

# A Pollen-Analytical Investigation of Holmegaards Mose with Considerations as to the Age of the Dwelling- Places of the Maglemosean Period in Denmark and Surrounding Areas.

By  
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## Historical Introduction.

Denmark is the classical country as regards the Maglemosean or Mullerup culture. There the first find was made, and there the most numerous remains of that culture have also been met with later.

The age of the Danish Maglemosean sites has been treated on several occasions from a pollen-analytical point of view. As early as 1919 K. JESSEN (in FRIIS JOHANSEN 1919, pp. 123 f.) briefly discussed some results of his pollen countings. In the following year he published complete pollen-spectra (K. JESSEN 1920, pp. 113 f.) from the culture layers of Mullerup Maglemose and Sværdborg Mose<sup>1)</sup>, the only find-localities known at that time. As a consequence of these pollen-analytical investigations the Maglemosean period could be definitely referred to the continuous-land period ("fastlandstiden", Ancyclus period).

More pollen-analytical material was procured in connection with the excavation of the two dwelling-places in Holmegaards Mose (K. JESSEN in BROHOLM 1924, p. 23; the same pollen-spectra published also by K. JESSEN 1929, p. 278, with corrected values for hazel).

Some years later the problems concerned with this subject were more exhaustively treated by the same author (K. JESSEN 1935 b) on the basis of a substantially increased material of pollen-spectra and pollen-diagrams, partly from the three sites mentioned above,

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<sup>1)</sup> Danish »Mose« = bog.

partly from a dwelling-place in Lundby Mose situated in the neighbourhood of the Sværdborg site. In the quoted work the Maglemosean period was assigned to the zones V—VI of the pollen-diagrammatical zone system proposed in the same year for the Late-Glacial and Post-Glacial of Denmark by JESSEN (1935 a). The various dwelling-places were found to be of some what different age, the settlement beginning earlier in Lundby Mose and at Koch's Holm in Mullerup Maglemose than at Sarauw's Holm in the same bog and at the western dwelling-place in Holmegaards Mose; the settlements started still later in Sværdborg Mose and at the eastern dwelling-place in Holmegaards Mose. As regards the end of the settlements, JESSEN held the view that Mullerup-Koch had only a comparatively short duration; Mullerup-Sarauw too was abandoned earlier than the other sites, while Sværdborg and particularly Holmegaard West and Holmegaard East continued until a later time than the rest.

Already a few years previously L. v. Post (1929, p. 151) expressed the opinion that the dwelling-places at Mullerup were abandoned a little earlier than the other Maglemosean sites known at that time.

In my work on the zone division of the Late-Glacial and Post-Glacial of Scania I made an attempt to date the Danish Maglemosean sites with the aid of the Scanian zone system (NILSSON 1935, p. 532, fig. 28)<sup>1</sup>). They were found to arrange themselves in two distinct groups. One group including the localities Mullerup and Lundby could be referred to zone VIII<sup>s</sup>, another, younger group (Sværdborg and Holmegaard) to zone VII<sup>s</sup>. Within the first group at least the oldest part of the Lundby site was assumed to be somewhat older than the Mullerup sites. As regards the sites at Holmegaard the question if the settlement perhaps continued also into zone VI<sup>s</sup> was left unsolved.

In the following years new dwelling-places of about the same age as those dealt with above have been discovered in different parts of Denmark. They have partly been dated by pollen-analysis, but hitherto only preliminary communications have been published on the subject. The most important of these finds is the site at Klosterlund, in the neighbourhood of the dried-up lake Bølling Sø in central

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<sup>1</sup>) In the following the Scanian zones (T. NILSSON) are marked with the index *S*, the Danish zones (K. JESSEN) with the index *D*.

Jutland. This settlement was dated pollen-analytically by JOHS. IVERSEN (1937, p. 184) to the end of zone IV<sup>D</sup> and was consequently claimed to be the oldest Danish dwelling-place known at that time. Archaeologically it is regarded by TH. MATHIASSEN (1937, p. 174) as the oldest stage of the Maglemosean culture, by others, however, as an independent culture (BRØNDSTED 1938, p. 85). Other Jutlandian finds, such as the Revelmose site, are, according to the pollen-analytical investigations, mainly of the same age as the Zealandian Maglemose sites (zones V—VI<sup>D</sup>)<sup>1</sup>). Archaeologically, however, they are held to belong to another culture sphere (the Gudenaa culture) than the Maglemosean culture proper (cf. BRØNDSTED *l. c.*).

Several true Maglemosean dwelling-places have been detected in Zealand during the last few years. In Aamosen settlements from many different times have been revealed. The oldest of them have been archaeologically and geologically shown to belong to the Maglemosean culture. Preliminary pollen-analytical age determinations have been performed in Aamosen by IVERSEN (in WESTERBY 1937, pp. 296 f.) and particularly by TROELS-SMITH (1943 b, pp. 147 ff., figs. 76, 78, 79, 82; scheme p. 162). Most of the Maglemosean sites in Aamosen have been referred to zone VI<sup>D</sup> (Øgaarde II, Magleø I [in the main], Hesselbjerggaard) and are accordingly held to be contemporary with Holmegaard and Sværdborg. The lowest culture layer at Øgaarde (Øgaarde I), which is incompletely known archaeologically, is considered to be substantially older and assigned to zone IV<sup>D</sup> or to the oldest part of zone V<sup>D</sup>.

Outside Denmark cultural remains of the Maglemosean type have been met with over a large part of northern Europe. In this work only the finds nearest to Denmark will be considered.

In Scania a dwelling-place at Baremosse, ENE of Landskrona<sup>2</sup>), was stated by L. v. POST (1928, pp. 65 ff.; 1929, pp. 149 ff.), by means of the pollen-analytical method, to be of the same age as the Danish Maglemosean sites. This result was confirmed by a new pollen-diagram from the find-locality published by EKSTRÖM (1934, fig. 16). On account of this material the Baremosse dwelling-place was

<sup>1</sup>) The Revelmose site is regarded to extend a little into the base of zone VII<sup>D</sup> (IVERSEN 1937, pp. 183, 186, fig. 32).

<sup>2</sup>) The locality "Baremosse" in the parish of Svalöv, ENE of Landskrona, must not be confused or put together with the locality "Bara lilla mosse" in the parish of Bara, E of Malmö, as has been done by several authors, in Sweden and elsewhere.

referred by me (NILSSON 1935, p. 427, fig. 28) to an early part of the Maglemosean period, the pollen zone VIII<sup>s</sup>, being thus contemporary with the Danish sites Lundby and Mullerup. K. JESSEN (1935 b, p. 37) expressed the opinion, however, that the settlement in Baremosse "is somewhat older than even the lowermost part of the Lundby culture layer, which may be the oldest known in Denmark".

Another ancient Swedish dwelling-place, Sandarna at Gothenburg (ALIN, NIKLASSON & THOMASSON 1934), was distinguished as a particular primitive culture by NIKLASSON, partly on account of the geological age determination performed by THOMASSON (cf. also THOMASSON 1936, 1937). In my work 1935 (pp. 532 f., fig. 28) it was, however, paralleled as to age with the early Danish Maglemosean sites.

Immediately south of Denmark culture layers of Maglemosean type have been revealed at Duvensee and Pinnberg in Holstein. Apart from some pollen countings performed by BEYLE in 1928, the first complete pollen-spectra from Duvensee have been given by SCHÜTRUMPF (1938, pp. 15 f.) in connection with his treatment of the Pinnberg sites (cf. further below pp. 215 f.).

### The Age of the Culture Layers in Holmegaards Mose.

As was stated above, it appeared to me in an earlier work (NILSSON 1935, pp. 531 f.) to be difficult to establish with certainty the time when the settlements in Holmegaards Mose came to an end. The cause of this was chiefly our then imperfect knowledge as regards the variation of the lime curve in southern Zealand in early post-glacial time. For this reason I found it appropriate to re-investigate the bog in question in order to erect a pollen-diagram with a close series of samples from a part of the bog where the sequence of strata was well developed. This was done in the summer of 1937. Two profiles were investigated, both in the area of the western dwelling-place, a complete section (P. 1), and a complementary one (P. 2) comprising only a part of the lower strata<sup>1</sup>). The microscopical study of the material was carried out in the following winter with the assistance of Miss MAJA PERSSON †.

<sup>1</sup>) The section P. 1 was bored in the western part of the area of the dwelling-place (about 20 m from its border), the section P. 2 in its northern part.

Holmegaards Mose is situated north of Næstved in southern Zealand. As regards the general conditions of the bog and its dwelling-places, the reader is referred to the works of BROHOLM (1924) and K. JESSEN (1935 b, pp. 13 ff.).

The stratigraphy of the two sections P. 1 and P. 2 is as follows (cf. pl. V):

P. 1.

- A. 0—80 cm. Sphagnum peat, highly decomposed (H 9), the uppermost part (10 cm) mouldered, the lowermost part (20 cm) with some remains of *Phragmites*.
- B. 80—120 cm. Sphagnum-birch forest peat, with *Phragmites*.
- C. 120—152 cm. Swamp dy, with some remains of *Phragmites* and *Dryopteris thelypteris*.
- D. 152—206 cm. Magnocaricetum peat, with remains of *Phragmites* and *Dryopteris thelypteris*, in the lowermost part also *Cladium mariscus*. At the top of the layer (about 15 cm) pieces of charcoal, indicating the presence of a culture layer.
- E. 206—228 cm. *Cladium* peat, with remains of *Carices*, *Phragmites*, and *Dryopteris thelypteris*.
- F. 228—233 cm. Shell-gyttja, brown, with some rootlets grown down from the above layer.
- G. 233—272 cm. Lime-gyttja, grey.  
Boulder-clay.

P. 2.

- A. ?—167 cm. *Cladium* peat, with remains of *Dryopteris thelypteris*.
- B. 167—196 cm. Algae-gyttja (Lyngbya gyttja), yellowish brown.
- C. 196—206 cm. Shell-gyttja, greyish brown.
- D. 206—? cm. Lime-gyttja, grey.

The parts of the pollen-diagrams comprising gyttjas and sphagnum peat without remains of wood have a normal appearance and are easily correlated with other Danish diagrams (cf. *i. a.* NILSSON

1948 a), and also with the Scanian diagrams (NILSSON 1935), notwithstanding the distance.

For the rest the curves are more or less disturbed, which makes a close comparison with normal pollen-diagrams difficult. The sphagnum-birch forest peat has evidently suffered from a local supply of birch pollen. In the different strata of radicle peat (layers D and E in P. 1, layer A in P. 2) the pine pollen is as usual strongly over-represented (cf. NILSSON 1935, p. 410, foot-note), depressing most of the other curves (hazel, birch, etc.), as is shown by comparison between the pollen-diagrams P. 1 and P. 2. A study of the two diagrams immediately shows that considerable parts of the fen peat in P. 1 distinguished by high pine frequencies must correspond to gyttja with much lower pine values in P. 2. It may also be noticed that the lime curve has not been subjected to the general depression of the deciduous tree pollen in the radicle peat; on the contrary it seems to lie higher than normally. The cause of this may be the more or less strong destruction that can frequently be observed on fen peat pollen. As is well known, such a characteristic pollen as that of lime is easily recognizable also in an advanced state of destruction, a condition tending to strengthen the frequencies of lime in pollen-spectra from fen peat. This is possibly also one cause of the over-representation of pine pollen in such peat. Another cause is probably the concentration of the easily floating pine pollen by drift in peat formed close to the shore, as was pointed out by myself in 1935 (*l. c.*). In spite of these difficulties so many characteristic features in the course of the curves are recognized that it has been possible to correlate the pollen-spectra of the fen peat with normal pollen-diagrams with a fairly high degree of certainty.

In order to make a comparison with Swedish conditions easier I have used the Scanian zone division (I—IX<sup>s</sup>), and also the Scanian index horizons as far as they could be discerned in the diagrams (cf. NILSSON 1935). As they have been defined by K. JESSEN (1935 a, pp. 187 ff.; 1938, pp. 124 f., 128), the Danish pollen zones may be applied on the present diagrams as follows: I—II<sup>s</sup> = IX<sup>D</sup>; III<sup>s</sup> = upper part of VIII<sup>D</sup>; V—VI<sup>s</sup> = VII<sup>D</sup>; VII<sup>s</sup> = VI<sup>D</sup>; VIII<sup>s</sup> = V<sup>D</sup>; IX<sup>s</sup> = IV<sup>D</sup>.

Only post-glacial strata are represented in the part of the bog investigated by me. The pollen frequency is high and the values of non-tree pollen are low already in the oldest samples. The zone

borders and other index horizons of the oldest post-glacial zones could easily be inserted. In zone IX<sup>s</sup> the post-glacial birch maximum IX c is well represented. The boundary between the zones IX<sup>s</sup> and VIII<sup>s</sup>, the rational hazel border, is magnificently developed. The very important zone border VII/VIII<sup>s</sup>, the rational alder border, is easily recognizable. The secondary index horizon VIII b, the rational elm border, is also well discernible.

The index horizon VII c is a very characteristic level, at which the alder curve rapidly increases, surpassing an amount of 15%. This horizon has a similar position in the present diagrams as it has in Scania<sup>1)</sup> and may therefore be taken as synchronous. The same holds also good of the other index horizons within zone VII<sup>s</sup>. By a comparison between the profiles P. 1 and P. 2 it becomes conspicuous that the lower part of zone VII<sup>s</sup> (below VII c) is comparatively much more prolonged in P. 1 (evidently rapidly formed magnocaricetum peat) than it is in the contemporary but more slowly developed gyttja in P. 2.

The hazel reaches its characteristic post-glacial maximum in zone VIII<sup>s</sup> with the high value of 359%. As is the case in Scania the enormous frequencies of hazel persist in, particularly, the lower part of zone VII<sup>s</sup> (up to 286%).

A characteristic of the diagrams from Holmegaards Mose is the high lime curve, also in gyttjas, a feature which must have its cause in a rich representation of lime in the surrounding forests. The continuous lime curve takes its origin already in the upper part of zone VIII<sup>s</sup>—with low frequencies, indeed—a feature unknown in Scania and all Danish diagrams published previously. Also in zone VII<sup>s</sup> it lies on an average a little higher than it normally does in Scania-Dania (cf. NILSSON 1935, pl. IX, fig. 2; 1948 a, etc.). Sometimes equally high values are found, as for example in the bog at Tengslemark in northern Zealand (K. JESSEN 1937, fig. 2). They are considerably surpassed, however, by the diagram from Bundsø on the isle of Als (K. JESSEN 1938, fig. 6) with lime values of 15–26% within zone VII<sup>s</sup> (spectra 37–40), that is in the neighbourhood of Sleswick-Holstein with its comparatively high lime occurrences (NILSSON 1948 b).

The zone border VI/VII<sup>s</sup> is placed on a level with the rapidly

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<sup>1)</sup> As regards the detailed characterization of the zones and index horizons cf. NILSSON (1935, pp. 392 ff.).

increasing lime curve. In Scania this horizon often forms the rational lime border. Above it the oak distinctly increases and the hazel declines. Possibly the top of zone VII<sup>s</sup> is not developed in profile P. 1. If so, there is a lacuna between the culture layer in the uppermost part of the magnocaricetum peat and the overlying swamp dy.

The pollen-analytical horizons in the upper part of the profile P. 1 will not be discussed at length, as they have no bearing upon the dating of the culture layers in the bog.

The growth history of the bog, as it is revealed in the present material, may be sketched in the following way. In early post-glacial time the present bog was a lake with a water rich in lime and with an abundant mollusc fauna. In this ancient lake lime-gyttja was deposited. The formation of lime-gyttja began in the time of the birch-pine forests (zone IX<sup>s</sup>), and continued in the deeper parts of the lake through the whole time of fir forests and hazel groves (zone VIII<sup>s</sup>) into the oldest part of the time of the beginning alder and oak mixed forests (zone VII<sup>s</sup>). Then the conditions became unfavourable for the formation of lime-gyttja, and algae-gyttja was instead deposited. The formation of this continued at least to the end of zone VII<sup>s</sup> (P. 2).

Already at a point of time corresponding to the younger part of zone VIII<sup>s</sup> the shallow borders of the lake began to be overgrown by bunches of *Cladium* and reeds. This growing-over gradually spread to the deeper parts of the ancient lake, so that at the beginning of zone VI<sup>s</sup> the whole lake, as far as we know, was changed into a swamp, with the formation of limnic-telmatic *Cladium* peat in the central parts and more pure telmatic fen peat in the higher parts of the bog. At the end of zone VI<sup>s</sup> *Sphagna* and birch spread over the bog. This grew slowly in height, the deciduous trees were choked, and the earlier fen was changed into a typical raised bog.

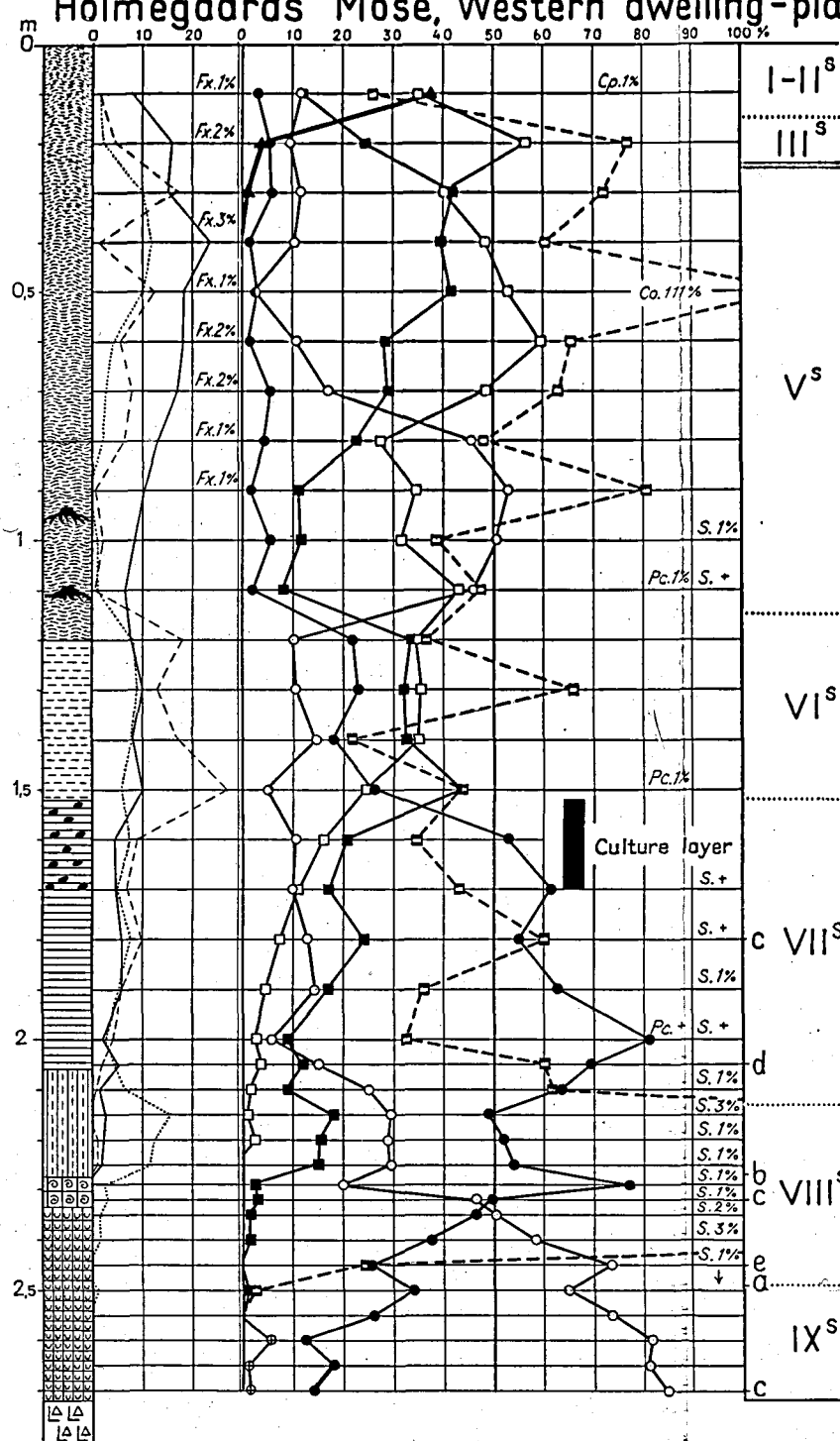
As was mentioned above, culture layers have been exposed at two places in the bog, the so-called western and eastern dwelling-places ("Holmegaard West" and "Holmegaard East")<sup>1</sup>). The geological investigations connected with the excavations have

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<sup>1</sup>) In this work I could not of course consider the new finds recently made in Holmegaards Mose, according to a verbal communication by Mr. J. TROELS-SMITH.

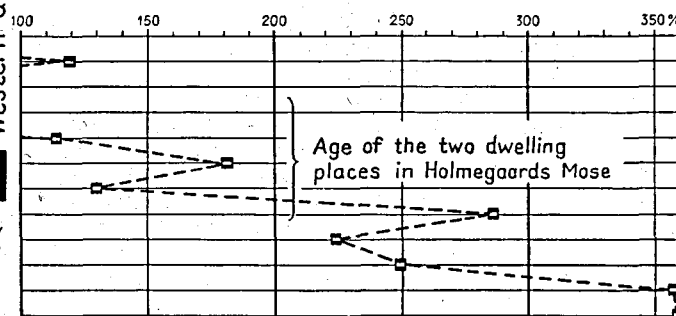
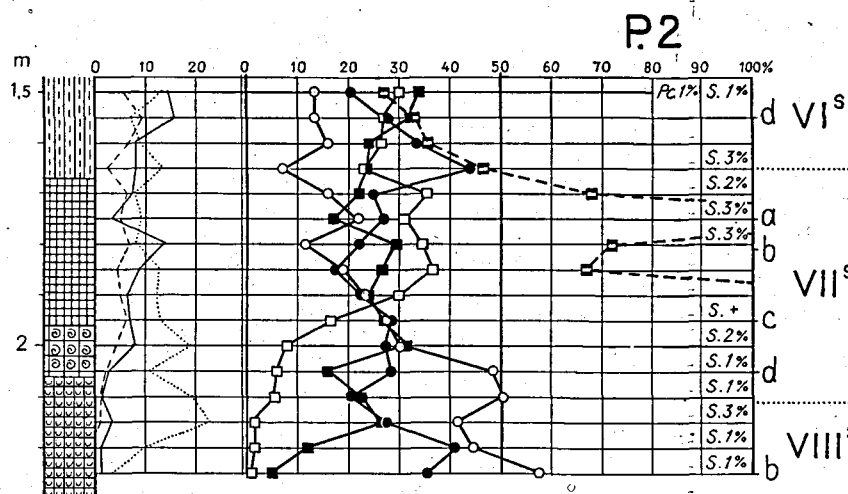
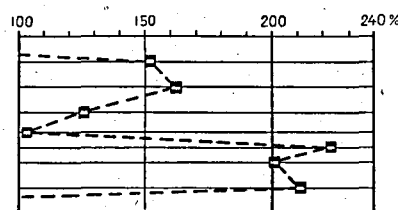


# Holmegaards Mose, Western dwelling-place P1



- Sphagnum peat
- Magnocaricetum peat
- Swamp dy
- Cladium peat
- Algae-gyttja
- Shell-gyttja
- Lime-gyttja
- Boulder-clay
- Charcoal
- Birch stump
- Salix
- Betula
- Pinus
- Alnus
- Quercus mixtum
- Ulmus
- Tilia
- Quercus
- Fraxinus
- Fagus
- Carpinus
- Picea
- Corylus (Co.)

Pollen-diagrams from sections P. 1 and P. 2 within the area of the western dwelling-place of Holmegaards Mose. The black pillars mark the extension of the culture layers in the bog, according to own observations (in the section P. 1) or to pollen-analytical correlations based on the material published by K. JESSEN (western dwelling-place a and b, eastern dwelling-place). On technical grounds the part of the diagrams showing the higher frequencies of hazel (exceeding 100 %) has been drawn a little aside of the main diagram. Pollen zones and index horizons according to NILSSON (1935).



been performed by K. JESSEN (cf. BROHOLM 1924, pp. 14 ff., and K. JESSEN 1935 b, pp. 13 ff.; pl. II, fig. 4; pl. III, figs. 1, 2).

The section fig. 1 shows the general stratigraphic position of the culture layer of Holmegaard West. Accordingly, the dwelling-place proper seems to have been situated on a little holm covered with *Phragmites* and *Cladium* and peat formed by that vegetation

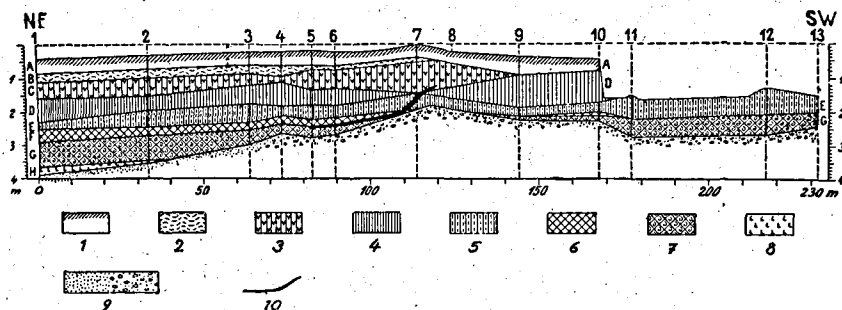


Fig. 1. Holmegaards Mose. Section through the bog showing the position of the culture layer of the western dwelling-place. After K. JESSEN (in BROHOLM 1924, fig. 6).

1 peat in secondary position, 2 sphagnum peat, 3 fen peat with alder, 4 *Phragmites* peat, 5 *Cladium-Phragmites* peat, 6 detritus-gyttja, 7 lime-gyttja, 8 clay-gyttja, 9 sand and stony sand, 10 culture layer.

and surrounded by open water, in which gyttja was deposited. The culture layer extends a good distance out in the gyttja, this part of it evidently being caused by refuse thrown out from the site on the holm. The culture layer on the holm cuts through the *Phragmites-Cladium* peat in an oblique direction. The part of the peat underlying the culture-layer on the top of the holm must be older than the part of it situated farther out in the bog. This is in good agreement with the result gained above, that the growing-over of the ancient Holmegaard lake did not occur simultaneously but spread gradually from the shallow to the deep parts of the lake.

In my profile P. 1 the location of a culture horizon was indicated by the find of several pieces of charcoal in the uppermost part of the magnocaricetum peat. This culture horizon must be referred to zone VII<sup>s</sup> and inserted somewhat above the level VII c and (presumably) below VII b.

K. JESSEN (1935 b, pl. III, figs. 1, 2) gives two pollen-diagrams from the site Holmegaard West, one from the dwelling-place proper (a) and one from the strata farther out in the bog (b). In the diagram a the culture layer is embedded in *Phragmites-Cladium* peat. The

three pollen-spectra given admit of a fairly positive proof as regards the age of the culture layer. It belongs without doubt to zone VII<sup>s</sup> and may be ranged approximately between the horizons VII b and VII d.

In the diagram *b* the culture-layer is situated in the uppermost part of a fairly thin bed of lime-gyttja at the transition to the overlying algae-gyttja. Unfortunately the pollen samples are here fairly sparse, making a close dating of the culture-layer impossible at this point. It can be enclosed between the following limits indicated by the two spectra next above and below the culture-layer. Accordingly, it must fall above zone IX<sup>s</sup> and below the index horizon VII c or a level situated slightly above this. Most probably the cultural remains uncovered at this point are of the same age as the lower part of the culture layer in diagram *a*.

Summing up what has been said above about the site Holmegaard West, it appears at present to be most likely referred to a lower and middle part of zone VII<sup>s</sup>, approximately between the horizons VII b and VII d. A somewhat younger dating of the upper parts of the culture layers is not impossible but not very likely.

The dwelling-place Holmegaard East is but little known, but its stratigraphical position is similar to that of Holmegaard West. According to the fragmentary pollen-diagram from this locality given by K. JESSEN (1935 b, pl. II, fig. 4) it must be referred to some part of zone VII<sup>s</sup>. Its beginning cannot be fixed with full certainty, however. The two pollen-spectra given indicate that the main part of the culture layer may probably be inserted somewhat below the level VII b. Accordingly, it cannot be stated by means of pollen-analysis that there is any marked difference of age between the dwelling-places Holmegaard West and Holmegaard East.

As regards the mutual age of the two sites of Holmegaard the opinion set forth above is in fairly good agreement with the view of K. JESSEN (1935 b, pp. 32 f., fig. 6). Thanks to the present investigation it has been possible to establish a more exact assignment of the culture layers at Holmegaard in the pollen-analytical zone system than in my earlier work on the same subject (NILSSON 1935, pp. 531 f., fig. 28). It is now clear that the settlements at Holmegaard did not continue into zone VI<sup>s</sup>, as was questioned in that work. TROELS-SMITH (1943 b, fig. 83) has placed the two sites in

the same zone as I have done (zone VI<sup>D</sup>, about = VII<sup>S</sup>)<sup>1)</sup>. According to TROELS SMITH, however, Holmegaard West should belong to the lower part of the zone, Holmegaard East to the upper part. Thus the latter should as a whole be younger than the former, a view differing from the one indicated by myself above.

### On the Age of the Maglemosean Sites in Denmark and Surrounding Areas.

In the scheme fig. 3 the age determinations of the culture layers in Holmegaards Mose carried out above have been graphically represented. For the sake of comparison the other dwelling-places of Maglemosean age found in Denmark and surrounding areas have also been registered<sup>2)</sup>. In addition to these culture layers I have also inserted the horizon of the skeleton of a woman brought to light in a little bog at Koelbjerg in Funen and said to exhibit certain features suggestive of the Cro-Magnon race (TROELS-SMITH 1943 a).

Apart from Holmegaards Mose the localities considered already in my work of 1935 have been inserted in the present scheme, with some modifications, in the same way as was done in that work.

To zone IX<sup>S</sup> only two finds have been referred. The oldest of them, the lowest culture layer (K. 1) at Pinnberg (cf. fig. 2), which *i. a.* comprises remains of reindeer, ought rightly not to be dealt with in this connection, as it is stated to belong to a late part of the Lyngby culture. The other find, Klosterlund, falls in the uppermost part of the zone and accordingly appears to be but little older than the oldest parts of the typical Maglemosean sites.

The true Maglemosean settlements belong all to the zones VII—VIII<sup>S</sup>. The site Magleø I in Aamosen probably continues into zone VI<sup>S</sup>. This is also the case with the Revelmose settlement in Jutland (considered to represent an early part of the Jutlandian Gudenaa culture). With regard to the find distribution there does not seem to be any marked difference between the zones VII<sup>S</sup> and

<sup>1)</sup> Cf. foot-note p. 215.

<sup>2)</sup> The dwelling-place at Vissinggaard in Jutland could not be considered, as the pollen-analyses used by IVERSEN (1937) for the dating of this site have not yet been published. Øgaarde I in Aamosen has also been disregarded on account of its uncertain archaeological character and the vague geological age determination.

VIII<sup>S</sup>, about as many finds being referred to the former as to the latter.

Culture layers of typically Maglemosean character are found already in the lower part of zone VIII<sup>S</sup> within the whole geographical region that is considered in the scheme. To this epoch the following finds belong, at least in part: Sandarna and Baremose in South

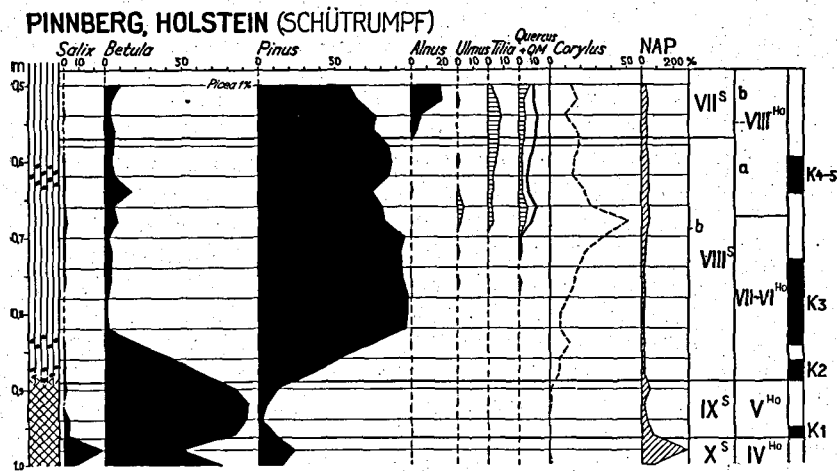


Fig. 2. Pollen-diagram from the pre-historic find-locality Pinnberg, NE of Hamburg, Holstein. After SCHÜTRUMPF (1938, fig. 2). The extension of the culture layers K 1–5 marked with black pillars. The pollen-diagrammatical zones indexed *S* are the Scanian (NILSSON 1935), those indexed *Ho* represent the zones introduced by SCHÜTRUMPF (1938) for Holstein. The series of strata begins with gyttja, upwards passing over into Phragmites peat. Finds of charcoal are denoted by small black spots. NAP = non-tree pollen. QM = Quercetum mixtum (oak mixed forest).

Sweden, Lundby and to a certain extent Mullerup-Koch in Zealand, Koelbjerg in Funen, further the lower culture layer at Duvensee and the layers K 2–3 at Pinnberg in Holstein. Pinnberg K 3 is said to be archaeologically related to Klosterlund (SCHÜTRUMPF 1938, p. 17).

Distinctly younger and belonging to an upper part of zone VIII<sup>S</sup> are among others: Lundby (in part), Mullerup-Koch (in part), Mullerup-Sarauw, and probably to some extent Øgaarde II, Maglø I, and the Gudena site Revelmose, further the upper culture layer at Duvensee and Pinnberg K 4–5.

The youngest group of Maglemosean sites belongs to zone VII<sup>S</sup> and comprises the following localities: Sværdborg, Holmegaard West,



Holmegaard East, Øgaarde II, Magleø I, and Hesselbjerggaard. To this group the main part of the Gudena site Revelmose may also be referred.

The above datings generally seem to correspond well to the archaeological conditions to the extent as they are known. Exceptions are possibly Mullerup and Lundby. The Lundby site, which is not yet thoroughly studied by the archaeologists, indeed, seems to be most related to the Sværdborg find, according to a preliminary notice by TH. MATHIASSEN (1937, p. 149; cf. also 1943, p. 26). The two Mullerup sites are said to represent a distinctly more primitive cultural stage than the settlements of the so-called Sværdborg group (Sværdborg, Holmegaard). Here is an antithesis which cannot be completely bridged over as yet. It may only be pointed out that from a pollen-analytical point of view there is a possibility that the settlement at Lundby continued into the early part of zone VII<sup>s</sup>. Accordingly, the youngest part of Lundby was possibly contemporary with the beginning of the Sværdborg and Holmegaard settlements.

In the following the results gained above will be compared with the pollen-analytical datings given by other authors (cf. the historical introduction).

As regards the sequence of the starting points of the Zealandian settlements, there is generally fairly good agreement between my datings and those given by K. JESSEN (1935 b, pp. 32 f., fig. 6). In my scheme, however, I have assumed an almost contemporaneous beginning of Holmegaard West and Sværdborg, whereas according to JESSEN Sværdborg started later than Holmegaard West. The relative time of the abandoning of the sites has also, broadly speaking, been determined similarly, considering the possibility of the long duration of the Lundby settlement expressed in my scheme and disregarding differences as to the end of the Sværdborg and Holmegaard sites. In other respects the differences are greater. According to the scheme given by JESSEN most of the Zealandian dwelling-places are contemporary with each other for a long time, a view wholly contrasting with the one expressed in my scheme of 1935 and in fig. 3 of the present work. On the other hand, according to JESSEN, the Scanian site Baremosse is older than even the earliest part of Lundby, contrary to my opinion.

The cause of these differences must be the method of age de-

termination employed by JESSEN. He based his datings mainly on the so-called Q/P-index, *i. e.* the proportion of the pollen sum of oak mixed forest (oak+elm+lime) to the pollen number of pine, finding a regularly increasing Q/P-index in the beginning Post-Glacial. In general outlines this method may lead to correct results, but as to details it may easily be misleading. As is shown above p. 206, pine pollen is liable to vary greatly in frequency on account of a strong tendency to become over-represented in radicle peat (and also in coarse gyttjas formed close to an ancient shore line). Evidently the quotient oak mixed forest:pine must be greatly influenced by this phenomenon and frequently assume different values also in synchronous layers.

Recently TROELS-SMITH (1942, fig. 5; 1943 b, fig. 83) has graphically expressed his opinions as regards *i. a.* the age of the Danish Maglemosean sites in relation to the Danish zone system. Generally his determinations agree well with those shown in my scheme. The greatest deviations fall upon the mutual age of the two Holmegaard sites, a question already touched upon above pp. 210 f. As regards the age of the Lundby site our views coincide, apart from the circumstance that the upper continuation of the settlement has been marked as uncertain in my scheme. In addition, in my graph the culture layer Øgaarde II has been supposed to begin already in zone VIII<sup>s</sup> (= V<sup>D</sup>), while in TROELS-SMITH's scheme it has been restricted to zone VI<sup>D</sup> (about = VII<sup>s</sup>)<sup>1)</sup>. For a more detailed comparison the reader is referred to the work by TROELS-SMITH (1943 b).

In his paper on the dating of the settlements at Pinnberg in Holstein SCHÜTRUMPF (1938, fig. 2) has given some parallelizations between the culture layers at Pinnberg, Duvensee, and the Jutlandian dwelling-places. As has been done also by me, he has placed Klosterlund between Pinnberg K 1 and K 2. Pinnberg K 3 has been correlated with an early part of the lower culture layer at Duvensee. In my scheme the latter has got a much more restricted extension, being in its entirety assumed to correspond only to the lower part of Pinnberg K 2—3. My age determination of the lower culture layer at Duvensee is based upon the low frequencies of hazel; the occurrences of oak and elm are probably occasional and do not permit of so young a dating as proposed by SCHÜTRUMPF.

The upper culture layer at Duvensee has got a considerably

<sup>1)</sup> As regards the upper boundary of zone VI<sup>D</sup> cf. NILSSON (1948 a).



longer duration in my scheme than in SCHÜTRUMPF's. According to this author, a lower part of it corresponds to Pinnberg K 4—5, in my opinion, however, instead the upper part of the culture layer in question may be correlated with Pinnberg K 4—5, the lower part on the other hand with the uppermost portion of Pinnberg K 3 (on account of the low frequencies of oak mixed forest characterizing some of the pollen-spectra from Upper Duvensee).

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