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The palaeoecological conditions of the tidal channel network of the Zwin region (Flanders, Belgium)

Supplementary material

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ABSTRACT

The northeastern coastal plain of Belgium was a well-developed region during the late medieval period when Bruges and a series of smaller harbours became connected to the North Sea via the Zwin tidal channel. Yet, ecological data related to the evolution of the regional environment of the former Zwin region are still lacking. Diatoms, pollen, and macrobotanical remains have been studied for the first time from two cores drilled in the surroundings of the lost harbour of Hoeke. The sediments in both cores were deposited in four successive tidal channel systems spanning the pre-Roman to late medieval periods. Marine tychoplanktonic and planktonic diatoms were dominant and confirmed the presence of open marine tidal channels, while marine epipsammic diatoms were specific to channel deposits (systems 1 and 4) and marine epipelic diatoms characterised channel and accretion deposits (systems 2 and 3). The sediments of the late medieval Zwin main channel and tributary (system 4) are both characterised by marine tychoplanktonic and epipsammic species. The palynomorphs were typical of marine tidal deposits and (reworked) peat, while macroremains pointed to freshwater plants growing in the vicinity. The palynomorphs (system 4) suggest a more open landscape associated with the extensive reclamation and embankment of the Zwin region. Diatoms in the superjacent tidal deposits indicate that the late medieval Zwin silted up rapidly.

KEYWORDS

Late Holocene,
palynology,
diatom analysis,
tidal channel system,
medieval harbour

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Appendix 1. Diatom counts in cores B3 and B5.

Sample box	B3																					
Depth (m)	0.26	0.82	1.13	1.35	1.90	2.35	3.21	3.51	4.40	4.75	5.12	5.60	6.22	6.60	6.97	7.70	8.49	8.91	10.47	11.29	11.615	11.91
Lithology	clay	silty clay	silty clay	fine sand	fine sand	fine sand	fine sand	fine sand	fine sand	fine sand	fine sand	fine sand	silty clay	fine sand	silty clay	fine sand	silty clay	silty clay	fine sand	silty clay	fine sand	silty clay
Architectural element	disturbed	tida flat	tida flat	channel s.s.	channel s.s.	channel s.s.	channel s.s.	channel s.s.	channel s.s.	channel s.s.	channel s.s.	channel s.s.	channel s.s.	channel s.s.	channel s.s.	channel s.s.	channel s.s.	channel s.s.	channel s.s.	channel s.s.	channel s.s.	channel s.s.
Tidal channel system				4	4	4	4	4	4	4	4	4	1	1	1	1	1	1	1	1	1	1
Vos & de Wolf (1993)																						
MARINE PLANKTONIC																						
Actinoptychus splendens (Shadbolt) Ralfs 1861		2	1		1	1	1		1	1	1	1										
Aulacodiscus argus (Ehrenberg) A.W.F.Schmidt 1886		1			1									1		1						
Coscinodiscus radiatus Ehrenberg 1840				1														2	1			
Lithodesmium undulatum Ehrenberg 1839									1	1		3				1						
Paralia sulcata (Ehrenberg) Cleve 1873	4	97	40	49	49	10	38	62	15	28	31	33	23	14	33	33	17	37	61	26	36	26
Podosira stelligera (Bailey) A.Mann 1907		7	3	2	5	1	1	2		1		6		2		3		5	2	1	3	1
Thalassionema nitzschioides (Grunow) Mereschkowsky 1902		13	27	15	11	1	11	12	8	9	24	16	9	8	15	19	24	23	24	16	14	37
Thalassiosira angulata (W.Gregory) Hasle 1978 or *Thalassiosira decipiens* (Grunow ex Van Heurck) Jørgensen 1905		11	20	25	28	31	25	45	15	23	34	25	23	23	21	35	15	20	18	31	11	15
Thalassiosira eccentrica (Ehrenberg) Cleve 1904		2			1		1	1		1	1	2			1	2			2		1	1
Thalassiosira tenera Proshkina-Lavrenko 1961				2	1		1	4				3		1	1	2			1			1
Triceratium favus Ehrenberg 1839														1				1				
Zygoceros ehrenbergii E.A.Sar 2016			2		4						1	1					1	2	1			1
MARINE TYCHOPLANKTONIC																						
Actinoptychus senarius (Ehrenberg) Ehrenberg 1843		4	3	4	2	1	8	1	1		6	10	1	2	1	8		2	2	4	2	1
Brockmanniella brockmannii (Hustedt) Hasle, Stosch & Syvertsen 1983			2				21		2	2	1		2	36	5	2	12	2	1	6	4	
Campylosira cymbelliformis (A.W.F.Schmidt) Grunow ex Van Heurck 1885		10	16	12	24	64	6	9	52	40	13	14	21	10	23	39	10	13	10	9	7	11
Cymatosira belgica Grunow 1881	3	137	148	120	90	110	80	72	123	95	88	94	94	54	94	97	108	106	97	91	114	76
Delphineis minutissima (Hustedt) Simonsen 1987	1	56	106	109	50	30	81	126	88	53	190	134	196	127	175	109	179	128	124	199	159	184
Delphineis surirella (Ehrenberg) G.W.Andrews 1981		50	19	40	58	15	48	42	47	70	25	34	12	37	20	34	10	21	38	10	40	17
Diploneis aestuarii Hustedt 1939		4	5	11	20	3	6	5	4	5	10	8	5	5	7	2	6	4	10	3	2	6
Neobrightwellia alternans (Bailey) M.P.Ashworth & P.A.Sims 2022								1														
Odontella aurita (Lyngbye) C.Agardh 1832			4	2	2	4	4	2		3	1	1	7	2	2	5		2	2	4	5	6
Plagiogrammopsis vanheurckii (Grunow) Hasle, Stosch & Syvertsen 1983		3	11	3	6	26	16	15	4	7	4	9	9	5	6	8	3	3	1	12	4	10
Pseudopodosira westii (W.Smith) Sheshukova-Poretskaya & Glezer 1964		16	1	2	6	3	2	2	1		1	3	1	1	2	7		3	7	4	2	7
Ralfsiella smithii (Ralfs) P.A.Sims, D.M.Williams & Ashworth 2018		2						1	8	3		2	1	2								
Rhaphoneis amphiceros (Ehrenberg) Ehrenberg 1844		22	10	24	34	14	14	15	34	49	17	28	12	78	11	26	2	13	17	2	26	2
MARINE/BRACKISH UNKNOWN LIFE FORM																						
Denticula subtilis Grunow 1862				1								2	1		2		1					
Eunotogramma marinum (W.Smith) Grunow 1908				1								1				1						2
Halamphora wisei (M.M.Salah) I.Álvarez-Blanco & S.Blanco 2014						3				1			1									
Nitzschia cf. *liebethruthii* Rabenhorst 1864	9																					

MARINE/BRACKISH EPIPELIC																						
Bacillaria paxillifera (O.F.Müller) T.Marsson 1901				1				1														
Diploneis didymus (Ehrenberg) Ehrenberg 1845		1		1	1						1	2				2			2			2
Diploneis smithii (Brébisson) Cleve 1894		2												1		1				1	1	2
Fallacia forcipata (Greville) Stickle & D.G.Mann 1990				1		2			1	1	1								1			
Fogedia finmarchica (Cleve & Grunow) Witkowski, Metzeltin & Lange-Bertalot 1997						3			2	1			1	1								
Gyrosigma cf. acuminatum Ehrenberg 1832					3																	
Halamphora cf. *coffeiformis* (C.Agardh) Mereschkowsky 1903						1			1	1		1		3	1		1		1			
Navicula arenaria Donkin 1861						12																
Navicula cf. phyllepta Kützing 1844					6	4	3		1		2	2										
Navicula cf. spartinetensis M.J.Sullivan & Reimer 1975					3		1	1			1		1			1	2			1		1
Navicula cincta (Ehrenberg) Ralfs 1861	7		4		4	5		1			2						4		2	3	3	2
Navicula digitoradiata (W.Gregory) Ralfs 1861																			1			1
Navicula meulemansii A.Mertens, A.Witkowski & Lange-Bertalot 2013			3	1												1	1	1				
Navicula microdigitoradiata Lange-Bertalot 1993			1				1	2		1	1						1	1				
Psammodictyon panduriforme var. *continuum* (Grunow) Snoeijis 1998					1		2	2	1	1	1	2	1	1	2	1		1	2	2	3	1
Nitzschia sigma (Kützing) W.Smith 1853		1					1	1				1										
Staurophora cf. *dubitabilis* (Hustedt) Clavero & Hernández-Mariné 2009					2	3	2		2	1												
Tryblionella apiculata W.Gregory 1857	2				1		2									1	2	1		1		1
Tryblionella granulata (Grunow) D.G.Mann 1990				1																		
Tryblionella navicularis (Brébisson) Ralfs 1861		3		1			1	1	1	1	2	1	1	1		4			2	1	1	1

MARINE/BRACKISH EPIPSAMMIC																						
Amphora pediculus (Kützing) Grunow 1875	1						1															
Anorthoneis cf. *pulex* Sterrenburg 1987															1	1						
Biremis lucens (Hustedt) Sabbe, Witkowski & Vyverman 1995				1	5	40	15	2	4	8	2		1	4		2			4	1	1	1
Catenula adhaerens (Mereschkowsky) Mereschkowsky 1903		1	1				1							1	1		1	3	2			3
Cocconeis peltoides Hustedt 1939				1	1		1		1	1	1	1		1						1		
Fallacia scaldensis Sabbe & Muylaert 1999					2	1		1														
Fragilaria cf. *eichhornii* Witkowski & Lange-Bertalot 1995							1		4	2		2										
Navicula perminuta group Grunow 1880		1	8	2	3	9	15	4	7	7	7	4	19	14	31	11	32	15	9	34	6	17
Opephora mutabilis Sabbe & Wyverman, nom. inval. 1995					3	8	1	1		2	2											
Plagiogramma minus (W.Gregory) Chunlian Li, Ashworth & Witkowski 2020		1	2		1		3	4	1	1	1	1	1		3	1	2	2	1	7	2	2
Plagiogramma staurophorum (W.Gregory) Heiberg 1863									1													
Plagiogrammopsis minima (Salah) Sabbe & Witkowski 2010					1	7	3	1	7	3		1	2		3	1	1	1				
Plagiogrammopsis sigmoidea Sabbe, Vaneslander, Witkowski, Ribeiro & Vyverman		2	19	3	1	16	2	5	3	10	6	1	5		6	4	21	10	6	5	6	21
Planothidium cf. *delicatulum* (Kützing) Round & Bukhtiyarova 1996		3	4	8	19	18	12	3	14	9	3	1	5	2	2			1	4	3	5	2
Pseudostaurosira perminuta (Grunow) Sabbe & Wyverman 1995					2	16	3		1		1		3	1	1	2	2	1				
Staurosirella guenter-grassii (Witkowski & Lange-Bertalot) E.A.Morales, C.E.Wetzel & Ector 2019				2		7	2	1	6	5	1	1		6	1	1	3	1				
Tryblionella coarctata (Grunow) D.G.Mann 1990		2		3	4		1	2	1			2		2		1		1	1			
Tryblionella compressa (Bailey) Poulin 1990												1						1		1		

MARINE/BRACKISH EPIPHYTIC																						
Cocconeis placentula var. *euglypta* (Ehrenberg) Cleve 1895	2	1	1	1	1			1			2	2						1				1
Cocconeis scutellum Ehrenberg 1838						1	1	3	1		1	5	1		1	1			1		1	

Ctenophora pulchella (Kützing) D.M.Williams & Round 1986	1																					
Rhopalodia musculus (Kützing) O.Müller 1900				2						1						1					1	
MARINE/BRACKISH AEROPHILOUS																						
Diploneis interrupta (Kützing) Cleve 1894			1																			
BRACKISH PLANKTONIC																						
Cyclotella striata (Kützing) Grunow 1880		4	1	3	4	1	2	1	2	3	2	2			2	3	1	7	2	1	2	2
BRACKISH/FRESHWATER UNKNOWN LIFE FORM																						
Amphora copulata (Kützing) Schoeman & R.E.M.Archibald 1986	4																					
Caloneis amphisbaena (Bory) Cleve 1894						1																
Gedaniella cf. *flavovirens* (H.Takano) Chunlian Li, A.Witkowski & Ashworth 2018	37																					
Gomphonema cf. *subclavatum* (Grunow) Grunow 1884	1																					
Gomphonema micropus Kützing 1844	4																					
Gomphonema parvulum (Kützing) Kützing 1849	7																					
Halamphora normanii (Rabenhorst) Levkov 2009	1																					
Halamphora veneta (Kützing) Levkov 2009	1																					
Hippodonta capitata (Ehrenberg) Lange-Bertalot, Metzeltin & Witkowski 1996					1																	
Navicula veneta Kützing 1844	2																					
Nitzschia amphibia Grunow 1862	3																					
Planothidium frequentissimum (Lange-Bertalot) Lange-Bertalot 1999	6																					
Planothidium lanceolatum (Brébisson ex Kützing) Lange-Bertalot 1999	18																					
Planothidium straubianum C.E.Wetzel, Van de Vijver & Ector 2019	4																					
Iconella brebissonii (Krammer & Lange-Bertalot) Bukhtiyarova 2021	1				1		1	1														
BRACKISH/FRESHWATER PLANKTONIC																						
Stephanocyclus meneghinianus (Kützing) Kulikovskiy, Genkal & Kociolek 2022					1						1											
FRESHWATER PLANKTONIC																						
Meridion constrictum Ralfs 1843											1											
BRACKISH/FRESHWATER TYCHOPLANKTONIC																						
Pseudostaurosira brevistriata (Grunow) D.M.Williams & Round 1988								1		1												
Staurosira construens Ehrenberg 1843	1																					
FRESHWATER EPIPHYTIC																						
Epithemia adnata (Kützing) Brébisson 1838																1						
Epithemia turgida (Ehrenberg) Kützing 1844						1																
UNKNOWN ECOLOGICAL GROUP																						
Actinocyclus spp.									1							1		1				
Cocconeis spp.			2						2	2			2	2	3			1		1		3
Cyclotella spp.														1		3		6	3	1		
Fallacia spp.					4					2		1								1		
Fragilaria cf. *cassubica* Witkowski & Lange-Bertalot 1993							1			1												

Halamphora group 1						3	1					1		1	1	1	1		2			
Halamphora group 2						4	2		1					1		1	1					1
Halamphora spp.				1	1	1	2		1													
Navicula group 1			1										1	1			2					
Navicula sp.2			1													1	1					1
Navicula sp.5						6		1		1												
Navicula spp.		1	1									1	2	1	4	4	5	3	1	2		2
Nitzschia sp.1		2	1														16	4		1	2	2
Nitzschia spp.	2																					
Opephora sp.1					2	6	2	1	3			1										
Opephora spp.		2				4	1		2		2			5	5	2	2	3				
Planothidium sp.1					3	7	2		1	1		1		1	2		1		1			
Planothidium spp.			2			8	5		2	1			2	1	6	1	1	1	2	1	1	2
Thalassiosira sp.1			7	2	2		1	3		4	2		1	1		4	6	3	3	5	3	11
Thalassiosira sp.2			1	1				1					3			6		2			2	
Thalassiosira spp.			1												1		3	3			1	2
Tryblionella pararostrata (Lange-Bertalot) Clavero & Hernández-Mariné 2009			1				1	1				1				1					1	

Diatom sum	**122**	**464**	**481**	**459**	**476**	**512**	**460**	**464**	**479**	**464**	**494**	**469**	**470**	**462**	**496**	**499**	**501**	**462**	**473**	**492**	**472**	**488**

Sample box	B5																													
Depth (m)	0.65	1.06	1.54	2.17	2.56	2.96	3.06	3.16	3.26	3.37	3.40	3.50	3.90	4.06	4.10	4.32	4.40	4.47	4.56	4.63	4.87	5.12	5.14	5.26	5.37	5.39	5.74	5.77	5.84	
Lithology	silty clay	silty clay	silty clay	silty clay	silty clay	silty clay	silty clay	silty clay	silty clay	organic detritus	silty clay	fine sand	fine sand	silty clay	fine sand	silty clay	sand	sand	sand	organic detritus	organic detritus	sand bed	organic detritus	fine sand	organic detritus	fine sand	fine sand	organic detritus	fine sand	
Architectural element	tidal flat	tidal flat	tidal flat	abandonned/low energy channel	abandonned/low energy channel	abandonned/low energy channel	accretion form	accretion form	accretion form	channel s.s.	channel s.s.	channel s.s.	channel s.s.	channel s.s.	channel s.s.	channel s.s.	channel s.s.	channel s.s.	channel s.s.	accretion form	accretion form	accretion form	accretion form	accretion form	accretion form	accretion form	accretion form	accretion form	accretion form	accretion form	
Tidal channel system			4	4	4	4	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2
Vos & de Wolf (1993)																														
MARINE PLANKTONIC																														
Actinoptychus splendens (Shadbolt) Ralfs 1861	1	1													2			4	2	1				1				2	1	
Aulacodiscus argus (Ehrenberg) A.W.F.Schmidt 1886																										1				
Coscinodiscus radiatus Ehrenberg 1840						1					2									2										
Paralia sulcata (Ehrenberg) Cleve 1873	151	105	49	28	32	35	17	28	21	49	36	36	52	40	54	48	61	85	44	52	36	29	32	48	53	46	34	41	34	
Podosira stelligera (Bailey) A.Mann 1907	9	3	1	1	2	4	4	3	2	12	3	9	7	3	8	9	12	19	10	4	6	3	3	5	2	6	2	1	3	
Thalassionema nitzschioides (Grunow) Mereschkowsky 1902	6	10	5	18	17	19	13	12	14	10	21	6	8	26	9	18	10	9	8	21	20	15	15	10	14	14	8	12	6	
Thalassiosira angulata (W.Gregory) Hasle 1978 or *Thalassiosira decipiens* (Grunow ex Van Heurck) Jørgensen 1905	3	14	21	18	18	22	13	16	16	19	22	17	5	10	20	21	16	13	12	21	15	11	12	25	13	12	15	8	12	
Thalassiosira eccentrica (Ehrenberg) Cleve 1904	1			1		1		1	1	2		2	1		4	3	2	2	1	1	1	2	1	3	2	1	1	1		
Thalassiosira tenera Proshkina-Lavrenko 1961				1		2		1	1					1						1										
Triceratium favus Ehrenberg 1839						1				1	1			1		1					1			1						
Zygoceros ehrenbergii E.A.Sar 2016	1		1	1					1				1				2					1			2	2	1		1	
MARINE TYCHOPLANKTONIC																														
Actinoptychus senarius (Ehrenberg) Ehrenberg 1843	13	2	2	2	2	4	3		1	4	4	4	4	4	2	3	2	13	8	2	4	1	3	2	1	1	1	4	3	
Brockmanniella brockmannii (Hustedt) Hasle, Stosch & Syvertsen 1983				1	1	1	2	1																						
Campylosira cymbelliformis (A.W.F.Schmidt) Grunow ex Van Heurck 1885	4	12	16	15	27	18	10	6	16	20	17	12	19	6	13	16	21	9	14	4	2	2	6	6	9	11	12	3	10	
Cymatosira belgica Grunow 1881	85	124	82	79	77	100	123	98	90	117	124	95	130	123	117	143	154	99	86	134	129	78	87	71	99	100	112	112	74	
Delphineis minutissima (Hustedt) Simonsen 1987	9	40	170	191	175	151	140	156	142	48	61	106	61	93	54	76	43	23	40	62	53	81	87	32	67	72	84	51	40	
Delphineis surirella (Ehrenberg) G.W.Andrews 1981	38	58	44	45	32	37	25	26	28	88	107	86	84	78	57	67	68	75	105	65	41	83	55	91	32	89	72	67	83	
Diploneis aestuarii Hustedt 1939	1	8	7	5	13	10	6	6	7	10	13	6	4	8	8	6	9	6	11	11	10	12	4	11	11	2	6	8	6	
Odontella aurita (Lyngbye) C.Agardh 1832			2	1	2	5	2	1	2	1	1			2	9	3				3	1		3	4	2	3	1	1		
Plagiogrammopsis vanheurckii (Grunow) Hasle, Stosch & Syvertsen 1983	1	3	5	12	10	5	6	5	10	2	9	2	4	9	5	10	3	3	3	2	5	6	9		3	6	2	1	3	
Pseudopodosira westii (W.Smith) Sheshukova-Poretskaya & Glezer 1964	13	11	5	3	4	3	8	2	9	9	3	5	5	7	7	9	9	16	6	4	5	2	2	5	3	6	2	4	3	
Ralfsiella smithii (Ralfs) P.A.Sims, D.M.Williams & Ashworth 2018						1																								
Rhaphoneis amphiceros (Ehrenberg) Ehrenberg 1844	47	35	12	11	17	20	13	12	19	56	30	44	31	24	31	31	27	45	62	36	28	41	27	48	22	34	31	29	59	
MARINE/BRACKISH UNKNOWN																														
Denticula subtilis Grunow 1862								1																						

Petroneis marina (Ralfs) D.G.Mann 1990	1											1														1		
MARINE/BRACKISH EPIPELIC																												
Bacillaria paxillifera (O.F.Müller) T.Marsson 1901						1																						
Diploneis didymus (Ehrenberg) Ehrenberg 1845	10	1	1						1	3		2			2	4	1	3	3	2	2	4	2	2	1	1	2	3	1
Diploneis smithii (Brébisson) Cleve 1894					1	1		1							1	1	2	6				2	1	1		1	1		1
Fallacia forcipata (Greville) Stickle & D.G.Mann 1990																		1											1
Fallacia pygmaea (Kützing) Stickle & D.G.Mann 1990										1	1										1				2			1	1
Fogedia finmarchica (Cleve & Grunow) Witkowski, Metzeltin & Lange-Bertalot 1997				1		1				1										1								1	
Gyrosigma cf. *acuminatum* Ehrenberg 1832				1	1	2	1	3		1		1			1			1			2	8	2	2	9	3			1
Hippodonta hungarica (Grunow) Lange-Bertalot, Metzeltin & Witkowski 1996																			1				2						
Metascolioneis tumida (Brébisson ex Kützing) Blanco & Wetzel 2016										2		3			1		2			2	1	1		2	5				
Navicula arenaria Donkin 1861						2		1							1	1	1		4		4	5	5	2	10		3	2	2
Navicula cf. *phyllepta* Kützing 1844				2	1	7		9	1						1	3				3	1	9	3	2	6	4	3	1	1
Navicula cf. *spartinetensis* M.J.Sullivan & Reimer 1975				3	4	3	1	5	2		1			1		3	3	3	3	1	5	2	7	1	10	3	3	9	3
Navicula cincta (Ehrenberg) Ralfs 1861		2				1	14	4	8	1	1		5	2	1	1	4	1		2	4	4	1	2	6	2	2	1	
Navicula digitoradiata (W.Gregory) Ralfs 1861									2																				
Navicula gregaria Donkin 1861																				1			1	1			1		
Navicula meulemansii A.Mertens, A.Witkowski & Lange-Bertalot 2013						2	6	12	5		2			11	5	8	2	1	1	9	7	5	8	4	5	5	6	2	1
Navicula microdigitoradiata Lange-Bertalot 1993				1		4	5	3	3	4	3	12	5	3	4	5	4	3	7	5	16	2	11	6	6	7	9	9	4
Nitzschia sigma (Kützing) W.Smith 1853	1	4		1	1	2		1	1	2			1		1	1	2	4	3		2	1			1		3	2	1
Psammodictyon panduriforme var. *continuum* (Grunow) Snoeijis 1998		1			3	2	1		1	1			1		2			1		2	1			1	2		2		1
Staurophora cf. *dubitabilis* (Hustedt) Clavero & Hernández-Mariné 2009			1		1						1					1	2	1	3	4	5		2	3	1		1	2	1
Trachyneis aspera (Ehrenberg) Cleve 1894			2		1	3	1							3	1			1			2			1					
Tryblionella apiculata W.Gregory 1857					1	1	4	5	1			1	1	3	2	3	2	1	1	5	7	4	3	2	3	3	5	3	3
Tryblionella granulata (Grunow) D.G.Mann 1990	17	3	1												1														
Tryblionella navicularis (Brébisson) Ralfs 1861	9		1	1	1	3		2	2	4	3	2	3		13	3	3	12	5	5	4	1	5	4	2	1	1	4	3
MARINE/BRACKISH EPIPSAMMIC																													
Achnanthes brevipes var. *brevipes* Agardh 1824	1												1												1				
Biremis lucens (Hustedt) Sabbe, Witkowski & Vyverman 1995					1	1	1																						
Catenula adhaerens (Mereschkowsky) Mereschkowsky 1903								1	1																				
Cocconeis peltoides Hustedt 1939	1		1					1					1		1	1			2						1		1	1	1	1
Fallacia scaldensis Sabbe & Muylaert 1999							1															1		1				1	1
Navicula perminuta group Grunow 1880			1	17	9	8	10	12	15			5	2		3		1	2		4	7	9	15	2	12	8	6	12	1
Opephora mutabilis Sabbe & Wyverman, nom. inval. 1995				1	2				2																				
Plagiogramma minus (W.Gregory) Chunlian Li, Ashworth & Witkowski 2020	2	4	12	10	7	3	1	1	1	2	1		3	3	1	2	7	1	2	2	4	2	1	1	1	2	4	2	
Plagiogrammopsis minima (Salah) Sabbe & Witkowski 2010					1	1			2						1														
Plagiogrammopsis sigmoidea Sabbe, Vaneslander, Witkowski, Ribeiro & Vyverman			1	2	4	8	9	8	3						3	3	3	1	1			1	2	3	1	1	3	1	1
Planothidium cf. *delicatulum* (Kützing) Round & Bukhtiyarova 1996			1	2	2	4	4	2	3	3		4	6	3	6	6	2	4	7	9	3	4	6	5		9	6	3	15
Pseudostaurosira perminuta (Grunow) Sabbe & Wyverman 1995								1	1	1	2		2			1	2	4	2	1	1	2	2			1	3	1	
Staurosirella guenter-grassii (Witkowski & Lange-Bertalot) E.A.Morales, C.E.Wetzel & Ector 2019	3			1			2	1	2						1		1		4			1					2	1	2
Tryblionella coarctata (Grunow) D.G.Mann 1990	2	3	2	1		1			2	5	1	1		1	1	2	3	1	2		3	4	2		5	2		3	2
Tryblionella compressa (Bailey) Poulin 1990	1	1				1					1		1			1	1		2					2					3
MARINE/BRACKISH EPIPHYTIC																													
Cocconeis placentula var. *euglypta* (Ehrenberg) Cleve 1895		1		1	2	4				1	3									2	2			1					2
Cocconeis scutellum Ehrenberg 1838		4	2	1				2	1		2						1	1	1	1			1	1	3		2		1

Grammatophora oceanica Ehrenberg 1840	1	1							1																			
Rhopalodia musculus (Kützing) O.Müller 1900											1	1					2				1	1					4	1	
MARINE/BRACKISH AEROPHILOUS																													
Diploneis interrupta (Kützing) Cleve 1894	1	1							1	1						2		1	2	2			2	1		1			
BRACKISH PLANKTONIC																													
Cyclostephanos dubius (Hustedt) Round 1988	1				1									1															
Cyclotella striata (Kützing) Grunow 1880	4	3	4	1		4	3	2	1	2	6	2	2		2	2	3	7	5	1	4	1	3	2	5	1	2	2	
BRACKISH/FRESHWATER UNKNOWN																													
Navicula tripunctata (O.F.Müller) Bory 1822																			1	2		1							
Stauroneis kriegeri R.M.Patrick 1945					1		1																						
Tryblionella levidensis W.Smith 1856																	1												
BRACKISH/FRESHWATER TYCHOPLANKTONIC																													
Pseudostaurosira brevistriata (Grunow) D.M.Williams & Round 1988									1						2	1		1								1			
Staurosira construens Ehrenberg 1843	1		1								1		2																
Staurosira venter group (Ehrenberg) Cleve & J.D.Möller 1879	2	1	1	2	2	1																							
FRESHWATER EPIPHYTIC																													
Epithemia turgida (Ehrenberg) Kützing 1844				1			1																						
BRACKISH/FRESHWATER AEROPHILOUS																													
Humidophila contenta (Grunow) Lowe, Kociolek, Johansen, Van de Vijver, Lange-Bertalot & Kopalová 2014									1																				
UNKNOWN																													
Actinocyclus spp.																	2												
Cocconeis spp.								3	2												1					1			6
Cyclotella spp.								1	2				1		1					2								1	
Diploneis sp.1		1									1					1													
Gomphonema spp.											1		1						1				1						
Halamphora spp.				1	1	1	1		2	1				1	6	2	1	1		4	5	4	5	3	3	3	3	1	6
Navicula group 1							2	8	1						1					2		3	4		3	2		7	
Navicula sp.2								7													4				4			1	
Navicula sp.3								1										1		1	1				1				
Navicula sp.4								1							3								1		1				
Navicula spp.							1	1					2		1	1					1	2	7		6	2		1	
Nitzschia spp.				1		2		1	2												3	1	2	1	4	2	3	3	
Opephora sp.1										1			2				1	1											
Pinnularia sp.									1			1												1		1		1	
Planotodium spp.	2	1						2	1	2	3			2		2				4	4		3						
Pseudostaurosira cf. ellipticolanceolata C.André, K.Sabbe & B.Van de Vijver 2023										1						1	1		1	1		1	1					1	
Pseudostaurosira spp.	1		1		1	3				2		1	6		1	2	4	5	7	1	1	4	2			4	5	6	2
Scolioneis sp.1								1					2		2	1	1			2	2	1		1		1	1		
Surirella spp.							1																		1				
Thalassiosira sp.1							1	1			3	2		1	3	1	1			2	2		2	5	1	4	3	1	2
Thalassiosira sp.2							1		3				4		1											2			

Thalassiosira spp.		1	1	3		2				1	1											2					1	1
Tryblionella pararostrata (Lange-Bertalot) Clavero & Hernández-Mariné 2009							1	2					2		1		1		1				1			2		
Diatom sum	**444**	**459**	**456**	**488**	**478**	**519**	**459**	**481**	**458**	**487**	**495**	**468**	**474**	**472**	**476**	**531**	**506**	**490**	**485**	**510**	**472**	**460**	**462**	**430**	**456**	**487**	**475**	**437**	**409**

Appendix 2. Pollen counts in core B5.

Sample box	B5																
Depth (m)	2.17	2.56	2.96	3.06	3.16	3.26	3.37	3.40	4.06	4.32	4.63	4.87	5.14	5.37	5.77	5.82	6.08
Lithology	silty clay	silty clay	silty clay	silty clay	silty clay	silty clay	organic detritus	silty clay	silty clay	silty clay	organic detritus	organic detritus	organic detritus	organic detritus	organic detritus	organic detritus	organic detritus
Architectural element	abandonned/low energy channel	abandonned/low energy channel	abandonned/low energy channel	accretion form	accretion form	accretion form	channel s.s.	channel s.s.	channel s.s.	channel s.s.	accretion form	accretion form	accretion form	accretion form	accretion form	accretion form	accretion form
Tidal channel system	4	4	4	3	3	3	3	3	3	3	2	2	2	2	2	2	2
TREES AND SHRUBS																	
Acer	2																
Alnus	73	75	62	43	68	47	63	62	91	85	72	80	73	61	63	65	83
Betula	24	30	25	32	27	28	24	19	14	25	36	33	28	39	38	25	49
Carpinus betulus	1	2	1	3	2	3		6	4	1	1			2			2
Corylus avellana	77	60	65	73	96	98	92	87	104	81	135	115	153	111	100	138	111
Fagus sylvatica	4	6	8	7	10	11	3	6	5	5	3		2	3	2	3	4
Frangula alnus				1	1						2	1		1			
Fraxinus excelsior	1	3	4	2	6	2	2	2	1	2	2	4	3		4	12	1
Hedera helix			1														
Ilex aquifolium			3					2		3							1
Juniperus communis	1				1									1			1
Pinus sylvestris	22	21	17.5	32.5	20	27.5	19	30	19	12.5	14.5	9.5	7	22.5	12	9.5	17
Quercus	33	34	42	72	63	60	41	35	41	42	51	46	39	46	58	57	39
Salix	3	7	3				3	3	8	4	6	3	5	2	1		5
Taxus baccata	4	5	6		2		2	2	4	6	1	3	7	4	6	5	8
Tilia	5	3	5	3	8	4	4	4	1	5	6	5	3	5	7	21	1
Ulmus	10		10	5	7	7	5	1	4		8	7	6	6	3	13	7
Saccate indeterminated	4	2	5.5	1	1	1	2.5	1		2				1.5	1		
HEATHLAND SHRUBS																	
Calluna vulgaris	16	8	16	34	24	46	17	6	15	14	16	22	19	27	33	44	28
Ericaceae		1					4	8	6	3	5	7	4	2	4		1
Vaccinium type	3	1	3	2	1	2	4	1		1	2	6	1	4	3	18	1
HERBS																	
Apiaceae	1	3	1				3	1		1	1		1			1	2
Artemisia	1	2	3	4	6	5		2	1	1	2	1	1	2			
Asteraceae-Liguliflorae	6	3	2	7	3	5		3		2							
Brassicaceae	3	7	1					1									
Caryophyllaceae	1		4	2		2			1		1	1	2	2			
Centaurea cyanus	1																
Cerealia type	5	8	4	1	3	3	1							1			
Chenopodiaceae	34	32	43	47	34	47	20	40	24	19	11	6	12	15	26	3	14
Cyperaceae	12	12	14	24	23	20	10	9	14	6	14	13	11	13	14	5	19
Filipendula		4			2		1			2							
Matricaria type	1		1		3		1										
Plantago lanceolata	1	1	3	2		2	2	1	3	1				1		1	1
Plumbaginaceae		1		3		2		1		1		4			3		1
Poaceae	75	91	80	96	47	68	93	84	61	87	53	71	51	57	58	11	55
Polygonum aviculare type		1								1							
Rubiaceae							1	2	1	2		1	1	1			2
Rumex acetosa type			1												1		
Senecio type	4	4	3	2	3	5	2	3	1	4			2				2
Trifolium	1	1															
Pollen sum	**429**	**428**	**437**	**498.5**	**461**	**495.5**	**419.5**	**422**	**423**	**418.5**	**442.5**	**438.5**	**431**	**430**	**437**	**431.5**	**455**
AQUATICS																	
Menyanthes trifoliata				1		1											
Potamogeton type	4	2	4				1	1	3	1		1				1	1
Rumex aquaticus type						2											
Sparganium type	6	2	2	12	1	2	6	13	5	5	15	12	9	7	8	3	12
Typha latifolia			1		2	1	1		1	1		3		1	1		1

SPORES																	
Filicales	55	53	70	138	124	178	132	83	117	88	89	104	147	103	60	38	144
Hymenophyllum							1										
Polypodium vulgare	1	1		1	2				1	1		1	1	1		3	1
Pteridium aquilinum	6	5	4	11	11	14	5	1	6	8	1	4	7	3	5	1	5
Thelypteris palustris		2	1	2	1	3	4		6		1	3		3	1	12	5
Osmunda regalis				3		1					2		1		2	1	
Sphagnum	51	33	42	21	18	11	42	28	46	27	58	58	76	73	143	230	63

NON POLLEN PALYNOMORPHS																	
FUNGI																	
Type HdV-1 (*Gelasinospora* sp.)											1						
Type HdV-4 (*Anthostomella fuegiana*)		2															
Type HdV-8B (*Microthyrium* sp.)					1											1	
Type HdV-10 (cf. *Trigocladium opacum*)	1	5	7				2		2	2	2	2	1	4	4		
Type HdV-13 (cf. *Entophlyctis lobata*)			1	1							1					23	1
Type HdV-14 (*Meliola niessleana*)			1				3	1			1		1	1			1
Type HdV-16 (*Byssothecium circinnans*)		1					1										
Type HdV-18 (unknown spore)	2	1					4	1		1		2		1			
Type HdV-23 (unknown spore)									1	1							
Type HdV-27 (*Tilletia sphagni*)		2	3				2		4	3	1		2	1		2	1
Type HdV-55A-B (Sodariaceae)		4		1													
Type HdV-143 (*Diporotheca* sp.)						1						2				1	1
Type HdV-207 (*Glomus* cf. *fasciculatum*)	1	1		4	1	6		2	1	1							
PROTOZOA																	
Type HdV-31 (*Amphitrema flavum*)									2					1	18	23	1
Type HdV-32 (*Assulina*)					2			1								7	
Type HdV-700 (linings of Foraminifera)	4	4	7	5	2	14		15	5	8	1	1	1		1		1
ACRITARCHS																	
Acritarch	4	1	3	11	5	12		3		2							
Type HdV-115 (*Micrhystridium*)	1	2			1				1								
Type HdV-116 (*Cymatiosphaera*)	1	1						1		1							3
ALGAE																	
Dinoflagellate cyst	18	16	11	23	10	18	2	9		8	1			1	3		5
Reworked dinoflagellate cyst		1		3	3	3		4	1	5					1		
Botryococcus braunii									1		1	1	1	1	2		
Pediastrum spp.	10	11	17	25	34	37	7	21	17	14	4	1	5	0	7	0	9
Type HdV-60 (Desmidiaceae)				1													
Type HdV-61 (*Mougeotia* cf. *gracillima*)			1	2	2	1	1			1				1			
Type HdV-128 (*Algae?*)	5	2	2	3	8	3	2	5	0	4	0	3	2	0	4	0	4
Type HdV-132 (*Spirogyra* sp.)						1											
Type HdV-314 (Zygnema-type)									1				2				
Type HdV-315 (*Spirogyra* sp.)				3													

ANIMALIA																	
Type HdV-28 (Spermatophore of Copepoda)	1																1
Type HdV-72 (*Alona rustica*)	1		1		5				1			1	2	1	1		
Type HdV-179 (Copepode or Protozoa)					1												
Type HdV-307B (unknown)					1												
Type HdV-353 (Rhabdocoela -Turbellaria)					1												
PLANTAE																	
Type HdV-114 (scalariform perforation plates)		3	2	8	8	8	3	2	9	1	1	2	1	3	1	2	3
INDETERMINATE	24	24	17	2	5	5	15	20	20	26	16	8	30	10	16	15	30
Pollen concentration																	
Lycopodium spores	131	124	118	236	217	291	84	426	143	174	79	41	44	33	270	195	139
Sample volume (cm^3)	1	1	1	1.3	1.3	1.3	1.2	1.6	1.0	1.0	1.4	1.5	2.7	2.6	1.0	1.0	1.0
Number of *Lycopodium* tablets	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Concentratie (pollen per mm^3)	46.8	49.3	52.9	23.2	23.3	18.7	59	9.1	42.3	34.4	58.8	99.9	52.2	73	23.1	31.6	46.8

Batchnr. 100320201:
14285 spores/tablet