APPENDIX-1

PALYNOLOGICAL ANALYSIS OF ROUNDHEAD-1 GIPPSLAND BASIN.

by

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INTERPRETED DATA

INTRODUCTION

Fourty-one sidewall core samples were processed and examined for spores, pollen and microplankton. As part of this analysis thirty-two of the samples which gave sufficient yields of palynomorphs were also counted to determine the variation in percentages and ratios of the principal spore-pollen and microplankton species. Both oxidised organic yield and palynomorph concentration were mainly high in the non-marine coastal plain facies in the Late Cretaceous part of the Latrobe Group, but were quite variable in the overlying sandy marine section which is mostly Paleocene in age. Recorded spore-pollen diversity is moderate to high in 80% of the samples and is clearly inversely proportional to residue yield and palynomorph concentration. Dinoflagellates were recorded from 60% of the samples and their diversity ranged from low to high reflecting variation in marine influence. This is interpreted to relate directly to the influence of the sea-level cycles.

Lithological units and palynological zones, from base of Lakes Entrance Formation to T.D., are given in the following summary. Interpreted data with zone indentifications and confidence ratings are recorded in Table-1 and basic data on residue yields, preservation and diversity are recorded in Table-2. Palynomorph counts and percentages are recorded in Tables-3 and 4, while all species that can be identified with bimomial names are tabulated on the accompanying range chart.

GEOLOGICAL COMMENTS

1. The Latrobe Group penetrated in Roundhead-1 is readily separated into two distinct lithological units. These are a mainly non-marine coastal plain facies between 2845.5m to 3021.0m (T.D.) comprised predominantly of the finer grained lithologies such as coals and shales, and a marine facies dominated by sands which extends to the top of the Group. This environmental interpretation of the lithological subdivision is based on microplankton, mostly dinoflagellate cysts, which are present, and often abundant, in the majority of productive samples above 2845.5m and virtually absent in samples below that depth.

2. Roundhead-1 is one of the few wells in the Gippsland Basin which shows clear lithological evidence of marine influence in the "coarse clastics" or undifferentiated Latrobe Group. Glauconite is recorded in sidewall cores from three separate levels and these samples also yielded the highest microplankton abundances.

PALYNOLOGICAL SUMMARY OF ROUNDHEAD-1

AGE	UNIT/FACIES		SPORE-POLLEN ZONES	DEPTH (mKB)	DINOFLAGELLATE ZONES	DEPTH (mKB)
Oligocene		Lakes Entrance Fm.	*P. tuberculatus*	2373.0		
UNCONFORMITY		2376.5m				
Eocene?	L A T R O B E	Gurnard Fm.?	(Barren of fossils)			
UNCONFORMITY		2380.1m				
Early Eocene		Undifferentiated sands & shales	Lower *M. diversus*	2418.1		
UNCONFORMITY		2437.5m				
Palaeocene	G R O U P	Undifferentiated marine sands and shales	Upper *L. balmei*	2442.5-2445.8	*A. homomorphum*	2445.8
			Lower *L. balmei*	2484.0-2808.0	*E. crassitabulata* *T. evittii*	2509.1-2535.8 2801.5-2808.0
--K/T Boundary------		----2811.0m---------	----------	----------	----------	----------
Maastrichtian		Condensed sequence shale overlying shoreface sand	Upper *T. longus*	2812.0	*M. druggii*	2812.0
Sequence Boundary		2845.5m				
Maastrichtian		Coastal plain sands, shales and coals	Upper *T. longus*	2855.5-2952.0		
		T.D. 3021.0m				

These sidewall cores and their corresponding microplankton percentages are listed below:

SAMPLE	DEPTH	MICROPLANKTON %
SWC 54	2442.5m	28.2%
SWC 53	2445.8m	28.6%
SWC 46	2540.0m	8.5%
SWC 22	2789.0m	0.8%
SWC 21	2793.3m	3.7%
SWC 20	2801.5m	32.2%
SWC 19	2804.5m	16.1%
SWC 18	2808.0m	40.5%
SWC 17	2812.0m	63.7%

3. Glauconite is also present in the two highest sidewall cores in the Latrobe Group at 2378.5m and 2380.0m, which unfortunately were barren of palynomorphs. On lithology and stratigraphic position this section is correlated with the Gurnard Formation in the palynological summary even though an age for the interval could not be obtained from the palynological analysis.

4. Samples were counted in an attempt to use palynology to identify Condensed Sections as defined by Loutit *et al.* (1988). In addition it was hoped to identify High-stand, Low-stand and Transgressive System Tracts as well as the Condensed Sections by repetitive changes in the dinoflagellate and spore-pollen assemblage composition.

5. Based on high abundance and diversity of microplankton, mostly dinoflagellate cysts species three major condensed intervals and two minor or more diffuse condensed intervals are proposed at the following sample depths:

MAJOR CONDENSED INTERVALS

A. 2442.5-2445.8m with 28-29% microplankton.
B. 2535.8-2540.0m with 8-16% microplankton.
C. 2801.5-2812.0m with 16-64% microplankton.

MINOR CONDENSED INTERVALS

a. 2505.9-2515.2m with 3-5% microplankton.
b. 2678.0-2679.1m with 10-13% microplankton.

The major three are also the intervals in the Latrobe Group containing glauconite in hand specimen. This mineral and its close relatives are typical of Condensed Sections (Loutit *et al.*, 1988).

Note that the intervals quoted above are the depth limits of the sidewall cores with high microplankton abundances. It may be more correct to interpret the entire shale packages containing these samples as the Condensed Sections.

6. The spore-pollen spectra from the counts was more difficult to analyse and only a few general observations can be made. Firstly, the three major interpreted Condensed Sections can be characterised by high abundances of *Araucariacites australis* and *Dilwynites ganulatus/tuberculatus*. Their combined abundances ranged from 17% to 23.5%. In contrast the abundances of these species in all other samples counted ranged from <1% to 10%. It is noteworthy that the two intervals interpreted as minor Condensed Sections lacked a similar increase in these species. The second observation is that the samples from the coastal plains facies below 2845.5m can be characterised by "one off" abundances of species, as would be expected of the variable vegetational mosaic growing on the shifting micro-environments of a coastal plain (e.g. see discussion in Anderson & Muller, 1975). Some of the most conspicuous isolated abundance peaks are *Phyllocladidites mawsonii* (26% at 2936.5m), *Podosporites microsaccatus* (14.9% at 2936.5m), *Proteacidites reticuloconcavus* (1.1% at 2936.5m and 4.4% at 2891.0m), *P. clinei* ms (3.4% at 2929.0m) and *Tricolpites waiparaensis* (15% at 2900.5m). The high but variable abundance of *Gambierina* spp. through this interval is also a reflection of fluctuating microenvironments.

7. The abrupt change at 2845.5m from coastal plain environment to a massive sand of probable shoreface environment, which is in turn overlain by a marine shale at 2813.5m, is interpreted to represent the "downward shift" associated with the 67 Ma Sequence Boundary. This Sequence Boundary can be confidently correlated with the sequence charts of Haq *et al.*(1987, 1988) because it is the first possible sequence boundary in Roundhead-1 below the Ctetaceous/Tertiary (K/T) boundary which also lies within the Upper *T. longus* Zone.

8. The K/T Boundary is picked in Roundhead-1 at 2811.0m between the *M. druggii* and *T. evittii* dinoflagellate Zones. It lies in the lower part of a Condensed Section at a point where there is a slight change on the dip-meter log.

9. The *A. hyperacanthum* Zone was not found in Roundhead-1. In this, Roundhead-1 resembles the sequence intersected in East Kingfish-1, which like Roundhead-1 is relatively closely sampled (Marshall, 1985), and supports the interpretation for a local unconformity near the top of the Latrobe Group. The other nearby wells Kingfish-1, 5 and 6 neither support or contradict this interpretation as they contain too few productive samples over this interval. The *A. hyperacanthum* Zone is present however in Bonita-1A which is located along the palaeo-depositional strike about 8km to the north-east of Roundhead-1. It is suggested that the Lower *M. diversus* Zone sample at 2418.1m is from the youngest part of the zone and therefore lies above the 53 Ma sequence boundary (Haq *et al.*, 1987, 1988). The unconformity at this sequence boundary is considered to have eroded down through the *A. hyperacanthum* Zone and the upper part of the Upper *L. balmei* Zone.

BIOSTRATIGRAPHY

Zone and age-determinations have been made using criteria proposed by Stover & Partridge (1973), Helby *et al.* (1987) and unpublished observations made on Gippsland Basin wells drilled by Esso Australia Ltd.

Author citations for most spore-pollen species can be sourced from Stover & Partridge (1973), Helby *et al.* (1987) and Dettmann & Jarzen (1988) or other references cited herein. Species names followed by "ms" are unpublished manuscript names. Zone names have not been altered to conform with recent nomenclature changes like *Forcipites* (al. *Tricolpites) longus* (Stover & Evans) Dettman and Jarzen 1988. Author citations for dinoflagellates can be found in Letin and Williams (1985, 1989) and Wilson (1988).

Upper *Tricolpites longus* Zone: 2812.0-2952.0 metres Maastrichtian.

Samples are assigned to the Upper subdivision of the zone on the consistent and characteristic presence of common *Gambierina* spp. (which has an average abundance of 14%), and the sporadic presence of *Stereisporites (Tripunctisporis) spp.*, a species complex not known to occur below the Upper

subdivision. Although individual samples have moderate diversity the zone overall has a high diversity with over 60 species of spores and pollen identified on the range chart. Fourteen species recorded from the assemblages are not known to extend above the *T. longus* Zone but most of these are only recorded from one or two samples. The indicator species occurring in most samples and therefore most characteristic of the zone are *Forcipites (al. Tricolpites) longus*, *Nothofagidites senectus*, *Proteacidites clinei* ms, *P. reticuloconcavus* ms, and *Quadraplanus brossus*. Of these *Proteacidites clinei* ms is the only indicator species for an age no younger than the *T. longus* Zone which occurs in the highest sample assigned to the zone. The age of this latter sample is based more confidently on its dinoflagellate content.

Manumiella druggii Zone: 2812.0 metres Maastrichtian.

The sample is dominated by acritarchs mostly represented by small simple spheres <15 microns in size, and a small *Micrhystridium* sp. which is characterised by very fine but proportionally long and flexible spines. The larger dinoflagellates in the assemblage are mostly fragmented and therefore are under-represented in both the assemblage count and their overall diversity. Nevertheless, the sample is confidently assigned to the zone on the presence of both *Manumiella druggii* and *M. seelandica*.

Lower *Lygistepollenites balmei* Zone: 2484.0-2808.0 metres Paleocene.

The counts of the assemblages on Tables 3 and 4 best display the characteristic change to the Lower *L. balmei* Zone from the underlying Upper *T. longus* Zone. This is an increase in overall abundance of gymnosperm pollen from an average of 26% in the Upper *T. longus* Zone to an average of 49% in the Lower *L. balmei* Zone. Most conspicuous of all the species increasing in abundance in this group is the eponymous species *Lygistepollenites balmei* which increases from not registering in the count to a maximum of 16.8% in the sample at 2515.2m. The other characteristic change in the counts is the increase in small triporate angiosperm pollen recorded under the category *Triporopollenites* spp. (small). Both the increase in gymnosperm pollen and the increase in small angiosperm pollen is a reflection of a change to wind pollinated plants (as reflected by the palynological record) in the vegetation of the Paleocene. This change is believed to be another manifestation of the extinction events which occur at the Cretaceous/Tertiary boundary.

As is often typical of the zone, key species whose first appearance datums (FADs) can be used to identify the base of the zone, are delayed in the stratigraphic record relative to the extinction horizon of those species which characterise the *T. longus* Zone. Key species which fall into this category in Roundhead-1 are *Proteacidites angulatus* (FAD at 2793.3m), *Tetracolporites multistrixus* ms (FAD at 22746.0m), *Haloragacidites harrisii* (FAD at 2535.8m), and *Polycolpites langstonii* (FAD at 2509.1m). In Roundhead-1 this situation of delayed appearances of pollen species is partially a facies problem related to the marine environment characteristic of the whole zone. It is the dinoflagellates associated with this marine facies which allows the high confidence pick for the base of the zone.

Trithyrodinium evittii Zone: 2801.5-2808.0 metres Basal Danian.

Three samples are assigned to this zone on the common to abundant occurrence (5.7% to 23%) of the eponymous species *Trithyrodinium evittii*. None of the other dinoflagellates identified can be considered diagnositic of the zone. The species *Senegalinim dilwynense (sensu lato)*, *Deflandrea speciosus* and frequent to common *Spinidinium* spp. may however be considered as having 'local' FADs within this zone.

Palaeoperidinium pyrophorum Association: 2793.3 metres Danian?

The occurrence of or acme of *Palaeoperidinium pyrophorum* above the acme of *Trithyrodinium evittii* has been observed in several wells. It is recorded here as a potential correlation point.

Alisocysta circumtabulata Association: 2657.5-2678.0 metres.

Alisocysta circumtabulata is the only dinoflagellate in Roundhead-1 restricted to the dinoflagellate abundance peak, and possible Condensed Section recorded in the counts (Table-4) between 2657.5-2679.1m. Although *A. circumtabulata* is known to have an earlier FAD (Helby *et al.* 1987, fig.40) its acme may be within this later condensed interval. This interpretation needs to be verified and tested in additional wells.

Eisenackia crassitabulata Zone: 2509.1-2535.8 metres Mid Paleocene.

The original concept of this zone was the total range of the indicator species *Eisenackia crassitabulata*, and this is how it is recognised in

Roundhead-1 where *E. crassitabulata* occurs in the shallowest and deepest samples in a sequence of three consecutive samples. However, the absence of *E. crassitabulata* in the middle sample highlights the difficulty of consistently correlating this zone. In the absence of the indicator species the associated dinoflagellates in the assemblages are not found frequently enough for consistent correlation.

Upper *Lygistepollenites balmei* Zone:

2442.5-2445.8 metres Late Paleocene.

The two samples are assigned to the Upper subdivision of the *L. balmei* Zone on the presence of the indicator species *Malvacipollis subtilis* and *Banksieaeidites elongatus* (at 2442.5m only). This interpretation is supported in the absence of other indicator species by a conspicuous increase in the abundance of *Myrtaceidites parvus/mesonesus* (3-4%) and *Haloragacidites harrisii* (6.7% at 2445.8m). The increase in abundance of *Dilwynites granulatus* and *D. tuberculatus* is not of age significance but instead parallels the increse in abundance of dinoflagellates and is also observed with the high dinoflagellate abundances in the *M. druggii* and *T. evittii* Zones.

Apectodinium homomorphum Zone: 2445.8 metres Late Paleocene.

This zone can only be confidently identified in the deepest of the two samples referred to the Upper *L. balmei* Zone based on the presence of the eponymous species. The higher sample although it contains a relatively high dinoflagellate count does not contain any particularly diagnostic dinoflagellate species.

Lower *Malvacipollis diversus* Zone: 2418.1 metres Early Eocene.

The single sample is assigned to the zone on the presence of *Proteacidites grandis*, *Malvacipollis diversus* and *M. subtilis* and absence of indicator species of the underlying *L. balmei* Zones. The assemblage from the sample is characterized by the very common occurrence of *Myrtaceidites* spp. (18.9%) and *Proteacidites* spp. (20.1%), the later mostly represented by small nondescript specimens. Only fragments of dinoflagellates were identified and it is the absence of distinctive dinoflagellates which suggests strongly that the sample is younger than the *A. hyperacanthum* dinoflagellate Zone which occurs consistently in other wells at the base of the Lower *M. diversus* Zone.

Proteacidites tuberculatus Zone: 2373.0 metres Oligocene.

The presence of spores *Cyatheacidites annulatus* (4 specimens in count) and *Cyathidites subtilis* (1 specimen) in a marine sample from the base of the Lakes Entrance Formation allow confident assignment to this zone. The dinoflagellates are typical of the formation but none are stratigraphically restricted to this unit or particularly diagnostic.

REFERENCES

ANDERSON, J.A.R. & MULLER, J., 1975. Palynological study of a Holocene peat and Miocene coal deposit from N.W. Borneo. *Review Palaeobot. Palyn.* 19, 291-351.

DETTMANN, M.E. & JARZEN, D.M., 1988. Angiosperm pollen from uppermost Cretaceous strata of southeastern Australia and the Antarctic Peninsula. *Mem. Ass. Australas. Palaeontols 5*, 217-237.

HAQ, B.U., HARDENBOL, J. & VAIL, P., 1987. Chronology of fluctuating sea levels since the Triassic. *Science 235*, 1156-1167.

HAQ, B.U., HARDENBOL, J. & VAIL, P., 1988. Mesozoic and Cenozoic chronostratigraphy and cycles of sea-level change. *SEPM Special Publication No. 42*, 71-108.

HELBY, R., MORGAN, R. & PARTRIDGE, A.D., 1987. A palynological zonation of the Australian Mesozoic. *Mem. Ass. Australas. Palaeontols 4*, 1-94.

LENTIN, J.K. & WILLIAMS, G.L., 1985. Fossil dinoflagellates: Index to genera and species, 1985 Edition. *Canadian Tech. Rep. Hydrog. Ocean Sci. 60*, 1-451.

LENTIN, J.K. & WILLIAMS, G.L., 1989. Fossil dinoflagellates: Index to genera and species, 1989 Edition. *AASP Contrib. Series No. 20*, 1-473.

LOUTIT, T.S., HARDENBOL, J. & VAIL, P., 1988. Condensed sections: The key to age determination and correlation of continental margin sequences. *SEPM Special Publication No. 42*, 183-213.

MARSHALL, N.G., 1985. Palynological analysis of East Kingfish-1 Gippsland Basin, Victoria. *Esso Australia Ltd. Palaeontology Report 1985/13* (unpubl.).

STOVER, L.E. & PARTRIDGE, A.D., 1973. Tertiary and Late Cretaceous spores and pollen from the Gippsland Basin, southeastern Australia. *Proc. R. Soc. Vict. 85*, 237-286.

WILSON, G.J., 1988. Paleocene and Eocene dinoflagellate cycts from Waipawa, Hawkes Bay, New Zealand. *N.Z. geol. Surv. Paleont. Bull. 57*, 1-96.

TABLE 1: INTERPRETATIVE PALYNOLOGICAL DATA ROUNDHEAD-1, GIPPSLAND BASIN

SAMPLE TYPE	DEPTH (METRES)	SPORE-POLLEN ZONE	DINOFLAGELLATE ZONE (OR ASSOCIATION)	CONFIDENCE RATING	COMMENT
SWC 60	2373.0	*P. tubercalatus*		0	*Nothofagidites* spp. dominant.
SWC 58	2378.5	Indeterminate			
SWC 57	2380.0	Indeterminate			
SWC 56	2407.1	Indeterminate			
SWC 55	2418.1	Lower *M. diversus*		1	Myrtaceidites spp. & *Proteacidites* spp. dominant
SWC 54	2442.5	Upper *L. balmei*		1	Characterised by *Parecaniella indentata*
SWC 53	2445.8	Upper *L. balmei*	*A. homomorphum*	0	A diverse marine sample
SWC 52	2484.0	Lower *L. balmei*		1	Coastal plain association
SWC 51	2487.1	Lower *L. balmei*		1	Coastal plain association
SWC 50	2505.9	Lower *L. balmei*		0	
SWC 49	2509.1	Lower *L. balmei*	*E. crassitabulata*	0	Early Cretaceous reworking present
SWC 48	2515.2	Lower *L. balmei*		0	
SWC 47	2535.8	Lower *L. balmei*	*E. crassitabulata*	0	A diverse marine assemblage
SWC 46	2540.0	Lower *L. balmei*		1	A marine assemblage
SWC 45	2546.8	Indeterminate			Low yield marine assemblage
SWC 43	2612.0	*L. balmei*		NA	Low yield marine assemblage
SWC 42	2614.0	Lower *L. balmei*		2	
SWC 41	2618.5	*L. balmei*		NA	Costal plain association
SWC 40	2639.0	Indeterminate			
SWC 38	2657.5	Lower *L. balmei*	(*A. circumtabulata*)	0	
SWC 37	2678.0	Lower *L. balmei*	(*A. circumtabulata*)	0	Low diversity marine assemblage
SWC 36	2679.1	Lower *L. balmei*		0	Low diversity marine assemblage
SWC 34	2693.5	*L. balmei*		NA	
SWC 33	2701.0	Indeterminate			
SWC 28	2731.3	Indeterminate			
SWC 26	2746.0	Lower *L. balmei*		1	
SWC 22	2789.0	Lower *L. balmei*		1	
SWC 21	2793.3	Lower *L. balmei*	(*P. pyrophorum*)	0	
SWC 20	2801.5	Lower *L. balmei*	*T. evittii*	0	A diverse marine assemblage
SWC 19	2804.5	Lower *L. balmei*	*T. evittii*	0	A diverse marine assemblage
SWC 18	2808.0	Lower *L. balmei*	*T. evittii*	0	A diverse marine assemblage

TABLE 1: INTERPRETATIVE PALYNOLOGICAL DATA ROUNDHEAD-1, GIPPSLAND BASIN (Cont.)

SAMPLE TYPE	DEPTH (METRES)	SPORE-POLLEN ZONE	DINOFLAGELLATE ZONE (OR ASSOCIATION)	CONFIDENCE RATING	COMMENT
SWC 17	2812.0	Upper *T. longus*	*M. druggii*	0	Dominated by acritarchs
SWC 13	2855.5	Upper *T. longus*		1	*Gambierina* spp. 27%
SWC 12	2862.5	Upper *T. longus*		1	
SWC 11	2871.5	Indeterminate			
SWC 10	2879.5	Upper *T. longus*		1	
SWC 9	2891.0	Upper *T. longus*		1	*Gambierina* spp. 26%
SWC 8	2900.5	Upper *T. longus*		1	*Tricolpites waiparensis* 15%
SWC 5	2929.0	Upper *T. longus*		1	
SWC 4	2936.5	Upper *T. longus*		1	
SWC 3	2952.0	Upper *T. longus*		1	

PALYNOLOGY DATA SHEET

BASIN: GIPPSLAND ELEVATION: KB: +21.0 m GL: -81.0 m

WELL NAME: ROUNDHEAD-1 TOTAL DEPTH: 2845.5 m

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*						2373	0			
	Upper *N. asperus*										
	Mid *N. asperus*										
	Lower *N. asperus*										
	P. asperopolus										
	Upper *M. diversus*										
	Mid *M. diversus*										
	Lower *M. diversus*	2418.1	1				2418.1	1			
	Upper *L. balmei*	2442.5	1				2445.8	0			
	Lower *L. balmei*	2484	1				2808	0			
LATE CRETACEOUS	Upper *R. longus*	2812	0				2952	1			
	Lower *R. longus*										
	T. lilliei										
	N. senectus										
	T. apoxyexinus										
	P. mawsonii										
	A. distocarinatus										
EARLY CRET.	*P. pannosus*										
	C. paradoxa										
	C. striatus										
	C. hughesi										
	F. wonthaggiensis										
	C. australiensis										

COMMENTS:

DINOFLAGELLATE ZONES	A. homomorphum	2445.8 m
	E. crassitabulata	2509.1 - 2535.8 m
	T. evittii	2801.5 - 2808.0 m
	M. druggii	2812.0 m

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: A.D. PARTRIDGE DATE: SEPTEMBER 1989

DATA REVISED BY: _____ DATE: _____

BASIC DATA

TABLE-2: BASIC DATA

TABLE-3: PALYNOMORPH COUNTS

TABLE-4: PALYNOMORPH PERCENTAGES

RANGE CHART

TABLE 2: BASIC PALYNOLOGICAL DATA ROUNDHEAD-1, GIPPSLAND BASIN

Sheet 1 of 2

SAMPLE TYPE	DEPTH (M)	LAB NO.	LITHOLOGY	RESIDUE YIELD	PALYNOMORPH CONCENTRATION	PRESERVATION	NUMBER S-P SPECIES	DINOFLAGELLATE ABUNDANCE	NO. SPECIES
SWC 60	2373.0	78240 H	Calcareous claystone	Moderate	Moderate	Poor-fair	19+	High	6+
SWC 58	2378.5	78240 F	Glauconitic sandstone	Negligible	Barren				
SWC 57	2380.0	78240 E	Glauconitic sandstone	Negligible	Barren				
SWC 56	2407.1	78240 D	Qtz sst with tr. glauconite	Very low	Very low	Poor	3+		
SWC 55	2418.1	78240 C	Sandstone	High	Low	Fair-good	29+		1+
SWC 54	2442.5	78240 B	Glauconitic sandstone	Low	Moderate	Fair	24+	High	8+
SWC 53	2445.8	78240 A	Glauconitic sandstone	High	High	Good	31+	High	9+
SWC 52	2484.0	78203 Z	Siltstone	High	High	Poor-fair	32+		
SWC 51	2487.1	78203 Y	Siltstone	High	High	Fair	27+	Very low	1
SWC 50	2505.9	78203 X	Siltstone	High	Moderate	Poor-fair	29+	Moderate	6+
SWC 49	2509.1	78203 W	Siltstone	Moderate	Moderate	Fair-good	26+	Moderate	5+
SWC 48	2515.2	78203 V	Silty sandstone	Moderate	Moderate	Poor	22+	Moderate	4+
SWC 47	2535.8	78203 U	Sandstone	Moderate	High	Poor	33+	High	8+
SWC 46	2540.0	78203 T	Glauconitic sandstone	Moderate	Moderate	Poor-fair	11+	Moderate	4+
SWC 45	2546.8	78203 S	Calcareous siltstone	Very low	Low	Poor-fair	6+	Low	2+
SWC 43	2612.0	78203 Q	Slightly calc. siltstone	Very low	Low	Poor	18+	Low	2
SWC 42	2614.0	78203 P	Silty sandstone	Moderate	Low	Poor	14+	Low	3
SWC 41	2618.5	78203 O	Calcareous siltstone	Low	Low	Poor	11+	Low	2
SWC 40	2639.0	78203 N	Fine sandstone	Very low	Barren				
SWC 38	2657.5	78203 L	Medium grn. sandstone	High	High	Poor-fair	28+	Moderate	8+
SWC 37	2678.0	78203 K	Calcareous siltstone	High	Low	Fair	33+	High	3+
SWC 36	2679.1	78203 J	Sandy siltstone	Moderate	High	Fair	18+	High	4+
SWC 34	2693.5	78203 H	Medium grn. sandstone	Very low	Low	Fair	10+	Low	1
SWC 33	2701.0	78203 G	Fine grn. sandstone	Very low	Very low	Poor	4+		
SWC 28	2731.3	78203 B	Fing grn. sandstone	Negligible	Barren				
SWC 26	2746.0	78202 Z	Fine - v. coarse sandstone	Low	High	Fair-good	28+	Low	2+
SWC 22	2789.0	78202 V	Sandstone with tr. glauconite	High	Low	Fair	19+	Low	2+
SWC 21	2793.3	78202 U	Glauconitic sandstone	High	Low	Fair	29+	Low	5+
SWC 20	2801.5	78202 T	Glauconitic siltstone	High	High	Poor-fair	24+	High	7+
SWC 19	2804.5	78202 S	Glauconitic siltstone	Low	High	Fair	23+	High	8+
SWC 18	2808.0	78202 R	Glauconitic siltstone	High	High	Poor-fair	13+	High	10+

TABLE-3: PALYNOMORPH COUNTS FROM ROUNDHEAD-1. Page 1 of 4

	2373.0m SWC 60	2418.1m SWC 55	2442.5m SWC 54	2445.8m SWC 53	2484.0m SWC 52	2487.1m SWC 51	2505.9m SWC 50	2509.1m SWC 49
TRILETE SPORES undiff.	8	10	5	5	5	2	4	3
Cyatheacidites annulatus	4							
Cyathidites spp.	19	11	1	6	4	7	2	4
Gleicheniidites spp.		14	10	4	8	9	5	5
Herkosporites elliottii								
Stereisporites spp.	2	11		1	2		1	
MONOLETE SPORES								
Laevigatosporites spp.	6	7	3	4	14	5	11	13
Peromonolites spp.					3	3	1	4
Verrucatosporites spp.	1					1		1
TOTAL SPORES	40	53	19	20	36	27	24	30
GYMNOSPERM POLLEN								
Araucariacites australis	1	4	5	1	1		4	5
Dilwynites spp.	12	25	32	61	15	13	16	12
Dacrycarpites australiensis								
Lygistepollenites balmei			11	8	21	28	18	18
Lygistepollenites florinii	7	3	5	6	2	2	5	2
Microcachryidites antarcticus		2	10	7	2	2	3	1
Parvisaccatus catastus				3				1
Phyllocladidites mawsonii	27	8	4	5	58	50	51	42
Phyllocladus paleogenicus		1						1
Podocarpidites spp.	17	21	18	30	45	45	51	51
Podosporites microsaccatus		4			5	3	3	6
TOTAL GYMNOSPERM POLLEN	64	68	85	121	149	143	151	139
ANGIOSPERM POLLEN undiff.	2	8	3	6	1	1	5	2
Australopollis obscurus				4	2	1	3	1
Casuarina (H. harrisii)	6	7	1	18	2	1	1	
Dicotetradites clavatus		1	3	5	1	1	1	2
Gambierina rudata/edwardsii			1	3			3	
Liliacidites spp.								
Myrtaceidites spp.	14	60	7	9	1			
Nothofagidites 'brassii' type	39		12	17	23	14	15	24
Nothofagidites 'fusca' type	1	1	4	10	3	2	2	2
Penninsulapollis gillii					2		1	
Periporopollenites spp.		4		10	1	1	3	5
Proteacidites angulatus								
Proteacidites clinei								
Proteacidites grandis		2						
Proteacidites reticuloconcavus								
Proteacidites spp.	1	62	17	5	61	41	27	38
Tricolpites confessus								
Tricolpites waiparensis								
Tricolpites spp.		4	2		1	2	1	1
Tricolporites lilliei								
Tricolporites spp.	4	41	3	29	5	11	17	10
Triporopollenites spp. (small)		7	1	11	5	46	19	10
TOTAL ANGIOSPERM POLLEN	67	197	54	127	108	121	98	95
TOTAL SPORES & POLLEN	171	318	158	268	293	291	273	264
FUNGAL SPORES	47	31	5	19	29	5	4	18
ALGAE								
Amosopollis cruciformis				3				
Dinoflagellates undiff.	20	3	17	24			9	5

TABLE-3: PALYNOMORPH COUNTS FROM ROUNDHEAD-1. Page 2 of 4

	2515.2m SWC 48	2535.8m SWC 47	2540.0m SWC 46	2612.0m SWC 43	2614.0m SWC 42	2618.5m SWC 41	2657.5m SWC 38	2678.0m SWC 37
TRILETE SPORES undiff.	2		4	4	5		6	1
Cyatheacidites annulatus								
Cyathidites spp.	7	3	2	3	2	2	3	4
Gleicheniidites spp.	3	7	3		2	1	1	1
Herkosporites elliottii								3
Stereisporites spp.		1			1		1	2
MONOLETE SPORES								
Laevigatosporites spp.	4	13	1	2		2	12	4
Peromonolites spp.		1		1				1
Verrucatosporites spp.		1						
TOTAL SPORES	16	26	10	10	10	5	23	16
GYMNOSPERM POLLEN								
Araucariacites australis	1	6	1			1		
Dilwynites spp.	17	50	16	1	4	2	4	1
Dacrycarpites australiensis		2					1	
Lygistepollenites balmei	30	16	3	1	7	1	6	4
Lygistepollenites florinii	2	4	5	3	4	3		1
Microcachryidites antarcticus	2	6	3	3	2	4	3	1
Parvisaccatus catastus								
Phyllocladidites mawsonii	18	30	15	17	12	21	37	20
Phyllocladus paleogenicus		1		2				1
Podocarpidites spp.	31	26	12	11	16	25	40	31
Podosporites microsaccatus		6	2	1	1	2	1	1
TOTAL GYMNOSPERM POLLEN	101	147	57	39	46	59	92	60
ANGIOSPERM POLLEN undiff.	3	3	2	2	1	3	3	1
Australopollis obscurus				7	1	3	7	
Casuarina (H. harrisii)	1							
Dicotetradites clavatus	1	1						
Gambierina rudata/edwardsii	1			1				
Liliacidites spp.								
Myrtaceidites spp.			1					
Nothofagidites 'brassii' type	7	19	6	1	1		2	3
Nothofagidites 'fusca' type	6	7	3		1		2	
Penninsulapollis gillii	1	1	3	1	1	5	9	1
Periporopollenites spp.		9	3	1	1	1	1	
Proteacidites angulatus								
Proteacidites clinei								
Proteacidites grandis								
Proteacidites reticuloconcavus								
Proteacidites spp.	26	39	9	28	18	37	50	33
Tricolpites confessus								
Tricolpites waiparensis								
Tricolpites spp.	5	12	1		3	2	3	4
Tricolporites lilliei								
Tricolporites spp.	2	15	3	10	12	13	34	7
Triporopollenites spp. (small)	9	15	2	6	20	17	20	
TOTAL ANGIOSPERM POLLEN	62	121	33	57	59	81	131	49
TOTAL SPORES & POLLEN	179	294	100	106	115	145	246	125
FUNGAL SPORES	1		8	6	9	3	32	10
ALGAE								
Amosopollis cruciformis	1						1	
Dinoflagellates undiff.	4	30	2	1	1		5	4
Areoligera spp.								
Deflandrea spp.							2	
Eisenackia/Alisocysta complex	2	1						1
Glaphrocysta spp.								
Manumiella druggii complex								
Operculodinium centrocarpum								
Parecaniella indentata	1							
Senegalinium dilwynensis		14	5					
Spinidinium spp.	1	25	1	1	1	1		11
Spiniferites spp.								
Trithyrodinium evittii								
DINOFLAGELLATES TOTAL	8	70	8	2	2	1	7	16
ACRITARCHS		15	2		5	1	5	
MICROPLANKTON TOTAL	8	85	10	2	7	2	12	16
TOTAL COUNT	189	379	118	114	131	150	291	151

TABLE-3: PALYNOMORPH COUNTS FROM ROUNDHEAD-1. Page 3 of 4

	2679.1m SWC 36	2746.0m SWC 26	2789.0m SWC 22	2793.3m SWC 21	2801.5m SWC 20	2804.5m SWC 19	2808.0m SWC 18	2812.0m SWC 17
TRILETE SPORES undiff.	5	11	13	9	6	2	1	3
Cyatheacidites annulatus								
Cyathidites spp.	6	2	1	2	1	5	1	10
Gleicheniidites spp.	3	3		1		1	2	1
Herkosporites elliottii								
Stereisporites spp.	1		6	3	2	6	4	2
MONOLETE SPORES			1	1				
Laevigatosporites spp.	4	8	19	17	2	8	3	
Peromonolites spp.		1		1				
Verrucatosporites spp.								
TOTAL SPORES	19	25	40	34	11	22	11	16
GYMNOSPERM POLLEN			1			1		
Araucariacites australis					2	1	1	1
Dilwynites spp.	1	4	9	7	43	40	34	9
Dacrycarpites australiensis								
Lygistepollenites balmei	8	10	1	2	1			
Lygistepollenites florinii	3	12	2	6	13	1	3	1
Microcachryidites antarcticus	10	6	5	3	5	4	4	1
Parvisaccatus catastus								
Phyllocladidites mawsonii	38	53	32	21	8	4	4	2
Phyllocladus paleogenicus		1		1	1	1		
Podocarpidites spp.	72	62	51	63	61	13	53	7
Podosporites microsaccatus	4	7	10	6	1	1	1	
TOTAL GYMNOSPERM POLLEN	136	155	111	109	135	66	100	21
ANGIOSPERM POLLEN undiff.	5	5	1	3	2	3	5	1
Australopollis obscurus	6	1					1	1
Casuarina (H. harrisii)								
Dicotetradites clavatus								
Gambierina rudata/edwardsii	1				1	1	1	
Liliacidites spp.								
Myrtaceidites spp.								
Nothofagidites 'brassii' type	3	2	2	2	1	5		
Nothofagidites 'fusca' type	1		2			1	1	
Penninsulapollis gillii	8	4	12	8	17	15	23	2
Periporopollenites spp.	3	4	2	2	5	1	3	
Proteacidites angulatus	6	4	2					
Proteacidites clinei								
Proteacidites grandis								
Proteacidites reticuloconcavus								
Proteacidites spp.	52	19	45	24	15	20	10	8
Tricolpites confessus								
Tricolpites waiparensis								
Tricolpites spp.	4	16	4	7	4	8	2	1
Tricolporites lilliei								
Tricolporites spp.	2	7	6	24	16	11	23	2
Triporopollenites spp. (small)		13	16	21	9	26	15	2
TOTAL ANGIOSPERM POLLEN	91	75	92	91	70	91	84	17
TOTAL SPORES & POLLEN	246	255	243	234	216	179	195	54
FUNGAL SPORES	2	2	12		1	3	9	16
ALGAE								
Amosopollis cruciformis				2	4			
Dinoflagellates undiff.	5	2	1	2	18	16	26	16
Areoligera spp.								15
Deflandrea spp.	8				4		4	1
Eisenackia/Alisocysta complex								
Glaphrocysta spp.						3		
Manumiella druggii complex								8
Operculodinium centrocarpum					3			
Parecaniella indentata		1		1	2		1	
Senegalinium dilwynensis						3	9	
Spinidinium spp.	23	1	1		68	3	12	
Spiniferites spp.						1	2	
Trithyrodinium evittii					6	5	32	
DINOFLAGELLATES TOTAL	36	4	2	3	101	31	86	40
ACRITARCHS	1			6	4	4	53	83
MICROPLANKTON TOTAL	37	4	2	9	105	35	139	123
TOTAL COUNT	285	261	257	245	326	217	343	193

TABLE-3: PALYNOMORPH COUNTS FROM ROUNDHEAD-1. Page 4 of 4

	2855.5m SWC 13	2862.5m SWC 12	2879.5m SWC 10	2891.0m SWC 9	2900.5m SWC 8	2929.0m SWC 5	2936.5m SWC 4	2952.0m SWC 3
TRILETE SPORES undiff.	7	9		10	3	1	2	8
Cyatheacidites annulatus								
Cyathidites spp.	5	6	5	10	3	5		13
Gleicheniidites spp.	1			2				4
Herkosporites elliottii		4						
Stereisporites spp.			2	11	8	3		6
MONOLETE SPORES								
Laevigatosporites spp.	7	3	3	5	9	10	7	10
Peromonolites spp.								
Verrucatosporites spp.								
TOTAL SPORES	20	22	10	38	23	19	9	41
GYMNOSPERM POLLEN								1
Araucariacites australis		2	2	1		1		
Dilwynites spp.				2	1		2	1
Dacrycarpites australiensis								
Lygistepollenites balmei				1				
Lygistepollenites florinii	1					1	10	5
Microcachryidites antarcticus	1		1	1	1	1	6	2
Parvisaccatus catastus								
Phyllocladidites mawsonii	11	20	31	20	47	46	70	32
Phyllocladus paleogenicus							1	
Podocarpidites spp.	4	3	9	18	10	12	30	17
Podosporites microsaccatus	2	2	4	2	11	6	40	6
TOTAL GYMNOSPERM POLLEN	19	27	47	45	70	67	159	64
ANGIOSPERM POLLEN undiff.	5			5	1	2	11	7
Australopollis obscurus								
Casuarina (H. harrisii)								
Dicotetradites clavatus			1					
Gambierina rudata/edwardsii	40	22	29	70	27	24	12	16
Liliacidites spp.	2				11			
Myrtaceidites spp.								
Nothofagidites 'brassii' type					1	1		1
Nothofagidites 'fusca' type				1				1
Penninsulapollis gillii	5	8	4	18	5	10	3	7
Periporopollenites spp.		1	2					
Proteacidites angulatus								
Proteacidites clinei				2		8		
Proteacidites grandis								
Proteacidites reticuloconcavus		1		12			3	
Proteacidites spp.	56	84	105	75	69	91	44	100
Tricolpites confessus			5					
Tricolpites waiparensis				1	44			
Tricolpites spp.	1	1	11	3	28	5	1	9
Tricolporites lilliei					6			
Tricolporites spp.	1	4	1		9	6	27	4
Triporopollenites spp. (small)						1		
TOTAL ANGIOSPERM POLLEN	110	121	158	187	201	148	101	145
TOTAL SPORES & POLLEN	149	170	215	270	294	234	269	250
FUNGAL SPORES	2	16	17	10	11	2	2	4
ALGAE								
Amosopollis cruciformis					5			
Dinoflagellates undiff.				1				
Areoligera spp.								
Deflandrea spp.								
Eisenackia/Alisocysta complex								
Glaphrocysta spp.								
Manumiella druggii complex								
Operculodinium centrocarpum								
Parecaniella indentata								
Senegalinium dilwynensis								
Spinidinium spp.				1				
Spiniferites spp.								
Trithyrodinium evittii								
DINOFLAGELLATES TOTAL				2				
ACRITARCHS					2			
MICROPLANKTON TOTAL	0	0	0	2	2	0	0	0
TOTAL COUNT	151	186	232	282	312	236	271	254

TABLE-4: PALYNOMORPH PERCENTAGES FROM ROUNDHEAD-1. Page 1 of 4

	2373.0m SWC 60	2418.1m SWC 55	2442.5m SWC 54	2445.8m SWC 53	2484.0m SWC 52	2487.1m SWC 51	2505.9m SWC 50	2509.1m SWC 49
TRILETE SPORES undiff.	4.7%	3.1%	3.2%	1.9%	1.7%	0.7%	1.5%	1.1%
Cyatheacidites annulatus	2.3%							
Cyathidites spp.	11.1%	3.5%	0.6%	2.2%	1.4%	2.4%	0.7%	1.5%
Gleicheniidites spp.		4.4%	6.3%	1.5%	2.7%	3.1%	1.8%	1.9%
Herkosporites elliottii								
Stereisporites spp.	1.2%	3.5%		0.4%	0.7%		0.4%	
MONOLETE SPORES								
Laevigatosporites spp.	3.5%	2.2%	1.9%	1.5%	4.8%	1.7%	4.0%	4.9%
Peromonolites spp.					1.0%	1.0%	0.4%	1.5%
Verrucatosporites spp.	0.6%					0.3%		0.4%
TOTAL SPORES	23.4%	16.7%	12.0%	7.5%	12.3%	9.3%	8.8%	11.4%
GYMNOSPERM POLLEN								
Araucariacites australis	0.6%	1.3%	3.2%	0.4%	0.3%	0.0%	1.5%	1.9%
Dilwynites spp.	7.0%	7.9%	20.3%	22.8%	5.1%	4.5%	5.9%	4.5%
Dacrycarpites australiensis								
Lygistepollenites balmei			7.0%	3.0%	7.2%	9.6%	6.6%	6.8%
Lygistepollenites florinii	4.1%	0.9%	3.2%	2.2%	0.7%	0.7%	1.8%	0.8%
Microcachryidites antarcticus		0.6%	6.3%	2.6%	0.7%	0.7%	1.1%	0.4%
Parvisaccatus catastus				1.1%				0.4%
Phyllocladidites mawsonii	15.8%	2.5%	2.5%	1.9%	19.8%	17.2%	18.7%	15.9%
Phyllocladus paleogenicus		0.3%						0.4%
Podocarpidites spp.	9.9%	6.6%	11.4%	11.2%	15.4%	15.5%	18.7%	19.3%
Podosporites microsaccatus		1.3%			1.7%	1.0%	1.1%	2.3%
TOTAL GYMNOSPERM POLLEN	37.4%	21.4%	53.8%	45.1%	50.9%	49.1%	55.3%	52.7%
ANGIOSPERM POLLEN undiff.	1.2%	2.5%	1.9%	2.2%	0.3%	0.3%	1.8%	0.8%
Australopollis obscurus				1.5%	0.7%	0.3%	1.1%	0.4%
Casuarina (H. harrisii)	3.5%	2.2%	0.6%	6.7%	0.7%	0.3%	0.4%	
Dicotetradites clavatus		0.3%	1.9%	1.9%	0.3%	0.3%	0.4%	0.8%
Gambierina rudata/edwardsii			0.6%	1.1%			1.1%	
Liliacidites spp.								
Myrtaceidites spp.	8.2%	18.9%	4.4%	3.4%	0.3%			
Nothofagidites 'brassii' type	22.8%		7.6%	6.3%	7.8%	4.8%	5.5%	9.1%
Nothofagidites 'fusca' type	0.6%	0.3%	2.5%	3.7%	1.0%	0.7%	0.7%	0.8%
Penninsulapollis gillii					0.7%		0.4%	
Periporopollenites spp.		1.3%		3.7%	0.3%	0.3%	1.1%	1.9%
Proteacidites angulatus								
Proteacidites clinei								
Proteacidites grandis		0.6%						
Proteacidites reticuloconcavus								
Proteacidites spp.	0.6%	19.5%	10.8%	1.9%	20.8%	14.1%	9.9%	14.4%
Tricolpites confessus								
Tricolpites waiparensis								
Tricolpites spp.		1.3%	1.3%		0.3%	0.7%	0.4%	0.4%
Tricolporites lilliei								
Tricolporites spp.	2.3%	12.9%	1.9%	10.8%	1.7%	3.8%	6.2%	3.8%
Triporopollenites spp. (small)		2.2%	0.6%	4.1%	1.7%	15.8%	7.0%	3.8%
TOTAL ANGIOSPERM POLLEN	39.2%	61.9%	34.2%	47.4%	36.9%	41.6%	35.9%	36.0%
TOTAL SPORES & POLLEN COUNT	171	318	158	268	293	291	273	264
DINOFLAGELLATES undiff.	28.6%	100.0%	26.6%	20.7%			60.0%	55.6%
Areoligera spp.								
Deflandrea spp.			18.8%				20.0%	11.1%
Eisenackia/Alisocyst complex								22.2%
Glaphrocysta spp.							6.7%	
Manumiella druggii complex								
Operculodinium centrocarpum	18.6%							
Parecaniella indentata			28.1%	4.3%				
Senegalinium dilwynensis			12.5%	3.4%			6.7%	
Spinidinium spp.			6.3%	0.9%		100.0%		
Spiniferites spp.	40.0%			5.2%			6.7%	
Trithyrodinium evittii								
DINOFLAGELLATES TOTAL	87.1%	100.0%	92.2%	34.5%		100.0%	100.0%	88.9%
ACRITARCHS	12.9%		7.8%	65.5%				11.1%
TOTAL MICROPLANKTON COUNT	70	3	64	116	0	1	15	9
PERCENTAGES FOR MAJOR CATEGORIES								
Spores %	13.9%	15.1%	8.4%	4.9%	11.2%	9.1%	8.2%	10.3%
Gymnosperm Pollen %	22.2%	19.3%	37.4%	29.8%	46.3%	48.1%	51.7%	47.8%
Angiosperm Pollen %	23.3%	56.0%	23.8%	31.3%	33.5%	40.7%	33.6%	32.6%
TOTAL Spore-Pollen %	59.4%	90.3%	69.6%	66.0%	91.0%	98.0%	93.5%	90.7%
Fungal Spores %	16.3%	8.8%	2.2%	4.7%	9.0%	1.7%	1.4%	6.2%
Algae %				0.7%				
Dinoflagellate %	21.2%	0.9%	26.0%	9.9%		0.3%	5.1%	2.7%
Acritarch %	3.1%		2.2%	18.7%				0.3%
TOTAL Microplankton %	24.3%	0.9%	28.2%	28.6%		0.3%	5.1%	3.1%
TOTAL COUNT	288	352	227	406	322	297	292	291

TABLE-4: PALYNOMORPH PERCENTAGES FROM ROUNDHEAD-1. Page 2 of 4

	2515.2m SWC 48	2535.8m SWC 47	2540.0m SWC 46	2612.0m SWC 43	2614.0m SWC 42	2618.5m SWC 41	2657.5m SWC 38	2678.0m SWC 37
TRILETE SPORES undiff.	1.1%		4.0%	3.8%	4.3%		2.4%	0.8%
Cyatheacidites annulatus								
Cyathidites spp.	3.9%	1.0%	2.0%	2.8%	1.7%	1.4%	1.2%	3.2%
Gleicheniidites spp.	1.7%	2.4%	3.0%		1.7%	0.7%	0.4%	0.8%
Herkosporites elliottii								2.4%
Stereisporites spp.		0.3%			0.9%		0.4%	1.6%
MONOLETE SPORES								
Laevigatosporites spp.	2.2%	4.4%	1.0%	1.9%		1.4%	4.9%	3.2%
Peromonolites spp.		0.3%		0.9%				0.8%
Verrucatosporites spp.		0.3%						
TOTAL SPORES	8.9%	8.8%	10.0%	9.4%	8.7%	3.4%	9.3%	12.8%
GYMNOSPERM POLLEN								
Araucariacites australis	0.6%	2.0%	1.0%			0.7%		
Dilwynites spp.	9.5%	17.0%	16.0%	0.9%	3.5%	1.4%	1.6%	0.8%
Dacrycarpites australiensis		0.7%					0.4%	
Lygistepollenites balmei	16.8%	5.4%	3.0%	0.9%	6.1%	0.7%	2.4%	3.2%
Lygistepollenites florinii	1.1%	1.4%	5.0%	2.8%	3.5%	2.1%		0.8%
Microcachryidites antarcticus	1.1%	2.0%	3.0%	2.8%	1.7%	2.8%	1.2%	0.8%
Parvisaccatus catastus								
Phyllocladidites mawsonii	10.1%	10.2%	15.0%	16.0%	10.4%	14.5%	15.0%	16.0%
Phyllocladus paleogenicus		0.3%		1.9%				0.8%
Podocarpidites spp.	17.3%	8.8%	12.0%	10.4%	13.9%	17.2%	16.3%	24.8%
Podosporites microsaccatus		2.0%	2.0%	0.9%	0.9%	1.4%	0.4%	0.8%
TOTAL GYMNOSPERM POLLEN	56.4%	50.0%	57.0%	36.8%	40.0%	40.7%	37.4%	48.0%
ANGIOSPERM POLLEN undiff.	1.7%	1.0%	2.0%	1.9%	0.9%	2.1%	1.2%	0.8%
Australopollis obscurus				6.6%	0.9%	2.1%	2.8%	
Casuarina (H. harrisii)	0.6%							
Dicotetradites clavatus	0.6%	0.3%						
Gambierina rudata/edwardsii	0.6%			0.9%				
Liliacidites spp.								
Myrtaceidites spp.			1.0%					
Nothofagidites 'brassii' type	3.9%	6.5%	6.0%	0.9%	0.9%		0.8%	2.4%
Nothofagidites 'fusca' type	3.4%	2.4%	3.0%		0.9%		0.8%	
Penninsulapollis gillii	0.6%	0.3%	3.0%	0.9%	0.9%	3.4%	3.7%	0.8%
Periporopollenites spp.		3.1%	3.0%	0.9%	0.9%	0.7%	0.4%	
Proteacidites angulatus								
Proteacidites clinei								
Proteacidites grandis								
Proteacidites reticuloconcavus								
Proteacidites spp.	14.5%	13.3%	9.0%	26.4%	15.7%	25.5%	20.3%	26.4%
Tricolpites confessus								
Tricolpites waiparensis								
Tricolpites spp.	2.8%	4.1%	1.0%		2.6%	1.4%	1.2%	3.2%
Tricolporites lilliei								
Tricolporites spp.	1.1%	5.1%	3.0%	9.4%	10.4%	9.0%	13.8%	5.6%
Triporopollenites spp. (small)	5.0%	5.1%	2.0%	5.7%	17.4%	11.7%	8.1%	
TOTAL ANGIOSPERM POLLEN	34.6%	41.2%	33.0%	53.8%	51.3%	55.9%	53.3%	39.2%
TOTAL SPORES & POLLEN COUNT	179	294	100	106	115	145	246	125
DINOFLAGELLATES undiff.	50.0%	35.3%	20.0%	50.0%	14.3%		41.7%	25.0%
Areoligera spp.								
Deflandrea spp.							16.7%	
Eisenackia/Alisocysta complex	25.0%	1.2%						6.3%
Glaphrocysta spp.								
Manumiella druggii complex								
Operculodinium centrocarpum								
Parecaniella indentata	12.5%							
Senegalinium dilwynensis		16.5%	50.0%					
Spinidinium spp.	12.5%	29.4%	10.0%	50.0%	14.3%	50.0%		68.8%
Spiniferites spp.								
Trithyrodinium evittii								
DINOFLAGELLATES TOTAL	100.0%	82.4%	80.0%	100.0%	28.6%	50.0%	58.3%	100.0%
ACRITARCHS		17.6%	20.0%		71.4%	50.0%	41.7%	
TOTAL MICROPLANKTON COUNT	8	85	10	2	7	2	12	16
PERCENTAGES FOR MAJOR CATEGORIES								
Spores %	8.5%	6.9%	8.5%	8.8%	7.6%	3.3%	7.9%	10.6%
Gymnosperm Pollen %	53.4%	38.8%	48.3%	34.2%	35.1%	39.3%	31.6%	39.7%
Angiosperm Pollen %	32.8%	31.9%	28.0%	50.0%	45.0%	54.0%	45.0%	32.5%
TOTAL Spore-Pollen %	94.7%	77.6%	84.7%	93.0%	87.8%	96.7%	84.5%	82.8%
Fungal Spores %	0.5%		6.8%	5.3%	6.9%	2.0%	11.0%	6.6%
Algae %	0.5%						0.3%	
Dinoflagellate %	4.2%	18.5%	6.8%	1.8%	1.5%	0.7%	2.4%	10.6%
Acritarch %		4.0%	1.7%		3.8%	0.7%	1.7%	
TOTAL Microplankton %	4.2%	22.4%	8.5%	1.8%	5.3%	1.3%	4.1%	10.6%
TOTAL COUNT	189	379	118	114	131	150	291	151

TABLE-4: PALYNOMORPH PERCENTAGES FROM ROUNDHEAD-1. Page 3 of 4

	2679.1m SWC 36	2746.0m SWC 26	2789.0m SWC 22	2793.3m SWC 21	2801.5m SWC 20	2804.5m SWC 19	2808.0m SWC 18	2812.0m SWC 17
TRILETE SPORES undiff.	2.0%	4.3%	5.3%	3.8%	2.8%	1.1%	0.5%	5.6%
Cyatheacidites annulatus								
Cyathidites spp.	2.4%	0.8%	0.4%	0.9%	0.5%	2.8%	0.5%	18.5%
Gleicheniidites spp.	1.2%	1.2%		0.4%		0.6%	1.0%	1.9%
Herkosporites elliottii								
Stereisporites spp.	0.4%		2.5%	1.3%	0.9%	3.4%	2.1%	3.7%
MONOLETE SPORES			0.4%	0.4%				
Laevigatosporites spp.	1.6%	3.1%	7.8%	7.3%	0.9%	4.5%	1.5%	
Peromonolites spp.		0.4%		0.4%				
Verrucatosporites spp.								
TOTAL SPORES	7.7%	9.8%	16.5%	14.5%	5.1%	12.3%	5.6%	29.6%
GYMNOSPERM POLLEN			0.4%			0.6%		
Araucariacites australis					0.9%	0.6%	0.5%	1.9%
Dilwynites spp.	0.4%	1.6%	3.7%	3.0%	19.9%	22.3%	17.4%	16.7%
Dacrycarpites australiensis								
Lygistepollenites balmei	3.3%	3.9%	0.4%	0.9%	0.5%			
Lygistepollenites florinii	1.2%	4.7%	0.8%	2.6%	6.0%	0.6%	1.5%	1.9%
Microcachryidites antarcticus	4.1%	2.4%	2.1%	1.3%	2.3%	2.2%	2.1%	1.9%
Parvisaccatus catastus								
Phyllocladidites mawsonii	15.4%	20.8%	13.2%	9.0%	3.7%	2.2%	2.1%	3.7%
Phyllocladus paleogenicus		0.4%		0.4%	0.5%	0.6%		
Podocarpidites spp.	29.3%	24.3%	21.0%	26.9%	28.2%	7.3%	27.2%	13.0%
Podosporites microsaccatus	1.6%	2.7%	4.1%	2.6%	0.5%	0.6%	0.5%	
TOTAL GYMNOSPERM POLLEN	55.3%	60.8%	45.7%	46.6%	62.5%	36.9%	51.3%	38.9%
ANGIOSPERM POLLEN undiff.	2.0%	2.0%	0.4%	1.3%	0.9%	1.7%	2.6%	1.9%
Australopollis obscurus	2.4%	0.4%					0.5%	1.9%
Casuarina (H. harrisii)								
Dicotetradites clavatus								
Gambierina rudata/edwardsii	0.4%				0.5%	0.6%	0.5%	
Liliacidites spp.								
Myrtaceidites spp.								
Nothofagidites 'brassii' type	1.2%	0.8%	0.8%	0.9%	0.5%	2.8%		
Nothofagidites 'fusca' type	0.4%		0.8%			0.6%	0.5%	
Penninsulapollis gillii	3.3%	1.6%	4.9%	3.4%	7.9%	8.4%	11.8%	3.7%
Periporopollenites spp.	1.2%	1.6%	0.8%	0.9%	2.3%	0.6%	1.5%	
Proteacidites angulatus	2.4%	1.6%	0.8%					
Proteacidites clinei								
Proteacidites grandis								
Proteacidites reticuloconcavus								
Proteacidites spp.	21.1%	7.5%	18.5%	10.3%	6.9%	11.2%	5.1%	14.8%
Tricolpites confessus								
Tricolpites waiparensis								
Tricolpites spp.	1.6%	6.3%	1.6%	3.0%	1.9%	4.5%	1.0%	1.9%
Tricolporites lilliei								
Tricolporites spp.	0.8%	2.7%	2.5%	10.3%	7.4%	6.1%	11.8%	3.7%
Triporopollenites spp. (small)		5.1%	6.6%	9.0%	4.2%	14.5%	7.7%	3.7%
TOTAL ANGIOSPERM POLLEN	37.0%	29.4%	37.9%	38.9%	32.4%	50.8%	43.1%	31.5%
TOTAL SPORES & POLLEN COUNT	246	255	243	234	216	179	195	54
DINOFLAGELLATES undiff.	13.5%	50.0%	50.0%	22.2%	17.1%	45.7%	18.7%	13.0%
Areoligera spp.								12.2%
Deflandrea spp.	21.6%				3.8%		2.9%	0.8%
Eisenackia/Alisocysta complex								
Glaphrocysta spp.						8.6%		
Manumiella druggii complex								6.5%
Operculodinium centrocarpum					2.9%			
Parecaniella indentata		25.0%		11.1%	1.9%		0.7%	
Senegalinium dilwynensis						8.6%	6.5%	
Spinidinium spp.	62.2%	25.0%	50.0%		64.8%	8.6%	8.6%	
Spiniferites spp.						2.9%	1.4%	
Trithyrodinium evittii					5.7%	14.3%	23.0%	
DINOFLAGELLATES TOTAL	97.3%	100.0%	100.0%	33.3%	96.2%	88.6%	61.9%	32.5%
ACRITARCHS	2.7%			66.7%	3.8%	11.4%	38.1%	67.5%
TOTAL MICROPLANKTON COUNT	37	4	2	9	105	35	139	123
PERCENTAGES FOR MAJOR CATEGORIES								
Spores %	6.7%	9.6%	15.6%	13.9%	3.4%	10.1%	3.2%	8.3%
Gymnosperm Pollen %	47.7%	59.4%	43.2%	44.5%	41.4%	30.4%	29.2%	10.9%
Angiosperm Pollen %	31.9%	28.7%	35.8%	37.1%	21.5%	41.9%	24.5%	8.8%
TOTAL Spore-Pollen %	86.3%	97.7%	94.6%	95.5%	66.3%	82.5%	56.9%	28.0%
Fungal Spores %	0.7%	0.8%	4.7%		0.3%	1.4%	2.6%	8.3%
Algae %				0.8%	1.2%			
Dinoflagellate %	12.6%	1.5%	0.8%	1.2%	31.0%	14.3%	25.1%	20.7%
Acritarch %	0.4%			2.4%	1.2%	1.8%	15.5%	43.0%
TOTAL Microplankton %	13.0%	1.5%	0.8%	3.7%	32.2%	16.1%	40.5%	63.7%
TOTAL COUNT	285	261	257	245	326	217	343	193

TABLE-4: PALYNOMORPH PERCENTAGES FROM ROUNDHEAD-1. Page 4 of 4

	2855.5m SWC 13	2862.5m SWC 12	2879.5m SWC 10	2891.0m SWC 9	2900.5m SWC 8	2929.0m SWC 5	2936.5m SWC 4	2952.0m SWC 3
TRILETE SPORES undiff.	4.7%	5.3%		3.7%	1.0%	0.4%	0.7%	3.2%
Cyatheacidites annulatus								
Cyathidites spp.	3.4%	3.5%	2.3%	3.7%	1.0%	2.1%		5.2%
Gleicheniidites spp.	0.7%			0.7%				1.6%
Herkosporites elliottii		2.4%						
Stereisporites spp.			0.9%	4.1%	2.7%	1.3%		2.4%
MONOLETE SPORES								
Laevigatosporites spp.	4.7%	1.8%	1.4%	1.9%	3.1%	4.3%	2.6%	4.0%
Peromonolites spp.								
Verrucatosporites spp.								
TOTAL SPORES	13.4%	12.9%	4.7%	14.1%	7.8%	8.1%	3.3%	16.4%
GYMNOSPERM POLLEN								0.4%
Araucariacites australis		1.2%	0.9%	0.4%		0.4%		
Dilwynites spp.				0.7%	0.3%		0.7%	0.4%
Dacrycarpites australiensis								
Lygistepollenites balmei				0.4%				
Lygistepollenites florinii	0.7%					0.4%	3.7%	2.0%
Microcachryidites antarcticus	0.7%		0.5%	0.4%	0.3%	0.4%	2.2%	0.8%
Parvisaccatus catastus								
Phyllocladidites mawsonii	7.4%	11.8%	14.4%	7.4%	16.0%	19.7%	26.0%	12.8%
Phyllocladus paleogenicus							0.4%	
Podocarpidites spp.	2.7%	1.8%	4.2%	6.7%	3.4%	5.1%	11.2%	6.8%
Podosporites microsaccatus	1.3%	1.2%	1.9%	0.7%	3.7%	2.6%	14.9%	2.4%
TOTAL GYMNOSPERM POLLEN	12.8%	15.9%	21.9%	16.7%	23.8%	28.6%	59.1%	25.6%
ANGIOSPERM POLLEN undiff.	3.4%			1.9%	0.3%	0.9%	4.1%	2.8%
Australopollis obscurus								
Casuarina (H. harrisii)								
Dicotetradites clavatus			0.5%					
Gambierina rudata/edwardsii	26.8%	12.9%	13.5%	25.9%	9.2%	10.3%	4.5%	6.4%
Liliacidites spp.	1.3%				3.7%			
Myrtaceidites spp.								
Nothofagidites 'brassii' type					0.3%	0.4%		0.4%
Nothofagidites 'fusca' type				0.4%				0.4%
Penninsulapollis gillii	3.4%	4.7%	1.9%	6.7%	1.7%	4.3%	1.1%	2.8%
Periporopollenites spp.		0.6%	0.9%					
Proteacidites angulatus								
Proteacidites clinei				0.7%		3.4%		
Proteacidites grandis								
Proteacidites reticuloconcavus		0.6%		4.4%			1.1%	
Proteacidites spp.	37.6%	49.4%	48.8%	27.8%	23.5%	38.9%	16.4%	40.0%
Tricolpites confessus			2.3%					
Tricolpites waiparensis				0.4%	15.0%			
Tricolpites spp.	0.7%	0.6%	5.1%	1.1%	9.5%	2.1%	0.4%	3.6%
Tricolporites lilliei					2.0%			
Tricolporites spp.	0.7%	2.4%	0.5%		3.1%	2.6%	10.0%	1.6%
Triporopollenites spp. (small)						0.4%		
ANGIOSPERM POLLEN TOTAL	73.8%	71.2%	73.5%	69.3%	68.4%	63.2%	37.5%	58.0%
TOTAL SPORES & POLLEN COUNT	149	170	215	270	294	234	269	250
DINOFLAGELLATES undiff.				50.0%				
Areoligera spp.								
Deflandrea spp.								
Eisenackia/Alisocysta complex								
Glaphrocysta spp.								
Manumiella druggii complex								
Operculodinium centrocarpum								
Parecaniella indentata								
Senegalinium dilwynensis								
Spinidinium spp.				50.0%				
Spiniferites spp.								
Trithyrodinium evittii								
DINOFLAGELLATES TOTAL				100.0%				
ACRITARCHS					100.0%			
TOTAL MICROPLANKTON COUNT	0	0	0	2	2	0	0	0
PERCENTAGES FOR MAJOR CATEGORIES								
Spores %	13.2%	11.8%	4.3%	13.5%	7.4%	8.1%	3.3%	16.1%
Gymnosperm Pollen %	12.6%	14.5%	20.3%	16.0%	22.4%	28.4%	58.7%	25.2%
Angiosperm Pollen %	72.8%	65.1%	68.1%	66.3%	64.4%	62.7%	37.3%	57.1%
TOTAL Spore-Pollen %	98.7%	91.4%	92.7%	95.7%	94.2%	99.2%	99.3%	98.4%
Fungal Spores %	1.3%	8.6%	7.3%	3.5%	3.5%	0.8%	0.7%	1.6%
Algae %					1.6%			
Dinoflagellate %				0.7%				
Acritarch %					0.6%			
TOTAL Microplankton %				0.7%	0.6%			
TOTAL COUNT	151	186	232	282	312	236	271	254