



① KLP ② [unclear] 6610/7-1

NORWEGIAN PETROLEUM DIRECTORATE

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Brev uten vedlegg

Statoil
P O Box 300
4001 STAVANGER

Attn: Tore Sund
References yours

Ours
OD 83/8849 /Lic/IB

Stavanger,
14 JUNI 1983

Dear Mr Sund,

BIOSTRATIGRAPHY OF TRÆNABANKEN WELL 6610/7-1

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Please find enclosed a copy of an interim report prepared by Oljedirektoratet's Biostratigraphy Group on the interval 390 m to 2100 m of well 6610/7-1.

Some sidewall core samples from the same interval are currently being prepared at our laboratory. As agreed, we will forward duplicates of these preparations to Statoil's Geological Laboratory, and inform of any modifications that their study suggest to the ages here reported.

A second interim report, covering the interval 2100 to 2885 m is presently being processed. We can anticipate that there are no major modifications to the ages previously reported by us by telex.

Yours sincerely

Finn R. Aamodt
Finn Roar Aamodt
Section Manager

Lucy I Costa
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Chief Palaeontologist

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Enclosure: 1

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APPEAL AGAINST DECISION (cf ADMINISTRATION ACT OF 10 FEBRUARY 1967, § 27, 3 PARAGRAPH AND CHAPTER VII)

The party or his representative may appeal a decision within 3 weeks following the receipt of the decision. The appeal shall: a) be presented to the Norwegian Petroleum Directorate, b) be signed by the appellant or his representative, c) state the decision appealed against, and if necessary give information to establish whether a right to appeal exists and whether the appeal period has been observed, d) state the modification desired in respect of the appealed decision, and preferably the grounds of the appeal. The Administration Act, § 18 cfr § 19 give the party right to see the documents of the case. The appeal does not have a postponing effect on the decision unless otherwise provided by the Norwegian Petroleum Directorate. Conditions for such postponement can be stipulated. The party or his representative has the right to request the execution of the decision in question postponed until the appeal has been considered, if an execution of the decision could cause damage to the party.

BIOSTRATIGRAPHY WELL 6610/7-1: INTERVAL 360 - 2100 m

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Introduction

Spot ditch cuttings samples (mostly 10 m composites) from the interval 360 to 2100 m in well 6610/7-1 were examined for micropalaeontology (AaM) and palynology (LIC).

This interval spans Neocomian to Pleistocene. The results are summarised in Table 1. Most of the age determinations in the Cenozoic are based on calcareous or siliceous microfossils, datings in the Cretaceous are based on micropalaeontological and palynological analyses on the same samples.

Because of the sparse sample coverage in parts of this sequence, the ages indicated on Table 1 may be somewhat modified by the study of intervening samples or of sidewall cores. Nevertheless, the rich microfossil assemblages recovered from the samples so far prepared, permit relatively confident age determinations, even at this early stage.

Biostratigraphy

360 - 700 m: PLEISTOCENE

This interval yields a relatively rich assemblage of benthonic foraminifera. Elphidella hannai, at 500 m and below, suggests early Pleistocene. The assemblages from this interval are indicative of subzone NSB 16b (King, in press).

730 - 910 m: PLEISTOCENE/PLIOCENE

Elphidium orogenense at 730 m indicates proximity to the Plio/Pleistocene boundary, and equivalence to King's subzone NSB 16a. The microfaunas become impoverished towards the lower part of this interval.

910 - 970 m: ?PLIOCENE

The sponge spicule Geodia sp., sporadically present in samples from this interval, has been used as index for Miocene elsewhere. However, the interval 910-970 m appears more comparable to well located Pliocene in the Haltenbanken area. The Bolboforma group, which usually occurs together with Geodia sp., has not been recorded from the samples examined here.

No indices (micropalaeontological or palynological) for Miocene, Oligocene or Late Eocene were observed in this well. This suggests that sediments of that age may be absent from the present locality.

970 - 1020 m: MIDDLE EOCENE

The interval 970 - 1080 m is barren of foraminifera. Radiolaria occur from 970 m, becoming abundant at 1000 m and below. The radiolarian form M sp.20 was recorded from 1000 m. In some of the wells in Haltenbanken, M sp.20 occurs immediately above the Globigerina linaperta Zone, and is taken as indicative of Middle to Early Eocene.

A rich palynological assemblage closely resembling those from the Bartonian in S England, France and the North Sea, was recovered from 970 m. This includes the critical taxa: Areoligera tauloma, A. undulata, Areosphaeridium diktyoplokus, A. multicornutum, Dracodinium pachydermum, Gochtodinium simplex and Wetzeliella ovalis. This assemblage unmistakably belongs to the regional European dinocyst Zone D 10 (Costa et al., in press), of latest Middle Eocene (Bartonian) age.

1020 - 1120 m: EARLY EOCENE

The following critical dinocyst taxa were recorded from 1020 m: Heteraulacacysta leptalea, Homotryblium oceanicum, Turbiosphaera galeata, and T. aff. magnifica; these are indicative of Lutetian (Middle Eocene). However, the co-occurrence of common Diphyes "eyrensis" and sparse Eatonicysta "membranosa" suggests uppermost Lower Eocene (Ypresian), and equivalence to the regional dinocyst Zone D 8.

At 1080 m, Lenticulina sp., Cancris cf. auriculus, Siphonina sp., and Globigerina gr. linaperta (pink stained), indicate correspondence with the Early Eocene Røsnæs Clay faunas. The interval 1080 - 1110 m is consequently allocated to zones NSB 3 and NSP 5 (King).

1120 - 1220 m: EARLY EOCENE - LATE PALAEOCENE

This interval yields abundant diatoms including Coscinodiscus sp. 1 and Coscinodiscus sp. 2 at 1120 m, and Triceratium sp. 1 at 1140 m. Forms so far only seen from the Balder Formation equivalents in Tromsø, have here been recorded from 1140 m. This interval corresponds to zones NSB 2 and NSP 4.

1220 - 1260 m: LATE PALAEOCENE

Arenaceous foraminifera including Spiroplectammina spectabilis, Globoconusa charoides, Praecystammina globigerinaeformis, Trochammina ruthven murrayi, and Rhabdammina gr., are abundant in the assemblages. This microfauna is typically Late Palaeocene and belongs to subzone NSB 1b.

1320 m: EARLY DANIAN - ?LATE MAASTRICHTIAN

The micropalaeontological assemblage from 1320 m is dominated by long-ranging coarse grained arenaceous foraminifera and includes the same genera as the assemblages from the overlying interval. The assemblage also contains sparse calcareous forms, such as Bullina trigonalis and Globoconusa cf. daubjergensis, the latter indicative of Early Palaeocene. The arenaceous Arenobulimina sp. and Textularia plummerae, usually recorded from Lower Palaeocene - Upper Cretaceous, are also present in this sample.

Critical Late Cretaceous foraminifera were not observed at this level.

The same sample (1320 m) yields a rich assemblage of Danian and younger dinoflagellates. The occurrence of abundant Senoniasphaera inornata indicates an age not younger than the lowermost Danian dinocyst zone D 1. The joint presence of Phelodinium kozlowskii, Senoniasphaera protrusa and Palynodinium sp.1 (n.sp.), if in place, suggests, however, uppermost Maastrichtian.

1340 - 1360 m: MAASTRICHTIAN

A rich planktonic microfauna including the indices Pseudotextularia elegans, Rugoglobigerina rugosa, Globigerinelloides asper, Biglobigerinella multispina, Heterohelix spp., Gavelinella vombonsis, Globorotalites sp., Spiroplectamina dentata and Bolivinoidea sp., diagnostic for Maastrichtian, occurs in this interval.

Foraminiferal evidence for the presence of Lower Maastrichtian in this well is provided by the occurrence of Reussella szajnochae as cavings in the Lower Cretaceous.

The dinoflagellate Palynodinium grallator, abundant at 1340 m, is clear evidence for Maastrichtian. This is further supported by the occurrence of Spongodinium delitiense and Laciniadinium arcticum.

At 1360 m, the incoming of the dinoflagellates Cyclonephelium distinctum, Chatangiella, Isabelidinium belfastensis and Triblastula utinensis, indicates Early Maastrichtian.

1500 m: CAMPANIAN

Arenaceous foraminifera predominate at this level. Hormosina ovulum, H. ovulum gigantea, Kalamopsis grzybowskii, Trochamminoides spp., and Arenoturrispirulina concavata, are taken to indicate Campanian. Similar assemblages have been recovered from the Campanian in Haltenbanken.

Species of the dinoflagellate Chatangiella, including C. tripartita, C. spectabilis, and C. granulifera, abound at 1500 m. Common Odontochitina striatoperforata (tabulate forms), Laciniadinium biconiculum, and Dictyopyxidia circulata (sensu McIntyre), support an Early Campanian age. This assemblage equates (although it is not identical with) the Early Campanian to Santonian zone TC 2 (internal OD zone) of Tromsø.

1600 m: SANTONIAN

The occurrence of the foraminifer Textularia cf. foeda at 1600 m may indicate penetration of Santonian. In Haltenbanken, this species occurs below the uppermost occurrence of Inoceramus prisms, indicative of Santonian.

The incoming of the dinocysts Cribooperidinium edwardsii and Pterodinium cornutum at 1600 m indicates an age not younger than Santonian. The assemblage also includes abundant Chatangiella and Isabelidinium spp., Trithyrodinium suspectum, and Palaeohystrichophora infusorioi-

1620 m: TURONIAN

Hedbergella spp. are common at 1620 m and below. The assemblage includes Haplophragmium sp., Triplasia sp., and ?Pseudobolivina parvissima, as

well as long-ranging arenaceous and caved calcareous foraminifera. ?P. parvissima may be indicative of Turonian (Neagy, 1970).

The dinoflagellates Florentinia mantellii and Cometodinium obscurum, recorded from 1620 m, indicate Turonian. Other critical dinoflagellates first recorded (in the downhole sense) from this level include Xiphophoridium alatum, Pterodinium aliferum and Cleistosphaeridium huguonioti.

1640 m: CENOMANIAN

Cenomanian may be inferred at 1640 m on the presence of Gavelinella cenomanica in a rich arenaceous microfauna containing abundant Glomospira/Glomospirella spp. Caved Cenomanian index taxa are common in samples from the underlying Lower Cretaceous.

The dinoflagellate Florentinia laciniata recorded from the same sample, is also indicative for Cenomanian. Most of the palynomorphs recorded from this level already occur in the overlying sequence.

1700 m: LATE ALBIAN

Planktonic foraminifera, mostly of the Hedbergella group abound. Quinqueloculina antiqua, Pleurostomella obtusa, Ramulina sp., Hedbergella planispira, H. infracretacea, Gavelinella baltica, etc., are diagnostic of Albian.

Common Apteodinium grande and the presence of Ovoidinium scabrosum at 1700 m, indicate the Late Albian A. grande Zone, widespread in the North Sea. Other diagnostic dinoflagellates recorded from this sample are Epelidosphaeridia spinosa and Litosphaeridium arundum.

1800 m: EARLY APTIAN

The ostracod Protocythere intermedia at 1800 m indicates penetration of Lower Aptian. This is supported by a foraminiferal fauna which includes Uvigerinamina sp.2 and other Uvigerinamina spp.

The dinoflagellate assemblage, including common Gardodinium eisenackii, Systematophora aff. complicata, Aptea securigera, Kleithriasphaeridium simplicispinum and Canninginopsis tabulata, also indicates an age not younger than Aptian.

1910 m: BARREMIAN

The samples prepared from 1910 m and 2102 m yield a non-diagnostic microfauna, heavily contaminated from younger sediments. Consequently, micropalaeontological age determinations are not possible in this interval.

Very few of the dinocysts recorded from 1910 m can be accepted to be "in situ". The presence of Pseudoceratium retusum, Trichodinium ciliatum, Phoberocysta ceratioides, Muderongia staurota, as well as suspected Pseudoceratium pelliferum, indicates penetration of Barremian. The underlying sample prepared for palynology (2102 m) yields an undiagnostic assemblage containing mostly Late Cretaceous taxa.

Table 1: BIOSTRATIGRAPHIC SYNTHESIS WELL 6610/7-1, INT::360-2100 m

SAMPLE DEPTH (m)	MICROPALAEONTOLOGY	PALYNOLOGY	SYNTHESIS
340	Pleistocene		Pleistocene
430	" "		
520	E Pleistocene		E Pleistocene
580	" "		
610	" "		
640	" "		
670	" "		
730	E Pleist/L Plioc		E Pleist/L Plioc
760	" "		
790	" "		
850	Pliocene		
880	" "		
910	? Pliocene		Pliocene
940	" "		
970	M - E Eocene	Middle Eocene	Middle Eocene
1000	" "		
1020	" "		
1040	" "	Early Eocene	Early Eocene
1060	" "		
1080	Early Eocene		
1100	" "		
1120	E Eoc - L Palaeoc		
1140	" "		
1150	" "		
1160	" "		E Eoc - L Palaeoc
1180	" "		
1200	" "		
1220	Late Palaeocene		
1240	" "		Late Palaeocene
1250	" "		
1320	Early Palaeoc	E Palaeoc-?Maastr	E Palaeocene
1340	Maastrichtian	L - M Maastrichtian	L-M Maastricht
1360	" "	Early Maastrichtian	E Maastricht
1500	Campanian	Early Campanian	E Campanian
1600	Santonian	Santonian	Santonian
1620	? Turonian	Turonian	Turonian
1640	? Cenomanian	Cenomanian	Cenomanian
1700	Albian	Late Albian	L Albian
1800	Early Aptian	Aptian-Barremian	E Aptian
1910	indet	Barremian	Barremian
2102	indet	indet	indet