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APPENDIX

PALYNOLOGICAL ANALYSIS

LUDERICK-1, GIPPSLAND BASIN

by

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INTERPRETATIVE DATA

INTRODUCTION

Seventy six (76) sidewall core and four conventional cores were processed and examined for spore-pollen and dinoflagellates. Whilst recovery was usually fair to good, indicator species were very rare in the Late Cretaceous and Paleocene sections and uncommon in the Eocene section. Consequently many of the zone boundaries must be treated as provisional. Palynological zones and lithological facies divisions from the base of the Lakes Entrance Formation to the total depth of the well are given below. The occurrence of spore-pollen and dinoflagellate species are tabulated in the accompanying range chart. Anomalous and unusual occurrences of taxa are listed in Table 2.

SUMMARY

UNIT/FACIES	ZONE	DEPTH (m)
Lakes Entrance Formation	*P. tuberulatus*	1745.0 - 1766.5
	log break at 1777.0m	
Gurnard Formation	Upper *N. asperus*	1777.0 - 1783.0
	Middle *N. asperus*	1787.0 - 1801.5
	log break at 1803.0m	
Latrobe Group coarse clastics	Middle *N. asperus*	1803.5 - 1816.0
	Lower *N. asperus*	1820.0 - 1914.4
	P. asperopolus	1919.0 - 1950.9
	Upper *M. diversus*	1981.0 - 2068.4
	Middle *M. diversus*	2081.7 - 2227.1
	Lower *M. diversus*	2270.0
	Upper *L. balmei*	2291.5 - 2445.0
	Lower *L. balmei*	2480.0 - 2935.0
	Upper *T. longus*	2995.0

T.D. 3021m.

GEOLOGICAL COMMENTS

1. The Luderick-1 well contains a continuous sequence of sediments from the Late Cretaceous Upper T. longus Zone to at least the Middle Eocene upper Middle N. asperus Zone.

2. The samples at 1754.0 and 1745.0 contain essentially the same (P. tuberculatus Zone) palynoflora despite foraminiferal data for a hiatus in deposition from the early Oligocene to the early Miocene in this interval (Hannah 1983).

3. Spore-pollen recovered from the Gurnard Formation, picked on lithological and log characteristics as occurring between 1803.0 to 1777.0m (Hannah ibid) demonstrates this unit is upper Middle N. asperus to (?) Upper N. asperus Zone in age. Despite lithological evidence for reworking of the Gurnard formation into the overlying calcareous sediments between 1777.0 and 1754.0m (Hannah ibid) no spore-pollen diagnostic of the Middle N. asperus Zone were recovered from this section. This indicates reworking was confined to the top of the Gurnard Formation.

4. Dinoflagellates are common to abundant from the highest sample analysed (1745.0m) down to 1812.0m and from 1820.0 to 1831.0m. This indicates the top 28m of the Latrobe Group coarse clastics were deposited in a marine environment during Lower and Middle N. asperus Zone times. This environment is represented by a marked change in the resistivity log character above 1833m. The highest coal is at 1873m, indicating that the isolated occurrence of a diverse dinoflagellate assemblage at 1896.0m represents a minor marine transgression during early Lower N. asperus Zone times.

5. An earlier (Lower M. diversus Zone) marine transgression is recorded at 2270.0m. The spore-pollen and dinoflagellate assemblage closely resembles that recorded from the Rivernook Bed of the onshore Princetown section, Otway Basin (Cookson & Eisenack 1967) and is likely to represent the same (Apectodinium hyperacantha Zone) event (Partridge 1976).

6. Relative depths of Upper N. asperus to Lower L. balmei Zone sediments in Luderick-1 correspond well with those recorded at Tarwhine-1 (Macphail 1982). The P. asperopolus and M. diversus 'seismic markers' lie within sediments of these ages in Luderick-1. As in Bream-3, the M. diversus

'seismic marker' is likely to be Middle M. diversus Zone in age. The lower L. balmei Zone 'seismic marker' in Luderick-1 lies within, but relatively close to the picked lower boundary of the Lower L. balmei Zone.

7. The lowest sidewall core sample at 2995.0m, contained a diverse Upper T. longus Zone palynoflora. This sample is approximately 26m above T.D. but given the occurrence of approximately 500m of T. longus Zone sediments in Tarwhine-1, it is probable that the Luderick-1 well also bottomed in Maastrichtian T. longus Zone sediments.

BIOSTRATIGRAPHY

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

Upper T. longus Zone: 2995.0m.
The occurrence of Tetracolporites verrucosus, Proteacidites reticuloconcavus, P. otwayensis and P. amolosexinus in a Gambierina rudata - dominated palynoflora confirm an Upper T. longus Zone age for the basal sidewall core sample.

Samples within the interval 2935.0 to 2322.0m are characterised by the general L. balmei Zone indicators such as abundant Lygistepollenites balmei and Australopollis obscurus in gymnosperm and Proteacidites - dominated assemblages. Relatively few of these contained indicator species for either of the L. balmei Zone subdivisions, and in several instances probable reworking has resulted in occurrences of Lower L. balmei Zone indicators such as Tetracolporites verrucosus and Jaxtacolpus pieratus above the lowest occurrence of species which first appear in the Upper L. balmei Zone, eg. Verrucosisporites kopukuensis.

Lower L. balmei Zone: 2935.0 - 2480.0m.
The lower boundary is provisionally placed at 2935.0m, a coal containing Tetracolporites verrucosus and Lygistepollenites balmei but not species ranging higher than the T. longus Zone. Proteacidites gemmatus which ranges no higher than the Lower L. balmei Zone occurs at 2881.3m. The lowest occurrence of Haloragacidites harrisii, a species which first appears in the L. balmei Zone, is at 2800m but this sample is contaminated with the Eocene species Proteacidites pachypolus. The lowest unequivocal occurrences of Haloragacidites harrisii and Tetracolporites verrucosus with frequent to abundant Lygistepollenites balmei are at 2580.0 and 2539.0m respectively. The upper boundary is picked on the highest unequivocal occurrences of these taxa, at 2480.0m.

Upper L. balmei Zone: 2445.0 - 2291.5m.

The lower boundary of this zone is provisionally placed at 2445.0m, based on the occurrence of Verrucosisporites kopukuensis. This sample is one of a small number containing both this species and Tetracolporites verrucosus; hence it is likely to lie close to the Upper/Lower L. balmei Zone boundary. Tetracolporites verrucosus also occurs at 2427.5m and Jaxtacolpus pieratus at 2322.0m. The highest occurrence of Verrucosisporites kopukuensis (a single poorly preserved grain) is at 2359.0m. Abundance of Lygistepollenites balmei in a coal at 2291.5m is used to define the upper boundary of the zone, but it is noted that coal palynofloras of M. diversus age in the Otway Basin do occasionally contain abundant Lygistepollenites balmei (A.D. Partridge, pars. comm).

Lower M. diversus Zone : 2270m.

One sample, at 2270m, is assigned to this zone. This contains abundant Malvacipollis diversus and dinoflagellates with Spinizonocolpites prominatus, Crassiretitriletes vanraadshoovenii and Polypodiaceoisporites varus.

Middle M. diversus Zone : 2227.1 - 2081.7m.

Two samples are provisionally assigned to this zone. The lower at 2227.1m contains Polycolpites esobateus (which rarely extends below this zone) in a palynoflora dominated by Malvacipollis subtilis and Proteacidites grandis. Abundance of the last species is more typical of the Lower M. diversus Zone and it is probable the sample lies close to the Lower/Middle M. diversus Zone boundary. The upper sample, at 2081.7m, is a coal containing abundant Malvacipollis diversus and frequent Tricolporites adelaidensis, a species which first appears in the Middle M. diversus Zone. Proteacidites species and other taxa characteristic of this and the Upper M. diversus Zone are absent. The sample contains Proteacidites recavus and Periporopollenites vesicus, probably representing a real downward extension of the known range of these taxa (see Table 2).

Upper M. diversus Zone : 2068.4 - 1981.0m.

Samples within this interval are characterised by Myrtaceidites tenuis and Proteacidites pachypolus, species which first appear in this zone, in Haloragacidites harrisii - Proteacidites dominated palynofloras which lack indicator species of the P. asperopolus Zone. Malvacipollis diversus was present but always less common than M. subtilis. The upper boundary at 1981.0m is provisional since the sample is a coal.

P. asperopolus Zone : 1950.9 - 1919.0m.

Three samples, including two coals, are assigned to this zone. All lack

Proteacidites asperopolus, the major indicator species which first appears in this zone. The lower boundary at 1950.9m is picked on the first occurrence of Sapotaceoidaepollenites rotundus in an assemblage dominated by Proteacidites pachypolus. Myrtaceidites tenuis demonstrates this sample is no younger than P. asperopolus Zone in age. The coal at 1946.5m also contains relatively abundant P. pachypolus but in this instance in association with Tricolpites incisus, a species which first appears in the Upper M. diversus Zone. The coal at 1919.0m is provisionally picked as P. asperopolus Zone in age, based on the slightly greater abundance (34%) of Proteacidites, including P. annularis and P. pachypolus, relative to Nothofagidites (29%) pollen. Beaupreadites trigonalis and Proteacidites rugulatus indicate the sample is no older than P. asperopolus Zone in age.

Lower N. asperus Zone : 1914.4 - 1818.0m.

Unlike deeper sections, the interval upwards from 1914.4m contained diverse, well-preserved palynofloras enabling confident age-determinations to be made. The lower boundary of the Lower N. asperus Zone, at 1914.4m, is defined by (i) dominance of palynoflora by Nothofagidites; (ii) the occurrence of Tricolporites leuros, a species which first appears in this zone; and (iii) occurrences of Proteacidites asperopolus and (large diameter) Intratriporopollenites notabilis which are not known to occur above this zone. Proteacidites asperopolus is frequent at 1896.0, 1879.0 and 1861.4m and occurs less frequently in samples up to 1821.5m. First occurrences of other taxa which first appear in the Lower N. asperus Zone are Nothofagidites falcatus (1896.0m), Tricolporites delicatus (1879.0m) and Tricolpites simatus (1838.9m). The dinoflagellate species Areosphaeridium diktyoplokus, which is diagnostic of the Zone, occurs at 1826.0m. The upper boundary is picked at 1820.0, based on the occurrence of Tricolpites simatus and T. delicatus with frequent Proteacidites pachypolus.

Middle N. asperus Zone : 1816.0 -

The zone is characterised by Nothofagidites dominated palynofloras, many of which include one to several specimens of Proteacidites pachypolus a species which last appears in this zone. The lower boundary is picked at 1816.0m, based on the occurrence of the very rare species Tricolpites arcilineatus. This species is not known to occur below the Middle N. asperus Zone but in view of its rarity and the occurrence of a small (32 µm diameter) specimen of Intratriporopollenites notabilis, this boundary should be regarded as provisional. The first appearance of the zone indicator species Triorites magnificus is at 1810.4m. Verrucatosporites attinatus which typically first appears in the upper Middle N. asperus Zone occurs at 1808.0m. The sample at 1804.5m contains a rare Eocene occurrence of the Oligocene-Miocene species Cyathidites subtilis. The dinoflagellate indicator species for this zone,

Vozzhenikovia extensa, occurs at 1800.5m (with Verrucatosporites attinatus), up to 1719.0m. This interval containing sporadic occurrences of Tricolpites simatus, Verrucatosporites attinatus, Tricolpites thomasii, Anacolosidites sectus and Proteacidites pachypolus. The upper boundary of the zone at 1791.0m is defined by the highest occurrence of Triorites magnificus. This sample contains Anacolosidites luteoides which is not known to range above the Lower N. asperus Zone and Polypodiaceoisporites cf. tumulus, a T. bellus Zone species.

Upper N. asperus Zone : 1783.0 - 1777.0m.

Two samples are provisionally assigned to this zone. Both are dominated by Nothofagidites pollen, including N. falcatus, but lack species restricted to the Middle N. asperus Zone. The sample at 1777.0m contains Proteacidites incurvatus, a species not known to range higher than the Lower N. asperus Zone.

P. tuberculatus Zone : 1766.5 - 1745.0m.

The occurrence of 5-10 specimens of Cyatheacidites annulatus in samples at 1745.0 and 1754.0m confirm a P. tuberculatus Zone age for these calcareous sediments. The sample at 1766.5m lacks C. annulatus but is included in this zone on the basis of (i) its general similarity to the above samples and (ii) the occurrence of Polyporina chenopodiaceoides, a species which is rare below the T. bellus Zone and not previously recorded from Eocene sediments.

PALYNOLOGY DATA SHEET

BASIN: Gippsland ELEVATION: KB: 21.0 GL: -52.0

WELL NAME: LUDERICK-1 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*	1745.0	0				1766.5	2	1754.0	0	
	Upper *N. asperus*	1777.0	2				1783.0	2			
	Mid *N. asperus*	1791.0	0				1816.0	2	1810.4	0	
	Lower *N. asperus*	1820.0	1				1914.4	0			
	P. asperopolus	1919.0	2				1950.9	1			
	Upper *M. diversus*	1981.0	2				2068.4	0			
	Mid *M. diversus*	2081.7	2				2227.1	2			
	Lower *M. diversus*	2270.0	0				2270.0	0			
	Upper *L. balmei*	2291.5	2	2359.0	1		2445.0	2			
	Lower *L. balmei*	2480.0	1				2935.0	2			
LATE CRETACEOUS	*T. longus*	2995.0	1				2995.0	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:

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: October 13, 1983.

DATA REVISED BY: DATE:

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TABLE 1 : SUMMARY OF PALYNOLOGICAL ANALYSIS LUDERICK-1, GIPPSLAND BASIN

INTERPRETATIVE DATA

SAMPLE NO.	DEPTH (m)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 121	1745.0	Good	Low	Mdst.calc.	P.tuberculatus	Early Miocene	0	C.annulatus freq., F.lacunosus.
SWC 120	1754.0	Fair	Low	Slst.glau.calc.	P.tuberculatus	Oligocene	0	C.annulatus freq.
SWC 119	1766.5	Good	Low	Mdst.calc.	P.tuberculatus	Oligocene	2	P.chenopodiaceoides, P.simplex.
SWC 118	1777.0	Good	Moderate	Mdst.calc.	Upper N.asperus	Late Eocene	2	P.incurvatus, P.rectomarginis, P.stipplatus.
SWC 117	1780.0	V. low	V. low	Slst.glau.	Indeterminate		-	
SWC 116	1783.0	Good	Moderate	Slst.glau.	Upper N.asperus	Late Eocene	2	P.incurvatus, P.stipplatus, H.spinata.
SWC 115	1787.0	Good	Low	Slst.glau	N.asperus	Late Eocene		S.dilwynense.
SWC 114	1791.0	V. good	Good	Slst.calc.	Upper Middle N.asperus	Late Eocene	0	T.magnificus, V.attinatus.
SWC 113	1795.0	Good	Low	Slst.calc.	Middle N.asperus	Late Eocene	1	T.thomasii, P.esobalteus, V.extensa.
SWC 112	1797.0	Good	Moderate	Slst.calc.	Middle N.asperus	Late Eocene	1	P.pachypolus, S.punctatus, V.extensa.
SWC 111	1798.0	Good	Low	Slst.calc.glau	Middle N.asperus	Late Eocene	0	A.sectus, V.extensa.
SWC 110	1799.0	Fair	Moderate	Slst.calc.glau	Middle N.asperus	Late Eocene	0	T.magnificus, P.pachypolus, S.asymmetricum.
SWC 109	1800.5	Good	Moderate	Slst.clac.	Upper Middle N.asperus	Late Eocene	1	P.pachypolus, V.attinatus, V.extensa.
SWC 108	1801.5	Fair	Moderate	Slst.calc.	Middle N.asperus	Late Eocene	2	N.vansteenii, P.crassus.
SWC 106	1803.5	Good	Moderate	Slst.	Middle N.asperus	Mid/Late Eocene	2	T.ambiguus, P.unicus, S.asymmetricum
SWC 102	1804.5	V. good	High	Slst	Middle N.asperus	Mid/Late Eocene	2	P.pachypolus, P.reticuloscabratus.
SWC 101	1808.0	Fair	Low	Slst.glau.	Middle N.asperus	Mid/Late Eocene	2	P.recavus, D.heterophylcta.
SWC 105	1810.4	Good	Moderate	Slst.	Middle N.asperus	Mid/Late Eocene	0	T.magnificus, P.recavus, D.heterophylcta
SWC 104	1812.0	Good	High	Ss.	Middle N.asperus	Mid/Late Eocene	2	P.pachypolus, P.rugulatus, D.heterophylcta.

TABLE I : SUMMARY OF PALYNOLOGICAL ANALYSIS LUDERICK-1, GIPPSLAND BASIN

INTERPRETATIVE DATA

SAMPLE NO.	DEPTH (m)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 98	1813.5	Good	High	Sist.glau.	Middle N.asperus	Middle Eocene	2	P.pachypolus, T.delicatus.
SWC 97	1816.0	V. low	V. low	Sist.pyr.	Middle N.asperus	Middle Eocene	2	T.arcilineatus, P.pachypolus.
SWC 96	1818.0	Low	Low	Sist.glau.	N.asperus	Middle Eocene	-	P.pachypolus.
SWC 103	1820.0	Good	Moderate	Sist.	Lower N.asperus	Middle Eocene	1	P.pachypolus freq, T.delicatus, T.simatus, T.pelligera.
SWC 94	1821.5	Fair	Moderate	Sist.glau.	Lower N.asperus	Middle Eocene	1	P.cf.asperopolus, P.tuberculiformis, T.pelligera.
SWC 92	1826.0	Fair	Moderate	Sist.	Lower N.asperus	Middle Eocene	1	Abundant Nothofagidites, A.diktyoplokus.
SWC 91	1827.9	Good	High	Sist.	Lower N.asperus	Middle Eocene	2	Abundant Nothofagidites, H.tricornus, D.heterophylcta.
SWC 90	1831.0	Low	Moderate	Sist.	Lower N.asperus	Middle Eocene	1	P.asperopolus, abundant Nothofagidites.
SWC 89	1833.0	Barren	-	Ss.	-	-	-	
Core 3	1839.0	V. good	V. high	-	Lower N.asperus	Middle Eocene	0	P.asperopolus, abundant Nothofagidites, T.leuros.
Core 9	1842.2	Fair	Moderate	-	Lower N.asperus	Middle Eocene	1	T.leuros, P.asperopolus, P.pachypolus, H.spinata.
Core -	1857.25	Fair	Low	Coal	Lower N.asperus	Middle Eocene	1	P.asperopolus, common Nothofagidites.
Core 3	1861.42	Good	High	-	Lower N.asperus	Middle Eocene	1	P.asperopolus frequent, Nothofagidites abundant.
SWC 83	1879.0	Good	High	Ss.	Lower N.asperus	Middle Eocene	0	P.asperopolus frequent, Nothofagidites abundant, T.leuros, T.delicatus.

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SAMPLE NO.	DEPTH (m)	YIELD	DIVERSITY SPORE	DIVERSITY POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 79	1896.0	V. good	High		Ss.	Lower N.asperus	Middle Eocene	0	P.asperopolus frequent, Nothofagidites abundant, N.falcatus, P.recavus.
SWC 75	1914.4	Good	High		Sist.	Lower N.asperus	Middle Eocene	0	T.leuros, P.asperopolus, abundant Nothofagidites.
SWC 74	1919.0	Good	Moderate		Coal	P.asperopolus	Early/Mid Eocene	2	B.trigonalis, P.rugulatus, 34% Proteacidites.
SWC 73	1923.2	Barren	-		Ss.	-	-	-	
SWC 69	1946.5	Good	Low		Coal	P.asperopolus	Early/Mid Eocene	2	Frequent P.pachypolus, M.subtilis.
SWC 68	1950.9	V. good	Moderate		Sh.	P.asperopolus	Early/Mid Eocene	1	M.tenuis, S.rotundus, abundant P.pachypolus.
SWC 65	1981.0	Good	Low		Coal	Upper M.diversus	Early Eocene	2	M.tenuis, P.'apis.
SWC 64	1984.0	Fair	V. low		Sist.	Upper M.diversus	Early Eocene	2	Abundant P.pachypolus and M.subtilis.
SWC 46	2000.9	Fair	Low		Sist.	Upper M.diversus	Early Eocene	1	Abundant P.pachypolus, M.subtilis, M.tenuis, T.moultonii.
SWC 63	2012.9	Barren	-		Ss.	-	-	-	
SWC 41	2022.5	Barren	-		Mdst.	-	-	-	
SWC 40	2068.4	Good	Low		Ss.	Upper M.diversus	Early Eocene	0	M.diversus common, M.tenuis, P.pachypolus.
SWC 38	2081.7	V. good	Moderate		Coal	Middle M.diversus	Early Eocene	2	M.diversus abundant, T.adelaidensis.
SWC 37	2092.0	V. low	Low		Ss.	-	Early Eocene	-	No older than Lower M.diversus.
SWC 35	2100.5	Negligible	-		-	-	-	-	

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SAMPLE NO.	DEPTH (m)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 34	2135.5	Negligible	-	-	-	-	-	
SWC 32	2171.0	V. low	V. low	Ss.	-	Early Eocene	-	No older than Lower M.diversus.
SWC 61	2200.0	Barren	-	-	-	-	-	
SWC 60	2227.1	Fair	Moderate	Clyst.	Middle M.diversus	Early Eocene	2	Abundant M.subtilis, P.esobalteus, P.leightonii.
SWC 59	2270.0	Low	Low	Slst.	Lower M.diversus	Early Eocene (marine)	0	Abundant M.diversus, C.vanraadshooveni, S.prominatus, P.varus.
SWC 58	2291.5	V. good	Moderate	Sh. coaly	Upper L.balmei	Paleocene	2	G.rudata, N.endurus, frequent L.balmei.
SWC 57	2322.0	Fair	Moderate	Ss.	Upper L.balmei	Paleocene	2	A.obscurus, P.langstonii, P.grandis.
SWC 56	2339.0	Good	Low	Sh.	L.balmei	Paleocene	-	A.obscurus, L.balmei common, H.harrisii.
SWC 55	2359.0	Low	Low	Sh. carb.	Upper L.balmei	Paleocene	1	V.kopukuensis, H.harrisii, G.rudata.
SWC 54	2383.0	Low	Low	Ss.	L.balmei	Paleocene	-	L.balmei, H.harris.i.
SWC 53	2403.0	Barren	-	-	-	-	-	
SWC 50	2427.5	Low	Low	Slst.	L.balmei	Paleocene	-	T.verrucosus, I.integricorpus.
SWC 31	2445.0	Good	Moderate	Slst.	Upper L.balmei	Paleocene	2	V.kopukuensis, T.verrucosus.
SWC 30	2461.0	V. low	V. low	Ss.	L.balmei	Paleocene	-	L.balmei, H.harrisii, T.cf.verrucosus.
SWC 29	2480.0	Good	Moderate	Slst.	Lower L.balmei	Paleocene	1	T.verrucosus, H.harrisii, abundant L.balmei.
SWC 28	2501.1	V. low	V. low	Ss.	Indeterminate	-	-	
SWC 27	2539.0	Fair	Moderate	Ss.	Lower L.balmei	Paleocene	1	frequent L.balmei, T.verrucosus.
SWC 26	2553.5	Fair	Low	Slst.	L.balmei	Paleocene	-	L.balmei common.

TABLE 1 : SUMMARY OF PALYNOLOGICAL ANALYSIS LUDERICK-1, GIPPSLAND BASIN

INTERPRETATIVE DATA

SAMPLE NO.	DEPTH (m)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 25	2580.0	Good	Low	Slst.	L.balmei	Paleocene	-	L.balmei common.
SWC 24	2611.0	Good	Low	Slst.	L.balmei	Paleocene	-	
SWC 23	2650.0	Low	Low	Slst.	L.balmei	Paleocene	-	
SWC 22	2681.0	Barren	-	Slst.	-	-	-	
SWC 21	2710.0	Fair	Low	Sh.	Lower L.balmei	Paleocene	2	P.verrucosus.
SWC 17	2800.0	Good	Moderate	Ss.	Lower L.balmei	Paleocene	2	frequent S.punctatus.
SWC 12	2841.0	V. low	V. low	Ss.	Indeterminate	-	-	No younger than Lower L.balmei.
SWC 9	2857.0	Low	V. low	Ss.	Lower L.balmei	Paleocene	-	L.balmei, abundant T.verrucosus.
SWC 8	2881.3	Low	Low	Sh.	Lower L.balmei	Paleocene	2	T.verrucosus, P.gemmatus, P.angulatus.
SWC 5	2935.0	Good	High	Ss.	Lower L.balmei	Paleocene	2	T.verrucosus, abundant Proteacidites.
SWC 4	2944.0	Barren	-	Ss.	-	-	-	
SWC 3	2952.3	V. low	Low	Ss.	Indeterminate	-	-	No older than Upper T.longus.
SWC 1	2995.0	V. low	Moderate	Slst.	Upper T.longus	Maastrichtian	1	Abundant G.rudata, P.otwayensis, P.reticuloconcavus.

TABLE 2

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

SAMPLE NO.	DEPTH(m)	ZONE	TAXON	COMMENTS
SWC 119	1766.5	P.tuberculatus (2)	Polyporina chenopodiaceoides	Rarely recorded in sediments older than Miocene.
SWC 116	1783.9	(Upper) Mid N.asperus (2)	Proteacidites incurvatus	Not recorded above Middle N.asperus Zone.
SWC 116	1783.0	(Upper) Mid N.asperus (2)	Horologinella spinata	Rare dinoflagellate species.
SWC 114	1791.0	(Upper) Mid N.asperus (0)	Horologinella spinata	Rare dinoflagellate species.
SWC 114	1791.0	(Upper) Mid N.asperus (0)	Anacolosidites luteoides	Not recorded above Lower N.asperus Zone.
SWC 114	1791.0	(Upper) Mid N.asperus (0)	Polyodiaceoisporites cf. tumulatus	T.bellus Zone species.
SWC 112	1797.0	Middle N.asperus (1)	Quintinia psilatispora	Rare sp. in Eocene.
SWC 110	1799.0	Middle N.asperus (0)	Proteacidites callosus	Rare sp.
SWC 106	1803.5	Middle N.asperus (2)	Proteacidites unicus	Rare ms sp. (Harris).
SWC 102	1804.5	Middle N.asperus (2)	Cyathidites subtilis	Rare below P.tuberculatus Zone.
SWC 104	1812.0	(Lower) Mid N.asperus (2)	Haloragacidites verrucatoharrisii	Rare ms. sp. (Macphail).
SWC 104	1812.0	(Lower) Mid N.asperus (2)	Elphredripites notensis	Rare sp.
SWC 104	1812.0	(Lower) Mid N.asperus (2)	Tricolpites cf. T.vergilius	Rare Late Cretaceous ms. sp. (Partridge).
SWC 98	1913.5	Middle N.asperus (2)	Beaupreadites trigonalis	Rare ms. sp. (Stough).
SWC 97	1816.0	Middle N.asperus (2)	Tricolpites arcilineatus	Very rare ms. sp. (Partridge).
SWC 97	1816.0	Middle N.asperus (2)	Intratriporopollenites notabilis	Appears to extend range of sp. into Middle N.asperus Zone - Specimen 32 u in diameter..
SWC 103	1820.0	Lower N.asperus (1)	Crassiretitriletes vanraadshoovenii	Rarely recorded in Middle Eocene.
SWC 103	1820.0	Lower N.asperus (1)	Proteacidites unicus	Rare ms. sp. (Harris).
SWC 103	1820.0	Lower N.asperus (1)	Dryptopollenites semilunatus	V. rare sp.
SWC 91	1827.9	Lower N.asperus (2)	Cunoniaceae (tricoporate)	Modern taxon.
SWC 91	1827.9	Lower N.asperus (2)	Dodonaea	Modern taxon.

TABLE 2

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

SAMPLE NO.	DEPTH(m)	ZONE	TAXON	COMMENTS
Core 3	1838.9	Lower N.asperus (0)	Dryptopollenites semilunatus	Rarely recorded in Middle Eocene.
Core 3	1838.9	Lower N.asperus (0)	Lidiacidites sp.	Echinate, aff. Astelia.
Core 3	1838.9	Lower N.asperus (0)	Tricolporites confragosus	Rare ms. sp. (Macphail).
SWC 75	1914.4	Lower N.asperus (1)	Tricolpites reticulatus	Rare ms. sp. (Cookson).
SWC 75	1914.4	Lower N.asperus (1)	Tricolpites reticulatus	Rare ms. sp. (Stover & Evans).
SWC 65	1981.0	Upper M.diversus (2)	Proteacidites lapis	abundant in H.harrisii coal palynoflora.
SWC 40	2068.4	Upper M.diversus (1)	Schizaea digitatoides	Unusually abundant occurrence of rare sp.
SWC 40	2068.4	Upper M.diversus (1)	Schizocolpus rarus	Rare sp.
SWC 38	2081.7	Middle M.diversus (2)	Proteacidites recavus	Not recorded before Lower N.asperus Zone (coal palynoflora).
SWC 38	2081.7	Middle M.diversus (2)	Periporopollenites vesicus	Not recorded before Lower N.asperus Zone (coal palynoflora).
SWC 37	2092.0	Lower (?) M.diversus	Haloragacidites verrucatoharrisii	Rare ms. sp. (Macphail).
SWC 60	2227.1	Lower M.diversus (2)	Polycolpites esobalteus	Rare below Middle M.diversus Zone.
SWC 60	2227.1	Lower M.diversus (2)	Gambierina rudata	Rarely reworked into non-marine M.diversus sediments.
SWC 59	2270.0	Lower M.diversus (0)	Kuylisporites waterbolkii	Rare below Middle M.diversus Zone (marine sample).
SWC 57	2322.0	Upper L.balmei (2)	Jaxtacolpus pieratus	Lower L.balmei/Upper T.longus Zone indicator sp.
SWC 57	2322.0	Upper L.balmei (2)	Tricolpites gigantis	Ms. sp. (Macphail).
SWC 31	2445.0	Upper L.balmei (2)	Example of rare simultaneous occurrence of V.kopukuensis and T.verrucosus.	
SWC 31	2445.0	Upper L.balmei (2)	Ilexpollenites anguloclavatus	Eocene sp.
SWC 23	2650.0	Lower L.balmei (2)	Proteacidites grandis	V. rare below Upper L.balmei Zone.
SWC 8	2881.3	Lower L.balmei (2)	Proteacidites gemmatus	Rare above T.longus Zone.
SWC 1	2995.0	Upper T.longus (1)	Proteacidites cf. grandis	V. rare occurrence of this morphotype.