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WELL 17/10-1

GENERAL

A total of 104 cutting samples and 20 sidewall samples covering the interval 1420-8800 ft have been studied in detail by the palaeontologist working for Norske Shell in the beginning of 1969. His faunal analysis has been reported on the enclosed distribution chart (encl. 1).

Compared with the subdivision used in the well resumé this palaeontological report shows relatively minor depth changes for certain intervals and in some cases gives a finer subdivision.

Palynological investigations have not been carried out for this well.

The time-stratigraphical succession, based on microfaunal evidence, is given below.

4328	1420 - 1480'	: Pleistocene and younger
469	1540 - 1960'	: Pliocene
616	2020 - 2260'	: Middle Miocene
707	2320 - 2740'	: Upper Oligocene
853	2800 - 3220'	: Middle Oligocene
1000	3280 - 3640'	: ? Lower Oligocene
1128	3700 - 4360'	: Eocene
1378	4520 - 4960'	: Upper Paleocene
1530	at 5020'	: Lower Paleocene : Danian
1548	5080 - 5320'	: Maastrichtian
1640	5380 - 5800'	: Campanian
1786	5860 - 6160'	: Santonian
1896	6220 - 6400'	: Albian
	6460 - 6700'	: Aptian
	6700 - 6940'	: Barremian
	7000 - 7240'	: Hauterivian
	7270 - 7780'	: Valanginian
	7875 - 8795'	: ? Middle-Upper Jurassic

QUATERNARY

Pleistocene and younger (1420-1480')

The microfaunal assemblage is dominated by numerous occurrences of *Elphidium* spp., especially

Elphidium hanna

Furthermore are present:

Buccella frigida
Cassidulina laevigata *pliocarinata*
Quinqueloculina seminula *

TERTIARY

Pliocene (1540-1960')

Guide fossils for this interval are:

Bolivina subspinescens
Cibicides cockei limbatusuturalis
scaldisiensis
Elphidium excavatum
Textularia sculpturata

in addition to : *Cassidulina laevigata*
Loxostomum lammeri
Nonion barleanum inflatum
Streblus beccarii

which are known to range upwards in the Quaternary, and

Cibicides sp.9
Sphaeroidina bulloides

which, reversely, may occur in older sediments.

Middle Miocene (2020-2260')

Samples from this interval yielded a rich fauna of which the following types are characteristic for Middle Miocene:

Elphidium inflatum
Globigerina apertura
pozonensis
Globorotalia sp.6
Marginulina dingdeni
Uvigerina tenuipustulata

*) Species underlined in the text are restricted to the particular time interval, in the North Sea area

Furthermore present are

Alabamina tangentialis
Asterigerina staeschei
Bulimina elongata
Ceratobulimina contraria
Cibicides pseudoungerianus
Ehrenbergina serrata
Epistomina elegans
Globoretalia scitula
Karrerella siphonella
Marginulina pedum
Siphonodosaria hirsuta
Uvigerina sp.6

which are all known from sediments not younger than Miocene.

Upper Oligocene (2320-2740')

This interval is characterized by the presence of numerous specimens of

Nonion roemer

in addition to scarce occurrences of

Cristellaria convergens
Sigmoidella sp.1
Sigmoidina sp.6
Spiroloculina canaliculata
Virgulina schreibersiana

The last species occurs already in the Miocene but is unknown from sediments older than Upper Oligocene.

Middle Oligocene (2800-3220')

The Middle Oligocene age of this interval is clearly defined by the presence of

Alabamina perlata
Cassidulina carapitana
Cibicides sp.5
Haplophragmium sp.5
Karrerella mexicana
Rotallatina bulimoides

Noteworthy is the presence of *Globigerina ampliapertura* which has its top occurrence in the Middle Oligocene and ranges downwards into the Upper Eocene.

?Lower Oligocene (3280-3640')

The appearance in this interval of the following arenaceous species

Ammodiscus incertus
Cyclammina placenta placenta
Glomospira charoides
Saccamina sp.1
Sigmoilina sp.7

although not restricted nevertheless may point to an Early Oligocene age.

Eocene (3700-4360')

This interval is characterized by the presence of

Bulimina jacksonensis
* *Cibicides ypresiensis*
 sp.48
Clavulina parisiensis
Epistominella acutimargo
* *Gaudryina hiltermanni*
Globigerapsis index
Globigerina yeguaensis
Haplophragmoides sp.15
Lenticulina decorata
Martinottiella sp.1
Pulvinulinella cancellata
Spiroplectammina spectabilis
* *Textularia plummerae*
* *Tritaxillina cubensis*

The species marked * would suggest that the interval 4300-4380' possibly belongs in the Lower Eocene.

Radiolaria spp. occur abundantly throughout the entire interval.

Upper Paleocene (4520-4960')

The age of this interval is clearly defined by the presence of

Bulimina denticulata
 trigonalis
Rotalia parvula

Lower Paleocene : Danian (5020')

One sample at 5020' yielded a rich microfaunal assemblage characteristic for the Danian.

The most important species are :

Anomalina bundensis
Bulimina sp.18
Gavelinopsis bambix
Globigerina daubjergensis
Globorotalia pseudobullesides

The first three species listed above may occur in the uppermost Cretaceous but, reversely, have never been recorded in sediments younger than Lower Paleocene.

Furthermore numerous Bryozoa, echinid remains and Algae are present in this sample.

UPPER CRETACEOUS

Maastrichtian (5080-5320')

The top occurrences within this interval of a considerable number of diagnostic foraminiferal species clearly indicate that the drill entered strata of Upper Cretaceous age.

Among the several species listed in the distribution chart, the following provide good evidence for Maastrichtian age :

Bolivina decurrens
" incrassata
Bolivinoidea draco draco
Globotruncana mayaroensis
Stensioina sp.7

Campanian (5380-5800')

Apart from many long-ranging Upper Cretaceous species observed, the presence of:

Arenobulimina sp.4
Bolivinoidea decoratus decoratus

and the top occurrence of

Gavelinella pseudexcolata
" clementiana
Stensioina exsculpta

indicate a Campanian age.

Santonian (5860-6160')

The age of this interval is based on the presence of:

Stensioina praexsculpta
" sp.3

Species older than Santonian have not been observed in this interval.

LOWER CRETACEOUS

Albian (6220-6400')

The upper limit of this interval is clearly defined, and the age of this interval is characterized by the presence of

Arenobulimina sp.5
Epistomina spinulifera polypoides
" reticulata
Meandropsina washitensis
Planulina schloenbachi
Tritaxia sp.8

and the top occurrences of

Anomalina bertheleni
Epistomina chapmani
" cretosa
Gaudryinella sherlocki

Aptian (6460⁶-7000')

Diagnostic species for this interval are:

Epistomina spinulifera spinulifera
" sp.14

(both occurring in Upper Aptian)

Anomalina sp.8
" sp.27

and Hedbergella aptiana which indicates a Lower Aptian age for the sample taken at 6640'.

Barremian (6700-6940')

This interval is characterized by the presence of

Anomalina sp.14
" sp.33
Epistomina hechti

which are restricted to sediments of this age.

Furthermore the following species have their top occurrence in the Barremian:

Cristellaria sp.36
Epistomina caracolla caracolla

On the other hand Valvulineria gracillina has its base occurrence in the Barremian but ranges upwards into the Cenomanian.

At 6940' *Gavelinella sigmoicostata* occurs which ranges from Upper Hauterivian to Lower Barremian. However, in the absence of diagnostic Hauterivian forms, this sample has been tentatively included in the Barremian.

Hauterivian (7000-7240')

Apart from the occurrence of long-ranging species already observed in the overlying Barremian sediments the following species are diagnostic for this interval:

Marginulina sp.18
Marssonella kummi

in addition to *Hechtina antiqua* which ranges also up into the Lower Barremian.

Valanginian (7270-7780')

As mentioned above several long-ranging species still occur in this interval although it is difficult to distinguish the autochthonous from caved forms.

Nevertheless the presence of

Ammobaculites sp.11
Ammonia cellensis
Gaudryinella hannoverana

in addition to that of the upward ranging species

Epistomina caracolla caracolla
Verneuilinoides inequalis

clearly indicates a Valanginian age.

Ostracods, fragments of crinoids and gastropods occur in the upper part of the interval.

JURASSIC

Middle to Upper Jurassic (7875-8795')

The presence of *Haplophragmoides canui*
sp.21

at 8320' is indicative of a late Jurassic age.

The occurrence of questionable *Epistomina* sp.6 at 8440', and the anomalous occurrence of *Lenticulina bicoatata* in a s.w.s. at 7875', both known from Dogger δ , would point to a Middle Jurassic age.

This interval therefore has been attributed to the ?Middle to Upper Jurassic.

Fish remains, echinoid fragments, rare undiagnostic ostracods, in addition to Radiolaria spp. and numerous arenaceous Foraminifera, occur also in this interval.

Below 8800' down to T.D. (11779') samples have not been investigated, as lithological evidence points to a Triassic age.

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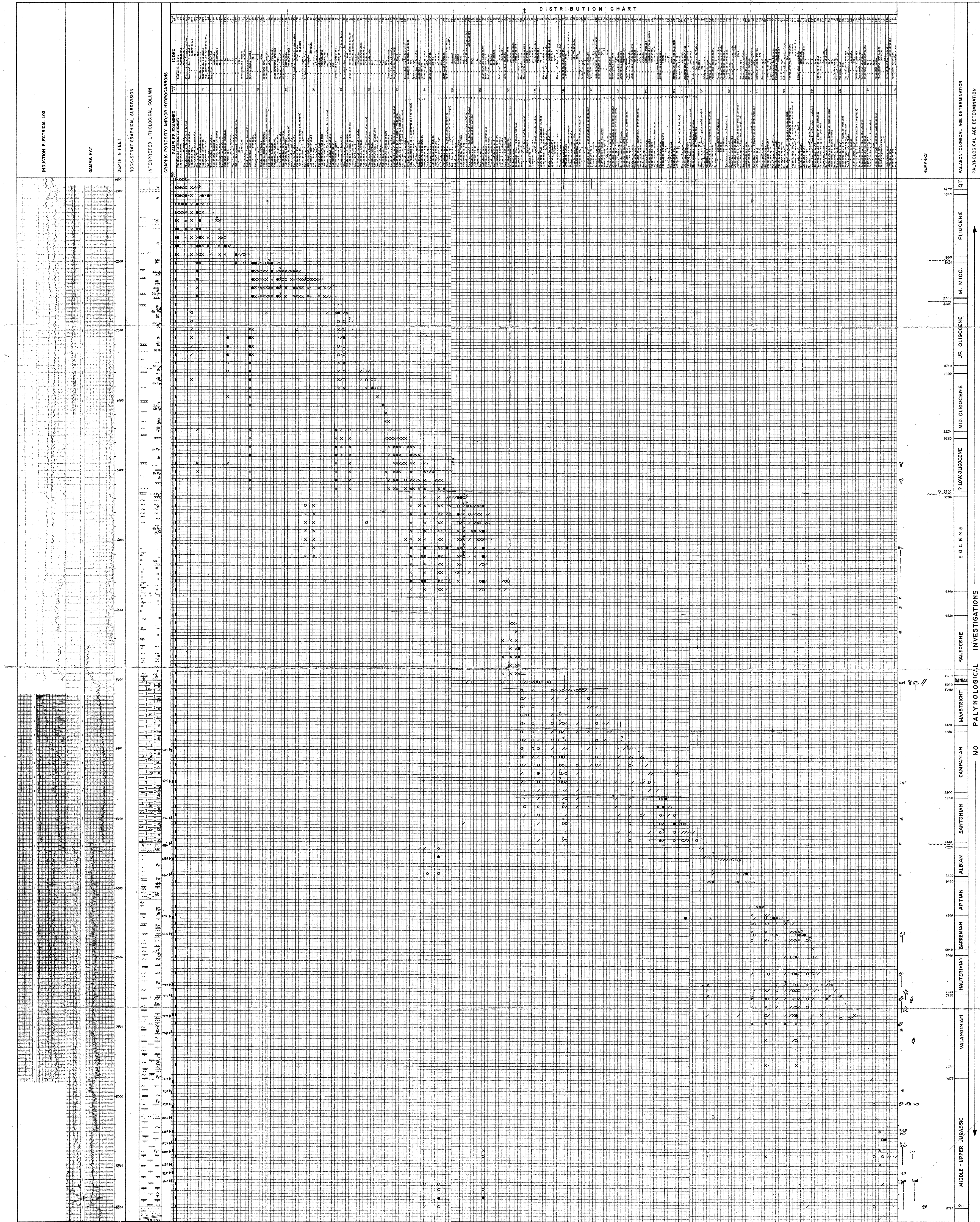
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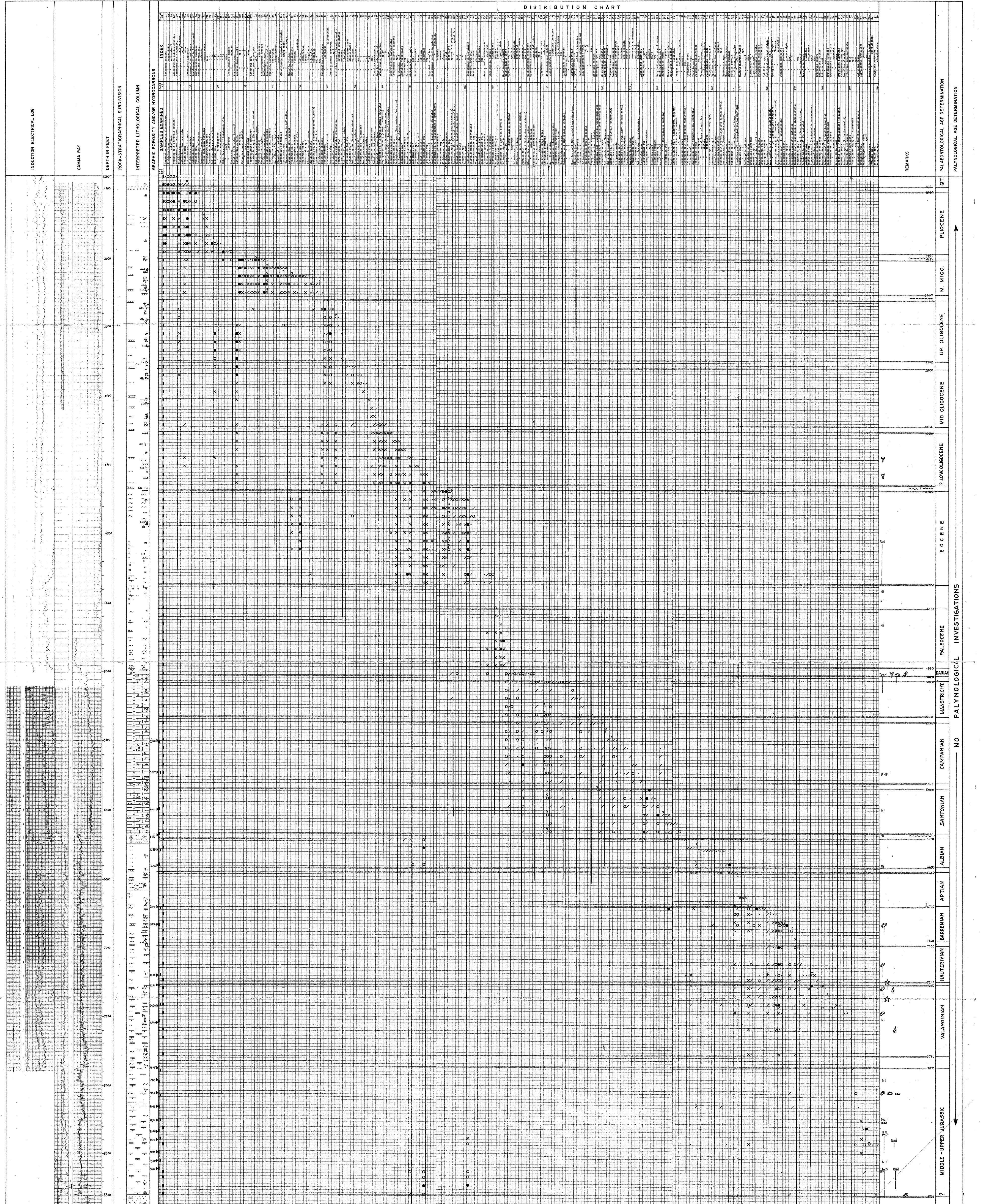
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Encl.: 1





Clay

Conglomerate

Dolomite

Fossil fragments and pebbles fragments

Chert

Chert

Chert

Chert

Shale

Limestone

Plant remains

Pelagic Foraminifera

Silt/Siltstone

Chalk

Gastropods

Foraminifera

Sand/Sandstone

Marl

Tuff

Tuff

Slack Well Sample

QUANTITY SYMBOLS

WF No foraminifera

PNF Practically no foraminifera

1 Specimen

2-5 Specimens

6-20 "

21-100 "

>100 "

X Qualitative determination only

Ni Sample not investigated

Red Radiolites

Algae

Bryozoa

Crinoids

Echinoids

Flux remains

Gastropods

Ostracods

CASING RECORD: 30° at 529', 20° at 477', 13 1/2° at 1398'

9 7/8" at 5109'

Scale 1:2500

Author: EP/12-1

Encl.: 1

Date: December 1970

Report No.: 5.55728/4

Draw. No.: 5.55728/4

THE HAGUE

EXPLORATION & PRODUCTION

NORSKE SHELL 17/10-1

PALAEOLOGICAL DISTRIBUTION CHART

OF SELECTED MICROFAUNA

(INTERVAL 1420-8800 FT)

Scale 1:2500

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Date: December 1970

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