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DEPARTEMENT GEOLOGIQUE CENTRAL
LABORATOIRES

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# EAST FRIGG 25/2-1 WELL

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# SEDIMENTOLOGICAL STUDY OF THE BASE OF THE TERTIARY SERIES

2035 n° 4/947 R
/ca

R. CUSSEY

June 1974

ELF NORGE, order n° 031005

# FICHE DE DIFFUSION

Réf. : 2035 n° 4/947 R

Titre : East FRIGG 25/2-1 well
Sedimentological study of the base
of the Tertiary series

Auteur : R. CUSSEY

Destinataires :

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| S.I.D. | 1 |
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| DIVISION II - EUROPE DU NORD | 20 |

# C O N T E N T S

Page

## I - CHARACTERIZATION OF LITHOSTRATIGRAPHICAL UNITS* (Pl. n° 1 and 2)

- From 1900 m (top of analysis) to 1905 m : Buff-brown dolomicrite with recrystallization.

- Zone of laminated shales : 1905 to 1915 m
  Locally laminated dark-brown shales. Traces of breccia and fissures of dessication, traces of silicifications.

- Zone of medium to coarse sands : 1915 to 2002 m
  White to light buff, medium to coarse (some fine grains), semi-transparent subangulous, badly sorted sand with feldspar, siliceous and granito-gneissiques debris of rocks.
  From 1958 to 1961 m, a level of grey laminated, lignitic, argillaceous, fine sandstone with numerous concretions of dickite 5 cm thick at the base.

- Zone of brown shales : 2002 to 2034 m
  Oxydized brow-red shales, slightly calcareous with numerous Globigerinidae at the top, grey-green shales near the base, occasional thin levels of poecilitic moderately sorted medium sandstone.

- Zone of fine to medium, poecilitic sandstones and sands : 2034 to 2111 m
  Fine to medium (locally coarse grains) subangulous, moderately to badly sorted sand and sandstone with irregular poecilitic cement, quartz grains are often broken and leached ; they are sometimes coalescents.
  Occasional glauconite grains and micas, frequent feldspar and rock debris.

- Zone of volcanic tuffa : 2111 to 2170 m
  Grey-brown, silicified volcanic tuffa with microliths of fedspar, often pyritic concretions, interbedded with fine to medium white sandstone often cemented with poecilitic carbonate or dickite.

- Zone of lignitic shales : 2170 to 2195 m
  Dark-grey to grey-green shale with locally lignitic laminations, frequent pyrite. Thin beds of medium, angulous, badly sorted, poecilitic cemented buff to dark buff sandstone.
  at 2165 m level of black pyritic shale with inclusions of volcanic tuffa.

- Zone of fine to medium sands : 2195 to 2336 m
  Clear, fine to medium (with rare coarse grains) moderately to badly sorted sand with debris of rocks, micas and occasional feldspar. Local cementation with poecilitic cement ; coalescence of grains.
  Few beds of grey micaceous pyritic or lignitic shale.

- Zone of sand and micaceous shales : 2336 to 2362 m
  Fine to medium moderately sorted clear sand, with debris of rocks, micas, occasional feldspar, often cemented by a badly developed poecilitic carbonate or by coalescence of grains, interbedded with grey, micaceous, pyritic shales.

- Zone of glauconious sandstones : 2362 to 2380 m
  Glauconious, pyritic, argillaceous fine (with some medium grains), badly sorted light buff sandstone.

- Zone of varicolor shales : 2380 to 2430 m
  Light green, brown-red to brown, light grey shales, traces of micro-foraminifera, silicified structures.

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*Lithological analysis made with FOSSAT.

- Zone of grey shales : 2430 to 2538 m
  Light grey to dark grey, slightly silty, irregularly micaceous and glauconious shales, local, abundant pyrite.

- Bed of poecilitic coarse sandstone : 2538 to 2551 m
  Light buff, medium to coarse, subangulous, badly sorted, poecilitic sandstone.

- Bed of grey lignitic shales : 2551 to 2557 m
  Dark grey lignitic shales, with fine grains of pyrite and glauconite.

- Zone of coarse, coalescent sandstones : 2557 to 2652 m
  Coarse subangulous to subrounded, badly sorted, clear sand, often cemented by coalescence of grains or sparse argillaceous cement.

- Zone of alternating coarse sands - glauconious shales : 2652 to 2670 m
  Coarse, subangulous, badly sorted, argillaceous, dickitic grey-buff sandstone interlayered with glauconious, lignitic, sandy grey-green shales.

- Zone of Globigerinidae Limestone : 2670 to 2700 m (base of the study)
  Light buff Mudstone Wackestone with abundant Globigerinidae, frequent Foraminifera and occasional Radiolaria.

## II - RESULTS OF GRAIN SIZE ANALYSIS AND X-RAY ANALYSIS OF CLAY MINERALS

### 1) Grain-size analysis (appendix n° 1)

The analysis was made on cores in the "Frigg sands" formation.

The results of these analyses show the presence of two populations :

- the first : highly predominant (95 %), medium to fine (250-125μ ) well sorted.
- the second : (5%), coarser (500 - 1500μ ), badly sorted.

The presence of two populations explains the apparently bad sorting of grains in thin sections.

The grain-size analysis results are characteristic of elaborate distribution in a probably littoral environment.

### 2) Clay mineral analysis by X-Ray (Pl. n° 3)

The clay minerals observed are :

- Predominantly Montmorillonite
- Kaolinite (in the upper part)
- Interlayered Illite/Montmorillonite (in the lower part)
- Illite and Chlorite (in small quantities and scattered throughout the whole series).

.../...

Clay minerals repartition :

- Zones 1900 - 1905 m and 1905 - 1915 m : almost exclusively Montmorillonite.

- Frigg sands (1915 - 2002 m) :

  Upper part with a small quantity of kaolinite (10 - 20 %)
  Lower part with predominant kaolinite (30 % - 80 %)

  This kaolinite occurrence seems characteristic of the Frigg sands serie (25/1-1x : 50 - 65 % of kaolinite).

- In underlying series (tuffa zone (2002 - 2362 m) - COD sands), Montmorillonite is predominant, almost to the exclusion of other clay minerals, except in the lignitic shales interval (2158 - 2195 m), where there is some Illite (15 % - 30 %).

- In varicolor shales and glauconious sands (2362 - 2430 m) there is mixing of different clay, materials (Kaolinite - Illite - Chlorite) but Montmorillonite is always strongly predominant.

- In grey shales (2430 - 2538 m) we find the same minerals as above, but in addition an interlayered Illite/Montmorillonite was analysed in clab samples (but not in cuttings).

- In the coarse coalescent sandstone zone (2557 - 2652 m), only one sample was analysed and the same minerals were found as in grey shales.

In the Paleocene - Danian series, Montmorillonite is predominant but the occurrence of other minerals, such as Kaolinite and Interlayered I/M, could be significant for establishing a zonation or for the interpretation of sedimentological evolution.

## III - SEDIMENTOLOGICAL INTERPRETATION

In the 25/2-1 well, deposits are various and they have been studied and classified in two ways based on different principles :

- From a sedimentological point of view based on examination of deposit conditions (determination of environment).

- From a statistical point of view based on statistical correlations* and variations of the analytical characteristics resulting from lithologic examination.

.../...

* statistical methods briefly described in the enclosed appendix 2.

In fact, these two classification methods if combined give fuller information :

Procedure for the determination of lithofacies

1) Collect the results of lithological analysis parameters
2) Systematical description of samples
3) Gather samples which have the same or nearly description

— Statistical method —

4) Compare these statistical lithofacies with those determine by sedimentological methods.
5) Determination of a final lithofacies for each sample.
6) Introduce the results and make a statistical evaluation of their correlation ratio.

— Statistical method —

7) Use this correlation ratio and compare the results with the sedimentological interpretation.
8) Put the final result on a log to make apparent the lithofacies evolution.

- The first process provides valuable informations about the relative importance of factors in terms of sedimentological interpretation.
- The second process improves determination of the lithofacies, enabling us to group them according to statistical features and to determine the vertical sequences formed by them.

By these methods, lithofacies have been characterized and grouped.

Lithofacies I : Dessication breccia shale (statistical n° 1)

Buff-grey lutite with dessication marks, laminated bedding.

II : Fine, lignitic sandstone (statistical n° 2 a + 4)

Fine, lignitic, argillaceous, micaceous sandstone ; very fine, subangulous, moderately sorted grains, with some interbedded fine sand.

III : Clear, fine to medium, badly-sorted sand (statistical n° 3a + 3b)
(N.B. : All sands are severely corroded and broken in the Paleocene - Lower Eocene series).

White, fine to medium, subangular, badly sorted*, sublithic to arkosic, micaceous sand with scattered coarse grains.
The nt Ia zone seems to have the same facies, but with coarser grains.

IV : Laminated, dark, lignitic, silty shale (statistical n° 5)

Grey to dark, laminated, silty shale with very finely divided pyrite and large fragments of lignite.

.../...

* In spite of good sorting as regards the grain size curve, the sands seem badly sorted in thin sections because of the occurrence of a low coarse population.

V : <u>Laminated, dark lignitic shale</u> (statistical n° 9a)

Dark shale with very small fragments of lignite.

VI : <u>Grey, dickitic sandstone</u> (statistical n° 2b)

Grey, medium, badly to moderately sorted, subangulous, dickitic sandstone.

VII : <u>Coalescent sand-sandstone</u> (statistical n° 3c)

Fine to medium, subangulous to angulous, moderately sorted, coalescent-grained sand-sandstone ; small quartz debris and lithic fragments are highly coalescent.

VIII : <u>Poecilitic sandstone</u> (statistical n° 7)

Fine to medium, angulous, moderately sorted, sandstone roughly cemented by sparite (poecilite crystals) ; detrital grains are always strongly corroded with carbonate replacement.

IX : <u>White, moderately sorted sand</u> (statistical n° 8)

White, fine to medium, subangulous, badly to moderately sorted, micaceous, slightly argillaceous sand.

X : <u>Argillaceous, glauconitic sandstone</u> (statistical n° 10)

Grey, fine to very fine, subangulous, argillaceous, glauconitic, pyritic and micaceous sandstone.

XI : <u>Red-brown shale</u> (statistical n° 6)

Red-brown shale with local presence of Globigerinidae.

XII : <u>Dark, silty micaceous shale</u> (statistical n° 5)

Dark, silty, micaceous, pyritic, laminated shale with thin bedding of organic matter.

XIII : <u>Grey-green shale</u> (statistical n° 11)

Light grey-green shale with occasional microrhombs of dolomite, frequent silicified tubular structures and arenaceous microforaminifera ; occasional glauconitic grains.

XIV : <u>Dark pyritic shale</u> (statistical n° 9b)

Brown-grey to grey shale with pyrite, glauconite, arenaceous microforaminifera ; silicified microstructures ; irregular aspect of sedimentation.

XV : <u>Grey shale</u> (statistical n° 12)

Grey, mottled shale, with pyrite, glauconite, silicified microstructures and organic matter.

The statistical relations between the lithofacies are summarized in the table below.

.../...

Table 1

# SUMMARY OF STATISTICAL RELATIONS BETWEEN THE LITHOFACIES

| LITHOFACIES | STATISTIC N° | OPEN MARINE DEPOSITS | | | | OXYDIZED SHALES | DISTAL SANDS | INTERNAL DELTA SANDS | | | SWAMPS | | | LITTORAL SANDS (Bars or Tidals) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lithofacies / Statistic n° | | XV (12) | XIV (9b) | XIII (11) | XII (5) | XI (6) | X (10) | IX (8) | VIII (7) | VII (3c) | VI (2b) | V (9a) | IV (5) | III (3b) | III (3a) | II (4) | II (2a) | I (1) |
| XV | 12 | o | 0,970 | | 0,988 | | | | | | | | | | | | | |
| XIV | 9b | 0,993 | o | 0,981 | | | | | | | | o | | | | | | |
| XIII | 11 | | 0,912 | o | | 0,990 | | | | | | | | | | | | |
| XII | 5 | 0,912 | | | o | 0,947 | | | | | | | o | | | | | |
| XI | 6 | | | | 0,952 | o | 0,998 | | 0,964 | | | | | | | | | |
| X | 10 | | | | | | o | 0,995 | | | | | | | | | | |
| IX | 8 | | | | | | | o | 0,996 | | | | | | | | | |
| VIII | 7 | | | | | 0,961 | | | o | | | | 0,963 | | | | | |
| VII | 3c | | | | | | | | 0,938 | o | | | 0,988 | | | | | |
| VI | 2b | | | | | | | 0,907 | | | o | 0,946 | | | | | o | |
| V | 9a | | o | | | | | | | | | o | | | | | | |
| IV | 5 | | | | o | | | | | 0,986 | | | o | | | | | |
| III | 3b | | | | | | | | | | | | | o | 0,942 | 0,999 | | |
| III | 3a | | | | | | | | | | | | | 0,988 | o | | 0,971 | |
| II | 4 | | | | | | | | | | | | | | 0,984 | o | | |
| II | 2a | | | | | | | | | | o | | | | | | o | 1,000 |
| I | 1 | | | | | | | | | | | | | | | | | o |

OPEN MARINE — INTERNAL DELTA-SANDS AND SWAMPS — LITTORALS BARS OR TIDALS SANDS

The sedimentological attempt at interpretation is mainly supported by :

- a lithological examination
- a detailed examination of traces of energy currents and other marks of environment
- an interpretation of the grain size curve
- palynological and micropaleontological information

The first question to be posed, in order to solve the problems of environment, is : "Did these sediments settle in turbidity currents or in littoral continental conditions" ?

Continental deposition seems impossible for the greatest part of sediments because of the presence of microfauna and marine microflora and the scarcity of exposure features.

The presence of turbidite deposits does not seem entirely impossible but there is no clear proof and very few arguments in favour of this hypothesis ; on the other hand the lithological characteristics appear to support the hypothesis of a littoral environment, and some of them directly rule out a turbidite origin :

- heterogeneity of lithofacies and types of sequence.
- heterogeneity of palynological ratio between marine and continental microflora.
- abundance of lignite.
- presence of dessication marks, kaolinitic concretions.
- good sorting of sands in grain size curve.
- lack of turbidity sequence and graded bedding.

If we accept the interpretation of a littoral origin it would seem to be related to a deltaic environment :

- shape of sand deposits
- variability in lithological features

and several types of deposits can be recognized :

(1) <u>Open marine deposits (lithofacies XV, XIV, XIII, XII, XI, X)</u>

The main criteria of determination are :

- presence of microfauna arenaceous foraminifera
  local pelagic Globigerinidae
  silicified microstructures.
- high predominance of marine microflora.
- homogeneity of deposits.
- lack of high energy.
- abundance of glauconite in sandstone deposits.

(2) <u>Littoral sands (lithofacies III, II, I) = tidal sands</u>

Their main characteristics are :

- good sorting of fine to medium sands
- presence of a second population (coarse grains)
- massive appearance.
- local presence of tidal flats deposits (lignitic sandstone) and tidal bars.
- presence of exposure traces (kaolinitic concretions, dessication breccia).

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③ <u>Internal delta sands and swamps or tidal flats shales and sands (lithofacies IX, VIII, VII, VI, V, IV)</u>

These deposits are strongly heterogeneous and characterized by :

- heterogeneity of sediments and sequences.
- predominant continental microflora.
- presence of dickite and poecilite cement.
- abundance of lignite.

.../...

# Table 2 = SUMMARY OF SEDIMENTOLOGICAL REPARTITION OF LITHOFACIES

| PETROPR. ref. of FACIES | STATISTICAL ref. of FACIES | DESCRIPTION | ENVIRONMENT |
|---|---|---|---|
| XV | (12) | Grey shale (lutite) | OPEN MARINE DEPOSITS |
| XIV | (9b) | Dark pyritic shale (lutite) | |
| XIII | (11) | Grey-green shale (lutite) | |
| XII | (5) * | Dark silty, micaceous shale | |
| XI | (6) | Red brown shale | MARINE OXYDIZED SHALE |
| X | (10) | Argillaceous micaceous, pyritic glauconious. Fine sandstone | DISTAL DELTA SANDS/ TRANSGRESSIVE SANDS |
| IX | (8) | - Moderately sorted white, subangulous medium sand | INTERNAL DELTA SANDS |
| VIII | (7) | Moderately sorted subangulous, fine to medium, poecilitic sandstone | |
| VII | (3c) | Moderately sorted coalescent sand-sandstone | |
| VI | (2b) | Badly sorted grey medium, dickitic sandstone | |
| V | (9a) | Laminated lignitic dark shale | SWAMPS / TIDAL FLATS |
| IV | (5) | Laminated dark, lignitic, silty shale | |
| III | (3b + 2a) | Badly sorted, subangulous, fine to medium, sublithic or arkosic sand (± coalescent.) + coarse grains | TIDAL SANDS |
| II | (4) + (2a) | Dark fine, lignitic or micaceous, argillaceous sandstone | |
| I | (1) | Buff-grey, dessication breccia shale | |
| | | | |

The interpretation of the DANIAN to LOWER EOCENE series is still hypothetical (Plate n° 4).

Above the pelagic deposits of MAESTRICHTIAN, the massive sand-sandstone of nt Ia is difficult to interpret ; it may be a littoral environment but there is not sufficient proof of this.

In the nt Ia and nt Ib shale, we are in an open marine environment.

In the lower nt IIa, we have succesively, marginal deltaïc sands ⟶ littoral sands.

In the middle and upper nt IIa, we are in an internal deltaïc environment with swamps and tidal flats channels. At the top, a thin interval made up of red Globigerina shales could be a littoral marine shale level marking a transgression level.

The littoral tidal sands settle in nt IIb and the open marine shales of nt III overlay the more restricted nt IIc deposits.

Some diagenetic phenomena can be observed which may bring about considerable changes in the reservoir :

- Poecilitic carbonate secondary cementation which could be due to the action of alternating fresh water/salt water. This phenomenon exists chiefly in the internal delta (tidal flat channels).
- Dickite secondary cementation.
- Coalescence of grains could be related to the effect of pressure.

## IV - CONCLUSIONS

This study contributes to supplying better information on the environment of FRIGG and COD sands in the area of the FRIGG FIELD, arguing in favour of the possibility of a littoral sedimentation enclosed in a regressive - transgressive sequence.

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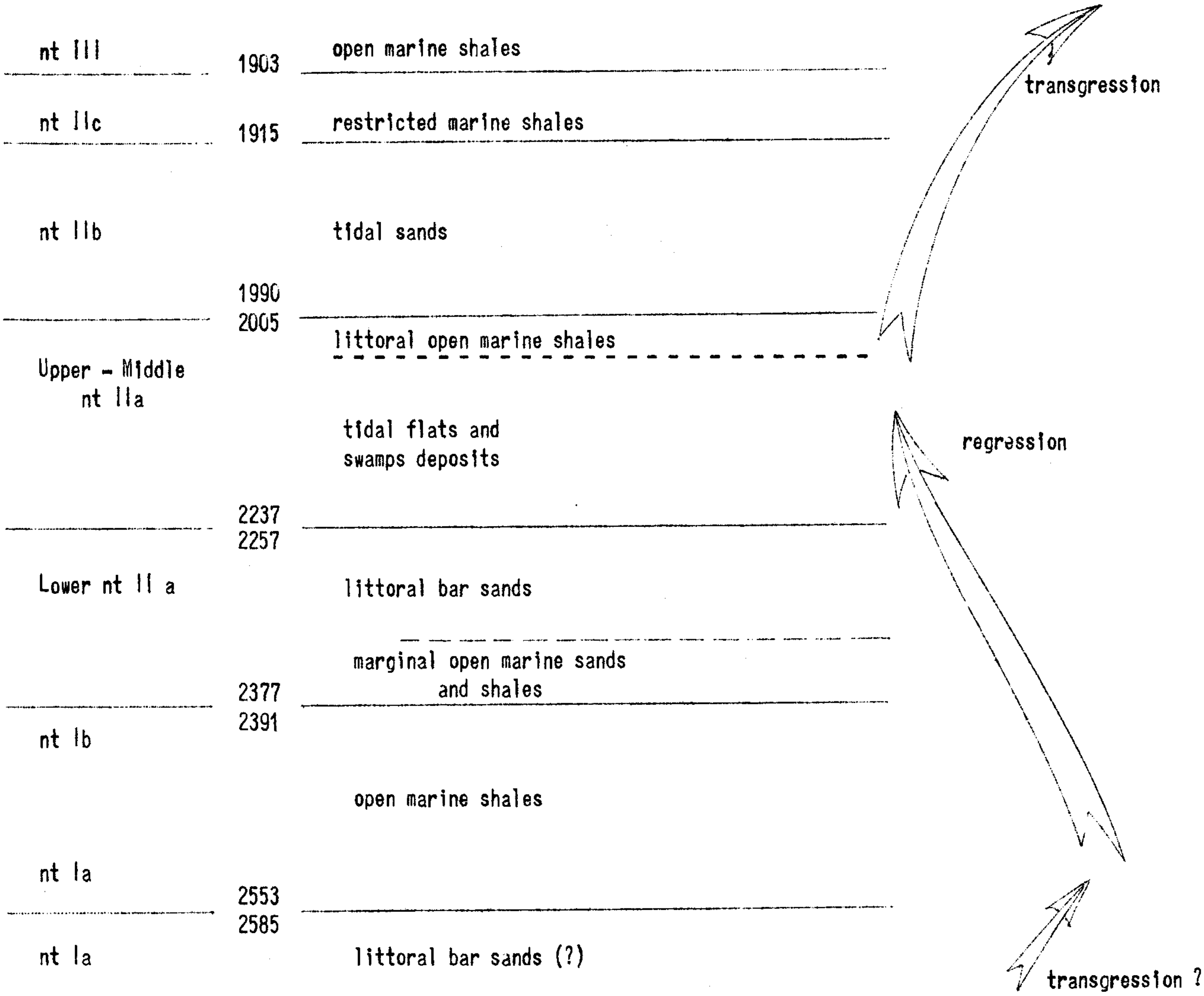

nt III
1903
open marine shales
transgression
nt IIc
1915
restricted marine shales
nt IIb
tidal sands
1990
2005
littoral open marine shales
Upper - Middle
nt IIa
tidal flats and
swamps deposits
regression
2237
2257
Lower nt II a
littoral bar sands
marginal open marine sands
and shales
2377
2391
nt Ib
open marine shales
nt Ia
2553
2585
nt Ia
littoral bar sands (?)
transgression ?

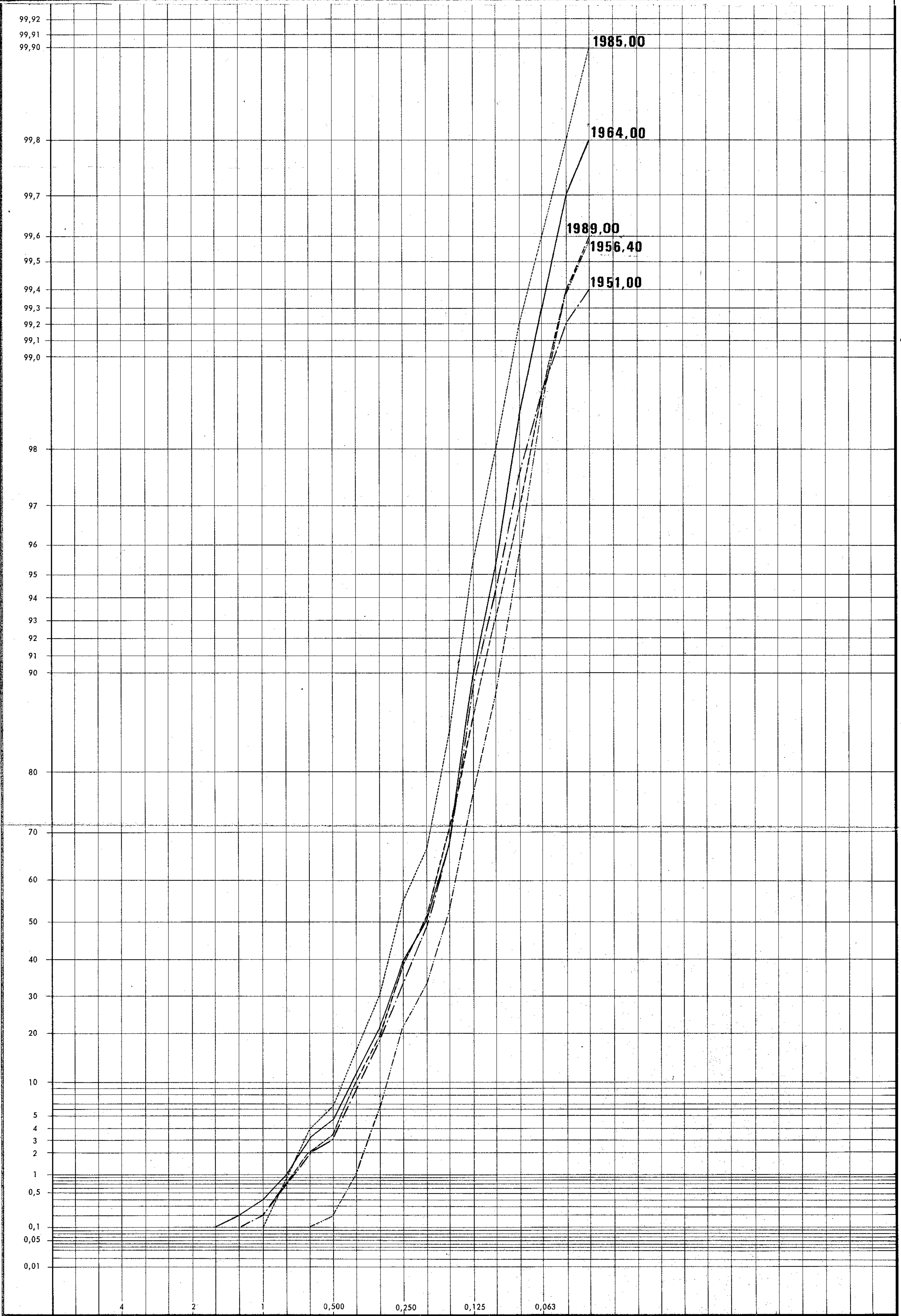
LABORATOIRE EXPLORATION

## GRAIN SIZE ANALYSIS BY SIEVING

(Wieght of the grain size fraction in decigrams)

Samples from 25/2-1 (NORWAY)

| REF. OF SAMPLES | TOTAL WEIGHT IN GRAMS | GRAIN SIZE IN MICRONS: MORE THAN 6300 | 5000 to 6300 | 4000 to 5000 | 3150 to 4000 | 2500 to 3150 | 2000 to 2500 | 1600 to 2000 | 1250 to 1600 | 1000 to 1250 | 800 to 1000 | 630 to 800 | 500 to 630 | 400 to 500 | 315 to 400 | 250 to 315 | 200 to 250 | 160 to 200 | 120 to 160 | 100 to 120 | 80 to 100 | 63 to 80 | 50 to 63 | 40 to 50 | LESS THAN 40 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1951 | 100 | | | | | | | | 001 | 001 | 005 | 013 | 010 | 062 | 090 | 158 | 151 | 198 | 198 | 055 | 028 | 010 | 006 | 002 | 006 |
| 1956 40 | 100 | | | | | | | | 001 | 001 | 005 | 015 | 011 | 063 | 092 | 199 | 115 | 197 | 164 | 064 | 038 | 016 | 008 | 002 | 004 |
| 1964 | 100 | | | | | | | 001 | 001 | 002 | 007 | 022 | 014 | 066 | 096 | 181 | 109 | 188 | 204 | 056 | 031 | 009 | 004 | 001 | 002 |
| 1985 | 100 | | | | | | | | | 001 | 009 | 032 | 023 | 097 | 141 | 246 | 117 | 174 | 114 | 025 | 012 | 004 | 002 | 001 | 001 |
| 1989 30 | 100 | | | | | | | | | | | 001 | 001 | 008 | 055 | 152 | 113 | 194 | 241 | 112 | 077 | 026 | 009 | 002 | 004 |

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**GRAIN - SIZE RESULTS OF SAMPLES FROM THE BASE OF THE TERTIARY**

elf ENTREPRISE DE RECHERCHES ET D'ACTIVITES PETROLIERES
DIRECTION EXPLORATION
LABORATOIRE

App^x 1

Date June .74
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**LITHOLOGICAL ANALYSIS OF THE BASE OF THE TERTIARY SERIES**

| | | |
|---|---|---|
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**POROSITY**

K. n° 1 from 1950 to 1968 m

**From 1950 to 1953,50 m**

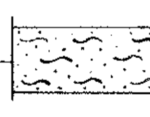
Fine to medium sand grey buff and grey, clear, poorly micaceous (muscovite) quartz (Ø max 400$\mu$ medium 200$\mu$ L, subangulous and translucent ± well sorted with some sparce, witish, opaque, subangulous and subrounded gravels (Ø 800$\mu$ rarely 2000$\mu$ ).

**From 1953,50 to 1958,80 m**

Grey medium sandstone, poorly argillaceous cemented, (quartz Ø 400$\mu$, medium 150$\mu$ ) subangulous and subrounded translucent some subangulous and subrounded gravels from ± Ø 1000$\mu$ , micaceous (muscovite) and brown sometimes block inclusions (lignitic fragments ?).

**From 1958,80 to 1960 m**

Sand " id. " 1950 m with slightly cemented noduls




From 1960 to 1960,40 : fine millimetrics subhorizontal laminations of silty dark shale with lignitic or coaly fragments, slightly pyritic, and siltstone to very fine grey sandy sandstone with dark coaly fragments. At the base 5 cm of dark grey sandy shale with lignite and mica (muscovite) rich in millimetrics white kaolinitic inclusions.

**From 1960,40 to 1965,50 m**

Sandstone " id. " 1953,50 m

**From 1965,50 to 1966,20 m** idem 1958,80 m. Light grey subangulous sand with dark coaly fragments.

No coring part

No coring part

K. n° 2 from 1973 to 1991 m

No recovered part of core n° 2

**From 1984,20 to 1986,45 m** — Porosity: High yellow show dark brown colored

Brown sand colored by oil impregnation, fine to medium quartz (Ø 500 medium 150$\mu$ ) subangulous and subrounded, translucent ± well sorted, micaceous (muscovite) occasional opaque and white quartz, subangulous and subrounded ± Ø 800$\mu$ , inclusions of coaly or lignitic fragments ? (aspect of quartz generaly subrounded).

**From 1986,45 to 1987,20 m** — Porosity: High yellow show Cognac colored

id. send as 1984,20, brown, nodulous, pebbles lightly argillaceous, grey, more amented, inclusions of black coal locally rich in micas (muscovite) some white inclusions (kaolinite) occasionally green (chlorite).

**From 1987,20 to 1989,70 m** — Porosity: Yellow show light cognac colored

Fine to medium sandstone pale brown colored by oil impregnation, slightly argillaceous cemented, sandy and micaceous (muscovite), some inclusions of kaolinite, occasional green chlorite (?), subrounded translucent, ± well sorted quartz (max = 400$\mu$ medium $\simeq$ ± 150$\mu$ ). Fragments of lignite or black coal.

**From 1989,70 to 1991 m** — Porosity: Yellowish show light cognac colored

Buff sand as at 1984,20 m.

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# LITHOLOGICAL ANALYSIS OF THE CORES

Vertical scale : 1 / 40

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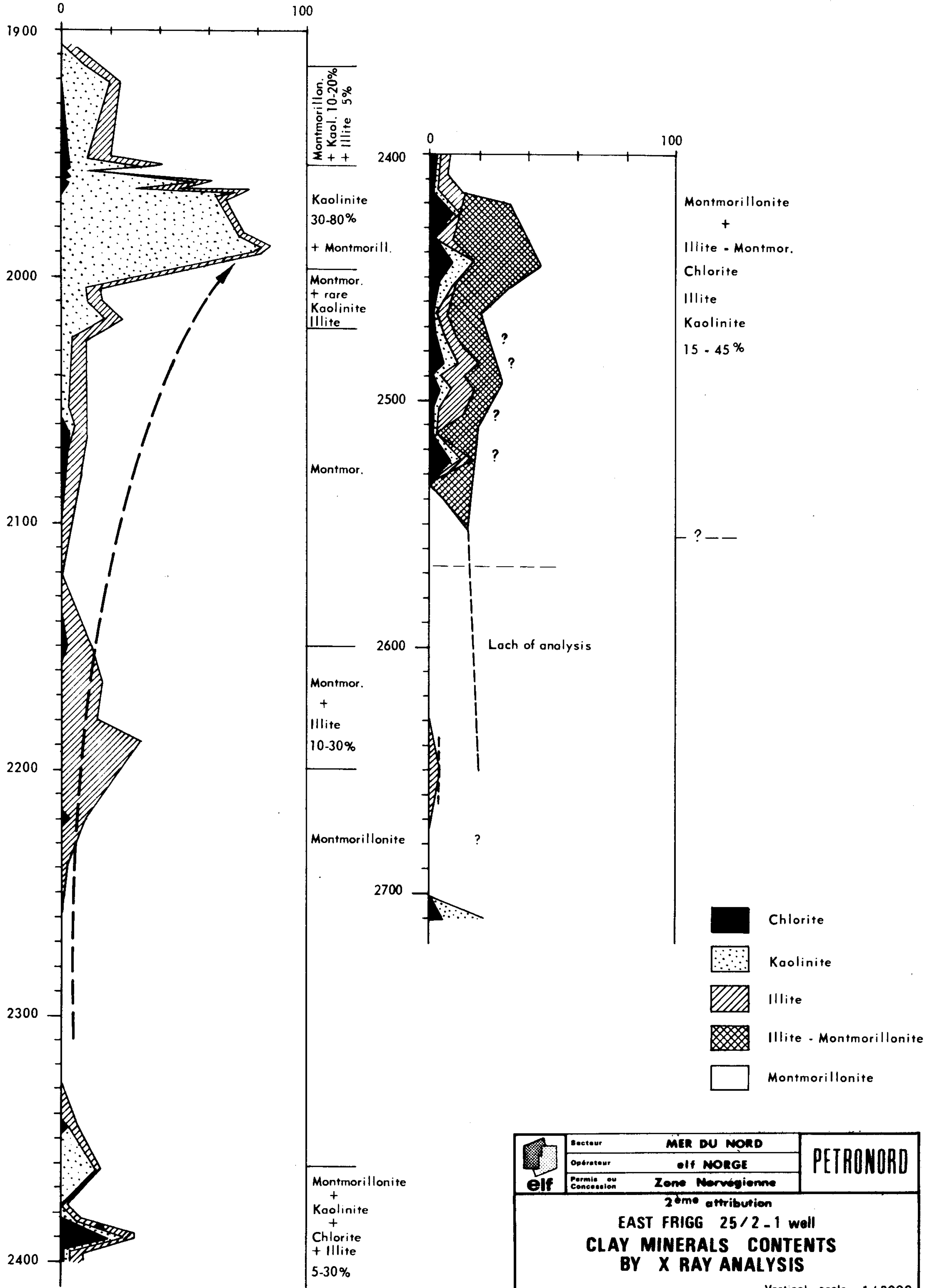


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**EAST FRIGG 25/2-1 well**

# CLAY MINERALS CONTENTS BY X RAY ANALYSIS

Vertical scale : 1 / 2000

| | | | |
|---|---|---|---|
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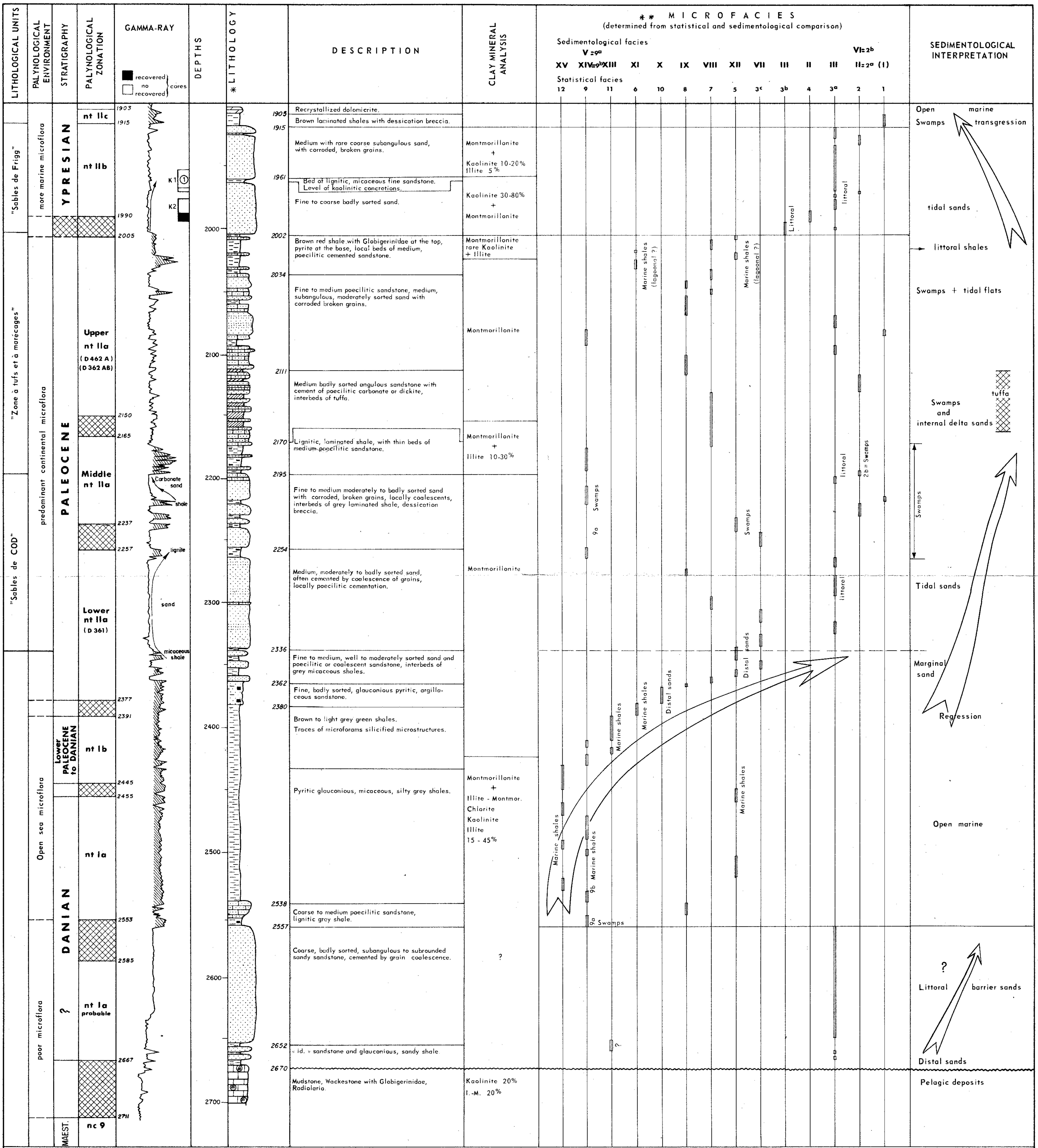
| DIRECTION EXPLORATION | | Auteur | R. Cussey |
| LABORATOIRE | | N° class' | 7507 |




✱ Legend of lithology

- Dolomicrite
- Coarse sand
- Medium/fine sand
- Grain coalescence of sands
- Poecilitic sandstone
- Tuffa
- Shale
- Lignite
- Pyrite

✱✱ Types of microfacies

| | | | | | |
|---|---|---|---|---|---|
| XV | Grey shale (lutite) | X | Argillaceous, micaceous glauconitic fine sandstone | V | Laminated lignitic dark shale |
| XIV | Dark pyritic shale | IX | Medium moderately sorted or dickitic sandstone | IV | Laminated lignitic dark silty shale |
| XIII | Grey green shale | VIII | Poecilitic sandstone | III | Badly sorted sand |
| XII | Dark silty shale | VII | Moderately sorted sand | II | Argillaceous sandstone |
| XI | Red shale | VI | Dickitic sandstone | I | Dark buff shale/dessication breccia |

Secteur MER DU NORD
Opérateur elf NORGE
Permis ou Concession Zone Norvégienne
PETRONORD
2ème attribution
EAST FRIGG 25/2-1 well
**SEDIMENTOLOGICAL INTERPRETATION OF THE BASE OF THE TERTIARY**
Vertical scale : 1/2000

elf ENTREPRISE DE RECHERCHES ET D'ACTIVITES PETROLIERES
DIRECTION EXPLORATION
LABORATOIRE
PL 4
Date June 74
Auteur R. Cussey
N° classt 7508