

BP CANADA

WELL EPHEsus F-94

OFFSHORE EASTERN CANADA

BIOSTRATIGRAPHY OF THE INTERVAL

2,210m – 5,065m (T.D.)

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1. INTRODUCTION

This report presents the results of micropalaeontological, nannopalaeontological and palynological analyses carried out on ditch cuttings samples over the interval 2,210m – 5,065m (T.D.) from the BP Canada Ephesus F-94, Orphan Basin well, offshore Eastern Canada.

Palaeodate Ltd. personnel and associates involved in this study were:

N. R. Ainsworth:	Micropalaeontology and all Lithology
N. Khanna:	Micropalaeontology
C. Newsam:	Nannopalaeontology
D. T. Stead:	Palynology

Analyses:

1. Lithology: on all samples studied for biostratigraphy.
2. Micropalaeontology: 147 ditch cuttings samples over the interval 2,220m – 5,065m (T.D.).
3. Nannopalaeontology: 147 ditch cuttings samples over the interval 2,210m – 5,057m.
3. Palynology: 147 ditch cuttings samples over the interval 2,210m – 5,057m.

Wireline logs, as supplied by the Client, have been used to interpret lithologies and lithostratigraphic boundaries.

All sample depths cited in this report are driller's depths.

2. BIOSTRATIGRAPHIC SUCCESSION (BASED ON PALAEONTOLOGICAL / SAMPLE CRITERIA)

<u>Sample / Sample Interval</u>	<u>Age</u>
2,210m – 2,560m (top not seen)	Pleistocene – Pliocene
2,570m – 3,200m	Late Miocene, Messinian – Tortonian
3,210m – 3,230m	Late Miocene, Tortonian
3,240m – 3,530m	Middle Miocene, Serravallian – ?Langhian
3,540m – 3,690m	Early Miocene, Burdigalian
3,700m – 3,840m	Early Miocene, Aquitanian
3,850m – 3,960m	Late Oligocene, Chattian
3,970m – 4,724m	Early Oligocene, Rupelian
4,733m? – 5,065m (T.D.)	Late Eocene, Priabonian

3. LITHOSTRATIGRAPHIC SUCCESSION **(BASED ON WIRELINE LOG CRITERIA)**

<u>Interval Top</u>	<u>Lithological Unit</u>
1,050m – 5,065m (T.D.) (top not seen)	Banquereau Formation
4,430m (log) – 4,728m (log)	“Ephesus Sand Member”
4,430m (log) – 4,690m (log)	“Main Sand Lobe”
4,703.25m (log) – 4,728m (log)	“Lower Sand Lobe”

4. **STRATIGRAPHY**

Lithostratigraphic terminology follows McIver (1972), Jansa & Wade (1975), McAlpine (1990) and internal nomenclature.

Chronostratigraphic terminology broadly follows Gradstein *et al.* (2020).

Micropalaeontology is based on Ascoli (1976, 1990), Gradstein *et al.* (1994) and unpublished personal observations.

Nannopalaeontology is based on Agnini *et al.*, (2014), Backman *et al.* (2012) and Martini (1971).

Palynology is based on palynostratigraphic data as presented by Manum *et al.* (1989), Powell (1992), Munsterman and Brinkhuis (2004), Schiøler (2005), Fensome *et al.* (2008, 2009, 2016), Dybkjær and Rasmussen (2007), Dybkjaer and Piasecki (2010), Sliwinska (2019) and unpublished personal observations.

The abbreviations FDO and LDO as used in the following text are:

FDO: First downhole (highest) occurrence

LDO: Last downhole (lowest) occurrence

HRA: High relative abundance

The Seismic Horizons for the Ephesus F-94 well have been provided by the Oil & Gas Corporation of Newfoundland and Labrador.

4.1 PLEISTOCENE – PLIOCENE

INTERVAL 2,210m – 2,560m: PLEISTOCENE – PLIOCENE (top not seen)

Interval age based on:

- the occurrences of moderately common *Coccolithus pelagicus*, in association with *Reticulofenestra haqii* and *R. pseudoumbilicus* (5-7µm), at 2,210m
- the occurrences of *Cassidulina laevigata*, *C. teretis*, common *Elphidium excavatum* and common *Melonis affinis* at 2,220m
- the FDO of *Neogloboquadrina pachyderma* (sinistral) at 2,240m
- the FDO of *Sphenolithus moriformis* at 2,270m
- the FDO of *Globigerina bulloides* at 2,280m
- the FDO of *Buccella frigida* at 2,400m
- the FDO's of *Elphidium ustulatum* and *Haynesina orbiculare* at 2,540m

Lithostratigraphy: Banquereau Formation (*pars*).

Palaeoenvironment: Marine, outer sublittoral.

Lithology: Claystone, dark greenish grey-dark greenish black, slightly micromicaceous, in part silty / sandy, non- to slightly calcareous, firm, subblocky, hydroclastic. Sand, clear, locally light grey, pale yellow, vfl-fU, locally mL, angular-rounded. Rare lithoclasts of hornblende or pyroxene, green-greenish black. Trace disseminated pyrite at c.2,440m.

Micropalaeontology: A two-fold subdivision is recognised:

2,220m – 2,540m: Pleistocene – Pliocene, on the occurrences of the calcareous benthic foraminifera *Cassidulina laevigata*, *C. teretis*, common *Elphidium excavatum* and common *Melonis affinis*, at 2,220m

Also present within this interval are the FDO's of *Neogloboquadrina pachyderma* (sinistral) (2,240m), *Globigerina bulloides* (2,280m), common *Cassidulina laevigata* (2,300m), *Buccella frigida* (2,400m), ?*Coscinodiscus* spp. (2,440m, definite 2,480m, common 2,520m), *Stellarima microtrias* (2,460m), *Elphidium ustulatum* (2,540m) and *Haynesina orbiculare* (2,540m).

The assemblages comprise rare to common calcareous benthic foraminifera, in association with very rare planktic taxa and rare diatoms. Diatoms have the FDO's at and below 2,440m.

2,560m: Age Indeterminate. No age diagnostic taxa recorded. Only pyritised burrow infill recovered.

Nannopalaeontology: A four-fold subdivision is recognised:

2,210m: Pleistocene or older; on the occurrences of moderately common *Coccolithus pelagicus*, in association with *Reticulofenestra haqii* and *R. pseudoumbilicus* (5-7µm).

Minor Cretaceous reworking is noted on the occurrence of *Watznaueria barnesiae* (2,210m).

2,230m – 2,250m: Age Indeterminate. No age diagnostic taxa recovered. Of note is the FDO of *Reticulofenestra perplexa* (2,250m).

A marked decrease in nannofossil recovery is noted between 2,210m and 2,230m. The assemblages are very poor.

2,270m – ?2,530m: Pliocene, Zanclean or older; on the FDO of *Sphenolithus moriformis* at 2,270m.

Other notable FDO's include *Sphenolithus abies?* (2,290m), *Reticulofenestra producta* (2,430m, frequent 2,490m), *R. cf. bisecta* (2,450m) and frequent *R. minuta* (2,490m).

Minor reworking is noted on the occurrences of *Cyclicargolithus floridanus* (small) (2,450m), *Nannoconus inornatus* (2,450m) and *Discoaster deflandrei* (2,490m).

Nannofossil recovery within this interval is generally very sparse. Slight increases in nannofossil recovery are noted at 2,450m and 2,490m. The sample at 2,310m is barren.

2,550m: Barren.

Palynology: 2,210m – 2,550m: Within range Pleistocene - Pliocene. No age diagnostic taxa recovered.

Notable occurrences within this interval include *Hystriochokolpoma rigaudiae* (2,210m), common *Operculodinium centrocarpum* (2,210m), very common *Spiniferites ramosus* grp. (2,210m), *Inaperturopollenites hiatus* (2,210m), common *Batiacasphaera sphaerica* (2,290m), *Achomosphaera ramulifera* (2,350m), *B. hirsuta* (2,350m), *Achomosphaera andalousiensis* (2,370m) and *Barssidinium* spp. (2,490m).

Common Tertiary and Late Cretaceous reworking is noted throughout this Quaternary - Neogene interval.

The palynomorph assemblages comprise moderate numbers of *in situ* dinocysts, in association with abundant miospores.

4.2 LATE MIOCENE

INTERVAL 2,570m – 3,200m: LATE MIOCENE, MESSINIAN – TORTONIAN

Interval top and age based on:

- the FDO of *Pentadinium taeniagerum* at 2,570m
- the FDO of *Invertocysta tabulata* at 2,610m
- the FDO of *Selenopemphix dianaecysta* at 2,650m
- the FDO of *Reticulosphaera actinocoronata* at 2,710m
- the FDO of *Sumatradinium soucouyanae* at 2,830m
- the FDO of *Impagidinium "granulatum"* at 2,850m
- the FDO of abundant specimens of *Cassidulina laevigata* at 2,880m
- the FDO of *Selenopemphix brevispinosa* at 2,950m
- the FDO of *Invertocysta tabulata* at 3,130m
- the FDO of *Neoglobobadrina pachyderma* (dextral) at 3,140m
- the FDO's of *Globigerina praebuloides*, *Neoglobobadrina atlantica* (dextral) and *N. continua* at 3,160m
- the FDO of *Trinovantedinium harpagonium* at 3,170m

Lithostratigraphy: Banquereau Formation (*pars*).

Seismic Horizon: C_10_Surface at 3164.09m.

Palaeoenvironment: Marine, outer sublittoral; poorly oxygenated at depth.

Lithology: Claystone, greenish grey-dark greenish black, slightly micromicaceous, in part silty / sandy, non-calcareous, firm-moderately well indurated, subblocky-blocky, hydroclastic. Sand, clear, locally light grey, pale yellow, vL-fU, locally mL, angular-rounded. Rare stringers of limestone, pale yellowish orange-greyish orange, light brown, mudstone, microcrystalline, indurated, angular. Trace disseminated pyrite between c.2,580m – c.2,660m and c.2,780m – c.3,060m, common at c.3,000m, and abundant between c.3,080m – c.3,200m.

Micropalaeontology: A seven-fold subdivision is recognised:

2,580m: Age Indeterminate. No age diagnostic taxa recovered. Only pyritised burrow infill recovered.

2,600m – 2,640m: Age Indeterminate. No age diagnostic taxa recovered. Very poor foraminiferal and diatom recovery.

2,660m – 2,860m: Age Indeterminate. No age diagnostic taxa recovered.

Of note are the FDO's of a pyritised ?*Cenosphaera* spp. (2,700m), *Neogloboquadrina* spp. (2,740m), *Hoeglundina elegans* (2,740m), *Islandiella islandica* (2,800m) and *Martinottiella communis* (2,800m).

Microfaunal recovery is very poor within this interval, with the assemblages dominated by pyritised burrow infill.

2,880m: No older than Late Miocene, Tortonian, on the FDO of abundant specimens of the calcareous benthic foraminifera *Cassidulina laevigata*.

2,900m – 3,040m: Age Indeterminate. No age diagnostic taxa recovered.

Of note are the FDO's of the diatoms *Coscinodiscus* sp. 25 (3,000m), common *C. radiatus* RRI (3,020m) and *Coscinodiscus* sp. 34 (3,040m).

Microfaunal recovery is poor within this interval, with the assemblages dominated by abundant to superabundant pyritised burrow infill.

3,060m – 3,120m: Age Indeterminate. No age diagnostic taxa recovered.

Of note are the FDO's of *Textularia decresens* (3,060m), major influxes of pyritised burrow infill (at and below 3,060m) and abundant pyritised ?*Cenosphaera* spp. (3,120m).

3,140m – 3,200m: No older than Late Miocene, Tortonian, on the FDO of *Neogloboquadrina pachyderma* (dextral) at 3,140m.

Support for an age no older than Late Miocene, Tortonian, is noted on the FDO's of *Globigerina praebulloides*, *Neogloboquadrina atlantica* (dextral) and *N. continua* at 3,160m.

Other notable FDO's include persistent *Coscinodiscus radiatus* RRI (3,160m) and *Globorotalia* spp. (3,200m).

Minor Tertiary reworking is noted on the occurrence of *Aulacodiscus alloergei* (3,180m).

Nannopalaeontology: 2,570m – 3,190m: Age Indeterminate. No age diagnostic taxa recovered. The samples mainly comprise very sparse non-diagnostic nannoflora or are locally barren.

Notable FDO's include *Reticulofenestra pseudoumbilicus* (7-14µm) (2,670m), common *Coccolithus pelagicus* (2,970m), *Pontosphaera discopora* (3,150m) and *P. multipora* (3,190m).

Minor reworking is noted on the occurrences of *Helenea chiastia* (2,910m), *Prinsius dimorphosus* (2,950m), *Watznaueria barnesiae* (3,010m) and *Reticulofenestra hillae* (3,190m).

Palynology: 2,570m – 3,190m: Late Miocene, Messian – Tortonian; on the FDO of the dinocyst *Pentadinium taeniagerum* at 2,570m.

Also present within this interval are *Invertocysta tabulata* (2,610m), *Nematosphaeropsis labyrinthea* (2,610m, common 3,050m), persistent *Sumatradinium* spp. (2,610m, common 2,670m), *Selenopemphix dianaecysta* (2,650m), *Reticulatosphaera actinocoronata* (2,710m), *Operculodinium giganteum* (2,790m), *S. hispidum* (2,830m), *S. soucouyanae* (2,830m), *Impagidinium "granulatum"* (2,850m), *S. brevispinosa* (2,950m), *Tuberculodinium vancampoe* (2,950m), *Achomosphaera ramulifera* (3,050m, common 3,070m), *Invertocysta lacrymosa* (3,050m), *Lingulodinium machaerophorum* (3,070m), abundant *Spiniferites ramosus* grp. (3,070m), *S. nephroides* (3,130m), *Reticulatosphaera actinocoronata* (3,150m) and *Trinovantedinium harpagonium* (3,170m).

At 3,030m a marked palynofacies change is noted, whereby a decrease in the amount of vitrinite and cuticle is noted compared to the overlying samples, together with an increase in the proportion of inertinite. This is only noted at this sample depth.

Common Tertiary and late Cretaceous reworking is noted throughout this Neogene interval.

The palynomorph assemblages are composed of moderate numbers of *in situ* dinocysts, in association with abundant miospores.

INTERVAL 3,210m – 3,230m: LATE MIOCENE, TORTONIAN

Interval top and age based on:

- the FDO of *Labyrinthodinium truncatum* at 3,210m

Lithostratigraphy: Banquereau Formation (*pars*).

Palaeoenvironment: Marine, outer sublittoral; poorly oxygenated at depth.

Lithology: Claystone, greenish grey-dark greenish black, slightly micromicaceous, in part silty / sandy, non-calcareous, firm-moderately well indurated, subblocky-blocky, hydroclastic. Abundant disseminated pyrite.

Micropalaeontology: 3,220m: Age Indeterminate. No age diagnostic taxa recovered.

Nannopalaeontology: A two-fold subdivision is recognised:

3,210m: Age Indeterminate. Very poor recovery, with no age diagnostic taxa recorded.

3,230m: Age Indeterminate. No age diagnostic taxa recovered.

Notable FDO's include moderately common *Coccolithus pelagicus* (large) and moderately abundant *Reticulofenestra producta*.

A marked increase in nannofossil recovery is noted between 3,210m and 3,230m.

Palynology: 3,210m – 3,230m: Late Miocene, intra-Tortonian; on the FDO of *Labyrinthodinium truncatum* at 3,210m.

Other notable occurrences include *Reticulatosphaera actinocoronata* (3,210m) and very common *Nematosphaeropsis labyrinthea* (3,230m).

Common Tertiary and Late Cretaceous reworking is noted throughout this interval.

A downsection increase in dinocyst abundance & diversity is noted at and below 3,210m.

4.3 MIDDLE MIOCENE

INTERVAL 3,240m – 3,530m: MIDDLE MIOCENE, SERRAVALLIAN – ?LANGHIAN

Interval top and age based on:

- the FDO's of *Globorotalia praescitula* and *Karreriella siphonella* at 3,240m
- the FDO's of *Palaeocystodinium golzowense* and *P. miocaenicum* at 3,270m
- the FDO's of *Globorotalia zealandica* at 3,260m
- the FDO of *Calcidiscus praemacintyreii* at 3,270m
- the FDO's of *Globigerina angustiumbilitata* and *G. ciperoensis* at 3,300m
- the FDO of *Unipontidinium aquaeductum* at 3,310m
- the FDO of *Cleistosphaeridium placacantha* at 3,410m

Lithostratigraphy: Banquereau Formation (*pars*).

Palaeoenvironment: Marine, outer sublittoral; in part poorly oxygenated at depth.

Lithology: Claystone, greenish grey-dark greenish black, slightly micromicaceous, non-calcareous, firm-moderately well indurated, subblocky-blocky, hydroclastic. Rare stringers of limestone, dark yellowish orange-greyish orange, mudstone, microcrystalline, indurated, angular. Common fine disseminated dark green glauconite between c.3,460m – c.3,480m, moderately abundant at c.3,500m and very abundant at c.3,520m. Abundant disseminated pyrite between c.3,240m – c.3,320m and between c.3,400m – c.3,500m, and common between c.3,040m – c.3,380m and at c.3,520m.

Micropalaeontology: A three-fold subdivision is recognised:

3,240m – 3,360m: Middle Miocene, no younger than Serravallian; on the FDO's of the planktic foraminifera *Globorotalia praescitula* and the agglutinating taxon *Karreriella siphonella* at 3,240m.

Other notable FDO's include *Bulimina aculeata* (3,240m), *Nodosaria longiscata* (3,240m, common 3,300m), common *Bathysiphon* spp. (3,240m), *Rhabdammina abyssorum* (3,240m), an influx of *Coscinodiscus radiatus* RRI (3,240m), *Coscinodiscus* sp. 54 (3,240m), abundant *Globigerina praebulloides* (3,260m), *Globorotalia zealandica* (3,260m), superabundant *Neogloboquadrina continua* (3,260m), *Bulimina elongata* (3,260m), *Cibicides lobatulus* (3,260m), *Cibicidoides dutemplei* (3,260m), *Pullenia quinqueloba* (3,260m), *Siphonina reticulata* (3,260m), *Sphaeroidina bulloides* (3,260m), *Ammodiscus* sp. A King (3,260m), *Martinottiella bradyana* (3,260m), *Cenodiscus* spp. (3,260m), *Cenosphaera* spp. (3,260m), *Cyclamina placenta* (3,280m), *Haplophragmoides* spp. (3,280m), common *Stellarima microtrias* (3,280m, superabundant 3,360m), *G. angustiumbilitata* (3,300m), *G. ciperoensis* (3,300m), *Valvulineria petrolei* (3,300m), superabundant *Cenodiscus* spp.

(3,300m), common *Cenosphaera* spp. (3,300m), echinoderm debris (3,300m), *Saccamina* spp. (3,320m), common *Stellarima* sp. 2414 (McNeill) (3,320m) and *Oridorsalis umbonatus* (3,360m).

A marked downsection increase in microfaunal recovery occurs between 3,220m and 3,240m, especially coinciding with the marked increases in the planktic and agglutinating foraminifera, plus the diatoms.

The caved occurrence (3,260m) of *Bolboforma metzmacheri* indicates the presence of Late – Middle Miocene, Tortonian – Langhian, sediments in the well section.

3,380m – 3,420m: Middle Miocene, no younger than Serravallian. A marked downsection decrease in microfaunal recovery occurs between 3,360m and 3,380m.

The assemblages are dominated by diatoms, but in smaller numbers than the overlying interval.

3,440m – 3,520m: Middle Miocene, no younger than Serravallian; on the occurrences of dominantly agglutinating foraminiferal assemblages at and below 3,440m.

Notable FDO's include *Glomospira charoides* (3,440m, common 3,520m), *Haplophragmoides kirki* (3,440m), *H. walteri* (3,440m), *Martinottiella bradyana* (3,440m, common 3,480m), common *Rhabdammina abyssorum* (3,440m, abundant 3,520m), *Globocassidulina subglobosa* (3,460m), persistent *Cyclammina placenta* (3,500m), common *Haplophragmoides* spp. (3,500m) and *Recurvoides* spp. (3,500m, common 3,520m), plus the re-appearance of a major influx of *Coscinodiscus radiatus* RRI (3,460m).

Minor reworking is noted on the occurrence of *Stensioeina beccariiformis* (3,480m).

Nannopalaeontology: A three-fold subdivision is recognised

3,250m – 3,370m: Age Indeterminate. No age diagnostic taxa recovered.

Of note is the FDO of *Cyclicargolithus floridanus* (small).

3,270m – 3,370m: Middle Miocene, Serravallian; on the FDO of *Calcidiscus praemacintyreii* at 3,270m.

Other notable FDO's include common *Coccolithus pelagicus* (3,270m), common *Reticulofenestra* cf. *bisecta* (3,270m), *R. minuta* (3,270m), *R. haqii* (3,270m), common *R. perplexa* (3,270m), common *R. producta* (3,270m), *R. pseudoumbilicus* (3,270m), *Discoaster deflandrei* (3,350m) and *Helicosphaera bipuncta* (3,370m).

A marked downsection decrease in nannofossil recovery occurs between 3,230m and 3,250m.

Minor reworking is noted on the occurrences of *Watznaueria barnesiae* (3,350m) and *Toweius pertusus* (3,370m).

3,390m – 3,530m: Age Indeterminate. Extremely poor recovery, with age diagnostic taxa recovered. Locally barren samples.

A reworked *Watznaueria barnesiae* occurs at 3,350m.

Palynology: A three-fold subdivision is recognised:

3,250m: Age Indeterminate. No age diagnostic taxa recovered.

3,270m – 3,290m: Middle Miocene, Serravallian; on the FDO's of the dinocysts *Palaeocystodinium golzowense* and *P. miocaenicum* at 3,270m.

3,310m – 3,530m: Middle Miocene, intra-Serravallian; on the FDO of the dinocyst *Unipontidinium aquaeductum* at 3,310m.

Other notable occurrences include *Cannosphaeropsis passeio* (3,310m), *Polysphaeridium zoharyi* (3,310m), *Minisphaeridium latirictum* (3,350m), abundant *Operculodinium centrocarpum* (3,370m), *Cleistosphaeridium placacantha* (3,410m, very common 3,470m), very common *Lingulodinium machaerophorum* (3,410m), common *Unipontidinium aquaeductum* (3,410m), *Pentadinium laticinctum imaginatum* (3,430m), *P. laticinctum laticinctum* (3,430m), very common *Spiniferites pseudofurcatus* (3,430m), *Tectatodinium pellitum* (3,430m), *Quadrina condita* (3,510m), *Distatodinium paradoxum* (3,530m) and *Hystriosphraeropsis obscura* (3,530m).

Common Tertiary and Late Cretaceous reworking is noted throughout this interval.

4.4 EARLY MIOCENE

INTERVAL 3,540m – 3,690m: EARLY MIOCENE, BURDIGALIAN

Interval top and age based on:

- the FDO's of *Trilobatus trilobus* and *Spirosigmoilinella compressa* at 3,540m
- the FDO of *Trochammina* sp. 1 Charnock & Jones at 3,560m
- the FDO of *Thalassiphora pelagica* at 3,590m
- the FDO of *in situ* *Cribroperidinium tenuitabulatum* at 3,610m
- the FDO's of *Exochosphaeridium insigne* and *Thalssiphora rota* at 3,630m
- the FDO of *Aulacodiscus singiliewskyanus* at 3,660m

Lithostratigraphy: Banquereau Formation (*pars*).

Palaeoenvironment: Marine, outer sublittoral; in part poorly oxygenated at depth.

Lithology: Claystone, dark grey-dark greenish black, slightly micromicaceous, non-calcareous, firm-moderately well indurated, subblocky-blocky, hydroclastic. Very rare stringers of limestone, moderate yellowish brown, mudstone, microcrystalline, indurated, angular. Common fine disseminated dark green glauconite at *c.*3,540m. Common disseminated pyrite between *c.*3,540m – *c.*3,620m, and abundant between *c.*3,640m – *c.*3,680m.

Micropalaeontology: 3,540m – 3,680m: Early Miocene, Burdigalian; on the FDO's of the planktic foraminifera *Trilobatus trilobus* and the agglutinating taxon *Spirosigmoilinella compressa* at 3,540m.

Also present within this interval are *Cystammina pauciloculata* (3,540m), common *Karreriella siphonella* (3,540m), superabundant *Rhabdammina abyssorum* (3,540m, superabundant 3,560m, influx 3,660m), *Gyroidina soldani* (3,560m), *Ammodiscus cretaceus* (3,560m), abundant *Bathysiphon* spp. (3,560m, superabundant 3,660m), common *Cyclammina placenta* (3,560m), *Rhabdammina* gr. *discreta* (3,560m), *Trochammina* sp. 1 Charnock & Jones (3,560m), abundant *Haplophragmoides* spp. (3,620m), abundant *Recurvoides* spp. (3,620m), superabundant *Coscinodiscus* spp. (3,640m), influx *S. microtrias* (3,640m), persistent *Stellarima* sp. 2414 (McNeill) (3,640m) and *Aulacodiscus singiliewskyanus* (3,660m).

The assemblages are dominated by agglutinating foraminifera, in association with large numbers of diatoms. Calcareous benthic foraminifera are very rare.

Nannopalaeontology: A three-fold subdivision is recognised

3,550m – 3,610m: Age Indeterminate. Samples are generally barren of nannofossils or yielding extremely poor recovery, with age diagnostic taxa recovered.

3,630m: Age Indeterminate. A slight increase in nannofossil recovery. No age diagnostic taxa recovered.

A reworked *Watznaueria barnesiae* is noted at this depth.

3,650m – 3,690m: Age Indeterminate. Generally very poor recovery, with no age diagnostic taxa recovered.

Notable FDO's include *Cyclicargolithus floridanus* (3,670m), persistent *Discoaster deflandrei* (3,670m) and persistent *Pontosphaera multipora* (3,690m).

A slight increase in nannofossil recovery is noted between 3,650m and 3,670m.

Palynology: A two-fold subdivision is recognised:

3,550m – 3,570m: Age Indeterminate. No age diagnostic taxa recovered.

Notable FDO's include *Distatodinium craterum* (3,550m), abundant *Apteodinium spiridoides* (3,570m), *Cousteaudinium aubryae* (3,570m) and *Heteraulacacysta campanula* (3,570m).

3,590m – 3,690m: Early Miocene, Burdigalian or older; on the FDO of the dinocyst *Thalassiphora pelagica* at 3,590m.

Also present within this interval are the FDO's of *in situ* *Cribroperidinium tenuitabulatum* (3,610m), *Exochosphaeridium insigne* (3,630m, very common 3,650m), *Thalssiphora rota* (3,630m), *Hystrichokolpoma salacium* (3,650m, common 3,670m), *H. truncatum* (3,650m), *in situ* *Cordosphaeridium cantharellum* (3,670m) and very common *Palaeocystodinium golzowense* (3,670m).

Frequent Late Cretaceous reworking is noted throughout this interval.

INTERVAL 3,700m – 3,840m: EARLY MIOCENE, AQUITANIAN

Interval top and age based on:

- the FDO of *Aulacodiscus aemulans* at 3,700m
- the crossover between *Helicosphaera carteri* / *H. euphratis* at 3,750m

- the FDO's of *Caligodinium amiculum* and *in situ Hystrichokolpoma cinctum* at 3,750m
- the FDO of *Homotryblium floripes* at 3,790m
- the FDO of *Chiropteridium galea* grp. at 3,830m

Lithostratigraphy: Banquereau Formation (*pars*).

Palaeoenvironment: Marine, outer sublittoral; in part poorly oxygenated at depth.

Lithology: Claystone, dark grey-dark greenish black, slightly micromicaceous, non-calcareous, firm-moderately well indurated, subblocky-blocky, hydroclastic. Rare stringers of limestone, moderate yellowish brown, mudstone, microcrystalline, indurated, angular. Common fine disseminated dark green glauconite at *c.*3,800m, and rare between *c.*3,820m – *c.*3,840m. Abundant disseminated pyrite between *c.*3,700m – *c.*3,720m, and common between *c.*3,740m – *c.*3,840m.

Micropalaeontology: A two-fold subdivision is recognised:

3,700m: Early Miocene, Aquitanian; on the FDO of the diatom *Aulacodiscus aemulans*.

The microfaunal assemblage is dominated by profuse numbers of agglutinating foraminifera, in association with abundant diatoms.

3,720m – 3,840m: Age Indeterminate. No age diagnostic taxa recovered.

Of note are the FDO's of an influx of *Stellarima* sp. 2414 (McNeill) (3,720m), common *Cystamina pauciloculata* (3,760m), superabundant *Recurvoides* spp. (3,780m) and *Spiroplectamina* spp. (3,780m), plus the re-appearance of an influx of *S. microtrias* (3,720m).

Minor reworking is noted on the occurrence of *Adercotryma glomeratum* (3,760m)

The microfaunal assemblages are dominated by large numbers of agglutinating foraminifera, in association with pulses of diatoms.

Nannopalaeontology: A four-fold subdivision is recognised:

3,710m – 3,730m: Age Indeterminate. No age diagnostic taxa recovered.

3,750m: Early Miocene, Aquitanian; on the crossover between *Helicosphaera carteri* / *H. euphratis*, in association with the FDO of moderately common *Cyclicargolithus floridanus*.

Recovery within this interval is generally sparse.

3,770m: Age Indeterminate. Extremely poor recovery, with no age diagnostic taxa recovered.

3,790m – 3,830m: Barren.

Palynology: A two-fold subdivision is recognised:

3,750m – 3,770m: Early Miocene, Aquitanian; on the FDO's of the dinocysts *Caligodinium amiculum* and *in situ Hystrichokolpoma cinctum* at 3,750m.

Also present within this interval is the FDO of *Distatodinium tenerum* (3,770m).

3,790m – 3,830m: Early Miocene, early Aquitanian; on the FDO of the dinocyst *Homotryblum floripes* at 3,790m.

Other notable FDO's include *Distatodinium "trabeculum"* (3,790m), abundant *Homotryblum floripes* (3,810m), common *H. tenuispinosum* (3,810m) and *Chiropteridium galea* grp. (3,830m).

4.5 LATE OLIGOCENE

INTERVAL 3,850m – 3,960m: LATE OLIGOCENE, CHATTIAN

Interval top and age based on:

- the FDO of *Dinopterygium cladoides sensu* Morgenroth at 3,850m
- the FDO's of *Ammodiscus* sp. B King and superabundant *Aulacodiscus insignis* var. *quadrata* at 3,860m
- the FDO of *Pentadinium lophophorum* at 3,890m
- the persistent occurrence of *Cyclicargolithus abisectus*, in association with the FDO's of *Reticulofenestra bisecta* and *R. stavensis*, at 3,910m
- the FDO's of *Chiasmolithus altus* and *Zygrhablithus bijugatus* at 3,950m
- the FDO of *Phthanoperidinium amoenum* and *Svalbardella damassaei* at 3,950m

Lithostratigraphy: Banquereau Formation (*pars*).

Palaeoenvironment: Marine, outer sublittoral – upper bathyal.

Lithology: Claystone, dark grey-dark greenish black, slightly micromicaceous, rare carbonaceous specks, non-calcareous, firm-moderately well indurated, subblocky-blocky, hydroclastic. Rare fine disseminated dark green glauconite at *c.*3,860m, very common between *c.*3,880m – *c.*3,920m, plus influxes between *c.*3,940m – *c.*3,960m. Common disseminated pyrite.

Micropalaeontology: A three-fold subdivision is recognised:

3,860m – 3,960m: Late Oligocene, Chattian; on the FDO's of the agglutinating foraminifera *Ammodiscus* sp. B King, in association with superabundant specimens of the diatom *Aulacodiscus insignis* var. *quadrata* at 3,860m.

Also present within this interval are the FDO's of common *Aulacodiscus alloergei* (3,860m), common *Coscinodiscus* sp. 15 RRI (3,860m) and *Nodosaria soluta* (3,960m), plus the re-appearances of abundant *Coscinodiscus radiatus* RRI (3,860m), abundant *Stellarima microtrias* (3,860m), plus the base abundant *Aulacodiscus insignis* var. *quadrata* (3,880m, LDO at 3,960m).

The microfaunal assemblages comprise large numbers of both agglutinating foraminifera and pyritised diatoms. Calcareous benthic foraminifera are extremely rare.

Nannopalaeontology: A three-fold subdivision is recognised:

3,850m – 3,870m: Age Indeterminate. No age diagnostic taxa recovered. A marked downsection increase in nannofossil recovery occurs between 3,830m and 3,850m.

Of note is the FDO of *Reticulofenestra dictyoda* (5-7 μ m) at 3,850m.

3,890m: Age Indeterminate. Extremely poor nannofossil recovery, with no age diagnostic taxa recorded.

3,910m – 3,950m: Late Oligocene, Chattian; on the persistent occurrence of *Cyclicargolithus abisectus*, in association with the FDO's of *Reticulofenestra bisecta* and *R. stavensis*, at 3,910m.

Other notable FDO's include *Reticulofenestra filewiczii* (3,910m), *R. lockeri* (3,910m), *Chiasmolithus altus* (3,950m), *R. macmillani* (3,950m), *Sphenolithus predistentus?* (3,950m) and *Zygrhablithus bijugatus* (3,950m).

A marked downsection increase in nannofossil recovery occurs between 3,890m and 3,910m.

Palynology: A two-fold subdivision is recognised:

3,850m – 3,930m: Late Oligocene, Chattian; on the FDO of the dinocyst *Dinopterygium cladoides sensu* Morgenroth at 3,850m

Also present within this interval are the FDO's of *Chiropteridium* spp. (3,870m, common 3,910m), *Deflandrea phosphoritica* (3,870m), *Pentadinium lophophorum* (3,890m) and *Membranophoridium aspinatum* (3,910m).

3,950m: Late Oligocene, early Chattian; on the FDO's of the dinocysts *Phthanoperidinium amoenum* and *Svalbardella damassaei*.

These taxa occur in association with the FDO of very common *Cordosphaeridium cantharellum*.

Frequent Late Cretaceous reworking is noted throughout this interval.

4.6 EARLY OLIGOCENE

INTERVAL 3,970m – 4,724m: EARLY OLIGOCENE, RUPELIAN

Interval top and age based on:

- the FDO's of common *Chiropteridium galea* grp., *Dapsilidium simplex* and *Licracysta semicirculata* at 3,970m
- the FDO's of *Catapsydrax unicavus* and *Karrieriella conversa* at 4,000m
- the FDO's of *Subbotina angioporoides* and *?Eratidus foliaceus* at 4,020m
- the FDO of *Wetzelilla gochtii* at 4,030m
- the FDO of *Trochamminopsis challengerii* at 4,040m
- the FDO of *Globorotalia opima nana* at 4,080m
- the FDO of definite *Eratidus foliaceus* at 4,100m
- the FDO of *Phthanoperidinium amoenum* at 4,110m
- the FDO of definite *Sphenolithus predistentus* at 4,130m
- the FDO of *Subbotina utilisindex* at 4,160m
- the FDO of *Chiasmolithus oamaruensis* at 4,250m
- the FDO's of *Achomosphaera alcornu*, *Enneadocysta pectiniformis* and *Spiniferites cornutus* at 4,250m
- the FDO of *Phthanoperidinium comatum* at 4,270m
- the FDO's of *Isthmolithus recurvus*, *Lanternithus minutus?* and *Reticulofenestrata umbilicus* at 4,330m
- the FDO of definite *Lanternithus minutus* at 4,350m
- the FDO of *Rhombodinium draco* at 4,679m

Lithostratigraphy: Banquereau Formation (*pars*)

4,430m (log) – 4,728m (log): “Ephesus Sand Fan”

4,430m (log) – 4,690m (log): “Main Sand Fan”

4,703.25m (log) – 4,728m (log): “Lower Sand Fan”.

Seismic Horizon: C_24_Surface at 4192.62m.

TopFan_Surface at 4632.88m.

Palaeoenvironment: Marine, outer sublittoral – upper bathyal. Sands (4,430m log) – 4,728m log) emplaced by mass gravity flow (turbidity and contourite currents) mechanisms.

Lithology: 3,970m – 4,430m (log): Claystone, medium dark grey-dark grey, slightly micromicaceous, locally silty, rare carbonaceous specks, non-calcareous, firm-moderately well indurated, subblocky-blocky, hydroclastic. Rare stringers of limestone, greyish orange-light brown, pale yellowish brown,

mudstone, microcrystalline, indurated, angular. Rare silty sandstone, very pale orange, silt-fL, well sorted, subangular-subrounded, friable, non-calcareous, at and below c.4,320m. Common fine disseminated dark green glauconite at c.3,980m. Common disseminated pyrite between c.3,980m – c.4,100m and c.4,200m – c.4,220m, abundant to very abundant between c.4,120m – c.4,180m and c.4,240m – c.4,420m.

4,430m (log) – 4,690m (log): Sand, clear, rarely very pale orange, white, rose pink, vFL-fU, locally mL-vcU, subangular-rounded, locally angular, generally well sorted, grading to silty sand or silt. Beds of claystone, medium dark grey-dark grey, slightly micromicaceous, locally silty, non-calcareous, firm-moderately well indurated, subblocky-blocky, hydroclastic, grading to siltstone.

4,690m (log) – 4,703.25m (log): Claystone, dark grey-greyish black, slightly micromicaceous, locally silty, non-calcareous, firm-moderately well indurated, subblocky-blocky, hydroclastic.

4,703.25m (log) – 4,728m (log): Sand, clear-light grey, vFL-fU, subangular-rounded, well sorted, grading to silty sand or silt. Claystone, dark grey-greyish black, slightly micromicaceous, locally silty, non-calcareous, firm-moderately well indurated, subblocky-blocky, hydroclastic.

Micropalaeontology: A three-fold subdivision is recognised:

3,980m: No age diagnostic taxa recovered.

Of note is the caved occurrence of the planktic foraminifera *Globigerina connecta*, in association with the FDO of common specimens of the agglutinating taxon *Ammodiscus cretaceus*.

4,000m – 4,418m: Early Oligocene, Rupelian, on FDO's of the planktic foraminifera *Catapsydrax unicavus* and the agglutinating taxon *Karreriella conversa* at 4,000m.

Other notable FDO's include *Subbotina angiporoides* (4,020m, common 4,100m, superabundant 4,160m, influx 4,200m), *?Eratidus foliaceus* (4,020m, definite 4,100m), common *Karreriella conversa* (4,000m), *Trochamminopsis challengerii* (4,040m), *Globorotalia opima nana* (4,080m, common 4,100m, abundant 4,340m), common *Subbotina* spp. (4,080m), common *Nodosaria soluta* (4,100m), *N. spinescens* (4,100m), *S. utilisindex* (4,160m, influx 4,200m), *G. gordialis* (2,030m), *Trifarina gracilis* (4,180m), abundant *Ammodiscus cretaceus* (4,180m), abundant *Cystamina pauciloculata* (4,180m), *Trochamminopsis pseudovesicularis* (4,180m), superabundant *Globigerina praebulloides* (4,200m), *Pullenia bulloides* (4,200m), *Valvulineria petrolei* (4,200m), common *G. praebulloides* (4,240m), *?Globorotaloides variabilis* (4,280m), *Aulacodiscus hirtus* (4,300m), *Chiloguembelina* spp. (4,400m) and persistent *Catapsydrax unicavus* (4,400m), plus the re-appearances of common *Stellarima*

microtrias (4,080m, abundant 4,100m, influx 4,300m), abundant *Coscinodiscus radiatus* RRI (4,300m) and *Globigerina angustiumbilitata* (4,340m).

The foraminiferal assemblages are dominated by the agglutinating taxa, in association with smaller numbers of both calcareous benthic taxa and planktic forms. Diatoms are present throughout the interval. Both planktic foraminifera and diatoms often occur as discrete pulses throughout this section.

4,436m – 4,724m: Age Indeterminate. A marked downsection decrease in microfaunal recovery occurs between 4,418m and 4,724m. Barren to extremely poor microfaunal recovery within this interval.

Nannopalaeontology: A five-fold subdivision is recognised:

3,970m – 4,110m: Within range Late – Early Oligocene, Chattian – Rupelian. No age diagnostic taxa recovered.

Notable FDO's include *Clausicoccus subdistichus*? (3,970m), abundant *Coccolithus pelagicus* (3,970m), moderately abundant *Cyclicargolithus abisectus* (3,970m), common *C. floridanus* (3,970m), moderately abundant *Discoaster nodifer* (3,970m), frequent *Pontosphaera enormis* (3,970m), *P. multipora* (3,970m), moderately abundant *Reticulofenestra dictyoda* (3,970m), *R. filewiczii* (3,970m), moderately abundant *R. haqii* (3,970m), moderately abundant *R. lockeri* (3,970m), moderately abundant *R. minuta* (3,970m, frequent 4,090m), moderately abundant *R. stavensis* (3,970m), common *R. bisecta* (3,990m), *Chiasmolithus nitidus* (small) (4,030m), *P. alta* (4,030m), *R. hillae* (4,030m), *R. onusta* (4,030m), *Helicosphaera recta* (4,050m) and *D. tanii*? (4,090m, definite 4,110m).

4,130m – 4,310m: No younger than intra-Late Oligocene, intra-Chattian; on the FDO of *Sphenolithus predistentus* at 4,130m.

Also present within this interval are the FDO's of *Sphenolithus tribulosus* (4,150m), *Helicosphaera compacta* (4,170m), *Clausicoccus subdistichus* (4,190m), *Pontosphaera punctosa* (4,190m), *S. radians* (4,190m), *Braarudosphaera bigelowii* (4,250m), common *Chiasmolithus altus* (4,250m), *C. oamaruensis* (4,250m), *H. seminulum* (4,250m) and *P. pectinata* (4,250m).

Marked decreases in nannofossil recovery are noted at both 4,230m and 4,290m.

4,330m – 4,409m: Early Oligocene, early Rupelian; on the FDO's *Isthmolithus recurvus*, *Lanternithus minutus*? and *Reticulofenestra umbilicus* at 4,330m.

Other notable FDO's include *Helicosphaera bramlettei* (4,350m), definite *Lanternithus minutus* (4,350m), rare *Clausicoccus subdistichus* (4,409m) and common *Isthmolithus recurvus* (4,409m).

4,427m – 4,679m: Early Oligocene, early Rupelian. A marked downsection decrease in nannofossil recovery occurs between 4,409m and 4,427m, with the incoming of the main “Ephesus Sand”. Recovery is generally very poor throughout this arenaceous sequence.

Of note are the FDO’s of *Pontosphaera obliquipons* (4,427m) and frequent *Clausicoccus subdistichus* (4,589m).

Minor Cretaceous reworking is noted on the occurrences of *Nannoconus kamptneri kamptneri* (4,445m) and *Watznaueria barnesiae* (4,517m).

4,697m – 4,715m: Early Oligocene, early Rupelian. A marked downsection increase in nannofossil recovery occurs between 4,679m and 4,697m.

Of note is the presence of persistent *Reticulofenestra wadeae* (4,715m).

Palynology: A four-fold subdivision is recognised:

3,970m – 4,230m: Early Oligocene, Rupelian; on the FDO’s of the dinocysts common *Chiropteridium galea* grp., *Dapsilidinium simplex* and *Licracysta semicirculata* at 3,970m

Other notable FDO’s include very common *Deflandrea phosphoritica* (3,970m), very common *Svalbardella damassaei* (3,970m), *Deflandrea* sp. B Powell (3,990m), common *Licracysta semicirculata* (3,990m very common 4,210m), very common *Chiropteridium galea* grp. (4,030m), very common *Chiropteridium* spp. (4,030m, abundant 4,130m), abundant *Palaeocystodinium golzowense* (4,030m), *Wetzeliiella gochti* (4,030m), abundant *Cordosphaeridium cantharellum* (4,050m), *W. symmetrica* (4,070m), *D. heterophlycta* (4,110m) and *Distatodinium biffii* (4,150m).

4,250m – 4,436m: Early Oligocene, early Rupelian; on the FDO’s of the dinocysts *Achomosphaera allicornu*, *Enneadocysta pectiniformis* and *Spiniferites cornutus* at 4,250m.

Also present with this interval are common *Dapsilidinium simplex* (4,250m), *Svalbardella cooksoniae* (4,250m), *Phthanoperidinium comatum* (4,270m), abundant *Spiniferites pseudofurcatus* (4,310m), very common *Deflandrea leptodermata* (4,330m), *S. manumii* (4,330m), *Distatodinium ellipticum* (4,370m) and *Lentinia serrata* (4,370m).

4,445m – 4,661m: Early Oligocene, early Rupelian. A marked downsection decrease in palynomorph recovery occurs between 4,436m and 4,445m.

The assemblages are dominated by bisaccate pollen, in association with rare dinocysts. Palynomorph recovery diminishes further at and below 4,625m.

4,679m – 4,715m: Early Oligocene, early Rupelian, on the FDO of the dinocyst *Rhombodinium draco* at 4,679m.

A marked downsection increase in palynomorph recovery occurs between 4,661m and 4,679m, with a further increase in recovery at and below 4,697m.

Rare Paleocene and Late Cretaceous reworking are noted throughout this interval.

Stratigraphic Comments: The thick sand package between 4,430m (log) – 4,728m (log) comprises the deep-water emplaced “Ephesus Sand Fan”. Prior to drilling of this prospect, it had been described as the Cape Freels Fan (Beaubouef *et al.*, 2019; Donnelly *et al.*, 2019), and was only later described by Henry *et al.* (2024) as the Ephesus Fan.

4,430m (log) – 4,690m (log): “Main Sand Fan”

4,703.25m (log) – 4,728m (log): “Lower Sand Fan”.

4.7 LATE EOCENE

INTERVAL 4,733m? – 5,065m (T.D.): LATE EOCENE, PRIABONIAN

Interval top and age based on:

- the FDO of *Coccolithus formosus?* at 4,733m
- the FDO's of *Parasubbotina varianta* and *Subbotina ?eocaena* at 4,742m
- the FDO's of definite *Coccolithus formosus* and *Reticulofenestra reticulata* at 4,751m
- the FDO's of definite *Subbotina eocaena* and *S. corpulenta* at 4,760m
- the FDO of *Phthanoperidinium levimurum* at 4,859m
- the FDO of *Phthanoperidinium stockmansii* at 4,877m
- the FDO of *?Turborotalia ampliapertura* at 4,940m
- the FDO of *Globigerinatheka index* at 5,065m
- the LDO of persistent of *Isthmolithus recurves* at 4,931m
- the LDO of *Isthmolithus recurvus* at 5,003m,
- the FDO of *Neococcolithes dubius* at 5,021m
- the FDO of *Schematophora speciosa* at 5,021m

Lithostratigraphy: Banquereau Formation (*pars*).

Seismic Horizon: C_45_Surface at 4936.55m.

Palaeoenvironment: Marine, upper bathyal.

Lithology: 4,728m (log) – 5,065m (log): Claystone, dark grey-greyish black, earthy, slightly micromicaceous, locally silty, rare carbonaceous specks, non- to slightly calcareous, firm-moderately well indurated, subblocky-blocky, hydroclastic. Stringers of limestone, light olive grey, greyish orange, pale yellowish brown, dark yellowish orange, microcrystalline, mudstone, moderately well indurated, subangular, grading to dolomitic limestone. Common disseminated pyrite between c.4,796m – c.4,886m, and abundant between c.4,904m – c.5,065m.

Micropalaeontology: 4,742m – 5,065m (T.D.): Late Eocene, Priabonian; on the FDO's of the planktic foraminifera common *Catapsydrax unicavus*, rare *Parasubbotina varianta* and *Subbotina ?eocaena*, at 4,742m.

Also present within this interval are the FDO's of common *Catapsydrax unicavus* (4,760m), common *Parasubbotina varianta* (4,760m), definite *Subbotina eocaena* (4,760m, superabundant 5,012m), *S. corpulenta* (4,760m), *Glomospira irregularis* (4,814m), an influx of *Aulacodiscus* spp. (4,904m), *?Turborotalia ampliapertura* (4,940m) and *Globigerinatheka index* (5,065m), plus the re-appearances

of *Haplophragmoides walteri* (4,796m), common *Karreriella conversa* (4,796m) and an influx of *Stellarima microtrias* (4,904m),

Minor reworking is noted on the occurrences of *Spiroplectamina spectabilis perplexa* (4,796m) and pyritised *Rhaxella perforata* (4,886m)

The assemblages are dominated by agglutinating and planktic foraminifera, in association with subsidiary calcareous benthic taxa and diatoms

Nannopalaontology: A two-fold subdivision is recognised:

4,733m: ?Late Eocene, ?Priabonian; on the FDO's of a tentative specimen of *Coccolithus formosus*, in association with *Pontosphaera exilis*.

4,751m – 5,003m: Late Eocene, intra-Priabonian; on the FDO's of definite *Coccolithus formosus*, in association with *Reticulofenestra reticulata*, at 4,751m.

Other notable FDO's include *Blackites deflandrei* (4,769m), *Pontosphaera pulcheroides* (4,769m), *P. versa* (4,787m), *B. friedrichii* (4,805m), *Sphenolithus acervus* (4,805m), *B. spinosus* (4,823m), common *Reticulofenestra reticulata* (4,823m), *Umbilicosphaera bramlettei* (4,823m), *Neococcolithes dubius?* (4,841m), *R. erbae* (4,913m), *R. westerholdii* (4,931m), *Calcidiscus bicircus* (5,003m) and *Chiasmolithus eoaltus* (5,003m).

A downsection decrease in *Isthmolithus recurvus* is noted at 4,931m, while its LDO is noted at 5,003m.

Minor reworking is noted on the occurrences of *Coccolithus bownii* (4,859m), *Prediscosphaera cretacea* (4,895m) and *Kamptnerius magnificus* (4,931m).

5,021m – 5,057m: Late Eocene, intra-Priabonian; on the FDO of *Neococcolithes dubius* at 5,021m.

Also present within this interval are *Daktylethra unitatis* (5,039m), *Clausicoccus fenestratus* (5,057m) and *D. punctulata* (5,057m).

Palynology: A two-fold subdivision is recognised:

4,733m – 5,003m: Age Indeterminate. No age diagnostic taxa recovered. The palynomorph assemblages are essentially similar in composition to those described from the overlying interval.

Of note are the FDO's of *Samlandia chlamydophora* (4,841m), *Cordosphaeridium exilimurum* (4,859m), *Phthanoperidinium levimurum* (4,859m), *P. stockmansii* (4,877m) and *Enneadocysta arcuata* (4,967m).

5,021m – 5,057m: Late Eocene, Priabonian; on the FDO of the dinocysts *Glaphyrocysta intricata* and *Schematophora speciosa* at 5,021m.

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