites orthoteichus	Very rare below M. diversus Zone
SWC 129	1895.0	Upper L. balmei (0)	Jaxtacolpus pleratus	Rare above Lower L. balmei Zone
SWC 126	1912.0	Upper L. balmei (1)	Cupanieidites orthoteichus	As for SWC 129
SWC 126	1912.0	Upper L. balmei (1)	Umbelliferae	Modern taxon
SWC 125	1919.1	Upper L. balmei (1)	Liliacidites sernatus	As for SWC 130
SWC 125	1919.1	Upper L. balmei (1)	Triporopollenites ambiguus	Rare below

TABLE 2

ANOMALOUS AND UNUSUAL OCCURRENCES OF SPORE-POLLEN TAXA IN GRUNTER-1

SAMPLE NO.	DEPTH(m)	ZONE	TAXON	COMMENTS
SWC 123	1940.0	(Upper *L. balmei*)	*Proteacidites crassus*, *P. recavus*, *Liliacidites lanceolatus*	Caved?
SWC 123	1940.0	(Upper *L. balmei*)	*Elphredripites notensis*	As for SWC 131
SWC 122	1975.6	Upper *L. balmei* (2)	*Banksiaeidites lunatus*	Uncommon ms sp. (A.D.P.) first appearing in this zone
SWC 122	1975.6	Upper *L. balmei* (2)	*Malvacipollis subtilis*	Uncommon ms sp. (A.D.P.) first appearing in this zone
SWC 122	1975.6	Upper *L. balmei* (2)	Cunoniaceae 3-p	Modern taxon
SWC 122	1975.6	Upper *L. balmei* (2)	*Periporopollenites vesicus*	Rare below Eocene
SWC 122	1975.6	Upper *L. balmei* (2)	*Simplicepollis meridianus*	Planar tetrad form
SWC 121	1981.0	Upper *L. balmei* (2)	Cunoniaceae 3-p	as for SWC 122
SWC 121	1981.0	Upper *L. balmei* (2)	*Proteacidites otwayensis*	Seems *in situ*, non-marine sample
SWC 120	2009.0	Upper *L. balmei* (2)	*Parvisaccites catastus*	Uncommon sp.
SWC 119	2011.1	Upper *L. balmei* (2)	*Triporopollenites delicatus*	Rare sp.
SWC 113	2103.0	Upper *L. balmei* (1)	*Proteacidites gemmatus*	Very rare above Lower *L. balmei* Zone, possibly reworked: marine sample
SWC 105	2176.0	(Upper *L. balmei*)	*Gephyrapollenites cranwellae*	Uncommon sp.
SWC 105	2176.0	(Upper *L. balmei*)	*Liliacidites lanceolatus*	Not prev. recorded below *M. diversus* Zone
SWC 96	2340.1	(Upper *L. balmei*)	*Gephyrapollenites cranwellae*	As for SWC 105
SWC 90	2425.0	Upper *L. balmei* (2)	*Gephyrapollenites cranwellae*	As for SWC 105
SWC 90	2425.0	Upper *L. balmei* (2)	*Elphredripites notensis*	As for SWC 131
SWC 84	2536.0	Lower *L. balmei* (2)	Cunoniaceae 3-p	Modern taxon
SWC 84	2536.0	Lower *L. balmei* (2)	*Amosopollis cruciformis*	Unusually common in sample
SWC 169	2539.1	Lower *L. balmei* (2)	Cunoniaceae 3-p	Modern taxon
SWC 82	2554.0	Lower *L. balmei* (2)	*Gamblerina verrucatus*	Rare ms sp. (M.K.M.)

TABLE 2

ANOMALOUS AND UNUSUAL OCCURRENCES OF SPORE-POLLEN TAXA IN GRUNTER-1

SAMPLE NO.	DEPTH(m)	ZONE	TAXON	COMMENTS
SWC 82	2554.0	Lower *L. balmei* (1)	*Proteacidites otwayensis*	Very rare above *T. longus* Zone
SWC 82	2554.0	Lower *L. balmei* (1)	*Trithyrodinium evittii*	Uncommon dinoflagellate
SWC 77	2645.0	Upper *T. longus* (0)	*Proteacidites protograndis*	Rare ms sp. (M.K.M.)
SWC 74	2683.1	Upper *T. longus* (0)	*Proteacidites protograndis*	Rare ms sp. (M.K.M.)
SWC 162	274.1	Upper *T. longus* (0)	*Jaxtacolpus pleratus*	Rare sp.
SWC 64	2929.0	Upper *T. longus* (2)	*Spinidinium/Apectodinium*	Undescr. Late Cretaceous dinoflagellate
SWC 159	2961.0	Upper *T. longus* (2)	*Dicktyotosporites speciosun*	?Reworked Early Cretaceous sp.
SWC 159	2961.0	Upper *T. longus* (2)	*Isobelidinium druggii*	Uncommon dinoflagellate
SWC 62	2975.0	(*T. longus*)	*Tricolpites labrum*	Highest occurrence of sp. in well
SWC 62	2975.0	(*T. longus*)	*Foveotriletes balteus*	Rare in this zone
SWC 58	3038.5	(Lower *T. longus*)	*Proteacidites gemmatus*	Not prev. recorded below Upper *T. longus* Zone
SWC 30	3125.0	(Lower *T. longus*)	*Spinidinium/Apectodinium*	Undescr. Late Cretaceous dinoflagellate
SWC 30	3125.0	(Lower *T. longus*)	*Grapnelispora* cf *evansii*	Form with simple processes
SWC 27	3174.9	(Lower *T. longus*)	*Proteacidites gemmatus*	Not prev. recorded below Upper *T. longus* Zone
SWC 24	3204.0	Lower *T. longus* (1)	*Quadraplanus brossus*	Rare sp.
SWC 11	3250.0	(Lower *T. longus*)	*Tetracolporites verrucosus*	Rare below Upper *T. longus* Zone
SWC 14	3359.8	(Lower *T. longus*)	*Triporopollenites sectilis, f. verrucatus*	Uncommon variety
Core 1	3396.0	(Lower *T. longus*)	*Tetracolporites verrucosus*	As for SWC 21
Core 1	3400.0	(Lower *T. longus*)	*Tetracolporites verrucosus*	As for SWC 21
Core 1	3403.0	Lower *T longus* (1)	*Tricolpites longus*	In Nothofagidites - Proteacidites assemblage
Core 2	3446.0	*T. lilliei* (2)	*Elphredripites notensis*	Uncommon sp.
Core 2	3450.8	*T. lilliei* (1)	*Tetracolporites verrucosus*	Prolate and oblate specimens. As for SWC 21

TABLE 2

ANOMALOUS AND UNUSUAL OCCURRENCES OF SPORE-POLLEN TAXA IN GRUNTER-I

SAMPLE NO.	DEPTH(m)	ZONE	TAXON	COMMENTS
SWC 4	3527.0	T. lilliei (I)	Ornamentifera semtosa	Rare sp.
SWC 4	3527.0	T. lilliei (I)	Tetracolporites verrucosus	As for SWC 21
SWC 192	3746.0	T. lilliei (I)	Tricolpites remmarkensis	Rare sp.
SWC 192	3746.0	T. lilliei (I)	Gephryapollenites cranwellae	Uncommon sp.
SWC 192	3746.0	T. lilliei (I)	Phyllocladidites verrucosus	Uncommon sp.
SWC 219	3761.0	T. lilliei (I)	cf Haloragacidites harrisii	In coal palynoflora
SWC 187	3785.0	T. lilliei (I)	Tricolporites lilliei	Verrucate var.
SWC 187	3785.0	T. lilliei (I)	Nothofagidites brachyspinulosus	Rare in Late Cretaceous

TABLE 3: SUMMARY OF BASIC PALYNOLOGICAL DATA

GRUNTER-1

DIVERSITY - low medium high
S & P less than 10 10-30 greater than 30
D 1-3 3-10 10

SAMPLE NO.	DEPTH (m)	YIELD SPORE-POLLEN	YIELD DINOS	DIVERSITY SPORE-POLLEN	DIVERSITY DINOS	PRESERVATION	LITHOLOGY	COMMENTS
SWC 142	1850.0	Low	Good	Low	Low	Variable	Slst., calc., glau.	
SWC 141	1851.9	Fair	Fair	Low	Medium	Fair	Slst., calc., glau.	
SWC 140	1850.0	Fair	Fair	Low	Medium	Poor	Slst., calc., glau.	
SWC 139	1856.0	Low	Low	Low	Low	Poor	Slst., calc., glau.	
SWC 138	1858.0	Low	Low	Low	Low	Poor	Slst., glau.	
SWC 137	1860.0	V. low	-	High	-	Good	Ss., carb.	
SWC 136	1865.1	Low	Low	Medium	Low	Fair	Ss., carb.	
SWC 135	1870.0	Low	V. low	Medium	Medium	Good	Slst., carb.	
SWC 134	1875.0	Good	Low	High	Low	Good	Slst., carb.	
SWC 131	1887.0	Fair	V. good	High	Medium	Fair	Slst.	Weakly pyritized
SWC 130	1884.6	V. good	V. low	Medium	Low	Fair	Slst.	
SWC 129	1895.0	V. good	V. low	Medium	Low	Good	Slst., laminated	Weakly pyritized
SWC 127	1911.0	Negllg.	-	Low	-	Good	Slst., carb.	
SWC 126	1912.0	Fair	-	High	-	Fair	Slst., carb.	
SWC 125	1919.1	Low	Good	Medium	Medium	Good	Slst.	Weakly pyritized
SWC 122	1975.6	Fair	V. low	High	Low	Good	Ss., carb.	
SWC 120	2009.0	Low	V. low	Low	Low	Variable	Slst., carb.	Weakly pyritized
SWC 119	2011.1	V. low	V. low	Low	Low	Good	Slst., carb.	
SWC 115	2052.0	-	-	-	-	-	Slst., carb.	

TABLE 3: SUMMARY OF BASIC PALYNOLOGICAL DATA

GRUNTER-1

DIVERSITY - low medium high
S & P less than 10 10-30 greater than 30
D 1-3 3-10 10

SAMPLE NO.	DEPTH (m)	YIELD SPORE-POLLEN	YIELD DINOS	DIVERSITY SPORE-POLLEN	DIVERSITY DINOS	PRESERVATION	LITHOLOGY	COMMENTS
SWC 113	2103.0	Good	Low	Medium	Low	Fair	Slst.	Mod. pyritized
SWC 110	2128.0	Good	Fair	Medium	Low	Fair	Slst., carb.	
SWC 105	2176.0	Fair	-	Medium	-	Fair	Slst., carb.	Mod. pyritized, rapid scan
SWC 102	2213.0	Fair	Low	Medium	Medium	Good	Slst.	Weakly pyritized
SWC 179	2244.6	Fair	V. low	Low	Low	Fair	Slst.	
SWC 175	2306.5	Good	-	Low	-	Poor	sh.	Rapid scan
SWC 96	2340.1	Low	Low	Medium	Medium	Poor	Slst., carb.	Mod. pyritized
SWC 91	2411.0	V. good	V. good	Medium	High	Variable	Slst.	Mod. pyritized
SWC 90	2425.0	V. good	V. good	High	Medium	Fair	Slst.	Strong pyritized
SWC 169	2539.1	Low	V. low	High	Low	Poor	Slst.	Weakly pyritized
SWC 84	2536.0	Good	V. low	Medium	Low	Fair	Slst.	Weakly pyritized
SWC 82	2554.0	Good	Fair	Medium	Medium	Poor	Slst.	Strongly pyritized
SWC 80	2581.0	V. low	V. low	Low	Low	Fair	Slst.	Mod. pyritized
SWC 79	2590.1	V. low	Fair	Medium	Medium	Variable	Slst.	Weakly pyritized
SWC 77	2645.0	Good	-	High	-	Fair	Slst.	Weakly pyritized
SWC 166	2649.0	Fair	-	Medium	-	Fair	Slst., laminated	Weakly pyritized
SWC 76	2673.1	V. low	-	Low	-	Fair	Slst., carb.	
SWC 75	2678.0	Negllg.	-	Low	-	Fair	Slst., carb.	
SWC 74	2683.1	V. good	-	high	-	Fair	Slst.	

TABLE 3: SUMMARY OF BASIC PALYNOLOGICAL DATA

GRUNTER-1

DIVERSITY - low medium high
S & P less than 10 10-30 greater than 30
D 1-3 3-10 10

SAMPLE NO.	DEPTH (m)	YIELD SPORE-POLLEN	YIELD DINOS	DIVERSITY SPORE-POLLEN	DIVERSITY DINOS	PRESERVATION	LITHOLOGY	COMMENTS
SWC 71	2751.1	Low	-	Medium	-	Poor	Slst.	
SWC 162	2774.1	Fair	V. low	Medium	Low	Fair	Slst.	
SWC 69	2801.0	Low	-	Low	-	Poor	Slst., carb.	Weakly pyritized
SWC 68	2836.0	Fair	-	Medium	-	Poor	Sh.	
SWC 67	2865.0	Low	-	Medium	-	Poor	Sh.	Mod. pyritized
SWC 160	2877.0	Fair	-	Medium	-	Poor	Slst., laminated	Mod. pyritized
SWC 65	2914.0	Fair	V. low	Medium	Low	Poor	Slst.	Strongly pyritized
SWC 64	2929.0	Fair	Low	Medium	Low	Fair	Slst., carb.	Mod. pyritized
SWC 63	2949.0	Low	-	Low	-	Poor	Slst.	
SWC 61	2993.0	Low	-	Low	-	Poor	Slst., carb.	
SWC 159	2961.0	Good	V. low	High	Low	Poor	Slst.	Strongly pyritized
SWC 62	2975.0	Fair	-	High	-	Good	Slst., carb.	Weakly pyritized
SWC 60	3007.1	Low	-	Medium	-	Poor	Slst., carb.	Mod. pyritized
SWC 58	3038.5	V. low	-	Medium	-	Good	Slst., carb.	
SWC 57	3057.0	Good	-	High	-	Good	Slst., carb.	
SWC 52	3112.0	Low	-	Low	-	Fair	Slst., carb.	
SWC 30	3125.0	Good	Low	Medium	Medium	Fair	Slst., carb.	No pyritization
SWC 27	3174.9	Good	-	Medium	-	Poor	Slst.	
SWC 24	3204.0	V. low	-	Medium	-	Poor	Slst., carb.	

TABLE 3: SUMMARY OF BASIC PALYNOLOGICAL DATA

GRUNTER-1

DIVERSITY - S & P: low less than 10; medium 10-30; high greater than 30
DIVERSITY - D: low 1-3; medium 3-10; high 10

SAMPLE NO.	DEPTH (m)	YIELD SPORE-POLLEN	YIELD DINOS	DIVERSITY SPORE-POLLEN	DIVERSITY DINOS	PRESERVATION	LITHOLOGY	COMMENTS
SWC 22	3233.0	Good	-	High	-	Poor	Slst., carb.-coaly	
SWC 21	3250.0	V. good	-	Medium	-	Poor	Slst., carb.	
SWC 19	3282.0	Low	-	Medium	-	V. poor	Slst., carb.	
SWC 16	3330.1	Negllg.	-	Low	-	Fair	Ss.	Rapid scan
SWC 14	3359.8	V. low	-	Low	-	Poor	Slst., carb.	
Core 1	3396.0	Low	-	Low	-	Poor	Slst.	
Core 1	3397.0	V. low	-	Low	-	Poor	Slst.	
Core 1	3400.0	Fair	-	Medium	-	Fair	Slst.	
Core 1	3403.0	Fair	-	Medium	-	Good	Slst.	
SWC 10	3423.9	Low	-	Medium	-	Poor	Slst.	
Core 2	3434.0	Low	-	Low	-	Fair	Ss.	
Core 2	3446.0	V. low	-	Medium	-	Variable	Slty. ss.	Mod. pyritized
Core 2	3450.8	Good	-	High	-	Fair	Slst.	
SWC 5	3500.5	Low	-	Medium	-	Poor	Slst., carb.	
SWC 4	3527.0	Fair	-	High	-	Good	Slst., carb.-coaly	
SWC 243	3550.0	Low	-	Medium	-	Poor	Sh., carb.	Weakly pyritized
SWC 1	3559.0	-	-	-	-	-	Ss.	
SWC 213	3567.5	-	-	-	-	-	Slst., carb.	
SWC 212	3571.0	Negllg.	-	Low	-	Poor	Ss.	

TABLE 3: SUMMARY OF BASIC PALYNOLOGICAL DATA

GRUNTER-1

DIVERSITY - low medium high
S & P less than 10 10-30 greater than 30
D 1-3 3-10 10

SAMPLE NO.	DEPTH (m)	YIELD SPORE-POLLEN	YIELD DINOS	DIVERSITY SPORE-POLLEN	DIVERSITY DINOS	PRESERVATION	LITHOLOGY	COMMENTS
SWC 210	3578.5	V. low	-	Low	-	Poor	Sh., carb.	Rapid scan
SWC 208	3604.0	V. low	-	Low	-	V. poor	Slst.	Rapid scan
SWC 207	3615.5	V. low	-	Low	-	V. poor	Slst., sandy	Rapid scan
SWC 237	3618.5	Negllg.	-	Low	-	V. poor	Sh., carb.-coaly	Rapid scan
SWC 235	3630.0	V. low	-	Low	-	V. poor	Sh., carb.-coaly	Rapid scan
SWC 229	3676.0	V. low	-	Low	-	V. poor	Slst., carb.	
SWC 228	3679.0	Fair	-	Low	-	V. poor	Coal	
SWC 224	3716.0	V. low	-	Low	-	V. poor	Sh., carb.	
SWC 222	3732.5	Low	-	Medium	-	V. poor	Coal	
SWC 192	3746.0	V. good	-	High	-	Poor	Sh., carb.	
SWC 219	3761.0	V. good	-	Medium	-	Poor	Coal	
SWC 189	3770.0	Low	-	Low	-	Poor	Slst.	Mod. pyritized
SWC 187	3785.0	V. low	-	Medium	-	V. poor	Slst.	
SWC 185	3797.0	V. low	-	Low	-	V. poor	Slst.	