



PE990017

PALYNOLOGICAL REPORT ON SHELL  
NERITA NO. 1 WELL, 2106-6456 FEET

by

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Test Figures

Table 1 : Preservation and zonal attribution of plant microfossil assemblages in sidewall cores of Nerita No. 1 well, 2106 feet - 6456 feet.

Enclosure

1. Distribution of Microflora from Nerita -1

PALYNOLOGICAL REPORT ON SHELL NERITA NO.1 WELL

2106 - 6456 FEET

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A palynological analysis of twenty five sidewall cores taken from between 2106 feet and 6456 feet in Nerita No.1 well forms the basis of the present account. Extraction of the palynological floras from the samples examined involved an initial treatment in cold hydrofluoric acid followed by mineral separation with zinc bromide. The residues were then examined and the quality of preservation of the contained plant microfossils was ascertained (see Table 1). A subsequent treatment with Schulze solution for five to fifteen minutes followed by brief immersion in 1% ammonium hydroxide was carried out on all residues before the microfloral suites were specifically analysed.

All samples were found to contain spores and pollen grains together with varying amounts of wood and cuticular fragments. Microplankton are of intermittent occurrence in the section between 2106 feet and 4782 feet and when present occur in strictly minor proportions. The spore - pollen - microplankton suites identified in the samples are tabulated below with reference to their qualitative and quantitative content; the quantitative estimates are expressed in the following terms:- Ab (abundant) - numerical representation of a particular species totals at least 5% of total microflora, C (common) - numerical representation of a species forms 1 - 5% of total microflora, and R (rare) - numerical representation of a species forms less than 1% of total microflora.

As outlined subsequently the Nerita No.1 microfloras possess features diagnostic of certain of the palynological assemblages delineated by Cookson (1954), Harris (1965), Evans (1966) and Dettmann and Playford (1968) in sediments of Lower Tertiary and Cretaceous age of the Otway Basin. An evaluation of this microfloral evidence clearly indicates that the section between 4804 feet and 6456 feet is Lower Cretaceous (mostly, if not all Upper Aptian) in age, and the overlying sediments between 2106 feet and 4782 feet range in age from Senonian to Eocene.

MICROFLORAL CONTENT AND AGE OF SAMPLES

A. 2106 feet - 2496 feet

2106 feet

An excellently preserved and diverse assemblage of abundant spores and pollen grains and rare microplankton was extracted from the sample. Species identified include:

Spores:	<u>Baculatisporites comaumensis</u> (Cookson)	C
	<u>Cyathidites splendens</u> Harris	R
	<u>Gleicheniidites circinidites</u> (Cookson)	R
	<u>Laevigatosporites major</u> (Cookson)	R
	<u>L. ovatus</u> Wilson & Webster	C
	<u>Stereisporites antiquasporites</u> (Wilson & Webster)	C
	<u>Stereisporites</u> sp.	R
	<u>Trilites kopukuensis</u> Couper	R

Pollen:	<u>Anacolosidites luteoides</u> Cookson & Pike	R
	<u>Araucariacites australis</u> Cookson	R
	<u>Casuarinidites cainozoicus</u> Cookson & Pike	R
	<u>Duplopollis orthoteichus</u> (Cookson & Pike)	R
	<u>Dacrydiumites florinii</u> Cookson & Pike	C
	<u>Myrtacidites eugenioides</u> Cookson & Pike	R
	cf. <u>Malvacipollis diversus</u> Harris	C
	<u>Nothofagidites brachyspinulosus</u> (Cookson)	R
	<u>N. emarcidus</u> (Cookson)	Ab
	<u>Nothofagus diminuta</u> Cookson	C
	<u>Phyllocladidites mawsonii</u> Cookson	C
	<u>Polyporina fragilis</u> Harris	R
	<u>Podosporites microsaccatus</u> Couper	R
	<u>Podocarpidites ellipticus</u> Cookson	C
	<u>Proteacidites adenanthoides</u> Cookson	R
	<u>P. annularis</u> Cookson	C
	<u>P. grandis</u> Cookson	R
	<u>P. cf. pachypolus</u> Cookson & Pike	R
	<u>Santalumidites cainozoicus</u> Cookson & Pike	R
	<u>Tricolporites prolata</u> Cookson	C
	<u>Triorites harrisii</u> Couper	Ab
	<u>T. magnificus</u> Cookson	R
Microplankton:	<u>Cordosphaeridium capricornum</u> Cookson & Eisenack	R
	<u>Cannosphaeropsis cf. densiradiata</u> Cookson & Eisenack	R

### 2270 feet

The following species of excellently preserved spores, pollen, and microplankton were identified in the residue:

Spores:	<u>Cyathidites australis</u> Couper	C
	<u>C. minor</u> Couper	C
	<u>Laevigatosporites major</u> (Cookson)	R
	<u>L. ovatus</u> Wilson & Webster	C
	<u>Stereisporites antiquasporites</u> (Wilson & Webster)	C
	<u>Trilites kopukuensis</u> Couper	C
Pollen:	<u>Araucariacites australis</u> Couper	C
	<u>Casuarinidites cainozoicus</u> Cookson & Pike	R
	<u>Dacrydiumites florinii</u> Cookson & Pike	C
	<u>Duplopollis orthoteichus</u> (Cookson & Pike)	R
	cf. <u>Malvacipollis diversus</u> Harris	C
	<u>Myrtacidites eugenioides</u> Cookson & Pike	R
	<u>Microcachryidites antarcticus</u> Cookson	R
	<u>Nothofagidites emarcidus</u> (Cookson)	C
	<u>Nothofagus aspera</u> Cookson	R
	<u>N. cincta</u> Cookson	R
	<u>N. diminuta</u> Cookson	C
	<u>N. goniata</u> Cookson	R
	<u>Phyllocladidites mawsonii</u> Cookson	C
	<u>Podocarpidites ellipticus</u> Cookson	C
	<u>Polyporina fragilis</u> Harris	R
	<u>Proteacidites annularis</u> Cookson	C
	<u>P. cf. crassus</u> Cookson	R
	<u>P. grandis</u> Cookson	R
	<u>P. incurvatus</u> Cookson	R
	<u>P. pachypolus</u> Cookson & Pike	R
	<u>P. subscabratus</u> Couper	R
	<u>Santalumidites cainozoicus</u> Cookson & Pike	R
	<u>Tricolporites prolata</u> Cookson	C
	<u>Tricolpites thomasii</u> Cookson & Pike	R
	<u>Triorites harrisii</u> Couper	Ab
Microplankton:	<u>Cordosphaeridium capricornum</u> Cookson & Eisenack	R

2496 feet

Spores and pollen grains exhibiting excellent preservation constitute the following microfloral assemblage:

Spores:	<u>Cyathidites minor</u> Couper	C
	<u>C. splendens</u> Harris	R
	<u>Gleicheniidites circinidites</u> (Cookson)	C
	<u>Laevigatosporites major</u> (Cookson)	R
	<u>Verrucatosporites speciosus</u> Harris	C
Pollen:	<u>Anacolosidites luteoides</u> Cookson & Pike	R
	<u>Araucariacites australis</u> Cookson	R
	<u>Dacrydiumites florinii</u> Cookson & Pike	R
	<u>Duplopollis orthoteichus</u> (Cookson & Pike)	R
	<u>Ephedra notensis</u> Cookson	R
	<u>Myrtaceidites eugenioides</u> Cookson & Pike	R
	cf. <u>Malvacipollis diversus</u> Harris	C
	<u>Nothofagidites emarcidus</u> (Cookson)	Ab
	<u>Nothofagus diminuta</u> Cookson	C
	<u>Phyllocladidites mawsonii</u> Cookson	C
	<u>Podocarpidites ellipticus</u> Cookson	C
	<u>Proteacidites annularis</u> Cookson	C
	<u>P. grandis</u> Cookson	C
	<u>P. ornatus</u> Harris	R
	<u>P. pachypolus</u> Cookson & Pike	Ab
	<u>P. rectomarginus</u> Cookson	R
	<u>P. reticuloscabratus</u> Couper	R
	<u>P. subscabratus</u> Couper	C
	<u>P. symphyonemoides</u> Cookson	R
	<u>Santalumidites cainozoicus</u> Cookson & Pike	R
	<u>Tricolporites prolata</u> Cookson	R
	<u>Triorites harrisii</u> Couper	Ab
	<u>Tiliaepollenites notabilis</u> Harris	R

Spore - pollen suites extracted from samples between 2106 feet and 2496 feet include Triorites magnificus, Tricolpites thomasi, Nothofagus aspera, N. diminuta, Proteacidites pachypolus, and Santalumidites cainozoicus and are thus closely conformable with Cookson's (1954) Microflora C which is considered to be of Eocene age. Moreover, except for P. pachypolus, the species cited above are considered by Harris (1965) to distinguish Microflora C from his older (Upper Paleocene) Duplopollis orthoteichus Assemblage which, as discussed below, occurs in underlying sediments in Nerita No.1 well.

The rare microplankton recovered from the samples at 2106 feet and 2270 feet are known from the Lower Tertiary of western Victoria in both Paleocene and Eocene strata (Cookson and Eisenack 1965a, 1967).

B. 2570 feet

Extremely well preserved spores and pollen grains extracted from the sample constitute the following diverse assemblage:

Spores:	<u>Baculatisporites comaumensis</u> (Cookson)	R
	<u>Cyathidites australis</u> Couper	Ab
	<u>C. splendens</u> Harris	R
	<u>Gleicheniidites circinidites</u> (Cookson)	C
	<u>Laevigatosporites ovatus</u> Wilson & Webster	C
	<u>Lycopodiumsporites</u> sp.	R
	<u>Stereisporites</u> sp.	R
	<u>Trilites tuberculiformis</u> Cookson	R

Pollen:	<u>Casuarinidites cainozoicus</u> Cookson & Pike	R
	<u>Dacrydiumites florinii</u> Cookson & Pike	C
	<u>Duplopollis orthoteichus</u> (Cookson & Pike)	R
	<u>Microcachryidites antarcticus</u> Cookson	R
	<u>Myrtaceidites parvus</u> Cookson & Pike	R
	<u>Nothofagidites emarcidus</u> (Cookson)	C
	<u>Nothofagus cincta</u> Cookson	R
	<u>Podocarpidites ellipticus</u> Cookson	C
	<u>Polyporina fragilis</u> Harris	C
	<u>Proteacidites annularis</u> Cookson	C
	<u>P. adenanthoides</u> Cookson	R
	<u>P. crassus</u> Cookson	C
	<u>P. crassipora</u> Harris	R
	<u>P. dilwynensis</u> Harris	C
	<u>P. grandis</u> Cookson	R
	<u>P. reticulosabratus</u> Harris	R
	<u>P. rectomarginus</u> Cookson	R
	<u>P. subscabratus</u> Couper	C
	<u>P. sp.</u>	R
	<u>Tricolporites prolata</u> Cookson	C
	<u>Triorites harrisii</u> Couper	Ab

The microfloral assemblage includes Duplopollis orthoteichus together with Proteacidites dilwynensis and conforms with Harris's (1965) Duplopollis orthoteichus Assemblage which is regarded to be of Upper Paleocene age.

#### C. 2682 feet

Poor concentrations of well preserved spores, pollen, and microplankton were recovered from the sample. Species identified include:

Spores:	<u>Baculatisporites comaumensis</u> (Cookson)	R
	<u>Cyathidites australis</u> Couper	C
	<u>C. splendens</u> Harris	R
	<u>Gleicheniidites circinidites</u> (Cookson)	C
	<u>Stereisporites antiquasporites</u> (Wilson & Webster)	C
Pollen:	<u>Araucariacites australis</u> Cookson	R
	<u>Dacrydiumites florinii</u> Cookson & Pike	C
	<u>Monosulcites prominatus</u> McIntyre	R
	<u>Nothofagidites emarcidus</u> (Cookson)	C
	<u>Podocarpidites ellipticus</u> Cookson	Ab
	<u>Proteacidites crassipora</u> Harris	C
	<u>Tricolporites prolata</u> Cookson	R
	<u>Tricolpites sp.</u>	R
Microplankton:	<u>Cordosphaeridium capricornum</u> Cookson & Eisenack	R

Although lacking both Duplopollis orthoteichus and Triorites edwardsii, the microflora is assigned to Harris's (1965) D. orthoteichus - T. edwardsii Concurrent Assemblage on the basis of Monosulcites prominatus (= Baltisphaeridium taylorii Cookson & Eisenack). This species appears to be restricted to western Victorian strata of Middle - Upper Paleocene age (Cookson and Eisenack 1965b, 1967).

The single species of microplankton recorded from the sample is also known from Middle - Upper Paleocene strata and extends into the Eocene (Cookson and Eisenack 1965a, 1967).

D. 2846 feet - 4065 feet

2846 feet

Well preserved spores and pollen grains extracted from the sample constitute the following diverse assemblage:

Spores:	<u>Baculatisporites comaumensis</u> (Cookson)	R
	<u>Camarozonosporites bullatus</u> Harris	R
	<u>Cyathidites minor</u> Couper	C
	<u>Gleicheniidites circinidites</u> (Cookson)	C
	<u>Latrobosporites crassus</u> Harris	R
	<u>Laevigatosporites ovatus</u> Wilson & Webster	C
	<u>Lycopodiumsporites</u> sp.	R
	<u>Stereisporites</u> sp.	C
	<u>Trilites tuberculiformis</u> Cookson	R
Pollen:	<u>Araucariacites australis</u> Cookson	R
	<u>Dacrydiumites florinii</u> Cookson & Pike	C
	<u>Microcachryidites antarcticus</u> Cookson	C
	<u>Myrtacidites parvus</u> Cookson & Pike	R
	<u>Nothofagidites</u> cf. <u>brachyspinulosus</u> (Cookson)	R
	<u>N. emarcidus</u> (Cookson)	C
	<u>Phyllocladidites mawsonii</u> Cookson	Ab
	<u>P. reticulosaccatus</u> Harris	R
	<u>Podocarpidites ellipticus</u> Cookson	C
	<u>Polyporina fragilis</u> Harris	C
	<u>Proteacidites annularis</u> Cookson	R
	<u>P. crassus</u> Cookson	R
	<u>P. incurvatus</u> Cookson	R
	<u>P. ornatus</u> Harris	R
	<u>P. reticuloscabratus</u> Harris	R
	<u>P. subscabratus</u>	C
	<u>P. symphyonemoides</u> Cookson	R
	<u>Stephanoporopollenites obscurus</u> Harris	R
	aff. <u>Triorites edwardsii</u> Cookson & Pike	R
	<u>Tricolpites gillii</u> Cookson	R

3048 feet

The following forms of well preserved spores and pollen grains were observed in the residue:

Spores:	<u>Cyathidites australis</u> Couper	C
	<u>C. splendens</u> Harris	R
	<u>Gleicheniidites circinidites</u> (Cookson)	C
	<u>Latrobosporites crassus</u> Harris	R
	<u>Laevigatosporites ovatus</u> Wilson & Webster	C
	<u>Stereisporites antiquasporites</u> (Wilson & Webster)	C
	<u>Trilites tuberculiformis</u> Cookson	R
Pollen:	<u>Banksiaeidites</u> sp.	R
	<u>Dacrydiumites florinii</u> Cookson & Pike	C
	<u>Microcachryidites antarcticus</u> Cookson	C
	<u>Nothofagidites</u> cf. <u>brachyspinulosus</u> (Cookson)	R
	<u>N. emarcidus</u> (Cookson)	C
	<u>Phyllocladidites mawsonii</u> Cookson	Ab
	<u>Podocarpidites ellipticus</u> Cookson	C
	<u>Podosporites microsaccatus</u> Couper	R
	<u>Polyporina fragilis</u> Harris	R
	<u>Proteacidites annularis</u> Cookson	C
	<u>P. dilwynensis</u> Harris	R
	<u>P. subscabratus</u> Couper	C
	<u>Stephanoporopollenites obscurus</u> Harris	R

3149 feet

A diverse assemblage of well preserved spores and pollen was obtained from the sample. The following species were observed:

Spores:	<u>Baculatisporites comaumensis</u> (Cookson)	R
	<u>Camarozonosporites bullatus</u> Harris	R
	<u>C. cf. ohaiensis</u> (Couper)	R
	<u>Cyathidites australis</u> Couper	C
	<u>C. splendens</u> Harris	R
	<u>Gleicheniidites circinidites</u> (Cookson)	Ab
	<u>Latrobosporites crassus</u> Harris	R
	<u>Laevigatosporites ovatus</u> Wilson & Webster	C
	<u>Lycopodiumsporites austroclavatidites</u> (Cookson)	R
	<u>Stereisporites antiquasporites</u> (Wilson & Webster)	C
	<u>Stereisporites</u> sp.	R
	<u>Trilites tuberculiformis</u> Cookson	R
Pollen:	<u>Araucariacites australis</u> Cookson	R
	<u>Dacrydiumites florinii</u> Cookson & Pike	C
	<u>Microcachryidites antarcticus</u> Cookson	C
	<u>Nothofagidites cf. brachyspinulosus</u> (Cookson)	R
	<u>N. emarcidus</u> (Cookson)	C
	<u>Phyllocladidites mawsonii</u> Cookson	Ab
	<u>P. reticulosaccatus</u> Harris	R
	<u>Polyporina fragilis</u> Harris	C
	<u>Proteacidites annularis</u> Cookson	C
	<u>P. crassus</u> Cookson	R
	<u>P. ornatus</u> Harris	R
	<u>P. reticulosabratus</u> Harris	R
	<u>P. subscabratus</u> Couper	Ab
	<u>Stephanoporopollenites obscurus</u> Harris	R
	aff. <u>Triorites edwardsii</u> Cookson & Pike	R

3253 feet

The following species of spores and pollen grains were observed in the residue:

Spores:	<u>Baculatisporites comaumensis</u> (Cookson)	R
	<u>Camarozonosporites cf. ohaiensis</u> (Couper)	R
	<u>Cyathidites australis</u> Couper	C
	<u>C. splendens</u> Harris	R
	<u>Gleicheniidites circinidites</u> (Cookson)	C
	<u>Laevigatosporites ovatus</u> Wilson & Webster	C
	<u>Stereisporites antiquasporites</u> (Wilson & Webster)	C
	<u>Stereisporites</u> sp.	R
	<u>Trilites tuberculiformis</u> Cookson	R
Pollen:	<u>Araucariacites australis</u> Cookson	R
	<u>Microcachryidites antarcticus</u> Cookson	C
	<u>Nothofagidites emarcidus</u> (Cookson)	C
	<u>Phyllocladidites mawsonii</u> Cookson	Ab
	<u>Proteacidites crassus</u> Cookson	R
	<u>P. dilwynensis</u> Harris	R
	<u>P. subscabratus</u> Couper	Ab
	<u>Triorites edwardsii</u> Cookson & Pike	R
	aff. <u>T. edwardsii</u> Cookson & Pike	R
Remanie:	<u>Cicatricosisporites ludbrooki</u> Dettmann - Lower Cretaceous	
	<u>Nuskoisporites</u> sp. - Permian	

3531 feet

A diverse assemblage composed of the following well preserved forms of spores and pollen was extracted from the sample:

Spores:	<u>Baculatisporites comaumensis</u> (Cookson)	R
	<u>Cyathidites australis</u> Couper	C
	<u>C. splendens</u> Harris	R
	<u>Camarozonosporites amplus</u> (Stanley)	R
	<u>Gleicheniidites circinidites</u> (Cookson)	C
	<u>Laevigatosporites major</u> (Cookson)	R
	<u>L. ovatus</u> Wilson & Webster	R
	<u>Stereisporites antiquasporites</u> (Wilson & Webster)	C
	<u>Trilites tuberculiformis</u> Cookson	R
Pollen:	<u>Dacrydiumites ellipticus</u> Harris	R
	<u>D. florinii</u> Cookson & Pike	C
	<u>Microcachryidites antarcticus</u> Cookson	C
	<u>Nothofagidites emarcidus</u> (Cookson)	C
	<u>Phyllocladidites mawsonii</u> Cookson	Ab
	<u>P. reticulosaccatus</u> Harris	R
	<u>Podocarpidites ellipticus</u> Cookson	C
	<u>Podosporites microsaccatus</u> (Couper)	R
	<u>Polyporina fragilis</u> Harris	R
	<u>Proteacidites annularis</u> Cookson	R
	<u>P. crassus</u> Cookson	R
	<u>P. crassipora</u> Harris	R
	<u>P. reticuloscabratus</u> Harris	R
	<u>P. subscabratus</u> Couper	Ab
	<u>Stephanoporopollenites obscurus</u> Harris	C

3704 feet

A well preserved assemblage composed of abundant spores and pollen grains and rare microplankton was recovered from the sample. The following species were identified:

Spores:	<u>Baculatisporites comaumensis</u> (Cookson)	R
	<u>Cyathidites australis</u> Couper	C
	<u>C. splendens</u> Harris	R
	<u>Gleicheniidites circinidites</u> (Cookson)	C
	<u>Laevigatosporites ovatus</u> Wilson & Webster	C
	<u>Stereisporites antiquasporites</u> (Wilson & Webster)	Ab
Pollen:	<u>Araucariacites australis</u> Cookson	R
	<u>Dacrydiumites ellipticus</u> Harris	R
	<u>D. florinii</u> Cookson & Pike	R
	<u>Microcachryidites antarcticus</u> Cookson	C
	<u>Nothofagidites cf. brachyspinulosus</u> (Cookson)	R
	<u>N. emarcidus</u> (Cookson)	C
	<u>Phyllocladidites mawsonii</u> Cookson	Ab
	<u>P. paleogenicus</u> (Cookson)	R
	<u>Podocarpidites ellipticus</u> Cookson	C
	<u>Podosporites microsaccatus</u> (Couper)	R
	<u>Polyporina fragilis</u> Harris	R
	<u>Proteacidites annularis</u> Cookson	R
	<u>P. subscabratus</u> Couper	C
Microplankton:	<u>Deflandrea dilwynensis</u> Cookson & Eisenack	R



3867 feet 1179

The sample contains a restricted microflora in which the following well preserved species were identified:

Spores:	<u>Baculatisporites comaumensis</u> (Cookson)	R
	<u>Cyathidites australis</u> Couper	C
	<u>C. splendens</u> Harris	R
	<u>Gleicheniidites circinidites</u> (Cookson)	C
	<u>Stereisporites antiquasporites</u> (Wilson & Webster)	Ab
Pollen:	<u>Araucariacites australis</u> Cookson	R
	<u>Dacrydiumites balmei</u> Cookson	R
	<u>D. florinii</u> Cookson & Pike	R
	<u>Microcachrydites antarcticus</u> Cookson	C
	<u>Nothofagidites emarcidus</u> (Cookson)	R
	<u>Phyllocladidites mawsonii</u> Cookson	C
	<u>Podocarpidites ellipticus</u> Cookson	C
	<u>Podosporites microsaccatus</u> (Couper)	C
	<u>Proteacidites parvus</u> Cookson	R
	<u>P. subscabratus</u> Couper	C
	<u>Stephanoporopollenites obscurus</u> Harris	R
Remanié:	<u>Nuskoisporites</u> sp. - Permian	R

4065 feet 1209

Well preserved spores and pollen grains extracted from the sample constitute the following assemblage:

Spores:	<u>Camarozonosporites bullatus</u> Harris	C
	<u>Cyathidites australis</u> Couper	C
	<u>C. splendens</u> Harris	R
	<u>Gleicheniidites circinidites</u> (Cookson)	C
	<u>Krauselisporites papillatus</u> Harris	R
	<u>Laevigatosporites major</u> (Cookson)	R
	<u>L. ovatus</u> Wilson & Webster	C
	<u>Stereisporites antiquasporites</u> (Wilson & Webster)	Ab
	<u>Stereisporites</u> sp.	C
	Pollen:	<u>Dacrydiumites florinii</u> Cookson & Pike
<u>Liliacidites</u> sp.		R
<u>Microcachrydites antarcticus</u> Cookson		C
<u>Phyllocladidites mawsonii</u> Cookson		Ab
<u>Podocarpidites ellipticus</u> Cookson		C
<u>Podosporites microsaccatus</u> (Couper)		R
<u>Proteacidites cf. rectomarginus</u> Cookson		R
<u>P. subscabratus</u> Couper		Ab
<u>Triorites edwardsii</u> Cookson & Pike		R
aff. <u>T. edwardsii</u> Cookson & Pike	R	
<u>Tricolpites gillii</u> Cookson	R	
<u>T. pachyexinus</u> Couper	R	

The microflora from 2846 feet possesses features of both the Triorites edwardsii Assemblage and the T. edwardsii - D. orthoteichus Concurrent Assemblage. The youngest occurrences of T. edwardsii (s.l.) and Phyllocladidites reticulosaccatus characterise the Concurrent Assemblage and were noted in the sample at 2846 feet. This horizon also yielded Proteacidites incurvatus recorded by Harris (1965) only from his D. orthoteichus Assemblage and Camarozonosporites bullatus which, however, is apparently restricted to the T. edwardsii Assemblage. Thus, the microflora at 2846 feet is only tentatively assigned to the T. edwardsii Assemblage.

Sediments between 3048 feet and 3704 feet yielded microfloras that are assignable to the T. edwardsii Assemblage which is dated as Middle Paleocene (Harris 1965) although its lower age limit has not been fully evaluated. Nevertheless, the occurrence of Triorites edwardsii, Dacrydiumites ellipticus, and Camarozonosporites bullatus in association with Phyllocladidites reticulosaccatus down to 3531 feet and the presence of Deflandrea dilwynensis at 3704 feet support a Middle Paleocene age for sediments between 3048 feet and 3704 feet. The last mentioned species is known only from Middle Paleocene deposits (Cookson & Eisenack 1965c) and Harris indicates that Phyllocladidites reticulosaccatus does not extend into the basal horizons from which he described the T. edwardsii Assemblage. The occurrence of the T. edwardsii Assemblage in Nerita No.1 well between 3048 feet and 3704 feet indicates that at least part of the sequence is equivalent to sediments at 3618 feet in Pecten -1A well (Dettmann 1967a).

The sample at 3867 feet yielded a restricted microflora in which Dacrydiumites balmei is a component. The microflora may thus be assigned to the T. edwardsii Assemblage although the species is now believed to extend into sediments that may be either of earliest Tertiary or latest Cretaceous age (Dettmann 1967a). The microflora at 4065 feet also shows characteristics of both late Cretaceous and early Tertiary assemblages and is similar to those obtained from Pecten -1A well at 3735 feet and 3797 feet (Dettmann 1967 a,b).

E. 4245 feet - 4782 feet

4245 feet 1294

A well preserved assemblage composed of the following species of spores and pollen grains was extracted from the sample:

Spores:	<u>Camarozonosporites amplus</u> (Stanley)	R
	<u>Cyathidites australis</u> Couper	C
	<u>C. splendens</u> Harris	R
	<u>Gleicheniidites circinidites</u> (Cookson)	C
	<u>Laevigatosporites ovatus</u> Wilson & Webster	R
	<u>Stereisporites antiquasporites</u> (Wilson & Webster)	C
	<u>Verrucatosporites speciosus</u> Harris	R
Pollen:	<u>Araucariacites australis</u> Cookson	R
	<u>Dacrydiumites florinii</u> Cookson & Pike	R
	<u>Nothofagidites emarcidus</u> (Cookson)	C
	<u>N. senectus</u> Dettmann & Playford	R
	<u>Phyllocladidites mawsonii</u> Cookson	C
	<u>Podocarpidites ellipticus</u> Cookson	C
	<u>Podosporites microsaccatus</u> (Couper)	R
	<u>Proteacidites scaboratus</u> Couper	C
	<u>P. subscabratus</u> Couper	Ab
	<u>Tricolpites gillii</u> Cookson	R
	<u>T. lillei</u> Couper	R
	<u>T. pachyexinus</u> Couper	C

4273<sup>3</sup> feet 1333

The sample yielded a rich microflora in which the following spore and pollen species were identified:

Spores:	<u>Camarozonosporites amplus</u> (Stanley)	R
	<u>Cyathidites australis</u> Couper	C
	<u>C. splendens</u> Harris	R
	<u>Gleicheniidites circinidites</u> (Cookson)	C
	<u>Laevigatosporites major</u> (Cookson)	R
	<u>L. ovatus</u> Wilson & Webster	Ab
	<u>Lycopodiumsporites austroclavatidites</u> (Cookson)	R
	<u>Stereisporites antiquasporites</u> (Wilson & Webster)	Ab
	<u>Verrucatosporites speciosus</u> Harris	R

Pollen:	<u>Cycadopites nitidus</u> (Balme)	R
	<u>Microcachryidites antarcticus</u> Cookson	C
	<u>Nothofagidites emarcidus</u> (Cookson)	R
	<u>N. senectus</u> Dettmann & Playford	C
	<u>Phyllocladidites mawsonii</u> Cookson	C
	<u>Podocarpidites ellipticus</u> Cookson	C
	<u>P. exiguus</u> Harris	C
	<u>Podosporites microsaccatus</u> (Couper)	R
	<u>Proteacidites amolosexinus</u> Dettmann & Playford	R
	<u>P. subscabratus</u> Couper	C
	<u>Tricolpites gillii</u> Cookson	R
	<u>T. pachyexinus</u> Couper	C
	<u>T. sabulosus</u> Dettmann & Playford	R
	<u>Triorites edwardsii</u> Cookson & Pike	R
	aff. <u>T. edwardsii</u> Cookson & Pike	R
Remanié:	<u>Aequitriradites spinulosus</u> (Cookson & Dettmann) - Lower Cretaceous	

4534 feet 1351

Fair concentrations of the following species of well preserved spores and pollen grains were observed in the residue:

Spores	<u>Camazonosporites amplus</u> (Stanley)	R
	<u>Cyathidites australis</u> Couper	C
	<u>C. splendens</u> Harris	R
	<u>Gleicheniidites circinidites</u> (Cookson)	C
	<u>Laevigatosporites ovatus</u> Wilson & Webster	C
	<u>Lycopodiumsporites austroclavatidites</u> (Cookson)	R
	<u>Stereisporites antiquasporites</u> (Wilson & Webster)	Ab
Pollen:	<u>Araucariacites australis</u> Cookson	R
	<u>Microcachryidites antarcticus</u> Cookson	C
	<u>Nothofagidites emarcidus</u> (Cookson)	R
	<u>N. senectus</u> Dettmann & Playford	C
	<u>Phyllocladidites mawsonii</u> Cookson	C
	<u>Podocarpidites ellipticus</u> Cookson	C
	<u>P. marwickii</u> Couper	R
	<u>P. exiguus</u> Harris	R
	<u>Podosporites microsaccatus</u> (Couper)	R
	<u>Proteacidites amolosexinus</u> Dettmann & Playford	R
	<u>P. scaboratus</u> Couper	R
	<u>P. subscabratus</u> Couper	Ab
	<u>Tricolpites gillii</u> Cookson	R
	<u>T. pachyexinus</u> Couper	R
	<u>T. sabulosus</u> Dettmann & Playford	C
Remanié:	<u>Aequitriradites spinulosus</u> (Cookson & Dettmann) - Lower Cretaceous	
	<u>Cicatricosisporites ludbrooki</u> Dettmann - Lower Cretaceous	

4660 feet 1420

The following species of well preserved spores and pollen grains were identified in the residue:

Spores:	<u>Baculatisporites comaumensis</u> (Cookson)	R
	<u>Camazonosporites amplus</u> (Stanley)	R
	<u>Cyathidites australis</u> Couper	C
	<u>Ceratosporites</u> sp.	R
	<u>Laevigatosporites ovatus</u> Wilson & Webster	C
	<u>Stereisporites antiquasporites</u> (Wilson & Webster)	Ab

Pollen:	<u>Araucariacites australis</u> Cookson	R
	<u>Microcachryidites antarcticus</u> Cookson	C
	<u>Nothofagidites senectus</u> Dettmann & Playford	C
	<u>Phyllocladidites mawsonii</u> Cookson	C
	<u>Podocarpidites ellipticus</u> Cookson	C
	<u>Podosporites microsaccatus</u> (Couper)	R
	<u>Proteacidites amolosexinus</u> Dettmann & Playford	R
	<u>P. subscabratus</u> Couper	C
	<u>Triorites minor</u> Couper	R
	aff. <u>Triorites edwardsii</u> Cookson & Pike	R
	<u>Tricolpites gillii</u> Cookson	R
	<u>T. pachyexinus</u> Couper	C
	<u>T. sabulosus</u> Dettmann & Playford	C

4782 feet 145 /

Spores, pollen, and microplankton were extracted from the sample and constitute the following assemblage:

Spores:	<u>Camarozonosporites amplus</u> (Stanley)	R
	<u>Clavifera triplex</u> (Bolkhovitina)	R
	<u>Cyathidites australis</u> Couper	R
	<u>Gleicheniidites circinidites</u> (Cookson)	C
	<u>Stereisporites antiquasporites</u> (Wilson & Webster)	Ab
	<u>S. viriosus</u> Dettmann & Playford	R
Pollen:	<u>Araucariacites australis</u> Cookson	R
	<u>Microcachryidites antarcticus</u> Cookson	C
	<u>Phyllocladidites mawsonii</u> Cookson	R
	<u>Podocarpidites ellipticus</u> Cookson	C
	<u>Podosporites microsaccatus</u> (Couper)	R
	<u>Proteacidites scaboratus</u> Couper	R
	<u>P. subscabratus</u> Couper	C
	<u>Tricolpites pachyexinus</u> Couper	C
	<u>T. sabulosus</u> Dettmann & Playford	R
	<u>Triorites minor</u> Couper	R
Microplankton:	<u>Hystriosphæridium heteracanthum</u> Deflandre & Cookson	R
Remanié:	<u>Aratrisporites</u> sp. - Triassic	

Sediments between 4245 feet and 4782 feet are dated as Upper Cretaceous (Senonian and later) on the basis of their content of spore-pollen assemblages diagnostic of Dettmann & Playford's (1968) Nothofagidites Microflora. Assemblages extracted from sediments between 4245 feet and 4660 feet contain Nothofagidites senectus in association with Triorites edwardsii, aff. T. edwardsii, Tricolpites pachyexinus, T. lillei, T. sabulosus, and Proteacidites amolosexinus. The presence of T. edwardsii and/or aff. T. edwardsii down to 4660 feet indicates that the section may be correlated with sediments in Pecten -1A well between 3833 feet and 4493 feet. (Dettmann 1967a,c).

The sample from 4782 feet did not yield Nothofagidites senectus but contains Tricolpites sabulosus which on present knowledge is restricted to the Nothofagidites Microflora. The rare microplankton recovered from this horizon are represented by one species Hystriosphæridium heteracanthum, a type that is of widespread distribution in the Victorian Upper Cretaceous.

F. 4804 feet - 6456 feet

4804 feet 1464

An extremely sparse microflora composed of corroded specimens of spores and pollen grains was extracted from the sample. Species identified include:

- Spores: Cyathidites australis Couper
- C. minor Couper
- Ceratosporites equalis Cookson & Dettmann
- Foraminisporis asymmetricus (Cookson & Dettmann)
- Neoraistrickia truncata (Cookson)
- Pollen: Araucariacites australis Cookson
- Alisporites grandis (Cookson)
- Microcachryidites antarcticus Cookson
- Podocarpidites cf. ellipticus Cookson

4944 feet 1507

Reasonably well preserved spores and pollen grains were obtained in low concentrations. The following forms were observed:

- Spores: Aequitriradites spinulosus (Cookson & Dettmann) R
- Baculatisporites comaumensis (Cookson) C
- Cyathidites australis Couper C
- C. minor Couper C
- C. punctatus (Delcourt & Sprumont) R
- Ceratosporites equalis Cookson & Dettmann R
- Cicatricosisporites australiensis (Cookson) C
- Crybelosporites striatus (Cookson & Dettmann) R
- Dictyotosporites speciosus Cookson & Dettmann R
- Lycopodiumsporites austroclavatidites (Cookson) C
- L. eminulus Dettmann R
- L. facetus Dettmann R
- Stereisporites antiquasporites (Wilson & Webster) Ab
- Pollen: Araucariacites australis Cookson R
- Alisporites grandis (Cookson) R
- Classopollis cf. classoides Pflug C
- Cycadopites nitidus (Balme) R
- Microcachryidites antarcticus Cookson C
- Remanié: Aratrisporites sp. - Triassic

5287 feet 1611

A fairly preserved microflora composed of the following species of spores and pollen grains occur in the sample:

- Spores: Baculatisporites comaumensis (Cookson) C
- Cingutritetes clavus (Balme) R
- Cyathidites australis Couper C
- Dictyotosporites speciosus Cookson & Dettmann R
- Foraminisporis asymmetricus (Cookson & Dettmann) R
- F. dailyi (Cookson & Dettmann) R
- F. wonthaggiensis (Cookson & Dettmann) R
- Gleicheniidites cf. circinidites (Cookson) R
- Leptolepidites major Couper R
- L. verrucatus Couper R
- Lycopodiumsporites austroclavatidites (Cookson) C
- L. circolumenus Cookson & Dettmann R
- L. facetus Dettmann R
- Neoraistrickia truncata (Cookson) C
- Stereisporites antiquasporites (Wilson & Webster) Ab
- Velosporites triquetrus (Lantz) R
- Pollen: Alisporites grandis (Cookson) R
- Araucariacites australis Cookson R
- Classopollis cf. classoides Pflug C
- Microcachryidites antarcticus Cookson C
- Podocarpidites cf. ellipticus Cookson Ab
- Podosporites microsaccatus (Couper) R

5561 feet

1675 m

A small residue containing a few specimens of the following spores and pollen grains was extracted from the sample:

- Spores: Cinguliradites clavus (Balme)  
Cyathidites australis Couper  
C. minor Couper  
Stereisporites antiquasporites (Wilson & Webster)
- Pollen: Microcachryidites antarcticus Cookson  
Podocarpidites cf. ellipticus Cookson

5900 feet

1798 m

The sample provided low concentrations of the following species of fairly preserved spores and pollen grains:

- Spores: Aequitriradites spinulosus (Cookson & Dettmann) R  
Baculatisporites comaumensis (Cookson) R  
Cicatricosisporites australiensis R  
Cyathidites australis Couper Ab  
C. minor Couper C  
C. punctatus (Delcourt & Sprumont) R  
Gleicheniidites cf. circinidites (Cookson) R  
Kraeuselisporites linearis (Cookson & Dettmann) R  
Stereisporites antiquasporites (Wilson & Webster) Ab
- Pollen: Araucariacites australis Cookson R  
Alisporites grandis (Cookson) R  
Classopollis cf. classoides Pflug R  
Microcachryidites antarcticus Cookson C  
Podocarpidites cf. ellipticus Cookson Ab
- Incertae Sedis: Schizosporis reticulatus Cookson & Dettmann R

6068 feet

1850 m

A diverse assemblage of fairly preserved spores and pollen grains occurs in the sample. Species identified include:

- Spores: Aequitriradites spinulosus (Cookson & Dettmann) C  
A. verrucosus (Cookson & Dettmann) C  
Baculatisporites comaumensis (Cookson) R  
Ceratosporites equalis Cookson & Dettmann R  
Cicatricosisporites australiensis (Cookson) C  
Crybelosporites striatus (Cookson & Dettmann) R  
Cyathidites australis Couper Ab  
C. minor Couper C  
C. punctatus (Delcourt & Sprumont) Ab  
Dictyosporites speciosus Cookson & Dettmann R  
Foraminisporis asymmetricus (Cookson & Dettmann) C  
F. wonthaggiensis (Cookson & Dettmann) R  
Gleicheniidites cf. circinidites (Cookson) R  
Leptolepidites verrucatus Couper R  
Rouseisporites reticulatus Pocock C  
Stereisporites antiquasporites (Wilson & Webster) B
- Pollen: Araucariacites australis Cookson R  
Alisporites grandis (Cookson) R  
Classopollis cf. classoides Pflug C  
Microcachryidites antarcticus Cookson C  
Podocarpidites cf. ellipticus Cookson C  
Podosporites microsaccatus (Couper) R

6456 feet 1968

Poorly preserved spores and pollen grains were extracted from the sample and include the following forms:

Spores:	<u>Baculatisporites comaumensis</u> (Cookson)	R
	<u>Ceratosporites equalis</u> Cookson & Dettmann	R
	<u>Cicatricosisporites australiensis</u> (Cookson)	C
	<u>Cyathidites australis</u> Couper	C
	<u>C. minor</u> Couper	R
	<u>Foveosporites canalis</u> Balme	R
	<u>Klukisporites scaberis</u> (Cookson & Dettmann)	R
	<u>Leptolepidites verrucatus</u> Couper	R
	<u>Lycopodiumsporites austroclavatidites</u> (Cookson)	C
	<u>Lycopodiumsporites</u> sp. indet.	R
Pollen:	<u>Araucariacites australis</u> Cookson	R
	<u>Alisporites grandis</u> Cookson	R
	<u>Cycadopites nitidus</u> (Balme)	R
	<u>Microcachryidites antarcticus</u> Cookson	Ab
	<u>Podocarpidites</u> cf. <u>ellipticus</u> Cookson	Ab
	<u>Podosporites microsaccatus</u> (Couper)	R

The sample from 4804 feet yielded only a sparse, poorly preserved microflora which in containing Foraminisporis asymmetricus is clearly of Lower Cretaceous age. However, assignment of the microflora to the spore-pollen assemblages delineated by Dettmann (1963) and Dettmann and Playford (1968) in the Lower Cretaceous of eastern Australia is precluded by the absence of other stratigraphically significant species.

The Crybelosporites striatus Subzone of the Dictyotosporites speciosus Zone is represented in sediments between 4944 feet and 6068 feet. This unit is diagnosed by the presence of C. striatus in association with D. speciosus and is of Upper Aptian age. It was not positively identified in Pecten -1A well but may be represented within the interval 8120 - 9132 feet. (Dettmann 1967c).

The lowest horizon investigated yielded a poorly preserved microflora which in containing Cicatricosisporites australiensis is Lower Cretaceous or at the oldest uppermost Jurassic in age. Other species identified have little stratigraphical value within the late Jurassic and Lower Cretaceous of Australia.

#### CONCLUSIONS

Palynological evidence indicates that sediments between 4804 feet and 6456 feet in Nerita No.1 well are of Lower Cretaceous age. Moreover, it has been demonstrated that the section between 4944 feet and 6068 feet belongs to the Crybelosporites striatus Subzone of the Dictyotosporites speciosus Zone and is thus of Upper Aptian age. The Lower Cretaceous deposits are overlain by an Upper Cretaceous to Lower Tertiary sequence. Within the younger sequence the Nothofagidites Microflora is represented in horizons between 4245 feet and 4782 feet, thus demonstrating an Upper Cretaceous (Senonian and later) age. Succeeding samples from 3867 feet and 4065 feet contain microfloras suggesting an uppermost Cretaceous or lowermost Tertiary age, whilst the interval between 2846 feet and 3704 feet is dated as Middle Paleocene on the basis of the Triorites edwardsii Assemblage. The Middle-Upper Paleocene Duplopollis orthoteichus - Triorites edwardsii Concurrent Range Zone is probably represented at 2682 feet, and is overlain by sediments at 2570 feet containing the Upper Paleocene Duplopollis orthoteichus Assemblage. Horizons between 2106 feet and 2496 feet yielded microfloral assemblages comparable to Cookson's (1954) Microflora C which is believed to be of Eocene age.

The palynological floras extracted from the Lower Cretaceous sequence are composed entirely of land derived forms which exhibit fair to poor preservation. Ramanie fossils of Triassic age occur at the horizon at 4944 feet.

The Upper Cretaceous and Lower Tertiary microfloras are well to excellently preserved and are mostly composed of spores and pollen grains. Microplankton are sparse in the Senonian sample at 4782 feet, in the Middle Paleocene horizon at 3704 feet, and in Eocene sediments at 2106 feet and 2270 feet. Ramanie fossils of Lower Cretaceous, Triassic, and Permian age occur spasmodically throughout the Upper Cretaceous - Lower Tertiary sequence.

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Depth (feet)	Yield	Spore - Pollen		Microplankton		Wood		Cuticle		Spore - Pollen Zone
		Col.	Pres.	Col.	Pres.	Col.	Pres.	Col.	Pres.	
2106	A	LY	exc	LY	exc	DY- Br	fair - good	L - DY	good	<i>Eocene</i>
2270	"	"	"	"	"	Br	"	"	"	"
2496	"	"	"	—	—	"	"	"	"	"
2570	"	"	"	—	—	"	"	"	"	<i>Duplopollis orthoteichus</i>
2682	S	L - DY	good	LY	good	"	"	"	"	<i>D. orthoteichus - T. edwardsii</i>
2846	A	"	"	—	—	"	"	"	"	? <i>Triorites edwardsii</i>
3048	C	"	"	—	—	"	"	"	"	<i>Triorites edwardsii</i>
3149	A	"	"	—	—	"	"	"	"	" "
3253	C	"	"	—	—	"	"	"	fair - good	" "
3531	"	"	"	—	—	Br - Bl	fair	"	"	" "
3704	"	"	"	DY	good	"	"	"	"	" "
3867	"	"	"	—	—	"	"	"	"	<i>Lowermost Tertiary -</i>
4065	"	"	"	—	—	"	"	"	"	<i>uppermost Cretaceous</i>
4245	"	"	"	—	—	"	"	"	"	<i>Nothofagidites</i>
4372	A	"	"	—	—	"	"	"	"	"
4534	C	"	"	—	—	"	"	"	"	"
4660	"	"	"	—	—	"	"	"	"	"
4782	S	"	"	DY	good	"	"	"	"	"
4804	"	DY - Br	poor fair - good	—	—	"	fair - poor	DY - Br	fair - poor	? <i>Crybelosporites striatus</i>
4944	"	"	"	—	—	"	"	"	"	" "
5287	C	"	"	—	—	"	"	"	"	" "
5561	S	"	fair	—	—	"	"	"	"	" "
5900	"	"	fair - poor	—	—	"	"	"	"	" "
6068	A	"	"	—	—	"	"	"	"	" "
6456	C	"	"	—	—	"	"	"	"	<i>Lower Cretaceous indet.</i>

Appendix VI  
Table I

## EXPLANATION OF TABLE 1

Preservation and zonal attribution of plant microfossil assemblages in sidewall cores of Nerita No.1 well, 2106 feet - 6456 feet.

### Abbreviations:

Yield expresses frequency of spores, pollen, and microplankton in the palynological residues as follows:-

Ab	=	abundant
C	=	common
Sp	=	sparse

Colour and Preservation. Spores, pollen, microplankton, wood, and cuticle present in the residues are denoted by their colour (col.) and quality of preservation (pres.) thus:-

LY	=	light yellow
DY	=	dark yellow
Br	=	brown
Bl	=	black
Exc	=	excellent
Good	=	good
Fair	=	fair
Poor	=	poor

Spore-pollen Zones are those defined by Harris (1965) and Deitmann and Playford (1968).