PALYNOLOGICAL ANANLYSIS, TORSK-1

GIPPSLAND BASIN

by

M.K. MACPHAIL

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Esso Australia Ltd.

Consultant Palynologist, 20 Abbey St., Gladesville, NSW 2111

INTRODUCTION

Thirty-nine sidewall core samples, representing the interval 1333.7 to 2401.0m in Torsk-1, were processed and examined for spore-pollen and dinoflagellates.

Yields and preservation were adequate to high but, as with other wells which intersect upper coastal plain environments some distance from the palaeoshoreline, indicator species were extremely rare and multiple palynological slides of each sample needed to be worked in order to obtain confident age-determinations.

Lithological units and palynological determinations are summarized below. Interpretative and basic data are given in Tables 1 and 2 respectively. Check lists of all species recorded are attached.

SUMMARY

AGE	UNIT	SPORE-POLLEN ZONE	DINO ZONE	DEPTH RANGE (m)
	LAKES ENTRANCE			not sampled
	log pick 1331m			
latest Eocene to earliest Oligocene	GURNARD facies	Upper *N. asperus*	*P. comatum*	1333.7
Late Eocene	"	Middle *N. asperus*	*C. incompositum*	1362.0
	log pick 1367m			
Late Eocene	LATROBE GROUP coarse clastics	Middle *N. asperus*	*D. extensa*	1370.50-1375.5
Middle Eocene	"	Lower *N. asperus*	-	1404.0 - 1546.0
Early Eocene	"	*P. asperopolus*	-	1600.5
"	"	Middle *M. diversus*	-	1743.5 - 1778.0
Paleocene	"	Upper *L. balmei*	-	1818.5 - 2044.0
"	"	Lower *L. balmei*	-	2081.0 - 2151.0
	Cretaceous/Tertiary boundary: log pick 2161m			
Maastrichtian	"	Upper *T. longus*	-	2187.5 - 2288.5
"	"	Lower *T. longus*	-	2309.5 - 2346.5
	unconformity?			
Campanian	LATROBE GROUP coarse clastics	*T. lilliei*	-	2401.0

TD 2421.0m

GEOLOGICAL COMMENTS

1. Torsk-1 contains an almost continuous sequence of palynological zones from the Campanian, T. lilliei to the latest Eocene/earliest Oligocene, Upper N. asperus Zone. Because of poor sidewall recovery over critical intervals and some indeterminate samples, it is unclear whether the missing zones are absent due to non-deposition or erosion, or were not sampled. Zones or intervals likely to have been characterized by low rates of sedimentation, or interrupted deposition at the well-site are:

(a) Early Eocene, M. diversus Zone

The Lower M. diversus Zone was not recorded in Torsk-1. On present indications, the maximum possible thickness of sediments of this zone is 40 m, between samples at 1778.5 and 1818.5m. A more realistic maximum value is less than 28m given that the sequence of coals between 1806-1815m [log data] is likely to represent the top of the Paleocene, L. balmei Zone unit in Torsk-1. A thin or absent section of Lower M. diversus Zone sediments is consistent with previous evidence for thinning of the Early Eocene, M. diversus Zone sediments as these onlap the margins of the Gippsland Basin [Partridge, 1976, fig.7].

(b) Maastrichtian, T. longus Zone

The established and possible maximum thickness [66.5, ca. 88m respectively] of Lower T. longus Zone sediments in Torsk-1 are significantly less than in wells to the east in the central deep. Again, this may reflect thinning of the unit up onto the flanks of the basin, or erosion.

The upper boundary of the Maastrichtian unit in Torsk-1 is picked at 2161m, the top of a thin sequence of coals and siltstones. The shallowest sample from the zone, at 2187.5m, contains a palynoflora that is different in character in terms of species composition and species abundances to palynofloras recovered from Upper T. longus Zone sediments in wells further to the east in the central deep. A similar palynoflora occurs at the top of the Upper T. longus Zone in Tarwhine-1 [Macphail, 1982].

These differences may relate to changes in vegetation and therefore palynoflora composition across the coastal plain, to subtle changes in facies, or may indicate a slight age difference for the top of the Upper T. longus Zone across the basin.

(c) Campanian, T. lilliei Zone

Irrespective of whether the sample at 2401.0m is 'lower' T. lilliei or 'uppermost' N. senectus Zone [see Biostratigraphy Section, p.4], the data indicate that younger T. lilliei Zone sediments are either absent or represented by the thin unit of siltstones and volcano-clastics (?) between 2401.0m and the volcanic or igneous material identified in the sidewall core at 2376m.

The explanation favoured here is that the base of the volcanics or igneous material marks an erosion surface, provisionally equated with the "intra Campanian" unconformity of Lowry [1987].

It is noted that the "intra-T. lilliei Zone" position of the unconformity suggested here is at odds with the "intra-N. senectus Zone" position proposed by Lowry [1987]. The youngest date cited by Lowry comes from West Seahorse-1 where the unconformity occurs within an interval dated by Macphail [1983a] as N. senectus Zone. The reliability of the age-determination is now questioned since it was based on limited assemblage lists given in a report by Harris (1982). These data demonstrate only that the unconformity is no older than uppermost N. senectus Zone.

2. Glauconite-rich claystones of the Gurnard facies between the log picks for the top of coarse clastics at 1366m and Top of Latrobe at 1331m accumulated during the Late Eocene, Middle N. asperus Zone to earliest Oligocene, Upper N. asperus Zone.

3. Marine dinoflagellates markedly increase in abundance close to the top of coarse clastics and dominate palynofloras within the Gurnard facies. This reflects the progressive encroachment of the Tasman Sea within the basin, culminating in open marine conditions at the wellsite by the latest Eocene. The earliest evidence for marginal marine conditions at Torsk-1 is Middle M. diversus Zone. Prior to this, coastal plain or intra-

rift valley environments are likely to have prevailed.

4. The A. hyperacanthum marine transgression [Partridge, 1976] was not recorded. However it is noted that the most likely interval, that immediately above 1806m, was not sampled. A slight marine influence is recorded within the Middle M. diversus Zone at 1743.5m but not at 1778.5m

5. A lacustrine depositional environment is suggested to be represented by the Lower T. longus Zone sample at 2309.5m, based on the presence of an algal cyst Rimosicysta sp. cf R. cucullatus, previously only reported from Turonian to Santonian age sediments in the Gippsland Basin. It is not known whether this younger occurrence in Torsk-1 reflects the re-development of a special lacustrine environment or whether palynologists working on the Basin have overlooked or not systematically recorded these types of palynomorphs.

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. The informal subdivision of the T. longus Zone proposed by Macphail (1983b: see Helby et al., ibid p.58) is followed here. Zone names have not been altered to conform with nomenclatural changes to nominate species such as Tricolpites longus [now Forcipites longus: see Dettman & Jarzen, 1988].

Tricolporites lilliei Zone 2401.0m Campanian

The basal sidewall core sample is assigned to this zone on the basis of a very poorly preserved and therefore not wholly reliable specimen of the nominate species. Reliable specimens of Forcipites sabulosus, Gambierina rudata and G. edwardsii demonstrate that the sample is no older than uppermost N. senectus Zone. The absence of distinctive Late Cretaceous Proteacidites spp. and abundance of spores, including a population of Latrobosporites amplus, suggests that the minimum age is the lower part of the T. lilliei Zone

SWC 3 [2381.5m] was barren whilst SWC 4 [2376m], identified as a rhyolite, yielded a sparse Eocene palynoflora. SWCs 2 and 5 were unsuitable for palynological analysis.

Lower Tricolpites longus Zone 2309.5-2346.5m Maastrichtian

Occurrences of Forcipites longus at 2346.5m and Quadraplanus brossus at 2309.5m provide a reliable Lower T. longus Zone age for this interval. Both assemblages include frequent Gambierina rudata, not infrequent Triporopollenites sectilis, and distinctive Late Cretaceous Proteacidites spp. such as P. otwayensis and P. wahooensis. The sample at 2332.5m contains Tricolporites lilliei and Tetradopollis securus and thus is no older than T. lilliei Zone. An algal cyst resembling the Turonian-early Santonian species Rimosicysta cucullata Marshall [in press] is present at 2309.5m

Upper Tricolpites longus Zone 2187.5-2288.5m Maastrichtian

The lower boundary of this zone is picked at 2288.5m, based on Stereisporites punctatus, Quadraplanus brossus and Forcipites longus in a Gambierina rudata-dominated palynoflora. The sample is unusual in that Nothofagidites kaitangata also is common to abundant and specimens of

Tricolporites lilliei and *Triporopollenites sectilis* frequent. *Grapnelispora evansii* and an undescribed species which possesses simple rather than the bifurcate processes of *G. evansii*, are present.

Although the highest record of *Forcipites longus* in an uncontaminated sample is at 2275.3m, the persistent occurrence of *Stereisporites punctatus* and [frequent to abundant] *Gambierina rudata* provides a reliable Upper *T. longus* Zone age for the interval. The upper boundary is placed at 2187.5m, a sample which includes abundant *Tetracolporites verrucosus* but only very rare occurrences of species which range no higher than the *T. longus* Zone [*Triporopollenites sectilis*, *P. palisadus*]. This *Gambierina*-*Tetracolporites* assemblage is considered to be transitional with Paleocene *Proteacidites*-dominated palynofloras

Lower *Lygistepollenites balmei* Zone 2081.0-2151.0m Paleocene

Samples within this interval are wholly dominated by gymnosperm pollen and small [less than 20 microns] *Proteacidites* spp. All palynofloras included one or more specimens of the nominate species but, as is usually the case with this zone, the age-determinations are based on the absence of species which first appear in the Upper *L. balmei* Zone. *Haloragacidites harrisii* occurs at 2151.0m but this record is unreliable evidence that the sample is no older than Lower *L. balmei* Zone given that the palynoflora includes caved Eocene species.

Upper *Lygistepollenites balmei* Zone 1818.5-2044.0m Paleocene

Samples within this interval resemble those of the lower zonule except that the nominate species and *Gleicheniidites* spp. tend to be more common. However most samples also contain Eocene contaminants, including dinoflagellates.

The lower boundary of the zone is placed at 2044.0m, based on the lowest, apparently *in situ*, occurrence of *Malvacipollis diversus*. Apart from the possibility of contamination [*Proteacidites reticuloscabratus* is present in the same sample and *Triorites magnificus* occurs at 2006.5m], the exact stratigraphic range of this species remains unclear and the zone boundary should be regarded as provisional. Nevertheless the occurrence of *Integricorpus antipodus* is consistent with a 'middle' Paleocene date.

A more confident Upper *L. balmei* Zone sample occurs at 1958.0m. This sample contains frequent-common

Lygistepollenites balmei as well as Polycolpites langstonii, Proteacidites sp. cf P. incurvatus, Malvacipollis subtilis and the Eocene contaminant Proteacidites asperopolus. Other first appearances indicative of an Upper L. balmei Zone date are: Matonisporites ornamentalis and Ischyosporites irregularis [1914.0m], and Beaupreadites orbiculatus, Crassiretitriletes vanraadshooyenii, Cupanieidites orthoteichus and Proteacidites annularis [1870.5m]. The upper zone boundary is placed at 1818.5m, the highest in situ occurrence of Gambierina rudata and Lygistepollenites balmei. Cupanieidites orthoteichus and Malvacipollis subtilis are present.

Lower Malvacipollis diversus Zone: not recorded

Middle Malvacipollis diversus Zone 1743.5-1778.5m Early Eocene

Two samples are provisionally assigned to this zone. The lowermost, at 1778.5m, contains Proteacidites ornatus and Triporopollenites heleosus and thus is no older than Middle M. diversus Zone. The date is of low confidence since several specimens of Lygistepollenites balmei occur in the same mount. An Early Eocene age is supported by an undescribed Polycolpites sp. which is substantially smaller [ca. 32 microns] than, but otherwise closely resembles P. langstonii.

The other sample, at 1753.5m, contains a general Early Eocene palynoflora which has been contaminated with T. longus Zone species, including Forcipites longus. Of uncertain significance is the presence of Tricolpites incisus, a species which usually first appears within the P. asperopolus Zone. Species typical of and whose first appearance are diagnostic of the Upper M. diversus Zone, Myrtaceidites tenuis and Proteacidites pachypolus, are absent. Two specimens of the Early Eocene dinoflagellate Deflandrea obliquipes were recorded [four strew mounts worked].

Upper Malvacipollis diversus Zone: not recorded

Proteacidites asperopolus Zone 1600.5m Early Eocene

One sample is assigned to this zone, based on the association of the nominate species and Tricolporites leuros with species which range no higher than the P. asperopolus Zone [Myrtaceidites tenuis, Proteacidites ornatus]. Although Nothofagidites spp. are marginally more frequent than Proteacidites spp., the relative abundance of Conbaculites apiculatus is inconsistent with a younger date.

The sample at 1555.0m yielded a very sparse palynoflora 'dominated' by Proteacidites spp., including P. pachypolus. It is possible that all are contaminants.

Lower Nothofagidites asperus Zone 1404.0-1546.0m Middle Eocene

Samples within this interval are dominated by Nothofagidites emarcidus-heterus and spores [1447.5m, 1514.0m]. High relative abundance of spores probably reflects the development of a particular [deltaic?] environment since this phenomenon typically occurs in the Early Eocene in offshore wells located further to the east in the central deep than Torsk-1.

The lower boundary is placed at 1546.0m, a sample containing Tricolpites simatus and Anacolosidites rotundus, and the lowest one that is clearly dominated by Nothofagidites rather than Proteacidites. Cyathidites splendens dominates the sparse palynofloras recovered at 1514.0m and, associated with frequent Ischyosporites gremius and Trilites tuberculiformis, at 1447.5m.

The upper boundary is provisionally picked at 1404.0m, the highest Nothofagidites-dominated palynoflora lacking Late Eocene spore-pollen or dinoflagellate species. A perfect specimen of the rare manuscript species Tricolporites circumlumenus is present. Minor contamination by Paleocene/Maastrichtian sediments is indicated by Tetracolporites verrucosus and Gambierina rudata.

Middle Nothofagidites asperus Zone 1362.0-1375.5m Late Eocene

As with the Lower N. asperus Zone, all palynofloras within this interval are dominated by Nothofagidites emarcidus-heterus. With the exception of 1374.0m, all samples yielded dinoflagellates, in particular the SWC at 1362.0m and conventional core samples between 1370.50-1372.02m.

The lower boundary, at 1375.5m, is defined by the first appearance of Dryadopollis (al. Tricolporites) retequetrus and [frequent-common] Gippslandica (al. Vozzhenikovia) extensa. A probable specimen of Proteacidites rectomarginis is present. The sample is unusual for the zone in that Malvacipollis spp. are also frequent-common. Gippslandica extensa dominates the conventional core palynofloras at 1370.50-1370.57, 1370.59-1370.67 [a sample yielding the very rare Camptostemon pollen type] and 1372.02m.

The upper boundary is placed at 1362.0m, a sample containing the zone index species _Triorites magnificus_ and _Corrudinium incompositum_. The dinoflagellate flora is exceptionally diverse and in species composition closely resembles that from the Browns Creek section [see Cookson & Eisenack, 1965].

Upper _Nothofagidites asperus_ Zone 1333.7m Latest Eocene/ Earliest Oligocene

The uppermost SWC, at 1333.7m, is provisionally assigned to this zone, based on abundant _Nothofagidites_ in an assemblage lacking either Middle _N_. _asperus_ or _P_. _tuberculatus_ Zone indicators. Dinoflagellates dominated the yield, with _Achomosphaera alcicornu_ and _Spiniferites ramosus_ the most abundant species. One definite specimen of _Phthanoperidinium comatum_ was located. The species composition is typical of assemblages recovered from the "Oligocene Wedge" marl.

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TABLE 1: SUMMARY OF INTERPRETATIVE PALYNOLOGICAL DATA

TORSK-1

SAMPLE NO.	DEPTH (m)	SPORE-POLLEN ZONE	DINOFLAGELLATE ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 60	1333.7	Upper *N. asperus*	*P. comatum*	latest Eocene-earliest Oligocene	1	"Oligocene Wedge" dinoflagellate assemblage
SWC 57	1362.0	Middle *N. asperus*	*C. incompositum*	Late Eocene	0	Browns Creeek dinoflagellate assemblage
Core 1	1370.50-.57	Middle *N. asperus*	*D. extensa*	Late Eocene	0	*G. extensa* dominant, *A. qualumis*
Core 1	1370.59-.67	Middle *N. asperus*	*D. extensa*	Late Eocene	2	*G. extensa* dominant
Core 1	1372.02	Middle *N. asperus*	*D. extensa*	Late Eocene	2	*G. extensa* dominant
SWC 54	1372.4	Middle *N. asperus*	*D. extensa*	Late Eocene	2	
SWC 53	1374.0	Middle *N. asperus*		Late Eocene	2	
SWC 50	1375.5	Middle *N. asperus*	*D. extensa*	Late Eocene	1	*T. retequetrus*, freq. *G. extensa*
SWC 48	1404.0	Lower *N. asperus*		Middle Eocene	2	*Nothofagidites* abundant, minor contamination
SWC 47	1447.5	Lower *N. asperus*		Middle Eocene	2	*Nothofagidites* abundant
SWC 45	1514.0	Indeterminate		Eocene	-	*C. splendens* dominant
SWC 42	1546.0	Lower *N. asperus*		Middle Eocene	1	*T. simatus*, *Nothofagidites* abundant
SWC 41	1555.5	Indeterminate		Eocene	-	*P. pachypolus*
SWC 39	1600.5	*P. asperopolus*		Early Eocene	0	*P. asperopolus*, *M. tenuis*, *P. ornatus*, *C. apiculatus*
SWC 33	1743.5	Middle *M. diversus*		Early Eocene	2	Contaminated by *T. longus* Zone spp.
SWC 32	1778.5	Middle *M. diversus*		Early Eocene	1	*P. ornatus*, *D. obliquipes*
SWC 30	1818.5	Upper *L. balmei*		Paleocene	0	*L. balmei* freq., *C. orthoteichus*.

SAMPLE NO.	DEPTH (m)	SPORE-POLLEN ZONE	DINOFLAGELLATE ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 29	1848.0	Upper L. balmei		Paleocene	1	L. balmei. G. rudata, C. orthoteichus
SWC 28	1870.5	Upper L. balmei		Paleocene	1	As above plus C. vanraadshoovenii, B. orbiculatus
SWC 27	1914.0	Upper L. balmei		Paleocene	1	I. irregularis, M. duratus
SWC 26	1929.0	L. balmei		Paleocene	-	L. balmei
SWC 25	1958.0	Upper L. balmei		Paleocene	1	L. balmei common, M. subtilis, P. langstonii
SWC 23	1985.0	Upper L. balmei		Paleocene	2	L. balmei, M. subtilis
SWC 22	2006.5	Indeterminate				Middle N. asperus Zone contaminants
SWC 21	2044.0	Upper L. balmei		Paleocene	2	L. balmei freq., I. antipodus, M. subtilis
SWC 19	2081.0	Lower L. balmei		Paleocene	1	L. balmei. T. verrucosus, abund. Proteacidites
SWC 16	2151.0	Lower L. balmei		Paleocene	2	As above but Proteacidites uncommon
SWC 15	2187.5	Upper T. longus		Maastrichtian	1	Gambierina common, P. palisadus, P. clinei, S. punctatus, T. verrucosus common
SWC 12	2231.5	Upper T. longus		Maastrichtian	1	Gambierina freq., P. amolosexinus, S. punctatus
SWC 11	2255.5	Upper T. longus		Maastrichtian	1	Gambierina abund., P. reticuloconcavus, S. punctatus
SWC 10	2275.3	Upper T. longus		Maastrichtian	0	F. longus, S. punctatus, P. reticuloconcavus P. otwayensis, P. askinae, T. verrucosus
SWC 9	2288.5	Upper T. longus		Maastrichtian	0	F. longus, S. punctatus, abund. Gambierina
SWC 8	2309.5	Lower T. longus		Maastrichtian	0	Q. brossus, F. longus, abund. Nothofagidites, freq. G. rudata, T. lilliei, & T. sectilis

SAMPLE NO.	DEPTH (m)	SPORE-POLLEN ZONE	DINOFLAGELLATE ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 6	2346.5	Lower T. longus		Maastrichtian	0	F. longus
SWC 4	2376.0	Indeterminate				Caved M. diversus Zone?
SWC 3	2381.5	Indeterminate				Barren sample
SWC 1	2401.0	T. lilliei		Campanian	2	Poor spm. of T. lilliei, G. edwardsii, G. rudata, N. cf kaitangata.

TABLE 2 : SUMMARY OF BASIC PALYNOLOGICAL DATA

TORSK-1

DIVERSITY -	low	medium	high
S & P	less than 10	10-30	greater than 30
D	1-3	3-10	10

SAMPLE NO.	DEPTH (m)	YIELD SPORE-POLLEN	YIELD DINOS	DIVERSITY SPORE-POLLEN	DIVERSITY DINOS	PRESERVATION	LITHOLOGY	PYRIZATION	COMMENTS
SWC 60	1333.7	Medium	High	Medium	Medium	Good-Perfect	Clyst.	-	
SWC 57	1362.0	Medium	High	Medium	High	Moderate	Clyst.	Minor	
Core 1	1370.50-.57	High	Medium	High	Low	Good	Slst.	Minor	
Core 1	1370.59-.67	High	High	Low	Low	Good	Slst.	Minor	
Core 1	1372.02	Medium	High	Medium	Low	Good	Slst.	Minor	Pollen swollen
SWC 54	1372.4	Low	Low	Medium	Low	Good	Sst.		
SWC 53	1374.0	Low	Low	High	Low	Good	Sst.		Dinos caved
SWC 50	1375.5	High	Medium	High	Low	Moderate	Slst/sst.	Minor	
SWC 48	1404.0	Medium	-	High	-	Moderate	Slst.		Contaminated sample
SWC 47	1447.5	Low	-	Medium	-	Moderate	Slst.		
SWC 45	1514.0	Low	-	Medium	-	Moderate	Slst.		
SWC 42	1546.0	High	-	High	-	Moderate	Slst.		
SWC 41	1555.0	Low	-	Medium	-	Poor	Slst.		
SWC 39	1600.5	Medium	-	High	-	Good	Slst		
SWC 33	1743.5	Low	Low	High	Low	Good	Slst		

TABLE 2: SUMMARY OF BASIC PALYNOLOGICAL DATA

TORSK-1

DIVERSITY -	low	medium	high
S & P	less than 10	10-30	greater than 30
D	1-3	3-10	10

SAMPLE NO.	DEPTH (m)	YIELD SPORE-POLLEN	YIELD DINOS	DIVERSITY SPORE-POLLEN	DIVERSITY DINOS	PRESERVATION	LITHOLOGY	PYRIZATION	COMMENTS
SWC 32	1778.5	Medium	-	High	-	Good	Slst.		
SWC 30	1818.5	Medium	-	Medium	-	Moderate	Sst.		
SWC 29	1848.0	Low	Low	Medium	Low	Moderate	Sst.	Minor	Dinos caved
SWC 28	1870.5	High	-	High	-	Good	Slst.		
SWC 27	1914.0	Medium	-	High	-	Good	Sst.		
SWC 26	1929.0	Low	Low	Medium	Low	Poor	Slst.		Dinos caved
SWC 25	1958.0	High	-	High	-	Moderate	Slst.		
SWC 23	1958.0	Medium	-	Medium	-	Moderate	Sst.		
SWC 22	2006.5	Low	-	Low	-	Good	Sst.		Caved spp. only
SWC	2044.0	Medium	-	High	-	Moderate	Sst.		
SWC 19	2081.0	Medium	-	Medium	-	Moderate	Sst		
SWC 16	2151.0	Low	-	Medium	-	Poor	Sst.		
SWC 15	2187.5	High	-	High	-	Good	Slst/coal		
SWC 12	2231.5	Low	-	High	-	Moderate	Slst.		
SWC 11	2255.5	Medium	-	High	-	Poor	Slst.		

TABLE 2 : SUMMARY OF BASIC PALYNOLOGICAL DATA

TORSK-1

DIVERSITY -	low	medium	high
S & P	less than 10	10-30	greater than 30
D	1-3	3-10	10

SAMPLE NO.	DEPTH (m)	YIELD		DIVERSITY		PRESERVATION	LITHOLOGY	PYRIZATION	COMMENTS
		SPORE-POLLEN	DINOS	SPORE-POLLEN	DINOS				
SWC 10	2275.3	High	-	High	-	Good	Slst.		
SWC 9	2288.5	High	-	High	-	Poor	Slst.		
SWC 8	2309.5	High	Low	High	Low	Good	Clyst.		Dinos lacustrine
SWC 7	2332.5	Medium	-	High	-	Poor	Slst., carb.		
SWC 6	2346.5	Medium	-	High	-	Moderate	Clyst.		
SWC 4	2376.0	Low	-	Low	-	Moderate	Volcanic		Caved spp. only
SWC 3	2381.5	Barren sample					Slst (volcanic?)		
SWC 1	2401.0	Low	-	High	-	Poor	Slst.		