

ROBERTSON RESEARCH COMPANY LIMITED

OILFIELDS REPORT NO. 530

THE MICROPALAEONTOLOGY AND STRATIGRAPHY

OF THE INTERVAL 9000' - 11440' OF

THE PHILLIPS 2/4-7X NORWEGIAN NORTH

SEA WELL.

GEOLOGY FILE

by

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Project No. IIA/128

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November, 1971.

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Enclosures

Micropalaeontological Analysis Charts Nos. 1 - 3.

Biostratigraphic Chart shows the distribution of the diagnostic Foraminifera in the interval 9000' - 11440' of the Phillips 2/4-7X Well, North Sea, Norway.

INTRODUCTION

This report summarises the results obtained from the micropalaeontological and stratigraphical analyses of material received from the interval 9000' - 11440' of the Phillips Petroleum Company's 2/4-7X Norwegian North Sea Well carried out under Project No. IIA/128.

The section examined commences in Eocene sediments which are underlain by Lower Eocene to Palaeocene and Palaeocene deposits. Danian Chalk marks the base of the Tertiary sequence and this lies in turn on Upper Cretaceous Chalk of Maestrichtian age. The well reached TD in chalk of this age.

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

A summary of the sequence penetrated in this well can be seen overleaf in Table 1.

II

SUCCESSION

TABLE 1

<u>Unit</u>	<u>Interval</u>	<u>Thickness</u>	<u>Stage</u>	<u>System/Subsystem</u>
A	9000' - 9280'	+280'	-	Eocene
B	9300' - 9940'	<u>±</u> 640'	-	Lower Eocene - Palaeocene
C	9960' - 10060'	<u>±</u> 100'	-	Palaeocene
D	10080' - 10370'	<u>±</u> 290'	?Danian	?Lower Palaeocene
E	10375' - 10825'	<u>±</u> 450'	Danian	Lower Palaeocene
F	10830' - 11440'	+610'	Maestrichtian	Upper Cretaceous

III

MATERIALS AND METHODS

Project No. IIA/128 involved the analysis of 261 ditch cuttings samples and 91 core pieces by standard micropalaeontological techniques.

A summary of the age determinations obtained from the samples was forwarded in a series of telex and telephone communications which contained the framework of factual information on which the report is based.

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

IV

TERTIARY

(a) Eocene

UNIT A, INTERVAL 9000' - 9280'; Eocene

General Lithology

This unit consists of an interbedded sequence of reddish-brown and buff, fissile, micaceous shales and similarly coloured occasionally pyritic, cryptocrystalline limestone and dolomite. Minor amounts of clear, fine-grained, angular quartz sand are present throughout the interval, however, they may have caved from the overlying strata. The shales in the basal sample of the interval are dark brown and micaceous.

Micropalaeontology and Stratigraphical Conclusions

The presence in the uppermost samples of such forms as Bathysiphon eocenicus, Cyclammina cf. challinori and Trochammina globigeriniformis would indicate that this upper section is of Eocene age.

Traces of green-stained foraminifera are noted at 9260' and these may signify that samples below this depth should be regarded as being of Lower Eocene - Palaeocene age. However, since no new diagnostic species are found this lower section has been retained in the Eocene interval.

Environmental Conclusions

An outer neritic to upper slope environment of deposition is postulated for this interval on account of the dominance of arenaceous foraminifera.

(b) Eocene - Palaeocene

UNIT B, INTERVAL 9300' - 9940'; Lower Eocene - Palaeocene

General Lithology

This is a predominantly argillaceous section and is composed of light, pale green, fissile, pyritic shales and brown and grey, micaceous shales. In association with these beds are thin intercalations of reddish-brown, cryptocrystalline to microcrystalline, frequently sphaerosideritic, dolomite. Isolated spheres of siderite are abundant at certain horizons, e.g. 9880', where they vary in colour from green to red or brown. The sphaerosiderite is often seen in association with a green homogeneous material which may be chamosite. From 9460' to the base, a white to light grey, biotitic shale is present. This rock varies from a soft, clay-like type to a well indurated, brittle, occasionally banded variety and it is possible that it has a volcanic origin. The base of the unit is marked by a bed of highly carbonaceous, blackish-brown, fissile shale.

Micropalaeontology and Stratigraphical Conclusions

The top of this unit has been delineated by the incoming of green-stained radiolaria in association with specimens of Cyclammina sp. 1. A Lower Eocene - Palaeocene age has been assigned on this basis and this is subsequently confirmed by the appearance of Verneuilina subeocaena and Spiroplectammina spectabilis. The number of green-stained foraminifera gradually increases with depth until below 9440' these dominate the samples.

Environmental Conclusions

A similar environment of deposition to that envisaged for the overlying sections is suggested for these sediments. Slightly deeper water may be indicated by the presence of common specimens of large radiolaria.

(c) Palaeocene

UNIT C, INTERVAL 9960' - 10060'; Palaeocene

General Lithology

The top sample of this unit is highly pyritic and consists of buff, sideritic dolomite; white, micro-crystalline limestone and greyish-brown, carbonaceous, fissile shale. At and below 9980' grey, buff and brown, banded, frequently pyritic, tuffaceous shales are encountered and they persist in varied amounts to the base of the interval. The laminations in the shales appear to be caused by concentrations of carbonaceous debris. These tuffaceous deposits are interbedded with dark greyish-brown, argillaceous, locally carbonaceous, cryptocrystalline to microcrystalline limestone together with brown, fissile, micaceous shales. A thin bed of brown, micaceous, argillaceous, glauconitic siltstone occurs at the base of the unit.

Micropalaeontology and Stratigraphical Conclusions

Abundant specimens of the planktonic foraminifera Globigerina triloculinoides are found at 9960' which would signify that this section is of Palaeocene age. Specimens of Coscinodiscus sp. occur at 9980' in association with tuffaceous material and would add weight to this determination.

Apart from the flood of planktonic foraminifera at the top of this unit the remainder of the section is composed entirely of agglutinating foraminifera.

Environmental Conclusions

The fact that this area had good connections to the open sea during the deposition of the upper part of this unit is evidenced by the floods of planktonic foraminifera that are present. The remainder of the faunas, however, suggest an outer neritic to upper slope environment. Volcanic activity occurred in the vicinity of this well as is seen by the presence of tuffaceous material.

UNIT D, INTERVAL 10080' - 10370'; ?Danian, ?Lower Palaeocene

General Lithology

The occurrence of a thin bed of white, well indurated chalk which contains bands of white to buff chert at 10080' marks the top of this unit. From 10100' to 10240' the predominant lithotypes are grey and brown, rarely red and green shales with minor developments of siltstones and fine-grained sandstones. These arenaceous sediments are buff coloured, glauconitic and occasionally sphaerosideritic or pyritic. Below 10260' the proportion of red shale increases and subordinate amounts of green shale and mottled red/green shales are also present. At 10340' there is a prominent bed of reddish-brown, cryptocrystalline limestone associated with the red shales. There are traces of white chalk in the sample at 10370'.

Micropalaeontology and Stratigraphical Conclusions

The presence of white chalk and specimens of Globigerina triloculinoides, Globigerina pseudobulliodes and Globorotalia compressa at the top of this interval would normally suggest a Danian age. However, this chalk horizon is very thin and the remainder of this sequence contains agglutinating faunas similar to those found in the overlying Palaeocene. We have therefore only assigned a ?Danian age to this unit.

Reworked Upper Cretaceous (mainly Maestrichtian) foraminifera are found throughout this interval and are particularly common towards the top of the unit.

Environmental Conclusions

The non-chalky sections of this interval were probably deposited under similar conditions to those previously described for the overlying unit. The presence of chalk could be the result of reworking (?slumping) or may be due to a slight shallowing in the water depths.

UNIT E, INTERVAL 10375' - 10825'; Danian, Palaeocene

General Lithology

The top of this interval at 10375' is marked by the appearance of moderate quantities of white chalk, which increases in amount with depth. The chalk varies from grey to white, is moderately to well indurated and locally arenaceous and pyritic. The grey colouration of some of the rock is probably due to the presence of argillaceous material. Stylolites are present at certain horizons and there are partings of brown, calcareous shale throughout the sequence. At 10530' the chalk is slightly glauconitic and contains laminae of finely disseminated pyrite. Laminations are also common elsewhere in the chalk, usually in the grey variety, and probably owe their origin to localised concentrations of the argillaceous matter.

*you have
seen Maastricht
Marl*

Towards the base of the unit, at 10770', there is a thin bed of light grey, sandy, microcrystalline limestone. The rock is slightly glauconitic and pyritic, very well indurated, and contains thin partings of brown shale. At 10780' the predominant lithotype is white chalk which is penetrated by dichotomous burrows consisting of series of nested chevrons incorporating light grey argillaceous material. The burrows are approximately 2.0mm wide, the finite lengths not being visible. Below this bioturbated chalk is a bed of medium to light grey, slightly pyritic, arenaceous limestone. The base of the interval comprises a bed of pinkish-grey chert in association with similarly coloured cryptocrystalline limestone.

Micropalaeontology and Stratigraphical Conclusions

An influx of non-chalky Danian foraminifera is noted at the top of this interval together with several reworked Upper Cretaceous species. The first Danian forms with a chalk preservation are seen at 10400'.

2 interval

Environmental Conclusions

Open marine conditions prevailed during the deposition of these sediments

and this is indicated by the common occurrence of planktonic foraminifera.

The upper part of the interval is probably a basinal deposit while slightly shallower conditions are envisaged for the chalk sections. The latter were probably deposited on the outer part of the continental shelf or upper part of the continental slope.

CRETACEOUSUNIT F, INTERVAL 10830' - 11440'; Maestrichtian, Upper CretaceousGeneral Lithology

The predominant lithotype of this interval is white, moderately to well indurated chalk. The rock is locally pyritic and contains chert bands and calcite veining along stylolites.

Micropalaeontology and Stratigraphical Conclusions

The presence of a white specimen of Pseudotextularia elegans elegans at 10830' indicates that Maestrichtian rocks have been penetrated. This determination is substantiated by the subsequent occurrence of Heterohelix globulosa, Bolivina incrassata incrassata, Stensioina pommerana, Rugoglobigerina rugosa rugosa and Bolivinoides draco draco. P. elegans is seen in the cored section from 10830' to 10955' and this part of the interval at least is therefore of Upper Maestrichtian age.

Environmental Conclusions

The lithology of microfauna of this interval would suggest an outer sublittoral environment of deposition.

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FORAMINIFERA AND OSTRACODA

ROBERTSON RESEARCH LABORATORIES
MICROPALAEONTOLOGICAL ANALYSIS CHART

DATE: 8.10.70. ANALYST: CWH, JMB. LOCATION: Norwegian North Sea Well 2/4-7X
 FOR: Phillips Petroleum Company CHART No. 1
 9000' - 10000'

LITHOLOGY

LIMESTONE	SILTSTONE	SALT
DOLOMITE	SANDSTONE	COAL
OOLITIC LIMESTONE	CONGLOMERATE	CHERT
CLAY	GYPSUM	Pyrites
SHALE	VOLCANICS	Sphaerosiderite
SILTY/SANDY SHALE	INTRUSIVES	

LITHOLOGY	DEPTH IN FEET	SYSTEM	STAGE	ZONE	MICROFOSSILS	OTHER FOSSILS
P	0-10	EOCENE			Bathysiphon eocenicus	
P	10-20				Trochammina globigeriniformis	
P	20-30				Hormosira sp.	
P	30-40				Cribratomoides sp.	
P	40-50				Glomospira charoides	
P	50-60				Sigmoilina tenuis	
P	60-70				Ammodiscus incertus	
P	70-80				Cyclamina exigua	
P	80-90				Cyclamina placenta	
P	90-100				Recurvoides sp.	
P	100-110				Haplophragmoides carinatum	
P	110-120				Cyclamina cf. challinori	
P	120-130				Sigmoilina schlumbergeri	
P	130-140				Pelosina sp.	
P	140-150				Haplophragmoides cf. obliquicameratus	
P	150-160				Trochammina inflata	
P	160-170				Trochammina globigeriniformis var. altiformis	
P	170-180				Cyclamina cf. incisa	
P	180-190				Cyclamina sp. 2	
P	190-200				Globigerina linaperta	
P	200-210				Cyclamina sp. 1	
P	210-220				Cibicides cf. proprius	
P	220-230				Verneuilina subeoaena	
P	230-240				Trochammina sp.	
P	240-250				Coccolithus sp.	
P	250-260				Spiroplectamina spectabilis	
P	260-270				Trochamminoides sp.	
P	270-280				Globigerina triloculinoides	
P	280-290				Cytheridea aff. unispinae	
P	290-300					
P	300-310	PALAEOCENE - LOWER EOCENE				
P	310-320					
P	320-330					
P	330-340					
P	340-350					
P	350-360					
P	360-370					
P	370-380					
P	380-390					
P	390-400					
P	400-410					
P	410-420					
P	420-430					
P	430-440					
P	440-450					
P	450-460					
P	460-470					
P	470-480					
P	480-490					
P	490-500					
P	500-510					
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P	730-740					
P	740-750					
P	750-760					
P	760-770					
P	770-780					
P	780-790					
P	790-800					
P	800-810					
P	810-820					
P	820-830					
P	830-840					
P	840-850					
P	850-860					
P	860-870					
P	870-880					
P	880-890					
P	890-900					
P	900-910					
P	910-920					
P	920-930					
P	930-940					
P	940-950					
P	950-960					
P	960-970					
P	970-980					
P	980-990					
P	990-1000	PALAEOCENE				

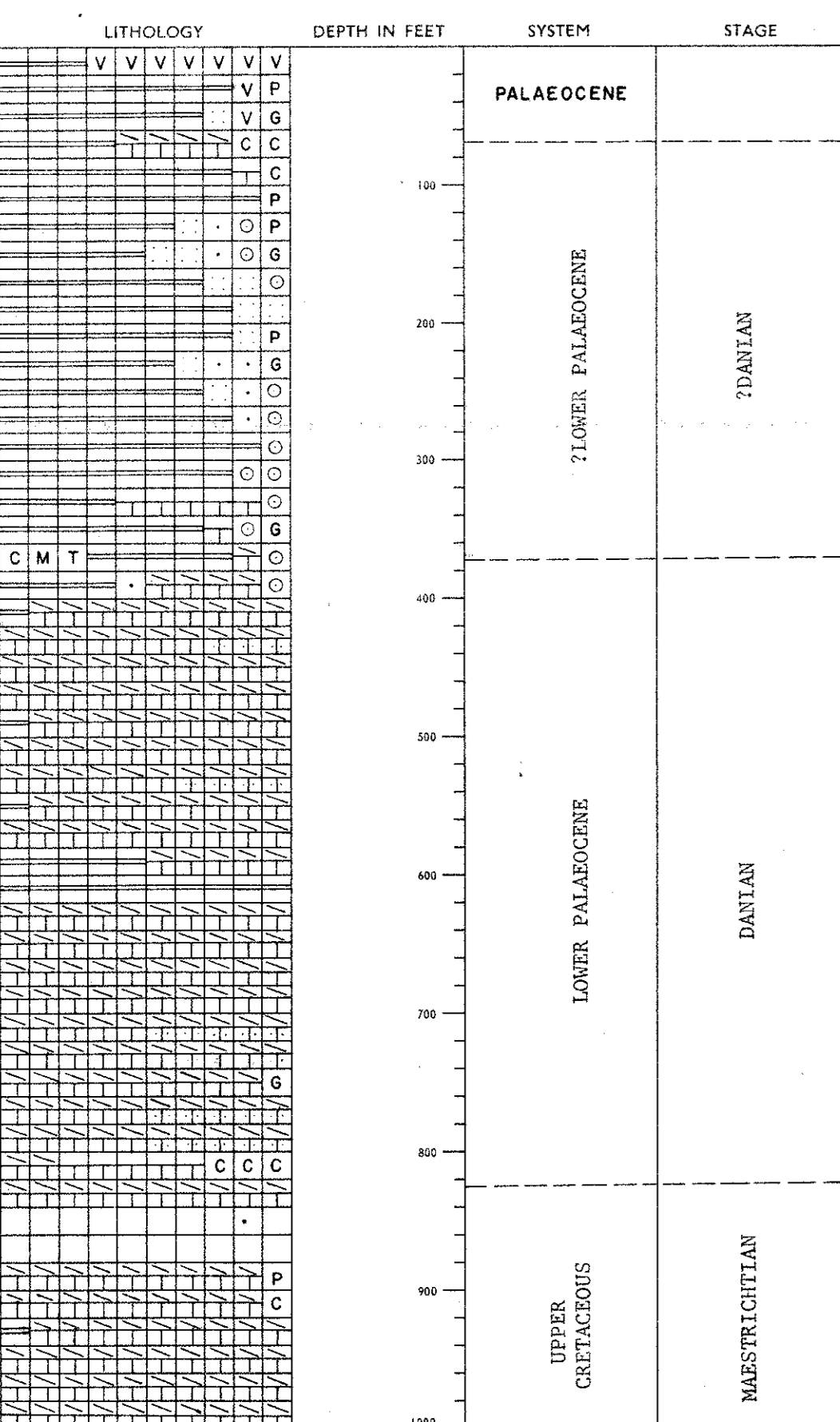
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MICROPALAEONTOLOGICAL ANALYSIS CHART

DATE 11. 10. 71. ANALYST CWH, JMB. LOCATION Norwegian North Sea Well 2/4-7X

FOR Phillips Petroleum Company CHART No. 2 10000' - 11000'

LITHOLOGY: Limestone, Dolomite, Oolitic Limestone, Clay, Shale, Silty/Sandy Shale, Siltstone, Sandstone, Conglomerate, Gypsum, Volcanics, Intrusives, Salt, Coal, Chert, Pyrites, Glauconite, Sphaerosiderite, White or grey chalk, Sandy white or grey chalk, CMT Cement, Reworked Upper Cretaceous forms.



MICROFOSSILS

- Cyclamina exigua
- Bathysiphon eocenicus
- Cyclamina cf. challinori
- Verneulina subocaeana
- Trochammina sp.
- Hormosira sp.
- Ammobaculites fragilis
- Glomospira charoides
- Hapliphragmoides cf. obliquicameratus
- Cyclamina sp. 2
- Sacamina sp.
- Recurvoides sp.
- Pelosina sp.
- Coscinodiscus sp.
- Cyclamina cf. incisa
- Trochammina globigeriniformis
- Heterohelix globulosa
- Pseudotextularia elegans elegans
- Rugoglobigerina sp.
- Globigerina pseudobulloides
- Globigerina trilobuloides
- Globigerina compressa
- Pullenia americana
- Eponides lunata
- Robulus turbinatus
- Cribrostomoides sp.
- Dorothia bulletta
- Globocornusa daubjergensis
- Rugoglobigerina rugosa rugosa
- Rugoglobigerina rugosa rotundata
- Stensioina pommerana
- Gavelinella vombensis
- Pseudotextularia elegans elegans
- Pseudotextularia elegans fructicosa
- Globigerinelloides aspera
- Praebulimina carsevae
- Cyroidinoides nitida
- Gavelinonion nobilis
- Gavelinella bembix
- Anomalinooides velascoensis
- Cibicides bosqueti
- Lamarckina paleocenica
- Gaudryina cf. faujasi
- Praeglobulimina ovata
- Allomorphina halli
- Eponides gracillima
- Hglundina scalaris
- Gavelinella ebbihami
- Globigerina danica
- Globocornusa daubjergensis gigantea
- Valvulineria laevis
- Osangularia lens
- Neoflabellina cf. numismalis
- Pseudotextularia elegans elegans
- Rugoglobigerina sp.
- Heterohelix globulosa
- Rugoglobigerina rugosa rugosa
- Rallivina incrassata incrassata
- Globigerinelloides aspera
- Stensioina pommerana
- Eponides sp.

OTHER FOSSILS

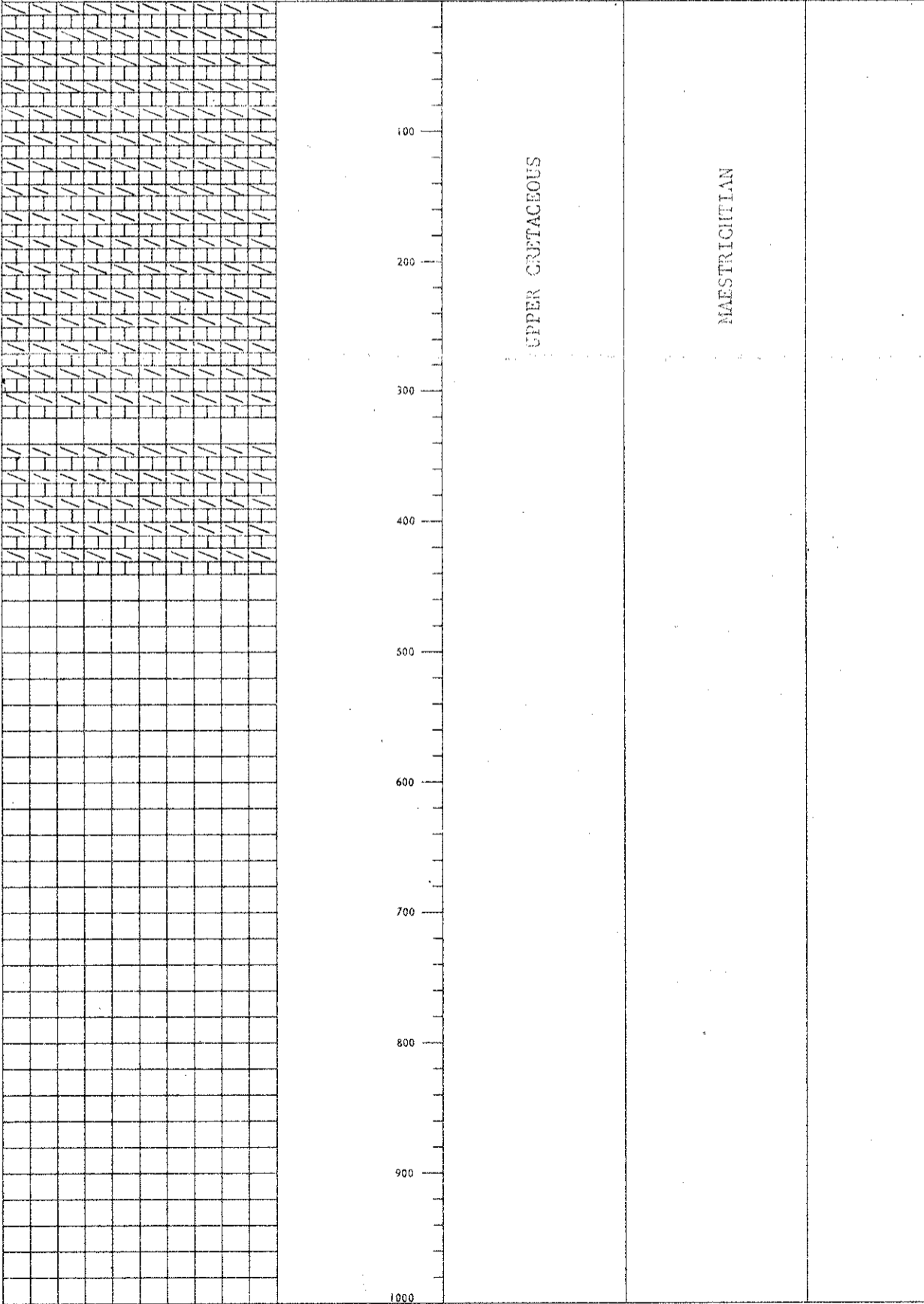
Table with columns for microfossil names and depth markers (0, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000 feet).

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MICROPALAEONTOLOGICAL ANALYSIS CHART

DATE: 19.11.71. ANALYST: JNB. LOCATION: Norwegian North Sea Well 2/4-7X
 FOR: Phillips Petroleum Company CHART No. 3
 11000' - 11440'

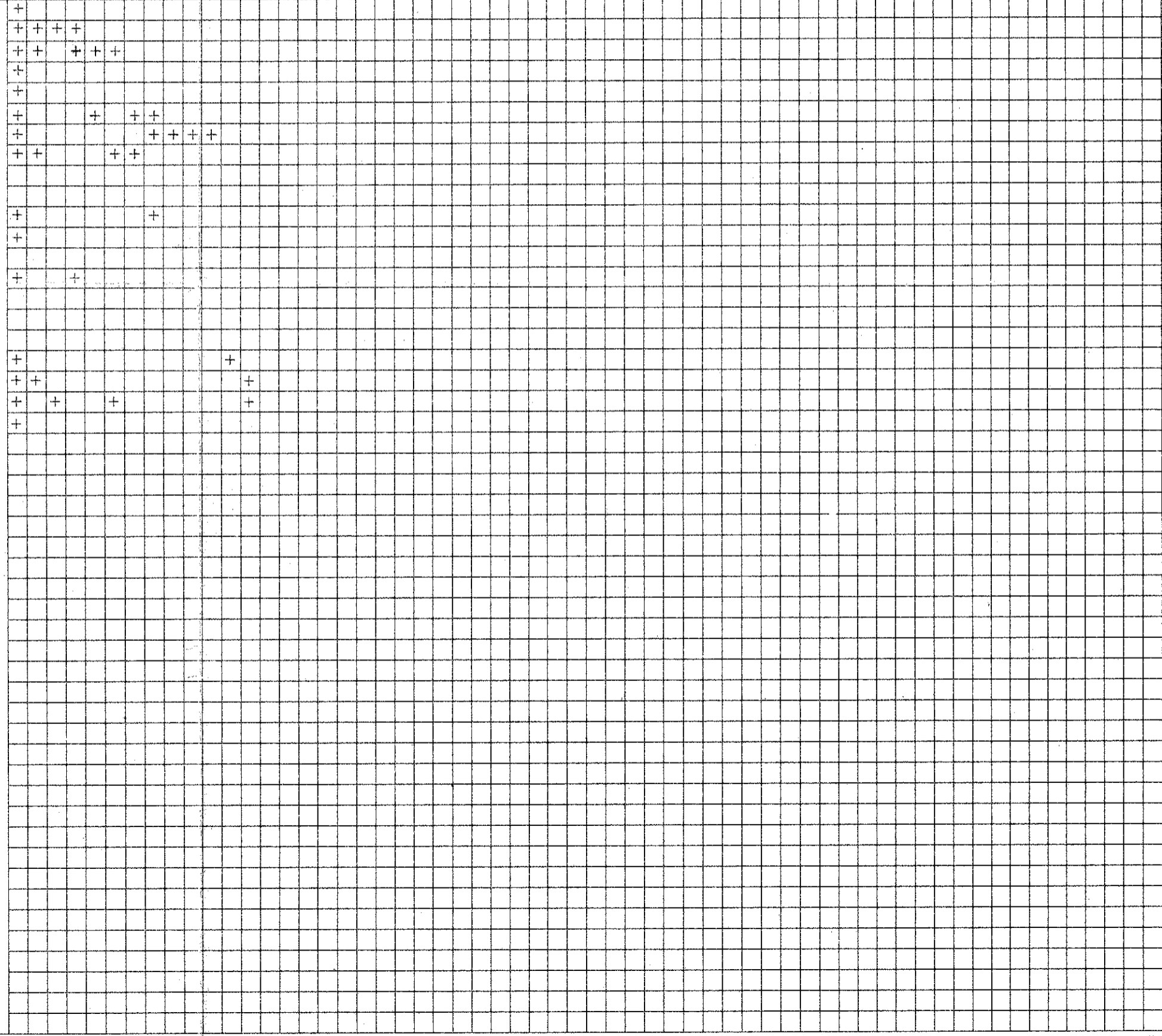
- LIMESTONE
- DOLOMITE
- OOLITIC LIMESTONE
- CLAY
- SHALE
- SILTY SANDY SHALE
- SILTSTONE
- SANDSTONE
- CONGLOMERATE
- GYPSUM
- VOLCANICS
- INTRUSIVES
- S SALT
- COAL
- C CHERT
- White chalk

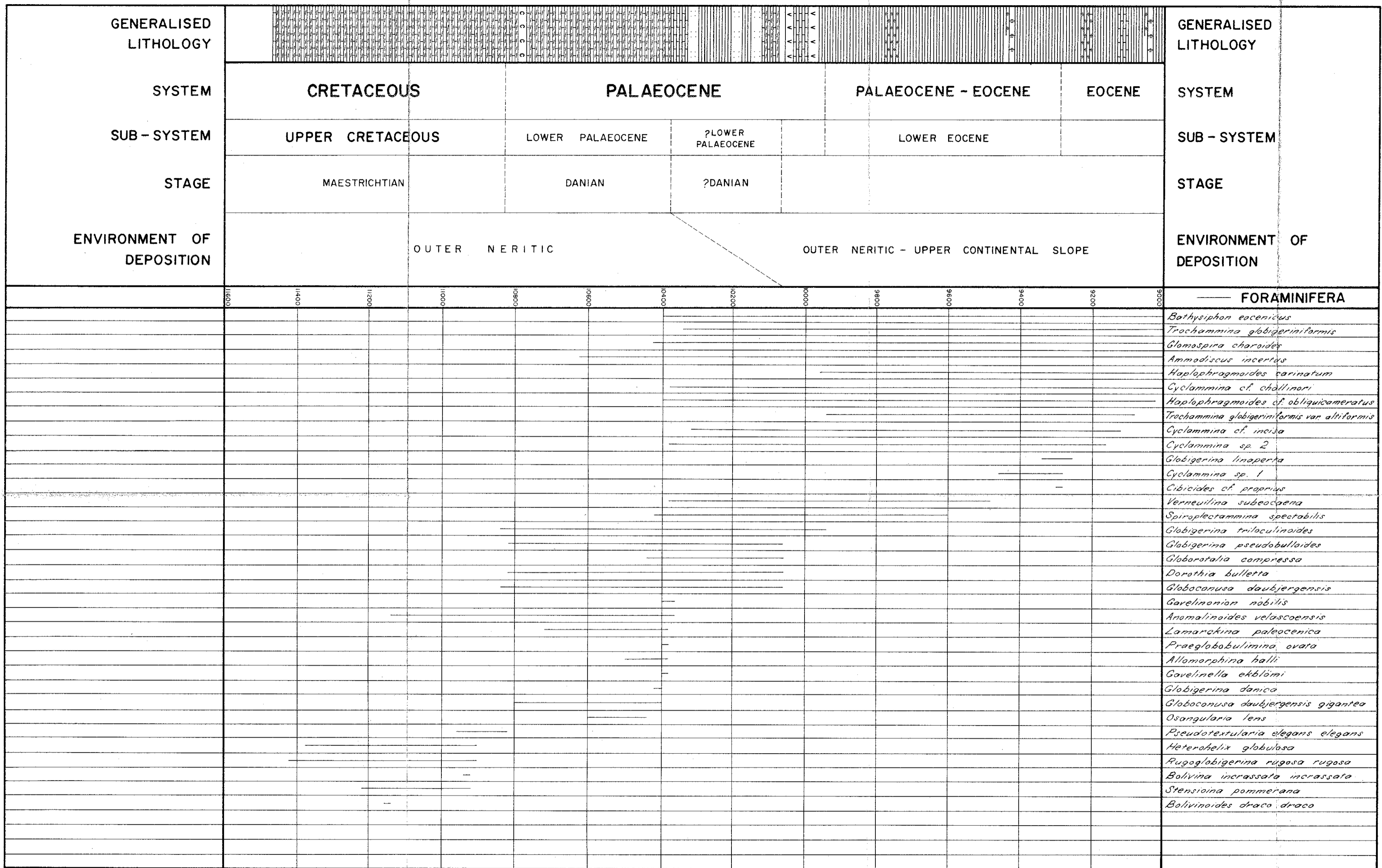
LITHOLOGY DEPTH IN FEET SYSTEM STAGE ZONE



MICROFOSSILS

- Rugoglobigerina rugosa rugosa
- Heterohelix globulosa
- Rugoglobigerina rugosa cf. rotundata
- Pullenia creatoca
- Gavelinella vombensis
- Praeulimina carseyae
- Gavelinopsis cf. voltziana
- Stensioina pommerana
- Eponides sp.
- Gavelinella costata
- Anomalinoidea velascoensis
- Bolivinoidea draco draco
- Globigerinelloidea aspera





BIOSTRATIGRAPHIC CHART SHOWING THE DISTRIBUTION OF THE DIAGNOSTIC FORAMINIFERA IN THE PHILLIPS 2/4-7X WELL, NORTH SEA, NORWAY

by

ROBERTSON RESEARCH LABORATORIES

'Tyn - y - Coed', Llanrhos, Llandudno

For key to lithology symbols see *Micropalaeontological Analysis Charts*