

WELL 31/6-2

BIOSTRATIGRAPHY
KEROGEN ANALYSIS

PREPARED FOR

STATOIL a.s.

OCT. 1984

I. THRONSEN T. BJAERKE



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SUMMARY

1. Drilling after respuod of Well 31/6-2 started in sediments of Early Toarcian age at 2020m.
2. Late Pliensbachian sediments were penetrated at 2095m.
3. Poor biostratigraphical evidence from 2175m makes subdivision of the lower part of the well difficult. Sediments of possible Hettangian age are present between 2175m and 2195m.
4. The appearance of scattered diagnostic Triassic species from 2195m suggests that sediments of Norianearly Rhaetian age are present in the deepest part of the well.
5. The stratigraphical breakdown suggested above indicates a Late Triassic hiatus at 2195m. Early Jurassic, Hettangian, nonmarine sediments were deposited, the sequence being condensed. After deposition of a possible basal sandstone at 2175m a Pliensbachian shallow marine sequence was deposited, sedimentation continuing up into the Early Toarcian. A restricted low energy marginal environment was established within this interval.



STRATIGRAPHICAL BREAKDOWN

Interval	Age	Thickness
2018.52085m	Early Toarcian	+66.5m
2095 2145m	Late Pliensbachian	+50m
2155 2165m	Early Pliensbachian	+10m
2175 2185m	?Hettangian	+10m
2195 2235m	?NorianEarly Pliensbachian	+40m

INTRODUCTION

This report presents the results of palynological and kerogen analysis of the interval 2018.5 to 2235m in Well 31/62.

The well had previously been drilled to 2020m and the sequence reported here was drilled after reentry of the well.

A total of 22 ditch cuttings samples (DCSs) and 8 sidewall cores (SWCs) were examined for the present report. Micropaleontology did not contribute to the dating of the overlying Early Toarcian sequence (IKU Report 31/62, 1984). Considering the marginal to nonmarine facies demonstrated by palynological and kerogen analysis further down in this well, the material available for the present study was regarded as unsuitable for micropaleontological analysis.

Sample quality was extremely poor due to heavy caving and contamination. Organic material originating from the highly productive sediments of Early Toarcian age dominates the assemblages from ditch cuttings samples throughout. Together with the low productivity of older sediments this resulted in extremely poor stratigraphical evidence for the intervals from the Early Pliensbachian downwards. The stratigraphical breakdown is largely based on single or extremely rare specimens of a few diagnostic species.



BIOSTRATIGRAPHY AND KEROGEN ANALYSIS

INTERVAL 2018.52095m

Age: Early Toarcian

Lithology

This interval is dominated by dark grey partly micaceous silty shales and siltstone. In the lowermost part from 2084m light grey siltstones and quartzitic very fine to fine sandstones appear.

Palynology

A typical Early Toarcian assemblage with common Nannoceratopsis gracilis and Mancodinium semitabulatum together with common to abundant Cerebropollenites mesozoicus, Classopollis classoides and Chasmatosporites major was recorded throughout the interval. Additional species like Nannoceratopsis triceras, Parvocysta bullula, Cerebropollenites thiergartii and Chasmatosporites apertus are further evidence of an Early Toarcian age.

Kerogen analysis

Seven DCSS and three SWCs were examined. The interval is dominated by degraded material and abundant terrestrial palynomorphs. Marine palynomorphs and membraneous material are rare to common. Differences in composition of assemblages obtained from DCSS and SWCs are regarded to be a result of caving. Both inertinite and wood fragments are rare in the SWCs from the upper part of the interval. A significant increase in these categories is observed at 2084m. Degraded material and marine palynomorphs are absent, while terrestrial palynomorphs are reduced to rare.

Finely dispersed debris is common to abundant in the upper part of the interval, but absent near the base at 2084m.

Depositional environment

A high energy marginal marine or nonmarine environment was established in the lower part of this interval. A transgressive development took place and a protected shallow marine medium to low energy depositional environment was established.





INTERVAL 20952155m

Age: Late Pliensbachian

Lithology

Ditch cuttings samples from this interval are dominated by fine to medium micaceous sandstone. Sidewall cores show the presence of intercalated light grey siltstone horizons.

Palynology

The appearance of Luehndea spinosa in the DCS at 2095m shows that sediments of supposedly Late Pliensbachian age have been reached.

The assemblages recorded are heavily contaminated by material from the interval above.

Kerogen analysis

Kerogen assemblages from the DCSs are dominated by degraded material regarded as caved from the interval above. SWCs show common to abundant inertinite and abundant to dominating wood fragments. Terrestrial palynomorphs are rare, while marine palynomorphs are absent. Rare marine palynomorphs recorded from DCSs are, however, regarded to be in situ.

Finely dispersed debris is rare or absent from assemblages obtained from SWCs.

Depositional environment

Medium to high energy inner marginal marine conditions were established during deposition of this interval.

INTERVAL 21552175m

Age: Early Pliensbachian

Lithology

Grey shaly siltstone and medium sandstone dominate over this interval. The SWC at 2162m consists of a grey siltstone.

Palynology

The appearance of Comparodinium perpunctatum in the DCSs at 2155 and 2165m and of C.stipulatum, C.cf.koessenium and Maturodinium "ornatum" at 2165m suggests an Early Pliensbachian age for this





interval.

This is further supported by the disappearance of Nannoceratopsis gracilis and Mancodinium semitabulatum and the appearance of Quadraeculina "minor" in the SWC at 2162m.

Kerogen analysis

DCSSs are again regarded to be heavily contaminated by caving. The kerogen assemblage obtained from the SWC at 2162m is thought to be representative for this interval. Inertinite is dominating this assemblage, while wood fragments are abundant. Terrestrial palynomorphs are common and marine palynomorphs are rare.

Finely dispersed debris is absent from this assemblage.

Depositional environment

A medium to high energy inner marginal marine environment was established at this horizon.

INTERVAL 21752195m

Age: ?Hettangian

Lithology

This interval is again represented by siltstones and fine to medium sandstones in the DCSSs. The SWC at 2180m consists of grey shale.

Palynology

The appearance of Trachysporites fuscus at 2175m suggests that sediments of Hettangian age have been penetrated at this depth. Other species appearing at this horizon like Deltoidospora crassexina, D.toralis and D.auritora are longranging species, but are usually characteristic elements in assemblages of this age. On the basis of this rather weak evidence we tentatively suggest a Hettangian age for this interval.

The presence of Comparodinium punctatum, typical of Upper Pliensbachian and Early Toarcian, in the SWC at 2180m is probably due to contamination.

Kerogen analysis

Caving of material from the productive Early Toarcian sediments still dominates assemblages from the DCSSs. Kerogen assemblages obtained from the SWC at 2180m show a remarkable composition with abundant inertinite and dominating membraneous material.





Terrestrial palynomorphs are rare and marine palynomorphs are absent.

Depositional environment

A nonmarine environment is suggested for this interval. However, sample quality was poor and our interpretation is based on poor evidence.

INTERVAL 21952235m

Age: ?Norian Early
Rhaetian

Lithology

This interval is characterized by grey and slightly reddish silty shales and siltstone.

Palynology

Stratigraphical evidence is extremely poor also for this interval. The appearance of Porcellispora longdonensis at 2195m and Eucommiidites major at 2215m shows that sediments of early Rhaetian or Norian age have been penetrated. Both species are stratigraphically restricted, but extremely rare in the present material.

The presence of a single specimen of Riccisporites umbonatus in the lowermost sample at 2235m further suggest a late Triassic, Norian, age at this depth.

The absence of a Middle and Upper Rhaetian microflora usually characterized by Limboisporites lundbladii and Riccisporites tuberculatus further indicates that this part of the stratigraphical column is probably absent from the studied sequence.

Kerogen analysis

Five DCSs and one SWC were examined. The SWC is barren of plant debris. Assemblages from the DCSs are dominated by wood fragments. Inertinite is common. Terrestrial palynomorphs are common to abundant. Rare marine palynomorphs and common degraded debris are regarded as caved.

Depositional environment

A highly oxydative low to medium energy non marine environment is suggested for this interval.





SEDIMENTATION HISTORY

Based on the interpretations presented in this report we may summarize the following depositional history.

The well terminated in sediments of supposed Late Triassic, Norian early Rhaetian age.

A non marine highly oxidative environment was established during this time interval with deposition of grey and red shales and siltstones. A hiatus is present between the Norian early Rhaetian and the Hettangian at 2185 2195m.

A condensed and fragmentary sequence of early Jurassic sediments overly the Triassic sequence. Sediments probably of Hettangian age are present from 2185m. They were deposited in a non marine environment. Another major hiatus separates this interval from the overlying condensed Pliensbachian sequence at 2165 2175m. A medium to high energy marginal marine environment was established with sedimentation of siltstones and fine to medium sandstones. During the Early Toarcian a restricted shallow marine basin was established through a continued transgressive development and dark silty shales and siltstones were deposited from 2081m.





APPENDIX 1
LISTING OF SAMPLES

SAMPLE DEPTH	SAMPLE TYPE	GENERAL DESCRIPTION
2018.5	SWC	Shale, dark grey
2040	SWC	Shale, dark - medium grey
2084	SWC	Sandstone, light grey - white, fine
2117.5	SWC	Siltstone, light grey
2131.5	SWC	Siltstone, light grey
2162	SWC	Siltstone, medium grey
2180	SWC	Siltstone, grey
2200	SWC	Siltstone, grey - red



