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DIATOMS OF LAKE DEPOSITS FROM THE POLISH BALTIC COAST I. LAKE DRUZNO

Okrzemki w dennych osadach zbiorników wodnych polskiego pobrzeża Bałtyku. I. Jezioro Druzno

ABSTRACT

The results of research carried out on diatom flora in Lake Druzno profile (North-eastern Poland), are presented. The diatom succession is discussed in climatic zones determined by palynological method by Zachowicz (1971). The profile comprises 2 Late-glacial horizons: the Alleröd and the Younger Dryas, and the whole Holocene. In the Late-glacial there are numerous stenothermic cold-water diatoms, mainly acidophilous. The occurrence of aerophilous species indicates terrestrial conditions. In the early Holocene epiphytic, oligohalobous-indifferent diatoms predominante. Towards the end of the Older Atlantic the Lake became part of the Vistula Firth. This period was marked by the occurrence of meso- and euhalobous diatoms, and by the increasing value of planktonic species. Towards the middle of the Sub-boreal, the Lake water again became fresher and more shallow. The prevailing species at that time were littoral, oligohalobous diatoms. The process of isolation of the Lake from the Vistula Firth noted from this time and terminated at the beginning of the Younger Sub-atlantic.

CONTENTS

Table 1
Tabela 1

Description of profile
Opis profilu

Depth in m Głębokość w m	Sample No. Nr próby	Description of deposit (Zachowicz 1971) Opis profilu (Zachowicz 1971)	Stratigraphy Stratygrafia
1	2	3	4
0·00—0·92	1—7	calcareous gyttia gytia wapienna	Younger Sub-atlantic mł. okres subatlantycki
0·92—1·83	8—13	,, ,,	Older Sub-atlantic st. okres subatlantycki
1·83—3·78	14—24	,, ,,	Sub-boreal okres subborealny
3·78—6·64	25—40	,, ,,	Younger Atlantic mł. okres atlantycki
6·64—6·91 6·91—6·99 6·99—7·11 7·11—7·32 7·32—7·53 7·53—7·56	41—48	,, ,, strongly decomposed peat with detritus gyttia torf silnie rozłożony z gytią detrytusową weakly decomposed peat torf słabo rozłożony strongly decomposed peat torf silnie rozłożony siliceous gyttia with humus admixture gytia krzemionkowa z domieszką humusu strongly decomposed peat torf silnie rozłożony	Older Atlantic st. okres atlantycki
7·56—7·78	49—50	,, ,, ,,	Boreal okres borealny
7·78—8·40	51—58	weakly decomposed peat torf słabo rozłożony	Pre-boreal okres preborealny
8·40—8·56 8·56—8·63 8·63—8·78	59—62	,, ,, ,, peat with sandy admixture torf zapiaszczony calcareous gyttia with detritus gytia krzemionkowa z detrytusem	Younger Dryas mł. dryas

1	2	3	4
8·78—8·86		mossy peat with detritus torf mszysty z detrytusem	
8·86—8·94		peat with clay and sandy admixture torf z domieszką iłu i piasku	
8·94—8·97		calcareous gyttia with clay gytia krzemionkowa z iłem	
8·97—9·09	63—65	mossy peat with detritus and gyttia torf mszysty z detrytusem i gytią	Alleröd
9·09—9·31		detritus gyttia gytia detrytusowa	
9·31—9·40		fine-grained sand piasek drobnoziarnisty	

INTRODUCTION

Previous information on fossil diatom flora in the region of the South Baltic coast has been limited to results contained in the publications: Schulz 1926, 1928; Sandegren 1935, 1938, and Brockmann 1954. Research undertaken in 1967 comprises both the Baltic Sea and the bodies of water affected by it. The present study on the Lake Druzno sediments is part of this research.

Lake Druzno, now a separate physiographic unit, was in the past a part of the Vistula Firth. In the history of the development of this body of water, this fact had caused a fundamental change in the ecological conditions determining the diatom flora composition. It is the aim of this study to trace these changes, and above all to determine the duration and extent of the action of waters of maritime origin (through the Lake's connection with the Vistula Firth) upon the formation of the Lake Druzno diatom communities.

The study was prepared at the Department of Geomorphology and Geology of the Sea, affiliated at the Polish National Institute for Hydrology and Meteorology in Gdynia, under the guidance of Dr K. Wypych, to whom I am deeply indebted for suggesting the subject of research, as well as for his aid and support. I wish also to express my gratitude to J. Zachowicz M. A. for lending me the results of the pollen analysis of the profile under discussion.

I owe special thanks to Prof. dr J. Siemińska for her advice and valuable comments throughout my work on the present report.

PREVIOUS RESEARCH

A number of studies and reports have been published about Lake Druzno, the first of them dating back to the first half of the nineteenth century.

The results of pollen analysis of the core from the surroundings of Lake Druzno (Knoblauch 1931) are of special interest. This author referred the upper part of the deposit (over 4·0 m) to the post-Atlantic, and the lower (below 4·5 m) to the Atlantic, the two parts being divided by a layer of peat and peaty mud.

Bertram (1924), on the basis of historical and archaeological findings and geological research, prepared a hypothetical map of the Vistula delta, which also included the area of the present-day Lake Druzno, as it had been around the year 1300. On this map the Lake occupies an area considerably exceeding that of today, and is still linked with the Vistula Firth (Majewski 1969).

On the map draw by Henneberger in 1576 the Lake still takes up a vast area, and its northern part, even at that early stage, was very much as it is today (Majewski 1969).

Complex investigations were carried out in the years 1950—1961 under the guidance of J. S. Mikulski (1955) who described the Lake's present limnological characteristic. Gromadska (1956) found that the water in the Lake is not very transparent, has no oxygen or thermic stratification, a small content of phosphoric, nitrogen, and iron compounds in the water and that there is a periodic increase of chloride concentration in it. Tadajewski (1956) determined the bottom deposits of the Lake as siliceous with a large amount of organic substance of autochthonous origin. The remaining reports from this series deal with the results of ornithological research, as well as of investigations on zooplankton and water vegetation.

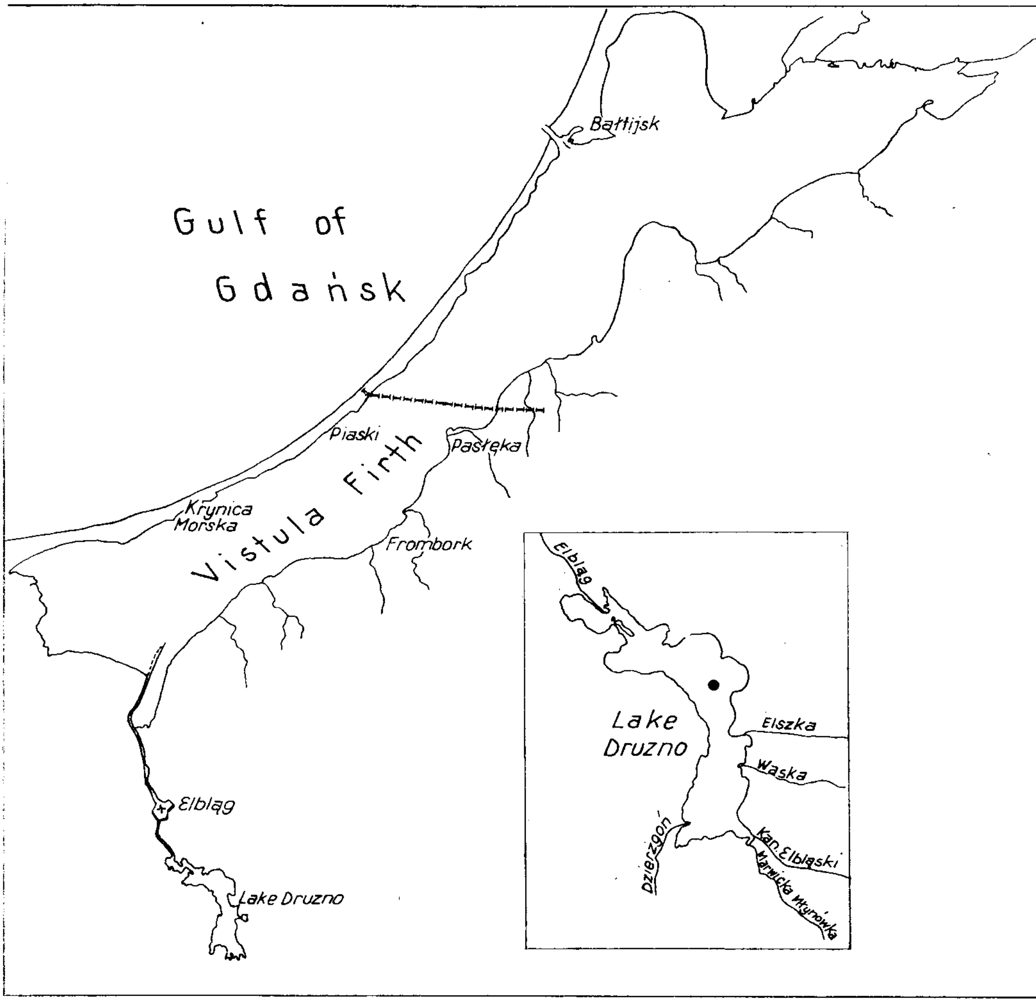
Hydrological research has served as a basis to calculate the Lake's water balance (Z. Mikulski 1964; Z. Mikulski, Bojanowicz, Ciszewski 1969).

Rosa (1963) described the Holocene formations surrounding Lake Druzno. He found that at the time when the Lake still formed a part of the Vistula Firth, its shore was "a live delta shore"; the accumulation of fluvial deposits led to a rapid decrease in the surface area of water in the Lake, particularly in its western part (accumulation of the Nogat delta).

THE SITE OF RESEARCH

Lake Druzno is situated between the Malbork Lowlands on one side, and the Elbląg Upland and the Vistula Firth, on the other. It is a remnant of the Vistula Firth bay, cut off by the Nogat delta deposits (Text-fig. 1).

The Lake is now a very shallow body of water, its mean depth amounting to 1·2 m and its maximum depth to 3·0 m. It is 10·0 km long, 2·2 km wide, the length of the developed shoreline amounting to 32·2 km (Z. Mikulski *et al.* 1969). The Lake is surrounded by protective dikes, necessary in view of the depression of the adjoining areas.



Text-fig. 1. Lake Druzno. ● — location of profile
Ryc. 1. Jezioro Druzno. ● — miejsce pobrania profilu

Lake Druzno is linked with the Vistula Firth by a navigable channel, more than a dozen kilometers long (the River Elbląg). This fact affects to some slight extent the hydrological conditions in the Lake, above all in its northern part. As found by Gromadska (1956), in 1950—1951 the average chloride concentration, calculated from 8 stations located along the Lake's axis, varied according to season and the position of the respective station from 20 to 360 mg Cl'/1. The maximum values are connected with the inflow of more brackish water from the Vistula Firth to the Lake and occasionnally occur in favourable anemobaric conditions. The predominant role in the Lake's water supply is now played by the inflow of fluvial water, amounting to about 70·0 per cent of the total volume (Z. Mikulski *et al.* 1969).

Lake Druzno is now rapidly becoming overgrown, and this is progressively reducting its area.

The Lake bed is covered by a 6 to 8 m layer of gyttia, whose thickness in the southern and western parts reaches to 10 m and more.

Because of the Lake's shallowness, the absence of oxygen and thermic stratification, the high oxidability of organic compounds inducted by the exuberant growth of organisms, this body of water may be classified as a pond type overflow-arm (J. S. Mikulski 1955).

MATERIAL AND METHODS

The investigations were carried out on a bottom-sediments core, coming from the central part of the Lake (Text-fig. 1). The core was collected with an "Instorf" type drill, by the Department of Marine Geomorphology and Geology of the Polish National Institute for Hydrology and Meteorology. At this place the water was 0·70 m deep.

Palynological investigations carried out by Zachowicz (1971) have shown that the examined core includes two Late-glacial zones (Alleröd and Younger Dryas) as well as the whole Holocene. The core sediments were described (Tab. 1; Text-fig. 2)[1] by Zachowicz (1971), in the terminology adopted by Troels-Smith (1955).

Samples for diatom analysis were collected at intervals ranging from 5 to 25 cm, dependent on the lithological changes in the sediment. In all samples were analysed.

The diatoms were extracted from the sediment by the method presented by Aleshinskaya and Pirumova (1963) and by Jusé (1966). The samples which contained calcium carbonate, were treated with a 10 per cent HCl. To clear the diatom valves of small clay particles, and in order to oxidize the organic parts, the samples were boiled in a water bath, in 15% H_2O_2. The diatoms were extracted from the deposit by floatation, with the aid of heavy cadmium liquid with a weight of 2·40. Solid preparations were made in pleurax (refractive index 1. 9).

[1] Text-fig. 2 and 3 are under the cover.

In determining the respective diatoms, the following works were referred to: Hustedt (1930—1966), Proshkina-Lavrenko (1949—1950), Cleve-Euler (1951—1955), Zabelina *et al.* (1951), and Siemińska (1964).

The number of diatom specimens in each examined sample was 500. Only in the poorer samples derived from the lower part of the core, did their number decreased to 300. When counting the specimens, only whole diatom valves or their large parts of them were taken into consideration, so as to eliminate any doubt which might arise as to their systematic relation. The taxonic frequenties are given in per cent.

In determining the dependence of diatom occurrence on the degree of water salinity, we have adopted Kolbe's halobe system (1927), distinguishing between:

1. euhalobous species, typically marine,
2. mesohalobous species, living in freshened seas, in sea gulfs, in brackish continental water bodies,
3. oligohalobous species, living in fresh water, among which the following may be distinguish:

(a) halophilous species, living in fresh water, a small amount of salt in the water stimulating their growth,
(b) inidifferent species — typical fresh-water diatoms, whose euryhaline forms can also live in waters of low salinity, where, however, they do not develop well,
(c) halophobous species — forms avoiding even the smallest amount of salt in view of its noxious effect.

In assigning diatoms to one of the above groups, the basis for determination were the ecological characteristics given by: Hustedt (1930—1966), Zabelina *et al.* (1951), Cleve-Euler (1951—1955), Proshkina-Lavrenko (1953), Brockmann (1954), Müller (1964), and Siemińska (1964).

The process of classification involved some major problems, in view of the fact that not infrequently the particular species have been classified differently by different authors. Divergence was found in particular in the ecological characteristics of oligohalobous halophilous and mesohalobous species. The decisive factor in their classification was the ecological description of the species as cited by the majority of the above authors.

QUALITATIVE AND QUANTITATIVE DIATOM COMPOSITION

In all, 389 taxonomic units of diatoms in the profile were determined, belonging to 43 genera; of this total 338 taxons belonged to the subdivision *Pennatae*, and 51 to the *Centricae*.

The number of taxons in the particular samples varied from 29 to 110 (Tab. 2). Diatom flora was most differentiated in the central part of the profile, less in the lower part, and least differentiated (31) at the depth of 6·95 to 7·06 m.

Throughout the profile the indifferent oligohalobous diatoms were most diversified in composition and were represented by 19 (at 6·95 to 7·06 m depth) up to 86 taxonomic units (in the top part of the profile).

The number of taxonomic units of halophilous diatoms is fairly high: from 3 (at 2·36 m) to 17 (6·64 — 6·31, 5·56—5·00 m). These taxons were a constant component of diatom flora in the examined profile.

The systematic units of halophobous oligohalobes are found only in the bottom part of the profile (from 9·31 to 8·40 m), but here, too, their number varies considerably, from 1 to 10 taxons. In the remaining part of the profile, halophobous diatoms are absent or occur only in small numbers. A slight increase and constant occurrence may again be observed in the top part of the profile (up to 4 taxons).

Taxons of mesohalobous diatoms are more numerous only in the middle part of the profile (from 6·87 to 3·17 m). Their number in the profile varies from 0 (in the top part of the profile) to 19 (at 6·40 m depth).

Euhalobous diatoms are least numerous. Only in the central part of the profile, their number slightly increases (up to 6). In the remaining parts of the deposit the euhalobes occur only in separate taxons, while they are totally absent from the top part of the profile.

The results of research on the proportion of taxonomic units in the halobous group, while giving a general idea of the changes taking place in the reservoir, do not reflect in full all essential changes in the ecological conditions occurring in the different periods of sedimentation of the deposit of the examined profile. The predominant units, those characteristic of present conditions, presented in the above form, occupy a position equal to that of accidentally found species, usually of allochtonous origin.

Far more accurate results were obtained by the quantitative method; and it was this method which served as the basis for the interpretation of the results of investigations (Tab. 3; Text-fig. 2).

Throughout the profile the number of specimens of oligohalobous indifferent diatoms is highest in comparison with the diatoms of the remaining ecological groups (from 60·9 to 97·5 per cent). They are most abundant in the lower and upper parts of the profile (from 9·31 to 6·87 m, and from 3·36 to 0·14 m), while they are least numerous in the central layer (from 6·87 to 3·36 m).

The number of specimens of halophilous oligohalobous diatoms, as well as the proportion of their taxonomic units is fairly significant throughout the profile (varying from 0·9 to 23·7 per cent). They are more numerous in the middle and top parts of the profile.

The quantitative value of halophobous diatoms varies from one part of the deposit of the examined profile to another. They are most numerous in its lower

Lake Druzno 1. Absolute numbers of diatom taxons

Jezioro Druzno 1. Bezwzględne ilości oznaczonych taksonów okrzemek

Table 2
Tabela 2

Sample No. / Nr próby	Depth in m / Głębokość w m	Pollen zone (after Firbas) / Fazy pyłkowe (według Firbasa)	Halobien groups / Grupy halobowe: Euhalobous / Euhaloby	Mesohalobous / Mezohaloby	Oligohalobous / Oligohalobowe: Halophilous / Halofile	Indifferent / Obojętne	Halophobous / Halofoby	Sum total of taxons / Suma taksonów
1	2	3	4	5	6	7	8	9
1	0,00-0,07		-	2	15	86	3	106
2	0,07-0,14		-	2	15	72	4	93
3	0,14-0,20		-	-	8	71	2	81
4	0,20-0,43	X	-	2	11	80	3	96
5	0,43-0,64		-	2	13	76	2	93
6	0,64-0,68		-	1	15	77	3	96
7	0,68-0,92		-	1	11	75	1	88
8	0,92-1,00		-	1	7	66	3	77
9	1,00-1,13		-	3	6	58	2	69
10	1,13-1,34	IX	1	-	7	68	1	77
11	1,34-1,50		-	1	10	58	1	70
12	1,50-1,61		-	1	8	62	2	73
13	1,61-1,83		3	2	14	68	3	90
14	1,83-2,11		5	3	7	65	-	80
15	2,11-2,22		3	2	5	48	-	58
16	2,22-2,34		3	3	5	45	2	58
17	2,34-2,39		6	3	3	40	-	52
18	2,39-2,69		2	4	4	49	-	59
19	2,69-2,85	VIII	4	1	6	45	-	56
20	2,85-3,06		2	2	8	54	-	66
21	3,06-3,17		1	3	8	50	1	63
22	3,17-3,36		2	4	11	64	2	83
23	3,36-3,54		3	6	10	59	-	78
24	3,54-3,78		5	9	15	56	-	85
25	3,78-3,93		6	10	9	42	-	67
26	3,93-4,03		3	8	9	44	-	64
27	4,03-4,18		4	10	11	56	1	82
28	4,18-4,29		3	11	13	65	-	92
29	4,29-4,47		3	9	12	67	1	92
30	4,47-4,73		1	6	14	70	1	92
31	4,73-5,00		6	10	15	74	1	106
32	5,00-5,22	VII	6	9	17	51	-	83
33	5,22-5,47		5	10	17	69	-	101
34	5,47-5,56		3	12	17	77	1	110
35	5,56-5,75		2	14	15	72	-	103
36	5,75-6,00		4	8	12	58	1	83
37	6,00-6,22		3	13	14	59	1	90
38	6,22-6,31		2	15	14	59	-	90
39	6,31-6,55		3	19	17	57	1	97
40	6,55-6,64		1	15	17	57	-	90
41	6,64-6,78		2	10	16	49	-	77
42	6,78-6,87		2	15	11	44	-	72
43	6,87-6,95		3	5	10	44	-	62
44	6,95-7,06	VI	1	6	4	19	1	31
45	7,06-7,15		3	2	8	24	1	38
46	7,15-7,34		-	3	10	42	2	57
47	7,34-7,45		1	3	9	31	2	46
48	7,45-7,59		1	2	9	37	1	50
49	7,59-7,67	V	-	2	7	38	-	47
50	7,67-7,76		1	4	11	52	-	68
51	7,76-7,80		1	3	10	59	-	73
52	7,80-7,87		1	4	12	59	1	77
53	7,87-7,95		2	5	7	52	-	66
54	7,95-8,04	IV	2	3	11	59	1	76
55	8,04-8,15		2	3	10	41	-	56
56	8,15-8,24		2	3	8	38	1	52
57	8,24-8,35		2	3	11	42	2	60
58	8,35-8,40		2	4	12	47	-	65
59	8,40-8,48		2	1	8	40	1	52
60	8,48-8,53	III	3	2	9	53	8	75
61	8,70-8,83		3	3	7	36	2	51
62	8,83-8,94		1	4	8	42	1	56
63	8,94-9,14		-	1	7	49	7	64
64	9,14-9,23	II	1	2	15	76	10	104
65	9,23-9,31		1	2	10	69	8	90

Table 3
Tabela 3

Lake Druzno 1. Percent proportion of different halobous diatom groups

Jezioro Druzno 1. Procentowy udział różnych grup halobowych okrzemek

Sample No. Nr próby	Depth in m Głębokość w m	Pollen zone (after Firbas) Fazy pyłkowe (według Firbasa)	Halobien groups Grupy halobowe				
			Euhalobous Euhaloby	Mesohalobous Mezohaloby	Oligohalobous Oligohalobowe		
					Halophilous Halofile	Indifferent Obojętne	Halophobous Halofoby
1	2	3	4	5	6	7	8
1	0,00-0,07		-	0,4	22,6	75,0	1,8
2	0,07-0,14		-	0,4	23,7	74,6	1,4
3	0,14-0,20		-	-	5,0	95,0	0,6
4	0,20-0,43	X	-	0,7	8,6	90,7	0,9
5	0,43-0,64		-	0,5	17,8	81,0	0,6
6	0,64-0,68		-	0,2	7,1	91,3	1,0
7	0,68-0,92		-	0,2	2,8	96,8	0,2
8	0,92-1,00		-	0,2	2,8	96,8	0,6
9	1,00-1,13		-	0,6	1,8	96,7	0,4
10	1,13-1,34	IX	0,2	-	5,0	94,3	0,2
11	1,34-1,50		-	0,2	2,7	97,1	0,2
12	1,50-1,61		-	0,2	5,0	94,2	0,4
13	1,61-1,83		0,7	0,4	4,7	93,1	0,6
14	1,83-2,11		1,0	0,5	2,2	96,4	-
15	2,11-2,22		0,8	0,4	1,9	96,7	-
16	2,22-2,34		1,0	0,6	0,9	96,7	0,4
17	2,34-2,39		1,4	0,6	1,1	97,5	-
18	2,39-2,69		0,5	1,0	1,6	96,4	-
19	2,69-2,85	VIII	1,3	0,2	3,1	95,8	-
20	2,85-3,06		0,5	0,5	2,6	96,2	-
21	3,06-3,17		0,7	0,3	6,5	92,8	0,2
22	3,17-3,36		0,4	1,2	6,3	92,2	0,4
23	3,36-3,54		3,3	2,6	15,5	78,3	-
24	3,54-3,78		23,3	3,6	11,8	60,9	-
25	3,78-3,93		9,5	4,3	8,0	78,2	-
26	3,93-4,03		9,1	3,4	3,9	84,1	-
27	4,03-4,18		11,4	4,5	9,8	73,6	0,2
28	4,18-4,29		10,1	4,5	11,0	74,6	-
29	4,29-4,47		1,0	1,8	8,8	88,7	0,2
30	4,47-4,73		1,0	1,9	7,8	89,6	0,2
31	4,73-5,00		8,6	3,1	10,0	78,6	0,2
32	5,00-5,22		4,0	1,9	9,8	84,5	-
33	5,22-5,47	VII	1,4	5,1	22,2	71,2	-
34	5,47-5,56		1,5	3,1	5,7	89,5	0,2
35	5,56-5,75		1,0	2,9	8,8	87,2	-
36	5,75-6,00		11,7	3,9	8,8	75,2	0,2
37	6,00-6,22		9,7	4,2	10,8	75,1	0,2
38	6,22-6,31		9,8	5,4	9,6	75,9	-
39	6,31-6,55		10,8	7,2	17,5	64,1	0,2
40	6,55-6,64		0,3	6,6	8,8	84,8	-
41	6,64-6,78		0,6	11,0	10,1	78,1	-
42	6,78-6,87		0,4	11,8	4,9	82,8	-
43	6,87-6,95		0,6	5,9	4,5	89,3	-
44	6,95-7,06	VI	0,2	1,9	1,7	96,1	0,4
45	7,06-7,15		0,8	0,5	2,4	96,2	0,3
46	7,15-7,34		-	0,8	3,8	95,0	0,4
47	7,34-7,45		0,2	0,6	5,1	94,0	0,4
48	7,45-7,59		0,2	0,9	3,5	94,9	0,2
49	7,59-7,67	V	-	0,7	2,5	97,3	-
50	7,67-7,76		0,2	0,8	4,4	94,9	-
51	7,76-7,80		0,2	0,7	4,3	95,1	-
52	7,80-7,87		0,2	0,9	6,6	92,3	0,2
53	7,87-7,95		1,0	1,7	7,9	89,2	-
54	7,95-8,04	IV	0,4	1,0	6,4	91,5	0,3
55	8,04-8,15		0,7	1,1	8,8	89,5	-
56	8,15-8,24		1,4	1,6	8,2	88,4	0,2
57	8,24-8,35		2,0	1,3	8,1	88,6	0,4
58	8,35-8,40		4,0	2,8	11,4	81,9	-
59	8,40-8,48		5,0	1,3	11,0	82,2	0,2
60	8,48-8,53	III	1,1	0,2	6,7	79,8	12,7
61	8,70-8,83		2,4	0,9	8,7	87,9	0,6
62	8,83-8,94		0,7	1,2	10,4	87,[illegible]	0,3
63	8,94-9,14		0,3	0,3	3,2	78,1	18,6
64	9,14-9,23	II	0,3	0,9	10,7	82,2	6,1
65	9,23-9,31		0,3	0,6	11,0	83,3	5,1

part (at deposit depth from 9·31 to 8·40 m); however, here too, the number of specimens of this group of diatoms oscillates over a wide range, from 0·2 to 18·6 per cent. In the remaining strata, halophobous diatoms occur, if at all, in a small number only, (from 0 to 0·6 per cent). The only exception is the top part of the profile, where the number of specimens increases again up to 1·8 per cent.

The number of specimens of mesohalobous diatoms is largest in the deposit layer from 3·36 to 6·95 m, and varies from 1·8 to 11·8 per cent. In the remaining strata, mesohalobous diatoms occur in very small numbers, from 0 to 2·8 per cent.

The euhalobous diatoms are more limited in range in the examined profile. Their quantitative value is the greatest in the deposit stratum from 3·36 to 6·55 m (up to 23·2 per cent of the total number of specimens). In the remaining parts of the profile the euhalobous species are either totally absent, or occur only in very small numbers (from 0 to 5·0 per cent).

DIATOM FLORA SUCCESSION

Diatom succession is treated according to the climatic zones, determined by the palynological method for the profile under examination, by Zachowicz (1971). The profile begins with a stratum of fine-grained sand, in which Zachowicz did not find any plant pollen. Diatoms are represented in this part of the deposit by 60 taxons, which however, occur in only very small numbers. In some preparations only 100 specimens of diatoms were counted. The largest per cent consisted of epiphytic and benthonic species, *Fragilaria construens* with var. *venter*, *F. pinnata*, *Opephora martyi*, *Cocconeis placentula*, *Amphora ovalis*, *Rhoicosphenia curvata*, *Pinnularia* sp. div., *Gyrosigma attenuatum*, *Epithemia zebra*, *E. sorex*, *E. turgida*, *Cymbella ehrenbergii*. In this part of the sediment there were only a small number of planktonic specimens: *Stephanodiscus astraea*, *S. hantzschii*, *Melosira granulata*, *Cyclotella meneghiniana*. In view of the uncertain origin of the diatoms which occur there, and their very low frequency, they are not discussed in detail in the present report.

The Late Glacial

In the sediment of this period the diatom frustules have undergone considerable destruction. This was particularly visible with frequent specimens of larger size. Diatom frequency was also so low that in some of the samples not even 500 specimens were counted, while in the stratum at 8·70—8·53 m depth (Younger Dryas) diatoms are almost totally absent.

As a result, special attention has been paid to the qualitative composition of the diatom flora occurring there. In fact, in this part of the sediment, a great many rare and interesting species clearly indicating climatic changes, were found which could easily be overlooked in quantitative analysis. Because of their very limited occurrence these species are highly significant from the stratigraphical point of view, this applying particularly to the stenothermal cold-water diatoms. Hustedt (1948) emphasizes that these species are rare in their native areas, and that as far as quantity is concerned, the eurithermal species greatly outnumber them.

The Alleröd

In the profile, this interstadial period comprises the stratum from 9·31 to 8·94 m (Tab. 1). Both the frequent changes in the lithological character of the sediment, and the accompanying changes in diatom flora composition, indicate the variable ecological conditions which presumably prevailed during the sedimentation period of this part of the deposit.

The diatom flora representative of the discussed period, has a characteristic composition (Tab. 2, 3, 4a-c[2]; Text-figs. 2, 3). Many stenothermic cold-water species were found, of which the major part consisted of diatoms of acidophilous character. Their occurrence in the profile is strictly confined to the Alleröd and, to a lesser extent, to the period following it. The species represented there are as follows: *Pinnularia viridis* and var. *commutata*, *P. streptoraphe*, *P. isostauron*, *P. borealis* with var. *minor*, *Eunotia praerupta* with var. *muscicola*, *E. sibirica*, *E. tenella*, *E. gracilis*, *E. fallax* and var. *gracillima*, *Cymbella gracilis*, *Navicula amphibola*, *N. semen*. The number of specimens of the above-listed species markedly increases towards the end of the period, then reaching their highest value. The most abundant specimens, there are those of *Pinnularia* and *Eunotia*, a species particularly characteristic of this period being *Eunotia sibirica*.

Diatoms which were a constant element throughout the whole profile were also found. The most numerous species are: *Fragilaria construens* with var. *venter* and var. *binodis*, *F. brevistriata*, *F. pinnata*, *F. capucina*, *F. virescens*, *F. alpestris*, *Opephora martyi*, *Cocconeis placentula*, *Amphora ovalis*, *Stauroneis anceps*, *S. phoenicentron*, *Gyrosigma attenuatum*, *Epithemia zebra*, *Cymbella ehrenbergii*, *C. cistula*, *Gomphonema acuminatum* and var. *brebissonii*, *Navicula menisculus*. Towards the end of this period, the number of specimens of aerophilous species, *Hantzschia amphioxys* and *Pinnularia borealis* increases (to 12·8 and to 2·7 per cent, respectively).

Of diatoms occurring within the period under discussion the epiphytic and benthonic species constitute a marked majority (up to 96 per cent of the over-all number of specimens). The proportion of planktonic species is insignificant in this part of the sediment; sporadic specimens of *Melosira granulata*, *M. italica*, *M. islandica* subsp. *helvetica*, *Stephanodiscus astraea*, and *Cyclotella meneghiniana* were found.

The main component of diatom flora from the Alleröd are the oligohalobous indifferent species (78·1—83·3 per cent of the total number of specimens). An important role was played during that period by halophobous species (chiefly representative of the genus *Eunotia*); towards the end of the period their per

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[2] Table 4a-c is under the cover.

cent value was the highest in the whole profile under examination (18·6 per cent of the total number of specimens).

The proportion of specimens of halophilous diatoms varies from 3·2 to 11·0 per cent. These are: *Rhoicosphenia curvata*, *Anomoeoneis sphaerophora*, *Navicula cryptocephala*, *Epithemia sorex*, *E. turgida*, *Cyclotella meneghiniana*. Their occurrence visibly decreases towards the end of the period.

Only single specimens of both the meso- and the euhalobous species of diatoms occur in the Alleröd, or they are absent altogether. Their rare occurrence, as well as the presence of Tertiary taxons (*Hemiaulus polymorphus*) among them seems to indicate that they had come from a redeposit. In the Alleröd sediment, as well as in the following one, we also observed the abundant presence of cysts *Chrysophyceae*, without, however, subjecting it to qualitative or quantitative analysis. Some of them are shown in photographs (Pl. VIII).

The Younger Dryas — III

The lithological character of the deposit strata referred to this colder period (8·94—8·40 m) is variable as it was in the preceding period (Tab. 1). This is also accompanied by some essential changes in diatom flora composition (Tab. 2, 3, 4; Text-figs. 2, 3).

In the lower part of the deposit (8·94—8·70 m) the flora composition of diatoms markedly differs from that observed in the Alleröd. Diatom flora had become considerably poorer, as to quality (as low as 51 taxons) and as to quantity. Cysts of *Chrysophyceae* also occur rarely here.

Of the species characteristic of Alleröd, the following only occur infrequently: *Pinnularia viridis* and var. *commutata*, *Eunotia praerupta*, *E. gracilis*, and *E. sibirica*. In this part of the deposit, it is the oligohalobous indifferent diatoms which are represented in greatest number viz.: *Opephora martyi*, *Fragilaria construens* and var. *venter*, *F. inflata*, *F. virescens*, *F. pinnata*, *Cocconeis placentula*, *Amphora ovalis*, *Epithemia zebra* and var. *saxonica*, *Gyrosigma attenuatum*, *Cymbella cistula*, whereas *Epithemia turgida*, *Navicula cryptocephala*, and *N. hungarica* represent the halophilous species.

Besides the above-listed epiphytic and benthonic species, this part of the sediment displayed a certain increase in the proportion of planktonic species. The most numerous of which are: *Melosira granulata*, *Stephanodiscus astraea* with var. *minutulus*, and, in lesser number: *Cyclotella meneghiniana*, *Melosira ambigua*, *M. isladica* subsp. *helvetica*, *M. italica*.

The unfavourable conditions accompanying the development of diatom flora at the time when the lower part of the Younger Dryas sediment was formed (as indicated by their low frequency) in all probability deteriorated still further, which may account for the almost total disappearance of diatoms in the upper part of the sediment. This gap can be observed in the sediment strata laying at 8·70 to 8·53 m in depth (Text-figs. 2, 3). A detailed revision of samples coming from this strata only revealed some isolated diatom specimens, and this with their marked deterioration and the occurrence among them of elements coming from a redeposition (*Actinocyclus igens* ?, *Actinoptychus undulatus*, *Coscinodiscus gorbunovi*, *Rhabdonema arcuatum*) made it impossible treat this material as having occurred in situ. In the pollen spectrum no such gap was observed. Throughout the Younger Dryas the pollen occurs without interruption (Zachowicz 1971).

In the upper strata of the sediment (8·53—8·48 m) the composition is different and diatom frequency higher. There is a growing number of specimens of cold-water stenothermal species, most of them of acidophilous character. The following species were observed to occur: *Navicula amphibola*, *N. semen*, *N. mularis*, *Pinnularia viridis* and var. *commutata*, *P. streptoraphe*, *P. isostauron*, *P. borealis*, *P. perlucens*, *Cymbella heteropleura* with var. *minor*, *Eunotia praerupta*, and var. *muscicola*, *E. bigibba*, *E. gracilis*, *E. tenella*. There is also an increase of the aerophilous species *Hantzschia amphioxys* and f. *capitata*. Apart from the above-listed species, the majority of which are present only in the strata of the Late-glacial sediment, a fairly large number of the species *Fragilaria construens* and var. *venter*, *F. pinnata*, *Neidium iridis* and f. *vernale*, *Stauroneis phoenicent-ron*, and *Cymbella aspera*, was also observed. This part of the deposit displays a marked prevalence of epiphytic and benthonic species, while only small numbers of planktonic species were found (8 per cent).

Species of the genus *Eunotia* were less numerously represented in the Younger Dryas than in the Alleröd. On the other hand, species of the genus *Navicula* were more numerously represented, among which the greatest proportion fell to *Navicula amphibola* (22·8 per cent of the total number). In the preceding period this species occurred only sporadically. The species *Eunotia sibirica*, characteristic of the preceding period, is totally absent from the Younger Dryas.

In the youngest part of the Younger Dryas there was a new, and quite important, change in diatom flora composition. Cold-water species, particularly those of acidophilous character, and the *Chrysophyceae* cystae, almost cease to occur at all. The predominant element is the genus *Fragilaria* (53 per cent of the total number of specimens), and especially *F. construens* with the variety *venter*, as well as the less numerous *F. pinnata* and *F. brevistriata*. There is also a fairly numerous occurrence of the following species: *Opephora martyi*, *Amphora ovalis* var. *pediculus*, *Cocconeis placentula*, and *Cymbella ehrenbergii*.

Particularly noteworthy is the occurrence in the Younger Dryas deposit, and in that of the early stage of the period which followed, i. e. the Pre-boreal, of mesohalobous (from 0·2 to 2·8 per cent), and euhalobous diatoms (from 0·7 to 5·0 per cent). The following species were observed: *Thalasiosira gravida*, *Anomoeoneis costata*, *A. sphaerophora* var. *sculpta*, *Caloneis amphisbaena*, *Campylodiscus echeneis*, *Mastogloia smithii*, and *Coscinodiscus* sp. div.

The occurrence of the above-listed species is accompanied by an increase in the frequenties of oligohalobous halophilous diatom specimens (up to 11·0 per cent), mostly represented by *Cyclotella meneghiniana*, *Anomoeoneis sphaero-phora*, *Navicula cryptocephala*, and *Nitzschia trybionella* var. *levidensis*.

The Holocene

The Pre-boreal — IV

The deposit relating to that period comprises the strata lying at a depth of 8·40 to 7·76 m (Tab. 1). As compared to the Late-glacial, a certain increase in diatom frequency was observed. The composition of diatom flora in this period resembled that observed towards the end of the preceding one (Tab. 2, 3, 4; Text-figs. 2, 3). The most numerous species was *Fragilaria construens*, with var. *venter* (up to 43·8 per cent). A lower per cent of specimens are *Fragilaria pinnata* and var. *lancettula*, *F. inflata*, *F. brevistriata*, *F. virescens*, *F. alpestris*, *Opephora martyi*, *Amphora ovalis*, *Cocconeis placentula*, and *Navicula scuteloides*, *N. menisculus*, *Epithemia zebra*, and *Gyrosigma attenuatum*. The above-listed epiphytic and benthonic species prevail in the composition of diatom flora during the Pre-boreal. Planktonic species are a major constituant only during the first half of this period (up to 36·3 per cent). The most numerous species among them was *Stephanodiscus astraea* with var. *minutulus*; less numerous species were: *Melosira granulata*, *M. ambigua*, *M. islandica* subsp. *helvetica*, *M. italica*. During the second part of that period these planktonic species were much less numerous, and they were only of minor significance (Tab. 4; Text-fig. 3).

Besides the above-listed oligohalobous indifferent species which constitute the predominant element in the composition of Pre-boreal diatom flora (from 81·9 to 95·1 per cent of the total number of specimens), a certain role is also played by halophilous species (from 4·3 to 11·4 per cent of the number of specimens). Their number were considerably higher in the lower part of the period than in the upper. The most numerous of the halophilous species were: *Cyclotella meneghiniana*, *Anomoeoneis sphaerophora*, *Rhoicosphenia curvata*, *Nitzschia trybionella* var. *levidensis*, and *Epithemia turgida*. The proportion of halophobous diatoms, abundantly represented in the Late-glacial, decreases and almost disappears (from 0 to 0·4 per cent).

As mentioned above, in the early Pre-boreal a more abundant occurrence of mesohalobous is observed (up to 2·8 per cent) and euhalobous (up to 4·0 per cent) species. These are the same as in the preceding period. In the higher part of the deposit relating to the period under discussion their number markedly decreases, and towards the end of the period they occur only sporadically.

The Boreal — V

In the examined profile, this period comprises the deposit strata at a depth 7·78 to 7·56 m (Tab. 1).

Diatom composition is in this part of the deposit similar to that of the Pre-boreal (Tab. 2, 3, 4; Text-figs. 2, 3). Epiphytic and benthonic species are again predominant. Again, too, the most abundantly represented genus is *Fragilaria*, the proportion of which even increases in the Boreal (up to 88·5 per cent). The largest percentual value is that of *Fragilaria construens* with var. *venter* (67·7 per cent). The following are less numerous: *Fragilaria pinnata* and var. *lancentulla*, *F. brevistriata*, *F. virescens*, *F. inflata*, *F. alpestris*, and *Opephora martyi*, *Navicula scuteloides*, *Cocconeis placentula*, *Amphora ovalis*, and var. *pediculus*. The above-listed species, as well as nearly all remaining ones during the Boreal, represent the indifferent oligohalobous diatom (94·9 to 97·3 per cent of the total number of specimens).

Halophilous diatoms are encountered in this part of the deposit in very small numbers (2·5 to 4·4 per cent of specimens), while meso- and euhalobous only occur sporadically. Halophobous species are absent altogether; they were also almost entirely absent from the preceding period.

Both in the pollen and in the diatom spectra the boundary lines of the Boreal are rather vague and blurred, so that it is not possible to draw far-reaching conclusions concerning the development of diatom flora during that period.

The Older Atlantic — VI

This period comprises the deposit strata at a depth of 7·59 to 6·64 m (Tab. 1). Both the lithological character of the deposit and the diatom composition display fundamental differences in the lower and upper parts of the discussed strata.

In the lower part of the deposit (7·56—6·95 m), diatom composition was found to be very much the same as in the two preceding periods (Tab. 2, 3, 4; Text-figs. 2, 3). There is a marked predominance of epiphytic species which are in fact more abundantly represented here than in any other part of the deposit, throughout the whole profile. The proportion of planktonic species in quite insignificant (up to 3·2 per cent). The most prominent species are again from the genus *Fragilaria*, among which *F. construens* with var. *venter* are the most abundant — up to 92·2 per cent (the maximum per cent value of this species for the profile as a whole). There is also an increase in the proportion of *F. pinnata*, *F. brevistriata*, *F. virescens*, and *F. inflata*. Other encountered species were *Amphora veneta* (the species did not occur in the preceding periods), *Nitzschia amphibia*, *Navicula oblonga*, and some others, found only in small numbers The species *Opephora martyi*, observed to be fairly numerous during the Preboreal, and somewhat less abundant in the Boreal, was found only as single specimens in the part of the deposit now under consideration.

In the composition of diatom flora relating to the lower part of the Atlantic there is a marked prevalence of the above-mentioned oligohalobous indifferent species (94·0 to 96·2 per cent of the total number of specimens).

The oligohalobous halophilous diatoms are not yet important in this part of the deposit (from 1·7 to 5·1 per cent of the total number of specimens). We found here mainly *Cyclotella meneghiniana* and *Anomoeoneis sphaerophora*. There was an almost total absence of both meso- and euhalobous species and, if they did occur, it was only as separate specimens.

During the second half of the Older Atlantic (the 6·95—6·64 m strata) there occurred changes both in the composition of diatoms (Tab. 2, 3, 4; Text-figs.

2, 3), and in the lithological character of the sediment (peat with gyttia passing into calcareous gyttia). Diatom flora becomes more differentiated and comprises from 62 to 77 taxonomic units, while during the first half of the period the number of taxons observed varied from 31 to 57.

In this strata, too, one observes an abundant development of oligohalobous indifferent diatoms, but their proportion is lower than in the lower part of the deposit (78·1 to 89·3 per cent of the total number of specimens). The genus *Fragilaria* continues to be the most numerous of all. A slight increase in the proportion of *Amphora ovalis* var. *libyca*, *Cymbella ehrenbergii*, *Nitzschia sigmoidea*, *Navicula cuspidata*, and *N. oblonga*, is noted. Moreover, we found some species absent from the older part of that age: *Synedra parasitica*, *Cymatopleura elliptica*, *C. solea* and var. *apiculata*, and in small numbers only *Gyrosigma attenuatum* and *G. acuminatum*.

Although the part of the Atlantic now discussed shows a prevalence of the same epiphytic species which constitute the main element during the first half of the period (mainly *Fragilaria*), they decrease noticeably in number. On the other hand, the number of benthonic diatom species increases, mainly of those of the genus *Navicula* and *Cymatopleura* (up to 29·4 per cent of the total number of specimens); also a slight increase in the number of planktonic species was noted (up to 5·6 per cent).

The feature most characteristic of the observed change in the diatom flora composition during the second half of the Older Atlantic is the constant occurrence of mesohalobous species, and the increase in their proportion up to 11·8 per cent. Among them the following were noted: *Anomoeoneis costata*, *A. sphaerophora* var. *sculpta*, *Caloneis amphisbaena* var. *subsalina*, *Campylodiscus clypeus*, *C. echeneis*, *Diploneis smithii*, species characteristic of the sea coast zone. The most numerously represented was *Anomoeoneis costata*, a species whose presence was prominent only in this particular part of the deposit. In the Younger Atlantic and later it is found only in very small numbers.

The halophilous species also increased in proportion during the second half of the period under discussion (up to 10·1 per cent of the total number of specimens). The following were comparatively more frequent: *Anomoeoneis sphaerophora*, *Cylotella meneghiniana*, *Caloneis amhisbaena*, *Navicula hungarica*, and *Diploneis smithii*.

The Younger Atlantic — VII

The deposit relating to that period comprises the strata of calciferous gyttia at a depth of 6·64 to 3·78 m (Tab. 1).

Throughout that period, diatom flora is differentiated, being composed of 64—110 taxons with a high frequency (Tab. 2, 3; Text-fig. 2). The oligohalobous indifferent diatoms continue to prevail, but their proportion is markedly lower, oscillating from 64·1 to 89·9 per cent of the total number of specimens. The composition is different from that of the preceding period. The most numerous species were the planktonic of which the most important was

Stephanodiscus astraea (up to 38·8 per cent of the total number of specimens, and the largest values in the whole profile), and *Melosira granulata* (up to 22·2 per cent of the total number of specimens). There also occur though in smaller numbers, *Melosira islandica* subsp. *helvetica*, M. *italica* and *M. ambigua* (Tab. 3, 4; Text-figs. 2, 3).

The proportion of planktonic species in the whole period under discussion varies greatly from one part of the deposit to another. In the case of *Stephanodiscus astraea* the maximum difference was 38·3 per cent.

An important role in the composition of diatoms belonging to that period is played by the epiphytic species *Opephora martyi* (up to 24·5 per cent). However, this particular species also varies in proportion in the different samples of this strata. During the second half of the period, when the most abundant development of *Stephanodiscus astraea* was noted, the quantitative value of *Opephora martyi* noticeably decreased.

The *Fragilaria* species, which had been prominent during the preceding periods, occur only in small numbers in the Younger Atlantic; towards the end of this period they decreased and almost disappeared, with the exception of *Fragilaria inflata*, which was found to increase in numbers.

Apart from the above-mentioned oligohalobous indifferent diatoms, occurring in greatest number in the deposit of the Younger Atlantic, another very large number of species was observed, which due to their constant occurrence or their growing presence constitute a characteristic component of diatom flora in this part of the deposit. These were: *Cocconeis disculus*, *C. placentula*, *Caloneis schumanniana* var. *biconstricta*, *Cymbella ehrenbergii*, *Cymatopleura elliptica* var. *hibernica*, *C. solea*, *Navicula menisculus*, *N. oblonga*, *N. pupula*, *N. reinhardtii*, *N. scuteloides*, *N. tuscula*, *Gyrosigma attenuatum*, *G. acuminatum*, *Nitzschia angustata*, *N. sigmoidea*, *Pinnularia microstauron*, *P. viridis*, *Surirella ovata*, *S. biseriata* var. *bifrons*, and a great many others which, however, occurred with less frequency.

An important part in the composition of diatom flora during the Younger Atlantic was played by oligohalobous halophilous species (Tab. 3, 4; Text-figs. 2, 3). However, their numbers vary over a fairly wide range, namely from 3·9 to 22·2 per cent of the total. The following species were observed (only the most important are listed); *Nitzschia trybionella* var. *levidensis*, *Navicula viridula*, *N. hungarica*, *Anomoeoneis sphaerophora*, *Surirella ovata* var. *crumena*.

The trait which is most characteristic of the change which took place in the composition of diatom flora of the Younger Atlantic is, along with an increase in the number of planktonic specimens, an increased in the number of euhalobous diatoms (Tab. 3, 4; Text-figs. 2, 3). Their proportion is not, however, the same through the period, and as in the case of indifferent oligohalobous and halophilous species, it varies considerably, from 0·3 per cent (in the lower part of the period) to 11·7 per cent of the total number of specimens (5·75—6·00 m). Such an abundance is observed only in the period now discussed and in the bottom part of the following one, when they attain their maximum value (23·2 per-cent).

The mesohalobous species, on the other hand, are less important during that period than they were towards the end of the preceding one, varying from 1·8 to 7·2 per cent of the total number of specimens.

Among the meso- and euhalobous species we noted the occurrence of *Achnanthes breviceps* var. *intermedia*, *Actinocyclus ehrenbergii*, *Actinoptychus undulatus*, *Caloneis amphisbaena* var. *subsalina*, *Campylodiscus clypeus*, *C. echeneis*, *Cocconeis scutellum*, *Diploneis didyma*, *D. interrupta*, *D. smithii*, *Grammatophora oceanica*, *Navicula crucicula*, *N. digitoradiata*, *N. forcipata*, *Nitzschia hungarica*, *N. commutata*, *N. scalaris*, *N. trybionella*, *Surirella striatula*, *Terpsinoë americana*, as well as species from the genus *Coscinodiscus*. The most important part in this composition is that of the planktonic species of the genus *Coscinodiscus*. The rest only occur in small numbers, nevertheless their occurrence in the deposit of the Younger Atlantic is important from the point of view of stratigraphy.

As mentioned above, the frequency of diatoms of every halobous group throughout the period under discussion varies greatly, which seems to imply some vital changes in the ecological conditions within the reservoir.

These changes were above all the outcome of the inflow of sea water to the reservoir. On studying the material it can be seen that the inflows become greater three times, which results in a more numerous occurrence of the euhalobous species of the genus *Coscinodiscus*. They are divided from one another by the periods when the reservoir was freshened and the fresh-water species developed more rapidly.

The first marked increase in water salinity, which is shown in the growth of the proportion of euhalobous diatoms to 11·7 per cent, and of mesohalobous to 7·2 per cent, is visible in the Lake Druzno profile at a depth 6·64 to 5·75 m. The inflow of sea water was acompanied by the raising of water level in the reservoir, which was reflected in the composition of diatom flora in the growth of the proportion of planktonic species. A particularly abundant development was noted in the species belonging to genus *Coscinodiscus* and *Stephanodiscus astraea*, which only occurred in small numbers during the preceding period. The number of specimens of this species in the lowest part of the deposit relating to the period now under discussion did not exceed 0·5 per cent, but then it increased to 34·3 per cent of the total number of specimens (Tab. 4; Text-fig. 3).

At 5·75 to 5·22 m a new change was noted in the composition of diatom flora. While the proportion of euhalobous species markedly decreased (to 1·0 per cent), that of the oligohalobous indifferent rose accordingly (to 89·5 per cent). This change is a reflection of a periodical freshening of the reservoir. Along with a decrease in the amount of euhalobous diatoms, a smaller per cent of plankton specimens was observed, both of the brackish- and fresh-water types (mainly *Coscinodiscus*, *Melosira*, and *Stephanodiscus astraea*). They were replaced to a considerable extent by epiphytic diatoms, among which *Opephora martyi* was represented most numerously.

Another increase in the number of euhalobous specimens (mainly plankton diatoms of the genus *Coscinodiscus*) was noted in the examined profile at 5·22 to 4·73 m.

The increase of salt concentration in the reservoir induced by the inflow must have been much lower this time, than in the early part of this period. The proportion of euhalobous diatom species was not particularly high in this part of the deposit (up to 8·6 per cent of the total number of specimens).

The deposit strata at 4·73 to 4·29 m shows another freshening of the reservoir, the last to be observed during the Younger Atlantic. A decrease is noted, both in the number of euhalobous diatom specimens (to 1·0 per cent), mesohalobous (down to 1·9 per cent), and oligohalobous halophilous (to 7·8 per cent). There is a marked predominance, in this part of the deposit, of oligohalobous indifferent diatoms (up to 89·9 per cent of the total number).

Whereas the first water freshening in the reservoir was accompanied by a decrease in the proportion of planktonic species, this tendency is not visible in the part of the deposit now discussed. The abundant growth of plankton to be observed in the lower strata of the deposit, goes on, and even grows more intensive (up to 57·2 per cent). Again, the most numerous representative is *Stephanodiscus astraea*.

The second period of the freshening of the reservoir did not, however, last long. At the depth of 4·29—3·54 m we observed the last — and the highest — increase in the number of euhalobous diatom specimens. Their largest occurrence (23·3 per cent of the total number of specimens) was already observed in the early part of the Sub-boreal. During the sedimentation of this part of the deposit, water salinity had probably reached the maximum values for the whole developmental period of the reservoir under examination.

The Sub-boreal — VIII

This period comprises the deposit strata at 3·78—1·83 m. It is again calcareous gyttia showing no marked changes in lithology, as compared to the strata representative of the preceding period (Tab. 1).

As mentioned above, in the lower part of the deposit from that period, we noted the maximum proportion of euhalobous diatoms, chiefly of plankton species of the genus *Coscinodiscus*. In the next sample their number rapidly decreases to 3·3 per cent of the total number of specimens, whereas in the rest of the deposit (from 3·36 m upwards) they are very rare (0·4—1·4 per cent). The mesohalobous and halophilous diatoms also occurred in more abundance (the former from 2·6 to 3·6 per cent, the latter from 11·8 to 15·5 per cent of the total number of specimens), whereas in the remaining part their role is insignificant (0·2—1·2 per cent, and 0·9—6·5 per cent, respectively). They are represented by the same species as in the preceding period (Tab. 3, 4; Text-figs. 2, 3).

Oligohalobous indifferent diatoms prevail throughout the whole Sub-boreal, but their number in the lower part of the deposit relating to that period — where the most abundant occurrence of diatoms of salophilous character was observed — is markedly lower (60·9—78·3 per cent of the total number). The strata at 3·36—1·83 m contains the maximum value (92·2—97·5 per cent of the overall number of specimens) of oligohalobous indifferent diatoms, for the whole profile (Tab. 3, 4; Text-figs. 2, 3).

The occurrence of oligohalobous diatoms — almost to the exclusion of all others — during the younger part of the Sub-boreal clearly points to an important change in the hydrological conditions in the reservoir, a change induced by the cessation of the inflow of sea water.

The diatom composition throughout this strata of the deposit is similar, the only varying element being the quantitative relations between the different components. This refers in particular to the varying proportion of planktonic species, as compared with epiphytic and benthonic.

In the early stages of the Sub-boreal, after the culmination of the inflow of sea water to the reservoir had passed there was a temporary decline in the proportion of planktonic species, *Melosira* and *Stephanodiscus astraea*, with a simultaneous increase of epiphytic and benthonic species *Fragilaria inflata*, *F. constuens* with var. *binodis*, *F. virescens*, *Gyrosigma attenuatum*, *Cymatopleura elliptica*, *C. solea*, *Epithemia turgida*, *Navicula menisculus*, *N. scuteloides*, *N. hungarica*, *Nitzschia angustata*, *Pinnularia microstauron*, *Surirella ovata* var. *crumena*.

In the upper part of the deposit (the 3·17—2·69 m strata) another major occurrence of planktonic species is observed — the last to take place, especially of *Melosira granulata* (up to 37·1 per cent of the total number of specimens), *M. italica* (up to 29 per cent) and, in smaller numbers, *M. islandica* subsp. *helvetica*, *M. ambigua* and *M. arenaria*, *Stephanodiscus astraea* constitutes only a very low per cent of the total number and, beginning from this part of the deposit, ceases to be a characteristic component.

During the second half of the Sub-boreal (from 2·69 m upwards), where an almost complete freshening of the reservoir was observed (maximum values of the proportion of oligohalobous indifferent diatoms), the frequency of planktonic species undergoes a striking decrease, the predominating species here being epiphytic and benthonic diatoms. This remained unchanged through the remaining parts of the profile (Tab. 4; Text-fig. 3).

Most of the species occurring in this strata were also found during the early stages of the Sub-boreal as well as during the preceding period; here, however, their per cent value increases noticeable. The species with largest number of specimens were *Navicula scuteloides* (up to 46·2 per cent), *Opephora martyi* (up to 30·7 per cent), and *Fragilaria inflata* (up to 22·1 per cent). Among the less frequent species were noted *Fragilaria construens* and var. *binodis*, var. *venter*, *F. pinnata*, *Campylodiscus noricus* with var. *hibernica*, *Cocconeis placentula*, *Gyrosigma attenuatum*, as well as others, present in this part of the deposit in small numbers only.

The Older Sub-atlantic — IX

This period comprises the deposit strata at 1·83—0·92 m (Tab. 1). Again, the predominant species were the oligohalobous indifferent ones (93·1—97·1 per cent of the total number of species, Tab. 2, 3, 4; Text-figs. 2, 3). Halophilous species were scarce (1·8—5·0 per cent of the total number), while the meso- and euhalobous almost disappear. Halophobous species (encountered sporadically in the lower Holocene zones) occur constantly, but in small numbers only (from 0·2 to 0·6 per cent of the total number).

The main component are epiphytic diatoms, reaching in the upper part of the period, their maximum values for the whole Holocene (82 per cent of the total number of specimens). Planktonic diatoms are poorly represented. It is only in the upper part of the deposit relating to this period (at 1·06 m and upwards), that a slight increase (up to 12 per cent) can be observed, which is due to a more abundant participation of *Melosira italica*. This change, was not, however, marked and was of short duration. Towards the end of the period the planktonic diatoms become very scarce.

There are great differences both in the flora composition, and in the numbers of the respective species, between the lower and the upper part of the Older Sub-atlantic. At the depth from 1·83 to 1·13 m diatom composition resembles that observed during the Younger Sub-boreal. The prevalent species continue to be *Fragilaria inflata* with var. *istvanffyi* (up to 23·9 per cent of the total number of specimens, the maximum value in the whole profile), *Opephora martyi*, *Navicula scuteloides*, and *Campylodiscus noricus* var. *hibernica*. Their participation, however, gradually decreases and they almost disappear towards the end of the period. The number of specimens of *Fragilaria construens* with var. *venter* and var. *binodis* increases in this part of the deposit, while we noted a decrease in the number of specimens of *Fragilaria virescens*, *F. pinnata*, *F. brevistriata*, *Gyrosigma attenuatum*, *Cymbella ehrenbergii*, *Cocconeis placentula*, *Cymatopleura elliptica*, *Surirella biseriata* var. *bifrons* f. *punctata*, and others.

During the second half of the period (the 1·13—0·92 m strata) we observed an almost total disappearance of the species characteristic of the Sub-boreal: *Campylodiscus noricus* var. *hibernica*, *Fragilaria inflata*, *F. virescens*, *Navicula scuteloides*, *Opephora martyi*, and *Surirella biseriata* var. *bifrons*. There is also a decrease in the number of *Gyrosigma attenuatum*, *Cocconeis placentula* and *Cymbella ehrenbergii*. The most numerously represented species are those of the genus *Fragilaria* (up to 66·5 per cent of the total number of specimens), especially *F. construens* with var. *binodis*, var. *exigua* and var. *venter*. The species *F. pinnata*, *F. brevistriata*, and *Amphora ovalis* are less numerous.

The Younger Sub-atlantic — X

The deposit relating to this period comprises the strata situated from 0·92 m to the top part of the profile (Tab. 1).

There is a marked prevalence of epiphytic species, particularly of *Fragilaria* *construens* with var. *binodis* and var. *venter*, *F. pinnata* and *Cocconeis placentula* as well as *Amphora ovalis* with var. *libyca* and var. *pediculus*. A smaller proportion was noted in the case of the following species: *Gyrosigma attenuatum*, *Cymatopleura elliptica*. *C. solea*, *Cymbella ehrenbergii*, *C. cistula*, *C. aspera*, *Gomphonema acuminatum*, *G. parvulum*, *Navicula menisculus*, *N. gracilis*, *Nitzschia amphibia*, *N. frustulum*, *Pinnularia viridis*, as well as others, encountered in small numbers only. In the top part of the core there are more numerous representatives of the species *Eunotia*, *Gomphonema* and *Cymbella* (Tab. 4).

Planktonic diatoms occur in the Younger Sub-atlantic in a small percentual proportion as during the preceding period (3·2—9·6 per cent). Among them, the greatest number of representatives belongs to *Stephanodiscus astraea* var. *minutulus*, whose share is growing in the top part of the core.

The main component of diatom flora during the Younger Sub-atlantic continues to be the oligohalobous indifferent diatoms (Tab. 2, 3; Text-figs. 2, 3), but the number of them varies from one part of the deposit to another (from 74·6 to 96·8 per cent). There is a decrease in their numbers in the strata from 0·64 to 0·43 m (81·0 per cent) and in the top part of the core (from 74·6 to 75·0 per cent). In particular, a marked decline was noted in the number of specimens of *Fragilaria construens* with varieties and *F. pinnata*, *Amphora ovalis* with varieties, *Gyrosigma attenuatum* and *Cymbella ehrenbergii*. On the other hand, there is a slight increase in the proportion of *Cocconeis placentula*, *Epithemia zebra* with varieties, *Achnanthes hungarica*, *A. lanceolata* var. *elliptica*, *Nitzschia amphibia*, *N. frustulum*, *Synedra amphicephala*, *S. ulna* and *Stephanodiscus astraea* var. *minutulus*.

The lower proportion of oligohalobous indifferent diatoms is linked with the increase in the numbers of halophilous ones. In the deposit strata from 0·64 to 0·43 m the number of these specimens constitutes 17·8 per cent, while in the top part of the core up to 23·7 per cent, which is the maximum per cent value for the whole profile. In the remaining parts of the deposit representative of the Younger Sub-atlantic, there is only a small number of halophilous diatoms, ranging from 2·8 to 8·6 per cent (Tab. 3, 4; Text-fig. 3).

Their growth was induced by an increased proportion of *Rhoicosphenia curvata*, *Epithemia turgida*, *E. sorex* and *Anomoeoneis sphaerophora*.

During the Younger Sub-atlantic a constant occurrence of halophobous diatoms was observed, and their increase up to 1·8 per cent (in the preceding period, from 0·2 to 0·6 per cent). They are represented mainly by the species belonging to the genus *Eunotia* and *Neidium*.

THE COURSE OF ECOLOGICAL TRANSFORMATION IN LAKE DRUZNO

Diatom analysis of the bottom sediment core in Lake Druzno has enabled the reconstruction of the ecological conditions in the reservoir during the Late Glacial and the Holocene.

The Late Glacial

In the deposits from this period there is a poor frequency of diatom occurrence and frequent changes in the diatom flora composition (Tab. 3, 4; Text-figs. 2, 3). It is accompanied by changes in the lithological character of the deposit (Tab. 1), induced by processes of intensive erosion. This supposition has found corroboration in the poor condition of the preserved diatom frustules, as well as in the occurrence of diatoms derived from the redeposit *(Coscinodiscus gorbunovi, Actinocyclus igens ?, Hemiaulus polymorphus)*.

According to Zachowicz (1971), it results from pollen analysis that in the examined profile the Alleröd is represented only by its youngest part, when the climatic conditions had deteriorated. The diatom flora from that part of the deposit confirms the results of pollen analysis.

Both in the Alleröd and in the Younger Dryas the composition of diatom flora is characterized by a numerous proportion of stenothermic cold-water species, chiefly of acidophilous character, whose occurrence is restricted to these periods only.

In the Alleröd the greatest number of specimens belong to the species of the genus *Eunotia* and *Pinnularia*, characteristic of the marshy bodies of water of a distrophic type. An important part is played by *Eunotia sibirica* whose occurrence is limited to this particular period only.

During the Alleröd we noted the occurrence of aerophilous diatoms (mainly *Hantzschia amphioxys*, *Pinnularia borealis*), considering that there is a marked increase of their numbers towards the end of the period, it may be inferred that conditions of growth were then more terrestrial.

The deterioration in climatic conditions led, in the Younger Dryas, to a considerable impoverishment of diatom composition and decrease in their number. This is a phenomenon characteristic of this period, confirmed by the observations of other researches (Fjerdingstad 1954; Simonsen 1957; Marciniak 1973). In the middle part of the deposit relating to the Younger Dryas (8·70—8·53 m) in all probability a further deterioration took place in the conditions for diatom flora development which, as a result, brought about their almost complete disappearance. A similar break in diatom development during the Younger Dryas was also observed in Lake Mikołajskie (Marciniak 1973). Material derived from both lakes, Druzno and Mikołajskie, shows this break dividing the younger from the older part of the Younger Dryas expressed in pollen diagrams. Owing to the absence of comparative material from North Poland it is not possible to estimate the extent of this phenomenon, or to account for the conditions which brought it about.

In the upper part of the Younger Dryas deposit, the increase in diatom frequency indicates that the climate became somewhat milder. Stenothermic cold-water species continue to occur in this part. The main component of diatom flora consists of the species *Pinnularia* and *Navicula*, the most characteristic being *Navicula amphibola* and *N. semen*.

Both *N. amphibola* and *N. semen* are common representatives in the Late-glacial deposits in North Europe, in the northern parts of the Soviet Union, and in Scandinavia (Mölder 1944; Hustedt 1948; Cleve-Euler 1953; Jusé 1966; Vishnevskaya, Davydova 1967; Marciniak 1973).

The composition of diatom flora from the Lake Druzno core during the Late-glacial was different from that of its contemporary deposits from the neighbouring bodies of water. Hustedt (1948) considers the following species most indicative of this period: *Cyclotella antiqua*, *C. distinguenda*, and *Gomphocymbella ancyli.* Simonsen (1957) had observed these species in the deposit from Dätgen (Holstein), from the Oldest Dryas up to Alleröd, inclusively. They were also noted in Lake Mikołajskie in the Late-glacial deposit (Marciniak 1973), while they are totally absent from the Late-glacial deposit from Lake Druzno.

The properties of diatom flora of the Late-glacial deposit examined by the present author, relating to the occurrence of cold-water species of acidophilous character, are consistent with the results of research on Late-glacial diatom flora in the reservoirs of northern areas, as well as with their present distribution. Jusé (1936) draws attention to the fact that the majority of species from the genus *Eunotia* and *Pinnularia*, which are numerously represented in the Late-glacial deposit of Lake Druzno, are now connected with northern areas, where they develop in water reservoirs of distrophic and oligotrophic type. According to Hustedt (1948) the present-day distribution of diatoms in the Sub-arctic region is determined chiefly by the chemical properties of the water (especially by the content of carbonates, and by the water pH dependent upon it). Most of the species developing within this climatic zone are of acidophilous character.

In the youngest part of the Younger Dryas deposit, diatom flora vitally differs from that in the older part, and is related by its composition to that observed in the period which followed it, the Pre-boreal. The occurrence of cold-water species, particularly of those of acidophilous character, almost ceases here. This change seems to imply a more moderate climate in the examined area, as early as towards the end of the Younger Dryas.

A similar composition of diatom flora was observed during the second half of Younger Dryas in Lake Mikołajskie (Marciniak 1973), where again the genus *Fragilaria*, represented by *F. construens* and var. *venter* and by *F. brevistriata* was the predominant element. Most of the remaining species which occurred at that time in Lake Mikołajskie were also found in the examined profile.

In diatom cores of other lakes, the genus *Fragilaria* is often among the most frequent components in the composition of Late-glacial diatom flora (Fjerdingstad 1954; Simonsen 1957; Robertsson 1973).

Particularly noteworthy is the occurrence, in the Younger Dryas deposit, in the examined profile, and early in the following Pre-boreal period, of meso- and euhalobous diatom species.

Their occurrence during that period is hard to account for, in view of the deficiency of comparative material, especially from the North of Poland. The assumption that they might have penetrated the area of research by way of inflow from the Baltic Sea, must be rejected in view of the low level of its waters at that time. The isolated specimens of Tertiary flora observed in this part of the deposit, no doubt coming from older formations, suggest that the remaining saliphilous species had found their way to this part of the deposit in a similar manner. However, their relatively high value (the mesohalobous species reaching 2·8 per cent, and the euhalobous 5·0 per cent of the total number of specimens) inclines us to look for another reason to account for the presence of these species.

Halophilous and mesohalobous diatoms were observed to occur in diatom cores in Scandinavian lakes, but earlier, in the Alleröd (Foged 1965; Robertsson 1973).

The occurrence of diatoms of saliphilous character observed in the core of Lake Druzno towards the end of the Younger Dryas and early in the Pre-boreal, is perhaps linked with a periodical increase in salt concentration in the waters: this however, requires further corroboration.

During the Alleröd and in the Younger Dryas, along with diatoms, an abundant occurrence of the cysts *Chrysophyceae* was observed, an occurrence restricted to these two period only.

The Holocene

The Pre-boreal — IV

In the early stages of Holocene the climate grew milder, and this is reflected in an increase in the frequency of diatom occurrence and the gradual disappearance of cold-water species typical of the Late-glacial.

The predominant type of diatoms in the Pre-boreal were the oligohalobous indifferent species, mainly epiphytic and benthonic, which shows that the water level was still low at that time. A certain increase in the number of planktonic diatoms during the first half of the Pre-boreal, seems to point to a slight rise of the water level, the result of a greater inflow of fluvial waters. It should be emphasized that throughout the Pre-boreal (as during those discussed above) the occurrence of rheophilous species is observed, among which *Fragilaria alpestris* was at the time most important.

The Boreal — V

The composition of diatom flora of the Boreal, as that observed during the preceding one, proves that the ecological condition in Lake Druzno did not undergo any visible change during that period.

The results obtained by other researches (Gross 1941; Brockmann 1954; Rosa 1963; Wypych, Nechay 1971) have proved that the Boreal had already brought the beginning of a slow process of biogenic accumulation on the site of the Vistula Firth of today.

The diatom flora composition in the Vistula Firth of the Boreal, as observed by Brockmann (1954) reveals a progressive rise in the water level. The fact that the composition of diatom flora in Lake Druzno shows no change induced by the rise of water level, as well as the fact that in the Lake different species prevail from those found in the Vistula Firth, indicate that these two bodies of water were unconnected during the Boreal. It has to be assumed that the rising of the water level in the Firth was not yet sufficient to permit the penetration of its waters into the waters under examination. Lake Druzno throughout the Boreal age continued to be covered by a vast peat-bog.

The boundary lines of the Boreal are in the examined profile rather vague, both in the pollen and in the diatom spectra. In the pollen diagram of the Vistula Firth deposits the situation is very much the same (Brockmann 1954).

Older Atlantic — VI

In the composition of diatom flora in this period there are considerable differences between the upper and its lower parts, connected with the change of the deposit: from peat to calcareous gyttia.

The resemblance of diatom composition in the lower part of the period (at 7·56—6·95 m) to that observed during the two preceding ones indicates that there was not vital change in the ecological conditions in the waters at that time. The almost total absence of plankton diatoms in this part of the deposit seems to indicate that the water level in the reservoir was as yet low.

In the pollen diagram still during the early stages of the period, Zachowicz (1971) observed a small increase in the proportion of water plants (*Potamogeton*, *Nymphaea*), which may be an indication that there was already a gradual rise of the water level, at the beginning of the period. However, as results from diatom analysis, this process only becomes distinct towards the end of the period, when the proportion of the genus *Potamogeton* increases, while that of rush communities decreases (*Typha latifolia* and *Sparganium-Typha*).

In the upper part of the Older Atlantic (at 6·95—6·64 m) the composition of diatom flora and the character of the deposit underwent a visible change, which shows that there must have been a marked change in the ecological conditions at that time. The peat-bog is covered with calcareous gyttia, and the examined area becomes a normal body of water. From the as yet small proportion of planktonic species it may be inferred that during the sedimentation period of this part of the deposit, Lake Druzno was as yet shallow. Oligohalobous indifferent diatoms still prevail, but their proportion diminishes, giving place to diatoms from other halobous groups. The value of meso- and oligohalobous halophilous diatoms grows, which indicates that the inflow of sea waters had already started at that time. The as yet small value of euhalobous species proves that the increase in salt concentration was still not considerable.

The most characteristic mesohalobous species is *Anomoeoneis costata*, playing a more important role only in this part of the deposit. During the Younger Atlantic and later it is found in very small numbers only. Its abundant occurrence, along with *A. sphaerophora* var. *sculpta*, was observed by the author in the cores of the Vistula Firth and Lake Jamno, again towards the end of the Older Atlantic, with the transition from peat to gyttia, which indicates the beginning of the inflow of sea water into these reservoirs (Przybyłowska-Lange 1973, 1974).

Other mesohalobous species, as well as the remaining diatom flora components, occurring in Lake Druzno towards the end of the Older Atlantic, were also found at that time in the Vistula Firth (Brockmann 1954; Przybyłowska-Lange 1974). Certain differences are related chiefly to their quantitative proportion. In the Vistula Firth the mesohalobous species are represented in larger numbers, thus proving that the inflow of sea water was greater.

From the above it may be concluded that towards the end of the Older Atlantic Lake Druzno of today was already part of Vistula Firth. The Littorina transgression which was taking place at that time in the Baltic Sea induced a rise of the water level in Vistula Firth,which, as a result, caused its inflow to the territory of Lake Druzno. At first it was just a shallow bay of the Firth, as can be seen from the small proportion of planktonic species, while in the Firth they developed more abundantly at that time (Przybyłowska-Lange 1974).

The Yonger Atlantic — VII

A feature characteristic of the composition of diatom flora of this period is the comparatively high value of euhalobous diatoms the occurrence of which is limited to that period and to the early stages of the following one. The large proportion of them proves that the inflow of sea waters which had begun towards the end of the preceding period, now increased, bringing an essential change in the hydrological conditions of the waters.

The fairly high oscillations in the proportion of diatoms of every halobous group, observed in the deposit of the Younger Atlantic, both in Lake Druzno and in the Vistula Firth cores, reveal a differentiation in the scale of sea water inflow to the two reservoirs. Greater inflows are visible in the material three times, reflected by a more abundant occurrence of diatoms, chiefly euhalobous. The third and largest value of them was observed at the borderline between the Atlantic and the Sub-boreal.

Between the consecutive increased inflows of sea waters the reservoir was freshened, which led to a decrease in the proportion of saliphilous diatoms. The water level in the lake also changed. The greater inflows of sea waters in the early stages of the period in question were accompanied by a raising of water level, which found expression in the increased value of planktonic species. The freshening of the reservoir, observed in the subsequent part of the deposit, was coupled with a periodical lowering of water level, which manifested itself in a decrease in the proportion of planktonic diatom species. The successive inflows of sea waters again brought about abundant growth of planktonic diatoms, which became the predominant element in the deposit and remained to the end of the period discussed.

The lowering of water level, observed in the middle of the Younger Atlantic was reflected in the pollen spectra. Zachowicz (1971) noted in this part of the deposit, visible signs of shallower water, shown in the growing proportion of floating water plants (*Potamogeton*, *Nymphaea*, *Trapa natans*). In the further part of the deposit, the pollen spectra again bear witness to a new raising of water level.

The increase in the inflow of sea waters, observed three times in the examined material, are in all probability connected with the consecutive transgression phases of the Littorina Sea in the Baltic. This has been corroborated by the composition of the saliphilous diatom flora, observed in the examined profile in the deposit for the Atlantic and early Sub-boreal. Nearly all meso- and euhalobous species occurring at that time are considered characteristic of the Littorina Sea (Schulz 1926; Sandegren 1935, 1938; Gross 1941; Brockmann 1954; Usikova *et al.* 1963; Kabaylene 1967, 1968, and others).

The majority of the above mentioned authors consider the species *Terpsincë americana* as the most characteristic for the Littorina Sea, in view of its occurrence being limited to this period only. Brockmann (1954) and others also consider as a fundamental characteristic of this period a diatom composition, in which *Campylodiscus clypeus* is represented with particular regularity. Brockmann classifies as "exclusive" (this term had been adopted by Brockmann after Cleve-Euler) the following species of the Littorina Sea occurring, along with the *C. clypeus*, in the Vistula Firth deposits: *Achnanthes breviceps* var. *intermedia*, *A. longiceps*, *Actinocyclus ehrenbergii*, *Caloneis amphisbaena* var. *subsalina*, *Campylodiscus bicostata*, *C. echeneis*, *Cocconeis scutellum*, *Coscinodiscus astreomphalus*, *C. radiatus* and *C. rothii* var. *subsalsa*. Both the *Terpsinoë americana* and nearly all the above-listed diatom species were observed in the Lake Druzno core in the strata coming from the Atlantic and early Sub-boreal.

The three-fold increase in the occurrence of diatoms — chiefly euhalobous — observed in the core under examination, and analysed as a results of the consecutive transgression phases of the Littorina Sea has found further corroboration in the results obtained by Kabaylene (1967) who studied the bottom sediments in the Kurish Firth. She had also distinguished in the cores three different horizons whose characteristic feature is an increased proportion of the saliphilous diatoms; she attributed these to the three phases of transgression of the Littorina Sea.

The results of investigations on the deposits from Lake Druzno and the Vistula Firth (Przybyłowska-Lange 1974) lead to the assumption that the transgression of the Littorina Sea — although it considerably affected the formative process of diatom flora in the waters under discussion — did not extend to this area. In fact, throughout the strata coming from the Atlantic and early Sub-boreal, it is the fresh-water diatom species that prevail. Transgression upon the examined area would probably have influenced the elimination of the fresh-water diatom flora to a greater extent. The Littorina Sea transgression probably induced slight changes in the salinity and in the water level within the Vistula Firth.

The more abundant sea water inflow may have penetrated to the investigated area through the Vistula Sand-Bar, then already in existence. Brockmann (1954) admits also the existence of the sand-bar at the very beginning of the Littorina transgression, founding this supposition on the low proportion of flora of Baltic origin in the examined profiles. Only in the region of the former straits, connecting the Vistula Firth with the Baltic, did he find a larger proportion of Baltic flora components.

The Sub-boreal — VIII

As already mentioned, in the early Sub-boreal period the inflow of sea wat er to the reservoir was the highest. In the Lake Druzno and Vistula Firth profiles this was expressed by the highest culmination of euhalobous diatoms, which was probably connected with the last Littorina transgression in the Baltic. The latter, as shown by Sauramo (1958), was the largest of all, and took place towards the end of the Atlantic and early in the Sub-boreal.

This inflow of sea waters to the examined area did not, however, last long, and suddenly came to an end. In a somewhat younger part of the Sub-boreal, the composition of diatom clearly shows that the reservoir had been freshened to a large extent. This part contains almost exclusively the oligohalobous indifferent diatom species, which reach their maximum proportion in this part, as compared with the rest of the profile.

This visible freshening of Lake Druzno during the first half of the Sub-boreal period was not, however, connected with its isolation from the Vistula Firth. This can be seen from the similar composition of diatom flora, as well as from the study of the changes in the Firth profiles, where the maximum value of the proportion of euhalobous diatoms also terminates the period of more abundant inflow of sea waters, starting a new period, during which the waters under examination considerably freshened (Przybyłowska-Lange 1974).

It appears that this freshening of the whole Vistula Firth area, which at that time still incorporated Lake Druzno, was not solely the result of the Littorina Sea regression which took place just at that time. And even though both the salinity and the water level in the Baltic fell, which may have affected the change of the hydrological conditions in the Firth, such a considerable freshening of the reservoir as expressed by a marked change in the composition of diatom flora leads to the assumption that this was due to the closing of the former straits which had connected the Firth with the Baltic.

Apart from the changes in the composition of diatom flora induced by the cessation of brackish-water inflow to the reservoir, throughout the Sub-boreal period some oscillation is also observed in the proportion of planktonic species on the one hand, and of epiphytic and benthonic species on the other, which indicates differences in water level. In the early stages of the period the water level in the reservoir probably did not undergo any major change as compared to the preceding period. The planktonic diatom species continued to prevail. True, the change in hydrological conditions induced a certain reduction in their proportion, but it was not considerable and of rather short duration. In the central part of this period where an almost complete freshening is observed, one notes a new — and final — increase in the proportion of the planktonic diatoms. This, however, did not last long, so that during the second half of the Sub-boreal planktonic diatoms were almost entirely absent, which is a proof of a considerable lowering of water level. This has also been clearly reflected in the pollen spectra of this part of the deposit. Zachowicz (1971) observed here an increase in the numbers of floating water plants (*Nuphar*, *Nymphaea*, *Nymphoides*), of rush species (*Sparganium-Typha*, *Typha latifolia*), and marsh species (*Caltha*, *Alisma plantago*). *Trapa natans*, characteristic of shallow pond-type waters also occurs here.

However, the fact that present-day Lake Druzno become much shallower during the second half of the Sub-boreal should not be attributed to the termination of the process of its isolation from the Vistula Firth. The similar composition of diatom flora in the two bodies of water testifies to this (Przybyłowska-Lange 1974). There are certain differences in the quantitative relations in this composition: thus, in the Vistula Firth there was a higher occurrence of planktonic species, which in the Lake Druzno profile only occurred in very small numbers. On the other hand, the Firth showed a less numerous occurrence of the littoral species *Navicula scuteloides* and *Opephora martyi*. Another difference consists in a somewhat greater share of mesohalobous species in the Vistula Firth deposit: which is of course to be accounted for by the direct contact between this part of the reservoir and the Baltic Sea.

The above data permit the conclusion that during the Sub-boreal Lake Druzno of today was still part of the Vistula Firth. Certain differences in the composition of diatom flora, occurring in the second half of the Sub-boreal, seem to indicate that even at that early time, the very slow process of the isolation of Lake Druzno from the Vistula Firth, had been started already.

The Older Sub-atlantic — IX

The differences in the composition of diatom flora in the older and younger parts of this period, point to a change in the ecological conditions within the reservoir.

During the older part of the period, diatom composition was similar to that observed during the preceding period. Almost the only diatom species occurring then were the oligohalobous indifferent ones, mainly represented by the epiphytic species the benthonic species were of less importance, whereas the planktonic species played only a minor part. At that time Druzno was a shallow fresh-water lake.

The composition of diatom flora in this part of the deposit was so far similar to that observed at that time in the Vistula Firth. There were some species characteristic of the Firth, mostly *Fragilaria inflata*, *Opephora martyi* and *Navicula scuteloides* (Przybyłowska-Lange 1974), but their value was gradually decreasing.

It may be supposed that in the older part of the Sub-boreal the water inflows from the Vistula Firth which had been freshened by then, still exerted a certain influence upon the ecological conditions of Lake Druzno, although to a much smaller extent than in the preceding period.

In the younger part of this period, the differences in the composition of diatom flora point to an essential change which had taken place in the ecological conditions in the lake under discussion. Whereas in the older part of the period the predominance of epiphytic species was coupled with a fairly high value of benthonic species, in this part of the deposit the latter occurred only in small numbers, while the proportion of epiphytic diatoms reached its maximum values for the whole Holocene. Lake Druzno had become a very shallow fresh-water lake.

Diatom flora in this part of the deposit differs widely from the Vistula Firth flora. While in the Firth the predominant species is *Opephora martyi*, in Lake Druzno its numbers gradually decreased, so that during the younger part of the period, this species was noted only in very small numbers. The remaining species, frequent at that time in the Vistula Firth, either did not occur in the discussed part of Lake Druzno deposit or, did so in only small amounts.

These differences in the proportion of the most characteristic species for both parts of the discussed body of water, observed towards the end of the Older Sub-atlantic, are an evident proof of the growing process of their separation. This process, induced by the rapid growth of the Nogat Delta, diminished the action of the Vistula Firth waters upon the ecological conditions in Lake Druzno.

The Younger Sub-atlantic — X

The composition of diatom flora during this period clearly indicates that the process of separation of Lake Druzno from the Vistula Firth, begun in the Sub-boreal, had been completed. From that time Lake Druzno become a separate physiographic unit, its only connection with the Firth being the Elbląg River.

Apart from some common species of ubiquitous character (mostly belonging to the genus *Fragilaria*), the remaining components of diatom flora in the two reservoirs were different at that time. In the Vistula Firth the predominant species was *Opephora martyi* (up to 64·0 per cent of the sum total), which occurred in the deposit of Lake Druzno in the early stages of the Younger Sub-atlantic only as single specimens, and was totally absent from the top part of the deposit. The remaining species characteristic of the Vistula Firth at that time, were also, either totally absent from the Lake Druzno deposit, or found only in very small numbers.

During the Younger Sub-atlantic, as in the preceding period, there was a marked prevalence of epiphytic diatoms, their composition clearly revealing a progressing process of this body of water becoming a marsh. This was particularly evident in the top part of the core.

As regards the composition, the oligohalobous indifferent species continued to be the prevailing component of diatom flora. However, their per cent value varied from one part to another: it decreased in the middle and top parts of the core, where the halophilous species grew in numbers. These changes may suggest a slight intensification of salt concentration in the reservoir, induced by a greater water inflow from the Vistula Firth. This hypothesis, is however, open to doubt.

In the Vistula Firth deposit we observed also at that time, a twice repeated change in the composition of diatom flora, as revealed by the growing proportion of saliphilous diatoms, but their composition seems to indicate that the reason for their appearance is different (Przybyłowska-Lange 1974).

The first change in the Vistula Firth ecological conditions observed in the upper part of the deposit in the examined cores, may have been connected with the Sub-atlantic transgression in the Baltic Sea. Besides a greater value of oligohalobous halophilous and mesohalobous diatoms, we noted also an increase in the number of planktonic species. The second change, clearly revealed by the increase in the proportion of diatoms, mostly mesohalobous (which reached their maximum value in the examined profile) was noted to occur in the top part of the profile. The latter was certainly due to the diminished amount of fluvial waters in the overall water balance of the Vistula Firth, which was induced by the closing of the Nogat River inflow (1915), whereas the volume of sea waters visibly increased at that time (Mikulski, Bojanowicz, Ciszewski 1969).

The changes observed in the composition of diatom flora in Lake Druzno within the Younger Sub-atlantic manifest themselves only by the growing number of specimens of halophilous species, mostly belonging to the genus *Epithemia* and *Rhoicosphenia curvata*, which occurred in small numbers only in the Vistula Firth profile.

It seems that the halophilous species in the Lake Druzno deposit cannot serve as a conclusive, indisputable index of the growth of water salinity in the reservoir. Most of them are alkalophilous species. Their increasing proportion, as well as the remaining components of diatom flora observed with them in the middle and top parts of the deposit relating to the Younger Sub-atlantic indicate a change of the reaction of the waters towards the alkaline. This is the more likely as the present-day reaction of the Druzno Lake water has also been determined as alkaline (Gromadska 1956). The change in the composition of diatom flora in the top part of the profile is a reflection of the contemporary ecological conditions in Lake Druzno.

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STRESZCZENIE

OKRZEMKI W DENNYCH OSADACH ZBIORNIKÓW WODNYCH POLSKIEGO POBRZEŻA BAŁTYKU. I. JEZIORO DRUZNO

Praca zawiera wyniki badań nad florą okrzemek z jednego profilu osadów dennych Jeziora Druzno (ryc. 1). Badania palinologiczne (Zachowicz 1971) wykazały, że profil ten obejmuje dwa piętra późnego glacjału (Alleröd i młodszy dryas) oraz cały okres holocenu.

W profilu oznaczono 389 taksonów, a ich liczba w poszczególnych próbach wahała się od 31 do 110 (tab. 2). Najliczniej występowały okrzemki oligohalobowe obojętne (19—86 jednostek), które i pod względem ilościowym były reprezentowane najobficiej (60,9—97,5% ogólnej liczby okazów). Udział okrzemek oligohalobowych halofilnych wynosi w całym profilu 0,9—23,7%, halofobowych 0—18,6%, mezohalobowych 0—11,8%, a euhalobowych 0—23,2%.

Osady późnoglacjalne odznaczają się na ogół słabą frekwencją okrzemek i częstymi zmianami ich składu (tab. 3, 4; ryc. 2, 3). Zjawisku temu towarzyszą litologiczne zmiany osadu (tab. 1). Analiza pyłkowa dowiodła, że Alleröd jest reprezentowany tylko przez najmłodszą jego część, kiedy to warunki klimatyczne uległy pogorszeniu (Zachowicz 1971). W składzie okrzemek znajdowano w tym okresie liczne gatunki stenotermiczne zimnowodne, z których większość należała do okrzemek acidofilnych. Najobficiej stwierdzono rodzaje *Pinnularia* i *Eunotia*, charakterystyczne dla zbiorników dystroficznych. Ważną rolę odgrywała *Eunotia sibirica*.

W Allerödzie i w młodszym dryasie licznie były reprezentowane okrzemki aerofilne (*Hantzschia amphioxys*, *Pinnularia*, *borealis*, *Navicula mutica*), co wskazuje na terestialne warunki w tym czasie. Pogorszenie się warunków klimatycznych w młodszym dryasie doprowadziło do znacznego zubożenia składu i ilości okrzemek, a w środkowej części osadu z tego okresu (8,70—8,53 m) do ich zaniku. W górnej części osadu młodszego dryasu głównymi składnikami są gatunki z rodzajów *Pinnularia* i *Navicula*, a do najbardziej charakterystycznych należą *Navicula amphibola* i *N. semen*.

Na pograniczu młodszego dryasu i okresu preborealnego występują okrzemki mezohalobowe (0,2—2,8% okazów) i euhalobowe (0,7—5,0% okazów). Liczniejsze tu są również okrzemki oligohalobowe halofilne (do 11,4%). Występowanie okrzemek mezo- i euhalobowych jest w tym okresie trudne do wytłumaczenia wobec braku materiałów porównawczych, a zwłaszcza z terenu Polski północnej.

Tylko w Allerödzie i młodszym dryasie obserwowano obfite występowanie cyst *Chrysophyceae*.

W okresach preborealnym, borealnym i w pierwszej połowie starszego okresu atlantyckiego obszar jeziora Druzno zajęty był przez torfowisko z okrzemkami litoralnymi oligohalobowymi obojętnymi. Najobficiej były reprezentowane gatunki z rodzaju *Fragilaria* (do 92,2% okazów w starszym okresie atlantyckim).

W górnej części starszego okresu atlantyckiego (6,95—6,64 m) dokonała się zmiana składu okrzemek i charakteru osadu — torfowisko pokrywa gytia wapienna. Przyczyną była transgresja Zalewu Wiślanego, która zmieniła obszar zajęty przez torfowisko w zbiornik wody. Od tego czasu jezioro Druzno było częścią Zalewu Wiślanego, początkowo jako płytka jego zatoka, o czym świadczy niewielki jeszcze udział okrzemek planktonowych (do 5,6% okazów). Później najliczniej reprezentowane były okrzemki porośłowe głównie *Fragilaria*, które jednak, w porównaniu z niższą częścią osadu, występują w mniejszej ilości. Wzrasta natomiast udział okrzemek dennych. Charakterystyczną cechą obserwowanej zmiany w składzie okrzemek tej części osadu jest stałe występowanie taksonów mezohalobowych oraz wzrost liczby ich okazów do 11,8%. Zwiększają również swój udział okrzemki halofilne (do 10,1%). Mała rola okrzemek euhalobowych (do 0,6% okazów) dowodzi, że stopień koncentracji soli w zbiorniku był w tym jeszcze czasie niewielki.

W młodszym okresie atlantyckim i na początku subborealnego dominują nadal okrzemki oligohalobowe obojętne, ale ich udział jest zdecydowanie mniejszy niż w poprzednim okresie (od 60,9—89,9% ogólnej liczby okazów). Najliczniej reprezentowane są gatunki planktonowe *Stephanodiscus astraea* i *Melosira granulata*, wykazujące spadek udziału jedynie w połowie młodszego okresu atlantyckiego, gdzie obficie znajdowano *Opephora martyi*. Ważną rolę odgrywają w tym czasie okrzemki oligohalobowe halofilne (3,9—22,2% okazów), natomiast okrzemki mezohalobowe występują w mniejszej liczbie okazów niż pod koniec okresu poprzedniego (1,8—7,2%).

Najbardziej charakterystyczną zmianą w składzie okrzemek młodszego okresu atlantyckiego i początku subborealnego jest, obok wzrostu liczby okazów planktonowych, zwiększony udział okrzemek euhalobowych. Ilość ich nie jest jednak stała i podobnie jak w przypadku okrzemek innych grup halobowych, waha się znacznie (od 0,3—23,3% ogólnej liczby okazów). Te znaczne różnice w udziale okrzemek poszczególnych grup halobowych, obserwowane w tym czasie zarówno w profilu z jeziora Druzno jak i z Zalewu Wiślanego (Przybyłowska-Lange 1974), dowodzą zróżnicowania w skali napływu wód morskich do obu zbiorników. Zwiększony napływ zaznaczony jest w materiale trzykrotnie obfitszym zjawieniem się okrzemek głównie euhalobowych z rodzaju *Coscinodiscus*. Trzeci i najwyższy ich wzrost obserwowany był na granicy okresu atlantyckiego z subborealnym. Między kolejnymi wzmożonymi napływami wód morskich zbiornik uległ wysłodzeniu, co prowadziło do spadku udziału okrzemek słonolubnych.

Zaobserwowane trzykrotne wzmożone napływy wód morskich wiążą się prawdopodobnie z kolejnymi fazami transgresji morza litorynowego na Bałtyku. Przypuszczenie to potwierdza obecność w składzie okrzemek jeziora Druzno gatunków charakterystycznych dla morza litorynowego. Łączne rezultaty badań nad osadami z jeziora Druzno i Zalewu Wiślanego (Przybyłowska-Lange 1974) skłaniają do przypuszczenia, że transgresja morza litorynowego nie objęła jednak swym bezpośrednim zasięgiem tego obszaru. W całej bowiem warstwie osadów z okresu atlantyckiego i początku subborealnego dominują okrzemki słodkowodne. Największy napływ wód morskich, przypadający w badanym materiale na początek okresu subborealnego, został raptownie zahamowany i zbiornik uległ znacznemu wysłodzeniu. Świadczą o tym okrzemki oligohalobowe obojętne, osiągające maksymalne wartości udziału w całym profilu (92,2—97,5% okazów).

Oprócz zmian w składzie flory okrzemek, wywołanych ustaniem dopływów wód słonych do zbiornika, w całym okresie subborealnym obserwowano również wahania udziału okrzemek planktonowych i litoralnych, wskazujące na istnienie różnic poziomu wody. Zmiana warunków hydrologicznych na początku tego okresu wywołała pewien spadek ilości okrzemek planktonowych, ale była to zmiana niewielka i dość krótkotrwała. W środkowej części okresu okrzemki planktonowe osiągały kolejny i zarazem ostatni wzrost udziału (*Melosira granulata*, *M. italica*, *M. islandica* subsp. *helvetica*, *M. ambigua*, *M. arenaria*).

W drugiej połowie okresu subborealnego (od głębokości 2,69 m), kiedy to obserwuje się nieomal całkowite wysłodzenie zbiornika, frekwencja gatunków planktonowych raptownie spada. Dominują okrzemki litoralne, co wskazuje na wypłycenie się jeziora Druzno. Najliczniej reprezentowane były: *Navicula scuteloides*, *Opephora martyi* i *Fragilaria inflata*. Wypłycenia i wysłodzenia zbiornika nie należy jednak wiązać z zakończonym procesem jego izolacji od Zalewu Wiślanego. Pewne różnice w składzie okrzemek występujące w tym czasie zdają się wskazywać na zapoczątkowany dopiero proces izolacji obu zbiorników.

Na początku starszego okresu subatlantyckiego skład okrzemek był podobny jak w okresie poprzednim, ale w jego górnej części okrzemki charakterystyczne dla okresu subborealnego zanikają już nieomal całkowicie. Najliczniej występowały wówczas gatunki z rodzaju *Fragilaria*, szczególnie *F. construens* z odmianami. Flora okrzemek z tej części osadu różni się istotnie od flory z Zalewu Wiślanego (Przybyłowska-Lange 1974). Szybkie narastanie delty Nogatu doprowadziło w tym czasie do ograniczenia oddziaływania wód Zalewu Wiślanego na warunki ekologiczne jeziora Druzno. Proces izolacji obu tych zbiorników został zakończony dopiero na początku młodszego okresu subatlantyckiego. Od tego czasu jezioro Druzno stało się odrębną jednostką fizjograficzną, którą z Zalewem łączy tylko rzeka Elbląg.

Podobnie jak w starszym, tak i w młodszym okresie subatlantyckim głównymi składnikami były okrzemki oligohalobowe obojętne (głównie *Fragilaria construens* z odmianami, *F. pinnata*, *Cocconeis placentula* z odmianami i *Amphora ovalis*). Ich udział nie był jednak stały, mniejszy w środkowej i stropowej części profilu, gdzie obficiej występowały gatunki halofilne (do 23,7% okazów), reprezentowane głównie przez *Rhoicosphenia curvata*, *Epithemia turgida*, *E. sorex* i *Anomoeoneis sphaerophora*.

W całym młodszym okresie subatlantyckim zdecydowanie dominowały gatunki poroślowe, a w stropowej części profilu skład okrzemek wskazuje wyraźnie na postępujący proces zabagnienia zbiornika.

PLATES

Plate I

Tablica I

1. *Terpsinoë americana* (Bail.) Ralfs.; × 1000
2. *Coscinodiscus radiatus* Ehr.; × 1000
3. *Coscinodiscus rothii* var. *subsalsa* (Juhl.-Dannf.) Hust.; × 1250
4. *Stephanodiscus astraea* var. *minutulus* (Kütz.) Grun.; × 1000
5. *Melosira sulcata* (Ehr.) Kütz.; × 1000
6. *Coscinodiscus excentricus* var. *fasciculata* Hust.; × 750
7. *Cyclotella meneghiniana* Kütz.; × 1000
8. *Actinoptychus undulatus* (Bail.) Ralfs.; × 1500
9. *Melosira arenaria* Moore; × 800

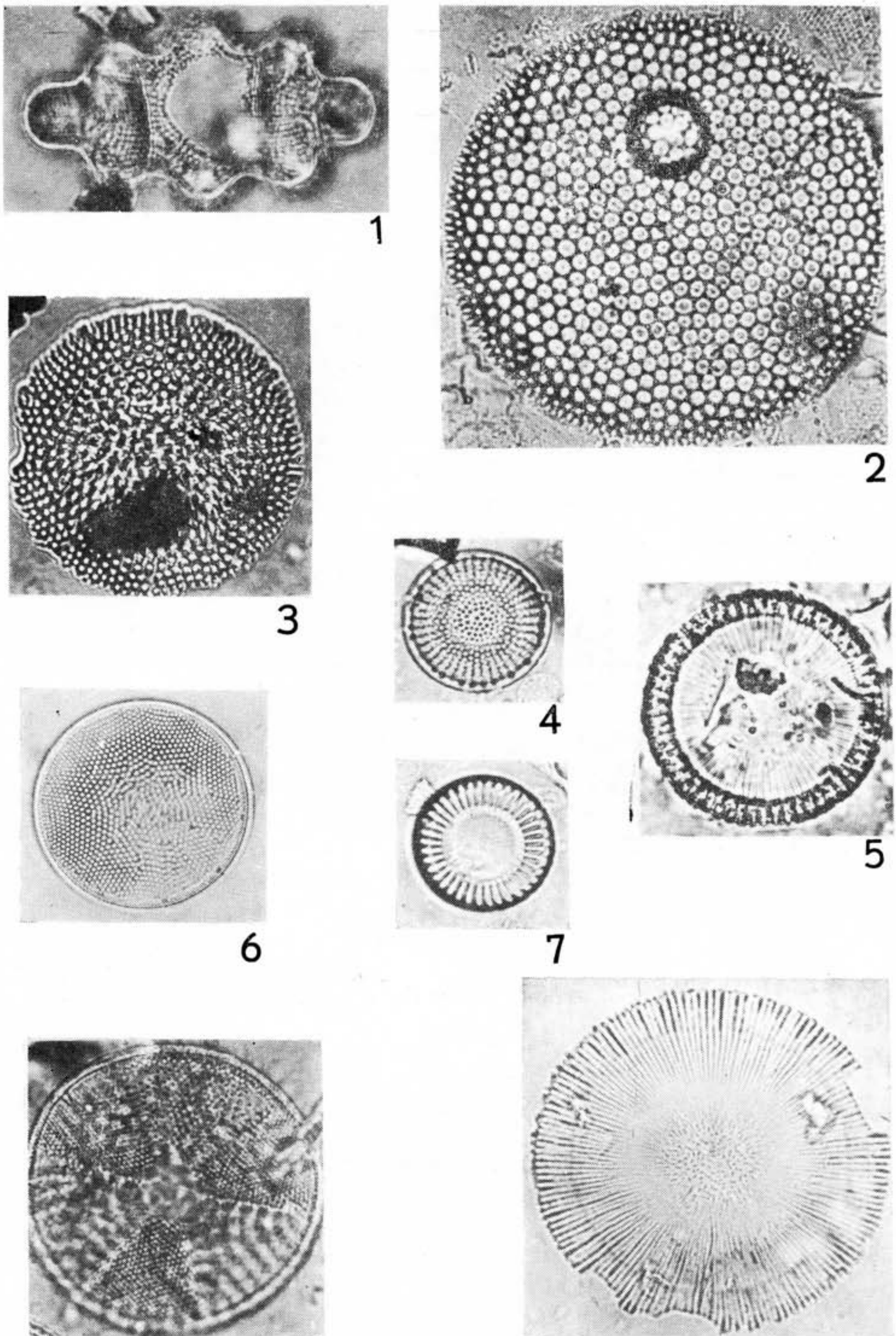
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Plate II

Tablica II

1. *Hemiaulus polymorphus* Grun.; × 1000
2. *Coscinodiscus gorbunovi* Sheshukova × 800
3. *Rhabdonema arcuatum* (Ag.) Kütz.; × 1000
4. *Grammatophora oceanica* (Ehr.) Grun.; × 750
5. *Cocconeis scutellum* Ehr.; × 750
6. *Fragilaria inflata* (Heid.) Hust.; × 1000
7, 8. *Fragilaria inflata* var. *istvanffyi* (Pant.) Hust.; × 1000
9, 10. *Rhicosphenia curvata* (Kütz.) Grun.; × 1000
11. *Synedra pulchella* (Ralfs) Kütz.; × 1000
12. *Synedra ulna* var. *sphathulifera* Grun.; × 600
13, 14, 15. *Eunotia sibirica* Cl.; × 1000

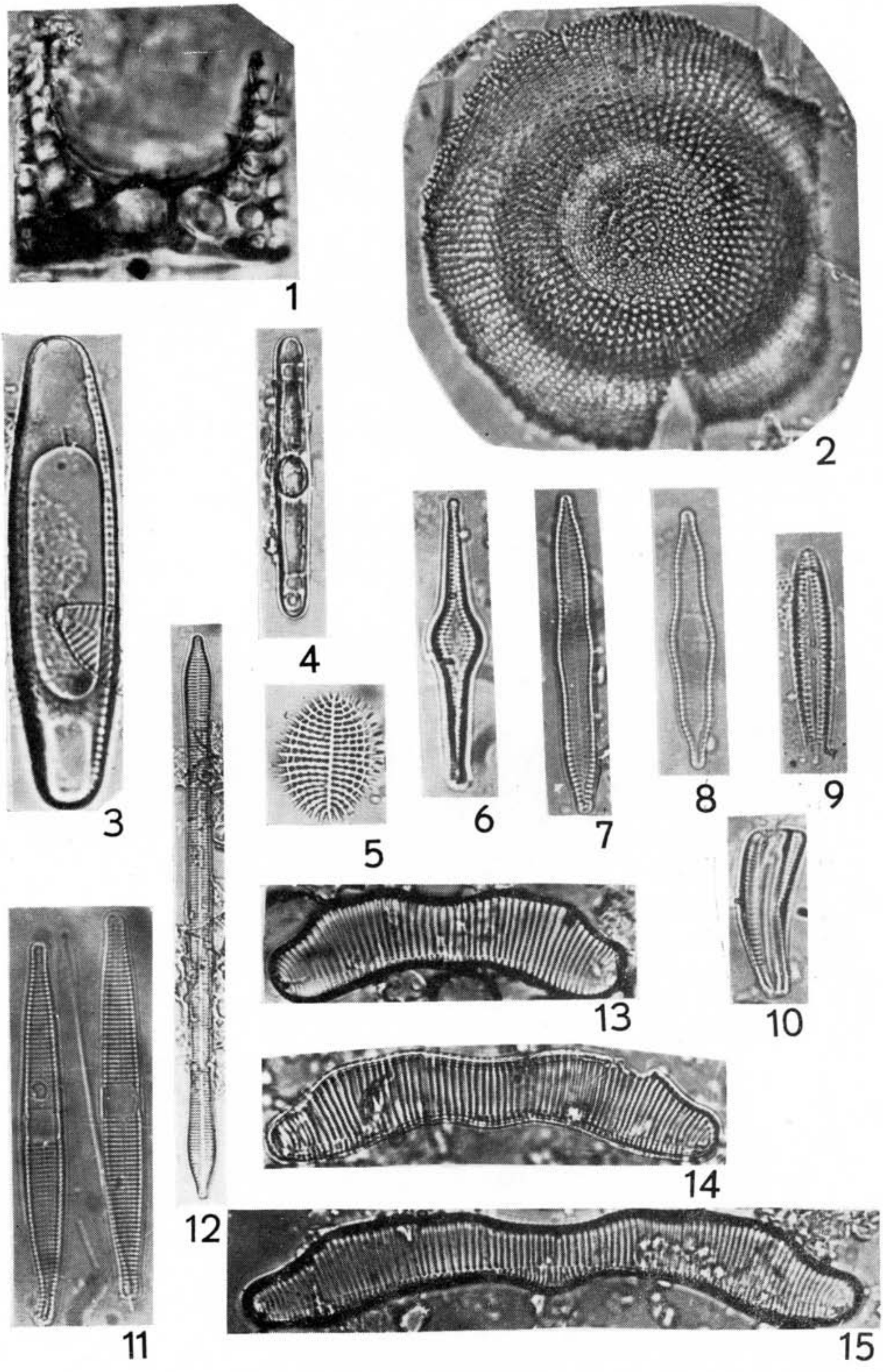

Plate III

Tablica III

1, 2. *Achnanthes dispar* Cl.; × 750
3, 4. *Achnanthes clevei* Grun.; × 1500
5. *Achnanthes exigua* Grun.; × 2000
6. *Achnanthes hauckiana* Grun.; × 1000
7. *Mastogloia smithii* Thw.; × 1000
8. *Diploneis smithii* (Bréb.) Cl.; × 1000
9. *Diploneis smithii* var. *rhombica* Mer.; × 1000
10. *Diploneis domblitensis* (Grun.) Cl.; × 1500
11. *Diploneis interrupta* (Kütz.) Cl.; × 1000
12. *Diploneis didyma* (Ehr.) Cl.; × 1500
13. *Stauroneis javanica* var. *oblongella* (Østr.); × 1000
14. *Anomoeoneis costata* (Kütz.) Hust.; × 1000
15. *Navicula salinarum* Grun.; × 1000
16. *Navicula elementis*; × 800
17. *Navicula mutica* Kütz.; × 1000
18. *Navicula protracta* Grun.; × 1500

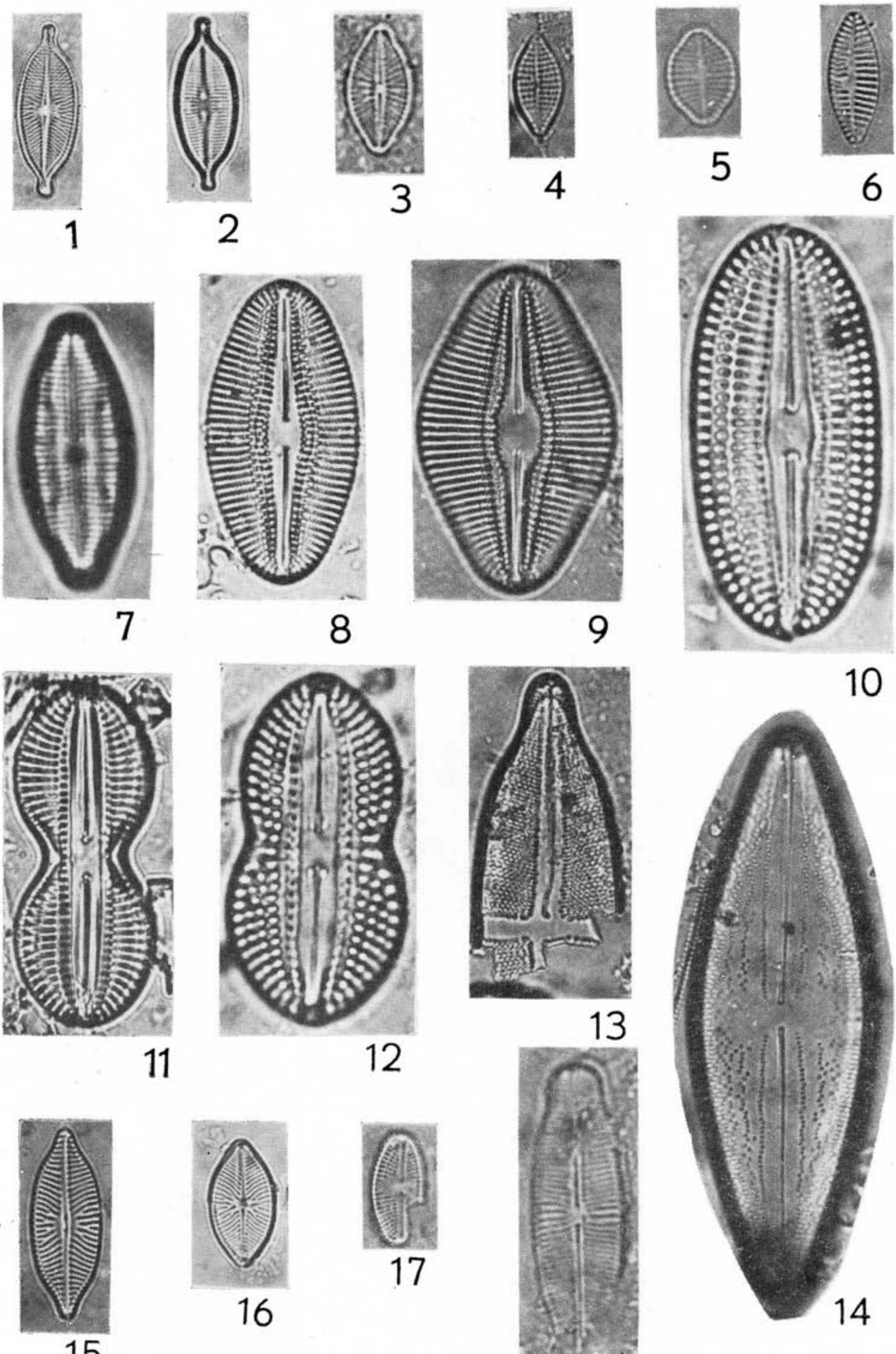
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Plate IV

Tablica IV

1, 2, 3, 4. *Navicula amphibola* Cl.; × 1000
5. *Navicula semen* Ehr.; × 1000
6. *Navicula reinhardtii* Grun.; × 1500
7. *Navicula rhychocephala* Kütz.; × 1500
8. *Navicula bacillum* Ehr.; × 1500
9. *Navicula crucicula* (W. Sm) Donk.; × 1000
10. *Navicula viridula* Kütz.; × 750
11. *Navicula tuscula* var. *minor* Hust.; × 1500
12. *Caloneis amphisbaena* var. *subsalina* (Donk.) Cl.; × 750

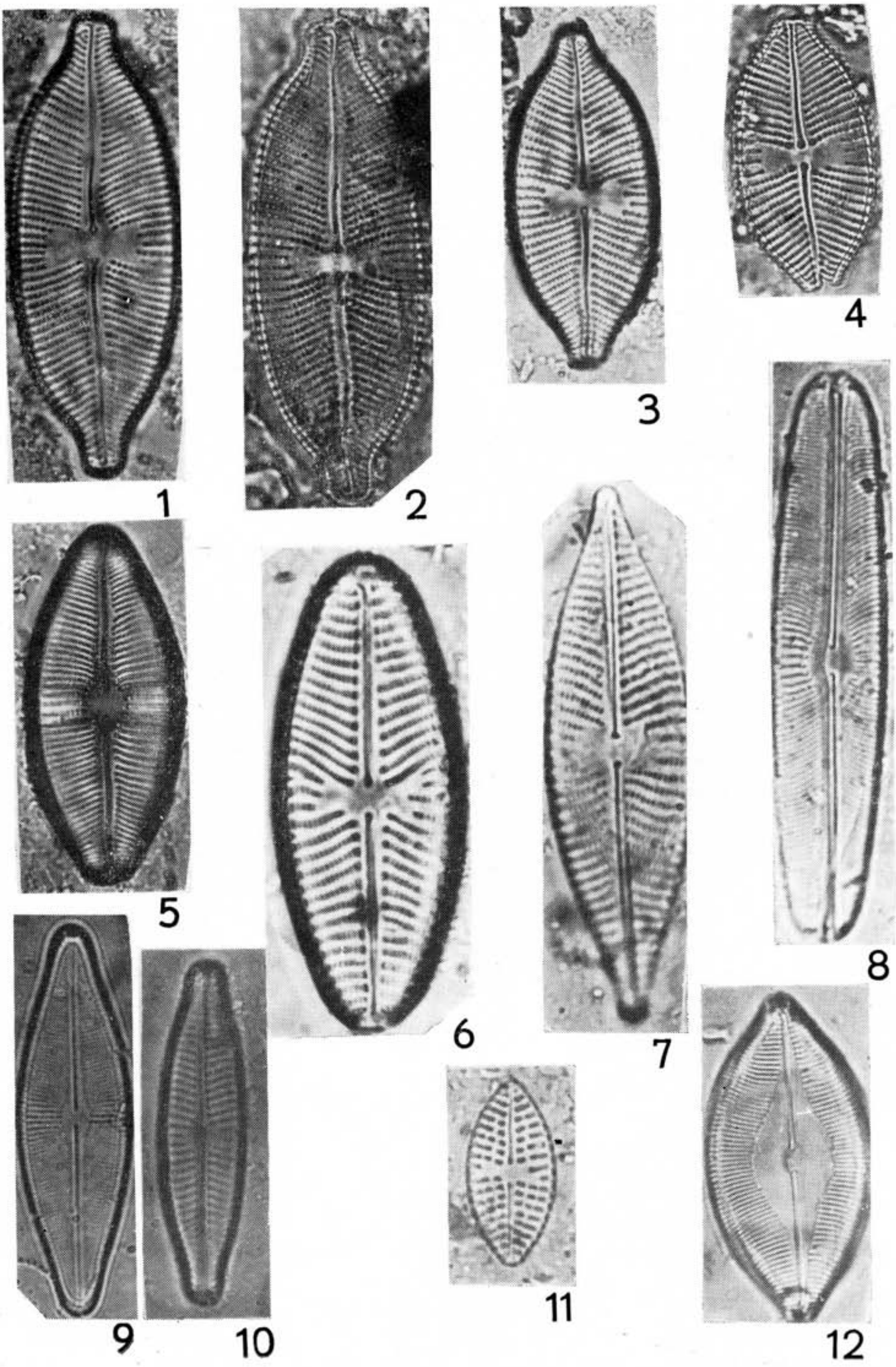
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Plate V

Tablica V

1. *Pinnularia viridis* var. *leptogongyla* (Ehr.? Grun.) Cl.; × 1500
2. *Pinnularia viridis* var. *commutata* (Grun.) Cl.; × 1000
3. *Pinnularia isostauron* Grun.; × 1000
4. *Pinnularia subcapitata* Greg.; × 1000

5, 6. *Pinnularia borealis* Ehr.; × 1000

7. *Pinnularia braunii* var. *amphicephala* (Mayer) Hust.; × 800
8. *Pinnularia microstauron* (Ehr.) Cl.; × 1000
9. *Cymbella hustedtii* Krasske; × 1000
10. *Cymbella cistula* (Hemp.) Grun.; × 1000
11. *Cymbella heteropleura* Ehr.; × 1000
12. *Cymbella cuspidata* Kütz.; × 1000
13. *Cymbella tumida* (Bréb.) V. H.; × 1500

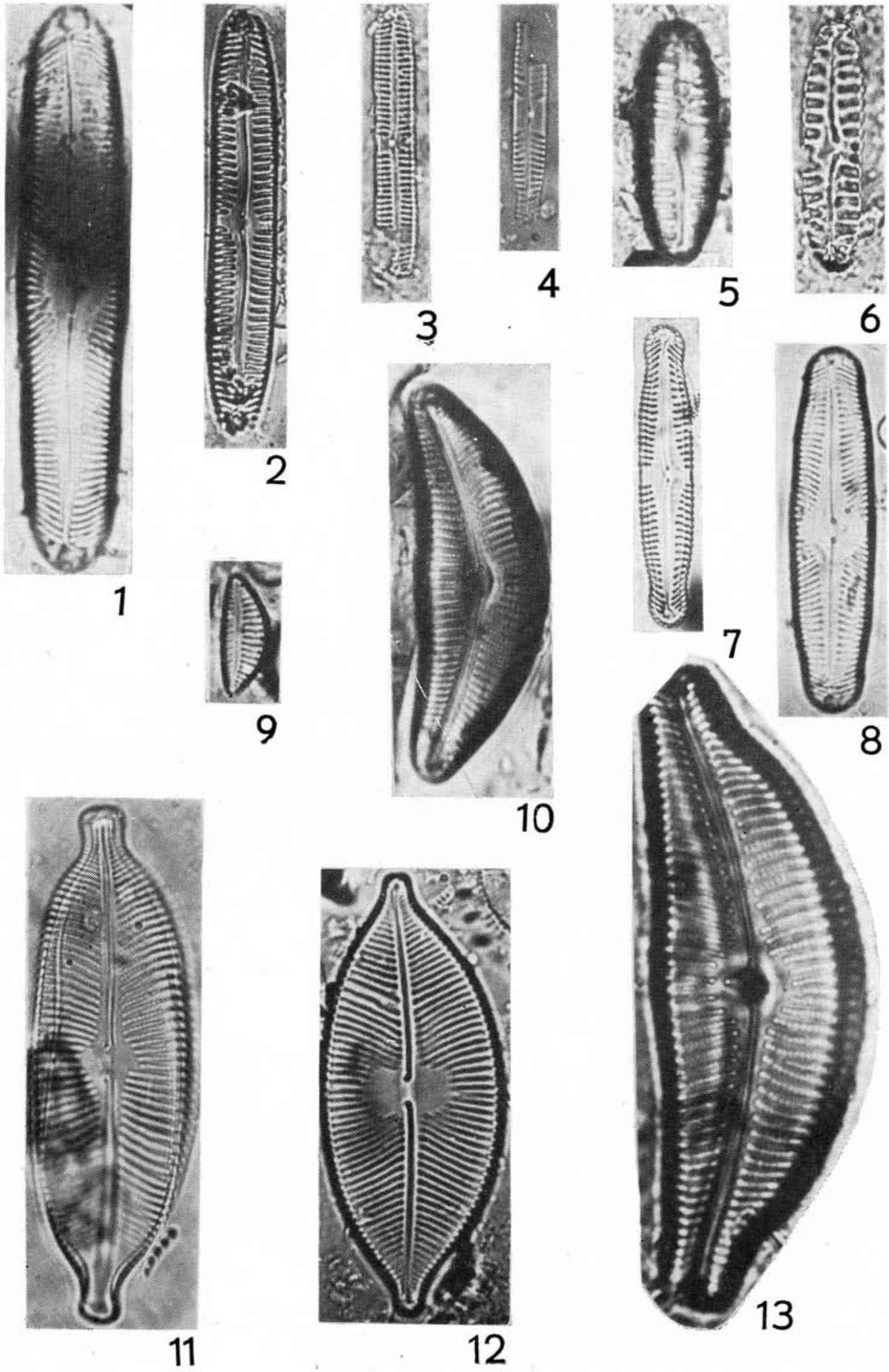
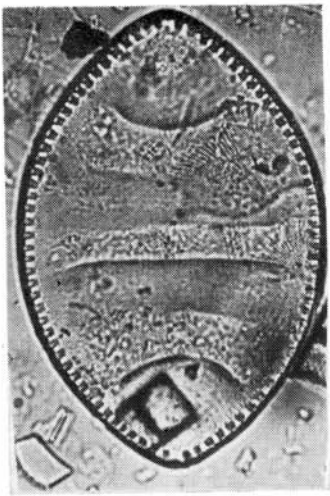


Plate VII

Tablica VII

1. *Cymatopleura elliptica* var. *nobilis* (Hantzsch) Hust.; × 800
2. *Cymatopleura solea* (Bréb.) W. Sm.; × 1000
3. *Cymatopleura solea* var. *gracilis* Grun.; × 1000
4. *Surirella linearis* var. *helvetica* (Brun) Meist.; × 1000
5. *Surirella ovata* Kütz.; × 1000
6. *Surirella ovata* var. *crumena* (Bréb.) V. H.; × 1000
7. *Surirella striatula* Turp.; × 750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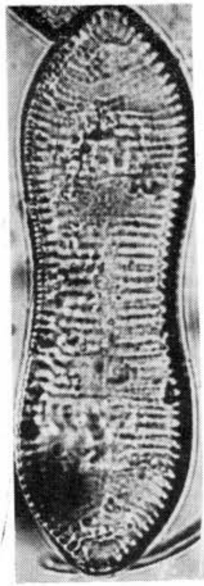
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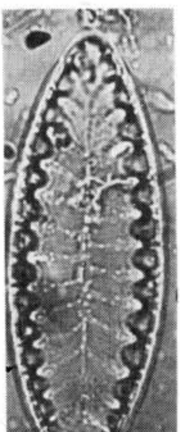
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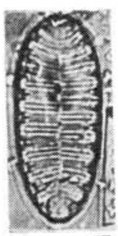
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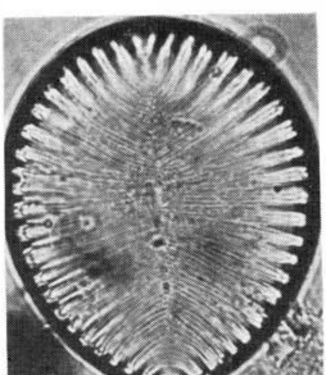
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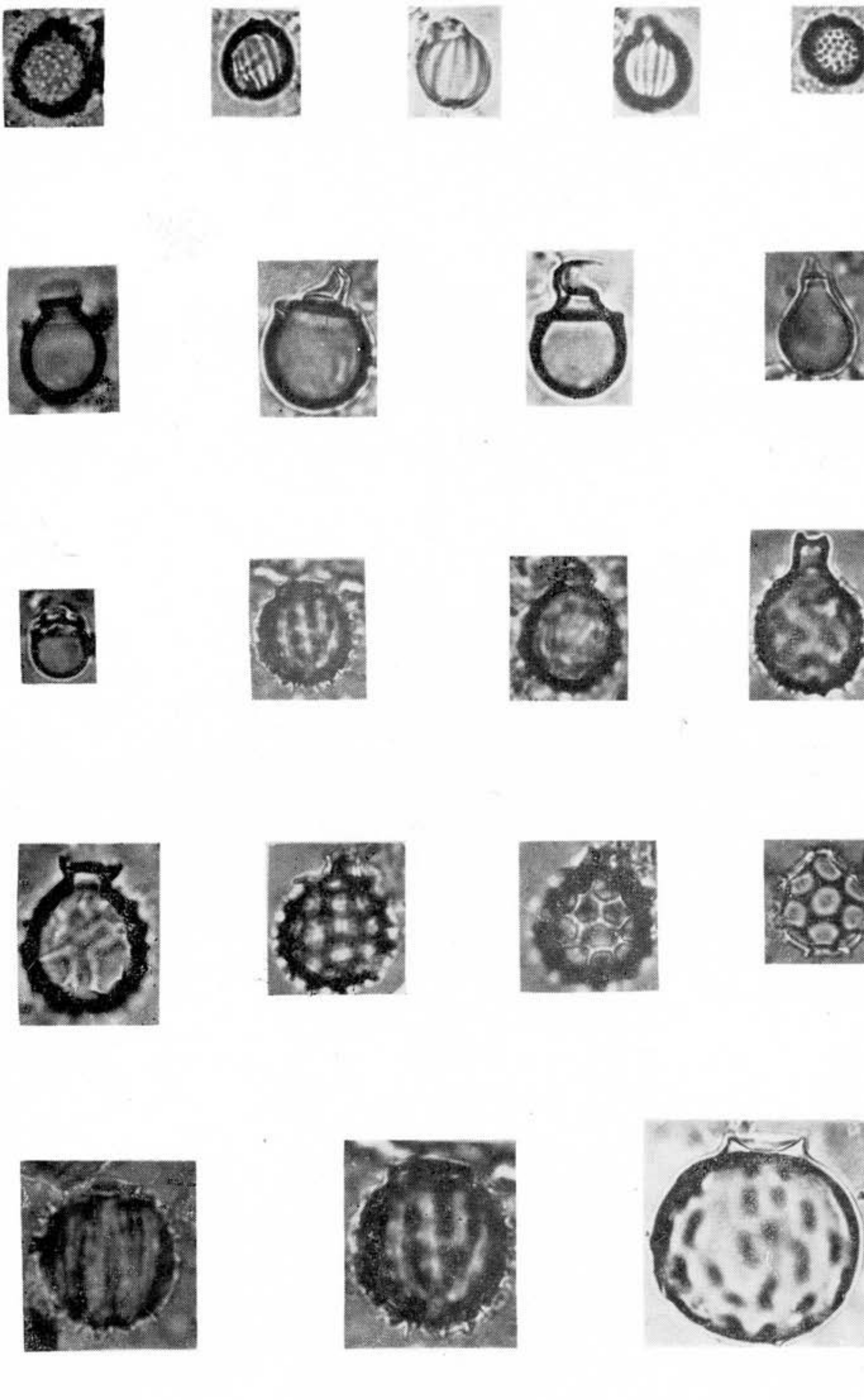
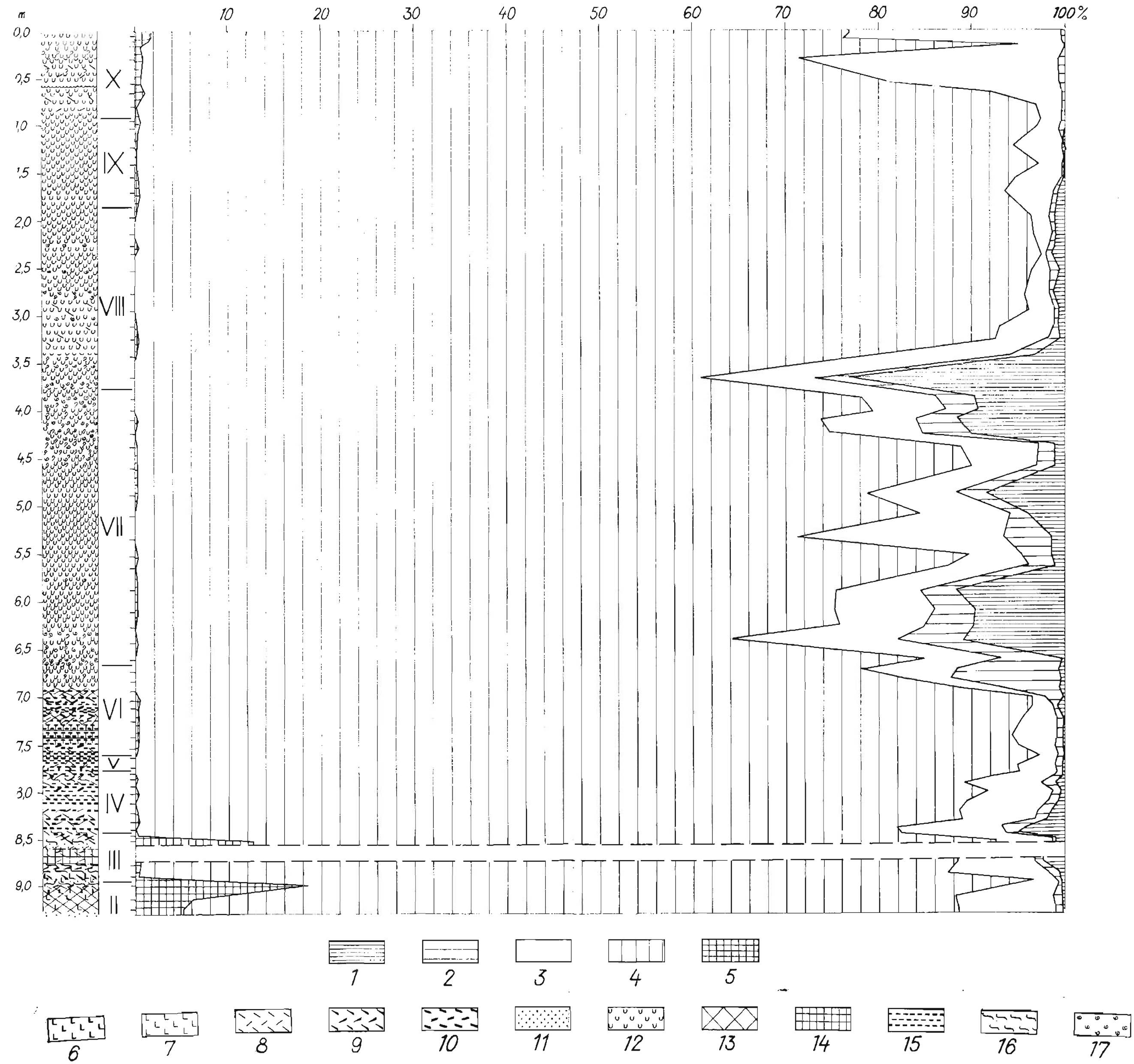
Plate VIII

Tablica VIII

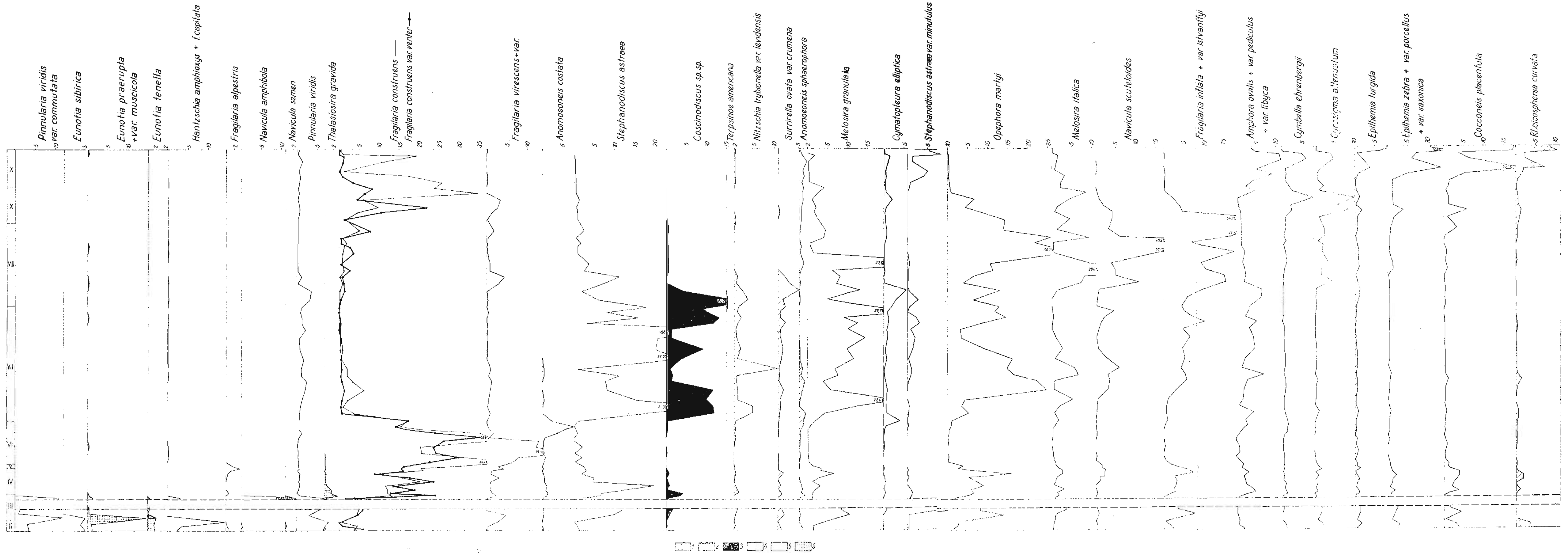
Cysts of *Chrysophyceae*; × 1000

Plate VIII
Tablica VIII





Text-fig. 2. Lake Druzno. Percentual value of different halobous diatom groups. 1 — euhalobous, 2 — mesohalobous, 3 — halophilous, 5 — indifferent, 5 — halophobous, 6 — *Argilla steatodes*, 7 — *Argilla granosa*, 8 — *Detritus granosus*, 9 — *Detritus herbosus*, 10 — *Detritus lignosus*, 11 — *Grana arenosa*, 12 — *Limus calcareus*, 13 — *Limus detrituosus*, 14 — *Limus siliceus*, 15 — *Substantia humosa*, 16 — *Turfa bryophytica*, 17 — *Acervus test (moll)*
Ryc. 2. Jezioro Druzno. Procentowy udział różnych grup halobowych okrzemek. 1 — euhaloby, 2 — mezohaloby, 3 — halofile, 4 — obojętne, 5 — halofoby



Text-fig. 3. Lake Druzno. Diatom diagram. 1 — euhalobous, 2 — mesohalobous, 3 — meso- and euhalobous, 4 — halophilous, 5 — indifferent, 6 — halophobous
Ryc. 3. Jezioro Druzno. Diagram okrzemkowy. 1 — euhaloby, 2 — mezohaloby, 3 — mezo- i euhaloby, 4 — halofile, 5 — obojętne, 6 — halofoby

Lake Druzno 1. Percent proportion of diatom taxons

Jezioro Druzno 1. Procentowy udział okrzemek

Abbreviations - skróty: E - euhalobous, H - halophilous, Hb - halophobous, I - indifferent, M - mesohalobous

Stratigraphy - Stratygrafia		Late Sub-atlantic							Early Sub-atlantic						Sub-boreal											Late Atlantic																Early Atlantic								Boreal		Pre-boreal								Younger Dryas				Alleröd		
Depth in m - Głębokość w m		0,07	0,14	0,20	0,43	0,64	0,68	0,92	1,00	1,13	1,34	1,50	1,61	1,83	2,11	2,22	2,34	2,39	2,69	2,85	3,06	3,17	3,36	3,54	3,78	3,93	4,03	4,18	4,29	4,47	4,73	5,00	5,22	5,47	5,56	5,75	6,00	6,22	6,31	6,55	6,64	6,78	6,87	6,95	7,06	7,15	7,34	7,45	7,59	7,67	7,76	7,80	7,87	7.95	8,04	8.15	8,24	8,35	8,40	8,48	8,53	8,70	8,94	9,14	9,23	9,31
No. of sample - Nr prób		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65
Achnanthes Bory																																																																		
affinis Grun.	H																																																					0,5											0,3	
bottnica Cl.	M																																			0,2																													
breviceps var. intermedia (Kütz.)	M																																					0,2																											
clevei Grun.	I											0,4		0,3			0,2	0,2					0,2	0,2				0,3	0,3	0,3		0,2		0,2	0,3						0,3																								
conspicua A. Mayer	I					0,2	0,3																																			0,2		0,3									0,2									0,2					0,5
var. brevistriata Hust.	I							0,2																																																											
dispar Cl.	H										0,2		0,2																														0,2																									
var. capitata Jasnitsky	I																																							0,2																										
exigua Grun.	I																																																					0,2	1,4	0,9											
exilis Kütz.	I																																0,2											0,2											0,2												
hauckiana Grun.	M																																								0,2		0,6				0,2		0,2				0,2		0,3		0,2		0,6						0,6	
hungarica Grun.	I	1,7	0,9	0,5	0,5	1,5	0,7	0,2	0,2						0,2																																							0,5											
lanceolata (Bréb.) Grun.	I	0,3	0,2	0,2	0,2	0,3	0,2	0,2	0,2		0,2		0,2																						0,2					0,2		0,2	0,2	0,2								0,3		0,2											
var. elliptica Cl.	I	1,2	1,4	0,2	0,5	0,8	0,6	0,2	0,6	0,2	0,7	0,7	0,4	0,2				0,2														0,2		0,5			0,3																													0,7
var. rostrata (Østr.) Hust.	I	0,2	0,2			0,5			0,2																																																								
linearis (W. Sm.) Grun.	I															0,2																																																		
östrupi (Cl.) Hust.	I															0,3																																																		
Actinocyclus Ehrenberg																																																																		
ehrenbergii Ralfs	E																		0,2	0,2						0,5	0,4																				0,2		0,2																					
Actinoptychus Ehrenberg																																																																		
undulatus (Bail.) Ralfs	E																	0,2	0,2		0,2					0,4	0,4						0,2			0,2																													0,7				
Amphora Ehrenberg																																																																		
commutata Grun.	M																																								0,2		0,3		0,2							0,2															
ovalis Kütz.	I	0,2	0,2	4,8	3,9	1,2	1,1	1,5	1,0	2,5	3,4	1,2	2,0	2,2	1,0	0,2	0,7	0,5	1,2	1,7	1,4	0,3	0,5	2,0	2,6	0,4	0,7	0,7	0,5	0,6	0,5	0,8	1,0	0,2	1,0	0,8	0,5	0,2	0,2	0,6	0,2			0,3	0,4	0,7		0,2	0,7	1,1	0,9	2,9	3,6	4,0	2,1	1,8	2,7	3,2	4,4		0,7	2,2	2,6	2,3	1,8	1,0
var. gracilis (Ehr.) Cl.	I										0,2				0,2				0,5			0,2	0,2		0,5	0,5					0,2	0,2					0,2																0,2		0,2				0,2								
var. libyca (Ehr.) Cl.	I	0,5	0,9	10,5	8,8	1,8	7,6	3,6	2,4	4,3	0,3	0,5	0,2	0,9	0,3	1,1	0,2	0,4	1,9	1,5	1,9	1,8	1,8	6,0	5,6	3,1	2,8	2,2	4,2	3,1	3,7	4,4	2,2	1,0	6,9	2,6	1,5	1,2	0,3	4,1	2,2	1,5	1,6	1,0	0,4		0,4	0,7		0,9	1,6					1,1		0,2	1,0			0,3	0,3	0,3		1,6
var. pediculus Kütz.	I	3,4	4,0	0,5	2,6	3,3	1,7	0,6	0,2	0,3	0,3	0,2	0,9	0,3	1,0	0,4		0,5	0,5	0,2	0,2	0,5	0,3	0,2	0,2		0,5	0,5	0,9	0,2	0,6	0,5	0,2	0,3	0,3	0,2	0,5	0,5	0,5	0,2	0,2	1,4	0,2	0,2			0,4	0,2				0,2				0,2	0,2			0,6	2,5	0,9	0,6		0,3	0,6	0,3
perpusilla Grun.	I									0,2																																								0,2			0,2	0,2	0,6											
veneta Kütz.	I	0,2	0,3	0,2	0,3	0,7	0,6	0,2																																			0,2				1,2	1,8	0,4																
Anomoeoneis Pfitzer																																																																		
costata (Kütz.) Hust.	M																																	0,3	0,2			0,3		0,2	2,3	7,9	5,6	3,8	0,8	0,3	0,2	0,2	0,7	0,4		0,3		0,4	0,5	0,5	1,2	0,9	1,4	1,3	0,2	0,3	0,3			0,3
sphaerophora (Kütz.) Pfitz.	H	0,3	0,5	0,8	1,9	0,8	1,1	0,5	1,0	0,7	0,9	0,4	0,4	0,3	0,2		0,2	0,4	0,2	1,1	0,3		0,2		0,2							0,2	0,2	0,8	0,3	1,4	0,8	0,2		2,3	0,9	0,9	0,3	0,2	0,4	0,2	0,2	0,4	0,4		0,2		0,7	0,6		0,5	0,6	0,7	1,6	1,6	0,7		0,3	0,3	0,6	1,6
var. sculpta (Ehr.) O. Müll.	M																																					0,3		0,2	1,4	0,6	1,8	1,4	0,5					0,2	0,2	0,2	0,2	0,3											
Caloneis Cleve																																																																		
amphisbaena (Bory) Cl.	H												0,2				0,2			0,2	0,2			0,2	0,2	0,2	0,2	0,2		0,2	0,3	0,3	0,2	0,3	0,2	1,0	0,8	0,7	0,3	1,7	1,6	1,6	0,3	0,3					0,4	0,2	0,5	0,5				0,5	0,6	1,1	1,2	0,4	0,4			0,3	0,3	
var. subsalina (Donk.) Cl.	M																																							0,2	0,2	1,1	1,0	0,3																			
bacillum (Grun.) Mer.	I	0,2	0,5	0,2	0,2	0,2														0,2	0,2			0,2	0,2	0,7			0,2	0,3	0,3	0,2	0,3		0,3	0,2	0,3		0,2	0,2	0,6	0,2	0,2	0,2																						
var. lancettula (Schulz) Hust.	I						0,2		0,2													0,2				0,2											0,2																													
permagna (Bail.) Cl.	M																																									0,2	0,3	0,2														0,2							
schumanniana (Grun.) Cl.	I																																					0,2		0,6													0,2											
var. biconstricta Grun.	I											0,2		0,2																							0,8	0,2		1,3		0,3											0,3										
silicula (Ehr.) Cl.	I	0,2	0,2	0,5	0,3	0,3	0,4	0,2	0,2	0,2	0,3	0,2	0,2	0,3		0,2							0,2	1,3	0,5	0,2	0,2	0,5	0,3	1,0	0,5	0,2	1,0	1,6	0,3	0,3	0,5	0,3	0,2	0,5	0,3	0,5	0,2	0,2											0,2	0,2			0,2							
var. inflata Grun.	I																																		0,2																														
var. truncatula Grun.	I	0,2																			0,2																0,2																												
Campylodiscus Ehrenberg																																																																		
clypeus Ehr.	M																	0,2	0,2								0,2							0,3	0,5	0,2	0,2	0,2	0,3	1,0			0,3	0,2																						
var. bicostata (W.Sm.) Hust.	M																									0,2										0,2																													
echeneis Ehr.	M																					0,2	0,2	0,2	0,4	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2		0,2		0,3	0,2		0,2													0,4	0,2					0,3	0,3			
noricus Ehr.	I			0,2				0,2			2,1	2,0	4,2	1,1	0,2	3,3	0,2		0,2					0,2							0,2													0,3										0,3	0,4	0,2		0,2	0,2									0,3	0,3
var. hibernica (Ehr.) Grun.	I					0,7	0,3	0,3	0,2	0,2	10,8	8,8	7,6	4,1	0,5	9,1	0,6		0,2			0,2		0,2	0,7		0,2	0,2	0,2	0,2	0,2		0,2		0,2		1,8	0,6	0,2	0,2	1,4										0,2	0,2													
Cocconeis Ehrenberg																																																																		
diminuta Pant.	I	1,5	0,5	0,5	0,7	0,8	0,6	0,2					0,5	0,2	0,7			0,2	0,2	0,3	0,5		0,2	0,4	0,2								0,3	0,3		0,3	0,2			0,2							0,4	0,2				0,2	0,3	0,3	0,8	0,7		0,2	0,2	0,4	0,2		0,3	0,3	0,3	0,6	0,7
disculus (Schum.) Cl.	I	0,8	0,2		0,3	0,5			0,2	0,2	0,2	0,4	0,2	0,7	0,5	1,1		0,2		0,4		1,0	0,6	0,2	0,2	1,6	3,0	1,3		1,3	0,6	0,3	0,3	0,6	0,2	1,9	1,5	0,6	0,6	0,2				0,2									0,2	0,3	0,5	0,2	0,5	0,2			0,4		0,4			0,3	0,3	
pediculus Ehr.	H	0,3	0,2	0,2		0,2												0,2							0,2	0,4		0,2					0,3	0,2		0,3	0,2	0,2	0,5	0,2				0,3		0,2	0,4							0,2					0,4			0,4			0,3		0,3
placentula Ehr.	I	17,5	17,1	3,5	6,3	20,1	5,3	1,6	1,2	0,5	1,2	1,1	5,8	0,9	3,3	0,4			0,7	0,4	0,9	0,2	0,2	0,4	0,2	0,2			0,2	0,2	0,2	0,2	0,3	0,2	0,3	1,0	0,3	0,3	0,2	0,6	0,3	0,3	0,2	0,3		0,3	0,7	0,4	0,2	0,4	1,2	0,9	1,4	3,8	3,7	3,2	2,3	2,0	3,6	1,3		2,5	4,3		3,0	3,6
var. euglypta (Ehr.) Cl.	I	1,8	0,5	0,5	0,5	0,5	0,4						0,2		0,3													0,2			0,2																					0,3	0,7	1,2	0,8		0,2		0,2							0,3	
var. lineata (Ehr.) Cl.	I																																																							0,2												
scutellum Ehr.	E																																					0,2																												
thumensis Mayer	I	1,2	1,0	0,2		3,0	0,8																								0,2																																		
Coscinodiscus Ehrenberg																																																																		
commutatus Grun.	M										0,2			0,2		0,2		0,2	0,2	0,4	0,2	0,3																																												
excentricus Ehr.	E														0,2	0,2			0,2	0,2	0,3		0,2	2,7	19,2	7,1	7,0	9,6	9,2	0,2	1,0	7,0	3,1	0,5	1,2	1,0	10,0	9,1	9,6	10,4	0,3	0,3	0,2	0,2				0,2						0,2	0,6	0,2	0,5	0,8	0,2	2,4	1,6	0,4	1,4	0,7		0,3	
var. fasciculata Hust.	E																								2,2	0,5	1,3	1,4	0,7	0,6		0,6	0,2				0,5			0,2			0,2																						
kützingii A. Schmidt	M											0,2		0,2								0,2		0,8	0,5	1,6	0,7	0,5	0,7	0,3		0,3	0,2	0,2	0,2	0,2	0,2	0,2	1,2	0,4	0,2											0,2											
lacustris Grun.	H																																															0,2																	
oculus-iridis Ehr.	E																							0,2																																					0,2					
radiatus Ehr.	E										0,2				0,2			0,2								0,3								0,3																															
rothii var. subsalsa J.-Dannf. Hust.	M																							0,5	0,2	0,3	0,7	1,7	1,0	0,3	0,8	1,2	0,2		0,2	0,2	2,0	0,6	0,9	0,6		0,2	0,2										0,2											
Chaetoceros sp.sp.	E														0,2	0,2	0,2		0,4		0,4	0,2	0,3		0,4	1,0	0,4	0,8	0,2	0,2			0,2	0,2				0,7	0,5	0,2	0,2		0,4	0,2	0,2		0,4																			
Cyclotella Kützing																																																																		
comta (Ehr.) Kütz.	I								0,2		0,2	0,4											0,2																																	0,2									
var. spectabilis Cl.	I																																																	0,2															
kützingiana Thwait.	I													0,2																					0,2																														
meneghiniana Kütz.	H	0,5	0,2		0,2		0,3	0,2	0,4		0,5	0,4	0,4	0,3	0,3	0,2	0,2			0,7		1,0	0,6	3,1	1,2	2,0	1,4	5,1	2,2	2,0	2,7	2,4	3,4	1,9	1,2	1,5	2,4	6,0	3,5	6,2	1,1	2,4	1,6	2,1	0,5	0,7	6,9	2,0	1,1	0,7	0,9	1,4	2,7	3,5	1,6	3,5	4,9	3,5	3,0	5,2	1,9	3,7	4,6	0,3	0,6	1,3
sp.																																																																	0,6	0,3
Cymatopleura W. Smith																																																																		
angulata Grev.	I										0,2	0,2	0,4	0,3		0,4								0,[illegible]															0,3			0,2	0,2																								
elliptica (Bréb.) W. Sm.	I	0,2	0,2	1,6	1,2	0,3	0,6	0,3	0,4	0,5	2,1	0,5	0,4	0,3	0,5	0,5	0,4	0,2	0,2		0,2		0,2	0,[illegible]	0,3	0,2	0,2	1,0	0,7	0,6	0,8	0,3	0,8	0,2	0,2	0,6	1,0	0,8	0,6	0,8	4,1	0,6	0,2	0,2			0,2					0,2			0,2	0,4	0,2	0,2	0,4	0,2		0,7					
var. hibernica (W. Sm.) V. H.	I														0,2	0,2							4,[illegible]	1,7	2,2	0,7	0,3	0,5	0,2	0,2																									0,2												
var. nobilis (Hantzsch) Hust.	I																																																						0,2													
solea (Bréb.) W. Sm.	I		0,2	0,3	0,7	0,2	0,3	0,5	0,2	0,5	0,3	0,2	0,2	0,5		0,2		0,2	0,2		0,2	1,5	1,5	1,[illegible]	0,2	0,2	0,2	0,5	0,5	1,3	1,9	0,2	0,5	1,0	0,8	0,6	0,3	0,8	0,8	0,6	0,3	1,3	0,5	0,2								0,2	0,2			0,2	0,2		0,4	0,2				0,3			0,3
var. apiculata (W.Sm.) Ralfs	I	0,2			0,2		0,2							0,3																																													0,2						
var. gracilis Grun.	I																															0,2		0,2	0,2							0,5	0,2																						
Cymbella Agardh																																																																		
aequalis W. Sm.	I					0,2	0,2																																																											
affinis Kütz.	I	0,3	0,2			0,2	0,2	0,2			0,2																																																	0,2						
aspera (Ehr.) Cl.	I	0,5		0,2	0,3	0,3	0,3	0,2	0,4	0,2	0,7	0,4	0,2		0,2	0,2	0,2		0,2		0,3		0,2	0,[illegible]	0,3	0,2	0,3	0,2	0,2	0,2		0,2	0,7	0,3	0,2	0,5	0,3			0,3				0,2		0,3		0,2		0,2								0,2	0,2		0,2	1,1						0,3
cistula (Hemp.) Grun.	I	2,3	1,2	0,3	0,9	1,0	0,3	0,6			0,5		0,4	0,2	0,2		0,2		0,2	0,2	0,2		0,3					0,2	0,2			0,3			0,2	0,2			0,3	0,3		0,2										0,2						0,2	0,2	0,4	0,2		0,3	1,0	0,3	0,9	0,3
cuspidata Kütz.	I			0,2																																																													
cymbiformis (Ag? Kütz.) V.H.	I	0,2	0,5	0,3	0,7	0,2	0,2						0,2																																								0,2													
ehrenbergii Kütz.	I		0,2	4,9	6,0	0,8	0,9	0,8	1,8	2,3	7,8	2,1	2,4	0,7	0,9	0,4	0,9	0,4	0,7	1,1	0,5	0,3	0,3	0,[illegible]	0,2		0,2	0,2		0,6	0,3	0,3	0,7	0,6	0,5	0,8	0,8	0,3	0,3	0,5	1,1	1,3	1,2	1,2	0,4	0,2	0,2	0,2	0,5	0,4	0,4	0,2	0,4	0,2	0,9	0,7	1,0	0,5	1,0	1,1					0,9	1,0
gracilis (Rabh.) Cl.	Hb																																																															0,7		
heteropleura Ehr.	I																																																													1,8					
var. minor Cl.	I																																																													0,9					
hustedtii Krasske	I	0,2	0,3		0,3																																																														0,3
lanceolata (Ehr.) V.H.	I		0,2	0,2	0,3				0,2		0,2	0,2	0,2	0,2	0,2		0,2	0,2	0,2		0,3			0,[illegible]	0,2					0,2	0,2			0,2	0,2			0,2			0,2						0,2										0,2	0,2		0,2				0,3	
naviculiformis Auersw.	I			0,2	0,5			0,2	0,2	0,3	0,2			0,2																																																			
prostrata (Berkeley) Cl.	I								0,2													0,2			0,[illegible]																																									
reinhardtii Grun.	I					0,2																	0,2	0,2																																										
sinuata Greg.	I												0,2		0,2					0,2														0,2				0,2																												
tumida (Bréb.) V.H.	I				0,3																																													0,2															
tumidula Grun.	I	0,2	0,2	0,2																									0,2		0,2																																		
turgida (Greg.) Cl.	I		0,2																				0,2								0,2																																				
ventricosa Kütz.	I	0,3	0,2	0,2	0,2	0,2		0,2																																												0,2			0,2												
Diatoma De Candolle																																																																		
elongatum (Lyngb.) Ag.	H	0,2																																																															
vulgare Bory	I		0,2																																					0,2																										
var. productum Grun.	I		0,2																																																														
Diploneis Ehrenberg																																																																		
didyma (Ehr.) Cl.	M																											0,2					0,3		0,3	0,2				0,2																									
domblittensis (Grun.) Cl.	I															0,3										0,2	0,2		0,2	0,2		0,3	0,3	0,2	0,5	0,5	0,2	0,3	0,2	0,3	0,3			0,2																						
elliptica (Kütz.) Cl.	I														0,2	0,2																							0,2	0,3			0,8	0,2																								
interrupta (Kütz.) Cl.	M																									0,2		0,2	0,2	0,2	0,2					0,2	0,2		0,3	0,2	0,2																										
oculata (Bréb.) Cl.	I							0,2																																																									
ovalis (Hilse) Cl.	H						0,3	0,3	0,2			0,2		0,2	0,2									0,2				0,2		0,2		0,2		0,2	0,2	0,3			0,3	0,3	0,3										0,2								0,2		0,4					
smithii (Bréb.) Cl.	M										0,2							0,2							0,[illegible]	0,3	0,2	0,2	0,2	0,2	0,2		0,2	0,2	0,2			0,3	0,5	0,2	0,3	0,2	0,2	0,2															0,2									
var. pumila (Grun.) Hust.	H																													0,2	0,2		0,2	0,2	0,2	0,3	0,2		0,2				0,2	0,2																						
Epithemia Brebisson																																																																		
argus Kütz.	I																																							0,2																										
hyndmannii W. Sm.	I																																								0,2																									
intermedia Fricke	I																																			0,2																	0,2	0,2	0,3									0,6	0,7
mülleri Fricke	I																		0,2																						0,2											0,2	0,2													
sorex Kütz.	H	0,8	2,6	0,6	0,3	1,7	0,6	0,2		0,2	0,5	0,2	0,4	0,2	0,2	0,2					0,2		0,2				0,3		0,2	0,2	0,2	0,2	0,3	0,5	0,2	0,3			0,2	0,2	0,2	0,2		0,2		0,2						0,3	0,2		0,3				0,2	0,2				0,6	1,6
turgida (Ehr.) Kütz.	H	8,5	5,9	0,5	1,9	3,7	0,9	0,2	0,2	0,3	1,2	0,2	1,8	0,5	0,7	0,2	0,3	0,5	1,0	0,7	0,5	0,2	0,6	1,[illegible]	0,7	0,3	0,3	0,2	0,2			0,2	0,5	0,2	0,2	0,2	0,5	0,2	0,2	0,8	0,2	0,2	0,2	0,2			0,4	0,7	0,4		0,4	0,3	0,9		0,3	0,9	0,4	0,2	0,8	0,9	0,7	1,3	1,3	0,3	1,2	0,7
var. granulata (Ehr.) Grun.	H	0,3	0,3	0,2	0,6	0,3	0,3	0,2	0,4	0,2	1,1	0,2	0,2	0,3	0,3					0,2	0,5				0,2						0,2	0,2		0,2		0,2																0,2											0,3	0,3
var. westermannii (Kütz.) Grun.	H	0,2	0,9		0,3	0,5	0,3						0,2		0,2				0,2					0,[illegible]					0,2			0,2			0,2			0,2	0,2		0,2	0,2																								
zebra (Ehr.) Kütz.	I	5,9	8,9	3,8	3,2	9,2	3,0	0,5	0,6	0,5	0,9	0,9	3,1	1,1	0,5	0,4	0,5	0,2	0,3	0,9	0,7	0,2	0,2	0,[illegible]	0,2		0,3	0,3	0,2	0,2	0,2	0,2	0,2	0,2	0,7	0,5	0,2	0,2	0,2	0,5	0,2	0,2	0,2	0,2		0,3				0,2	0,5	0,5	0,7	0,8	1,4	1,1	1,0	0,4	1,8		0,2	0,3	1,0	0,7	1,8	1,6
var. porcellus (Kütz.) Grun.	I	3,9	4,4	2,5	2,0	2,2	0,9	0,5	0,6	0,3	0,3	0,4	0,9	0,5	0,2	0,2		0,2		0,2	0,7		0,2		0,2	0,4		0,2	0,2		0,2	0,2	0,2				0,2		0,2	0,3	0,2	0,2	0,2	0,2											0,2	0,3						0,7	0,2				0,3	0,7
var. saxonica (Kütz.) Grun.	I	0,5	3,4	1,0	1,0	1,8	0,9	0,2		0,3									0,2																																		0,2			0,3	0,4						0,2	1,0	0,7	0,3	0,6	1,3
Eunotia Ehrenberg																																																																		
alpina (Näg.) Hust.	Hb																																														0,2																		
arcus Ehr.	I																																																									0,2				0,2			0,2		
bigibba Kütz.	I																																																													1,5					
diodon Ehr.	I								0,2																																																								
faba (Ehr.) Grun	Hb																																															0,2																	
fallax Cl.	Hb																0,2																																											0,[illegible]			0,3	0,6	0,3
var. gracillima Krasske	Hb	0,8	0,5	0,3	0,3	0,3	0,4																												0,2												0,2																	0,7	1,5	0,7
gracilis (Ehr.) Rabh.	I																																																													0,4		0,3	0,7		0,7
lunaris (Ehr.) Grun.	I	1,0	0,9		0,3	1,2	0,3	0,2		0,2																																				0,2	0,2											0,2								0,3
var. subarcuata (Näg.) Grun.	Hb																																																													0,2				0,3	0,3
parallela Ehr.	Hb																																																0,2				0,2											0,3	0,3

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65
pectinalis var. minor (Kütz.) Rabh.	Hb											0,2	0,2																																																					
praerupta Ehr.	Hb	0,3	0,2										0,2				0,2						0,2					0,2																			0,2													0,2	1,0	0,3	0,3	13,5	0,6	0,3
var. muscicola Peterson	Hb																																																												0,2			1,5	0,3	1,0
sibirica Cl.	I																																																															5,4	4,3	5,2
sudetica O. Müll.	Hb	0,5	0,5						0,2																																																										
tenella (Grun.) Hust.	Hb																																																												0,4	0,3		2,0	1,6	1,7
valida Hust.	Hb																																																									0,2						0,3		
Fragilaria Lyngbye																																																																		
alpestris Krasske	I																																																		1,6	3,6	1,2	0,4	0,2				0,8						0,3	0,7
brevistriata Grun.	I	0,2	0,2	1,3	1,0	0,7	3,6	1,8	3,4	4,6	0,9	0,2	0,4	1,3	1,0	0,9	0,7	0,4	0,7	0,4	0,5	0,7	0,6	0,5	0,5	0,2	0,5	0,2	2,2	0,3	0,3	0,9	0,3	4,0	3,0	3,2	1,3	0,5	0,3	2,4	3,1	2,8	4,7	5,0	1,2	4,3	8,4	5,8	5,2	5,9	3,0	3,9	1,6	1,4	4,8	5,0	3,1	9,1	4,4	5,6	0,2					
capucina Desm.	I	0,3	0,2		0,2																																																	0,6											1,5	2,3
var. mesolepta Rabh.	I	0,2	0,5																																												0,4																	1,7	2,1	1,7
construens (Ehr.) Grun.	I	0,5	0,9	19,4	10,7	1,7	17,3	25,7	23,9	34,9	6,0	9,6	4,7	1,6	5,1	0,9	1,3	1,1	0,0	0,7	1,2	0,2	0,8	0,2	0,2			0,2	0,5	0,2	0,2	0,2	0,5	1,9	3,2	6,1	2,0	0,9	0,9	3,6	16,9	15,5	20,3	35,5	52,6	39,1	20,3	20,6	31,0	43,9	30,3	20,6	10,2	15,9	20,2		11,7	12,1	12,2	13,0	3,8	4,8	4,5	0,7	4,2	3,9
var. binodis (Ehr.) Grun.	I	0,3	0,2	3,9	1,9	0,3	6,3	22,4	17,6	10,9	4,9	11,8	6,0	1,4	4,2	0,2	2,4	6,4	5,7	1,1	3,5	4,0	6,7	0,7					0,2	0,3	0,3	0,9	0,2	0,2	0,3	0,6	0,2	0,2	0,6	0,3	0,3								0,4	0,9	2,8	2,6	2,1	1,9	2,1		0,4		2,4	0,4	0,7			0,3	5,2	3,2
var. exigua (W. Sm.) Schulz	I							2,4	2,6	1,2				0,2																																					0,2	0,2													0,3	
var. triundulata Reich.	I							0,2	0,6		0,2	0,2		0,2	1,0	0,4			0,5																							0,2					0,2	0,7		0,2	0,2	0,5	0,4													
var. venter (Ehr.) Grun.	I	0,2		1,1	1,0		0,8	3,6	8,1	6,3	4,4	21,8	10,5	1,4	7,8	0,5	0,5	2,8	3,5	0,5	2,6	0,7	1,0	1,3	0,3			0,2	0,3		0,3	0,8	0,5	0,6	0,3	0,6	1,3	0,6	0,3	0,5	17,3	14,1	16,8	23,9	35,3	26,2	23,7	24,3	30,0	22,7	16,2	15,6	16,0	8,9	17,6	23,6	13,5	19,0	12,8	24,2	1,6	5,9	4,6	0,7	0,9	5,9
crotonensis Kitt.	H																																																																		1,0
inflata (Heid.) Hust.	I			0,2		0,2	0,3	0,2	0,2	0,3	2,1	3,5	4,5	22,5	21,5	16,2	6,4	8,6	17,3	8,6	10,1	14,9	15,1	5,5	4,1	10,0	5,0	6,5	9,9	4,1	6,0	2,6	3,1	3,9	5,2	5,5	3,0	0,8	0,6	0,5	0,9	0,2					0,2			0,4	1,9	3,7	5,9	7,0	2,3	3,1	2,9	2,4	2,7	0,9		3,5	6,5	0,3	1,5	2,3
var. istvanffyi (Pant.) Hust.	I										0,2	0,4		1,4	0,3	0,4	3,4	0,7	0,5	0,7	0,2	0,2	0,5		0,2			0,5	0,3		0,5				0,2	0,2	0,2	0,2																									1,0			
intermedia Grun.	I	0,3			0,2		0,2				0,2				0,2				0,5				0,2						0,2		0,2	0,4						0,3				0,3					0,4		0,4	0,2		0,2	0,5	0,4	0,2										0,3	
lapponica Grun.	I								0,4	0,2	0,3		0,5	0,3	0,7	0,9	0,7	1,5	0,6				0,3		0,2			0,2	0,3	0,2	0,2	0,5	0,3	0,3	0,2	0,5	0,3		0,2					0,5	0,2	0,2	0,4	0,2	0,2	0,2	0,2	0,5	0,4	0,2	0,2										0,6	0,3
pinnata Ehr.	I	1,0	0,7	9,5	6,5	2,3	14,4	11,0	9,1	3,8	3,9	2,7	2,2	7,7	3,0	2,7	0,5	1,5	2,0	0,9	1,4	0,0	1,3	0,4	4,2	0,4	6,2	1,7	1,0	0,3	0,3		0,5	1,9	1,5	3,1	1,3	0,8	0,6	2,4	15,2	22,2	20,6	9,2	2,4	7,9	16,8	12,4	10,2	6,4	9,9	7,6	5,0	2,3	4,0	4,2	3,7	4,6	4,2	5,4	1,0	1,5	0,7	1,0	0,9	2,0
var. lancettula (Schum.) Hust.	I																																									1,5	6,1	2,1				0,4	1,8	1,2	3,5	2,7	1,2	1,8	0,5		1,2	1,3	3,2	1,1						
virescens Ralfs	I	0,2					0,2	0,2			3,4	2,7	1,3		1,8	0,2	0,2		0,2	0,7	0,7	4,3	2,7		0,2	0,2	0,3	0,2				0,2										0,2	0,5	1,6	0,5	0,5	0,4	0,5	1,1	1,4	0,5	1,1	1,7	0,4	1,0	0,7	0,6	0,7	0,9	1,5			0,3			
var. elliptica Hust.	I																						0,2							0,2					0,8	0,2	1,1	0,7	0,3	0,2	0,8						3,4	7,5	4,5	2,8	0,9	1,5		0,6	1,0											
var. oblongella Grun.	I																																		0,2	0,2							0,2			12,5	8,0	11,3	2,3	2,3	1,4	1,9	0,5		1,2	0,2	0,6	0,2	0,4	0,9	0,2		2,6	2,7	0,3	0,3
Frustulia Ag.																																																																		
rhomboides (Ehr.) De Toni	I									0,2																																																								
Gomphonema Agardh																																																																		
acuminatum Ehr.	I	0,7	1,0	0,2	0,3	0,2	0,8	0,3				0,4	0,2	0,2	0,2		0,2																		0,2	0,2						0,2	0,2				0,2	0,2			0,2													1,0	0,3	0,3
var. brebissonii (Kütz.) Cl.	I	0,5	0,7		0,7	0,2							0,3			0,2															0,3															0,2																		1,9	0,3	
var. coronatum (Ehr.) W.Sm.	I	0,7	0,5		0,2	0,5	0,2				0,2												0,2	0,2	0,2											0,2																														
var. trigonocephalum (Ehr.) Grun.	I				0,2																																																													
angustatum (Kütz.) Rabh.	I					0,2	0,2		0,2	0,2			0,7	0,2	1,0	0,5	0,7	0,5	0,5	0,5	0,5	0,2	0,2		0,2	0,2	0,2	0,2					0,3	0,5	0,2	0,3	0,2	0,2	0,2								0,2						0,2	0,2			0,4							1,0	0,9	0,7
var. productum Grun.	I										0,3		0,4	0,2		0,2	0,4																		0,2																															
augur Ehr.	I										0,3																																																						0,3	
constrictum Ehr.	I		0,4															0,2																		0,2									0,2	0,2									0,2				0,2							
var. capitatum (Ehr.) Cl.	I		0,5	0,5																																																												0,7		
f. robusta A. Mayer	I																						0,2																																									0,3		
gracile Ehr.	I																																										0,2	0,2																						
var. auritum (A.Br.) Cl.	I																																																																0,3	
intricatum Kütz.	I	0,2																																																															0,3	
var. dichotomum (Kütz.) Grun.	I	0,2				0,3																																																												
var. minor Skv.	I																																																																	
var. pumilum Grun.	I				0,2																																																											0,3		
longiceps Ehr.	I				0,3		0,2						0,2																																																					
var. montanum f. suecicum Grun.	I	0,2	0,2																																																															
var. subclavatum Grun.	I		0,2	0,2	0,2			0,3																																															0,2											
olivaceum (Lyngb.) Kütz.	I	0,2	0,2	0,2	1,0		0,2	0,2	0,2	0,2	0,2		0,4						0,2										0,2			0,2			0,2		0,2		0,2		0,2						0,2				0,2		0,2							0,2					0,3	
parvulum (Kütz.) Grun.	I	0,7	0,6	0,3	0,6	0,8	0,2	0,2																							0,2																0,2																		0,2	
var. micropus (Kütz.) Cl.	I																																																																	
var. subellipticum Cl.	I	0,2			0,2		0,2																																																											0,3
ventricosum Greg.	I					0,2																																																												
Grammatophora Ehrenberg																																																																		
hamulifera Kütz.	E																																					0,2							0,2																					
oceanica (Ehr.) Grun.	E													0,2								0,2				0,4				0,2		0,2	0,2	0,2	0,2																															
Gyrosigma Hassall																																																																		
acuminatum (Kütz.) Rabh.	I	0,5	0,3	0,5	1,6	0,3	0,2	0,3	0,2					0,3	0,2								0,2	0,5	2,1	1,5	0,7	0,7	2,7	1,3	0,5	2,1	0,5	0,3	1,0	1,3	0,7	0,6	1,1	0,8	1,0	0,3		0,2									0,5	0,4	0,5	0,9				0,2					0,3	0,7
attenuatum (Kütz.) Rabh.	I	0,5	0,6	4,1	4,9	1,6	0,8	1,0	2,3	1,2	10,3	5,8	8,5	1,3	2,6	2,6	1,1	2,2	2,0	3,5	1,7	1,8	4,4	0,5	0,7	0,6	0,5	0,2	0,2	0,2	0,2	0,5	0,5	0,3	0,2	0,8	0,3	0,3	0,2	1,1	0,3	0,2	0,2	0,2					0,2	0,2	0,5	1,0	1,4	0,2	0,9	0,2	0,8	0,5	0,8		0,4	1,7	1,6	0,7	2,1	2,0
spenceri (W. Sm.) Cl.	M																											0,2							0,3	0,2	0,2		0,2																											
Hantzschia Grunow																																																																		
amphioxis (Ehr.) Grun.	I							0,2									0,2		0,2				0,2		0,2			0,2	0,2	0,2	0,2	0,2	0,2		0,2												0,2	0,2	0,2												1,8			12,8	3,6	2,3
f. capitata O. Müll.	I																																																												1,3			1,7		0,3
Hyalodiscus Ehrenberg																																																																		
scoticus (Kütz.) Grun.	M																																																															0,3		
Mastogloia Thwaits																																																																		
elliptica (Ag.) Cl.	M																	0,2					0,2																																											
smithii Thw.	M																																																													0,3				
Melosira Agardh																																																																		
ambigua (Grun.) O. Müll.	I																				0,2				0,7	0,6	1,0	1,0	1,0	0,5	8,1	1,0	0,5	0,5	0,7	0,2		1,4	2,9	1,3	1,3									0,2	0,9	2,6	1,6	2,7	1,1	0,4	2,5	1,7	1,2	1,1	0,4	2,8	0,3	0,3	0,3	1,0
arenaria Moore	I						0,2	0,2	0,2	0,2	2,6	1,4	1,1	0,7	1,9	0,4	1,5	2,2	1,3	1,1	1,6	0,6	0,5	1,3	1,8	1,0	1,8	0,3	0,3	0,4	0,2	0,2	1,2	1,1	1,0	2,1	2,2	0,5	0,3	0,8	0,2	0,2	0,5	0,2						0,2		0,2			0,2				0,2							
distans (Ehr.) Kütz.	I																																																													0,7	1,3			
granulata (Ehr.) Ralfs	I			1,8	0,3	0,3	0,4	0,3	4,2	2,7	1,1	2,1	1,6	2,5	4,4	4,0	0,5	0,7	1,5	37,1	6,7	9,1	8,2	13,1	4,9	17,0	25,7	9,0	12,6	10,1	14,4	9,9	11,7	7,0	7,7	4,0	5,9	22,0	11,8	4,3	1,9	0,8	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,3	1,4	3,4	3,4	6,7	3,0	1,3	3,1	1,9	2,4	1,1	1,3	8,7	9,7	0,7	1,5	1,6
var. angustissima (O. Müll.) Hust.	I				0,3															0,2		0,2						0,3			1,0	1,3																								0,2									0,3	0,3
islandica subsp. helvetica O. Müll.	I	0,2															0,2	0,4		0,4	2,4	1,8	1,3	2,4	1,0	3,0	2,9	0,8	0,5	3,8	2,1	1,9	2,7	0,3		0,6	0,3	3,8	0,9	0,8	0,2										0,4	0,5	0,4	0,8	1,8	1,5	2,9	1,7	0,6	0,4	0,4	2,8	4,0	0,9	0,9	0,7
italica (Ehr.) Kütz.	I	0,2	0,2	1,6	1,2	0,8	3,3	2,3	2,2	8,6	4,4	1,4	0,7	4,7	1,4	9,2	0,4	0,4	0,5	9,4	29,0	9,2	7,4	1,3	0,4		0,2	0,3	0,2		1,0	2,7	0,8	5,8	6,6	0,6	0,3	5,2	2,0	0,6	1,7	0,8	0,2	0,2	0,2			0,2	0,4	0,5	0,6	1,5	2,3	2,1	1,2		0,4	2,4	0,9	1,3	0,7	3,4	0,3	0,3	0,3	0,3
var. subarctica O. Müll.	I																				0,9																																	0,2				0,2		0,4		0,3				
var. tenuissima (Grun.) O. Müll.	I																				0,2	0,5																												0,2	0,4		0,2	0,4		0,9		0,4	0,4				0,7	0,3		
sulcata v. biseriata Grun.	E													0,3	0,2	0,4	0,4	0,2	0,3	0,5			0,2										0,2	0,2																																
varians Ag.	H																																																0,2												0,7	0,3				
Meridion Agardh																																																																		
circulare Ag.	I									0,2			0,2	0,2	0,3		0,5	0,2								0,2				0,3					0,2		0,3																													
Navicula Bory																																																																		
americana Ehr.	I						0,2																																																												
amphibola Cl.	I																																																												22,8				0,3	
anglica Ralfs	I	0,2		0,5	0,2	0,3	0,2	0,2	0,2	0,2	0,2				0,2																													0,2					0,2			0,2													0,3	0,3
bacillum Ehr.	I	0,7	0,2	1,5	0,2	0,2	0,3	0,5	0,2	0,2			0,2																	0,3	1,0	0,2				0,2		0,2											0,2		0,2	0,3	0,2	0,2		0,4			0,2						0,3	0,3
bacilliformis Grun.	I							0,2																																																										
bonoides Ehr.	I			0,2																																																														
cari Ehr.	I	0,2											0,2	0,2																						0,2		0,2																					0,2							
cincta (Ehr.) Kütz.	H	0,2	0,3			1,0	0,3														0,2			0,2															0,2		0,2	0,3				0,2		0,2														0,3				
clementis var. acuta A. Cl.	H													0,2					0,2																											0,2																				
crucicula (W. Sm.) Donk.	M							0,2	0,2													0,3	0,[illegible]	0,5	0,2	0,2	0,7	0,3	0,3		0,2	0,3	0,3	0,5		0,3	0,3	0,5	0,6	0,5												0,2	0,4	0,2		0,2							0,3			0,3
cryptocephala Kütz.	H																						0,[illegible]				0,3			0,2			0,2	0,2							0,5	0,2								0,2			0,3	0,5		0,3		0,2	0,4	1,6	1,3	1,4	1,3	1,0	1,2	1,9
var. intermedia Grun.	H					0,2																																																												
var. veneta (Kütz.) Grun.	H	0,8						0,3																											0,2																													0,3		
cuspidata Kütz.	I			0,3	0,2	0,2	0,2	0,3	0,2	0,7	0,2																					0,2			0,2	0,3					0,8	0,9	0,7	0,2	0,2	0,3	0,2	0,2	0,2	0,2	0,4	0,2	0,2		0,3			0,2	0,2	0,2						0,3
var. ambigua (Ehr.) Cl.	I																						0,[illegible]	0,2	0,2																																									
dicephala (Ehr.) W. Sm.	I					0,2																																											0,2																	
digitoradiata (Greg.) A. Sm.	M																																					0,2	0,2	0,3	0,2																									
forcipata Grev.	M	0,2	0,2													0,2			0,2		0,2		0,[illegible]	0,4	1,1				0,5	0,2		0,2	0,2																		0,2				0,2											
exigua (Greg.) O. Müll.	I																															0,2			0,2						0,2																									
gastrum Ehr.	I	0,3	0,2		0,2		0,3				0,2	0,2	0,2	0,3																		0,2			0,2								0,3					0,2	0,2																	
gibbula Cl.	I																																																																0,3	
gracilis Ehr.	I	1,3	0,6		0,7	0,3	0,3	0,3	0,4		0,2	0,2											0,[illegible]				0,2					0,2			0,2																	0,2														
gracilloides A. Mayer	I																																																																0,3	
hungarica Grun.	H	0,2	0,2		0,2	0,3	0,2	0,2		0,2				0,2								0,3	0,[illegible]	1,6	0,5	0,2	0,2	0,2	1,3	0,5	1,1	0,2	0,2	1,0	0,3			0,2	0,3	0,8	0,6	1,7	0,5	0,2			0,4	0,4	0,4	0,2	0,8	0,3	0,2				0,2	0,5	1,0		0,3	0,3	1,0		0,3	
var. capitata (Ehr.) Cl.	H	0,2	0,2				0,2																													0,3		0,2				0,2						0,5					0,2			0,3		0,2							0,3	
lanceolata (Ag.) Kütz.	I	0,2													0,3																					0,3																														
laterostrata Hust.	I					0,2						0,2			0,3																																																			
menisculus Schum.	I	1,2	0,2	1,7	1,6	0,8	0,8	0,5	0,5	0,3	0,3	0,2	0,2	0,7	0,2				0,8	1,1	1,6	7,9	3,[illegible]	2,4	2,5	0,2	0,7	0,3	3,2	2,0	4,6	1,7	0,8	0,3	2,2	0,8	0,8	1,6	1,6	0,8	1,3	0,2								0,2	0,2	0,3	0,4	1,2	0,2	0,2						0,3	0,3			1,0
muralis Grun.	I																																																												0,3					
mutica Kütz.	H																																				0,2																		0,2											
oblonga Kütz.	I	0,2	0,2	0,3	0,3	0,2	0,2	0,2	0,4	0,2		0,2	0,2	0,2	0,3		0,2		0,2		0,2		0,[illegible]		0,4	0,2			0,2				0,3	0,3	0,2	0,6		0,2		0,3	0,2	0,5	0,5	0,5	0,5	0,5	0,5	0,4	0,5	0,4	0,5	0,5			0,2		0,2		0,4	0,4	0,3				0,3	
peregrina (Ehr.) Kütz.	M																																								0,6	0,2																								
placentula (Ehr.) Grun.	I	0,2		0,6	0,2	0,3	0,2	0,2	0,4	0,2	0,2	0,2		0,2	0,2							0,2	0,[illegible]	0,5	0,2	0,2	0,2	0,3	0,2	0,2	0,3				0,2	0,2			0,2																											
f. rostrata A. Mayer	I						0,2												0,2			0,2																									0,2																		0,3	
platystoma Ehr.	I																										0,2	0,2	0,2	0,2		0,2																																		
protracta Grun.	M																														0,2												0,2																							
pupula Kütz.	H		0,2	0,2	0,2		0,3	0,2	0,4	0,2	0,3	0,2			0,2						0,5	0,7	0,[illegible]	0,2							0,3	0,3	0,3	1,0	0,2			0,2		0,3								0,4			0,2					0,2										
var. capitata Hust.	I	0,2				0,2						0,2																																																						
var. rectangularis (Greg.) Grun.	I																																														0,2																			
pygmaea Kütz.	M																												0,7													0,3	0,2																						0,3	
radiosa Kütz.	I	0,5	0,5		0,9	0,5	0,3	0,2					0,2						0,2					0,5	0,2				1,0	0,2	0,2				0,2			0,3	0,6	0,2	0,2	0,2																					0,3		0,6	
reinhardtii Grun.	I														0,2			0,2	0,2									0,2	0,3	0,2	0,2	0,2	0,5	0,2		0,2	0,2		0,2	0,2	0,3		0,2													0,2										
rhynchocephala Kütz.	H			0,2										0,2							0,2				0,5	0,2	0,2	0,5	1,2	1,6	0,3	0,3							1,2	0,5	0,5	0,3	0,5		0,3								0,2		0,2											
salinarum Grun.	M																												0,2			0,2								0,3	0,2																									
schoenfeldii Hust.	I										0,5	0,2																																																	0,2					
scutelloides W. Sm.	I					0,2				0,2	0,7	1,9	4,0	4,2	3,1	6,0	46,2	36,1	15,8	3,8	4,9	4,9	10,[illegible]	0,7	0,3	0,2	4,5	2,2	1,3	0,8	0,2	0,5	2,2	5,6	2,9	3,4	3,0	0,3	0,2	0,2		0,2		0,2	0,2				0,2		1,4	1,3	2,3	2,1	1,0	0,9			0,2	0,2		0,3	0,7		0,3	0,3
semen Ehr.	Hb																																																												2,6				0,3	
tuscula (Ehr.) Grun.	I			0,2										0,2	0,2							0,2		0,4	0,4	0,2	0,2	1,0	1,5	0,2	0,2				0,2	0,2				0,2													0,2		0,2							0,3			0,3	
viridula Kütz.	H		0,7		0,4	1,2	0,2															1,7	0,5	1,6	0,9	1,9		0,8	1,7	2,0	0,7	1,8	1,0	0,5	0,5	1,0	1,0	0,9	0,5	0,8	0,9	0,8	0,5				0,5	0,2	0,2	0,4	0,4	0,6	0,6	1,4	0,7	0,7	0,8	0,4	0,4							
Neidium Pfitzer																																																																		
affine (Ehr.) Cl.	Hb								0,2																												0,2																													
var. amphirhynchus (Ehr.) Cl.	Hb													0,2									0,2															0,2		0,2																										
bisulcatum (Langerst.) Cl.	I																													0,2																	0,2														0,5					
dubium (Ehr.) Cl.	I							0,3															0,2																																											
var. constrictum Hust.	I				0,2																	0,2	0,2																																											
iridis (Ehr.) Cl.	Hb	0,2	0,2	0,3	0,6	0,3	0,3	0,2	0,2	0,2	0,2			0,2								0,2								0,2	0,2	0,2			0,2	0,2									0,4	0,3	0,2								0,3		0,2	0,2			5,2				0,3	0,3
f. vernale Reich.	Hb				0,2		0,3			0,2				0,2																																															2,9					
kozlowii (Mer.) Hust.	Hb																																																																0,3	0,3
productum (W. Sm.) Cl.	I	0,2	0,2					0,2		0,2				0,2						0,2			0,2	0,2			0,3	0,2	0,2	0,2	0,2	0,2			0,2	0,3	0,2	0,2	0,2																											

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Nitzschia Hassel																							
acuta Hantzsch	I		0,2	0,2		0,5			0,2	0,2				1,3	0,3								
amphibia Grun.	I	2,2	1,4	0,2	0,9	0,8	0,3	0,5	0,2	0,2	0,2			0,5			0,2		0,2		0,2		
angustata (W. Sm.) Grun.	I	0,2	0,2	0,3	0,3	0,3	0,3	0,6	0,6	0,2	0,3		0,2	1,1		0,2			0,2		0,7	0,3	0,8
var. acuta Grun.	I	0,2							0,2	0,2	0,2												0,5
apiculata (Greg.) Grun.	M																						
capitellata Hust.	H																						
circumsuta (Bail.) Grun.	M																						
commutata Grun.	M																						
dissipata (Kütz.) Grun.	I	0,2											0,2										
frustulum (Kütz.) Grun.	H	1,2	0,8			0,3	0,2																
hungarica Grun.	M				0,2	0,3	0,2																
kützingiana Hilse	I								0,2	0,3													
palea Kütz. (W. Sm.)	H																						
punctata (W. Sm.) Grun.	B														0,2		0,2	0,2					
recta Hantzsch	I			0,2	0,5	0,3				0,3	0,2	0,2		0,2								0,2	0,2
scalaris (Ehr.) W. Sm.	M																						
sigma (Kütz.) W. Sm.	M																						
sigmoidea (Ehr.) W. Sm.	I	0,5	0,2	0,2				0,5	0,4	0,3	0,2	0,2	0,2	0,3	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2
trybionella Hantzsch	M														0,2								
var. levidensis (W. Sm.) Grun.	H	0,2	0,2		0,3	0,3	0,2	0,2						0,3								0,7	0,5
var. victoriae Grun.	H													0,2									
vermicularis (Kütz.) Grun.	I	0,2	0,2	0,2				0,2															
Opephora Petit																							
martyi Hérib.	I			0,3	0,3	0,3	0,2	0,5	0,6	0,9	6,7	4,4	8,5	14,2	14,0	25,7	21,9	24,7	30,7	10,6	11,4	6,5	3,9
Pinnularia Ehrenberg																							
aestuarium var. minor Cl.	I																						
borealis Ehr.	I																						
var. minor Schirschow	I																						
braunii v.amphicephala (A.Mayer) Hust.	I																						
brevicostata Cl.	I																						
cardinalis (Ehr.) W. Sm.	I													0,2						0,2			
distinguenda Cl.	I																						
gentilis (Donk.) Cl.	I			0,2								0,2											
globiceps Greg.	H																						
interrupta W. Sm.	I																					0,3	
isostauron Grun.	I																						
macilenta (Ehr.) Cl.	I																						
major (Kütz.) Cl.	I			0,5	0,2		0,3	0,3					0,2	0,3		0,4					0,2		
microstauron (Ehr.) Cl.	I	0,2						0,2				0,2					0,4				0,2	0,3	
var. brebissonii (Kütz.) Hust.	I	0,2	0,2	0,2	0,2	0,2	0,3	0,2	0,2									0,2					
nobilis Ehr.	I		0,2			0,2			0,2			0,2							0,2	0,2			
perlucens (Østr.) A. Cl.	I																						
streptoraphe Cl.	I																						
subcapitata Greg.	I																						
viridis (Nitzsch) Ehr.	I	0,5	0,2	0,6	1,4	0,5	0,9	0,6	0,4	0,5	0,3	0,7	0,7	0,5	0,5	0,5	0,7	0,2	0,2	0,2	0,3	1,2	0,3
var. commutata (Grun.) Cl.	I																						
var. leptogongyla (Ehr? Grun.) Cl.	I																						
sp.																							
Rhabdonema Kützing																							
arcuatum (Ag.) Kütz.	E																						
Rhoicosphenia Grunow																							
curvata (Kütz.) Grun.	H	8,7	10,5	2,1	2,3	7,3	1,7	0,3	0,2	0,2	0,5	0,5	1,4	0,9	0,3	0,4	0,2			0,2			
Rhopalodia O. Müller																							
gibba (Ehr.) O. Müll.	I	0,5	0,6	0,2	0,3	1,5	0,2				0,3	0,2	0,5	0,3			0,2						
var. ventricosa (Ehr.) Grun.	I	0,2	0,9		0,3										0,2								
gibberula (Ehr.) O. Müll.	M																0,2						
Stauroneis Ehrenberg																							
acuta W. Sm.	I								0,2	0,2	0,2	0,2	0,5	0,2	0,2	0,2	0,5			0,2			0,2
anceps Ehr.	I																						
javanica v. oblongella Østr.	I																						
phoenicentron Ehr.	I	0,2			0,2				0,4			0,2		0,2	0,5	0,2				0,4			0,3
smithii Grun.	I				0,2																		
var. karelica Wisl, et Kolbe	I																			0,2			
Stephanodiscus (Ehrenberg) Grun.																							
astraea (Ehr.) Grun.	I					0,2	0,4	0,2	0,4	0,3	1,1	0,5	0,9	0,7	2,3	0,4	1,6	0,7	0,7	3,7	2,3	11,0	7,2
var. intermedius Fricke	I																						
var. minutulus (Kütz.) Grun.	I	5,5	8,4	1,3	1,2	4,9	4,0	0,6	0,4											0,5	0,2	0,2	
hantzschii Grun.	I	0,3	0,5	0,2		0,3	0,2	0,2			0,2	0,2								0,2		0,5	
Surirella Turpin																							
angustata Kütz.	I	0,2																					
biseriata Bréb.	I			0,3				0,6	0,4	0,5			0,4			0,2						0,3	0,5
var. bifrons (Ehr.) Hust.	I						0,3													0,2	0,3	0,2	0,2
f. punctata Meist.	I								0,4		1,1	0,5	0,2	1,8		2,2	0,2						0,2
var. robusta Schulz	I															0,7							
capronii Bréb.	H											0,2		0,7		0,9						0,2	
elegans Ehr.	I	0,2														0,2							
linearis W. Sm.	I							0,2															
v. helvetica (Brun.) Meist.	I												0,2										
ovata Kütz.	I	0,2						0,2								0,2							0,2
var. crumena (Bréb.) V. H.	H																					1,7	2,8
var. pseudopinnata A. Mayer	I			0,2																			0,5
robusta Ehr.	I																						
var. splendida (Ehr.) V. H.	I													0,2									0,2
striatula Turp.	M																						
tenera Greg.	I						0,2													0,2	0,2		
Synedra Ehrenberg																							
acus Kütz.	I			0,2	0,2	0,3		0,2															0,3
amphicephala Kütz.	I	1,0	0,3																				
capitata Ehr.	I	0,2			0,2								0,2		0,2		0,4	0,2			0,2		
parasitica (W. Sm.) Hust.	I			0,3			0,4	0,2	0,2														
var. subconstricta Grun.	I					0,2	0,2	0,2		0,2	0,2				0,2								
pulchella (Ralfs) Kütz.	M	0,2	0,2		0,2	0,2																	
tabulata (Ag.) Kütz.	M														0,2	0,2							
var. fasciculata (Kütz.) Grun.	M																						
ulna (Nitzsch) Ehr.	I	1,3	0,7	0,6	0,7	1,3	0,2	0,5	0,6	0,3	0,5	0,5	0,9	0,3	1,4	0,7	0,5	0,5	0,5	0,4	0,5	0,2	0,5
var. biceps (Kütz.) Schönf.	I	0,2			0,2	0,2	0,2	0,2	0,2	0,3	0,3	0,2					0,2	0,2		0,4			
var. danica (Kütz.) Grun.	I																		0,3				
var. sphathulifera Grun.	I																						
vaucheriae Kütz.	I	0,5	0,5	0,3	0,3	0,3	0,3		0,3		0,2	0,2			0,3		0,2		0,3		0,2	0,7	0,3
Tabellaria Ehrenberg																							
fenestrata (Lyngb.) Kütz.	I														0,2								
Terpsinoë Ehrenberg																							
americana (Bail.) Ralfs	M																						
Thalassiosira P.T. Cleve																							
baltica Grun.	M																						
gravida Cl.	E																						

		23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
Nitzschia Hassel																							
acuta Hantzsch	I									0,2		0,3			0,2	0,2							
amphibia Grun.	I	0,2	0,2			0,3	0,2	0,6	2,7	0,2		0,2	0,2	0,2	0,2		0,2		0,5		0,3	0,2	
angustata (W. Sm.) Grun.	I	1,1	0,2	0,2	0,9	0,5	0,7	0,6	1,2	1,6	0,2	1,6	1,0	0,4	0,2	0,3	0,5		0,5	0,3		0,2	
var. acuta Grun.	I	0,2			0,2	0,2	0,2	0,2	0,2			0,2	0,3		0,2		0,2						
apiculata (Greg.) Grun.	M																		0,2				
capitellata Hust.	H								0,2														
circumsuta (Bail.) Grun.	M												0,2				0,3						
commutata Grun.	M								0,2	0,2			0,2				0,3						
dissipata (Kütz.) Grun.	I															0,2	0,2			0,6	0,5	0,2	
frustulum (Kütz.) Grun.	H																0,3	0,2					
hungarica Grun.	M					0,3	0,3	0,2	0,3		0,2	2,0	0,2	0,2			0,2	0,3	0,2	0,3			
kützingiana Hilse	I							0,4	0,7	0,2			0,2	0,2				0,2					
palea Kütz. (W. Sm.)	H									0,5	0,2	0,6	0,3										
punctata (W. Sm.) Grun.	B					0,2																	
recta Hantzsch	I				0,2	0,2			0,2	0,2		0,5							0,2	0,3			
scalaris (Ehr.) W. Sm.	M									0,2		0,3	0,3	0,3	0,5	0,2	0,2	0,3	0,2	0,2	0,3		0,2
sigma (Kütz.) W. Sm.	M																0,2	0,2					
sigmoidea (Ehr.) W. Sm.	I	0,5	0,3	0,3	0,3	0,5	0,2	0,7	0,3	0,2	0,3	2,3	0,7	0,5	0,8	0,6	0,2	0,8	1,3	1,7	1,4	0,3	
trybionella Hantzsch	M		0,5	0,8	0,5	0,7						1,1					0,2	0,2	0,2	0,2			
var. levidensis (W. Sm.) Grun.	H	2,0	3,3	1,1	0,7	1,7	1,0	0,5	0,6	1,6	0,8	10,9	0,5	0,5	0,8	0,9	2,5	2,5	0,4	0,2	0,3	0,2	0,3
var. victoriae Grun.	H		0,3			0,2	0,8	0,5	0,3	0,3	0,5	3,6	0,2	0,2	0,2								
vermicularis (Kütz.) Grun.	I							0,2	0,3	0,3		0,3	0,2	0,2		0,3							
Opephora Petit																							
martyi Hérib.	I	13,1	6,7	13,2	11,8	14,5	8,9	3,1	3,4	9,5	16,1	14,8	16,6	22,2	24,5	4,1	3,5	5,1	0,9	0,8	0,3	0,3	
Pinnularia Ehrenberg																							
aestuarium var. minor Cl.	I																						
borealis Ehr.	I																						
var. minor Schirschow	I																						
braunii v.amphicephala (A.Mayer) Hust.	I																						
brevicostata Cl.	I																						
cardinalis (Ehr.) W. Sm.	I		0,3	0,2			0,2					0,3											
distinguenda Cl.	I																						
gentilis (Donk.) Cl.	I															0,2							
globiceps Greg.	H		0,2																				
interrupta W. Sm.	I			0,2		0,2	0,2	0,2	0,3	0,2	0,5												
isostauron Grun.	I																						
macilenta (Ehr.) Cl.	I							0,2															
major (Kütz.) Cl.	I			0,2			0,2	0,2	0,2		0,2		0,2		0,3			0,6	0,9	0,5	0,2	0,3	
microstauron (Ehr.) Cl.	I	1,6	0,3	0,2	0,2	1,0	0,8	1,0	0,6	0,2	0,5	0,2	0,3	0,3	0,3	0,5	0,2	0,3	0,5	0,3	0,3	0,2	
var. brebissonii (Kütz.) Hust.	I					0,2			0,2					0,2	0,2								0,2
nobilis Ehr.	I	0,2	0,2		0,2			0,2								0,5	0,3						0,2
perlucens (Østr.) A. Cl.	I																						
streptoraphe Cl.	I																						
subcapitata Greg.	I																						
viridis (Nitzsch) Ehr.	I	3,6	3,3	1,1	0,9	1,2	1,2	2,1	0,6	0,8	1,7	1,1	1,2	2,4	2,0	1,2	0,8	0,6	0,5	0,5	0,5	1,2	0,5
var. commutata (Grun.) Cl.	I																						
var. leptogongyla (Ehr? Grun.) Cl.	I																						0,3
sp.																							
Rhabdonema Kützing																							
arcuatum (Ag.) Kütz.	E									0,2	0,2				0,4								
Rhoicosphenia Grunow																							
curvata (Kütz.) Grun.	H		0,2				0,2	0,3		0,2	0,2	0,2	0,2	1,3	0,2			0,5	0,6	0,2	0,2	0,2	0,2
Rhopalodia O. Müller																							
gibba (Ehr.) O. Müll.	I										0,2					0,2	0,2						
var. ventricosa (Ehr.) Grun.	I																0,2			0,2			
gibberula (Ehr.) O. Müll.	M																						
Stauroneis Ehrenberg																							
acuta W. Sm.	I																						
anceps Ehr.	I																						
javanica v. oblongella Østr.	I																						
phoenicentron Ehr.	I												0,2	0,2		0,5	0,3	0,2			0,2		
smithii Grun.	I																						
var. karelica Wisl, et Kolbe	I					0,2	0,2			0,2		0,3	0,5	0,3									
Stephanodiscus (Ehrenberg) Grun.																							
astraea (Ehr.) Grun.	I	1,8	5,8	17,0	8,0	16,0	3,0	38,7	20,7	20,2	26,6	0,8	11,1	7,7	8,3	15,5	34,3	17,9	0,5		0,3	0,7	
var. intermedius Fricke	I									0,2			0,2										
var. minutulus (Kütz.) Grun.	I	0,4	2,4	0,2		2,2	3,0	0,8	1,9	1,3	0,2	1,0	0,8	0,2			0,3	0,2		0,2			
hantzschii Grun.	I	0,2					2,4	0,3	0,6	0,3	0,2	0,3	0,3	0,2	0,2		0,6	0,3					
Surirella Turpin																							
angustata Kütz.	I									0,2													
biseriata Bréb.	I	0,4		0,2	0,2		0,2	0,3	0,3			0,2	0,2	0,2	0,2	0,2	0,2		0,5				
var. bifrons (Ehr.) Hust.	I	0,2				0,2	0,2	0,2	0,2	0,2		0,3	0,3	0,2		0,3	0,2		0,2				
f. punctata Meist.	I								0,2			0,3	0,5							0,2			
var. robusta Schulz	I																						
capronii Bréb.	H					0,2			0,2		0,2		0,2			0,2							
elegans Ehr.	I												0,2										
linearis W. Sm.	I												0,2										
v. helvetica (Brun.) Meist.	I							0,2		0,3		0,2	0,2										
ovata Kütz.	I	0,2		0,2		0,2	0,3	0,3	0,2	0,3	0,3	0,2	0,2	0,2		0,2	0,3	0,2	0,2				
var. crumena (Bréb.) V. H.	H	5,1	3,0	1,7	0,3	0,5	1,8	0,6	0,5	1,0	0,8	0,2	0,3	0,2	1,3	0,5	0,3	0,3	0,2	0,2	0,2	0,2	
var. pseudopinnata A. Mayer	I								0,3														
robusta Ehr.	I	0,2												0,3					0,2				
var. splendida (Ehr.) V. H.	I									0,2													
striatula Turp.	M			0,2														0,2	0,2				0,2
tenera Greg.	I																						
Synedra Ehrenberg																							
acus Kütz.	I								0,2	0,5						0,2							
amphicephala Kütz.	I																						
capitata Ehr.	I									0,2				0,3	0,5		0,2	0,2	0,3		0,2	0,2	
parasitica (W. Sm.) Hust.	I								0,3	0,6		0,2				0,5			0,2	1,4	0,5		
var. subconstricta Grun.	I								0,2										0,2				
pulchella (Ralfs) Kütz.	M						0,2					0,2		0,2									
tabulata (Ag.) Kütz.	M													0,2	0,2			0,2					
var. fasciculata (Kütz.) Grun.	M		0,2																				
ulna (Nitzsch) Ehr.	I	0,2	0,2	0,2	0,2		0,2	0,2	0,2	0,5	0,2	0,2	0,3	0,5	0,5	0,6	0,5	0,5	0,2		0,2	0,2	
var. biceps (Kütz.) Schönf.	I									0,2	0,2	0,2		0,3	0,2			0,5	0,2	0,2			
var. danica (Kütz.) Grun.	I											0,2						0,2					
var. sphathulifera Grun.	I																						
vaucheriae Kütz.	I	0,2								0,2	0,3	0,2			0,2		0,3	0,5				0,2	
Tabellaria Ehrenberg																							
fenestrata (Lyngb.) Kütz.	I											0,2											
Terpsinoë Ehrenberg																							
americana (Bail.) Ralfs	M		0,2	0,2																			
Thalassiosira P.T. Cleve																							
baltica Grun.	M									0,2						0,5	0,2						
gravida Cl.	E																						

		45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65
Nitzschia Hassel																						
acuta Hantzsch	I																					
amphibia Grun.	I	0,7	1,8	2,6	0,5	0,5	0,2	-0,2	0,4	1,5	0,7	0,4			0,4	0,5	0,2	0,7	0,4	0,3	0,3	0,3
angustata (W. Sm.) Grun.	I						0,4	0,2	0,4	0,6		0,4		0,2			0,2		0,7			
var. acuta Grun.	I												0,2	0,2								0,7
apiculata (Greg.) Grun.	M																					
capitellata Hust.	H																					
circumsuta (Bail.) Grun.	M																					
commutata Grun.	M																					
dissipata (Kütz.) Grun.	I																					
frustulum (Kütz.) Grun.	H		0,2	0,5	0,2	0,4	0,2	0,3			0,2											
hungarica Grun.	M						0,2			0,6				0,2	0,6				0,3			
kützingiana Hilse	I		0,7	1,0		0,2							0,2			0,2			0,3		0,3	
palea Kütz. (W. Sm.)	H																					
punctata (W. Sm.) Grun.	B																					
recta Hantzsch	I				0,2		0,2	0,5		0,2	0,3	0,2			0,2	0,4	0,2					
scalaris (Ehr.) W. Sm.	M	0,2																				
sigma (Kütz.) W. Sm.	M																					
sigmoidea (Ehr.) W. Sm.	I		0,2		0,2	0,2	0,4	0,5	0,2	0,2	0,3		0,4	0,2	0,2	0,2	0,2					
trybionella Hantzsch	M																					
var. levidensis (W. Sm.) Grun.	H	0,2						0,2	0,2	0,4	0,2		0,2	0,7	1,2			0,7	0,3			
var. victoriae Grun.	H																					
vermicularis (Kütz.) Grun.	I						0,2	0,2														
Opephora Petit																						
martyi Hérib.	I	0,2			0,2		3,7	2,5	6,0	15,9	5,1	7,2	8,8	5,8	6,5	5,1	1,8	9,1	13,9	[illegible]	2,4	1,3
Pinnularia Ehrenberg																						
aestuarium var. minor Cl.	I																			1,0	1,0	1,6
borealis Ehr.	I																0,4			2,7		
var. minor Schirschow	I																			0,7		
braunii v.amphicephala (A.Mayer) Hust.	I								0,2				0,2									
brevicostata Cl.	I																				[illegible]	0,7
cardinalis (Ehr.) W. Sm.	I																				[illegible]	
distinguenda Cl.	I																2,6		0,3	1,5	[illegible]	
gentilis (Donk.) Cl.	I																				[illegible]	
globiceps Greg.	H						0,2															
interrupta W. Sm.	I									0,4	0,2					0,7						
isostauron Grun.	I		0,2														2,2				0,3	
macilenta (Ehr.) Cl.	I																					
major (Kütz.) Cl.	I								0,2			0,6	0,4	0,4		0,9	0,4	0,7	0,9	0,9	1,2	
microstauron (Ehr.) Cl.	I						0,2		0,2						0,2			0,7	0,3	0,3	0,3	
var. brebissonii (Kütz.) Hust.	I																				0,6	0,3
nobilis Ehr.	I				0,4	0,4					0,2								0,3			
perlucens (Østr.) A. Cl.	I																0,4					
streptoraphe Cl.	I																	0,7	0,3	1,7	1,0	2,3
subcapitata Greg.	I																				0,3	
viridis (Nitzsch) Ehr.	I	0,3	0,2	0,3	0,2	0,5	0,4	0,6	0,2	1,3	1,0	0,9	1,0	0,7		1,1	6,8	5,2	2,9	8,0	7,0	6,8
var. commutata (Grun.) Cl.	I																10,6	1,1	0,9	11,8	3,1	3,4
var. leptogongyla (Ehr? Grun.) Cl.	I	0,4		0,2													0,2		0,4	0,6		0,7
sp.																	0,7	1,4	0,7	0,8	0,6	1,0
Rhabdonema Kützing																						
arcuatum (Ag.) Kütz.	E	0,2																				
Rhoicosphenia Grunow																						
curvata (Kütz.) Grun.	H	0,2	0,2	0,2			0,2	0,2		0,2	1,8	1,8		0,2	1,0	0,2	0,2			0,7	3,4	2,3
Rhopalodia O. Müller																						
gibba (Ehr.) O. Müll.	I																					0,3
var. ventricosa (Ehr.) Grun.	I																					0,3
gibberula (Ehr.) O. Müll.	M																					
Stauroneis Ehrenberg																						
acuta W. Sm.	I																0,4			0,7	2,1	
anceps Ehr.	I											0,2					0,2					
javanica v. oblongella Østr.	I																2,4	0,3		2,0	2,4	1,0
phoenicentron Ehr.	I						0,2															
smithii Grun.	I																					
var. karelica Wisl, et Kolbe	I																					
Stephanodiscus (Ehrenberg) Grun.																						
astraea (Ehr.) Grun.	I		0,2		0,2		2,3	2,6	3,0	1,7	4,8	4,6	19,9	12,7	6,7	6,5	1,5	11,8	9,9	0,7	0,9	1,3
var. intermedius Fricke	I																					
var. minutulus (Kütz.) Grun.	I								0,2		0,3			0,9	1,2	1,1	0,7	10,0	4,0	0,3	0,3	0,3
hantzschii Grun.	I	0,2					0,5	1,0	0,4	0,8	0,7	0,2	0,2	0,2	0,4		0,2	0,7	0,7	0,3		0,3
Surirella Turpin																						
angustata Kütz.	I																					
biseriata Bréb.	I							0,2														
var. bifrons (Ehr.) Hust.	I																					
f. punctata Meist.	I								0,2					0,2								
var. robusta Schulz	I																					
capronii Bréb.	H																					
elegans Ehr.	I																				0,3	
linearis W. Sm.	I																					
v. helvetica (Brun.) Meist.	I																					
ovata Kütz.	I																					0,3
var. crumena (Bréb.) V. H.	H				0,2		0,2	0,2		1,4	0,3		0,6		0,8	0,9		1,0	1,6		0,3	0,7
var. pseudopinnata A. Mayer	I																					
robusta Ehr.	I																					
var. splendida (Ehr.) V. H.	I																					
striatula Turp.	M																					
tenera Greg.	I																					
Synedra Ehrenberg																						
acus Kütz.	I																					
amphicephala Kütz.	I																					
capitata Ehr.	I		0,4	0,4	0,4	0,5	0,2	0,2	0,5	0,2	0,3		0,2	0,2			0,2	0,3	0,3			
parasitica (W. Sm.) Hust.	I						0,2	0,2							0,2		0,3				0,3	
var. subconstricta Grun.	I																					
pulchella (Ralfs) Kütz.	M		0,4	0,2																		
tabulata (Ag.) Kütz.	M																					
var. fasciculata (Kütz.) Grun.	M																					
ulna (Nitzsch) Ehr.	I	0,3	0,9	0,5	0,4	0,2		0,3			0,2	0,4			0,2	0,2						0,7
var. biceps (Kütz.) Schönf.	I											0,2	0,2	0,2							0,6	0,3
var. danica (Kütz.) Grun.	I		0,4		0,4			0,2	0,2					0,2								
var. sphathulifera Grun.	I					0,4			0,2													
vaucheriae Kütz.	I		0,5																			
Tabellaria Ehrenberg																						
fenestrata (Lyngb.) Kütz.	I																					
Terpsinoë Ehrenberg																						
americana (Bail.) Ralfs	M																					
Thalassiosira P.T. Cleve																						
baltica Grun.	M											0,2	0,6	1,8	1,6	3,4						0,3
gravida Cl.	E				0,2		0,2	0,2		0,4	0,2											