APPENDIX-5

PALYNOLOGICAL ANALYSIS, TARWHINE-1, GIPPSLAND BASIN

by

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Palaeontology Report 1982/20

13 May 1982.

INTRODUCTION:

Seventy six (76) sidewall cores and two core samples were processed and examined for spore-pollen. The recovery of microfossils was good to fair for most samples except in the *Lygistepollenites balmei* Zone. Preservation was usually poor and relatively few samples contained zone species of spores and pollen. Age determinations are supported by an analysis of the dinoflagellate assemblages by A.D. Partridge.

Palynological zones and lithological facies subdivisions from the base of the Lakes Entrance Formation to the total depth of the well are given below. Table 1 represents a summary of the palynological analyses. The occurrence of each spore and pollen type is tabulated in the accompanying range chart.

SUMMARY

UNIT/FACIES	ZONE	DEPTH (metres)
LAKES ENTRANCE FORMATION	*P. tuberculatus*	1310
GURNARD FORMATION	Upper *N. asperus*	1345-1348
	Middle *N. asperus*	1351-1381
LATROBE GROUP COARSE CLASTICS	Middle *N. asperus*	1392-1405
	Lower *N. asperus*	1412-1591
	P. asperopolus	1643-1656
	Upper *M. diversus*	1666-1727
	Middle to Lower *M. diversus*	1818-1892
	Upper *L. balmei*	1911-1932
	Lower *L. balmei*	2026-2391
	T. longus	2420-2934
	T. lilliei	2940-2949

2955 T.D.

GEOLOGICAL COMMENTS:

1. The Tarwhine-1 well contains a continuous sequence of zones from the Late Cretaceous T. lilliei Zone to the Early Oligocene P. tuberculatus Zone. Although spore-pollen assemblages were not sufficiently diverse to separate the Middle and Lower M. diversus Zones, it is probable both are represented in the well.

2. The Gurnard Formation, recognised by glauconitic sediments from 1345 to 1386 metres, contains both Middle and Upper N. asperus spore-pollen and dinoflagellate assemblages. The Upper N. asperus Zone is represented in sidewall cores at 1345 and 1348 metres. The lower of the two also contains foraminiferal faunas referable to the Late Eocene Zone K (Hannah 1982). The Gurnard Formation, initially picked on cutting lithology at the time of drilling as occurring between 1370 to 1386 metres, is clearly Middle N. asperus in age.

3. The Middle N. asperus Zone extends down into the coarse clastics below the Gurnard Formation, demonstrating that there is no significant unconformity at this lithological boundary. Dinoflagellates remain common across the boundary to 1412 metres, top of the Lower N. asperus Zone. This is close to the uppermost occurrence of coal at 1407 metres and consistent with a change from a terrestrial/fluvial to an open marine environment during the Middle Eocene.

4. The presence of Upper N. asperus age sediments in the Tarwhine-1 well strengthens the probability (Partridge 1977) that the unsampled interval between 1040 to 1045 metres in

the Barracouta-4 well is also Upper N. asperus in age, i.e., that there is no unconformity between the Middle N. asperus Gurnard Formation and the P. tuberculatus Lakes Entrance Formation at Barracouta-4. A similar sequence of time-rock units at the two well sites is consistent with a Middle Eocene shoreline parallel to the present-day coastline.

5. Although no major periods of non-deposition and/or erosion are evident, mean sedimentation rates show a sustained decrease from greater than 80 metres per million years in the T. longus Zone to less than 30 metres per million years in the Middle N. asperus Zone. This may reflect a shift (northwards) in the depositional centre of the basin away from the Tarwhine area. Anomalously low deposition rates calculated for the Upper N. asperus and P. asperopolus Zones suggest that minor periods of erosion/non-deposition have occurred. Alternatively, portions of the undated interval between 1644 and 1591 metres may also be P. asperopolus in age.

6. There is no evidence in the form of dinoflagellate cysts for any marine transgression at the Tarwhine-1 well site before the top of the Lower N. asperus Zone at 1412 metres.

7. The Thermal Alteration Index for all samples is less than 2.

DISCUSSION OF ZONES.

Zone boundaries have been established using the criteria of Stover and Evans (1973), Stover and Partridge (1973) and subsequent revisions (A.D. Partridge per comm.).

Proteacidites tuberculatus Zone - above 1310 metres.
The zone is recognised on the presence of Cyatheacidites annulatus at 1250 metres and 1310 metres. The other sample at 1280 metres contains Quintinia psilatispora Martin. This is the lowest stratigraphical record of this taxon in the Gippsland Basin to date.

Upper Nothofagidites asperus Zone: 1345 - 1348 metres
This zone is identified by the absence of spore-pollen indicator species of the underlying zone (e.g., Triorites magnificus) and the overlying zone (e.g., Cyatheacidites annulatus). The age-determination is supported by (i) Pthanoperidinium comatum being the dominant dinoflagellate species in both samples, (ii) Proteacidites rectomarginis being the most common large proteaceous pollen and (iii) Nothofagidites flemingii being a common element in the lowermost sample.

Middle Nothofagidites asperus Zone and Vozzkenikova extensa Dinoflagellate Zone: 1351.1 - 1405 metres.
The top of the zone is based on the highest occurrence of the pollen taxa Triorites magnificus and Proteacidites adenanthoides, and the dinoflagellates V. extensa and Corrudinium incompositum, at 1351.1 metres. The base of the zone is placed at the lowest occurrence of V. extensa, in samples at 1405.44 metres (core) and 1401.8 metres (sidewall core). Spore-pollen diagnostic of the zone appear later in the zone: Anacolosidites sectus at 1392 metres and Triorites magnificus at 1380.9 metres (base of the Gurnard Formation). The late appearance of diagnostic species is attributed to poor concentration and poor preservation of spore-pollen in samples from the hydrocarbon column at the top of the coarse clastics. Although these samples are rich in terrestrially-derived organic matter, oxidation tends to destroy all forms of organic material except for the highly resistant dinoflagellate cysts.

Lower Nothofagidites asperus Zone: 1411.8 - 1591 metres.
The base of the zone is placed at the marked increase in Nothofagidites spp. abundance, from less than 1% at 1643.5 metres to 33% at 1591 metres. Nothofagidites asperus is recorded at the base but other zone species are recorded higher within the zone, e.g., N. falcatus at 1426.6 metres, and Rugulatisporites trophus at 1542.4 metres. The top of the zone is picked by the absence of indicator species of the overlying zone, i.e., Triorites magnificus and V. extensa. The two lowermost samples, at 1542.4 metres and 1591 metres, contain abundant Proteacidites asperopolus pollen. This phenomenon has been previously noted for Lower N. asperus age samples in the Barracouta-4 well (Partridge 1977).

Proteacidites asperopolus Zone: 1643.5 - 1656 metres.
Two sidewall core samples are identified as belonging to this zone. Confidence in the age-determination of the uppermost, at 1643.5 metres, is good due to the first appearance here of Sapotaceoidaepollenites rotundus, the occurrence of Myrtaceidites tenuis, a species which ranges no higher than the P. asperopolus Zone, and the dominance of proteaceous pollen, particularly P. pachypolus, P. reticuloscabratus and P. xestoformis. Although none of these species is restricted to the P. asperopolus Zone, the marked difference in composition between these samples, the overlying Nothofagidites spp. -dominant and underlying Malvacipollis -dominant palynofloras is typical of the zone. The lower of the two samples, 1656 metres, contains M. tenuis. The remainder of this spore-pollen assemblage consists of long-ranging taxa and the sample is assigned a P. asperopolus age on the basis that it is more similar to sample 1643.5 metres than those in the underlying M. diversus Zone.

Upper Malvacipollis diversus Zone: 1666.4 - 1727 metres.
The top of the zone is identified by the first occurrence of abundant M. diversus pollen and also contains the first appearance of Myrtaceidites tenuis. The occurrence of abundant M. diversus, Proteacidites pachypolus and Milfordia homeopunctata pollen confirm an Upper M. diversus age for samples at 1715.5 and 1727 metres. The quartz-rich sediments between 1727 and 1818.5 metres were barren or contained reworked spore-pollen only. e.g., Gambierina rudata.

Middle-Lower Malvacipollis diversus Zone: 1818.5 - 1892.5 metres.
The base of the zone is picked at the first occurrence of M. diversus pollen, at 1892.5 metres. The species is relatively common in this sample and at 1882.1 metres but is absent from samples between 1818.5 and 1882.1 metres. The top of the zone, at 1818.5 metres is based on the absence of indicator species of the Upper M. diversus Zone, e.g., Proteacidites pachypolus. However this sample cannot be definitely assigned to the Middle M. diversus Zone due to the absence of Middle M. diversus indicator species such as Proteacidites ornatus, P. tuberculiformis and P. xestoformis. The variable occurrences of Cupanieidites orthoteichus, Ischyosporites irregularis, Proteacidites lapis, P. obscurus, Tricolporites adelaidensis, T. paenestriatus and Triporopollenites helosus demonstrate the interval is no older than M. diversus age but the low yields and generally poor spore-pollen diversity make it impossible to make a more detailed subdivision.

Upper Lygistepollenites balmei Zone: 1911 - 1932 metres.
The top of the zone is identified by the first appearance of L. balmei (abundant) with Verrucosisporites kopukuensis. The presence of Gambierina edwardsii, Nothofagidites endurus and Phyllocladidites verrucosus demonstrate the sample is no younger

The top of the zone is defined by the occurrence of Grapnelispora evansii sp. nov. at 2420 metres. The highest occurrence of T. longus is at 2431 metres. Quadraplanus brossus which is diagnostic of the zone occurs lower down, at 2445 metres. The base of the zone is picked on the simultaneous first appearances of T. longus, Proteacidites otwayensis amd P. reticuloconcavus at 2934.5 metres. There is currently some uncertainty as to the exact stratigraphic range of these Palaeocene Proteacidites spp. and subsequent work may show the first appearance of Stereisporites (Tripunctisporis) punctatus at 2699.3 metres represents the base of the T. longus Zone.

Tricolporites lilliei Zone: 2939.8 - 2948.5 metres.
The zone is characterised by a marked increase in Nothofagidites endurus relative to other spore-pollen species (Stover & Evans 1973). These authors distinguish the base of the overlying T. longus Zone by the virtual absence of Nothofagidites spp. and a marked increase in Triorites edwardsii (= Gambierina rudata) pollen. On these criteria, the age of the sediment at 2934.5 metres is equivocal since G. rudata is abundant and N. endurus frequent.

The top of the zone is picked at 2939.8 metres, the highest sample in which N. endurus is clearly more abundant than G. rudata. T. lilliei is also present. The basal sample, at 2948.5 metres, contains a mixed late Cretaceous, Paleocene and Eocene spore-pollen assemblage, lacking T. lilliei. The sample has been contaminated by cavings but is obviously no older than the T. lilliei Zone due to the presence of G. rudata and Triporopollenites sectilis.

than Upper L. balmei in age. V. kopukuensis at 1926 metres confirms an Upper L. balmei age for this sample. The base of the zone is picked at 1932 metres due to, (i) the absence of indicator species of the Lower L. balmei Zone, e.g., Tetracolporites verrucosus, and (ii) an abundance of Australopollis obscurus. Occurrences of Dryptopollenites semilunatus at 1911 metres and 1932 metres and Periporopollenites demarcatus at 1932 metres and 2496.1 metres represent extensions in the range of these taxa into the Paleocene and late Cretaceous respectively.

Lower Lygistepollenites balmei Zone: 2026.6 - 2391.5 metres.
The zone falls within an interval in which most samples are either barren or contain spore-pollen assemblages of low diversity and limited stratigraphic usefulness. The top of the zone, 2026.6 metres, is identified by the highest occurence of Tetracolporites verrucosus and the first occurrence of Proteacidites annularis. The base of the zone is picked at 2391.5 metres on the lowermost occurrence of an L. balmei and (abundant) Gambierina rudata assemblage lacking indicator species of the T. longus Zone. Spore-pollen diagnostic of sediments no older then L. balmei were recorded higher in the zone, e.g., Basopollis mutabilis at 2346 metres, Haloragacidites harrisii and Malvacipollis subtilis at 2036 metres.

Tricolpites longus Zone: 2420 - 2934.5 metres.
The zone is characterised by spore-pollen assemblages that are more diverse than in the overlying L. balmei Zone. Gambierina rudata and gymnosperms are the dominant taxa but many samples also contain T. longus and species which first appear in the T. longus zone, e.g., Tetracolporites verrucosus. Triporopollenites sectilis and Tricolporites lilliei occur in most samples.

R E F E R E N C E S

HANNAH, M.J., 1982. Micropalaeontological analysis of Tarwhine-1, Gippsland Basin, Victoria. Esso Australia Ltd, Palaeontological Report: 1982/18.

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STOVER, L.E., & EVANS, P.R., 1973. Upper Cretaceous spore-pollen zonation, offshore Gippsland Basin, Australia. Special Publication Geological Society of Australia 4: 55-72.

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BASIC DATA

Table-1: Palynological Data

Range Chart - Dinoflagellates

Range Chart - Spore Pollen

PALYNOLOGY DATA SHEET

BASIN: GIPPSLAND — ELEVATION: KB: 21m GL: -48m

WELL NAME: TARWHINE-1 — TOTAL DEPTH: 2955 metres

AGE	PALYNOLOGICAL ZONES	HIGHEST DATA Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time	LOWEST DATA Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time
NEOGENE	*T. pleistocenicus*										
	M. lipsis										
	C. bifurcatus										
	T. bellus										
	P. tuberculatus	1250.0	0				1310.0	0			
PALEOGENE	Upper *N. asperus*	1345.0	1				1348.0	1			
	Mid *N. asperus*	1351.1	0				1405.4	2	1392.0	1	
	Lower *N. asperus*	1411.8	2				1591.0	2	1542.4	1	
	P. asperopolus	1643.5	2				1656.0	2			
	Upper *M. diversus*	1666.4	1				1727.0	1			
	Mid *M. diversus*	1818.5	2								
	Lower *M. diversus*						1892.5	1			
	Upper *L. balmei*	1911.0	0				1932.0	2	1926.0	0	
	Lower *L. balmei*	2026.6	1				2391.5	2	2346.0	1	
LATE CRETACEOUS	*T. longus*	2420.0	0				2934.5	2	2699.3	1	
	T. lilliei	2939.8	1				2948.5	2	2939.8	1	
	N. senectus										
	U. *T. pachyexinus*										
	L. *T. pachyexinus*										
	C. triplex										
	A. distocarinatus										
EARLY CRET.	*C. paradoxus*										
	C. striatus										
	F. asymmetricus										
	F. wonthaggiensis										
	C. australiensis										
PRE-CRETACEOUS											

COMMENTS: It has not been possible to subdivide the Middle and Lower *M. diversus* Zones due to poor diversity and poor preservation of spore-pollen.

CONFIDENCE RATING:
- O: 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 & A.D. Partridge — DATE: May 4, 1982.

DATA REVISED BY: ____ DATE: ____

TABLE-1

PALYNOLOGICAL DATA

BASIC DATA

SAMPLE NO.	DEPTH (Metres)	YIELD	DIVERSITY SPORE POLLEN
SWC 139	1250	Good	Low
SWC 138	1280	Good	Low
SWC 137	1310	Good	Low
SWC 135	1345	Good	Moderate
SWC 134	1348	Good	High
SWC 133	1351.1	Good	High
SWC 132	1353	Good	High
SWC 130	1359	Good	Moderate
SWC 127	1367.1	Fair	Moderate
SWC 123	1375.1	Good	High
SWC 120	1380.9	Good	Moderate
SWC 116	1392	Good	Moderate
SWC 113	1401	Good	High
Core 2	1405.44	Good	Low
Core 2	1411.8	Good	Moderate
SWC 101	1422.1	Low	Poor
SWC 99	1426.6	Good	Moderate
SWC 92	1503	Good	Moderate
SWC 89	1542.4	Good	Moderate
SWC 86	1591	Good	Moderate
SWC 82	1643.5	Good	Moderate
SWC 81	1656	Low	Low
SWC 107	1666.4	Good	Moderate
SWC 78	1693	Nil	-
SWC 76	1715.5	Fair	Moderate
SWC 75	1727	Good	High
SWC 73	1754	Nil	-
SWC 69	1807	Nil	-
SWC 68	1818.5	Good	Moderate
SWC 67	1836	Good	Moderate
SWC 65	1860	Fair	Low
SWC 64	1882.1	Low	Low
SWC 62	1892.5	Low	Low
SWC 61	1900	Very Low	Very Low
SWC 60	1911	Good	High
SWC 59	1926	Fair	Low
SWC 58	1932	Good	Moderate
SWC 57	1955	Nil	-
SWC 51	2003.1	Very Low	Very Low
SWC 49	2026.6	Good	Moderate
SWC 48	2036	Fair	Moderate
SWC 41	2115.7	Fair	Low
SWC 38	2163	Fair	Low
SWC 36	2196.2	Nil	-
SWC 35	2204.9	Fair	Low
SWC 33	2230.9	Nil	-
SWC 32	2241.1	Very Low	Very Low
SWC 31	2255.1	Nil	-
SWC 29	2273	Nil	-
SWC 28	2290.1	Very Low	Very Low
SWC 27	2304	Low	Low
SWC 26	2315	Fair	Low
SWC 24	2346	Fair	Low
SWC 23	2352.5	Nil	-

TABLE-1

SUMMARY OF PALYNOLOGICAL ANALYSIS, TARWHINE-1, GIPPSLAND BASIN

INTERPRETATIVE DATA

SAMPLE NO.	DEPTH (Metres)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 139	1250	Good	Low	Marl	P. tuberculatus	Oligocene	0	Cyatheacidites annulatus
SWC 138	1280	Good	Low	Marl	P. tuberculatus	Oligocene	0	Quintinia psilatospora
SWC 137	1310	Good	Low	C. lut.	P. tuberculatus	Oligocene	0	Cyatheacidites annulatus
SWC 135	1345	Good	Moderate	Clyst, calc, glauc.	Upper N. asperus	Late Eocene	2	Diverse Nothofagidites assemblage
SWC 134	1348	Good	High	Clyst, calc, glauc.	Upper N. asperus	Late Eocene	1	Proteacidites rectomarginis and Phthanoperidinium common.
SWC 133	1351.1	Good	High	Clyst, calc.	Middle N. asperus	Late Eocene	0	Triorites magnificus
SWC 132	1353	Good	High	Clyst, calc.	Middle N. asperus	Late Eocene	0	Triorites magnificus, Aglaoreidis qualumis, Proteacidites pachypolus, Simplicepollis meridianus
SWC 130	1359	Good	Moderate	Clyst, tr. glauc.	Middle N. asperus	Late Eocene	2	Proteacidites rectomarginis common
SWC 127	1367.1	Fair	Moderate	Clyst, calc. tr.glauc.	Middle N. asperus	Late Eocene	2	Rugulatisporites trophus
SWC 123	1375.1	Good	High	Clyst, calc, glauc.	Middle N. asperus	Late Eocene	0	Triorites magnificus
SWC 120	1380.9	Good	Moderate	Stst, glauc.	Middle N. asperus	Late Eocene	1	Aglaoreidia qualumis, Triporopollenites ambiguus, Proteacidites recavus
SWC 116	1392	Good	Moderate	Sltst, calc, carb.	Middle N. asperus	Late Eocene	1	Anacolosidites sectus, Proteacidites crassus
SWC 113	1401	Good	High	Sst, clay-rich	Middle N. asperus	Late Eocene	1	Dryptopollenites semilunatus, Schizocolpus marlinensis, Proteacidites crassus
Core 2	1405.44	Good	Low	——	Middle N. asperus	Middle Eocene	2	Malvacipollis robustus. Sample from oil column.
Core 2	1411.8	Good	Moderate	——	Lower N. asperus	Middle Eocene	2	Malvacipollis robustus, Proteacidites pachypolus,. Sample from oil column.
SWC 101	1422.1	Low	Poor	——	——	——	—	——
SWC 99	1426.6	Good	Moderate	Sst, carb. lens	Lower N. asperus	Middle Eocene	2	Nothofagidites falcatus
SWC 92	1503	Good	Moderate	Sst, carb.	Lower N. asperus	Middle Eocene	2	Proteacidites asperopolus, P. pachypolus

TABLE-1 Cont. 2

SAMPLE NO.	DEPTH (Metres)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 89	1542.4	Good	Moderate	Clyst	Lower N. asperus	Middle Eocene	1	Rugulatisporites trophus
SWC 86	1591	Good	Moderate	Clyst	Lower N. asperus	Middle Eocene	0	Rugulatisporites trophus, Proteacidites asperopolus & P. rugulatus common
SWC 82	1643.5	Good	Moderate	Clyst, carb.	P. asperopolus	Middle Eocene	1	Sapotaceoidaepollenites rotundus, Myrtaceidites tenuis, abundant Proteacidites
SWC 81	1656	Low	Low	Sst, carb. lens	Indeterminate	——	-	Nothofagidites spp. rare, Myrtaceidites tenuis
SWC 107	1666.4	Good	Moderate	Sst, carb. stringers	Upper M. diversus	Early Eocene	1	M. diversus dominant; Proteacidites pachypolus
SWC 78	1693	Nil	-	Clyst	Indeterminate	——	-	——
SWC 76	1715.5	Fair	Moderate	Ss	Upper M. diversus	Early Eocene	2	M. diversus dominant, P. pachypolus
SWC 75	1727	Good	High	Slst	Upper M. diversus	Early Eocene	1	Proteacidites pachypolus, P. tuberculiformis
SWC 73	1754	Nil	-	Sst	Indeterminate	——	-	——
SWC 69	1807	Nil	-	Clyst	Indeterminate	——	-	——
SWC 68	1818.5	Good	Moderate	Sst, carb. lens	Middle-Lower M. diversus	Early Eocene	1	Tricolporites moultonii
SWC 67	1836	Good	Moderate	Clyst	M-L M. diversus	Early Eocene	2	Proteacidites lapis
SWC 65	1860	Fair	Low	Sltst	M-L M. diversus	Early Eocene	2	Proteacidites leightonii
SWC 64	1882.1	Low	Low	Sst, carb.	M-L M. diversus	Early Eocene	2	Infrequent M. diversus
SWC 62	1892.5	Low	Low	Sst	M-L M. diversus	Early Eocene	1	M. diversus frequent.
SWC 61	1900	Very Low	Very Low	Sst, carb. lens	Indeterminate	——	-	——
SWC 60	1911	Good	High	Sst, carb.	Upper L. balmei	Late Paleocene	0	L. balmei frequent
SWC 59	1926	Fair	Low	——	Upper L. balmei	Late Paleocene	0	L. balmei frequent Verrucosisporites kopukuensis
SWC 58	1932	Good	Moderate	Clyst	Upper L. balmei	Late Paleocene	2	Australopollis obscurus abundant, L. balmei, Polycolpites langstonii
SWC 57	1955	Nil	-	——	Indeterminate	——	-	——
SWC 51	2003.1	Very Low	Very Low	——	Indeterminate	——	-	Haloragacidites harrisii
SWC 49	2026.6	Good	Moderate	Ss - Slst	Lower L. balmei	Early-Middle Paleocene	1	Tetracolporites verrucosus, Proteacidites annularis

TABLE-1 Cont. 3

SAMPLE NO.	DEPTH (Metres)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 48	2036	Fair	Moderate	Slst	Lower L. balmei	Early-Middle Paleocene	1	Tetracolporites verrucosus
SWC 41	2115.7	Fair	Low	Clyst	Lower L. balmei	Early-Middle Paleocene	2	L. balmei, Nothofagidites endurus common
SWC 38	2163	Fair	Low	Shale	Lower L. balmei	Early-Middle Paleocene	2	L. balmei common
SWC 36	2196.2	Nil	-	Shale	Indeterminate	——	-	——
SWC 35	2204.9	Fair	Low	Shale	L. balmei	Paleocene	2	Australopollis obscurus abundant
SWC 33	2230.9	Nil	-	Clyst	Indeterminate	——	-	——
SWC 32	2241.1	Very Low	Very Low	Ss	Indeterminate	——	-	——
SWC 31	2255.1	Nil	-	Shale	Indeterminate	——	-	——
SWC 29	2273	Nil	-	Slst	Indeterminate	——	-	——
SWC 28	2290.1	Very Low	Very Low	Slst	Indeterminate	——	-	——
SWC 27	2304	Low	Low	Clyst	Indeterminate	——	-	Latrobosporites cf. ohaiensis
SWC 26	2315	Fair	Low	Clyst	Lower L. balmei	Early-Middle Paleocene	2	Tetracolporites verrucosus frequent
SWC 24	2346	Fair	Low	Slst	L. balmei	Paleocene	1	Basopollis mutabilis
SWC 23	2352.5	Nil	-	Ss	Indeterminate	——	-	Amorphous substrates
SWC 20	2362	Low	Very Low	Ss, carb. fragments	Indeterminate	——	-	Gambierina edwardsii
SWC 17	2374	Low	Low	Clyst	L. balmei	Paleocene	2	Gambierina rudata frequent, Stereisporites (Tripunctisporis) punctatus
SWC 13	2391.5	Low	Low	Clyst	L. balmei	Paleocene	2	Gambierina rudata (common), L. balmei
SWC 11	2401.2	Nil	-	Clyst	Indeterminate	——	-	Amorphous substrates
SWC 10	2420	Low	Moderate	Clyst	T. longus	Late Cretaceous	0	Grapnelispora evansii
SWC 9	2431	Good	Moderate	Shale	T. longus	Late Cretaceous	1	T. longus, Tetracolporites verrucosus
SWC 52	2445	Good	High	—	T. longus	Late Cretaceous	0	Quadraplanus brossus
SWC 7	2457.2	Fair	Low	Slstst, carb.	T. longus	Late Cretaceous	0	Quadraplanus brossus
SWC 6	2465.2	Fair	Very Low	Finely bdd argil. mtx	Indeterminate	——	-	Gambierina rudata only.
SWC 3	2496.1	Fair	Low	Clyst	T. longus	Late Cretaceous	2	Tetracolporites verrucosus
SWC 245	2571.8	Fair	Low	Ss, trace coal	T. longus	Late Cretaceous	0	Quadraplanus brossus with abundant Gambierina rudata
SWC 240	2608.3	Fair	Very Low	Slst	Indeterminate	——	-	Tricolporites lilliei

TABLE-1 Cont. 4

SAMPLE NO.	DEPTH (Metres)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 232	2646.5	Fair	Moderate	Slst, some coal	T. longus	Late Cretaceous	1	T. longus, Proteacidites reticuloconcavus, Stereisporites (Tripunctisporis) punctatus
SWC 217	2699.3	Fair	Low	Slst, carb.	T. longus	Late Cretaceous	1	Lowest occurrence of Stereisporites (Tripunctisporis) punctatus
SWC 194	2776	Fair	Low	Ss, some coal	T. longus	Late Cretaceous	2	Proteacidites reticuloconcavus, Tricolporites lilliei, common Gambierina rudata
SWC 187	2799	Fair	Moderate	Ss, some coal	T. longus	Late Cretaceous	2	Proteacidites reticuloconcavus, P. amalocexinus, P. angulatus
SWC 185	2807	Very Low	Very Low	Ss	Indeterminate	——	-	——
SWC 177	2858.5	Good	Moderate	Ss	T. longus	Late Cretaceous	2	Proteacidites otwayensis, Tetracolporites verrucosus
SWC 175	2868.4	Very Low	Very Low	Ss	Indeterminate	——	-	Mud contamination
SWC 166	2901.5	Fair	Moderate	Sltst	Indeterminate	——	-	Gambierina rudata common, Tricolporites lilliei
SWC 157	2934.5	Good	Moderate	Slst	T longus	Late Cretaceous	2	Proteacidites otwayensis, P. reticuloconcavas, T. longus, Gambierina rudata common, Nothofagidites endurus frequent
SWC 156	2939.8	Low	Low	Sltst	T. lilliei	Late Cretaceous	1	Nothofagidites endurus, N. senectus more common than Gambierina rudata, T. lilliei
SWC 154	2948.5	Fair	Moderate	Ss	T. lilliei	Late Cretaceous	2	Contaminated sample but no older than T. lilliei due to occurrence of Gambierina rudata, Triporopollenites sectilis