

THE FORAMINIFERA IN THE HOUTHALEN SANDS (MIDDLE MIOCENE) OF THE DEEPBORING HELCHTEREN (NE BELGIUM)

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I. Foraminiferal Association

When studying the microfauna of the deep-boring Helchteren, some levels yielded a very rich and characteristic foraminiferal fauna. Lithostratigraphically these levels have to be placed in the Houthalen Sands (cf. contribution by M. GULINCK in the same volume). Helchteren is situated in the close vicinity of Houthalen (cf. map in the contribution by A. RINGELÉ).

Ninety nine species could be listed. Table 1 shows the relative frequencies of the species in the studied deepboring, together with a comparison with our Middle Miocene samples of the Antwerpen area, and with other faunas of the Middle Miocene of the North Sea basin. The list has been composed according to the classification of the "Treatise" by LOEBLICH & TAPPAN (1964). *Florilus boueanus* (D'ORBIGNY, 1846) and *Heterolepa dutemplei peelensis* (TEN DAM & REINHOLD, 1942) are abundant. The fauna is also characterised by the great number and diversity of large *Textularia* and by a few large Miliolidae. *Asterigerina guerichi staeschei* (TEN DAM & REINHOLD, 1941) is very common.

II. Biostratigraphical Remarks

1. The Netherlands and Belgium

TEN DAM & REINHOLD (1942), having examined the Foraminifera of the Oligocene and the Miocene of deepborings in the Peel area, distinguish two different foraminiferal asso-

ciations in the Middle Miocene; one of these associations is characteristic of the "Dingdener Stufe" and the other of the "Hemmoorer Stufe". The microfauna of the Houthalen Sands, which we studied, can be easily correlated with the association of the "Hemmoorer Stufe". Especially the high frequency of *Elphidium inflatum* (REUSS, 1861) and of *Heterolepa dutemplei peelensis* TEN DAM & REINHOLD, 1942) seems to be typical.

TEN DAM & REINHOLD (1942) included the fauna of one sample taken in the neighbourhood of Antwerpen, and which probably belongs to the Antwerpen Sands, in their results. They concluded that these sands must be compared with the Dingden deposits. However, our recent observations on the Foraminifera of some rich levels in said Antwerpen Sands pointed to a micropaleontological relationship between the Antwerpen Member and the Hemmoor deposits. Also the microfauna of the underlying Edegem Sands has affinities with those of Hemmoor rather than with those of Dingden.

BATJES (1958) studied Foraminifera from the type locality of the Houthalen Sands. However the fossiliferous samples, at the base of the Member, contain practically only Oligocene, and thus very probably reworked species.

2. Northern Germany

A table showing associations of the "Hemmoor-Stufe" and of the "Reinbek-Stufe" is given by INDANS (1962). A correlation of the

microfauna of Helchteren with that of Germany appears to be more difficult. However, in general, the foraminiferal association corresponds fairly well with the fauna of Hemmoor. The presence of large specimens of the families Textulariidae and Miliolidae in both our fauna and in the Hemmoor sediments could be of stratigraphical significance.

A correlation between the deposits of northern Germany and those of the Netherlands and Belgium has been recently proposed by LANGER (1969). This author also correlated the "Houthalénien" with the "Hemmoor-Stufe". The "Anversien inférieur" (Edegem Sands?) is compared with the "Dingden-Reinbek-Stufe", and the "Anversien supé-

rieur" (Antwerpen Sands?) with the lower "Langenfelde-Stufe". This statement has some thing in common with the conclusions of VAN VOORTHUYSEN (1963). The latter also considered that the "Anversien" must be younger than the "Houthalénien".

For the present we have no sufficient data in order to confirm the view of LANGER (1969) regarding the place of the so-called "Anversien". Further studies on the Foraminifera of the Miocene are being carried out. They could clear up the biostratigraphical position of the Antwerpen deposits. In any case, it is possible that the "Anversien" laterally passes into the "Houthalénien".

TABLE 1

The Foraminifera in the Houthalen Sands of the deepboring Helchteren and their presence in Middle Miocene faunas of the North Sea basin	Houthalen	Edegem	Antwerpen	Ten Dam & Reinhold (1942)		Indans (1962)	
				Hemmoor	Dingden	Hemmoor	Reinbek
1. <i>Spiroplectammina carinata carinata</i> (D'ORBIGNY, 1846)	c		r	+	○	+	+
2. <i>Spiroplectammina carinata pectinata</i> (REUSS, 1850)	c	c	c			+	+
3. <i>Spiroplectammina carinata deperdita</i> (D'ORBIGNY, 1846)	c		c			+	+
4. <i>Textularia mayeriana</i> D'ORBIGNY, 1846	c					+	
5. <i>Textularia agglutinans</i> D'ORBIGNY, 1839	c						
6. <i>Textularia speyeri</i> (REUSS, 1865)	r		rr				
7. <i>Textularia haueri</i> D'ORBIGNY, 1846	c	c	r				
8. <i>Textularia gramen gramen</i> D'ORBIGNY, 1846	c		r	+	+	+	+
9. <i>Textularia gramen abbreviata</i> D'ORBIGNY, 1846	c		c			+	+
10. <i>Textularia gramen deltoidea</i> REUSS, 1850	c		c			+	
11. <i>Textularia gramen subangulata</i> D'ORBIGNY, 1846	r		r				
12. <i>Bigenerina nodosaria</i> D'ORBIGNY, 1826	r	c	c			+	+
13. <i>Karrerella affinis</i> (FORNASINI, 1883)	r	r	r	+			
14. <i>Martinottiella communis</i> (D'ORBIGNY, 1846)	c	c		+	○	+	+
15. <i>Quinqueloculina ackneriana</i> D'ORBIGNY, 1846	r					+	+
16. <i>Massilina</i> sp.	r		rr			+	
17. <i>Flintina</i> sp.	r					+	
18. <i>Triloculina inflata</i> D'ORBIGNY, 1846	rr					+	
19. <i>Pyrgo inornata</i> (D'ORBIGNY, 1846)	r						
20. <i>Pyrgo bulloides</i> (D'ORBIGNY, 1826)	r					+	+
21. <i>Sigmoilina tenuis</i> (CZJEK, 1847)	c	c					+

22. <i>Sigmoilopsis schlumbergeri</i> (SILVESTRI, 1904)	c	r		+	+		
23. <i>Nodosaria bacillum</i> DEFRANCE, 1826	r			○		+	
24. <i>Nodosaria irregularis</i> D'ORBIGNY, 1846	r			c			
25. <i>Nodosaria longicauda</i> D'ORBIGNY, 1826	c	c	r				
26. <i>Dentalina guttifera</i> D'ORBIGNY, 1846	c		c	○	+	+	+
27. <i>Dentalina konincki</i> REUSS, 1861	c		c				
28. <i>Dentalina communis</i> D'ORBIGNY, 1826	rr	rr	r				
29. <i>Demalina soluta</i> REUSS, 1851	c			+			
30. <i>Dentalina badenensis</i> D'ORBIGNY, 1846	rr						
31. <i>Dentalina intermittens</i> (ROEMER, 1838)	l	rr	r	+	+	+	+
32. <i>Dentalina inornata</i> D'ORBIGNY, 1846	r	c	r				+
33. <i>Dentalina acuta</i> D'ORBIGNY, 1846	rr						
34. <i>Fronicularia dumontana</i> REUSS, 1861	rr		r				
35. <i>Lagena tenuis</i> (BORNEMANN, 1855)	r	c	c			+	+
36. <i>Lagena elongata</i> (EHRENBERGH, 1844)	r	c	c				+
37. <i>Lagena hexagona</i> (WILLIAMSON, 1848)	r	c	c	+		+	+
38. <i>Lagena hystrix</i> REUSS, 1863	rr		rr	+		+	+
39. <i>Lagena striata</i> (D'ORBIGNY, 1839)	c	rr		+	+	+	+
40. <i>Lagena laevis</i> (MONTAGU, 1803)	rr	r	r	+	+		
41. <i>Lenticulina crassa</i> (D'ORBIGNY, 1846)	r	r	r				+
42. <i>Lenticulina teschi</i> (TEN DAM & REINHOLD, 1947)	rr			○			+
43. <i>Lenticulina cultrata</i> (MONTFORT, 1808)	rr		r	+	+	+	+
44. <i>Lenticulina calcar</i> (LINNAEUS, 1767)	rr		rr	+	+	+	+
45. <i>Lenticulina rotulata</i> (LAMARCK, 1804)	r		rr	+	+	+	+
46. <i>Lenticulina nysti</i> REUSS, 1863	r		rr				
47. <i>Lenticulina clericii</i> FORNASINI, 1895	rr		rr				+
48. <i>Lenticulina inornata</i> (D'ORBIGNY, 1846)	rr		rr				+
49. <i>Lenticulina gibba</i> (D'ORBIGNY, 1826)	c	r	r	+	+		
50. <i>Marginulina hirsuta</i> D'ORBIGNY, 1826	r				+	+	+
51. <i>Marginulina hosiusi</i> LANGER, 1969	rr						+
52. <i>Margulinopsis ackneriana</i> (NEUGEBOREN, 1851)	r		rr	+	+	+	+
53. <i>Planularia grundensis</i> (KARRER, 1867)	r	l		+			
54. <i>Globulina gibba gibba</i> D'ORBIGNY, 1826	r	c	r	+	+	+	+
55. <i>Globulina gibba punctata</i> D'ORBIGNY, 1846	c						
56. <i>Globulina gibba tuberculata</i> D'ORBIGNY, 1846	c	rr	r	+	+	+	+
57. <i>Guttulina problema</i> (D'ORBIGNY, 1826)	c	c	c	+	+	+	+
58. <i>Pseudopolymorphina incerta</i> (EGGER, 1857)	rr					+	
59. <i>Sigmomorphina schwageri</i> (KARRER, 1877)	rr		rr				+
60. <i>Glandulina laevigata</i> D'ORBIGNY, 1826	r	r		+	+	+	+
61. <i>Fissurina laevigata</i> REUSS, 1850	r	c	r	+	+	+	+
62. <i>Fissurina orbignyana</i> SEGUENZA, 1862	rr	c	rr			+	+
63. <i>Sphaeroidina bulloides</i> D'ORBIGNY, 1826	r			+	+		+
64. <i>Bulimina aculeata</i> D'ORBIGNY, 1826	r	r	r		+	+	+
65. <i>Bulimina elongata elongata</i> D'ORBIGNY, 1846	c	c	c		+	+	+
66. <i>Bulimina elongata subulata</i> CUSHMAN & PARKER, 1937	r	r	r	r		+	+
67. <i>Bulimina dingdenensis</i> BATJES, 1958	c					+	+
68. <i>Trifarina gracilis tenuistriata</i> REUSS, 1870	r	c					
69. <i>Trifarina bradyi</i> CUSHMAN, 1929	c	c	r			+	+
70. <i>Discorbis mira</i> CUSHMAN, 1922	rr	c	r			+	+
71. <i>Cancris auriculus</i> (FICHTEL & MOLL, 1803)	c	c	c	+	+	+	+
72. <i>Asterigerina guerichi staeschei</i> (TEN DAM & REINHOLD, 1941)	c	c	a	+	●	+	+
73. <i>Ammonia beccarii</i> (LINNAEUS, 1758)	c					+	
74. <i>Elphidium ungeri</i> (REUSS, 1850)	r	r				+	+
75. <i>Elphidium inflatum</i> (REUSS, 1861)	c		c	●	+	+	+
76. <i>Elphidium subnodosum</i> (ROEMER, 1838)	c						

77. *Cribronion heteroporum* (EGGER, 1857)
78. *Protelphidium granosum* (D'ORBIGNY, 1826)
79. *Globigerina ciperoensis* BOLLII, 1954
80. *Globigerina bulloides* D'ORBIGNY, 1846
81. *Globigerinoides trilobus* (REUSS, 1850)
82. *Eponides umbonatus* (REUSS, 1851)
83. *Cibicides lobatulus* (WALKER & JACOB, 1798)
84. *Cibicides ungerianus* (D'ORBIGNY, 1846)
85. *Virgulina pertusa* (REUSS, 1861)
86. *Globocassidulina subglobosa* (BRADY, 1884)
87. *Globocassidulina oblonga* (REUSS, 1850)
88. *Ehrenbergina healyi* FINLAY, 1947
89. *Astrononion perfossum* (CLODIUS, 1922)
90. *Florilus boueanus* (D'ORBIGNY, 1846)
91. *Nonionella limba* (D'ORBIGNY, 1826)
92. *Pullenia bulloides* (D'ORBIGNY, 1846)
93. *Pullenia quinqueloba* (REUSS, 1851)
94. *Gyroidina soldanii* D'ORBIGNY, 1826
95. *Hanzawaia boueana* (D'ORBIGNY, 1846)
96. *Heterolepa dutemplei dutemplei* (D'ORBIGNY, 1846)
97. *Heterolepa dutemplei peelensis* (TEN DAM & REINHOLD, 1942)
98. *Melonis affinis* (REUSS, 1851)
99. *Ceratobulimina haueri* (D'ORBIGNY, 1846)

rr	c	c			+	+
r	r	c			+	+
c	c	c				
r			+	+	+	+
c	r	c	+	+	+	+
r	rr		+		+	+
c	a	c	+	+	+	+
c	r	rr				
c	c	c	+	+	+	+
rr	c	c			+	+
r	rr				+	+
rr						
r	c	c			+	+
a	c	c	●	○	+	+
r	c	r			+	+
r	rr	rr	+	+	+	+
r	c		+		+	+
r	r				+	+
c	c	c			+	+
rr					+	+
a	c	c	●	+	+	+
c	c	c	+	+	+	+
c	c		+	+	+	+

Symbols: a — more than 15 % of the fauna
 c — 10 specimens to 15 %
 r — 3 to 9 specimens
 rr — 1 or 2 specimens

● — "Charakterformen"
 ○ — "wichtige accessorische Formen"
 + — "accessorische Formen"
 after TEN DAM & REINHOLD (1942)

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