Palynological analysis of two cuttings samples from top of the Latrobe Group in Sperm Whale–1, Gippsland Basin.

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INTERPRETATIVE DATA

Summary

Two new cuttings samples were collected and analysed from the top fifteen metres of the Latrobe Group to investigate whether any Gurnard Formation was present in Sperm Whale–1. The shallowest sample at 810m contained a microplankton dominated assemblage interpreted as caved from the overlying Seaspray Group. The deeper sample at 820m contained a spore-pollen dominated assemblage that is assigned to the Early Eocene *P. asperopolus* Zone. Neither assemblage contained any spores, pollen or microplankton restricted to the Middle and Late Eocene or diagnostic of the Gurnard Formation. The top of the Latrobe Group in Sperm Whale–1 is therefore marked by an significant unconformity with Miocene sediments overlying Early Eocene sediments. The stratigraphic succession in the well is tabulated below:

Table 1: Palynological Summary for Sperm Whale–1.

AGE	STRATIGRAPHY	SPORE-POLLEN ZONES (MICROPLANKTON ZONES)	DEPTHS mKB
RECENT to MIOCENE	GIPPSLAND LIMESTONE Seafloor to 805m	*P. tuberculatus* Zone (*Operculodinium* Superzone)	Caved assemblage in cuttings at 810m
Early EOCENE to PALEOCENE	LATROBE GROUP Undiff. coarse clastics 805 to 947m	*P. asperopolus* Zone *L. balmei* Zone †	820m 846 to 851m†
LATE ALBIAN	STRZELECKI GROUP 947 to 1417mTD	*C. paradoxa* Zone †	958 to 1302.1m†

† Zone picks after Harris & Foster (1983).

Introduction

The new palynological analyses from Sperm Whale–1 were undertaken as part of a larger review project for Basin Oil Pty Ltd, revising the age dating and correlation of the Gurnard Formation in the wells Baleen–1, Flathead–1, Judith–1, Patricia–1, and Whale–1 located on the Northern Strzelecki Terrace of the offshore Gippsland Basin. The samples were collected by the author from the

Victorian Department of Natural Resources & Environment (DNR&E) on 13th September 2000, and submitted to Laola Pty Ltd in Perth for palynological processing. The prepared palynological slides were returned during the next two weeks and the Provisional Report on the new analyses for Sperm Whale–1 was submitted on the 25th September.

Although adequate quantities of washed and dried cuttings were processed for each sample (average 24 grams), recovery of the organic residue was only low to moderate. Fortunately, the palynomorph concentrations on the palynological slides was high enabling highly diverse spore-pollen assemblages and low to moderate diversity microplankton assemblages to be recorded. Details of zone assignments, confidence ratings and key comments are given in Table 2, while the basic sample data is provided in Table 3, and visual residues yields, palynomorph preservation and recorded species diversity are provided in Table 4. The distribution and abundances of principal spore-pollen and microplankton species identified are listed alphabetically in Table 5. Author citations for spore-pollen species are mostly sourced from Stover & Partridge (1973, 1982), and for the microplankton species from the indexes of Williams *et al.* (1998) and Fensome *et al.* (1990).. Species names followed by "ms" or "†" are unpublished manuscript names.

Geological Discussion

Both new cuttings samples analysed from Sperm Whale–1 lack all palynomorphs considered diagnostic of the of the Gurnard Formation, and therefore the Seaspray Group is interpreted to directly and unconformably overlie the Latrobe Group coarse clastic sediments.

The top assemblage is interpreted as caved because it lies below the boundary between the Latrobe and Seaspray Groups picked on the electric logs at 804m, and is also inconsistent with the predominant lithology of the cuttings, a brownish-grey argillaceous sandstone. In addition, the palynological assemblages reported by Harris & Foster (1983) from the three sidewall core samples between 806 and 817m contain exclusively spore-pollen assemblages, which are more consistent with the underlying *P. asperopolus* Zone. It is therefore seem likely that the assemblage recorded from the cuttings at 810m is coming from a small amount of marl caved from the overlying Seaspray Group and that the predominant sandstone lithology is extremely lean or barren of palynomorphs.

The deeper cuttings at 820m containing a non-marine *P. asperopolus* Zone assemblage is similar to assemblages recorded from the top of the Latrobe coarse clastic reported in Patricia–1 and Flathead–1 (Partridge, 2000a-b). Although there are significant differences in the species recorded in the assemblages assigned to the *P. asperopolus* Zone in the three wells it is not currently possible to use these differences to further subdivide the zone or to determine relative age difference between the samples.

As neither sample contain any palynomorphs considered diagnostic of the Middle and Late Eocene or Oligocene the unconformity at the top of the Latrobe Group in Sperm Whale–1 is interpreted to extend from the Early Eocene into the Early Miocene. The only contrary evidence comes from the micropalaeontological report where the sidewall core at 803.9m, directly on the unconformity surface, is given a latest Eocene age (Zone K) based on a limited assemblage of planktonic foraminifera comprising only *Globigerina angioporoides* and *G. linaperta* (Paltech, 1982). In my opinion, based on the results of the palynological dating of other Zone K faunas in the Gippsland Basin, the occurrence of these species should be dismissed as either reworking or misidentification of poorly preserved specimens. Instead, more credence needs to be given to the diverse Zone G fauna reported from the overlying sidewall core at 799m in assigning a Early Miocene to the base of the Seaspray Group.

Discussion of Assemblages

Middle *Proteacidites tuberculatus* spore-pollen Zone or younger and *Operculodinium* microplankton Superzone.
Sample at: 810 metres.
Age: Miocene.
The shallower cuttings sample gave an assemblage dominated by marine microplankton (71% of SP + MP count), with the dominance of *Spiniferites* (61% of MP count) and *Operculodinium centrocarpum* (15% of MP count) confirming the assemblage was largely or entirely derived from the Seaspray Group and therefore belongs to the *Operculodinium* Superzone. No definitive Eocene microplankton were recorded.

The limited spore-pollen assemblage is also consistent with a post-Eocene age as it contains the Late Oligocene or younger index species *Ophioglossisporites* (al. *Foveotriletes*) *lacunosus, Cyathidites subtilis* and *Rugulatisporites cowrensis* in an

assemblage dominated by *Nothofagidites* pollen (41% of SP count). The single poorly preserved or ghosted specimen of *Proteacidites pachypolus* recorded is interpreted as reworked.

***Proteacidites asperopolus* spore-pollen Zone.**

Sample at: 820 metres.

Age: Early Eocene.

The deeper cuttings sample gave a spore-pollen assemblage (all recorded microplankton are considered caved) which is assigned the *P. asperopolus* Zone based on the presence of multiple specimens of *Sapotaceoidaepollenites rotundus*, which is not known to range below this zone, and the presence of *Myrtaceidites tenuis* and *Proteacidites ornatus*, which are not known to range above this zone (Stover & Partridge, 1973). The eponymous species *Proteacidites asperopolus* was not recorded but *Proteacidites pachypolus* was conspicuous in the assemblage even though only 2% of the assemblage count.

The gross composition of the assemblage also conforms to the *P. asperopolus* Zone with the abundance of *Haloragacidites harrisii* pollen (12%) greater than or equal to the abundance of *Nothofagidites* pollen (11%). In addition pollen of *Proteacidites* are relatively abundant (>17%), while gymnosperm pollen (11%) and spores (8%) are relatively low.

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Table 2: Interpretative data from Sperm Whale–1 well.

Sample Type	Depth	Spore-Pollen Zone (Microplankton Zone)	CR*	Comments and Key Species Present
Cuttings	810m	Middle *P. tuberculatus* Zone or younger (*Operculodinium* Superzone)	D1	Interpreted caved assemblage with MP 71% and *Nothofagidites* pollen 41%. Age based on FADs of spores *Foveotriletes lacunosus* and *Cyathidites subtilis*.
Cuttings	820m	*P. asperopolus* Zone	D1	MP 12% with est. >20% of assemblage caved from Seaspray Group. *Nothofagidites* pollen 11%; Age based on LADs of *Myrtaceidites tenuis* and *Proteacidites ornatus* and the FAD of multiple specimens of *Sapotaceoidaepollenites rotundus*

MP %= microplankton expressed as % of combined SP & MP count.
Nothofagidites % = abundance expressed as % of SP count only.
FAD & LAD = First & Last Appearance Datums.
*CR = Confidence Ratings

*Confidence Ratings used in STRATDAT database and applied to Table 2.

Alpha codes: Linked to sample		**Numeric codes:** Linked to fossil assemblage		
A	Core	**1**	**Excellent confidence:**	High diversity assemblage recorded with key zone species.
B	Sidewall core	**2**	**Good confidence:**	Moderately diverse assemblage recorded with key zone species.
C	Coal cuttings	**3**	**Fair confidence:**	Low diversity assemblage recorded with key zone species.
D	Ditch cuttings	**4**	**Poor confidence:**	Moderate to high diversity assemblage recorded without key zone species.
E	Junk basket	**5**	**Very low confidence:**	Low diversity assemblage recorded without key zone species.

BASIC DATA

Table 3: Basic sample data on new samples processed from Sperm Whale–1.

Sample Type	Depth	Lithology	Weight (grams)
Cuttings	810m	Medium brownish-grey argillaceous medium quartz sandstone	24.0
Cuttings	820m	Medium grey argillaceous medium grained quartz sandstone	23.4
		Average:	**23.7**

Table 4: Basic assemblage data on samples examined in Sperm Whale–1.

Sample Type	Depths	Visual Yield	Palynomorph Concentration	Preservation	No. SP Species	No. MP Species
Cuttings	810m	Very low	High	Poor-good	41+	16+
Cuttings	820m	Moderate	High	Fair-good	52+	5+
				Averages:	**46+**	**10+**

Legend for Table 5.

† Manuscript Species
X = Present (<1%)
CV = Caved
RW = Reworked
cf. = Compare with

BASIC DATA

Table 5: Palynomorph assemblage data from cuttings in Sperm Whale–1.

Sample Type:	Cuttings	Cuttings
Depth (m):	810	820
SPORE-POLLEN SPECIES		
Anacolosidites acutullus		X
Angiosperm pollen undiff.		3.4%
Araucariacites australis	4.3%	1.7%
Australopollis obscurus	RW	
Baculatisporites spp.		0.9%
Bluffopollis scabratus	X	
Camarozonosporites heskermensis	X	
Crybelosporites striatus		RW
Cupanieidites orthoteichus		0.9%
Cyathidites australis	RW	
Cyathidites palaeospora	10.9%	3.4%
Cyathidites splendens		X
Cyathidites subtilis	X	
Dicotetradites clavatus		1.7%
Dilwynites granulatus	8.7%	X
Dilwynites tuberculatus	X	
Diporites delicatus†		X
Foveotriletes balteus	X	
Haloragacidites harrisii	6.5%	12.1%
Helciporites astrus		X
Ilexpollenites spp.		0.9%
Kuylisporites waterbolkii		X
Laevigatosporites ovatus		1.7%
Lygistepollenites florinii	8.7%	4.3%
Malvacipollis diversus		X
Malvacipollis robustus†		X
Malvacipollis subtilis	X	6.0%
Monolete spores undiff:		0.9%
Myrtaceidites mesonesus/parvus	X	1.7%
Myrtaceidites tenuis		X
Myrtaceidites verrucosus		X
Nothofagidites asperus	2.2%	X
Nothofagidites brachyspinulosus	X	
Nothofagidites deminutus/vansteenisii	2.2%	
Nothofagidites emarcidus/heterus	34.8%	9.5%
Nothofagidites falcatus	X	
Nothofagidites flemingii	2.2%	1.7%
Nothofagidites goniatus	X	
Ophioglossisporites lacunosus	X	
Periporopollenites demarcatus	X	0.9%
Periporopollenites polyoratus	X	X
Phyllocladidites mawsonii	10.9%	0.9%
Podocarpidites spp.	2.2%	4.3%
Polycolpites esobalteus		X
Polypodiidites perverrucatus		X

BASIC DATA

Table 5: Palynomorph assemblage data from cuttings in Sperm Whale–1.

	Sample Type:	Cuttings	Cuttings
	Depth (m):	810	820
SPORE-POLLEN SPECIES			
Proteacidites adenanthoides			X
Proteacidites latrobensis		X	
Proteacidites leightonii			X
Proteacidites nasus			X
Proteacidites obscurus			X
Proteacidites ornatus			X
Proteacidites pachypolus		RW	1.7%
Proteacidites spp.		2.2%	15.5%
Rugulatisporites cowrensis		X	CV
Rugulatisporites mallatus			X
Santalumidites cainozoicus			X
Sapotaceoidaepollenites rotundus			X
Stereisporites antiquisporites		2.2%	X
Tricolp(or)ates spp.			23.3%
Tricolporites adelaidensis		X	X
Tricolporites moultonii†			X
Tricolporites paenestriatus			1.7%
Trilete spores undiff.		2.2%	0.9%
Triporopollenites heleosus†			X
Tripunctisporis maastrichtiensis		X	
Verrucosisporites cristatus		X	
Verrucosisporites kopukuensis		X	X
	TOTAL SPORES:	15%	8%
	TOTAL GYMNOSPERM POLLEN:	35%	11%
	TOTAL ANGIOSPERM POLLEN:	50%	81%
	TOTAL SPORE-POLLEN COUNT:	**46**	**116**
MICROPLANKTON			
Dinoflagellates undiff:		10%	21%
Achomosphaera spp.		X	
Cyclopsiella vieta		1%	
Hystrichokolpoma rigaudiae		X	
Impagidinium spp.		X	
Lingulodinium machaerophorum		1%	X
Operculodinium centrocarpum		15%	7%
Protoellipsodinium simplex†		10%	14%
Pyxidinopsis pontus†		X	X
Systematophora placacanthum		2%	
Spiniferites spp.		61%	57%
	MICROPLANKTON COUNT:	**115**	**14**
	TOTAL SP & MP COUNT:	**161**	**130**
	Microplankton as % SP + MP:	71%	11%
OTHER PALYNOMORPHS			
Fungal fruiting bodies		X	
Fungal spores & hyphae		2.4%	3.7%
	TOTAL palynomorph COUNT:	**166**	**135**