16. DIATOMS

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INTRODUCTION

The diatom studies concentrate mainly on the cores from Brastad, Moltemyr and Solberga, which were included in the Pleistocene/Holocene boundary programme. The interpretation is based on many diatom investigations in Bohuslän. Some of the studies from more than 20 localities are published (Miller 1964, Miller 1966, Miller and Robertsson 1974, Miller 1981), others were carried out in connection with geological mapping and documentation programmes in Bohuslän for the Geological Survey of Sweden (Fredén, Miller and Robertsson, in progress).

The location of the cores presented in the following text is shown in Fig. 4:2 (Chapter 4).

MATERIAL

The following numbers of samples from the cores were prepared and studied.

	Prepared	Studied	Analyses performed	Barren or almost barren
Brastad	30	23	13	10
Moltemyr	40	39	39	–
Solberga	50	40	28	12
	120	102	80	22

Diatoms were also studied in cores from Rörmyr and Vägen to establish the sedimentary environment and relation to sea level.

TECHNIQUE

From each sample, 100 mm^3 ($\cong$0.25 g wet weight) sediment is concentrated for diatom analysis. Lime is dissolved with dilute hydrochloric acid (5% HCl). Coarse mineral grains are separated by sedimentation. Organic material is bleached and destroyed by heating in hydrogen peroxide (30% H_2O_2) for 2 h in a water bath. Clay particles and colloids are eliminated by repeated washings in distilled water (Miller 1964, p. 13).

Slides of the residue are prepared for analysis. One drop (0.05 ml) of the concentrated sample (5 ml) is spread over a coverglass, dried and embedded in a strongly refractive embedding medium (Mikrops $n = 1.65$). A difference in refractive index between the diatom frustule ($n = 1.43$) and the embedding medium means that fine structures of the diatoms appear more distinct, which promotes identification.

Analysis is carried out at maximum magnification of the light microscope (about 1 000 x) with oil immersion and phase contrast. When necessary a scanning electron microscope with magnification up to 50 000 x is used.

For relative quantitative analysis, all the diatom frustules identified are counted. The total diatom frustules counted in a sample slide forms a basic figure (Σ D) for percentage calculations. The percentages are calculated for the individuals of each identified diatom species/taxon separately, or for a group having the same ecological or environmental requirements.

Σ D should preferably be 300. In this study it was sometimes less (100–300), because of low diatom frequency.

Diatom frequency (DF) was calculated both as semi-absolute (per microscope traverse of the slide) and absolute (per 1 g wet sediment). In general, the absolute frequency DF_g corresponds approximately to 100 000 x semi-absolute frequency DF_t.

$$(DF_g \cong DF_t \cdot 10^5).$$

ECOLOGICAL GROUPING AND DIAGRAM CONSTRUCTION

Grouping of diatom taxa and construction of diatom diagrams are dependent on the aim of the investigation and composition of the diatom flora.

Here, the fossil diatom flora is divided into two major groups: sea- and freshwater diatoms. These groups are subdivided into planktonic and littoral (epiphytic and benthic) floras as follows:

1. Sea-water diatoms (marine and brackish: poly-, eury- and mesohalobous)
1.1. Planktonic
1.1.1. Mainly Arctic plankton (a)
1.1.2. Mainly coastal and temperate plankton, incl. *Melosira sulcata,* (c)
1.2. Littoral
1.2.1. Marine (polyhalobous) diatoms (M+MB) – sublittoral or deep water flora
1.2.2. Brackish (eury- and mesohalobous) diatoms (BM+B) – littoral or shallow water flora
2. Freshwater diatoms (oligohalobous)
2.1. Freshwater plankton (mainly *Melosira islandica* subsp. *helvetica*)
2.2. Other freshwater diatoms

Representatives of the ecological groups are illustrated in Fig. 16:1.

Graphs of diatom frequency and number of diatom taxa, with sea-water (here called marine *s.l.*) diatoms as separate curves, are added to the diagrams.

The sediments (except for the Brastad, Moltemyr and Solberga cores, see Chapter 7) were classified according to SGU 1978.

RESULTS

Because of obvious differences in diatom stratigraphy the cores will be presented in two groups. The first group comprises cores from central, the second those from southern Bohuslän.

DIATOM STRATIGRAPHY IN CORES FROM CENTRAL BOHUSLÄN: THE BRASTAD, MOLTEMYR AND RÖRMYR CORES

Brastad has marine sediments, at Moltemyr there is a transition from marine to brackish to limnic sediments, and at Rörmyr a transition from brackish to limnic sediments.

Brastad (45 m above sea level)

Figure 16:2 illustrates the diatom spectra of the sediments. Three diatom assemblage zones were distinguished.

Zone 1 (15–8 m). Almost barren. The few diatom frustules noted belong to Arctic plankton species.

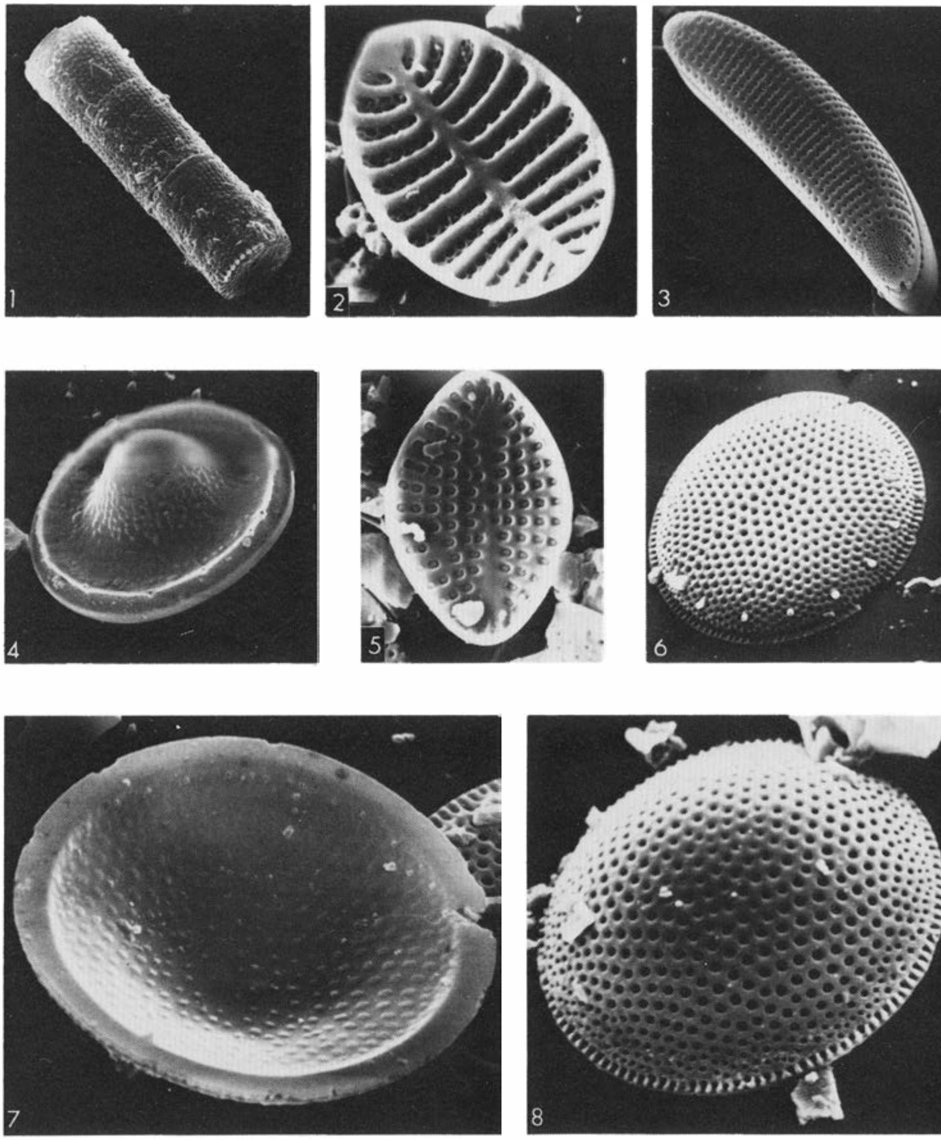


Fig. 16:1. Diatoms from the Pleistocene/Holocene sediments in Bohuslän, western Sweden. Stereoscan micrographs. Magnification x2000. – 1. *Melosira islandica* subsp. *helvetica* O. Müller. – 2. *Cocconeis costata* Gregory. – 3. *Grammatophora arcuata* Ehrenberg. – 4. *Chaetoceros* resting spore. – 5. *Rhaphoneis surirella* (Ehrenberg) Grunow. – 6. *Thalassiosira angulata* (Greg.) Hasle. – 7. *Thalassiosira antarctica* Comber. Resting spore, internal view. 8. *Do.*, external view.

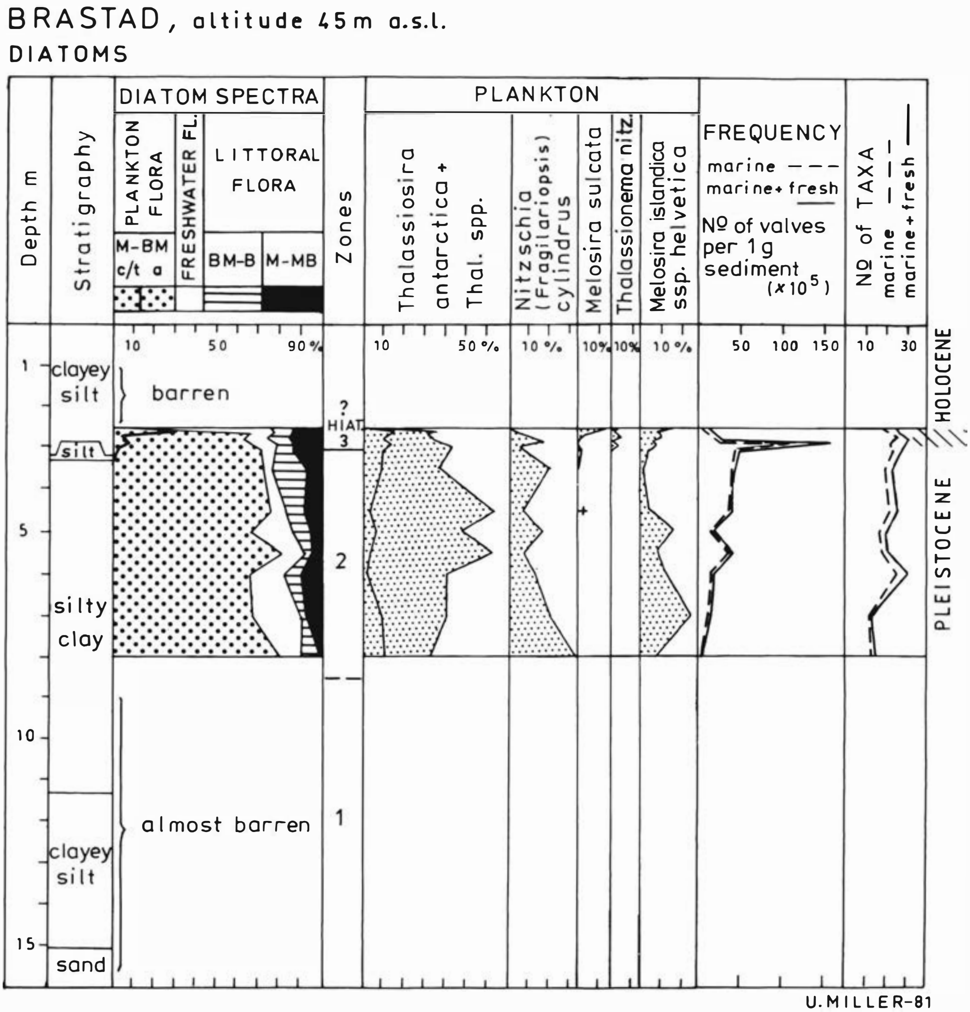


Fig. 16:2. Diatom spectra of the Brastad core, with separate curves of characteristic planktonic diatom species, diatom frequency and number of taxa.

Zone 2 (8–3 m). Mainly Arctic-oceanic plankton (*Thalassiosira antarctica* + *T.* spp., *Nitzschia cylindrus*).

Zone 3 (3–2.5 m). First occurrence of coastal planktonic species (*Thalassionema nitzschioides, Melosira sulcata*). The diatom frequency has a marked peak at 3 m.

Zone 4 (2.5–1 m). Almost barren to barren samples. The few frustules and fragments belong mostly to coastal plankton and littoral flora, or are reworked and originate from Lower Tertiary marine deposits. There seems to be a hiatus above 2.5 m.

The diatom spectra of the Brastad core register a change in sedimentary conditions at 3 m. The sediments above 2.5 m appear to be reworked.

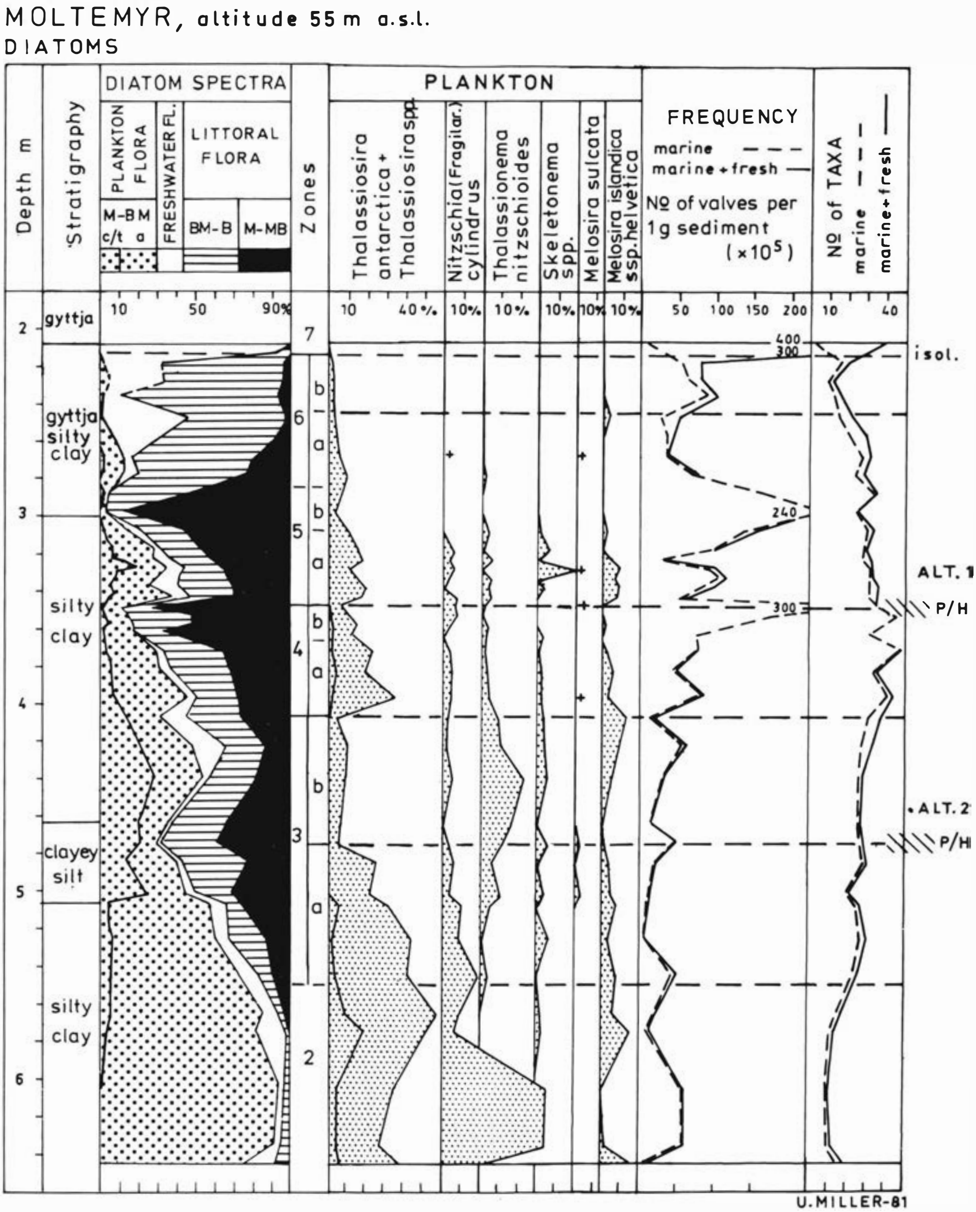


Fig. 16:3. Diatom spectra of the Moltemyr core, with separate curves of characteristic planktonic diatom species, diatom frequency and number of taxa.

Moltemyr (55 m above sea level)

Figure 16:3 shows the diatom spectra of the sediments, subdivided into 6 diatom assemblage zones (zones 2–7).

Zone 2 (6.4–5.4/5.0 m) has a dominance of Arctic plankton flora.

Zone 3 (5.4/5.0–4.1 m), lower part, subzone 3a (5.4/5.0–4.8 m), shows continuous increase in marine and brackish littoral flora, indicating shallowing and/or inlet. In the lower part of 3a the Arctic plankton group decreases, but still dominates. At 5 m there is a marked rise in coastal/temperate plankton. The upper part of zone 3, subzone 3b (4.8–4.1 m) is characterized by decrease in littoral flora and low values of Arctic plankton. Marine coastal plankton *(Thalassionema nitzschioides)* increase.

Zone 4 (4.1–3.45 m) registers return of Arctic plankton (*Thalassiosira* species) combined with increase in marine sublittoral flora. This may relate to colder climatic conditions with almost no freshwater influence. The high diatom frequency in the upper part of zone 4 indicates stable conditions with low sedimentation rate.

Zone 5 (3.45–2.8 m). Diatom frequency decreases. Coastal/temperate plankton return in the lower part. Arctic plankton are present, but may be reworked. In the upper part, a marine littoral/sublittoral flora predominates.

Zone 6 (2.8–2.15 m). Brackish littoral, and freshwater flora increase, indicating shallower water and the start of isolation of the Moltemyr basin from the sea. At 2.40 m, interruption of the freshening is shown by a small increase in brackish littoral flora. Diatom frequency is relatively low between 2.8 and 2.4 m.

Zone 7 (2.15–2.0 m). Isolation from the sea is completed at 2.15 m. Upwards, a freshwater diatom flora of small lake type occurs.

The diatom stratigraphy of Moltemyr core registers two main changes in sedimentary conditions, which may relate to climate and sea level. The first change starts at 5.4 m and shows a pronounced amelioration of climate between 4.8 and 4.1 m (subzone 3b). The second change occurs at 3.5/3.45 m, at the boundary between zone 4 and 5 and indicates change from marine littoral Arctic/Subarctic to more temperate conditions before isolation of the Moltemyr basin (zones 6 and 7).

Rörmyr (115 m above sea level), Bp 1 and 2

Figure 16:4 shows that isolation of the Rörmyr basin from the sea is registered in Rörmyr Bp 2 at 7.8 m. Before isolation the sediments were deposited in a shallow, brackish littoral environment. After isolation, the *Fragilaria* spp. predominates in the sediments (uppermost clay and clay gyttja). In the gyttja layer, *Fragilaria* spp. disappears being replaced by a small lake flora. A more detailed description of the sediments and development is given in Chapter 18.

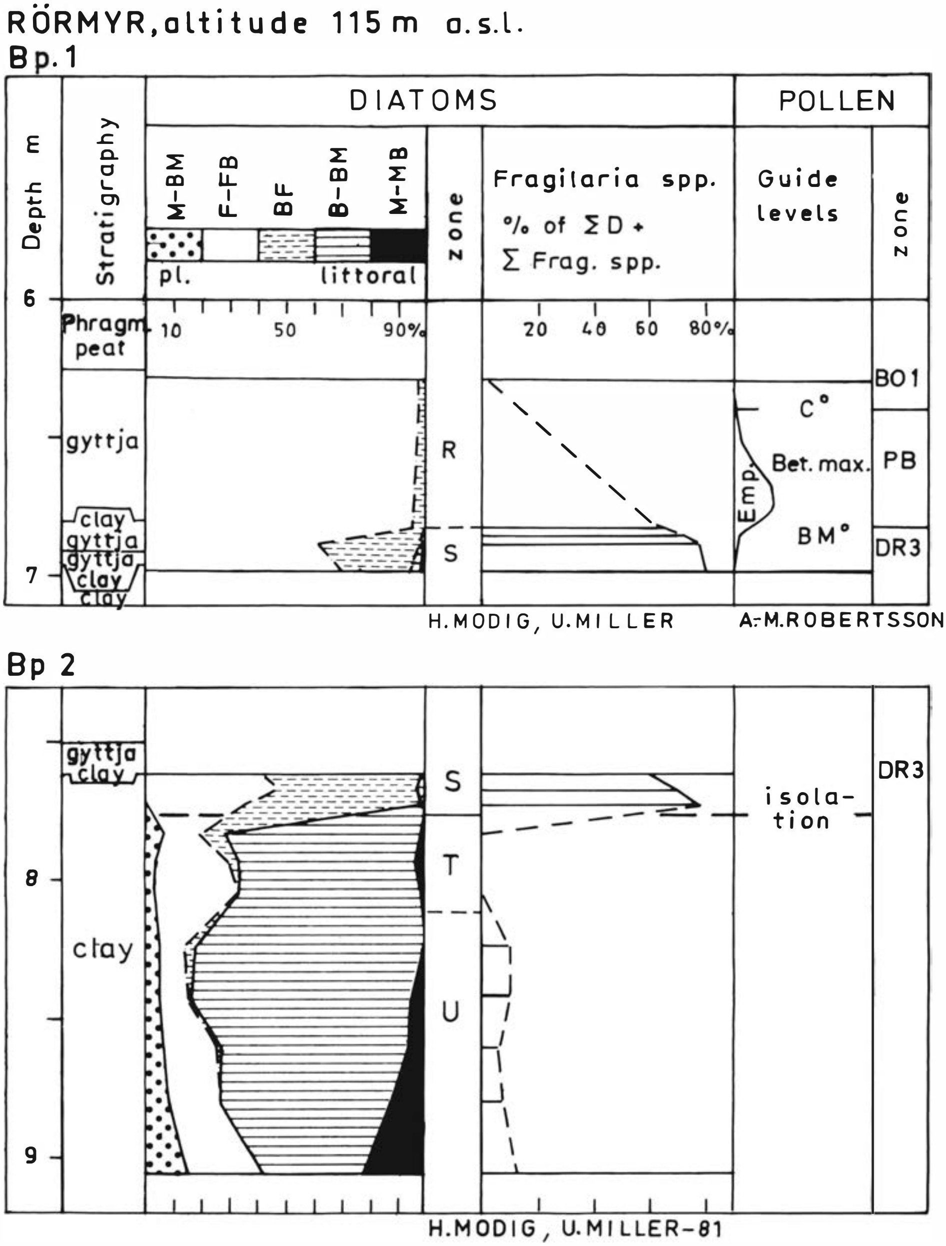


Fig. 16:4. Diatom spectra of the Rörmyr Bp 1 and 2, showing the isolation of the basin from the sea.

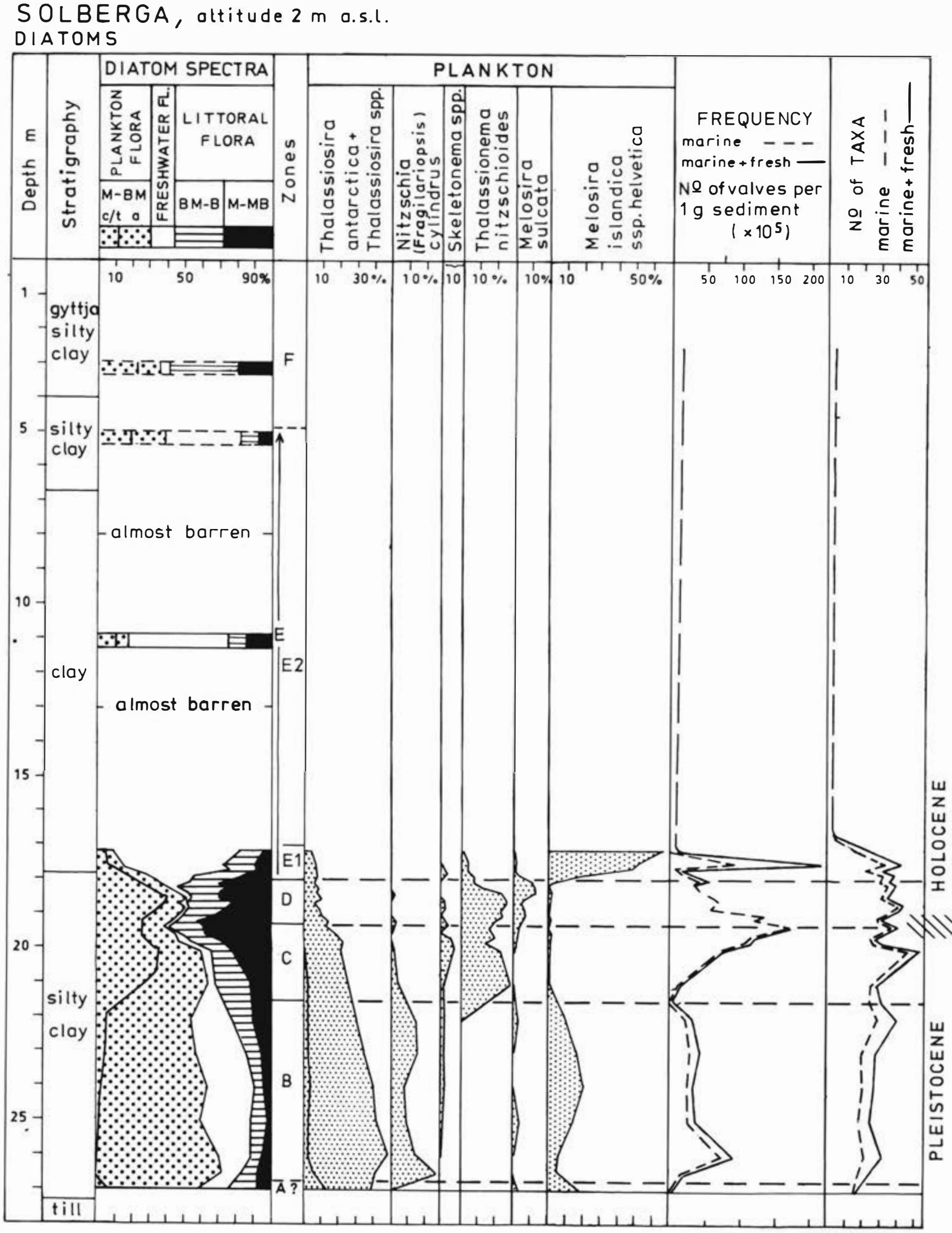


Fig. 16:5. Diatom spectra of the Solberga core with separate curves of characteristic planktonic diatom species, diatom frequency and number of taxa.

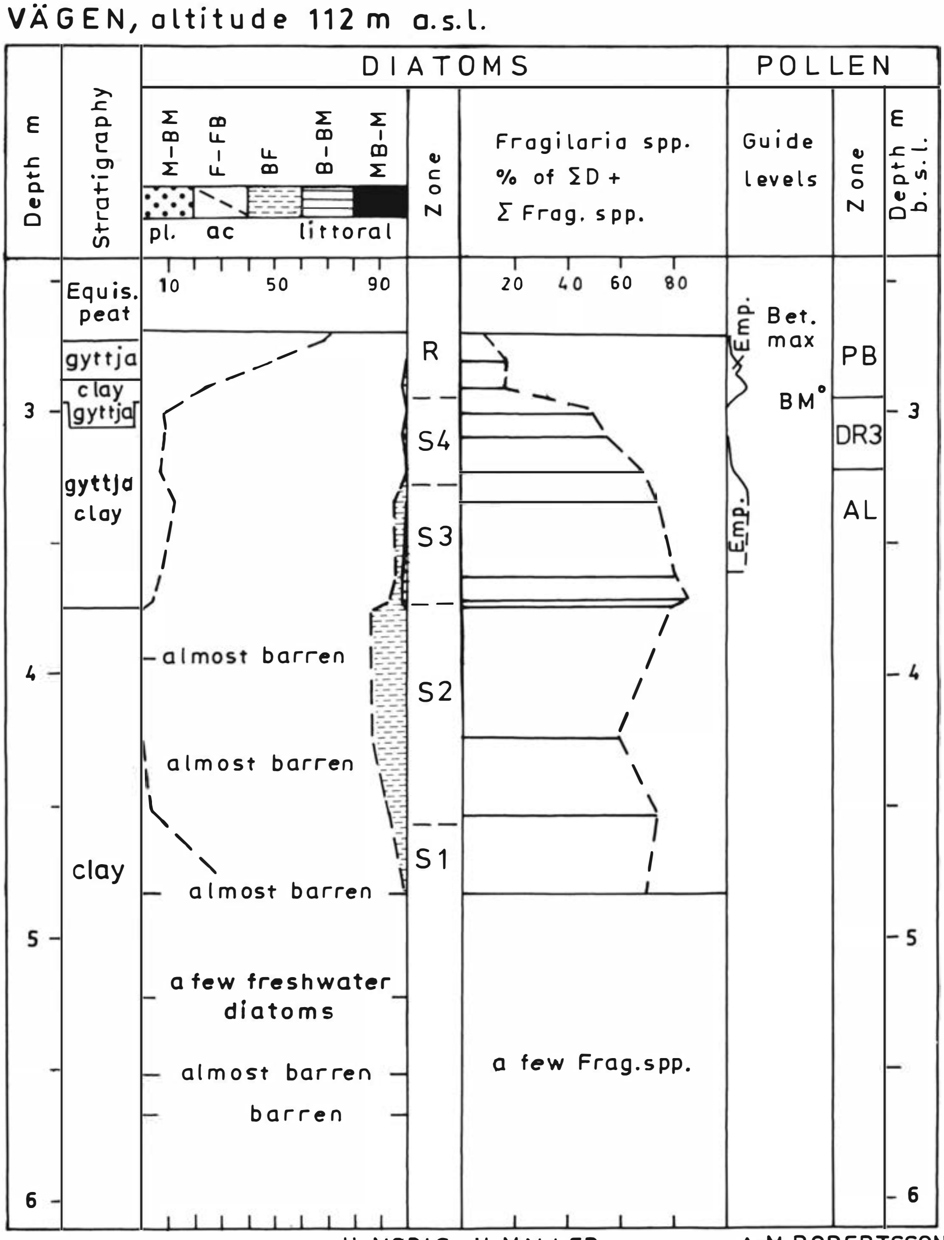


Fig. 16:6. Diatom spectra of the Vägen core, showing that the basin was not connected to the sea. The diatom spectra indicate a small lake environment above the highest shore line and marine limit.

DIATOM STRATIGRAPHY IN CORES FROM SOUTHERN BOHUSLÄN: THE SOLBERGA AND VÄGEN CORES

The whole sediment sequence at Solberga is marine, while at Vägen it is limnic. Vägen is situated above the highest shore line.

Solberga (2 m above sea level)

Figure 16:5 illustrates the diatom stratigraphy with subdivision into 6 diatom zones (A–F).

Zone A (below 27.0 m). Barren or almost barren.

Zone B (27.0–21.5 m). Dominance of Arctic plankton. The valves of marine and brackish littoral flora is more or less constant, not exceeding 25%. Freshwater plankton *Melosira islandica* is present, but not dominant.

Zone C (21.5–19.2). Marine littoral flora increases upwards. Coastal plankton *(Thalassionema nitzschioides)* show a marked increase, but Arctic plankton still have values of 20–30%. At 19.5–19.2 m the frequency of marine diatoms is extremely high. Freshwater plankton *(Melosira islandica)* has almost disappeared.

Zone D (19.2–18.0 m). Dominance of littoral flora and coastal/temperate plankton *(Melosira sulcata, Thalassionema nitzschioides)*. Arctic plankton has decreased to about 10%. Almost no freshwater diatoms.

Zone E (18.0–*c.* 5 m). Predominance of freshwater plankton *Melosira islandica*. A frequency peak of freshwater diatoms occurs between 18 and 17.5 m (subzone E 1). Upwards the diatom frequency is very low, but the diatom spectra show a clear dominance of freshwater plankton (subzone E2).

Zone F (*c.* 5–1.5 m). Diatom frequency still very low. A change in composition of diatom flora occurs at about 5 m. Littoral brackish flora and coastal/temperate plankton dominate. Freshwater diatoms have almost disappeared.

Changes in sedimentary environment are best registered at zone boundaries B/C at 21.5 m and C/D at 19.2 m. Zone D represents a change to improved conditions before the huge freshwater outflow registered by high frequency of *Melosira islandica* (E 1), followed by high sedimentation rate characteristic of subzone E1.

Vägen (112 m above sea level)

Figure 16:6. According to diatom analysis sedimentation occurred in a limnic environment. The stratigraphy of the core is described in detail, together with the pollen diagram in Chapter 18. Diatom spectra show a shallow, small lake environment, with predominance of *Fragilaria* spp. in the minerogenic sediments. In the gyttja layer acidophilous diatoms, which prefer pH <7, manifest a marked increase.

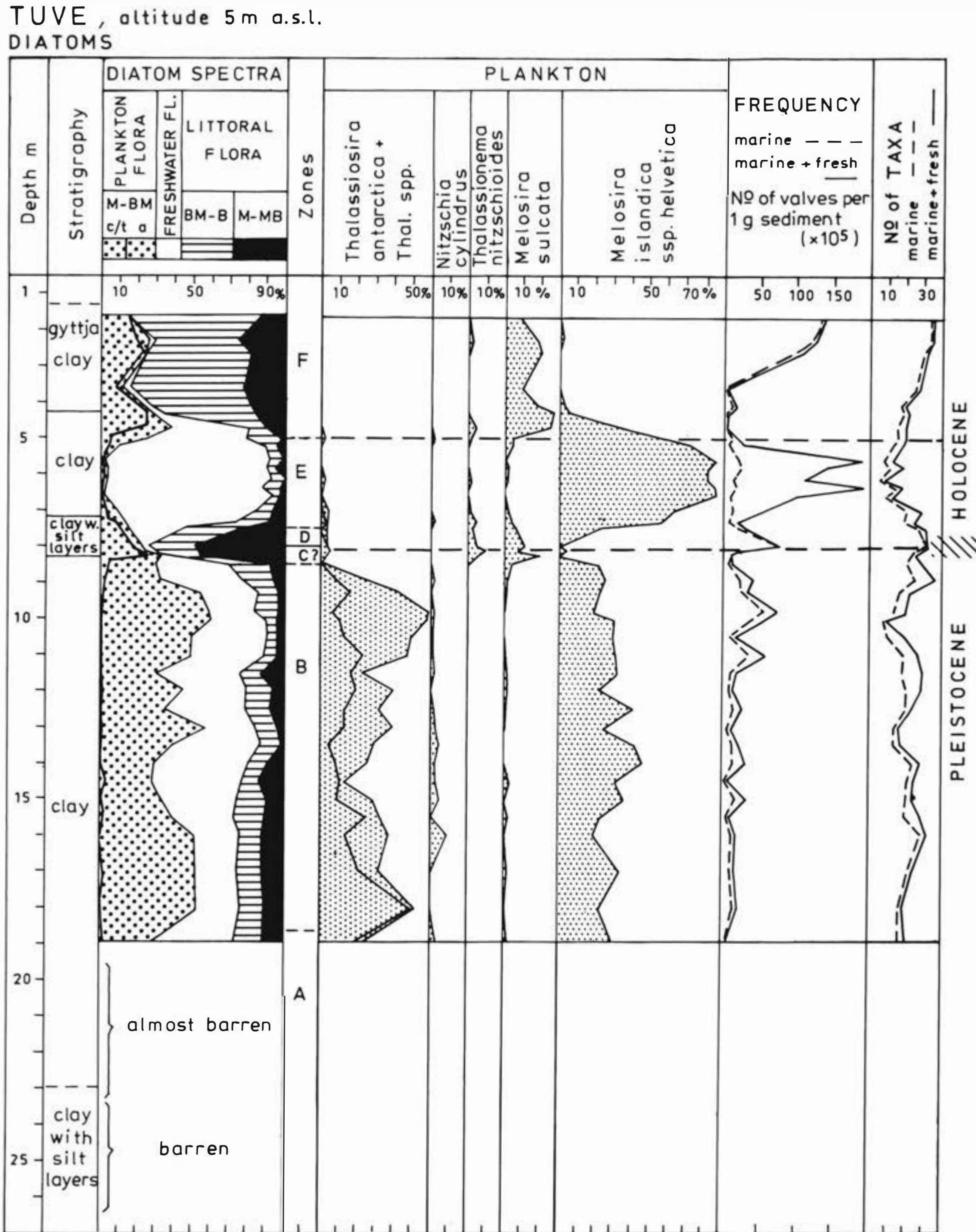


Fig. 16:7. Diatom spectra of the Tuve core, with separate curves of characteristic planktonic diatom species, diatom frequency and number of taxa.

COMPARISON WITH OTHER CORES FROM SOUTHERN BOHUSLÄN – GÖTEBORG

Tuve (5 m above sea level)

Tuve core was studied in the course of investigations carried out after the 1977 landslide (Miller 1981).

The diatom stratigraphy of Tuve (Fig. 16:7) is comparable with Solberga. Zones A–F are present, with some reservation for zone C. The most marked change in sedimentary conditions occurs at 8.4/8.3 m. Increase in littoral flora, in combination with appearance of coastal plankton, indicates diminishing water depth. No freshwater influence is registered in zones C–D. High frequency of freshwater plankton *Melosira islandica* in zone E, followed upwards by brackish-marine littoral flora together with coastal plankton in zone F, corresponds well with the diatom stratigraphy of Solberga.

Botanical Garden Göteborg, B 873 (17.4 m above sea level)

For correlation, the diatom diagram of the Botanical Garden core (Du Saar in Mörner 1976) is drawn as for Tuve and Solberga (Fig. 16:8). The unpublished list of diatom taxa by Du Saar has been used for grouping and percentage calculations.

There is an obvious absence of the Arctic plankton characteristic of zone B in the Solberga and Tuve cores. If sediments between 14.0 and 3.5 m in core B 873 were deposited during the Late Weichselian, Arctic plankton should have been present.

The higher altitude and proximity to the Göta River Valley may have influenced the composition of the diatom flora, but other dissimilarities are also present in the diatom stratigraphy.

Bottom sediments at 13.5 m contain a diatom flora characterized by *Melosira sulcata* and littoral species. *Melosira islandica,* which reflects influx of freshwater, is very poorly represented. The diatom flora indicates a marine coastal environment of about 30 m depth of water, in contrast to the sedimentary conditions interpreted by Mörner (1976) as denoting the transition from Arctic pre-Bölling to Bölling at a depth of about 90 m.

The sediments between 13.5 and 2.5 m are dominated by freshwater plankton *Melosira islandica,* except for those between 6.2 and 4.2 m which are almost barren. The diatom flora corresponds with the flora in zone E of Solberga and Tuve, *i.e.* the drainage of the Baltic Ice Lake and the influx of freshwater during the Preboreal.

The diatom flora in the top sediments (2.5–1.8 m) of core B 873 corresponds well with the flora of zone F of Solberga and Tuve, *i.e.* the

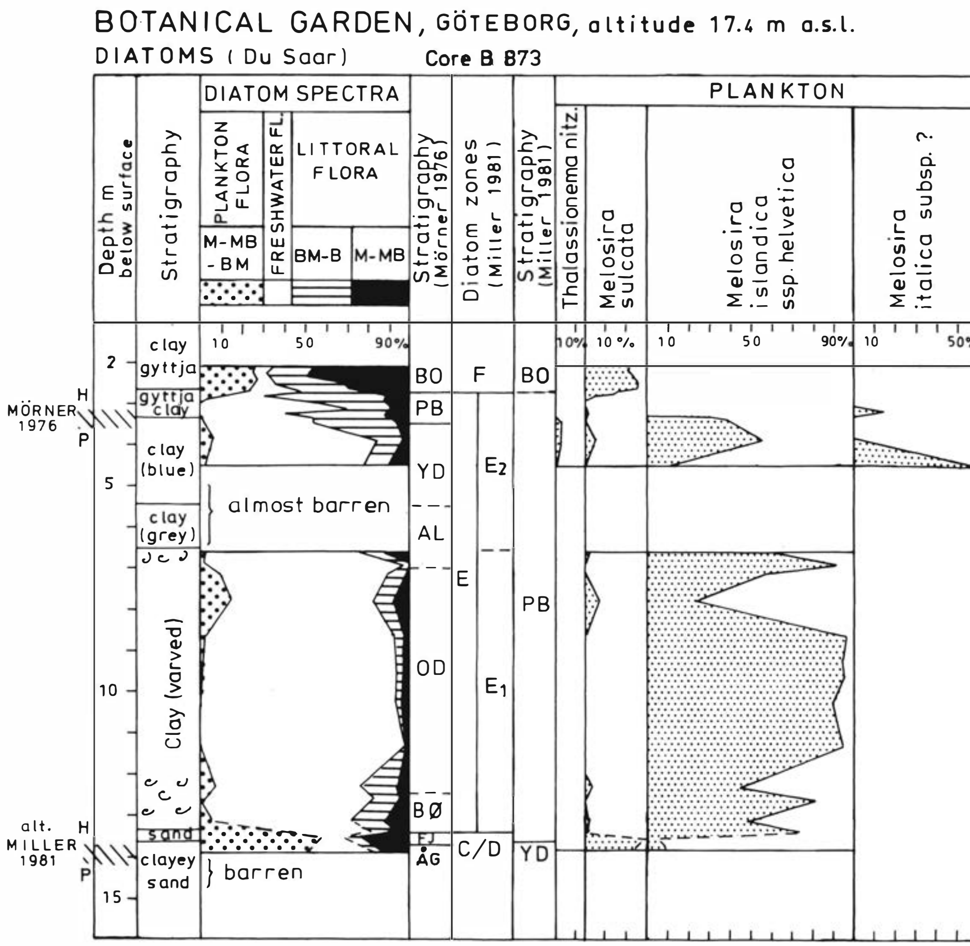


Fig. 16:8.Diatom spectra of the Botanical Garden core B 873 (redrawn after Du Saar in Mörner 1976), combined with the frequency values from the unpublished list of diatom taxa by Du Saar.

Boreal transgression with marked increase of coastal plankton and littoral flora. There is almost no influx of freshwater plankton in the uppermost sediments.

Mörner's stratigraphical interpretation (1976) of core B 873 from the Botanical Garden, Göteborg, has been revised on the basis of diatom stratigraphy. The lower part of the sequence may register the Pleistocene/Holocene boundary, while the boundary proposed by Mörner reflects the sedimentary conditions at the end of the Preboreal.

GÖTA RIVER VALLEY

Comparison has also been made with cores from the Göta River Valley: Tingstad (or Hisinge Tunnel), Träpiren, Surte, and Ingebäck.

Tingstad (about 2 m above sea level)

The stratigraphy of the Tingstad core is described by Tullström and Brotzen (Tullström 1961, Brotzen 1961a and b). A preliminary diatom diagram is shown in Figure 16:9.

The sediments between 82 and 77 m are almost barren (zone A). In zone B (77–54 m) Arctic plankton predominate in the lower part, with increase of freshwater plankton in the upper. Zone B here may also represent older interstadial sediments with almost Arctic conditions in the lower part and more Boreal-Arctic conditions in the middle. Between zones B and E there may be a hiatus at 54 m (sand layer).

The sediments of Tuve and Solberga zones C and D, which represent the Pleistocene/Holocene boundary, are absent, probably eroded by vigorous freshwater outflow.

The transition from zones E to F (the Preboreal/Boreal) occurs at 37 m. The diatom spectra of the uppermost zones, G and H, show Holocene conditions after the Atlantic transgression maximum. Zone H may be contaminated by filling.

Träpiren (8 m below sea level)

The results of the biostratigraphical studies of the Träpiren core made by Mohrén (pollen), Florin (diatoms) and Brotzen (foraminifers) were published in Mohrén 1945. The pollen and diatom spectra combined with foraminiferal stratigraphy show that the Pleistocene/Holocene boundary may occur at about 50 m or still lower, probably eroded (hiatus?).

Surte (1.5 m above sea level)

The Surte core E 14 is described by Mohrén 1956. Pollen (Mohrén) and foraminiferal analyses (Brotzen) were carried out, but no diatom analysis. The Late Glacial/Post Glacial boundary, according to Mohrén, is at 21.5 m depth. This boundary represents a transition from the Preboreal to the Boreal. The boundary of the Younger Dryas/Preboreal or the Pleistocene/Holocene is presumed by Mohrén to be at 23.5 m. It is more likely that the level registers the Preboreal regression maximum. The sediments in the lower part of the core are probably of Preboreal age.

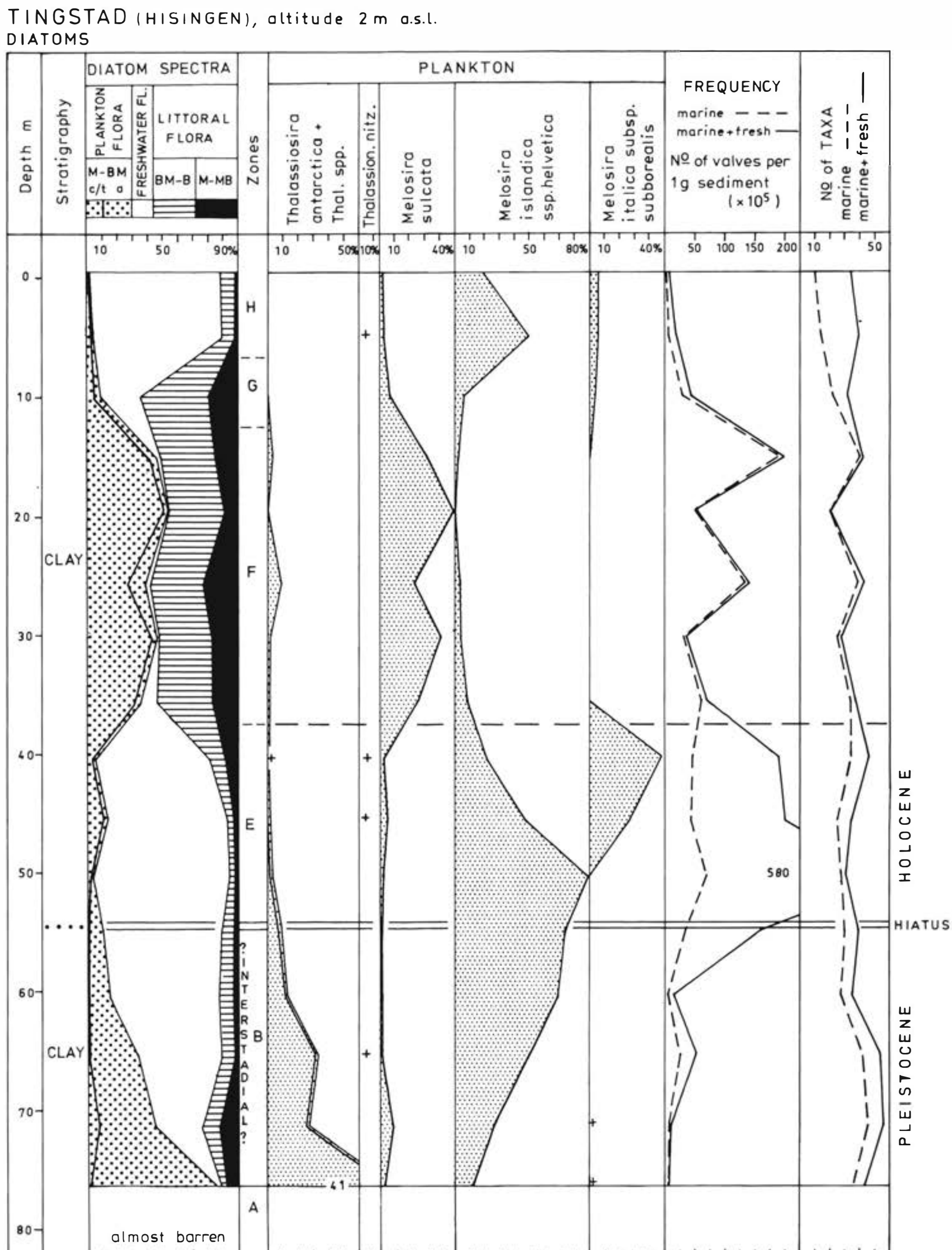


Fig. 16:9. Preliminary diatom spectra of the Tingstad core with separate curves of characteristic planktonic diatom species, diatom frequency and number of taxa.

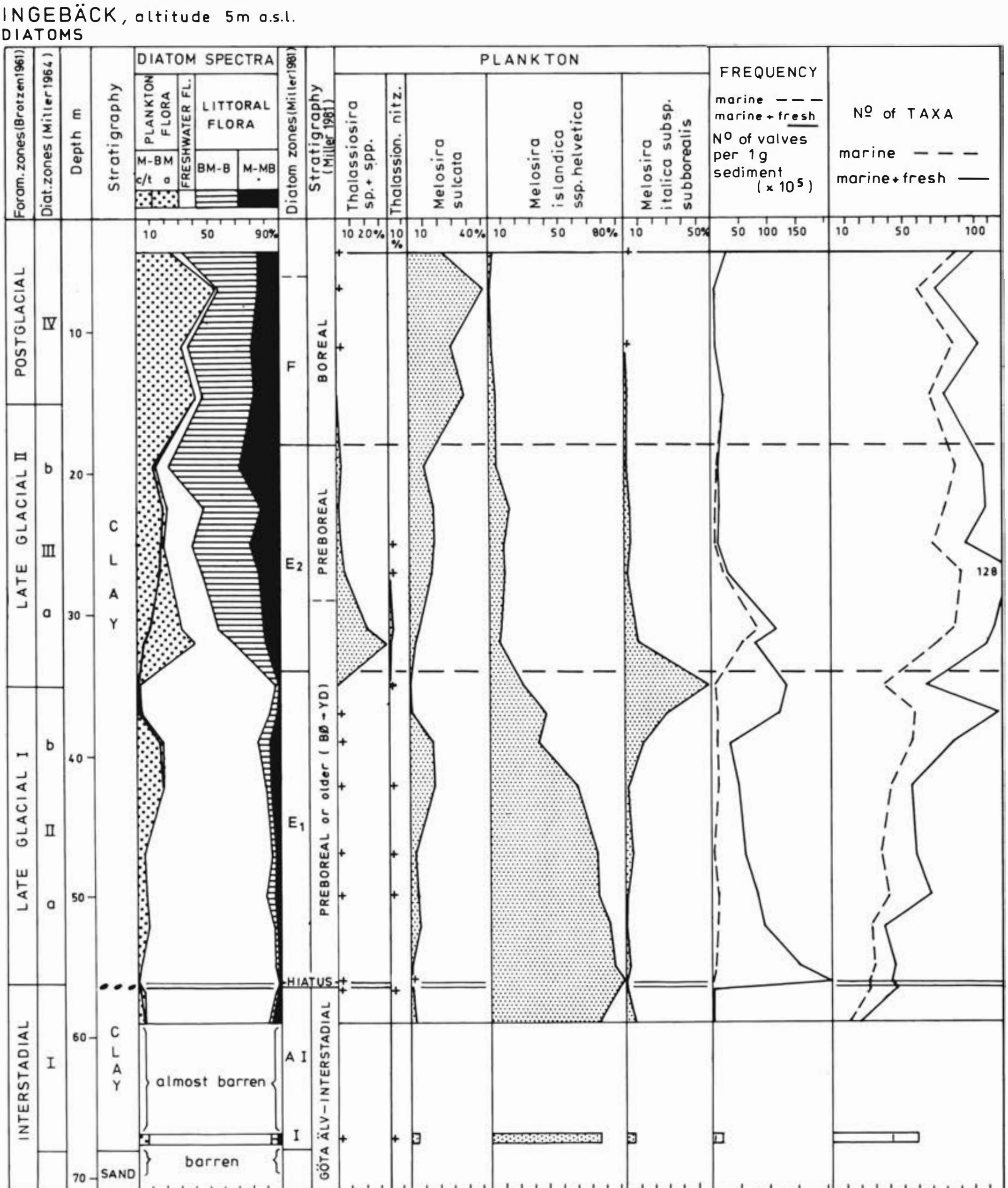


Fig. 16:10. Diatom spectra of the Ingebäck core with separate curves of characteristic planktonic diatom species, diatom frequency and number of taxa.

Ingebäck (5 m above sea level)

The locality is situated 12 km north of Göteborg. The Ingebäck core has been investigated biostratigraphically: foraminifers by Brotzen (1961), diatoms by Miller (1964) and preliminary pollen analyses by Robertsson (unpublished).

The diatom diagram, Fig. 16:10, is redrawn after Miller 1964. The diatom stratigraphy of Ingebäck core is difficult to compare with other cores from the Göta River Valley. The lowermost part of the core (67.5–56 m) is presumed to represent interstadial sedimentation (zones I and I/A). The diatom frequency is very low, except at 67 m (zone I). At 56 m there is a layer of gravel and sand indicating a hiatus. The sediments between 56 and 35 m have a dominance of *Melosira islandica* subsp. *helvetica,* characteristic of zone E, which represents the meltwater discharge of the Baltic basin. The absence of Arctic plankton makes comparison with Late-Weichselian sedimentation difficult. Diatom zones B, C and D seem to be eroded by violent freshwater outflow. Accordingly, the sediments between 35 and 19 m may represent the Preboreal regression with decreasing influx of freshwater plankton and increase in littoral flora.

Between 19 and 15 m the diatom spectra clearly indicate a change to boreal conditions with marked increase in *Melosira sulcata* (zone F).

This revision of the diatom stratigraphy of the Ingebäck core is only preliminary. It may be that special sedimentary conditions in the Göta River Valley were more important than has so far been considered. The presence of Götaälv Interstadial (Brotzen 1961) in the lowermost clay sediment of the Ingebäck core is proven. The age of the sediment is still in question, whether Middle Weichselian or Late Weichselian.

CORRELATION OF THE DIATOM ASSEMBLAGE ZONES IN THE CORES

Figure 16:11 shows a tentative correlation of the diatom assemblage zones. The characteristic composition of diatom spectra of zones in cores from southern Bohuslän is as follows.

Zone F	*Melosira sulcata* + brackish-marine littoral flora. Almost no influx of freshwater plankton	The BOREAL transgression
Zone E	The upper part (subzone E2) is poor in diatoms, sometimes barren, because of high sedimentation rate. *Melosira islandica* subsp. *helvetica* indicates influx of	

	freshwater. Brackish littoral flora, coastal plankton	The PREBOREAL regression
	In the lower part (subzone E1) *Melosira islandica* subsp. *helvetica* dominates with high frequency indicating vigorous outflow of freshwater	Beginning of the PREBOREAL with meltwater discharge from the Baltic basin
Zone D	Sublittoral marine-brackish flora + *Melosira sulcata*. Amelioration of the climate. Almost no influx of freshwater plankton	Transition the YOUNGER DRYAS/ PREBOREAL the PLEISTOCENE/ HOLOCENE boundary
Zone C	Increase of sublittoral marine-brackish flora and coastal plankton *(Thalassionema nitzschioides, Skeletonema costatum)*	The YOUNGER DRYAS regression
Zone B	Arctic plankton flora dominates (*Thalassiosira antarctica, Thalassiosira* spp., *Nitzschia cylindrus*). Some influx of freshwater plankton *Melosira islandica* subsp. *helvetica*	The YOUNGER DRYAS and/or older (ALLERÖD, OLDER DRYAS, BÖLLING)
Zone A	Almost barren to barren. Arctic conditions	The OLDER DRYAS or older
Zone I/A	Diatom flora of the same type as zone E	MIDDLE WEICHSELIAN Götaälv Interstadial (or Late Weichselian)

In cores from central Bohuslän:

Zone 1 =	zone A: almost barren to barren	The OLDER DRYAS or older
Zone 2 =	zone B: Arctic plankton dominate	The YOUNGER DRYAS and/or older
subzone 3a =	zone C: increase of sublittoral flora and coastal plankton	The YOUNGER DRYAS/PREBOREAL or the OLDER DRYAS/ALLERÖD.
subzone 3b =	zone D: Sublittoral marine – brackish flora with *Melosira sulcata*	Beginning of the PREBOREAL or the ALLERÖD
and zone 4	zone 4 seems to register a temporary deterioration of the climate with some increase of Arctic plankton	Oscillation in the PREBOREAL or the YOUNGER DRYAS
Zone 5 =	zone E, except for the great influx of freshwater plankton	The PREBOREAL
Zone 6	(subzone 6b) = the beginning of zone F	Start of the BOREAL transgression

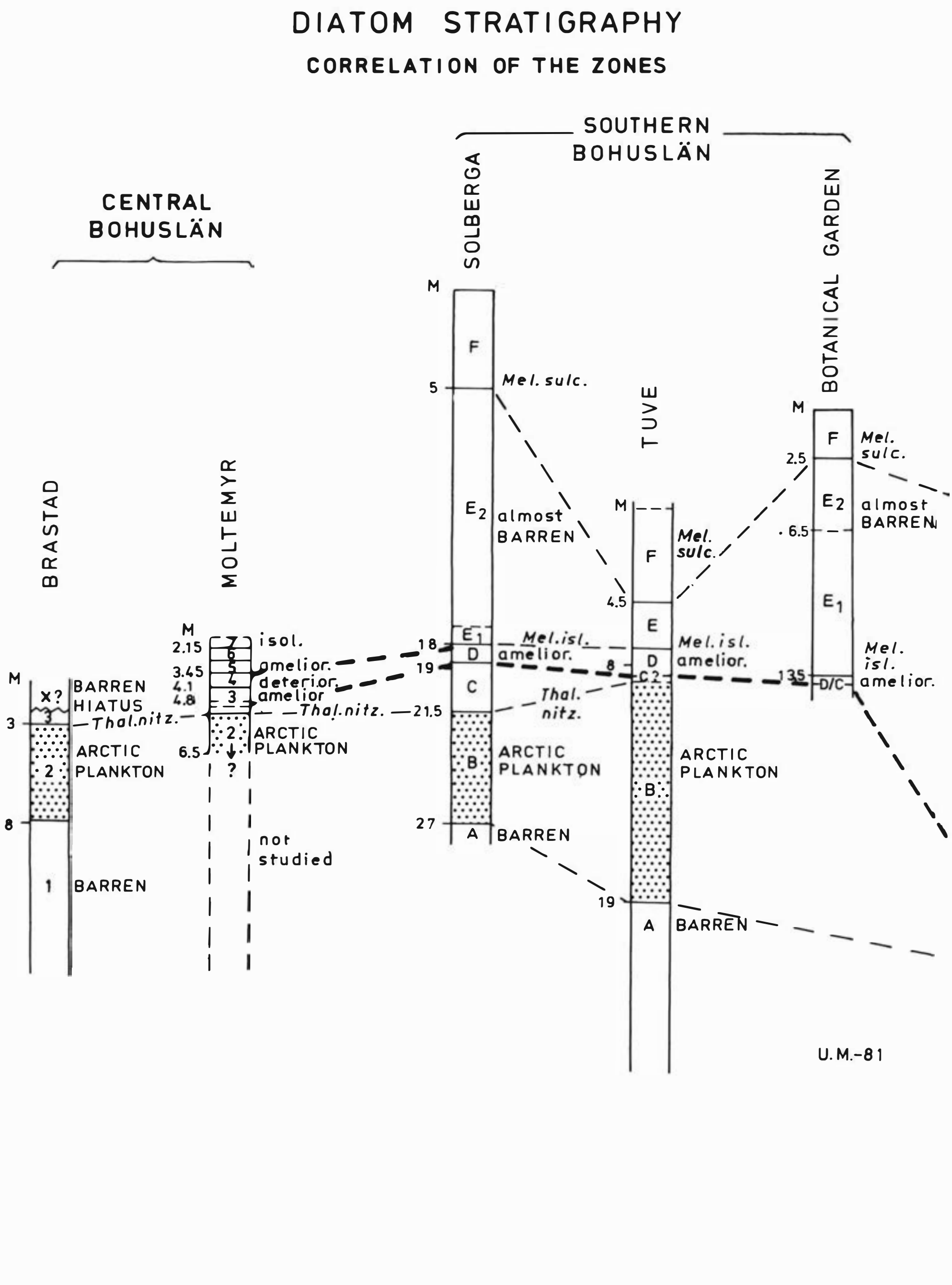
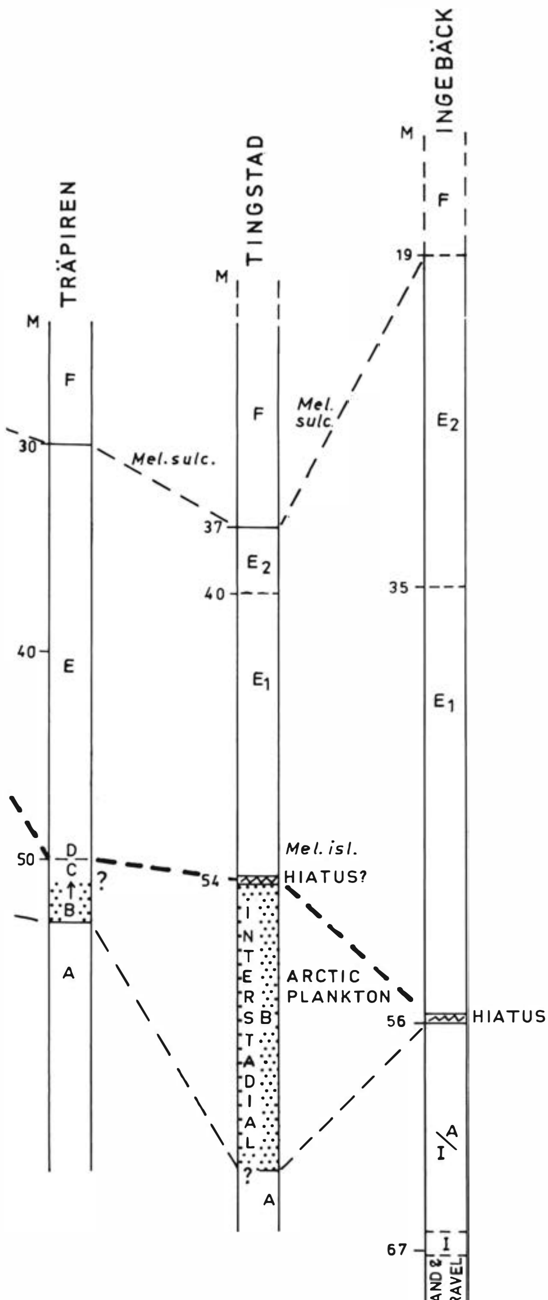


Fig. 16:11. Tentative correlation of diatom assemblage zones in cores from central and southern Bohuslän.


TRÄPIREN
TINGSTAD
INGEBÄCK
M
F
30
Mel. sulc.
37
Mel. sulc.
19
E
E2
40
E1
35
E1
40
D
C
B
A
50
?
54
Mel. isl.
HIATUS?
INTERSTADIAL
B
ARCTIC PLANKTON
56
HIATUS
I
A
?
A
67
SAND & GRAVEL

CONCLUDING REMARKS AND DISCUSSION

The Pleistocene marine sediments (the Younger Dryas and older) are characterized by dominance of Arctic plankton and some influx of freshwater plankton. The rapid diminution of water depth at the end of the Younger Dryas is registered in the diatom flora by increase of coastal plankton and littoral flora. The influx of freshwater plankton decreases.

In southern Bohuslän (Solberga and Tuve cores) the Preboreal sediments are characterized by dominance of freshwater plankton *Melosira islandica.* The influx of freshwater plankton begins with marked peaks in frequency. The frequency decreases upwards because of the high sedimentation rate, but *Melosira islandica* as the most common species indicates meltwater discharge or redeposition of freshwater sediments.

In central Bohuslän, the Preboreal sediments register only a minor influx of freshwater plankton. The basins situated at higher altitudes (above 55 m) gradually became isolated from the sea during the rapid Preboreal shore displacement. In basins at lower altitudes (below 55 m), the Boreal transgression corresponds to a more or less stable sea level. In Boreal sediments, there is an increase in coastal plankton (incl. *Melosira sulcata*) and littoral flora. The influx of freshwater plankton stops.

In Moltemyr core, two transitions comparable with the Pleistocene/ Holocene boundary are registered in the diatom stratigraphy (at 5–4.7 m and at 3.5–3.45 m). Possibly because of the higher altitude (55 m) of the Moltemyr basin, and its relatively small area, the diatom flora registers more clearly the sea level changes. The increase of littoral flora and coastal plankton at 5–4.7 m may reflect conditions at the transition from the Older Dryas to the Alleröd as well as from the Younger Dryas to the Preboreal. The Older Dryas/Alleröd transition is the more likely because there is no marked frequency peak in marine diatoms at 5–4.7 m. The littoral diatoms in these sediments may have been washed in from nearby shores. However, the frequency peak at 3.5–3.45 m seems to represent autochthonous littoral flora characteristic of 20–30 m water depth, which agrees with the sea level at the Pleistocene/Holocene boundary, about 80–90 m above the present.

Studies in progress on shore displacement in central Bohuslän (Fredén, Miller and Robertsson) are based mainly on the sites studied by Fries (1951), supplemented by new sites at altitudes important for interpretation of the shore displacement. The preliminary results show that a rapid regression of the sea took place during the Older Dryas/Alleröd, followed by a period of more or less stable sea level during the Alleröd. At the end of the Younger Dryas, a further rapid regressive shore displacement started and continued during the Preboreal.

Contemporary shore displacement and sea-level changes should also have occurred in southern Bohuslän (Göteborg region), but because of the low altitudes of the basins studied the Older Dryas/Alleröd sea-level changes are not so clearly registered in the diatom floras. However, the Younger Dryas/ Preboreal regression is recognizable in the cores from southern Bohuslän.

SUMMARY

In diatom stratigraphy of the marine clay sequences in Bohuslän the Pleistocene/Holocene boundary is registered by the following changes:

1, decrease of Arctic plankton
2, marked increase, a peak, in diatom frequency, mainly caused by increase of marine littoral flora
3, almost no influx of freshwater plankton
4, increase of coastal and temperate plankton and littoral flora
5, in southern Bohuslän the sediments deposited after the Pleistocene/ Holocene boundary are characterized by marked influx of freshwater plankton (meltwater discharge and/or redeposition of freshwater sediments). The influx of freshwater plankton stops at the transition to Boreal conditions.

REFERENCES

Brotzen, F., 1951: Bidrag till de svenska marina kvartäravlagringarnas stratigrafi. – Geol. Fören. Stockh. Förh. 73, 57–68.

– 1961a: Geologisk datering av sediment i Götaälvdalen. Appendix Ug 02. – *In* H. Tullström: Götaälvdalen. Redogörelse för undersökningar utförda av Sveriges Geologiska Undersökning åren 1954–1961. – Sver. geol. unders. (internal report).

– 1961b: An interstadial (radiocarbon dated) and substages of the Last Glaciation in Sweden. – Geol. Fören. Stockh. Förh. 83, 144–150.

Caldenius, C., and Lundström, R., 1956: The landslide at Surte on the River Göta älv. A geologic-geotechnical study. – Sver. geol. unders., Ca 27. 64 pp.

Du Saar, A., 1976: Diatoms: quantitative analysis. Chapter 11. – *In* N.-A. Mörner: The Pleistocene/Holocene boundary: a proposed boundary-stratotype in Gothenburg, Sweden. – Boreas 5, 227–230.

Florin, M.-B., 1945: Fig. 2 – *In* E. Mohrén: Något om de hydrogeologiska förhållandena i Göteborgstrakten vid övergången mellan sen- och postglacial tid. – Geol. Fören. Stockh. Förh. 67, p. 257.

Fries, M., 1951: Pollenanalytiska vittnesbörd om senkvartär vegetationsutveckling, särskilt skogshistoria, i nordvästra Götaland. – Acta Phytogeograph. Suec. 29, 220 pp.

MILLER, U., 1964: Diatom Floras in the Quaternary of the Göta River Valley. – Sver. geol. unders. Ca 44. 67 pp.

– 1966: Diatom analysis. Appendix 1. – *In* O.A. Talme *et al.*: Secondary Changes in the Origin of Sensitive Clays. – Byggforskningen Stockholm, Report 46, 119–125.

– 1981: Diatomeanalytisk undersökning. – *In* Fredén *et al.*, 1981: Tuveskredet 1977-11-30. Geologiska undersökningar. – Sver. geol. unders., Rapp. & medd. 26, 113–131.

MILLER, U., and ROBERTSSON, A.-M., 1974: Resultat av den första preliminära undersökningen av marina lagerföljder i Bohuslän för fastläggande av en internationellt brukbar gräns Pleistocene/Holocene. – Sver. geol. unders. (internal report). 17 pp.

MOHRÉN, E., 1945: Något om de hydrogeologiska förhållandena i Göteborgstrakten vid övergången mellan sen- och postglacial tid. – Geol. Fören. Stockh. Förh. 67, 249–295.

– 1956: Geology of the Valley of the Göta älv. Chapter 3. – *In* C. Caldenius and R. Lundström: The landslide at Surte on the River Göta älv. A geologic-geotechnical study. – Sver. geol. unders., Ca 27, 7–29.

MÖRNER, N.-A., 1976: The Pleistocene/Holocene boundary: a proposed boundary-stratotype in Gothenburg, Sweden. – Boreas 5, 193–275.

SGU, 1978: Metodik och jordartsindelning tillämpad vid geologisk kartläggning i skala 1:50 000. – Sver. geol. unders. Särtryck ur serie Ae.

TALME, O.A., PAJUSTE, M., and WENNER, C.-G., 1966: Secondary Changes in the Origin of Sensitive Clays. – Byggforskningen Stockholm, Report 46. 138 pp.

TULLSTRÖM, H., 1961: Götaälvdalen. Redogörelse för undersökningar utförda av Sveriges Geologiska Undersökning åren 1954–1961. – Sver. geol. unders. (internal report).