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3/7-2 WELL (NORWAY)

BIOSTRATIGRAPHICAL REPORT (2540 - 4316 METRES)

Direction Exploration

Département Laboratoire de Géologie

(Boussens)

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BIOSTRATIGRAPHICAL REPORT (2540 - 4316 METRES)

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Boussens - March 1982

Reference : Order n° 103103081

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A B S T R A C T

The biostratigraphical study of the 3/7-2 well was carried out between 2540 and 4316 m, using micropaleontological and palynological methods.

The oldest sediments encountered were of Upper Permian age (4166 - 4154 m). The Early Triassic was characterized between 2997 and 2943 m.

An unconformity separates the Early Triassic (top 2943 m) from the Early Bajocian deposits (base 2926 m).

The Jurassic sequence (2885 - 2843 m) consists of Early Bajocian, Middle Callovian and Early Kimmeridgian. Unconformities can be seen throughout this interval.

The Lower Cretaceous (2837.50 - 2799 m) appears to be fairly continuous from Valanginian to Aptian/Albian.

The Maastrichtian (2783 - 2625 m) rests unconformably upon Lower Cretaceous.

Danian occurs between 2602 and 2540 m.

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11 pages
1 figure
2 plates

C O N T E N T S

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1 - MICROPALEONTOLOGY

1.1 - INTRODUCTION

The micropaleontological study of well 3/7-2 deals with the interval 2540 m to 2874 m (T.D. 4330 m), which covers a stratigraphical series ranging from Danian/Paleocene to Upper Jurassic.

Sampling : The study was carried out on composite cutting samples (15 m approx.), collected at about 5 m-intervals, and on cores 1-3. The samples were washed to free the microfauna (Foraminifera and Ostracoda).

Summary of results : The series 2540 m/2602 m can be attributed to the Danian/Paleocene. The Maastrichtian ranges from 2625 m to 2780 m. The Lower Cretaceous series is subdivided as follows : 2799 - 2801 m : Aptian/Albian ; 2814 - 2830 m : Barremian (to Hauterivian ?) ; 2832 - 2837.5 m : (Hauterivian ?) to Valanginian. The Upper Jurassic has been ascertained in the sample 2868 - 2874 m only. The whole section examined was deposited in an outer neritic environment.

1.2 - ZONATION AND STRATIGRAPHICAL REMARKS

1.2.1 - Interval 2540 - 2602 m - Globoconusa daubjergensis zone : Danian/Paleocene

The age is firmly based on the co-occurrence of Globigerina triloculinoides, G. pseudobulloides, Globorotalia compressa and Globoconusa daubjergensis in ditch samples and cores. Senonian reworking, however, occurs throughout almost the whole of the interval. The benthic attending fauna reflects an outer neritic environment.

1.2.2 - Interval 2625 - 2780 m - Incertae sedis 12/40 zone : Maastrichtian

This zone covers the whole of the upper Cretaceous, which yielded no identifiable pre-Maastrichtian species. A noticeable part of the fauna is planktic, including the assemblage Globotruncana contusa, Pseudotextularia elegans and Planoglobulina brazoensis (Upper Maastrichtian) in the upper part of the interval. The lower part of the interval yielded only a poor fauna, because of difficulties in disintegrating the indurated chalk. The microfauna indicates at the least an outer neritic environment.

1.2.3 - Interval 2799 - 2801 m - Uvigerinammina zone - Aptian/Albian

This zone comprises the ditch sample 2783/2799 and the S.W.C. 2801. The reddish fauna is mostly planktic (small Hedbergella) with few index benthic species.

Ecology : At the least outer neritic.

.../...

1.2.4 - Interval 2814 - 2830 m - G. barremiana zone - Barremian (to Hauterivian ?)

Although the zonal marker was not recovered from this interval, the Lenticulina fauna (L. schreiteri, L. gr. subalata...) sufficiently supports the ascribed age.

Ecology : same as the above interval.

1.2.5 - Interval 2832 - 2837.5 - Gaudryina richteri zone - (Hauterivian ? to) Valanginian

The upper and lower limits of this interval are based on S.W.C., and their accuracy, therefore, relies upon the assumption that the S.W.C. were correctly labelled. This interval yielded a distinctive fauna dominated by the zonal marker, G. richteri, Textularia bettenstaedti, and numerous smooth-walled Lenticulina, including L. nodosa.

Ecology : same as the above interval.

1.2.6 - Interval 2838 - 2866 m - Unnamed zone - No age assigned

The fauna is similar to that of the above interval, impoverished, which is regarded as indicative of cavings.

1.2.7 - Sample 2866 - 2874 m (last sample) - Upper Jurassic

This sample gave the usual markers of the Upper Jurassic : Porifera rhaxes, and Radiolaria of the Lithostrobus/Dictyomitra group.

Ecology : At the least outer neritic.

.../...

2 - PALYNOLOGY

2.1 - INTRODUCTION

The palynological study of the 3/7-2 well was carried out between 2804 and 4316 m only on sidewall core and core samples. A total of thirty one samples were examined. These include 23 samples ranging from Lower Cretaceous, Jurassic and Early Triassic down to 2997 m. The interval 2997 - 4154 m has not been studied. 7 samples have been examined between 4154 and 4316 m ; Permian microfloras were recovered at 4154 and 4166 m. The lower part of the well section has not been characterized by palynology (TD 4330 m).

2.2 - PALYNOLOGICAL ZONATION (see Plate 2)

2.2.1 - 2804 m - Probably BARREMIAN

1 SWC sample

Poor microplanktonic assemblage including Phoberocysta neocomica, Aptea polymorpha, Polystephanophorus anthophorum.

The organic facies yields abundant small black ligneous debris. Darkish amorphous organic matter occurs in minor amounts. The thermal alteration index (TAI) is 3^-.

2.2.2 - 2814 m

This sample is devoid of palynomorphs.

2.2.3 - 2827 m - Nc IIIa zone - Early BARREMIAN

1 SWC sample.

The microplankton appears to be extremely abundant and diverse. The main dinocyst taxa include Cassiculosphaeridia magna, Kleithriasphaeridium corrugatum, Muderongia crucis, M. staurota, Pseudoceratium pelliferum.

The organic facies contains predominantly black ligneous material. TAI 3^-.

2.2.4 - 2832 m - Nc Ib zone - Late VALANGINIAN

1 SWC sample.

Diagnostic and rich microplanktonic assemblage including Speetonia delicatula, Kleithriasphaeridium fasciatum, Isthmocystis distincta.

The darkish amorphous organic matter is clearly predominent. TAI 3^-.

.../...

2.2.5 - 2833.5 and 2837 m

2 SWC samples.

These two samples differ mainly from the 2832 overlying sample and from the underlying 2837.50 sample by the lack of Cretaceous dinocyst species. The very scarce dinocysts encountered (Chytroeisphaeridia chytroeides, Adnatosphaeridium caulleryi) can be found within Early Cretaceous and/or Late Jurassic deposits. It is worth noting that the terrestrial and marine microflora exhibits a very clear appearance, in contrast to the Cretaceous microflora above.

These samples could be supposed to be mislabelled and taken from a somewhat lower Late Jurassic level. The residues contain predominantly amorphous organic matter.

2.2.6 - 2837.50 m - VALANGINIAN

1 SWC sample.

The microflora is heterogenous in appearance. If this sample is correctly labelled and taking into account the dinocyst Cretaceous assemblage (TAI 3-), this sample is thought to be of an age not older than Valanginian (Phoberocysta neocomica, Kleithriasphaeridium fasciatum). The organic facies yields mainly darkish amorphous material, together with black ligneous particles.

2.2.7 - 2843 - 2875 m - NJ6b zone - Early KIMMERIDGIAN

2 SWC samples
1 cutting sample.

Diagnostic microplanktonic assemblage with Scriniodinium luridum, Glossodinium dimorphum, Gonyaulacysta jurassica, G. dualis.

The terrestrial microflora is considerably predominant throughout this interval. The organic residue yields abundant ligneous material, structured or opaque, together with amorphous material. TAI 2.5.

2.2.8 - 2885 m - NJ5a2 zone - Middle CALLOVIAN

1 SWC sample.

The terrestrial assemblage continues to be considerably abundant including numerous representatives of Callialasporites genera. The microplankton yields diagnostic dinoflagellates such as Wanaea accolaris, Lithodinia deflandrei, Tubotuberella sphaerocephala...

Ligneous and amorphous material occurs abundantly in small debris.
TAI 2.5.

2.2.9 - 2913 - 2916 m - NJ4a1 zone - Early Bajocian

2919 m - Unfossiliferous

2926.5 m - Probably Bajocian

3 core samples
1 SWC sample.

The spore assemblage recovered throughout the cored interval between 2913 and 2916 m was high in abundance and diverse. Typical records of Cyathidites australis, Densosporites perinatus, Araucariacites australis, Contignisporites problematicus, Foveotriletes microalveolatus, Klukisporites

.../...

pseudoreticulatus, Callialasporites dampieri... were made. Abundant, large structured ligneous and plant debris constitute significant elements of this organic facies. The Thermal Alteration Index is 2.5.

This diagnostic terrestrial assemblage has been correlated with the NJ4a1 zone (Early Bajocian) despite the lack of marine microplankton. The microflora recovered between 2919 and 2926.50 m is poorer but it is considered to approximate the Early Bajocian.

2.2.10 - 2932.5 - 2933.50 m

2 SWC samples.

These samples are devoid of palynomorphs and only contain a black degraded humic material.

2.2.11 - 2943 - 2997 m - Early TRIASSIC

8 SWC samples.

Taeniate bisaccate pollen grains are an important component of the Early Triassic assemblages and include Lunatisporites novimundi, L. noviaulensis, Striatoabietites cf. aytugii. In addition, Kraeuselisporites cf. apiculatus, Punctatisporites cf. gretensis, Nevesisporites sp. have also been recorded.

The organic residues are relatively poor in organic matter. They contain mainly black material and degraded humic debris. The Thermal Alteration Index is 3.

2.2.12 - 4154 - 4166 m - Upper PERMIAN

2 SWC samples.

An extremely rich terrestrial microflora is to be encountered throughout this interval in which Lueckisporites virkkiae and Vittatina sp. predominate considerably. Klausipollenites schaubergeri, Potonieisporites cf. novicus are also prominent in these assemblages. The organic facies contains ligneous degraded material and darkish organic matter (abundant at 4166 m). TAI 3⁻.

2.2.13 - 4185 - 4316 m

4 SWC samples
1 core sample.

These samples are devoid of palynomorphs and practically of any organic matter.

.../...

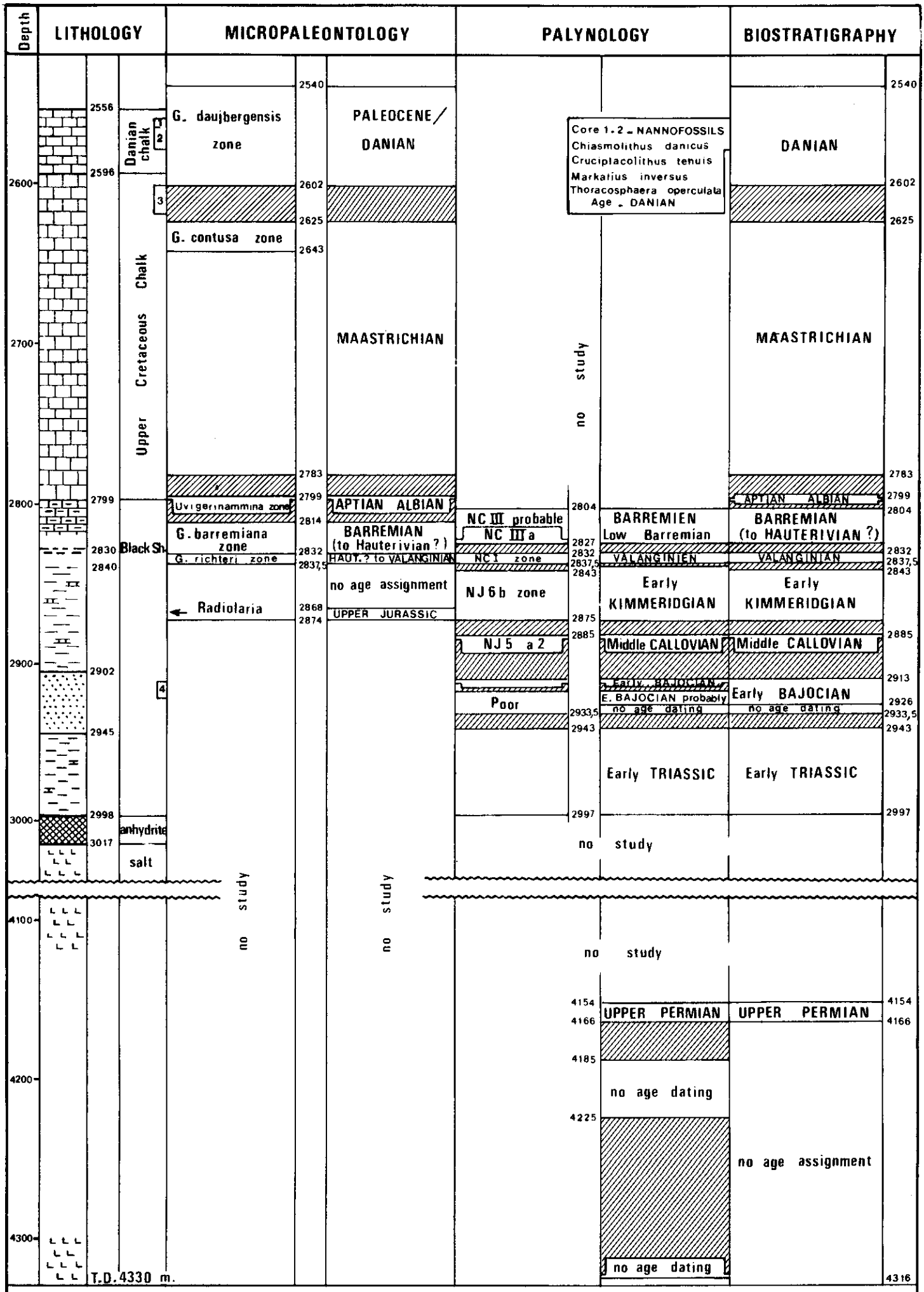


Fig. 1 - **3/7.2** well (Norway) -
BIOSTRATIGRAPHICAL RESULTS BETWEEN 2540 and 4316 m.

A.7206

3 - CONCLUSIONS

See Fig.1

3.1 - BIOSTRATIGRAPHICAL RESULTS

2540 - 2602 m	-	DANIAN
2625 - 2783 m	-	MAASTRICHTIAN
2799 m	-	APTIAN - ALBIAN
2804 - 2827 m	-	BARREMIAN (to HAUTERIVIAN)
2832 - 2837.50 m	-	VALANGINIAN
2843 - 2875 m	-	Early KIMMERIDGIAN
2885 m	-	Middle CALLOVIAN
2913 - 2926 m	-	Early BAJOCIAN
2919 - 2933.50 m	-	No age dating
2943 - 2997 m	-	Early TRIASSIC
4154 - 4166 m	-	Upper PERMIAN

3.2 - BIOSTRATIGRAPHICAL COMMENTS

3.2.1 - No palynological evidence is available throughout the 4316 - 4185 interval. The samples are devoid of palynomorphs and exceedingly poor in organic material.

3.2.2 - 4166 - 4154 m

The Upper Permian is accurately characterized between 4166 and 4154 m. Gymnosperm pollen grains, such as Vittatina and Lueckisporites virkkiae, constitute up to 90 % of the total assemblage. The palynological evidence points strongly to a presence of stable floral elements throughout this period.

3.2.3 - 2997 - 2943 m

The Early Triassic is characterized by a significant change in the palynological assemblages. Bisaccate taeniate pollen grains and spores are prominent microfloral components of the continental Early Triassic deposits.

3.2.4 - The Early Triassic sediments (top 2943 m) are unconformably overlain by Early Bajocian sediments (base 2926 m) . Throughout the Early Bajocian period (2926 - 2913 m), the usual high content of Pteridophyte spores and the lack of marine organisms lend support to the view that restricted conditions prevail throughout this period.

.../...

3.2.5 - An unconformity separates the continental Early Bajocian sediments (top 2913 m) from the marine Middle Callovian sediments (2885 m)

The marine jurassic sedimentation, initiated in the Middle Callovian (NJ5a zone), continues throughout Early Kimmeridgian time and ends at 2843 m (top NJ6b zone). Numerous stratigraphical gaps are suggested throughout this period.

3.2.6 - Another unconformity separates the Jurassic sediments (top 2843 m) from the Valanginian sediments (base 2837.5 m)

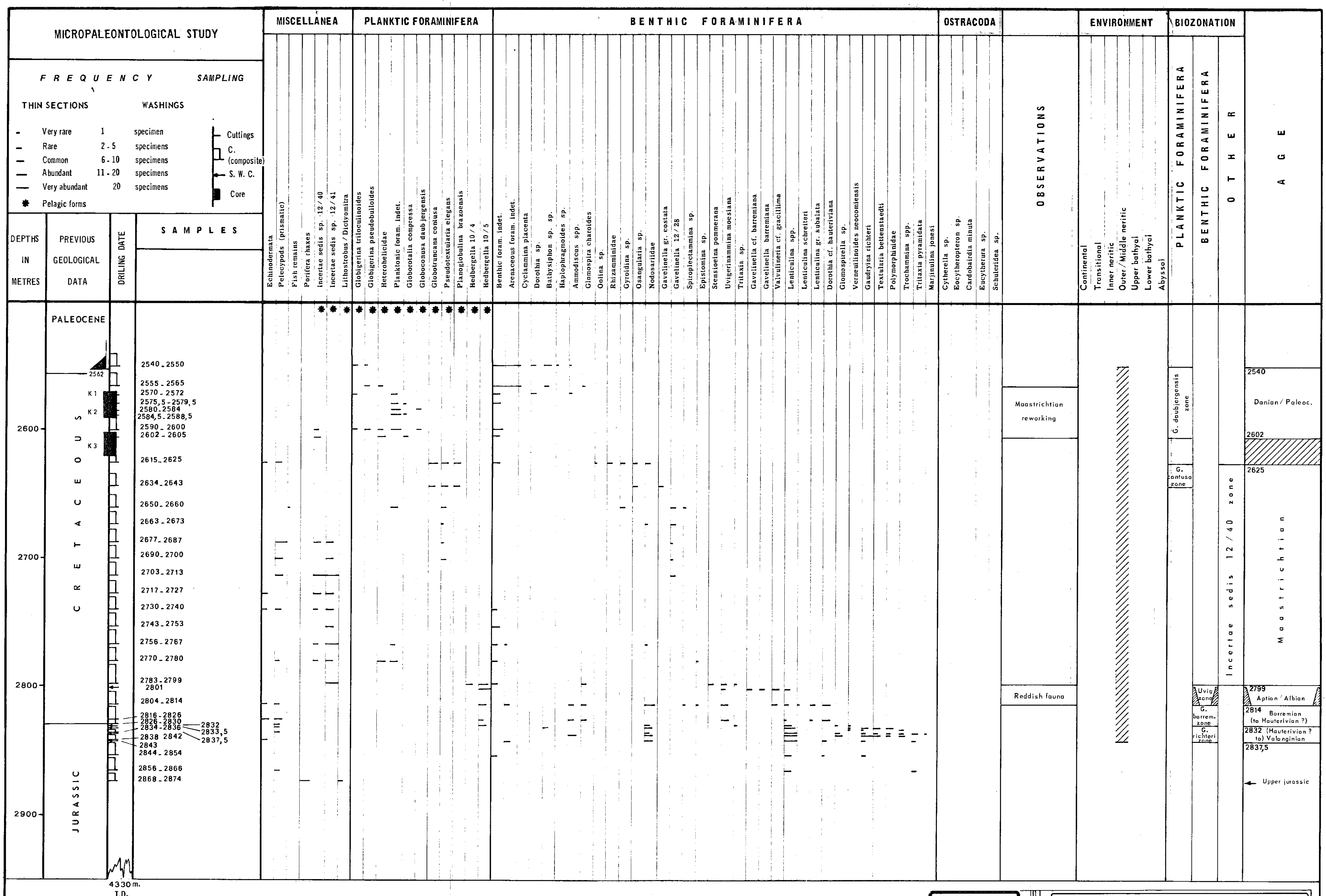
The Valanginian (2837.50 - 2832 m) is characterized by marine microplankton (NC1 zone) and marine microfauna (Gaudryina richteri zone), which reflect an outer neritic environment. The lower limit of this interval is fixed at 2837.50 m, that is supposing that the sidewall core sampled is correctly labelled.

The Early Cretaceous deposits (2837.50 - 2799 m) range throughout Valanginian, Barremian (to Hauterivian ?) and Aptian/Albian period. Rich and diagnostic microflora and microfauna characterize these deposits. An outer neritic environment is suggested throughout this interval.

3.2.7 - A strong unconformity separates the Early Cretaceous (top 2799 m) from the Maastrichtian deposits (base 2783 m)

The Maastrichtian deposits are characterized by microfaunas deposited in outer neritic conditions. An influx of planktonic forms is evident in the upper part of the interval, between 2643 and 2625 m (Globotruncana contusa zone).

3.2.8 - The Danian is well established throughout the cored interval 2588.50 - 2570 m (core 1-2) using a rich nannoplanktonic assemblage. The microfauna (Globorotalia daujbergensis zone), recovered between 2602 m (core 3) and 2540 m confirms the age assignment.


MICROPALEONTOLOGICAL STUDY
FREQUENCY
SAMPLING
THIN SECTIONS
WASHINGS
Very rare 1 specimen
Rare 2-5 specimens
Common 6-10 specimens
Abundant 11-20 specimens
Very abundant 20 specimens
Pelagic forms
Cuttings
C. (composite)
S. W. C.
Core
DEPTHS IN METRES
PREVIOUS GEOLOGICAL DATA
DRILING DATE
SAMPLES
MISCELLANEA
Echinodermata
Pelecypods (prismatic)
Fish remains
Porifera rhaxes
Incertae sedis sp. 12/40
Incertae sedis sp. 12/41
Lithostrobus / Dictyomitra
PLANKTIC FORAMINIFERA
Globigerina triloculinoides
Globigerina pseudobulloides
Heterohelicidae
Planktonic foram. indet.
Globorotalia compressa
Globoconusa daubjergensis
Globotruncana contusa
Pseudotextularia elegans
Planoglobulina brazoensis
Hedbergella 10/4
Hedbergella 10/5
BENTHIC FORAMINIFERA
Benthic foram. indet.
Arenaceous foram. indet.
Cyclammina placenta
Dorothia sp.
Bathysiphon sp.
Haplophragmoides sp.
Ammodiscus spp.
Glomospira charoides
Oolina sp.
Rhizamminidae
Gyroidina sp.
Osangularia sp.
Nodosariidae
Gavelinella gr. costata
Gavelinella 12/28
Spiroplectammina sp.
Epistomina sp.
Stensioeina pommerana
Uvigerinammina moesiana
Tritaxia sp.
Gavelinella cf. barremiana
Gavelinella barremiana
Valvulineria cf. gracillima
Lenticulina spp.
Lenticulina schreiteri
Lenticulina gr. subalata
Dorothia cf. hauteriviana
Glomospirella sp.
Verneuilinoides neocomiensis
Gaudryina richteri
Textularia bettenstaedti
Polymorphinidae
Trochammina spp.
Tritaxia pyramidata
Marginulina jonesi
OSTRACODA
Cythereila sp.
Eocytheropteron sp.
Cardobairdia minuta
Eucytherura sp.
Schuleridea sp.
OBSERVATIONS
ENVIRONMENT
Continental
Transitional
Inner neritic
Outer / Middle neritic
Upper bathyal
Lower bathyal
Abyssal
BIOZONATION
PLANKTIC FORAMINIFERA
BENTHIC FORAMINIFERA
OTHER
AGE
PALEOCENE
CRETACEOUS
JURASSIC
2562
K1
K2
K3
2600
2700
2800
2900
2540_2550
2555_2565
2570_2572
2575,5-2579,5
2580_2584
2584,5_2588,5
2590_2600
2602_2605
2615_2625
2634_2643
2650_2660
2663_2673
2677_2687
2690_2700
2703_2713
2717_2727
2730_2740
2743_2753
2756_2767
2770_2780
2783_2799
2801
2804_2814
2816_2826
2826_2830
2834_2836
2838 2842
2843
2844_2854
2856_2866
2868_2874
2832
2833,5
2837,5
4330 m. T.D.
Maastrichtian reworking
Reddish fauna
G. daubjergensis zone
G. contusa zone
Uvig. zone
G. barrem. zone
G. richteri zone
Incertae sedis 12/40 zone
2540
Danian / Paleoc.
2602
2625
Maastrichtian
2799
Aptian / Albian
2814
Barremian (to Hauterivian ?)
2832 (Hauterivian ? to) Valanginian
2837,5
Upper jurassic

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Elf Norge .	
Pays :	NORWAY
Permis ou concession :	3/7

DIRECTION EXPLORATION_PRODUCTION

DIRECTION EXPLORATION

Date : Mars 1982

Auteur : Volat J.L.

N°Classt : C.7207

PL.1

_ 3/7.2 well _

MICROPALEONTOLOGICAL RANGE CHART ON BASAL TERTIARY, CRETACEOUS AND JURASSIC SERIES.

(2540 - 2874 m)

elf aquitaine

	Elf Norge
Pays :	NORWAY
Permis ou concession :	3 / 7

DIRECTION EXPLORATION - PRODUCTION

DIRECTION EXPLORATION

Date : Mars 1982
Auteur : Ducazeaux
N°Classt : D.7208

PL. 2

— 3/7.2 well —

PALYNOLOGICAL RANGE CHART ON CRETACEOUS, JURASSIC, TRIASSIC AND PERMIAN SERIES

(2804 - 4316 m)