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PALYNOLOGICAL ANALYSIS, TOMMYRUFF-1

GIPPSLAND BASIN

by

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INTRODUCTION

Thirty six sidewall core and four cuttings samples, representing the interval 815.0 to 1545.1m in Tommyruff-1 were processed and examined for spore-pollen and dinoflagellates.

Yields and preservation were adequate to good but difficulties in distinguishing between reworking and bioturbation of palynomorphs has meant that marl samples 897.0-1000m cannot be dated with confidence [see Biostratigraphy]. In more general terms, spore-pollen does not allow carbonates above Top of Latrobe to be dated with the same degree of precision as planktonic foraminifera.

Palynological determinations and interpreted lithological units are summarized below. Interpretative and basic data are given in Tables 1 and 2 respectively. Check lists of all species recorded are attached. Electric log data were unavailable.

SUMMARY

AGE	UNIT	ZONE	DEPTH RANGE (M)	ENVIRONMENT
Late Oligocene -Early Miocene	LAKES ENTRANCE FORMATION	P. tuberculatus	815.0-857.0	open marine
- - - - -	- - - - -	- - unconformity? - -	- - - - -	- - - - -
latest Eocene-Early Oligocene	"	P. tuberculatus	885.0-894.0	open marine
"	unnamed marl ?	Upper N. asperus	897.0-900.0	open marine?
Late Eocene	LATROBE GROUP coarse clastics	Middle N. asperus	922.4-1092.0	marginal marine
Early Eocene	"	Upper M. diversus - P. asperopolus	1167.1-1220.0	coastal plain
Paleocene	"	Upper L. balmei	1251.5-1281.0	coastal plain
"	"	Lower L. balmei?	1288.0	coastal plain
- - - - -	- - - - -	- - unconformity - -	- - - - -	- - - - -
Turonian-early Santonian	[KIPPER SHALE]	P. mawsonii	1312-1513.4	rift valley lake

GEOLOGICAL COMMENTS

1. Tommyruff-1 contains a discontinuous sequence of zones from the Turonian-earliest Santonian P. mawsonii Zone to the Late Oligocene-late Early Miocene P. tuberculatus Zone. There is no evidence that Maastrichtian-Campanian sediments are present. Sediment accumulation rates were low during the Paleocene-Early Eocene and ?Early Oligocene and the entire Tertiary section is characterized by long periods of erosion or non-deposition.

2. Bioturbation and reworking across Top of Latrobe has blurred the boundaries between the Middle and Upper N. asperus Zones and Upper N. asperus and P. tuberculatus Zones.

   Nevertheless it is probable that marls overlying the Latrobe Group coarse clastics consist of two distinct units:

   (a) An upper section between 815.0-857.0m which is likely to be no older than Late Oligocene or younger than late Early Miocene.

   (b) A lower section between 885.0-900m which is likely to be latest Eocene-Early Oligocene.

   This unit [a calcareous shale?] appears to include both P. tuberculatus Zone and Upper N. asperus Zone units, implying continuity of sediment accumulation during this period - unlike at wellsites closer to or within the central deep.

3. The sporadic occurrences of diverse spore-pollen between 1167.1-1288.0m confirm the existence of thin Early Eocene [P. asperopolus Zone?] and Paleocene [L. balmei Zone] units in Tommyruff-1. Unlike Kyarra-1A, Lower M. diversus Zone facies are absent or were not sampled.

4. Conversely, the palynological data are definite that clay-and siltstones between 1312-1513.4m are Turonian-earliest Santonian, P. mawsonii Zone.

   This unit is characterized by an unique association of lacustrine dinocysts [Marshall, 1989] diagnostic of the "Kipper Shale" in the Kipper wells and adjacent wells such as Judith-1, Shark-1 and Admiral-1? drilled along the northern platform.

Along the southern platform this dinocyst flora previously has been recorded only in wells much closer to the shelf edge, in Omeo-2 and Pices-1. Only one other 'inshore' analogue of this assemblage has been recorded to date - within the P. mawsonii Zone interval in Sunfish-1 [Macphail, 1985; Marshall, 1989].

Based on these dinocysts, the unit is certainly a correlative of the Kipper Shale, if not the same formation. The increasing abundance and diversity of the dinocysts upsection indicate that only the basal section of this Kipper Shale equivalent is preserved at Tommyruff-1.

5. In spite of gross mud-contamination of SWCs between 1530.1-1545.1m, it is likely that Tommyruff-1 terminated in the Latrobe Group.

PALAEOENVIRONMENTS

1. Based on the first reliable occurrence of marine dinoflagellates, the Tommyruff-1 wellsite was located in a coastal plain environment but away from any direct marine influence until the Late Eocene, Middle N. asperus Zone.

2. Marginal marine conditions appear to have been replaced by an open marine environment during the latest Eocene-Early Oligocene.

3. During the Turonian-earliest Santonian, the wellsite is likely to have been located within a rift valley, almost certainly within but close to the shoreline of a large freshwater lake.

   This lake appears to have fluctuated in area/depth based on the relative abundance of dinocysts, with times of maximum lacustrine influence occurring at 1312m, 1417.0m, 1451.0-1456.1m and 1490.1m.

BIOSTRATIGRAPHY

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

It is noted that spore-pollen criteria published in Stover & Partridge (1973) for subdividing the Oligocene-Early Miocene *P. tuberculatus* Zone are no longer considered reliable [see Macphail & Truswell, 1989]. Dinoflagellates may provide an alternative method, but to date the relevant formations in the Gippsland Basin have not closely sampled or all the species systematically recorded

The majority of SWC palynofloras included caved palynomorphs, derived from drilling mud. In most cases, differential uptake of stain allowed caved and *in situ* specimens to be distinguished. This is critical in the case of *P. mawsonii* Zone samples which may include both caved and *in situ* specimens of the nominate/index species *Phyllocladidites mawsonii*.

This criterion is difficult to apply where no great age difference exists between the contaminant and *in situ* spore-pollen. For example a number of the SWC shot across Top of Latrobe [897.0-1000m] yielded mixed palynofloras which included two species which simply do not overlap in age: *Triorites magnificus*, the index species of the Middle *N. asperus* Zone, and *Cyatheacidites annulatus*, the index species of the *P. tuberculatus* Zone.

Since it was unclear whether *T. magnificus* had been reworked upwards or *C. annulatus* bioturbated downwards, geological criteria have been used to assist in dating these samples.

Similarly it is unclear whether anomalous species records in the *P. tuberculatus* Zone interval represent real extensions in the time range of species in the Gippsland Basin or are reworked. The former option is preferred for species such as *Proteacidites crassus* and *P. reticulatus* given (i) the nearshore location of the well and (ii) range data from the adjoining Murray Basin [see Macphail & Truswell, 1989].

Samples at 1530.1m, 1542.9m and 1545.1m yielded reworked and caved spore-pollen only and cannot be dated.

Phyllocladidites mawsonii Zone 1312-1513.4m Turonian-earliest Santonian

Palynofloras in this interval are dominated by trilete spore and long-ranging gymnosperm pollen, viz. Araucariacites australis, the Cretaceous var. of Dilwynites granulatus and Podocarpidites. Most also contain reworked Early Cretaceous and Permo-Triassic species and caved Tertiary species derived from drilling mud.

The majority of samples yielded an acritarch [Micrhystridium] and non-marine dinocysts [Luxadinium, Rimosicysta and Wuroia] - an association that is diagnostic of the "Kipper Shale" [see Marshall, 1989]. Although occasional specimens are found [reworked?] above the P. mawsonii Zone, assemblages of these dinocysts appear to be restricted to Turonian-earliest Santonian lacustrine facies in the Gippsland Basin.

The base of the zone is provisionally placed at 1513.4m, the lowest sample yielding what appear to be in situ specimens of Phyllocladidites mawsonii and an undescribed Late Cretaceous Tricolpites sp. A more reliable lower boundary is at 1512.6m, based on the lowest record of Micrhystridium.

Rimosicysta first appear at 1490.1m, associated with Micrhystridium [frequent], Amosopollis cruciformis [common], Phimopollenites pannosus and Tricolpites variverrucatus. Reworked Early Cretaceous spp. include Cyclosporites hughesii, Dictyotosporites speciosus and Corollinia spp. Other significant first appearances include:

i. Luxadinium and Laevigatosporites musca at 1451.0m.

ii. Triorites minor at 1446.9m.

iii. Interulobites intraverrucatus at 1418.1.

The association of I. intraverrucatus and Phyllocladidites mawsonii at 1389.9m, 1417.0m and 1418.1m confirm a P. mawsonii Zone date for the associated dinocysts.

The upper boundary is placed at 1312m, a cuttings sample yielding caved L. balmei Zone spore-pollen and the most diverse assemblage of "Kipper Shale" dinocysts recovered in Tommyruff-1: Rimosicysta aspera, R. concava, R. cf eversa, R. kipperii, Tetrachacysta? keenii, Wuroia corrugata and a distinctive but previously unrecorded cyst informally cited as Wuroia luna. Micrhystridium is rare in this sample but frequent in the underlying SWC at 1333.0m

Lower Lygistepollenites balmei Zone 1288.0m Paleocene

One sample is assigned to this zone with a very low degree of confidence, based on Proteacidites retiformis a Late Cretaceous species which ranges into the base of this zone.

However it is noted that Haloragacidites harrisii is unusually frequent for a sample of this age and an Upper L. balmei Zone remains a distinct possibility given high levels of reworking elsewhere in Tommyruff-1. The sample is no older than Lower L. balmei Zone.

Upper Lygistepollenites balmei Zone 1251.5-1281.0m Paleocene

Palynofloras within this interval and at 1288.0m differ from those in the underlying zone in that Proteacidites spp. are abundant and Lygistepollenites balmei and Gleicheniidites are usually frequent to common. Gambierina rudata, a species which ranges no higher than this zone, is present throughout. Rare examples of marine dinoflagellates are assumed to be caved.

The sample picked as the base of the zone [1281.0m] yielded Malvacipollis subtilis and Triporopollenites ambiguus, species which seldom range below this zone. Beaupreadites orbiculatus and Latrobosporites amplus confirm the minimum age is Upper L. balmei Zone.

Banksieaeidites arcuatus, Tricolporites moultonii and Triporopollenites cirrus at 1270.0m and Proteacidites annularis at 1252.6m and 1272.5m provide a confident Upper L. balmei Zone date for these samples.

The upper boundary is placed at 1251.5m, a sample which is no younger than Upper L. balmei Zone based on Australopollis obscurus, abundant Lygistepollenites balmei and frequent Gambierina rudata. The palynoflora includes a variant grain of Triporopollenites ambiguus.

Upper M. diversus - Proteacidites asperopolus Zone 1167.1-1220.0m Early Eocene

Two SWC samples provisionally are assigned to this zone. Both yielded large numbers of the usually very rare pollen Anacolosidites rotundus as well as frequent L. balmei Zone [1220.0m] and occasional Middle N. asperus Zone [1167.1m] species. The intervening SWC at 1218.0m yielded a caved Middle N. asperus zone palynoflora.

Maximum and minimum dates for the interval are Upper M. diversus-P. asperopolus Zone if Santalumidites cainozoicus and [1167.1m] Proteacidites pachypolus, Concolpites apiculatus and Proteacidites tuberculotumulatus are in situ.

Middle Nothofagidites asperus Zone 922.4-1092.0m Late Eocene

Palynofloras in this interval are wholly dominated by Nothofagidites spp. With the exception of cuttings at 1000m, all include the zone index species Triorites magnificus and moderate to abundant numbers of marine dinocysts, chiefly Gippslandica extensa.

The lower boundary, picked at 1092.0m, is defined by the first occurrence of **multiple** specimens of Triorites magnificus and Tricolpites thomasii, a species which typically first appears in this zone. The sample includes T. simatus, a species which ranges no lower than the Lower N. asperus Zone.

A similar palynoflora occurs in cuttings at 1045m. Here the Middle N. asperus Zone date is reinforced by Anacolosidites sectus and Tricolporites retequetrus. Caved species in this sample appear to have come from a T. bellus Zone facies based on Symplocoipollenites austellus and Haloragacidites haloragoides.

The uppermost two samples assigned to the Middle N. asperus Zone [922.4m, 1000m] contain the P. tuberculatus Zone index sp., Cyatheacidites annulatus. These specimens are assumed to be bioturbated based on the lithology of the sediments - sandstones and claystones respectively.

Support for the zonal determination is given by frequent of the usually rare species Schizocolpus marlinensis at 922.4m. Other species that typically range no higher than higher than the Middle N. asperus Zone are Proteacidites crassus, P. rugulatus and Santalumidites cainozoicus. Verrucatosporites attinatus indicates the cuttings sample at 1000m is no older than upper Middle N. asperus Zone.

Upper Nothofagidites asperus Zone 897.0-900.0m latest Eocene -Early Oligocene

Two SWC samples, at 897.0m and 900.0m, are provisionally assigned to this zone with varying degrees of confidence. Proteacidites stipplatus demonstrates the maximum and minimum ages for the interval are upper Middle N. asperus Zone and P.

tuberculatus Zone respectively.

Both more closely resemble palynofloras recovered from the Middle N. asperus Zone coarse clastics than palynofloras in the overlying P. tuberculatus Zone marls in two respects: spore-pollen are more abundant than dinoflagellates and Nothofagidites emarcidus-heterus is the dominant taxon.

The lower sample lacks indicator species of both the P. tuberculatus and Middle N. asperus Zone and is unique in the Tommyruff-1 sequence in that the dinocyst Tritonites sp. cf Hologoginella spinosa is frequent. Unlike the Middle N. asperus Zone dinocyst floras, Gippslandica extensa is very rare and possibly absent if the single "bald" cyst recorded represents a new species. Mud contamination is slight, indicated by a specimen of the T. bellus Zone species Proteacidites symphionemoides.

The upper palynoflora includes Cyatheacidites annulatus, Triorites magnificus, Proteacidites crassus, P. rugulatus and Santalumidites cainozoicus. The date is of low confidence but it is noted this implies sediments at 897.0m have been subjected to bioturbation **and** include reworked material from the underlying Latrobe Group coarse clastics.

Proteacidites tuberculatus Zone 815.0-894.0m Oligocene-
Early Miocene

Palynofloras within this interval are dominated by marine dinoflagellates rather than, as in previous samples, spore-pollen. Prominent to abundant types are: Apteodinium australiense, Cyclopsiella vieta, Histrichokolpoma rigaude, Lingulodinium machaerophorum, Operculodinium centrocarpum and Spiniferites. Reworked? Gippslandica extensa occurs at 852.0.

Numbers of spore-pollen recovered vary but, except at 885.0m and 894.0m where Nothofagidites emarcidus-heterus is common, gymnosperms such as Araucariacites australis and Phyllocladidites mawsonii tend to dominate the spore-pollen component. Samples at 815.0m, 835.0m,852.0m and 857.0m have been contaminated by Lygistepollenites balmei.

The lower boundary is defined by the first appearance at 894.0m of Cyatheacidites annulatus in a palynoflora that lacks Triorites magnificus. The dinocyst flora is unusual in it includes a rare in situ specimen of the typically Lower N. asperus Zone species Deflandrea heterophylcta.

The palynoflora at 885.0m includes Granodiporites nebulosus, a species which ranges from within the Upper N. asperus Zone into the lower part of the P. tuberculatus Zone, and Foveotriletes crater and F. lacunosus, species which first appear in the P. tuberculatus Zone.

It is unclear whether records of Proteacidites crassus and P. reticulatus in this sample are due to reworking or represent real extensions in their time-range near the south-west margin of the Gippsland Basin. Both species range into the P. tuberculatus Zone in the adjacent Murray Basin [see Macphail & Truswell, 1989].

Based on G. nebulosus and the relative abundance of Nothofagidites, the interval between 885.0-894.0m is more likely to be Early Oligocene than Late Oligocene-late Early Miocene in age. Conversely, palynofloras at and above 857.0m are more typical of Late Oligocene-Early Miocene assemblages recovered from the Lakes Entrance Formation in central deep wells.

The palynoflora at 857.0m consists mostly of mud-contaminants but is unlikely to be older than Late Oligocene-Early Miocene P. tuberculatus Zone, based on the dinocyst flora. Cyatheacidites annulatus occurs at 852.0m and 835.0m.

The upper boundary of the zone is picked at 815.0m, based on Foveotriletes crater and F. lacunosus and the absence of indicator species of the T. bellus Zone

A number of unusual faunal microfossils are preserved in this [upper] interval: e.g. trochospiral liners of foraminifera [815.0m], fish teeth [835.0] and, as in Amberjack-1 [see Macphail, 1990], fragmented and whole nematocysts [stinging cells] of a unidentified Cnidarian [852.0m].

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TABLE 1: SUMMARY OF INTERPRETATIVE PALYNOLOGICAL DATA

SWC	DEPTH (m)	ZONE S-P	ZONE DINO	CONF. RTG.	COMMENT
59	815.0	P. tub.	-	2	No older than this zone
56	835.0	P. tub.	-	2	
55	852.0	P. tub.	-	1	C. annulatus
54	857.0	P. tub.	-	2	mud contaminants
51	885.0	P. tub.	-	1	G. nebulosus
50	894.0	P. tub.	-	1	C. annulatus
49	897.0	U. N.a.	-	2	C. annulatus + T. magnificus
48	900.0	U. N.a.	-	1	Abund. Nothofagidites
42	922.4	M. N.a.	D. ext.	2	S. marlinensis
ctg	1000	M. N.a.	D. ext.	3	P. tuberculotumulatus
ctg	1045	M. N.a.	D. ext.	3	T. retequetrus
ctg	1051	M. N.a.	D. ext.	3	T. magnificus
41	1092.0	M. N.a.	D. ext.	0	T. magnificus
39	1167.1	P. asp./U. M.d.		-	C. apiculatus
38	1218.0	Indet.	-	-	mud contaminants
37	1220.0	P. asp./U. M.d.		-	S. cainozoicus
36	1251.5	U. L.b.	-	2	L. balmei, G. rudata
35	1252.6	U. L.b.	-	1	P. annularis
34	1270.0	U. L.b.	-	1	B. arcuatus
33	1272.5	U. L.b.	-	1	P. annularis
32	1281.0	U. L.b.	-	2	T. ambiguus
31	1288.0	L. L.b.	-	2	P. retiformis
ctg	1312	P. maw.	Kip. Sh.	3	Kipper Shale dinocysts
30	1333.0	P. maw.	"	1	"
29	1335.0	P. maw.	"	1	"
27	1387.0	P. maw.	"	1	"
26	1389.9	P. maw.	"	0	I. intraverrucatus + P. mawsonii
25	1417.0	P. maw.	"	0	"
28	1418.1	P. maw.	"	0	"
24	1420.0	P. maw.	"	1	P. mawsonii
20	1446.9	P. maw.	"	1	T. minor
19	1451.0	P. maw.	"	1	
16	1456.1	P. maw.	"	1	P. mawsonii
14	1466.0	P. maw.	"	2	
07	1490.1	P. maw.	"	1	Kipper Shale dinocysts
06	1512.6	P. maw.	"	1	P. mawsonii
05	1513.4	P. maw.	-	1	P. mawsonii
03	1530.1	Indet.	-	-	negligible yield
02	1542.9	Indet.	-	-	mud contaminants
01	1545.1	Indet.	-	-	mud contaminants

TABLE 2: SUMMARY OF BASIC PALYNOLOGICAL DATA

SWC	DEPTH (m)	YIELD S-P	YIELD DINO	DIVERSITY S-P	DIVERSITY DINO	PRES.	LITH.*
59	815.0	med.	high	low	med.	good	marl
56	835.0	med.	high	low	high	good	marl
55	852.0	med.	med.	low	low	good	marl
54	857.0	low	low	low	low	good	marl
51	885.0	low	high	high	low	poor	marl
50	894.0	high	high	high	low	mod.	marl
49	897.0	high	med.	high	low	good	marl
48	900.0	low	low	med.	low	good	marl
42	922.4	high	low	high	low	good	sst.
ctg	1000	high	med.	high	med.	good	clst.,sst.
ctg	1045	high	high	med.	low	mod.	clst.,sst.
ctg	1051	med.	med.	med.	low	mod.	clst.,sst.
41	1092.0	high	high	high	med.	good	clst.,coal
39	1167.1	high	low	high	low	good	clst.
38	1218.0	low	caved	low	low	good	clst.
37	1220.0	low	caved	low	low	good	clst.
36	1251.5	high	-	med.	-	good	clst.
35	1252.6	low	caved	med.	-	poor	clst.
34	1270.0	high	-	high	-	good	clst.
33	1272.5	high	caved	high	-	good	clst.
32	1281.0	high	-	high	-	good	clst.
31	1288.0	high	caved	high	-	good	clst.
ctg	1312	high	med.	med.	med.	good	clst.
30	1333.0	med.	low	med.	low	mod.	clst
29	1335.0	low	low	low	low	mod.	clst.
27	1387.0	low	low	low	low	mod.	clst.
26	1389.9	med.	low	med.	low	mod.	clst.
25	1417.0	med.	low	med.	med.	good	clst.
28	1418.1	high	low	high	med.	good	clst.
24	1420.0	med.	low	high	low	good	clst.
20	1446.9	med.	low	high	low	good	clst.
19	1451.0	high	med.	low	low	mod.	clst.
16	1456.1	high	med.	med.	med.	good	clst.
14	1466.0	high	low	med.	low	good	clst.
07	1490.1	med.	med.	med.	med.	mod.	clst.
06	1512.6	low	low	low	low	mod.	clst.
05	1513.4	low	caved	low	low	mod.	clst.
03	1530.1	negl.	-	low	-	mod.	slst.,clst.
02	1542.9	caved	caved	high	med.	good	clst
01	1545.1	caved	caved	high	med.	good	arg. clst.

* Lithological descriptions [main rock type only] taken from sidewall core sample description on transmittal sheets.

TABLE NO.:

Well Name BHP TOMMYRUFF-1 Basin GIPPSLAND Sheet No. 1 of 5

FOSSIL NAMES \ DEPTHS (m)	815.0	835.0	852.0	857.0	885.0	894.0	897.0	900.0	922.4	1000.	1045	1051	1092.0	1167.1	1218.0	1220.0	1251.5	1252.6	1270.0	1272.5	1281.0	1288.0
SAMPLE TYPE OR NO. *	S	S	S	S	S	S	S	S	S	T	T	T	S	S	S	S	S	S	S	S	S	S
Aglaoreidia qualumis										•												
Anacolosidites rotundus														•		•						
A. sectus											•											
Araucariacites australis	•	•	•	•	•	•	•	•		•			•	•		•		•	•		•	•
Australopollis obscurus																	•				•	
Baculatisporites disconformis					•									•			•			•		•
Banksieaeidites arcuatus											•		•	•		•			•			
B. elongatus		•																				
Basopollis otwayensis														•			•	•		•	•	•
Beaupreadites elegansiformis						•	•						•									
B. orbiculatus																					•	
B. verrucosus							•		•				•	•								
Bluffopollis scabratus			C								•											
Clavifera triplex		C	C						•						•	•	•	•	•	•	•	
Conbaculites apiculatus		C												•								
Concolpites leptos							•															
Cupanieidites orthoteichus								•	•		•	•	•			•						
C. reticularis					•															i		
Cyatheacidites annulatus		•	•		•	•	•		•	•												
Cyathidites australis	•	•		•	•	•							•			•				•		•
C. minor	•	•	•						•	•								•				•
C. palaeospora		•			•			•		•												
C. splendens					•											•	•	•		•		
C. subtilis					•																	
Dicotetradites meridianus												•	•	•		•	•		•	•	•	
Dacrycarpites australiensis							•	•														
Dilwynites granulatus	•		•			•							•	•				•				
Ericipites scabratus	•		•	•		•	•		•		•	•	•						•			
Foveotriletes balteus														•					•			
F. crater					•																	
F. lacunosus		•			•																	
Gambierina spp.															R		•	•	•	•	•	•
Gleichenilidites spp.		•	•	•		•		•		•	•	•		•	•	•	•	•	•	•		•
Granodiporites nebulosus					•																	
Haloragacidites cainozoica								•					•									
H. haloragoides																						
H. harrisii	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Herkosporites elliotii		•			•	•	•	•										•	•	•	•	
Ilexpollenites anguloclavatus	•					•	•	•	•		•	•	•	•		•	•	•				
Ischyosporites gremius	•	•			•	•	•	•		•												
I. irregularis																		•				
I. lachlanensis							•			•												
Kuylisporites waterbolkii							•			•						•						
Laevigatosporites spp.	•	•	•		•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•
Latrobosporites amplus																		•		•	•	•
L. crassus						•		•					•		•							
L. marginis					•	•														•	•	
Liliacidites lanceolatus							•		•	•			•									
L. spp.										•	•		•									
Lygistepollenites balmei	R	R	R	R			R						R		R	R	•	•	•	•	•	•
L. florinii	•	•	•	•	•	•	•	•	•	•	•		•	•	•		•	•	•		•	
Malvacipollis diversus				•																		
M. robustus						•	•	•				•	•							•		
M. subtilis			C		•	•	•	•	•	•	•		•	•	•	•		•	•	•	•	
Matonisporites ornamentalis					•								•									
Microalatidites palaecgenicus	•				•			•		•				•	•						•	•

* C=CORE S=SIDEWALL CORE

R - REWORKED SP.
C - CONTAMINANT

TABLE NO.:

Well Name BHP TOMMYRUFF-1 Basin GIPPSLAND Sheet No. 2 of 5

SAMPLE TYPE OR NO. *	S	S	S	S	S	S	S	S	S	T	T	T	S	S	S	S	S	S	S	S	S	S
FOSSIL NAMES / DEPTHS (m)	815.0	835.0	852.0	857.0	885.0	894.0	897.0	900.0	922.4	1000	1045	1051	1092.0	1167.1	1218.0	1220.0	1251.5	1252.6	1270.0	1272.5	1281.0	1288.0
Microcachrydites antarcticus								•	•		•		•		•			•	•			•
Milfordia homeopunctatus													•									
Monogemmites uvatus ms												•										
Myrtaceidites eucalyptoides		•									•											
M. parvus-mesonesus					•		•	•	•	•	•	•	•	•								
M. rhodamnoides						•	•															
Nothofagidites asperus	•	•			•	•	•		•	•	•	•	•	•						C	•	
N. brachyspinulosus	•	•	•	•	•	•	•	•		•	•	•	•		•			•	•			
N. deminutus-vansteenii	•	•			•		•	•	•	•	•		•	•	•	•				C		
N. emarcidus-heterus	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
N. endurus																	•	•	•	•	•	•
N. falcatus	•	•		•	•	•	•	•		•	•	•	•		•		C					
N. flemingii	•	•	C		•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•
N. goniatus	•		C			•	•	•	•		•		•		•							
Paripollis orchesis						•																
Parvisaccites catastus		•			•			•														
Peninsulapollis gillii								•													•	•
Periporopollenites demarcatus				•	•	•	•		•	•				•	•			•	•	i	•	
P. polyoratus							•				•	•				•	•	•	•		•	•
P. vesicus	•				•	•			•				•									
Phyllocladidites mawsonii	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
P. reticulosaccatus			R												R	R	•	•	•	•	•	•
P. verrucosus																						
Podocarpidites exiguus																•		•	•	•	•	•
P. spp.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Podosporites microsaccatus		•	•		•	•	•	•	•	•	•	•		•	•		•	•	•	•	•	•
Polycolporopollenites esobalteus			•				•									•						
Polypodiisporites spp.	•							•		•								•	•			•
Proteacidites adenanthoides												•	•	•			•		•	•	•	•
P. annularis			•		•	•		•	•	•	•	•	•	•		•		•		•		
P. beddoesii																•						
P. callosus								•					•									
P. crassus					•		•		•	•	•	•	•									
P. grandis														•								
P. kopiensis																						
P. latrobensis											•											
P. obscurus							•			•		•				•					•	•
P. pachypolus														•								
P. recavus													•							C		
P. reflexus			•																			
P. reticulatus					•																	
P. reticuloscabratus					•																	
P. retiformis																					•	•
P. rugulatus							•		•		•	•										
P. stipplatus		•			•	•	•	•														
P. symphionemoides								•														
P. tenuiexinus																			•	•		
P. tuberculatus	•				•				•													
P. tuberculotumulatus										•				•								
Pseudowinterapollis cranwellae													•									•
Quintiniapollis psilatispora						•				•										C		
Rhoipites alveolatus									•					•								
Retitriletes spp.			•			•	•										•	•		•	•	
Rugulatisp orites mallatus										•				•				•				
Santaluminidites cainozoicus							•		•			•		•	•							
Sapotaceoipollenites rotundus			•	•				•						•								

C=CORE S=SIDEWALL CORE

R - REWORKED SP.
C - CONTAMINANT

TABLE NO. :

Well Name BHP TOMMYRUFF-1 Basin GIPPSLAND Sheet No. 3 of 5

FOSSIL NAMES / DEPTHS (m)	815.0	835.0	852.0	857.0	885.0	894.0	897.0	900.0	922.4	1000	1045	1051	1092.0	1167.1	1218.0	1220.0	1251.5	1252.6	1270.0	1272.5	1281.0	1288.0
SAMPLE TYPE OR NO. *	S	S	S	S	S	S	S	S	S	T	T	T	S	S	S	S	S	S	S	S	S	S
Schizocolpus marlinensis									•													
S. rarus							•				•		•									
Simpsonipollis sp.																						
Stephanocolpites oblatus														•								
Stereisporites australis f. crassa		•				•				•												
S. (Tripunctisporis) sp.	R		R													•	•	•		•	•	•
S. regium																				•		
S. spp.	•	•		•	•		•	•										•		•	•	•
Symplocoipollenites austellus											C											
Tetracolporites multistrixus																		•	•		•	
Tricolpites confessus																			•			
T. durus ms																			•			
T. phillipsii																•	•	•	•	•	•	•
T. reticulatus																					•	
T. simatus									•		•		•									
T. thomasii													•	•								
Tricolporites adelaidensis					•		•	•			•		•	•								
T. cf asperamarginis							•															
T. angurium							•				•			•								
T. leuros								•					•									
T. sp. cf T. leuros						•	•			•												
T. moultonii																			•			
T. paenestriatus		•			•	•								•								
T. retequetrus											•											
T. scabratus		•					•			•			•	•								
Undescribed tricolpate/tricolporate spp		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Undescribed trilete spores	•	•	•	•	•	•	•		•	•	•	•		•				•			•	•
Triletes tuberculiformis		•		•		•				•		•						•				
Triorites magnificus							•		•		•	•	•		C							
Triporopollenites ambiguus						•											•				•	
T. cirrus ms																			•			
Verrucatosporites attinatus										•												
Verrucosisporites kopukuensis		•			•						•	•		•		•				•		•
REWORKED MESOZOIC SPP.	•	•	•		•				•						•	•						•
Cleistosphaeridium epacrum															•	•						
Glaphyracysta retiintexta																						
Hystrichokolpoma rigaude	•	•			•		•	•					•									
Schematophora speciousus																						
Deflandrea heterophylcta						•																
D. phosporitica													•									
Gippslandica extensa			C	C			•	•	•		•	•	•	•	C					C		
Achomosphaera alcicornu		•							•	•												
Apteodinium australiense		•																				
Impagidinium spp.	•	•	•	•																		
Lingulodinium machaerophorum	•	•	•	•	•	•	•	•	•	•						C						
Nematosphaeropsis balcombiana/labrynthus	•																					
Operculodinium centrocarpum	•	•	•	•	•	•	•	•		•		•	•		•	•	C					
Pentadinium laticinctum									•	•												
Spiniferites spp.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		C		C		C
Tectadodinium pellitum	•				•	•	•															
Thalassiphora flammea/peligica											•	•										
Polysphaeridium zoharyii		•						•		•												
Protoellipsodinium mammilatus										•												
P. simplex	•	•								•	C				C							
Tritonites sp. cf H. spinata							•	•														

* C=CORE S=SIDEWALL CORE
T=CUTTINGS J=JUNK BASKET

R - REWORKED SP.
C - CONTAMINANT

TABLE NO.:

Well Name BHP TOMMYRUFF-1 Basin GIPPSLAND Sheet No. 4 of 5

SAMPLE TYPE OR NO. *	T	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
FOSSIL NAMES / DEPTHS (m)	1312	1333.0	1335.0	1387.0	1389.9	1417.0	1418.1	1420.0	1446.9	1451.0	1456.1	1466.0	1490.1	1512.6	1513.4	1530.1	1542.9	1545.1
Alisporites grandis			•			•		•				•	•	•				
A. similis											•	•		•				
Amosopollis cruciformis							•				•		•					
Araucariacites australis	•	•	•	•	•	•		•	•	•	•	•	•	•	•		•	•
Baculatisporites comaumensis	•				•		•	•	•				•		•	•		
Camarozonosporites australiensis								•										
Cicatricosisporites australiensis	•	•		•	•	•		•	•		•	•	•				•	•
C. ludbrookii							•					•						
Ceratosprotes equalis						•		•			•			•				
Clavifera triplex	•					•					•						•	
C. vultuosus ms									•									
Concavissimisporites penolaenensis										•								
Corollinia spp.		•	•	•	•	•		•	•	•	•	•	•	•	•			
Cyathidites australis	•	•		•	•	•	•	•		•	•	•	•	•	•	•		•
Cyclosporites hughesii									•				•					
Densoisporites vellatus			•							•								
Dictyophyllidites crenatus								•						•				
Dictyotosporites speciosus				•	•	•	•		•		•		•		•			
Dilwynites granulatus [Cret. var.]	•	•	•	•	•		•	•	•	•	•		•		•			
Foraminisporis dailyii									•									
Foveosporites canalis								•			•							
Foveotriletes balteus																		
F. parviretus							•		•									
Gleicheniidites spp.	•	•	•				•	•	•	•	•	•	•		•		•	•
Herkosporites elliotii		•	•		•				•		•		•					•
Interulobites intraverrucatus					•	•	•						•					
Ischyosporites punctatus		•							•									
Klukisporites scaberis		•	•		•			•	•	•		•	•	•				
Kraeuselisporites spp.					•			•										•
Laevigatosporites musca ms							•	•			•		•					
L. spp.	•	•	•			•	•	•	•	•	•	•	•		•			•
Leptolepidites major			•										•					
L. verrucatus		•		•	•	•		•	•	•	•	•		•				•
Lygistepollenites balmei	C								C	C		C	C	C	C	C		C
Lycopodiacites asperatus							•									•		
L. varirugulatus ms.							•		•			•						•
Matonisporites cooksonae											•							
Microcachrydites antarcticus	•	•	•		•	•	•	•	•	•	•	•	•					•
Neoraistrickia truncata		•						•		•		•						
Nothofagidites spp. [caved]	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•
Peninsulapollis gillii																		
Phimopollenites pannosus						•							•					
Phyllocladidites mawsonii [in situ]		•			•	•	•	•			•			•	•			
" [caved]	•	•	•	•		•		•	•	•		•	•	•		•	•	•
Podocarpidites spp.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
Podosporites microsaccatus	•	•			•			•	•	•	•	•	•	•	•	•		
Polycingutriletes pocockii			•					•			•			•				
Polypodiisporites spp.	•										•							
Proteacidites spp. [caved]	•	•	•	•	•		•		•			•		•	•	•		•
Reticulatisporites pudens													•					
Retitriletes australoclavatidites	•	•	•	•	•		•	•	•	•	•	•	•	•				
R. circolumenus						•		•										
R. facetus						•												
R. nodosus								•	•		•	•						
Rogalskaisporites sp.				•						•	•		•					
Stereisporites antiquisporites	•	•	•	•	•	•	•		•		•		•	•				•

* C=CORE S=SIDEWALL CORE

R - REWORKED SP.
C - CONTAMINANT

PALYNOLOGY DATA SHEET

BASIN: GIPPSLAND　　ELEVATION: KB: ______ GL: ______

WELL NAME: TOMMYRUFF-1　　TOTAL DEPTH: ______

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*	815.0	2	852.0	1		894.0	1			
	Upper *N. asperus*	897.0	2	900.0	1		900.0	1			
	Mid *N. asperus*	922.4	2				1092.0	0			
	Lower *N. asperus*										
	P. asperopolus	1167.1	2								
	Upper *M. diversus*						1220.0	2			
	Mid *M. diversus*										
	Lower *M. diversus*										
	Upper *L. balmei*	1251.1	2	1252.6	1		1281.0	2	1272.5	1	
	Lower *L. balmei*	1288.0	2				1288.0	2			
LATE CRETACEOUS	Upper T. longus										
	Lower T. longus										
	T. lilliei										
	N. senectus										
	T. apoxyexinus										
	P. mawsonii	1312	3	1333.0	1		1513.4	1			
	A. distocarinatus										
EARLY CRET.	*C. paradoxus*										
	C. striatus										
	F. asymmetricus										
	F. wonthaggiensis										
	C. australiensis										
PRE-CRETACEOUS											

COMMENTS: Gippslandica (Defleanrea) extensa Zone 922.4-1092.4m
"Kipper Shale" dinocyst flora 1312-1490.1m

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: 20 September 1990

DATA REVISED BY: ______　　DATE: ______