

LITHO- AND BIOSTRATIGRAPHICAL STUDY OF QUATERNARY DEEP  
MARINE DEPOSITS OF THE WESTERN BELGIAN COASTAL PLAIN.

DIATOM ANALYSIS

by L. DENYS (★)

INTRODUCTION AND METHODS.

Twenty-six samples from ten borings were placed at our disposal for diatom analysis. Only eleven of them were found to contain more or less well-preserved diatom frustules (tab. 1).

Based on counts of at least 300 valves, relative percentages for the taxa were calculated (tab. 4) which were used to construct certain ecological spectra. The halobion system of VAN DER WERFF & HULS (1957-1974) (tab. 2) was applied for

BORING	SAMPLE	DEPTH (m)	DIATOMS	Cl <sup>-</sup> (mg/l)	salinity (mg/l)
117DB5	M56	28		MARINE >17000	>30000
117DB6	M61	30.5		MARINE-BRACKISH 10000-17000	18000-30000
117DB7	M40	20	+	BRACKISH-MARINE 5000-10000	9000-18000
"	M49	24.5	+	BRACKISH 1000-5000	1800-9000
"	M58	29	+	BRACKISH-FRESH 500-1000	900-1800
"	M64	32	+	FRESH-BRACKISH 100-500	180-900
117DB8	M42	21	+	FRESH <100	<180
"	M61	30.5			
117DB9	M70	35			
"	M79	39.5			
117DB10	M68	34			
117DB12	M41	20.5			
"	M43	21.5			
"	M50	25			
"	M64	32			
117DB14	M28	14	+		
"	M44	22			
"	M63	31.5			
"	M68	34			
193DB5	M51	25.5	+		
"	M54	27			
"	M61	30.5			
193DB6	M24	12	+		
"	M36	18	+		
"	M60	30	+		
"	M65	32.5	+		

Tab. 2 - The halobion system of VAN DER WERFF & HULS (1957-1974).

the salinity spectra (fig. 1). Benthonic, epontic (sessile) and planktonic taxa were distinguished in the habitat spectra (tab. 3). Aerophilous, pseudampotiphilous (tidal zone diatoms) and ampotixenous forms (diatoms preferring permanent inundation) were used to infer tidal flat conditions (tab. 3). The composition of the last two groups was based mainly on the work of SIMONSEN (1962). The ratio of allochthonous fresh water diatoms to autochthonous salt water taxa was calculated as in BEYENS & DENYS (1982) (tab. 3). The percentage of euryhaline forms was used as an indication of short term salinity variations during deposition (tab. 3).

Table 1 - Examined samples.

Small amounts of sediment from these samples were treated with 30% H<sub>2</sub>O<sub>2</sub> and KMnO<sub>4</sub> according to the method of VAN DER WERFF (1955) for removal of organic matter and with 0,1 N HCl for removal of lime particles. Only sand was removed by means of decantation. No attempts were made to get rid of smaller particles, since then small valves may be lost also. Slides of the residue were made using Cumaron (nD : 1.65) and examined qualitatively and quantitatively by means of a Leitz Orthoplan microscope equipped with Nomarski differential interference contrast optics.

RESULTS.

SALINITY (Fig. 1)

Sample 117DB14/M28 was found to be deposited in a typically marine environment where fresh water influence was very low (F : 0.05); Deposition of samples 193DB6/M36, 117DB7/M40/M58 and M64 occurred in a marine to marine-brackish milieu, with probably stronger salinity variations for 117DB7/M64 (58% euryhaline forms, tab. 3).

Somewhat lower palaeosalinities were found for 117DB7/M42 (marine-brackish to marine), 117 DB/M42 and 193DB6/M24 (both

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marine-brackish). Sample 193DB6/M24 contains a very high percentage of euryhaline taxa (69%). However, salinity does not seem to have fluctuated much beyond the marine-brackish to marine region. Samples 193DB6/M60/M65 and 193 DB5/M51 show rather high percentages of fresh-brackish and brackish forms, probably due to a higher influx of allochthonous valves from less saline areas during sedimentation or coring technique.

WATERDEPTH AND TIDAL INFLUENCE (tab. 3).

Benthonic and epontic (especially epipsamnic) taxa dominate the habitat spectra. Percentages of planktonic forms are always low and generally less than ten percent. Ampotixenous forms are always scarce. Aerophilous and pseudampotiphilous forms are generally well represented. Together this points to rather undep water and sedimentation between tidal limits. Typical tidal flat associations are found in samples 193DB6/M24/M36, 117DB7/M40/M49 and 117DB14/M28; this character is less pronounced in samples 117DB7/M58 and M64. Although 117DB/M42 scores low values for aerophilous (17%) and pseudampotiphilous forms (12%), tidal flat origin should not be excluded. *Nitzschia granulata* makes up more than 36% of all diatoms in this sample. SIMONSEN (1962) does not classify this species in his system regarding tolerance of tidal zone conditions, but it is known to occur on shores, flats and salt marshes (GIFFEN, 1970; HENDEY, 1964; HUSTEDT, 1939; SULLIVAN, 1975, 1978). Samples 193DB6/M60/M65 and 193DB5/M51 may have been deposited in a slightly less shallow environment than the other samples.

FLORISTICS AND CHRONOLOGY.

Most diatoms found in the samples are normal constituents of the present-day littoral flora of the southern North Sea and are found more or less frequently in the Flandrian deposits at our coast. However, some exceptions have to be made. A number

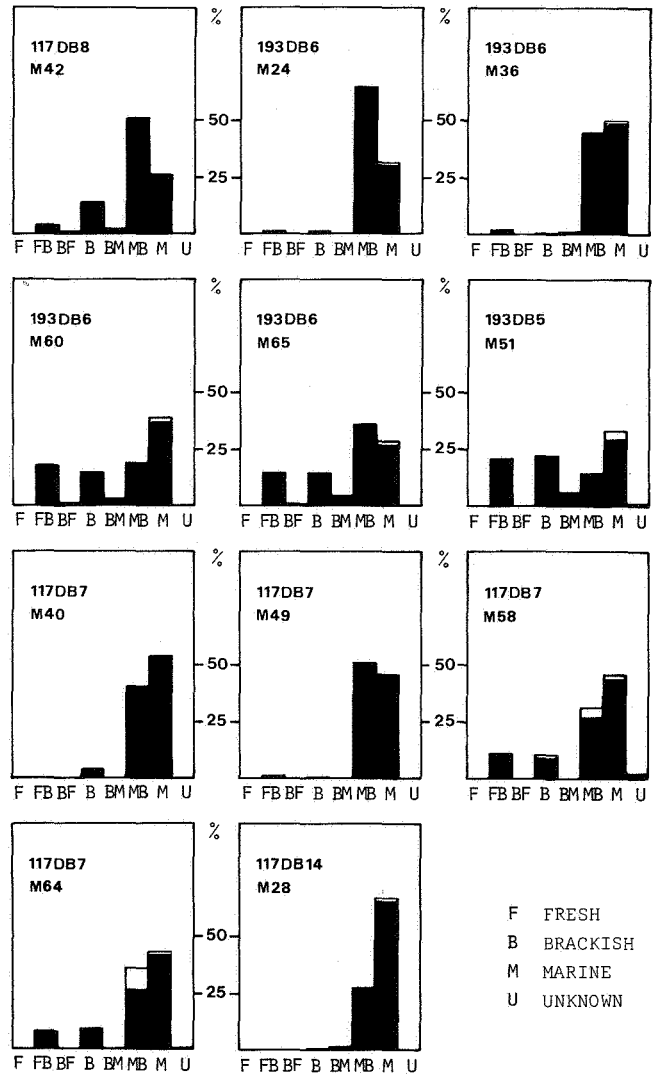


Fig. 1 - Salinity spectra. Blank sections of the columns represent uncertain entries.

	% Aerophilous	% Pseudampotiphilous	% Ampotixenous	% Euryhalinous	% Benthonic	% Epontic	% Planktonic	F-value
117DB8 M42	17	12	<1	33	80	16	4	0.26
193DB6 M24	84	66	2	69	28	69	2	0.03
193DB6 M36	77	42	3	47	44	48	8	0.05
193DB6 M60	37	10	3	37	62	25	13	0.72
193DB6 M65	32	17	2	51	54	34	12	0.55
193DB5 M51	24	6	5	45	57	37	6	
117DB7 M40	54	39	1	46	52	42	6	0.05
117DB7 M49	49	47	1	49	46	52	2	0.02
117DB7 M58	35	23	3	39	64	32	4	0.27
117DB7 M64	34	23	1	58	65	30	5	0.22
117DB14M28	61	26	0	32	66	27	7	0.05

Table 3 - Percentages of several groups reflecting local ecological conditions during sedimentation and ratio of "allochthonous" freshwater taxa to "autochthonous" salt water taxa (F-value).

Tab. 4: Relative percentages of the observed diatoms ( +: present but not counted) (continued).

		Boring.....	117		193		193		117		117	
		DB8	DB6		DB5		DB7		DB14			
Sample.....		M42	M24	M36	M60	M65	M51	M40	M49	M58	M64	M28
Ecology		Number of valves counted.....										
		420	386	348	330	345	382	356	404	385	459	433
5,2,e	<i>Achnantes brevipes</i> Ag. ....				+	1.5	+	+				+
4,1,e	<i>A. delicatula</i> (Kütz.) Grun. (1) .....	0.5	1.3	0.6	5.8	4.4	10.0		0.3	6.5	7.6	0.5
1,1	<i>A. exigua</i> Grun. ....						0.3			+		
7?,2	<i>A. groenlandica</i> (Cl.) Grun. ....										+	
2,2	<i>A. lanceolata</i> (Bréb.) Grun. ....			0.3	0.3		0.3					
7,1	<i>A. lilljeborgii</i> Grun. ....										+	0.2
4,1	<i>A. linkei</i> Hust. ....									+	+	
1,2	<i>A. minutissima</i> Kütz. ....										+	+
7,3	<i>Actinocyclus ehrenbergii</i> Ralfs .....	+		+						+	+	+
7,3	<i>A. kützingii</i> (Schmidt) Sim. ....					0.3						
6,3,e	<i>Actinoptychus senarius</i> Ehr. ....	0.2	0.3	1.2	0.6	1.5	0.3	0.6	1.0	0.5	0.7	0.7
7,3	<i>A. splendens</i> (Shadb.) Ralfs .....		0.3	0.6		+		0.6	+		+	+
4,1,e	<i>Amphora coffaeiformis</i> (Ag.) Kütz? (2) .....			+	+	+	0.3		0.3	+	0.4	
7?,1,am	<i>A. crassa</i> Greg. ....										+	
7-6,1,a	<i>A. dubia</i> Greg. ....					0.3						
7-6,1,a	<i>A. exigua</i> Greg. ....				0.3		0.5					
2,1	<i>A. libyca</i> Ehr. ....				+						+	
2,1	<i>A. ovalis</i> Kütz. ....	0.2	+	+	0.6	1.7	0.8			1.8	1.3	
2,2	<i>A. pediculus</i> (Kütz.) Grun. ....		1.0	0.9		0.6	2.9					
7,1	<i>A. pusio</i> Cl. ....									+		
	<i>A. sp.</i> .....									+		
7,1	<i>A. turgida</i> Greg. ....									+	0.7	
2-3,1,e	<i>Anomooneis sphaerophora</i> (Kütz.) Pfitzer .....											+
7,1-3,e	<i>Aulacodiscus argus</i> (Ehr.) Schmidt .....	+	0.3	+	+	+	0.3	+				+
7,1	<i>Auliscus sculptus</i> (W. Sm.) Ralfs .....				+				0.3		+	+
2,3,e	<i>Bacillaria paradoxa</i> Gmelin .....							+				
7,3-2	<i>Biddulphia aurita</i> (Lyngb.) Bréb. & Godey .....			1.2	+	0.3		0.3	+			
7,1	<i>B. rhombus</i> (Ehr.) W. Sm. ....		0.5	0.6	+	0.6	0.3	+	0.3	0.5	0.2	0.5
3,1	<i>Caloneis permagna</i> (Bailey) Cl. ....				0.3							
4,1	<i>C. westii</i> (W. Sm.) Hendey .....	0.2		+				+				
4,1,a	<i>Campylodiscus clypeus</i> Ehr. var. <i>bicoostatus</i> (W. Sm.) Hust. ....						0.3					
4,1,a	<i>C. echeneis</i> Ehr. ....	+		+	0.3	0.9	0.3					+
7,1-3,a	<i>Campylosira cymbelliformis</i> (Schmidt) Grun. ....		0.5	0.9	0.3	0.3		0.6				3.9
7,1-3	<i>Cerataulus smithii</i> Ralfs .....		+	+		+						0.5
7,1,am	<i>C. turgidus</i> Ehr. ....										+	
7?,1	<i>Cocconeis britannica</i> Naeg. ....										+	
7,1,am	<i>C. clandestina</i> Schmidt .....									+		
7?,1	<i>C. costata</i> Greg. ....				1.8	0.6	2.4			1.3	0.4	
7?,1	<i>C. debesi</i> Hust. ....		0.3	0.3				0.8		+	0.7	0.7
2,1-2	<i>C. diminuta</i> Pant. ....	0.2						0.3				
7,1,am	<i>C. distans</i> Greg. ....									0.3	0.2	
7?,1	<i>C. fluminensis</i> (Grun.) Perag. ....										+	
7?,2	<i>C. molesta</i> Kütz. ....										+	
3,2	<i>C. pediculus</i> Ehr. ....			+								
7?,2,am	<i>C. pelta</i> Schmidt .....		1.3	0.9		0.6	1.3			0.3	0.2	+
6,1,e	<i>C. peltoides</i> Hust. ....									+	0.4	
7?,1,am	<i>C. pinnata</i> Greg. ....										+	
2,2,e	<i>C. placentula</i> Ehr. ....	0.2		+	0.9	4.1	7.6			+	0.2	
2,2	<i>C. p.</i> var. <i>euglypta</i> (Ehr.) Cl. ....								0.3	0.3	0.2	+
7,1,am	<i>C. pseudomarginata</i> Greg. ....										+	
7,1,am	<i>C. quarnerensis</i> Grun. ....									+	+	
6,2,e	<i>C. scutellum</i> Ehr. ....	1.7		0.3	4.6	7.0	7.3		+	0.8	0.4	+
6,2,e	<i>C. s.</i> var. <i>parva</i> (Grun.) Cl. ....				+	0.3	1.3	0.3			+	
7?,1?	<i>C. s.</i> var. <i>speciosa</i> (Greg.) Cl.- E. ....									0.3	+	
	<i>C. sp. 1</i> .....									+	+	
	<i>C. sp. 2</i> .....						1.3					
2,2	<i>C. thumensis</i> Mayer .....										+	
7,3	<i>Coccinodiscus argus</i> Ehr. ....			+								
7,3	<i>C. centralis</i> Ehr. ....						0.3					

	Boring.....	117 DB8	193 DB6	193 DB5	117 DB7	117 DB14						
	Sample.....	M42	M24	M36	M60	M65	M51	M40	M49	M58	M64	M28
Ecology	Number of valves counted.....	420	386	348	330	345	382	356	404	385	459	433
7,3	<i>C. cf. curvatus</i> Grun. ....					0.3						
7,3	<i>C. lineatus</i> Ehr. ....			0.3								
7,1	<i>C. nitidus</i> Greg. ....									+	+	+
7,1-3	<i>C. oculus-iridis</i> Ehr. ....	+		0.3				0.8				+
7,3	<i>C. perforatus</i> Ehr. var. <i>cellulosa</i> Grun. ....											+
7,1-3	<i>C. radiatus</i> Ehr. ....			+								+
4,3,e	<i>C. rothii</i> (Ehr.) Grun. var. <i>subalsa</i> (Juhl.- Dannf.) Hust. ....	0.2			+	1.7		0.6		0.5	0.2	0.5
3,3	<i>Cyclotella meneghiniana</i> Kütz. ....									+	0.2	
4,3,e	<i>C. striata</i> (Kütz.) Grun. ....	0.2		+	1.2	1.5	+	1.7		+		+
7,4,a	<i>Cymatosira belgica</i> Grun. ....	2.1	16.8	31.6	16.7	6.4	12.0	11.5	1.0	8.8	7.6	29.3
2,1-2	<i>Cymbella aspera</i> (Ehr.) Cl. ....										+	
2,1	<i>C. caespitosa</i> (Kütz.) Brun ....				0.3							
2,1	<i>C. sinuata</i> Greg. ....											+
2,1	<i>C. tumida</i> (Bréb.) V. Heurck ....									+		
2,1	<i>C. ventricosa</i> Ag. (incl. <i>C. turgida</i> Greg.) ....								0.3			
3,3	<i>Diatoma elongatum</i> (Lyngb.) Ag. ....										+	
7,1	<i>Dimerogramma marinum</i> (Greg.) Ralfs ....								+			+
7,1,a	<i>D. minor</i> (Greg.) Ralfs ....				+	0.6	0.3	0.6		+	+	+
7,1,a	<i>D. m. var. nana</i> (Greg.) V. Heurck ....			0.9			0.3					+
5,1,e,a	<i>Diploneis aestuarii</i> Hust. ....		0.5	0.9	0.3	+		0.3		+		1.8
7,1	<i>D. bombus</i> Ehr. ....	0.2	+	0.3	0.9	0.9	1.8					+
7?,1,am?	<i>D. coffaeiformis</i> (Schmidt) Cl. ....		0.3									
7,1	<i>D. crabro</i> Ehr. ....	+	+				+	+		+	+	
6,1,e	<i>D. didyma</i> (Ehr.) Cl. ....	1.2	0.5	+	+	1.5	+	1.1	+	+		0.2
7,1-3	<i>D. fusca</i> (Greg.) Cl. ....		+				0.3	0.3			+	+
7,1-3	<i>D. incurvata</i> (Greg.) Cl. ....								+			
4,1,e	<i>D. interrupta</i> (Kütz.) Cl. ....	0.5		+		+		0.3			+	
7,1	<i>D. lineata</i> (Donk.) Cl. ....										+	
7,1	<i>D. litoralis</i> (Donk.) Cl. ....			+							+	
6,1,e	<i>D. smithii</i> (Bréb.) Cl. ....	1.0	0.3			+		0.3		+		0.2
6,1,e	<i>D. s. var. pumila</i> (Grun.) Hust. ....									+		
7,1	<i>D. weisflogii</i> (Schmidt) Cl. ....		0.3	+				+				+
2,2	<i>Epithemia sorex</i> Kütz. ....									+		
2,2	<i>E. turgida</i> (Ehr.) Kütz. ....					0.3	+			+		
2,2	<i>E. zebra</i> (Ehr.) Kütz. ....											+
7,1	<i>Eunotogramma dubium</i> Hust. ....			0.3						0.5	0.7	
2,1-3	<i>Fragilaria brevistriata</i> Grun. ....						0.3	+		+	+	
2,1-3	<i>F. b. var. inflata</i> (Pant.) Hust. ....				+							
2,1-2-3	<i>F. capitata</i> (Ehr.) Lange - Bert. ....									+		
2,1-3	<i>F. construens</i> (Ehr.) Grun. ....				3.6					0.3		
2,1-3	<i>F. c. var. binodis</i> (Ehr.) Grun. ....				0.3						0.2	
2,2	<i>F. c. var. subsalina</i> Hust. ....				+	0.3	1.3					
2,2-3	<i>F. c. var. venter</i> (Ehr.) Grun. ....	0.2		0.6	1.8	0.9	0.5		0.7	3.6	3.9	
2,1-3	<i>F. inflata</i> (Heid.) Hust. ....	0.2				+						
5?,2	<i>F. investiens</i> (W. Sm.) Cl. - E. ....									0.5		0.2
1,1	<i>F. leptostauron</i> (Ehr.) Hust. ....										+	
	<i>F. cf. nitaschioides</i> Grun. ....									+		
2,1-3	<i>F. pinnata</i> Ehr. ....				2.1	1.2	4.2			1.6	0.2	
3,2-3,e	<i>F. pulchella</i> (Ralfs) Lange - Bert. ....									+		+
5,2,e	<i>F. tabulata</i> (Ag.) Lange - Bert. ....	+			+	+		+			+	
5,2,e	<i>F. t. var. obtusa</i> (Pant.) Lange - Bert. ....						0.3				0.2	
4,2,e	<i>F. t. var. truncata</i> (Grev.) Lange - Bert. ....							+		0.3		
7,1	<i>Glyphodermis distans</i> (Greg.) Grun. ....											+
2,2	<i>Gomphonema lanceolatum</i> Ag. ....									0.3		
2,2	<i>G. olivaceum</i> (Lyngb.) Desmazières ....									+	0.2	
7,2-3	<i>Grammatophora angulosa</i> Ehr. ....	0.2	+	0.3	0.6					+	+	0.9
7,2,am	<i>G. arcuata</i> Ehr. ....										+	
7,2,am?	<i>G. oceanica</i> (Ehr.) Grun. ....			+	2.1			0.3	+		0.2	+
7,2,am?	<i>G. o. var. macilenta</i> (W. Sm.) Grun. ....	0.2				1.7	2.6	0.3	0.5	0.3	+	+
7,2,am?	<i>G. o. var. m. f. nodosa</i> (Grun.) Hust. ....									+		

		Boring.....	117 DB8	193 DB6	193 DB5	117 DB7	117 DB14						
		Sample.....	M42	M24	M36	M60	M65	M51	M40	M49	M58	M64	M28
Ecology		Number of valves counted.....	420	386	348	330	345	382	356	404	385	459	433
7,2-3	<i>G. serpentina</i> (Ralfs) Ehr.								+	0.5	+	+	
	<i>G. sp.</i>										+		
4,1,a,ps	<i>Gyrosigma balticum</i> (Ehr.) Rabenh.				+								
5,1	<i>Hantzschia virgata</i> (Roper) Grun.												+
6,2,e	<i>Hyalodiscus scoticus</i> (Kütz.) Grun.									4.0	1.3	1.3	
7,2	<i>Isthmia enervis</i> Ehr.									+	+	+	
6,1,e	<i>Mastogloia pumila</i> (Grun.) Cl.							0.3					
2,3	<i>Melosira ambigua</i> (Grun.) Müll.	1.2			3.0	3.5	+						
2,3	<i>M. granulata</i> (Ehr.) Ralfs			+	+			1.1					
5,2-3	<i>M. moniliformis</i> (Müll.) Ag.							1.6					
7,3	<i>M. sol</i> (Ehr.) Kütz.										+		
7,4	<i>M. sulcata</i> (Ehr.) Kütz.	19.8	5.4	4.9	7.9	9.0	4.7	21.1	40.8	27.8	26.6	24.9	
7,4	<i>M. westii</i> W. Sm.	0.2	1.6	0.9	0.3	1.2	0.3	12.6	1.0	+			1.8
2,3	<i>Meridion circulare</i> (Grev.) Ag.				+								
6,1,e,a	<i>Navicula abrupta</i> (Greg.) Donk.			+	+	0.3							+
6,1,e	<i>N. arenaria</i> Donk.							1.1		1.3	0.7		
4,1,e,a	<i>N. avenacea</i> (Bréb.) Cl.				0.6	0.3							
7,1,a	<i>N. cancellata</i> Donk.												0.5
2,1	<i>N. capitata</i> Ehr. var. <i>hungarica</i> (Grun.) Ross									+			
2,1,e,a	<i>N. cari</i> Ehr. var. <i>cincta</i> (Ehr.) Lange - Bert.	1.0		0.6	3.0	1.2	0.3			0.5	0.9	0.5	
4,1,e	<i>N. clementis</i> Grun.									+	+		
6?,1	<i>N. cluthensis</i> Greg.												+
2-3,1	<i>N. costulata</i> Grun.				0.3	0.3							
7,1,a	<i>N. crucifera</i> Grun.									+	+		
2,1	<i>N. cryptocephala</i> Kütz.									+			
2,1	<i>N. dicephala</i> Ehr.				0.3		0.3			+			
4,1,e,a	<i>N. digitoradiata</i> (Greg.) Ralfs					0.6							
7?,1,am	<i>N. directa</i> (W. Sm.) Ralfs									+			
7,1	<i>N. distans</i> (W. Sm.) Ralfs												+
7,1,a	<i>N. finmarchica</i> (Cl. & Grun.) Cl.												+
6,1,a	<i>N. foreipata</i> Grev.				0.3	0.3	0.3			0.3			+
4,2,e	<i>N. gracilis</i> Ehr. var. <i>neglecta</i> (Thwaites) Grun.				2.1	0.3	2.6			1.3	1.3		
4,1	<i>N. gregaria</i> Donk.												+
4,1	<i>N. halophila</i> (Grun.) Cl.			+									
7,1,a,am	<i>N. hemedyi</i> W. Sm.												+
6,1,e	<i>N. humerosa</i> Bréb.									+	+	+	
5?,1	<i>N. integra</i> (W. Sm.) Ralfs										+		
7?,1	<i>N. maculosa</i> Donk.										+		
3,1,a	<i>N. mutica</i> Kütz.				0.3	+							+
3,1,a	<i>N. m.</i> var. <i>cohmii</i> (Hilse) Grun.										0.3		+
2-3,1,a	<i>N. m.</i> var. <i>nivalis</i> (Ehr.) Hust.					+							
7,1,e	<i>N. palpebralis</i> Bréb.			+									+
6?,1	<i>N. diserta</i> Hust.										4.4	11.3	
4?,1,e	<i>N. cf. nolens</i> Sim.										1.6		
4,1,e	<i>N. peregrina</i> (Ehr.) Kütz.			+			0.3						
3,1	<i>N. protracta</i> (Grun.) Cl.												+
2,1	<i>N. pseudolanceolata</i> Lange - Bert.							+			+	0.2	
2,1	<i>N. radiosa</i> Kütz.					0.3	0.3						+
4,1	<i>N. rostellata</i> Kütz. (3)			+			0.3			0.6			
4,1,e	<i>N. salinarum</i> Grun.				0.3		0.3						+
7,1	<i>N. scoliopleura</i> Schmidt											0.2	
2,1	<i>N. scutelloides</i> W. Sm.						+						
	<i>N. sp.</i>										2.1		
6?,1	<i>N. subforeipata</i> Hust.										+		
2,1	<i>N. viridula</i> (Kütz.) Ehr.						0.3			0.3			
6,1,e	<i>Nitzschia acuminata</i> (W. Sm.) Grun.			+	0.6	0.9	+					+	+
4,1	<i>N. commutata</i> Grun.					0.6	0.3						
5,1,e	<i>N. compressa</i> (Bailey) Boyer	1.4	+	+	2.1	3.2	3.9	0.3				+	+
2,1	<i>N. denticula</i> Grun.				+								
6,1	<i>N. granulata</i> Grun.	36.7			1.8	6.7	+					+	+

		Boring.....	117 DB8	193 DB6		193 DB5		117 DB7		117 DB14			
Ecology		Sample.....	M42	M24	M36	M60	M65	M51	M40	M49	M58	M64	M28
		Number of valves counted.....	420	386	348	330	345	382	356	404	385	459	433
4,1	<i>N. hustedtiana</i> Salah					2.7	1.7	6.0					
4,1,e	<i>N. navicularis</i> (Bréb.) Grun.	14.3	+	+	0.6	2.0	0.3	1.4		+	+	+	
5,1,a	<i>N. obtusa</i> W. Sm.				+								
7,1,e,a	<i>N. panduriformis</i> Greg.	0.2	+	0.6	3.0	1.2	1.6	0.3				0.4	0.5
3,1,e,a	<i>N. sigma</i> (Kütz.) W. Sm.		+	+	+	+					+		+
2,1	<i>N. sociabilis</i> Hust.					0.6							
3,1,e	<i>N. tryblionella</i> Hantzsch	0.5		0.3	0.6	1.2							
7,1	<i>Opephora marina</i> (Greg.) Petit										+		
2,1	<i>O. martyi</i> Hér.rib.	1.0			0.6	1.2	0.3		0.3	1.0	1.1		
7,1,a	<i>O. pacifica</i> (Grun.) Petit		+		1.2	0.3	0.8		0.5	1.8	1.5		
7,1,a	<i>Pinnularia cruciformis</i> (Donk.) Cl.			+									
7,1	<i>Plagiogramma laevis</i> (Greg.) Ralfs				0.6							+	
7,1,a	<i>P. staurorhizum</i> (Greg.) Heib.	0.2				0.3	0.3		0.7	0.5	0.9	+	
7,1	<i>P. vanheurokii</i> Grun.			0.6	0.9	1.2				1.0	0.4		
7,1	<i>Pleurosigma affine</i> Grun.												0.2
??,2	<i>Podosira hormoides</i> (Mont.) Kütz.					0.3							
7,2-3	<i>P. stelliger</i> (Bailey) Mann	2.6	1.6	1.2	+	0.9	1.1	3.1	+	+	1.2		
7,2,am	<i>Rhabdonema adriaticum</i> Kütz.				+	+	+		+		+		
7,2,am	<i>R. arcuatum</i> (Lyngb.? Ag.) Kütz.									+	+		
7,2,am	<i>R. minutum</i> Kütz.		0.5	1.7	0.9		1.3	0.3					+
6,2,e,a,ps	<i>Rhaphoneis amphiceeros</i> Ehr.	4.3	21.8	18.7	4.6	5.5	0.5	12.9	7.4	2.1	2.4	7.9	
6,2,e,a,ps	<i>R. minutissima</i> Hust.	0.5	0.5	3.2	4.6	5.5	5.0	0.3					2.5
??,2	<i>R. nitida</i> (Greg.) Grun.										+		
6,2,e,a,ps	<i>R. surirella</i> (Ehr.) Grun.	5.5	43.3	20.1		5.5	0.5	25.0	39.1	20.5	20.7	14.6	
7,3	<i>Rhizosolenia setigera</i> Brightwell			+						+	+	+	
2,2	<i>Rhoicosphenia curvata</i> (Kütz.) Grun.				0.3		+			+	+	+	
2,1	<i>Rhopalodia gibba</i> (Ehr.) Müll.										+		
4,1	<i>R. gibberula</i> (Ehr.) Müll.	+		+	0.3	2.0	1.3			+			
4,1,e	<i>R. musculus</i> (Kütz.) Müll.				0.3					+			
5,1,a,ps	<i>Scoliolepta tumida</i> (Bréb.) Rabenh.	0.7	+	+	0.3	+							+
7,1	<i>Scoliotropis latestrata</i> (Bréb.) Cl.									+			
5,1,e	<i>Stauroneis amphioeys</i> Greg.				0.6	0.3	0.5						+
2,3	<i>Stephanodiscus astraea</i> (Ehr.) Grun. var. <i>minutula</i> (Kütz.) Grun.											+	
7,2-3,e,am	<i>Striatella delicatula</i> (Kütz.) Grun.										2.1	0.7	
7,1	<i>Surirella fastuosa</i> Ehr.				+		0.3		+	+			
5,1,a	<i>S. gemma</i> Ehr.				+								
5,1	<i>S. ovalis</i> Bréb.				+								
2,1,a	<i>S. ovata</i> Kütz.						0.3						
2,1,a	<i>S. o. var. crumena</i> (Bréb.) Hust.				+								
6,1,am	<i>Synedra crystallina</i> (Ag.) Kütz.	+			+	+	+					+	
2,1-3	<i>Tabellaria fenestrata</i> (Lyngb.) Kütz.											+	
7,3,e	<i>Thalassionema nitsschioides</i> Grun.		+		+	0.3		0.3	0.5	+	0.2	2.3	
7-6,3	<i>Thalassiosira decipiens</i> (Grun.) Jørg.	0.2	0.3	2.9	3.3	0.9	0.3				0.3	0.4	+
6,1-3	<i>T. excentrica</i> (Ehr.) Cl.	+	0.5	0.3		0.3		+					1.6
7,3	<i>T. nordenskiöldii</i> Cl.			0.3							+	0.2	
7,1,a	<i>Trachyneis aspera</i> (Ehr.) Cl.	+			0.3	0.6	0.5	+		+	+	0.5	
7,2-3	<i>Triceratium altermans</i> Bailey				+	0.3	+						0.2
7,1	<i>T. antediluvianum</i> (Ehr.) Grun.	+			+	+	+	+			+		
7,1-3	<i>T. favus</i> Ehr.		+	+	+			+			+	+	
7,2-3	<i>T. reticulum</i> Ehr.												+
	Indeterminata (Centrales)												0.5
	Indeterminata (Pennales)											1.1	

(1) sensu LANGE-BERTALOT & RUPPEL (1980)  
(2) sensu VAN LANDINGHAM (1967)  
(3) sensu BROCKMANN (1950)

Ecology: 1<sup>st</sup> number (salinity group): 1 fresh  
2 fresh-brackish  
3 brackish-fresh  
4 brackish  
5 brackish-marine  
6 marine-brackish  
7 marine

2<sup>nd</sup> number (habitat): 1 benthonic  
2 epontic  
3 planktonic  
4 generally benthonic, facultatively planktonic

e: euryhaline  
a: aerophilous  
am: ampotixenous  
ps: pseudampotiphilous

of taxa, especially from samples 117DB7/M58 and M64, have not yet or only very rarely been met with in Holocene Belgian coastal deposits. This is the case for *Achnantes groenlandica*, *Cerataulus turgidus*, *Cocconeis brittanica*, *C. clandestina*, *C. fluminensis*, *C. molesta*, *C. scutellum* var. *speciosa*, *C. quarnerensis*, *Grammatophora arcuata*, *Isthmia enervis*, *Melosira sol* and *Rhaphoneis nitida*. *Achnantes groenlandica* and *Grammatophora arcuata* are considered to be arctic species (CLEVE-EULER) 1951-1955; HUSTEDT, 1931-1959). According to HENDEY (1964), *Cocconeis scutellum* var. *speciosa* is probably also a cold water form. *Cocconeis brittanica*, *C. fluminensis*, *C. molesta*, *C. quarnerensis*, *Cerataulus turgidus*, *Melosira sol* and *Rhaphoneis nitida* are recorded to prefer warmer water (CLEVE-EULER, 1951-1955; HUSTEDT, 1927-1930, 1931-1959). Nevertheless most of the diatoms mentioned may be found on recent southern North Sea coasts.

BROCKMANN (1928, 1930, 1934, 1940) studied Dutch and German Quaternary coastal deposits and concluded that Eemian sediments could be distinguished from younger deposits mainly by the absence of *Aulacodiscus argus* and the presence of *Cocconeis debesi*, *C. quarnerensis*, *Endictya oceanica*, *Stephanopyxis turris* and *Terpsinoe americana*. According to KONIG (1953) however *Aulacodiscus argus* is not completely absent from all German Eemian deposits. So far the diatoms of only a very limited number of marine Eemian samples from Belgium have been examined. CLARYSSE (1974) examined eight samples of the Steenbrugge clay. In these samples *Aulacodiscus argus*, a conspicuous species present in almost all Holocene North Sea sediments, is lacking, however none of the other species mentioned above are reported to be present. *Aulacodiscus argus* is also absent in our samples 117DB7/M49/M58 and M64. Of BROCKMANN's "Characterformen" for the Eemian, *Cocconeis quarnerensis* was found in samples M58 and M64. *Cocconeis debesi* was found to occur fairly frequently in Belgian Calais- and Dunkerque deposits (DENYS, 1982) and was thus not considered. From this it can be concluded that the lower samples of 117DB7 show a certain similarity to known Eemian deposits with respect of their diatom flora. Possibly, the floristic differences between these samples and normal Fladrian deposits discussed above, may also indicate a pre-Holocene age. A conclusion on the chronology of these samples based on diatoms alone however seems as yet premature.

NOTE ON THE STRATIGRAPHIC RANGE OF  
*Rhaphoneis nitida* (GREG.) GRUN.

Until recently *R. nitida* was not known to occur as a fossil (ANDREWS, 1975). Nowadays the species is known from the marine littoral of the Mediterranean and the southern North Sea. VAN HEURCK (1896) observed one specimen at Blankenberge, probably the only recent finding on our coast as yet. In the last few years this species was found to occur sporadically in deposits from Holocene (DENYS, 1981) to Eemian age (NIEMELA & TYNNI, 1979). It was also found in sample 117DB7/M64.

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