

24 FEB. 1986/37 3 of 8  
3

S. N. E. A. (P)  
DIRECTION EXPLORATION  
DIVISION RECHERCHES et APPLICATIONS en GEOLOGIE  
LABORATOIRE  
ETABLISSEMENT DE BOUSSENS

EP/S/EXP/RAG-Lab.Bss n° 121/85 RP  
/sr/dd

WELL 30/6-11

(NORWAY)

-  
MICROSCOPICAL STUDY  
OF ORGANIC MATTER

27 FEB. 1986  
REGISTRERT  
OLJEDIREKTORATET

J. DUCAZEUX  
G. NICOLAS

Boussens - February 1986

DESTINATAIRES

EXPLORATION ELF AQUITAINE NORGE

8

S.I.D. BOUSSENS

2

## ABSTRACT

The DRAUPNE Formation contains marine amorphous Kerogen from good source rock facies.

Kerogen of predominantly continental origin is identified in the BRENT deposits. Mixed continental and marine (dinocysts) organic matter is found in the ETIVE (cored interval) ; the marine autochthonous organic matter appears to be poorly represented.

The DUNLIN deposits contain mainly continental originating Kerogen. The marine autochthonous organic matter is poorly represented.

The diagenesis survey is high and continuous through the Jurassic series, from 0.70 % (top DRAUPNE) to 1 % (base DUNLIN).

## CONTENTS

- 1 - INTRODUCTION
- 2 - ORGANIC MATTER CHARACTERISTICS
- 3 - THERMAL EVOLUTION
- 4 - CONCLUSIONS

## ENCLOSURES

In text.

Fig. 1 - Location MAP

Fig. 2 - Stratigraphical summary

Fig. 3 - Optical data synthesis (cores 2 to 6)

Fig. 4 - Optical data synthesis (core 7)

Fig. 5 - Maturation profile

Out of text.

Plate 1 - Organic matter petrology

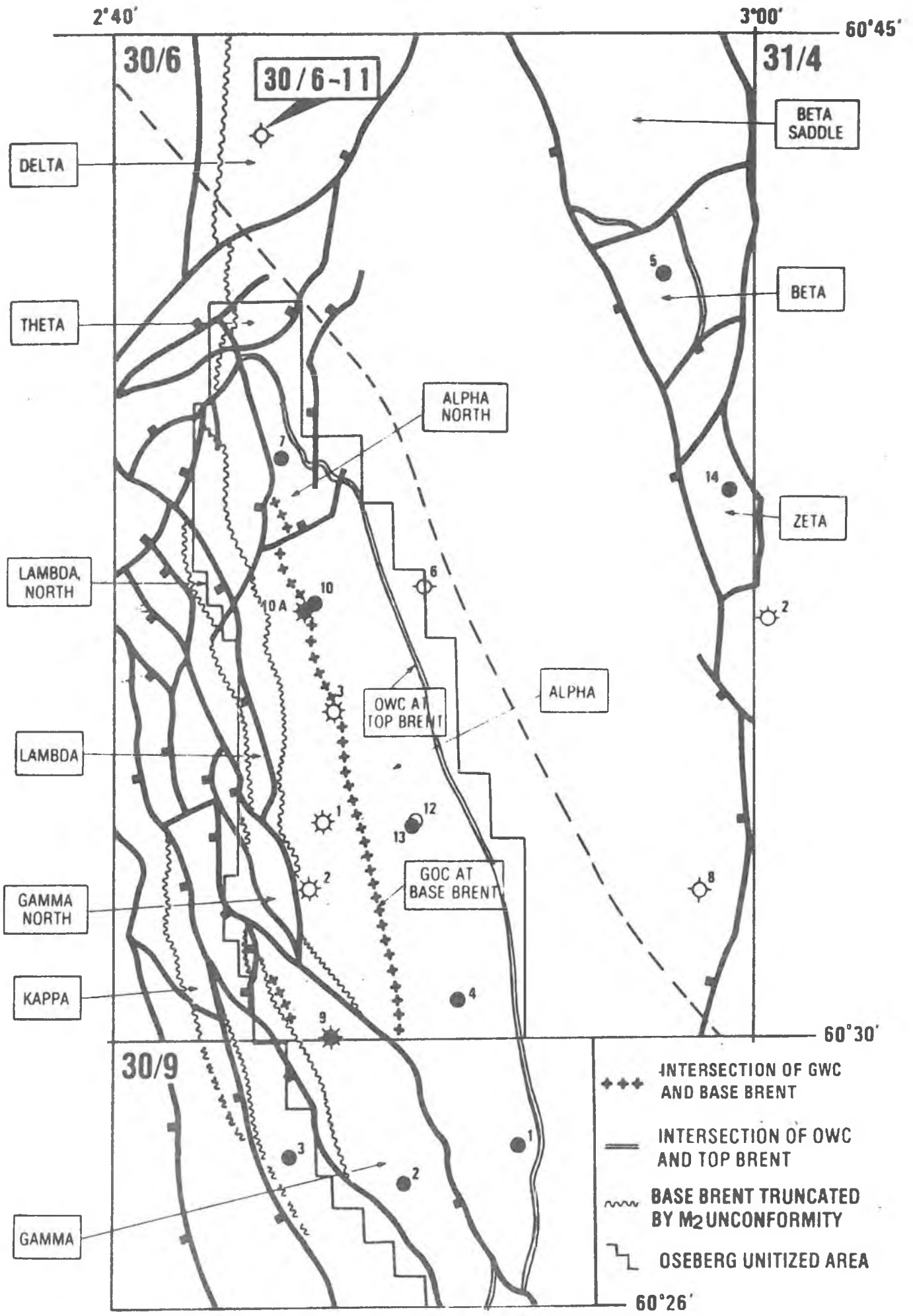


Fig. 1 - LOCATION MAP

1 - INTRODUCTION

This work deals with the optical study of the organic matter throughout the Cretaceous and Jurassic series of well 30/6-11 :

Reflected light and Fluorescence between 2600 and 4000 m (4 core samples and 17 cutting samples).

Transmitted light (PALYNOLOGY) : core samples only

. core 1 - 3265.00 - 3266.75 m - DRAUPNE

. cores 2 to 6 - 3452.00 - 3508.00 m - ETIVE

. core 7 - 3756.50 - 3768.00 m - DUNLIN

The general Jurassic lithostratigraphical framework (DRAUPNE, HEATHER, BRENT, DUNLIN and STATFJORD) and the BRENT splitting into five major units have been summarized from the ELF synthesis study of the Oseberg Field\*. The paleodating in the Cretaceous and Jurassic section have been taken from Robertson Research data\*\*.

All the lithostratigraphical and biostratigraphical data (including the ELF palynological results on cored sections) have been summarized on Fig. 2. Detailed accounts of organic matter study throughout the cored intervals are shown on Fig. 3 (core 2 to 6) and Fig. 4 (core 7).

Reflectance and Fluorescence data and a maturation profile are given on Plate 1 and Fig. 5 respectively.

---

\* Geological synthesis study of 15 wells from the Oseberg Field, Block 30/6 and 30/9, Norway. G. SAMBET June 1984.

\*\* NORSK Hydro 30/6-11 Norwegian North sea well : Biostratigraphy of the interval 260 - 4002 m T.D. Robertson Research. June 1983.

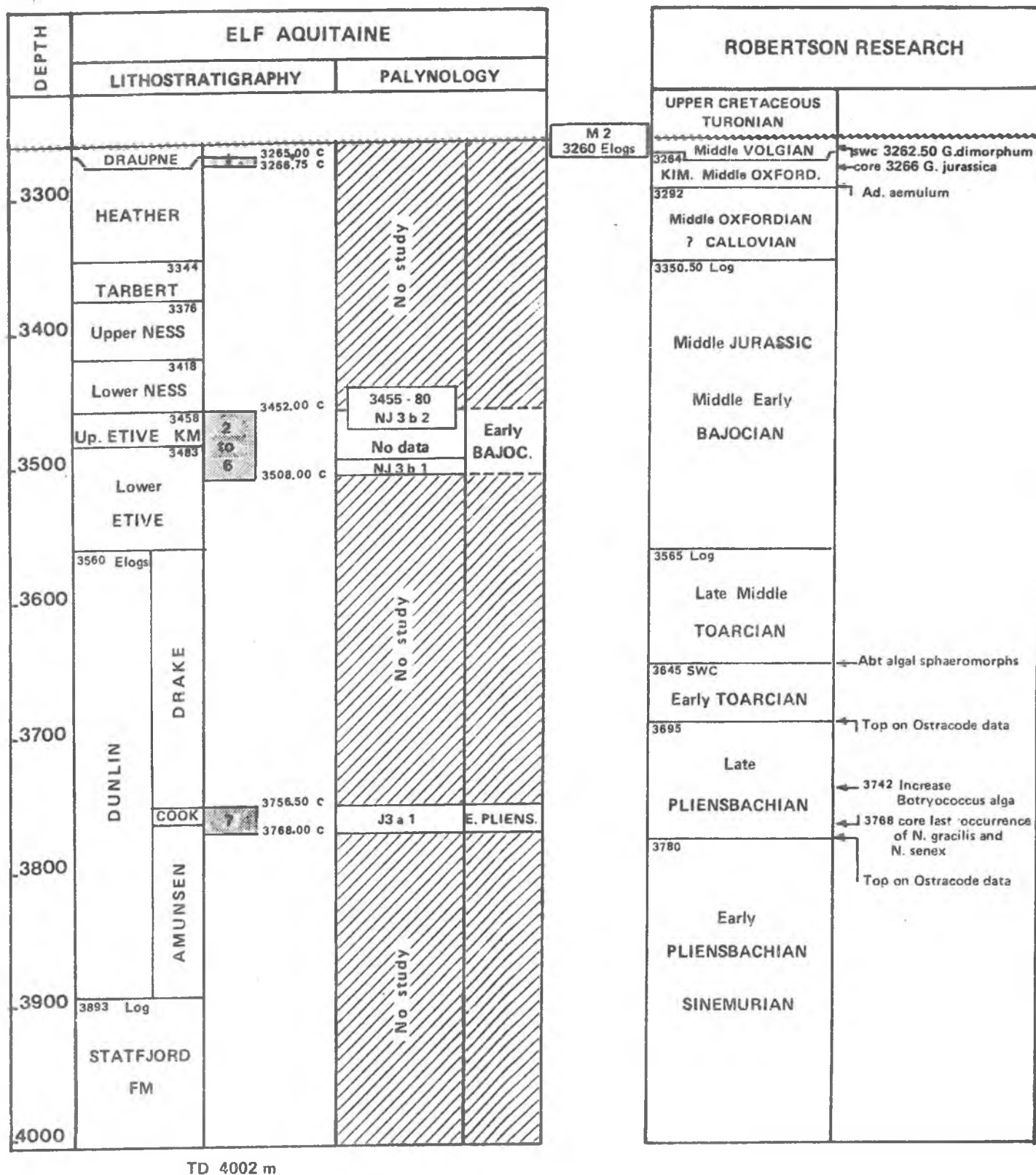


Fig. 2 - WELL 30/6-11 (NORWAY) - STRATIGRAPHICAL SUMMARY

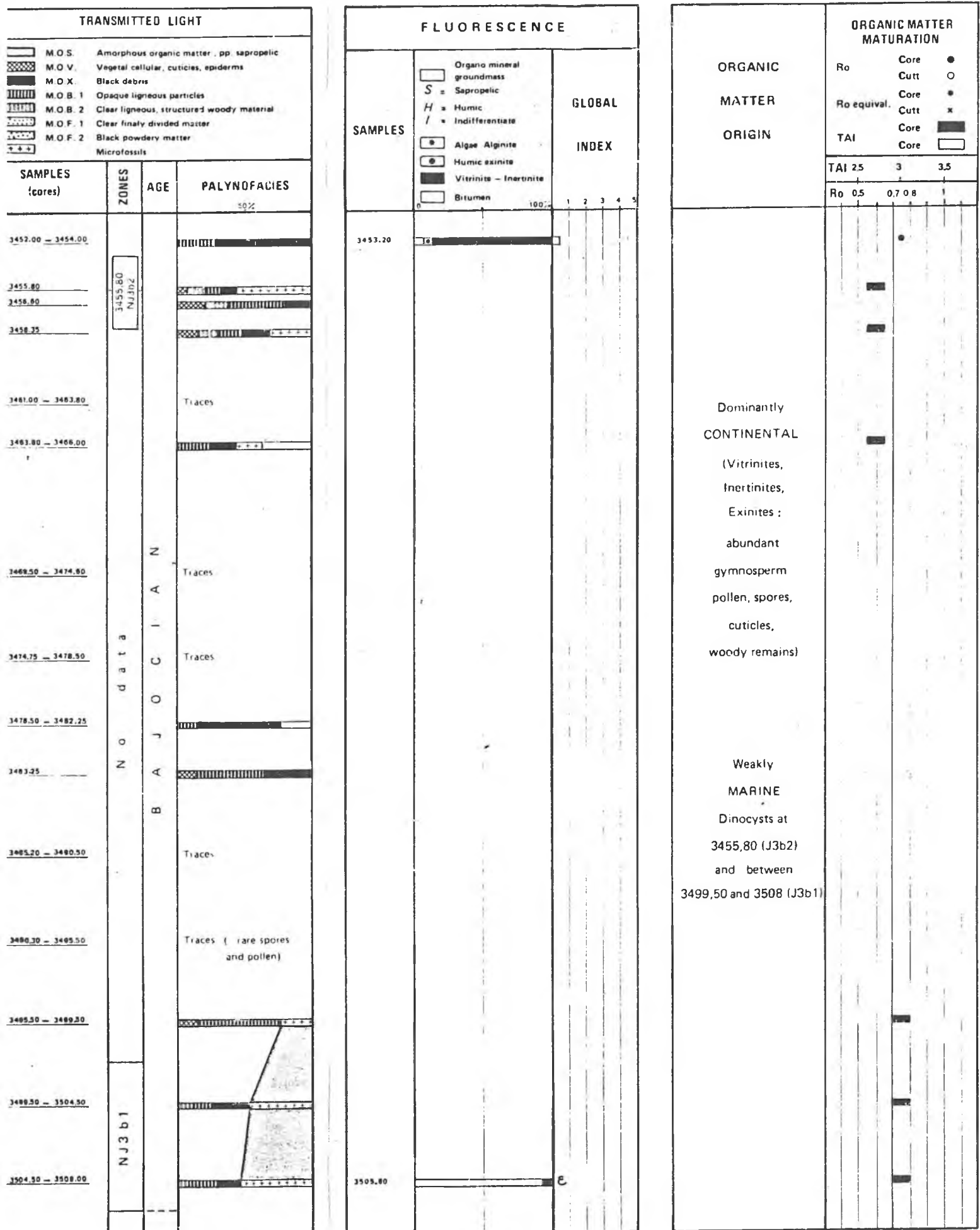


Fig. 3 - WELL 30 / 6 - 11 (NORWAY) - OPTICAL DATA SYNTHESIS (CORES 2 to 6)



## 2 - ORGANIC MATTER CHARACTERISTICS

Reflectance and fluorescence data was collected between 2600 and 4000 m on 21 samples. 23 core samples have been analysed in transmitted light (core 1 à 7).

### 2.1 - LATE CRETACEOUS

Reflectance and Fluorescence data was collected between 2600/2605 and 3230/3235 m throughout Late campanian, Early Campanian/Coniacian, Coniacian/Turonian and Turonian series. 8 cutting samples have been analysed and reveal pale fluorescent groundmasses together with high reflectant homogeneous vitrinites and rare linked exinites. It seems that most of the vitrinites have probably been reworked. The 3200 - 3205 and 3230/35 samples contain frequent vitrinites which are regarded as doubtful (frequent mud additives).

### 2.2 - JURASSIC

#### 2.2.1 - DRAUPNE Formation

The organic matter recovered in the core 1 interval (3265.25 m) shows a marine sapropelic facies, rich in yellow fluorescent Tasmanacean Alga, Botryococcus (fluorescence indice 3) and dinocysts.

The samples include two populations of reflecting particles : a few fluorescent bitumens and coaly particles rich in vitrinites and inertinites.

#### 2.2.2 - HEATHER Formation

The cutting sample at 3330 - 3340 m contains mainly organic matter of a continental origin. The groundmass is low fluorescent and of humic type. Vitrinites are abundant and weakly fluorescent. Frequent orange coloured exinites (sporinites and cutinites) are also observed.

#### 2.2.3 - BRENT Formation (3344 - 3560 E. logs)

In Fluorescence survey, four samples have been analysed from the BRENT interval :

NESS cutting sample 3400 - 3410 m

(core 2 sample 3453.20 m

ETIVE (core 6 sample 3505.80 m

(cutting sample 3550 - 3555 m

The cored interval (core 2-3-4-5-6 between 3452 and 3508 m) corresponds to the UPPER ETIVE, and LOWER ETIVE. Fifteen core samples have been studied in Palynology.

- NESS

Coals are abundant at 3400 - 3410 m reaching 90 % of the organic content. The coaly particles present a trimaceral composition : homogeneous vitrinites, inertinites (up to 50 %) and exinites.

- ETIVE

The organic matter recovered from the cored interval is predominantly of continental origin. Coals are particularly abundant at 3453.20 m and show a trimaceral composition (vitrinites, inertinites and exinites). The palynological investigations (see Fig 3) confirm the abundance of land derived material : gymnosperm pollen grains, spores, cuticles, black ligneous debris and coaly fragments.

The microfossils are particularly abundant (up to 60 % of the organic content) at 3455.80 m (palynozone NJ3b2) and in two composite samples at 3499.50 - 3504.50 m and 3504.50 - 3508 m (palynozone NJ3b1) - In these three samples, the autochthonous organic matter of marine origin (dinocysts) is weakly represented whereas, as for the whole cored interval, terrestrial microfossils predominate.

At 3508.50 m (core 6) the vitrinites exhibit some oil veinlets exsuding during the blue irradiation.

In fluorescence study, the groundmasses appear to be weakly fluorescent and uncharacteristic in all the studied sample.

2.2.4 - DUNLIN Formation (3560 - 3893 E. logs)

Fluorescence data were obtained on Five samples :

(cutting sample 3650 - 3655 m  
DRAKE (cutting sample 3682.60 - 3685 m  
(cutting sample 3730 - 3732 m

COOK core 7 sample 3762.50 m

AMUNDSEN cutting sample 3820 - 3825 m

In Palynology, six core samples (core 7) have been analysed between 3756.50 and 3768 m.

In the Upper DUNLIN shales (DRAKE Formation), fluorescence data indicates humic coaly material and pale fluorescent groundmasses - Vitrinites are abundant, together with inertinites and exinites. The 3650 - 3655 sample is rich in sporinites, with a fluorescence index of 1.

The cored 3756.50 - 3768 interval (palynozone NJ3a1) corresponds to the COOK Formation and to the uppermost part of the AMUNDSEN shales (see Figure 4). The organic matter is predominantly of continental origin, including abundant spores, gymnosperm pollen grains, mainly saccates, plant debris and black ligneous material. Abundant fluorescent vitrinites are observed at 3762.50 m. The figured organic matter (microfossils) represents 45 to 75 % of the total organic content.

**FLUORESCENCE**

SAMPLES

- Organo mineral groundmass
- S = Sapropelic
- H = Humic
- I = Indifferentiate
- \* Algae Alginite
- Humic exinite
- Vitrinite - Inertinite
- Bitumen

GLOBAL  
INDEX

100% 1 2 3 4 5

ORGANIC  
MATTER  
ORIGIN

**ORGANIC MATTER MATURATION**

- Ro Core ●
- Cutt ○
- Ro equival. Core \*
- Cutt x
- TAI Core ■
- Core □

TAI 2.5 3 3.5

Ro 0.5 0.7 0.8 1

Dominantly  
CONTINENTAL

(Vitrinites,  
Inertinites,  
Exinites:  
(abundant  
Gymnosperm  
pollen, spores,  
cuticles and  
ligneous debris)

Weakly  
MARINE

(10 Botryococcus  
alga at 3762.50 m)  
(very occasional  
dinocyst)

3762.50

The organic matter of marine origin is weakly represented by sporadic dinocysts and some dark Botryococcus alga observed at 3762.50 m.

The sample 3820 - 3825 m (AMUNDSEN) exhibits pale brownish groundmass and very rare exinites.

Numerous lignituous mud additives are observed in the cutting samples, particularly at 3682.50 and 3730 - 3732 m where they represent more than 75 % of the concentrates.

#### 2.2.5 - STATFJORD Formation (3893 - TD 4002 m)

Fluorescence data were obtained on two cutting samples at 3900 - 3905 m and 3995 - 4000 m - The concentrates are mainly composed of coaly particles. The abundant vitrinites are homogeneous and low fluorescent - Inertinites (<10 % and exinites are scarcely observed.

3 - THERMAL EVOLUTION

The thermal evolution with depth may be summarized as follows :

| LITHOSTRATIGRAPHY  | DEPTH<br>(m)   | RO %             | RO % equiv.<br>:Fluorescence: | TAI   | Conclusions<br>RO %  |
|--------------------|----------------|------------------|-------------------------------|-------|----------------------|
| CRETACEOUS         | 3200           | (0.45)           |                               |       | (0.45)               |
| (Coniacian - Tur.) | 3230           | (0.50)           |                               |       | (0.50)               |
| JURASSIC           | DRAUPNE        | core 1-3265.25   | 0.70                          | 0.70  | 0.70                 |
|                    |                | ( 3400 - 3410    | 0.75                          |       | 0.75                 |
|                    |                | ( core 2-3453.20 | 0.75                          |       | 0.75                 |
|                    |                | ( core 2-3455.80 |                               |       | 2.5 + :0.55<TAI<0.60 |
|                    |                | ( core 3-3463.80 |                               |       | 2.5 + :0.55<TAI<0.60 |
|                    |                | ( 3466           |                               |       |                      |
|                    | BRENT          | core 5-3495.50   |                               |       | 3 :0.70<TAI<0.80     |
|                    |                | ( 3499.50        |                               |       |                      |
|                    |                | ( core 6-3499.50 |                               |       | 3 :0.70<TAI<0.80     |
|                    |                | ( 3504.50        |                               |       |                      |
|                    |                | ( core 6-3504.50 |                               |       | 3 :0.70<TAI<0.80     |
|                    |                | ( 3508.00        |                               |       |                      |
|                    |                | ( 3550 - 3555    | 0.90                          |       | 0.90                 |
|                    |                | ( 3650 - 3655    | 0.95                          |       | 0.95                 |
| DUNLIN             | core 7-3762.50 |                  | 1                             | 3 + 1 |                      |
|                    | ( 3820 - 3825  | 1                |                               | 1     |                      |

High reflectant vitrinites, probably reworked, are observed to a great extent in the upper Cretaceous.

Through Jurassic samples, the abundant vitrinites enabled significant reflectance histograms to be obtained. Reliable values on fluorescence Alga are also to be found. The diagenesis survey is high and continuous from 0.70 % (top Jurassic) to 1 % (base DUNLIN FM). A slight difference was detected between  $R_o$  values and TAI values, the latter generally being lower.

#### 4 - CONCLUSIONS

The compilation of fluorescence, reflectance and palynological data enables us to make a detailed evaluation of both organic matter type and maturation trends in the Upper Cretaceous and Jurassic series of the well 30/6-11.

The DRAUPNE Formation mainly contains marine amorphous Kerogen from good source rock facies.

Kerogen of predominantly continental origin is identified in the BRENT deposits. A detailed study on cored interval (ETIVE) indicates an abundant land derived material (vitrinites, inertinites, plant cuticles, gymnosperm pollen and spores). Mixed continental and marine (dinocysts) organic matter is present in the ETIVE deposits but the marine organic matter appears to be generally little represented.

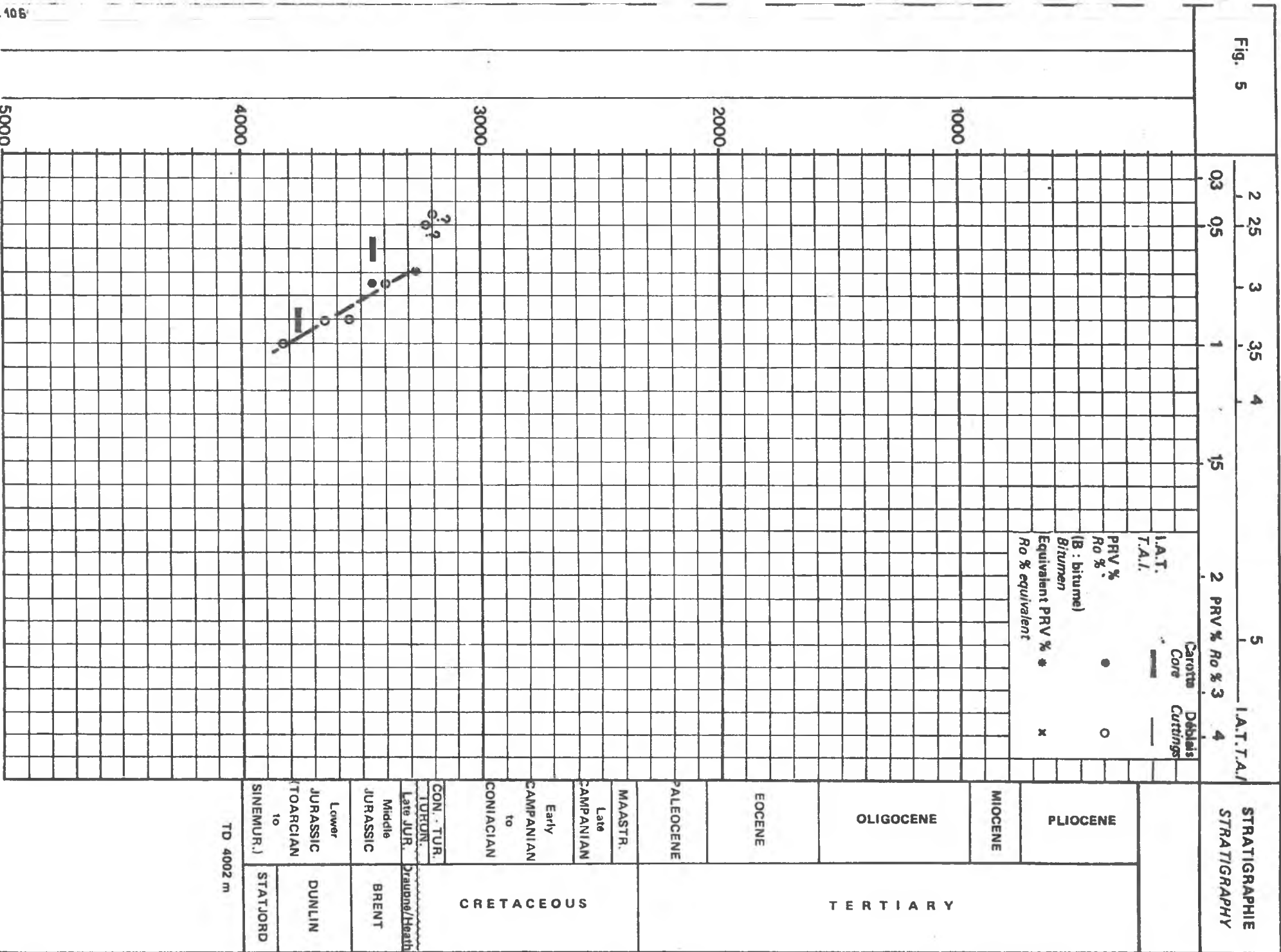
The DUNLIN Formation mainly contains a continental originating Kerogen. A detailed study of the cored interval (COOK and top AMUNDSEN) indicates abundant land derived material in all the samples (vitrinites, inertinites, plant cuticles, gymnosperm pollen grains and spores). The rare occurrence of marine organic matter is noteworthy. A Botryococcus algal facies is observed at 3762.50 m (COOK).

The diagenesis survey is high and continuous throughout Jurassic deposits. Increasing maturation values can be observed between 0.70 % (to DRAUPNE Formation - Middle Volgian) to 1 % (base DUNLIN - Early Pliensbachian/Sinemurian).

PAYS NORWAY  
 COUNTRY NORWAY  
 SONDAGE 30 / 6 - 11  
 WELL

# PROFIL de MATURATION

## MATURATION PROFILE





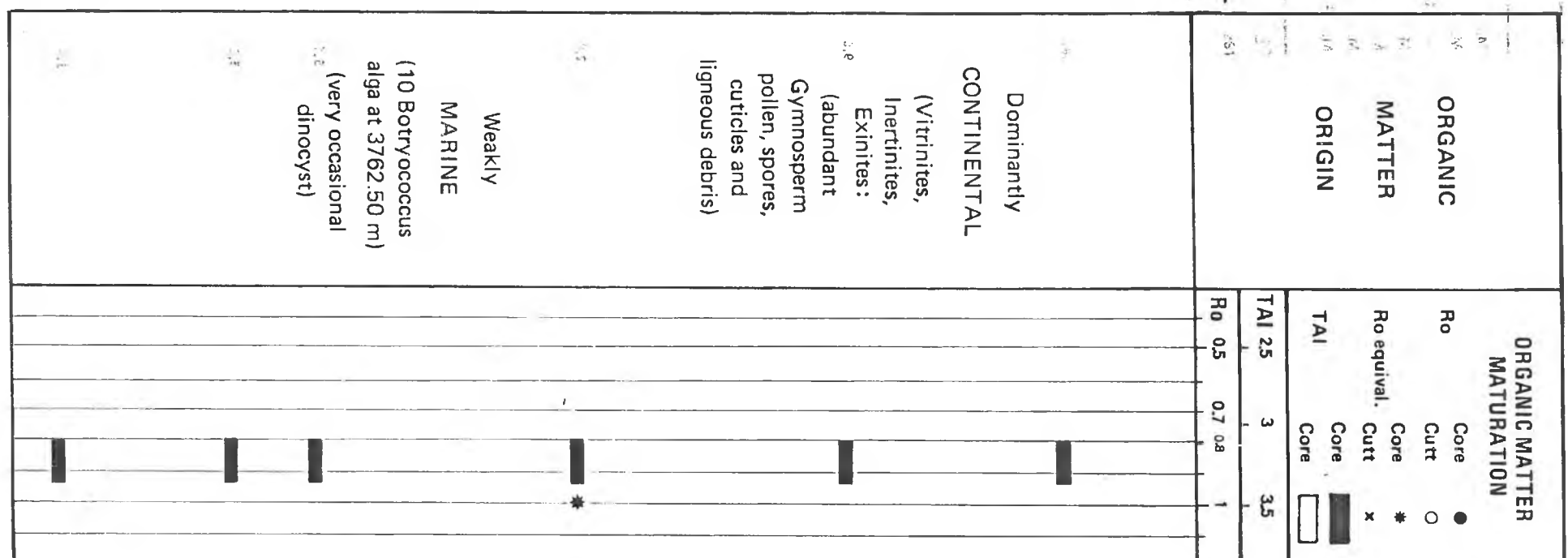
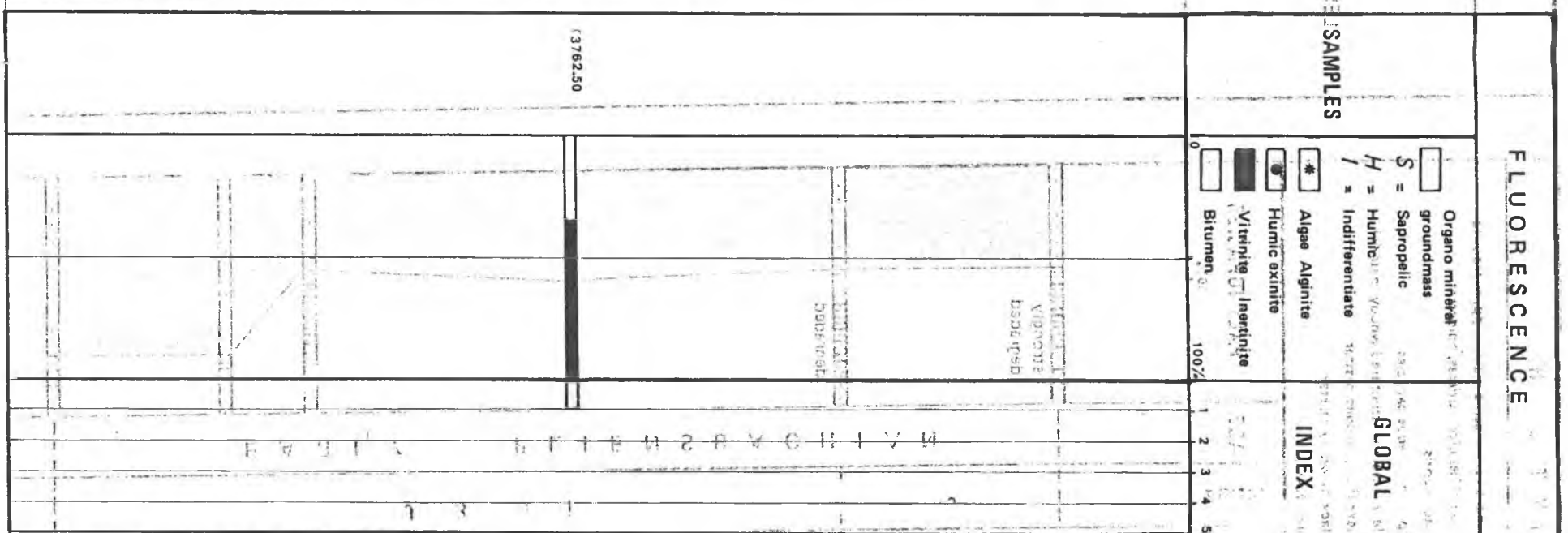
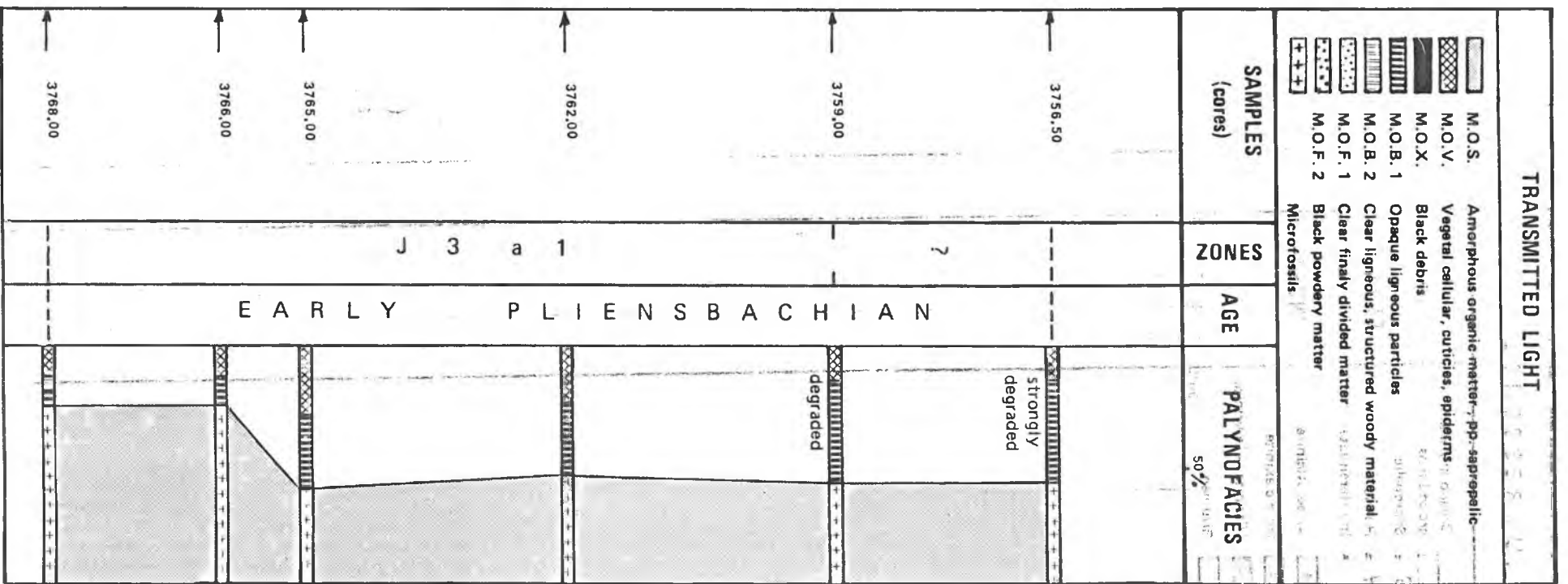
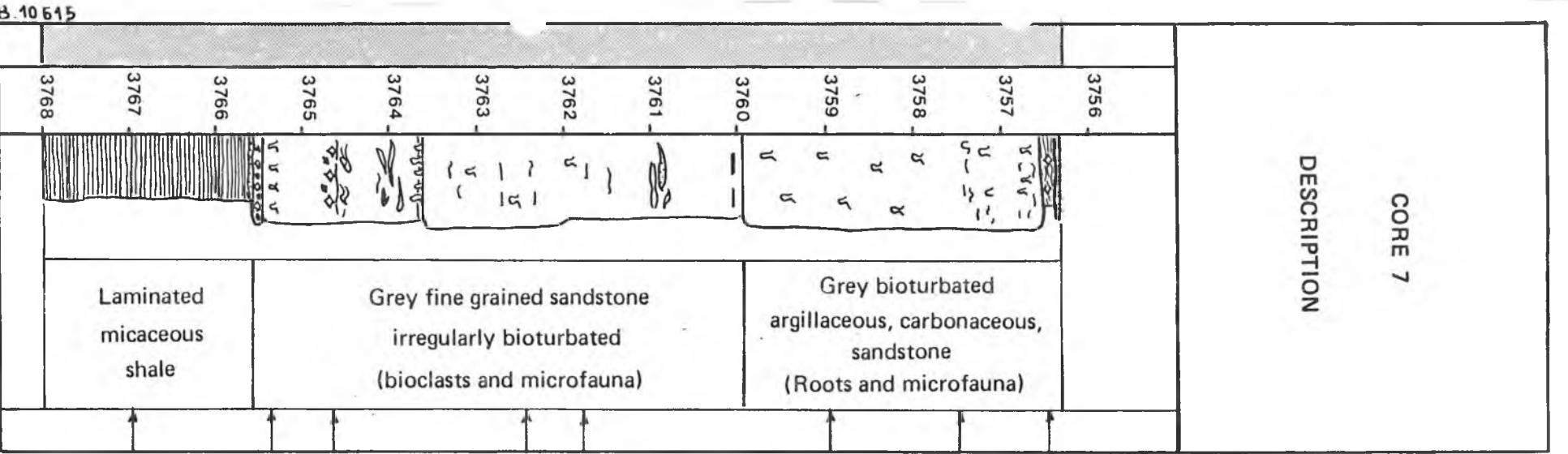


Fig. 4 - WELL 30/6-11 - OPTICAL DATA SYNTHESIS (CORE 7) - FT-6105 JEW

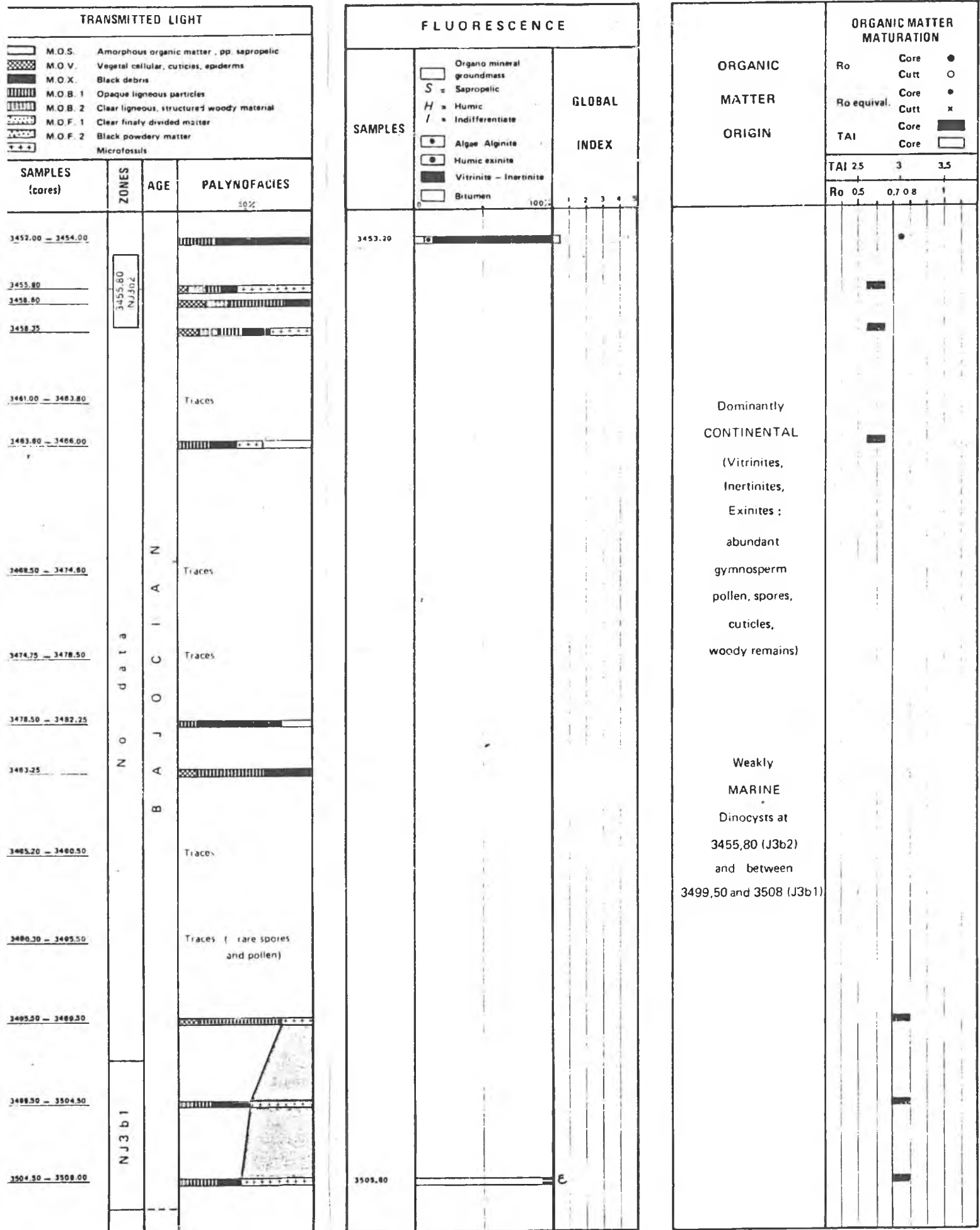


Fig. 3 - WELL 30 / 6 - 11 (NORWAY) · OPTICAL DATA SYNTHESIS (CORES 2 to 6)