APPENDIX

PALYNOLOGICAL ANALYSIS, WIRRAH-2

GIPPSLAND BASIN

by

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INTRODUCTION

Eighty (80) sidewall cores, four (4) conventional cores and one cuttings samples were processed and examined for spore-pollen and dinoflagellates. Recovery and preservation was often poor to very poor particularly for samples older than Middle Eocene. This necessitated analysis of several slides per sample to obtain an age-determination.

Palynological zones and lithological facies divisions from the base of the Lakes Entrance Formation to the total depth of the well are given below. Occurrences of spore-pollen and dinoflagellate species are tabulated in the accompanying range charts. In order to facilitate future revisions of the Gippsland Basin Late Cretaceous-Tertiary Zonation, anomalous and unusual occurrences in this and subsequent wells will be listed at the end of the Biostratigraphy Section (see Table 2).

SUMMARY

UNIT/FACIES	ZONE	DEPTH (m)
Lakes Entrance Formation	*P. tuberculatus*	1463.7
	Unsampled interval	
Gurnard Formation?	Middle *N. asperus*	1513.5
Latrobe Group Coarse clastics	Middle *N. asperus*	1515.5 - 1534.5
	Lower *N. asperus*	1590.9 - 1647.4
	P. asperopolus	1694.6
	Upper *M. diversus*	1811.8 - 1828.8
	Middle *M. diversus*	1873.3
	Lower *M. diversus*	1923.0
	Upper *L. balmei*	1946.2 - 2206.8
	Lower *L. balmei*	2254.6 - 2424.9
	Upper *T. longus*	2512.6 - 2630.0
	T. lilliei	2648.9 - 2669.2
	C. triplex	2765.0 - 2838.0
	? Uppermost *A. distocarinatus*	2849.5 - 3067.0

GEOLOGICAL COMMENTS

1. The Wirrah-2 well contains a continuous sequence of sediments from at least the Late Cretaceous T. lilliei Zone to the Late Eocene Middle N. asperus Zone.

2. Because of massive caving, the interval between 1463.7 and 1513.5m was not sampled by sidewall coring and the base of the Lakes Entrance Formation cannot be picked from log characteristics. Foraminiferal data (Hannah 1983) demonstrate the sample at 1463.7m is Early Miocene in age.

3. The sidewall core at 1513.5m, below the caved interval, contains trace amounts of glauconite and has been provisionally picked as the base of the Gurnard Formation. This sample contains a rich upper Middle N. asperus Zone palynoflora. The Gurnard Formation in the Wirrah-1 well is wholly Middle N. asperus Zone in age (Macphail 1983) and a similar situation may be expected to exist in Wirrah-2. Unlike in Wirrah-1, marine sediments of Middle N. asperus Zone age occur below the picked base of the Gurnard Formation.

4. Abundance of dinoflagellates decreases below 1515.5m with the lowest records being found approximately 19m into the Latrobe Group coarse clastics at 1532.4m. This sample is 1m above an exceptionally rich upper Middle N. asperus Zone palynoflora lacking in dinoflagellates (1533.3m). As in Wirrah-1, sediments of Lower N. asperus Zone age were deposited in a fluvial deltaic environment. The highest occurrence of a coal is at 1555m.

5. Only one sample (1694.6m) contained a reliable P. asperopolus Zone palynoflora. This is in contrast with Wirrah-1 (Macphail 1983 ibid) where sediments of P. asperopolus Zone age were exceptionally thick (144m). Thick masses of M. diversus Zone sediments are approximately the same in both wells (118m and 110m respectively). Accordingly, much of the undated section between 1694.6 to 1811.8m may be P. asperopolus Zone in age. Palynomorphs at 1710.6m are swollen, indicating prolonged contact with liquid hydrocarbons and therefore probably differential destruction of less robust species. None of the species recorded in this sample range no higher than the Upper M. diversus Zone.

6. Thicknesses of Paleocene (L. balmei Zone) sediment in Wirrah-2 are greater than in Wirrah-1 (Macphail 1983 ibid) irrespective of whether the lower boundary of the Lower L. balmei Zone is placed at 2424.9m or 2472.4m (see Biostratigraphy Section). The reverse situation occurs in the Late

Cretaceous sections. Here sediments of T. longus and T. lilliei Zone ages are markedly thinner in Wirrah-2 than in Wirrah-1 (117m vs. 370m, 20m vs. 208m respectively). The phenomenon is still apparent if the undated intervals between the T. longus, T. lilliei and C. triplex Zones in Wirrah-2 are assigned T. longus and T. lilliei Zone ages respectively. Unlike Wirrah-1 (2705.0 - 2752.5m), sediments of Lower T. longus Zone age cannot be recognised in Wirrah-2.

7. Sediments of T. pachyexinus and N. senectus Zone ages could not be recognised in the essentially barren interval between 2669.2 and 2765.0m. The former zone has not been recorded to date in the Gippsland Basin and, unlike in the Otway Basin, may not be separable via spore-pollen from the underlying C. triplex Zone. This is not the case with the N. senectus Zone.

8. Thinning of the Late Cretaceous sediments between Wirrah-1 and Wirrah-2 and absence of sediments older than T. lilliei Zone age in Wirrah-1 suggests that the Wirrah-2 well may lie close to a structural high of pre-Campanian age. Because of relatively poor spore-pollen recovery in the Late Cretaceous section in Wirrah-2, it is not possible to say whether deposition has been continuous but slow since the A. distocarinatus Zone (resulting in a condensed N. senectus to Upper T. longus Zone sequence) or whether periods of erosion and non-deposition have occured.

9. The well bottomed in sediments of possible uppermost A. distocarinatus Zone age.

BIOSTRATIGRAPHY

The zone boundaries have been established using the criteria of Dettman & Playford (1969), Stover & Evans (1973), Stover & Partridge (1973) and subsequent revisions. It is noted that published ranges for pre-Maastrichtian Late Cretaceous species are unreliable and the present zonation is in urgent need of revision. Unusual or anomalous occurrences of spore-pollen taxa are ennumerated in Table 2.

? Uppermost Appendicisporites distocarinatus Zone 2927.7 - 3067.0m.
Samples within this interval are characterised by Pilosisporites notensis, a species which is not known to range higher than the A. distocarinatus Zone but which is occasionally found reworked into younger sediments, and Phyllocladidites mawsonii, a species which is not known below the C. triplex Zone. Because of the consistency with which P. mawsonii occurs throughout the

interval it is unlikely to have been caved. Because of relatively poor biostratigraphic information concerning Albian to Santonian palynofloras, the interval is provisionally identified as Uppermost A. distocarinatus Zone in age but may well be C. triplex Zone in age. The zone species Appendicisporites distocarinatus was not recorded, but the absence of angiosperm pollen indicates the interval is unlikely to be younger than C. triplex Zone in age. Otherwise the palynofloras in this and the overlying interval provisionally identified as C. triplex Zone in age consisted of widely ranging Cretaceous species and reworked Paleozoic/Mesozoic species only.

C. triplex Zone 2838.0 - 2765.0m.

The lower boundary of the zone is provisionally placed at 2838.0m, based on the first occurrence of angiosperm pollen (an undescribed Proteacidites sp.) in an assemblage lacking distinctive species restricted to the A. distocarinatus or earlier Zones. Phyllocladidites mawsonii is recorded at 2810.4m and, in association with Amosopollis cruciformis, at 2808.96m. The top of the zone is provisionally placed at 2765.0m, based on the highest occurrence of Amosopollis cruciformis in an assemblage otherwise dominated by long-ranging Late Cretaceous spores and gymnosperm pollen. The adjoining sample, at 2716.9m contains a mixed Paleocene/Late Cretaceous palynoflora including Proteacidites grandis, Haloragacidites harrisii and Proteacidites gemmatus. The zone indicator species, Clavifera triplex was not recorded.

T. lilliei Zone 2669.2 - 2648.9m.

As with the deeper samples within the Late Cretaceous sediments, samples assigned a T. lilliei Zone age are characterised by poorly preserved palynofloras dominated by long-ranging Cretaceous spores and gymnosperm pollen. The base of the zone is placed at 2669.2m, the first occurrence of Gambierina edwardsii, a species which ranges no lower than the T. lilliei Zone. This sample contains abundant Proteacidites and Latrobosporites amplus, a species which first appears in the T. pachyexinus Zone in the Otway Basin. Proteacidites reticuloconcavus, Triporopollenites sectilis occur with frequent Gambierina rudata and Lygistepollenites balmei at 2661.0m, showing the sample is no younger than T. longus Zone in age. The top of the zone is placed at 2648.9m, based on Tricolporites lilliei and Proteacidites reticuloconcavus in an assemblage lacking species restricted to T. longus Zone age or younger sediment.

Upper T. longus Zone 2630.0 - 2512.6m.

The base of the zone is defined by the first appearances of Tricolpites longus and Proteacidites gemmatus in a sparse palynoflora of low diversity at 2630.0m. Stereisporites (Tripunctisporis) punctatus occurs at 2587.2m. This sample is overlain by 75m of essentially barren sandstones and claystones. The top of the zone, at 2512.5m is defined by highest occurrence of the Late Cretaceous species Proteacidites otwayensis in an assemblage containing other relatively large diameter but undescribed Proteacidites species.

Lower L. balmei Zone 2424.9 - 2254.6m.

As with the Late Cretaceous section in Wirrah-2, the Paleocene section comprises essentially barren sediments in which well-preserved or diverse palynofloras are rare. The lower boundary is defined by the first occurrence of frequent Lygistepollenites balmei and Proteacidites gemmatus in an assemblage lacking other distinctive or large Proteacidites spp. (2424.9m). The sample at 2472.4m contains rare L. balmei, P. gemmatus and Stereisporites regium and may be either Lower L. balmei or Upper T. longus Zone in age. Tetracolporites verrucosus, which is also recorded in the Lower L. balmei Zone, occurs at 2373.0m, 2259.4m and, in association with abundant Australepollis obscurus, at 2254.6m.

Upper L. balmei Zone 2206.8 - 1946.2m.

The lower boundary of the zone is defined by the first appearance of Verrucosisporites kopukuensis at 2206.8m. This species in association with common to abundant Lygistepollenites balmei occurs throughout the section up to 2119.0m. Other general L. balmei Zone markers are first recorded in this zone, including Polycolpites langstonii, Tetracolporites multistrixus, Peromonolites densus and common Periporopollenites polyoratus. Gambierina rudata is last recorded at 2160.5m. The top of the zone is provisionally placed at 1946.2m, based on the highest appearance of Lygistepollenites balmei. There is some uncertainty about this age-determination since the sample contains frequent Ischyosporites irregularis, a species which normally first appears in the Lower M. diversus Zone. An alternative upper boundary for the Upper L. balmei Zone is 2119.0m.

Lower M. diversus Zone 1923.0m.

One sample, at 1923.0m, is assigned to this zone, based on the occurrence of Ischyosporites irregularis with other species which first occur in this Lower M. diversus Zone, eg. Ilexpollenites anguloclavatus and Polycolpites esobalteus. Parvisaccites catastus and Basopollis otwayensis occur in the sample.

Middle M. diversus Zone 1873.3m.

The simultaneous first appearance of Intratriporopollenites notabilis, Proteacidites tuberculiformis, P. xestoformis, P. kopiensis, Polypodiaceosporites varus and Beaupreadites verrucosus in an assemblage lacking dinoflagellates, indicates the sample at 1873.3m is no older than Middle M. diversus. Species first appearing in the Upper M. diversus Zone, eg. Myrtaceidites tenuis, Proteacidites pachypolus, P. crassus and Foveotriletes balteus, are absent and the sample is unlikely to be younger than Middle M. diversus.

Upper M. diversus Zone 1811.8 - 1828.8m.

Two samples are assigned to this zone. The lowermost, at 1828.8m contains the first occurrences of Myrtaceidites tenuis, Proteacidites tuberculotumulatus and Foveotriletes balteus as well as taxa that first occur in the Middle M. diversus Zone eg. Anacolosidites acutullus and Proteacidites ornatus. The upper samples, at 1811.8m mostly lacks species characteristic of the Upper M. diversus but is assigned to this unit on the basis of its closer similarity to M. diversus than P. asperopolus Zone palynofloras.

P. asperopolus Zone 1694.6m.

One sample only, at 1694.6m is identified as P. asperopolus Zone in age, based on the first occurrences of Proteacidites pachypolus (frequent in the sample) and P. latrobensis in a Proteacidites - dominated assemblage (38%). The sample contains 26% Nothofagidites pollen which is high for P. asperopolus Zone sediments but well below values recorded in the adjoining sample. Geological considerations indicate the sample at 1710.6m is also P. asperopolus Zone in age (see Geological Comments).

Lower N. asperus Zone 1647.4 - 1590.9m.

The zone is distinguished by common to abundant Nothofagidites together with Proteacidites asperopolus, a species which first appears in the P. asperopolus Zone. The lower boundary of the zone is placed at 1647.4m, based on 39% Nothofagidites and common Proteacidites asperopolus. The upper boundary, at 1590.9m, is defined by the last appearance of P. asperopolus. Tricolpites simatus and Nothofagidites falcatus, which first appear in the Lower N. asperus Zone, occur in this sample. The sample at 1577.2m contains N. falcatus and Proteacidites scitus and is therefore no older than Lower N. asperus Zone in age.

Middle N. asperus Zone 1534.5 - 1513.5m.

The base of the zone is defined by frequent Proteacidites pachypolus in a species rich Nothofagidites - dominant assemblage which lacks Proteacidites asperopolus. The presence of Polycolpites esobalteus, Banksieaeidites elongatus and Tricolpites thomasii shows the sample is no younger than Middle N. asperus Zone in age. The sample also contains the rare species Verrucatosporites attinatus, Ilexpollenites cf. megagemmatus, Cranwellia notodemus and C. costata. The latter two species strongly indicate the sample is upper Middle N. asperus Zone in age. A similar age is demonstrated by occurrences of Proteacidites tuberculatus at 1521.3m and Tricolporites retequetrus at 1533.5, 1521.3 and 1513.5m. Anacolosidites sectus which is restricted to the Middle N. asperus Zone occurs at 1518.5m. The sample at 1513.5m, representing the upper boundary of the zone, contains the zone indicator species, Triorites magnificus. Also present are a large number of species which range no higher than, or are rare above, the Middle N. asperus Zone, eg. Proteacidites pachypolus, P. crassus, P. incurvatus, Santalumidites cainozoicus, Tricolpites thomasii and Beaupreadites trigonalis.

Dinoflagellates are first recorded at 1532.4m but only become common above 1518.9m. This sample and those at 1518.5m and 1513.5m contain frequent to common Vozzhenikova extensis and (1513.5m) Corrudinium corrugatum.

P. tuberculatus Zone 1463.5m.

The occurrence of Cyatheacidites annulatus at 1463.5m confirms a P. tuberculatus Zone age for this level. Dacrycarpidites australiensis is unusually abundant in the sample.

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TABLE - 1 SUMMARY OF PALYNOLOGICAL ANALYSIS, WIRRAH-2, GIPPSLAND BASIN.

INTERPRETATIVE DATA

SAMPLE NO.	DEPTH (m)	YIELD	DIVERSITY SPORE-POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
114	1463.7	High	Good	Mdst., calc.	P. tuberculatus	Early Miocene	0	C. annulatus
113	1513.5	V. High	Excellent	Ss., tr. glau.	Middle N. asperus	Late Eocene	0	T.magnificus, T.thomasii, V.extensa, C. corrugatum.
112	1515.5	Low	Poor	Ss.	Middle N. asperus	Late Eocene	1	V.extensa, B.verrucosus.
111	1518.9	High	Fair	Ss.	Middle N. asperus	Late Eocene	0	A.sectus, common V.extensa.
110	1521.3	Low	Fair	Ss.	Middle N. asperus	Late Eocene	0	P.tuberculatus, T.retequetrus, P.unicus, C.subtilis, V.extensa.
109	1522.3	V. Low	Poor	Ss.	N. asperus	Eocene	-	
108	1524.4	V. Low	Poor	Ss.	Middle N. asperus	Late Eocene	1	P.pachypolus, abundant Nothofagidites.
107	1530.0	Negligible	Spore pollen	Ss.	Indeterminate	-	-	
106	1532.4	V. Low	Poor	Ss.	N. asperus	Eocene	-	Lowest records of dinoflagellates.
105	1533.5	High	Good	Ss.	Upper Middle N. asperus	Late Eocene	0	T.retequetrus, P.pachypolus, B.verrucosus.
104	1534.5	V. High	Excellent	Ss.	Upper Middle N. asperus	Late Eocene	0	Frequent P.pachypolus, C.costata, C.notodemus, V.attinatus.
103	1548.8	Barren	-	Ss.	-		-	
102	1577.2	V. Low	Poor	Ss.	N. asperus	Eocene	-	C.glarius, P.scitus, D.cf.dilwynensis.
101	1590.9	High	Good	Ss.	Lower N. asperus	Middle Eocene	1	P.asperopolus, T.simatus, T.leuros.
100	1598.5	High	Fair	Ss.	Lower N. asperus	Middle Eocene	1	P.asperopolus, abundant Nothofagidites.
99	1630.7	Moderate	Good	Ss.	Lower N. asperus	Middle Eocene	2	Abundant Nothofagidites.
98	1647.4	V. High	Good	Ss.	Lower N. asperus	Middle Eocene	1	39% Nothofagidites, common P.asperopolus and P.pachypolus.

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SAMPLE NO.	DEPTH (m)	YIELD	DIVERSITY SPORE-POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
97	1694.6	High	Fair	Ss.	P. asperopolus	Middle Eocene	2	26% Nothofagidites, 38% Proteacidites, P.pachypolus frequent.
96	1710.6	Low	Fair	Ss.	Indeterminate	Early Eocene	2	M.diversus, hydrocarbon - affected.
95	1761.9	Barren	-	Ss.	-	-	-	
93	1811.8	Moderate	Fair	Ss.	Upper M. diversus	Early Eocene	2	F.balteus, P.ornatus, P.xestoformis.
92	1828.8	High	Good	Ss.	Upper M. diversus	Early Eocene	1	F.balteus, M.tenuis, P.tuberculo-tumulatus, frequent M.diversus.
91	1873.3	High	Excellent	Ss.	Middle M.diversus	Early Eocene	1	P.varus, B.verrucosus, P.xestoformis, P.tuberculiformis.
90	1901.0	Barren	-	Ss.	-	-	-	
89	1923.0	High	Good	Ss.	Lower M.diversus	Early Eocene	2	I.anguloclavatus, I.irregularis, P.esobalteus, P.catastus.
88	1946.2	V. High	Fair	Sist.	Upper L. balmei	Paleocene	2	L.balmei, V.kopukuensis.
87	1984.1	Barren	-	Ss.	-	-	-	
86	2023.3	Negligible Spore pollen		Ss.	Indeterminate	-	-	
85	2052.0	Barren	-	Sistst.	-	-	-	
83	2119.0	Moderate	Low	Mdst.	L. balmei	Paleocene	-	Abundant L.balmei.
82	2146.2	Good	Fair	Mdst.	L. balmei	Paleocene	-	Abundant L.balmei.
153	2160.1	High	Good	Ss., coaly	Upper L. balmei	Paleocene	1	Common L.balmei, V.kopukuensis.
151	2180.0	High	Fair	Ss.	Upper L. balmei	Paleocene	1	Abundant L.balmei, V.kopukuensis.
149	2199.5	V. Good	Fair	Ss.	Upper L. balmei	Paleocene	2	Abundant L.balmei.
148	2206.8	V. High	Low	Sist.	Upper L. balmei	Paleocene	1	Abundant L.balmei, V.kopukuensis.

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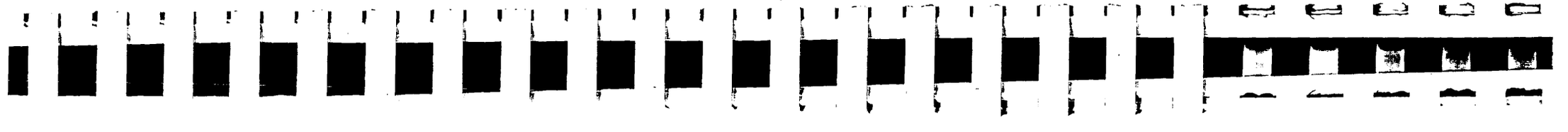
SAMPLE NO.	DEPTH (m)	YIELD	DIVERSITY SPORE-POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
147	2221.1	Negligible	Spore pollen	Slst.	Indeterminate	-	-	
Core	2254.6	Moderate	Fair	-	Lower L. balmei	Paleocene	1	T.verrucosus, abundant A.obscurus.
Core	2258.98	Barren	-	-	-	-	-	
143	2259.4	High	Fair	Ss.	Lower L. balmei	Paleocene	1	L.balmei, T.verrucosus, A.obscurus.
142	2263.0	Barren	-	Ss.	-	-	-	
140	2274.3	Barren	-	Slst.	-	-	-	
139	2275.0	Barren	-	Slst.	-	-	-	
138	2281.0	Barren	-	Clyst.	-	-	-	
137	2284.0	Moderate	Fair	Slst.	Indeterminate	-	-	Reworked Middle Cretaceous spore-pollen.
136	2290.9	Barren	-	Mdst.	-	-	-	
135	2295.9	Low	V. Poor	Ss.	L. balmei	-	-	L.balmei, abundant Proteacidites.
134	2301.2	Barren	-	Mdst.	-	-	-	
133	2306.2	Barren	-	Mdst.	-	-	-	
81	2312.1	Barren	-	Mdst.	-	-	-	
79	2337.0	Barren	-	Ss.	-	-	-	
78	2349.6	V. Low	Low	Ss.	Indeterminate	-	-	B.otwayensis.
77	2373.0	Moderate	High	Mdst.	Lower L. balmei	Paleocene	1	Frequent L. balmei, T. verrucosus
75	2422.9	Barren	-	Ss.	-	-	-	
74	2424.9	High	Fair	Ss.	Lower L. balmei	Paleocene	1	Frequent L. balmei, P. gemmatus, S. punctatus
73	2447.0	Barren	-	Mdst.	-	-	-	



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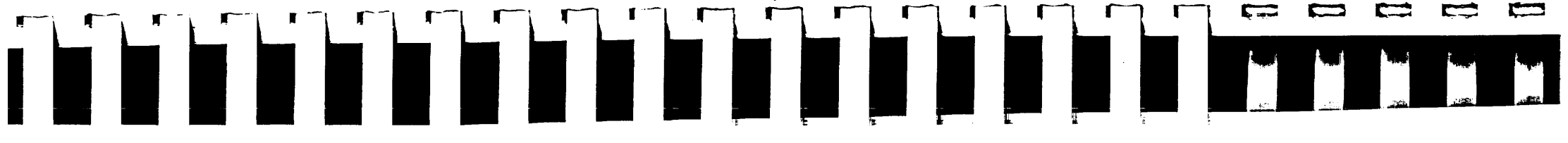
SAMPLE NO.	DEPTH (m)	YIELD	DIVERSITY SPORE-POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
72	2472.2	Moderate	Fair	Ss.	Lower L. balmei/ Upper T. longus		-	P. gemmatus, S. regium, L. balmei
71	2512.6	Moderate	Low	Ss.	Upper T. longus	Maastrichtian	2	S. punctatus, P. otwayensis, L. balmei, S. regium
69	2540.8	Barren	-	Ss	-		-	
68	2545.3	Barren	-	Ss	-		-	
67	2583.4	Barren	-	Clyst.	-		-	
66	2587.2	Low	V. low	Mdst./Ss	Upper T. longus	Maastrictian	2	S. punctatus, G. rudata
64	2630.0	Low	V. low	Slst/Mdst	Upper T. longus	Maastrictian	1	P. gemmatus, T. longus, G. rudata
63	2648.9	Moderate	Fair	Mdst.	T. lilliei	Late Cretaceous	2	T. lilliei, P. reticuloconcavus
62	2661.0	Low	Good	Ss.	T. lilliei	Late Cretaceous	2	G. rudata, P. reticuloconcavus, L. balmei
60	2669.2	Low	Fair	Mdst	T. lilliei	Late Cretaceous	2	G. edwardsii, Late Cretaceous spores
57	2716.9	Moderate	Good	Mdst.	Indeterminate	-	-	Mixed Paleocene & Late Cretaceous palynoflora
52	2773.4	Low	Low	Mdst.	Indeterminate	-	-	Early Upper Cretaceous spores only
30	2792.6	Moderate	Fair	Ss	C. triplex	Late Cretaceous	2	Proteacidites sp., F. assymetricus
Core	2808.96	Low	Good	-	C. triplex	Late Cretaceous	1	P. mawsonii, A. cruciformis, angiosperm pollen absent
Core	2810.41	Moderate	Fair	-	C. triplex	Late Cretaceous	2	P. mawsonii
25	2830.0	Barren	-	Ss	-	-	-	-
24	2838.0	V. low	Low	Ss; carb	C. triplex	Late Cretaceous	2	Proteacidites sp



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INTERPRETATIVE DATA

SAMPLE NO.	DEPTH (m)	YIELD	DIVERSITY SPORE-POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
20	2849.5	Moderate	Low	Ss./Mdst.	No older than uppermost *A. distocarinatus*	Late Cretaceous	2	*P. notensis*, *P. mawsonii*
14	2891.0	V. low	V. low	Ss.	Indeterminate	-	2	*K. scaberis*, *C. equalis*
12	2905.0	Moderate	Good	Ss./Mdst.	Indeterminate	-	-	*C. australiensis*, *C. ludbrookii*
9	2972.7	Good	Fair	Mdst	No older than uppermost *A. distocarinatus*	Late Cretaceous	-	*P. mawsonii*, *F. assymmetricus*
53	2765.0	V. low	V. low	Mdst	*C. triplex*	Late Cretaceous	2	*A. cruciformis*
8	2985-90	Moderate	Fair	Ss./Mdst.	No older than uppermost *A. distocarinatus*	Late Cretaceous	3	*P. mawsonii*, *C. hughesii*, Late Cretaceous spores & gymnosperm pollen
7	3022.3	Good	Good	Mdst.	No older than uppermost *A. distocarinatus*	Late Cretaceous	2	*P. mawsonii*, *P. notensis* *C. ludbrookii*
6	3034.6	Low	Low	Mdst.	Indeterminate	-	-	Non-diagnostic Late Cretaceous spores & gymnosperm pollen only
4	3049.6	Barren	-	Mdst.	-	-	-	
1	3067.0	Moderate	Fair	Sltst.	No older than uppermost *A. distocarinatus*	Late Cretaceous	2	*P. mawsonii*, *Proteacidites* sp

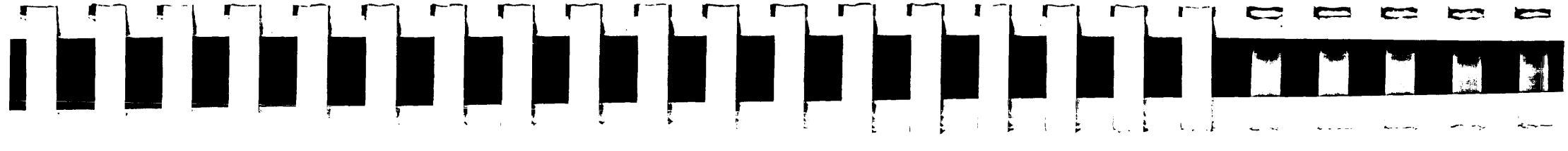


TABLE 2

ANOMALOUS AND UNUSUAL OCCURRENCES OF SPORE-POLLEN TAXA IN WIRRAH-2

SAMPLE NO.	DEPTH (METRES)	ZONE	TAXON	COMMENTS
SWC 114	1463.7	P. tuberculatus	Rugulatisporites trophus	Although R. trophus extends into the P. tuberculatus Zone, it is not known above the early Oligocene. Foram data indicate the sample is early Miocene.
SWC 114	1463.7	P. tuberculatus	Gleichenlidites magnus	Rare species described by Stough (1969)
SWC 114	1463.7	P. tuberculatus	Proteacidites cf P. cumulus	P. cumulus not recorded outside W.A.
SWC 113	1513.5	Middle N. asperus	Gyrostemanaceae	
SWC 111	1518.9	Middle N. asperus	? Dododaea	Pore lalongate not circular. Possibly Umbelliferae
SWC 110	1521.3	Middle N. asperus	Cyathidites subtilis	Rare below P. tuberculatus Zone
SWC 110	1521.3	Middle N. asperus	Proteacidites unicus	Ms species (Harris)
SWC 110	1521.3	Middle N. asperus	Proteacidites truncatus	Rare below P. tuberculatus Zone
SWC 105	1533.5	Middle N. asperus	Tricolporites retequetrus	Tetrad with individual units of ca. 70m
SWC 104	1534.5	Middle N. asperus	Cranwellia notodemus, C. costata	Rare species not known outside Middle N. asperus Zone. C. costata is restricted to the Plio-Pleistocene in N.Z.
SWC 104	1534.5	Middle N. asperus	Tricolpites reticulatus (Cookson)	Possibly conspecific with Late Cretaceous species T.
SWC 104	1534.5	Middle N. asperus	Tricolporites aff T. geranlodes	New species with sculpturing analogous to Proteacidites confragosus
SWC 102	1577.2	Lower N. asperus?	Clavatipollenites glarius	Rare species homologous with modern N.Z. species Ascarina lucida. See Stover & Partridge 1982.
SWC 101	1590.9	Lower N. asperus	Proteacidites callosus (Cookson)	Very rare species. Second record in Gippsland wells
SWC 101	1590.9	Lower N. asperus	Triporopollenites apiculatus	Rare species (ms?)
SWC 98	1647.4	P. asperopolus	Astelia	Echinate monosulcate type analogous with Astelia (Liliaceae)

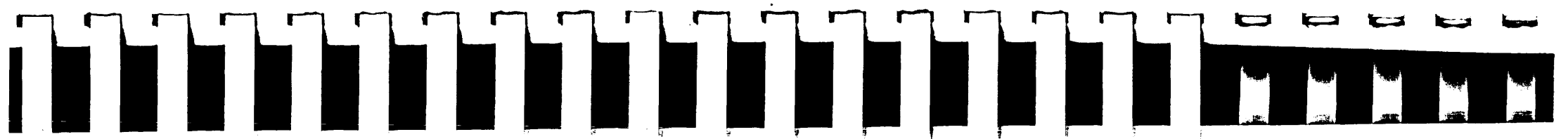


TABLE 2

ANOMALOUS AND UNUSUAL OCCURRENCES OF SPORE-POLLEN TAXA IN WIRRAH-2

SAMPLE NO.	DEPTH (METRES)	ZONE	TAXON	COMMENTS
SWC 98	1647.4	*P. asperopolus*	*Tricolporites* sp. nov.	Similar to prolate *T. retequetrus* but exine punctate - reticulate across pole. Differs from *Rhoipites pilatus* (N.Z.) in that widest diameter lumina are confined to equatorial not polar regions.
SWC 98	1647.4	*P. asperopolus*	*Tricolpites gigantis*	ms species (Macphail). Similar to "*T. enormus*", ms species (Mulholland & Evans 1970)
SWC 93	1811.8	Upper *M. diversus*	*Cicatricosisporites australiensis* (frequent)	Late Cretaceous species
SWC 92	1828.8	Upper *M. diversus*	*Tricolpites circumlumenus* (sp.nov)	Ms sp. (Macphail). Reticulate, lumina circular to elliptical; name derived from *Lycopodiumsporites circumlumenus*.
SWC 92	1828.8	Upper *M. diversus*	*Proteacidites reticulatus*	Very rare below *P. tuberculatus* Zone
SWC 91	1873.3	Middle *M. diversus*	*Proteacidites santius*	Ms sp. (Mulholland & Evans 1970)
SWC 91	1873.3	Middle *M. diversus*	*Tetracolporites multistrixus*	Paleocene species extending very rarely into Lower *M. diversus* Zone
SWC 91	1873.3	Middle *M. diversus*	*Tricolpites reticulatus/waiparensis*	Conforms with Late Cretaceous morphotype of *T. waiparensis*
SWC 89	1923.0	Lower *M. diversus*	*Basopollis otwayensis*	Palaeocene species
SWC 89	1923.0	Lower *M. diversus*	*Tricolporites adelaidensis*	Uncommon below Middle *M. diversus* Zone
SWC 88	1946.2	Upper *L. balmei*	*Ischyosporites irregularis*	Not recorded below Lower *M. diversus* Zone
SWC 88	1946.2	Upper *L. balmei*	*Tricolporites moultonii*	Not recorded below Lower *M. diversus* Zone (Middle *M. diversus* Zone in Bass Basin)

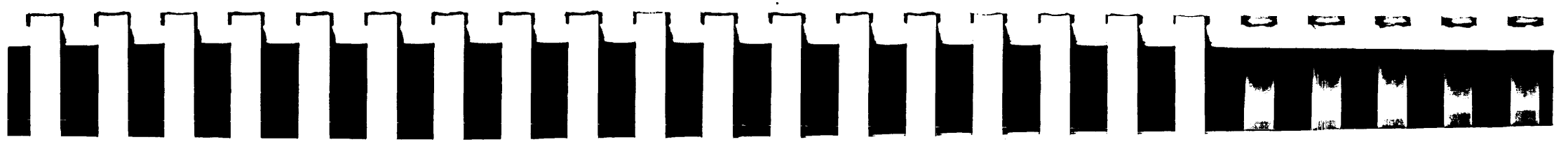
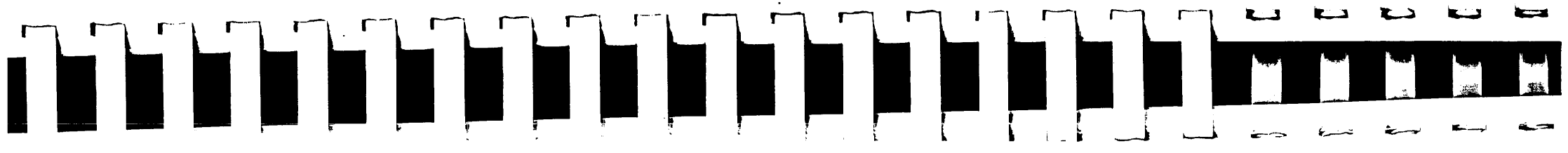


TABLE 2

ANOMALOUS AND UNUSUAL OCCURRENCES OF SPORE-POLLEN TAXA IN WIRRAH-2

SAMPLE NO.	DEPTH (METRES)	ZONE	TAXON	COMMENTS
SWC 82	2146.2	Upper *L. balmei*	*Tricolporites* cf *adelaidensis*	See above (SWC 89)
SWC 153	2160.5	Upper *L. balmei*	*Banksieacidites arcuatus*	Not recorded below upper Lower *M. diversus* Zone
SWC 153	2160.5	Upper *L. balmei*	*Polycolpites* cf *langstonii*	Markedly small var. of *P. langstonii*
SWC 151	2180.0	Upper *L. balmei*	*Tricolpites* cf *T. gigantis*	See above (SWC 98)
Core	2254.6m	Lower *L. balmei*	*Tricolpites reticulatus* (Stover & Evans	In *Australopollis obscurus* dominated palynoflora
SWC 77	2373.0	Lower *L. balmei*	*Proteacidites otwayensis*	Not previously recorded in post Late Cretaceous sediment
SWC 74	2425.0	Lower *L. balmei*	*Camarozonosporites bullatus*	Rare species
SWC 74	2425.0	Lower *L. balmei*	*Proteacidites gemmatus*	Specimen with tuberculate sculpturing



BASIC DATA

Table 3 - Palynological Data

Range Chart - Dinoflagellates ✓

Range Chart - Spore pollen ? where

TABLE - 3 SUMMARY OF PALYNOLOGICAL ANALYSIS, WIRRAH-2, GIPPSLAND BASIN.

BASIC DATA

SAMPLE NO.	DEPTH (m)	YIELD	DIVERSITY SPORE-POLLEN	LITHOLOGY
114	1463.7	High	Good	Mdst., calc.
113	1513.5	V. High	Excellent	Ss., tr. glau.
112	1515.5	Low	Poor	Ss.
111	1518.9	High	Fair	Ss.
110	1521.3	Low	Fair	Ss.
109	1522.3	V. Low	Poor	Ss.
108	1524.4	V. Low	Poor	Ss.
107	1530.0	Negligible Spore pollen		Ss.
106	1532.4	V. Low	Poor	Ss.
105	1533.5	High	Good	Ss.
104	1534.5	V. High	Excellent	Ss.
103	1548.8	Barren	-	Ss.
102	1577.2	V. Low	Poor	Ss.
101	1590.9	High	Good	Ss.
100	1598.5	High	Fair	Ss.
99	1630.7	Moderate	Good	Ss.
98	1647.4	V. High	Good	Ss.
97	1694.6	High	Fair	Ss.
96	1710.6	Low	Fair	Ss.
95	1761.9	Barren	-	Ss.
93	1811.8	Moderate	Fair	Ss.
92	1828.8	High	Good	Ss.
91	1873.3	High	Excellent	Ss.
90	1901.0	Barren	-	Ss.
89	1923.0	High	Good	Ss.
88	1946.2	V. High	Fair	Slst.
87	1984.1	Barren	-	Ss.
86	2023.3	Negligible Spore pollen		Ss.
85	2052.0	Barren	-	Slstst.
83	2119.0	Moderate	Low	Mdst.
82	2146.2	Good	Fair	Mdst.

TABLE - 3 SUMMARY OF PALYNOLOGICAL ANALYSIS, WIRRAH-2, GIPPSLAND BASIN.

BASIC DATA

SAMPLE NO.	DEPTH (m)	YIELD	DIVERSITY SPORE-POLLEN	LITHOLOGY
153	2160.1	High	Good	Ss., coaly
151	2180.0	High	Fair	Ss.
149	2199.5	V. Good	Fair	Ss.
148	2206.8	V. High	Low	Slst.
147	2221.1	Negligible Spore pollen		Slst.
Core	2254.6	Moderate	Fair	-
Core	2258.98	Barren	-	-
143	2259.4	High	Fair	Ss.
142	2263.0	Barren	-	Ss.
140	2274.3	Barren	-	Slst.
139	2275.0	Barren	-	Slst.
138	2281.0	Barren	-	Clyst.
137	2284.0	Moderate	Fair	Slst.
136	2290.9	Barren	-	Mdst.
135	2295.9	Low	V. Poor	Ss.
134	2301.2	Barren	-	Mdst.
133	2306.2	Barren	-	Mdst.
81	2312.1	Barren	-	Mdst.
79	2337.0	Barren	-	Ss.
78	2349.6	V. Low	Low	Ss.
77	2373.0	Moderate	High	Mdst.
75	2422.9	Barren	-	Ss.
74	2424.9	High	Fair	Ss.
73	2447.0	Barren	-	Mdst.
72	2472.2	Moderate	Fair	Ss.
71	2512.6	Moderate	Low	Ss.
69	2540.8	Barren	-	Ss
68	2545.3	Barren	-	Ss
67	2583.4	Barren	-	Clyst.
66	2587.2	Low	V. low	Mdst./Ss
64	2630.0	Low	V. low	Slst/Mdst

TABLE - 3 SUMMARY OF PALYNOLOGICAL ANALYSIS, WIRRAH-2, GIPPSLAND BASIN.

BASIC DATA

SAMPLE NO.	DEPTH (m)	YIELD	DIVERSITY SPORE-POLLEN	LITHOLOGY
63	2648.9	Moderate	Fair	Mdst.
62	2661.0	Low	Good	Ss.
60	2669.2	Low	Fair	Mdst
57	2716.9	Moderate	Good	Mdst.
52	2773.4	Low	Low	Mdst.
30	2792.6	Moderate	Fair	Ss.
Core	2808.96	Low	Good	-
Core	2810.41	Moderate	Fair	-
25	2830.0	Barren	-	Ss
24	2838.0	V. low	Low	Ss; carb
20	2849.5	Moderate	Low	Ss./Mdst.
14	2891.0	V. low	V. low	Ss.
12	2905.0	Moderate	Good	Ss./Mdst.
9	2972.7	Good	Fair	Mdst
53	2765.0	V. low	V. low	Mdst
8	2985-90	Moderate	Fair	Ss./Mdst.
7	3022.3	Good	Good	Mdst.
6	3034.6	Low	Low	Mdst.
4	3049.6	Barren	-	Mdst.
1	3067.0	Moderate	Fair	Sltst.

PALYNOLOGY DATA SHEET

BASIN: GIPPSLAND ELEVATION: KB: 21m GL: 37m

WELL NAME: WIRRAH-2 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*	1463.7	0				1463.7	0			
	Upper *N. asperus*										
	Mid *N. asperus*	1513.5	0				1534.5	0			
	Lower *N. asperus*	1590.9	1				1647.4	1			
	P. asperopolus	1694.6	2				1694.6	1			
	Upper *M. diversus*	1811.8	2	1828.8	1		1828.8	1			
	Mid *M. diversus*	1873.3	1				1873.3	1			
	Lower *M. diversus*	1923.0	2				1923.0	2			
	Upper *L. balmei*	1946.2	2	2119.0	1		2206.8	1			
	Lower *L. balmei*	2254.6	1				2424.9	1			
LATE CRETACEOUS	*T. longus*	2512.6	1				2630.0	1			
	T. lilliei	2648.9	2				2669.2	2			
	N. senectus										
	U. *T. pachyexinus*										
	L. *T. pachyexinus*										
	C. triplex	2765.0	2	2792.6	2		2838.0	2			
	A. distocarinatus	2849.5	2				3067.0	2			
EARLY CRET.	*C. paradoxus*										
	C. striatus										
	F. asymmetricus										
	F. wonthaggiensis										
	C. australiensis										
PRE-CRETACEOUS											

COMMENTS: Samples within the A. distocarinatus Zone are no older than Uppermost A. distocarinatus Zone and possibly C. triplex Zone in age.

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: 2 May, 1983.

DATA REVISED BY: DATE: