PALEONTOLOGICAL STUDY OF THE STATOIL 34/10-5

OFFSHORE NORWAY WELL

by

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EPR-E.WA11.80

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INTRODUCTION

Paleontological studies were carried out on the Statoil 34/10-5 well from 1730 to 2773m with the purpose of verifying and eventually polishing up Paleoservices stratigraphic interpretation.

For the palynological studies, we used mainly slides borrowed from Paleoservices, although some samples were also processed at EPR-E. Nannofossil, foraminifer, and ostracode studies are based on samples prepared at EPR-E. The list of the samples studied at EPR-E is given in the appendix.

Our studies support the following stratigraphic interpretation:

TOP (m)	AGE
1730	Late Maastrichtian
1781	Early Maastrichtian-Late Campanian
1857	Late Jurassic
±1858	Bathonian
2003.5	Early Bathonian to Bajocian
2142	Early Bajocian (Aalenian)
2160	Early Bajocian (Aalenian) to Late Toarcian
±2255	Probable Early Toarcian
±2277	Early Toarcian
2294	Late Pliensbachian
2462	Earliest Late Pliensbachian
2480	Early Pliensbachian
2565.5	?Sinemurian-?Hettangian
2672	Hettangian
2738	Rhaetian.

STRATIGRAPHY

CRETACEOUS 1730-1856m

LATE MAASTRICHTIAN: 1730-1778m

Nannofossils

The presence at 1730m of *Nephrolithus frequens* together with *Arkangelskiella cymbiformis* indicate a Late Maastrichtian age. *Eiffellithus turriseiffeli, Kamptnerius magnificus, Predicosphaera cretacea, Micula staurophora* are the most important species present in this unit.

Foraminifera

Pseudotextularia elegans, Heterohelix globulosa, Globotruncana contusa, Globigerinelloides asper, Gl. multispina and *Bolivina incrassata* are observed at 1736m.

Globotruncana havanensis and *Rugoglobigerina* ex gr. *rugosa* are present at 1742m.

At 1763m, *Stensioeina pommerana* and *Abathomphalus mayaroensis* are observed.

EARLY MAASTRICHTIAN-LATE CAMPANIAN: 1781-1856m

Nannofossils

The association of *Arkhangelskiella cymbiformis* and *Reinhardtites anthophorus* at 1781m indicates an Early Maastrichtian to Late Campanian age.

Foraminifera

Rugoglobigerina ex gr. *rugosa, Globigerinelloides asper* and *Gl. multispina* are the most important species in this interval.

JURASSIC 1856-2734m

?LATE JURASSIC: 1857-1858m

According to Paleoservices, the sidewall core at 1856m, not examined by EPR-E, still contains a Late Cretaceous microfauna, while the cuttings from 1856-1859 contains Late Cretaceous, Late Jurassic and Middle Jurassic (Bathonian) faunas.

The palynological examination of the cutting sample from 1856-1859m has also shown the presence of Late Cretaceous dinoflagellates *(Australiella* and *Deflandrea)* associated with numerous Middle Jurassic dinoflagellates *(Pareodinia evittii, Sentusidinium verrucosum)*. This association indicates a Bathonian age, confirmed by the presence of *Quadraeculina anellaeformis*. *Pluriarvalium osmingtonense*, a Late Jurassic dinoflagellate not occurring below the Oxfordian suggests that a thin Late Jurassic horizon has been drilled somewhere between 1856 and 1859m. It has been tentatively placed in the paleolog between 1857 and 1858m.

BATHONIAN: 1858-1991m

Dinoflagellates, common in the cuttings at 1856-1859m, are abundant, but poorly diversified in the SWC at 1860m. In the later assemblage, *Chythrocisphaeridia* spp. dominate the assemblage while *Sentusidinium verrucosum* is common. *Chythroeisphaeridium pocockii* is well represented at 1888m, scarcer below. *Pareodinia ceratophora* has been identified in several samples between 1912.5 and 1956.9m.

Below this level, dinoflagellates become much scarcer. Within this interval, the terrestrial palynomorphs assemblages are dominated by disaccate grains, simple prilate spores, *Cerebropollenites mesozoicus*, *Classopollis* spp. and *Lycopodiumsporites* spp. *Quadraeculina anellaeformis* is present in most samples, while *Callialasporites dampieri* seems to become much scarcer below 1973.1m.

Between 1859 and 1901m, arenaceous foraminifera are abundant and include *Ammobaculites* spp., *Haplophragmoides* spp., *Trochammina* sp. and *Verneuilinoides mauritii*. Below 1901m, microfauna is scarce or absent.

This interval has been attributed to the Bathonian mainly because of the presence of *Quadraeculina anellaeformis* which does not occur above the middle part of the Bathonian.

EARLY BATHONIAN-BAJOCIAN: 2003.5-2136m

In complete agreement with Paleoservices, the upper limit of this interval has been placed at 2003.5m, based on the top occurrence of *Nannoceratopsis gracilis*, a species not occurring above the lowermost part of the Bathonian. The terrestrial palynomorph assemblage is very similar to the one observed in the overlying interval, but *Cerebropollenites mesozoicus* is scarcer and *Callialasporites dampieri* has not been observed.

Below 2040 and above 2136m, all sidewall core samples are practically barren. A similar barren interval has been observed in the 34/10-4 well, below 1822m and above 1901m.

The sidewall core at 2136m, which contains rare specimens of *Nannoceratopsis gracilis* and *Nannoceratopsis senex*, is included in this interval, in which microfauna is rare or absent.

EARLY BAJOCIAN (AALENIAN): 2142-2151.5m

The sidewall core at 2142m is characterized by a microplankton assemblage in which *Nannoceratopsis gracilis* is dominant (constituting more than 90% of the marine microplankton). A similar dominance of *Nannoceratopsis gracilis* has been observed in the 34/10-4 well, between 1902.1m and 1912m, and is known locally to occur in the Early Bajocian.

This Early Bajocian (Aalenian) age is confirmed by the top occurrence, at 2147m, of the ostracode marker species *Camptocythere parvula*.

EARLY BAJOCIAN (AALENIAN) TO LATE TOARCIAN: 2160-2255m

Moesiodinium raileanui has its top occurrence at 2160m and occurs in all sidewall cores between this level and 2230m. Dinoflagellate type 2 of Thusu occurs also in several samples and has its deepest occurrence at 2230m. *Nannoceratopsis gracilis* occurs also, but *Nannoceratopsis senex* is rare or absent.

The Early Bajocian (Aalenian) ostracode species *Camptocythere parvula*, which has its top occurrence in the overlying interval, at 2147m, has also been observed at 2162m, while the Toarcian ostracode *Lophodentina tricostata* occurs at 2180m.

Within this interval, marine microplankton constitutes from 24 to 46% of the palynological assemblages. Spores and pollen assemblages are characterized by abundant *Alisporites* spp. and *Classopollis* spp. *Deltoidospore* spp., *Cerebropollenites mesozoicus, Osmundacidites wellmanii* and *Lycopodiumsporites* are common. *Cerebropollenites thiergartii, Chasmatosporites* spp. and *Rogalskaisporites* have also been observed. *Clavatisporites hughesii* is common in the latter part of the interval, at 2203m. A similar observation has been made in the 34/10-4 well between 1960 and 1968m.

PROBABLE EARLY TOARCIAN: 2255-2270m

In the 34/10-4 well, the top of the Early Toarcian was marked by the top occurrence of the ostracode marker *Ektyphocythere intrepida.* We have not been able to find this microfossil in the 34/10-5 well. In the sample from 2277m, on the other hand, small sphaeromorphs *(Inaperturapollenites* spp.) are dominant. Similar abundances of *Inaperturapollenites* spp. are known to occur in the Early Toarcian, and this phenomenon has been observed at 2030m in the 34/10-4 well, below the top occurrence of *Ektyphocythere intrepida.* In the 34/10-4 well, the top occurrence of *Ektyphocythere intrepida* takes place between the deepest occurrence of *Moesiodinium raileanui* and the level with dominant sphaeromorphs. Taking into account the position of these two markers in the 34/10-5 well, we have tentatively placed the upper limit of the Early Toarcian at approximately 2255m.

EARLY TOARCIAN: 2277m

As mentioned above, in the sample at 2277m, small sphaeromorphs are dominant. Locally this dominance is known to occur in the Early Toarcian. In the same sample, a marked increase in the relative abundance of *Nannoceratopsis senex* has been observed.

LATE PLIENSBACHIAN: 2294-2450m

The top of the Late Pliensbachian has been placed at 2294m, where *Luehndea* cf. *spinosa* has its top occurrence. *Mancodinium semitabulatum* and *Scriniocassis weberi* occur in the same sample. In the upper part of this interval, *Nannoceratopsis senex* is more abundant than *N. gracilis. Nannoceratopsis ambonis* was identified at 2343m.

The Late Pliensbachian ostracode marker *Ogmoconchella* gr. *adenticulata* has its top occurrence at 2306m. Other Pliensbachian ostracodes have their top occurrence in this interval: *Kinkelinella* sp. at 2342m, *Ogmonconcha amalthei* and *O. contractula* at 2423m.

Among the terrestrial palynomorphs, *Chasmatosporites* spp. become more abundant. There is also a marked increase in the relative abundance of *Cerebropollenites thiergartii* below 2359m. Marine microplankton versus terrestrial palynomorphs ratios decrease below 2359m. The minimum noticeable in the curve at 2412m can be correlated with a similar minimum observed in the 34/10-4 well at 2185m.

EARLIEST LATE PLIENSBACHIAN: 2462-2476m

The ostracode marker species *Wicherella semiora*, which is known to be restricted to the lowermost part of the Late Pliensbachian (lower part of the *A. margaritatus* zone), occurs at 2462m, where two other ostracode species, *Ogmoconchella transversa* and *Grammanella apostolescui* have also their first occurrences.

EARLY PLIENSBACHIAN-SINEMURIAN: 2480-2559m

The Early Pliensbachian age proposed for this interval is based on the top occurrence of the ostracode marker *Gammacythere ubiquita* at 2480m and confirmed by the occurrences of the ostracodes *Ogmoconchella* cf. *danica* and *Klinglerella elongata* at 2522m.

At 2559m, *Cerebropollenites mesozoicus* is still common, suggesting an age not older than Sinemurian.

?SINEMURIAN-?HETTANGIAN: 2565.5-2666.4m

The palynological samples from this interval are very poor or barren, and the few pollen and spores observed in the cutting samples are probably due to caving. The ?Sinemurian-?Hettangian age assigned to this interval is entirely based on its stratigraphical position.

HETTANGIAN: 2672-2734m

Microreticulatisporites reticulatus and *Ovalipollis ovalis* have been identified in the cutting sample from 2666-2672m. The presence of the

latter species suggests an age not younger than the Hettangian. The only other good palynological assemblage from this interval, at 2682,4m, does not contain any pre-Hettangian forms. Since Rhaetian palynomorphs observed in the cutting samples at 2732-2738m, do not occur in the sidewall core at 2734m, the interval 2672-2734m is assigned to the Hettangian.

RHAETIAN: 2738-2773m

The presence of the Rhaetian is marked by the occurrence, in the cutting samples from 2732-2738m, of several specimens of *Ricciisporites tuberculatus*. *Taeniaesporites rhaeticus* has also been observed in the same sample. In the sidewall core at 2763m, microplankton is relatively common, but includes only relatively long-ranging acritarchs. The presence of *Kraeuselisporites reissingeri* in the deepest sample studied, the sidewall core at 2773m, is noteworthy: this form does not occur below the Rhaetian; mud contamination, however, cannot be excluded. *Cerebropollenites mesozoicus*, which should not occur below the Sinemurian has been identified in the same sample.

Mud contamination is obvious in two other sidewall core samples from this interval, at 2741 and 2768m: Tertiary pollen grains dominate in both palynological assemblages.

COMPARISONS BETWEEN EPR-E AND PALEOSERVICES

BIOSTRATIGRAPHIC INTERPRETATION ON STATOIL 34/10-5

(See attached paleolog)

CRETACEOUS

EPR-E agrees with Paleoservices in attributing to the Late Maastrichtian the first sample we examined, at 1730m. Paleoservices places the upper limit of its Maastrichtian-?Campanian unit at 1766m, based on the first downhole occurrence of *Reussella szajnochae*. We prefer, however, to place the top of our Early Maastrichtian-Late Campanian at 1781m, where the coccoliths *Arkhangelskiella cymbiformis* and *Reinhardtites anthophorus* have been identified.

JURASSIC

The presence of Late Jurassic microfaunas in the ditch cutting sample 1856-1859m, reported by Paleoservices, is supported by our identification of a Late Jurassic dinoflagellate in the same sample.

Both Paleoservices and EPR-E agree in placing the top of the Bathonian at 1858m and the top of the Early Bathonian-Bajocian unit at 2003.5m.

Paleoservices places the top of the Early Bajocian (Aalenian) at 2136m, based on the incoming of consistent *Nannoceratopsis gracilis*. We locate it slightly lower at 2142m, where *Nannoceratopsis gracilis* dominates the microplankton assemblage.

Paleoservices does not state clearly the criteria used for the top of their next unit, dated Early Bajocian-Toarcian, that they place at 2147m. We prefer a slightly lower location, at 2160m, where we notice the top occurrence of *Mesiodinium raileanui*, a very characteristic dinoflagellate which has its base at 2230m.

Paleoservices reports the occurrence of *Ektyphocythere intrepida* at 2222m, and consequently attributes the underlying interval to the Early Toarcian. We have not been able to find this ostracode in the samples we studied. At 2230m, however, *Mesiodinium raileanui* is still present, and in the 34/10-4 well, its base is above the top occurrence of *Ektyphocythere intrepida*. For the reasons given at the p. 5 of the present report, we place the top of our Early Bajocian (Aalenian) to Late Toarcian unit at approximately 2255m.

There is also a slight discrepancy on the top of the Late Pliensbachian, placed by Paleoservices at 2303m, where they first observed representatives of the ostracode genus *Ogmoconchella*. In the samples we studied, *Ogmoconchella* gr. *adenticulata* has its top occurrence at 2306m, but we consider that the SWC at 2294m, in which the dinoflagellate *Luehndea* cf. *spinosa* has its top occurrence, already belongs to the Late Pliensbachian.

While Paleoservices notes the top occurrence of the Early Pliensbachian ostracode *Gammacythere ubiquita* at 2468m, we have not observed it above 2480m.

The presence of *Ovalipollis ovalis* in the cutting sample 2666-2672m, also reported by Paleoservices, suggests that an Hettangian interval is present between this level and the top occurrence of Rhaetian palynomorphs,in the cutting sample 2732-2738m.

The slightly different location of the top Rhaetian, in the paleolog, 2732m for Paleoservices, 2738m for EPR-E, results from EPR-E policy to place an occurrence observed in a cutting sample at the base of the interval studied.

MEM/JPC/MP:mc1
July 3, 1980

APPENDIX

LIST OF SAMPLES STUDIED FOR PALYNOLOGY

(E: processed by EPR-E; all other samples: slides loaned by Paleoservices)

	Depth (m)	
Cutting	1856-59	
SWC	1860	
"	1875	
"	1884	
"	1888	
"	1895	
"	1903	
"	1910	
Core	1912.5	
"	1932.27	E
"	1932.6	E
"	1956.9	E
"	1958.8	E
"	1967.9	E
"	1969.9	E
"	1973.1	E
SWC	1979	
"	1991	
"	2003.5	
"	2012	
Cutting	2018-24	
SWC	2031	
"	2040	
"	2054	
Cutting	2060-66	
SWC	2077	
"	2085	
"	2093	
"	2102	
"	2115	
Cutting	2120-26	
SWC	2136	

	Depth (m)
SWC	2142
"	2151.5
"	2160
Cutting	2168-74
Cutting	2180-86
SWC	2195
"	2202
"	2215
"	2230
Cutting	2240-46
"	2252-58
"	2264-70
SWC	2277
"	2294
Cutting	2315-18
"	2324-30
SWC	2343
"	2359
"	2365
"	2387
Cutting	2396-402
SWC	2412
Cutting	2420-23
SWC	2435
Cutting	2444-50
"	2456-62
SWC	2476
Cutting	2486-92
SWC	2500
"	2514

	Depth (m)
Cutting	2531-37
SWC	2545
Cutting	2552-55
SWC	2559
"	2565.5
Cutting	2570-76
"	2585-91
"	2600-606
"	2645-51
"	2654-57
SWC	2666.4
Cutting	2666-72
SWC	2673.5
Cutting	2675-81
SWC	2677.4
"	2682.4
Cutting	2684-90
SWC	2686
Cutting	2696-2702
"	2708-14
"	2714-20
"	2732-38
SWC	2734
Cutting	2738-44
SWC	2741
"	2753
Cutting	2762-68
SWC	2763
"	2768
"	2773
Cutting	2774-80

LIST OF SAMPLES STUDIED FOR MICROPALEONTOLOGY

(Processed at EPR-E)

(M = Foraminifera and/or Ostracodes. C = Coccoliths)

Cuttings	
1730m	M-C
1736m	M
1742m	M
1745m	M-C
1754m	M-C
1763m	M-C
1772m	M-C
1778m	C
1781m	M-C
1790m	M-C
1799m	M-C
1808m	M-C
1814m	M-C
1823m	M-C
1832m	M-C
1841m	M-C
1850m	M-C
1856m	C
1859m	M
1880m	M
1901m	M
1919m	M
1940m	M
1955m	M
1982m	M
2000m	M
2021m	M
2042m	M

Cuttings	
2060m	M
2081m	M
2102m	M
2120m	M
2141m	M
2147m	M
2162m	M
2177m	M
2180m	M
2201m	M
2222m	M
2240m	M
2261m	M
2282m	M
2300m	M
2306m	M
2324m	M
2342m	M
2360m	M
2381m	M
2402m	M
2423m	M
2441m	M
2462m	M
2480m	M
2501m	M
2522m	M
2540m	M
2564m	M

DEPTH (Meters)

SAMPLES STUDIED

SPECIES

1800 1900 2000 2100 2200 2300 2400 2500

1799 1790 1781 1778 1772 1763 1754 1745 1742 1736 1730
1859 1856 1850 1841 1832 1823 1814 1808

2564 2540 2522 2501 2480 2462 2441 2423 2402 2381 2360 2342 2324 2306 2300 2282 2261 2240 2222 2201 2180 2177 2162 2147 2141 2120 2102 2081 2060 2042 2021 2000 1982 1955 1940 1919 1901 1880

NANNOFOSSILS

Nephrolithus frequens
Arkhangelskiella cymbiformis
Micula staurophora
Ahmuellerella octoradiata
Eiffellithus turriseiffeli
Zygodiscus acanthus
Glaukolithus fessus
Glaukolithus compactus
Kamptnerius magnificus
Predicosphaera cretacea
Lucianorhabdus cayeuxi
Eiffellithus anceps
Staurolithites bochotnicae
Cribrosphaerella ehrenbergi
Watznaueria barnesae
Microrhabdulus decoratus
Microrhabdulus stradneri
Cretarhabdus crenulatus
Cretarhabdus decorus
Braarudosphaera bigelowi
Predicosphaera spinosa
Reinhardtites anthophorus
Cretarhabdus conicus

FORAMINIFERA

Pseudotextularia elegans
Heterohelix globulosa
Heterohelix spp.
Bolivina incrassata
Globotruncana contusa
Globigerinelloides asper
Globigerinelloides multispina
Globigerinelloides spp.
Heterohelix glabrans
Globotruncana havanensis
Rugoglobigerina ex. gr. rugosa
Rugoglobigerina spp.
Rugoglobigerina subpetaloidea
Heterohelix aff. ultimatumida
Stensioeina pommerana
Abathomphalus mayaroensis
Globotruncana sp.
Osangularia sp.
Reussella szajnochae szajnochae
Glomospira sp.
Bulimina sp.
Gyroidinoides sp.
Lenticulina sp.
Bathysiphon sp.
Globotruncana arca
Globorotalites sp.
Neoflabellina sp.
Haphophragmoides spp.
Ammobaculites spp.
Trochammina sp.
Verneuilinoides mauritii
Lenticulina spp.
Dentalina spp.
Marginulinopsis inaequistriata
Rectoglandulina vulgata
Ammodiscus asper
Nodosaria spp.
Mesodentalina matutina
Saracenaria laevis
Frondicularia bicostata
Nodosaria corallina
Dentalina tenuistriata

OSTRACODES

Camptocythere parvula
Camptocythere cf. foveolata
Rutlandella sp.
Lophodentina tricostata
Ogmoconchella gr. adenticulata
Ogmoconchella aequalis
Kinkelinella sp.
Bairdia molesta
Pseudohealdia truncata
Ogmoconcha amalthei
Ogmoconcha contractula
Ogmoconchella transversa
Wicherella semiora
Grammanella apostolescui
Polycope cerasia
Gammacythere ubiquita
Ogmoconchella cf. pseudospina
Ogmoconchella gr. danica
Klinglerella elongata
Cytheropteron foveolatum
Polycope cincinnata

Fig.2 - DISTRIBUTION CHART OF CALCAREOUS MICROFOSSILS IN 34/10-5

STATOIL 34/10-5

JURASSIC MICROPLANKTON AND POLLEN - SPORES DISTRIBUTION CHART

Prepared by M.E. MILLIOUD. EPR-E (Bordeaux) june 1980

DEPTH (meters) | SAMPLES STUDIED | MARINE MICROPLANKTON / POLLEN - SPORIES RATIOS (Marine / Microplankton) | SPECIES

MARINE MICROPLANKTON

Pluriarvalium osmingtonense
Pareodinia evittii
Sentusidinium verrucosum
Chythroeisphaeridia pocockii
Chythroeisphaeridia sp. A
Pareodinia cf. ceratophora
Nannoceratopsis gracilis
Nannoceratopsis gracilis sbsp. A
Nannoceratopsis senex
Nannoceratopsis cf. spiculata
Leiofusa jurassica
Micrhystridium spp.
Veryhachium spp.
Dinoflagellate N-101
Dinoflagellate N-102
Nannoceratopsis ambonis
Fromea elongata
Dinoflagellate type 2 in Thusu
Pterospermopsis sp.
Moesiodinium raileanui
Nannoceratopsis triceras
Mancodinium semitabulatum
Luehndea spinosa
Scriniocassis weberi
Nannoceratopsis plegas
Dinoflagellate N-106

POLLEN-SPORES

Alisporites spp.
Classopollis spp.
Deltoidospora spp.
Osmundacidites wellmanii
Cerebropollenites mesozoicus
Vitreisporites pallidus
Podocarpidites spp.
Quadraeculina anellaeformis
Chasmatosporites spp.
Lycopodiumsporites austroclavidites
Lycopodiumsporites spp.
Tripartina variabilis
Callialasporites dampieri
Cerebropollenites thiergartii
Neoraistrickia truncata
Chomotriletes sp.
Corrugatisporites amplectiformis
Rugalskaisporites cicatricosus
Kraeuselisporites reissingeri
Lueckisporites sp.
Taeniaeporites triassicus
Clavatisporites hughesii
Stereisporites aulosonensis
Ceratosporites spinosus
Deltoidospora juncta
Leptolepidites equatibossus
Leptolepidites rotundus
Inaperturopollenites spp.
Microreticulatisporites fuscus
Ovalipollis ovalis
Ricciisporites tuberculatus
Taeniasporites rhaeticus

1800

1856-59
1860
1875
1884
1888
1895
1900
1903
1910
1912.5
1932.6
1956.9
1958.8
1969.9
1973.1
1979
1991
2000
2003.5
2012
2031
2040
2054
2077
2085
2093
2100
2102
2115
2136
2142
2151.5
2160
2195
2200
2202
2215
2230
2277
2294
2300
2343
2350
2365
2381
2400
2412
2435
2416
2500
2514
2545
2559
2565.5
2600
2666.4
2666-72
2673.5
2677.4
2682.4
2686
2700
2734
2732-8
2741
2753
2763
2768
2773
2800

Present, no quantitative data
+ < 4 %
* 4 - 10 %
▲ 10 - 25 %
● > 25 %

STATOIL 34/10-5

LOG I

SCALE : 1/2000

PREPARED BY J.P. COLIN, M.E. MILLIOUD, M. PONS
EPR-E (BORDEAUX) june 1980

METERS	EPR-E	PALEOSERVICES	REMARKS
1700			
	1730	1730	1730 *Nephrolitus frequens, Arkhangelskiella cymbiformis*
	LATE MAASTRICHTIAN	LATE MAASTRICHTIAN	1736 *Pseudotextularia elegans, Heterohelix globulosa, Globotruncana contusa*
		1766	
	1781		1781 Association of *Arkhangelskiella cymbiformis and Reinhardtites*
1800	EARLY MAASTRICHTIAN	MAASTRICHTIAN	
	LATE CAMPANIAN	? CAMPANIAN	
	1856 1857 LATE JURASSIC	1857 1858 LATE JURASSIC	1956-9 *Pluriarvalium osmingtonense Pareodinia evittii Quadraeculina anellaeformis*
1900	BATHONIAN	BATHONIAN	
2000	2003.5	2003.5	*Top Nannoceratopsis gracilis*
	EARLY BATHONIAN	EARLIEST BATHONIAN	
2100	BAJOCIAN	BAJOCIAN	
		2136	N. gracilis consistent
	2142 EARLY BAJOCIAN (AALENIAN)	EARLY BAJOCIAN	2142 *Nannoceratopsis gracilis* (abundant)
		2147 Agglutinated foram	2147 *Camptocythere parvula*
	2160	2160 PC+CP	2160 *Top Moesiodinium raileanui*
	EARLY BAJOCIAN (AALENIAN)	EARLY BAJOCIAN	2180 *Lophodentina tricostata*
2200	TOARCIAN	TOARCIAN	
		2222	K. inkulinella intrepida
		EARLY TOARCIAN	2230 Base *Moesiodinium raileanui* SWC
		2237	
	±2255 probably EARLY TOARCIAN	EARLY TOARCIAN	
	2277 EARLY TOARCIAN	LATE PLIENSBACHIAN	2277 *Sphaeromorphs dominant*
	2294		2394 *Lüehndea spinosa*
2300		2303	2306 *Ogmoconchella* gr. *adenticulata*
			2342 *Ogmoconchella aequalis Kinkelinella* sp.
	LATE PLIENSBACHIAN	LATE PLIENSBACHIAN	
2400			2402 *Ogmoconcha amalthei*
	2462 lowermost LATE PLIENSBACHIAN	2468	2462 *Wicherella semoria Ogmoconchella transversa*
	2480		2480 *Gammacythere ubiquita*
2500	EARLY PLIENSBACHIAN	EARLY PLIENSBACHIAN	
		2525	2322 *Klinglerella elongata*
	SINEMURIAN	EARLY PLIENSBACHIAN SINEMURIAN	
	2565.5	2561	2559 *Cerebropollenites mesozoicus* (commun)
	? SINEMURIAN		
2600		? SINEMURIAN	
	HETTANGIAN		
	2672	HETTANGIAN	2666-72 *Ovalipollis ovalis*
2700	HETTANGIAN		
	2738	2732	2732-8 *Riciisporites tuberculatus Taeniaesporites rhaeticus*
	RHAETIAN	RHAETIAN	
		2762	
		? RHAETIAN	
			2780 T.D.