

SVERIGES GEOLOGISKA UNDERSÖKNING

SERIE C NR 755 AVHANDLINGAR OCH UPPSATSER ÅRSBOK 72 NR 17

CHRISTER PERSSON

SHORE DISPLACEMENT
DURING ANCYLUS TIME
IN THE REJMYRA AREA
SOUTH CENTRAL SWEDEN



UPPSALA 1979

SVERIGES GEOLOGISKA UNDERSÖKNING

SERIE C NR 755 AVHANDLINGAR OCH UPPSATSER ARSBOK 72 NR 17

CHRISTER PERSSON

SHORE DISPLACEMENT
DURING ANCYLUS TIME
IN THE REJMYRA AREA
SOUTH CENTRAL SWEDEN

UPPSALA 1979

ISBN 91-7158-160-X



A contribution to
Project 61 SEA LEVEL MOVEMENTS
DURING THE LAST DEGLACIAL HEMICYCLE

Kartan på s. 4 är godkänd ur sekretessynpunkt för spridning.
Statens lantmäteriverk 1979-03-12.

Address:

Christer Persson
Sveriges geologiska undersökning
Box 670
S-751 28 Uppsala

Schmidts Boktryckeri AB
Helsingborg 1979

CONTENTS

Abstract	3
Introduction	4
Sampling and analyses	5
Description of localities	5
The bog at St. Orrkojgölen	5
Björnmossen	7
Myrkärret	7
Orrmossen	7
Målaremossen	11
Kyrkmossen	12
Stora Mossen	12
Results	13
Some remarks on the development of the vegetation	13
The uplift of land and shore displacement	16
Acknowledgements	21
References	22
The carbon-14 age-determinations	23

ABSTRACT

Christer Persson: Shore displacement during Ancyclus time in the Rejmyra area, south central Sweden.

While carrying out geological survey on the map-sheet Katrineholm SV six bogs south of Rejmyra were investigated in respect to strata, isolation of the basins and immigration of different species of trees. The bogs investigated are situated south and south-east of Rejmyra and between 92 m and 56 m above sea-level. Radiocarbon age determinations show that the basins were isolated between about 8 400 B.C. and about 6 500 B.C. Data from investigations carried out in areas eastwards and with about the same land uplift are put together in a diagram, showing the shore displacement in the area. It is also compared with the shore displacement in adjacent areas.

INTRODUCTION

While carrying out geological survey on the map-sheet Katrineholm SV (Persson 1976), many peat deposits were investigated. Peat deposits cover about 15 per cent of the region. Within the map area there are bogs, fens and poor fens situated between 50 m and 100 m above sea-level. There were thus good chances that investigations of isolation sequences from basins at different altitudes would give information about the shore displacement in the area. East of the map area detailed investigations of three localities have been carried out by M.-B. Florin (1975 and 1977).

A number of borings were made in different fens and bogs. The borings

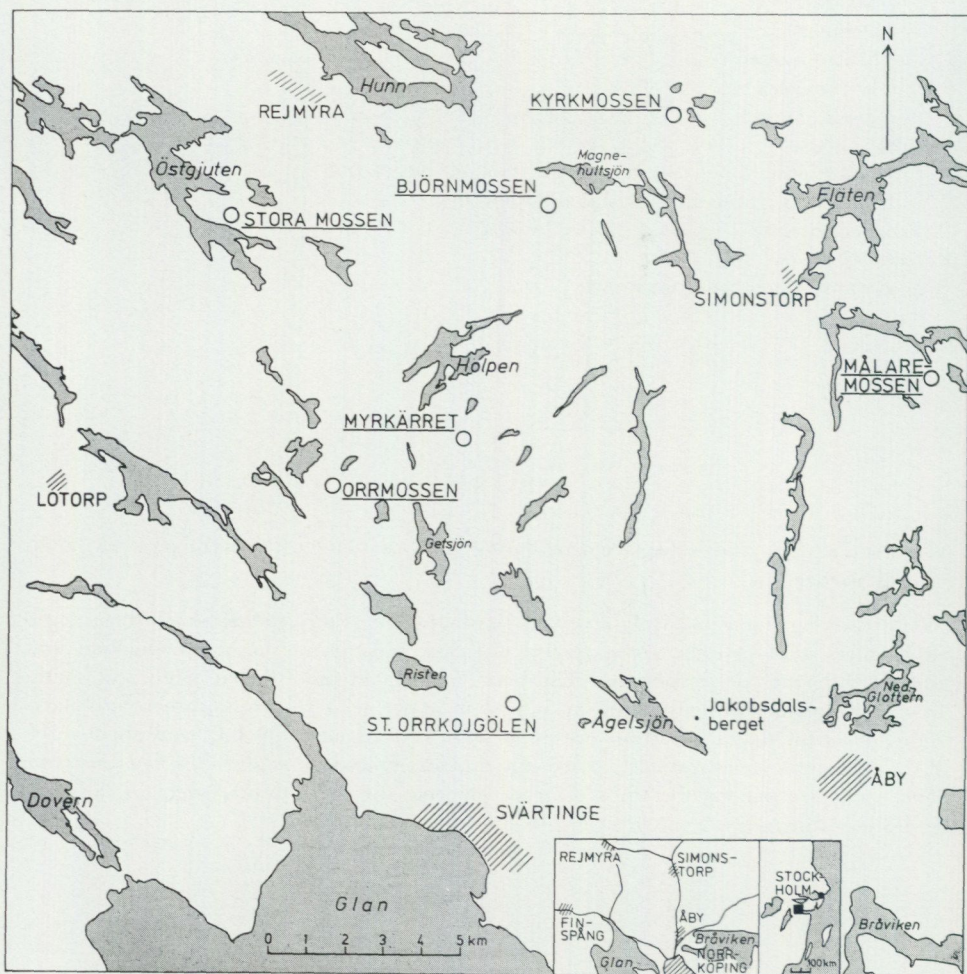


Fig. 1. Investigated localities.

showed that in many localities pure minerogenic sediments were deposited at the time of isolation. In other localities the lagoon sediments containing gyttja were utterly thin, making a dating with carbon-14 impossible. Later it also became clear that in some localities the gyttja clay and clayey gyttja had been deposited long time after the isolation. After sorting out the uninteresting localities only seven localities were left. (Fig. 1).

SAMPLING AND ANALYSES

The field investigations were carried out during 1973 and 1974. Borings for peat strata determination were made with a Hiller-auger while sampling were made with a special piston-auger.

Pollen and diatom analyses have been carried out at the micropalaeontological laboratory of the Geological Survey of Sweden where the original material and the lists of the diatom species are kept.

The carbon-14 datings were made at the Laboratory for Isotope Geology in Stockholm. The datings were calculated with the half-life $5\,568 \pm 30$ years and the accuracy 1 δ . In the text and diagrams, however, all the carbon-14 datings given are recalculated for the half-life $5\,730 \pm 30$ years. No other corrections have been made.

DESCRIPTION OF LOCALITIES

THE BOG AT ST. ORRKOJGÖLEN

The bog is situated about 1.2 km northeast of Västgötetorp and the threshold is at 99.5 m above sea-level. The *Sphagnum* peat is between 0.5 m and 1.5 m thick and covers about 3.5 m fen peat and less than 0.5 m with clayey gyttja, gyttja clay and in places clay.

The diatom analyses show that in the gyttja sediments fresh water diatoms are dominating. There also occur about 5 per cent of species belonging to marine, brackish-marine and brackish water environment. Probably these diatoms represent the Yoldia stage. Diatoms belonging to the Ancylus stage are missing.

Pollen analyses show that the gyttja sediments were deposited long time after the isolation of the basin. These sediments contain about 10 per cent of *Corylus* pollen, 15 per cent of *Alnus* pollen and 8 per cent of pollen of *Quercus*, *Ulmus* and *Tilia*.

Probably the 5 per cent of the strange diatoms belonging to marine and brackish water found in the sediment are redeposited. As diatoms from the Ancylus stage are missing, the Ancylus Lake did not reach an altitude of 99.5 m in this area.

BJÖRNMOSSEN

The bog is situated 1 km SSE of Magnehult. It is not drained and the threshold is situated 91.5 m above sea-level. The peat in the central part of the bog is just a little more than 2.5 m thick and consists mainly of *Carex* peat and *Carex-Sphagnum* peat. The *Sphagnum* peat is 0.5 m thick at most. The peat in the central part is underlain by gyttja, clayey gyttja, gyttja clay and fine sand. The transition between the sediments containing gyttja is undistinct.

The diatom analyses (Fig. 2) show that the basin was isolated from the Ancylus Lake. The fine sand beneath the gyttja clay probably was deposited in the Yoldia Sea when the hills round the basin were exposed to the waves. The transition between the Yoldia Sea and the Ancylus Lake could thus be placed between 92 m and 98 m above sea-level in the area. According to the carbon 14-dating of gyttja clay between 340 cm and 345 cm beneath the surface the basin was isolated $8\,420 \pm 325$ B.C. However, the difficulties of separating the fresh water of the Ancylus Lake from the water of the Yoldia Sea by means of diatoms must be great. It is therefore possible that the basin was isolated from the Yoldia Sea, the water of which probably was very fresh in the superstratum.

According to the pollen diagram, *Corylus* immigrated to the area $7\,655 \pm 185$ B.C. and *Alnus* $6\,995 \pm 175$ B.C. The first rise of the *Tilia* curve was dated at $5\,990 \pm 175$ B.C.

MYRKÄRRET

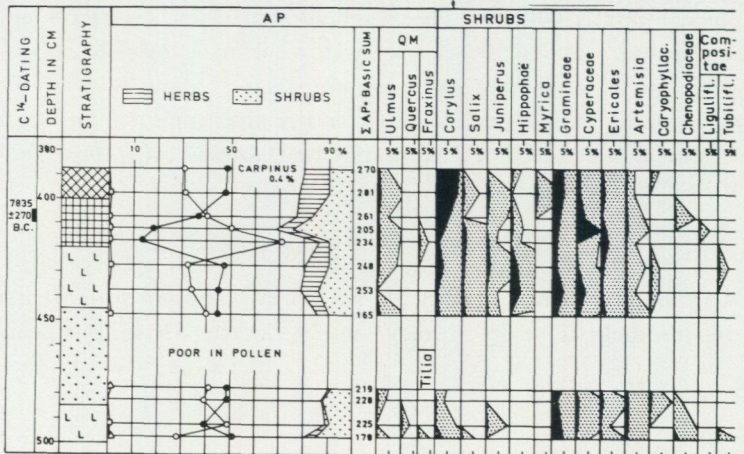
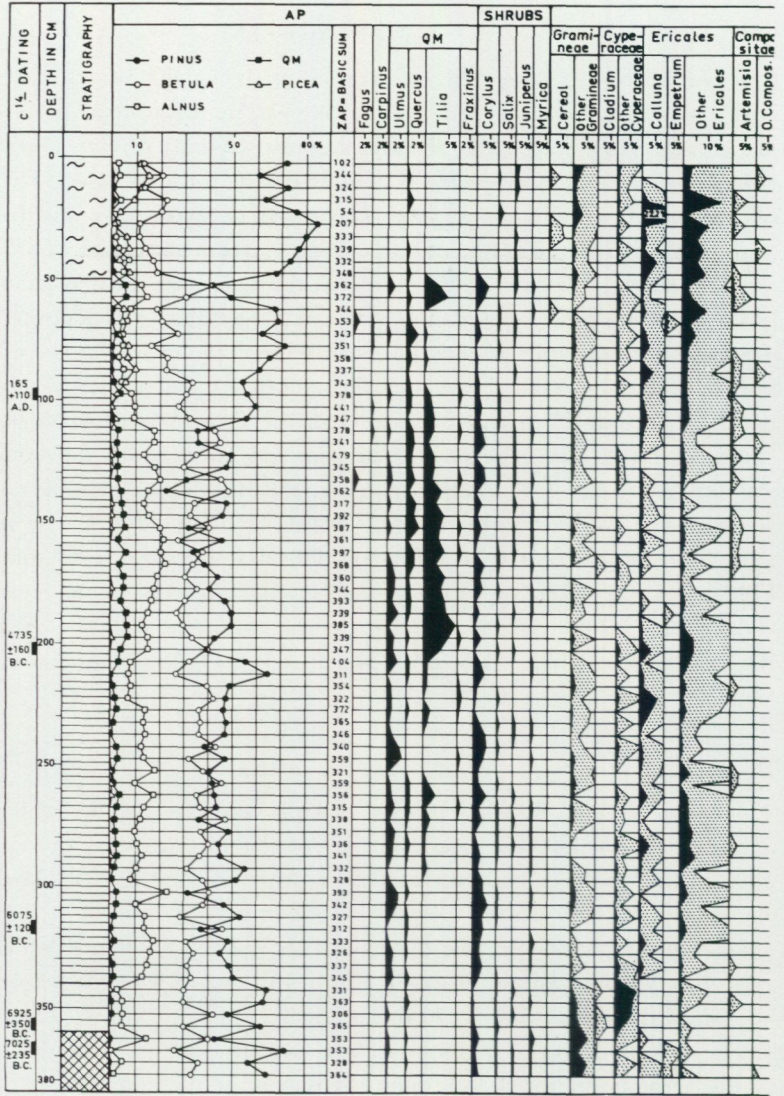
The bog is situated 800 m southeast of Grävsten. It is drained and the threshold is situated 87.5 m above sea-level. The *Sphagnum* peat is thin and the main part of the strata is built up of *Carex* peat covering gyttja, clayey gyttja and clay.

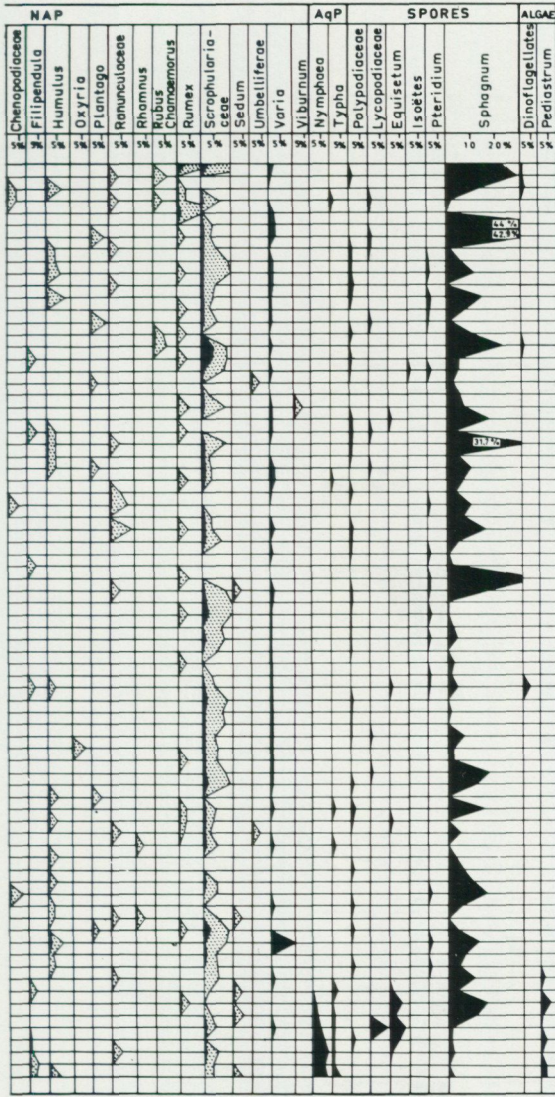
Diatom analyses show that the basin was isolated from the Ancylus Lake and according to the carbon 14-dating from 405 cm to 410 cm below surface, the isolation took place $7\,835 \pm 270$ B.C. (Fig. 3).

The pollen diagram shows that *Corylus*, although it never became common in the area, immigrated about the same time as the isolation of the basin took place. About 7 000 B.C. *Alnus* immigrated. The first traces of *Tilia* are found in the strata about 290 cm below the surface, probably about 5 800 B.C. The large spread of *Tilia* took place much later, about 4 700 B.C. *Picea* seems to have immigrated about 165 A.D. and at that time the distribution of *Tilia* and *Ulmus* was reduced. *Picea* immigrated to the area from the north (Persson 1975).

ORRMOSSEN

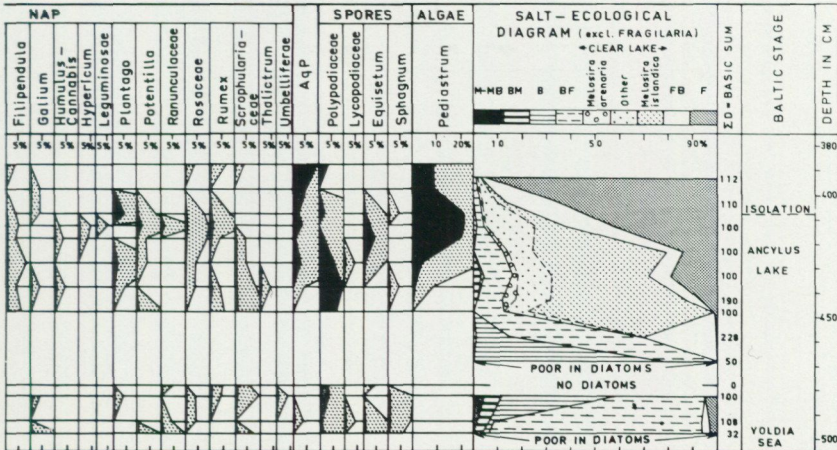
A raised bog situated about 1.7 km north of Lämmetorp. It is not drained and the threshold is at 86 m above sea-level. The *Sphagnum* peat is a little more





ANALYS. I. ORTMAN, 1974

Fig. 3. Pollen and diatom diagram from Myrkärret. For explanations of the symbols see Fig. 2.



ANALYS. K. MEDIN, 1974

ANALYS. B. FALKENSTRÖM, 1974

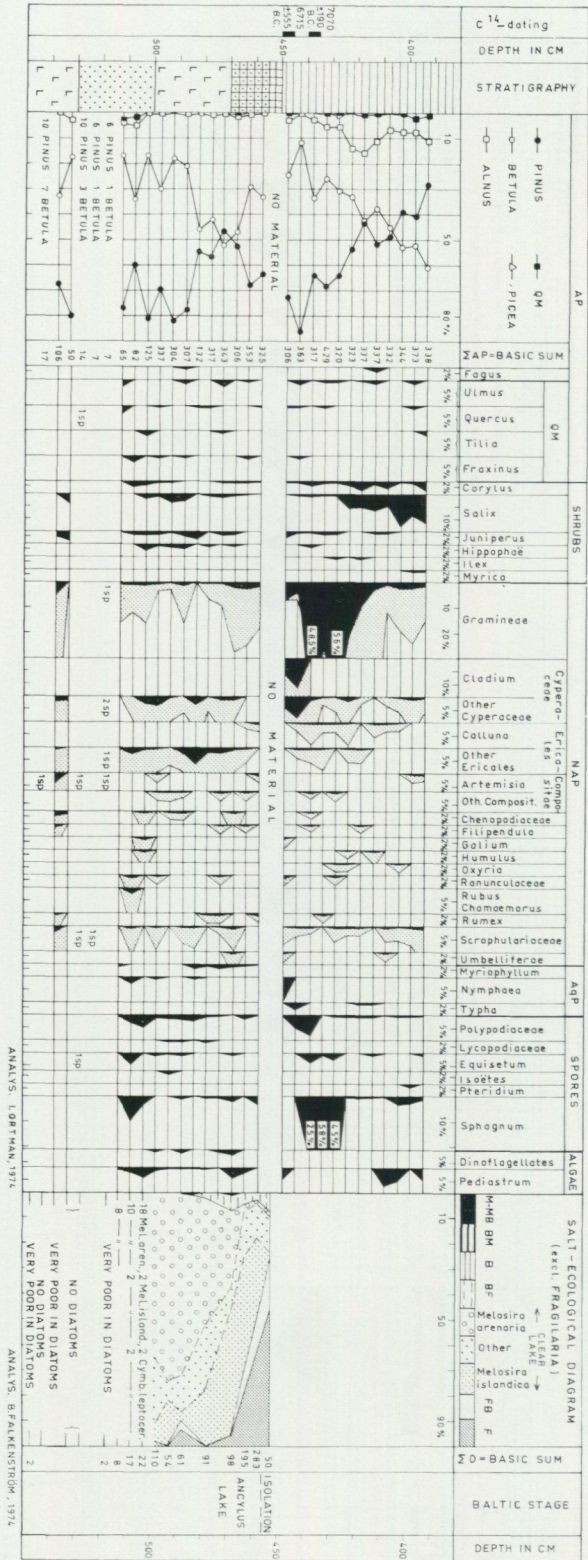


Fig. 4. Pollen and diatom diagram from Ormossen. For explanation of the symbols see Fig. 2.

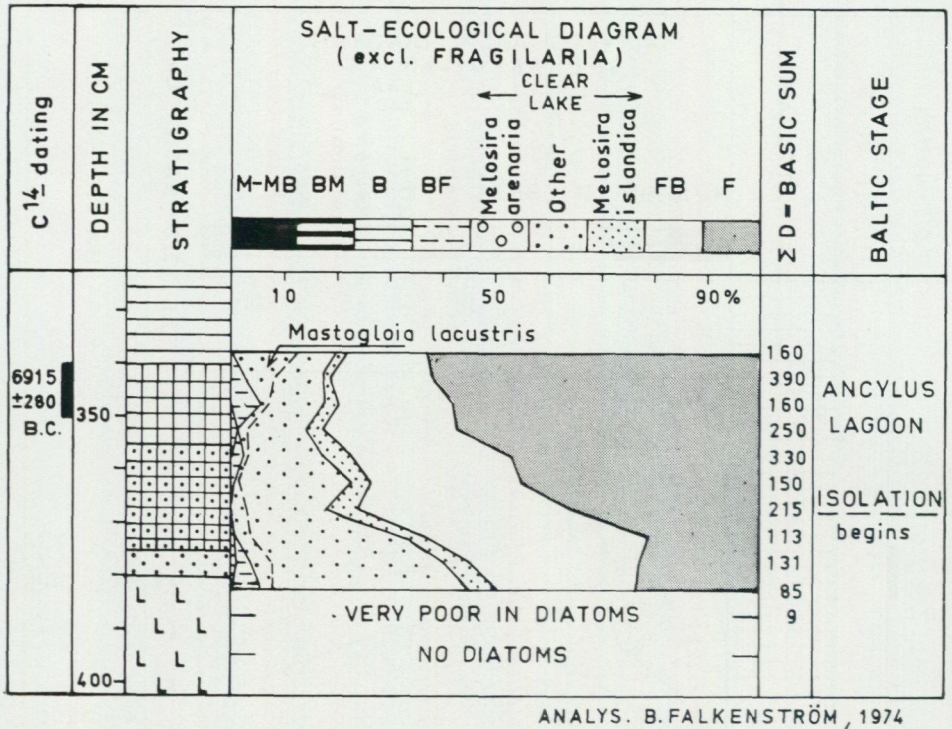


Fig. 6. Diatom diagram from Kyrkmossen. For explanations of the symbols see Fig. 2.

KYRKMOSSEN

The bog is situated about 1 km NNW of Stenstorp and about 500 m west of Gubbstugusjön. It is not drained. The two thresholds are about 20 m wide and situated 71.5 m above sea-level. The *Sphagnum* peat is less than 1 m thick and the main part of the strata is built up of fen peat, underlain by thin layers of clayey gyttja and gyttja clay.

According to the diatom analyses (Fig. 6) the basin was isolated from the Ancylus Lake. The beginning of the isolation probably took place around the level 370 cm below surface. The isolation seems to have been a slow process and was finished about 6915 ± 280 B.C. During this long period of isolation the basin probably was a shallow lagoon of the Ancylus Lake.

STORA MOSSEN

This poor fen is situated 800 m SSW of Målstorp between the lakes Målsjön and Östjuten. It is not drained and the threshold is situated 56.5 m above sea-level. The peat thickness in the central part is about 4.5 m. The strata consist of *Carex-Sphagnum* peat, *Carex* peat and thin layers of gyttja sediments underlain by clay.

The diatom analyses show that the basin was isolated from the Ancylus Lake. The isolation was finished $6\ 515 \pm 110$ B.C. (Fig. 7).

The pollen diagram shows that *Alnus* was spread at the time of deposition of the lowest part of the clayey gyttja. Pollen grains of *Tilia* occur about 5 500 B.C. to 5 600 B.C. but the large spread took place $5\ 200 \pm 300$ B.C. About 600 A.D. *Tilia* and *Ulmus* declined and somewhat earlier *Picea* had reached the area. The large spread of *Picea* into the area seems to have taken place $1\ 335 \pm 190$ A.D. From this time *Cereal* pollen are recorded in the strata.

RESULTS

SOME REMARKS ON THE DEVELOPMENT OF THE VEGETATION

Strata from four different localities have been pollen analysed and certain levels dated with carbon-14. Often it is rather difficult to define when a certain type of tree immigrated. The shape of the pollen-curves can be very varying, although the localities are situated very near to each other. This is illustrated by the *Corylus* curve in the diagrams from Björnmossen and Myrkärret. In the diagram from Björnmossen, *Corylus* pollen first appear just beneath the level 335 cm below surface and with a frequency of less than 1 per cent. This level was dated at $7\ 655 \pm 185$ B.C. In Myrkärret *Corylus* pollen occur with a frequency of 0.5 to 3 per cent in the lower part of the strata. At the level 405 cm below surface there is, however, a marked rise of the *Corylus* curve and this level was dated at $7\ 835 \pm 270$ B.C. In Långa Getsjön the rise of the *Corylus* curve has been dated at $7\ 835 \pm 130$ B.C. (M.-B. Florin 1977). Probably *Corylus* immigrated to the area 7 700 B.C. to 7 800 B.C.

The rise of the *Alnus* curve was dated at $6\ 995 \pm 250$ B.C. in Björnmossen, $7\ 025 \pm 235$ B.C. in Myrkärret and at $7\ 070 \pm 190$ B.C. in Orrmossen. In Långa Getsjön, situated about 15 km ESE of this area, the rise of the *Alnus* curve was dated at $7\ 415 \pm 170$ B.C. (M.-B. Florin 1977). The datings show that *Alnus* became common in the area about 7 000 B.C.

The first traces of trees belonging to "*Quercetum mixtum*" are found between 7 800 B.C. and 7 400 B.C. The great spread of *Quercus* and *Ulmus*, however, took place about 6 000 B.C. The large expansion of *Tilia* in the area was dated at $4\ 735 \pm 160$ B.C. in Myrkärret and at $5\ 200 \pm 300$ B.C. in Stora Mossen, that is to about 4 900 B.C.

The rise of the *Picea* curve was dated at 165 ± 110 A.D. in Myrkärret and at 595 ± 255 A.D. in Stora Mossen. In Långa Getsjön a dating showed 20 ± 65 A.D. (M.-B. Florin 1977). There are clear differences in age between the datings. A possibility is that *Picea* during a long period grew in thin and irregularly spread clumps in the area. According to the dating in Stora Mossen the large expansion of *Picea* took place $1\ 335 \pm 190$ A.D.

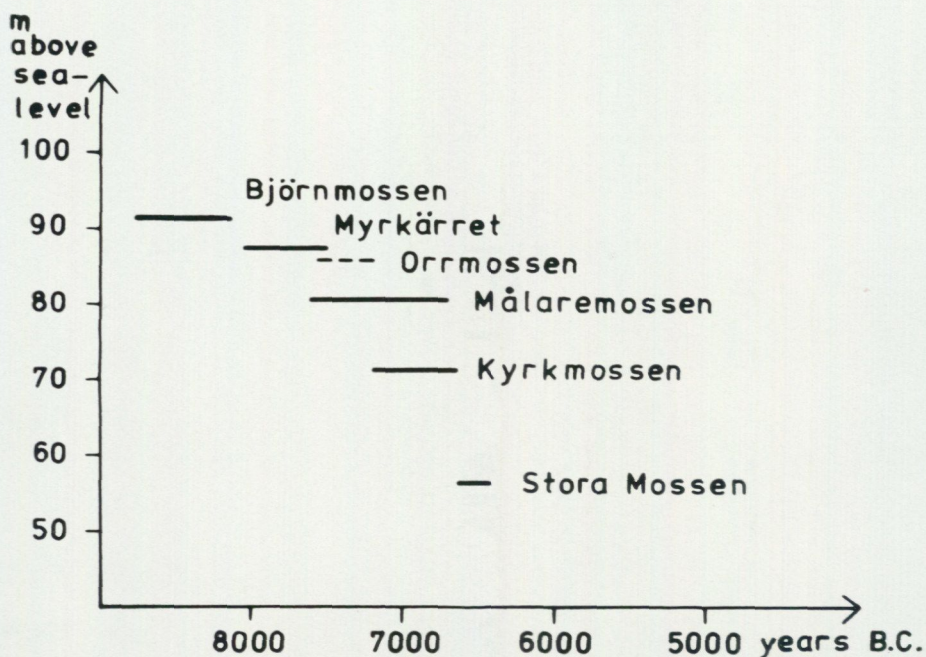


Fig. 8. The isolation of the investigated localities according to carbon 14-datings.

THE UPLIFT OF LAND AND SHORE DISPLACEMENT

Six of the localities investigated have thresholds situated between 91.5 m and 54.5 m above sea-level. They became isolated between 8 400 B.C. and 6 500 B.C. (Fig 8). The threshold of the locality St. Orrkojgölen is situated 99.5 m above sea-level. That basin was most probably isolated from the Yoldia Sea. Five of the localities investigated are situated between 91.5 m and 71.5 m above sea-level and they were isolated between 8 400 B.C. and 6 900 B.C. The difference between the isostatic and eustatic movements during this period thus resulted in an uplift of land of about 1.5 m per 100 years. When taking the deviations of the age determinations into consideration the rate of the uplift of land possibly varied between 1 m and 2 m per 100 years. Probably the land uplift was not constant during the period. There are indications that the uplift was slower during the older part of the period than during its later part. This might be caused by very rapid melting of the ice during the older part of the period, resulting in rise of the water level compensating the isostatic movement.

The transition between the Yoldia Sea and the Ancylus Lake should, according to the diatom analyses, be placed between 92 m and 98 m above sea-level, that is about 8 000—8 400 B.C. It must, however, be stated that it might be difficult or even impossible in certain areas to separate, by means of diatoms, the fresh water of the Ancylus Lake from the surface water of the Yoldia Sea,

which most probably was rather fresh. The terms Ancylus Lake, Ancylus stage etc. are therefore in this paper used when the diatom flora indicates clear-water lake conditions. About the locality Stuggölen, 90 m above sea-level, M.-B. Florin (1977, p. 33) says that the basin was a part of the Yoldia Sea, but that "This Pre-boreal isolation flora is remarkably similar to that which 800—1 000 years later characterized the Ancylus stage".

In Kyrkmossen, with the threshold at 71.5 m above sea-level, the isolation was lengthy. It was finished $6\,915 \pm 280$ B.C., that is close to the Ancylus transgression, dated at 7 000 B.C. on Öland (Königsson 1968), Gotland (Persson 1978) and in the area of Linköping (Fromm 1976). According to investigations in the southeastern Finland (Eronen 1976), the Ancylus transgression started just before 7 350 B.C. It is possible that Kyrkmossen is situated so far to the north that the Ancylus transgression is marked only as a period of equilibrium between the isostatic and eustatic movements. The threshold of Kyrkmossen is, however, situated 3.5 m lower than the Ancylus beach ridges at Kärna, west of Linköping (Fromm 1976). In a locality named Skärgölen, situated 20 km north of Linköping and at 87.2 m above sea-level, the diatom flora might indicate a transgression of the Ancylus Lake (Fromm 1976). If the values from the Linköping area are extrapolated to the north, the Ancylus transgression would be found at an altitude as high as about 100 m above sea-level in the area of Kyrkmossen.

It is evident that further investigations are necessary to solve the problems especially about the transition between the Yoldia Sea and the Ancylus Lake and the duration of these stages of the Baltic. Also the range of the Ancylus transgression northwards is of great interest. A historical review of the Ancylus Lake is given by Fredén (1967).

Investigations concerning the land uplift in the south part of Sörmland and in the Stockholm region have been published by S. Florin (1959), M.-B. Florin (1977) and Möller (1969). Besides there are available data (Persson, in manuscript) from three localities, Frillingsmossen, Åtorpsmossen and Korsnäs, situated in the eastern part of Sörmland. The localities in the south of Sörmland are situated within the zone of the Middle-Swedish end moraines, formed during the Younger Dryas Stage. These localities (Fig. 9) have been put together in a diagram showing the shore displacement and the stages of the Baltic (Fig. 10).

The curve of the shore displacement shows that when the ice had left the area the uplift of land was very rapid and thereafter decreased successively. At certain times transgressions probably took place.

The investigations indicate that in the area the highest shore-line, situated 150 m to 154 m above sea-level (Persson and Svantesson 1976, Persson and Bergh 1977), was formed about 8 800 B.C. The land uplift was somewhat more than 20 m per 100 years just after the retreat of the ice. About 8 500 B.C. the

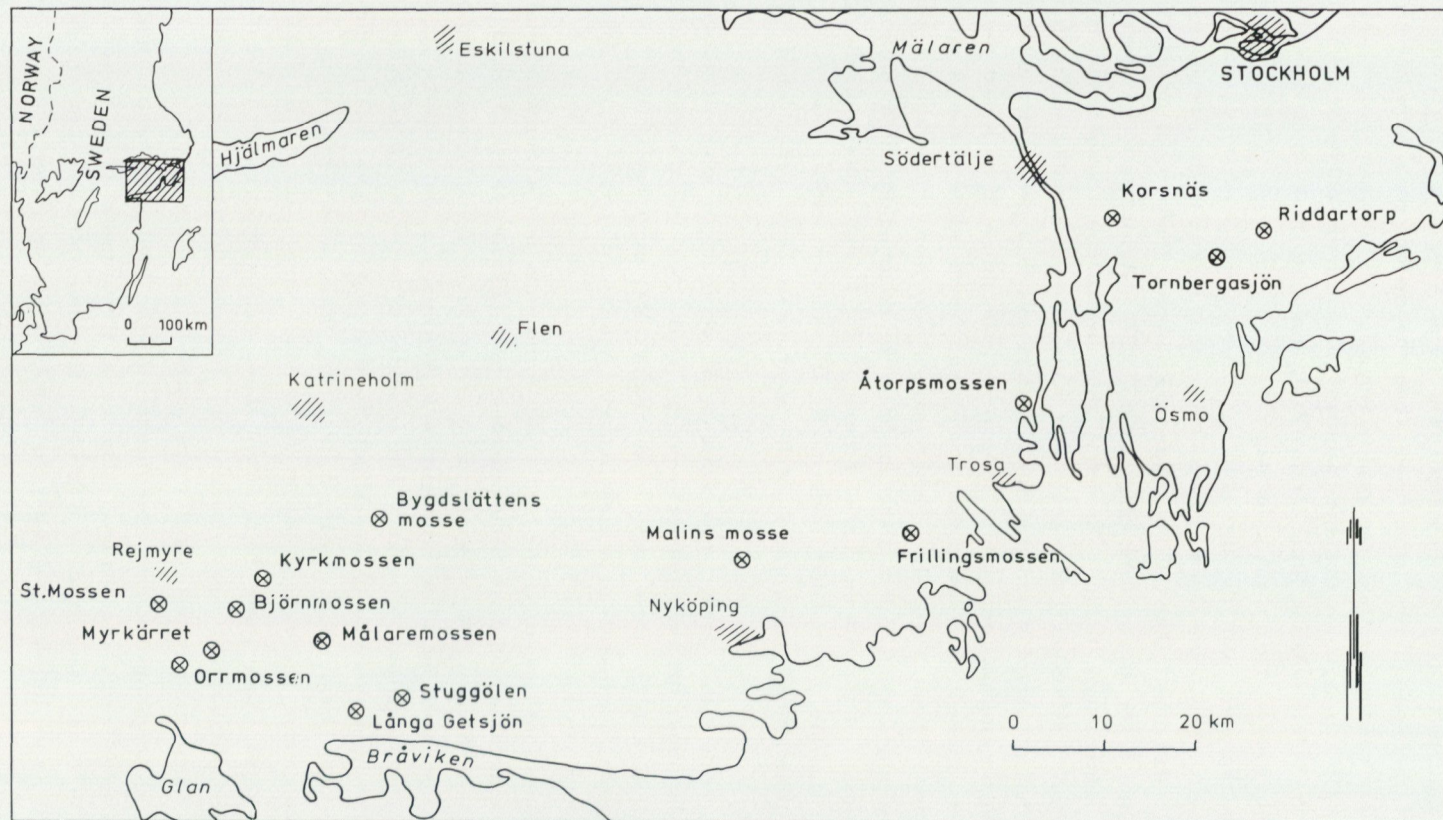


Fig. 9. Localities used for drawing the shore displacement of the region.

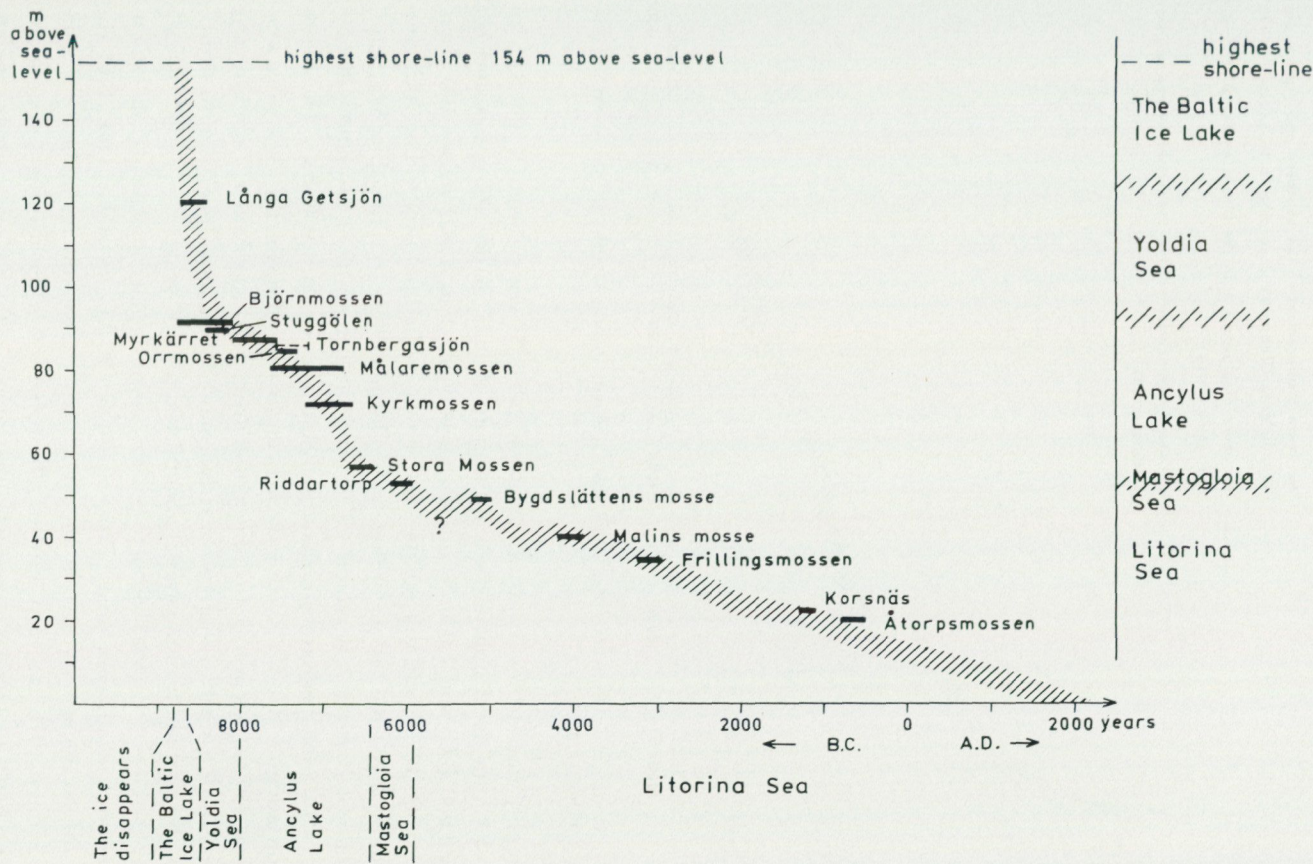


Fig. 10. The shore displacement within the eastern part of the zone of the Middle-Swedish end moraines and the relation to the different stages of the Baltic.

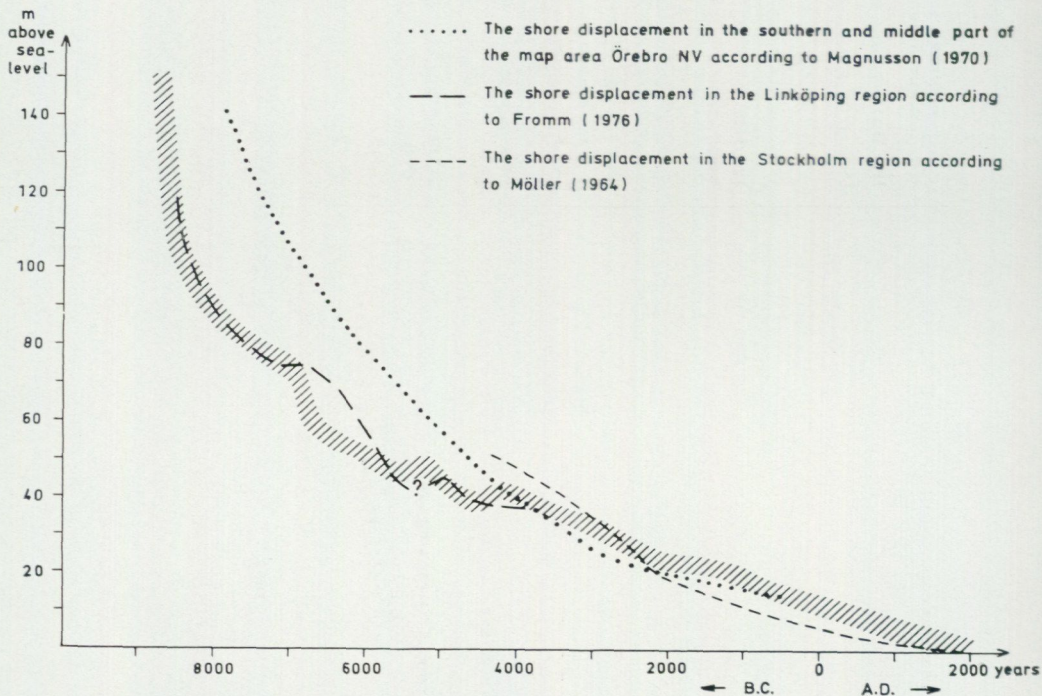


Fig. 11. Comparison between the shore displacement in the south of Sörmland and in adjacent areas.

land uplift had decreased to about 10 m per 100 years. From 8 500 B.C. to 8 000 B.C. the land uplift was a little more than 3 m per 100 years and between 8 000 B.C. and 7 000 B.C. it varied between 1 m and 2 m per 100 years. About 6 500 B.C. there is a notable slow down in the land uplift. The transgression about 5 100 B.C. is, according to S. Florin (1959), the first Litorina transgression. In Blekinge (Berglund 1971) and on the south of Gotland (Persson 1978) a Litorina transgression has been dated at about 4 900 B.C. The transgression about 4 400 B.C. was indicated at two localities in the Nyköping area (Persson 1973). According to information from Dr Urve Miller, there are also indications of a small transgression at Korsnäs (Miller and Robertsson in print). Today the land uplift in the area is about 0.4 m per 100 years.

Fig. 11 shows a comparison between the shore displacement in the investigated area and in adjacent areas. From about 8 500 B.C. to about 4 000 B.C. the shore displacement curves from the investigated area and from the Linköping area (Fromm 1976) are very similar. The curves from the investigated area and the area north of Örebro cross each other about 4 000 B.C. The Örebro region is situated about 80 km northwest of the investigated area. From 4 000 B.C. the shore-lines in the investigated area should thus be higher elevated than corresponding shore-lines in the Örebro region (Magnusson 1970), and from 2 500

B.C. also higher than corresponding shore-lines in the Stockholm region (Möller 1964).

It does not seem probably that the large irregularities can be due only to statistical errors in the carbon 14-datings. It is possible that the stagnation of the ice during the Younger Dryas Stage caused a change in the land uplift within the zone of the Middle Swedish end moraines in relation to adjacent areas.

ACKNOWLEDGEMENTS

The field investigations have been carried out together with Mr B.-E. Holmgren and Mr G. Bergh.

Dr Urve Miller has given valuable remarks to the pollen and diatom diagrams and with Dr L. Engstrand I have had many discussions about the radiocarbon datings. Valuable ideas about the results have also been given by Dr E. Fromm, Dr E. Magnusson and Dr C. Fredén. Dr E. Magnusson has also critically read the manuscript. To all I express my sincere thanks.

REFERENCES

GFF = Geologiska Föreningens i Stockholm Förhandlingar
 SGU = Sveriges geologiska undersökning

- BERGLUND, B., 1971: Littorina transgressions in Blekinge, south Sweden, a preliminary survey. — GFF 93.
- ERONEN, M., 1976: A radiocarbon-dated *Ancylus* transgression site in south-eastern Finland. — *Boreas* 5.
- FLORIN, M.-B., 1975: Microfossils contents of two soil profiles from western Kolmården, southern central Sweden. — GFF 97.
- 1977: Late-glacial and Pre-boreal vegetation in southern central Sweden. — *Striae* 5.
- FLORIN, S., 1959: Hagtorp. — *Tor* V.
- FREDÉN, C., 1967: A historical review of the *Ancylus* Lake and the Svea River. — GFF 89.
- FROMM, E., 1976: Beskrivning till jordartskartan Linköping NO. — SGU Ae 19.
- KÖNIGSSON, L.-K., 1968: The *Ancylus* transgression in the Skede Mose area, Öland. — GFF 90.
- MAGNUSSON, E., 1970: "Kvartära bildningar" i Beskrivning till geologiska kartbladet Örebro NV. — SGU Ae 6.
- MILLER, U., & ROBERTSSON, A.-M., in print: Quaternary biostratigraphic studies in connection with the excavations at Korsnäs, a Stone Age dwelling site southwest of Stockholm.
- MÖLLER, H., 1964: "Kvartära bildningar" i Beskrivning till geologiska kartbladet Stockholm NO. — SGU Ae 1.
- 1969: "Kvartära bildningar" i Beskrivning till geologiska kartbladet Stockholm SV. — SGU Ae 3.
- PERSSON, CH., 1973: Indications of a *Litorina* transgression in the Nyköping area. — SGU C 680.
- 1975: Speculations on the immigration of spruce into Sweden. — GFF 97.
- 1976: Beskrivning till jordartskartan Katrineholm SV. — SGU Ae 29.
- 1978: Dateringar av *Ancylus*- och *Litorina*transgressionerna på södra Gotland. — SGU C 745.
- PERSSON, CH., & SVANTESSON, S.-I., 1976: The highest shore-line on Jakobsdalsberget in Kolmården, Sweden. — GFF 94.
- PERSSON, CH., & BERGH, G., 1977: The highest shore-line on Getberget. — GFF 99.

Carbon-14 age-determinations

Locality	Lab No	T/2 = 5568 ± 30	T/2 = 5730 ± 30		Notes
Björnmossen	St 4952	7775 ± 175 BP	7940 ± 175 BP	5990	B.C.
"	St 4949	8730 ± 250 BP	8945 ± 250 BP	6995	B.C.
"	St 5267	9325 ± 185 BP	9605 ± 185 BP	7655	B.C.
"	St 5266	10070 ± 325 BP	10370 ± 325 BP	8420	B.C.
Myrkärret	St 4970	1735 ± 110 BP	1785 ± 110 BP	165	A.D.
"	St 4971	6490 ± 160 BP	6685 ± 160 BP	4765	B.C.
"	St 4972	7790 ± 210 BP	8025 ± 210 BP	6075	B.C.
"	St 5063	8615 ± 350 BP	8875 ± 350 BP	6925	B.C.
"	St 5062	8715 ± 235 BP	8975 ± 235 BP	7025	B.C.
"	St 4973	9500 ± 270 BP	9785 ± 270 BP	7835	B.C.
Orrmossen	St 4957	8755 ± 190 BP	9020 ± 190 BP	7070	B.C.
"	St 5272	8415 ± 555 BP	8665 ± 555 BP	6715	B.C. Carex peat, unsol. fract.
"	St 5276	8560 ± 135 BP	8815 ± 135 BP	6865	B.C. sol. fract. of the sample above
Mälaremossen	St 5268	8860 ± 455 BP	9125 ± 455 BP	7175	B.C.
Kyrkmossen	St 5273	8605 ± 280 BP	8865 ± 280 BP	6915	B.C.
Stora Mossen	St 5067	595 ± 190 BP	613 ± 190 BP	1335	A.D.
"	St 5365	1315 ± 255 BP	1355 ± 255 BP	595	A.D.
"	St 5065	6940 ± 300 BP	7148 ± 300 BP	5200	B.C.
"	St 5275	7550 ± 105 BP	7777 ± 105 BP	5825	B.C.
Långa Getsjön	U 426	10210 ± 140 BP	10515 ± 140 BP	8565	B.C. M.-B. Florin 1977
Stuggölen	U 420	9930 ± 140 BP	10230 ± 140 BP	8280	B.C. M.-B. Florin 1977
Tornbergasjön	St 2039	9155 ± 180 BP	9430 ± 180 BP	7480	B.C. Möller 1969
Riddartorp	St 2297	7750 ± 100 BP	7985 ± 100 BP	6035	B.C. Möller 1969
Bygdslättens mosse	U 41	6830 ± 120 BP	7035 ± 120 BP	5085	B.C. Florin 1959
Malins mosse	St 3423	5830 ± 140 BP	6005 ± 140 BP	4055	B.C. Persson 1973
Frillingsmossen	St 5656	4750 ± 115 BP	4895 ± 115 BP	2945	B.C. Persson (in print)
Korsnäs	St 5278	3105 ± 100 BP	3200 ± 100 BP	1250	B.C. Miller & Robertsson (in print)
Åtorpsmossen	St 5436	2535 ± 165 BP	2610 ± 165 BP	660	B.C. Persson (in print)

PRISKLASS B

Distribueras genom
LiberKartor
162 89 VÄLLINGBY

Schmidts Boktryckeri AB
Helsingborg 1979

ISBN 91-7158-160-X