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APPENDIX

THE DIATOMS IN THE SOMERO CLAY

by

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The diatoms found in the samples from boreholes A and B in Somero were discussed by Gardemeister (1968 a, 1968 b), who concluded that the flora represented an interglacial marine flora, similar to that described from Rouhiala (Brander 1937, 1937 b, 1941) and also from Mga. Further, Brander (1941) also found a similar diatom flora in some tills from western Finland. All above-mentioned floras differ clearly from those in Late Weichselian varved clays, which are poor in diatoms and contain mostly fresh-water forms, as the varved clay at Jokela (Mölder 1956). In those cases where Late Weichselian or early Flandrian Baltic sediments are rich in diatoms the diatoms have been explained as having been derived from interstadial or interglacial sediments, as in Ostrobothnia (Mölder 1949, Aario 1966, Ignatius and Leskelä 1970). The interstadial deposits in northern Finland, having a radiocarbon age of about 45 000 years, contain only fresh-water diatoms (Korpela 1969). Some sediments found underneath till from Finland and the Karelian Isthmus have been dated as interstadial or interglacial (Aurola 1949, Sauramo 1940, Hyyppä 1937 b). In some cases they have contained marine diatoms, usually dominated by *Grammatophora oceanica*, in other cases they have been extremely poor in diatoms and some sediments have not been investigated in detail. In the present diatom investigation the main question is whether or not there was a connection between the Gulf of Finland and the White Sea.

Many of the diatoms shown in Table 1 are marine forms, which during the Flandrian have not thrived in the coastal areas of Finland. The following diatoms belong to these according to Hustedt (1930): *Actinoptychus undulatus*, *Auliscus caelatus*, *Biddulphia rhombus*, *Dimerogramma minor*, *Grammatophora arcuata*, *Stephanopyxis turris* and *Trachyneis aspera*. *Actinoptychus undulatus* is a littoral form found in all seas. *Auliscus caelatus* and *Stephanopyxis turris* occur along all European coasts as well as the littoral forms *Biddulphia rhombus* and *Dimerogramma minor*. *Biddulphia rhombus* is, according to Brander (1941) particularly found in sediments of the Eemian Portlandia Sea. Of the diatoms from Somero *Grammatophora arcuata* is at present only found in the coastal arctic and antarctic waters. *Trachyneis aspera* grows now for instance on the coasts of France (Peragallo 1908). *Synedra crystallina* is common in Europe and also in those parts of the Baltic with high salinity, and has been present in the coastal waters of south-western Finland at a time when the waters had a salinity at least as high as during the Flandrian Litorina Sea period.

The above-mentioned species are the same as those described by Brander from Rouhiala. Even if they occur in small numbers the number of species makes their presence significant. *Grammatophora ocenica*, *G. marina* and *Epithemia turgia* + var. *westermanni* are most common, of which *G. oceanica* and *G. marina* are common marine forms, but are also found at present in the brackish waters of the Gulf of Finland and the Gulf of Bothnia, and which are frequently found also in older Flandrian sediments in that area. *Epithemia turgida* + var. *westermanni* grows in fresh-water as well as in slightly brackish water. This was also found in Rouhiala.

In the sandy sediment at the bottom of borehole B the most common form is the fresh-water diatom *Melosira italica* ssp. *subarctica*. There are no marine forms, and the sediment thus has an origin different from that of the clay above. The sediment was probably formed immediately after the retreat of the ice. In the clay there is no indication of a mixing of different diatom floras. The greatest frequency of diatoms is in the light-coloured summer layers. Higher up in the series of samples from borehole B the diatoms are less frequent. If the diatoms were contemporaneous with the formation of the disturbed varves it would be difficult to understand the high frequency of diatoms in the summer layers of these clays. It is more likely that all or most of the diatoms are redeposited interglacial diatoms and that the diatoms in each varve come from sediments representing a longer period of time than only one year. It has been observed that even in deep-water clay sediments most diatoms are deposited during the summer with the coarser fractions. Margalef (1961) showed that diatoms sink with a velocity of $1.7—6 \times 10^{-3}$ cm/sec, which means that smaller diatoms sink 80 m in about 54 days.

The diatoms in the Somero clay show that the water in which the clay was deposited had a higher salinity than the water in the same area after the last glaciation. This can be explained by assuming that the Gulf of Finland was connected with the White Sea. This assumption is supported by the presence of the arctic species *Grammatophora arcuata*. The diatoms can well represent the time of the Eemian transgression during the interglacial climatic optimum, during which cold water penetrated into the Baltic from the White Sea.

A Late Weichselian connection in the Alleröd period between the Baltic and the White Sea has been suggested (Hyyppä 1943, Mölder 1944), but in Finland no clear diatom floras supporting this view have been found. From the Leningrad area (Iinoridze and Kleimenova 1965) and from eastern Karelia in the U. S. S. R. the same diatoms have been found in Late Weichselian sediments as in the Mga area. Lavrova and Ladyschkina (1965) mention the possibility of redeposition of the diatoms but point out that the marine diatoms occur in a very large area.

The diatoms found in the Somero clay show that the water in which the diatoms grew had a higher salinity than that can be assumed for Late Weichselian or Flandrian times. Thus, an interstadial or interglacial origin for the diatoms is most likely. The pollen studies support an interglacial age.

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TABLE 1

Diatoms in borehole A and B

	Borehole A							Borehole B												
Depth m	0.8	3.2	11.2	11.25	12.0	13.6	13.8	15.0	18.2	22.4	22.45	23.3	23.5	23.55	24.3	27.4	27.5	28.0	30.0	33.4
Colour			grey	pink				grey	pink	grey	pink	pink	grey	pink	grey	pink	grey			
Achnanthes brevipes				1					1			3								
Actinoptychus undulatus						1														
Auliscus caelatus							1													
Biddulphia rhombus																1				
Campylodiscus clypeus, fragm.												1								
C. echeneis, fragm.						2														
Coscinodiscus asteromphalus, fragm.							1											1		
C. marginatus										1										
Dimerogramma minor																1				
Diploneis didyma						2			1							3				
D. domblittensis				1																
D. finnica																				2
D. interrupta											2									
D. smithii							2					1				2			1	
Epithemia argus																3				
E. muelleri				1																
E. sorex																1				
E. turgida				1	5	6	7		3			6					1		1	
E. t. var. westermanni				2	2	1	5				3					7	1		4	
E. zebra						2	1	1	1			2				13			2	
Eunotia formica				1																
E. praerupta								1				1								
E. valida								1												
E. veneris																				1
Comphonema acuminatum							1													
Grammatophora arcuata					1													1		
G. marina				3	2	2	6		3			+				4		1		
G. oceanica			4	5	6	12	23	2	6	1	11	+		1	1	42	4	+	+	
G. o. var. macilenta						2	2		1							7		+	+	
G. o. + var. macilenta																		7	9	
G. o. + G. marina												15								
Hantzschia amphioxys																1				
Hyalodiscus scoticus					1	2	5					4				2	1	1		
Mastogloia elliptica var. dansei												1								
Melosira arenaria																		1		
M. distans					2															
M. granulata							2													
M. islandica									1										1	
M. i. ssp. helvetica				1	1							1				3				
M. italica												1								
M. i. ssp. subarctica												1								37
M. moniliformis				2		2	1		1		1					1				
M. sulcata								1								1				
M. westii							2													
M. sp.							1													
Navicula lyra									1											
N. radiosa															1					
N. sp.									1											
Nitzschia punctata					1	3	5		2										1	
N. sigma							2									2				
Pinnularia brevicostata		1																		
P. gibba																				1
P. viridis var. sudetica	1															1				
P. sp.												1								2
Pleurosigma sp. fragm.							1													
Rhabdonema arcuatum			2				2													
Rhizosolenia calcar avis																1				
Rhopalodia gibba												1								
R. g. var. ventricosa												1								

Continues

	Borehole A							Borehole B												
Depth m	0.8	3.2	11.2	11.25	12.0	13.6	13.8	15.0	18.2	22.4	22.45	23.3	23.5	23.55	24.3	27.4	27.5	28.0	30.0	33.4
Colour			grey	pink				grey	pink	grey	pink	pink	grey	pink	grey	pink	grey			
R. gibberula							1													
Stephanodiscus astraea					1	2										3				
Stephanopyxis turris					1															
Surirella sp. fragm.							1													
Synedra crystallina																1				
S. tabulata												1								
Trachyneis aspera						1														
	1	1	6	18	23	40	72	6	22	2	17	41	—	1	2	100	7	12	19	43