

EXXONMOBIL EXPLORTION COMPANY

**Biostratigraphy and Paleoenvironments of East Pilchard-1 Well,  
Gippsland Basin, Australia**

**Thomas D. Davies**

TECHNOLOGY  
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**TECHNOLOGY  
BIOSTRATIGRAPHY REPORT**

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## EXECUTIVE SUMMARY

- Palynology and kerogen analyses of East Pilchard-1 provides: 1) age control beneath the 'Top of Latrobe' unconformity; 2) verification for positioning of the K/T boundary; 3) age control above, within and below the volcanics; 4) palynologic subdivision and biofacies of the Upper Cretaceous reservoir section; 5) age constraints for the lower marine section; 6) description of both potentially regionally correlative and local (subzonal) biostratigraphic events from the Lower Cretaceous; and 7) paleoenvironmental interpretations to better constrain sequence stratigraphic interpretations, facies models, and paleogeographic reconstructions.
- Ten biozones are identified in the studied section from 1650-3130m. Four from the Tertiary Lower N. asperus to lower part Lower L. balmei zones and six from the Upper Cretaceous T. longus to Lower T. apoxyexinus-?P. mawsonii zones.
- Similar assemblages to those identified earlier (Davies and Ioannides, 1999) in the Kipper Field are recognized here. These are the T. lilliei, N. senectus, T. apoxyexinus, Lower T. apoxyexinus, and Lower T. apoxyexinus-?P. mawsonii zones.
- Sample 1680m is in the P. asperopolus Zone. The two samples from 1938 and 2105m are in the Lower L. balmei Zone, with 2105m being in the basal part of this Zone.
- Sample 2177m is poorly preserved but the can be placed tentatively in the Maastrichtian T. longus Zone. This indicates that the Tertiary/Cretaceous boundary occurs between this sample and sample 2105m above.
- Sample 2415-20m, just above the volcanics, is confidently placed in the T. lilliei Zone. Sample 2520-25m, within the volcanic package, is placed in the T. lilliei Zone.
- The basal marine section from 2970 is assigned to the T. apoxyexinus-P. mawsonii? Zone.
- Samples with the most marine diversity occur at 2105, 3005, 3056m and are interpreted as shallow marine. Cuttings samples 2850-55, 2970-75, and SWC 2997m also contain common marine dinocysts and are interpreted as marginal marine-lagoonal.

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## INTRODUCTION

At the request of Esso Australia Ltd. (Gerard O'Halloran), we examined samples from the East Pilchard-1 five Kipper Field wells, Gippsland Basin, Australia focusing on the Upper Cretaceous reservoir interval. This report presents results of biostratigraphic analyses of sidewall cores and cuttings in the interval from 1650-3130m. The stratigraphic breakdown is summarized in Table 1 on page 2 and discussed in detail in Biostratigraphic Discussion section beginning on page 3.

The purpose of the study was to:

- provide age control for the volcanics, i.e., determine the age of the section above, within and below the volcanics,
- subdivide the subvolcanic Upper Cretaceous reservoir section and related zonation to that previously described by Davies and Ioannides (1999),
- determine the age of the lower marine section,
- verify the position of the K/T flooding surface,
- provide age constraints for the Top of Latrobe section, and
- provide paleoenvironmental interpretations to better constrain sequence stratigraphic interpretations, facies models, and paleogeographic reconstructions.

The results of this study are based on analyses of palynology and kerogen slides from forty-one sidewall core and cuttings samples from 1650-3130m (Appendix A). Where possible these palynozones are defined on downhole occurrences, but they also are characterized by influxes and base occurrences, as well as trends in overall assemblage composition. Each unit is defined as the stratigraphic interval between two distinctive biostratigraphic events. The age interpretations are approximate, as little independent information has been obtained to calibrate the Gippsland spore-pollen to the standard chronostratigraphy shown on the current Global Cycle Chart of Hardenbol and others (1998).

The age and paleoenvironmental interpretations are based on comparisons with materials from Alley (1988); Askin (1990); Burger (1980, 1990); Costa and Davey (1992); Davies and Ioannides (1999); Dettman (1984); Dettman and Jarzen (1988, 1990a, 1990b); Dettman and Playford (1969); Dettman, Pocknall and others (1990); Hardenbol and others (1998); Helby and others (1987); Jell and Playford (1988); Manum and Cookson (1964); Marshall (1988), Norvick and Burger (1976); Partridge (1976); Powell (1992); Stover and Evans (1973); Stover and Partridge (1973); Williams and Bujak (1986); and Wilson (1984).

Interpretations of paleoecology were made based on observed changes in the palynology assemblages and on biofacies from kerogen slides. Appendix A, following the references, gives a sample-by-sample listing of the distribution of important species. Relative abundance abbreviations used are: EA - extremely abundant; VA - very

abundant; A - abundant; C - common; F - few; R - rare; and VR - very rare. Other abbreviations used are: SP - spores and pollen, D - dinoflagellates, and A - acritarchs.

## BIOSTRATIGRAPHIC ZONATION

Table 1. Biozonation and Ages for East Pilchard-1 Well, Gippsland Basin, Australia

<b>Depth (m MD)</b>	<b>Palynozone</b>	<b>Age</b>
1650	Undiff. Lw. N.asper.-P.asperopolus	Middle-uppermost Eocene
1680	P. asperopolus	lower Middle-up. Lower Eocene
1720		Indeterminate
1938	Lower L. balmei	Paleocene
2105	lw. Lower L. balmei	Lowermost Paleocene
2177	Prob. T. longus	Prob. Maastrichtian
2415	Lower? T. lilliei	Upper- Middle Campanian
2675	N. senectus	Middle-Lower Campanian
2805	T. apoxyexinus	Santonian
2850	Lower T. apoxyexinus	Santonian
2905		Indeterminate
2970	Lower T. apoxyexinus-P. mawsonii?	Santonian-Turonian?

## BIOSTRATIGRAPHIC DISCUSSION AND ZONATION

This section describes the results of the biostratigraphic analyses and highlights those events that are potentially of local or regional correlatable value. The zones assigned in this report are correlated, where possible, to those previously developed by Davies and Ioannides (1999) for the Kipper field.

Ten biozones are identified in the studied section from 1650-3130m. Four are in the Tertiary and range from the Middle-upper part of the Lower Eocene Lower N. asperus to lower part Lower L. balmei zones. Six are from the Upper Cretaceous T. longus to Lower T. apoxyxinus-?P. mawsonii Zone. Similar assemblages to those identified earlier (Davies and Ioannides, 1999) in the Kipper Field are recognized here. These are the T. lilliei, N. senectus, T. apoxyxinus, Lower T. apoxyxinus, and Lower T. apoxyxinus-?P. mawsonii Zones.

Samples with the most marine diversity are at 2105, 3005, 3056m and are designated as shallow marine. Cuttings samples 2850-55, 2970-75, and SWC 2997m also contain common marine dinocysts and are interpreted as marginal marine-lagoonal.

The upper two samples from 1650 and 1658m are broadly assigned to the Lower N. asperus-P. asperopolus Zone. Sample 1680m is in the P. asperopolus Zone. The two samples from 1938 and 2105m are in the Lower L. balmei Zone, with 2105m being in the basal part of this Zone.

Sample 2177m is poorly preserved but the can be placed tentatively in the Maastrichtian T. longus Zone. Sample 2415-20m is clearly in the Cretaceous and is assigned to the Lower? T. lilliei Zone. Sample 2415-20m, just about the volcanics, and sample 2520-25m within the volcanic package are placed in the T. lilliei Zone.

The basal marine section from 2970 is assigned to the T. apoxyxinus-P. mawsonii? Zone.

**Interval:** 1650-1680 m MD

**Age:** Middle-upper part Lower Eocene

**Zonation:** Undifferentiated Lower N. asperus-P. asperopolus

**Palynology:**

- The highest sample analyzed is assigned to the undifferentiated Lower N. asperus-P. asperopolus Zone.

- taxa recorded include rare *Nothofagidites* spp., *Nothofagidites* cf. *deminutus*, *Proteacidites* spp., *Triporopollenites harrisii*, *Simplicipollis meridianus* and rare fern spores (Appendix A).
- marine dinoflagellate cysts are very rare at 1650m. This sample is interpreted as marginal-shallow marine.

**Interval: 1680-1720 m MD**

**Age: Basal Middle-upper part Lower Eocene**

**Zonation: P. asperopolus**

**Palynology:**

- sample 1680m is placed in the P. asperopolus Zone.
- taxa noted include *Proteacidites* spp., such as *Proteacidites dilwynensis* sensu Stover and Evans, 1973 and *Proteacidites asperopolus*, *Tiliapollenites*, *Triporopollenites harrisii*, rare *Nothofagidites* spp., *Anacolosidites luteoides*, and *Malvacipollis subtilis*, and rare fern spores (Appendix A).
- marine dinoflagellate cysts are very rare in this sample and it is interpreted as marginal marine.

**Interval: 1720-1938 m MD**

**Age and Zonation: Indeterminate**

**Palynology:**

- kerogen is very sparse and no spores, pollen, or marine dinoflagellates are recovered.

**Interval: 1938-2105 m MD**

**Age: Paleocene**

**Zonation: Lower L. balmei**

**Palynology:**

- Taxa recorded that are consistent with this zone are *Gambierina edwardsii*, *Proteacidites angulata*, *Nothofagidites* spp., *Lygistepollenites florinii* and *L. cf. balmei* (Appendix A).
- marine dinoflagellate cysts are not recovered in this sample.

**Interval:** 2105-2177 m MD

**Age:** Lower Paleocene

**Zonation:** Lower part Lower L. balmei

**Palynology:**

- *Tricolpites confessus*, *Tetracolporites verrucosus*, *Gambierina edwardsii*, *G. rudata*, *Proteacidites angulata*, rare *Nothofagidites* spp., *Lygistepollenites florinii* and *L. balmei* occur in this interval (Appendix A).
- marine dinoflagellates are common in sample 2105-10m. Taxa include *Deflandrea* cf. *deliniata*, *D.* cf. *medcalfii*, *Senegalinium ?dilwynense*, *Cerodinium* cf. *dartmooria*, *C.* cf. *striatum*, *Oligosphaeridium complex*. This interval is interpreted as shallow marine.

**Interval:** 2177-2415 m MD

**Age:** Maastrichtian

**Zonation:** Probable T. longus

**Palynology:**

- taxa recorded are ?*Tricolpites lilliei*, *Tricolpites confessus*, *Simplicipollis meridianus*, *Proteacidites* cf. *angulatus*, *Nothofagidites* spp., *Australopollis obscurus* and *Phyllocladidites mawsonii verrucosus* (Appendix A). Species are relatively rare and preservation is poor.
- only very rare marine dinoflagellate fragments are recovered in SWC sample 2177m. This interval is interpreted as marginal?-nonmarine.

**Interval:** 2415-2675 m MD

**Age:** Upper-Middle Campanian

**Zonation:** Lower? T. lilliei

**Interval age and zones:**

- 2415m - occurrences of *Tricolpites* spp. and *Aequitriradites* spp.
- 2647m - presence of *Nothofagidites* spp. and *Tricolpites confessus*
- 2654m - presence of *Nothofagidites* spp. and *N. senectus*

### **Palynology:**

- taxa recovered in this interval include *Aequitriradites* spp., *Tricolpites* spp., such as *Tricolpites lilliei*, *T. longus*, *T. confessus*, *T. waiparaensis*, *T. apoxyexinus*, *T. stipulatus/sabulosa*, *T. confessus* and *T. remarkensis*, *Gephyrapollenites wahooensis*, *Proteacidites* spp., *Nothofagidites senectus*, *Gambierina edwardsii* and *G. rudata*, and cf. *Phimopollenites pannosus* (Appendix A).
- a single marine dinoflagellate fragment is recovered in sample 2415-20m. All other samples in this section contain no marine palynomorphs and are interpreted as nonmarine.
- a similar assemblage was recorded in Kipper-1 in the sample from 2005-2110m and in Kipper-2 at 2216.18m, just beneath the volcanics (Davies and Ioannides, 1999).

**Interval:** 2675-2805 m MD

**Age:** Middle-Lower Campanian

**Zonation:** N. senectus

#### **Interval age and zones:**

### **Palynology:**

- taxa present that indicate a N. senectus Zonation include *Phimopollenites pannosus*, frequent *Proteacidites* spp., few-rare *Nothofagidites senectus*, *Tricolpites* spp., including *T. waiparaensis*, *T. gillii*, *T. apoxyexinus*, *T. stipulatus/sabulosa* and *T. confessus* (Appendix A).
- it is possible that this zone may occur slightly higher at 2620-25m.
- no marine dinoflagellates are recovered in any of the samples in this zone (Appendix A).
- a similar assemblage was recorded in Kipper-1 in the sample from 2135-2155m and in Kipper-2 at 2339.48m (Davies and Ioannides, 1999).

**Interval:** 2805-2850 m MD

**Age:** Santonian

**Zonation:** T. apoxyexinus

### **Palynology:**

- there are occurrences of *Tricolpites* spp., including *T. confessus*, *T. stipulatus*, and *T. cf. sabulosus*, and *Phimopollenites pannosus*.

- marine dinoflagellate cysts are not recovered in the two samples from this zone (Appendix A).
- the spore-pollen assemblage here is most similar to that first recovered in Kipper-1 at 2187.5m and in Kipper-2 in the cuttings sample at 2390m (Davies and Ioannides, 1999).

**Interval: 2850-2905 m MD**

**Age: Santonian**

**Zonation: Lower T. apoxyexinus**

**Palynology:**

- taxa recovered include *Phimopollenites pannosus*, *Tricolpites confessus*, *T. stipulatus/sabulosus*, *Chatangiella victoriensis*, and *Aequitriradites* spp. (Appendix A). Preservation is poor to very poor in all of the samples from this zone.
- marine dinoflagellates cysts are common in the cuttings sample at 2850-55m. This sample contains a nearly monospecific assemblage of *Chatangiella victoriensis*. The paleoenvironment is interpreted as marginal marine. SWC sample 2857m contain very rare, poorly preserved dinocysts. The other two samples in this interval contain no marine palynomorphs and are interpreted as nonmarine.
- a similar assemblage was recorded in Kipper-1 in the sample from 2196.5m and in Kipper-2 at 2437.92m (Davies and Ioannides, 1999).

**Interval: 2905-2970 m MD**

**Age and Zonation: Indeterminate**

**Palynology:**

- microfossils are sparse and preservation is very poor in this interval. No age diagnostic taxa are observed

**Interval: 2970-3127 m MD**

**Age: Santonian-Turonian**

**Zonation: Lower T. apoxyexinus-?P. mawsonii**

**Palynology:**

- palynomorphs recovered in this interval include *Chatangiella victoriensis*, *C. porosa*, *Trythyrodinium suspectum*, cf. *Heterosphaeridium difficile*, *Aequitriradites* spp.; *Tricolpites* cf. *confessus*, *T. cf. stipulatus/sabulosus*, *T. cf. apoxyexinus*, and *Phimopollenites pannosus*.
- marine dinoflagellates cysts are frequent to common in all samples from this interval, except for SWC sample 3087m, which is from the basal sandstone section. This depositional environment for this interval is interpreted as marginal to shallow marine.
- a similar assemblage was recorded in Kipper-2 at 2491.00m (Davies and Ioannides, 1999).

**Interval: 3127-3130m m MD**

**Age and Zonation: Indeterminate**

**Palynology:**

- kerogen is mainly dark coaly. Microfossils are very sparse to barren and preservation is very poor. No age diagnostic taxa are observed (Appendix A)

## Paleoenvironmental Summary

Listed below is the paleoenvironmental summary.

<u>Depth</u>	<u>Environment</u>
1650-1658m	Marginal marine
1658-1680m	Probably Nonmarine
1680-1720	Marginal marine
1720-2105	Nonmarine
2105-2177	Shallow marine
2177-2520	Marginal-nonmarine
2520-2850	Probably nonmarine
2850-2857	Marginal marine
2857-2887	Non-marginal marine
2887-2970	Probably nonmarine
2970-3005	Marginal marine
3005-3087	Shallow-marginal marine
3087-3088	Non-?marginal marine
3088-3127	Marginal marine
3127-3130	Indeterminate (no marine forms recovered)

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# APPENDIX A

## East Pilchard-1

### SAMPLE-BY-SAMPLES LISTING OF BIOSTRATIGRAPHIC AND PALEOENVIRONMENTAL DATA

Depths in meters MD

#### **Palynozone: Lower N. asperus-P. asperopolus undiff. (Middle-uppermost Eocene) (1650-1680m)**

- 1650  
(SWC 60)      Paleoenvironment: Marginal marine  
Kerogen: 15-20% amorph; 40-45% woody/coaly; 15-25% biodeg terr 5-10; 3-5% herbac.; 1-2% S/P  
Spore/pollen (R); Dinoflagellates (VR); Pyrite (R-F); Poor preservation  
Dinoflagellate unidentified (VR)  
Proteacidites spp. (SP) (VR)  
Proteacidites cf. reversus. (SP) (VR)  
Nothofagidites spp. (SP) (VR)  
Nothofagidites deminutus (SP) (VR) 93/8.9  
Nothofagidites emarcidus (SP) (VR)  
Nothofagidites cf. endurus (SP) (VR)  
Ilexpollenites sp. (VR)  
Cyathidites spp. (VR)
- 1658  
(SWC 59)      Paleoenvironment: Nonmarine  
Kerogen: 20-25% amorph; 35-40% woody/coaly; 15-25% biodeg terr 5-10%; 3-5% herbac.; 1-2% S/P; sparse  
Spore/pollen (R); Dinoflagellates (barren); Pyrite (C); Very poor preservation  
Nothofagidites spp. (SP) (VR)  
Nothofagidites cf. deminutus (SP) (T. bellus (Mioc.)-M. diversus) (VR)  
Triporopollenites harrisii (VR)  
Simplicipollis meridianus (VR)  
Cyathidites spp. (R)  
Gleicheniidites spp. (VR)  
Ischyosporites cf. gremius (VR)

#### **Palynozone: P. asperopolus (lower part Middle Eocene-upper part Lower Eocene) (1680-1720m)**

- 1680  
(SWC 58)      Paleoenvironment: Marginal marine  
Kerogen: 10-15% amorph; 45-50% woody/coaly; 25-30% biodeg terr 5-10%; 3-5% herbac.; 1% S/P; abund.  
Spore/pollen (C); Dinoflagellates (VR); Pyrite (EA); Fair-poor preservation  
Dinoflagellate unidentified (VR)  
Cleistosphaeridium spp. (VR)  
Proteacidites spp. (SP) (C)  
Proteacidites dilwyensis sensu S&E, 1973 (SP) (VR)  
Proteacidites pachypolus (SP) (R-F)  
Proteacidites asperopolus (SP) (VR)  
Nothofagidites spp. (SP) (R)  
Nothofagidites cf. deminutus (SP) (VR-R)  
Nothofagidites emarcidus (SP) (VR)  
Triporopollenites harrisii (VR) (C)  
Tiliapollenites notabilis (VR)  
Anacolisidites luteoides (VR)  
Malvacipollis subtilis (VR)  
Podocarpites spp. (VR)  
Cyathidites spp. (VR)  
Gleicheniidites spp. (VR)  
Rugulatisporites mallatus (VR)

#### **Palynozone: Indeterminate (1720-1938m)**

1720  
(SWC 57) Paleoenvironment: Indeterminate  
Kerogen: sparse; mainly woody/coaly with some biodeg. terres.  
Spore/pollen (barren); Dinoflagellates (barren); Pyrite (R)

**Palynozone: Lower L. balmei (Paleocene)**  
**(1938-2105m)**

1938  
(SWC 56) Paleoenvironment: Nonmarine  
Kerogen: amorph; 15-20% woody/coaly; 55-60% biodeg terr 10-15%; 3-5% herbac.; 2-5% S/P  
Spore/pollen (F); Dinoflagellates (barren); Pyrite (F); Fair-poor preservation  
Proteacidites spp. (SP) (R)  
Proteacidites angulatus (SP) (VR)  
Gambierina rudata (SP) (VR)  
Gambierina edwardsii (SP) (VR)  
Nothofagidites spp. (SP) (R)  
Nothofagidites endurus (SP) (VR)  
Lygistepollenites cf. balmei (SP) (R)  
Lygistepollenites florinii (SP) (VR)  
Phyllocladidites spp. (SP) (VR)  
Phyllocladidites mawsonii (SP) (VR)

**Palynozone: Basal Lower L. balmei (Basal Paleocene)**  
**(2105-2177m)**

2105  
(SWC 54) Paleoenvironment: Shallow marine  
Kerogen: amorph; 10-20% woody/coaly; 55-65% biodeg terr 10-15; 3-5% herbac.; 1-2% S/P  
Spore/pollen (C); Dinoflagellates (A); Pyrite (C); Fair-poor preservation  
Dinoflagellate unidentified (F)  
Glaphyrocysta cf. retiintexta (VR)  
Peridinioid dinoflagellates (A, broken)  
Deflandrea cf. deliniata (L) (F)  
Deglandrea cf. medcalfii (R)  
Senegalinium ?dilwynense (Paleocene) (R)  
Cerodinium cf. dartmooria (VR)  
Cerodinium cf. striatum (Paleocene, L.balmei) (VR)  
Oligosphaeridium complex (R)  
cf. Hystrichosphaeridium tubiferum brevispinosum (VR)  
Proteacidites spp. (SP) (R)  
Proteacidites angulatus (SP) (R)  
Gambierina rudata (SP) (VR)  
Gambierina edwardsii (SP) (R)  
Nothofagidites spp. (SP) (R)  
Nothofagidites endurus (SP) (VR)  
?Quadruplanus brossus (SP) (VR, reworked?)  
Tricolpites confessus (SP) (VR-R)  
Tricolpites gillii (SP) (R)  
Tetracolporites verrucosus  
Australopollis obscurus (R)  
Podocarpites spp. (VR)  
Lygistepollenites balmei (SP) (R)  
Lygistepollenites florinii (SP) (VR)  
Phyllocladidites spp. (SP) (R)  
Phyllocladidites mawsonii (SP) (R)  
Phyllocladidites microsaccatus (SP) (R)  
Stereisporites antiquasporites (SP) (R)  
Stereisporites (Tripunctisporis) sp. (SP) (R)  
Cyathidites spp. (VR)  
Gleicheniidites spp. (VR)  
Ischyosporites spp. (VR)

**Palynozone: prob. T. longus (Maastrichtian)**  
**(2177-2415m)**

2177  
(SWC 53) Paleoenvironment: Prob. marginal-nonmarine  
Kerogen: amorph; 10-20% woody/coaly; 60-70% biodeg terr 5-10; 1-2% herbac.; <1% S/P  
Spore/pollen (R-F); Dinoflagellates (ER); Pyrite (C); Poor preservation  
Dinoflagellate unidentified (ER, piece), s104/11  
Proteacidites spp. (SP) (R-F)  
Proteacidites cf. angulatus (SP)(VR)  
Nothofagidites spp. (SP) (VR)  
Nothofagidites cf. senectus (SP) (VR)

Simplicipollis meridianus (VR) (R-F)  
Tricolpites confessus (SP) (R)  
?Tricolporites lilliei (SP) (VR)  
Australopollis obscurus (VR)  
Podocarpites spp. (VR)  
Phyllocladidites mawsonii verrucosus (SP) (R)

**Palynozone: Lower? T. lilliei (basal Maastrichtian-Campanian)**  
**(2415-m)**

- 2415-20  
Paleoenvironment: Non-marginal marine  
Kerogen: amorph; 10-20% woody/coaly; 60-70% biodeg terr 5-10; 1-2% herbac.; 2-3% S/P  
Spore/pollen (R-F); Dinoflagellates (ER); Pyrite (C); Poor preservation  
Dinoflagellate unidentified (ER, piece)  
Proteacidites spp. (SP) (R-F)  
Proteacidites cf. angulatus (SP) (VR)  
Proteacidites cf. reticulconcavus (SP) (VR)  
Nothofagidites spp. (SP) (R)  
Nothofagidites cf. senectus (SP) (VR)  
Tricolpites confessus (SP) (R)  
Tricolpites gillii (SP) (R)  
Tricolpites waiparaensis (SP) (VR)  
Tricolpites longus (SP) (R) 105/15.2  
Tricolporites lilliei (SP) (VR) 89.5/18.2  
Gephyrapollenites wahooensis (SP) (VR) -104.9/14.3  
Podocarpites spp. (VR)  
Lygistepollenites florinii (SP) (R)  
Phyllocladidites spp. (SP) (F)  
Phyllocladidites mawsonii (SP) (F)  
Phyllocladidites mawsonii verrucosus (SP) (R)  
Phyllocladidites microsaccatus (SP) (R)  
Stereisporites antiquasporites (SP) (R)  
Stereisporites regium (SP) (R)  
?Stereisporites viriosus (SP) (VR)  
Cyathidites spp. (VR)  
Gleicheniidites spp. (VR)  
Aequitriradites sp. (SP) (VR) 98/5.8
- 2520-25  
(inter volc.)  
Paleoenvironment: Prob. nonmarine  
Kerogen: amorph; 5-10% woody/coaly; 60-75% biodeg terr 5-10; 1-2% herbac.; 2-3% S/P  
Spore/pollen (C); Dinoflagellates (barren); Pyrite (F-R); fair preservation  
Proteacidites spp. (SP) (R-F)  
Proteacidites angulatus (SP) (VR)  
Proteacidites amolosexinus (SP) (VR)  
Gambierina rudata (SP) (VR)  
Gambierina edwardsii (SP) (R)  
Nothofagidites spp. (SP) (R)  
Nothofagidites cf. senectus (SP) (VR)  
Tricolpites confessus (SP) (R-F)  
Tricolpites gillii (SP) (VR)  
Tricolpites cf. sabulosus (SP) (VR)  
Tricolpites remarkensis (SP) (R)  
Tricolpites apoxyexinus (SP) (VR, top)  
cf. Australopollis obscurus (VR)  
cf. Gephyrapollenites wahooensis (SP) (VR)  
Podocarpites spp. (R)  
?Lygistepollenites balmei (SP) (VR)  
Phyllocladidites spp. (SP) (F)  
Phyllocladidites mawsonii (SP) (VR)  
Phyllocladidites mawsonii verrucosus (SP) (VR)  
Phyllocladidites microsaccatus (SP) (R-F)  
Araucariacites australis (R)  
Stereisporites regium (SP) (R)  
Cyathidites spp. (VR)  
Gleicheniidites spp. (R)  
Ischyosporites spp. (VR)  
Lycopodiumsporites spp. (R)  
Aequitriradites sp. (SP) (F) +96/21; 106.8/20.8; 92.9/17  
Aequitriradites spinosus (SP) (R) +105.8/15.5  
Aequitriradites verrucosus (SP) (VR)  
Triporoletes reticulatus (Rouseisporites sp.) (R)

- Zlivisporis blansensis (R) 101.5/18  
Laeivigatosporites spp. (F)
- 2613  
(SWC 36) Paleoenvironment: Prob. nonmarine  
Kerogen: sparse; 25-30% amorph; 50% woody/coaly; 20% biodeg terr; % herbac.; % S/P  
Spore/pollen (R); Dinoflagellates (barren); Pyrite (F-R); poor preservation  
Nothofagidites spp. (SP) (VR)  
Phyllocladidites spp. (SP) (R)  
Stereisporites antiquasporites (SP) (VR)
- 2620-25 Paleoenvironment: Prob. nonmarine  
Kerogen: 5-10% amorph; 50-60% woody/coaly; 15-20% biodeg terr; % herbac.; 3-5% S/P  
Spore/pollen (C); Dinoflagellates (barren); Pyrite (F-R); fair-poor preservation  
Proteacidites spp. (SP) (R)  
Proteacidites cf. angulatus (SP) (VR)  
Nothofagidites spp. (SP) (R)  
Nothofagidites senectus (SP) (R-)  
Tricolpites confessus (SP) (R)  
Tricolpites gillii (SP) (VR)  
Tricolpites cf. longus (SP) (R)  
Tricolpites apoxyexinus (SP) (R-F, incr)  
Australopollis obscurus (VR)  
Podocarpites spp. (F)  
Lygistepollenites cf. balmei (SP) (VR)  
Lygistepollenites florinii (SP) (VR)  
Phyllocladidites spp. (SP) (C)  
Phyllocladidites mawsonii (SP) (F)  
Phyllocladidites microsaccatus (SP) (C)  
Araucariacites australis (R)  
Cyathidites spp. (F-R)  
Gleicheniidites spp. (R)  
Aequitriradites sp. A (SP) (R)  
Aequitriradites verrucosus (SP) (R)  
Laeivigatosporites spp. (R)
- 2647  
(SWC 35) Paleoenvironment: Prob. nonmarine  
Kerogen: 5-10% amorph; 50-60% woody/coaly; 20-25% biodeg terr; 5% herbac.; 1-2% S/P  
Spore/pollen (C); Dinoflagellates (barren); Pyrite (C-A); poor- preservation  
Proteacidites spp. (SP) (R-F)  
Proteacidites cf. scaboratus (SP) (VR)  
Nothofagidites spp. (SP) (VR)  
Nothofagidites cf. senectus (SP) (VR)  
Nothofagidites cf. kaitangataensis-type (SP) (VR) -97.2/21  
Tricolpites confessus (SP) (VR)  
Tricolpites cf. sabulosus (SP) (VR)  
Podocarpites spp. (R)  
Phyllocladidites spp. (SP) (F)  
Phyllocladidites cf. mawsonii (SP) (VR)  
Phyllocladidites microsaccatus (SP) (R)  
Araucariacites australis (R-F)  
Cyathidites spp. (VR)  
?Aequitriradites verrucosus (SP) (R)  
cf. Foraminispora wonthagiensis (SP) (VR)  
Circaticosisporites cf. cuniformis (SP) (VR)  
Circaticosisporites cf. australiensis (SP) (VR)
- 2645-2650 Paleoenvironment: Prob. nonmarine  
Kerogen: 5-8% amorph; 60-65% woody/coaly; 15-20% biodeg terr; 5% herbac.; 3-5% S/P  
Spore/pollen (C); Dinoflagellates (barren); Pyrite (R); fair preservation  
Proteacidites spp. (SP) (R-F)  
Proteacidites amolosexinus (SP) (VR)  
Nothofagidites spp. (SP) (R-F, caved?)  
Nothofagidites senectus (SP) (R)  
Nothofagidites endurus (SP) (VR, caved?)  
Tricolpites confessus (SP) (VR)  
Tricolpites sabulosus (SP) (R-F)  
Tricolpites cf. remarkensis (SP) (R, caved?)  
Podocarpites spp. (R-F)  
Phyllocladidites spp. (SP) (F)  
Phyllocladidites mawsonii (SP) (R, caved?)  
Phyllocladidites microsaccatus (SP) (R)  
Phyllocladidites antarcticus (SP) (R)

Araucariacites australis (R)  
 Cyathidites spp. (R-F)  
 Gleicheniidites spp. (R)  
 Lycopodiumsporites spp. (VR)  
 Lycopodiadites asperatus (SP)(VR)  
 Foraminispora asymmetricus (SP) (R) +97.8/17.7; 96/17  
 Circaticosporites cf. australis (SP) (VR)  
 Circaticosporites cf. australis (SP) (VR)  
 Laevigatosporites spp. (R)

2654  
 (SWC 34)

Paleoenvironment: Prob. nonmarine  
 Kerogen: 45-55% amorph; 15-20% woody/coal; 15-20% biodeg terr; 3-5% herbac.; 3-5% S/P  
 Spore/pollen (C, com mud contam.); Dinoflagellates (barren); Pyrite (F-C); poor-fair preservation  
 Proteacidites spp. (SP) (F-C)  
 Proteacidites cf. angulatus (SP) (VR)  
 Gambierina rudata (SP) (VR)  
 Nothofagidites spp. (SP) (F-C, contam?)  
 Nothofagidites senectus (SP) (R)  
 Nothofagidites cf. aperus-type (SP) (VR, contam.?)  
 Tricolpites confessus (SP) (VR)  
 cf. Tricolpites gillii (SP) (VR)  
 Tricolpites waiparaensis (SP) (VR)  
 cf. Phimopollenites pannosus (SP) (VR-R)  
 Podocarpites spp. (R-F)  
 Phyllocladidites spp. (SP) (F)  
 Phyllocladidites microsaccatus (SP) (F)  
 Phyllocladidites antarcticus (SP) (R)  
 Araucariacites australis (R)  
 Gleicheniidites spp. (R)  
 Aequitriradites sp. (SP) (R-F)  
 Aequitriradites spinosus (SP) (R)  
 Aequitriradites verrucosus (SP) (R) +106.9/21  
 cf. Ceratosporites equalis (SP) (VR)

**Palynozone: N. senectus (Middle-Lower Campanian)**  
**(2675-2805m)**

2675  
 (SWC 33)

Paleoenvironment: Prob. nonmarine  
 Kerogen: 5% amorph; 65-70% woody/coal; 15-20% biodeg terr; 3-5% herbac.; 2-3% S/P  
 Spore/pollen (C, com mud contam.); Dinoflagellates (barren); Pyrite (F-R); poor-fair preservation  
 Proteacidites spp. (SP) (F, incr.)  
 Nothofagidites spp. (SP) (F, mud contam?)  
 Nothofagidites senectus (SP) (R)  
 Nothofagidites endurus (SP) (VR, mud contam.?)  
 Tricolpites confessus (SP) (VR)  
 Tricolpites gillii (SP) (VR)  
 Tricolpites waiparaensis (SP) (VR)  
 Tricolpites cf. remarkensis (SP) (R, caved?)  
 Tricolpites apoxyexinus (SP) (R)  
 Tricolpites sabulosus (SP) (R)  
 Phimopollenites pannosus (SP) (R)  
 Retimonocolpites sp. (SP) (VR)  
 Podocarpites spp. (R-F)  
 Phyllocladidites spp. (SP) (F-C)  
 Phyllocladidites mawsonii (SP) (R)  
 Phyllocladidites microsaccatus (SP) (C)  
 Phyllocladidites antarcticus (SP) (R-F)  
 Araucariacites australis (R-F)  
 Classopollis spp. (SP) (VR, reworked)  
 Cyathidites spp. (R-F)  
 Gleicheniidites spp. (R)  
 Lycopodiumsporites spp. (VR)  
 Aequitriradites verrucosus (SP) (VR) +106.9/21  
 cf. Foraminispora asymmetricus (SP) (VR, reworked)  
 Kraeuselisporites spp. (SP) (VR, reworked) +  
 Circaticosporites spp. (SP) (VR)  
 cf. Ceratosporites equalis (SP) (VR)

2690  
 (SWC 32)

Paleoenvironment: Prob. nonmarine  
 Kerogen: 10-15% amorph; 45-50% woody/coal; 25-30% biodeg terr; 5-10% herbac.; 2-3% S/P  
 Spore/pollen (C, com mud contam.); Dinoflagellates (barren); Pyrite (C); fair-poor preservation

- Proteacidites spp. (SP) (F)  
 Nothofagidites spp. (SP) (F, mud contam?)  
 Nothofagidites senectus (SP) (R)  
 Nothofagidites cf. aperus-type (SP) (VR, mud contam.?)  
 Tricolpites sabulosus (SP) (R)  
 Tricolpites cf. remarkensis (SP) (R, caved?)  
 Phimopollenites pannosus (SP) (R-F)  
 Podocarpites spp. (C)  
 Phyllocladidites spp. (SP) (F)  
 Phyllocladidites microsaccatus (SP) (A)  
 Phyllocladidites antarcticus (SP) (R-)  
 Araucariacites australis (C)  
 cf. Callialasporites dampieri (SP) (VR)  
 Cyathidites spp. (R)  
 Gleicheniidites spp. (R)  
 Triporoletes lavigatus (Rouseisporites sp.) (~Cenom. and lower) (VR) +94.5/20.9  
 cf. Cybelosporites striatus (SP) (R)
- 2698  
 (SWC 31)
- Paleoenvironment: Prob. nonmarine  
 Kerogen: 15-20% amorph; 45-50% woody/coaly; 10-20% biodeg terr; 5-10% herbac.; 1-2% S/P  
 Spore/pollen (F-C, com mud contam.); Dinoflagellates (barren); Pyrite (C-A); poor preservation  
 Proteacidites spp. (SP) (F)  
 Nothofagidites spp. (SP) (R, mud contam?)  
 Tricolpites sabulosus (SP) (R)  
 cf. Phimopollenites pannosus (SP) (R)  
 Phyllocladidites spp. (SP) (F)  
 Phyllocladidites microsaccatus (SP) (F)  
 Araucariacites australis (R)  
 Gleicheniidites spp. (R)  
 Laevigatosporites spp. (R-F)
- 2730-35
- Paleoenvironment: Prob. nonmarine  
 Kerogen: 5% amorph; 65-70% woody/coaly; 10-15% biodeg terr; 5-10% herbac.; 2-3% S/P  
 Spore/pollen (C, com mud contam.); Dinoflagellates (barren); Pyrite (R); poor-fair preservation  
 Proteacidites spp. (SP) (F)  
 Nothofagidites spp. (SP) (R, mud contam?)  
 Nothofagidites senectus (SP) (R)  
 Tricolpites cf. confessus (SP) (VR)  
 Tricolpites cf. gillii (SP) (VR)  
 Tricolpites waiparaensis (SP) (VR)  
 Tricolpites sabulosus (SP) (R-F)  
 cf. Phimopollenites pannosus (SP) (R)  
 Podocarpites spp. (F-C)  
 Phyllocladidites spp. (SP) (C)  
 Phyllocladidites mawsonii (SP) (R)  
 Phyllocladidites microsaccatus (SP) (C)  
 Phyllocladidites antarcticus (SP) (R-F)  
 Araucariacites australis (R)  
 Cyathidites spp. (R)  
 Gleicheniidites spp. (R)  
 Lycopodiumsporites spp. (VR)  
 Triporoletes lavigatus (Rouseisporites sp.) (VR, reworked) +92.5/16  
 Laevigatosporites spp. (F)
- 2747  
 (SWC 29)
- Paleoenvironment: Prob. nonmarine  
 Kerogen: 5% amorph; 65-70% woody/coaly; 5-10% biodeg terr; 10-15% herbac.; 1-2% S/P  
 Spore/pollen (A, com mud contam.); Dinoflagellates (barren); Pyrite (R); fair preservation  
 Proteacidites spp. (SP) (F)  
 Gambierina cf. edwardsii (SP) (VR, mud contam.?)  
 Nothofagidites spp. (SP) (R, mud contam?)  
 Nothofagidites senectus (SP) (R)  
 cf. Illexpollenites sp. (VR)  
 cf. Tricolpites cf. confessus (SP) (VR)  
 Tricolpites sabulosus (SP) (R)  
 Phimopollenites pannosus (SP) (R)  
 Australopollis obscurus (VR)  
 Retimonocolpites peroreticulatus (SP) (VR)  
 Liliacidites lanceolatus-type (SP) (R, mud contam.)  
 Podocarpites spp. (F-C)  
 Phyllocladidites spp. (SP) (C-A)  
 Phyllocladidites mawsonii (SP) (R-F)  
 Phyllocladidites microsaccatus (SP) (C-A)

- Phyllocladidites antarcticus (SP) (R-F)  
 Araucariacites australis (F)  
 Cyathidites spp. (R)  
 Gleicheniidites spp. (R)  
 Aequitriradites spinosus (SP) (R)  
 Aequitriradites verrucosus (SP) (R) +  
 Laeivigatosporites spp. (F)
- 2761  
 (SWC 28)      Paleoenvironment: Prob. nonmarine  
 Kerogen: 5% amorph; 70-75% woody/coaly; 5-10% biodeg terr; 5-10% herbac.; 1-2% S/P  
 Spore/pollen (C, com mud contam.); Dinoflagellates (barren); Pyrite (F); poor-fair preservation  
 Proteacidites spp. (SP) (R-)  
 Proteacidites amolosexinus (SP) (VR)  
 Nothofagidites spp. (SP) (R, mud contam?)  
 Nothofagidites senectus (SP) (R)  
 Nothofagidites cf. kaitangataensis-type (SP) (VR)  
 Tricolpites sabulosus (SP) (R)  
 Tetracolporites verrucosus (VR, mud contam.?)  
 Podocarpites spp. (R)  
 Phyllocladidites spp. (SP) (F)  
 Phyllocladidites mawsonii (SP) (R-F)  
 Phyllocladidites microsaccatus (SP) (F)  
 Phyllocladidites antarcticus (SP) (R)  
 Laeivigatosporites spp. (F)
- 2771  
 (SWC 27)      Paleoenvironment: Prob. nonmarine  
 Kerogen: 5-10% amorph; 60-65% woody/coaly; 10-15% biodeg terr; 5-10% herbac.; 2-3% S/P  
 Spore/pollen (C-A, com mud contam.); Dinoflagellates (barren); Pyrite (F); fair preservation  
 Proteacidites spp. (SP) (F)  
 Nothofagidites spp. (SP) (VR, mud contam?)  
 Tricolpites confessus (SP) (VR)  
 Tricolpites sabulosus/stipulatus (SP) (-T.apo.) (R)  
 Phimopollenites pannosus (SP) (VR)  
 Liliacidites spp. (SP) (R-F, mud contam.)  
 Liliacidites lanceolatus-type (SP) (R, mud contam.) -105.6/11.1; 97.5/7.8  
 Podocarpites spp. (R)  
 Phyllocladidites spp. (SP) (C)  
 Phyllocladidites mawsonii (SP) (F)  
 Phyllocladidites microsaccatus (SP) (C)  
 Phyllocladidites antarcticus (SP) (F)  
 Araucariacites australis (R-F)  
 Cyathidites spp. (R)  
 Gleicheniidites spp. (R)  
 Laeivigatosporites spp. (F)

**Palynozone: T. apoxyxinus (Santonian)**  
**(2805-2850m)**

- 2805-10      Paleoenvironment: Prob. nonmarine  
 Kerogen: 3-5% amorph; 65-75% woody/coaly; 5-10% biodeg terr; 10-15% herbac.; 1-2% S/P  
 Spore/pollen (C-A, com mud contam.); Dinoflagellates (barren); Pyrite (F); fair preservation  
 Proteacidites spp. (SP) (F)  
 Proteacidites cf. angulatus (SP) (VR, contam.)  
 Beaupreadites sp. (SP) (VR) -106.8/8.8  
 Nothofagidites spp. (SP) (VR, mud contam?)  
 Tricolpites confessus (SP) (VR)  
 Tricolpites waiparaensis (SP) (VR)  
 Tricolpites sabulosus/stipulatus (SP) (R-F, incr.)  
 Liliacidites spp. (SP) (R, mud contam.)  
 Liliacidites lanceolatus-type (SP) (R, mud contam.) -100.10.8  
 Podocarpites spp. (F)  
 Phyllocladidites spp. (SP) (C)  
 Phyllocladidites mawsonii (SP) (F-R)  
 Phyllocladidites microsaccatus (SP) (F-C)  
 Phyllocladidites antarcticus (SP) (F)  
 Araucariacites australis (F)  
 Cyathidites spp. (F-C)  
 Gleicheniidites spp. (F)  
 Clavifera triplex (SP) (VR)  
 Circaticosporites cf. australiensis (SP) (VR)  
 Circaticosporites cf. ludbrookii (SP) (VR)

- Laeivigatosporites spp. (F)
- 2821  
(SWC 24) Paleoenvironment: Prob. nonmarine  
Kerogen: 2-3% amorph; 65-70% woody/coal; 5-8% biodeg terr; 15-20% herbac.; 2-3% S/P  
Spore/pollen (F, ? mud contam.); Dinoflagellates (barren); Pyrite (R); v. poor preservation  
Tricolpites cf. sabulosus/stipulatus (SP) (VR)  
Phimopollenites pannosus (SP) (VR)  
Podocarpites spp. (F)  
Phyllocladidites spp. (SP) (C)  
Phyllocladidites microsaccatus (SP) (F-C)  
Araucariacites australis (R)  
Stereisporites antiquasporites (SP) (VR)  
Cyathidites spp. (F)  
Gleicheniidites spp. (R)  
Laeivigatosporites spp. (F)
- Palynozone: Lower T. apoxyxinus (Santonian)**  
**(2850-2905m)**
- 2850-55 Paleoenvironment: Shallow-marginal marine  
Kerogen: 3-5% amorph; 65-70% woody/coal; 5-10% biodeg terr; 10-15% herbac.; 2-3% S/P  
Spore/pollen (C ? mud contam.); Dinoflagellates (F-C); Pyrite (R); poor-fairpreservation  
Dinoflagellate unidentified (VR) +89\14.5  
Chatangiella spp. (D) (F-C)  
Chatangiella victoriensis (D) (F-) +100/14.4 ;103.21  
cf. Trythyrodinium suspectum (D) (R-F)  
Proteacidites spp. (SP) (F, some caved?)  
Proteacidites sp. Eocene (SP) (VR, contam.)  
Phimopollenites pannosus (SP) (F-R, incr.)  
Podocarpites spp. (F-C)  
Phyllocladidites spp. (SP) (C)  
Phyllocladidites microsaccatus (SP) (F-C)  
Phyllocladidites antarcticus (SP) (F)  
Araucariacites australis (R-F)  
Cyathidites spp. (F)  
Gleicheniidites spp. (R)  
Lycopodiumsporites spp. (VR)  
cf. Ceratosporites equalis (SP) (VR) +102/14.3
- 2857  
(SWC 21) Paleoenvironment: Marginal- non marine  
Kerogen: 5-10% amorph; 50-55% woody/coal; 15-20% biodeg terr; 5-10% herbac.; 3-5% S/P  
Spore/pollen (F-C, ? mud contam.); Dinoflagellates (~barren); Pyrite (C); v. poor preservation  
cf. Chatangiella victoriensis (D) (-) +  
Proteacidites spp. (SP) (r)  
Tricolpites confessus (SP) (VR)  
Tricolpites cf. sabulosus/stipulatus (SP) (VR)  
Phimopollenites pannosus (SP) (F-C) 96/7.4  
Podocarpites spp. (F-C)  
Phyllocladidites spp. (SP) (F)  
Phyllocladidites mawsonii (SP) (R)  
Phyllocladidites microsaccatus (SP) (F)  
Cyathidites spp. (F-R)
- 2887  
(SWC 19) Paleoenvironment: Prob. nonmarine  
Kerogen: 5-10% amorph; 50-55% woody/coal; 15-20% biodeg terr; 5-10% herbac.; 5-8% S/P  
Spore/pollen (C); Dinoflagellates (barren); Pyrite (C); very poor preservation  
Phimopollenites pannosus (SP) (F-C, incr.)  
Podocarpites spp. (F-C)  
Phyllocladidites spp. (SP) (F-C)  
Phyllocladidites mawsonii (SP) (F-C)  
Phyllocladidites mawsonii verrucosus (SP) (VR)  
Phyllocladidites microsaccatus (SP) (F)  
Phyllocladidites antarcticus (SP) (R-F)  
Cyathidites spp. (R)  
Gleicheniidites spp. (F)
- 2890-95  
(+SWC 18) Paleoenvironment: Prob. nonmarine  
Kerogen: 2-5% amorph; 70-75% woody/coal; 5-10% biodeg terr; 3-5% herbac.; 3-5% S/P  
Spore/pollen (F); Dinoflagellates (barren); Pyrite (R-F); very poor preservation  
Phimopollenites pannosus (SP) (F)  
Podocarpites spp. (R)

Phyllocladidites spp. (SP) (R-F)  
 Phyllocladidites microsaccatus (SP) (R)  
 Phyllocladidites antarcticus (SP) (R)  
 Stereisorites sp. (?Tripunctisporis) (SP) (VR)  
 Cyathidites spp. (R)  
 Gleicheniidites spp. (R)  
 Aequitriradites sp. A (SP) (VR)  
 Aequitriradites verrucosus (SP) (VR) +  
 Circaticosporites cf. ludbrookii (SP) (VR)  
 cf. Ceratosporites equalis (SP) (VR)

**Palynozone: Indeterminate  
 (2905-2970m)**

- 2905  
 (SWC 17) Paleoenvironment: Prob. nonmarine  
 Kerogen: 2-5% amorph; 70-75% woody/coaly; 5-10% biodeg terr; 3-5% herbac.; 1% S/P  
 Spore/pollen (R); Dinoflagellates (barren); Pyrite (F); very poor preservation  
 Podocarpites spp. (R)  
 Phyllocladidites spp. (SP) (R)  
 Phyllocladidites microsaccatus (SP) (R)
- 2911  
 (SWC 16) Paleoenvironment: Prob. nonmarine  
 Kerogen: 5-8% amorph; 70-75% woody/coaly; 5-10% biodeg terr; 3-5% herbac.; 2-3% S/P  
 Spore/pollen (F-R); Dinoflagellates (barren); Pyrite (C); v. poor preservation  
 Podocarpites spp. (R)  
 Phyllocladidites spp. (SP) (R)
- 2943  
 (SWC 14) Paleoenvironment: Prob. nonmarine  
 Kerogen: 5-10% amorph; 50-55% woody/coaly; 15-20% biodeg terr; 5-10% herbac.; 2-3% S/P  
 Spore/pollen (F); Dinoflagellates (barren); Pyrite (C); v. poor preservation  
 Proteacidites spp. (SP) (R)  
 Podocarpites spp. (R)  
 Phyllocladidites spp. (SP) (R)  
 Phyllocladidites microsaccatus (SP) (R)  
 Cyathidites spp. (R)

**Palynozone: Lower T. apoxyxinus-?P. mawsonii (Santonian-?Turonian)  
 (2970-3127m)**

- 2970-75  
 Paleoenvironment: Shallow-marginal marine  
 Kerogen: 5-10% amorph; 70-75% woody/coaly; 5-10% biodeg terr; 3-5% herbac.; 1-3% S/P  
 Spore/pollen (F); Dinoflagellates (R-F); Pyrite (C-A); fair-poor preservation  
 Chatangiella victoriensis (D) (F)  
 cf. Xiphophoridium alatum (D) (Cam8-A16) (VR, folded)  
 Podocarpites spp. (R)  
 Phyllocladidites spp. (SP) (R)  
 Phyllocladidites microsaccatus (SP) (R)  
 Phyllocladidites antarcticus (SP) (R)  
 Cyathidites spp. (R)  
 ?Cybelosporites stylosus (SP) (VR) (Lw. Alb and lower)
- 2997  
 (SWC 11) Paleoenvironment: Shallow-marginal marine  
 Kerogen: 5-10% amorph; 70-75% woody/coaly; 5-10% biodeg terr; 3-5% herbac.; 1-3% S/P  
 Spore/pollen (C; some mud contam.); Dinoflagellates (F); Pyrite (C-A); fair-poor preservation  
 Dinoflagellate unidentified (vR)  
 Chatangiella porosa (D) (F) +b101/14.2, 105.5/12;95.5/9.9  
 ?Isabelidium variabile (D) (ER)  
 Proteacidites spp. (SP) (F, some contam?)  
 Proteacidites cf. angulatus (SP) (VR), contam.)  
 Tricolpites cf. confessus (SP) (VR)  
 Tricolpites cf. sabulosus/stipulatus (SP) (VR)  
 Australopollis obscurus (VR)  
 Podocarpites spp. (F)  
 Phyllocladidites spp. (SP) (F)  
 Phyllocladidites microsaccatus (SP) (F)  
 Phyllocladidites antarcticus (SP) (R)  
 Cyathidites spp. (R)  
 Circaticosporites cf. australiensis (SP) (VR)

- 3005  
 (SWC 10) Paleoenvironment: Shallow-marginal marine  
 Kerogen: 5-10% amorph; 70-75% woody/coaly; 5-10% biodeg terr; 3-5% herbac.; 1-3% S/P

- Spore/pollen (C; some mud contam.); Dinoflagellates (F); Pyrite (C-A); fair-poor preservation  
Dinoflagellate unidentified (R) 1111; +a104.3/5.5  
Chatangiella porosa (D) (F) +a  
Chatangiella triparita (D) (VR) +a  
cf. Exochosphaeridium stiolatum/Fibrocyta sp. (D) (R) +a99.1/15.2  
cf. Spongodinium delitiense (D) (VR, piece)  
Tricolpites cf. confessus (SP) (VR)  
Tricolpites cf. sabulosus/stipulatus (SP) (VR)  
Tricolpites cf. apoxyxinus (SP) (VR, base)  
cf. Phimopollenites pannosus (SP) (R)  
Australopollis obscurus (VR)  
Podocarpites spp. (F)  
Phyllocladidites spp. (SP) (F)  
Phyllocladidites microsaccatus (SP) (F)  
Phyllocladidites antarcticus (SP) (R)  
Stereisporites antiquasporites (SP) (VR)  
Gleicheniidites spp. (R)
- 3015-20  
Paleoenvironment: Shallow-marginal marine  
Kerogen: 4-5% amorph; 70-75% woody/coaly; 5-10% biodeg terr; 3-5% herbac.; 3-5% S/P  
Spore/pollen (C); Dinoflagellates (F); Pyrite (VA); poor-fair preservation  
Dinoflagellate unidentified (VR)  
Chatangiella porosa (D) (R-F) +a  
Isabelidinium spp. (D) (VR)  
Trythyrodinium suspectum (D) (VR)  
Tricolpites cf. sabulosus/stipulatus (SP) (VR)  
Phimopollenites pannosus (SP) (R-F)  
Podocarpites spp. (F)  
Phyllocladidites spp. (SP) (F)  
Phyllocladidites microsaccatus (SP) (F)  
Phyllocladidites antarcticus (SP) (R)  
Stereisporites antiquasporites (SP) (VR)  
Gleicheniidites spp. (R)  
Circaticosporites cf. australiensis (SP) (VR)  
Circaticosporites cf. ludbrookii (SP) (VR)
- 3056  
(SWC 8)  
Paleoenvironment: Shallow-marginal marine (possible P. mawsonii, if in place)  
Kerogen: 5-10% amorph; 60-70% woody/coaly; 10-15% biodeg terr; 3-5% herbac.; 1-3% S/P  
Spore/pollen (C); Dinoflagellates (F-C); Pyrite (VA); poor-fair preservation  
Dinoflagellate unidentified (R) 1  
Chatangiella victoriensis (D) (R-F) +  
Trythyrodinium suspectum (D) (VR)  
cf. Heterosphaeridium difficile (D) (F; distorted, degraded, pitted)  
cf. Xenascus ceratioides (D) (VR)  
Tricolpites cf. sabulosus/stipulatus (SP) (VR)  
Podocarpites spp. (F-R)  
Phyllocladidites spp. (SP) (F)  
Phyllocladidites microsaccatus (SP) (R)  
Phyllocladidites antarcticus (SP) (R)  
Gleicheniidites spp. (R)  
Aequitriradites sp. (SP) (VR)  
Aequitriradites spinosus (SP) (VR)  
Balmeisporites holodictyus (SP) (VR, reworked?) +100/9.5
- 3072  
(SWC 7)  
Paleoenvironment: Shallow-marginal marine  
Kerogen: 5% amorph; 60-70% woody/coaly; 15-20% biodeg terr; 3-5% herbac.; 1-3% S/P  
Spore/pollen (C); Dinoflagellates (F); Pyrite (A); poor preservation  
Dinoflagellate unidentified (VR) 1  
Chatangiella victoriensis (D) (Camp-Turon. (F)  
Proteacidites spp. (SP) (, some contam?)  
Podocarpites spp. (R)  
Phyllocladidites spp. (SP) (F)  
Phyllocladidites microsaccatus (SP) (R)
- 3087  
(SWC 6)  
Paleoenvironment: Non-?marginal marine  
Kerogen: 5% amorph; 60-70% woody/coaly; 15-20% biodeg terr; 3-5% herbac.; 1-3% S/P  
Spore/pollen (F); Dinoflagellates (~barren); Pyrite (C); poor preservation  
? Trythyrodinium suspectum (D) (VR)  
Podocarpites spp. (R)  
Phyllocladidites spp. (SP) (F)  
Phyllocladidites microsaccatus (SP) (R)  
Phyllocladidites antarcticus (SP) (R)

Cyathidites spp. (R)

3088  
(SWC 5)      Paleoenvironment: Marginal marine  
 Kerogen: 5% amorph; 60-70% woody/coaly; 15-20% biodeg terr; 3-5% herbac.; 1-3% S/P  
 Spore/pollen (F); Dinoflagellates (R); Pyrite (C); poor preservation  
 Dinoflagellate unidentified (VR) 1  
 Chatangiella spp. (D) (VR)  
 Chatangiella cf. victoriensis (D) (Camp-Turon. (VR)  
 Podocarpites spp. (R)  
 Phyllocladidites spp. (SP) (F)  
 Phyllocladidites microsaccatus (SP) (R)  
 Phyllocladidites antarcticus (SP) (R)  
 Cyathidites spp. (R)  
 Aequitriradites spinosus (SP) (VR)

3085-90      Paleoenvironment: Marginal-shallow marine  
 Kerogen: 5% amorph; 60-70% woody/coaly; 15-20% biodeg terr; 3-5% herbac.; 1-3% S/P  
 Spore/pollen (F-C, some contam.); Dinoflagellates (F); Pyrite (C-A); poor preservation  
 Chatangiella spp. (D) (VR)  
 Chatangiella victoriensis (D) (R)  
 Isabelidium variabile (D) (VR)  
 Proteacidites spp. (SP) (F, some contam?)  
 Tricolpites cf. sabulosus/stipulatus (SP) (VR)  
 Podocarpites spp. (R)  
 Phyllocladidites spp. (SP) (F)  
 Phyllocladidites microsaccatus (SP) (F)  
 Phyllocladidites antarcticus (SP) (R)  
 Araucariacites australis (R)  
 Stereisorites antiquasporites (SP) (VR)  
 Cyathidites spp. (R)  
 Gleicheniidites spp. (R)  
 cf. Ceratosporites equalis (SP) (VR) -

**Palynozone: Indeterminate  
(3127-3130m)**

3127  
(SWC 3)      Paleoenvironment: Indeterminate  
 Kerogen: Dark coaly; 1-2% amorph; 80-85% coaly; 5-10% biodeg terr; <1% herbac.; <1% S/P  
 Spore/pollen (nearly barren); Dinoflagellates (nearly barren); Pyrite (C-A);v. poor preservation

3125-30      Paleoenvironment: Indeterminate  
 Kerogen: Dark coaly; 5-10% amorph; 75-80% coaly; 5-10% biodeg terr; <1% herbac.; % S/P  
 Spore/pollen (R, mostly caved); Dinoflagellates (nearly barren); Pyrite (VA); poor preservation  
 Phyllocladidites spp. (SP) (VR, caved?)  
 Phyllocladidites microsaccatus (SP) (VR, caved?)