PALYNOLOGICAL ANALYSIS, WILD DOG-1, VIC-P-28, TORQUAY SUB-BASIN, VICTORIA

by

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INTRODUCTION

Eleven sidewall core and three cuttings samples, representing the interval 928 to 1220m in Wild Dog-1, were processed and examined for spore-pollen and dinoflagellates.

Yields and preservation were highly variable but overall were adequate for dating the major lithological units intersected within the above interval.

Lithological units and palynological determinations are summarized below. Kerogen yields (ccs of organic matter per gm sediment) are given on p.3.

Interpretative and basic data are given in Tables 1 and 2 respectively. The stratigraphic distribution of all species recorded is given in the attached range chart. Partial electric log data were made available for discussion.

SUMMARY

Age	Unit	Zone	Depth (m)	Environment
Late Eocene	**Boonah Fm.**	Middle *N. asperus*	928-990	Deltaic (marginal marine)
		unconformity		
Late Paleocene	**Eastern View Gp.**	Upper *L. balmei*	1008-1054.5	Coastal plain (fluvio-lacust.)
		unconformity		
Early Campanian	**Eastern View Gp.**	*N. senectus*	1110-1152	Rift valley (fluvio-lacust.)
		unconformity		
Early Albian	**Eumeralla Fm.**	*C. striatus*	1161-1220	Rift valley (fluvio-lacust.)
				TD 1223m

GEOLOGICAL COMMENTS

1. Wild Dog-1 intersects a stacked sequence of Late Eocene (Middle *N. asperus* Zone), Late Paleocene, (Upper *L. balmei* Zone) and Early Campanian (*N. senectus* Zone) units unconformably overlying the Eumeralla Formation. The top of this formation almost certainly is Early Albian, *C. striatus* Zone.

   The zone boundaries defined by the palynology are in excellent agreement with the lithologic formations established from electric log data.

2. Low yields and mostly poor preservation of spore-pollen dinoflagellates from the interval identified as Boonah Formation (922-1006m) are consistent with the sandy nature of this marginal marine unit. Caliper log data are against the palynomorphs being caved from the overlying clay/siltstone (ca. 890-1006m) at the base of the Demons Bluff Formation.

3. The presence of a non-marine Paleocene unit unconformably overlying Late Cretaceous sediments within the Eastern View Group corresponds well with the lithostratigraphic sequence recorded in Nerita-1A (Macphail, 1989) although the thickness of the unit is much less (46.5m vs 126m).

   The location of the SWCs close to the formation boundaries makes it certain that correlatives of the Lower *M. diversus* Zone and Lower *L. balmei* Zone facies in Nerita-1A are absent rather than not sampled. Maastrichtian *T. longus* and Late Campanian *T. lilliei* Zone facies may occur in the unsampled interval between 1054.5-1110m.

4. Based on confident *N. senectus* Zone dates for the interval between 1110-1152m, Wild Dog-1 includes a late Early Campanian unit that is missing or not sampled in the interval between 4460-4944ft. in Nerita-1A.

5. The absence of *in situ* Late Cretaceous angiosperm pollen in the SWC at 1161m confirms the log pick of 1160m for the unconformity separating the Eastern View and Otway Groups.

6. TAI values within the Early Cretaceous interval are immature to sub-mature.

KEROGEN YIELDS

Kerogen yields were highly variable with concentrations being highest in the Upper *L. balmei* Zone interval of the Eastern View Group and lowest at the top of the Boonah Formation (928m) and the Eumeralla Formation respectively.

Values for the individual SWC samples, determined by Konrad Weiss, Loala Pty Ltd., are:

SWC	DEPTH (m)	ORGANIC YIELD (cc/gm)
15	928	0.077
12	966	0.121
11	989	0.101
10	1008	0.530
09	1014.5	0.408
08	1054.5	0.425
07	1110	0.086
05	1152	0.075
04	1161	no data
02	1191	0.007
01	1220	0.006

Trends in the Organic yield will parallel variation in Total Organic Content (TOC) but, without additional data, the individual values cannot be directly correlated to TOC values.

PALAEOENVIRONMENTS

The variable (poor to excellent) preservation of Early Cretaceous palynofloras at 1220m and Early Campanian palynofloras at 1100m and 1152m are consistent with accumulation in fluvio-lacustrine depositional environments. Numbers of fresh-brackish water algal cysts are extremely low. There is no evidence of a marine-influence within the Paleocene interval within the Eastern View Group.

The sandy lithology and relative abundance of marine dinoflagellates to spore-pollen imply that the Boonah Formation is upper shore-face. This is consistent with evidence from other Torquay wells for a progressive encroachment of the Southern Ocean into the sub-basin during the Eocene.

BIOSTRATIGRAPHY

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

Crybelosporites striatus Zone 1161-1220m Early Albian

The age determination for the interval is based on the palynofloras at 1220m. This includes multiple specimens of *Crybelosporites striatus* but lacks indicator species of the *C. paradoxa* Zone. *Pilosisporites notensis* indicates the sample is no younger than earliest *C. paradoxa* Zone. The sample yielded rare specimens of the fresh-brackish water actritarch *Micrhystridium*.

Samples at 1161m and 1191m yielded very low numbers of long-ranging Cretaceous spores and/or gymnosperm pollen, consistent with an Early Cretaceous age. All angiosperm pollen appears to be caved.

Nothofagidites senectus Zone 1110-1152m Early Campanian

The two samples bracketing this interval yielded essentially the same assemblage of pollen and spores, dominated by *Nothofagidites senectus*, and related *Nothofagidites* spp. including *N. endurus*. The lowermost sample yielded a single specimen of *Micrhystridium*.

These "ancestral" *Nothofagus* pollen types and the consistent presence of *Forcipites sabulosus* and *Tricolporites apoxyexinus* show that the interval is no older than upper *N. senectus* Zone. That the interval is no younger than this zone is confirmed by multiple occurrences of *Forcipites stipulatus* and *Phimopollenites pannosus* and absence of *Gambierina* spp. and *Tricolporites lilliei*.

Both palynofloras are exceptionally well-preserved for their age. An anomalously young specimen of *Foraminisporis asymmetricus* occurs at 1110m: unusually early records of *Proteacidites amolosexinus* and *Dicotetradites meridianus* occur at 1152m and 1110m respectively.

Upper *Lygistepollenites balmei* Zone 1008-1054.5m Paleocene

Palynofloras within this interval are dominated by one or more of *Proteacidites*, *Nothofagus endurus* and gymnosperms of which *Araucariacites australis* and *Phyllocladidites mawsonii* are the most abundant. The nominate species, *Lygistepollenites balmei* is rare to infrequent throughout. A feature of the interval is presence of several *Proteacidites*

spp. that are typical of the Otway Basin but which are rare to absent in the adjacent Bass and Gippsland Basins: *P.* sp. cf *P. fromensis*, *P. tripartitus* and *P wilkatenaensis*. Caved dinoflagellates occurs in very low numbers.

The lower boundary is placed at 1054.5m based on the association of *Cupanieidites orthoteichus*, *Malvacipollis diversus*, *M. subtilis*, *Proteacidites annularis* and *P obscurus* with frequent to common *Australopollis obscurus*, *Gambierina* spp. and *Proteacidites angulatus*. The last three taxa and *Camarozonosporites bullatus* show that the sample is no younger than Upper *L. balmei* Zone. Rare taxa restricted to Paleocene or older sediments include *Amosopollis cruciformis*, *Gambierina tenuis*, *G. edwardsii* and *Triporopollenites cirrus* ms. *Haloragacidites harrisii* provides a maximum lower age limit of Lower *L. balmei* Zone.

The palynofloras at 1014.5m includes *C. bullatus*, *G. rudata* *L. balmei*, *P. annularis* and *P.* sp. cf *P. incurvatus*.

The upper boundary is picked at 1008m, the highest sample to yield *in situ* *Lygistepollenites balmei* associated with *Malvacipollis diversus* and *M. subtilis*. *Australopollis obscurus*, *Nothofagidites endurus* and *Gleicheniidites* spp. are frequent to common. Rare species include *Tetracolporites multistrixus* ms and *Proteacidites dierama* ms.

Middle *Nothofagidites asperus* Zone 928-990m Late Eocene

SWC samples taken at 928m, 966m and 989m yielded abundant structured kerogen but negligible spore-pollen. Occurrences of typically Paleocene taxa such as *Nothofagidites endurus* and *Phyllocladidites verrucosus* imply most of the latter are derived from drilling mud.

Conversely, three cuttings samples from within the same interval yielded low to moderate numbers of poorly preserved (oxidized) Eocene spores, pollen and dinoflagellates. Well-preserved palynomorphs were rare, indicating that down-hole caving has been minimal. All samples included low numbers of reworked Mesozoic-Paleocene spores and gymnosperm pollen and unidentified chorate dinoflagellates.

The sample picked as the lower boundary of the zone (990m) includes the index species of the Middle *N. asperus* Zone (*Triorites magnificus*) and its correlative dinoflagellate zone, the *C. incompositum* (*Corrudinium incompositum*). Both provide a highly reliable Late Eocene date assuming they are *in situ*. The same age limits are reliably indicated by the association of *Proteacidites stipplatus*, *P. recavus* and *P. leightonii*. The maximum age limit is Middle Eocene, Lower *N. asperus* Zone based on the dinoflagellate *Systematophora placacantha*.

The samples at 942m and 930m are no older than Middle *N. asperus Zone* based on *Proteacidites stipplatus* and (930m) *Proteacidites rectomarginis P. reticulatus* and *Corrudinium incompositum*. The upper age limit for the latter sample is Middle *N. asperus* Zone based on *P. recavus*, *P. rugulatus* and *Triporopollenites delicatus*.

The upper boundary is provisionally picked at 928m, a SWC including *Aglaoreidia qualumis*.

REFERENCES

Helby, R., Morgan, R. & Partridge, A.D. (1987). A palynological zonation of the Australian Mesozoic. *Association of Australasian Palaeontologists, Memoir* **4**: 1-94.

Macphail, M.K. (1989). Palynological analysis of samples from Nerita-1A, Torquay Sub-basin. *Shell Company of Australia Palaeontological Report*, 1 September 1989.

Stover, L.E. & Partridge, A.D. (1973). Tertiary and Late Cretaceous spores and pollen from the Gippsland Basin, Southeastern Australia. *Proceedings of the Royal Society of Victoria* **85**: 237-286.

TABLE 1: SUMMARY OF INTERPRETATIVE PALYNOLOGICAL DATA

SWC	DEPTH (m)	ZONE S-P	ZONE DINO	CONF. RTG.	COMMENT
15	928	M. N.a	-	2	No older than zone
ctg	930	M. N.a.	C. incom.	3	C. incompositum, P. leightonii, P. recavus P. rectomarginis
ctg	942	M. N.a.	-	4	P. stipplatus
12	966	indet.	-	-	mud contaminants only
11	989	indet.	-	-	mud contaminants only
ctg	990	M. N.a.	C. incom.	3	T. magnificus, C. incompositum
10	1008	U. L.b.	-	0	L. balmei, M. subtilis
09	1014.5	U. L.b.	-	0	C. bullatus, P. annularis
08	1054.5	U. L.b.	-	0	As above
07	1110	N. sen.	-	1	N. senectus, F. sabulosus,
05	1152	N. sen.	-	1	As above
04	1161	Early Cretaceous		-	E. Cretaceous spp.
02	1191	Early Cretaceous		-	Mostly mud contaminants
01	1220	C. str.	-	1	C. striatus, P. notensis

M. N.a. = Middle N. asperus Zone
C. incom. = Corrudinium incompositum Zone
U. L.b. = Upper L. balmei
N. sen. = Nothofagidites senectus Zone
C. str. = Crybelosporites striatus Zone

TABLE 2: SUMMARY OF BASIC PALYNOLOGICAL DATA

SWC	DEPTH (m)	YIELD S.-P.	YIELD DINO	DIVERSITY S-P	DIVERSITY DINO	PRES.
15	928	very low	-	low	-	poor
ctg	930	medium	low	high	medium	poor
ctg	942	low	low	low	low	poor
12	966	very low	-	low	low	moderate
11	989	very low	-	low	-	variable
ctg	990	medium	medium	medium	low	moderate
10	1008	medium	-	high	-	poor
09	1014.5	low	-	high	-	moderate
08	1054.5	very high	very low	high	low	good
07	1110	medium	-	high	-	good
05	1152	low	very low	medium	low	moderate
04	1161	very low	-	low	-	very poor
02	1191	very low	-	low	-	very poor
01	1220	low	-	medium	-	moderate