

**ESSO PRODUCTION RESEARCH
EUROPEAN**

PALEONTOLOGICAL REPORT OF THE ESSO 16/7-4 WELL
OFFSHORE, NORWAY

By

R. JAN DU CHENE, N.S. IOANNIDES AND M. PONS

JULY 1983

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INTRODUCTION

A detailed palynological investigation of the Cenozoic sequence in the subject well has been completed and the results are presented herein. Although the palynosequence obtained may not be always directly applicable to other well, it certainly provides information which will help resolve stratigraphic problems related to certain intervals.

The Mesozoic part of the section has been treated on a routine basis, although more thorough studies of the Cretaceous are desirable, at least from the paleontological point of view.

The results below the Cretaceous are very generalized because of limited or no fossil recovery from the SWC's and cores and dilution of the in situ floras by cavings in the cutting samples.

At the end of the text, an Appendix shows the samples utilized both by Micropaleontology and Palynology.

The study of the Cenozoic sequence has been initially carried out by R. Jan du Chêne and subsequently refined by a consultant (D. Michoux) under the former's supervision.

The biostratigraphic results may be summarized as follows:

<u>Depth in m</u>	<u>Palynology</u>	<u>Micropaleontology</u>	<u>Environment</u>
500		Pleistocene-Pliocene	Inner neritic
590		Pliocene	Inner neritic
860		Late Miocene	Inner neritic to brackish
1200		Middle to Early Miocene	Outer neritic to bathyal
1350	Palynozone IX; Late to Middle Oligocene		Outer neritic to bathyal
1410	Palynozone VIII; Late to Middle Oligocene		
1530	Palynozone VI; Early Oligocene to Late Eocene	Middle Oligocene (or slightly older)	Outer neritic to bathyal
1950	Palynozone VI; Middle Eocene		Outer neritic to bathyal
2009	Indeterminate		
2040	Palynozone IV; Early to Middle Eocene		
2129	Palynozone II; Late to Middle Paleocene		

2159	Palynozone 1B; Late to Middle Paleocene	Outer neritic to bathyal
2189	Palynozone IA2; Middle to Early Paleocene	
2249	Palynozone IA1; Early to Middle Paleocene	Bathyal to outer neritic
2279	Late Cretaceous	
2327	?Maastrichtian	Marine
2338	Early Maastrichtian to Late Campanian	as above
2140	Late Campanian	as above
2453	Early Campanian to Late Santonian	as above
2495,5	Early Santonian to Turonian	as above
2509,5	Cenomanian?	as above
2519	Albian?	Albo-Aptian as above
2549	?Late Jurassic (or older)	
2579(?)	Indeterminate	

From 500 to 560 m: Pleistocene-Pliocene

The above age assignment was based on the following rare foraminiferal occurrences: *Cassidulina laevigata*, *Elphidium clavatum* and *E. incertum*.

Abundant Neogene pollen, mostly bisaccates, were also observed.
Environment: inner neritic

From 590 to 830 m: Pliocene

The presence of *Cibicides lobatulus grossa* at 590 m indicates a Pliocene age. *Elphidium* sp. 16, generally seen at these levels, is recorded at 770 m. Environment: inner neritic.

From 860 to 1170 m: Late Miocene

The foraminifer *Nonion elongatum* indicates a Late Miocene age. *Nonion soldanii?* var. *magnum* and *Ammonia beccarii* are additionally observed at 950 m and 1010 m, respectively. This assemblage indicates an inner neritic to brackish environment.

From 1200 to 1320 m: Middle to Early Miocene

The associated presence of *Sphaeroidinellopsis* aff. *subdehiscens*, *Globorotalia* aff. *zealandica/praescitula*, *Neogloboquadrina* aff. *atlantica* and *N.* aff. *acostaensis* at 1200m indicates a Middle to Early Miocene age. A bathyal to outer neritic environment is inferred from this assemblage.

From 1350 to 1410 m: Late to Middle Oligocene; Palynozone IX

Rare *Bathysiphon* sp. are seen at 1350 m; in the North Sea, this genus is generally found in rocks of Oligocene age. Sediments of same age continue to be present as low as 1380 m

as it is indicated by the occurrence of the foraminifera *Cyclammia* sp. *Ammodiscus* sp. and *Haplophragmoides* sp. Environment: outer neritic to bathyal.

The top of Palynozone IX is identified at 1350 m, immediately below the Miocene-Oligocene boundary.

From 1410 to 1500 m: Late to Middle Oligocene; Palynozone VIII

The top of Palynozone VIII is placed at 1410 m.

From 1530 to 1930 m: Early Oligocene to Late Eocene; Palynozone VII

At 1530 m the mid-Oligocene (or slightly older) foraminifer *Rotaliatina bulimoides* is found.

Lower in the section, at 1650 m, *Alabamina scitula* is also observed, a form generally indicative of Early Oligocene to Eocene. Arenaceous foraminifera are abundant. Environment: outer neritic to bathyal.

The marker species for Palynozone VII is observed at 1530 m.

From 1950 to 2009 m: Middle Eocene; Palynozone VI

The index species of Palynozone VI is first documented at 1950 m.

Arenaceous formaminifera are still persistent in fair abundance. Same environment as above.

From 2009 to 2040 m: Indeterminate

No Samples studied.

At 2040 m: Middle to Early Eocene?

Species representative of both V and IV zones are encountered together. This implies that zone V is either missing or represented in the overlying interval 31 m. The foraminifer *Bolivina* aff. *spectabilis* indicates a Middle Eocene age.

From 2070 to 2100 m: Early Eocene; Palynozone III

The top of Palynozone III is placed at 2070 m.

At the top of the zone (2070 m), dinoflagellate cysts are dominant, and amongst pollen grains, *Carya* is the most prominent numerically. In the underlying sample, (at 2100 m) terrestrially derived pollen are increasing dramatically in relation to dinocysts; *Carya* is still predominant.

At 2129 m: Late to Middle Paleocene; Palynozone II

A few specimens of the index species allow the recognition of the top of Palynozone II.

AT 2159 m: Late to Middle Paleocene; Palynozone IB

A characteristic species of Palynozone IB is first introduced downhole of 2159 m, accompanied by numerous Areoligeraceae.

The foraminifer *Bolivinopsis spectabilis* is also observed. Environment: Outer neritic to bathyal.

From 2189 to 2219 m: Middle to Early Paleocene; Palynozone IA2

Palynozone IA2 is drawn at 2189 m on the basis of abundant index species.

From 2249 to 2279 m: Middle to Early Paleocene-Palynozone IA1

A single specimen of the index species from palynozone IA1 is seen at 2249 m.

The first occurrences of the foraminifera *Globorotalia compressa* and *G. aff. pseudobulloides* are noted at 2249 m. They are known from Middle and Early Paleocene rocks. Environment: bathyal to outer neritic.

At 2279 m: Late Cretaceous

A nannofossil association composed of *Arkhangelskiella cymbiformis*, *Watznaueria barnesae*, *Micula staurophora*, *Predicosphaera cretacea*, *Kamptnerius magnificus* suggests a Late Cretaceous age.

Rare prisms of *Inoceramus* and chalky *Globigerinids* are also encountered.

Dinoflagellates are abundant, apparently caved from the interval above. Mud contaminants of mid-Cretaceous age are present there and throughout the sequence below.

At 2327 m: Maastrichtian?

Possible fragments of *Palynodinium grallator* are indicative of the above stated age. Environment: Marine.

From 2338 to 2399 m: Early Maastrichtian to Late Campanian

The association of *Arkhangelskiella cymbiformis* and *Reinhardtites anthophorus* with *Predicosphaera cretacea*, *Micula staurophora* favor an Early Maastrichtian to Late Campanian age.

Rare *Rugoglobigerina* ex. gr. *rugosa* and prisms of *Inoceramus* are present in this interval

Although Tertiary palynomorphs still predominate, rare, long-ranging Cretaceous elements are seen within this interval. Environment: Marine.

From 2410 to 2429 m: Late Campanian

The appearance of *Eiffellithus eximius* at 2410 m (SWC) defines the top of Late Campanian. *Reinhardtites anthophorus*, *R. levis*, *Arkhangelskiella cymbiformis* and *Cretarhabdus surirellus* are additionally recorded from these levels.

Heterohelix globulosa and *Globotruncana* gr. *lapparenti* are also present.

Mid-Cretaceous palynomorphs continue to be present very likely introduced through contamination. *Ovoidinium scabrosum* is the most frequently encountered whereas *Hapsocysta peridyctia* is confined to the sample at 2429 m.

From 2453 to 2489 m: Early Campanian to Late Santonian

The occurrence of *Reinhardtites* spp., *Eiffellithus turriseifeli*, *E. eximius*, *Broinsonia* aff. *parca* may suggest the above quoted age.

Subsidiary elements include *Marginotruncana coronata* (2489 m) and rare *Globigerinelloides* spp. and *Hedbergella* spp.

Palynologically, assemblages are marked by a considerable reduction of the caved material, but mud-contaminants are never diminished. Cretaceous dinocysts are occasionally found including the ubiquitous *Odontochitina operculata* (at 2465 m).

Environment: Marine.

At 2495,5 m (SWC): Early Santonian to Turonian

The appearance of *Cribrosphaerella primitiva* at this level

points out to an Early Santonian to Turonian age.

Micula staurophora, *Eiffellithus turriseiffeli*, *E. eximius*, *E. trabeculatus*, *Tranolithus orionatus*, *T. manifestus*, *Cretarhabdus crenulatus*, *C. surirellus* are also identified. Between this SWC and the one below isolated fragments of what appears to be *Compositosphaeridium costatum* are seen (at 2501 m). They are almost certainly derived from the underlying Jurassic sediments.

At 2509,5 m (SWC): Cenomanian?

Strictly on negative evidence, a Cenomanian age is speculated for this level. This is because of the disappearance of *Micula staurophora* and the absence of Albian elements.

Eiffellithus turriseiffeli, *Predicosphaera cretacea*, *P. spinosa*, *Gartnerago obliquum*, *Cribrosphaerella ehrenbergi*, *Glaukolithus diplogrammus*, *Gl. compactus* are here noted for future reference. Environment: Marine.

From 2519 to 2539 m: Albo-Aptian (or older)

In this interval, the microfauna is very scarce and poorly preserved.

Parhabdolithus asper, *P. infinitus*, *Nannoconus* sp. *Watznaueria communis* are recorded at 2539 m, together with the foraminifera *Vidalina* sp. and *Ammodiscus* sp.

Rare, Early and also younger Cretaceous palynomorphs are present in this sample including such forms as *Oligosphaeridium asterigerum*, *Litosphaeridium siphoniphorum* and *Palaeohystrichophora infusorioides*. Considering the remote possibility that they are in place, an Albian age would appear likely.

Although log evidence suggests that Jurassic rocks may be present as high as 2520 m, there is nothing to support this

interpretation above 2549 m. Even there the prove is scanty, as it is discussed below, and on lithological grounds a still older age could not be excluded for certain.

Environment: Marine

From 2549 to 2579 m: ?Late Jurassic (or older)

Rare marine palynomorphs attributable to the "*Leptdoninium subtile*" group and fragments of *Compositosphaeridium costatum* were seen in these two samples. In addition, a noticeable increase of amorphous/biodegraded type of organic matter occurred at 2579 m. Evidently, this is a slim evidence to base an age on but from previous studies, one may reasonably conclude that Jurassic rocks are already penetrated.

From 2579(?) to 2780(?)m: Indeterminate

From these levels and down to 2780 m, assemblages are impoverished and probably not in place. Intermittently, very scarce and hardly identifiable Oxfordian to Callovian marine elements were seen as well as recycled carboniferous and caved (or contaminants) Early to Middle Cretaceous dyncocysts. We argue against their in situ position because closely spaced SWC samples and several core chips (seen Appendix) obtained from these horizons contained no microfossils whatsoever. Careful examination of the cuttings samples have given no indication for a Triassic age.

This leaves very little room for a reliable interpretation but it is likely that a very thin Jurassic section exists from which the Jurassic fossils mentioned have originated. The remaining of the sequence (red beds) could be as old as Triassic but this remains to be proven.

RJDC:NSI:MP:cm:cs:cl

July 1983

APPENDIX
LIST OF SAMPLES EXAMINED

PALYNOLOGY

<u>DEPTH (m)</u>		<u>DEPTH (m)</u>	
500	1590		* 2568.3
530	1620	+	2410 + 2569
560	1650		* 2569.7
620	1680	+	2426 2579
650	1710		+ 2581-2586,7
680	1740		+ 2589,7
710	1770		+ 2593,2
740	1800	+	2453 2594
770	1830		* 2596,5
800	1860		+ 2597
830	1890	+	2467 + 2597,6
860	1920		* 2602,5
890	1950		+ 2603,8
920	1980		2489 2609
950	2009	+	2490 + 2613,7
980	2040	+	2495,5 2624
1010	2070		* 2501 2626,5
1050	2100	+	2509,5 2639
1080	2129	+	2517 + 2641
1110	2159		2519 2645
1140	2189		2520 + 2678,2
1170	2219	+	2520,5 2687
1200	2249	+	2522-2526,5 2690
1230	2279		2525 + 2701,2
1260	2300		2534 2702
1290	2309	+	2535 + 2718,7
1320	2318	+	2536,5 2720
1350	2327	+	2538 2735
1380	+ 2338	+	2540 2750
1410	2339	+	2547,2 + 2752,7
1440	2354		2549 2765
1470	+ 2361,5	+	2555 + 2765,5
1500	2369	+	2558 + 2774
1530	2384	+	2560 2777
1560	2399		2564 2780

+: SWC
*: Cores

LIST OF SAMPLES EXAMINED

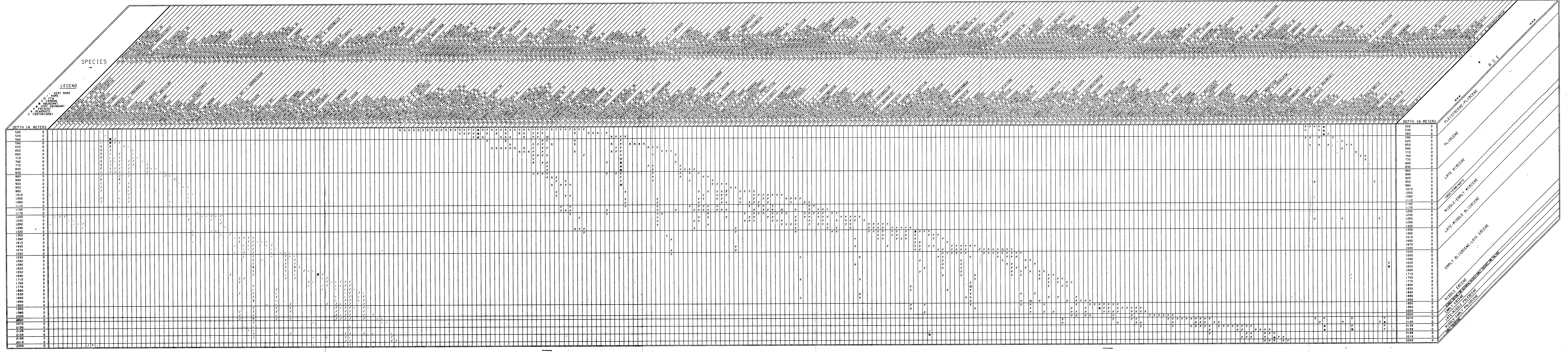
MICROPALEONTOLOGY

D E P T H (m)

500	1320	2129
530	1350	2159
560	1380	2189
590	1410	2219
620	1440	2249
650	1470	2279
680	1500	2309
710	1530	+ 2338
740	1560	2339
770	1590	+ 2361,5
800	1620	2369
830	1650	2399
860	1680	+ 2410
890	1710	+ 2428
920	1740	2429
950	1770	+ 2453
980	1800	2459
1010	1830	+ 2467
1050	1860	+ 2481
1080	1890	2489
1110	1920	+ 2495,5
1140	1950	+ 2509,5
1170	1980	2519
1200	2009	+ 2522,5
1230	2040	2549
1260	2070	2579
1290	2100	

+: SWC

PALEONTOLOGY OF 16/7-4, OFFSHORE NORWAY, 500M-2249M



SPECIES

LEGEND

DEPTH IN METERS

DEPTH IN METERS

R.C.E.

PLEISTOCENE-PLIOCENE

PLIOCENE

LATE MIOCENE

MIDDLE MIOCENE

MIDDLE-EARLY MIOCENE

MIDDLE-LATE OLIGOCENE

LATE MIOCENE-LATE EOCENE

EARLY OLIGOCENE

MIDDLE EOCENE

EARLY EOCENE

MIDDLE-LATE PALEOCENE

MIDDLE-LATE PALEOCENE

