

SNEA (P)
D.G.H. - D. EXPLORATION
LABORATOIRE DE GEOLOGIE DE BOUSSENS

GEO/LAB Bss n° 6/1418 R
/ca

16/3-2 WELL (NORWAY)

PALYNOLOGICAL REPORT ON THE LOWER TERTIARY
AND UPPER CRETACEOUS

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Boussens - December 1976

Reference : Order n° 031213

You have already been sent the following documents relating to the same order :

- P. DURIF - E. GROSDIDIER - Report n° 6/1359 R -
"Well 16/3-2 (Norway) - Micropaleontological report (Cretaceous and Jurassic)".

LISTE DE DIFFUSION

DESTINATAIRES :

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| DISTRICT 2 | 1 |
| DISTRICT 2 - NORVEGE | 21 |
| DIRECTION EXPLORATION | |
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1 - INTRODUCTION

This report summarises the results from palynological and stratigraphical analyses which have been carried out on material supplied from the interval 1230 - 1480. A total of 20 sidewall core samples have been analysed in the Lower Tertiary section. In addition, 8 sidewall core samples from the Upper Cretaceous section (1490 - 1665) have also been treated by palynological means and the results of these analyses are provided, for information purposes on Plate 1.

2 - PALYNOLOGICAL RESULTS

Five biozones (nt III, nt IIc, Middle nt IIa, Lower nt IIa, nt I (a-b)) have been recognized in the Lower Tertiary section studied. Palynological assemblages have enabled correlations to be made with the biozones originally defined in the Frigg area.

The range chart of the main types is summarized on Plate 1. Quantitative data and ecological interpretations are presented on Plate 2.

3 - PALYNOLOGICAL ZONATION

3.1 - 1230 - 1275 - nt III Zone - LUTETIAN

3 sidewall core samples.

- Microplankton

A low diversity dinoflagellate assemblage of highly fragmented specimens occurs in the 1230 and 1250 samples with however a good representation of *Deflandrea phosphoritica* and some specimens of the genera *Chiropteridium*. No diagnostic nt III markers have been encountered.

Sample 1275 contains a rich and diversified microplanktonic assemblage with

C. capricornum
A. dictyoplokus

This significant occurrence has made it possible to recognize here the nt III zone (base).

- Terrestrial elements

The bisaccate pollen grains represent the major part of the land vegetation (54 to 66 %).

Other pollen grains, spores and uncharacterized sporomorphs are found in abundance in the 1230 and 1250 samples :

- Taxodiaceae (*T. hiatus* - *Sequoia*) - 10-29 %
- Tricolpate - Tricolporate pollen group : 36 to 51 %
- Juglandaceae (*Carya*) - 6-8 %
- Spores (*Polypodiaceae*) - 14-28 %.

- Palynofacies

The palynofacies contains a mixture of amorphous organic matter, opaque woody fragments and coals.

- Environment

The microflora encountered at 1275 m indicates open marine conditions (exclusive microplankton, dominating anemophilous pollen, composite palynofacies). Above, the environment is probably marine with a high concentration of terrestrial material.

- Age : LUTETIAN.

3.2 - 1287 - nt IIc Zone - YPRESIAN

1 sidewall core sample.

- Microplankton

- Rich microplankton assemblage (96 %) with appearance of :

M. ursulae
W. ovalis
Homothyrium D.897

- Persistence of some species also occurring in the nt II zone. *T. pelagica*, *W. articulata*, *Cordosphaeridium* D.353 B are abundant constituents of the microflora.
- Disappearance of several species : *C. capricornum*, *A. dictyoplokus*, *S. reticulifera*, ...

- Terrestrial microflora

The bisaccate pollen grains grossly runs up to 100 %.

.../...

- Palynofacies

The palynofacies contain a mixture of amorphous organic matter, opaque woody fragments and coals.

- Environment

Marine environment (W + H) : exclusive microplankton, dominating anemophilous pollen, composite palynofacies.

3.3 - 1301.50 m - nt IIc (with probably mixing) - YPRESIAN

1 sidewall core sample.

- Microplankton

The character of this microflora shows close similarity with the microflora at 1275 m (nt III zone) in particular the occurrence of *C. capricornum* and *A. dictyoplokus*. The scarcity of *M. ursulae* and *W. ovalis*, which were abundant at 1287 m (nt IIc zone) is worth noting in this assemblage.

The hypothesis of a locally extended range (nt III + nt IIc) could be made for *C. capricornum* and *A. dictyoplokus*, but according to previous studies in the North Sea, *C. capricornum*, *A. dictyoplokus* and *M. ursulae* are stratigraphically disjunct elsewhere. Their occurrence together at 1301.5 m probably indicates mixing.

- Terrestrial microflora

The bisaccate pollen grains are dominant.

- Palynofacies

The palynofacies is made up of amorphous organic matter, opaque woody fragments and coals.

- Environment

Marine environment : exclusive microplankton, dominating anemophilous pollen, composite palynofacies.

- Age : YPRESIAN.

3.4 - 1310 - 1370 - MIDDLE nt IIa (with probable reworking) - THANETIAN to YPRESIAN

6 sidewall core samples.

- The terrestrial elements increase considerably and abruptly.

- Taxodiaceae (*T. hiatus* - *Sequoia*) gradually rise to high values : 38 to 66 %.

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- Juglandaceae - The average percentage of *Carya* remains 20 %.
Platycarya : 2 - 14 %.
- Betulaceae (*Corylus* - *Alnus* - *Betula*), Tiliaceae, constitute 7 to 29 % of the triporate pollen spectra.
- The tricolpate - tricolporate pollen group varies between 12 and 30 %.
- *Trudopollis pertrudens* (rare).

- Microplankton

- 1310 - 1325 - 1350 - 1370 - All these samples contain good representative microflora of Middle nt IIa zone.

Occurrence of :

D. oebisfeldensis
C. ordinatum.

Scarcely - developed microplankton with the usual significant predominance of *Deflandrea* (W association). The average percentage of marine organisms over total organisms is 10 % with a slight increase to 22 % at 1350 m.

- 1339 and 1360 m

The 1339 m sample contains abundant *W. hyperacantha* (58 %) which is normally restricted to the Lower nt IIa zone. *P. pyrophorum*, identified in the nt Ia assemblages, occurs unusually in the 1360 m sample. The hypothesis of a locally extended range could be made for *W. hyperacantha* and *P. pyrophorum*. However, mixture by reworking could not be totally dismissed.

The diagram of marine organisms over total organisms is not disturbed by the occurrence of possible reworked species and remains low with an average percentage of 10 %.

- Palynofacies

Sapropelic organic matter is predominant at 1310 m then, black powdery matter and coals gradually increase and become predominant.

- Environment

In the main, the oligospecific microplankton, the abundance of terrigenous material (*Taxodiaceae* - Frequent *Angiospermae*), the predominance of sapropelic and black powdery organic matter would suggest restricted conditions near those of the Middle nt IIa of FRIGG.

- Age : THANETIAN to YPRESIAN.

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3.5 - 1400 - LOWER nt IIa - THANETIAN

1 sidewall core sample.

- Rich dinoflagellate assemblage with
W. hyperacantha (48 %)

The ratio of marine organisms over total organisms is 19 %. There is a good representation of W association (Wetzeliella, Deflandrea, Lejeunia) : 61 %.

- High pollen content

- High triporate pollen content, the pollen grains of Juglandaceae contributing much of it : Platycarya 42 %, Carya 3 %.
- Tricolpate - tricolporate pollen group : 38 %
- Taxodiaceae - 1 %.

- Palynofacies

The sapropelic organic matter is predominant.

- Environment

Restricted marine environment with oligospecific microplankton and subtropical Juglandaceae flora.

- Age : THANETIAN.

3.6 - 1413 - 1480 - nt Ia - DANIAN

7 sidewall core samples.

- Rich and diversified dinoflagellate assemblage with

E. crassitabulata
P. pyrophorum
A. senonensis ...

The ratio of marine organisms over total organisms varies between 52 and 92 %, with a minimum at 1420 m of 12 %.

- Abundant terrestrial material

- The bisaccate pollen grains are predominant, 70 à 96 %.
- Taxodiaceae locally frequent - 56 % at 1420 m.
- Juglandaceae (rare Caryapollenites, Subtriporopollenites, Engelhardtia) locally frequent (24 % 1420 m and 1455 m).
- Tricolpate - Tricolporate pollen group - 8-12 %.
- Trudopollis pertrudens.
- Spores generally abundant - 30 to 64 %.

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- Palynofaciès

This is essentially made up of coals associated with opaque woody fragments and black powdery matter.

- Environment

Open marine environment.

- Age : DANIAN.

3.7 - 1490 - 1650 - Barren interval

7 sidewall core samples.

These samples are devoid of palynomorphs.

3.8 - 1665 - nc 7 (to nc 6) Zone - LOWER SENONIAN to TURONIAN

1 sidewall core sample.

- Very rich and diversified microplanktonic assemblage with

X. alatum
P. gochti
O. striatoperforata
Spongodinium sp.
H. voigti
...

- Palynofacies

This is made up of coals

- Environment : Open marine

- Age : LOWER SENONIAN to TURONIAN.

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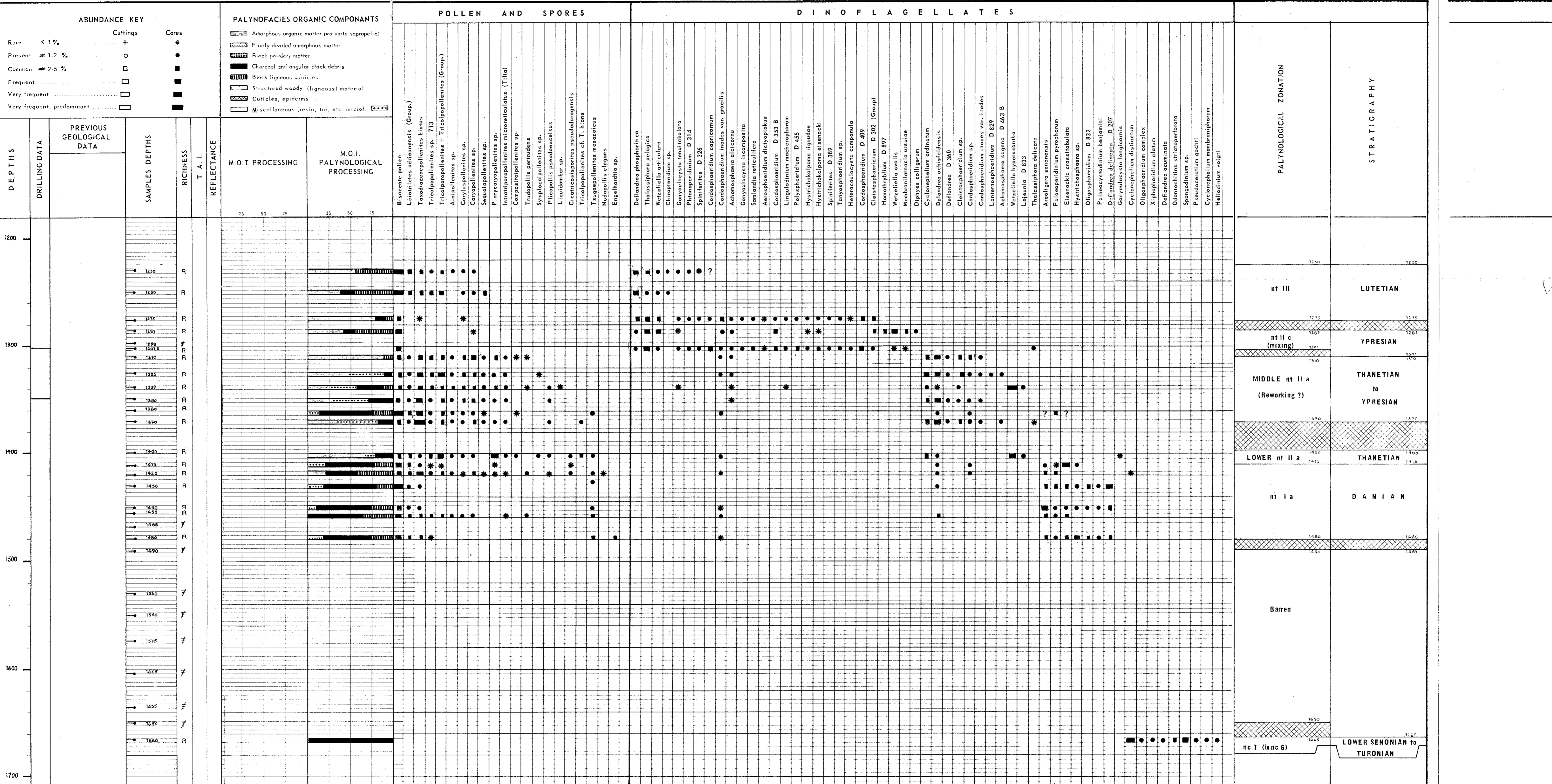
3 - STRATIGRAPHICAL CONCLUSIONS

The aim of this conclusion is to direct attention to some distinctive points.

The Danian strata (nt Ia) corresponds to marine sediments. *P. pyrophorum* can be considered as a diagnostic marker in the Danian assemblages. Its occurrence from 1480 to 1413 m has made it possible to recognize here the presence of the nt Ia zone. It is worth noting that the nt Ib zone is lacking.

The Lower and Middle nt IIa zone correspond to restricted marine sediments. There is palynological evidence of a typical Lower nt IIa zone at 1400 m. The relationship between the Middle nt IIa zone of 16/3-2 and the classic Middle nt IIa zone of Frigg area remains approximate, due to the locally-mixed microflora. It is difficult to assess the significance of this phenomenon, and mixture by reworking could not be totally dismissed.

The onset of Ypresian sedimentation is marked by the nt IIc transgression. The nt IIc zone lies in unconformity over the Middle nt IIa zone (lack of nt IIb and Upper nt IIa zone).

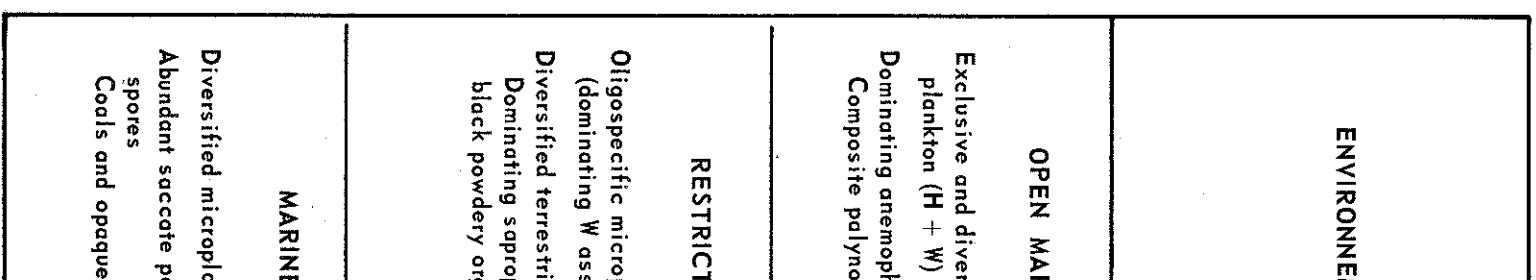
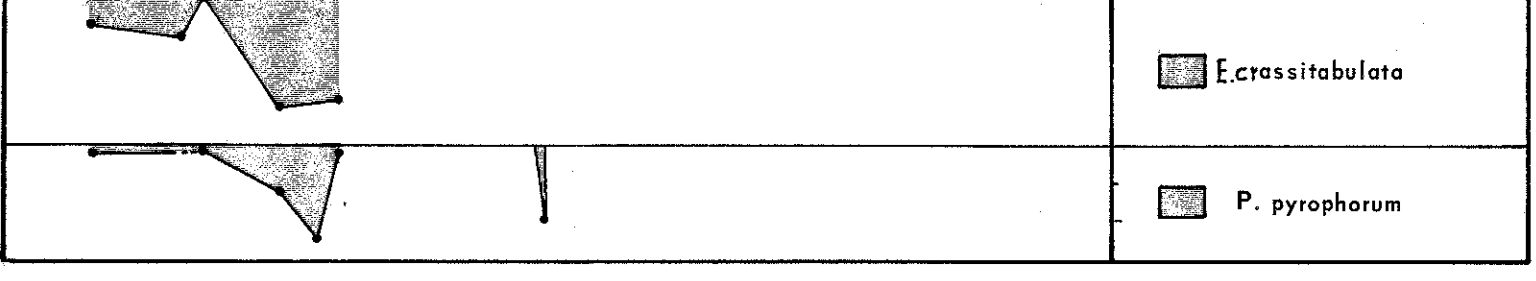
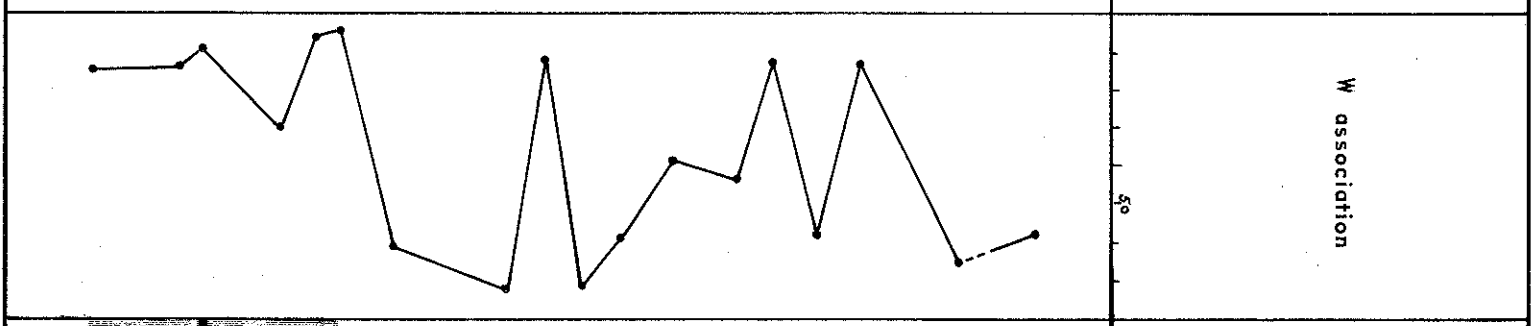
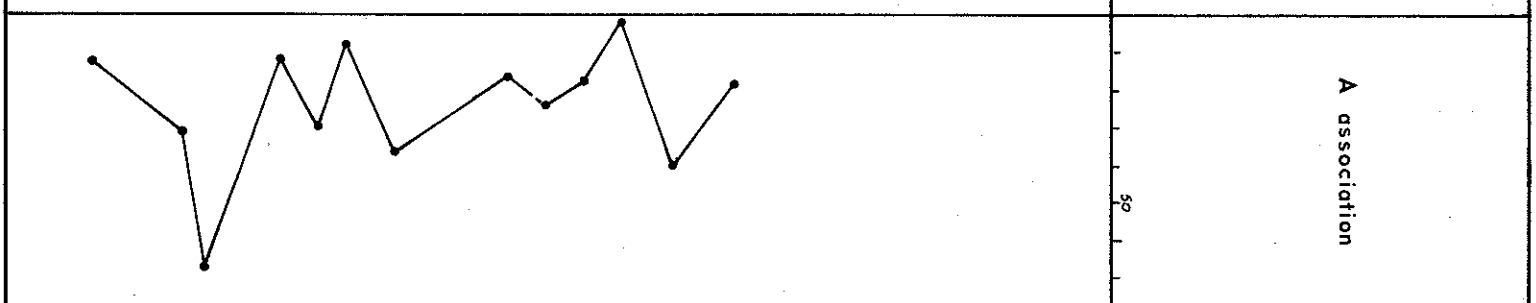
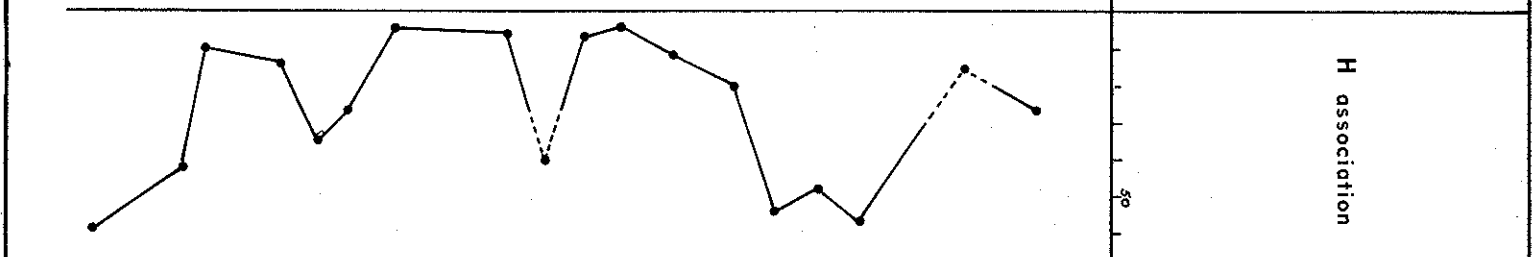
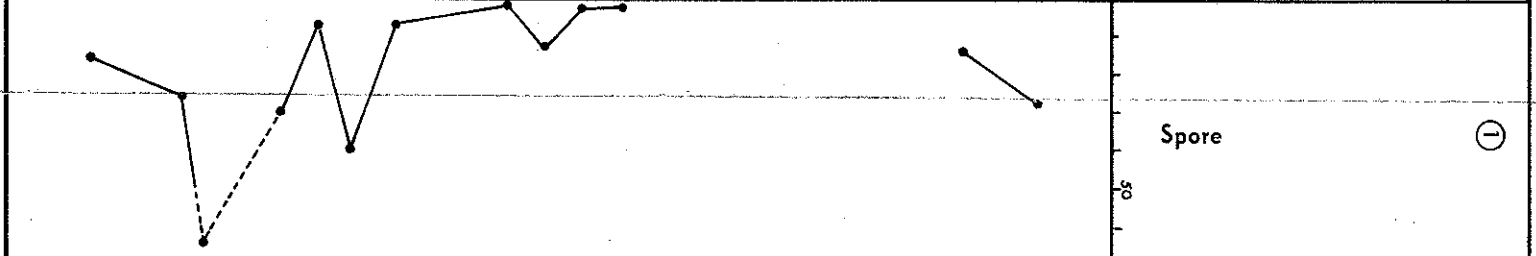
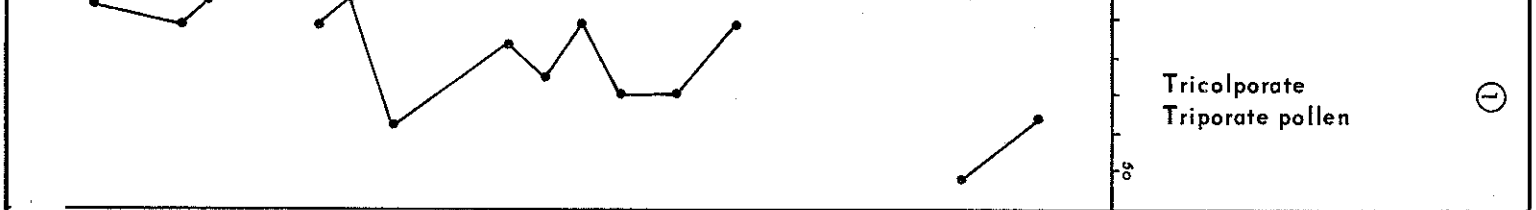
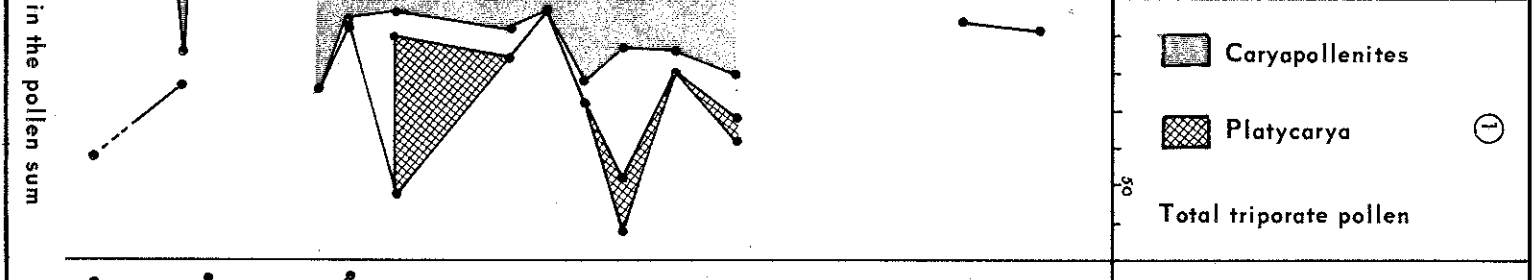
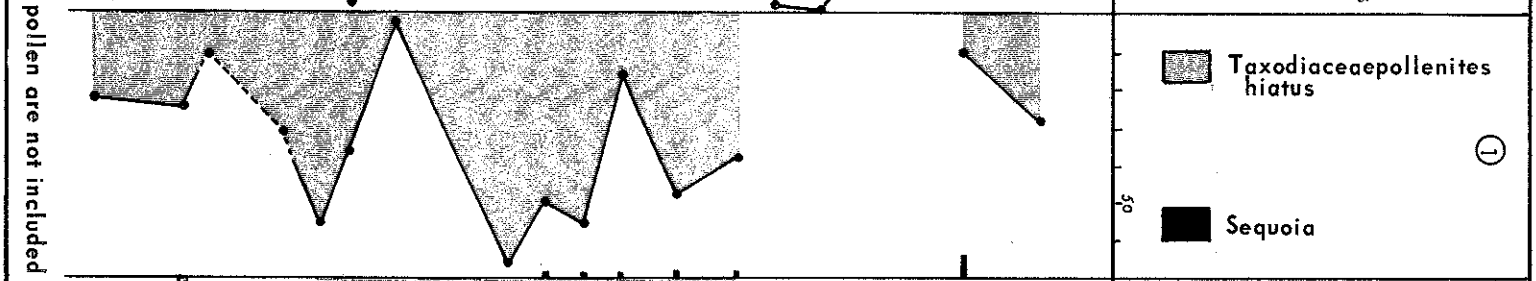
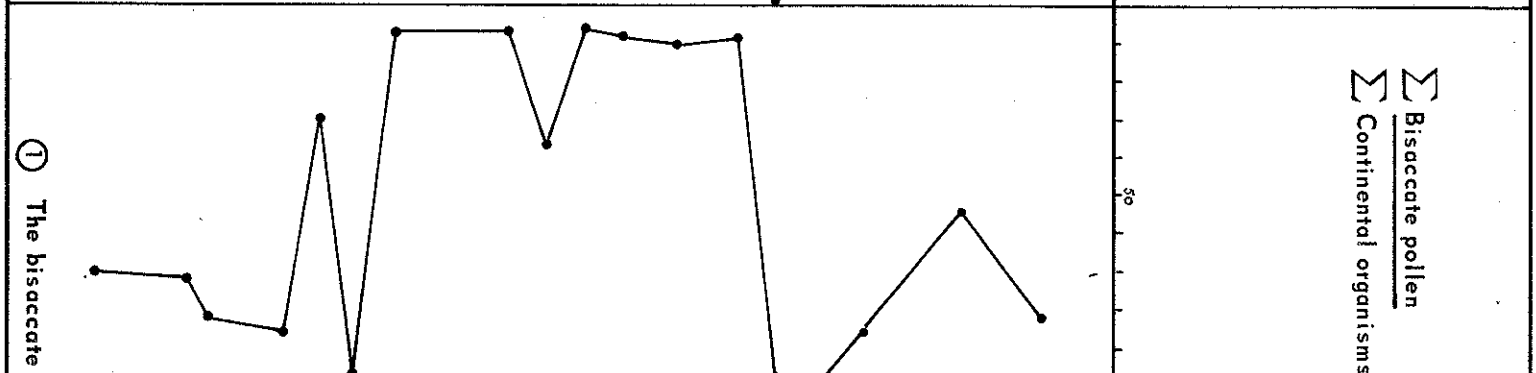
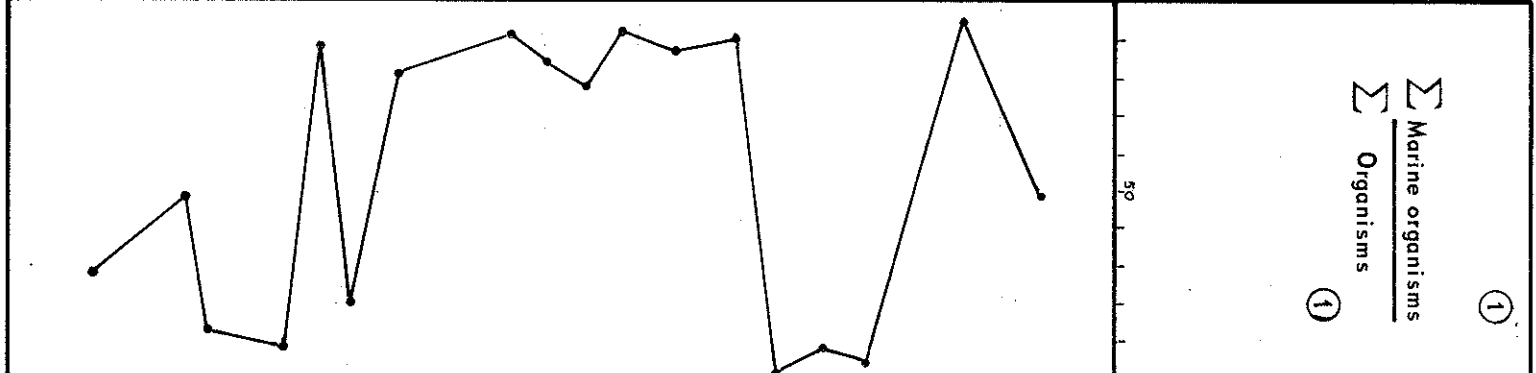
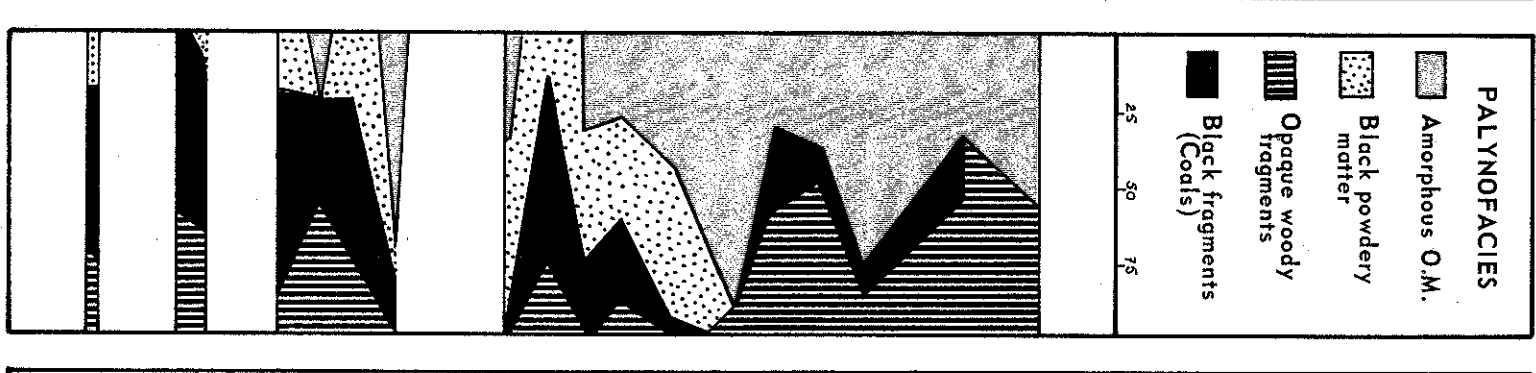


Secteur NORVEGE
 Operateur ELF NORGE
 Point de Contrôle

PETRONORD
 WELL 16/3-2
 PALYNOLOGICAL RANGE CHART
 LOWER TERTIARY
 Echelle: 1/2000
 Date: Nov. 76
 DIRECTION EXPLORATION
 LABORATOIRE
 PL.1
 DUCAZEUX
 N° 1311

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|--------------------------------|------|------|--------|------|------|
| PALYNOLOGICAL ZONATION | | | | | |
| nt III | 1275 | 1287 | 1301.5 | 1310 | 1370 |
| MIDDLE nt IIa (with reworking) | 1370 | 1390 | 1399 | 1400 | 1413 |
| L. nt IIa | 1413 | 1420 | 1430 | 1440 | 1480 |
| nt Ia | 1480 | | | | |

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|--------------------------|------|------|------|------|--------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|--|
| DEPTHS in metres 1/2000° | 1230 | 1250 | 1275 | 1287 | 1301.5 | 1310 | 1325 | 1339 | 1350 | 1360 | 1370 | 1385 | 1399 | 1400 | 1413 | 1420 | 1430 | 1440 | 1450 | 1455 | 1480 | |
| SIDEWALL CORE SAMPLES | | | | | | | | | | | | | | | | | | | | | | |



ENVIRONNEMENT

OPEN MARINE
Exclusive and diversified microplankton (H + W)
Dominating anemophilous pollen
Composite palynofacies

RESTRICTED
Oligospecific microplankton (dominating W association)
Diversified terrestrial elements
Dominating sapropelic and black powdery organic matter

MARINE
Diversified microplankton
Abundant saccate pollen and spores
Coals and opaque debris

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|---|---------------------|---|
| | Secteur NORVEGE | PETRONORD |
| | Opérateur ELF NORGE | |
| Permis de Concession WELL 16/3-2 PALYNOLOGICAL DIAGRAM QUANTITATIVE DATA Echelle 1/2000° | | |
| ENTREPRISE DE RECHERCHES ET D'ACTIVITES PETROLIERES DIRECTION EXPLORATION LABORATOIRE | | Date Nov.76 PL.2 DUCAZEUX N°classé C1312 |