

EXXON EXPLORATION COMPANY

DEPT. NAT. RES & ENV

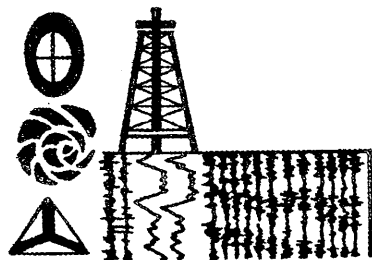


PE906495

**Biostratigraphic Zonation and Paleoenvironments of the
Turrum-5 Well, Gippsland Basin, Australia
(Unclassified)**

Thomas D. Davies

TECHNOLOGY DEPARTMENT
GLOBAL STUDIES - GEOLOGICAL SERVICES DIVISION
BIOSTRATIGRAPHY SECTION
EEC.07A.BIO.96
MARCH, 1996



**BIOSTRATIGRAPHY
REPORT**

EXXON UNCLASSIFIED

EXXON EXPLORATION COMPANY

POST OFFICE BOX 2189 • HOUSTON TEXAS 77252-2189

TECHNOLOGY DEPARTMENT
GLOBAL STUDIES/DATABASE DIVISION
BIOSTRATIGRAPHY

April 2, 1996

Mr. Brodie Thomson
Esso Australia Limited
360 Elizabeth Street
Melbourne, Victoria
Australia 3000

Attn: Peter Glenton

Dear Brodie:

Attached is an unclassified version of the report "Biostratigraphic Zonation and Paleoenvironments of the Turrum-5 Well, Gippsland Basin, Australia" (EEC.07A.BIO.96) by Thomas D. Davies. This report summarizes the results of examination of the palynologic assemblages and biofacies in sidewall core samples from the Turrum-5 Well. This work was originally requested by John Phillips.

The purposes of this palynologic study focused on 1) stratigraphic control based on the age/stratigraphic position of sidewall core samples relative to Exxon's Gippsland Basin palynological zonation and 2) constraints on depositional environments. The section studied from 2133.5 to 2756.5 mKB ranges in age from basalmost lower Eocene to Upper Maastrichtian.

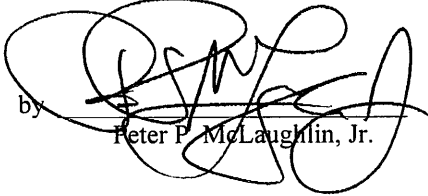
Eight zones and one subzone was recognized in this well. The section from 2133.5 to 2472.6 mKB is considered marginal marine to marine, based on abundance and type of dinoflagellate cysts. From 2472.6 to 2596.5 mKB no marine microfossils were recovered and this section is interpreted to be nonmarine. Marine dinoflagellates reappear in samples in the basal part of the well from 2598 to 2748.3 mKB and suggest some marine influences at these depths.

This report is unclassified, with all proprietary interpretations removed, so it can be distributed outside Exxon without further permission from EEC.

The Biostratigraphy Section appreciates this opportunity to work with you in ensuring the effective application of biostratigraphy to your project. If you have any questions regarding this work or require any further assistance, please contact Pete at 423-5988 or Tom at 423-5992.

Yours truly,

B. A. Vining

by 
Peter P. McLaughlin, Jr.

TDD



EXXON EXPLORATION COMPANY
BIOSTRATIGRAPHY REPORT
EEC.07A.BIO.96
MARCH, 1996

**Biostratigraphic Zonation and Paleoenvironments of the
Turrum-5 Well, Gippsland Basin, Australia
(Unclassified)**

Thomas D. Davies

EXECUTIVE SUMMARY

- The palynology of the Turrum-5 Well was studied to provide stratigraphic control based on age and biostratigraphic position of sidewall core samples from 2133.5 to 2756.5 mKB and environments of deposition.
- Eight palynology zones and one subzone, ranging in age from basalmost lower Eocene to Upper Maastrichtian, were differentiated for this well.
- Palynology demonstrates that Blue Grey SB occurs between zones Ra and Rb, Bottle Green SB occurs just above the top of Zone Rc, and MFS "E" falls within Zone Rc. Near Top L-200 falls near the boundary between Rc and Rd, within the base of Zone Rc. Naples Yellow SB at the Rd1 and Rd2 boundary, Pink SB within Rf, MFS "A" in the base of Zone Rf, and Rg near the 450 Marker.
- Most of the "shales" associated with the reservoir sandstone, particularly above the MFS "B" SB, contain common to abundant marine dinoflagellate cysts. Five intervals were identified that contain relatively rich and diverse marine assemblages. These intervals correlate with the marine flooding events associated with MFS "B" SB and Near Top L-200.

TABLE OF CONTENTS

EXECUTIVE SUMMARY	iv
TABLE OF CONTENTS.....	v
INTRODUCTION	1
DATABASE AND PRODUCTS.....	2
BIOSTRATIGRAPHY AND PALEOENVIRONMENTAL SUMMARY	2
DISCUSSION OF RESULTS	3
PALYNOSTRATIGRAPHIC CORRELATION.....	4
PALEOENVIRONMENTS	5
RECOMMENDATIONS.....	6
REFERENCES	6
Appendix A.....	8

**EXXON EXPLORATION COMPANY
TECHNOLOGY DEPARTMENT
GLOBAL STUDIES - GEOLOGICAL SERVICES DIVISION
BIOSTRATIGRAPHY SECTION**

10/01/96

**Biostratigraphy Report
Spores, Pollen, and Dinoflagellates**

EEC.07A.BIO.96

**ESSO AUSTRALIA, LTD
Gippsland Basin, Australia**

Turrum-5 Well

INTRODUCTION

At the request of Esso Australia Limited (John Phillips), fifty-eight sidewall core samples were studied from the Turrum-5 Well, Gippsland Basin. Samples were analyzed for age and paleoenvironment, and the results of these analyses were integrated with Exxon's Turrum Field palynological zonation recently proposed by Davies (1995).

The main purposes of this palynologic study were to provide: 1) stratigraphic control based on the age and biostratigraphic position of sidewall core samples relative to Exxon's Gippsland Basin palynological zonation, and 2) constraints on the depositional environments.

The age and paleoenvironmental interpretations are based on comparisons with materials from Askin (1990); Besems (1993); Churchhill (1973); Cookson and Eisenack (1965 and 1967); Damassa et al. (1994); Davies (1995); Davey et al. (1966); Germeraad et al. (1968); Heilmann-Clausen (1985); Helby et al. (1987); Marshall (1985); Muller (1964); Partridge (1973 and 1976); Powell (1992); Stover and Evans (1973); Stover and Partridge (1973 and 1984); Wilson (1984 and 1988); and Wrenn and Hart (1988).

Interpretations of paleoecology were made based on observed changes in the spore-pollen (S/P) assemblages and biofacies analyses from kerogen slides. Relative abundance abbreviations used below are: 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, F - foraminifera. Depths given are in meters KB.

DATABASE AND PRODUCTS

Approximately 175 microscope slides from fifty-eight Turrum-5 sidewall core samples were examined for palynology and paleoenvironments. These core samples were processed by EEC's Biostratigraphic Lab in Houston.

Microscope slides: The palynology and kerogen microscope slides from the fifty-eight sidewall core samples (2133.5 to 2756.6 m) from the Turrum-5 well are stored at EEC's biostratigraphy laboratory in Houston.

BIOSTRATIGRAPHY AND PALEOENVIRONMENTAL SUMMARY

Approximately 175 microscope slides were studied from thirty-eight Turrum-1 sidewall core samples in the interval from 2133.5 to 2756.5 m. Marine dinoflagellate cysts are common to abundant in many of the samples from 2151 to 2462.8 m, particularly at 2253.2, 2296.1, 2298, 2317.5, 2338*, 2421*, 2442*, 2453, 2455.5*, 2458.5, and 2462.8*. (Those depths annotated with an asterisk are interpreted as intervals of maximum marine incursions based on dinoflagellate cyst diversity and type.) The section from 2472.6 to 2596.5 is interpreted to be nonmarine, as no marine forms were recovered. Marine dinocysts occur again, mainly in small numbers, in the basal part of this well from 2598 to 2748.3 m. Terrestrially derived spores and pollen are common to abundant in most of the samples, but often poorly preserved.

The palynostratigraphic subdivision, zone tops, and ranges for the Turrum-5 well are listed below. Questioned depths shown in parenthesis, e.g. (?2253.2), denotes possible shallowest depth of the zone top.

2133.5-2179.5	Zone Ra?, but no higher than upper L. balmei
2179.5-2253.2	Zone Rb?
(?2253.2) 2269.1-2338	Zone Rc
2238-2396.7	Zone Rd1
2396.7-2426	Zone Rd2?
(?2426) 2448.5-2472.6	Zone Re
2472.6-2499.5	Indeterminate
(?2499.5) 2510.5-2585.3	Zone Rf
2585.3-2598	Indeterminate
(?2598) 2629-2645	Rg
2645-2681.5	Indeterminate
(?2681.5) 2703-2756.5	Upper Maastrichtian, Zone Ma

Intervals of maximum flooding occur in samples 2338, 2421, 2442, 2455.5, and 2462.8 m associated with Near Top L-200, and MFS "B" SB.

DISCUSSION OF RESULTS

Zone Sz was not identified in this well.

Zone Ra is provisionally assigned to samples from 2133.5 to 2179.5 m. Preservation is only fair to poor and identification of marker species is difficult. Appendix A, following the references, gives a sample-by-sample listing of the important species.

The fossil assemblage is mixed at 2179.5 m, but is characteristic of Zone Rb (Appendix A). Zone Rb is assigned to the late Paleocene.

The zonation of sample 2253.2 m is not well established. However, fossils and biofacies in this sample suggests possible penetration of Zone Rc (Appendix A).

At sample 2269.1 m the section is definitely in Zone Rc, which is interpreted in the early part of the late Paleocene. The assemblage associated with zone Rc continues through sample 2317.5 m (Appendix A).

Zone Rd, interpreted to be early Paleocene, is subdivided into two subzones. Subzone Rd1 is recorded from 2238 to 2396.7 m. The interval from 2396.7 to 2426 m is tentatively assigned to Subzone Rd2. This subzone may be as high as 2382 m (Appendix A).

The top of Zone Re is placed at 2448 m. The assemblage associated with this zone continues down through sample 2462.8 m

Zone Rf is tentatively assigned to the interval from 2499.5 to 2510. The interval from 2510 to 2585.5 m in Zone Rf.

Zone Rg is tentatively placed from 2629 to 2645 m and possibly as high as 2598 m. The assemblage in the samples is consistent with this zone in the other well in the area.

The interval from 2645 to 2681 m is indeterminate for zonation, because of poor fossil preservation.

The three samples from 2681.5 to 2695 m are questionable, but the assemblage suggests this interval is probably within Zone Ma. Definitive Zone Ma occurs from 2703 to 2756.5 m (Appendix A).

PALYNOSTRATIGRAPHIC CORRELATION

The palynologic assemblages recovered from this well are similar to those reported for the other wells studied from the Turrum field (Davies, 1995). Eight biozones and one subzone were recognized in this well, based on first, last, and peak occurrences, and concurrent ranges which were compared with ranges previously established in the area by Stover and Partridge (1973), Stover and Evans (1973), Helby, Morgan, and Partridge (1987), Wilson (1984, 1988), Wrenn and Hart (1988), and others. The pick for the palynozones were done independently of the stratigraphic picks, resulting in good correlation control, which is consistent with EAL's log picks.

The zonation of the upper samples from 2133.5 to 2235.3 m is not well established, so the designations for zones Ra and Rb are tentative. In relationship to the physical surface, ?Ra Zone occurs in the upper three samples, about 10 m above proposed MFS "M" at about 2169 m (as picked by EAL). Zone Ra was recognized by Davies (1995) in Marlin-2, Turrum-4, Turrum-3, and Turrum-2 at approximately 5 to 20 m above MFS "M".

The top of ?Rb Zone is tentatively placed at 2179.5 m in this well. This sample contains a mixed assemblage of Rb and Rc palynomorphs and the preservation is generally only fair to poor. This level is approximately 10 m below Blue Grey SB at 2269 m. Zone Rb occurs at or just below the Blue Grey SB in Turrum-4, Turrum-3, and Turrum-2, and Marlin-4 (Davies, 1995).

The top of Palynozone Rc, which occurs at or near the Bottle Green SB in the other Turrum wells, is tentatively placed at 2253.2 m about 4 m below Bottle Green SB at 2249 m. At sample 2269.1 m the section is definitely in Zone Rc. This zone was recorded in most of the Turrum field wells. An alternative pick for Bottle Green is 2261 m.

The top of Subzone Rd1, which is usually occurs near the Near Top L-200 surface (Davies, 1995), was recorded at 2338 m. This is about 10 m beneath the Near Top L-200 surface at 2328 m. Near Top L-200 falls between the last pick of Rc at 2318 m and the first downhole pick of Rd1 at 2338 m. Subzone Rd1 was recognized in most of the Turrum well, except Marlin-2.

The top of Subzone Rd2 is tentatively placed at 2396.7 m just beneath the Naples Yellow SB surface at 2395 m. Naples Yellow is usually found in Zone Rd2, but it occurs within the very top of this zone, or in some cases, as in Marlin-4, it occurs just above the top of Rd2. Because of changes that occur in the biofacies in Turrum-5 from 2369.47 and 2382 m, it is possible that Rd2 may occur as high as 2383 m.

Top Zone Re occurs at 2448.5 m, but may be as high as 2426 m. It is generally associated with the MFS "B" SB and the physical surface at about 2453 m. by EAL. Alternative pick for this surface may be 2468 or 2481 m. This zone was recognized with certainty in Marlin-2, Turrum-4, Turrum-3, and Turrum-2 (Davies, 1995). Subzone Re2 was not differentiated in this well.

The top of the Rf Zone, which is typically located just above the Pink SB, was recognized at 2510.5 m and possibly as high as 2499.5 m. The surface at about 2509 m was picked as Pink SB by EAL. An alternative pick is 2429 m. MFS "A" at 2595 m occurs within the basal part of Zone Rf.

Zone Rg top, which generally sits close to 450 Marker, probably occurs at 2629 m, or possibly as high as 2598 m. It was identified with certainty in the four of the Turrum field wells, Turrum-4, -3, -2, and Marlin-4 (Davies, 1995). The 450 Marker is placed at 2628 m.

The top of Upper Maastrichtian Palynozone Ma typically appears beneath the Oriental Blue SB at the base of the section and is provisionally placed at 2681.5 m and certainly at 2703 m. The Oriental Blue SB was picked by EAL at 2675 m.

PALEOENVIRONMENTS

Results indicate that deposition of the interval studied from the Turrum-5 well took place in a non-marine to marginal marine environment with periodic and short-lived marine floods. The middle and upper portions of the reservoir sequence above approximately 2263 m appeared to have experienced more numerous and extensive flooding, whereas the basal part of the section contains fewer marine records. Although most of the shales associated with the reservoir sands above 2472.6 m contain at least some fossils indicative of marine influence, five horizons were identified that contain rich, relatively diverse marine palynomorph assemblages. These occur near the MFS "B" SB and Near Top L-200 surfaces at 2338, 2421, 2442, 2455.5, and 2462.8 m. These flooding events also were recognized near the Near Top L-200 surface in Turrum-1, Marlin-4, and Turrum-3 and near the MFS "B" SB in Turrum-1, Turrum-3 (30 m above), and Turrum-4 (25 and 30 m above) (Davies, 1995). Appendix A give the sample-by-sample interpretation of the paleoenvironments.

The Late Maastrichtian climate in this area was apparently humid and mild, with a cooling trend near the Cretaceous/Tertiary boundary (Askin, 1990). The composition of the palynomorphs and palynofacies assemblage in the basal part (uppermost Maastrichtian to lower Paleocene) of the reservoir section implies a cool and wet climate.

The decrease in frequency of indicators of humid environments, upward in the section, suggest that conditions became slightly drier during deposition of most of the upper part of the reservoir section.

Pyrite, which is common to transitional marine to nonmarine settings, is abundant in many of the samples, suggesting deposition took place near shore, where there was possibility of some marine influence.

RECOMMENDATIONS

Zones Ra and Rb are not well defined in this well. If further definition of the top of these zones is required, we recommend augmenting the SWC's with a few cuttings samples selected from fine-grained lithologies in the upper part of the well from about 2060 down to about 2250 mKB, particularly samples from 2210 to 2220 and 2225 to 2231 mKB.

REFERENCES

- Askin, R.A., 1990. Campanian to Paleocene spore and pollen assemblages of Seymour Island, Antarctica. *Review of Palaeobotany and Palynology*, 65: p. 105-113.
- Besems, R.E., 1993. Dinoflagellate cyst biostratigraphy of Tertiary and Quaternary deposits of offshore NW Borneo. *Geol. Soc. Malaysian, Bull* 33, p. 65-93.
- Churchhill, D.M., 1973. The ecological significance of tropical mangroves in the early Tertiary floras of southern Australia. *Geol. Soc. Aust. Spec. Publ.* 4: p. 79-86.
- Cookson, I.C., and Eisenack, A., 1965. Microplankton from the Dartmoor Formation, S.W. Victoria. *Proc. Royal Soc. Vic.*, 79(1): p. 133-137.
- Cookson, I.C., and Eisenack, A., 1967. Some microplankton from the Paleocene, Rivernook bed, Victoria. *Proc. Royal Soc. Vic.*, 80(2): p. 247-258.
- Damassa, S.P., Williams, G.L., and Brinkhuis, H., 1994. Short course in Paleogene dinoflagellate cysts. Conducted at Amoco Prod. Co., Houston, Texas, Nov. 7-10, 1994.
- Davies, T.D., 1995. New Biostratigraphic Subdivision and Paleoecology of the Paleocene Turrum Field Reservoir Section from Seven Gippsland Basin Wells, Australia. Exxon Exploration Co. rept. EEC.16A.BIO.95.
- Davey, R.J., Downie, C., Sargeant, W.A.S., and Williams, G.L., 1966. Studies of Mesozoic and Cainozoic dinoflagellate cysts. *Bull. Brit. Mus. (Nat. Hist.) Geol., Suppl.* 3, p. 1-248.
- Germeraad, J.H., Hopping, C.A., and Muller, J., 1968. Palynology of Tertiary sediments from tropical areas. *Review of Palaeobotany and Palynology*, 6: p. 189-348.
- Heilmann-Clausen, C., 1985. Dinoflagellate stratigraphy of the uppermost Danian to Ypresian in the Viborg 1 borehole, central Jylland, Denmark. *Danmarks Geologiske Undersogelse, Serie A*, 7: p. 1-69.

- Helby, R., Morgan, R., and Partridge, A.D., 1987. A palynological zonation of the Australian Mesozoic; *in* Jell, P.A. (ed.), *Assoc. Australasian Palaeont., Mem. 4*: p. 1-94.
- Partridge, A.D., 1973. Revision of the spore-pollen zonation of the Bass Basin. *Esso Aust. Ltd. Palaeontological rept. 1973/4*: 22 p.
- Partridge, A.D., 1976. The geological expression of eustacy in the early Tertiary of the Gippsland Basin. *Aust. Pet. Explor. Assoc. Jour., v. 16, pt.1*: p. 73-79.
- Powell, A.J., 1992. Dinoflagellates of the Tertiary system; *in* Powell, A.J. (ed.), *A Stratigraphic Index of Dinoflagellate Cysts*, Chapman and Hall, London: p. 155-252.
- Stover, L.E. and Partridge, A.D., 1973. Upper Cretaceous-Eocene spore-pollen zonation, offshore Gippsland Basin, Australia. *Geol. Soc. Aust. Spec. Publ. 4*: p.55-72
- Stover, L.E. and Partridge, A.D., 1973. Tertiary and Late Cretaceous spores and pollen from the Gippsland Basin, Southeastern Australia. *Proc. Royal Soc. Vic., 85 (2)*: p. 237-286.
- Stover, L.E. and Partridge, A.D., 1984. A new Late Cretaceous megaspore with grapnel-like appendage tips from Australia and New Zealand. *Palynology, 8*: p. 139-144.
- Wilson, G.J., 1984. New Zealand Late Jurassic to Eocene dinoflagellate biostratigraphy - a summary. *Newsletters on Stratigraphy 13 (2)*: p. 104-117.
- Wilson, G.J., 1988. Paleocene and Eocene dinoflagellate cysts from Waipawa, Hawkes Bay, New Zealand. *New Zealand Geol. Surv. Paleo. Bull. 57*: 96 p.
- Wrenn, J.H., and Hart, G.F., 1988. Paleocene dinoflagellate cyst biostratigraphy of Seymour Island, Antarctica. *Geol. Soc. Am., Mem. 169*: p. 321-447.

Appendix A

BIOSTRATIGRAPHY AND PALEOENVIRONMENTAL SUMMARY

- 2133.5 Paleoenvironment: nonmarine to marginal marine
Kerogen: woody/coaly (VA); amorphous (R); biodegraded terr. (C-A); S/P (A);
 dinoflagellates (VR); pyrite (R-F)
Senegalinium cf. dilwynense (D) (VR)
?Apectodinium spp. (D) (VR)
Gambierina rudata (SP) (R)
Nothofagidites spp. (SP) (F)
Nothofagidites emarcidus-heterus (SP) (R)
Nothofagidites cf. brachyspinulosus (SP) (R)
Nothofagidites endurus (SP) (F)
?Nothofagidites flemingii (SP) (R)
Polycolpites langstonii (SP) (R)
Australopollis obscurus (SP) (R-F)
Proteacidites spp. (SP) (F-C)
?Proteacidites angulatus (SP) (R)
Proteacidites adenanthoides (SP) (R)
?Herkosporites elliotii (SP) (VR)
Stereisporites antiquasporites (SP) (R-F)
Stereisporites (Tripunctisporis) (SP) (R)
Phyllocladidites mawsonii (SP) (F)
Phyllocladidites microsaccatus (SP) (R-F)
Podosporites antarcticus (SP) (R)
Lygistipollenites balmei (SP) (R)
Lygistipollenites florinii (SP) (R)
Bisaccates (SP) (C-A)
Botryococcus spp. (algal) (R-F)
- 2151 Paleoenvironment: marginal marine
Kerogen: woody/coaly (A); amorphous (A); biodegraded terr. (R); S/P (VA);
 dinoflagellates (VA); pyrite (C)
?Apectodinium spp. (D) (VA)
Vozzhennikovia/Spinidinium spp. (D) (R)
Nothofagidites spp. (SP) (F)
Nothofagidites endurus (SP) (R)
Australopollis obscurus (SP) (R)
Proteacidites spp. (SP) (F-C)
?Proteacidites angulatus (SP) (R)
?Proteacidites annularis (SP) (VR)
Stereisporites antiquasporites (SP) (F)

Phyllocladidites mawsonii (SP) (R)
Phyllocladidites microsaccatus (SP) (R-F)
?Lygistipollenites balmei (SP) (R)
Bisaccates (SP) (F)

2159.5 Paleoenvironment: nonmarine to marginal marine
Kerogen: woody/coaly (A); amorphous (A); biodegraded terr. (C); S/P (A);
 dinoflagellates (R); pyrite (C-A)
Senegalinium cf. dilwynense (D) (R)
Nothofagidites spp. (SP) (F)
Nothofagidites brachyspinulosus (SP) (R)
Nothofagidites endurus (SP) (R)
Nothofagidites emarcidus-heterus (SP) (R)
Australopollis obscurus (SP) (F)
Proteacidites spp. (SP) (F-C)
Proteacidites angulatus (SP) (R-F)
Proteacidites annularis (SP) (VR)
Proteacidites adenanthoides (SP) (R)
Stereisporites antiquasporites (SP) (C)
Stereisporites regium (SP) (VR)
Stereisporites (Tripunctisporis) (SP) (R)
Phyllocladidites mawsonii (SP) (R)
Phyllocladidites microsaccatus (SP) (F)
Podosporites antarcticus (SP) (R)
Lygistipollenites balmei (SP) (F)
Lygistipollenites florinii (SP) (F)
Bisaccates (SP) (VA)

2179.5 Paleoenvironment: marginal marine to marine
Kerogen: woody/coaly (A); amorphous (F); biodegraded terr. (C); S/P (A);
 dinoflagellates (C); pyrite (A)
Senegalinium cf. dilwynense (D) (F)
?Spinidinium-type (D) (VR)
Cerodinium spp. (D) (F)
Cerodinium sp S (D) (F-R)
Glaphyrocysts cf. retiintexta (D) (F-R)
Paleocystodinium spp. (D) (R)
Paleocystodinium golzowense (D) (R-F)
Nothofagidites spp. (SP) (F)
Nothofagidites brachyspinulosus (SP) (R)
Nothofagidites endurus (SP) (R)
?Tetracolporites verrucosus (SP) (VR)
Proteacidites spp. (SP) (F)
Stereisporites antiquasporites (SP) (C)
Phyllocladidites mawsonii (SP) (R)
Phyllocladidites microsaccatus (SP) (R)
Lygistipollenites balmei (SP) (R)
Lygistipollenites florinii (SP) (R)
Bisaccates (SP) (F)

2191 Paleoenvironment: probably nonmarine

Kerogen: woody/coaly (VA); amorphous (F-C); biodegraded terr. (C); S/P (VA);
dinoflagellate (VR); pyrite (A)
Nothofagidites spp. (SP) (F)
Nothofagidites brachyspinulosus (SP) (R)
Nothofagidites endurus (SP) (R)
Nothofagidites emarcidus-heterus (SP) (VR)
Australopollis obscurus (SP) (F)
Proteacidites spp. (SP) (F)
Proteacidites angulatus (SP) (R)
Stereisporites antiquasporites (SP) (C)
Stereisporites (Tripunctisporis) (SP) (R)
Phyllocladidites mawsonii (SP) (R)
Phyllocladidites microsaccatus (SP) (R)
Lygistipollenites balmei (SP) (R)
Lygistipollenites florinii (SP) (R)
Bisaccates (SP) (C-A)

2235.3

Paleoenvironment: marginal marine
Kerogen: woody/coaly (VA); amorphous (A-C); biodegraded terr. (C); S/P (A);
dinoflagellates (R-F); pyrite (VA)
Senegalinium cf. dilwynense (D) (R-F)
Cerodinium sp S (D)(R)
Cerodinium spp. (D) (F)
Glaphyrocysts cf. retiintexta (D)(R)
?Paleoperidinium pyrophorum (D) (VR)
Deflandrea-type spp. (D) (R)
Nothofagidites spp. (SP) (R)
Nothofagidites endurus (SP) (R)
Australopollis obscurus (SP) (R-F)
Proteacidites spp. (SP) (F)
Proteacidites angulatus (SP) (R)
Stereisporites antiquasporites (SP) (F-C)
?Herkosporites elliotii (SP) (VR)
Phyllocladidites mawsonii (SP) (R)
Phyllocladidites microsaccatus (SP) (R)
Lygistipollenites balmei (SP) (R)
Lygistipollenites florinii (SP) (R)
Bisaccates (SP) (F)

2253.2

Paleoenvironment: marginal marine
Kerogen: woody/coaly (VA); amorphous (C-A); biodegraded terr. (C); S/P (A);
dinoflagellates (VA); pyrite (VA)
Spiniferites spp. (D) (VR)
Senegalinium cf. dilwynense (D) (F-C)
Spinidinium spp. (D) (VR)
?Apectodinium spp. (D) (VA)
Cerodinium spp. (D) (R)
Alisocysta circumtabulata (D) (VR)
Glaphyrocysts cf. retiintexta (D) (R-F)
Nothofagidites spp. (SP) (R)
Nothofagidites endurus (SP) (R)

Australopollis obscurus (SP) (R)
Proteacidites spp. (SP) (F)
Proteacidites angulatus (SP) (R)
Stereisporites antiquasporites (SP) (F-C)
Stereisporites (Tripunctisporis) (SP) (R-F)
Latrobosporites spp. (SP) (VR)
Phyllocladidites mawsonii (SP) (R)
Phyllocladidites microsaccatus (SP) (R)
Lygistipollenites balmei (SP) (F)
Lygistipollenites florinii (SP) (R)
Bisaccates (SP) (F)

- 2269.1 Paleoenvironment: marginal marine
Kerogen: woody/coaly (C); amorphous (VA); biodegraded terr. (F); S/P (A);
 dinoflagellates (C-A); pyrite (VA)
Cerodinium spp. (D) (R)
Senegalinium dilwynense (D) (C)
?Isabelidium cingulatum (D) (VR)
Glaphyrocysts retiintexta (D) (C-A)
Paleocystodinium golzowense (D) (F-C)
Deflandrea-type spp. (D) (R)
Nothofagidites spp. (SP) (VR)
Proteacidites spp. (SP) (F)
Proteacidites angulatus (S) (R)
Proteacidites cf. adenanthoides (SP) (R)
Tricolpites gillii (SP) (R)
Stereisporites antiquasporites (SP) (F-C)
Lygistipollenites balmei (SP) (R-F)
Bisaccates (SP) (F)
- 2298 Paleoenvironment: marginal marine
Kerogen: woody/coaly (A); amorphous (C-A); biodegraded terr. (A); S/P (A);
 dinoflagellates (VA); pyrite (VA)
Spiniferites spp. (D) (VR)
?Spinidium-type (D) (R)
Senegalinium dilwynense (D) (A)
Cerodinium sp S (D) (C)
Glaphyrocysts retiintexta (D) (F)
Paleocystodinium golzowense (D) (F)
Deflandrea-type spp. (D) (F)
Nothofagidites spp. (SP) (R)
Proteacidites spp. (SP) (F)
Phyllocladidites mawsonii (SP) (R)
Phyllocladidites microsaccatus (SP) (R)
Lygistipollenites balmei (SP) (R)
Lygistipollenites florinii (SP) (R)
Bisaccates (SP) (R-F)
- 2317.5 Paleoenvironment: marginal marine to marine
Kerogen: woody/coaly (C-A); amorphous (A); biodegraded terr. (A); S/P (A);
 dinoflagellates (VA); pyrite (VA)

Spiniferites spp. (D) (R)
Spiniferites septatus (D) (R)
?Spinidinium-type (D) (R)
Senegalinium dilwynense (D) (A)
Cerodinium sp S (D) (F)
Glaphyrocysts retiintexta (D) (F-C)
Paleocystodinium golzowense (D) (F-C)
Deflandrea-type spp. (D) (F)
Nothofagidites spp. (SP) (VR)
Proteacidites spp. (SP) (R-F)
Stereisporites antiquasporites (SP) (F-C)
Phyllocladidites microsaccatus (SP) (R)
Lygistipollenites balmei (SP) (R-F)
Lygistipollenites florinii (SP) (R)
Bisaccates (SP) (R)

2338

Paleoenvironment: marginal marine to marine
Kerogen: woody/coaly (A); amorphous (F-C); biodegraded terr. (A); S/P (A);
dinoflagellates (VA); pyrite (A)
Spiniferites spp. (D) (R)
Spiniferites septatus (D) (VR)
Spinidinium cf. densispinatum (D) (VA)
Vozzhenikovia spp. (D) (F)
?Isabelidinium bakeri (D) (VR)
Cerodinium spp. (D) (R)
Glaphyrocysts retiintexta (D) (F)
Paleocystodinium golzowense (D) (R)
Deflandrea-type spp. (D) (R)
Alisocysta reticulata (D) (R)
Hystrichosphaeridium sp. T (D) (VR)
Nothofagidites spp. (SP) (R)
Nothofagidites cf. brachyspinulosus (SP) (VR)
Nothofagidites endurus (SP) (VR)
Proteacidites spp. (SP) (F)
Proteacidites angulatus (SP) (R)
Proteacidites cf. adenanthoides (SP) (F)
Stereisporites antiquasporites (SP) (R)
Phyllocladidites mawsonii (SP) (R)
Lygistipollenites balmei (SP) (R-F)
Lygistipollenites florinii (SP) (R)
Bisaccates (SP) (R-F)

2369.47

Paleoenvironment: nonmarine
Kerogen: woody/coaly (VA); amorphous (R); biodegraded terr. (C); S/P (A); pyrite (R)
Australopollis obscurus (SP) (R)
Proteacidites spp. (SP) (F)
Proteacidites angulatus (SP) (R)
Stereisporites antiquasporites (SP) (F-C)
Stereisporites (Tripunctisporis) sp. (SP) (R)
Phyllocladidites mawsonii (SP) (F)
Phyllocladidites microsaccatus (SP) (R)

Lygistipollenites balmei (SP) (R)
Bisaccates (SP) (R-F)
Botryococcus spp. (algal) (R-F)

2382

Paleoenvironment: nonmarine to marginal marine
Kerogen: woody/coaly (C-A); amorphous (C); biodegraded terr. (A); S/P (A);
dinoflagellates (VR), pyrite (C-A)
Spinidinium cf. densispinatum (D) (R)
Gambierina rudata (SP) (R)
Nothofagidites spp. (SP) (VR)
Australopollis obscurus (SP) (A)
Proteacidites spp. (SP) (F)
Proteacidites angulatus (SP) (R)
Proteacidites dilwynensis (SP) (VR, mud contaminant)
Stereisporites antiquasporites (SP) (F-C)
Herkosporites elliotii (SP) (VR)
Latrobosporites ohaiensis (SP) (R)
Phyllocladidites mawsonii (SP) (F)
Phyllocladidites microsaccatus (SP) (R)
Podosporites antarcticus (SP) (R)
Lygistipollenites balmei (SP) (F-C)
Lygistipollenites florinii (SP) (F)
Bisaccates (SP) (F-C)

2396.7

Paleoenvironment: nonmarine
Kerogen: woody/coaly (R-F); amorphous (VA); biodegraded terr. (R); S/P (A); pyrite (C-A)
Australopollis obscurus (SP) (VA)
Tetracolporites verrucosus (SP) (R-F)
Proteacidites spp. (SP) (F)
Proteacidites angulatus (SP) (R)
Stereisporites antiquasporites (SP) (R)
Stereisporites (Tripunctisporis) sp. (SP) (VR)
Phyllocladidites mawsonii (SP) (R)
Lygistipollenites balmei (SP) (R)
Bisaccates (SP) (F)
Botryococcus spp. (algal) (R)

2399.6

Paleoenvironment: nonmarine
Kerogen: woody/coaly (C-A); amorphous (C); biodegraded terr. (F); S/P (A); pyrite (A)
Gambierina rudata (SP) (R)
Australopollis obscurus (SP) (C)
Tricolpites gillii (SP) (R)
Proteacidites spp. (SP) (F)
Proteacidites angulatus (SP) (R)
Stereisporites antiquasporites (SP) (F-C)
Stereisporites regium (SP) (R)
Herkosporites elliotii (SP) (R)

Ephedripites spp. (SP) (VR)
Phyllocladidites mawsonii (SP) (R)
Phyllocladidites microsaccatus (SP) (R)
Podospirites antarcticus (SP) (R)
Lygistipollenites florinii (SP) (F)
Bisaccates (SP) (F)
Botryococcus spp. (algal) (R)

2404

Paleoenvironment: nonmarine
Kerogen: woody/coaly (A); amorphous (C-F); biodegraded terr. (C); S/P (A); pyrite (A)
Gambierina rudata (SP) (R)
Australopollis obscurus (SP) (C)
Tetracolporites verrucosus (SP) (R)
Tricolpites gillii (SP) (R)
Proteacidites spp. (SP) (F-C)
Proteacidites angulatus (SP) (R-F)
Proteacidites cf. adenantoides (SP) (VR)
Stereisporites antiquasporites (SP) (F-C)
Stereisporites regium (SP) (R)
Herkosporites elliotii (SP) (R)
Ephedripites spp. (SP) (VR)
Phyllocladidites mawsonii (SP) (R)
Phyllocladidites microsaccatus (SP) (R)
Podospirites antarcticus (SP) (R)
Lygistipollenites florinii (SP) (F)
Bisaccates (SP) (F)
Botryococcus spp. (algal) (R-F)

2421

Paleoenvironment: marginal marine to marine
Kerogen: woody/coaly (C); amorphous (A-C); biodegraded terr. (C); S/P (A);
dinoflagellates (F-C); pyrite (A)
Spiniferites spp. (D) (F)
Spiniferites septatus (D) (R)
Senegalinium dilwynense (D) (F-C)
Spinidinium cf. densispinatum (D) (R-F)
Vozzhenikovia spp. (D) (R)
Cerodinium spp. (D) (VR)
?Apectodinium spp. (D) (F)
Alisocysta reticulata (D) (frag.)
Operculodinium spp. (D) (VR)
Hystrichosphaeridium sp. T (D) (VR)
Gambierina rudata (SP) (R)
Australopollis obscurus (SP) (F)
Tetracolporites verrucosus (SP) (R-F)
Proteacidites spp. (SP) (C)
Proteacidites angulatus (SP) (R)
Stereisporites antiquasporites (SP) (C)
Stereisporites (Tripunctisporis) sp. (SP) (R)
Stereisporites regium (SP) (R)
Herkosporites elliotii (SP) (R)
Phyllocladidites microsaccatus (SP) (R)
Podospirites antarcticus (SP) (R)
Lygistipollenites balmei (SP) (R)
Lygistipollenites florinii (SP) (R)

Bisaccates (SP) (F)

2426

Paleoenvironment: nonmarine

Kerogen: woody/coaly (A); amorphous (R); biodegraded terr. (C-A); S/P (A); pyrite (C)

Nothofagidites spp. (SP) (VR)

Nothofagidites endurus (SP) (VR)

Australopollis obscurus (SP) (F)

Tricolpites gillii (SP) (R)

Proteacidites spp. (SP) (C)

Proteacidites angulatus (SP) (R)

Stereisporites (Tripunctisporis) sp. (SP) (R)

Herkosporites elliotii (SP) (R)

Phyllocladidites mawsonii (SP) (R)

Phyllocladidites microsaccatus (SP) (R)

Lygistipollenites balmei (SP) (R)

Lygistipollenites florinii (SP) (R)

Bisaccates (SP) (F)

2432.5

Paleoenvironment: nonmarine

Kerogen: woody/coaly (A-C); amorphous (C); biodegraded terr. (C-A); S/P (A); pyrite (C-A)

Nothofagidites spp. (SP) (VR)

Nothofagidites endurus (SP) (VR)

Australopollis obscurus (SP) (R)

Proteacidites spp. (SP) (C)

Proteacidites angulatus (SP) (R)

Stereisporites antiquasporites (SP) (C)

Herkosporites elliotii (SP) (R)

Phyllocladidites mawsonii (SP) (R)

Phyllocladidites microsaccatus (SP) (R-F)

Podosporites antarcticus (SP) (R)

Lygistipollenites balmei (SP) (R)

Lygistipollenites florinii (SP) (R)

Bisaccates (SP) (F)

Botryococcus spp. (algal) (R)

2442

Paleoenvironment: marginal marine

Kerogen: woody/coaly (C-A); amorphous (C-A); biodegraded terr. (C); S/P (A);
dinoflagellates (F); pyrite (C-A)

Spiniferites spp. (D) (R)

Spiniferites septatus (D) (R)

Impagidinium cf. dispartitum

Spinidinium cf. densispinatum (D) (F)

Vozzhenikovia spp. (D) (R-F)

Cerodinium spp. (D) (VR)

Glaphyrocysts spp. (D) (R)

?Glaphyrocysts retiintexta (D) (R)

Hystrichosphaeridium sp. T (D) (VR)

Turbiosphaera cf. galeata (D) (VR)

Ovoidinium verrucosum (D) (VR)

Australopollis obscurus (SP) (F)

Tetracolporites verrucosus (SP) (R)

Tricolpites gillii (SP) (R)
Proteacidites spp. (SP) (C)
Proteacidites angulatus (SP) (R)
Stereisporites antiquasporites (SP) (F)
Herkosporites elliottii (SP) (R)
Phyllocladidites mawsonii (SP) (R)
Phyllocladidites microsaccatus (SP) (R-F)
Podosporites antarcticus (SP) (R)
Lygistipollenites balmei (SP) (R-F)
Lygistipollenites florinii (SP) (R)
Bisaccates (SP) (F)
Botryococcus spp. (algal) (R)

2443.5

Paleoenvironment: marginal marine
Kerogen: woody/coaly (A); amorphous (C); biodegraded terr. (C); S/P (A);
dinoflagellates (C); pyrite (VA)
Spinidinium cf. densispinatum (D) (F)
Vozzhenikovia spp. (D) (R)
Cerodinium spp. (D) (VR)
Cerodinium sp S (D) (VR)
Alisocysta circumtabulata (D) (VR)
Glaphyrocysts spp. (D) (R)
Turbiosphaera cf. galeata (D) (VR)
Cordosphaeridium gracile (D) (VR)
Australopollis obscurus (SP) (F)
Proteacidites spp. (SP) (C)
Proteacidites angulatus (SP) (R)
Stereisporites antiquasporites (SP) (R)
Herkosporites elliottii (SP) (R)
Phyllocladidites mawsonii (SP) (R)
Phyllocladidites microsaccatus (SP) (R-F)
Podosporites antarcticus (SP) (R)
Lygistipollenites balmei (SP) (R-F)
Lygistipollenites florinii (SP) (R)
Bisaccates (SP) (F)
Botryococcus spp. (algal) (R)

2448.5

Paleoenvironment: marginal marine
Kerogen: woody/coaly (A); amorphous (C); biodegraded terr. (C); S/P (A);
dinoflagellates (C); pyrite (VA)
Spiniferites spp. (D) (R)
Spinidinium cf. densispinatum (D) (F-C)
Vozzhenikovia spp. (D) (R)
Cerodinium spp. (D) (VR)
Cerodinium sp S (D) (R-F, increase)
Gambierina rudata (SP) (R)
Australopollis obscurus (SP) (F-C)
Tricolpites gillii (SP) (R)
Proteacidites spp. (SP) (R-F, decrease from above)
Proteacidites angulatus (SP) (VR)
Stereisporites antiquasporites (SP) (R)

Phyllocladidites mawsonii (SP) (R)
Phyllocladidites microsaccatus (SP) (R-F)
Podosporites antarcticus (SP) (R)
Lygistipollenites balmei (SP) (R-F)
Lygistipollenites florinii (SP) (R)
Bisaccates (SP) (F-C)

2453

Paleoenvironment: marginal marine
Kerogen: woody/coaly (A); amorphous (F); biodegraded terr. (VA); S/P (C-A);
dinoflagellates (C); pyrite (R)
Spiniferites spp. (D) (R)
Senegalinium dilwynense (D) (F)
Spinidinium-type (D) (VR)
Spinidinium densispinatum (D) (F-C)
Cerodinium spp. (D) (F)
Cerodinium sp. S (D) (R-F)
Deflandrea-type spp. (D) (R)
Australopollis obscurus (SP) (R-F)
?Tetracolporites verrucosus (SP) (VR)
Tricolpites sp. L (SP) (VR)
Proteacidites spp. (SP) (F)
Proteacidites angulatus (SP) (VR)
Stereisporites antiquasporites (SP) (F-C)
Fern spores (SP) (F)
Ceratosporites equalis (SP) (VR)
Ephedripites spp. (SP) (indicative of arid climate) (VR)
Phyllocladidites mawsonii (SP) (R)
Bisaccates (SP) (F)

2455.5

Paleoenvironment: marginal marine to marine
Kerogen: woody/coaly (VA); amorphous (F); biodegraded terr. (VA); S/P (C-A);
dinoflagellates (A); pyrite (R-F)
Spiniferites spp. (D) (R-F)
Spinidinium densispinatum (D) (VA)
Alisocysta spp. (D) (R-F)
Alisocysta cf. circumtabulata (D) (R)
Alisocysta cf. reticulata (D) (R)
Cerodinium spp. (D) (F)
Cerodinium sp. S (D) (F-C)
Paleocystodinium spp. (D) (R)
Paleocystodinium bulliforme (D) (R)
Hystrichosphaeridium sp. T (D) (F)
Hystrichosphaeridium danicum ssp. "solinooides" (D) (R)
Gambierina rudata (SP) (VR)
Gambierina edwardsii (SP) (VR)
Nothofagidites endurus (SP) (VR)
Australopollis obscurus (SP) (F)
?Tetracolporites verrucosus (SP) (VR)
Tricolpites gillii (SP) (R)
?Tricolpites cf. confessus (SP) (VR)
Tricolpites sp. L (SP) (VR)
Proteacidites spp. (SP) (F-C)
Proteacidites angulatus (SP) (VR)
Stereisporites antiquasporites (SP) (F)

?Stereisporites (Tripunctisporis) sp. (SP) (R)
Stereisporites regium (SP) (R)
Fern spores (SP) (F)
Ephedripites spp. (SP) (VR)
Phyllocladidites mawsonii (SP) (R)
Phyllocladidites microsaccatus (SP) (R)
Podosporites antarcticus (SP) (R)
Lygistipollenites balmei (SP) (VR)
Bisaccates (SP) (F)

2458.5

Paleoenvironment: marginal marine to marine
Kerogen: woody/coaly (A); amorphous (C-A); biodegraded terr. (VA); S/P (C)
dinoflagellates (A); pyrite (C-A)
Spiniferites spp. (D) (R-F)
Spinidinium densispinatum (D) (VA)
Cerodinium spp. (D) (F)
Cerodinium sp. S (D) (F)
Proteacidites spp. (SP) (F)
Proteacidites sp. S (SP) (F)
Stereisporites antiquasporites (SP) (F)
Fern spores (SP) (F)
Phyllocladidites microsaccatus (SP) (R)
Podosporites antarcticus (SP) (R)
Lygistipollenites balmei (SP) (R)
Lygistipollenites florinii (SP) (VR)
Bisaccates (SP) (F)

2462.8

Paleoenvironment: marginal marine to marine
Kerogen: woody/coaly (A); amorphous (F-C); biodegraded terr. (VA); S/P (C)
dinoflagellates (A); pyrite (VA)
Spiniferites spp. (D) (F)
Senegalinium dilwynense (D) (F)
Spinidinium densispinatum (D) (VA)
Alisocysta spp. (D) (R-F)
Cerodinium spp. (D) (F)
Cerodinium sp. S (D) (F)
Paleocystodinium spp. (D) (R)
Turbiosphaera cf. galeata (D) (R)
Cordosphaeridium spp. (D) (R)
Gambierina edwardsii (SP) (VR)
Australopollis obscurus (SP) (F)
Tricolpites sp. L (SP) (VR)
Proteacidites spp. (SP) (F)
Proteacidites angulatus (SP) (VR)
Stereisporites antiquasporites (SP) (F)
Fern spores (SP) (F)
Phyllocladidites microsaccatus (SP) (R)
Podosporites antarcticus (SP) (R)
Lygistipollenites balmei (SP) (R)
Bisaccates (SP) (F)

Proteacidites spp. (SP) (F-R)
Stereisporites antiquasporites (SP) (F)
Stereisporites (Tripunctisporis) (SP) (R)
Fern spores (SP) (F)
?Herkosporites elliotii (SP) (VR)
Phyllocladidites mawsonii (SP) (R)
Phyllocladidites microsaccatus (SP) (R)
Lygistipollenites florinii (SP) (VR)
Bisaccates (SP) (F-C)

2491.5 Paleoenvironment: nonmarine to ?marginal marine
Kerogen: woody/coaly (VA); amorphous (R); biodegraded terr. (VA); S/P (F);
 dinoflagellates (VR); pyrite (R)
Ovoidinium verrucosum (D) (VR)
Australopollis obscurus (SP) (R)
Tetracolporites verrucosus (SP) (VR)
?Haloragacidites harrisii (SP) (R)
Proteacidites spp. (SP) (F-R)
Proteacidites angulatus (SP) (VR)
Stereisporites antiquasporites (SP) (F)
Stereisporites (Tripunctisporis) (SP) (R)
Fern spores (SP) (F)
Herkosporites elliotii (SP) (R)
Latrobosporites ohaiensis (SP) (R)
Phyllocladidites mawsonii (SP) (F)
Phyllocladidites microsaccatus (SP) (R)
Podosporites antarcticus (SP) (R)
Lygistipollenites florinii (SP) (VR)
Bisaccates (SP) (F-C)

2499.5 Paleoenvironment: nonmarine
Kerogen: woody/coaly (VA); amorphous (F); biodegraded terr. (VA); S/P (F); pyrite (R)
Nothofagidites spp. (SP) (VR)
Nothofagidites cf. brachyspinulosus (SP) (R)
Australopollis obscurus (SP) (R)
Tricolpites gillii (SP) (R)
Tricolpites spp. (SP) (VR)
?Tricolpites cf. confessus (SP) (VR)
Tricolpites sp. L (SP) (VR)
Tricolpites cf longus (S)
Proteacidites spp. (SP) (C-A)
Proteacidites angulatus (SP)
Stereisporites antiquasporites (SP) (F)
Stereisporites (Tripunctisporis) (SP) (R-F)
Fern spores (SP) (F)
?Herkosporites elliotii (SP) (R)
Ceratosporites equalis (SP) (VR)
Phyllocladidites mawsonii (SP) (F)
Phyllocladidites microsaccatus (SP) (R)
Podosporites antarcticus (SP) (R)
Lygistipollenites florinii (SP) (R)

Bisaccates (SP) (C; increase)

- 2510.5 Paleoenvironment: nonmarine
Kerogen: woody/coaly (VA); amorphous (F-C); biodegraded terr. (VA); S/P (VA); pyrite (R)
Gambierina spp. (SP) (VR)
Gambierina edwardsii (SP) (VR)
Australopollis obscurus (SP) (F)
Tetracolporites verrucosus (SP) (C-A)
Tricolpites gillii (SP) (R)
Tricolpites spp. (SP) (R)
Tricolpites cf. confessus (SP) (F-C)
Tricolpites sp. L (SP) (R)
Proteacidites spp. (SP) (C-A)
Proteacidites angulatus (SP) (F-C)
Stereisporites antiquasporites (SP) (F)
Stereisporites regium (SP) (R)
Fern spores (SP) (F)
Herkosporites elliottii (SP) (R)
Ephedripites spp. (SP) (VR)
Phyllocladidites mawsonii (SP) (F)
Phyllocladidites microsaccatus (SP) (R)
Podosporites antarcticus (SP) (R)
Lygistipollenites balmei (SP) (F)
Lygistipollenites florinii (SP) (R)
Bisaccates (SP) (C; increase)
- 2515.5 Paleoenvironment: nonmarine
Kerogen: woody/coaly (C); amorphous (R); biodegraded terr. (VA); S/P (VA); pyrite (R)
Gambierina spp. (SP) (VR)
Gambierina edwardsii (SP) (VR)
Australopollis obscurus (SP) (VR)
Tricolpites gillii (SP) (VR)
Tricolpites cf. confessus (SP) (VR)
Proteacidites spp. (SP) (R)
Stereisporites antiquasporites (SP) (R)
Stereisporites regium (SP) (VR)
Fern spores (SP) (R)
?Herkosporites elliottii (SP) (VR)
Bisaccates (SP) (R)
- 2520.5 Paleoenvironment: nonmarine
Kerogen: woody/coaly (C-A); amorphous (R-F), S/P (VA); biodegraded
terrestrial (VA)
Tetracolporites verrucosus (SP) (A)
Tricolpites gillii (SP) (R)
Tricolpites cf. confessus (SP) (R-F)
Proteacidites sp. S (SP) (F)
Proteacidites angulatus (SP) (F-C)
Australopollis obscurus (SP) (R-F)
Fern spores (SP) (R)
Ephedripites notensis (SP) (VR)

Lygistipollenites balmei (SP) (VR)
Phyllocladidites mawsonii (SP) (A)
Phyllocladidites microsaccatus (SP) (A)
Podosporites antarcticus (SP) (F)
Bisaccates (SP) (VA)

2549.8 Paleoenvironment: nonmarine
Kerogen: woody/coaly (VA); amorphous (R-F), S/P (VA); biodegraded terrestrial (A)
Nothofagidites spp. (SP) (R)
Nothofagidites cf. brachyspinulosus (SP) (R)
Nothofagidites endurus (SP) (R)
Tetracolporites verrucosus (SP) (F)
Tricolpites gillii (SP) (F)
Haloragacidites harrisii (SP) (R)
Proteacidites sp. S (SP) (F)
Proteacidites angulatus (SP) (F-C)
Stereisporites antiquasporites (SP) (R)
Stereisporites (Tripunctisporis) sp. (SP) (R)
Fern spores (SP) (R)
Phyllocladidites mawsonii (SP) (A)
Phyllocladidites microsaccatus (SP) (A)
Podosporites antarcticus (SP) (F)
Bisaccates (SP) (VA)

2559.5 Paleoenvironment: nonmarine
Kerogen: woody/coaly (VA); amorphous (R-F); biodegraded terrestrial (VA); S/P (VA)
Nothofagidites spp. (SP) (VR)
Tricolpites gillii (SP) (R-F)
Tricolpites cf. confessus (SP) (R)
Proteacidites sp. S (SP) (F-C)
Proteacidites angulatus (SP) (F-C)
Stereisporites antiquasporites (SP) (R)
Stereisporites (Tripunctisporis) (SP) (R-F, increase)
Stereisporites regium (SP) (R)
Fern spores (SP) (C)
Herkosporites elliottii (SP) (R)
Latrobosporites spp. (SP) (R)
Ephedripites spp. (SP) (VR)
Ephedripites notensis (SP) (R)
Phyllocladidites mawsonii (SP) (C)
Phyllocladidites microsaccatus (SP) (C)
?Lygistipollenites balmei (SP) (VR)
Lygistipollenites florinii (SP) (VR)
Bisaccates (SP) (VA)

2565.2 Paleoenvironment: nonmarine
Kerogen: woody/coaly (A); amorphous (R-F); biodegraded terrestrial (VA); S/P (VA)
Tricolpites gillii (SP) (F)
Tricolpites cf. confessus (SP) (R-F)
Proteacidites sp. S (SP) (F-C)
Proteacidites angulatus (SP) (R-F)
Stereisporites antiquasporites (SP) (R)
Stereisporites (Tripunctisporis) (SP) (R)
Stereisporites regium (SP) (R)

- Fern spores (SP) (R-F)
 Latrobosporites spp. (SP) (VR)
 Ephedripites spp. (SP) (VR)
 Phyllocladidites mawsonii (SP) (C)
 Phyllocladidites microsaccatus (SP) (C)
 ?Lygistipollenites balmei (SP) (VR)
 Bisaccates (SP) (VA)
- 2578 Paleoenvironment: nonmarine
 Kerogen: woody/coaly (C-A); amorphous (F); biodegraded terrestrial (VA); S/P (A)
 ?Algal cyst (R)
 Australopollis obscurus (SP) (F)
 Nothofagidites spp. (SP) (VR)
 Tetracolporites verrucosus (SP) (R)
 Tricolpites gillii (SP) (F)
 Tricolpites cf. confessus (SP) (R)
 Proteacidites sp. S (SP) (F)
 Proteacidites angulatus (SP) (R-F)
 Stereisorites antiquasporites (SP) (R)
 Fern spores (SP) (F)
 Herkosporites elliottii (SP) (R)
 Latrobosporites spp. (SP) (VR)
 Phyllocladidites mawsonii (SP) (R)
 Phyllocladidites microsaccatus (SP) (C)
 Bisaccates (SP) (A)
- 2585.3 Paleoenvironment: nonmarine
 Kerogen: woody/coaly (C-A); amorphous (F); biodegraded terrestrial (VA); S/P (A)
 ?Algal cyst (VR)
 Australopollis obscurus (SP) (R)
 Proteacidites sp. S (SP) (F)
 Proteacidites angulatus (SP) (R)
 Stereisorites antiquasporites (SP) (R)
 Fern spores (SP) (F)
 Phyllocladidites microsaccatus (SP) (F)
 Bisaccates (SP) (C)
- 2589.5 Paleoenvironment: nonmarine
 Kerogen: woody/coaly (C-A); amorphous (F); biodegraded terrestrial (VA); S/P (A)
 ?Algal cyst (VR)
 Australopollis obscurus (SP) (R)
 Tricolpites gillii (SP) (F)
 ?Tricolpites cf. confessus (SP) (VR)
 Proteacidites sp. S (SP) (F)
 Proteacidites angulatus (SP) (R)
 Fern spores (SP) (F)
 Phyllocladidites mawsonii (SP) (F)
 Phyllocladidites microsaccatus (SP) (F)
 Bisaccates (SP) (C)
- 2596.5 Paleoenvironment: nonmarine

Kerogen: woody/coaly (A); amorphous (F); biodegraded terrestrial (VA); S/P (R-F)
Nothofagidites endurus (SP) (VR)
Tetracolporites verrucosus (SP) (VR)
Tricolpites gillii (SP) (VR)
Fern spores (SP) (R)
Phyllocladidites mawsonii (SP) (R)
Bisaccates (SP) (F)

2598

Paleoenvironment: nonmarine to marginal marine
Kerogen: woody/coaly (VA); amorphous (R); biodegraded terrestrial (VA);
dinoflagellates S/P (F)
Microforam lining (F) (VR, ?reworked)
Spiniferites spp. (D) (VR)
Spinidinium-type (D) (VR)
Ovoidinium verrucosum (D) (R)
Nothofagidites spp. (SP) (F-R)
Nothofagidites endurus (SP) (R)
Polycolpites langstonii (SP) (VR)
Tricolpites gillii (SP) (R)
Tricolpites cf. confessus (SP) (VR)
Proteacidites sp. S (SP) (R)
Stereisporites antiquasporites (SP) (R)
Fern spores (SP) (R)
Phyllocladidites mawsonii (SP) (R)
Phyllocladidites microsaccatus (SP) (R)
Bisaccates (SP) (F)

2625.5

Paleoenvironment: nonmarine to ?marginal marine
Kerogen: woody/coaly (VA); amorphous (R); biodegraded terrestrial (VA); dinoflagellates (VR);
S/P (F)
Spinidinium-type (D) (VR)
Ovoidinium verrucosum (D) (VR)
Gambieria spp. (SP) (R)
?Algal cyst (VR)
Tetracolporites verrucosus (SP) (VR)
Tricolpites gillii (SP) (R)
Tricolpites cf. confessus (SP) (VR)
Proteacidites sp. S (SP) (F)
Stereisporites (Tripunctisporis) sp. (SP) (R)
Fern spores (SP) (R-F)
Phyllocladidites mawsonii (SP) (R)
Phyllocladidites microsaccatus (SP) (F)
Podosporites antarcticus (SP) (R)
Bisaccates (SP) (F)

2629

Paleoenvironment: marginal marine
Kerogen: woody/coaly (A); amorphous (C); biodegraded terrestrial (A);
dinoflagellates (R); S/P (F-C; very poor pres.)

Spiniferites spp. (D) (R)
Spinidinium-type (D) (VR)
?Cordosphaeridium gracilis (D) (R)
Hystrichosphaeridium/Oligosphaeridium spp. (D) (R)
Tricolpites gillii (SP) (R)
Proteacidites spp. (SP) (R-F)
Stereisporites antiquasporites (SP) (R)
Fern spores (SP) (F)
Phyllocladidites microsaccatus (SP) (R)
Bisaccates (SP) (F-C)

2645 Paleoenvironment: nonmarine to ?marginal marine
Kerogen: woody/coaly (A); amorphous (C-F); biodegraded terrestrial (A); dinoflagellates (VR);
S/P (F)

Tricolpites gillii (SP) (R)
Proteacidites spp. (SP) (R-F)
Stereisporites antiquasporites (SP) (R)
Stereisporites (Tripunctisporis) (SP)(R)
Fern spores (SP) (F)
Herkosporites elliottii (SP) (R)
Phyllocladidites microsaccatus (SP) (R)
Bisaccates (SP) (F-C)

2659 Paleoenvironment: marginal marine to marine
Kerogen: woody/coaly (VA); amorphous (R); biodegraded terrestrial (F);
dinoflagellates (F); S/P (F); pyrite (VA)

Spiniferites spp. (D) (VR)
Spinidinium-type (D) (VR)
Areoligera spp. (D) (F)
Glaphyrocysts sp. O (D) (F)
Deflandrea spp. (D) (VR)
Tricolpites gillii (SP) (VR)
Proteacidites spp. (SP) (F)
Stereisporites antiquasporites (SP) (R)
Stereisporites (Tripunctisporis) (SP) (R)
Fern spores (SP) (F)
Phyllocladidites mawsonii (SP) (R)
Phyllocladidites microsaccatus (SP) (R)
Bisaccates (SP) (F-C)

2675.6 Paleoenvironment: marginal to nonmarine
Kerogen: woody/coaly (VA); amorphous (C-F); biodegraded terrestrial (C);
dinoflagellates (C); S/P (C-A); pyrite (A-C)

Spiniferites spp. (D) (C)
Spinidinium-type (D) (VR)
Areoligera spp. (D) (F)
Glaphyrocysts sp. O (D) (C-A)
Glaphyrocysts cf. retiintexta (D) (F)
Paleocystodinium spp. (D) (VR)
Ovoidinium verrucosum (D) (VR)
Deflandrea spp. (D) (VR)

Tricolpites gillii (SP) (VR)
?Tricolpites cf. confessus (SP) (VR)
Proteacidites spp. (SP) (F)
Stereisporites antiquasporites (SP) (F)
Stereisporites (Tripunctisporis) (SP) (R)
Fern spores (SP) (F)
Herkosporites elliotii (SP) (VR)
Phyllocladidites microsaccatus (SP) (R)
Bisaccates (SP) (F-C)

- 2681.5 Paleoenvironment: nonmarine to marginal marine
Kerogen: woody/coaly (VA); amorphous (F-C); biodegraded terrestrial (R);
 dinoflagellates (VR); S/P (A)
?Cordosphaeridium gracilis (D) (VR)
Gambierina spp. (SP) (F; increase)
Gambierina rudata (SP) (F)
Gambierina edwardsii (SP)(R)
Nothofagidites spp. (SP) (VR)
Nothofagidites endurus (SP) (VR)
Tricolpites gillii (SP) (VR)
?Tricolpites cf. confessus (SP) (VR)
Proteacidites spp. (SP) (F)
Liliacidites cf. lanceolatus (SP) (R)
Stereisporites antiquasporites (SP) (F)
Fern spores (SP) (F)
Latrobosporites spp. (SP) (VR)
Latrobosporites ohaiensis (SP) (R)
Phyllocladidites mawsonii (SP) (R)
Phyllocladidites microsaccatus (SP) (R)
Bisaccates (SP) (F-C)
- 2685.5 Paleoenvironment: nonmarine
Kerogen: woody/coaly (VA); amorphous (VR); biodegraded terr. (R); S/P (C-A)
Gambierina spp. (SP) (R-F)
Gambierina rudata (SP) (R)
Gambierina edwardsii (SP) (R)
Tricolpites gillii (SP) (VR)
Proteacidites spp. (SP) (F)
Stereisporites antiquasporites (SP) (F)
Fern spores (SP) (F)
Herkosporites elliotii (SP) (R)
Phyllocladidites microsaccatus (SP) (R)
Bisaccates (SP) (R-F)
- 2695 Paleoenvironment: nonmarine
Kerogen: woody/coaly (A); amorphous (R); biodegraded terr. (C); S/P (A)
Gambierina spp. (SP) (C-A)
Gambierina rudata (SP) (F-C)
Gambierina edwardsii (SP) (R-F)
Australopollis obscurus (SP) (R)
Tricolpites gillii (SP) (VR)

?Tricolpites cf. confessus (SP) (VR)
Proteacidites spp. (SP) (F)
Liliacidites cf. lanceolatus (SP) (VR)
Stereisporites antiquasporites (SP) (F-C)
Stereisporites (Tripunctisporis) (SP) (R)
Fern spores (SP) (F)
Herkosporites cf. elliotii (SP) (VR)
Latrobosporites ohaiensis (SP) (R)
Phyllocladidites mawsonii (SP) (R)
Phyllocladidites microsaccatus (SP) (F)
Bisaccates (SP) (C)

2703 Paleoenvironment: marine to marginal marine
Kerogen: woody/coaly (A); amorphous (F); biodegraded terr. (C); S/P (VA);
 dinoflagellates (F-C); pyrite (C-A)
Spiniferites spp. (D) (A)
Paleocystodinium spp. (D) (R-F)
Deflandrea spp. (D) (F)
Alterbidinium spp (D) (F)
?Alterbidinium pentaradiatum ssp.preceum (D)
Grapnelispora evansii (SP)(R, pieces)
Gambierina spp. (SP)(C-F)
Gambierina rudata (SP)(F-C)
Gambierina edwardsii (SP)(R-F)
Nothofagidites spp. (SP)(VR)
Nothofagidites endurus (SP)(VR)
Tetracolporites verrucosus (SP)(VR)
Tricolpites gillii (SP)(F)
?Tricolpites cf. confessus (SP)(VR)
Tricolpites sp. L (SP)(VR)
?Tricolpites longus (SP)(VR)
Proteacidites spp. (SP)(F-C)
Proteacidites reticuloconcavus (SP)(R)
Stereisporites antiquasporites (SP) (F-C)
Stereisporites (Tripunctisporis) (SP)(R-F)
Fern spores (SP)(F)
Herkosporites elliotii (SP)(R)
Phyllocladidites mawsonii (SP) (R)
Phyllocladidites microsaccatus (SP)(F)
Podosporites antarcticus (SP) (R)
Bisaccates (SP)(C)

2708.5 Paleoenvironment: marine to marginal marine
Kerogen: woody/coaly (A); amorphous (A); biodegraded terr. (C); S/P (VA);
 dinoflagellates (C); pyrite (VA)
Spiniferites spp. (D) (A)
Paleocystodinium spp. (D) (R)
Paleocystodinium golzowense (D) (R)
Alterbidinium spp (D) (R-F)
?Alterbiadinium pentaradiatum ssp.preceum (D) (Paleocene) (R)
Gambierina spp. (SP) (F)

Gambierina rudata (SP) (F)
Gambierina edwardsii (SP)(R)
Tetracolporites verrucosus (SP) (VR)
Tricolpites gillii (SP) (F)
?Tricolpites cf. confessus (SP) (VR)
Tricolpites longus (SP) (R)
Proteacidites spp. (SP) (C)
Proteacidites otwayensis (SP)(R)
Stereisporites antiquasporites (SP) (F-C)
?Stereisporites (Tripunctisporis) (SP) (R)
Stereisporites regium (SP) (R)
Fern spores (SP) (F-C)
Herkosporites elliottii (SP) (R)
Latrobosporites spp. (SP) (VR)
Latrobosporites ohaiensis (SP) (R)
Phyllocladidites mawsonii (SP) (R)
Phyllocladidites microsaccatus (SP) (F)
Podosporites antarcticus (SP) (R)
Bisaccates (SP) (C)

2716.5

Paleoenvironment: nonmarine to ?marginal marine
Kerogen: woody/coaly (A); amorphous (A); biodegraded terr. (C); S/P (VA);
dinoflagellates (VR); pyrite (VA)
?Alterbiadinium pentaradiatum ssp.preceum (D) (Paleocene) (VR)
?Grapnelispora evansii (SP) (VR; pieces)
Gambierina spp. (SP) (C)
Gambierina rudata (SP) (F-C)
Gambierina edwardsii (SP)(R)
Tricolpites gillii (SP) (F)
Tricolpites longus (SP) (R)
Proteacidites spp. (SP)(C)
Proteacidites reticuloconcavus (SP)(R)
?Proteacidites otwayensis (SP) (R)
Stereisporites antiquasporites (SP)(C)
Stereisporites (Tripunctisporis) (SP)(R)
Stereisporites regium (SP)(R)
Fern spores (SP)(C)
Herkosporites elliottii (SP)(R)
Latrobosporites spp. (SP) (VR)
Latrobosporites ohaiensis (SP)(R)
Phyllocladidites mawsonii (SP)(R)
Phyllocladidites microsaccatus (SP)(F)
Podosporites antarcticus (SP)(R)
Bisaccates (SP)(C)

2721

Paleoenvironment: nonmarine to ?marginal marine
Kerogen: woody/coaly (VA); amorphous (VR); biodegraded terr. (R); S/P (F); dinoflagellates
(VR)
Gambierina spp. (SP)(R)
Gambierina rudata (SP)(R)
Tricolpites gillii (SP)(R)
Proteacidites spp. (SP)(F)
Fern spores (SP)(F)
Bisaccates (SP)(F)

- 2732.8 Paleoenvironment: marginal marine
 Kerogen: woody/coaly (VA); amorphous (F); biodegraded terr. (R); S/P (C);
 dinoflagellates (F-R), pyrite (A)
 Alterbidinium/Isabelidium/Mamumiella spp. (D) (F, broken)
 ?Alterbiadinium pentaradiatum ssp. preceum (D) (Paleocene) (VR; broken)
 Gambierina spp. (SP)(R)
 Gambierina rudata (SP)(R)
 Gambierina edwardsii (SP)(R)
 Tricolpites gillii (SP) (R)
 Proteacidites spp. (SP)(F)
 ?Proteacidites otwayensis (SP)(R)
 Stereisorites antiquasporites (SP)(C)
 Stereisorites (Tripunctisporis) (SP)(R)
 Stereisorites regium (SP)(R)
 Fern spores (SP) (F)
 ?Herkosporites elliottii (SP)(VR)
 Latrobosporites spp. (SP)(VR)
 Phyllocladidites microsaccatus (SP)(F)
 ?Lygistipollenites balmei (SP)(VR)
 Bisaccates (SP)(F)
- 2748.3 Paleoenvironment: nonmarine to ?marginal marine
 Kerogen: woody/coaly (VA); amorphous (R); biodegraded terr. (F); S/P (A);
 dinoflagellates (VR); pyrite (C)
 Alterbidinium-type (D) (VR, frag.)
 Gambierina spp. (SP)(C-A)
 Gambierina rudata (SP)(C)
 Gambierina edwardsii (SP)(R)
 ?Tricolpites cf. confessus (SP)(VR)
 Tricolpites longus (SP)(R)
 Tricolpites lilliei (SP)(R)
 Triporopollenites sectilis (SP)(R)
 Proteacidites spp. (SP)(F)
 Proteacidites cf. reticuloconcavus (SP)(VR; 40m)
 Proteacidites reticuloconcavus (SP)(VR)
 Stereisorites antiquasporites (SP)(F-C)
 Stereisorites (Tripunctisporis) (SP)(R-F)
 Stereisorites regium (SP)(R)
 Fern spores (SP)(F)
 Ceratosporites equalis (SP)
 Latrobosporites spp. (SP) (VR)
 Latrobosporites ohaiensis (SP)(R)
 Phyllocladidites mawsonii (SP)(R)
 Phyllocladidites microsaccatus (SP)(F)
 Podosporites antarcticus (SP)(R)
 Bisaccates (SP)(F)
- 2756.5 Paleoenvironment: nonmarine
 Kerogen: woody/coaly (A); amorphous (R); biodegraded terr. (VA); S/P (C); pyrite (C)
 Gambierina spp. (SP)(R-F)
 Gambierina rudata (SP)(R)
 Gambierina edwardsii (SP)(R)
 Tricolpites cf. confessus (SP)(VR)

Tricolpites gillii (SP) (R)
Proteacidites spp. (SP) (F)
Proteacidites reticuloconcavus (SP)(VR)
Stereisporites antiquasporites (SP) (F)
?Stereisporites (Tripunctisporis) (SP)(R)
Fern spores (SP)(F)
Latrobosporites spp. (SP)(VR)
Latrobosporites ohaiensis (SP)(R)
Bisaccates (SP)(F)