PALYNOLOGICAL REPORT ON ESSO MUSSEL NO. 1, OTWAY BASIN

by

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INTRODUCTION

Available sidewall cores, main core samples and selected cuttings from Mussel No.1 have been examined for their spore/pollen and dinoflagellate content. The results of this study are summarized in Table 1: observed species on which ages are based are listed below with comments as necessary. Zones through the Cretaceous and Tertiary in question have been previously described and defined by Dettmann (1963), Dettmann & Playford (in press), Evans (1966) and Harris (1965).

TABLE 1: SUMMARY OF RESULTS

SAMPLE	DEPTH	AGE
swc 23	4085'	Tertiary indeterminate
swc 22	4152'	Upper Palaeocene, equivalent to Princetown Member of Dilwyn Clay in type section.
Cutt.	4170-4190'	As above
swc 21	4208'	As above
swc 20	4315'	Upper Cretaceous, Nothofagidites microflora
swc 19	4462'	As above
swc 18	4543'	As above
swc 17	4654'	As above
swc 16	4735'	As above
swc 15	4854'	As above - and top of Xenikoon australis dinoflagellate Zone.
swc 14	5084'	As above
swc 11	5600'	As above
swc 10	5764'	As above
swc 9	5909'	Upper Cretaceous ? Tricolpites pachyexinus Zone and continuing in X. australis Zone
swc 8	6061	As above
swc 1	6660'	Upper Cretaceous, ? Clavifera triplex and ? Deflandrea cretacea Zones.
core 1	6891	Upper Cretaceous, C. triplex or A. distocarinatus Zone
core 3	7337-42'	" " Appendicisporites distocarinatus Zone and Ascodinium parvum dinoflagellate Zone
swc 36	7348'	Upper Cretaceous A. distorcarinatus or Tricolpites pannosus Zone
swc 35	7360'	As above
swc 34	7396'	As above
cutt.	7500'	Cretaceous, indeterminate.
cutt.	7600'	As above
cutt.	7700'	As above
cutt.	7810'	As above
cutt.	7900'	As above
cutt.	8010'	As above

OBSERVATIONS & COMMENTS

A. 4085 feet Tertiary, indetminate.

Sidewall core 23, 4085 feet.

Very small residue, mainly of vegetable debris. Extremely rare bisaccate pollen and a specimen. of Cyathidites minor. Age therefore indeterminate.

B. 4152-4208 feet Upper Paleocene.

The microfloras from the three samples taken within this interval were not abundant, but were very distinctive, containing dinoflagellates as well as spores and pollen. The most productive sample, at 4208 feet has an assemblage which resembles ones described by Harris (1965) from the Princetown Member of the Dilwyn Clay, although the dinflagellates are more reminiscent of the forms described by Cookson & Eisenack (1967) from the base of the Rivernook Bed in the outcropping Dilwyn Clay.

Sidewall core 22, 4152 feet.
Fossil yield small, but including : -

Cyathidites minor

C. splendens

Lycopodiumsporites sp.

Bisaccate pollen undet.

Araucariacites australis

Microcachryidites antarcticus

Cycadopites spp. undiff.

Parasaccites sp.*

Nothofagidites spp. undiff. rare

Proteacidites pachypolus

P. incurvatus

Periporopollenites polyoratus

Triorites harrisii

Dinoflagellates undiff.

* Probably re-cycled.

Cuttings 4170-4190 feet.

Yield relatively abundant and without obvious signs of substantial cavings. The assemblage included:

Proteacidites dilwynensis

P. pachypolus

P. annularis

P. ornatus

Polycolpites esobalteus

Cupaneidites orthoteichus

Simpliceopollis meridianus

Malvacipollis diversus

Bankeaeidites minimus

Triorites harrisii

Nothofagidites spp. undiff.

Periporopollenites polyoratus

Sidewall core 21, 4208 feet.

The most abundant assemblage of the Upper Paleocene sequence, this sample is marked by a diverse content of dinoflagellates. Fossils included: -

Cyathidites splendens

C. minor

Baculatisporites comaumensis

Cupaneidites reticularis

Proteacidites annularis

P. pachypolus

P. ornatus

P. spp. nov.

Simplicepollis meridianus

Tricolporites microreticulatus

Malvacipollis diversus

Laevigatosporites ovatus

Dilwynites granulatus

Triorites harrisii fairly common

Nothofagidites spp. fairly common

Bisaccate spp. undiff.

Parasaccites sp.*

Bankseaeidites minimus

Deflandrea spp. nov.

Homotribulum ? sp. nov.

Kenleyia fimbriata fairly common

Leptodinium sp.

Hystrichosphaera sp.

Thalassiphora flammea

Hystrichokolpoma sp.

Wetzeliella cf. W. glabra

C. 4315 - 4854 feet. Upper Cretaceous, Nothofagidites microflora.

The samples considered within this interval contain elements of the upper portion of the Nothofagidites microflora described by Dettman & Playford (in press). They are separated from a lower section bearing the microflora by the presence of Tricolpites lilliei Couper and by dinoflagellates which are apparently younger than the Xenikoon australis Zone (Evans, 1966).

Dacrydiumites balmei is present to a depth of 4735 feet. Tricolpites sabulosus and Proteacidites amolosexinus do not make their appearance until 4654 feet. It is therefore possible that the interval 4315 - 4543 feet is somewhat younger than the typical Nothofagidites microflora determined by Dettman & Playford, but it is still placed within the Upper Cretaceous because of the presence of the New Zealand species Tricolpites lilliei and the absence of species regarded as typical of the basal Tertiary. Associated dinoflagellates help little with the determination of the age of the section without further work. Forms of Deflandrea are present but cannot be exactly matched with known species. cf. D. bakeri is identified at 4462 feet; cf. D. pellucida at 4462-4654 feet; and a cf. D. korajongensis at 4654 feet. These appear to be in the relative order of sequence previously noted for the actual species within the Otway Basin. D. korojongensis has not been recorded from the Otway Basin, but was described from the Campanian - Lower Maastrichtian Korojong Calcarenite of the Carnarvon Basin. (Cookson & Eisenack, 1958).

Xenikoon australis was identified in the basal sample of the interval in question, at 4854 feet, but continued to lower levels. In view of the fact that the entire sequence from 4315 to 4854 feet was a dinoflagellate bearing facies, the 4854 feet horizon is probably a valid expression of the top of the range of X. australis. The following fossil lists do not include long ranging species such as Araucariacites australis, Cyathidites spp., Gleicheniidites.

Sidewall core 20, 4315 feet.

Nothofagidites spp. undiff	fairly common
Triorites edwardsii	fairly common
Tricolpites gillti	
T. lilliei	
T. pachyexinus	
"Dacrydiumites" balmei	
Dacrydiumites mawsonii verrucosus	
Simplicepollis cf. S. meridianus	
Camarozonosporites chaiensis	
Liliacidites sp.	
Australopollis obscurus	
Stereisporites regium	
Deflandrea spp. undiff.	
Epicephalopyxis dentata	
Svalbardella cf. S. granulata	
Cymatiosphaera sp.	

Cribroperidinium sp

Sidewall core 19, 4462 feet.

Nothofagidites spp.
Triorites edwardsii
Tricolpites gillii
Tr. lilliei
T. pachyesinus
T. cf. T. waiparaensis
Dacrydiumites mawsonii verrusosus
"D". balmei
Simplicepollis cf. S. meridianus
Liliacidites sp.
Camarozonosporites sp.
Ornamentifera sentosa

Deflandrea spp. undiff.
Deflandrea sp. cf. D. bakeri
D. sp. cf. D. pellucida
? Spinidinium sp.

Sidewall core 18, 4543 feet.

Nothofagidites spp.
Triorites edwardsii
Tricolpites gillii
T. pachyexinus
T. cf. T. waiparaensis
Liliacidites sp.
Dacrydiumites mawsonii verrucosus
Simplicepollis sp.
"Ericipites" cf. "E". scabratus
? Protaecidites retiformis
P. cf. P. granoratus
Australopollis obscurus

Deflandrea spp. indiff.
D. cf. pellucida
Spinidinium sp.
Hystrichosphaeridium sp.

Sidewall core 17, 4654 feet.

Nothofagidites spp.
Triorites edwardsii
Tricolpites gillii
T. pachyesinus
T. lilliei
T. sabulosus
T. cf. waip araensis
Dacrydiumites mawsonii verrucosus
"Ericipites" cf. scabratus
Liliacidites sp.
Proteacidites sp. cf. P. retiformis
P. amolosexinus
Camerozonosporites sp.
Australopollis obscurus
Ornamentifera sentosa

Deflandrea sp.
Deflandrea sp. cf. D. pellucida
Deflandrea sp. cf. D. korojongensis
Oligosphaeridium sp.

Sidewall core 16, 4735 feet.

Nothofagidites sp.
Triorites edwardsii
Tricolpites gillii
T. cf. T. waiparaensis
T. pachyexinus
Dacrydiumites balmei
D. mawsonii verrucosus
Simplicepollis sp.
"Ericipites" sp. cf. E. clavatus
Liliacidites sp.
Proteacidites sp. cf. P. retiformis
P. sp. cf. P. granoratus
? Camarozonosporites sp.
? Ornamentifera sentosa

Deflandrea spp. undiff.

Deflandrea cretacea

Spinidiniums sp.

Sidewall core 15, 4854 feet.

Nothofagidites spp. undiff.

Triorites edwardsii

Tricolpites gillii

T. pachyexinus

T. sp. cf. T. waiparaensis

? T. lilliei

T. sabulosus

Camarozonosporites chaiensis

Dacrydiumites mawsonii verrucosus

Simplicepollis sp.

"Ericipites" sp. cf. "E". scabratus

Liliacidites sp.

Proteacidites amolosexinus

Xenikoon australis

Deflandrea spp. incl. D. cretacea

D. 5084-6061 feet. Upper Cretaceous. Nothofagidites microflora. Xenikoon australis dinoflagellate Zone.

The correct base to the Nothofagidites microflora may be as high as 5764 feet, the lowest level at which the genus has been recorded. X. australis ranges further than this depth and provisionally the base of the Nothofagidites microflora, which evidence elsewhere has shown to be very close to or coincident with the base, of the X. australis Zone is taken to 6061 feet. However, the sequence in Mussel may be a more precise demonstration of the relationship of the pollen and dinoflagellate zone boundaries.

Sidewall core 14, 5084 feet.
Yield relatively abundant and including the following species:

Nothofagidites spp.

Tricolpites pachyexinus

T. gillii

T. sabulosus

P. amolosexinus

Proteacidites amolsexinus

Camarozonosporites chaiensis

Cicatricosisporites spp. *

Dacrydiumites mawsonii
"D" balmei ??

Xenikoon australis

Sidewall core 11,5600 feet.
Low yield, with more abundant dinoflagellates than preceding sample.

Nothofagidites spp.
Tricolpites gillii
T. sabulosus
Ceratosporites equalis
Leptolepidites verrucatus *
Dictyotosporites speciosus *
Clavifera triplex
Cicatricosisporites spp.
Klukisporites scaberis*
Parasaccites sp. *

Xenikoon australis
Nelsoniella aceras
Odontochitina porifera
Hystrichosphaera sp.

* recycled. from the Permian or the Lower Cretaceous.

Sidewall core 10, 5764 feet.

Nothofagidites spp. (very rare)
Tricolpites pachyexinus
? T. sabulosus
T. gillii
Camarozonosporites chaiensis
C. amplus
Ceratosporites equalis
Oranmentifera sentosa
Gleicheniididites spp. undiff.
Cicitricosisporites spp. undiff *
Parasaccites sp. *
Striatiti undiff. *

Xenikoon australis (fairly common)
Nelsoniella aceras
N. tuberculata

Sidewall core 9?, 5909 feet.

A relatively limited yield, again dominated by dinoflagellates. Fossils of stratigraphic significance include :

Xenikoon australis

Odonotochitina porifera

Nelsoniella aceras

Tricolpites pachyexinus

T. gillii

? T. sabulosus

Dacrydiumites mawsonii

Ornamentifera sentosa

Callialasporites dampieri *

Camarozonsoporites amplus

Clavifera triplex

Sidewall core 8, 6061 feet.
As for preceding sample:

Xenikoon australis (very rare)

Nelsoniella aceras

Odontochitina porifera

Tricolpites pachyexinus

T. cf. sabulosus

"Triorites edwardsii" Evans 1966, pl.1, fig. 18.

Camarozonosporites amplus

Cicatricosisporites spp.

Australopollis obscurus

Aequitriradites verrucosus *

* recycled from the Permian or the Lower Cretaceous.

E. 6660 feet. Upper Cretaceous. ?Deflandrea cretacea dinflagellatee Zone. Probably Clavifera triplex Zone.

The sidewall core 1, 6660 feet, is provisionally placed in the D. cretacea Zone because of the presence of two specimens of the nominate species among mainly spinose dinoflagellates, the apparently complete absence of X. australis and N. aceras, the presence of Odontochitina striatoperforata and spores/pollen suggestive of the C. triplex Zone.

F. 6891 feet. Upper Cretaceous. Clavifera triplex or Appendixisporites distocarinatus Zone.

Although numerous specimens have been extracted from core 1, 6891 feet, it has not been possible to determine which of the C. triplex and the A. distocarinatus Zones the horizon represents. Dinoflagellates are extremely rare in the sample, spores are the most common forms and angiosperm pollen very rare. Some of the fossils present have been identified as :

Cyathidites minor	(common)
Clavifera triplex	
Sphagnumsporites antiquasporites	(fairly common)
Gleicheniidites spp. undiff.	(fairly common)
Osmundacidites wellmannii	
Cicatricosisporites cf. C. ludbrookii	
C. cuneiformis	
Appendicisporites distocarinatus	
Rugulatisporites sp.	
Tricrassate gen et sp. nov.	
Microcachryidites antarcticus	
Bisaccate pollen undiff.	(common)
Araucariacities australis	
Camarozonsporites sp. nov.	
Lycopodiumsporites spp.	
Dacrydiumites mawsonii	
Vitreisporites pallidus	
Laevigatosporites ovatus	
L. major	
Cycadopites sp.	
Perotrilites jubatus	
Neoraistrickia truncata	
Triporines spp. undet.	(rare)
Triptyches spp. undet.	(rare)

G. 7337 - 7396 feet. Upper - ?Lower Cretaceous. Ascodinium parvum dinoflagellate Zone; Appendicisporites distocarinatus spore/pollen zone.

The samples within this sequence are the lowest to which a relatively positive age may be assinged. Only cuttings were avilable below 7396 feet. Samples from core 3 are placed in the A. distocarinatus Zone because of the presence of angiosperm pollen in extremely rare proportions, the presence of A. distocarinatus, Balelmisporites glenelgensis, Cicatricosisporites cuneiformis, Laevigatosporites major, and cf. Australopollis obscurus. Lacking B. glenelgensis and A. obscurus and possessing Trilobosporites trioreticulosus, the assemblage

at 7348 feet might be as old as the Tricolpites pannosus Zone. Dinoflagellates are present throughout, but the zone fossil was only identified in company with "Palaeonystrichophora"infusioroides Odontochitina operculata, O. striatoperforata, Gonyaulacysta edwardsii and Appendicisporites distocarinatus at 7360 feet.

Core 3, 7337 - 7342 feet.

Several samples were taken from this core, but the following list is a composite of the assemblages extracted therefrom.

Cyathidites minor
C. australis
Balmeisporites glenelgensis
Osmundacidites wellmannii
Gleicheniidites spp. undiff.
Clavifera triplex?
Cicatricosisporties cuneiformis
C. australiensis
C. ludbrookii
Appendicisporites distocarinatus
Densoisporites velatus
Perotrilites jubatus
Dictyophyllidites concavus
cf. Dacrydiumites mawsonii
Bisaccate pollen undiff. (common)
Microcachridites antarcticus)
Podosporites microsaccatus)
Lycopodiumsporites sp.
Tricrassate gen. et sp. nov.
Camarozonosporites sp. nov.
cf. Australopollis obscurus
Stereisporites antiquasporites
cf. Kuylisporites lunaris
Parasaccites sp. *
Striatiti sp. undiff. *
Rouseisporites reticulatus
Cingutrilites clavus
Tricolporate sp.. undet.

* Recycled Permian.

Sidewall core 36, 7348 feet.

Cyathidites minor
C. australis

Pilisisporites grandis
Appendicisporites distocarinatus
Cicatricosispoorites cuneiformis
C. australiensis
Foraminisporis dailyi
Microcachryidites antarcticus
Dictyophyllidites concavus
Vitreisporites pallidus
Bisaccate spp. undiff. (common)
Laevigatosporites ovatus
L. major
Densoisporites velatus
Classopollis sp.
Gleicheniidites spp. undiff.
Cycadopites sp.
Trilobosporites trioreticulosus
Triptyches undiff. (extremely rare)
Araucariacites australis

Odontochitina operculata
O. Striatoperforata
Gonyaulacysta edwardsii

Sidewall core 35, 7360 feet.

Cyathidites minor
C. australis
Osmundacidites vellmannii
Bisaccate pollen undiff. (common)
Microcachrydities antarcticus (common)
Dictyophyllidites concavus
Appendicisporites distocarinatus
Araucariacites australis
Laevigatosporites ovatus
Gleicheniidites spp. undiff.
Cycadopites sp.
Perotrilites sp.
Densoispoorites valatus
Cicatricosisporites australiensis
C. cuneiformis
Foraminisporis assymetricus
F. dailyi

Lycopodiumsporites spp.
Monocolpate reticulate sp. undiff.

Amosopollis cruciformis
Odontochitina operculata
O. striatoperforata
Gonyaulacysta edwardsii
Palaeohystrichophora infusorioides
Diconodinium sp.
Cycloneophelium sp.
Ascodinium parvum
Hystrichosphaeridium cf. H. salpinophorum

Sidewall core 34, 7396 feet.

Cyathidites minor
C. australis
Cicatricosisporites cuneiformis
C. ludbrookii
Camarozonosporites sp. nov.
Stereisporites antiquasporites
Microcachryidites antarcticus (common)
Podosporites microsaccatus
Araucariacites australis
Foraminisporis dailyi
Appendicisporites distocarinatus
Cycadopites sp.
Laevigatosporites ovatus
Trypryches sp. (one specimen)

Amosopollis cruciformis
Odontochitina operculata
Gonyaulacysta edwardsii

H. 7500 - 8010 feet. Cretaceous undifferentiated.

Only cuttings were available from this interval and the residues derived from them were heavily contaiminated with fossils from younger beds - mainly in the X. australis Zone of the Upper Cretaceous. Nothing distinctive within the range T. pannosus - C. paradoxa Zones was identified except for the presence of Perotrilites majus at 7810 feet, Tricolpites pannosus and Pilosisporites cf. P. notensis at 8010 feet, which might suggest that the T. pannosus and the C. paradoxa Zones had been penetrated or entered.

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