PALYNOLOGICAL ANALYSIS
SNAPPER-4, GIPPSLAND BASIN

by

M.K. Macphail

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INTRODUCTION

One hundred and twelve (112) sidewall core samples were processed and examined for spore-pollen and dinoflagellates. Recovery, preservation and diversity were mostly good and, given the good sampling density, it is likely that the well will improve correlations within the Snapper field. Palynological zones and lithological facies division from the base of the Lakes Entrance Formation to the total depth of the well are given below. The occurrences of spore-pollen and dinoflagellate species are tabulated in the accompanying range chart. Anomalous and unusual occurrences of spore-pollen and dinoflagellates are listed in Table 2.

SUMMARY

AGE	UNIT/FACIES	ZONE	DEPTH(m)
Early Miocene	Lakes Entrance Formation	*P. tuberculatus*	1258.5
	Log break at 1259.5m		
Late Eocene	Gurnard Formation	Middle *N. asperus*	1260.0-1265.0
Mid./Late Eocene		Lower *N. asperus*	1266.5-1287.0
	Log break at 1288.0m		
Mid./Early Eocene		Lower *N. asperus*	1306.0-1346.5
Mid./Early Eocene		*P. asperopolus*	1350.5-1414.9
Early Eocene		Upper *M. diversus*	1441.9-1530.4
Early Eocene	Latrobe Group	Middle *M. diversus*	1574.5-1746.5
Early Eocene	Coarse Clastics	Lower *M. diversus*	1765.5-1780.3
Paleocene		Upper *L. balmei*	1800.6-2078.9
Paleocene		Lower *L. balmei*	2084.0-2352.2
Maastrichtian		Upper *T. longus*	2368.0-2740.0
Late Cretaceous		Lower *T. longus*	2768.2-2804.0
			T.D. 2821m

GEOLOGICAL COMMENTS

1. The Snapper-4 well contains a continuous sequence of sediments from the Late Cretaceous Lower T. longus Zone to the Middle/Late Eocene Middle N. asperus Zone. An approximately 172m thick section of Middle M. diversus Zone sediments is recognized. It is highly unlikely that comparable thicknesses of Middle M. diversus Zone sediments do not occur in other Snapper wells (cf. data sheets Partridge, 1975).

2. The palynological data support the foraminiferal evidence (Rexilius, 1984) for a hiatus in deposition from the Late Eocene to the Early Miocene at the Snapper-4 wellsite. The surface represented by the log-break at 1288.0m is likely to represent either or both the 21.4 and 30 million year unconformities.

3. Spore-pollen and dinoflagellates recovered from the Gurnard Formation, picked on lithological and log characteristics as occurring from 1259.5 to 1288.0m (Rexilius ibid) demonstrate this unit is Middle N. asperus to Lower N. asperus Zone in age. Abundance of dinoflagellates over this section varies from virtually absent, e.g. at 1279.0m and 1265.0, to common e.g. at 1266.5m. This probably reflects facies-related variation in preservation. Relative yield and types of spore-pollen encountered across this section however suggest the Lower N. asperus interval of the Gurnard Formation was deposited in a shallow marine environment, relatively close to the palaeoshore line. The sample at 1266.5m represents the time equivalent of the Lower N. asperus Zone Wetzeliella echinosuturata Zone recognized by Partridge (1976). The highest coal, representing a fully terrestrial environment, is at 1313m.

4. A number of marine transgressions or marginal marine environments are recorded within the Latrobe Group coarse clastics below 1313m. These are (in order of increasing age): 1414.9m (P. asperopolus Zone), 1441.9m (Upper M. diversus Zone), 1628.9m, 1638.5m, and 1675.5m (Middle M. diversus Zone), 1765.5m (Lower M. diversus Zone), and 2029.0m and 2063.0-2078.9m (Upper L. balmei Zone). None can be correlated with the dinoflagellate zones established by Partridge (1976). The sample at 1780.3m may be the time equivalent of marine Rivernook Beds in the onshore Princetown Section, Otway Basin (cf. Cookson & Eisenack 1967).

5 The M. diversus and T. longus Seismic Markers fall within sediments of these ages in the Snapper-4 well. However the Upper L. balmei Seismic Marker lies within sediments of Middle M. diversus Zone age.

6. Sediment deposited in T. longus and L. balmei Zone times are markedly thicker in Snapper-3 and Snapper-4 than in Snapper-A21 or Snapper-1 (average 405m, 485m vs 515m, 535m). This supports the conclusion (A. Young, pers. comm.) that a growth fault exists between Snapper-1 and Snapper-4. Since thicknesses of M. diversus and P. asperopolus/Lower N. asperus Zone sediments are approximately the same in all four wells, growth of this fault was largely pre-Eocene.

7. The well bottomed in T. longus Zone sediments as predicted by seismic stratigraphy and biostratigraphic data from the Snapper-3 well.

BIOSTRATIGRAPHY

The zone boundaries have been established using the criteria of Stover & Evans (1973), Stover & Partridge (1973), Partridge (1975) and subsequent proprietry revisions including Macphail (1983).

Lower Tricolpites longus Zone, 2768.2 to 2804.0m

Two samples are recognized as belonging to this zone, based on the prevelance of Gambierina over Nothofagidites. Dilwynites granulatus, which first appears within the T. longus Zone occurs at 2804.0m and Tricolporites longus at 2768.2m.

Upper Tricolpites longus Zone 2390.1 to 2740.0m

Samples within this section contain the general T. longus Zone indicators such as, frequent to abundant Gambierina, Tricolpites longus, Proteacidites amolosexinus, P. otwayensis, P. cleinii and P. wahooensis in addition to Late Cretaceous species such as Tricolporites lilliei and Triporopollenites sectilis. The base of the zone is defined by the first appearances of Tetracolporites verrucosus and Proteacidites gemmatus at 2740.0m. Stereisporites punctatus first occurs at 2710.0m. The upper boundary is provisionally picked at 2368.0m, the highest sample to contain frequent Gambierina. Occurrences of Stereisporites punctatus, Tetracolporites verrucosus, Proteacidites gemmatus, P. otwayensis, and Triporopollenites sectilis in a Gambierina rudata-dominated palynoflora at 2390.1m confirm this sample as Upper T. longus Zone in age.

Lower Lygistepollenites balmei Zone, 2084.0 to 2352.2m

Palynofloras within this interval are dominated by small-diameter Proteacidites species and gymnosperm pollen (including rare to frequent Lygistepollenites balmei). The lower boundary is picked at 2352.2m, the first sample to lack species ranging no higher than the Late Cretaceous. Tetracolporites verrucosus in this sample shows it likely to be no younger

than Lower L. balmei Zone in age. The upper boundary is placed at 2084.0m, the highest sample containing Proteacidites gemmatus. The first occurrences of taxa which first appear in the Lower L. balmei Zone are: Integricorpus antipodus at 2309.4m, and Polycolpites langstonii at 2265.3m. The first occurrence of Haloragacidites harrisii is in the Upper L. balmei Zone, at 2029.0m.

Upper Lygistepollenites balmei Zone, 1800.6 to 2078.9m
The first occurrence of Verrucosisporites kopukuensis at 2078.9m defines the base of this zone. Apectodinium homomorpha, a dinoflagellate which first appears at or slightly below the Lower/Upper L. balmei Zone boundary is abundant in this sample, as is Lygistepollenites balmei. Tetracolporites verrucosus and Jaxtacolpus pieratus extend their range into the Upper L. balmei section in this well, occurring at 2029.0m, 1986.0m, and 1902.0m and 2029.0m and 1918.1m respectively. With the exception of Verrucosisporites kopukuensis, taxa which first appear in the Upper L. balmei Zone are not recorded until close to the upper boundary, e.g. Proteacidites annularis at 1918.1m, P. incurvatus at 1902.0m and Cyathidites gigantis at 1822.0m. Conversely, a number of typically Eocene species occur in this section: Beaupreadites elegansiformis at 2011.5m, Periporopollenites vesicus at 1945.7m, Cupanieidites orthoteichus and Triporopollenites ambiguus at 1867.0m, and Malvacipollis diversus at 1822.0. The upper boundary is defined by the last appearance of Lygistepollenites balmei at 1800.6m (3 specimens in an otherwise virtually barren siltstone). Australopollis obscurus, Cyathidites gigantis and (common) Lygistepollenites balmei confirm an Upper L. balmei Zone age for the sample at 1822.0m.

Lower Malvacipollis diversus Zone, 1765.5 to 1780.3m
Two samples are assigned to this zone. The lowermost, at 1780.3m, contains abundant Malvacipollis diversus and rare occurrences of species which first occur in this zone: Intratriporopollenites notabilis, Spinizonocolpites prominatus, Crassiretitriletes vanraadshoovenii and Polypodiaceoisporites varus. The sample at 1765.5m contains Cyathidites gigantis, a species not known to range above the Lower M. diversus Zone. This extends the range of Banksiaeidites elongatus down into this zone.

Middle Malvacipollis diversus Zone, 1574.5 to 1746.5m
The first occurrence of Proteacidites tuberculiformis at 1746.5m defines the base of this zone. Other species which first appear in the Middle M. diversus Zone occur higher within the zone: Anacolosidites acutullus at 1719.7m, Proteacidites leightonii at 1675.5m, Tricolporites paenestriatus at 1648.5m Anacolosidites rotundus at 1647.3m (common in a coal palynoflora), Beaupreadites verrucosus at 1638.5m and Proteacidites alveotatus and P. ornatus at 1574.5m. The upper boundary is picked at 1574.5m, the highest sample to lack indicator species of the Upper M. diversus Zone.

The section assigned to the Middle M. diversus Zone contains a number of significant anomalous occurrences (see Table 2). The more important of these include: the typically Lower M. diversus Zone dinoflagellate indicator species Deflandrea dartmooria at 1675.5m and 1628.9m; Lygistepollenites balmei (5 specimens) and Cyathidites gigantis (2 specimens) in a non-marine siltstone at 1634.0m; Tricolpites incisus and Proteacidites recavus, species which first appear in the P. asperopolus Zone, at 1628.9m; and an assemblage virtually comprised of thick-walled spore species only, Crassiretitriletes vanraadshoovenii, Polypodiaceoisporites varus, Verrucosisporites kopukuensis, Cyathidites splendens and Stereisporites punctatus at 1609.0m. This spore assemblage is rarely recorded outside the Lower M. diversus Zone (where it usually includes Cyathidites gigantis).

Upper Malvacipollis diversus Zone, 1441.9 to 1530.4m
This section comprises samples containing frequent to common Malvacipollis diversus with Proteacidites pachypolus and, at 1441.9m, Myrtaceidites tenuis. Spinizonocolpites prominatus occurs at 1495.5m.

Proteacidites asperopolus Zone, 1350.5 to 1414.9m
The concurrence of Myrtaceidites tenuis and Proteacidites asperopolus at 1414.9m define the lower boundary of this zone. This sample contains Spinizonocolpites prominatus, a species which is last recorded in this zone, and Tricolpites leuros and Tricolporites retequetrus, species which have not been previously recorded below the N. asperus Zone. Intratriporopollenites notabilis occurs at 1411.9m - in a coal palynoflora dominated by Proteacidites, Haloragacidites and Periporopollenites demarcatus. The upper boundary, at 1350.5m, is defined by the highest sample containing Proteacidites asperopolus in a Proteacidites-dominated palynoflora.

Lower Nothofagidites asperus Zone 1266.5 to 1346.5m
The lower boundary of this zone is picked at 1265.5m, the first sample to be dominated by Nothofagidites. The occurrence of Anacolosidites rotundus indicates the sample is no younger than Lower N. asperus Zone in age. Proteacidites asperopolus, which ranges no higher than this zone, occurs in a Nothofagidites-dominated assemblage at 1330.0m. Species which first appear in the Lower N. asperus Zone occur at 1313.4m (Nothofagidites falcatus, Tricolporites delicatus), 1306.0m (Proteacidites rugulatus), 1287.0m (Rugulatisporites trophus and the dinoflagellate Areosphaeridium diktyoplokus), and 1275.4m (Tricolpites simatus). Verrucatosporites attinatus, which first appears in the upper part of the Lower N. asperus Zone, occurs at 1270.0m. The upper boundary, picked at 1266.5m, is defined by the last appearance of Proteacidites asperopolus. This sample contains the very rare dinoflagellate species Wetzeliella echinosuturata.

Middle Nothofagidites asperus Zone, 1260.0 to 1265.0m
Two samples are assigned to this zone. The lowermost contains the very rare species Tricolpites arcilineatus as well as Proteacidites rugulatus, a species which ranges no higher than the Middle N. asperus Zone. The higher sample contains the dinoflagellate indicator species Vozzhenikovia extensa together with Milfordia homeopunctata, a species rarely recorded below this zone.

Proteacidites tuberculatus Zone, 1258.5
Occurrences of Cyatheacidites annulatus (8 specimens), Foveotriletes crater and the dinoflagellate Pyxidinopsis pontus confirm a P. tuberculatus Zone age for this sample.

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PALYNOLOGY DATA SHEET

BASIN: GIPPSLAND ELEVATION: KB: + 21m GL: - 57m

WELL NAME: SNAPPER-4 TOTAL DEPTH:

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										
PALEOGENE	*P. tuberculatus*	1258.5	0				1258.5	0			
	Upper *N. asperus*										
	Mid *N. asperus*	1260.0	1				1265.0	1			
	Lower *N. asperus*	1266.6	1				1346.5	2	1330.0	1	
	P. asperopolus	1350.5	2				1414.9	0			
	Upper *M. diversus*	1441.9	1				1530.4	1			
	Mid *M. diversus*	1574.5	1				1746.5	1			
	Lower *M. diversus*	1765.5	0				1780.3	0			
	Upper *L. balmei*	1800.6	2	1822.0	1		2078.9	1			
	Lower *L. balmei*	2084.0	2	2169.2	1		2352.2	2	2328.4	1	
LATE CRETACEOUS	*T. longus*	2368.0	2	2390.1	0		2804.0	2	2768.2	1	
	T. lilliei										
	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: Subdivision of the T. longus Zone is as follows (confidence ratings in parenthesis)

Upper T. longus 2368.0 (2) - 2740.0 (1)

Upper T. longus 2768.2 (1) - 2804.0 (2)

Please note the Upper T. longus Zone approximates to the T. longus Zone as recognised in pre-1982 wells.

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: 1 June 1984

DATA REVISED BY: DATE:

TABLE I : SUMMARY OF PALYNOLOGICAL ANALYSIS - SNAPPER-4

INTERPRETATIVE DATA

SAMPLE NO.	DEPTH (m)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 35	1258.5	Good	Fair	Lmst.	P. tuberculatus	Early Miocene	0	Frequent C. annulatus; F. crater
SWC 34	1260.0	Fair	Low	Slst.	Middle N. asperus	Late Eocene	1	V. extensa
SWC 33	1265.0	Good	Good	Ss., carb. glau.	Middle N. asperus	Late Eocene	1	T. arcilineatus, P. rugulatus
SWC 32	1266.5	Good	Good	Ss., glau.	Lower N. asperus	Middle Eocene	2	P. asperopolus (? contam.), N. falcatus, T. simatus
SWC 31	1270.0	Low	Low	Slst.	Lower N. asperus	Middle Eocene	2	V. attinatus, P. pachypolus
SWC 30	1273.0	Good	Low	Ss.	Lower N. asperus	Middle Eocene	2	N. falcatus, P. pachypolus
SWC 29	1274.0	V. good	V. good	SS., carb.	Lower N. asperus	Middle Eocene	0	P. asperopolus, T. simatus, N. falcatus D. heterophylcta
SWC 28	1275.4	Good	Fair	Slst.	Lower N. asperus	Middle Eocene	0	T. simatus, P. asperopolus
SWC 27	1279.0	V. low	Good	Slst.	Lower N. asperus	Middle Eocene	1	P. asperopolus, abund. Nothofagidites
SWC 26	1281.5	Good	Good	Slst.	Lower N. asperus	Middle Eocene	1	N. falcatus, A. diktyoplokus
SWC 25	1287.0	Good	V. good	Slst.	Lower N. asperus	Middle Eocene	0	A. rotundus, P. asperopolus, R. trophus, T. delicatus, A. diktyoplokus
SWC 23	1306.0	Good	Fair	Slst.	Lower N. asperus	Middle Eocene	1	P. asperopolus, P. rugulatus, abund. Nothofagidites
SWC 22	1307.4	Negligible	-	Coal	Indeterminate	-		H. harrisii
SWC 21	1313.4	Good	Fair	Slst.	Lower N. asperus	Middle Eocene	0	T. delicatus, P. asperopolus
SWC 20	1330.0	Good	Fair	Slst.	Lower N. asperus	Middle Eocene	1	P. asperopolus, abund. Nothofagidites
SWC 18	1346.5	Good	Fair	Cly.	Lower N. asperus	Middle Eocene	1	A. rotundus, abund. Nothofagidites
SWC 17	1350.5	Good	Low	Slst.	P. asperopolus	Mid./Early Eocene	1	P. asperopolus, abund. Proteacidites
SWC 16	1362.0	V. good	Fair	Coal	Indeterminate	-	-	Nothofagidites abundant
SWC 15	1372.0	Low	Low	Slst.	Indeterminate	-	-	contaminated

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INTERPRETATIVE DATA

SAMPLE NO.	DEPTH (m)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 14	1387.5	Fair	Low	Coal	Indeterminate	-	-	Abund. H. harrisii & Nothofagidites
SWC 10	1411.9	Good	Fair	Coal	P. asperopolus	Mid./E. Eocene	1	M. tenuis, I. notabilis
SWC 9	1414.9	V. good	V. good	Slst.	P. asperopolus	Mid./Early Eocene	0	M. tenuis, P. asperopolus, S. prominatus, frequent M. diversus & P. pachypolus
SWC 8	1441.9	Fair	Good	Slst.	Upper M. diversus	Early Eocene	1	M. diversus, P. pachypolus
SWC 3	1495.5	V. low	Low	Ss.	Upper M. diversus	Early Eocene	1	P. pachypolus, S. prominatus
SWC 153	1514.0	Good	Good	Ss.	Upper M. diversus	Early Eocene	1	P. pachypolus, abund. M. diversus
SWC 152	1530.4	Low	Good	Slst.	Upper M. diversus	Early Eocene	1	as above
SWC 150	1574.5	Good	Good	Slst.	Middle M. diversus	Early Eocene	1	B. elegansiformis, P. tuberculiformis P. ornatus, P. alveolatus
SWC 149	1609.0	V. low	Fair	Slst.	Middle M. diversus	Early Eocene	2	C. vanraadshooveni, P. varus
SWC 175	1611.5	Fair	Low	Coal	Middle M. diversus	Early Eocene	2	T. paenestriatus; common M. subtilis, H. harrisii and Nothofagidites
SWC 147	1614.5	V. low	Fair	Slst.	Middle M. diversus	Early Eocene	1	P. tuberculiformis
SWC 146	1621.0	Good	Fair	Coal	Middle M. diversus	Early Eocene	1	A. acutullus
SWC 174	1628.9	Good	Good	Slst.	Middle M. diversus	Early Eocene	2	B. verrucosus, D. dartmooria
SWC 144	1634.0	Low	Fair	Slst.	No older than Lower M. diversus		-	C. orthoteichus, I. notabilis
SWC 143	1638.5	V. good	Good	Slst. carb.	Middle M. diversus	Early Eocene	1	P. tuberculiformis, B. verrucosus, P. leightonii
SWC 173	1647.3	Good	Good	Coal	Middle M. diversus	Early Eocene	1	P. tuberculiformis
SWC 141	1648.5	Good	Good	Slst.	Middle M. diversus	Early Eocene	2	T. paenestriatus
SWC 172	1675.5	V. good	Good	Sh.	M. diversus	Early Eocene	-	D. dartmooria, frequent M. diversus
SWC 137	1688.7	Low	Fair	Slst.	No older than Lower M. diversus		-	I. notabilis

TABLE I : SUMMARY OF PALYNOLOGICAL ANALYSIS SNAPPER-4

INTERPRETATIVE DATA

SAMPLE NO.	DEPTH (m)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 171	1702.0	Good	Good	Sist.	M. diversus	Early Eocene	-	P. kopiensis
SWC 135	1719.7m	Fair	Low	Clyst.	Middle M. diversus	Early Eocene	1	A. acutullus
SWC 134	1728.0	Low	Fair	Sist.	Middle M. diversus	Early Eocene	2	T. heleosus, P. lapis
SWC 170	1746.5	Good	Good	Sh.	Middle M. diversus	Early Eocene	1	P. tuberculiformis
SWC 132	1765.5	Good	Fair	Sist.	Lower M. diversus	Early Eocene	0	M. diversus, C. gigantis, D. dartmooria . P. incurvatus
SWC 131	1780.3	Good	Fair	Ss.	Lower M. diversus	Early Eocene	0	I. notabilis, S. prominatus (abund.), M. diversus, C. vanradshooveni, P. varus
SWC 130	1800.6	Negligible	V. low	Sist.	Upper L. balmei	Paleocene	2	L. balmei
SWC 129	1822.0	Good	Fair	Sist.	Upper L. balmei	Paleocene	0	L. balmei common, C. gigantis V. kopukuensis
SWC 128	1849.0	Good	Good	Sist.	Upper L. balmei	Paleocene	1	L. balmei, V. kopukuensis and Gleichenlidites frequent-common
SWC 127	1856.0	Good	Low	Sist.	Upper L. balmei	Paleocene	1	L. balmei abund., V. kopukuensis
SWC 126	1867.0	Fair	Low	Clyst.	Upper L. balmei	Paleocene	1	L. balmei freq., V. kopukuensis
SWC 125	1877.0	V. Low	V. Low	Sist.	L. balmei	Paleocene	1	L. balmei
SWC 169	1889.4	Negligible	V. low	Ss.	L. balmei	Paleocene	-	L. balmei
SWC 124	1889.5	Negligible	V. low	Ss.	L. balmei	Paleocene	-	L. balmei
SWC 123	1894.3	Negligible	Low	Ss.	Indeterminate	-	-	
SWC 167	1902.0	Good	Fair	Sh.	Upper L. balmei	Paleocene	0	L. balmei common, P. incurvatus
SWC 168	1902.0	Good	Good	Sh.	L. balmei	Paleocene	1	L. balmei frequent, H. harrisii

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INTERPRETATIVE DATA

SAMPLE NO.	DEPTH (m)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 121	1905.0	Barren	-	Ss	-	-	-	
SWC 120	1910.0	Negligible	-	Ss	-	-	-	L. balmei
SWC 119	1918.1	Good	Good	Sh.	Upper L. balmei	Paleocene	2	L. balmei abund., V. kopukuensis, J. pieratus, I. antipodus
SWC 166	1925.0	V. low	Fair	Ss.	L. balmei	Paleocene	-	L. balmei, H. harrisii, A. obscurus
SWC 165	1933.0	Low	Fair	Ss.	Upper L. balmei	Paleocene	2	N. endurus and Gleichenilidites frequent
SWC 115	1935.5	Negligible	V. low	Ss.	Indeterminate	-	-	
SWC 164	1942.3	Negligible	V. low	Ss.	Indeterminate	-	-	
SWC 163	1945.7	Low	V. Low	Ss.	L. balmei	Paleocene	-	L. balmei
SWC 112	1953.0	V. good	Good	Slst.	Upper L. balmei	Paleocene	1	L. balmei abund., V. kopukuensis, freq. Gleichenilidites
SWC 111	1970.4	Low	Fair	Slst.	Upper L. balmei	Paleocene	2	L. balmei, P. annularis
SWC 108	1986.0	Good	Good	Slst.	Upper L. balmei	Paleocene	2	L. balmei abund., P. langstonii, V. kopukuensis, T. verrucosus,
SWC 107	2011.5	Low	Fair	Slst., coaly,	Upper L. balmei	Paleocene	2	Gleichenilidites frequent
SWC 106	2029.0	V. good	Fair	Slst.	L. balmei	Paleocene	-	L. balmei abund., H. harrisii, J. pieratus, G. retiintexta, A. homomorpha
SWC 105	2046.9	V. good	Low	Slst.	L. balmei	Paleocene	-	Abundant A. obscurus
SWC 161	2063.0	V. low	V. low	Sh.	L. balmei	Paleocene	-	frequent L. balmei
SWC 102	2078.9	V. good	Fair	Sh.	Upper L. balmei	Paleocene	1	L. balmei abund., V. kopukuensis, A. homomorpha

TABLE I : SUMMARY OF PALYNOLOGICAL ANALYSIS SNAPPER-4

INTERPRETATIVE DATA

SAMPLE NO.	DEPTH (m)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 101	2084.0	Low	V. Low	Ss., carb.	Lower *L. balmei*	Paleocene	2	*L. balmei* frequent, *P. gemmatus*
SWC 100	2104.0	Fair	Fair	Sh.	Lower *L. balmei*	Paleocene	2	*H. elliotii* and *L. balmei* frequent
SWC 97	2169.2	Good	Low	Slst.	Lower *L. balmei*	Paleocene	1	*L. balmei* and *T. verrucosus* frequent; *P. angulatus* abundant
SWC 96	2188.0	V. low	Low	Slst.	Indeterminate	-	-	*H. elliotii*; *P. angulatus* common
SWC 95	2211.1	Low	Low	Ss.	Eocene spore pollen only		-	
SWC 94	2226.3	Low	V. Low	Ss.	*L. balmei*	Paleocene	-	*L. balmei*, common *P. angulatus*
SWC 93	2246.0	Good	Low	Sh.	Lower *L. balmei*	Paleocene	1	*L. balmei*, frequent *T. verrucosus* *I. antipodus*, *P. langstonii*
SWC 91	2288.1	V. low	V. low	Slst.	Indeterminate	-	-	*L. balmei*
SWC 90	2309.4	Low	Low	Sh.	Lower *L. balmei*	Paleocene	0	*T. verrucosus*, *I. antipodus*
SWC 89	2328.4	Good	Fair	Sh.	Lower *L. balmei*	Paleocene	1	*L. balmei*, *T. verrucosus* and *S. punctatus* frequent
SWC 88	2352.2	Low	Fair	Sh.	Lower *L. balmei*	Paleocene	1	*L. balmei*, *T. verrucosus*
SWC 87	2368.0	Low	Low	Slst.	Upper *T. longus*	Maastrichtian	2	Gambierina > *L. balmei*
SWC 86	2390.0	Low	Fair	Sh.	Upper *T. longus*	Maastrichtian	0	*T. verrucosus*, *S. punctatus* *P. gemmatus*, *P. otwayensis*, *T. sectilis*
SWC 85	2407.4	Fair	Fair	Sh.	Upper *T. longus*	Maastrichtian	0	*G. rudata* frequent, *S. punctatus*, *P. gemmatus*, *P. wahooensis*
SWC 84	2425.0	V. Low	V. Low	Slst.	No younger than Upper *T. longus*			*P. otwayensis*

TABLE I : SUMMARY OF PALYNOLOGICAL ANALYSIS SNAPPER-4

INTERPRETATIVE DATA

SAMPLE NO.	DEPTH (m)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 83	2448.1	Good	Good	Sist.	Upper *T. longus*	Maastrichtian	0	*G. rudata* common, *S. punctatus*, *T. longus*, *P. otwayensis*, *T. verrucosus*
SWC 82	2465.0	V. low	V. low	Sist.	Upper *T. longus*	Maastrichtian	0	*T. longus*, *S. punctatus*
SWC 160	2477.0	V. low	V. low	Ss.	*T. longus*	Late Cretaceous	-	*T. longus*
SWC 80	2504.9	Good	Fair	Sh., coaly	Indeterminate	-	-	*L. balmei* palynoflora (caved)
SWC 79	2516.0	Low	Good	Sh.	Upper *T. longus*	Maastrichtian	0	*T. longus*, *T. verrucosus*, *S. punctatus*, *P. gemmatus*, *P. otwayensis*, *G. wahooensis*, *T. lilliei*
SWC 78	2524.4	Low	Low	Ss.	Eocene palynoflora only			
SWC 77	2532.9	V. low	Low	Ss.	Upper *T. longus*	Maastrichtian	1	*S. punctatus*, *P. wahooensis*
SWC 76	2550.0	V. low	Fair	Sist.	Upper *T. longus*	Maastrichtian	0	*T. longus*, *S. punctatus*, *T. verrucosus*, *P. gemmatus*, freq. *G. rudata*
SWC 75	2572.0	Barren	-	Ss.	Indeterminate		-	Eocene contaminants only
SWC 103	2640.0	V. low	Low	Sist.	Upper *T. longus*	Maastrichtian	1	*S. punctatus*, *P. otwayensis*
SWC 70	2650.5	Low	Low	Sh.	Upper *T. longus*	Maastrichtian	0	*P. otwayensis*, frequent *G. Rudata* and *T. verrucosus*
SWC 68	2670.0	Low	V. Low	Sh.	*T. longus*	Late Cretaceous	-	*G. rudata* relatively frequent
SWC 66	2683.5	Barren	-	Sh./Ss.	Indeterminate	-	-	
SWC 65	2688.0	Negligible	V. Low	Ss.	Indeterminate	-	-	*G. rudata*
SWC 63	2693.0	Low	V. Low	Sh.	Upper *T. longus*	Maastrichtian	1	*G. rudata* freq., *T. verrucosus* *P. gemmatus*

TABLE 1 : SUMMARY OF PALYNOLOGICAL ANALYSIS SNAPPER-4

INTERPRETATIVE DATA

SAMPLE NO.	DEPTH (m)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 61	2710.0	Fair	Fair	Slst.	Upper T. longus	Maastrichtian	0	G. rudata common, S. punctatus, T. lilliei
SWC 60	2713.3	V. good	Low	Coal	T. longus	Late Cretaceous	-	R. mallatus, P. cleinei, G. rudata in P. mawsonii-dominated palynoflora
SWC 59	2725.5	Low	Fair	Sh.	Upper T. longus	Maastrichtian	1	G. rudata common. P. gemmatus, P. otwayensis, T. verrucosus
SWC 58	2740.0	Low	Fair	Sh.	Upper T. longus	Maastrichtian	1	T. longus, T. verrucosus, P. gemmatus, frequent G. rudata
SWC 57	2743.6	Negligible	-	Ss.	No older than T. lilliei	Late Cretaceous		G. rudata
SWC 56	2750.7	Barren	-	Ss.	-	-	-	
SWC 55	2760.0	Negligible	-	Ss.	Indeterminate	-	-	G. rudata
SWC 54	2768.2	V. low	V. low	Ss.	Lower T. longus	Late Cretaceous	1	G. rudata, G. edwardsii, T. longus
SWC 53	2784.0	Fair	Low	Sh., carb.,	T. longus	Late Cretaceous	-	G. rudata frequent, T. sectilis
SWC 52	2804.0	Low	Fair	Sh.	Lower T. longus	Late Cretaceous	2	T. lilliei, nos. G. rudata = N. endurus, D. granulatus, T. sectilis

TABLE 2

ANOMALOUS AND UNUSUAL OCCURRENCES OF SPORE-POLLEN TAXA IN SNAPPER-4

SAMPLE NO.	DEPTH(m)	ZONE	TAXON	COMMENTS
SWC 35	1258.5	P. tuberculatus (O)	Myrtaceidites eucalyptoides	
SWC 35	1258.5	P. tuberculatus (O)	Foveotriletes crater	Rare sp.
SWC 34	1260.0	Middle N. asperus (1)	Milfordia homeopunctata	Rare sp.
SWC 33	1265.0	Middle N. asperus (1)	Beaupreadites trigonalis	Uncommon sp.
SWC 33	1265.0	Middle N. asperus (1)	Tricolpites arcilineatus	Very rare ms. sp. (A. Partridge)
SWC 32	1266.5	Lower N. asperus (2)	Rhamnaceae	Modern taxon
SWC 32	1266.5	Lower N. asperus (2)	Wetzeliella glabra	Rare dinoflagellate
SWC 32	1266.5	Lower N. asperus (2)	Verrucatosporites attinatus	Rare sp.
SWC 30	1273.0	Lower N. asperus (2)	Parvisaccites catastus	
SWC 29	1274.0	Lower N. asperus (O)	cf. Amperea	Modern Euphorbiaceae
SWC 29	1274.0	Lower N. asperus (O)	Cunoniaceae	DI-and tricolpate spp.
SWC 29	1274.0	Lower N. asperus (O)	Dodonaea	Modern taxon
SWC 29	1274.0	Lower N. asperus (O)	Phyllocladidites palaeogenicus	Rare sp.
SWC 29	1274.0	Lower N. asperus (O)	Lygistepollenites balmei	(Rare reworked) Paleocene sp.
SWC 28	1275.4	Lower N. asperus (O)	Cemarozonosporites australiensis	V. rare in Eocene
SWC 27	1279.0	Lower N. asperus (1)	Proteacidites reticulatus	Rare below Middle N. asperus Zone
SWC 25	1287.0	Lower N. asperus (O)	Anacolosidites rotundus	Rare sp.
SWC 25	1287.0	Lower N. asperus (O)	Rugulatisporites trophus	Rare sp.
SWC 25	1287.0	Lower N. asperus (O)	Clavatipollenites glarius	Very rare sp.
SWC 25	1287.0	Lower N. asperus (O)	Phyllocladidites palaeogenicus	Rare sp.
SWC 18	1346.5	Lower N. asperus (1)	Anacolosidites rotundus	As for SWC 25
SWC 16	1362.0	(P. asperopolus)	Proteacidites callosus	In Nothofagidites, H. harrisii-dominated coal palynoflora
SWC 15	1372.0	(P. asperopolus)	Tetracolpites psilatus	Ms. sp. (Macphail)
SWC 14	1387.5	(P. asperopolus)	Beaupreadites verrucosus	In H. harrisii-dominated coal palynoflora

TABLE 2

ANOMALOUS AND UNUSUAL OCCURRENCES OF SPORE-POLLEN TAXA IN SNAPPER-4

SAMPLE NO.	DEPTH(m)	ZONE	TAXON	COMMENTS
SWC 14	1387.5	(P. asperopolus)	Proteacidites echinatus	V. rare ms. sp. (Macphail). As above.
SWC 14	1387.5	(P. asperopolus)	Tricolpites reticulatus	Ms. sp (Stover)
SWC 10	1411.9	P. asperopolus (1)	Intratriporopollenites notabilis	In H. harrisii, P. demarcatus-dominated coal palynoflora
SWC 9	1414.9	P. asperopolus (0)	Spinizonecolpites prominatus	Top of range of rare sp. (marine siltstone).
SWC 9	1414.9	P. asperopolus (0)	Tricolpites reticulatus Cookson	Rare sp.
SWC 9	1414.9	P. asperopolus (0)	Tricolpites retequetrus	Not prev. recorded below Middle N. asperus Zone
SWC 3	1495.5	Upper M. diversus (1)	Spinizonocolpites prominatus	Rare sp. (non marine sandstone)
SWC 153	1514.0	Upper M. diversus (1)	Gemmatricolporites cf. gestus	
SWC 153	1514.0	Upper M. diversus (1)	Proteacidites echinatus	As for SWC 14
SWC 153	1514.0	Upper M. diversus (1)	Proteacidites callosus	Uncommon sp.
SWC 149	1609.0	(Middle M. diversus)	Palynoflora of thick walled spore spp. including C. vanraadshooveni, P. varus & V. kopukuensis	
SWC 152	1530.4	Upper M. diversus (1)	Proteacidites xestoformis	Uncommon sp.
SWC 149	1609.0	(Middle M. diversus)	Aequitriradites verrucosus	Cretaceous sp.
SWC 146	1621.0	(Middle M. diversus)	Proteacidites lapis	In Gleichenlidites coal palynoflora
SWC 174	1628.9	Middle M. diversus (2)	Proteacidites recavus	Very rare below upper P. asperopolus Zone; in marginal marine siltstone
SWC 174	1628.9	Middle M. diversus (2)	Tricolpites incisus	Not prev. recorded below P. asperopolus Zone
SWC 174	1628.9	Middle M. diversus (2)	Deflandrea mooria	Lower M. diversus Zone dinoflagellate
SWC 144	1634.0	(Middle M. diversus)	Cyathidites gigantis	Reworked ? Sample contains 5 spores of L. balmei
SWC 143	1638.5	Middle M. diversus (1)	Tricolpites circumlumenus	Ms. sp. (Macphail)
SWC 143	1638.5	Middle M. diversus (1)	Myrtaceoipollenites australis	Uncommon sp.
SWC 173	1647.3	Middle M. diversus (1)	Proteacidites tuberculiformis	Common in coal palynoflora
SWC 173	1647.3	Middle M. diversus (1)	Anacolosidites rotundus	Common in coal palynoflora

TABLE 2

ANOMALOUS AND UNUSUAL OCCURRENCES OF SPORE-POLLEN TAXA IN SNAPPER-4

SAMPLE NO.	DEPTH(m)	ZONE	TAXON	COMMENTS
SWC 173	1647.3	Middle M. diversus (1)	Podosporites microsaccatus	Common in coal palynoflora
SWC 141	1648.5	Middle M. diversus (2)	Umbelliferae	Modern taxon
SWC 172	1675.5	(Middle M. diversus)	Proteacidites rugulatus	35 um, as for SWC 174 (P. recavus)
SWC 172	1675.5	(Middle M. diversus)	Clavifera cf. vultuosus	V. rare ms. sp. (A. Partridge)
SWC 172	1675.5	(Middle M. diversus)	Foveoglelchenlidites	Ms. genus
SWC 172	1675.5	(Middle M. diversus)	Deflandrea dartmoorla	As for SWC 174
SWC 171	1702.0	(Middle M. diversus)	Foveotrilletes balteus	
SWC 132	1765.5	Lower M. diversus (2)	Banksieaidites elongatus	Not prev. recorded below Middle M. diversus Zone
SWC 132	1765.5	Lower M. diversus (2)	Tricolporites adelaidensis	Rare below Middle M. diversus Zone
SWC 132	1765.5	Lower M. diversus (2)	Tricolporites moultonii	As above
SWC 132	1765.5	Lower M. diversus (2)	Proteacidites rugulatus	V. rare below P. asperopolus Zone
SWC 129	1822.0	Upper L. balmei (0)	Tricolporites scabratus	
SWC 129	1822.0	Upper L. balmei (0)	Foveotrilletes balteus	
SWC 128	1849.0	Upper L. balmei (1)	Matonisporites ornamentalis	Frequent
SWC 126	1867.0	Upper L. balmei (1)	Tricolpites circumlumenus	Rare ms. sp. (Macphail)
SWC 167	1902.0	(Upper L. balmei)	Tetracolporites verrucosus	Rare above Lower L. balmei Zone
SWC 119	1918.1	Upper L. balmei (1)	Jaxtacolpus pleratus	V. rare above Lower L. balmei Zone
SWC 166	1925.0	(Upper L. balmei)	Tricolpites vergillus	Late Cretaceous ms. sp. (Partridge)
SWC 165	1933.0	Upper L. balmei (2)	Triporopollenites ambiguus	Not prev. (?) recorded below M. diversus Zone
SWC 163	1945.7	(Upper L. balmei)	Periporopollenites vesicus	Eocene sp.
SWC 112	1953.0	Upper L. balmei (1)	Pantocolpate sp.	
SWC 108	1986.0	Upper L. balmei (2)	Tetracolporites verrucosus	As for SWC 167
SWC 108	1986.0	Upper L. balmei (2)	Proteacidites cf. reflexus	

TABLE 2

ANOMALOUS AND UNUSUAL OCCURRENCES OF SPORE-POLLEN TAXA IN SNAPPER-4

SAMPLE NO.	DEPTH(m)	ZONE	TAXON	COMMENTS
SWC 107	2011.5	Upper *L. balmei* (2)	*Gleichenilidites* sp. nov.	Apiculate
SWC 107	2011.5	Upper *L. balmei* (2)	*Beaupreadites elegansiformis*	V. rare below Middle *M. diversus* Zone
SWC 106	2029.0	(Upper *L. balmei*)	*Jaxtacolpus pieratus*	As for SWC 119 (marine siltstone)
SWC 106	2019.0	(Upper *L. balmei*)	*Parvisaccites catastus*	
SWC 103	2078.9	Upper *L. balmei* (1)	*Tricolporites gigantis*	Rare ms. sp. (Macphail)
SWC 96	2188.0	(Lower *L. balmei*)	*Dacrycarpites australiensis*	V. rare in Paleocene
SWC 93	2246.0	Lower *L. balmei* (1)	*Elphredripites notensis*	Rare sp.
SWC 92	2265.3	Lower *L. balmei* (0)	*Polycolpites langstonii*	Rare in this zone
SWC 89	2328.4	Lower *L. balmei* (1)	*Schizaea digitatoides*	Rare sp.
SWC 89	2328.4	Lower *L. balmei* (1)	*Aquitriradites spinulosus*	Typically Late Cretaceous
SWC 89	2328.4	Lower *L. balmei* (1)	*Foveosporites canalis*	Typically Late Cretaceous
SWC 88	2352.2	Lower *L. balmei* (1)	*Schizaea digitatoides*	As for SWC 89
SWC 86	2390.1	Upper *T. longus* (1)	*Peromonolites* cf. *baculatus*	
SWC 80	2504.9	(Upper *T. longus*)	*Cupanieidites orthoteichus*	Not prev. recorded below *M. diversus* Zone, not apparently caved.
SWC 79	2516.0	Upper *T. longus* (0)	*Dacrycarpites australiensis*	Rare in Maastrichtian
SWC 79	2516.0	Upper *T. longus* (0)	*Periporopollenites demarcatus*	
SWC 79	2516.0	Upper *T. longus* (0)	*Gephyrapollenites wahcoensis*	Rare sp.
SWC 76	2550.0	Upper *T. longus* (0)	*Phyllocladidites palaeogenicus*	Rare sp.
SWC 103	2640.0	Upper *T. longus* (1)	*Proteacidites* cf. *protograndis*	Ms. sp. (Macphail)