APPENDIX III

BIOSTRATIGRAPHY OF WELL 31/2-2 (NORSKE SHELL)

by

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E. Noordermeer-Perrijn
B. Prins

(SIPM, EP/12)

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1. INTRODUCTION

At request of Norske Shell, SIPM (EP/12.1) carried out a biostratigraphic study of the sedimentary sequence penetrated by well 31/2-2.

Previous experience in Mesozoic-Cenozoic stratigraphy of the general North Sea region suggested the following approach to this study :

a)	Tertiary	:	microfaunal analyses
b)	Cretaceous	:	calcareous nannoplankton investigations, supplemented by palynological work on the Lower Cretaceous, and
c)	Jurassic-Triassic	:	study of palynomorphs

Some overlap of investigations occurred across the boundaries of the major systems, e.g. microfaunal and nannoplankton studies on the basal Tertiary and higher Cretaceous strata.

The major objective of this well was the Jurassic sequence. For the Tertiary the main interest was on establishing the most important time-stratigraphic boundaries. Therefore, only ditch cuttings were available down to 1179 m, whilst SWS and cores in addition to cutting samples were recovered from 1185.5 m down to T.D.

The microfaunal and palynological data are recorded on separate distribution charts (encls. 1,2); the nannoplankton work is documented on text-figure 1.

The biostratigraphic results can be summarized as follows (not adjusted to wireline log readings) :

540 - 600 m : Miocene and/or younger
640 - 880 m : Oligocene
890 - 1217.5 m : Eocene
1224.9 - 1377 m : Paleocene
1379.6 m : Early-Middle Turonian
1381.0 - 1393.4 m : Early Turonian
1396.0 - 1421.9 m : Late Cenomanian
1427.6 - 1430.9 m : Late Albian
1434.0 - 1438.0 m : Hauterivian
1439.9 - 1446.5 m : Middle-Late Valanginian
1449.1 - 1454.9 m : (? Early) Valanginian
1458.5 - 1467 m : Early Valanginian
1470 m : Indeterminable
1472 m : Berriasian-Early Valanginian
1474 - 1489.5 m : Berriasian
1493.5 m : Portlandian-Berriasian
1495.5 - 1515.12 m : Portlandian
1521.07 - 1562.95 m : Kimmeridgian
1566.75 m : Indeterminable
1569 - 1600 m : Late Oxfordian
1604.24 - 1626.76 m : Early Oxfordian
1633.55 - 1649 m : Indeterminable
1657.5 - 1784 m : Middle Callovian
1793 m : Indeterminable
1812.5 - 1845.1 m : Late Bathonian-Early Callovian
1862 - 1982.5 m : Middle Bathonian
1998 - 2019 m : Indeterminable
2036 - 2140 m : Toarcian
2159 - 2181.5 m : Late Pliensbachian
2224.5 - 2340 m : (Early?) Pliensbachian
2351 - 2387 m : Hettangian-Sinemurian
2389 - 2571.5 m : Indeterminable

2. MICROFAUNA

2.1. General

The microfaunal studies concentrated on establishing the major age subdivision of the Tertiary interval. Consequently, the 14 sidewall cores and 47 cutting samples, selected for investigation, were primarily checked on marker types and no detailed studies were undertaken. Hence, the data plotted on the microfaunal distribution chart (encl. 1) do not represent the full picture of the faunal assemblages but only marker types and commonly occurring species.

The depths quoted in this chapter are sample depth figures, no adjustements to wireline log depths have been attempted. Especially in cases where only cutting samples were available, discrepancies may be inavoidable.

2.2. Miocene and/or younger (540-600 m)

The encountered assemblages consist essentially of species known from younger Tertiary-Quaternary strata, e.g.

Bulimina marginata D'ORBIGNY
Cibicides grossa TEN DAM & REINHOLD
Elphidiella hannai (CUSHMAN & GRANT)

Species restricted to the Miocene were not encountered. Therefore, only an age indication as Miocene and/or younger is possible. However, the occurrence of Elphidiella hannai in only sample 540 m could indicate that the Miocene/Pliocene boundary lies at about that level.

Depositional environment : The relatively poor benthonic fauna (consisting of calcareous types) and the scattered occurrences of single planktonics is considered indicative for an open-marine, inner neritic environment.

2.3. Oligocene (640-880 m)

This interval is characterized by poor to very poor assemblages, composed of (scarce) calcareous benthonic foraminifera, radiolarians, sponge spicules and echinoid remains.

The boundaries of this interval are defined by the highest occurrence of Turrilina alsatica ANDREAE (640 m) and the supposed top of Eocene strata (890 m) - see below.

Depositional environment : Based on the very scanty microfaunal information a general setting of open marine, shallow shelf is envisaged. Some samples were barren of foraminifera but showed relatively high amounts of lignite, thus possibly indicative for coastal influences.

2.4. Eocene (890-1217.5 m)

The top of this interval, at 890 m, is defined by a drastic change in the composition of the faunal assemblages, as well as in preservation (colour change).

The upper section (890-950 m) shows an occurrence of white-coloured, arenaceous types, such as Bathysiphon, Cyclammina placenta (REUSS) and Recurvoides obsoletum (GOËS) in association with abundant radiolarians.

The middle part (960-1120 m) yielded relatively rich and diversified arenaceous assemblages. In addition to the already mentioned types also species as Cyclammina challinori HAYNES and C. amplectens GRZYBOWSKI are characteristic, together with the important markers Dorothia eocenica (CUSHMAN) and Textularia plummerae LALICKER, as well as Ammodiscus. The occurrence of pink sedimentary particles in cutting samples of 1100-1130 m togehter with Globigerina triloculinoides PLUMMER is considered significant as a similar phenomenon was observed in well 31/2-1 at the depth of 1170-1180 m.

The lowermost part of the Eocene interval (1130-1217.5 m) is characterized by the dominance of radiolarians and pyritized diatoms, such as

Coscinodiscus sp. 1 BETTENSTAEDT
C. sp. 2 BETTENSTAEDT
Triceratium sp. 1 BETTENSTAEDT

together with small numbers of arenaceous foraminifera.

Depositional environment : Outer neritic-bathyal.

2.5. Paleocene (1224.9 - 1377 m)

The Paleocene-Eocene boundary is taken to be located between SWS 1217.5 m (deepest occurrence of tuffaceous lithologies) and SWS 1224.9 m. The latter sample is devoid of microfaunal elements, a common feature for the topmost Paleocene strata in the general North Sea region.

The samples of the next interval (1233.5-1377 m) contain the following Paleocene marker species :

Rzehakina minima CUSHMAN & RENZ
Saccammina rhumbleri (FRANKE)
Trochammina ruthven-murrayi CUSHMAN & RENZ

The major part of the foraminiferal fauna, however, consists of arenaceous types also occurring in the overlying Eocene interval, e.g.

Spiroplectammina spectabilis (GRZYBOWSKI)
Glomospira charoides (JONES & PARKER)
Haplophragmoides kirki WICKENDEN
Cyclammina chalinori HAYNES

Conspicuous is the green colour of parts of the faunas in the higher part of this section, a phenomenon regionally known to be characteristic for younger Paleocene deposits.

From 1284.3 m downwards very coarse-grained Bathysiphon specimens were encountered.

Cutting sample 1371 m yielded, amongst others, Ceratobulimina tuberculata BROTZEN, indicative for Lower Paleocene.

SWS 1372 m and cutting sample 1377 m yielded Lower Tertiary faunas, but on log evidence the Paleocene-Cretaceous boundary is located at 1374 m.

Depositional environment : Outer neritic-bathyal.

2.6. Cretaceous (1383-1398 m (deepest sample examined))

The sidewall samples taken at 1379.6, 1381.7 and 1384.4 m contained only a few undiagnostic arenaceous foraminifera. On the other hand, the cutting samples 1383, 1389, 1395 and 1398 m yielded, apart from rich Paleocene faunas, also some Upper Cretaceous types, as

Guembelina globulosa (EHRENBERG)
Hedbergella debrioensis (CARSEY)
H. planispira (TAPPAN)
H. ? hoelzli (HAGN & ZEIL)

indicative for a Cenomanian-Turonian age.

SWS 1388.9 m yielded a mainly benthonic fauna with as the most important components :

Planularia bradyana (CHAPMAN)
Textularia bettenstaedti BARTENSTEIN & OERTLI
Verneuilinoides subfiliformis BARTENSTEIN
Trochammina concava CHAPMAN

and only a few specimens of Praeglobotruncana.

Based on the above fauna, an Albian-Cenomanian age is concluded. This evidence is contradictory to the available nannoplankton data, which conclude a Turonian age. The last dating is preferred as most ranges of Cretaceous benthonic foraminifera are, as yet, not well established for the northern North Sea region.

SWS 1396 and 1398 m are characterized by a fauna entirely composed of planktonic foraminifera, e.g.

Globigerinoides alvarezi (ETERNOD OLVERA)
Hedbergella simplex (MORROW)
H. debrioensis (CARSEY)

indicative for a Late Albian-Coniacian age.

Depositional environment : Open marine, outer neritic-bathyal.

3. CALCAREOUS NANNOPLANKTON

3.1. General

The investigation of the nannofloras in well 31/2-2 was confined to the interval 1180.5-1501.5 m, mainly representing the Cretaceous interval. A total of 53 sidewall cores have been prepared and analysed.

The species composition of the Cretaceous nannofloras differs considerably from other localities reported in literature and/or known from own investigations. However, a detailed biostratigraphic subdivision could be obtained by the application of evolutionary trends in a few groups of nannoplankton, in combination with rare occurrences of important marker species. This enabled the recognition of several gaps of differing magnitude, indicating the following Cretaceous intervals as absent : Barremian-Lower/Middle Albian, Early-Middle Cenomanian, Late Turonian-Maastrichtian.

As in the previous chapter, quoted depth figures are sample depths. No adjustments to wireline log depths have been introduced.

3.2. Early Tertiary (1180.5-1372.0 m)

All investigated samples were devoid of nannofossils. This interval may represent the (? decalcified) Middle/Late Paleocene-Eocene shales, widely distributed in the North Sea Basin.

No indications have been found for the presence of Early Paleocene (Danian) deposits.

3.3. Turonian (1379.6-1393.4 m)

1379.6-1393.4 m : Early to Middle Turonian, zone NK 11.

The presence of seven and eight rayed specimens in the Eprolithus lineage, the fairly large size and frequent occurrence of Prediscosphaera intercisa, the decreasing number of P. ponticula, the absence of P. columnata and Podorhabdus albianus indicate this interval as not older than Turonian. Furthermore, the presence in all samples of Zeugrhabdotus thetha (a species becoming extinct halfway the Turonian) restrict the age of this interval to Early to Middle Turonian, zone NK 11.

3.4. Cenomanian (1396.0-1421.9 m)

1396.0-1421.9 m : Late Cenomanian, zone NK 10.

The age-diagnostic criteria are the co-occurrences of Podorhabdus albianus, Lithraphidites acutum, Prediscosphaera columnata and large specimens of P. intercisa.

The rather sudden change in the floral composition of the Eprolithus and Prediscosphaera lineages between the lowest Turonian sample at 1393.4 and the highest Cenomanian sample at 1396.0 m points to a small hiatus, which may coincide with a distinct change in log expression at around 1395 m.

3.5. Albian (1427.6-1430.9 m)

1427.6-1428.8 m : Late Albian, subzone NK 9a.

This age determination is based on the co-occurrence of Nannofossil sp. 138, Rucinolithus irregularis and Eiffellithus turriseiffeli.

A distinct hiatus exists between the Late Cenomanian sample at 1421.9 m and the highest Albian sample at 1427.6 m, the two subzones NK 9b and 9c being absent. The extent of the hiatus is demonstrated by a marked difference in the Prediscosphaera assemblages above and below the hiatus, which might be located at 1424 m where a distinct change in log expression occurs.

1430.9 m : Albian ?, zones NK 8 - NK 9a ?.

The very poor preservation of the nannoflora in this sample does not allow a more precise age determination. The presence of a few specimens of Prediscosphaera columnata may indicate this sample not being older than Early Albian, subzone NK 8a. However, their presence may also be explained by mud penetration into the sidewall core, a phenomenon regularly observed in the samples from this well.

Note : The three Albian sidewall cores of this well consisted lithologically of various parts with markedly different colours. From the sample at 1427.6 m several chips with different colours have been prepared separately, but the nannofloras of all chips were found to be identical.

3.6. Hauterivian (1434.0-1438.0 m)

1434.0-1438.0 m : Huaterivian, zone NK 4.

The presence of Tegumentum striatum suggests a Hauterivian age for this interval. The absence of Palaeopontosphaera salebrosa in the upper two sidewall cores at 1434.0 and 1435.5 m and its common occurrence at 1438.0 m may indicate that the upper two samples belong to the upper part of zone NK 4 and the lower sample to the lower part of this zone.

3.7. Valanginian (1439.9-1454.9 m)

1439.9-1446.5 m : Middle to Late Valanginian, zone NK 3.

The age of these samples has been based on the presence of the very distinct species Micrantholithus speetonensis.

1449.1-1454.9 m : (Early ?) Valanginian, zone NK 2 upper - NK 3.

The presence of several specimens of Nannoconus bermudezii in both samples indicates this interval not being older than Valanginian. The complete absence of Micrantholithus or allied genera in these (and two deeper samples) suggests that the absence of M. speetonensis may also be explained by unfavourable environmental conditions. Therefore, a Middle to Late Valanginian age for these two samples is not excluded.

3.8. Berriasian-Valanginian (1457.5-1474.0 m)

1457.5 m : Late Berriasian to Valanginian, zones NK 2-3.

Although this sample contains a rich and diversified nannoflora, no zonal indicators could be found, even after detailed analysis of the flora. Therefore, only an age-range can be given based on the ages of over- and underlying samples.

1458.5-1470.0 m : Late Berriasian to Early Valanginian, zone NK 2

The age of this interval has been based on the presence of Brachyolithus quadratus and the allied Nannofossil sp. B.

1472.0-1474.0 m : Early Berriasian to Early Valanginian, zones NK1-2.

The nannoflora is badly preserved and poor in species, the prevailing type being Watznaueria barnesae. Its presence, combined with the absence of Ellipsagelosphaera suggests these samples to be not older than Berriasian.

3.9. Berriasian and/or older (1482,0-1493,5 m)

The majority of the ten samples, covering the section of 1479.0-1501.5 m, did not contain any nannofossils. Only 3 samples, between 1482.0 and 1493.5 m, yielded a few to rare specimens of Ellipsagelosphaera indicative for an age range of Bajocian-Early Berriasian.

4. PALYNOLOGY

4.1. General

A total of 99 samples have been examined, viz. 19 core samples, 78 sidewall cores and 2 cutting samples. All samples have been prepared following the standard preparation method, consisting of treatment with HCl and HF, followed by a heavy liquid separation (zincbromide with S.G. of 2.2). The organic residue was finally sieved through microsieves of 15 microns, to concentrate palynomorphs in general, and of 30 microns to concentrate dinocysts. Especially in the Jurassic interval, the organic residues received an oxidation by means of cold HNO_3, prior to sieving, in order to gain a further concentration of dinocysts.

For the major part of the Jurassic sequence only dinocysts have been recorded. General evidence has shown this group to be far more suitable for a subdivision of the Middle-Upper Jurassic than sporomorphs, provided marine strata are investigated. However, the often sandy development of these beds influenced dinocysts recoveries unfavourably. In the Pliensbachian-uppermost Triassic interval, dinocyst diversities decrease drastically, in general agreement with the known evolutionary development of the group. Therefore, selected sporomorphs were applied for a further subdivision of this part of the drilled sequence, starting from the top occurrence of the dinocyst species Nannoceratopsis gracilis.

The relative frequencies of the determined palynomorphs have been recorded on a distribution chart (encl. 2). A number of samples appear to yield fair amounts of palynomorphs obviously derived from caved material or mud infiltration.

Throughout the studied section the sporomorph colour was estimated as "upper light", corresponding to a FCC of less than approximately 69. The quoted depths are sample depths, no adjustments to wireline log depths have been attempted.

4.2. Cenomanian-Early Turonian (1381-1421.9 m)

Four sidewall cores were examined. These yielded rich and well-preserved dinocyst assemblages with a number of significant species, e.g.

Palaeohystrichophora infusorioides (Late Albian to Campanian)
Odontochitina costata (id.)
Phoberocysta ceratioides (id.)
Xiphophoridium alatum (Late Albian to Early Turonian)
Cyclonephelium hughesii (id.)
Cometodinium obscurum (Albian to Early Turonian)
Microdinium irregulare (Cenomanian to Maastrichtian)
Exochosphaeridium striolatum (Cenomanian and younger)

4.3. Late Albian-Cenomanian (1430.9 m)

One sidewall core yielded a few dinocysts only, with

Palaeohystrichophora infusorioides (Late Albian to Campanian).

4.4. Valanginian-Cenomanian (1435.5-1454.9 m)

From this interval six sidewall cores and one cutting sample were examined. Five samples proved to be barren of palynomorphs. The cutting sample, at 1440 m, yielded only Tertiary palynomorphs derived from mud contamination. One SWS, at 1446.5 m, contained, in addition to several obviously allochthonous palynomorphs, a few specimens of dinocysts which could well be autochthonous, viz.

Pareodinia ceratophora (top occurrence in Barremian)
Exochosphaeridium striolatum (base in Cenomanian)

As the co-occurrence of these species is conflicting, no conclusion on the age of this sample can be made.

4.5. Valanginian (1461.5-1467 m)

Two sidewall cores yielded a very rich, well-preserved Valanginian dinocyst flora with as typical species :

Heslertonia heslertonense (base in Valanginian)
Pseudoceratium pelliferum subsp. solocispinum (id.)
Muderongia simplex, circumvate variety (id.)
Achomosphaera neptuni (id.)
Occisucysta tentoria (id.)
Trichodinium ciliatum (acme in Valanginian)
Speetonia delicatula (Valanginian)
Endoscrinium pharo (top in Valanginian)
Occisucysta evittii (Berriasian to Valanginian)

4.6. Indeterminable (1470 m)

A cutting sample from 1470 m yielded only Tertiary palynomorphs, obviously derived from mud contamination, and the Berriasian to Valanginian age is based on the ages of over- and underlying samples.

4.7. Berriasian (1474-1489.5 m)

Three sidewall cores yielded rich and well-preserved dinocyst assemblages of Berriasian age, based on co-occurrence of :

Occisucysta evittii (Berriasian to Valanginian)
Gonyaulacysta sp. A DAVEY (top in Berriasian)
"Escharisphaeridia ryazanica" manuscript name (= Canningia sp.1) (typical acme in Berriasian)
Parvocavatus spinosus (Portlandian to Berriasian)
Tanyosphaeridium sp. 1 (top in Berriasian)
Tubotuberella apatela (top regular occurrence in Berriasian)
Hystrichogonyaulax sp. 2 (id.)
"Cordosphaeridium daveyi" manuscript name (= Kleithriasphaeridium sp. A DAVEY) (top in Berriasian)
Systematophora cf. complicata (id.)
Leptodinium eumorphum (id.)

4.8. Portlandian (1495.5-1515.12 m)

From this interval, three SWS and one core sample have been studied. These yielded rich dinocyst assemblages with :

Millioudodinium mamilliferum (base occurrence in Portlandian)
Pareodinia dasyforma (id.)
Parvocavatus spinosus (id.)
Hystrichodinium pulchrum (base regular occurrence in Portlandian)
Glossodinium dimorphum (Kimmeridgian to Portlandian)
Hystrichogonyaulax sp. 1 (typical acme in Portlandian)

4.9. Kimmeridgian (1521.07-1562.95 m)

Two SWS and 8 cores were examined. Below 1535 m a low diversity and qualitatively poor dinocyst flora is common.

A Kimmeridgian age was concluded on :

Hystrichogonyaulax cladophora (top(regular) occurrence in Kimmeridgian)
Muderongia simplex - cornucavate variety (id.)
Sentusidinium rioultii (id.)
Leptodinium mirabile (id.)
Cassiculosphaeridia sp. 1 (base (regular) occurrence in Kimmeridgian)
Systematophora cf. complicata (id.)
Glossodinium dimorphum (id.)
Senoniasphaera jurassica (id.)
Cyclonephelium distinctum (id.)
Hystrichodinium pulchrum (id.)
Acanthaulax sp. A IOANNIDES et al. (id.)

A core sample, at 1521.07 m, contains also a high number of

Gonyaulacysta longicornis s.s. (common and typical in Kimmeridgian)

4.10. Indeterminable (1566.75 m)

One core sample, at 1566.75 m, proved to be barren of palynomorphs, and the Oxfordian-Kimmeridgian age is inferred from the ages of the over- and underlying samples.

4.11. Oxfordian (1569-1626.76 m)

A total of 8 core samples and 1 cutting sample have been examined. One core sample, at 1574.80 m, was barren of autochthonous dinocysts but contained numerous Tertiary and Late Cretaceous palynomorphs derived from mud infiltration into the core.

An Oxfordian age was concluded on :

Nov. gen. G sp. 1 (top and base occurrence in Oxfordian, very rare in Callovian)
Endoscrinium galeritum (top in Oxfordian)
Adnatoshaeridium aemulum (id.)
Stephanelytron (id.)
Gonyaulacysta jurassica subsp. longicornis (id.)
G. areolata (id.)
Leptodinium mirabile (base in Oxfordian)
Scriniodinium crystallinum (acme in Oxfordian)
Prolixosphaeridium capitatum (id.)

The inverval can be subdivided into :

Late Oxfordian (1569 -1600 m)
Early Oxfordian (1604.24-1626.76 m)

based on the absence and presence of Gonyaulacysta areolata, respectively.

4.12. Indeterminable (1633.55-1649 m)

One core sample, at 1633.55 m, proved to be barren of dinocysts. A sidewall core, at 1649 m, yielded a dinocyst assemblage which was too poor for age determination.

The Callovian-Early Oxfordian age could only be inferred from the stratigraphic position of the interval.

4.13. Middle Callovian (1657.5-1784 m)

Fourteen sidewall cores have been examined. These yielded rather poor to moderately rich dinocyst assemblages, in which the presence of the following species is significant :

Hystrichogonyaulax pectinigera (Middle Bathonian to Middle Callovian)
Gonyaulacysta jurassica (Latest Bathonian to Kimmeridgian)
Lithodinia jurassica (Middle to Late Callovian)
"Lithodinia suturocomplexa" manuscript name (= L. sp. 1) (Early to Middle Callovian)
Ctenidodinium ornatum (Callovian to Oxfordian)
Sentusidinium rioultii (base regular occurrence in Callovian)
Hystrichogonyaulax sp. 5 (Middle Bathonian to Middle Callovian)

4.14. Indeterminable (1793 m)

This sidewall sample contains a poor dinocyst flora, and the Callovian age is inferred.

4.15. Late Bathonian-Early Callovian (1812.5-1845.1 m)

Seven sidewall cores yielded moderately rich dinocyst assemblages. The age determination is based on the presence of

Hystrichogonyaulax pectinigera (id.) (Middle Bathonian-Middle Callovian)
Emmetrocysta sp. nov. (Late Bathonian to Early Callovian)
cf. Lunatadinium sp. 1 (Bathonian to Callovian)
Lithodinia sp. 6 (Bathonian to Callovian)
Lithodinia sp.10 (so far only found in Late Bathonian to Early Callovian strata)

4.16. Middle Bathonian (1862-1982.5 m)

Seven sidewall samples have been analysed. The age is based on significant species such as

Hystrichogonyaulax sp. 5 (Middle Bathonian to Early Callovian)
Lunatadinium sp. 1 (Middle Bathonian to Middle Callovian)
Ctenidodinium sp. 1 (so far found only in Middle Bathonian)

and scattered occurrences of

Hystrichogonyaulax sp. 6 (so far found only in Middle Bathonian)
Pareodinia sp. 2 (id.)
Pareodinia sp. 4 (id.)

The sidewall core at 1982.5 m yielded very poor dinocyst assemblage. The presence of

Hystrichogonyaulax cladophora (base in Middle Bathonian)

is indicative for an age not older than Middle Bathonian, and the sample is included in this interval.

4.17. Indeterminable (1998-2019 m)

The sidewall cores at 1998 m and 2019 m proved to be barren of dinocysts, and the Toarcian to Middle Bathonian age has been inferred from the over- and underlying samples.

4.18. Toarcian (2036-2140 m)

Five sidewall cores were examined. These yielded relatively rich palynomorph assemblages, dominated by saccate sporomorphs and the dinocyst species Nannoceratopsis gracilis ("teardrop" variety). Significant sporomorph types are :

Klukisporites variegatus (base in Toarcian)
Chasmatosporites magnolioides (acme in Toarcian)
Cerebropollenites macroverrucosus (base in Sinemurian)

The consistent absence of the otherwise omnipresent sporomorph group of Callialasporites may suggest that only Early Toarcian is represented.

4.19. Late Pliensbachian (2159.0-2181.5 m)

Three sidewall cores from this interval yielded rich sporomorph assemblages. The presence in sidewall core 2181.5 m of

Nannoceratopsis gracilis (base in Late Pliensbachian)

suggests that the age of this interval is not older than Late Pliensbachian.

4.20. (Early ?)Pliensbachian (2224.5-2340.0 m)

Six sidewall cores from this interval have been examined. They yielded rich sporomorph assemblages, in which

Chasmatosporites thiergarti

shows a distinct acme throughout the interval, which is diagnostic for a Pliensbachian age.

Based on the consistent absence of

Nannoceratopsis gracilis (base in Late Pliensbachian)

the age of this interval may be limited to Early Pliensbachian.

4.21. Hettangian-Sinemurian (2351.0-2387.0 m)

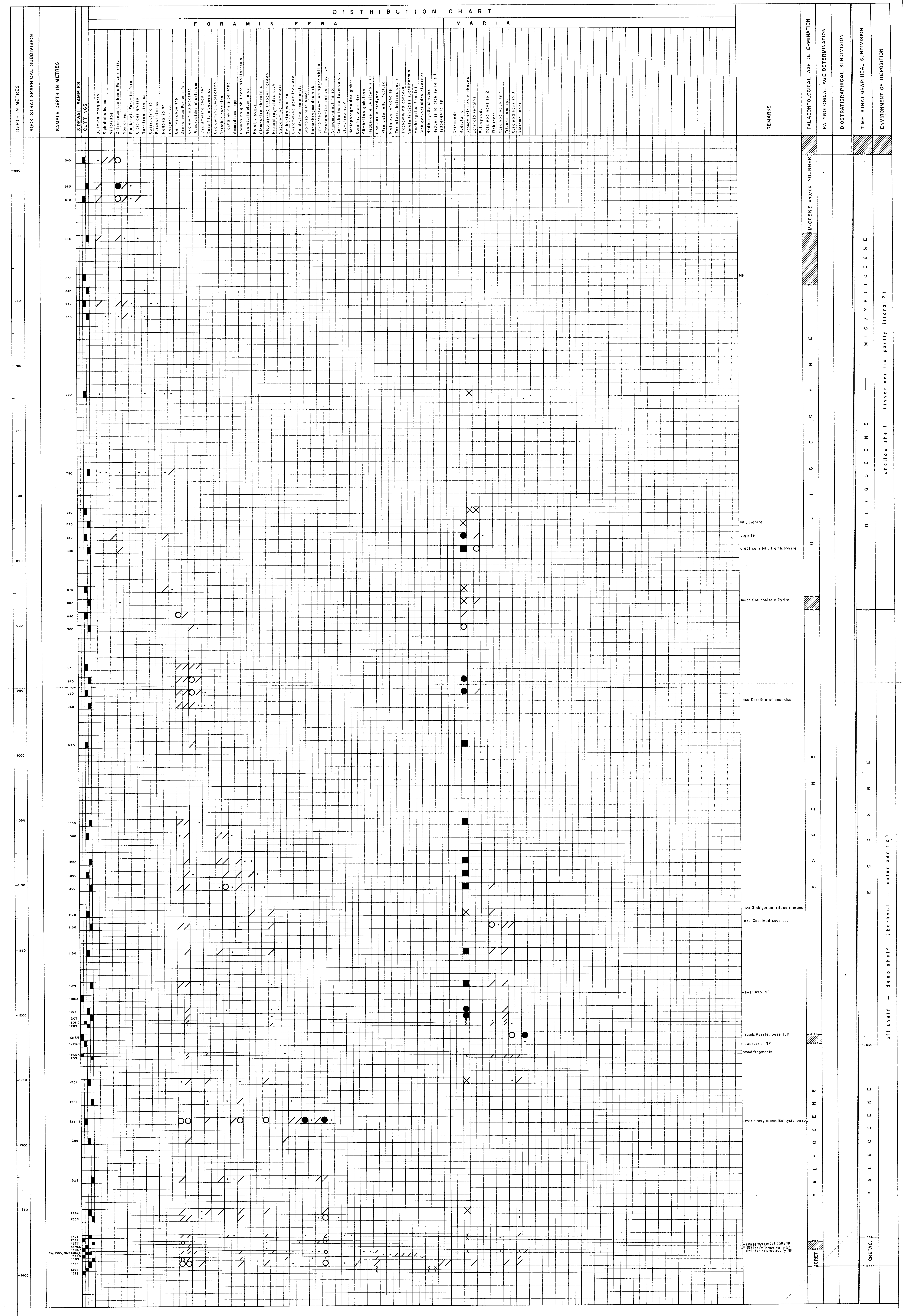
Two sidewall cores in this interval yielded only a rather poor sporomorph assemblage, with rare occurrence of

Cerebropollenites mesozoicus (base regular occurrence in Sinemurian)
Quadraeculina anellaeformis (Rhaetian to Lower Jurassic)
Chasmatosporites magnolioides (Early to Middle Jurassic)

Based mainly on the absence of pre-Hettangian markers, as well as of absence of Pliensbachian elements, a Hettangian to Sinemurian age has been inferred to these two samples.

4.22. Indeterminable (2389.0-2571.5 m)

Eleven sidewall cores in this interval have been examined. They were all devoid of palynomorphs.



NOTE: only marker types and common species are plotted.

LEGEND

- • single occurrence
- / 2-5 specimens
- ○ 6-20 "
- ● 21-100 "
- ■ >100 "
- ✕ quantity not specified

SHELL INTERNATIONALE PETROLEUM MAATSCHAPPIJ N.V.		
THE HAGUE	EXPLORATION & PRODUCTION	
NORWAY OFFSHORE MICROFAUNAL DISTRIBUTION CHART NORSKE SHELL WELL 31/2-2 INTERVAL 540 m – 1398 m Scale 1:1000		
Author E. Noordermeer	Date July 1980	
Appendix III Well Résumé 31/2-2	Encl. 1	Draw. No. G.66227/1

CALCAREOUS
NANNOPLANKTON
NORWAY
WELL 31/2-2

DEPTH IN METRES	STAGE	NANNOPLANKTON ZONE	SIDEWALL SAMPLES	Ellipsagelosphaera sp.	Watznaueria barnesae	Palaeopontosphaera salebrosa	Brachyolithus quadratus	Nannofossil sp. B	Micrantholithus hoschulzii	Braarudosphaera "discula"	Cruciellipsis cuvillieri	Micrantholithus obtusus	Nannoconus bermudezii	Nannoconus globulus	Nannoconus spp.	Micrantholithus speetonensis	Tegumentum striatum	Prediscosphaera columnata	Eprolithus 9-rays	Zeugrhabdotus thetha	Eiffellithus turriseiffeli s.l.	Rucinolithus irregularis	Nannofossil sp. 138	Podorhabdus albianus	Prediscosphaera ponticula	Prediscosphaera intercisa small	Cruciellipsis chiastia	Lithraphidites acutum	Eprolithus apertior, side view	Eprolithus floralis, side view	Prediscosphaera intercisa large	Microrhabdulus decoratus	Ahmuellerella octoradiata	Eprolithus "constrictus", side view	Eprolithus 8-rays	Eprolithus 7-rays
1180.5	—	—																																		
1185.5	—	—																																		
1208.5	—	—																																		
1217.5	—	—																																		
1224.9	—	—																																		
1233.5	—	—																																		
1284.3	—	—																																		
1304.8	—	—																																		
1317.2	—	—																																		
1338.1	—	—																																		
1350.2	—	—																																		
1372.0	—	—																																		
1379.6	TR	NK 11			●														•	•	○				•	•			○	•	○		•	•		○
1381.0	TR	NK 11			●														•	•	○				•	•			•	•	○		•	•		•
1381.7	TR	NK 11			●														•	•	○				•	•					○		•			•
1384.4	TR	NK 11			●														•	•	○				○				•	○	•		•	•		○
1388.9	TR	NK 11			●													•	•	•	○				•					•	•		•			•
1393.4	TR	NK 11			●														•	○	○				○	•			○	•	○		•	∘	•	
1396.0	CE	NK 10			●													●	•	•	○			○	○	●			•	○	•	•		•		
1398.0	CE	NK 10			●													●	•	•	○			•	•	○					•	•	•			
1403.0	CE	NK 10			●													●	•	○	●			•	○	○		•	○	•	•		?			
1405.6	CE	NK 10			●													•	•	•	○			•	○	•	•	?	○	•	•	•				
1411.0	CE	NK 10			●													●	•	•	○			•	○	○	•	•	•		•					
1421.9	CE	NK 10			●													○	•	●	○			•	○	•	•	•	•	•	•			cf.		
1427.6	AB upp.	NK 9a			●													○	•	○	○	•	○													
1428.8	AB upp.	NK 9a			●													●	•	○	○															
1430.9	AB ?	—			○					•								•	•	•																
1434.0	HT	NK 4 upp.			○				○	•			•	•	•		•																			
1435.5	HT	NK 4 upp.			○				○	•			•				•																			
1438.0	HT	NK 4 low.			○	○			●	•							•																			
1439.9	VA	NK 3			●	●				•						○																				
1442.6	VA	NK 3			●	●			•							○																				
1446.5	VA	NK 3			●	●			•						•	•																				
1449.1	VA	NK 2-3			●	○							○	•	○																					
1454.9	VA	NK 2-3			●	●							•																							
1457.5	BE-VA	NK 2-3			●	●					•																									
1458.5	BE-VA	NK 2			●	●		○																												
1461.5	BE-VA	NK 2			●	●	○	○		•																										
1465.5	BE-VA	NK 2			●	●	•	○	•	•		○																								
1467.0	BE-VA	NK 2			●	○	○	○		•	•	○																								
1470.0	BE-VA	NK 2			●	●	•	•	•	•																										
1472.0	BE-VA	NK 1-2			○	•																														
1474.0	BE-VA	NK 1-2			●																															
1479.0	—	—																																		
1481.5	—	—																																		
1482.0	BT-BE low.	—		○	●																															
1484.0	—	—																																		
1485.5	BT-BE low.	—		•	○																															
1486.0	—	—																																		
1489.5	—	—																																		
1493.5	BT-BE low.	—		•																																
1497.5	—	—																																		
1501.5	—	—																																		

TEXT FIGURE 1

Appendix III Well Résumé 31/2-2 Drawing Nº G.66227/3

STANDARD LEGEND

NF	NO FAUNA/FLORA
•	1 SPECIMEN
/	2 -5 SPECIMENS
○	6 -20 "
●	21-100 "
■	> 100 "
*	QUALITATIVE DETERMINATION

S SINGLE
R RARE
C COMMON
F FREQUENT
A ABUNDANT

SAMPLES EXAMINED:

1 CORE SAMPLE
2 SIDEWALL SAMPLE
3 DITCH CUTTING
4 SURFACE SAMPLE
5 SEABOTTOM SAMPLE

SCHLUMBERGER ELECTRICAL LOG

DEPTH IN DECIMETRES

NF	SAMPLES EXAMINED SP. NO.	GENUS	REG NO.	SPECIFIC DETERMINATION GENUS AND SPECIES		INDEX SP. NO.	GENUS	REG NO.
		80000216	1	CALLIALASPORITES DAMPIERI	SPOROMORPHS		80000018	5
		80000046	2	CHASMATOSPORITES MAJOR			80000046	2
		80000143	3	CEREBROPOLLENITES MACROVERRUCOSUS			80000065	7
		80000225	4	QUADRAECULINA ANELLAEFORMIS			80000143	3
		80000018	5	KLUKISPORITES VARIEGATUS			80000203	8
		80000373	6	CHASMATOSPORITES APERTUS CF.			80000210	9
		80000065	7	CHASMATOSPORITES THIERGARTI			80000216	1
		80000203	8	RUGULATISPORITES RUGULATUS			80000225	4
		80000210	9	STAPLINISPORITES TELATUS			80000373	6
		80000483	10	APICULATISPORITES SPINIGER			80000483	10
			11	CHATANGIELLA VICTORIENSIS CF.	MICRO PLANKTON			11
		85001210	12	CALLAIOSPHAERIDIUM ASYMMETRICUM			†	170
		85001050	13	CYCLONEPHELIUM MEMBRANIPHORUM			†	234
		85001198	14	LEBERIDOCYSTA CHLAMYDATA			†	108
		85100151	15	LEJEUNIA SP.			†	157
		85100171	16	MORKALLACYSTA SP.			†	174
		85001023	17	ODONTOCHITINA OPERCULATA			†	207
		85001051	18	COMETODINIUM OBSCURUM			†	160
		85001199	19	XIPHOPHORIDIUM ALATUM			†	82
			20	HYSTRICHOSPHAERIDIUM STELLATUM			†	20
		85001024	21	ODONTOCHITINA COSTATA			†	36
		85001579	22	CYCLONEPHELIUM			†	149
		85001025	23	PALAEOHYSTRICHOPHORA INFUSORIOIDES			†	244
		85001265	24	SYSTEMATOPHORA AREOLATA			†	151
			25	EXOCHOSPH.STRIOLATUM			†	25
		85100242	26	SPINIFERITES SP.			†	89
		85001031	27	ENDOSCRINIUM CAMPANULA			†	169
		85001033	28	CRIBROPERIDINIUM EDWARDSIT			†	59
		85001194	29	CLEISTOSPHAERIDIUM ANCORIFERUM			†	219
		85001200	30	HYSTRICHODINIUM PULCHRUM			†	60
		85100105	31	FLORENTINIA SP			†	94
		85001254	32	MICRODINIUM IRREGULARE			†	159
		85001021	33	CORONIFERA OCEANICA			†	111
		85001202	34	CYCLONEPHELIUM DISTINCTUM			†	224
			35	OLIGOSPHAERIDIUM COMPLEX CF.			†	35
		†	36	ISABELIDINIUM CF.			†	241
		†	37	HEXAGONIFERA CF.			†	37
		85001184	38	CYCLONEPHELIUM HUGHESII			†	227
		85001213	39	COMETODINIUM WHITEI			†	260
		85001369	40	COMASPHAERIDIUM COMETES			†	261
		85001453	41	LEPTODINIUM SP.1			†	168
		85001661	42	PTERODINIUM ALIFERUM			†	247
		85001802	43	OLIGOSPHAERIDIUM ALBERTENSE			†	264
		85100192	44	PALAEOSTOMOCYSTIS SP.			†	256
		85001179	45	OLIGOSPHAERIDIUM COMPLEX			†	187
		85001192	46	XENASCUS CERATIOIDES			†	251
		85001266	47	ACHOMOSPHAERA RAMULIFERA			†	125
		85001281	48	HESLERTONIA HESLERTONENSE			†	254
		85001078	49	HYSTRICHOSPHAEROPSIS OVUM			†	255
		85001454	50	PTERODINIUM CORNUTUM			†	250
		85022427	51	FLORENTINIA RADICULATA CF.			†	246
		85100071	52	DEFLANDREA SP.				204
		85100248	53	SUBTILISPHAERA SP.			†	74
		85100152	54	LEPTODINIUM SP			†	185
		85100254	55	SYSTEMATOPHORA SP.			†	257
		85001296	56	CORDOSPHAERIDIUM CF.			†	258
		85001795	57	PTEROSPERMELLA REGULARIS			†	161
		85001005	58	PAREODINIA CERATOPHORA			†	95
			59	PSALIGONYAULAX SP.1 CF.			†	262
		†	60	SPINIFERITES DENTATUS CF.			†	176
		85001012	61	POLYSPHAERIDIUM LAMINASPINOSUM			†	175
		85001018	62	DINGODINIUM CERVICULUM			†	237
		85022429	63	EPIPLOSPHAERA BIRETICULATA			85001000	228
		85100233	64	SCRINIODINIUM SP.			85001001	91
		85001509	65	PSEUDOCERATIUM PELLIFERUM SOLOCISPIN			85001002	92
		85001511	66	ACHOMOSPHAERA NEPTUNII			85001003	147
		85001158	67	GONYAULACYSTA HELICOIDEA			85001004	134
		85001263	68	HYSTRICHODINIUM VOIGHTII			85001005	58
		85001280	69	OCCISUCYSTA EVITTII			85001006	183
		85001571	70	ACANTHAULAX SPHAERICA			85001009	72
		85001011	71	LEPTODINIUM PERFORANS			85001011	71
		85001009	72	MUDERONGIA SIMPLEX			85001012	61
		85001497	73	LEPTODINIUM ARCUATUM			85001014	109
		85001267	74	KLEITHRIASPHAERIDIUM EOINODES			85001018	62
		85001269	75	TRICHODINIUM SPEETONENSIS			85001021	33
		85001506	76	MILLIOUDODINIUM SP.1			85001023	17
		85001513	77	HYSTRICHOGONYAULAX FASTIGIATA			85001024	21
		85001517	78	ESCHARISPHAERIDIA RYAZANICA M.NAME			85001025	23
		85001545	79	KLEITHRIASPHAERIDIUM FASCIATUM			85001031	27
		85001521	80	PAREODINIA SP.3			85001033	28
		85001527	81	SURCULOSPHAERIDIUM SP.1			85001038	265
			82	CA			85001048	223
		85001322	83	LEPTODINIUM SUBTILE			85001050	13
		85001503	84	ISTHMOCYSTIS DISTINCTA			85001051	18
		85001329	85	SYSTEMATOPHORA CF.VESTITUM			85001078	49
		85025142	86	OVOIDINIUM WALTONI			85001120	184
		85001644	87	DINGODINIUM CF.JURASSICUM			85001154	136
		85001300	88	CRIBROPERIDINIUM GRANULATUM			85001158	67
			89	SYSTEMATOPHORA SP.(CF S.VESTITUM)			85001179	45
		85001350	90	TANYOSPHAERIDIUM CF.XANTHIOPYXIDUS			85001184	38
		85001001	91	TUBOTUBERELLA APATELA			85001192	46
		85001002	92	GONYAULACYSTA EISENACKII			85001194	29
		85001461	93	SIRMIODINIUM GROSSI			85001198	14
			94	APTEODINIUM SP.CF.			85001199	19
		85025286	95	EPIPLOSPHAERA SP.			85001200	30
		85001502	96	OCCISUCYSTA TENTORIA			85001202	34
		85001504	97	SPEETONIA DELICATULA			85001210	12
		85001633	98	SURCULOSPHAERIDIUM SP.2			85001213	39
		85001757	99	LINGULODINIUM SP.1			85001254	32
		85001499	100	ENDOSCRINIUM PHARO			85001260	101
		85001260	101	CASSICULOSPHAERIDIA MAGNA			85001263	68
		85001519	102	MILLIOUDODINIUM MAMILLIFERUM			85001265	24
		85001320	103	HYSTRICHOGONYAULAX SP.2			85001266	47
		85001524	104	TANYOSPHAERIDIUM TORYNUM			85001269	75
		85001480	105	ESCHARISPHAERIDIA SP.2			85001275	114
		85100048	106	CHLAMYDOPHORELLA SP.			85001278	117
		85001525	107	PARVOCAVATUS SPINOSUS			85001280	69
			108	APTEODINIUM SP-1			85001281	48
		85001014	109	TANYOSPHAERIDIUM SP.1			85001290	142
		85001321	110	LEPTODINIUM EUMORPHUM			85001296	56
			111	PTEROSPERMOPSIS HELIOS			85001300	88
		85001518	112	ATHIGMATOCYSTA GRANULATA			85001302	210
		85001531	113	SURCULOSPHAERIDIUM SP.3			85001308	138
		85001275	114	BATIOLADINIUM JAEGERII			85001309	162
		85001640	115	GEISELODINIUM PAEMINOSUM			85001310	150
		85001805	116	PSALIGONYAULAX SP.1			85001313	177
		85001278	117	HYSTRICHOSPHAERINA SCHINDEWOLFII			85001314	171
		85001358	118	CORDO SPHAERIDIUM DAVEYI MANUSCR.N.			85001318	163
		85001641	119	ENDOSCRINIUM ANCEPS			85001320	103
		85001507	120	WALLODINIUM LUNA			85001321	110
		85001468	121	PAREODINIA DASYFORMA			85001322	83
		85001562	122	SYSTEMATOPHORA COMPLICATA			85001326	197
		85100280	123	AVELLODINIUM SP.			85001329	85
		85001777	124	SENTUSIDINIUM PILOSUM			85001335	158
			125	EPIPLOSPHAERA RETICULISPINOSA CF.			85001336	188
		85100065	126	CTENIDODINIUM SP.			85001338	181
		85001774	127	SENTUSIDINIUM SP.1			85001339	206
		85001543	128	ACANTHAULAX SP.A (IOANNIDES ET.AL.)			85001340	140
		85001657	129	FROMEA AMPHORA			85001342	240
		85001477	130	MENDICODINIUM WOODHAMENSIS			85001344	143
		85001563	131	CANNOSPHAEROPSIS APICULATUM			85001345	199
		85022647	132	PARVOCAVATUS SP.3			85001346	203
		85001636	133	PERISSEISPHAERIDIUM SP.A (IOANNIDES)			85001349	156
		85001004	134	GONYAULACYSTA LONGICORNIS			85001350	90
		85001564	135	HYSTRICHOGONYAULAX SP.1			85001353	166
		85001154	136	OPERCULODINIUM CF.DIVERGENS			85001356	139
		85001639	137	ALDORFIA SP-1			85001358	118
		85001308	138	LEPTODINIUM			85001369	40
		85001356	139	DINOPTERYGIUM DIMORPHUM			85001453	41
		85001340	140	ELLIPSOIDICTYUM GOCHTII MANUSCR.NAME			85001454	50
		85001672	141	ELLIPSOIDICTYUM CINCTUM			85001460	194
		85001290	142	CASSICULOSPHAERIDIA MAGNA			85001461	93
		85001344	143	EGMONTODINIUM POLYPLACOPHORUM			85001462	164
		85001541	144	SENTUSIDINIUM RIOULTII			85001464	165
		85100197	145	PAREODINIA SP.			85001468	121
		85020987	146	ELLIPSOIDICTYUM CF.AREOLATUM			85001469	216
		85001003	147	ENDOSCRINIUM LURIDUM			85001470	235
		85001796	148	OLIGOSPHAERIDIUM PULCHERRIMUM			85001472	253
			149	GONYAULACYSTA LONGICORNIS AFF.			85001474	229
		85001310	150	HYSTRICHOGONYAULAX SP.4			85001477	130
			151	CASSICULOSPHAERIDIA MAGNA AFF.			85001478	226
		85001500	152	PARVOCAVATUS TUBEROSUS			85001480	105
		85001537	153	LITHODINIA STOVERI			85001482	200
		85001714	154	ALDORFIA ALDORFENSIS			85001483	208
		85025643	155	HYSTRICHOSPHAERIDIUM PETILUM			85001486	238
		85001349	156	SENONIASPHAERA JURASSICA			85001487	245
			157	PROLIXOSPHAERIDIUM ANASILLUM			85001491	239
		85001335	158	SENTUSIDINIUM			85001494	195
			159	GONYAULACYSTA AFF.CONFOSSA			85001495	236
		†	160	LI			85001496	180
		85091523	161	LITHODINIA BULLOIDEA CF.			85001497	73
		85001309	162	HYSTRICHOGONYAULAX SP.3			85001499	100
		85001318	163	EXIGUISPHAERA PHRAGMA			85001500	152
		85001462	164	CTENIDODINIUM ELEGANTULUM			85001501	242
		85001464	165	SYSTEMATOPHORA IUNCTISPINA			85001502	96
		85001353	166	PAREODINIA			85001503	84
		85001512	167	ACANTHAULAX COMPTA			85001504	97
			168	SCRINIODINIUM AFF.CRISTALLINUM			85001506	76
		†	169	BROOMEA AFF.			85001507	120
		†	170	CLEISTOSPHAERIDIUM CF.ANCORIFERUM			85001509	65
		85001314	171	TRICHODINIUM SP.1			85001511	66
		85100239	172	SIRMIODINIUM SP.			85001512	167
		85001532	173	CANNINGINOPSIS DENTICULATA ?			85001513	77
			174	COMASPHAERIDIUM			85001517	78
		85091324	175	ENDOSCRINIUM CF.			85001518	112
		85091532	176	CANNINGINOPSIS DENTICULATA CF.			85001519	102
		85001313	177	APTEODINIUM ?			85001521	80
		85001528	178	LITHODINIA STAFFINENSIS			85001523	189
		85022648	179	SIRMIODINIUM TRANSEPTATUM CF.			85001524	104
		85001496	180	ATOPODINIUM PROSTATUM			85001525	107
		85001338	181	NOV.GEN.G N.SP.1 (M+R)			85001527	81
		85001786	182	PARVOCAVATUS SP.1			85001528	178
		85001006	183	GONYAULACYSTA JURASSICA			85001531	113
		85001120	184	HYSTRICHOGONYAULAX CLADOPHORA			85001532	173
		85025290	185	OCCISUCYSTA SP.			85001537	153
		85001570	186	LEPTODINIUM MIRABILE			85001539	211
			187	SCRINIOCASSIS DICTYOTUS CF.			85001541	144
		85001336	188	NOV.GEN.F N.SP.2 (M+R)			85001543	128
		85001523	189	LITHODINIA BULLOIDEA			85001545	79
		85100019	190	ARANEOSPHAERA SP.			85001562	122
		85001778	191	LITHODINIA SP.3			85001563	131
		85001782	192	CHYTROEISPHAERIDIA CHYTROEIDES			85001564	135
		85024956	193	SENTUSIDINIUM SP.2			85001570	186
		85001460	194	ENDOSCRINIUM GALERITUM			85001571	70
		85001494	195	HYSTRICHOGONYAULAX PECTINIGERA			85001579	22
		85001681	196	ESCHARISPHAERIDIA POCOCK 11			85001632	222
		85001326	197	ENDOSCRINIUM CRYSTALLINUM			85001633	98
		85001780	198	CHYTROEISPHAERIDIA CERASTES			85001636	133
		85001345	199	STEPHANELYTRON REDCLIFFENSE			85001639	137
		85001482	200	ADNATOSPHAERIDIUM AEMULUM			85001640	115
		85001779	201	GONYAULACYSTA JURASSICA LONGICORNIS			85001641	119
		85001765	202	PROLIXOSPHAERIDIUM CAPITATUM			85001644	87
		85001346	203	STEPHANELYTRON SCARBURGHENSE			85001657	129
		85091737	204	ESCHARISPHAERIDIA SP.			85001661	42
		85001732	205	ENDOSCRINIUM GALERITUM RETICULATUM			85001669	248
		85001339	206	NOV.GEN.G.N.SP.2 (M+R)			85001672	141
			207	VALENSIELLA VERMICULATA CF.			85001673	225
		85001483	208	KALYPTEA DICERAS			85001681	196
		85001781	209	LITHODINIA SP.4			85001683	231
		85001302	210	OCCISUCYSTA AREOLATA			85001687	212
		85001539	211	SYSTEMATOPHORA DIVARICA MANUSCR.NAME			85001688	232
		85001687	212	CTENIDODINIUM NORRISII			85001692	217
		85001746	213	PALAEOSTOMOCYSTIS TORNATILIS			85001712	233
		85020933	214	ESCHARISPHAERIDIA SP-2			85001714	154
		85001725	215	WANAEA DIGITATA			85001725	215
		85001469	216	LITHODINIA JURASSICA			85001727	249
		85001692	217	SYSTEMATOPHORA SP.2			85001731	218
		85001731	218	DINOPTERYGIUM ABSIDATUM			85001732	205
			219	LITHODINIA SP.7 CF.			85001734	252
		85100089	220	ELLIPSOIDICTYUM SP.			85001746	213
		85100251	221	SURCULOSPHAERIDIUM SP.			85001757	99
		85001632	222	PAREODINIA PROLONGATA			85001758	259
		85001048	223	VALENSIELLA OVULUM			85001761	230
			224	HYSTRICHOGONYAULAX SP.5			85001765	202
		85001673	225	OCCISUCYSTA SP.2			85001768	263
		85001478	226	NOV.GEN.B.N.SP.2 (DE H.)			85001774	127
			227	NOV.GEN.B.N.SP.1(DE H.)CF.			85001777	124
		85001000	228	CTENIDODINIUM ORNATUM			85001778	191
		85001474	229	LITHODINIA SUTUROCOMPLEXA MANUSCR.N.			85001779	201
		85001761	230	ESCHARISPHAERIDIA SP.1			85001780	198
		85001683	231	DIACANTHUM FILAPICATUM			85001781	209
		85001688	232	OCCISUCYSTA			85001782	192
		85001712	233	LITHODINIA SP.6			85001786	182
			234	CHLAMYDOPHORELLA RECTILINEA MAN.NAME			85001795	57
		85001470	235	NANNOCERATOPSIS PELLUCIDA			85001796	148
		85001495	236	LUNATADINIUM CF.			85001802	43
		85020936	237	LITHODINIA SP.			85001805	116
		85001486	238	LITHODINIA SP.9			85020933	214
		85001491	239	LANTERNA			85020987	146
		85001342	240	LITHODINIA ?			85022427	51
			241	NOV.GEN.E N.SP.2(DE H.) AFF.			85022429	63
		85001501	242	LITHODINIA FUSIFORMA MANUSCR. NAME			85022647	132
		85100091	243	EMMETROCYSTA SP.			85022648	179
			244	LITHODINIA SP.10			85024956	193
		85001487	245	HESLERTONIA TEICHOPHERA			85025142	86
			246	OCCISUCYSTA AFF.			85025643	155
		†	247	NOV.GEN.G.N.SP.2(DE H.)CF.			85100019	190
		85001669	248	LITHODINIA SP.7			85100048	106
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			250	PARAGONYAULACYSTA CALLOVIENSE			85100071	52
		†	251	CTENIDODINIUM SP-1			85100089	220
		85001734	252	NOV.GEN.B N.SP.3 (DE H.)			85100091	243
		85001472	253	MANCODINIUM SEMITABULATUM			85100105	31
			254	GONGYLODINIUM ERYMNOTEICHOS CF.			85100151	15
		†	255	LITHODINIA			85100152	54
			256	PAREODINIA SP2			85100171	16
			257				85100192	44
		85091683	258	DIACANTHUM FILAPICATUM CF.			85100197	145
		85001758	259	BATIACASPHAERA			85100233	64
			260	ESCHARISPHAERIDIA INFRARUGULATA M.N.			85100239	172
		†	261	OCCISUCYSTA CF.			85100242	26
		85091832	262	HYSTRICHOGONYAULAX CF. SP.6			85100248	53
		85001768	263	NANNOCERATOPSIS PLEGAS			85100251	221
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REMARKS

BIOFACIES DEVELOPMENT

MICROFAUNAL ZONATION

MICROFLORAL ZONATION

BIOSTRATIGRAPHIC SUBDIVISION

TIME-STRATIGRAPHIC SUBDIVISION

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