

REPORT NO. 2395

PHILLIPS 2/4 - 8X NORWEGIAN NORTH SEA WELL:
BIOSTRATIGRAPHY OF CORE SAMPLES FROM
THE INTERVAL 9795' - 10635'

by

GEOLOGY FILE

**WELL FILE
DO NOT REMOVE**

J. W. CHURCH

C. G. LOMAS

C. A. NICHOLSON

PROJECT NO. RRPS/789/A/1655

Prepared by:

Robertson Research International Limited,
Ty'n-y-Coed,
Llanrhys,
Llandudno,
Gwynedd LL30 1SA,
Wales,
U.K.

Prepared for:

Phillips Petroleum Company Norway,
P.O. Box 69,
4801 Stavanger,
Norway.

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I

SUMMARY

1. The interval received consists essentially of chalky limestone with minor shales.
2. The Tertiary section has been dated as Danian, although nannofossils suggest that the youngest samples (9795'-9925') could be of younger Palaeocene age.
3. The Tertiary - Cretaceous contact appears to be conformable.
4. The Cretaceous consists of late Maastrichtian and Maastrichtian sediments.
5. Deposition of the Maastrichtian sediments occurred in a general shelf environment, although at the close of this section slightly deeper water outer shelf conditions became established and these persisted throughout the remainder of the section.

II

INTRODUCTION

This report summarises the results of the micropalaeontological, palynological and stratigraphical analyses which have been carried out on 58 core pieces received from the section 9795'-10635' from the Phillips Norway 2/4-8X North Sea Well under Project No. RRPS/789/A/1655.

Under this project all of the samples were described lithologically (see Appendix I) and of these a total of 35 was analysed for micropalaeontology and 15 for calcareous nannoplankton. In addition 3 samples at the Tertiary - Cretaceous boundary were thin sectioned for micropalaeontological analysis.

The basic breakdown obtained by these analyses has already been communicated by telex and telephone and forms the framework of factual information on which this report is based. A summary of the sequence penetrated in this well can be seen on page 3.

The prepared samples and recorded information are now filed and curated in the confidential records section of these laboratories.

We wish to acknowledge the continued co-operation and assistance received from the various members of Phillips Petroleum Company Norway with whom we have been associated during the course of this work.

Robertson Research staff involved in this study were:

| | |
|------------------|--|
| John Church: | Project Co-ordinator and Cretaceous foraminifera. |
| Cliff Lomas: | Lithologies. |
| Chris Nicholson: | Tertiary foraminifera. |

The calcareous nannofossils were studied by Dr. K. Perch-Nielsen. The nannofossil zones used in the Tertiary follow those of Martini (1971) whilst those in the Cretaceous are after Perch-Nielsen (1972).

III

SUCCESSION

| <u>System/Subsystem</u> | <u>Stage</u> | <u>Interval</u> |
|-------------------------|----------------------|-----------------|
| Lower Palaeocene | Danian | 9795'-10125' |
| | (late Maastrichtian | 10135' |
| Upper Cretaceous | (Maastrichtian | 10145'-10635' |

This breakdown is based on core samples only.
Electric logs were not available.

IV

TERTIARY

INTERVAL 9795'-10125'; LOWER PALAEOCENE, DANIAN

The age of this interval is based on the occurrence of the following:

- Globigerina pseudobulloides, Globigerina triloculinoides, Gavelinella vombensis and Anomalinoides velascoensis at 9795'.
- The subsequent appearance of other diagnostic foraminifera.

LITHOLOGY

Most of the core samples are hard chalky limestones and these are usually very light to light grey apart from the section 9915'-10005' where they are predominantly very pale brown. Thin grey calcareous shale bands and laminae occur sporadically and pyrite nodules are present in some of the lowermost samples.

MICROPALAEONTOLOGY

The presence of Globigerina pseudobulloides, Globigerina triloculinoides, Gavelinella vombensis and Anomalinoides velascoensis at 9795' indicates a Danian age. The subsequent appearance of Globorotalia compressa (9825'), Anomalinoides acuta (9913') and Globoconusa daubjergensis (9985') provide further evidence for a Danian age.

The microfaunal assemblage throughout this interval is dominated by planktonic foraminifera, but calcareous benthonic foraminifera are also of importance.

NANNOFOSSILS

Nannofossils are common in the upper part of this unit, but are very rare in the basal part.

The samples at 9795' and 9925' contain the diagnostic NP5 marker Fasciculithus tympaniformis. The NP5 zone is considered by Martini (1971) to be of Middle Palaeocene age but in this well it would seem to be of Danian age. The NP4 zone marker was not recorded probably because this form is easily dissolved.

Chiasmolithus danicus, the NP3 zone marker, is present between 9945'-10025' and Cruciplacolithus tenuis (NP2 zone marker) occurs between 10035'-10045'.

The samples between 10065'-10125' only contain Thoracosphaera which in the North Sea characterises the Danian. In the absence of the NPI marker this basal unit is taken to be equivalent to the NPI zone.

ENVIRONMENT

The microfaunal assemblage, nannofossils and lithologies suggest an outer shelf environment of deposition throughout this interval.

CRETACEOUSSAMPLE 10135'; UPPER CRETACEOUS, LATE MAASTRICHTIAN

The age of this sample is based on the occurrence, in thin section, of common Pseudotextularia elegans fructicosa.

LITHOLOGY

This sample consists of hard, very pale brown chalky limestone.

MICROPALAEONTOLOGY

The occurrence in thin section of common specimens of both Pseudotextularia elegans elegans and P. elegans fructicosa indicates that this sample is of late Maastrichtian age. The microfauna is dominated by planktonic species and, in addition to the forms noted above, includes common specimens of Heterohelix globulosa and the Rugoglobigerina/Archaeoglobigerina complex.

ENVIRONMENT

The predominance of planktonic species in this assemblage suggests that deposition took place in an outer shelf environment.

INTERVAL 10145'-10635'; UPPER CRETACEOUS, MAASTRICHTIAN

The upper limit of this interval is based on the reduction in the microfaunas.

The age of these sediments is based on:

- the general microfauna.
- the general nannoflora.

LITHOLOGY

The core samples are nearly all hard, very pale brown chalky limestones with stylolites. Thicker shaly/stylolitic partings occur below 10535'.

MICROPALAEONTOLOGY

The assemblages recovered from this interval are generally poor and poorly preserved, although the thin section at 10155' contains abundant Heterohelix globulosa and Globigerinelloides asper. The general aspect of the assemblages suggests that this interval is of Maastrichtian age.

NANNOFOSSILS

Nannofossils are rare and poorly preserved from this interval. The absence of Nephrolithus frequens, the index species of the late Maastrichtian does not necessarily mean that the top of the Cretaceous is marked by an hiatus since in such poorly preserved material this species is unlikely to have survived. In addition, sample 10135' has not been analysed for nannofossils. The absence of Reinhardtites spp., which are relatively resistant to solution, and the presence of Arkhangelskiella cymbiformis throughout suggest that these samples are no older than the middle Maastrichtian M2 Zone.

The basal sample, 10635', yielded very rare and very poorly preserved forms only.

ENVIRONMENT

A general shelf environment is suggested on both the lithology and poor microfaunas.

VI

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APPENDIX I

Core Piece Descriptions

| <u>Depth</u> | <u>Type of Analysis</u> | <u>Lithology</u> |
|--------------|-------------------------|--|
| 9795' | M N | <u>LIMESTONE</u> : hard, light grey, chalky. |
| 9825' | M | <u>LIMESTONE</u> : hard, cream white, chalky. |
| 9855' | M | <u>LIMESTONE</u> : hard, cream white to very light grey, chalky. |
| 9885' | M N | <u>LIMESTONE</u> : hard, light olive grey, crystalline. |
| 9913' | M N | <u>CALCAREOUS SHALE</u> : fissile, dark grey, moderately calcareous. |
| 9915' | | <u>LIMESTONE</u> : hard, pinkish grey, chalky. |
| 9925' | M N | <u>LIMESTONE</u> : hard, very pale brown, chalky. |
| 9935' | | <u>LIMESTONE</u> : as 9925'. |
| 9945' | M | <u>LIMESTONE</u> : as 9925'. |
| 9959' | | <u>LIMESTONE</u> : as 9925'. |
| 9965' | M | <u>LIMESTONE</u> : as 9925'. |
| 9975' | | <u>LIMESTONE</u> : as 9925'. |
| 9985' | M | <u>LIMESTONE</u> : hard but weakly fissile, very light grey, chalky. |
| 9995' | | <u>LIMESTONE</u> : hard, very pale brown, chalky. |
| 10005' | M N | <u>LIMESTONE</u> : as 9995'. |

| <u>Depth</u> | <u>Type of Analysis</u> | <u>Lithology</u> |
|--------------|-------------------------|--|
| 10015' | | <u>LIMESTONE</u> : hard, very light grey with some fine dark laminae, chalky. |
| 10025' | M | <u>LIMESTONE</u> : hard, light grey, chalky. |
| 10035' | M N | <u>CALCAREOUS SHALE</u> : fissile, dark grey with common light grey limestone laminae. |
| 10045' | M | <u>LIMESTONE</u> : hard, light grey, chalky with some dark grey shale laminae. |
| 10055' | | <u>LIMESTONE</u> : hard, very light grey, chalky. |
| 10065' | M N | <u>LIMESTONE</u> : hard, very light grey with some brownish mottling, chalky. |
| 10075' | | <u>LIMESTONE</u> : hard, medium grey with common light olive grey, laminae and mottling, pyrite nodule. |
| 10085' | M | <u>LIMESTONE</u> : hard, very light to light grey, chalky. |
| 10095' | | <u>LIMESTONE</u> : hard but thinly bedded, medium light grey with minor shaly laminae and pyrite nodule. |
| 10105' | M N | <u>LIMESTONE</u> : with <u>SHALE</u> laminae, as 10095'. |
| 10115' | TS | <u>LIMESTONE</u> : hard, light grey with minor darker laminae, chalky. |
| 10125' | M | <u>LIMESTONE</u> : as 10115' but with dark grey shale laminae and pyrite nodules. |

| <u>Depth</u> | <u>Type of Analysis</u> | <u>Lithology</u> |
|--------------|-------------------------|---|
| 10135' | TS | <u>LIMESTONE</u> : hard, very pale brown, chalky. |
| 10145' | M N | <u>LIMESTONE</u> : as 10135' with some fine dark grey laminae and stylolites. |
| 10155' | TS | <u>LIMESTONE</u> : hard, very pale brown, chalky. |
| 10165' | M | <u>LIMESTONE</u> : as 10155' with stylolites. |
| 10175' | | <u>LIMESTONE</u> : as 10155'. |
| 10185' | M | <u>LIMESTONE</u> : as 10155'. |
| 10197' | | <u>LIMESTONE</u> : moderately hard, pale yellowish brown, stylolitic, chalky. |
| 10204' | M N | <u>LIMESTONE</u> : hard, very pale brown, chalky. |
| 10258' | | <u>LIMESTONE</u> : as 10204'. |
| 10265' | M | <u>LIMESTONE</u> : as 10204'. |
| 10275' | | <u>LIMESTONE</u> : as 10204'. |
| 10285' | M | <u>LIMESTONE</u> : as 10204' with stylolites. |
| 10295' | | <u>LIMESTONE</u> : as 10204'. |
| 10305' | M N | <u>LIMESTONE</u> : as 10204'. |
| 10315' | | <u>LIMESTONE</u> : as 10204'. |
| 10325' | M | <u>LIMESTONE</u> : as 10204' with stylolites. |
| 10335' | | <u>LIMESTONE</u> : as 10204'. |
| 10345' | M | <u>LIMESTONE</u> : as 10204'. |

| <u>Depth</u> | <u>Type of Analysis</u> | <u>Lithology</u> |
|--------------|-------------------------|--|
| 10355' | | <u>LIMESTONE</u> : as 10204' with stylolite. |
| 10365' | M N | <u>LIMESTONE</u> : as 10204' with stylolite. |
| 10375' | | <u>LIMESTONE</u> : as 10204'. |
| 10385' | M | <u>LIMESTONE</u> : as 10204'. |
| 10415' | | <u>LIMESTONE</u> : as 10204'. |
| 10445' | M N | <u>LIMESTONE</u> : as 10204' with stylolites. |
| 10475' | M | <u>LIMESTONE</u> : as 10204'. |
| 10505' | M | <u>LIMESTONE</u> : as 10204'. |
| 10535' | M | <u>LIMESTONE</u> : hard, very light grey chalky with dark grey <u>SHALE</u> partings and stylolites. |
| 10565' | M N | <u>LIMESTONE</u> : with <u>SHALE</u> partings, as 10535'. |
| 10595' | M | <u>LIMESTONE</u> : hard, very pale brown, chalky. |
| 10625' | | <u>LIMESTONE</u> : hard, very light grey with dark grey shale/ stylolite. |
| 10635' | M N | <u>LIMESTONE</u> : as 10625'. |

KEY

M - MICROPALAEONTOLOGY
N - NANNOFOSSIL
TS- THIN SECTION

LEGEND FOR STRATIGRAPHIC CHARTS

LITHOLOGY COLUMNS

| | | | |
|--|-------------------------------|-----------------------------------|--|
| Clay | | Calcareous sediments | |
| Shale/claystone/mudstone | | Dolomitic sediments | |
| Silty/sandy clay | | Carbonaceous sediments | |
| Silty/sandy shale/claystone/mudstone | | Anhydrite | |
| Silt/siltstone | | Salt | |
| Sand/sandstone { | very fine to medium | Coal/lignite | |
| | coarse sand to granules | Undifferentiated volcanics | |
| | pebbles | Basement (undifferentiated) | |
| Argillaceous sandstone | Mudflakes | Mudflakes | |
| Limestone | Oolites | Oolites | |
| Silty/sandy limestone | Concretions | Concretions | |
| Argillaceous limestone | Sample gap | Sample gap | |
| Dolomite | | | |
| Silty/sandy dolomite | | | |
| Chalk | | | |

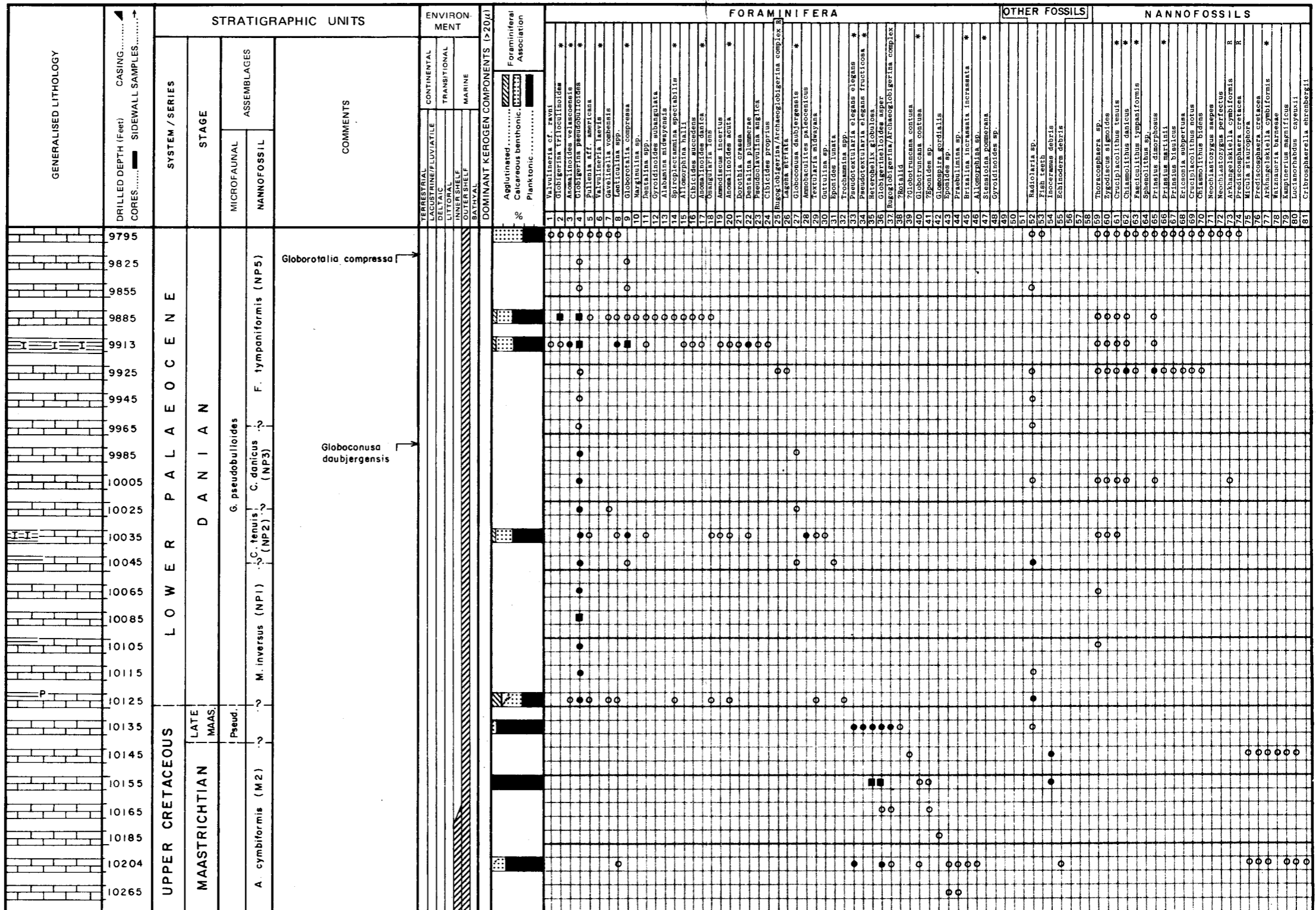
LITHOLOGICAL AND DRILLING ABBREVIATIONS

| | |
|---|-----|
| Red sedimentary rocks | red |
| Silica | si |
| Chert | ▼ |
| Pyrite | P |
| Ironstone | Fe |
| Glauconite | G |
| Kaolinite | K |
| Siderite/sphaerosiderite | S |
| Shell fragments | ~ |
| Cement | cmt |
| Lost circulation material | lcm |
| Turbo drilling or diamond drilling | tu |
| <small>(Samples unsuitable for good stratigraphic analysis)</small> | |

PALAEONTOLOGICAL SYMBOLS

| | | |
|-------------------------------|--------------------------|---|
| Present | o | |
| Common | ● | |
| Abundant | ■ | |
| Diagnostic forms | * | |
| Caved forms | C | |
| Reworked forms | R | |
| Dominant Kerogen Components { | Inertinite | I |
| | Vitrinite | V |
| | Exinite | E |
| | Amorphous sapropel | s |
| Incoming of | ↗ | |
| Outgoing of | ↘ | |

ENCLOSURE 1



ROBERTSON RESEARCH INTERNATIONAL

WELL: - 2/4 - 8X
 LOCATION: - NORWEGIAN NORTH SEA
 CLIENT: - PHILLIPS PETROLEUM CO. NORWAY

CORES
 SHEET 1 OF 2
 ANALYST: - CND, JWC, CGL, KP-N.

DRAWING NO.: - 395 / 1655 / 4294
 DATE: - NOVEMBER 1978
 ENCLOSURE 2
 For legend see Enclosure 1

BIOSTRATIGRAPHICAL ANALYSIS CHART

