RESEARCH CENTRE

SUNBURY-ON-THAMES

MIDDLESEX

EXPLORATION AND PRODUCTION DIVISION

PAB/32/82

MAY 1982

THE BIOSTRATIGRAPHY OF BP/STATOIL WELL 29/6-1

NORWEGIAN SECTOR, NORTH SEA

By

J. Crux (nannofossils), I. R. Hoskin (microfaunas) and

A. Welsh (palynology)

Compiled by A. Welsh

21/22-1

NIB

DATE 24.6.82

TO AMS

FROM DGD

SUBJECT 29/6-1 Palaeo report

No comments on the palaeontology however the lithology column in enclosure 1 has some errors - sandstones throughout the Humber Gp are overemphasised - there were only minor SST stringers present In addition the lower part of the Brent Fm should contain more sandstones. Where did they get their lithological info?

The taxalist we requested is fine - it should help with palaeo correlation

REPLY

Sola trykkeri A.s. B.P. 4 G

The British Petroleum Company Limited

BP Research Centre, Chertsey Road, Sunbury-on-Thames, Middlesex TW16 7LN

Dr. A.M. Spencer,
BP Petroleum Development Ltd., Norway,
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PO Box No. 3077,
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Norway.

Our reference	Your reference	Telephone Sunbury on-Thames 81234 Extn. 270	Date
PAB/447/6			9th June 1982

Dear Tony,

Please find enclosed five copies of the report, **'The Biostratigraphy of BP/Statoil Well 29/6-1 Norwegian Sector, North Sea'**, by J.A. Crux, I.R. Hoskin and A. Welsh. Also enclosed is a palynomorph list for S.W.C. samples from 29/6-1 (Jurassic interval) requested by P. Rattey in a telephone conversation recently.

A thick Tertiary sequence overlies with apparent conformity Late Cretaceous deposits of Cenomanian to Late Maastrichtian age. These Late Cretaceous deposits in turn unconformably overlie Jurassic sediments, ranging in age from ?Late Toarcian to Portlandian. Much of this Jurassic interval and the basal part of the well remain undated due to poor microfossil recovery.

Yours sincerely,

I.R. HOSKIN (DR.)
Chief Palaeontologist

Enc: PAB/32/82 (copies nos. 1-5) and Palynomorph Taxa List

c.c. R.E.M. Europe - North, Central and U.S.S.R. (copy no.6)
BP Pet. Dev. (DUK) Ltd., Dyce (copy no. 7)
EPD Library, Sunbury (copies nos. 8 and 9)
Palaeontology Branch Files (copy no. 10)

IRH/JE/356

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ABSTRACT

Palaeontological analysis of ditch cuttings, sidewall core and conventional core samples from the BP/Statoil well 29/6-1. Norwegian Sector, North Sea has allowed the recognition of a thick Tertiary sequence which overlies with apparent conformity Late Cretaceous sediments of Cenomanian to Late Maastrichtian age. The Late Cretaceous unconformably overlies the Jurassic which consists of sediments ranging in age from?Late Toarcian to Portlandian. However much of the Jurassic remains undated because of poor microfossil recovery.

1. INTRODUCTION

BP/Statoil well 29/6-1, located in the Norwegian Sector of the North Sea (see figure 1) was drilled to a T.D. of 4832 metres.

Ditch cuttings, from 290m. downwards, and also sidewall and conventional core samples from specific intervals, were available for examination. The final stratigraphical breakdown is the result of multidisciplinary studies involving microfaunas, palynomorphs and nannofossils.

LOCATION OF 29/6-1 AND NEIGHBOURING WELLS.

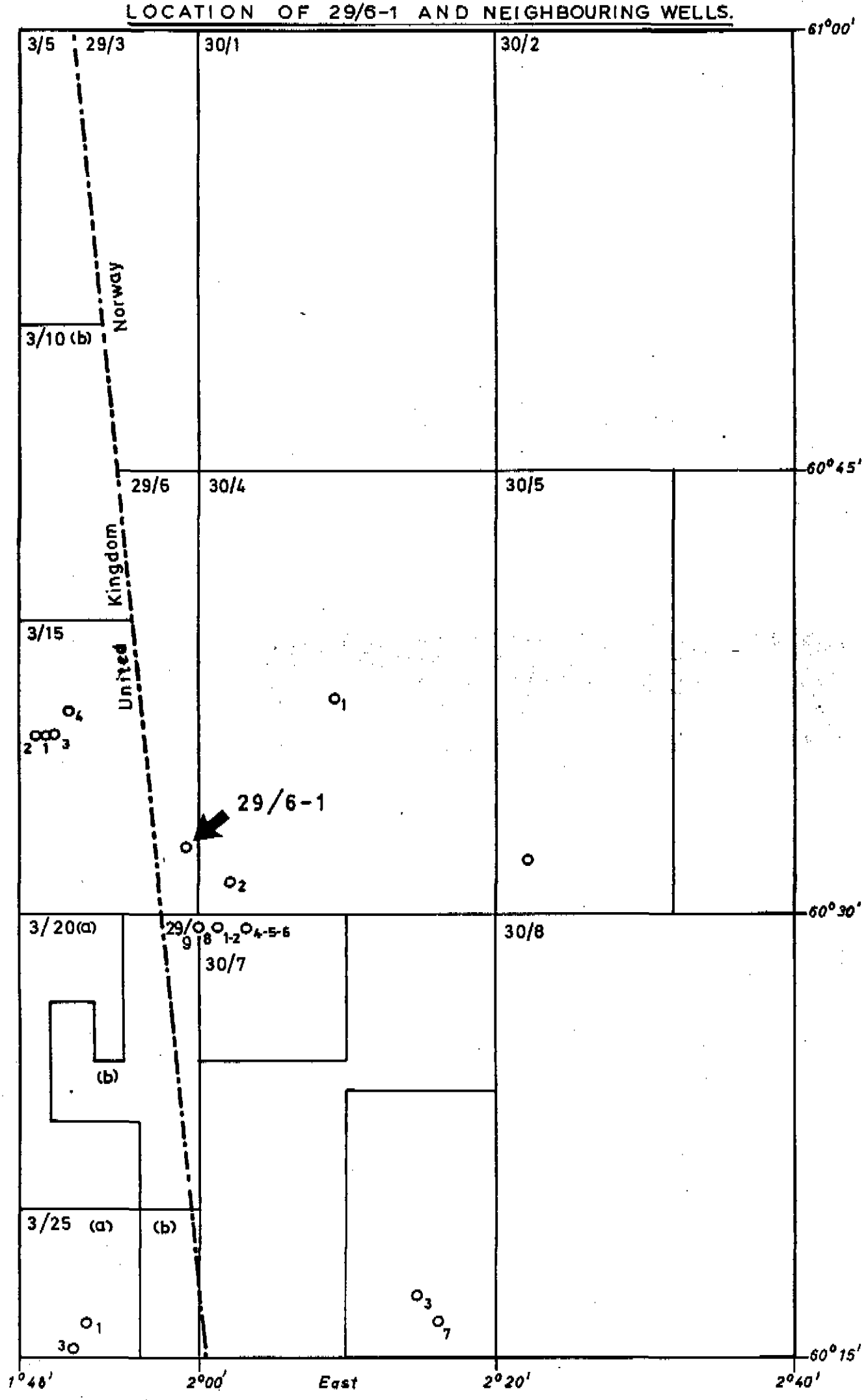

FIG 1

2. SAMPLE LIST (depths in metres)

Samples examined:

M Microfauna
N Nannofossils
P Palynomorphs
* Sidewall Core Sample
** Core Chip

350M	1100M	1660M	2120M	2620N	3315NP	3924.9*P
400M	1110M	1680M	2140MP	2649.9*N	3350N	3951P
500M	1120M	1700M	2160M	2650N	3400N	3963*P
600M	1130M	1720M	2170P	2670N	3425N	4007*P
620M	1140M	1750M	2180M	2700MNP	3450N	4026.9*P
640M	1150M	1770M	2190M	2720N	3485N	4075*P
660M	1160M	1780M	2200MNP	2750N	3500*NP	4083P
680M	1180M	1800M	2220M	2750*PN	3549.9*N	4098P
690M	1200M	1820M	2260M	2770N	3650*N	4107P
720M	1220M	1850MP	2280M	2800MNP	3699.9*N	4110M
730M	1240M	1870P	2300MNP	2820N	3750*NP	4113P
740M	1260M	1880M	2320NM	2850N	3751.1*N	4125.1*P
750M	1280M	1890P	2330M	2870N	3769.5*NP	4147.6*P
760M	1290M	1900M	2350M	2900MNP	3770P	4155.1*P
780M	1300M	1910P	2360M	2920N	3774*N	4160.1*P
800M	1320M	1920M	2370NM	2950N	3775P	4169.9*P
820M	1340M	1930MP	2380M	2970N	3777*NP	4192*P
840M	1360M	1940M	2390M	3000MN	3780*N	4196.9*P
860M	1380M	1950MP	2400MNP	3025N	3790*NP	4197P
880M	1400M	1960M	2420MN	3050N	3800*P	4202.9*P
900M	1420M	1970P	2440M	3075N	3803*N	4223.9**P
920M	1440M	1980M	2450N	3100MN	3810.5*P	4249**P
940M	1460M	1990P	2460M	3125N	3820*P	4251**P
950N	1480M	2010MNP	2470N	3150N	3829.2*P	4253.4**P
960M	1500M	2030MP	2480M	3175N	3861.9*P	4302.68**P
980M	1520M	2040P	2500MN	3200MN	3872*P	4396.1*P
1000M	1540M	2050MP	2520N	3225N	3882*P	4527*P
1020M	1560M	2070MP	2550N	3250N	3890*P	4540*P
1040M	1580M	2080P	2565N	3275N	3900P	4615*P
1050N	1600M	2090MP	2570N	3295P	3903.5*P	4657*P
1060M	1620M	2100MNP	2599.9*NP	3300M	3916*P	4720*P
1080M	1640M	2110P	2600MN	3310N	3918*P	4785*P
						4815*P

3. BIOSTRATIGRAPHICAL SUMMARY

	all depths in metres (mbrt)
QUATERNARY-TERTIARY	350-2370
Pleistocene-?Late Miocene	350-690
Miocene	720-750
?Early Miocene-Oligocene	760-1100
Oligocene	1110-1420
Eocene	1440-2050
Eocene (undifferentiated)	1440-1920
Early Eocene	1930-2050
Palaeocene	2070-2370
Palaeocene (undifferentiated)	2070-2330
Early Palaeocene	2350-2370
CRETACEOUS	2380-3803
Maastrichtian	2380-2670
Late Maastrichtian	2380-2520
Early Maastrichtian	2550-2670
Campanian	2700-2970
?Campanian	3000-3485
Santonian-Late Coniacian	3500-3650
Early Coniacian-Late Turonian	at 3699.9
'Middle' Turonian	at 3750
'Middle' Turonian-Cenomanian	at 3769.5
Cenomanian	3780-3803
Cenomanian (undifferentiated)	at 3780
'Middle'-Early Cenomanian	3790-3803
JURASSIC	3829.2-4540
'Middle' Portlandian-'Middle' Kimmeridgian	at 3829.2
Early Oxfordian	at 3872
Early Oxfordian-Late Callovian	3916-3918
Late Callovian	3924.9-4026.9
Indeterminate	4075-4396
Bajocian-?Late Toarcian	4527-4540
Indeterminate	4615-4815

4. BIOSTRATIGRAPHICAL ANALYSIS

4.1 QUATERNARY-TERTIARY 350-2370 metres.

PLEISTOCENE-?LATE MIOCENE 350-690 metres.

Calcareous benthonic foraminifera dominated this interval but most forms are undiagnostic or long ranging. The age of the interval is based on (i) the occurrence of Elphidiella hannai at 350m. which indicates the penetration of early Pleistocene age sediments by this depth, and (ii) the occurrence of the foraminifera Florilus commune and Oridorsalis umbonatus at 640m, which are both typically found in Late Miocene-Pliocene sediments of this region.

The predominance of these calcareous benthonic foraminifera probably indicates a middle shelf depositional environment.

MIOCENE (undifferentiated) 720-750 metres.

The first downhole occurrence of Asterigerina staeschei and Elphidium cf. inflatum at 720 m. indicates the penetration of Miocene age sediments by this depth. This age is supported by the occurrence of Heterolepa dutemplei at 740m, and Ehrenbergina serrata at 750m.

The presence of a diverse calcareous benthonic foraminiferal assemblage indicates a middle shelf depositional environment.

?EARLY MIOCENE-OLIGOCENE 760-1100 metres.

The foraminifera Elphidium subnodosum and Asterigerina gurichi were first recorded at 760m. and 1060m. respectively. These forms are considered by some authors as Oligocene marker taxa, while others consider that their ranges possibly extend into the Early Miocene. Abundant sponge spicules occur between 920m. and 1040m.

The diverse calcareous benthonic foraminiferal assemblage recorded throughout the interval suggests a middle shelf depositional environment.

OLIGOCENE 1110-1420 metres.

The appearance of Turrilina alsatica at 1110m. indicates that sediments of Oligocene age have definitely been penetrated. At 1130 metres, an Early-Middle Oligocene age is indicated by the co-occurrence of the foraminifera Rotaliatina bulimoides, and the pyritised diatom Coscinodiscus sp B. The first downhole occurrence of Silicosigmoilina tenuis at 1300m. is further evidence for an Oligocene age.

Calcareous benthonic foraminifera dominate assemblages in this interval down to 1260m. A few agglutinating forms appear between 1220m. and 1260m. and then become dominant throughout the remainder of the interval. These agglutinating assemblages include Cyclammina, Bathysiphon, Recurvoides and Glomospira. Radiolaria and diatoms were also recorded at certain levels.

The predominance of calcareous benthonic foraminifera in the upper part of the interval suggests a shelf depositional environment. The incoming of agglutinating forms below 1220m. suggests a change to bathyal conditions.

EOCENE 1440-2050 metres.

EOCENE (undifferentiated) 1440-1920 metres

The first downhole occurrence of Cyclammina challinori (≡ C. amplectens) at 1440m. indicates an age no younger than Eocene at this depth. This age is confirmed by the first occurrences of the agglutinating foraminifera Bolivinopsis spectabilis at 1560m. and Karreriella subeocaena at 1720m. In some areas of the North Sea Basin these two forms are associated with Early Eocene sediments, but their ranges have been extended into the Middle and possibly latest Eocene. Several new agglutinated genera appear in the interval including Bolivinopsis, Trochammina, Cystammina and Ammodiscus. Large flattened radiolaria also occur commonly, especially at 1640m., where they are present in flood abundance.

The occurrence of the dinoflagellate cysts Eatonicysta ursulae and Wetzeliella pachyderma at 1850m. provides palynological support for an Eocene age, and suggests that Middle Eocene age sediments have been penetrated by that depth.

The foraminiferal assemblages throughout the interval are almost exclusively agglutinating suggesting a bathyal depositional environment. The presence of occasional floods of large flattened radiolaria is suggestive of open marine conditions, and that the seafloor was probably below the C.C.D.

Several reworked palynomorphs were recorded at 1870m., including the ubiquitous Carboniferous miospore, Lycospora pellucida and the dinoflagellate cyst Nannoceratopsis gracilis (Pliensbachian - Bajocian).

EARLY EOCENE 1930-2050 metres.

The top of this interval is defined at 1930m. by a flood of planktonic foraminifera, which includes red and white stained Subbotina triloculinoides (sensu lato). Further evidence

for Early Eocene age sediments is indicated by (1) the appearance of the large pyritised diatom Coscinodiscus sp.1 at 1950m., and (2) the foraminifera Bulimina orphanensis at 1960m, and (3) the first downhole occurrences of the palynomorphs Deflandrea oebisfeldensis and Hystrichosphaeridium tubiferum at 1950m.,and Hafniasphaera septata at 2030m. H. tubiferum was particularly common at 1990m.

Open marine conditions are indicated in this interval by the occurrence of pyritised diatoms, Coscinodiscus, and a flood of planktonic foraminifera. The occurrence of large amounts of land derived material including the pollen genera Taxodiaceaepollenites and Carya in the lower part of the interval, below 2030m., suggests a strong terrigenous influence.

Reworked specimens of the Carboniferous miospore Crassispora kosankei, and Nannoceratopsis gracilis were recorded at 2010 and 2040 metres respectively.

PALAEOCENE 2070-2370 metres.

PALAEOCENE (undifferentiated) 2070-2330 metres.

The first downhole occurrence of the dinoflagellate cyst Wetzeliella augusta at 2070m., indicates the penetration of Palaeocene age sediments. Several other species which become extinct in the Palaeocene were observed in this interval, including Alisocysta circumtabulata and Apectodinium hyperacantha at 2110m., and Deflandrea striata at 2200m. The typically Palaeocene taxa Alisocysta circumtabulata, and Hafniasphaera spp. were particularly common at 2200m. and 2300m.

Throughout this interval agglutinating foraminiferal assemblages were dominant. Many of the forms first encountered in the Eocene interval were recorded here in abundance e.g. B. spectabilis, Cystammina pauciloculata, Glomospira charoides, but Cyclammina was less apparent. The agglutinating forms encountered between 2140m. and 2330m. were stained dark green, this being a common feature of Palaeocene foraminifera in this part of the North Sea Basin, which enables these forms to be clearly distinguished from their caved Eocene counterparts. The Palaeocene-restricted agglutinating foraminifera Trochammina sp.A (= T. aff.albertensis) was first recorded downhole at 2330m.

The occurrence of almost exclusively agglutinating foraminifera throughout this interval suggests a bathyal depositional environment.

Land derived material including Taxodiaceaepollenites and Carya pollen was particularly common in the interval 2070-2170m. suggesting terrigenous influence.

Extensive palynological reworking was recorded throughout this interval eg. Carboniferous: Lycospora pusilla at 2070m., Cingulizonates loricatus at 2080m., Knoxisporites sp. at 2300m., Jurassic: Gonyaulacysta jurassica at 2070m., 2100m., and 2170m., Adnatosphaeridium aemulum at 2170m., Scriniocassis dictyotus at 2200m., Nannoceratopsis gracilis and Pareodinia sp. at 2300m., Cretaceous: Odontochitina costata at 2090m., and Scriniodinium campanulum at 2300m.

EARLY PALAEOCENE 2350-2370 metres.

The top of this interval was recognized at 2350m. by a noticeable change in the foraminiferal assemblage composition from a predominantly agglutinating type above, to a mainly calcareous benthonic and planktonic type below. Age diagnostic Early Palaeocene planktonic foraminifera recorded in this interval include Globorotalia (Turborotalia) compressa and Eoglobigerina edita at 2350m., G.(T.) pseudobulloides at 2360m., and Globoconusa cf. daubjergensis at 2370m. Benthonic foraminifera which indicate a similar age include Discorynopsis parvula at 2350m., Quadrimorphina allomorphinoides and Anomalinoides velascoensis at 2360m., and Allomorphina halli at 2370m.

The occurrence of the nannofossil Chiasmolithus danicus at 2370m. also supports an Early Palaeocene age.

The occurrence of abundant, diverse calcareous benthonic and planktonic foraminiferal assemblages in this interval suggests an outer shelf, open marine, depositional environment.

4.2 CRETACEOUS 2380-3803 metres.

MAASTRICHTIAN 2380-2670 metres.

LATE MAASTRICHTIAN 2380-2520 metres.

The appearance of abundant specimens of the foraminifera Globotruncana contusa, Pseudotextularia elegans, Racemiguembelina fructicosa and Stensioina pommerana at 2380m. indicates the penetration of Late Maastrichtian sediments. The highest occurrences of several other foraminiferal species known to become extinct in the Maastrichtian were also noted and include Rugoglobigerina rugosa and Gavelinella vombensis at 2390m., and Abathomphalus mayaroensis and Reussella szajnochae at 2460m.

The first downhole occurrence of the Late Maastrichtian-restricted nannofossil species Neprolithus frequens was recorded at 2400m. Other typical Maastrichtian species which appear between 2400m. and 2520m. include Arkhangelskiella cymbiformis and Zygodiscus spiralis.

The presence of abundant calcareous and planktonic foraminifera between 2380m. and 2460m. suggests an open marine, outer shelf depositional environment.

EARLY MAASTRICHTIAN 2550-2670 metres.

The first downhole appearance of the nannofossil Reinhardtites levis at 2550m. indicates the penetration of Early Maastrichtian sediments.

The association of the dinoflagellate cysts Deflandrea diebeli (common), Palaeoperidiniun pyrophorum, Spongodinium delitiense, Spinidinium clavum, and the pollen species Orbiculapollis globosus, Triprojectus magnus and Aquilapollenites spp. in a sidewall core at 2599.9m. is confirmatory evidence for an Early Maastrichtian age at this depth.

The occurrence of microplankton and nannofossils in this interval suggests a marine depositional environment.

CAMPANIAN 2700-2970 metres.

The top of this interval is defined by the first downhole occurrence of the foraminifera Tritaxia dubia and Globotruncana lapparenti (sensu Pessagno 1967) at 2700m.

Further evidence for the penetration of Campanian sediments is provided by the first downhole occurrences of the dinoflagellate cysts Palaeohystrichophora infusorioides, Xenascus ceratioides (common), Odontochitina operculata and O. costata, in a sidewall core at 2750m., and the Campanian-restricted nannofossil Orastum campanensis at 2970m.

The presence of dinoflagellates and planktonic foraminifera through this interval suggests a marine depositional environment.

?CAMPANIAN 3000-3485 metres.

Ditch cuttings examined from this interval contain nannofossil assemblages of general Late Cretaceous aspect with no forms allowing a more precise subdivision.

Tentative evidence for the occurrence of Campanian age sediments within this interval is provided by:

(i) the occurrence of a single specimen of the 'Middle' Campanian restricted nannofossil Ceratolithoides arcuatus at 3075m.

(ii) the occurrence of the dinoflagellate cyst Trithyrodinium suspectum a species becoming extinct in the Campanian, in a 'spot sample' at 3295m.

(iii) the occurrence of the foraminifera Gyroidina quadrata which becomes extinct in the Early Campanian in a 'spot sample'at 3300m.

It cannot be ruled out that all of these forms are caved into older barren strata.

SANTONIAN-LATE CONIACIAN 3500-3650 metres.

The occurrence of the nannofossil Lithastrinus floralis in a sidewall core at 3500m. indicates that sediments no younger than Santonian age occur at this depth. The sidewall core at 3650m. contains Micula staurophora which first appears in the Late Coniacian. This interval is therefore dated as Santonian-Late Coniacian. The sidewall core at 3500m. also contained abundant specimens of the dinoflagellate cyst Chatangiella spp., a genus which is often common in Senonian sediments.

The occurrence of exclusively marine microfossils through this interval suggests a marine depositional environment.

EARLY CONIACIAN-LATE TURONIAN at 3699.9 metres.

The sidewall core at 3699.9m. contains the nannofossils Eiffellithus eximius and Kamptnerius magnificus which first appear in the Late Turonian in the North Sea Basin.

The absence of Micula staurophora indicates a pre Late Coniacian age.

The occurrence of nannofossils in this sample suggests a marine depositional environment.

'MIDDLE' TURONIAN at 3750 metres.

An age no older than 'Middle' Turonian is indicated for the sidewall core at 3750m. by the occurrence of Lucianorhabdus quadrifidus. Taken in conjunction with the absence of E. eximus which has its inception in the Late Turonian, the age of the sample is limited to 'Middle' Turonian.

The occurrence of the dinoflagellate cysts Scriniodinium campanulum, Litosphaeridium siphoniphorum and Xiphophoridium alatum in the same sidewall core indicates a latest Albian-mid.Turonian age.

The presence of exclusively marine microfossils in this sample suggests a marine depositional environment.

'MIDDLE' TURONIAN-CENOMANIAN at 3769.5 metres.

The sidewall core at 3769.5m. yielded a dinoflagellate cyst assemblage which includes Cyclonephelium membraniphorum (common), Palaeohystrichophora infusorioides (common), Scriniodinium campanulum, Stephodinium coronatum, Xiphophoridium alatum, Surculosphaeridium longifurcatum and Odontochitina costata.

The association of these species indicates a latest Albian-mid. Turonian age. In view of the firm evidence for Cenomanian below, a 'middle' Turonian-Cenomanian age is assigned to the sample.

The occurrence of dinoflagellate cysts in this sample suggests a marine depositional environment.

CENOMANIAN 3780-3803 metres.

CENOMANIAN (undifferentiated) at 3780 metres.

The occurrence of the nannofossil Parhabdolithus asper (Valanginian-Cenomanian) in a sidewall core at 3780m. indicates the penetration of Cenomanian age sediments. Also present in the assemblage is E. turriseiffeli (Late Albian-Maastrichtian).

'MIDDLE'-EARLY CENOMANIAN 3790-3803 metres.

The association of the nannofossils P. asper and E. turriseiffeli, with Corollithion kennedyi (Early-Middle Cenomanian) in the sidewall core at 3790m. indicates an Early-'Middle' Cenomanian age at this depth. This sidewall core also yielded a fairly diverse dinoflagellate cyst assemblage including L. siphoniphorum (common), P. infusorioides (common), S. campanulum, X. alatum, O. costata, Hexagonifera chlamydata, Surculosphaeridium longifurcatum and a form similar to Epelidosphaeridia spinosa, which together suggest a latest Albian-Cenomanian age.

The occurrence of exclusively marine microfossils in the Cenomanian interval suggests a marine depositional environment.

4.3 JURASSIC 3829.2-4540 metres.

'MIDDLE' PORTLANDIAN-'MIDDLE' KIMMERIDGIAN at 3829.2 metres.

The occurrence of the dinoflagellate cyst Gonyaulacysta longicornis (sensu stricto) in a poorly diversified assemblage from the sidewall core at 3829.2m. suggests a 'middle' Kimmeridgian-'middle' Portlandian age at this depth. This sample also contains poorly preserved specimens of the dinoflagellate cysts, Tubotuberella apatela,

Systematophora sp., an uncertain record of the miospore Cicatricosisporites, and the acritarch Pterospermella, with fairly abundant amorphous debris. This palynological association has often been recorded previously in the Kimmeridge Clay Formation. The presence of microplankton and amorphous debris in this sample suggests a marine depositional environment with restricted circulation.

It is worth noting that in the sidewall cores at 3810.5m. and 3820m., despite the absence of diagnostic dinoflagellates, the overall composition of the palynological residues is more similar to that recorded at 3829.9m., than that from the stratigraphically higher Cenomanian samples.

EARLY OXFORDIAN at 3872 metres.

The association of Wanaea fimbriata, Dinoflagellate cyst 15, Nannoceratopsis pellucida, Adnatosphaeridium aemulum and Hystrichogonyaulax cladophora in a sidewall core at 3872m. suggests an Early Oxfordian age at this depth.

EARLY OXFORDIAN-LATE CALLOVIAN 3916-3918 metres.

The occurrence in a sidewall core at 3916m. of Lithodinia jurassica which is generally considered to range no higher than Callovian, and the restricted Early Oxfordian species W. fimbriata in a sidewall core at 3918m. is apparently anomalous. It is possible however that an overlap of their ranges may occur in some areas, and the interval is therefore dated as Early Oxfordian-Late Callovian. Other species occurring in these samples include Gonyaulacysta areolata, Scriniodinium crystallinum, H. cladophora, Tubotuberella eisenackii, Gonyaulacysta jurassica and Compositosphaeridium costatum.

LATE CALLOVIAN 3924.9-4026.9 metres.

The occurrence in a sidewall core at 3924.9m. of the dinoflagellate cyst assemblage L. jurassica, H. cladophora, C. costatum, G. jurassica (common), G. areolata, S. crystallinum and Stephanelytron spp, is in the absence of W. fimbriata, considered indicative of Late Callovian age sediments. A more diverse assemblage with fairly common L. jurassica and G. jurassica, Sentusidinium rioultii and Wanaea digitata was recorded in a sidewall core at 4007m. The first downhole occurrence of two species considered by some authors to become extinct in the Callovian, Wanaea cf. fimbriata and Ctenidodinium continuum was also recorded in a sidewall core at 4026.9m. The presence of G. areolata (common) in this sample is evidence for an age no older than Late Callovian at this depth.

The presence of dinoflagellate cysts in the Early Oxfordian and Late Callovian sediments suggests a marine depositional

environment. Sporadic occurrences of abundant amorphous debris in samples from these intervals suggests that there were periods of restricted circulation.

INDETERMINATE 4075-4396 metres.

The sidewall and conventional core samples analysed from this interval were either palynologically barren, or contained undiagnostic forms. Several of the sidewall cores from the interval 4075-4196.9m. yielded sparse dinoflagellate cyst assemblages. Pareodinia ceratophora was recorded in abundance at 4125.1m. and 4160.1m. in association with Escharisphaeridia spp. and Chytroeisphaeridia chytroeides. These are all fairly long ranging forms.

Core chips from the interval 4223.9-4302.68m. were barren of palynomorphs with the exception of poorly preserved miospores eg. Lycopodiumsporites spp. at 4302.68m.

The occurrence of dinoflagellate cysts with some land derived material indicates a marine depositional environment with weak terrigenous influence for the interval 4075-4160.1m.

BAJOCIAN-?LATE TOARCIAN 4527-4540 metres.

The sidewall core at 4527m. contained rare specimens of the dinoflagellate cyst Nannoceratopsis gracilis suggesting the presence of Late Pliensbachian-Bajocian sediments at this depth.

An uncertain record of the miospore Staplinisporites caminus in the sidewall core at 4540m. is tentative evidence for an age no older than Late Toarcian. Several specimens of N. gracilis were also recorded in this sample.

INDETERMINATE 4615-4815 metres.

Samples examined from this interval were barren of palynomorphs.

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LISTS OF PALYNOMORPHS RECORDED IN SIDEWALL CORE SAMPLES

FROM THE JURASSIC INTERVAL OF

BP/STATOIL WELL 29/6-1

Sidewall core 133, 3810.5m.

rare bisaccate pollen
Pterospermella sp.
Pareodinia sp.

Sidewall core 189, 3820m.

Pterospermella sp.
Oligosphaeridium sp?
Sirmiodinium grossi

Sidewall core 188, 3829.2m.

Tubotuberella apatela
Systematophora sp.
Cicatricosisporites sp?
Pterospermella sp.
Gonyaulacysta longicornis

Sidewall core 186, 3861.9m.

Senoniasphaera sp.?

Sidewall core 185, 3872m.

Dinoflagellate cyst 15
Wanaea fimbriata

Sentusidinium sp.

Nannoceratopsis pellucida

Adnatosphaeridium aemulum

Gonyaulacysta sp.

Hystrichogonyaulax cladophora

Oligosphaeridium sp.?

Sidewall core 184, 3882m.

Gonyaulacysta sp.

Systematophora sp.?

Sidewall core 153, 3890m.

Deltoidospora sp.

Scriniodinium crystallinum

Sidewall core 152, 3903.5m.

palynologically barren

Sidewall core 149, 3916m.

Adnatosphaeridium aemulum

Sentusidinium sp.

Scriniodinium crystallinum

Pareodinia sp.

Gonyaulacysta jurassica

Hystrichogonyaulax cladophora
Tubotuberella apatela
Tubotuberella eisenackii
Gonyaulacysta areolata
Nannoceratopsis pellucida
Lithodinia jurassica

Sidewall core 118, 3918m.

Adnatosphaeridium aemulum
Gonyaulacysta jurassica
Gonyaulacysta areolata
Tubotuberella apatela
Nannoceratopsis pellucida
Wanaea fimbriata
Hystrichogonyaulax cladophora
Compositosphaeridium costatum
Chytroeisphaeridia chytroeides
Tubotuberella eisenackii
Scriniodinium sp.

Sidewall core 181, 3924.9m. 3924.5

Stephanelytron spp.
Gonyaulacysta areolata
Adnatosphaeridium aemulum
Scriniodinium sp.
Gonyaulacysta jurassica
Pareodinia sp.
Hystrichogonyaulax cladophora
Scriniodinium crystallinum

Nannoceratopsis pellucida
Compositosphaeridium costatum
Sirmiodinium grossi
Tubotuberella apatela
Polygonifera minima
Lithodinia jurassica

Sidewall core 145, 3963m.

palynologically barren

Sidewall core 143, 4007m.

Nannoceratopsis pellucida
Dinoflagellate cyst 15.
Hystrichogonyaulax cladophora
Gonyaulacysta jurassica
Cerebropollenites mesozoicus
Wanaea digitata
Lithodinia jurassica
Compositosphaeridium costatum
Sentusidinium rioultii
Polygonifera minima
Escharisphaeridia spp.
Gonyaulacysta areolata
Mendicodinium groenlandicum
Pareodinia ceratophora
Systematophora sp.
Chytroeisphaeridia chytroeides

Sidewall core 141, 4026.9m.

Compositosphaeridium costatum
Nannoceratopsis pellucida
Gonyaulacysta areolata
Tubotuberella dangeardii
Wanaea digitata
Adnatosphaeridium aemulum
Sentusidinium rioultii
Ctenidodinium continuum
Hystrichogonyaulax cladophora
Gonyaulacysta jurassica
Mendicodinium groenlandicum
Sirmiodinium grossi
Pareodinia ceratophora
Wanaea cf. fimbriata
Systematophora sp.
Lithodinia jurassica

Sidewall core 92, 4075m.

Callialasporites sp.
Pareodinia sp.
Escharisphaeridia sp.
Callialasporites dampieri

Sidewall core 86, 4125.1m.

Pareodinia ceratophora
Chytroeisphaeridia chytroeides

Lycopodiumsporites cf. austroclavatidites

Gonyaulacysta sp.

Sidewall core 84, 4147.6m.

Pareodinia ceratophora

Deltoidospora spp.

Escharisphaeridia spp.

Sidewall core 83, 4155.1m.

Cerebropollenites mesozoicus

Escharisphaeridia sp.

Sidewall core 111, 4160.1m.

Pareodinia ceratophora

Cerebropollenites mesozoicus

Escharisphaeridia spp.

Sidewall core 138, 4169.9m.

Several unidentifiable miospores

Sidewall core 136, 4192m.

No identifiable palynomorphs

Sidewall core 79, 4196.9m.

Cerebropollenites mesozoicus

Sidewall core 77, 4202.9m.

No identifiable forms

Core chip, 4223.9m.

No palynomorphs

Core chip, 4249m.

No palynomorphs

Core chip, 4251m.

No palynomorphs

Core chip, 4253.4m.

No palynomorphs

Core chip, 4302.68m.

Lycopodiumsporites sp.

Sidewall core 180, 4396m.

Contaminated core

Sidewall core 176, 4527m.

Nannoceratopsis gracilis

Sidewall core 175, 4540m.

Nannoceratopsis gracilis
Staplinisporites caminus?
Mancodinium sp.
Cerebropollenites mesozoicus

Sidewall core 172, 4615m.

Contaminated core

Sidewall core 170, 4657m.

No identifiable forms

Sidewall core 167, 4720m.

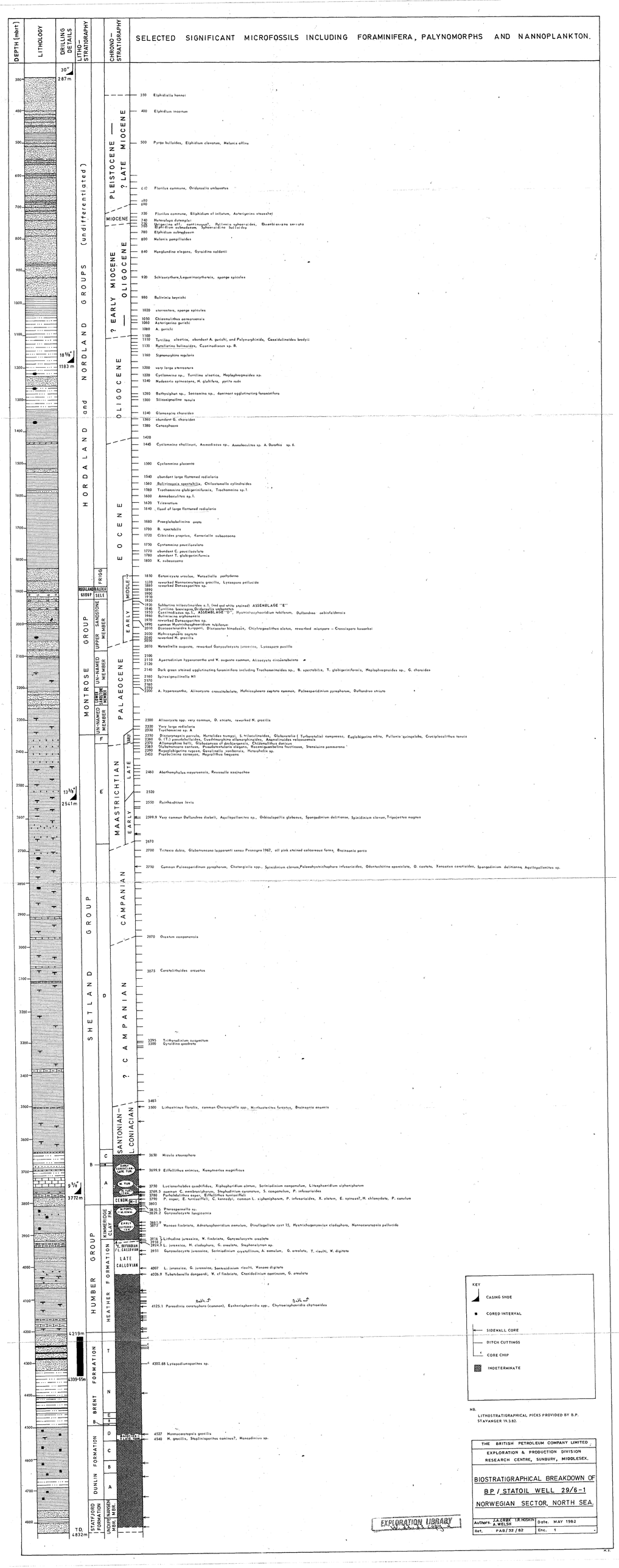
Palynologically barren

Sidewall core 47, 4785m.

Palynologically barren

Sidewall core 46, 4815m.

Palynologically barren



NB.
LITHOSTRATIGRAPHICAL PICKS PROVIDED BY B.P. STAVANGER 19.3.82.

THE BRITISH PETROLEUM COMPANY LIMITED
EXPLORATION & PRODUCTION DIVISION
RESEARCH CENTRE, SUNBURY, MIDDLESEX.

BIOSTRATIGRAPHICAL BREAKDOWN OF BP / STATOIL WELL 29/6-1 NORWEGIAN SECTOR, NORTH SEA.

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