A PALYNOLOGICAL ANALYSIS OF BREAM-4A, GIPPSLAND BASIN

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PART I

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INTRODUCTION:

Thirty-three (33) sidewall cores and chips from one conventional core (Core 4) were processed and examined for palynomorphs. Most of the samples yielded fair microfloras and all but three could be assigned to a stratigraphic zone.

Palynological zones and lithological facies subdivisions from the base of the Lakes Entrance Formation to the total depth is summarised below. All samples are summarised in Table 1 and each occurrence of the individual species is tabulated in the accompanying check charts.

S U M M A R Y

Unit/Facies	Zone	Depth (metres)
Lakes Entrance Formation (base)	*P. tuberculatus*	1860
1856	UNCONFORMITY	1861±
Gurnard Formation	Middle *N. asperus*	1861.9 - 1879
1913	Lower *N. asperus*	1889.5 - 1940.6
	P. asperopolus	1953.44- 2076.5
Latrobe Group "coarse clastics"	Upper *M. diversus*	2094.5 - 2106.8
	Lower-Middle *M. diversus*	2180.5 - 2234
	Upper *L. balmei*	2242 - 2407.5
		T.D. — 2421

GEOLOGICAL REMARKS:

1) One major unconformity, or period of non-deposition, can be recognised in the pre-Oligocene sediments. It separated the *P. tuberculatus* Zone (Lakes Entrance Formation) and the Middle *N. asperus* Zone (top of the Gurnard Formation). This gap in sedimentation includes all of the time represented by the Upper *N. asperus* Zone and is a break of at least 3 million years.

2) A second break in sedimentation may occur at the top of the Upper *L. balmei* Zone (Paleocene/Eocene boundary) but this cannot be clearly demonstrated.

3) The Gurnard Formation, as picked from the electric log, extends from 1856. to 1913 metres and is characterised, in the descriptions of the sidewall cores, as a dark grey-brown, moderately calcareous shale with minor amounts of mica, pyrite and coal. This apparent homogenous unit contains three different biostratigraphic elements. The uppermost sample from this zone, SWC 69 (1860 metres) contained a well developed Late Oligocene (*P. tuberculatus*), flora. Index species of both dino-flagellates and spores were present. Samples from 1861.9 to 1879 metres yielded an Upper Eocene, Middle *N. asperus* Zone assemblage. As noted above, this suggests a gap in the sedimentary record of about 3 million years, located between 1860 and 1861.9 metres in this section. The lower part of the "Gurnard" section, from 1819.5 to 1909.5 metres enclosed a Lower *N. asperus* flora of Middle Eocene age. This same Lower *N. asperus* assemblage extends at least through the upper 30 metres of the top of the Latrobe clastic sediments (to 1940.6 metres). No obvious shift in sedimentary pattern or electrical characteristics, electric log or sedimentary pattern marks the change from *P. tuberculatus* Zone to Middle *N. asperus* flora nor to the Lower *N. asperus* Zone. Neither is there any marked change in assemblage composition between the Lower *N. asperus* flora in the shaley "Gurnard" and that recovered from the shale stringers in the Latrobe.

4) Similar stratigraphic distribution of the Gurnard-Latrobe boundary was found in other wells around the margin of the basin, e.g. Seahorse-1, Sweep-1, Palmer-1 and Barracouta-4. In contrast, the boundary between the coarse (Latrobe) and finer grained (Gurnard) clastics is found stratigraphically deeper in wells in the more central part of the basin. For example, at Gurnard-1 it lies at base of Lower *N. asperus* Zone and on the Kingfish structure where sampling is available it lies at base of *P. asperopolus* Zone.

5) No clear cut division between the Lower and Middle *M. diversus* Zones could be found in this well. The several *Proteacidites* species, *P. tuberculiformis, P. xestoformis* and *P. ornatus,* that separate the Middle from the Lower *M. diversus* flora were not present in any of the samples.

6) The base of the *P. asperopolus* Zone was separated from the underlying Upper *M. diversus* Zone on the basis of increase of *Proteacidites pachypolus* (over 5% of total assemblage), rather than the lowest occurrence of the marker species, *P. pachypolus* abundances for correlation is found in the Swordfish-1 well report (Partridge, 1977/13).

DISCUSSION OF ZONES:

The presence and distribution of identified species are tabulated in the accompanying check-charts. The basis for biostratigraphic subdivisions and zone identification is given below.

Upper *Lygistepollenites balmei* Zone: 2242 - 2407.5 metres.

The highest in-place appearance of *L. balmei,* and below the lowest occurrence of such Lower Eocene species as *S. prominatus, M. diversus* and *Apectodinium hypercantha* is the basis for picking the top of the *L. balmei* Zone. The rare but consistent occurrence of *P. annularis, P. lapis* and frequent presence of *H. harrisii* suggest that sediments below the Upper *L. balmei* Zone were not penetrated.

Lower to Middle *Malvacipollis diversus* Zone: 2180.5 to 2234 metres.

Sediments above the highest occurrence of *L. balmei* and the inclusion of such forms as *Prominatus* and *M. diversus* in the assemblages are indicative of *M. diversus* Zone or younger. The bottom sample of this section (2234 metres) has a moderate marine element that includes a number of specimens of *Apectodinium hypercantha*. This is indicative of the *Wetzeliella hypercantha (= Apectodinium hypercantha)* marine zone at the base of the Lower *M. diversus* Zone. Confirmation that this sample is from the Lower *M. diversus* sediments is provided by the several specimens of *Cyathidites gigantis*, a form that does not extend above the Lower *M. diversus* horizon. The rest of the samples, from 2180.5 to 2218.2 metres, contain a Middle to Lower *M. diversus* assemblage without specific markers that are restricted to either the Middle or Lower zones.

Malvacipollis diversus Zone: 2110.5 - 2162 metres.

The three samples examined from this section contained a gernalised *M.diversus* flora, without any specific marker species for the Lower, Middle or Upper Zones.

Upper *Malvacipollis diversus* Zone: 2094.5 - 2106.8 metres.

The presence of *M. tenuis* in all these samples confirm that they are Upper *M. diversus*, or younger. The lack of *P. asperopolus*, more than 5% abundance of *P. pachypolus* or other indications of a younger section indicates that an Upper *M. diversus* assignment is correct for this group of samples.

Proteacidites asperopolus Zone: 1953.44 - 2076.5 metres.

The upper two samples (1953.44 and 2016.2 metres) contained specimens of the index species for this zone, *P. asperopolus*. The lower sample (2076.5) did not contain *P. asperopolus*, however it was assigned to this zone on the basis of the presence of *P. pachypolus* in excess of 5% of the assemblage (see geological remarks above for further comment).

Lower *Nothofagidites asperus* Zone: 1889.5 - 1940.6 metres.

The lowest sample in this section (1940.6) contained *N. asperus* and *I. thomasii*, markers for the *N. asperus* Zone sediments, but no forms restricted to the lower part. However the dinoflagellate index species for the Lower *N. asperus*, *A. dictyoplokus* was noted in many of the other samples.

Middle *Nothofagidites asperus* Zone: 1879 - 1865.5 metres.

Deflandria extensa, index species for the Middle of the *N. asperus* Zone was present in thelimiting samples.

Nothofagidites asperus Zone: 1861.9 metres.

This sample did not contain the Middle *N. asperus* Marker, *D. extensa*, however, the occurrence of specimens of *Phthanoperidinium coreoides* and *P.eocenicum* demonstrate that this is Eocene (*N. asperus* Zone), rather than Oligocene (*P. tuberculatus* Zone), age.

Proteacidites tuberculatus Zone: 1860 metres.

The presence of *Cyatheacidites annulatus* in the sample shows that it is from the base of the *P. tuberculatus* Zone. Samples above this depth were not examined for palynomorphs.

TABLE-1

SUMMARY OF PALAEONTOLOGICAL ANALYSIS, BREAM-4A, GIPPSLAND BASIN

PLE	DEPTH(m)	DEPTH(ft)	ZONE	AGE	CONFIDENCE RATING	YIELD	SPORE-POLLEN DIVERSITY	DINO. DIVERSITY	COMMENTS
C 69	1860	6102	P. tuberculatus	Oligocene	1	Poor	Low	Low	C. annulatus
C 68	1861.9	6108.5	N. asperus	Late Eocene	1	Poor	Low	Low	Phthanoperidinium eocenicum
C 67	1865.5	6120.5	Middle N. asperus	Late Eocene	0	Fair	Low	Moderate	D. extensa
C 66	1869	6132	Middle N. asperus	Late Eocene	1	Fair	Moderate	Moderate	
C 63	1879	6165	Middle N. asperus	Late Eocene	0	Fair	Moderate	Moderate	D. extensa
C 60	1889.5	6199	Lower N. asperus	Middle Eocene	0	Fair	Moderate	Moderate	A. dictyoplokus
C 56	1903	6243.5	Lower N. asperus	Middle Eocene	0	Fair	Moderate	Moderate	A. dictyoplokus
C 55	1905.7	6252	N. asperus	Middle Eocene	1	Poor	Low	Low	
C 54	1909.5	6265	N. asperus	Middle Eocene	1	Fair	Moderate	Moderate	
C 53	1911.8	6272	N. asperus	Middle Eocene	1	Fair	Moderate	Moderate	
C 52	1929.8	6331.5	Indeterminate	-	-	Almost Barren	-	-	
C 51	1935.5	6350	Indeterminate	-	-	Barren	-	-	
C 50	1937.2	6355.5	Lower N. asperus	Middle Eocene	0	Fair	High	Low	A. dictyoplokus
C 48	1940.6	6367	Lower N. asperus	Middle Eocene	1	Fair	Moderate	None	
C 47	1941.9	6371	Indeterminate	-	-	Barren	-	-	
RE 4	1953.44	6409	P. asperopolus	Early-Middle Eocene	1	Fair	Moderate	Low	
C 38	2016.2	6615	P. asperopolus	Early-Middle Eocene	2	Poor	Moderate	Low	
C 34	2076.5	6812.5	P. asperopolus	Early-Middle Eocene	1	Good	High	Moderate	
C 33	2094.5	6872	Upper M. diversus	Early Eocene	1	Fair	Moderate	None	Coal
C 32	2097.7	6882	Upper M. diversus	Early Eocene	1	Fair	Moderate	None	Coal
C 31	2106.8	6912	Upper M. diversus	Early Eocene	1	Fair	Moderate	None	-
C 30	2110.5	6924	M. diversus	Early Eocene	2	Good	High	None	Coal
C 27	2150	7054	M. diversus	Early Eocene	2	Poor	Low	None	Coal
C 25	2162	7093	M. diversus	Early Eocene	2	Poor	Moderate	None	Coal
C 24	2180.5	7154	Lower-Middle M. diversus	Early Eocene	1	Good	High	None	-
C 23	2191.2	7189	Lower-Middle M. diversus	Early Eocene	2	Poor	Moderate	None	-
C 22	2204.9	7234	Indeterminate	-	-	Poor	Low	None	Coal
C 21	2208	7244	M. diversus	Early Eocene	2	Fair	Moderate	None	Mud contamination.
C 20	2218.2	7277.5	Lower-Middle M. diversus	Early Eocene	1	Good	High	Low	-
C 19	2234	7329.5	Lower M. diversus	Early Eocene	2	Fair	Moderate	Moderate	W. hypercantha Zone
C 18	2242	7355.5	Lower L. balmei	Late Paleocene	1	Good	High	None	
C 16	2273.3	7358	Upper L. balmei	Late Paleocene	1	Fair	High	None	Coal
C 15	2275.5	7465.5	Upper L. balmei	Late Paleocene	1	Fair	Moderate	None	
C 1	2407.5	7898.5	Upper L. balmei	Late Paleocene.	1	Fair	Moderate	None	

PALYNOLOGY DATA SHEET

BASIN: GIPPSLAND ELEVATION: KB: 21 GL: 80

WELL NAME: BREAM-4A TOTAL DEPTH: 2421 metres

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*	1860	0				1860	0			
	Upper *N. asperus*										
	Mid *N. asperus*	1861.9	2	1865.5	0		1879	0			
	Lower *N. asperus*	1889.5	0				1940.6	1	1938.2	0	
	P. asperopolus	1953.44	0				2076.5	1			
	Upper *M. diversus*	2094.5	1				2110.5	1			
	Mid *M. diversus*	2180.5	1								
	Lower *M. diversus*						2234	1			
	Upper *L. balmei*	2242	1				2407.5	1			
	Lower *L. balmei*										
LATE CRETACEOUS	*T. longus*										
	T. lilliei										
	N. senectus										
	U. *T. pachyexinus*										
	L. *T. pachyexinus*										
	C. triplex										
	A. distocarinatus										
EARLY CRET.	*C. paradoxus*										
	C. striatus										
	F. asymmetricus										
	F. wonthaggiensis										
	C. australiensis										
PRE-CRETACEOUS											

COMMENTS: *D. extensa:* 1865.5 to 1879; *A. dictyoplokus:* 1889.5 - 1937.2; *A. hypercantha:* 2234 metres.

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: Howard E. Stacy DATE: January 12, 1982

DATA REVISED BY: Howard E. Stacy DATE: January 19, 1982.

PART II

BASIC DATA

Table 1: Basic Data

Range Charts

TABLE 1 - BASIC DATA

SUMMARY OF PALAEONTOLOGICAL ANALYSIS, BREAM-4A, GIPPSLAND BASIN

SAMPLE	DEPTH (METRES)	DEPTH (FEET)	YIELD	SPORE-POLLEN DIVERSITY	DINO. DIVERSITY
SWC 69	1860	6102	Poor	Low	Low
SWC 68	1861.9	6108.5	Poor	Low	Low
SWC 67	1865.5	6120.5	Fair	Low	Moderate
SWC 66	1869	6132	Fair	Moderate	Moderate
SWC 63	1879	6165	Fair	Moderate	Moderate
SWC 60	1889.5	6199	Fair	Moderate	Moderate
SWC 56	1903	6243.5	Fair	Moderate	Moderate
SWC 55	1905.7	6252	Poor	Low	Low
SWC 54	1909.5	6265	Fair	Moderate	Moderate
SWC 53	1911.8	6272	Fair	Moderate	Moderate
SWC 52	1929.8	6331.5	Almost Barren	-	-
SWC 51	1935.5	6350	Barren	-	-
SWC 50	1937.2	6355.5	Fair	High	Low
SWC 48	1940.6	6367	Fair	Moderate	None
SWC 47	1941.9	6371	Barren	-	-
CORE 4	1953.44	6409	Fair	Moderate	Low
SWC 38	2016.2	6615	Poor	Moderate	Low
SWC 34	2076.5	6812.5	Good	High	Moderate
SWC 33	2094.5	6872	Fair	Moderate	None
SWC 32	2097.7	6882	Fair	Moderate	None
SWC 31	2106.8	6912	Fair	Moderate	None
SWC 30	2110.5	6924	Good	High	None
SWC 27	2150	7054	Poor	Low	None
SWC 25	2162	7093	Poor	Moderate	None
SWC 24	2180.5	7154	Good	High	None
SWC 23	2191.2	7189	Poor	Moderate	None
SWC 22	2204.9	7234	Poor	Low	None
SWC 21	2208	7244	Fair	Moderate	None
SWC 20	2218.2	7277.5	Good	High	Low
SWC 19	2234	7329.5	Fair	Moderate	Moderate
SWC 18	2242	7355.5	Good	High	None
SWC 16	2273.3	7358	Fair	High	None
SWC 15	2275.5	7465.5	Fair	Moderate	None
SWC 1	2407.5	7898.5	Fair	Moderate	None