APPENDIX-1

PALYNOLOGICAL ANALYSIS OF SWEETLIPS-1
GIPPSLAND BASIN.

by

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Palaeontology Report 1990/3

February, 1989

INTERPRETED DATA

INTRODUCTION

Thirty-three sidewall cores and four conventional core samples from Sweetlips-1 were processed and examined for spores, pollen and microplankton. As part of the analysis twenty-four samples were also counted to determine the variation in percentages and ratios of the principal spore-pollen and microplankton species. Both oxidised organic residue yields and palynomorph concentrations were mostly moderate to high and this was reflected in the moderate spore-pollen diversity recorded from the majority of samples. Average diversity from productive samples was 19.6 spore-pollen species per sample. Microplankton were abundant and the assemblages were of moderate diversity in the Lakes Entrance Formation, but were generally of low abundance and diversity in the Latrobe Group. Preservation of palynomorphs overall was fair to good.

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

PALYNOLOGICAL SUMMARY OF SWEETLIPS-1

AGE	UNIT/FACIES		SPORE-POLLEN ZONES (Dinoflagellate Zones)	DEPTH RANGE (mKB)
Miocene-Oligocene	Lakes Entrance Fm.		*P. tuberculatus*	1433.0-1504.0
		1505.0m		
Mid-Late Eocene	LATROBE GROUP	Gurnard Fm.?	NOT SAMPLED	
UNCONFORMITY		1510.0m		
Early Eocene		Undifferentiated "coarse clastics" facies	Lower *M. diversus* (*A. hyperacanthum*)	1518.6-1559.0 (1559.0)
Paleocene			Upper *L. balmei*	1567.0-1631.5
Paleocene			Lower *L. balmei*	1643.2-1690.0
Maastrichtian			Upper *T. longus*	1713.9-1787.0
UNCONFORMITY		1813.0m		
Coniacian-Turonian		Kipper Shale	*P. mawsonii*	1815.0-1849.0
		T.D. 1870.0m		

GEOLOGICAL COMMENTS

1. Sweetlips-1 was abandoned at a total depth of 1870m while still within the Kipper Formation. This formation was first proposed as a discrete unit of the Latrobe Group in the Kipper-1 well completion report (Marshall & Partridge, 1986). In Sweetlips-1 the formation consists of 57 metres of predominately dark grey argillaceous siltstone with minor thin beds of predominately very fine grained sandstone.

2. The environment of deposition of the the Kipper Formation is envisioned to be a large, deep, fresh water lake.

   A fresh water environment is strongly suggested by the occurrence in all samples of a low diversity suite of algal cysts and microplankton. In Kipper-1, Marshall & Partridge (1986), suggested a restricted marine influence on the Kipper Formation. However, a more detailed study of these algal cysts by Marshall (1989) shows that they are unlike any contemporary marine assemblages, and that they are more likely to be fresh water forms. Their current endemic occurrence in the Gippsland Basin is consistent with deposition within a lake or lakes formed during the rifting associated with the breakup of southeastern Australia.

   The composition of the spore-pollen assemblages suggest the environment of deposition of the Kipper Formation is a large and deep lake. Relative to similar age assemblages outside of the Gippsland Basin counts of the spore-pollen assemblages in Sweetlips-1 (Table-4) show an unusual dominance of gymnosperm pollen (particularly the *Araucariacites/Dilwynites* species group). This is interpreted to be a manifestation of the "Neves effect", which is the tendency, for bisaccate pollen, certain buoyant spores, and other pollen with 'comparatively great transportability' to have greater relative abundance the further offshore you go in any depositional basin (Traverse, 1988; p.413). As the "Neves effect" is present in all samples in the *P. mawsonii* Zone in Sweetlips-1 it suggests stability of environment through a considerable period of geological time and this is a prerequisite only fulfilled by a large lake. Based on the known distribution of the algal cysts this Turonian lake may extend about 100 km east-west by 50 km north-south (i.e. from Sweetlips-1 to Kipper-1 to dredge sample in Bass Canyon examined by Marshall, 1989). Assuming, based on comparison to modern lakes, a conservative average water depth of 100 metres the lake would have a volume of 500 km^3. A lake of this size would rank 18th on list of the largest modern lakes of the world by volume, and therefore could justifiably be called a large lake (see Herdendorf, 1982, table 8).

3. The top of the Kipper Formation at 1813m is marked by the Late Cretaceous erosive unconformity described by Lowry (1987, 1988) from the adjacent Emperor-1 and other wells. In Sweetlips-1 this unconformity is overlain by well dated latest Maastrichtian sediments. On the time scale of Haq *et al.* (1987, 1988) the unconformity at Sweetlips-1 represents a time gap of more than 20 million years.

4. The latest Maastrichtian section between 1725-1813m assigned to the Upper *T. longus* Zone is predominantly sandstone and siltstone with minor claystone. It notably lacks any coal seams and therefore is considered to represent fluviatile environments rather than coastal plain environments as is typical in more basinward position within this zone. The claystone to siltstone unit between 1700-1725m in contrast contains thin coal seams and is therefore considered to represent an upper coastal plain environment. The interval is assigned to the "upper" coastal plain because it lacks any dinoflagellates. In contrast the modifying prefix "lower" is assign to the coastal plain environment with dinoflagellates. It is suggested the interval between 1700-1725m correlates with all or part of the transgressive T.1 Shale which contains the *M. druggii* and *T. evittii* dinoflagellate Zones, and is a widely distributed unit in the basin (see Partridge, 1989).

5. The Paleocene *L. balmei* Zone section between 1565-1700m shows a similar environmental pattern to the Maastrichtian section. The basal interval from 1655-1700m is predominantly sandy and lacks coals and is therefore interpreted as fluviatile. The overlying section between 1565-1655m becomes increasingly shaly upwards and also contains thin coal seams and is therefore interpreted represent upper coastal plain environments. No *in situ* dinoflagellates were found in samples over this interval.

6. In the Early Eocene Lower *M. diversus* Zone section between 1510-1565m the environment of deposition is interpreted as lower coastal plain at the base because marine dinoflagellates are present in the samples, grading upwards into upper coastal plain based on the absence of dinoflagellates.

7. The described lithology of the recovered sidewall cores compared to their interpreted lithology from the electric logs is considered anomalous for at least three sidewall cores recovered from the Lower *M. diversus* Zone interval. The sequence of anomalous sidewall cores are:

SWC No.	Depth (m)	Described Lithology	Interpreted Lithology	Comment
47	1547.0	White Sandstone	Claystone	Not processed/ probably 1537.2
46	1550.8	Not recovered	Siltstone/ claystone	
45	1555.0	Grey Sandstone/ with clay matrix	Claystone	Probably 1550.8
44	1559.0	Claystone	Sandstone	Probably 1555.0

Sidewall cores 44 and 47 are the two samples whose lithologies are most in conflict with the interpreted lithologies from the electric logs. As an explanation it is suggested that the four sidewall cores numbered 46, 48, 49 and 52 which were not recovered led to a mislabelling of the recovered samples. It is speculated that sidewall core 44 was not recovered and that the next three recovered samples (i.e. SWCs 45, 46, and 48) were all moved down one place. This interpretation is the simplest and best fit for the lithologies of the recovered samples. The interpretation does not materially affect the palynological zonation of Sweetlips-1 but may have bearing on the electric log correlation of the *A. hyperacanthum* Zone with adjacent wells.

8. In Sweetlips-1 there is less than 10 metres of undated section present at the top of the Latrobe "coarse clastics" section. Relative to the adjacent Emperor-1 well it is estimated that approximately 35 metres of Early Eocene sediments belonging to the Middle to Upper *M. diversus* and *P. asperopolus* Zones have been eroded from the Latrobe in Sweetlips-1.

9. No *N. asperus* Zone section was sampled in Sweetlips-1, but is present in a thin Gurnard Formation in Emperor-1 between 1518-1524m (4980-5000ft). It is suggested that the thin high density unit between 1505-1510m may be the equivalent unit in Sweetlips-1.

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, 1982), 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 nomenclatural changes to nominate species such as *Forcipites* (al. *Tricolpites*) *longus* (Stover & Evans) Dettmann & Jarzen 1988. Author citations for dinoflagellates can be found in Lentin & Williams (1985, 1989), and for most algae and acritarchs in Marshall (1989).

Phyllocladidites mawsonii Zone: 1815.0-1849.0 metres Coniacian-Turonian.

Six samples are assigned to this zone based on the similarity of their gross assemblage compositions in Table-4. Key spore-pollen zone species are often only represented by single specimens. Strong supporting evidence for this zone and the Coniacian-Turonian age assignment comes form the algae and microplankton in the samples. Several of the distinctive algae species described by Marshall (1989) were recorded.

The counts of the spore-pollen fraction in all samples are dominated by gymnosperm pollen (60% to 82%), particularly the species groups *Dilwynites* spp. (21% to 52%), *Podocarpidites* spp. (5% to 25%) and *Araucariacites australis* (3% to 15%). The parent plants of these pollen are all wind pollinated and it is well documented in the palynological literature that the concentrations of these pollen types reach their highest values in 'offshore' environments, either in marine situations or towards the centre of large lakes. This pattern of distribution has been termed the "Neves effect" and is summarized by Traverse (1988, p.394-416, figs 17.15 & 17.16). Total spores in the samples are also a significant component (16% to 33%) but without any particularly dominant spore species. Angiosperm pollen in all samples are conspicuously low (<1% to 7%) in marked contrast to their abundance in the overlying *T. longus* and younger Zones where they have an average abundance of 50%.

Spore-pollen species indicating an age no older than the *P. mawsonii* Zone following the zone definition and range chart data in Helby *et al.* (1987) are *Phyllocladidites mawsonii* (a single poorly preserved specimen recorded at 1815m) and *Proteacidites* sp. (a single small specimen at 1825m). Species indicating an age no younger than the *P. mawsonii* Zone are *Interulobites intraverrucatus*, *Appendicisporites distocarinatus* both at 1815m, *Cyatheacidites tectifera* (a single corroded specimen at 1817m) and *Hoegisporis* sp. (this is an undescribed species characterised by three subdued nodes and was found at 1817m and 1825m). Other significant species recorded over this section are *Foraminisporis asymmetricus*, *Cicatricosisporites cuneiformis*, *C. hughesii* and *Ceratosporites equalis*.

Algae and microplankton were recorded in all samples varying from 1.5% to a high 41% of the total assemblage count (Table-4). Small smooth spheres identified broadly with *Sigmopollis carbonis* (Newman) are the commonest element and because of their small size are probably under-represented in the counts. Of most stratigraphical importance are the identification of algal cysts and microplankton described by Marshall (1989). Key species identified are *Rimosicysta kipperii*, *R. aspera*, *Wuroia corrugata*, *Luxadinium?* sp. A & B, and *Micrhystridium* sp. A. Another frequent to common form regarded as an algal cyst is *Amosopollis cruciformis* (see Helby *et al.* 1987, p.55).

The above algal assemblages are of considerable age and environmental significance within the Latrobe Group and are here informally named the *Rimosicysta kipperii* Microplankton Association.

Upper *Tricolpites longus* Zone: **1713.9-1787.0 metres** **Maastrichtian.**

The seven productive samples assigned to the Upper *T. longus* Zone contain well preserved and moderately diverse assemblages which are confidently assigned to the zone on both species recorded and species abundance. The deepest two samples at 1770m and 1787m are given confidence ratings of 2, because they contain diverse assemblages with frequent to common occurrences of *Gambierina rudata*, but lack the presence of *Stereisporites (Tripunctisporis)* spp. which is first recorded in the overlying sample at 1762m. A confidence rating of 1 or better is usually reserved for the FAD (First Appearance Datum) of the latter species. The top of the zone is normally picked at the LADs (Last Appearance Datums) of a number of indicator species (Helby *et al.* 1987). The relevant species in the shallowest sample assigned to this zone are *Pseudowinterapollis wahooensis*, *Ornamentifera sentosa*, *Beaupreaidites orbiculatus* (formerly *Proteacidites gemmatus* ms), and *Tricolporites lilliei*.

The choice of the top of the Upper *T. longus* Zone in Sweetlips-1 is unusual in two respects. Firstly, the occurrences of *Proteacidites clinei* ms and *Tricolporites lilliei* at 1690m, and *Camarozonosporites horrendus* at both 1680m and 1690m are all considered to reflect reworking of *T. longus* Zone sediments. This is an rare occurrence within the Gippsland Basin. The second unusual aspect is that the two shallowest samples assigned to the zone at 1713.9m and 1716.2m lack a significant abundance of *Gambierina* spp. This significant change in assemblage composition near the top of the Upper *T. longus* Zone may have significance for either age or facies correlation and needs to be looked for in other wells in the basin.

No dinoflagellates or other microplankton were recorded from this zone.

Lower *Lygistepollenites balmei* Zone: 1643.2-1690.0 metres Paleocene.

The increase in abundance of gymnosperm pollen particularly *Phyllocladidites mawsonii* and to a lesser extent *Lygistepollenites balmei* is the main criteria for placing the base of the zone at 1690.0m and treating the *T. longus* Zone indicator species in this sample and in the overlying sample at 1680m as reworked. The use of this abundance criteria to establish the base of the Lower *L. balmei* Zone was first demonstrated in Roundhead-1 were there was supporting data from the dinoflagellates (Partridge, 1989). The top of the zone is placed at 1643.2m at the last frequent occurrence of *Proteacidites angulatus*.

Upper *Lygistepollenites balmei* Zone: 1567.0-1631.5 metres Paleocene.

Only three samples can be confidently assigned to the Upper *L. balmei* Zone. A further three samples were examined and counted within the zone interval. These latter samples could be confidently assigned to the broader *L. balmei* Zone but lacked indicator species for either the Upper or Lower subdivisions.

The deepest sample at 1613.5m is assigned to the Upper subzone on the presence of a single specimen of *Proteacidites annularis*. The next sample at 1567.5m is assigned to the Upper subzone based on the common occurrence of *Cupanieidites orthoteichus* and presence of *Malvacipollis subtilis.* The shallowest sample at 1567m contains the FAD for the indicator species *Anacolosidites acutullus* and is no younger than the Upper subzone on the frequent occurrence of *Lygistepollenites balmei.*

The rare dinoflagellate species recorded from the sidewall core at 1575.9m are all considered to be contaminants.

Lower *Malvacipollis diversus* Zone: **1518.6-1559.0 metres** **Early Eocene.**

The base of the zone is picked on the FADs of *Spinozonocolpites prominatus* (frequent) and *Polypodiaceoisporites varus* (rare) as well as the first common occurrence of *Malvacipollis diversus.*

The two shallowest samples from core-2 at 1518.6m and 1519.8m are assigned to the zone with only a fair confidence rating. They rely on the absence of the key species *Proteacidites ornatus, P. tuberculiformis* and *P. xestoformis* ms, characteristic of the next younger zone, for their assignment to the Lower subzone. A possible assignment to the Middle *M. diversus* Zone may be considered for the sample at 1519.8m based on the what would be considered secondary or less reliable FADs of the species *Polycolpites esobalteus* and *Proteacidites nasus* Truswell & Owen 1988 (formerly *Proteacidites plemmelus* ms). The assemblages are good enough, however, to emphatically state that no section assignable to either the Upper *M. diversus* or *P. asperopolus* Zones is present in Sweetlips-1.

The top of the Lower *M. diversus* Zone with a good confidence rating is picked at the sidewall core at 1520m on the LAD of *Cyathidites gigantis.*

The deepest sample, at 2215.0m, also contains a microplankton assemblage referable to the *Apectodinium hyperacanthum* dinoflagellate Zone. The key indicators for the zone are the frequent occurrence of the eponymous species *Apectodinium hyperacanthum* associated with *A. homomorphum* (long spined variety), *Dyphes colligerum* and *Fibrocysta bipolare.*

Proteacidites tuberculatus Zone: **1433.0-1504.0 metres** **Miocene-Oligocene.**

The four shallowest samples analysed were readily assigned the the Lakes Entrance Formation based on the lithology of the sidewall cores as well as the abundant and characteristic microplankton assemblage which were extracted. The spore-pollen recorded from the samples are mostly long ranging species associated with rare reworked indicator species of older zones. *Cyatheacidites annulatus* the key indicator species for the *P. tuberculatus* Zone was only recorded from one sample.

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TABLE-1: INTERPRETATIVE PALYNOLOGICAL DATA SWEETLIPS-1, GIPPSLAND BASIN.

SAMPLE TYPE	DEPTH (METRES)	SPORE-POLLEN ZONE	DINOFLAGELLATE ZONE (OR ASSOCIATION)	CONFIDENCE RATING	COMMENT
SWC 60	1433.0	*P. tuberculatus*		2	
SWC 55	1497.0	*P. tuberculatus*		1	*Cyatheacidites annulatus* present.
SWC 54	1500.0	*P. tuberculatus*		2	
SWC 53	1504.0	*P. tuberculatus*		2	
Core-1	1516.8	Indeterminate			
Core-2	1518.6	Lower *M. diversus*		2	
Core-2	1519.8	Lower *M. diversus*		2	
SWC 50	1520.0	Lower *M. diversus*		1	LAD *Cyathidites gigantis*
Core-3	1544.0	Lower *M. diversus*		2	
SWC 45	1555.0	Lower *M. diversus*		1	
SWC 44	1559.0	Lower *M. diversus*	*A. hyperacanthum*	0	*Spinizonocolpites prominatus* conspicuous.
SWC 39	1567.0	Upper *L. balmei*		1	
SWC 38	1567.5	Upper *L. balmei*		1	Common *Cupanieidites orthoteichus* - 8.3%
SWC 37	1570.2	*L. balmei*		2	*Laevigatosporites* spp. > 75%
SWC 36	1575.9	*L. balmei*		1	Dinoflagellates considered to be contaminants.
SWC 32	1614.5	*L. balmei*		1	
SWC 30	1631.5	Upper *L. balmei*		2	
SWC 29	1643.2	Lower *L. balmei*		1	Proteacidites angulatus - 3.9%
SWC 28	1655.3	Lower *L. balmei*		1	Common *Proteacidites angulatus* - 9.1%
SWC 27	1668.0	Lower *L. balmei*		1	Abundant *Phyllocladidites mawsonii* - 31%
SWC 25	1680.0	Lower *L. balmei*		2	Rare *T. longus* Zone indicators are reworked.
SWC 24	1690.0	Lower L. balmei		2	Dominated by *P. mawsonii* - 56.7%
SWC 23	1703.0	Indeterminate			Palynomorph concentration low.
SWC 22	1713.9	Upper *T. longus*		1	*Gambierina* < 1%
SWC 21	1716.2	Upper *T. longus*		1	*Gambierina* << 1%
SWC 20	1720.0	Upper *T. longus*		1	*Gambierina* abundance - 8.5%

TABLE-1: INTERPRETATIVE PALYNOLOGICAL DATA SWEETLIPS-1, GIPPSLAND BASIN.

Sheet 2 of 2

SAMPLE TYPE	DEPTH (METRES)	SPORE-POLLEN ZONE	DINOFLAGELLATE ZONE (OR ASSOCIATION)	CONFIDENCE RATING	COMMENT
SWC 17	1739.0	Upper *T. longus*		1	*Gambierina* abundance 16.7%
SWC 16	1744.0	Indeterminate			
SWC 14	1762.0	Upper *T. longus*		1	FAD *Stereisporites (Tripunctisporis)* spp.
SWC 13	1770.0	Upper *T. longus*		2	*Gambierina* abundance 12%
SWC 11	1787.0	Upper *T. longus*		2	*Gambierina* abundance 9%
SWC 8	1815.0	*P. mawsonii*	(*Rimosicysta kipperii*)	1	Abundant *Sigmopollis carbonis*.
SWC 7	1817.0	*P. mawsonii*	(*Rimosicysta kipperii*)	1	
SWC 5	1825.0	*P. mawsonii*		1	
SWC 4	1832.0	*P. mawsonii*	(*Rimosicysta kipperii*)	1	
SWC 2	1840.0	*P. mawsonii*		1	
SWC 1	1849.0	*P. mawsonii*		1	

LAD - Last Appearance Datum.
FAD - First Appearance Datum.

PALYNOLOGY DATA SHEET

BASIN: *GIPPSLAND* ELEVATION: KB: *+21.0m* GL: *-52.0m*

WELL NAME: *SWEETLIPS - 1* TOTAL DEPTH: *1870m*

AGE	PALYNOLOGICAL ZONES	HIGHEST DATA Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time	LOWEST DATA Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time
NEOGENE	*T. pleistocenicus*										
	M. lipsis										
	C. bifurcatus										
	T. bellus										
PALEOGENE	*P. tuberculatus*	*1433*	*2*				*1504*	*2*	*1497*	*1*	
	Upper *N. asperus*										
	Mid *N. asperus*										
	Lower *N. asperus*										
	P. asperopolus										
	Upper *M. diversus*										
	Mid *M. diversus*										
	Lower *M. diversus*	*1518.6*	*2*	*1519.6*			*1559*	*0*			
	Upper *L. balmei*	*1567*	*1*				*1631.5*	*2*	*1567.5*	*1*	
	Lower *L. balmei*	*1643.2*	*1*				*1690*	*2*	*1668*	*1*	
LATE CRETACEOUS	Upper *T. longus*	*1713.9*	*1*				*1787*	*2*	*1762*	*1*	
	Lower *T. longus*										
	T. lilliei										
	N. senectus										
	T. apoxyexinus										
	P. mawsonii	*1815*	*1*				*1849*	*1*			
	A. distocarinatus										
EARLY CRET.	*P. pannosus*										
	C. paradoxa										
	C. striatus										
	C. hughesi										
	F. wonthaggiensis										
	C. australiensis										

COMMENTS: *All depths in metres.*

Apectodinium hyperacanthum Dinoflagellate Zone at 1559m

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: *February 16, 1990*

DATA REVISED BY: DATE:

BASIC DATA

TABLE-2: BASIC DATA

TABLE-3: PALYNOMORPH PERCENTAGES FOR
Upper *T. longus* to *L. balmei* Zones.

TABLE-4: PALYNOMORPH PERCENTAGES FOR
P. mawsonii Zone.

RANGE CHARTS FOR SAMPLES BETWEEN
1433.0m - 1787.0m
AND
1815.0m - 1849.0m

TABLE-2: BASIC PALYNOLOGIC DATA SWEETLIPS-1, GIPPSLAND BASIN.

Sheet 1 of 2

SAMPLE TYPE	DEPTH (METRES)	LAB NO.	LITHOLOGY	RESIDUE YIELD	PALYNOMORPH CONCENTRATION	PRESERVATION	NUMBER OF S-P SPECIES	MICROPLANKTON ABUNDANCE	MICROPLANKTON NO. SPECIES
SWC 60	1433.0	78262H	Calc. claystone	Very low	Very low	Fair	18+	Low	4+
SWC 55	1497.0	78262C	Calc. claystone	Low	Low	Good	10+	High	5+
SWC 54	1500.0	78262B	Calc. claystone	Low	Low	Good	9+	Moderate	6+
SWC 53	1504.0	78262A	Calc. claystone	Moderate	Moderate	Poor-good	16+	High	8+
Core-1	1516.8	78305A	Carbonaceous claystone	Very low	Barren				
Core-2	1518.6	78305B	Carbonaceous siltstone	High	High	Poor	24+		
Core-2	1519.8	78305C	Siltstone	Moderate	Moderate	Poor-fair	23+		
SWC 50	1520.0	78261X	Sst. with clay matrix	Low	Low	Fair-good	22+		
Core-3	1944.0	78305D	Coal	High	Moderate	Poor-fair	15+		
SWC 45	1555.0	78261S	Gry-brn sandstone	Moderate	Moderate	Good	13+	Low	1
SWC 44	1559.0	78261R	Claystone	High	Moderate	Fair	21+	Moderate	5+
SWC 39	1567.0	78261M	Claystone grad'g slst	Moderate	Moderate	Poor	13+		
SWC 38	1567.5	78261L	Siltstone	High	High	Poor-good	28+		
SWC 37	1570.2	78261K	Claystone	Low	Low	Poor	8+		
SWC 36	1575.9	78261J	Claystone	Low	Moderate	Fair	12+	(Very low)	(3)
SWC 32	1614.5	78261F	Claystone	High	High	Good	18+		
SWC 30	1631.5	78261D	Claystone	High	High	Good	31+		
SWC 29	1643.2	78261C	Claystone	High	High	Good	24+		
SWC 28	1655.3	78261B	Claystone	High	High	Poor-fair	18+		
SWC 27	1668.0	78261A	Interlaminated sst/slst	High	High	Fair-good	21+		
SWC 25	1680.0	78260Y	Carbonaceous sst.	Moderate	Moderate	Fair-good	30+	(Very low)	(1)
SWC 24	1690.0	78260X	Carbonaceous claystone	High	Low	Poor	9+		
SWC 23	1703.0	78260W	Claystone	High	Low	Poor	7+		
SWC 22	1713.9	78260V	Dk. grey siltstone	High	High	Good	45+		
SWC 21	1716.2	78260U	Dk. grey siltstone	High	High	Fair-good	31+		
SWC 20	1720.0	78260T	Siltstone	Moderate	Moderate	Fair-good	25+		
SWC 17	1739.0	78260Q	Claystone w/. coal clasts	Moderate	High	Fair-good	18+		
SWC 16	1744.0	78260P	Claystone	Very low	Barren				

TABLE-2: BASIC PALYNOLOGIC DATA SWEETLIPS-1, GIPPSLAND BASIN.

Sheet 2 of 2

SAMPLE TYPE	DEPTH (METRES)	LAB NO.	LITHOLOGY	RESIDUE YIELD	PALYNOMORPH CONCENTRATION	PRESERVATION	NUMBER OF S-P SPECIES	MICROPLANKTON ABUNDANCE	MICROPLANKTON NO. SPECIES
SWC 14	1762.0	78260N	Micaceous siltstone	High	Moderate	Fair-good	16+		
SWC 13	1770.0	78270M	Micaceous siltstone	Moderate	Moderate	Fair-good	20+		
SWC 11	1787.0	78260K	Sandstone	Moderate	Moderate	Good	31+		
SWC 8	1815.0	78260H	Claystone	High	High	Good	23+	Abundant	4+
SWC 7	1817.0	78260G	Siltstone	High	Moderate	Fair	18+	Low	2
SWC 5	1825.0	78260E	Carbonaceous siltstone	High	Moderate	Fair	17+	Low	3
SWC 4	1831.0	78260D	Siltstone	Moderate	Moderate	Fair	16+	Moderate	2
SWC 2	1840.0	78260B	Silstone	Moderate	Moderate	Fair	19+	Low	3
SWC 1	1849.0	78260A	Siltstone	Moderate	Moderate	Fair	17+	Very low	2

Microplankton in (brackets) = contamination.
* Diversity: Very Low = 1- 5 species.
Low = 6-10 species.
Moderate = 11-25 species.
High = 26-74 species.
Very High = 75+ species.

(ADP235)

TABLE-3: PALYNOMORPH PERCENTAGES FOR Upper T. longus - L. balmei Zones FROM SWEETLIPS-1

	1567.0m SWC 39	1567.5m SWC 38	1570.2m SWC 37	1575.9m SWC 36	1614.5m SWC 32	1631.5m SWC 30	1643.2m SWC 29	1655.3m SWC 28	1668.0m SWC 27
TRLIETE SPORES undiff.		2.8%	2.5%	1.1%	3.2%	1.6%	0.9%		3.7%
Cyathidites spp.	5.4%	2.8%	4.2%	8.6%	9.6%	1.6%	1.9%	1.8%	2.5%
Gleicheniidites/Clavifera spp.	7.6%	11.6%	3.3%		8.5%	29.6%	0.5%	0.5%	5.0%
Stereisporites spp.		0.8%	0.8%		1.1%	1.6%		0.5%	1.0%
MONOLETE SPORES							0.5%		0.5%
Laevigatosporites spp.	14.1%	15.3%	75.0%	8.1%	5.3%	0.8%	9.7%	4.5%	2.5%
Marratisporites scabratus	3.3%	2.8%			0.5%				0.5%
TOTAL SPORES	30.4%	36.4%	85.8%	17.8%	28.2%	35.2%	13.5%	7.3%	15.7%
GYMNOSPERM POLLEN									
Araucariacites australia							0.5%		0.5%
Dilwynites spp.								0.9%	1.5%
Lygistepollenites balmei	2.2%	5.0%	2.5%	5.4%		6.6%	2.4%	1.4%	3.0%
Lygistepollenites florinii		0.4%				0.4%	1.0%	0.5%	1.5%
Microcachryidites antarcticus						0.8%		0.5%	0.5%
Phyllocladidites mawsonii (s.l.)	2.2%	1.2%		1.6%	5.3%	14.5%	5.8%	7.3%	30.3%
Phyllocladus palaeogenicus							0.5%		
Podocarpidites spp.	2.2%	5.4%			3.2%	8.9%	24.2%	17.7%	10.6%
Podosporites microsaccatus		0.8%			1.1%		1.4%		
TOTAL GYMNOSPERM POLLEN	6.5%	12.8%	2.5%	7.0%	9.6%	31.3%	35.7%	28.2%	47.5%
ANGIOSPERM POLLEN undiff.	1.0%	1.7%		0.8%		0.6%	2.8%		2.0%
Australopollis obscurus				0.5%	19.1%	0.8%	1.0%	28.2%	
Casuarina (H. harrisii)		2.0%			1.1%				
Cupanieidites orthoteichus		8.3%							
Dicotetradites clavatus	3.3%	0.4%		0.5%		0.8%	1.0%		
Gambierina spp.									
Malvacipollis spp.		1.2%							
Nothofagidites spp.	3.3%	2.5%		2.7%	1.1%		1.9%	0.4%	0.5%
Penninsulapollis gillii				0.5%		0.4%			
Periporopollenites spp.	2.2%	1.2%		2.2%		1.2%	1.0%	5.0%	1.5%
Proteacidites angulatus							3.9%	9.1%	
Proteacidites clinei									
Proteacidites reticuloconcavus									
Proteacidites spp.	25.0%	18.2%	10.8%	55.1%	10.1%	20.3%	18.8%	15.9%	6.1%
Tetracolporites verrucosus									0.5%
Tricolpites confessus									
Tricolporites lilliei									
Tricolp(or)ates undiff.	7.6%	3.7%		7.0%	9.6%	4.7%	19.8%	3.6%	14.6%
Triporopollenites sectilis									
Triporopollenites spp. (small)	20.7%	11.6%	0.8%	5.9%	21.3%	4.7%	0.5%	2.3%	11.6%
TOTAL ANGIOSPERM POLLEN	63.1%	50.8%	11.7%	75.2%	62.2%	33.5%	50.7%	64.5%	36.8%
TOTAL SPORES AND POLLEN COUNT	92	242	120	185	188	256	207	220	198
PERCENTAGES FOR MAJOR CATEGORIES									
Spores %	30.4%	35.5%	85.5%	17.8%	26.8%	35.2%	13.3%	7.3%	13.5%
Gymnosperm Pollen %	6.5%	12.5%	2.5%	7.0%	9.1%	31.3%	35.2%	28.2%	40.9%
Angiosperm Pollen %	63.1%	49.6%	11.7%	75.2%	59.0%	33.5%	50.0%	64.5%	31.7%
TOTAL SPORE-POLLEN %	100.0%	97.4%	100.0%	100.0%	94.9%	100.0%	98.6%	100.0%	86.1%
Fungal Spores and Hyphae %		2.4%			5.1%		1.4%		13.9%
TOTAL COUNT	92	248	120	185	198	256	210	220	230

TABLE-3: PALYNOMORPH PERCENTAGES FOR Upper T. longus - L. balmei Zones FROM SWEETLIPS-1

	1680.0m SWC 25	1690.0m SWC 24	1713.9m SWC 22	1716.2m SWC 21	1720.0m SWC 20	1739.0m SWC 17	1762.0m SWC 14	1770.0m SWC 13	1787.0m SWC 11
TRLIETE SPORES undiff.	3.5%	1.0%	4.2%	2.1%	2.2%	4.9%	3.4%	5.1%	3.4%
Cyathidites spp.	1.4%	1.0%	11.3%	2.0%	1.6%	8.0%	4.0%	1.8%	1.0%
Gleicheniidites/Clavifera spp.	1.9%		6.1%	4.9%	0.8%	0.6%	3.5%	0.9%	
Stereisporites spp.	1.4%		1.4%	4.1%	3.9%	1.9%	7.9%	5.3%	3.4%
MONOLETE SPORES			0.5%						
Laevigatosporites spp.	2.4%	6.0%	6.1%	5.3%	4.7%	5.6%	6.4%	13.2%	4.4%
Marratisporites scabratus	1.0%		1.4%	0.4%					
TOTAL SPORES	11.6%	8.0%	31.0%	18.8%	13.2%	21.0%	25.2%	26.3%	12.2%
GYMNOSPERM POLLEN									
Araucariacites australia	3.9%		1.9%		3.9%		0.5%	1.8%	0.5%
Dilwynites spp.	3.4%		0.5%		0.8%		0.5%		
Lygistepollenites balmei	3.7%	1.0%	0.5%	0.4%	1.6%	1.9%			1.4%
Lygistepollenites florinii	1.9%	1.0%		0.8%			5.9%		0.5%
Microcachryidites antarcticus	1.9%		0.5%	0.1%	0.8%		2.0%		2.0%
Phyllocladidites mawsonii (s.l.)	15.5%	56.7%	2.8%	2.0%	9.3%	1.9%	4.5%	3.5%	12.7%
Phyllocladus palaeogenicus		3.0%							
Podocarpidites spp.	16.4%	8.0%	7.9%	15.5%	8.4%	3.1%	8.8%	14.0%	5.8%
Podosporites microsaccatus	1.0%		18.3%	6.1%	3.9%	2.4%	4.0%	1.8%	2.0%
TOTAL GYMNOSPERM POLLEN	47.8%	69.7%	32.4%	24.9%	28.7%	9.3%	26.2%	21.1%	24.9%
ANGIOSPERM POLLEN undiff.	2.4%		1.8%	1.7%	2.3%		2.0%	1.6%	0.8%
Australopollis obscurus			0.5%	20.4%					
Casuarina (H. harrisii)									
Cupanieidites orthoteichus									
Dicotetradites clavatus				0.4%			2.0%		
Gambierina spp.	0.5%		0.9%		8.5%	16.7%	3.5%	12.3%	8.8%
Malvacipollis spp.									
Nothofagidites spp.							0.5%	1.8%	0.5%
Penninsulapollis gillii	1.9%		0.5%	0.4%	6.2%	5.6%	2.0%	0.9%	10.7%
Periporopollenites spp.					2.3%	1.2%	1.0%		
Proteacidites angulatus									
Proteacidites clinei				0.8%	1.6%		3.5%	4.4%	1.0%
Proteacidites reticuloconcavus								0.9%	2.0%
Proteacidites spp.	15.5%	4.0%	15.5%	6.5%	31.0%	35.8%	22.3%	26.3%	32.2%
Tetracolporites verrucosus				4.1%					
Tricolpites confessus						1.2%	1.0%		
Tricolporites lilliei	0.5%						0.4%	0.9%	0.5%
Tricolp(or)ates undiff.	7.2%	16.3%	14.1%	20.8%	3.1%	6.2%	5.9%	3.5%	1.5%
Triporopollenites sectilis									2.9%
Triporopollenites spp. (small)	12.6%	2.0%	3.3%	1.2%	3.1%	3.1%	4.5%		2.0%
TOTAL ANGIOSPERM POLLEN	40.6%	22.3%	36.6%	56.3%	58.1%	69.8%	48.6%	52.6%	62.9%
TOTAL SPORES AND POLLEN COUNT	207	99	213	245	129	162	202	114	205
PERCENTAGES FOR MAJOR CATEGORIES									
Spores %	10.5%	7.2%	30.6%	18.4%	22.6%	20.9%	23.2%	26.3%	11.3%
Gymnosperm Pollen %	43.2%	62.2%	31.9%	24.4%	27.8%	9.2%	24.1%	21.1%	23.0%
Angiosperm Pollen %	36.7%	19.8%	36.1%	55.2%	56.4%	69.3%	44.5%	52.6%	58.0%
TOTAL SPORE-POLLEN %	90.4%	89.2%	98.6%	98.0%	97.0%	99.4%	91.8%	100.0%	92.3%
Fungal Spores and Hyphae %	9.6%	10.8%	1.4%	2.0%	3.0%	0.6%	8.2%		7.7%
TOTAL COUNT	229	111	216	250	133	163	220	114	222

TABLE 4: PALYNOMORPH PERCENTAGES FOR P. mawsonii Zone FROM SWEETLIPS-1

	1815.0m SWC 8	1817.0m SWC 7	1825.0m SWC 5	1831.0m SWC 4	1840.0m SWC 2	1849.0m SWC 1
TRILETE SPORES undiff.	5.9%	8.1%	5.3%	2.8%	5.9%	4.2%
Baculatisporites spp.	1.8%	2.2%	2.9%	2.8%	1.4%	0.8%
Cyathidites spp.	5.8%	5.8%	16.6%	5.6%	12.9%	10.0%
Gleicheniidites spp.	2.3%	1.5%	0.5%	2.8%	1.4%	
Stereisporites spp.	0.6%	2.2%	2.0%	0.7%	5.0%	0.8%
MONOLETE SPORES	0.6%		0.5%		2.2%	1.7%
Laevigatosporites spp.	2.3%	3.6%	2.9%	1.4%	5.0%	0.8%
HILATE SPORES						
Triporoletes reticulatus		0.7%	1.0%			
TOTAL SPORES	19.3%	24.1%	31.7%	16.1%	33.8%	18.3%
GYMNOSPERM POLLEN						
Araucariacites australis	10.5%	14.6%	10.2%	13.3%	5.0%	3.3%
Dilwynites spp.	53.2%	51.7%	21.5%	43.4%	25.9%	45.0%
Corollina spp.			2.4%	0.7%	5.0%	0.8%
Cycadopites spp.	5.8%			1.3%		
Microcachryidites antarcticus	1.8%		5.4%	7.7%	6.5%	5.0%
Podocarpidites spp.	5.3%	6.7%	24.9%	11.2%	17.3%	25.0%
Podosporites microsaccatus	2.3%	2.2%	1.0%	4.2%		2.6%
TOTAL GYMNOSPERM POLLEN	78.9%	75.2%	65.4%	81.8%	59.7%	81.7%
ANGIOSPERM POLLEN undiff.						
Tricolpites spp.	1.8%	0.7%	1.4%		3.6%	
Tricolporites spp.			0.5%	2.1%	2.9%	
Triporopollenites spp.			1.0%			
TOTAL ANGIOSPERM POLLEN	1.8%	0.7%	2.9%	2.1%	6.5%	
TOTAL SPORES & POLLEN COUNT	171	137	205	143	139	120
PERCENTAGES FOR MAJOR CATEGORIES						
Spores %	10.7%	20.1%	30.1%	13.9%	29.7%	16.2%
Gymnosperm Pollen %	44.0%	62.8%	62.0%	70.5%	52.5%	72.0%
Angiosperm Pollen %	1.0%	0.6%	2.8%	1.8%	5.7%	
TOTAL Spore-Pollen %	55.7%	83.5%	94.9%	86.2%	87.9%	88.2%
Fugal Spores & Hyphae %	3.6%	4.3%	0.9%	2.4%	8.2%	10.3%
ALGAE & MICROPLANKTON undiff..		1.2%		6.0%	1.3%	
Amosopollis cruciformis	7.2%	6.1%		0.6%		
Micrhystridium spp.			1.8%		0.6%	1.5%
Rimosicysta spp.	0.7%	1.2%		4.8%		
Sigmopollis carbonis	32.6%	3.7%	2.3%		1.9%	
Wuroia spp.	0.3%					
TOTAL Algae & Microplankton	40.7%	12.2%	4.1%	11.4%	3.8%	1.5%
TOTAL COUNT	307	164	216	166	158	136