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# *A Late Palaeolithic Flint Workshop at Egtved, East Jutland*

## – a Glimpse of the Federmesser Culture in Denmark

by ANDERS FISCHER

### INTRODUCTION

The article presents an example of a category of cultural remains that undoubtedly occurs very commonly, but which is so unassuming that it is normally overlooked during archaeological excavation and research. The present instance involves a few handfuls of flint waste (fig. 1) found close together in the sand under a tumulus near Egtved. The article reports how a detailed analysis of such a find material can give a clear picture of an event and a crafts tradition in the distant past. In addition it holds out the homily that it is just such studies of unassuming archaeological sources that are apparently a prerequisite for better knowledge of the Federmesser culture – an epoch of Denmark's Stone Age which hitherto has largely escaped the attention of culture-historians.

### FIND CIRCUMSTANCES

The find was made as a bye-product of investigations in connection with the establishment of a small museum and restoration of the "Egtved girl's" barrow (Alexandersen et al. 1983). In connection with this, a ploughed-down neighbouring barrow was investigated (1). Excavation was done mechanically by scraping away thin horizontal layers over a total area of 174 $m^2$. The barrow itself was found to be largely obliterated, an up to 10 cm thick brownish sand layer with scattered small flakes produced from small frost-shattered flint nodules being all that was left. However, under this layer, down in the firm, apparently pure and undisturbed "subsoil sand", worked flint appeared, in this case some of it in the form of much larger flakes. These were found within an area of 1 $m^2$ and were encountered up to 70 cm down in the layer. The larger part stood upright in the sand.

The finds from the subsoil sand merely consisted of a few handfuls of apparently rather ordinary cores and flakes. It was therefore not immediately possible to ascertain their proper nature and age. It was clear, however, that several of the flakes fitted together, and that they possibly derived from the working of only a couple of flint nodules. This observation, and an assumption that the material could be of Late Palaeolithic origin, was the reason why the author started a closer analysis.

### THE FIND MATERIAL

Altogether, 147 flint objects have been recovered from the "subsoil sand". They all consist of Senonian flint – an easily cleavable rock which occurs commonly – here and there abundantly – in Danish moraine deposits. Judging from the somewhat worn but only partially crushed natural surfaces, the present material was collected directly from the moraine – most likely in the immediate vicinity of the knapping site.

From the point of view of a flint-knapper, the selected flint is of relatively good – although not quite perfect – quality. At only a few spots were there fine inner cracks and small tough parts making the flint-knapper's work difficult.

There are no signs that the flint used had been subjected to strong frost shock before it was worked. Two of the largest and most massive objects on the other hand exhibit distinct cryofracturing sustained *after* working (fig. 10a).

All objects deriving from the "subsoil sand" have a slightly lustrous surface. In addition, the flint is strongly bleached, so that only the parts just below the cortex surface have retained the Senonian flint's original dark colour. The remainder has turned a pale grey. In some cases, the surfaces have a slightly bluish tint

Fig. 1. The 151 fragments of the Egtved flint assemblage. Scale in cm. Their coarse irregular character is due partly to the simple flaking technique and partly to the flint-knapper having taken a handful of the best blades with him on his further travels. A.F. photo.

and in many cases the outer parts of the flint have been stained by yellowish iron deposits. These conditions suggest that the soil in which the objects were bedded was originally slightly basic but later – presumably after leaching of its content of lime – became weakly acid. Small spots of hard pan, deposited on the surfaces of the flint pieces, support the impression of acid soil.

The flint objects from the brownish layer between the "subsoil sand" and the tilth generally deviate strongly from those just described. This applies as much to the size and quality of the flint nodules employed as to the working technique and chemically and physically determined surface transformation. Four relatively small flakes, stored with the objects from the brown layer, fall outside this pattern, however. They agree in every respect with the material from the deeper lying sand, for which reason they will be included in the description of finds from there which follows.

The 151 objects of the find material can purely morphologically – without reference to the results of the refitting to be described below – be divided into the following categories.

| | |
|---|---|
| Cores, incl. fragments (fig. 10a and 10b) | 4 |
| Platform rejuvenation flakes, certain (fig. 11e) | 8 |
| Platform rejuvenation flakes, possible or probable (fig. 11f) | 23 |
| Simple blades ($L \geq 2B$), incl. fragments which definitely derive from flakes with $L \geq 2B$ (fig. 9a-j) | 45 |
| Blades with partial unilateral guide ridge (fig. 11c) | 3 |
| Blades with through-going unilateral guide ridge (fig. 11b) | 1 |
| Blades with partial bilateral guide ridge (fig. 9d) | 2 |
| Blades with through-going bilateral guide ridge (fig. 11a) | 1 |
| Simple flakes ($L < 2B$), incl. fragments | 59 |
| Flakes with partial unilateral guide ridge | 2 |
| Triangular flakes (fig. 11d) | 2 |
| Eraillure flake | 1 |
| Total, incl. fragments | 151 |

If one takes the results of refitting into account, it is seen that there are in reality only 2 cores in the material. On the other hand it turns out that there are more platform rejuvenation flakes than the number obtained from a cautious morphological classification. The group comprises not only all those flakes designated possible or probable platform rejuvenation flakes, but also a few simple blades and various simple flakes.

## REFITTING OF FRAGMENTS

The 151 pieces of worked flint from the subsoil sand, etc., have been subjected to comprehensive refitting. This was done for the following purposes:

1) to illuminate the actual event that the inventory represents – what was the purpose and result of the flint working? – and
2) to place the inventory culturally and chronologically by comparative studies of working techniques and procedures.

The refitting showed that about half of the original volume of flint had disappeared. Some of it was undoubtedly overlooked during excavation – especially the smaller fragments, since the soil was not sieved. Other material was presumably removed from the site by the flint-knapper himself, since a remarkably large part of the most slender and regular bades seem to be lacking. The absence of a considerable part of the pieces in the jigsaw puzzle reduces the chance of combining the remaining elements, but it has nevertheless been possible to piece 70% of the fragments together into larger or smaller units.

Three fragments together form a complete blade core (fig. 10b), which has been divided by secondary frost fissuring. A further number of fragments can be assembled into seven flakes, which apparently broke at the moment of detachment. Three of these flakes are each made up of three fragments and five of them each of two fragments (e.g. fig. 9j). Finally, it should be remarked that shape and flint structure suggest that two further flake fragments originally belonged together. It can thus be established that the 151 fragments together represent 2 cores and a maximum of 139 flakes. 84 of these flakes are included in refitted flake series comprising respectively 18, 13, 12, 10, 10, 6, 3, 3, 3, 2, 2 and 2 flakes.

One of the two cores found (fig. 10a) fits one of the refitted flaking sequences with ten flakes, whereas it has not been possible to match the other (fig. 10b) with so much as a single flake.

To judge from the structure of the flint, the nature of the cortex, etc., it is extremely likely that several of the refitted units derive from the dressing of one and the same flint nodule, which would thus have furnished the raw material for more than one blade core. This applies, for instance, almost certainly to two refitted units with 18 and 10 elements respectively. To this grouping, at least 3 non-fitted flakes very likely also belong. The non-conjoining core has locally a flint structure which is very closely related to this, but its considerable size rules out the possibility that it can represent the final product of the flaking sequence indicated.

To summarize, it seems probable that the Egtved flint represents the working of at least 5 blade cores which have had the following characteristics and dimensions (length, width, thickness):

- Unipolar blade core, of semiconical shape (fig. 10b), 11 × 10 × 10 cm. Scars from 4 blades are seen. After 3 unsuccessful attempts at rejuvenating the platform, production has been abandoned. Only the core is present.
- Unipolar blade core of semiconical shape, originally c. 15 × 10 × 9 cm. Blades detached along 2/3 of the circumference. Core missing.
- Unipolar blade core of semiconical form, originally c. 15 × 6 × 6 cm. Detachment of blades along a good half of the circumference. Core present (fig. 10a).
- First bipolar, later unipolar blade core of semiconical shape. Originally c. 15 × 10 × 8 cm. Detachment of blades along 2/3 to 3/4 of the circumference. The completely exhausted core absent. The final stages of the flaking are shown schematically in fig. 2.
- Bipolar blade core of approximately cylindrical shape, originally c. 20 × 12 × 15 cm. Detachment of blades along 2/3 to 3/4 of the circumference. Core missing. The later stages of the flaking are shown schematically in fig. 3.

Several of these 5 groupings are very similar with respect to flint structure and cortex, so the material probably derives from the working of three large flint nodules at the most.

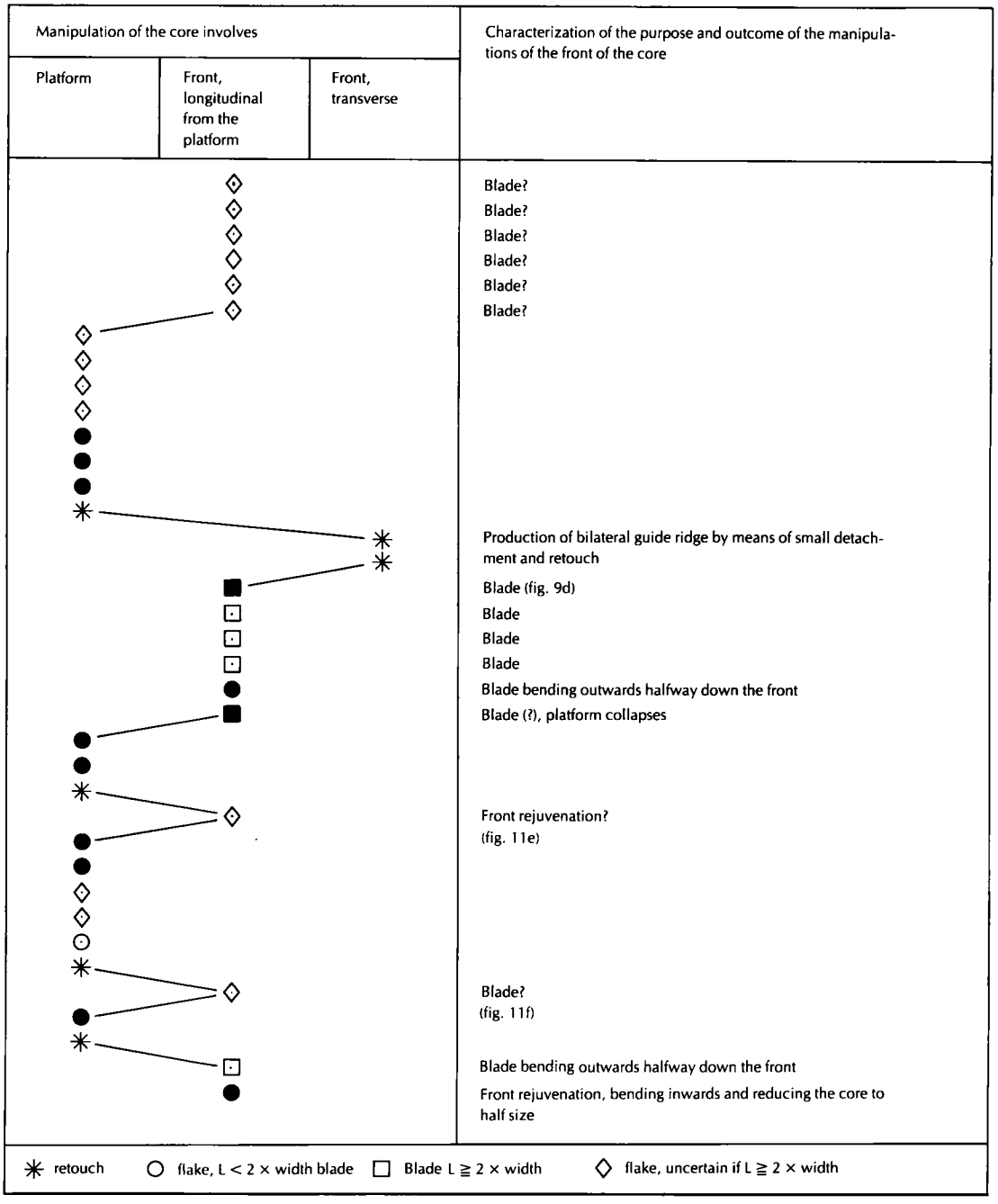



Fig. 2. Schematic description of the flaking sequence for one of the unipolar blade cores. The time sequence runs from above down. In the interests of clarity, only flakes with a length exceeding 2 cm are shown. Solid signatures indicate extant flakes, open signatures flakes known only in more or less complete negative.

The first stages of the sequence are not known, whereas it is likely that the last-produced extant flake – due to the unsuccessful trajectory of flaking – put a stop to the use of the core.

The flaking is characterized by a cyclically repeated working process comprising first the formation of the platform, next the retouching of the platform ("preparation") and finally longitudinal blade detachment. This working process is supplemented by adjustments in the shape of the core by means of transverse flaking on the front.

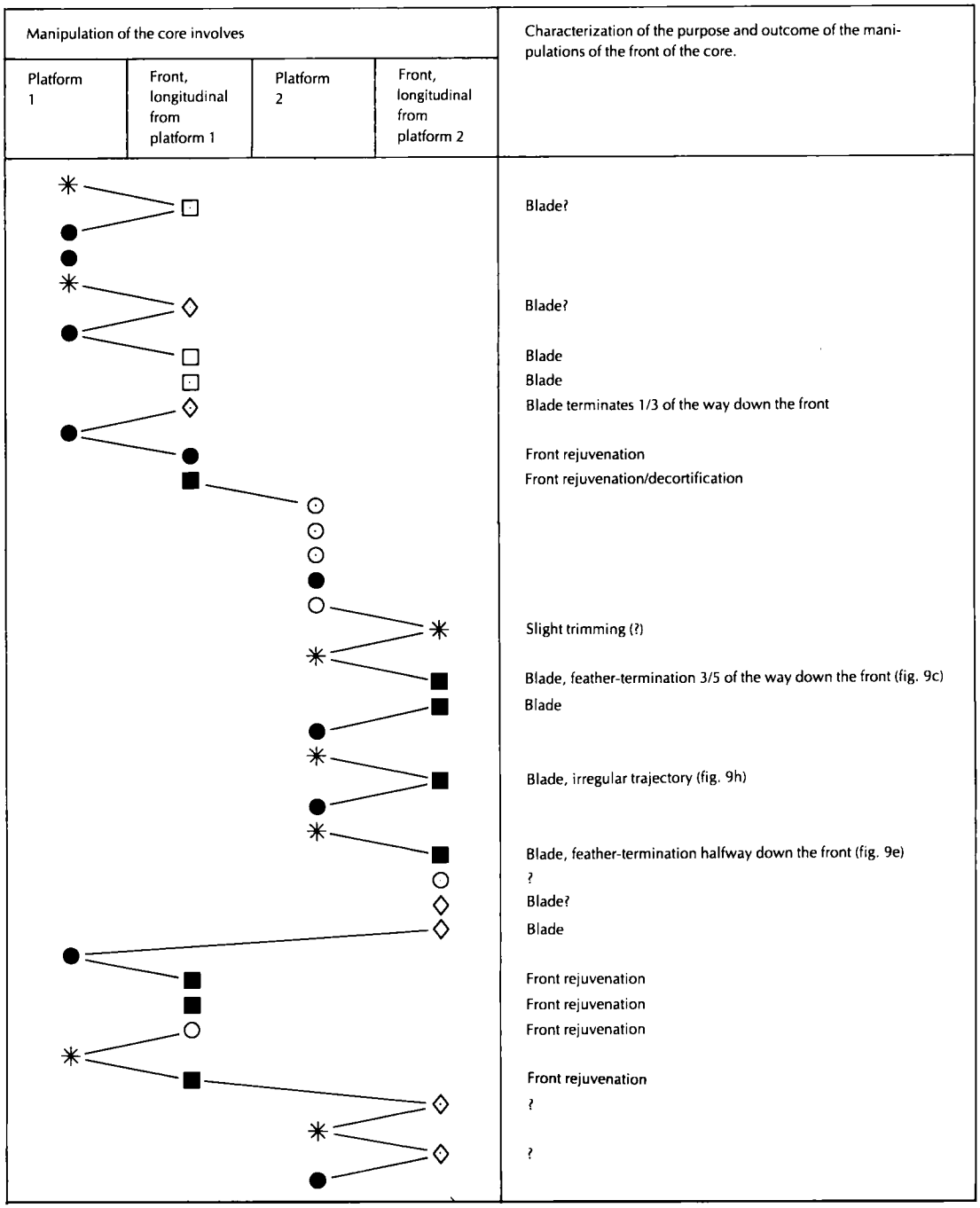
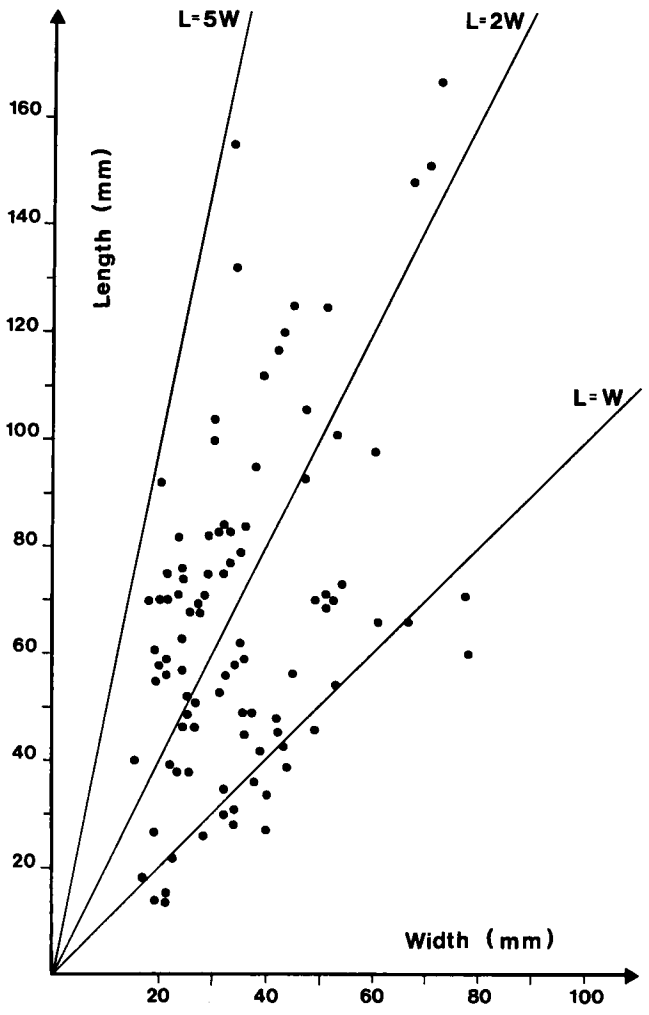



Fig. 3. Flaking sequence for one of the bipolar blade cores. Signatures, etc., as in fig. 2. The first flakes from the working of the core are absent from the refitted sequence, but probably the larger part of them are actually present in the shape of another refitted unit with 10 members. To judge by the small quantity of flint which remained afterwards, the present knapping sequence must represent the production stages immediately before the core was discarded.

Flaking of this core is characterized by a cyclically repeated process comprising platform formation, preparation and blade detachment. This process is to some extent supplemented by detachment of strong, longitudinal flakes, serving to adjust the shape of the blade front. The cyclically repeated process was carried out alternately at both ends of the block. The frequently rejuvenated platforms at each end were on each occasion placed approximately parallel to each other and at right-angles to the direction of blade detachment. NB! Preparation may not be attested in cases where the associated longitudinal flakes are absent.




| | Number of analysed flakes | Number og determinable flakes | Frequency of "soft flakes" |
|---|---|---|---|
| Egtved | 107 | 94 | 2% |
| Hammer-stone of quartzite | 39 | 30 | 0% |
| Hammer-stone of limestone | 39 | 33 | 3% |
| Fabricator of red deer antler tip | 15 | 14 | 43% |
| Club of red deer antler base | 49 | 40 | 48% |
| Fabricator of red deer antler tip | 82 | 79 | 53% |
| Fabricator of red deer antler tip | 22 | 22 | 55% |

Table I. Frequency of "soft" flakes in the Egtved find and in a series of experimental blade productions. Each of the experimental assemblages comprises flakes larger than 2.5 cm detached from a blade core of Senonian flint by means of the flaking tool indicated. Flakes in "soft technique" are defined by: 1) the presence of a projecting "lip" all along the edge between the platform remnant and the ventral surface, and 2) the absence of any incipient cone on the platform remnant.

Fig. 4. The length-width ratio of all extant flakes – including fragments, where at least 4/5 of the original length is judged to be present. The length has been measured from the point of percussion to the farthest point on the ventral surface. The width is greatest width parallel to the platform remnant. The circles in fig. 5–8 represent a gradually reduced proportion of the population shown here.

## PRODUCTION METHODS

Although the find material does not include any kind of flaking tool, it can be established with great certainty that all the work has been carried out with a hammer-stone alone. This is apparent from the high frequency of pronounced percussion bulbs, eraillure scars, completely or partially collapsed platforms and striking-scars around the detachment point (see fig. 9 and 11). The presence of 2 flakes with a pronounced "lip" – a feature that often accompanies flaking with a soft instrument – does not alter this conclusion. The phenomenon also occurs experimentally when a hammer-stone is used (cf. table 1).

On the basis of the refitting it can be established that the working of each core has followed a fixed schema with cyclic repetition of the three procedures: first formation of a platform, then retouching ("preparation") of the new platform and finally flaking along the front.

The characteristic working procedure is exemplified in fig. 2 and 3, which comprise the refitted flakes as well as those known only from their negatives. It is apparent from these two examples that it has occasionally been necessary to interrupt the ideal procedure in order to adjust the shape of the blade core. Such adjustments were carried out with one or a few blows from the distal end or from the side of the blade front.

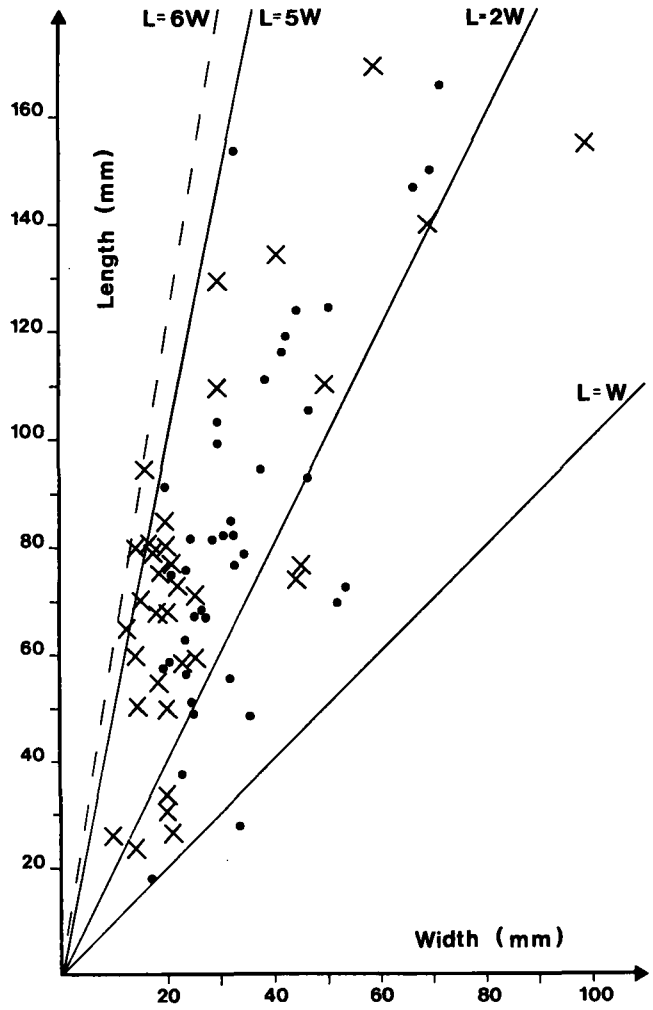



Fig. 5. Longitudinal flakes from the 9 best known refitted units (with the largest number of flakes).
Circles: extant flakes. Crosses: phantom flakes with precisely or approximately known dimensions and with a length exceeding 2 cm.

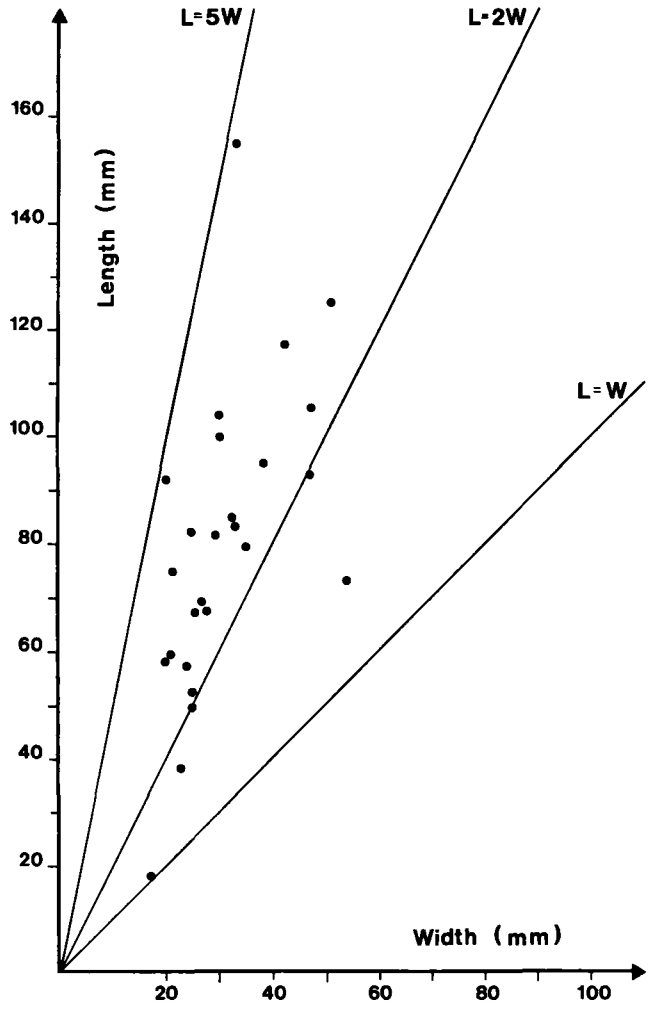



Fig. 6. Longitudinal flakes with less than 10% cortex, thus excluding flakes detached primarily to remove the cortex from the front of the core.

## THE IDEAL PRODUCT

Refitting has given the impression that it is particularly the most successful blades which are absent from the inventory. This impression can be further supported by comparing the length-width proportions of the extant and absent flakes, respectively. Before this occurs, it should be remarked that a comparison of this kind is hampered somewhat by the fact that whereas it is often possible to establish the maximum width of the missing flakes, the full length is seldom known. As the proportions in the following are calculated from the known lengths and breadths, the lacking flakes ("phantom flakes") may in some cases appear less slender than they in fact were.

If all present and absent flakes from the two flaking sequences shown in figures 2 and 3 are ranked according to slenderness, a striking result is obtained. It turns out that it is primarily the most slender specimens that are lacking. From the unipolar core, rank positions 1, 3, 4 and 12 of a total of 15 are missing. From the bipolar core, positions 1, 2, 4 and 13 of a total of 23 flakes of known dimensions are absent.

Corresponding conditions apply to the other refitted

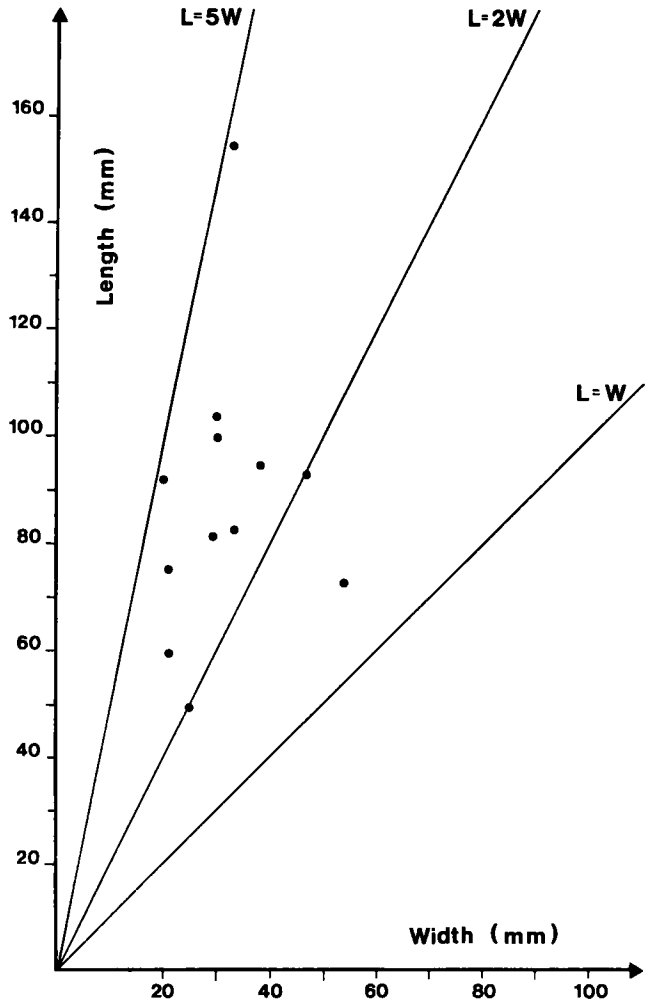



Fig. 7. Longitudinal flakes with less than 10% cortex and with primary preparation. The population represents flakes which the flint-knapper has carefully prepared by the shaping of a smoothly retouched platform right above a longitudinal ridge which could guide flaking in a straight line down to the tip of the core.

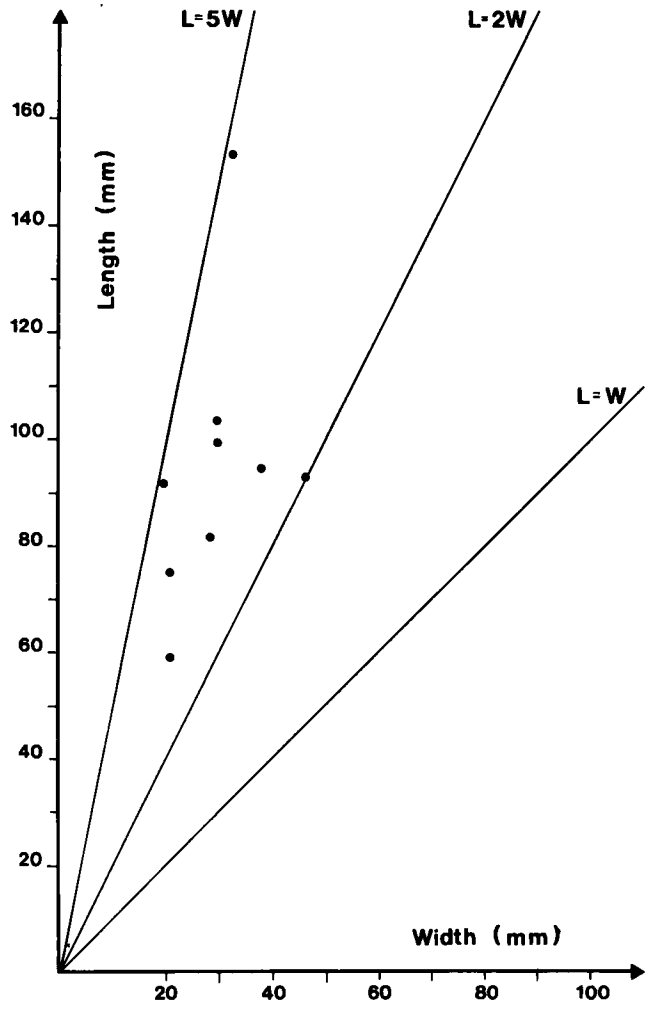



Fig. 8. Longitudinal flakes with less than 10% cortex, with primary preparation and with more or less feather-shaped ("feather-terminating") distal ends. The population comprises the carefully prepared and reasonably successful flakes approximating the desired product.

units – the slenderest flakes, which are also often among the very longest (cf. fig. 5) and most regularly formed, are remarkably often absent. In those cases where high-ranking flakes nevertheless are present, conditions can in each case be demonstrated which suggest that the flint-knapper did not consider these blades to be quite successful (cf. fig. 9).

There is thus much to suggest that the desired product is systematically missing from the preserved material. If one should attempt to give a description of the product itself, it has to be done indirectly by adducing the waste products which come closest to the ideal. This can be carried out in a simple manner by exploiting knowledge of the flaking process achieved with the aid of the refitting. Those flakes which combine the following four clear and easily perceived properties are selected:

1) The flake must be detached along the length of the core.
2) Less than 10% of the flake must be covered by cortex.
3) The platform remnant must have primary preparation, i.e. the fine retouch of the platform must

depart from the edge of the flake's platform remnant.

4) The flaking trajectory must be successful, which in this connection means a) that the cleavage surface should not curve inwards to the degree that it removes the core tip and runs onto the other side of the core ("outre passé"), and b) that it must not curve outwards more than 90° and thus become visible on the dorsal side of the flake ("hinge-terminating").

The result of such a selection is shown graphically in fig. 4 to 8. It is apparent from this that the final "distillate" is characterized by the following lower limits for dimensions and proportions:

- length ≥ 60 mm
- width ≥ 20 mm
- length ≥ 2 × width

If the phantom flakes whose dimensions can be established from their negatives are included (fig. 5), it is further possible to give some upper limits for the size and shape of the desired product. It seems to be definable with the following dimensions and proportions:

- 60 mm ≤ length ≤ 170 mm
- 2 × width ≤ length ≤ 6 × width.

Of the present flakes from the 9 refitted units with the most flakes there are only 9 examples which live up to the four criteria for the "ideal blade". They are all shown in fig. 9. It appears from the figure that it is a matter of thin and at least partially sharp-edged blades. It is also seen that the majority tend towards having hinge-terminated ventral surfaces. They are thus to a certain extent unsuccessful, because they did not utilize the full length of the core. Only fig. 9b, 9d, 9f-g and 9j, utilized the length of the core fully. On the other hand, the long edges of 9b, 9f and 9g are so irregular that the blades are unfit for cutting. The somewhat more regularly shaped flake 9j has been disqualified beforehand, having broken at the moment of detachment.

Several of the 9 blades could undoubtedly have served as blanks for burins or scrapers, but as knives they would be second grade.

The prime quality specimens must be found among the missing flakes, of which at least 21 fall within the just given description of the dimensions and proportions of the desired product.

In summary, it can be established that the desired product has been characterized by the following properties:

- greath absolute length
- great length relative to width and thickness
- straight, sharp edges.

Such properties would have been especially desirable if there was a need for long clean cuts. In the Palaeolithic such a function can hardly have occurred in other connections than in the skinning and dismemberment of big game.

## DATING

The find site (fig. 13) lies within the area that was covered by Weichelian inland ice. The concentrated find distribution must therefore be taken as expressing that the flint inventory has been left at the site after the inland ice disappeared, and the objects be of Late Glacial or perhaps Post-Glacial origin.

If the find circumstances and the objects themselves are examined more closely, the dating can be further narrowed. The position of the objects – more or less vertical – in the subsoil sand can thus best be regarded as the result of late glacial cryoturbation of the soil. The slightly lustrous surface of the flints likewise suggests that the inventory has been subjected to periglacial cryoturbation. Corresponding surface changes have thus been observed in many Late Glacial flint inventories from the South Scandinavian area (see, for example, Madsen 1983: 21 and Fischer et al. 1984: 36). The clearest sign of the material's Late Glacial origin is, however, the presence of secondary frost cracks (fig. 10b). Corresponding frost fissuring, incurred after the knapping, has namely been observed in numerous indisputably Late Glacial inventories from South Scandinavia (e.g. Trollesgave, see Fischer et al. 1979 fig. 14), but never in purely Post-Glacial finds.

An attempt at closer dating within the Late Palaeolithic poses a number of problems, because the cultures or technocomplexes of this era are defined on the basis of types of retouched implements. Nonetheless, it should be possible to go some of the way. There are at least quite evident differences in flint technology within the four archaeological culture groups into which the Late Palaoeolithic find material of South Scandinavia is traditionally divided, viz. Hamburg, Federmesser,

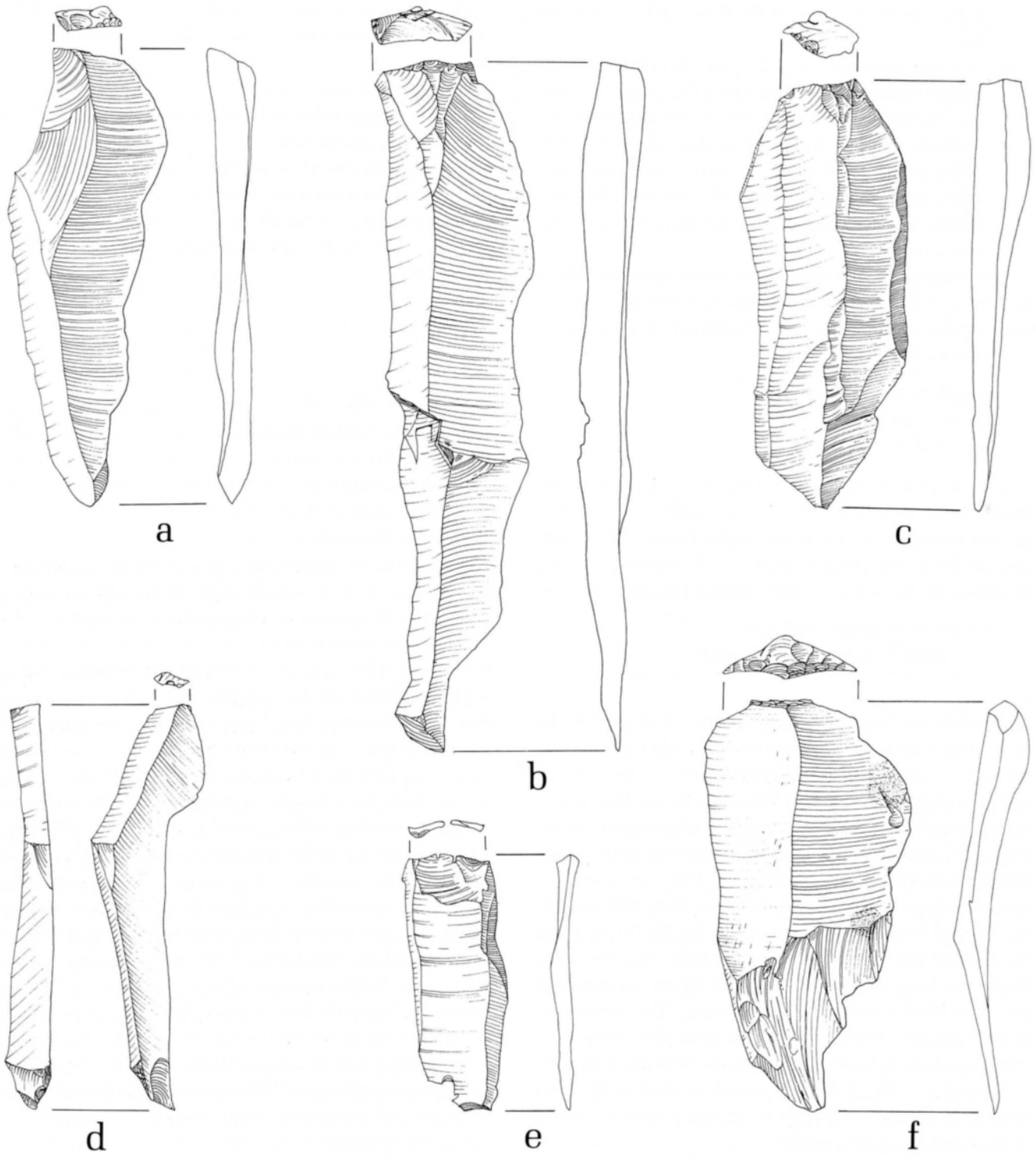
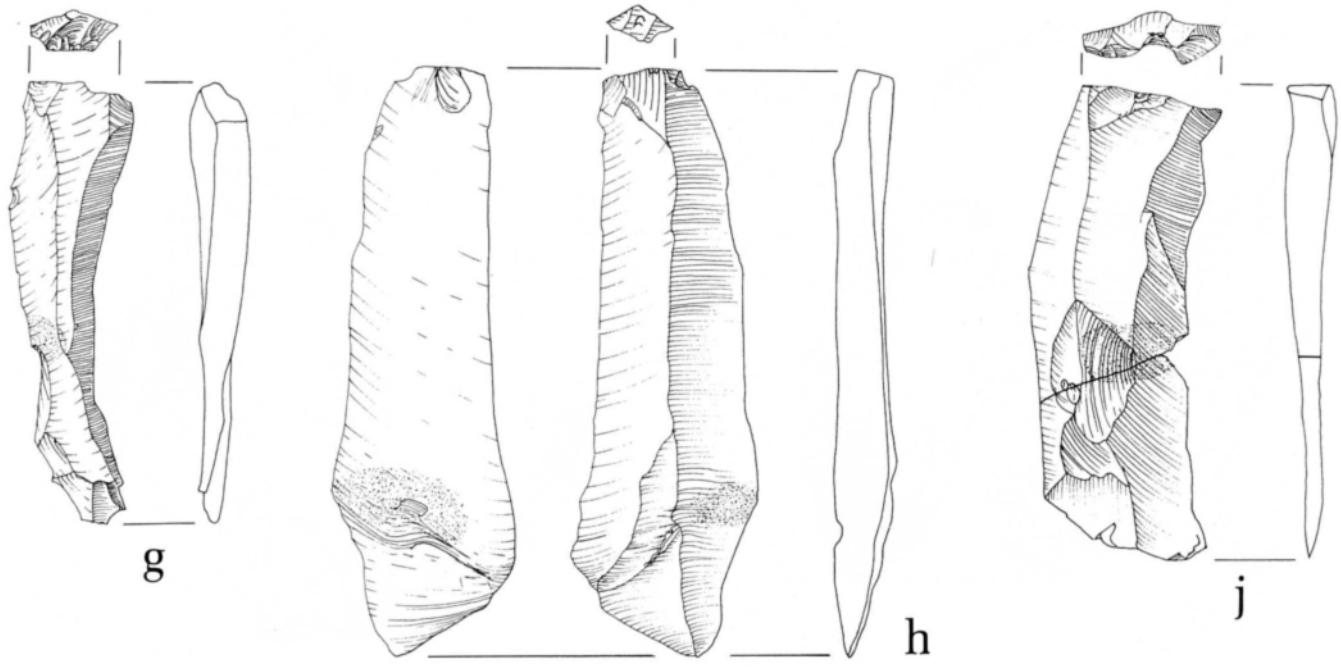



Fig. 9. Approaches to the Egtved flint-knapper's ideal blade – the final result of the selection process reproduced in fig. 4–8. All 9 flakes are relatively thin and have sharp edges. None of them can be called perfect, however. Excurrent and irregular flaking has thus caused them to be relatively short or their edges to be uneven. 3:4. Drawing: Kurt Petersen, 1988.




Bromme and Ahrensburg cultures (see for example Bokelmann 1978 and 1983, Fischer 1978: 45, 1982: 92–93 and in press B, Fischer et al. 1979: 11f., Madsen 1983: 23–25 and not least Hartz in press).

If one should attempt to refer the Egtved flint to a particular cultural epoch, it must primarily be done on the basis of the flaking technique alone, because the dimensions and proportions of the debitage are probably to too great an extent determined by local not culture-specific variations in the supply of raw materials. In a just completed work, Sönke Hartz (in press) enumerates a series of flint-technical characteristics for the four culture groups mentioned above. If the Egtved inventory is compared with these non-quantitative characteristics, there can hardly be any doubt as to where the find belongs. It can be characterized by the following features:

- detachment entirely in hard technique
- frequent occurrence of facetted and finely retouched ("prepared") platform remnants
- almost total lack of fine retouch from the platforms down the flaking fronts ("trimming")
- unipolar blade cores of conical form and bipolar cores with approximately parallel platforms and blade detachment along most of the perimeter of the cores.

The inventory hereby falls within the variation range of the Federmesser culture, while in several respects it falls outside the flint-technological spectra of the other cultures.

With respect to the hardness of the flaking implements, the Egtved flint clearly deviates from inventories which indisputably belong to the Hamburg and Ahrensburg cultures (fig. 12). This can in theory be due to the Egtved find representing an atypical situation, where the flint-knapper did not have soft fabricators (antler) at hand, and therefore had to make do with locally available stones. But such a hypothesis claiming that in reality we are confronted by a "disguised" Hamburgian or Ahrensburgian flint-knapper runs into other difficulties. One must namely in this case also assume that the flint-knapper quite exceptionally forgot the systematic trimming of the core edges, and that that he did not as usual work with bipolar cores with striking platforms laid obliquely to each other and with blade flaking along a limited part of the core side. Altogether it should thus be possible to rule out that the Egtved inventory originated in the Hamburg or Ahrensburg cultures.

Although the Egtved flint in respect of percussion bulb characteristics is close to the inventories of the Bromme culture, it seems nonetheless possible to rule out descent from this. At least the preparation of plat-

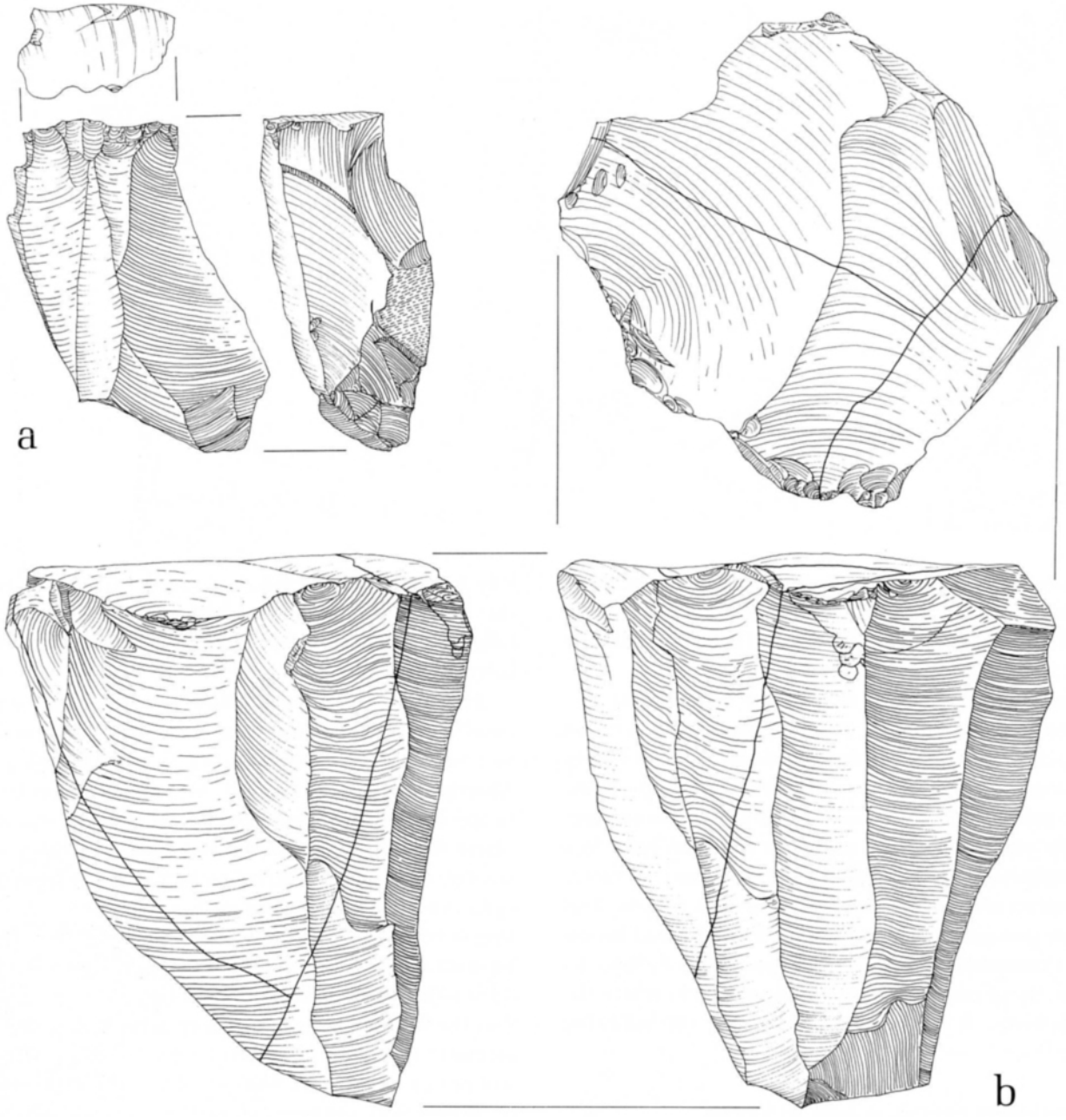



Fig. 10. a: Fully utilized blade core, part of a refitted unit with 10 flakes. In the course of the flaking sequence, the length of the block has been reduced from 15 to 7 cm by means of repeated platform rejuvenation.

b: Core with facetted platform and traces of fine retouching of the platform edge (preparation). Working has stopped after detachment of a few blades and after three unsuccessful attempts at platform rejuvenation. The thick strokes indicate frost fissures incurred after working. 3:4. Drawing: Kurt Petersen, 1988.

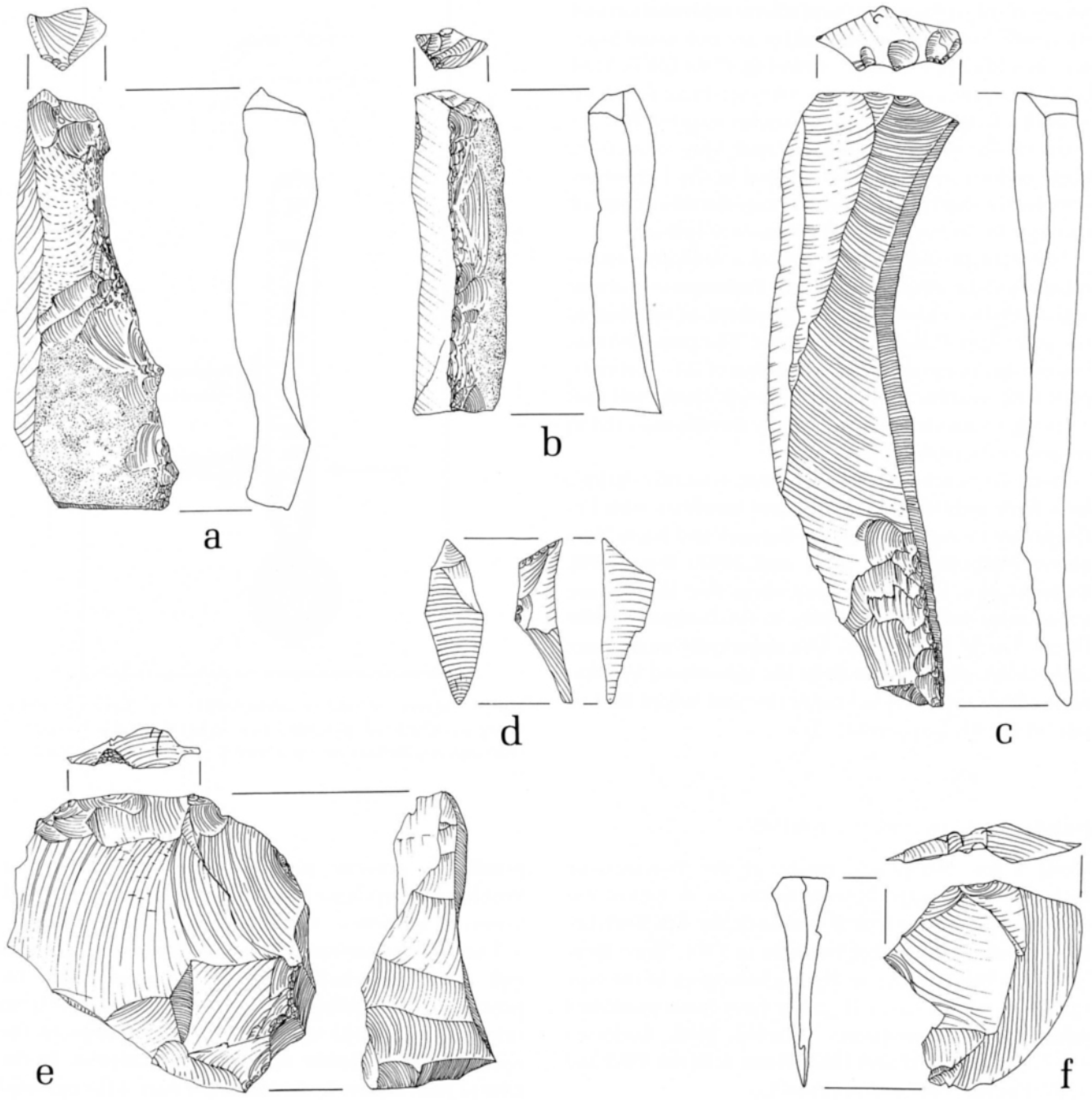



Fig. 11. Selection of flakes with special knapping characteristics. a: Guide ridge dressed from two sides ("crested blade"). b: Through-going guide ridge, unilaterally dressed. c: Partial guide ridge dressed from one side. d: Triangular flake – a bye-product of flaking in "hard technique"; it comprises parts of the platform edge and has no true percussion bulb. e–f: Platform rejuvenation flakes. 3:4. Drawing: Kurt Petersen, 1988.

forms does not belong to the characteristic blade technology of this culture, just as platform rejuvenation and bilaterally retouched guide ridges are not usual practice. In addition, thorough trimming of the blade front is a quite consistent feature in all hitherto analysed inventories from this culture (cf. Fischer in press B).

Based on the characteristic and very consistent blade-making technique manifested in the Egtved inventory, this find can thus with a considerable degree of certainty be referred to the Federmesser culture.

The available data do not permit a definitive establishment of the absolute age of the Federmesser culture and a relative chronological placement in relation to the other Late Palaeolithic cultures. The principal reason for this is the marked association of this find complex with localities with well-drained sandy soil and consequent paucity of scientifically datable material in secure stratigraphical position.

From the South Scandinavian area, scientific datings have been published for only three localities with Federmesser inventories: Rissen, Borneck and Klein Nordende (Schwabedissen 1954 and 1957, Rust 1958, Bokelmann et al. 1983). They show that the culture group must belong somewhere in the interval Middle Dryas – early Late Dryas. The apparently most exact and reliable dates derive from the last-named locality, whose finds evidently belong to the time before the last part of the Allerød period.

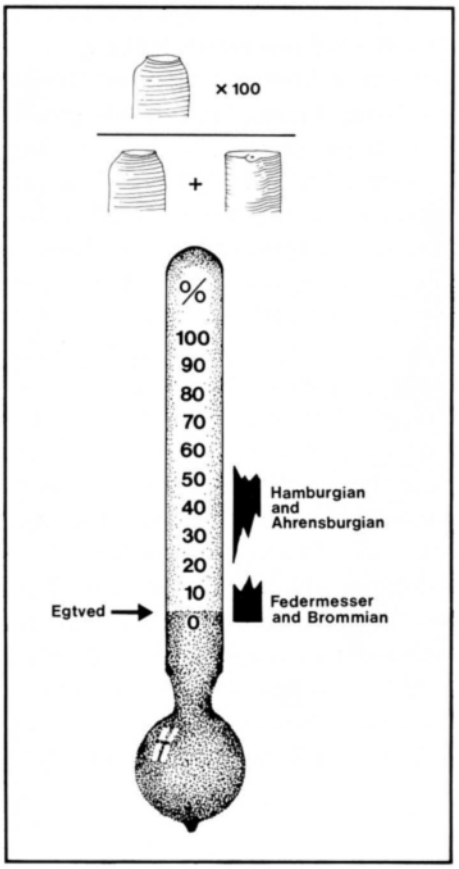



Fig. 12. Frequency of flakes in "soft technique" in the Egtved find and in inventaries which can be unambiguously referred to one of the four archaeological cultures occurring in South Scandinavian Late Palaeolithic (2).

## FEDERMESSER CULTURE IN DENMARK

Until a few years ago, traces of the Federmesser technocomplex were a quite unknown or rather unrecognized phenomenon in Denmark, the first finds being published by B. Fugl Petersen in 1974. Since then, summary information on objects belonging to the type spectrum of the cultural group have been published with increasing frequency (Fischer 1976, Andersen 1977, Madsen 1982 and 1983, Holm & Rieck 1983 and 1987, Fischer 1987 and in press A).

By far the majority of Danish finds of the Federmesser culture's characteristic artefact types stem from localities that have also yielded other Late Palaeolithic material (cf. fig. 13). This applies, for instance, to the locality Jels I, which in addition to a gravette point and a few Wehlen scrapers have also furnished objects from the Hamburg culture (Holm & Rieck 1987). Correspondingly, gravette points, "Federmessers" and/or Wehlen scrapers have been found with Bromme points at several localities – e.g. Rundebakke (fig. 13 & 14).

The find circumstances at all these sites make it difficult to decide whether the Federmesser aspect represents an independent phase of occupation or is an integral part of the material from occupation in the epochs of the Bromme and Hamburg cultures. In the case of Jels I, where by far the larger part of the material derives from disturbed layers, the connection is doubtful, since the Wehlen scrapers are made from much coarser flakes than the other scrapers of more normal Hamburg character (hard versus soft flaking technique?; cf. Hartz in press). The Løvenholm find's combination of Wehlen scrapers and Bromme points (Madsen 1983) is in this respect far more convincing, all the

scrapers being of the same type and all the material being based on hard percussion technique.

The Løvenholm inventory must on the basis of its flint points (tanged points with partly preserved platform remnant) be assigned to an early part of the Bromme culture (cf. Fischer 1978). The same apparently applies to all the other Danish inventories in which Federmesser types occur with tanged points. It can thus by no means be ruled out that at least some of the Federmesser culture's types in Denmark are an integrated aspect of the early Bromme culture's implement inventory. Purely typologically, the possibility therefore stands that within the Danish or South Scandinavian area a gradual typological and chronological development from the Federmesser to the Bromme culture has occurred. Such an interpretation of the course of events would be in agreement with the few available scientific datings, which place the two cultures in and around the Allerød period – the former rather in the early phases and the latter rather in the later (cf. Fischer & Tauber 1986). The Egtved find with its limited affinities to the known Bromme inventories must in this case be placed in the early part of this developmental sequence.

## SUMMARY AND CONCLUSION

The few handfuls of flint debitage from Egtved represent an episode of probably less than one hour, during which a few flint nodules were worked for the sole purpose of producing blades for use elsewhere. The impressions of the removed blades and analyses of those left behind show that the long, thin and narrow blades with the straightest and sharpest edges were carefully selected. Flakes with these properties are especially suitable in situations where there is a need for long, clean cuts, which in a Late Palaeolithic context probably must be in the skinning and dismemberment of big game.

The flint waste left behind reflects a very characteristic and consistently performed flaking procedure, which within the South Scandinavian area is known only from the Federmesser culture. This sets the scene for the flint-knapping episode at Egtved. It was probably played out in the open landscape of the early Allerød period, when hunters of big game could encounter reindeer, elk and giant deer (Aaris-Sørensen 1988).

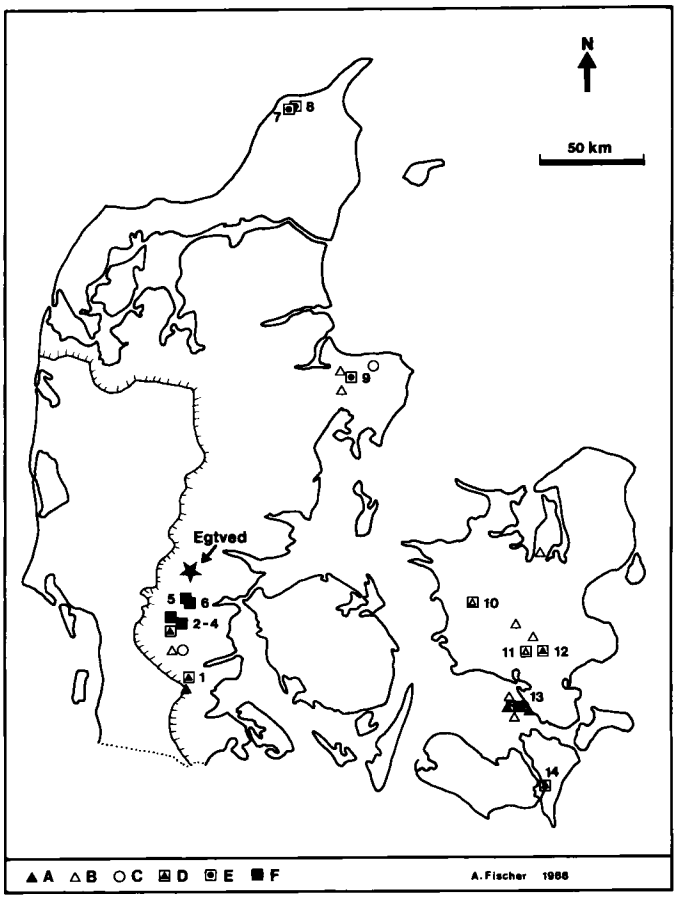



Fig. 13. Maximum extent of Weichselian glaciation and finds of Federmesser culture in Denmark – both the Egtved flint assemblage and finds of retouched flint implements of types considered to be characteristic of the culture.

A Stray find of definite Federmesser or gravette point
B Stray find of possible Federmesser or gravette point
C Stray find of possible Wehlen scraper
D Settlement inventory with Federmesser(s), gravette point(s), or the like
E Settlement inventory with Wehlen scraper(s)
F Settlement inventory with Wehlen scraper(s) and Federmesser(s) or gravette point(s).

1: Hjarup Mose (Andersen 1978). 2–4: Jels I and II and Jels Oversø (Holm & Rieck 1987). 5–6: Sølyst et al. 7–8: Ramsgaard et al. (Nilsson in prep.). 9: Løvenholm (Madsen 1983). 10: Rørmose. 11: Fensmark Skydebane. 12: Stoksbjerg Vest. 13: Rundebakke. 14: Hasselø (Vemming Hansen 1988).

The finding place lies in a slightly undulating, sandy moraine landscape without marked topographical features within the nearest hundreds of metres. In this respect it differs from the main part of the Late Palaeolithic sites in Denmark, which lie either directly by lake basins of that time (base camps?) or at the foot of hills

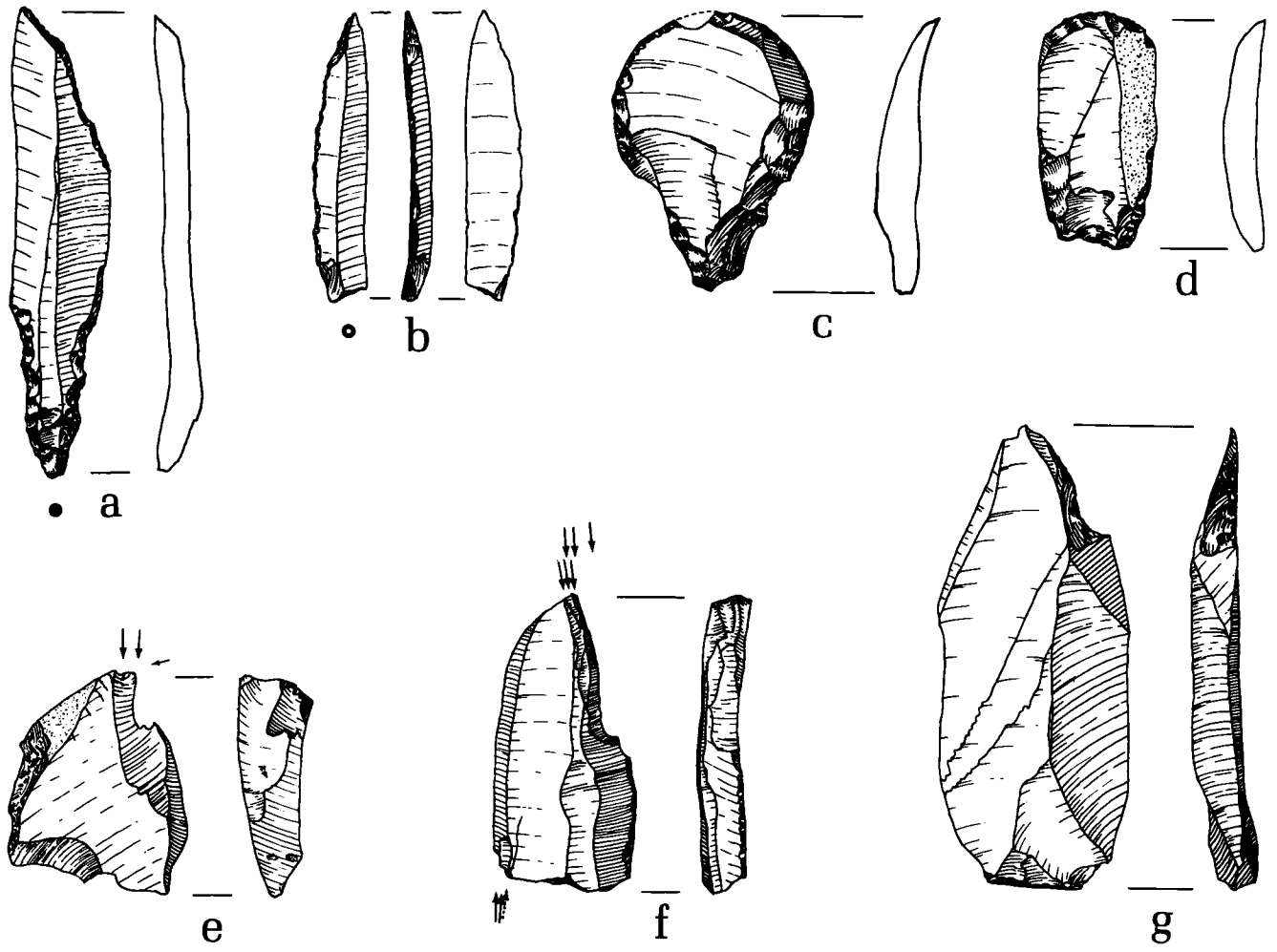



Fig. 14. Surface finds from the settlement of Rundebakke. The inventory comprises types diagnostic of both the Federmesser and the Bromme technocomplexes. a: Tanged point of Bromme type. b: Federmesser with obliquely retouched base. c–d: Scrapers with lateral edge retouch. e–f: Burins. g: Flake with oblique retouch. 3:4. Drawing: A. Fischer, 1976.

from which there is a good view (hunting stands?) (Fischer 1987 and in press A). Purely topographically, the site thus appears to have been chosen quite at random and is rather associated with a specific hunting situation where a big game animal was to be skinned and dismembered in order to be carried home.

The Egtved flint is one of the most modest archaeological finds from Denmark, and a whole combination of fortunate circumstances was required before it became a part of the culture-historical source material. Furthermore, substantial refitting and analysis had to be carried out before the material could be placed in its correct culture-historical context. As a result, we now have the first glimpse of behaviour and way of life in a hitherto little known and archaeologically almost invisible epoch of the Danish Late Palaeolithic.

*Translated by Peter Crabb*

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## NOTES

1. The project for restoring the Egtved girl's barrow as a tourist attraction was directed by *mag.art.* Lone Hvass, and the excavation of the flint material carried out by *mag.art.* Steen Hvass, both of *Vejle Kulturhistoriske Museum.* They are thanked for permission to investigate and present the Late Palaeolithic bye-product of their Bronze Age excavations. I am also indebted to *Dronning Margrethe II's Arkæologiske Fond* for financial support for the present investigation. Furthermore, I am grateful to *Kalundborg og Omegns Museum* for providing a workplace and administering the project's economy. Finally, *hørepædagog* John Rasmussen is thanked for permission to reproduce his finds from the Rundebakke settlement.

   The Egtved flint site is registered in the culture-historical central register as no. 110; Egtved sogn, Jerslev herred, Vejle amt.
2. Fig. 12 collates the results of a series of analyses of percussion bulb characteristics in Late Palaeolithic inventories from Sweden, Denmark and Schleswig-Holstein. They have been carried out on blades and flake tools. As far as the Hamburg culture is concerned, it is a question of the industries from Borneck, Jels I and II, and the lower culture layer at Stellmoor. The Federmesser culture is represented by Borneck West, Borneck Mitte, Rissen 14 and 18, Kampen and Wehlen. From the Bromme culture, inventories have been analysed from among other places Bromme, Segebro, Trollesgave and Fensmark Skydebane, whilst the Ahrensburg culture is represented by Stellmoor's upper culture layer, Teltwisch Mitte, Eggstedt, Immenbeck, Risten 14a and Ketzendorf II.

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# *Prehistory in Permafrost*

## Investigations at the Saqqaq Site, Qeqertasussuk, Disco Bay, West Greenland

by BJARNE GRØNNOW

### BACKGROUND – THE FIRST ESKIMO CULTURE

About 4,500 years ago the extensive high Arctic area of America was populated for the first time. Groups of hunters from eastern Siberia and the Bering area began to exploit the rich, but largely inaccessible game resources around the Polar basin. These pioneer groups with an Eskimo way of life did not merely adapt to the demanding arctic environment – they spread in the course of a very few generations from Alaska in the west across Arctic Canada to Greenland in the far east. The archaeological remains deriving from this very extensive palaeo-Eskimo cultural complex are covered by the term Arctic Small Tool tradition (ASTt) (Irving 1968).[1]

Our knowledge of ASTt builds for the most part on stone artefacts (inventories of bifacially flaked tools and microblades) and the remains of dwellings – including mid-passage dwellings (Knuth 1967) – which are still preserved in the old settlement areas. Most often, the settlements are located on raised beaches, which only occasionally offer good conditions of preservation for organic material. A number of bone objects are known, for example from Pearyland (Knuth 1967) and Devon Island (Helmer 1986), but we have by no means a reasonable knowledge of the organic tool inventory, let alone of the hunting economies of the times.

It is therefore of great importance that the latest years' work in West Greenland have revealed a couple of localities with exceptional conditions of preservation. There are unique opportunities here for getting to know at close hand the Saqqaq culture (2400–1000 BC cal.) – the West Greenlandic branch of ASTt.

In 1982, the local museums of Disco Bay carried out a small excavation at the settlement Qajaa in Jakobshavn Isfjord (J. Meldgaard 1983, Møhl 1986). Here the permafrost had preserved thick culture layers from the Saqqaq and the succeeding Dorset culture, and this investigation gave a "foretaste" of the many new, surprising aspects of the palaeo-Eskimo implement inventory in wood and bone.

In 1983, archaeologists from Christianshåb Museum found a further Saqqaq settlement with permafrozen culture layers, Qeqertasussuk, and the following years' investigation at this site will be presented here.

### CHRISTIANSHÅB MUSEUM'S PROJECT

The settlement on the island of Qeqertasussuk was found during Christianshåb Museum's mapping and registration of prehistoric sites in the Sydostbugt (the southernmost part of Disco Bay (Fig. 1).

The settlement, which is situated on a small promontory on the northeasternmost part of the island, proved during a pilot investigation to contain quite intact structures and culture layers. In peat-covered permafrozen layers there were large amounts of bone, and even easily perishable objects of wood, feathers, whalebone and skin were very well preserved. A more detailed investigation could thus contribute considerable new knowledge on the Saqqaq culture, and the local museum, under the direction of Torben Simonsen, entered into collaboration with *the Greenland Museum* on a major interdisciplinary research programme.

In the Qeqertasussuk project, which is directed by archaeologist Bjarne Grønnow (Copenhagen Institute of Prehistoric Archaeology) and quaternary zoologist Morten Meldgard (Zoological Museum, Copenhagen), emphasis has been placed on an interdisciplinary approach and on Greenlandic-Danish collaboration. Eskimological investigations have been carried out by Hans Lange (Copenhagen Institute of Eskimology) and Maria Stenholdt (Ilisimatusarfik University of Greenland). Pollen and macrofossil analyses and quaternary geology are the responsibility of Bent Fredskild (Greenland's Botanical Investigation) and Charlie Christensen (National Museum, Copenhagen). The entomological investigations of the many well-preserved insect

remains have been performed by Jens Bøcher (Zoological Museum). Greenlandic and Danish conservators and photographers, students within a number of disciplines and many interested local people have taken part in the fieldwork. Laboratory analyses of costume remains and human bones are the responsibility of Gerda Møller (National Museum) and Bruno Frölich (Anthropological Laboratory), respectively.

Four years of fieldwork on the settlement have now been rounded off (1987) and a number of finds and a considerable amount of information obtained. In the course of the coming years, the results of the many special investigations will be collated to give a comprehensive picture of conditions of life and activities at the Qeqertasussuk settlement, but the most important finds and a number of preliminary results can already be presented.

## THE EXCAVATIONS

Based on the settlement's topography, on the location of the visible structures, on the surface finds, and on trial excavations, we could discern three areas calling for detailed investigation (fig. 2). The sectors investigated in these areas were systematically excavated in quarter or whole metre squares with plotting of imple-

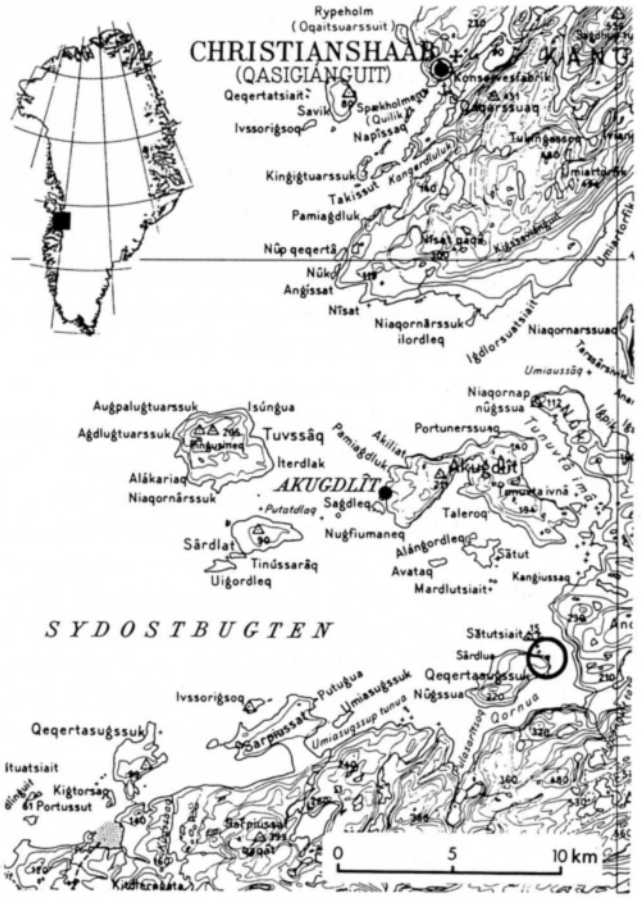


Fig. 1. Map section and photograph (from the east) showing the southeasternmost part of Disco Bay, the Sydostbugt. The settlement on the island, Qeqertasussuk, is marked with an arrow. (Photo: M. Meldgaard).


Fig. 2. The promontory on the east side of the island of Qeqertasussuk. In the background, the mainland is visible. The three most important excavation sectors (A, B and C) are marked. (Photo: Bjarne Grønnow).

ments, plan and profile drawing, and photographic documentation. Numerous sediment samples for sieving and scientific analysis were extracted. Sector A (c. 25 $m^2$) was laid out in an area with freely exposed cooking places in the highest part of the settlement. Sector B originated in the northern erosion bank which transects the thickest midden layers of the site. 10 $m^2$ of the midden were systematically excavated. The third main sector, Sector C, covered part of a fossil, now peat-covered, terrace about 15 m south of the midden sector. In Sector C (c. 45 $m^2$), we excavated the remains of two or three "mid-passage dwellings" under midden layers from younger phases of the Saqqaq culture. Through a network of probes covering the whole settlement, and a c. 15 m long profile trench, we have supplemented the information from these systematically excavated sectors.

*Location of the settlement*

The settlement is, most typical for palaeo-Eskimo localities, situated on a series of fossil raised beaches, which form a promontory with a rocky knoll at its extremity. There are remains of structures and implements all over the promontory.

The view from this point on Qeqertasussuk over a strait to the mainland is very extensive, and the same applies to the archipelago to the north out to Disco Bay itself. There is thus a perfect view of the hunting area.

The strait is merely about 1 km wide and forms a natural migration route for harp seals and whales. Large bird cliffs are found along the coasts. On the mainland side there is good access to the caribou areas of the interior.

*Game animals*

Morten Meldgaard is in the process of analysing the very extensive bone material, with species, age and season determinations and analyses of cut-marks. Provisionally, it can be said that harp seal (*Phoca groenlandica*) and ringed seal (*Phoca hispida*) were by far the most important game animals (fig. 3). But these resources were heavily supplemented by birds – especially fulmars (*Fulmarus glacialis*), gulls and alcids – and a number of other seals such as bearded seal (*Erignathus barbatus*) and hooded seal (*Cystophora cristata*). Fish, *i.a.* cod (*Gadus morhua*), and land game, such as arctic fox (*Alopex lagopus*) and caribou (*Rangifer tarandus*), were also exploited. The remains of no less than six different species of whales – bowhead or right whale (*Balena mysticetus/glacialis*) sperm whale (*Physeter macrocephalus*), killerwhale (*Orcinus orca*), narwhale (*Monodon monoceros*), minkle whale or sei whale (*Balaenoptera acutorostrata/borealis*) and porpoise (*Phocoena phocoena*) – were found in the midden layers, but it is an open question as to whether the large whales and killerwhales were caught, or whether it was merely stranded cadavers that were used. Also the now extinct great auk (*Pinguinus impennis*) must be mentioned among the comprehensive range of game animals – 45 different species – which were exploited from the settlement.

With a view to placing the resource exploitation of the settlement in broader perspective, we have both mapped the occurrence of game animals in the area on the basis of ethnographical and zoological investigations and undertaken an intensive search for other Saqqaq localities in the area. About 15 Saqqaq settlements (plus a single Dorset locality) were registered in the selected areas in the Sydostbugt. Qeqertasussuk should naturally be seen as part of a larger settlement pattern, though with varying function through the c. 1000 years during which the settlement was used. The layer series in the settlement's midden gives a solid background against which such processes of change and actual changes in resource exploitation can be elucidated (fig. 4).

*Man and dog*

It is not only the bones of game animals that have been found at the settlement. Also human bones – the oldest known from the Arctic – have turned up in the lower midden layers: four bones comprising two fibulae, a tibia and a fragment of humerus. Anthropologists are at present examining these bones. At this stage the analyses indicate that the humerus derives from an adult male person and that the two fibulae (left and right) belong to an adult female person (age about 30 and about 152.5 cm tall). The tibia seems to derive from another female who was about 151 cm tall and 10 years older than the first mentioned (Bruno Frölich, pers. comm.).

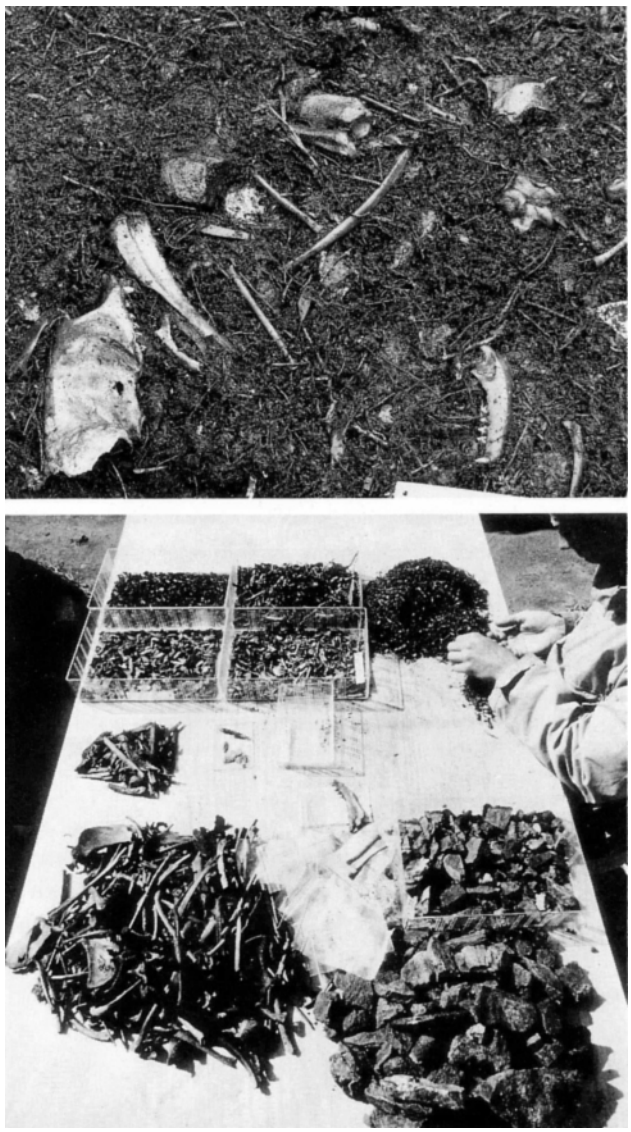

Fig. 3. A section of the surface of the lowest permafrozen midden layer (A) and coarse sorting of its content (B). The largest heap of bones is of harp seal and ringed seal, whilst the smaller comprises bird bones. In the midden layers there are also quantities of cooking-stone fragments, wood shavings, heather (cleared bed and floor covering) and broken implements. (Photo: Geert Brovad).

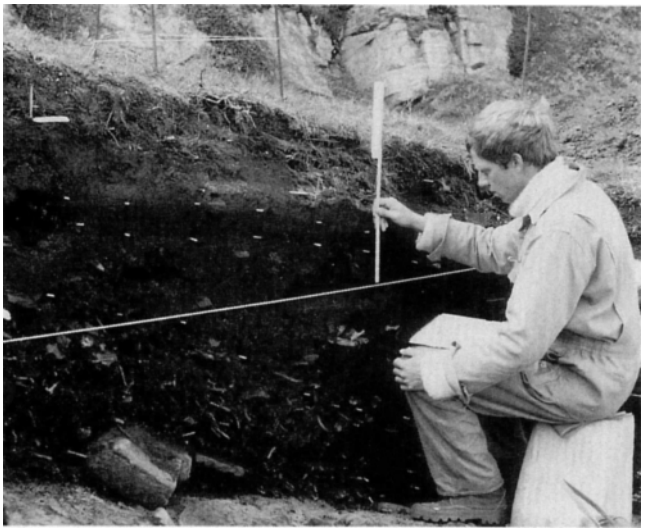

Fig. 4. Morten Meldgaard is measuring the layer series in the midden. The deepest culture layer, about 40 cm thick, has been provisionally $C^{14}$-dated: bottom, 2370–2425 BC (cal.) (corresponding to 3880 ± 85 BP (K 4566)); top, 2135–2170 BC (cal.) (corresponding to 3750 ± 85 BP (K 4565)). This oldest culture layer has, then, been formed through a shorter period's "hectic" activity at the site. After this the cultural traces in the midden are more scattered. The latest traces of activity at the site are dated to 1515–1335 BC (cal.) (corresponding to 3150 ± 85 BP (K4820)). (Photo: Bjarne Grønnow).

Several bones of dog have been recovered from the site. The dogs of the Saqqaq culture have been of roughly the same size as the dogs of the present day, but we do not know yet whether they were used as sledge dogs or as pack- and hunting-dogs.

*The dwellings*

The investigation of an area with preserved dwelling remains was a very complicated and time-consuming operation.

In the excavated area we exposed, under a thick midden from a later Saqqaq phase, an activity surface with numerous structures, including three "mid-passages", provisionally $C^{14}$-dated to c. 2000–2200 BC (cal.) (fig. 5). The two mid-passages lying parallel and close together in the northwestern part of the excavation (Structures A3 and A9) seem to be coeval and stratigraphically slightly older than the third, found near the centre of the excavation (Structure A8). The structure and size of the mid-passages is roughly the same.

The passages were c. 2.5 m long and 0.5 m wide frames of flagstones laid on edge. They are divided into 2–3 chambers, and all have a section paved with small stones from the beach, and one or two chambers containing a little charcoal, round, fire-embrittled cooking stones and horizontal flags.

Several phases of use of the mid-passage, Structure A8, could be ascertained. In the frontal (northern) part, one sees a shift from cooking-place to "work-table". On an underlay of small beach stones there were several tools, such as burins, scrapers and whetstones.

The superstructure and outline of the dwelling or dwellings represented by the two mid-passages (A3 and A9) could not be determined, whereas we found stones and ground-set posts and stakes of driftwood as part of the construction of the later mid-passage dwelling (A8). We provisionally interpret this complex as the remains of an over 7 m long and c. 4 m wide tent or tent-house. The mid-passage divides the ground plan into two parts and is surrounded by a small floor surface covered in birch brushwood and crowberry. On either side of the floor was found a slightly raised surface consisting of alternating layers of grass turf and heather. This is probably the remains of the sleeping platforms. Several stakes were also stuck into the ground at the edge and at the end of the mid-passages – perhaps the remains of drying frames.

In connection with the dwelling, a small, round cooking-place and a series of "dumps" of broken cooking-stones were found. The real connection between these structures and the dwelling remains can first be discovered after analysis of the plan and profile drawings and refitting of the many fragments of cooking-stones and flagstones employed in the structure.

The distribution of finds in and around the mid-passages can yield valuable information on the activities in the dwelling. The "work-table" in the later mid-passage has been mentioned, but distinct traces of crafts activities in antler, tooth, skin and wood could also be seen on the floor and in connection with the platforms. In some places heaps of shavings and split pieces of driftwood were often mixed with very small chips from the resharpening of the stone implements. Near one platform a "cache" of complete tools including a hafted double scraper and a burin were found. Household utensils – ladles of caribou antler and tooth, and platters and bowls of driftwood – lay on either side of the mid-passages.

Distribution analyses of this implement and waste

Fig. 5. A: Excavation sector C viewed form the west. It measures 5.5 × 7.5 m. A settlement surface from the early phase at the site (c. 2200–2000 BC, cal.) has been exposed, and the stone-built structures are seen against the background of the dark peat. At the edges of the sector are seen sections through the culture layers from later settlement phases (still within the Saqqaq culture) at the site.


B: Vertical photograph of Sector C. Same level as in fig. 5A. North up. The three mid-passage structures (A8, A9 and A3) are most clearly seen, of which the two at the northeasternmost edge of the sector are probably slightly older than the centrally placed mid-passage. Structures A2, A6 and A7 are "dumps" of spent cooking-stones, while Structure A1 is a round cooking-place containing cooking-stones, flag fragments, charcoal and charred blubber.

The analysis of this complicated activity surface is not complete. Among other things the find distribution and refitting of cooking- and structural stones is to be included in the evaluation of the relationships of the various structures. (Photo: E. Holm).

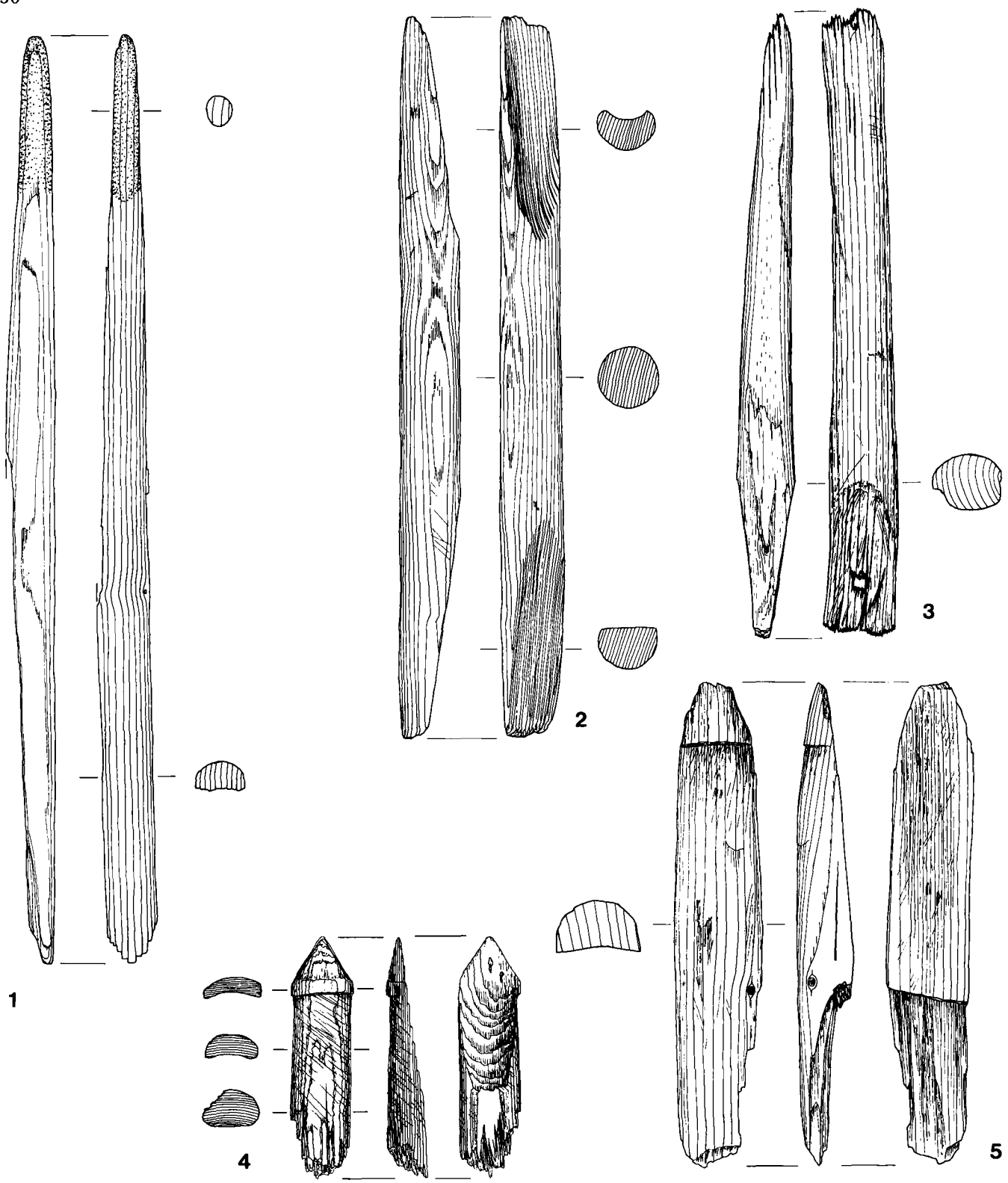


Fig. 6. Foreshafts of driftwood for harpoon (1) and lances (2–5). Note the pieces 2 and 3 with preserved bases, which have been lashed to the hind-shafts. The bases are usually oblique (lashing surfaces), but some foreshafts have, like no. 3, wedge-shaped bases with a rivet-hole. (Drawing: Eva Koch). 2:3.

material in combination with the analysis of the distribution of meal remains (the bone material) in the dwelling area could give us new information on the daily life of the Saqqaq folk, and this work will occupy a considerable part of the aftertreatment of the Qeqertasussuk material.

*New information on technology*

The excavation of permafrozen culture layers is a lengthy affair. In high summer, when the thaw is at its maximum, a layer 2–5 cm thick can be excavated each day. But this very permafrost has meant that we have now obtained quite new information on the Saqqaq culture's technology. The many well-preserved items of driftwood are of special interest.

## HUNTING IMPLEMENTS

The important hunting of marine game animals, especially seals, is manifested in the many pieces of hunting tackle found in the culture layers. These include the driftwood shaft parts of harpoons, lances and spears – both light and sturdy types. The foreshafts (fig. 6) have an oblique or wedge-shaped basal end (lashing surface), and there are often traces of the binding to the hind-shafts. The hind-shafts were originally made of several parts lashed together. All the shafts have been made with great accuracy and are either smooth or with a finely rasped surface – perhaps to furnish a better grip for wet skin mittens. The harpoon foreshafts are made of hardened wood, caribou antler or whale bone, and these materials are also preferred for the harpoon heads (fig. 7). There are common stylistic features, but otherwise the harpoon inventory is characterized by great variation. Open-socketed toggle harpoons were, for example, used concurrently with the "typical Saqqaq type" with tanged base for fitting into the foreshaft. The "Saqqaq type" has a slot for a small harpoon blade at the point and holds the quarry with a double barb. It does not twist in the animal like the toggle harpoon. The harpoon heads are – by present standards – quite small and could reflect an emphasis on seal hunting methods like breathing hole or ice edge hunting or hunting with darts from a boat.

A couple of foreshafts for lances were found with the point still fixed in the blade bed. The bifacially flaked

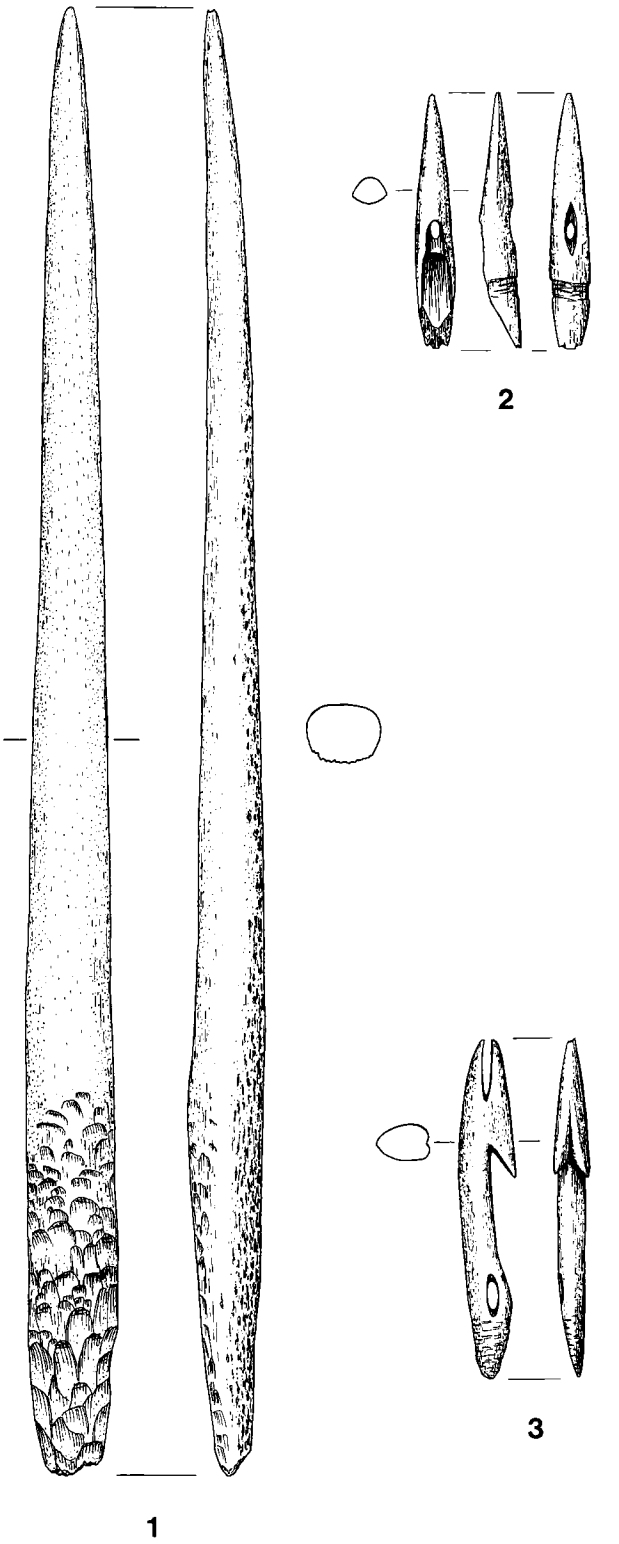


Fig. 7. Sturdy harpoon foreshaft of whale bone (1), a toggle-harpoon head (2) and a "typical Saqqaq harpoon" (3). Both harpoon heads are of caribou antler. (Drawing: Eva Koch). 2:3.

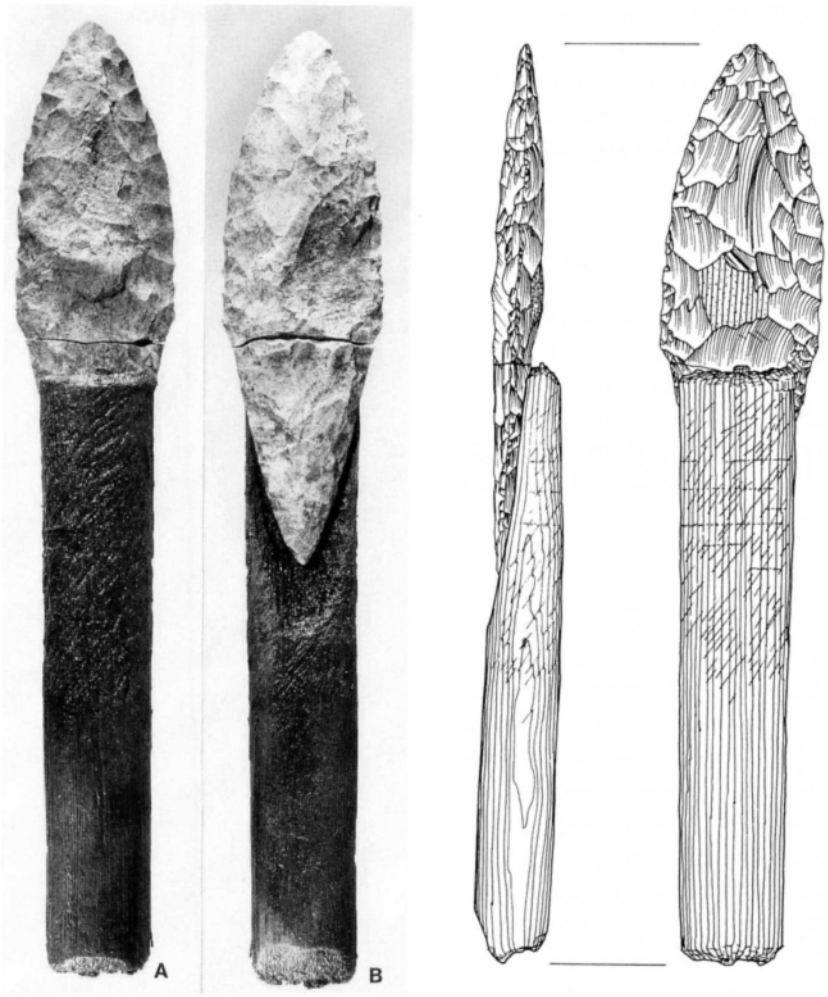


Fig. 8. The outermost broken-off part of a sturdy lance – perhaps for whale-hunting. The bifacially flaked blade of killiaq, which is a typical Saqqaq form, was found with the base still in the blade on the wooden shaft. The broken-off point lay beside it. One one side of the shaft (A), faint traces of lashing cord and a distinct oblique scoring which formed the base for the lashing are seen. (Drawing: Eva Koch).

points of killiaq (a silicified kind of slate) are, unlike knife blades, unilaterally hafted, and were originally fixed into the blade bed with a broad lashing. One of the hafted lances is so sturdy that it could well have been a whale lance (fig. 8).

The spear shafts are often furnished with three grooves for fixing flexible end prongs of whale bone with inward-pointing barbs. These weapons must have been used as light bird spears, as known, for example, from Alaska in historical times (van Stone 1984: 231).

Fishing is only weakly attested, but several sharpened bird bones have been found, with parallels in the fishhook spikes of recent times.

The bow parts found show that the bows of the Saqqaq hunters were strong and composite. A bow piece, which in section has a flat back and convex inner side, has a longitudinal groove revealing a back reinforcement, presumably of sinew. Another type of bow, with broader and flatter cross-section, must have been reinforced (fig. 9). (For ethnographical parallels see Birket-Smith 1916.) The slender arrow shafts, which were about 70 cm long, were often made up of several parts lashed together. The foreshafts are furnished with a blade bed for a lanceolate or tanged point of killiaq or they have a slot for a triangular piece of chert (fig. 10). On the hind-shafts traces of the lashing for the feathers

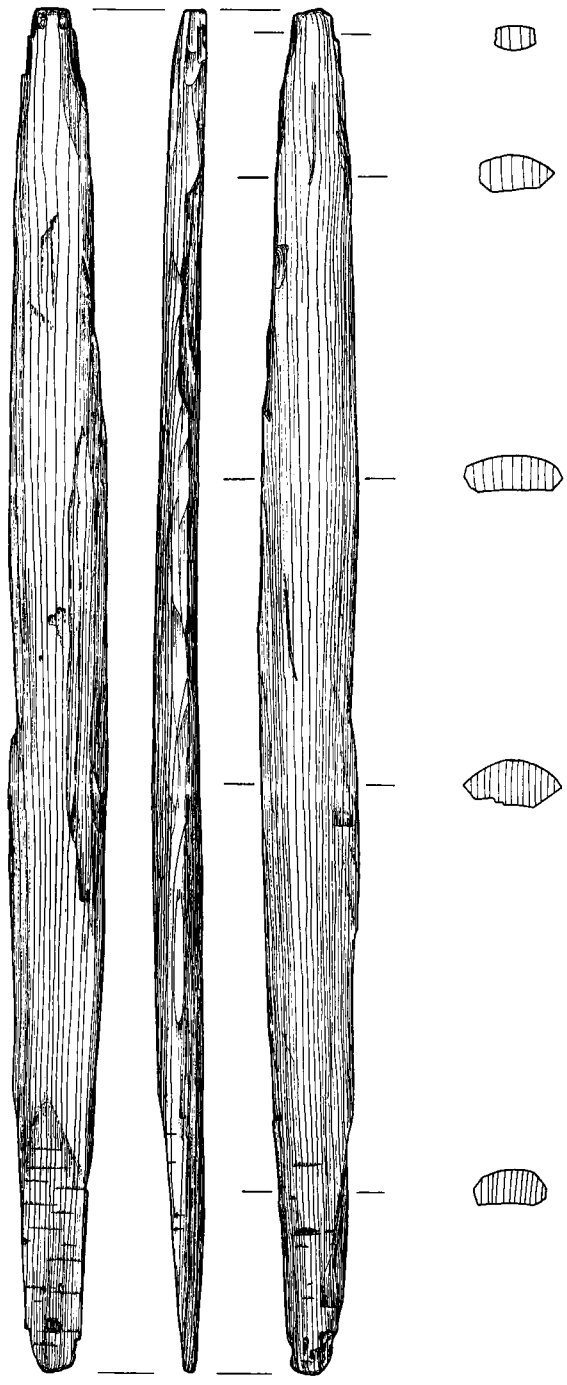

Fig. 9. Part of bow, probably not quite finished. (Drawing: Eva Koch). 2:5.

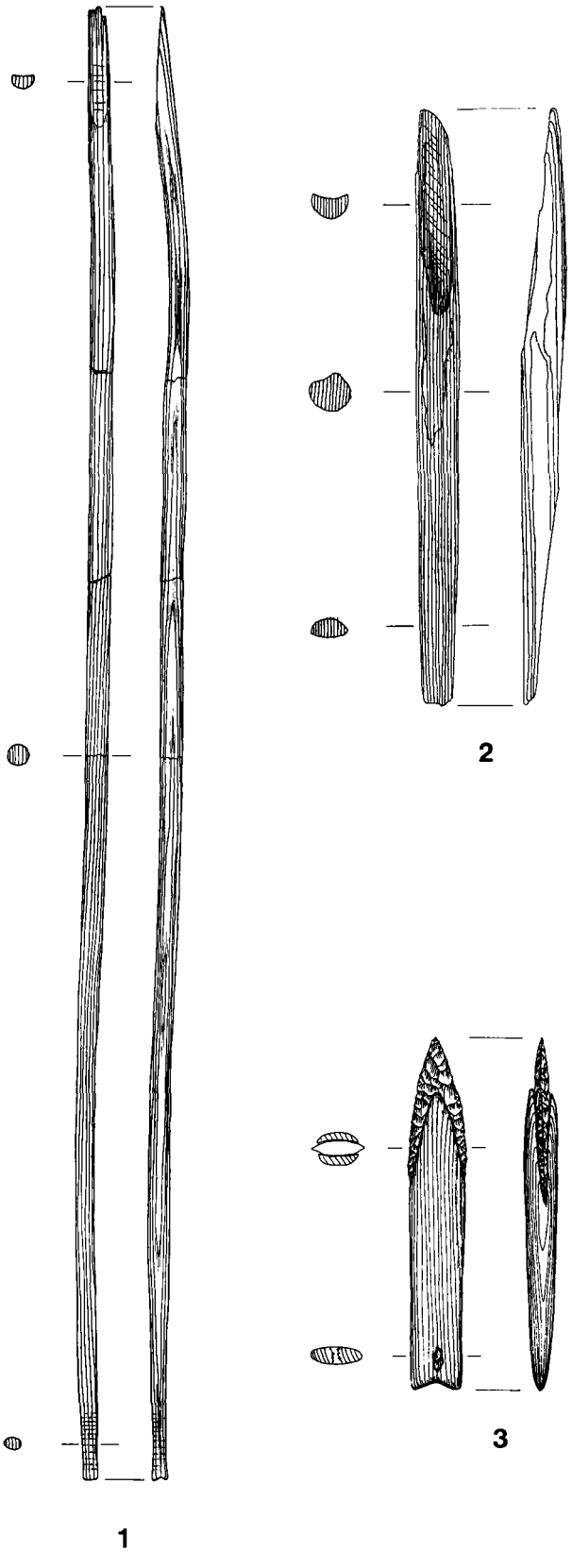


Fig. 10. Hind-shaft of arrow (1) and two different types of arrow foreshaft: one with blade bed (2) and one with a triangular point of chert, stuck into a slot in the foreshaft (3). (Drawing: Eva Koch). (1) 1:3, (2) and (3) 2:3.

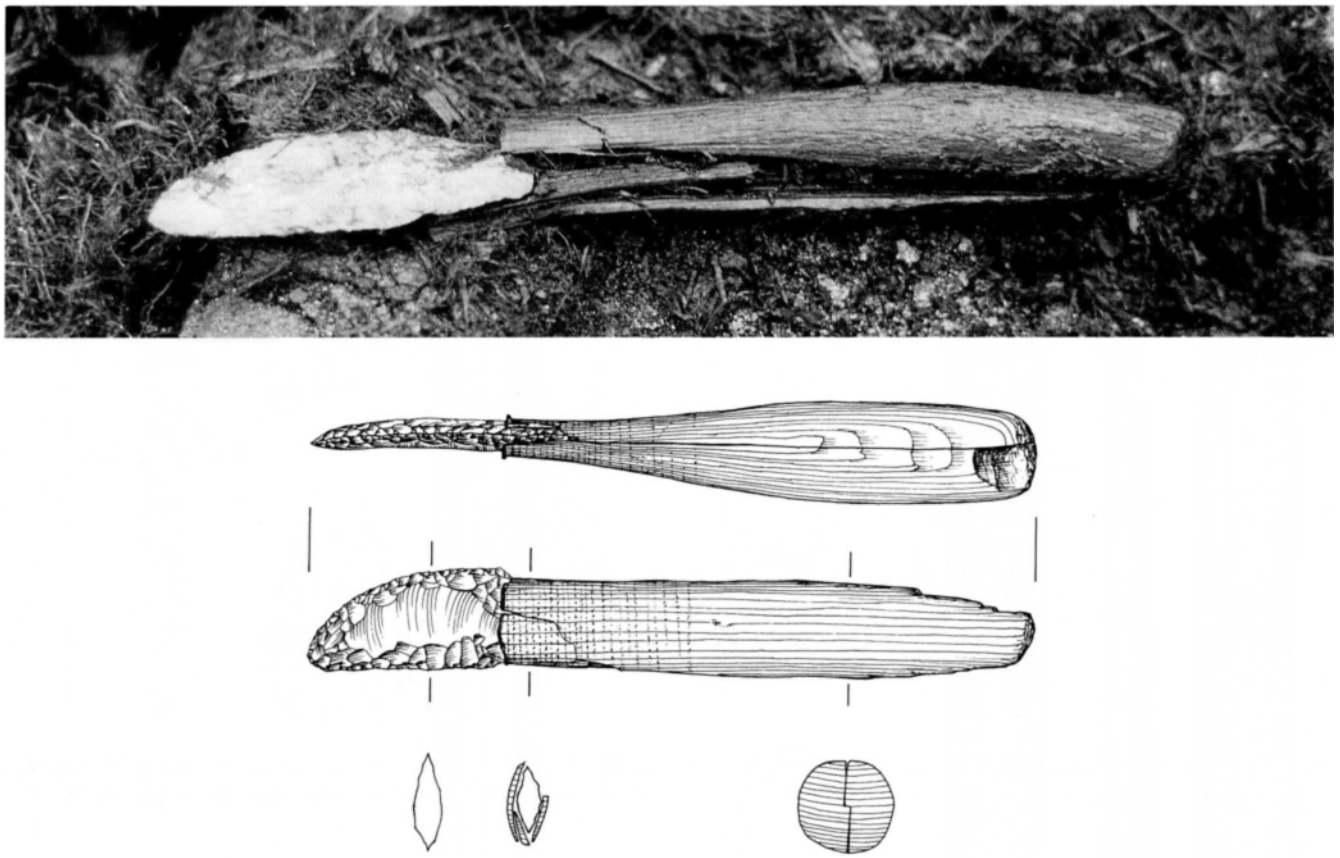

Fig. 11. Hafted knife with bifacially flaked blade of killiaq. The lashing traces are marked on the drawing. (Drawing: Eva Koch; "in situ" photo: B. Grønnow). 2:3.

are still seen above the finely formed notch end. Like the other hunting implements, the bows and arrows of the Saqqaq folk are very carefully made.

## TOOLS

Several complete hand tools have been recovered from the permafrozen layers. The hafted tools have been found in particular near the mid-passage structures and must be regarded as sets of tools stored in the dwelling. Among other objects, about ten hafted knives were recovered. Here the bifacially flaked blade of killiaq is fixed at the end of a short shaft consisting of two halves lashed together to hold the blade (bilateral hafting) (fig. 11). The knife shafts were originally closely wound with baleen cords, as seen in a very well preserved specimen.

Burins, microblades of rock crystal, lateral scrapers and end scrapers have also been found hafted. Thus we now have knowledge of the hafting of most of the Saqqaq culture's stone implements. In particular it must be mentioned that the "fan-shaped" end scrapers – a characteristic Saqqaq type – were hafted in "double handles". A scraper blade was lashed to each end of a finely formed U- or V-shaped wooden shaft (fig. 12).

The analysis of hafting principles and wear marks of this material promises to yield new information on the use of the stone implements – a knowledge which is relevant for Stone Age research in general.

Finally, flaking tools, mid-pieces and club-heads of antler, tooth and bone for working the flint-like raw materials should be mentioned, and wedges of caribou antler and whale bone for the initial splitting of the driftwood prior to working.

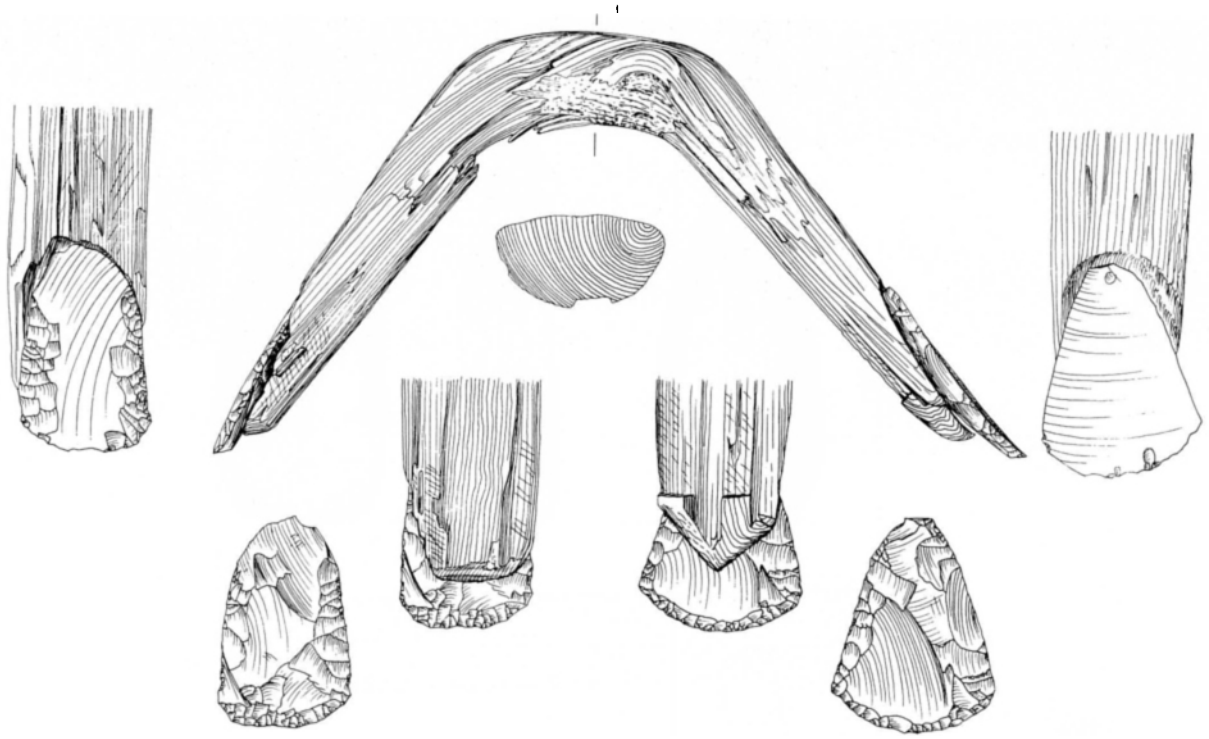

Fig. 12. Double scraper handle. At each end of the curved handle of driftwood, an end-scraper blade was found. In the drawing, the two scraper blades are seen mounted in their original position, which is apparent both from the find situation and impressions in the blade beds. (Drawing: Eva Koch). 2:3.

## HOUSEHOLD UTENSILS

Within the household utensils, it is especially the aforementioned ladles, spoons and bowls which attract attention. The ladles are of driftwood, while the slender spoons are most often made of the broad parts of caribou antlers. In one case, a spoon has been cut out of a large sperm whale tooth (fig. 13). The bowls are of hollowed-out pieces of driftwood. They vary from small, thin-walled oval bowls to over half-metre long, flat specimens, perhaps "blubber trays". Some bowls have local charring on the inside, which may be the marks of use as a base for fire-making (fig. 14).

### *Costume remains*

Both in the dwelling area and in the midden, various pieces of seal and bird skin have been found. Some have fine sewing and must be the remains of clothing. These skins are now to be identified and examined in greater detail by the conservators, so that we may have information on the skin treatment, cut and sewing technique of the Saqqaq culture. One piece could already on excavation be identified as the entire foot of an inner stocking for a kamik – sole, sewing, and "upper" were preserved (fig. 16). They are the hitherto oldest parts of garments from the Arctic – about 3500 years older than the clothing from the Qilakitsoq graves (Hansen et al. 1985). Perhaps the finely cut and ornamented needle case of dog bone symbolizes the Saqqaq woman's dress. If so, this was furnished with a little end in front and a wide tail at the back (fig. 17).

### *Boats*

The history of Arctic skin boats can now with certainty be traced back to the Saqqaq culture. Six small fragments among the thousands of wooden objects from the culture layers proved to belong together. They could be pieced together into a c. 35 cm wide and 22 cm high frame (fig. 15). The frame is quite thin and probably derives from a slender kayak-like vessel. Parts of thicker

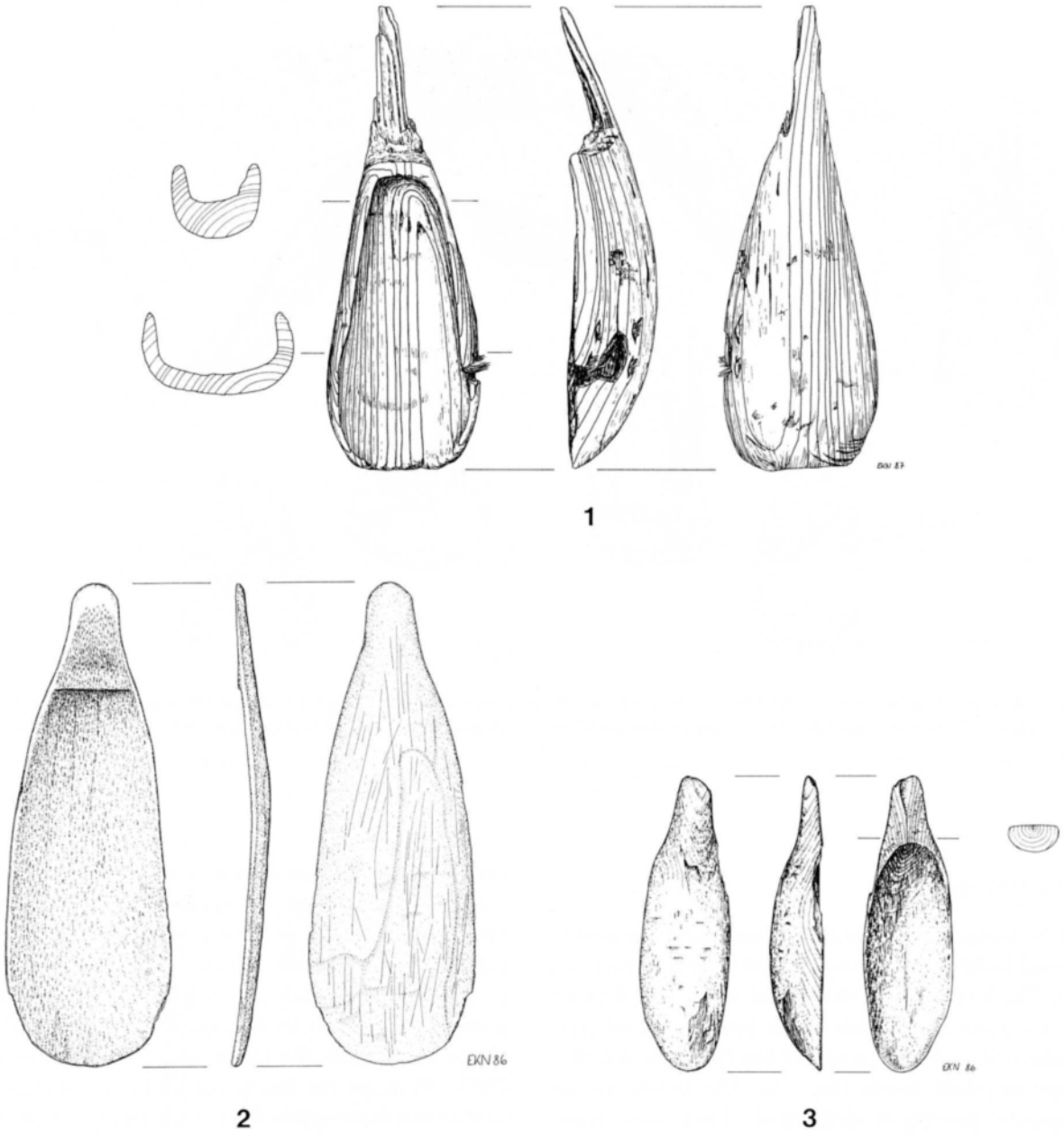


Fig. 13. 1) Ladle of driftwood. Note the repair with baleen thread. 2) Spoon of caribou antler. 3) Spoon of sperm whale tooth. (Drawing: Eva Koch). 1:3.

frames and a part of the blade of a slender paddle have also been found at Qeqertasussuk.

*Publication and exhibition*

The Qeqertasussuk project has now entered the analysis phase. Plans have been made for a number of publications in "Meddelelser om Grønland, Man and Society".

The material has for practical reasons been sent to Denmark for analysis, but will later naturally be returned to Christianshåb Museum where it will form the core of a permanent exhibition. This local museum will then be able to present a material of interest far outside

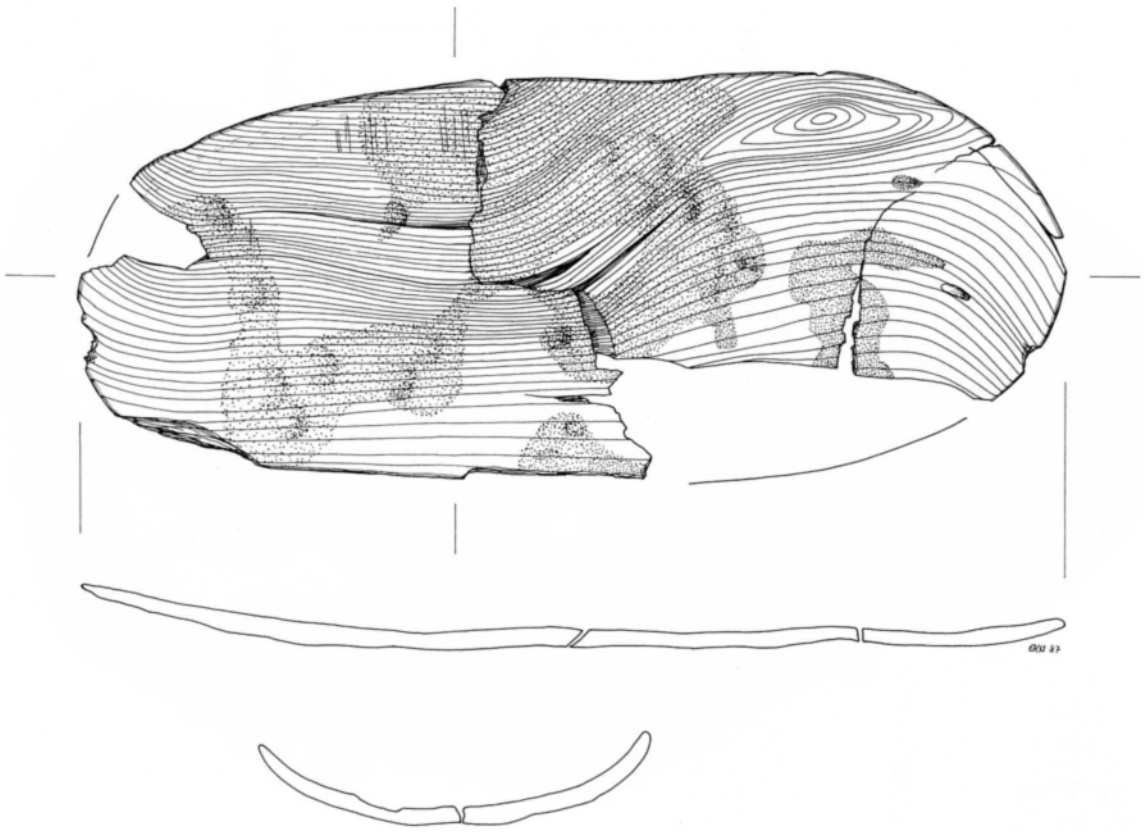

Fig. 14. Bowl or platter of driftwood. Charred parts on the inside are shown with screen tints. (Drawing: Eva Koch). 1:3.

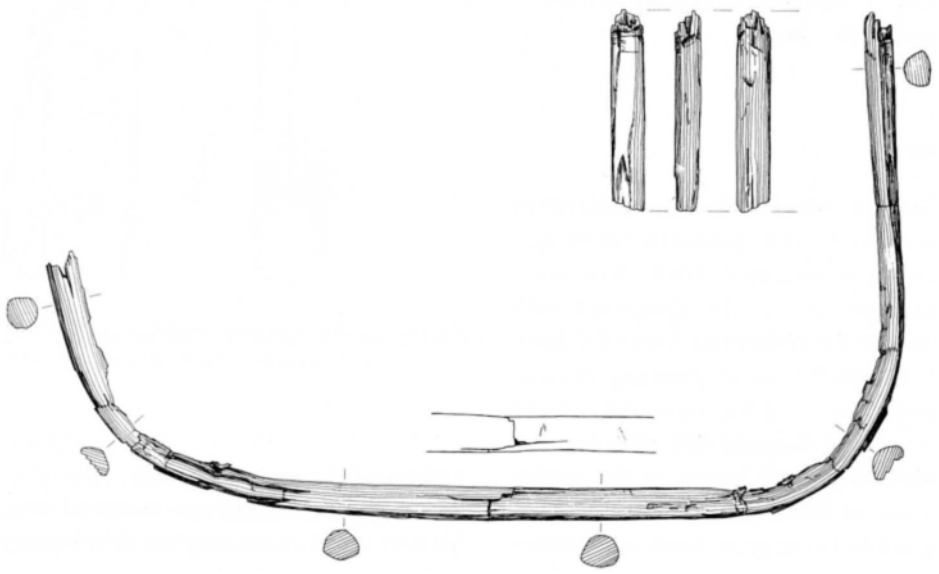

Fig. 15. Frame of kayak-like vessel. This piece is made of what was originally one long piece of driftwood, split, shaped and finally bent into shape. Faint traces of lashing are still seen in the middle of the frame and in the preserved end. (Drawing: Eva Koch). 1:3.

Fig. 16. Foot of inner stocking of kamik, seen from the top. The toe is best preserved. (Photo: John Lee).

Greenland, helping to tie the cultural history of Greenland to that of the rest of the Arctic.

## RESEARCH PERSPECTIVES

The picture of the Saqqaq culture – the first hunters in West Greenland – as a distant and "primitive Stone Age culture" can no longer be maintained. With Christianshåb Museum's investigations at the Qeqertasussuk settlement, which is briefly presented here, we have now obtained the best possiblities of drawing an entirely new, many-sided picture of the material culture and living conditions of the Saqqaq folk. The excavations in the permafrozen culture layers at the settlement have given a mass of information on the production, hafting and use of hunting gear, tools and household utensils. The construction and arrangement of the dwelling and settlement activities are beginning to appear, and we will obtain a detailed picture of the exploitation of the game animals. Also the research of the coming years within raw material utilization, dwelling patterns and chronological development of the Saqqaq culture can take its starting point in the "fixed point" of Qeqertasussuk. We thus hope that the results of the project will lead to intensified research within the field

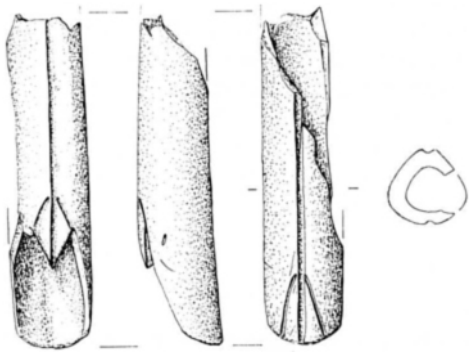

Fig. 17. Small ormanented needle case of dog bone. Perhaps it symbolizes the cut of a Saqqaq costume. (Drawing: Eva Koch). 2:3.

of palaeo-Eskimo archaeology, and that the very earliest part of Greenland's cultural history can become a part of the awareness of the present-day hunters and fishermen of the Arctic.

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## NOTE

1. The early part – the "pioneer groups" within ASTt are: Denbigh Flint Complex in Alaska (Giddings 1964), Pre-Dorset in Canada (Meldgaard 1960), Independence I in North Greenland (Knuth 1967) and the Saqqaq culture in the rest of Greenland (Larsen & Meldgaard 1958). The earliest reliable $C^{14}$ datings of these groups lie in the period 2500–2100 BC (cal.).

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# *The Long Dolmen at Asnæs Forskov, West Zealand*

by ANNE BIRGITTE GEBAUER

Continuing erosion by the sea necessitated the archaeological rescue of a protected long dolmen on the south coast of the peninsula Asnæs in northwest Zealand[1] (fig. 1). The excavation was conducted by *Kalundborg and Omegns Museum* and provided new insights into the multistage construction of monuments and earth graves with a combined wood and stone architecture. The following pages discuss the topographic situation of the monument and then parts of the construction as it was revealed during the excavations: from the outer line of kerb stones, to the mound itself, and finally the earth grave and its contents. A reconstruction of the earth grave provides some information on the possible appearance of these structures. Evidence from the excavated portion of the dolmen suggests that like in Jutland single earth graves were often the initial stage in the construction of megalithic monuments on Zealand.

## *The Topographic Setting*

The major axis of the long dolmen at Asnæs lies perpendicular to the south coast of the Asnæs peninsula, with one end pointing toward the sea. The intact northern end of the dolmen lies in mixed oak forest. To the south towards the beach, the dolmen today is dissected by a 4 m high wave cut slope, where the sea is continuously eroding both the shoreline and the monument. On the beach below the monument lie several large stones that came either from the outer row of kerb stones or from structures inside the mound itself. Smaller stones similar to the stone cover on the mound are likewise abundant along this part of the beach, while almost no stones are seen west or east of the dolmen. According to local informants the coastline has changed dramatically since the beginning of this century. A section of flat land in front of the present coastline has been removed and the present slope itself has gradually moved further inland.

These changes in the coast line and the concentration of stones at the beach both indicate that the dolmen originally was longer. However, accurate estimates of how much of the monument has been lost to the sea cannot be made. Measurements of the monument prior to the excavation indicated that the dolmen was 23.5 m long – or 1.5 m longer than estimated by earlier surveys from the 1940s onwards. This apparent discrepancy is explained by the fact that the southernmost part of the dolmen was hidden by an impenetrable scrub of whitethorn. The new measurements do, however, suggest that the erosion by the sea has been a gradual process and that only a minor part of the mound has disappeared in recent years.

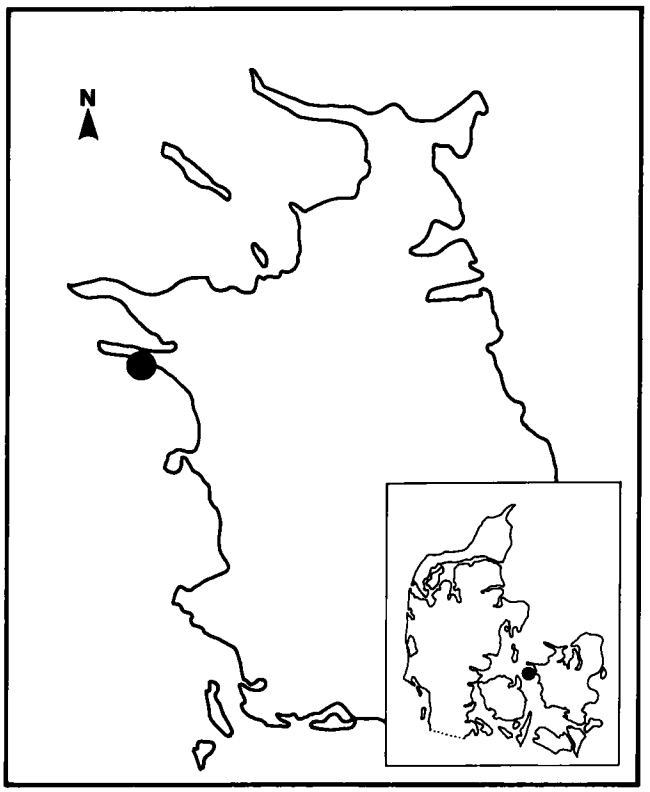



Fig. 1. Location of the longdolmen at the south coast of Asnæs in northwest Zealand.

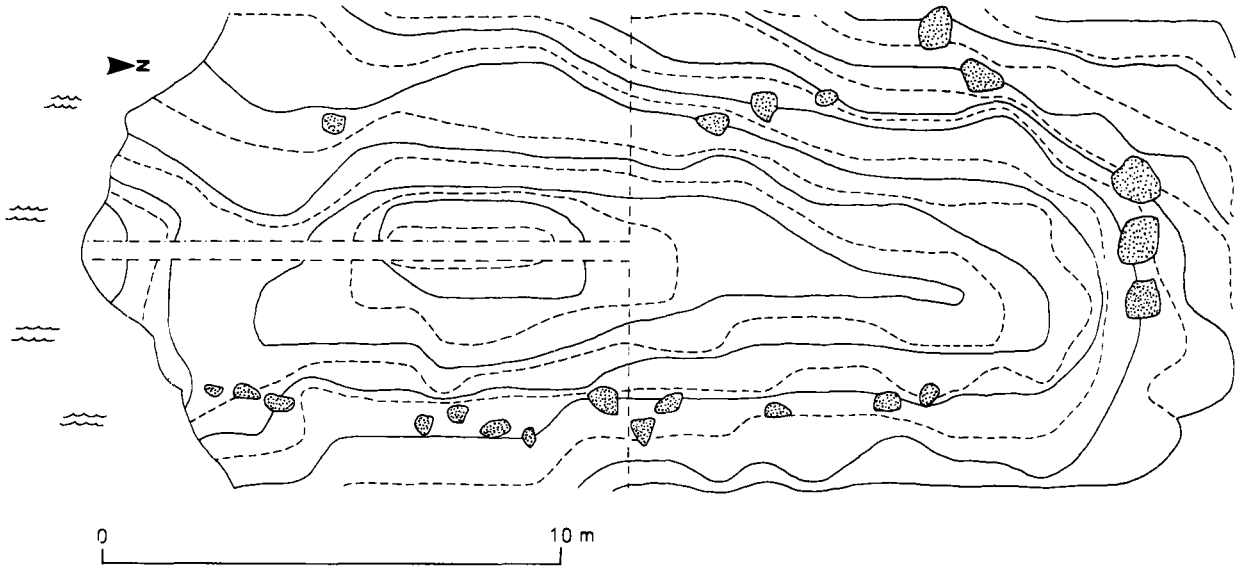



Fig. 2. Dolmen with visible kerb stones prior to excavation. Surface levels are indicated at 10 cm intervals.

*The Kerb Stone Line*

Twenty-two kerb stones were visible around the dolmen prior to excavation (fig. 2). Most of the kerb stones had slipped out of their original position and were standing or lying in an oblique position. The three largest kerb stones at the northern end of the dolmen suggested that the ends were emphasized by kerb stones larger than those used along the sides.

Within the excavation area, the kerb stones were numbered 1 to 13 from south to north along the east side and 14 to 22 north to south along the west side of the dolmen (fig. 3). Only four stones were found in their original upright position (No. 1, 2, 13, and 22), but the actual line of kerb stones was almost completely preserved. On the west side stones 20 and 21 had been removed, but their position was clear from the foundation pits. Between stone 22 and the south slope, however, no foundation pits were observed. On the east side, kerb stones previously had been removed between stone 3 and 7. A foundation pit was found in place of stone 6, while similar unambiguous traces of foundation pits could not be located for stones 4 and 5 – perhaps only one kerb stone had been placed here.

The southern part of the line kerb stones on the east side (stones 1 to 3) was clearly distinguished. The southern kerb stones were small, very regular in shape, and only a limited dry stone masonry had been put between the kerb stones. There were no foundation pits; instead, stones supporting the base of these kerb stones were placed on the original ground surface.

The northern segment of the kerb stone line was built of larger stones set in foundation pits. Large amounts of dry stone were used for walling along this part of the line. Overturned piles of 6 or 7 flat sandstone pieces were found at intervals in front of kerb stones. The quantity of flagstones suggests that the dry stone walling probably covered the top of the kerb stones as well. The overall impression of the kerb stone line would have been of a dry stone wall enclosing the kerb stones.

Two stages of construction apparently are represented in the kerb stone line. The northern part of large kerb stones and dry stone walling includes stones 6 to 13 on the east side and stones 22 to 14 on the east side. Kerb stones in the northern unexcavated part of the dolmen are likely part of this stage as well.

The southern stage of the kerb stone line includes stones 1 to 3 on the east side of the dolmen. The absence of foundation pits in this stage might explain the difficulties tracing the base of one or two kerb stones between stones 3 and 6. Likewise the apparent absence of kerb stones on the southwest side might be explained

by the lack of the foundation pits in relation to this stage of the line. It remains, however, uncertain whether or not the southern part of the kerb stone line originally existed on both sides of the dolmen.

*The Mound*

The long dolmen measured 23.5 × 6.8 m and was 1.4 m in height. The surface of the mound was almost horizontal (fig. 2). Some compensation for the northerly sloping ground surface seems to have been made during the construction of the monument. Longitudinal and transverse sections record the construction stages of the mound (fig. 4 A and B). Both sections reveal that north of the earth grave the mound had an inner core of boulders, covered by a layer of earth filling, and a surface cover of smaller stones. With the exception of the surface cover, the following description concerns only the portion of the mound north of the grave.

The surface was covered by two layers of smaller and larger stones (fig. 4A and 5). The southern part of this surface covering consisted of smaller and more closely packed stones than the northern part. Flag stones were incorporated in the surface cover, especially at the north-central portion of the dolmen and in relation to kerb stones. Recent disturbances were detected in the north-central section of the dolmen and in the northernmost 3 m of the inner side of the eastern kerb stone line.

It is likely that the original shape of the mound had a more pronounced transversal vault; the present mound surface was somewhat vaulted prior to the excavation (fig. 2). A great number of stones similar to those in the surface cover of the mound were found on the original ground surface at either side of the dolmen. The distribution of the stones indicates that they had slipped down from top of the mound through erosion, and were not a pavement alongside the kerb stones (fig. 4A).

The fill of the mound beneath the stone cover consisted of pure, or somewhat sandy, greyish-yellow clay with small particles of charcoal (layers 4 and 5). Clays in the mound fill is very similar to the local subsoil. The northern part of the longitudinal section includes a layer with an abundance of charcoal (layer 9), another containing unburned crushed flint (layer 9a), and another of clay mixed with gravel (layer 8). Such layers are often found in the packing around graves. However, no indications of grave structures were found in this part of the dolmen.

The central part of the mound was formed by a pile of large erratic boulders of almost megalithic size. The rocks were covered by a layer of clay (layer 5). The

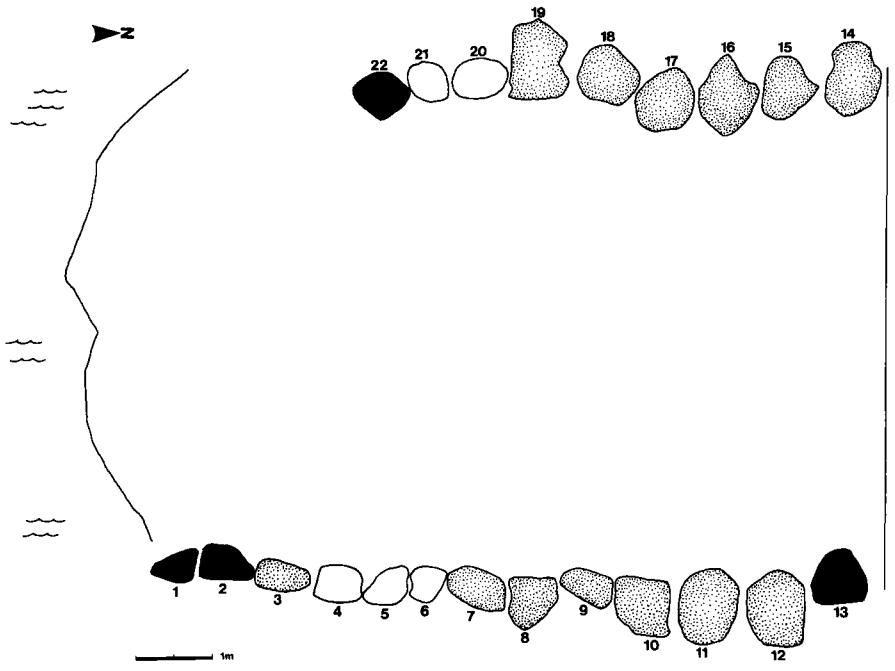



Fig. 3. Line of kerb stones in the excavated part of the dolmen. Stones in original position: black; Stones erected as part of the reconstruction: dotted; Stones added at the reconstruction: white.

outermost rocks in particular were set in solid clay, probably intended to stabilize the stone prior to the addition of the levelling layer of fill.

Beneath the core of rocks was a sandy layer of clay with varying amounts of charcoal particles (layer 6) – the original neolithic ground surface. No indications of settlement activities such as flint flakes or potsherds were found in this layer. Small areas in this layer were greyish-black from charcoal, especially in the area immediately north of the grave and a little further to the northeast. No structures were found in relation to these concentrations of charcoal.

*The Relationship between the Mound and the Earth Grave*

In the area immediately adjacent to the earth grave was a layer of solid yellow clay similar to the local subsoil, layer 14 in the north-south section (fig. 4B and C, see also 4E). This clay layer is thin and becomes discontinuous at the periphery, apparent only in small lumps. The yellow clay overlies the original ground surface or the subsoil (layer 10) where the original ground surface is absent. The yellow clay is also found beneath both the stone packing of the grave (layer 12 and 13) and the fill of the mound (layer 4 and 5).

The yellow clay (layer 14) most likely derives from original excavation of the northern posthole during the construction of the earth grave. Given this interpretation, it follows from the stratigraphic sequence that the earth grave is the primary structure while the mound north of the grave is a later addition.

*Stratigraphic Sequence in the Earth Grave*

The west side of the north-south section (fig. 4C) reveals the stratigraphic sequence inside the grave, while the east side of the 0.4 m wide section shows the stratigraphy of the stone frame around the outside of the grave (fig. 4B). A cross-section shows the packing at the northern end of the grave (fig. 4E).

Packing around the grave was placed on the original ground surface (layer 6) or on a thin layer of yellow clay (layer 14), probably remains of sediments removed from the northern posthole (see above). The packing itself consisted of hard solid clay with a few particles of charcoal (layer 12) or gravel (layer 13). Enclosed in the clay was a double row of boulders, built up in two or more layers at either end of the grave.

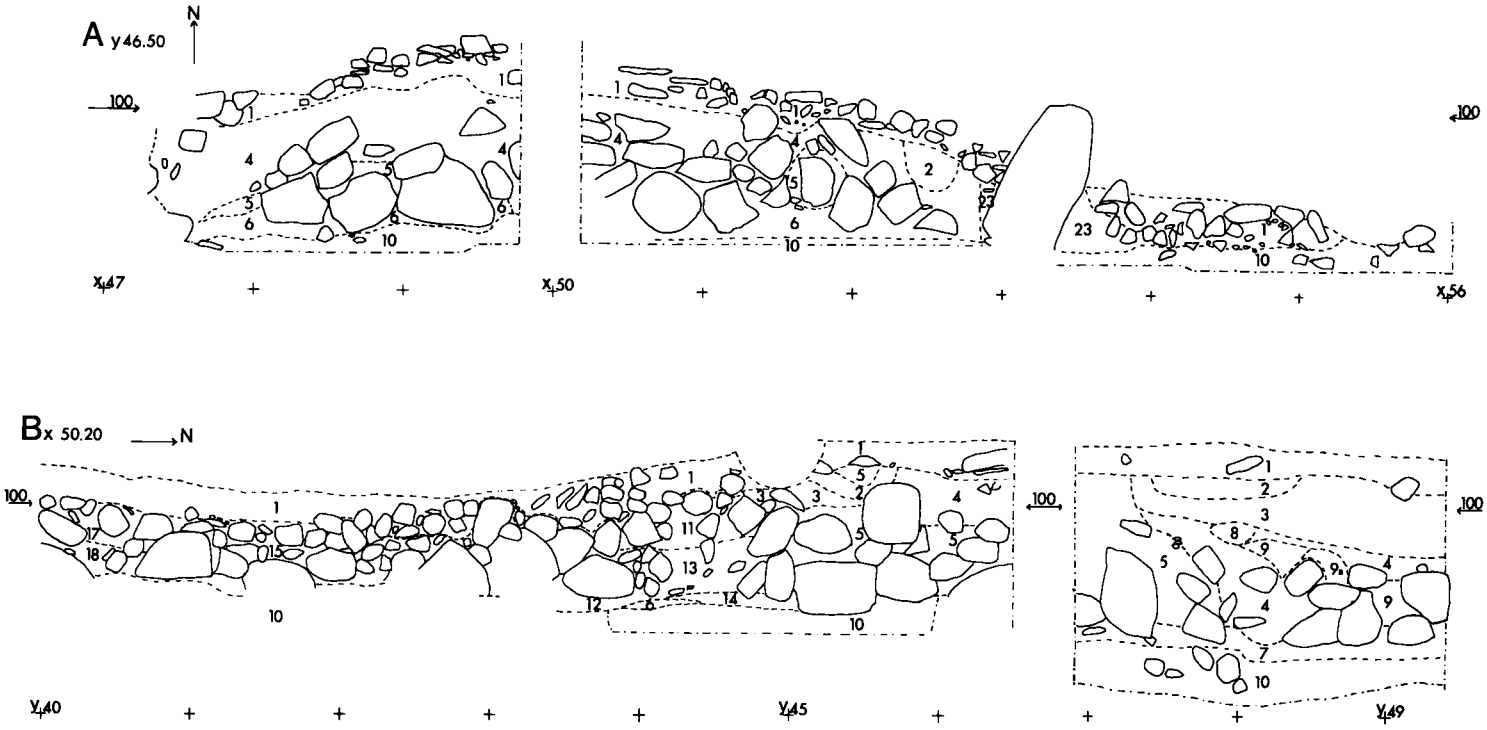
The stratigraphic sequence inside the grave showed two or three horizontal layers of stones above the burial floor. At the northern and southern ends of the grave stones were found in irregular piles, lying at oblique angles. Fill above the floor (layer 15) was homogeneous from the upper humus cover to the level of the grave floor. This layer of loose sandy clay mixed with humus was likely formed by materials which filtered down between the layers of horizontal stones.

Fill between the stones above the postholes at either end of the grave, was formed by two layers. The upper layer consisted of dark sandy clay mixed with humus, fragments of flag stones similar to those found on the grave floor, and unburned crushed flint, which was also found on the floor and in the postholes (to the south: layer 17, to the north: layer 11). Beneath was a layer of lighter clay with inclusions of the above layer, sand and humus, and unburned crushed flint (to the south: layer 16 and 18, to the north: layer 19). Fill in the central part of the postholes was similar to layer 18 and 19, while the fill along the periphery was almost indistinguishable from the subsoil (layer 22).

The stratigraphic sequence in relation to the postholes and the oblique position of the stones found above and in the holes themselves show that the original posts were removed before the wood deteriorated. Likely the stone packing around the posts was removed to roughly the level of the floor and then the posts were pulled up. Through this action, material from the level of the floor was brought to the top of the stratigraphic sequence, forming the darker layer mixed with humus above the postholes (layer 11 to the north and layer 17 to the south).

*The Construction of the Earth Grave*

The sequence of construction for the earth grave could be determined by combining both the vertical stratigraphy and the horizontal plan of the grave (fig. 6 and 7: 1–6). The first step was the excavation of the two postholes at either end of the grave (fig. 7.1). The northern posthole measured 0.9 × 0.6 m and was 0.9 m deep below floor level; the southern posthole measured 0.8 × 0.6 m and was 0.8 m deep. The northern posthole was carefully lined with flagstone towards the grave floor and along the sides. The bottom of the northern hole was covered by one large flagstone measuring 0.60 × 0.36 × 0.03 m. On the top of this large flagstone were




smaller pieces supporting the base of the post. The position of these smaller flagstones indicated that two posts, each with a triangular cross section caused by splitting a tree trunk, were placed in the hole. Under the lowest flag stone, gray grooves about 0.02 m wide appeared in the clay subsoil. Most likely these grooves are traces of the digging stick used for excavating the posthole.

The southern posthole did not have an elaborate flagstone lining. In the side of the grave floor, the hole was bounded by a round stone immediately below floor level; beneath that was a large flagstone. The bottom of the hole was covered by a pavement to support the base of the post. However, it was not possible to determine the number of posts placed here. Perhaps the southern posthole contained only one large post.

The next step in the construction was the placement of boulders to create a frame measuring 5.5 × 3.7 m on the outside and 3.8 × 2.1 m on the inside (fig. 7.2). At either end of the grave, a boulder partially covered the post hole and likely served to support the post. At the top of both boulders, another stone was lying in an oblique position with a plane surface turned towards the center of the grave. These two boulders must have originally supported the end posts as well. Several other large stones were piled up at either end of the grave as part of the outer stone frame for further support. Removal of the posts allowed the pair of boulders, together with part of the stone piles, to slide down and partially cover the postholes.

After erecting the end posts and the outer frame of boulders, the grave chamber itself was constructed. Low walls were built along each side by piling up three or four layers of red sandstone flags (fig. 7. 3a–b). Large flagstones formed a continuous base of the wall along the full length of the inner side of the boulder frame. At the southwest corner of the northern posthole, one of the bottom flagstones was dressed with a right angled corner to make it fit with the stone lining of the posthole underneath. On top of the large flagstones the frame wall was constructed of separate piles of two or three smaller flagstones.

The stone walls likely served as the foundation for wooden walls of horizontal planks. The wooden planks would have lain flush with the end post on the inner side of the frame wall. A number of stones were packed between the lowest plank and the outer frame of boulders as support on the outside (fig. 7.4). These stones were found immediately outside of the stone walls or partly on the walls.

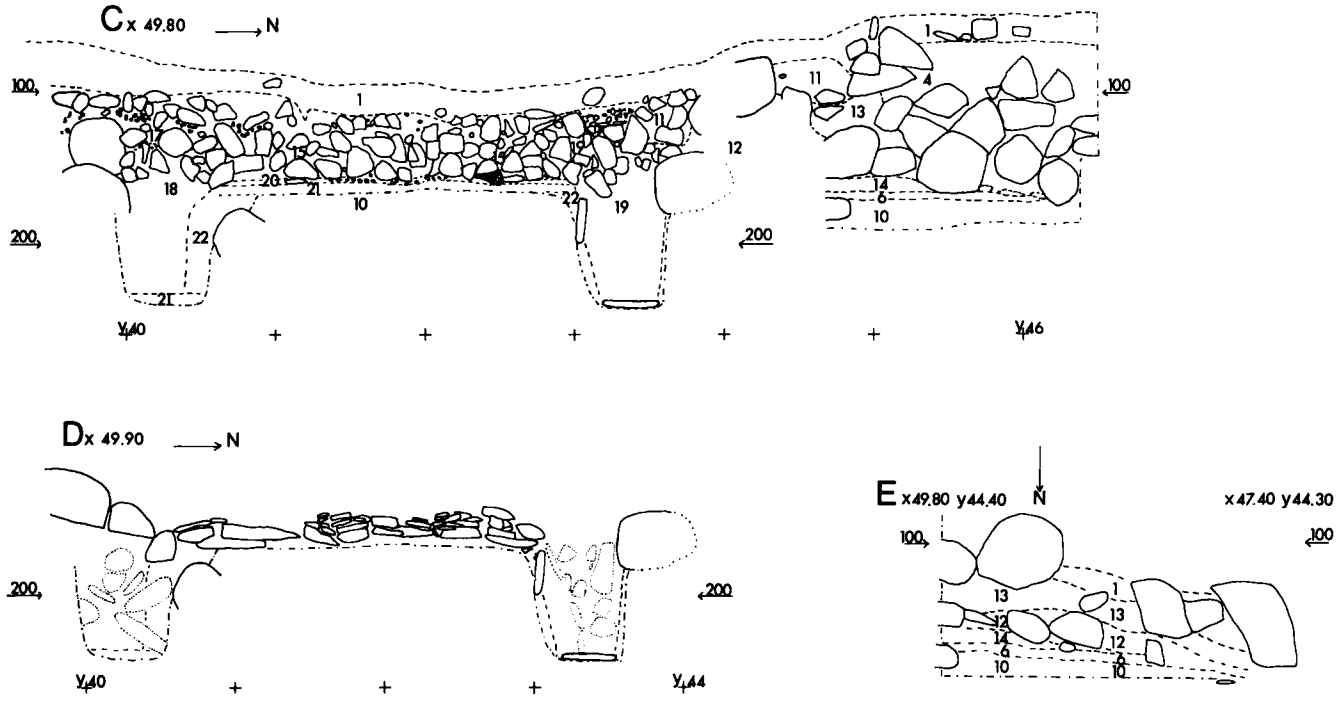



Fig. 4. (A) Cross section seen from the south; (B) longitudinal section seen from the east; (C) same section as (B) seen from the west 0.4 m apart from (B); (D) section through bottom part of the earthgrave showing the eastern dry stone wall and a projection of a section through the central part of the grave and the end postholes. Profiles (C) and (D) are laterally reversed to facilitate comparison with (B). (E) Cross section through the northern end of the stone packing around the earth grave, seen from north. 1:50.

Layer 1. Loose brown-black humus – forest turf.
Layer 2. Loose brown-black layer from animal activity.
Layer 3. Greyish yellow-brown clay – recent disturbance.
Layer 4. Loose to hard greyish yellow to yellow-brown clay mixed with sand and some charcoal particles – mound fill.
Layer 5. Hard greyish yellow clay, more homogeneous than layer 4 – mound fill.
Layer 6. Loose greyish black sandy clay with charcoal – activity layer / original ground surface.
Layer 7. Greyish yellow-brown spotted sandy clay with some charcoal particles – activity layer / original ground surface.
Layer 8. Hard yellow clay mixed with gravel.
Layer 9. Hard greyish yellow to black clay mixed with charcoal.
Layer 9a. Layer 9 mixed with crushed flint.
Layer 10. Solid yellow clay with occasional grey or yellow brown spots – subsoil.
Layer 11. Loose homogeneous brown-grey sandy clay.
Layer 12. Hard greyish yellow clay with some charcoal particles – packing around the earth grave.
Layer 13. Hard greyish yellow clay mixed with gravel – packing around the earth grave.
Layer 14. Solid yellow clay similar to the local subsoil.
Layer 15. Loose greyish yellow sandy clay – fill between stones above the earth grave.
Layer 16. Loose light grey sand with spots of yellow clay – enclosed in layer 18.
Layer 17. Loose homogeneous brown-greyish yellow sandy clay like layer 15, but darker and mixed with fragments of flint and sand stone flagstones similar to the layer just above the burial floor.
Layer 18. Spotted greyish brown clay mixed with dots of layer 17 and of grey sand, enclosing layer 16.
Layer 19. Spotted greyish yellow clay with brown dots, mixed with sand and humus.
Layer 20. Loose dark brown clay mixed with fragments of flint and sand stone flagstones and sand stone gravel.
Layer 21. Red sand stone flagstones.
Layer 22. Solid greyish yellow clay.
Layer 23. Loose grey-brown spotted clay – foundation and fill immediately around kerb stone.

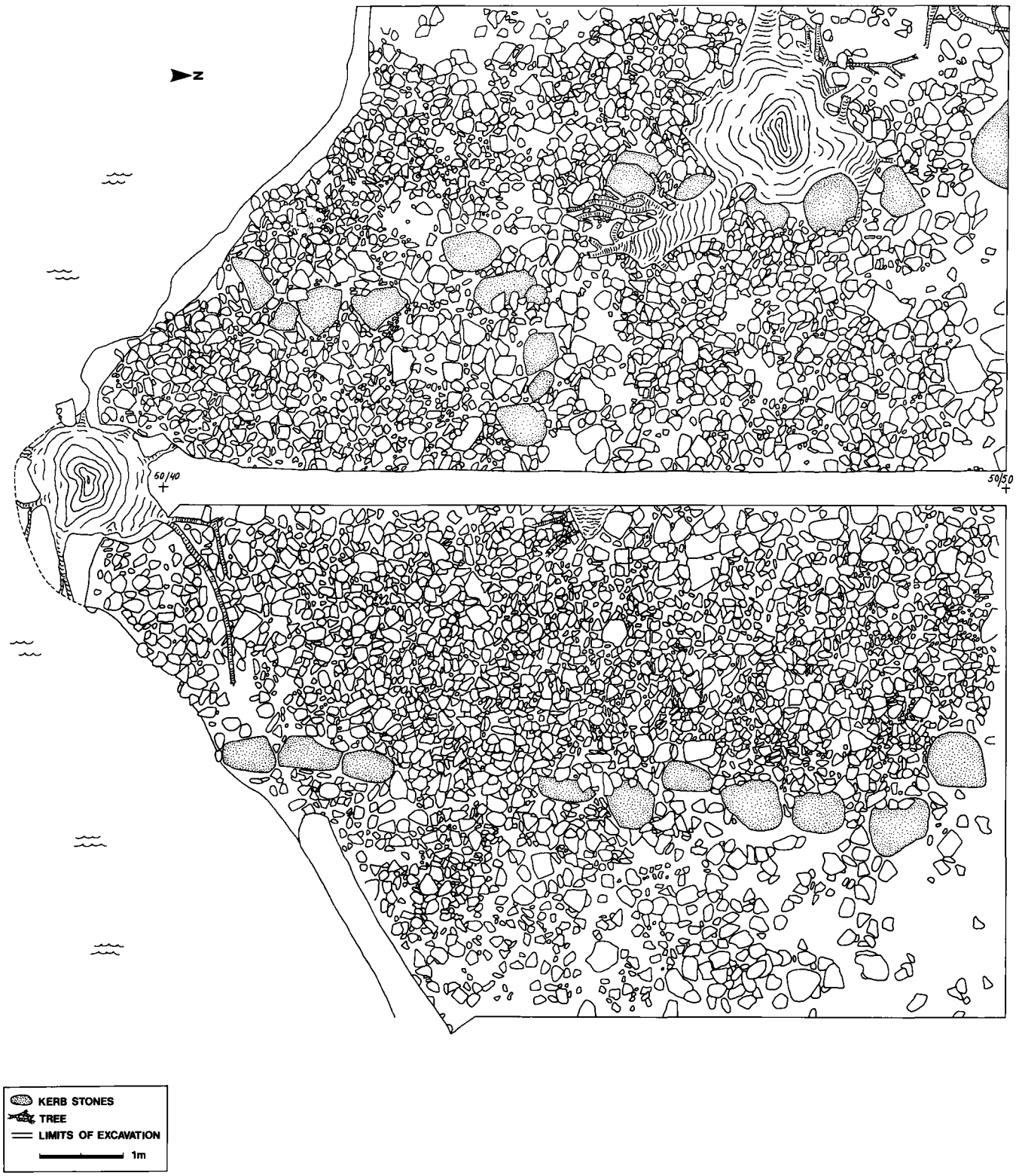



Fig. 5. Surface cover of the mound with kerb stones and the stone frame around the earth grave marked with a dotted signature.

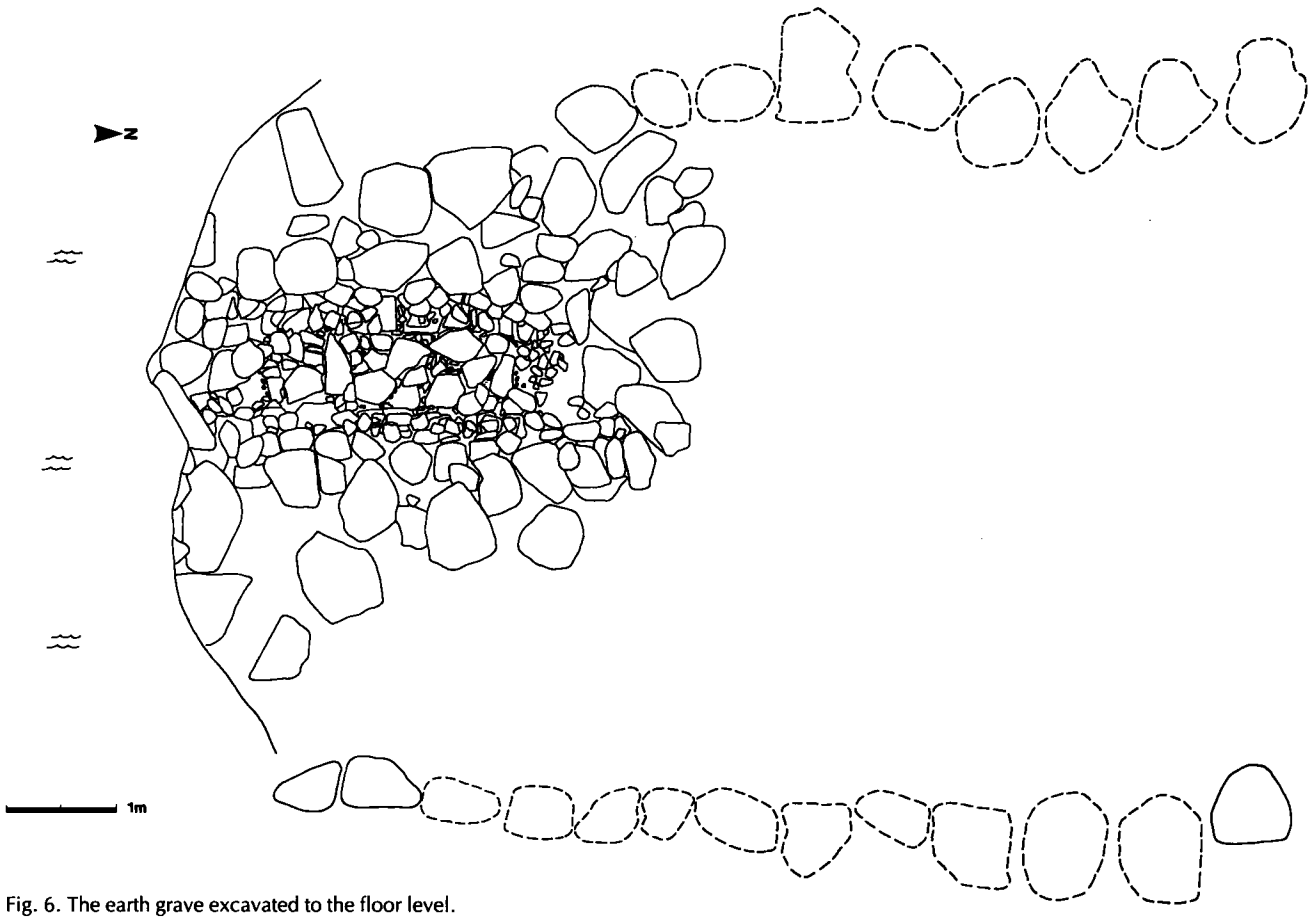



Fig. 6. The earth grave excavated to the floor level.

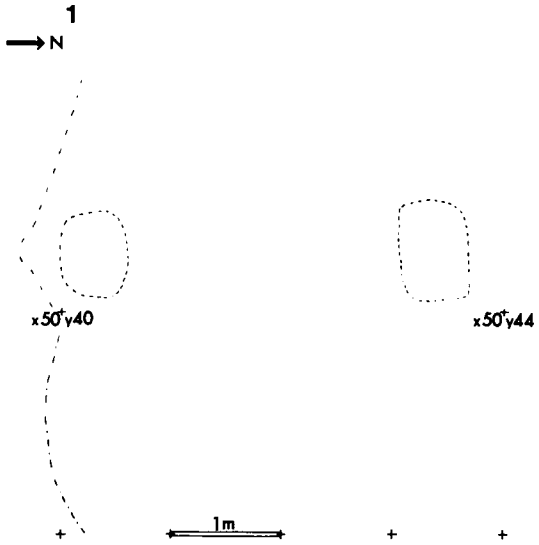
A few flagstones from the top of the stone walls apparently tipped over and were found in vertical position just outside of the wall. This indicates that there was some free space outside the grave chamber and that no other packing or mound was added directly around the chamber.

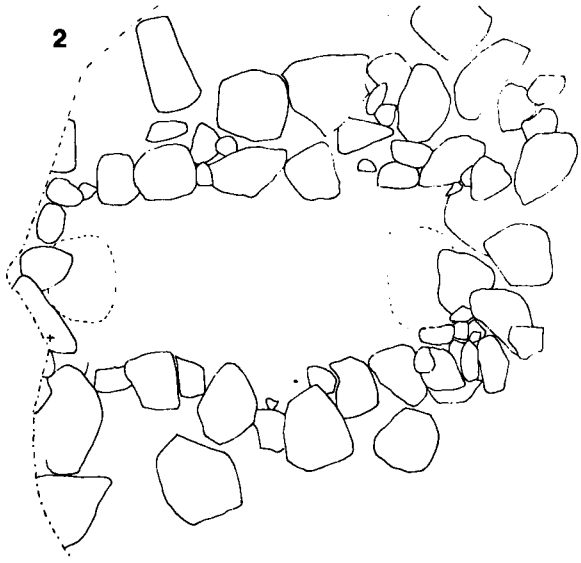
After erecting the stone walls, the next step was to pave the burial floor with red sandstone flags (fig. 4. Section C, layer 21; fig. 7.5). The floor pavement was made in one even layer across the area between the end posts and the side walls. The pavement was very regular with smaller flag fragments added as fill between the floor and the walls.

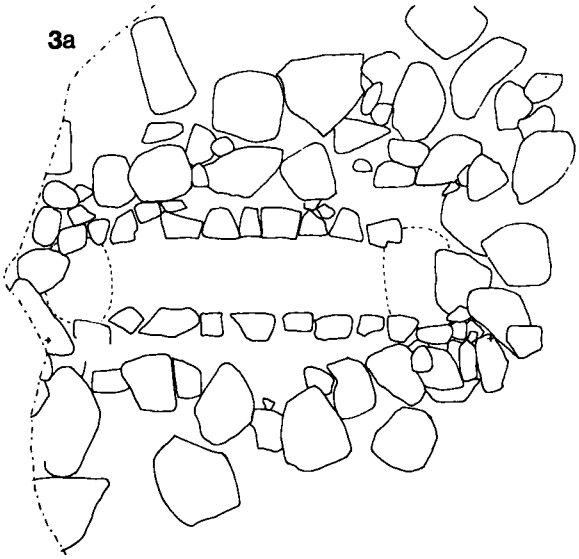
Following the pavement of the floor, wooden side walls and perhaps a wooden roof would have been built prior to the actual burial. Grave goods were found on the floor pavement inside the grave, covered by a dark brown layer mixed with unburned crushed flint, fragments of sandstone flags and sandstone gravel (fig. 4. Section C, layer 20). This layer must have formed the immediate covering in the grave chamber. On top of this were added three horizontal layers of stones. Perhaps these stone layers were added as a final cover for the grave when the end posts were removed. There was no indications of a mound in connection with the earth grave.

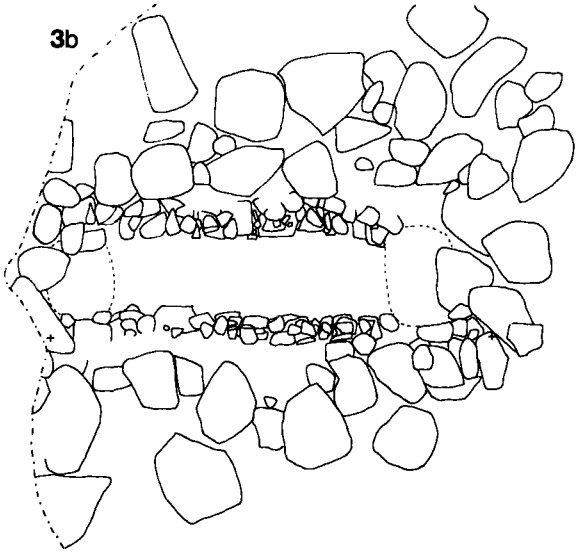
### *Grave Goods*

Grave furnishings were found along the stone wall on the eastern side of the grave (fig. 7.6). At the northern end two clay flasks had been placed together. One of these pots was a collared flask with vertical incised grooves on it's strongly curved bottom. The other flask had similar grooves on the bottom and two lugs at the




neck/bottom transition. Neither of the flasks were decorated at the at the rim (fig. 8).

To the south, two flakes and two blades were found (fig. 7.6). One of these blades and one of the flakes were lightly retouched; the other blade had a regular retouched back. Analysis of the four pieces of flint by Peter Rasmussen of the National Museum showed that only the blade with retouched back had microwear polish preserved. This blade knife showed traces of meat cutting (fig. 9).

No traces were found of the body. Given the position of the grave goods, it was placed along the western wall. In early dolmens the dead are usually placed in surpine position, often with one or two pots near the feet (Thorsen 1980). If these rules were followed at Asnæs, the dead person(s) would have been laid out on their back with the feet to the north and the head to the south. Thus the flint tools would have been placed in the breast region of the body.

Flint flakes were also included in the fill of the post

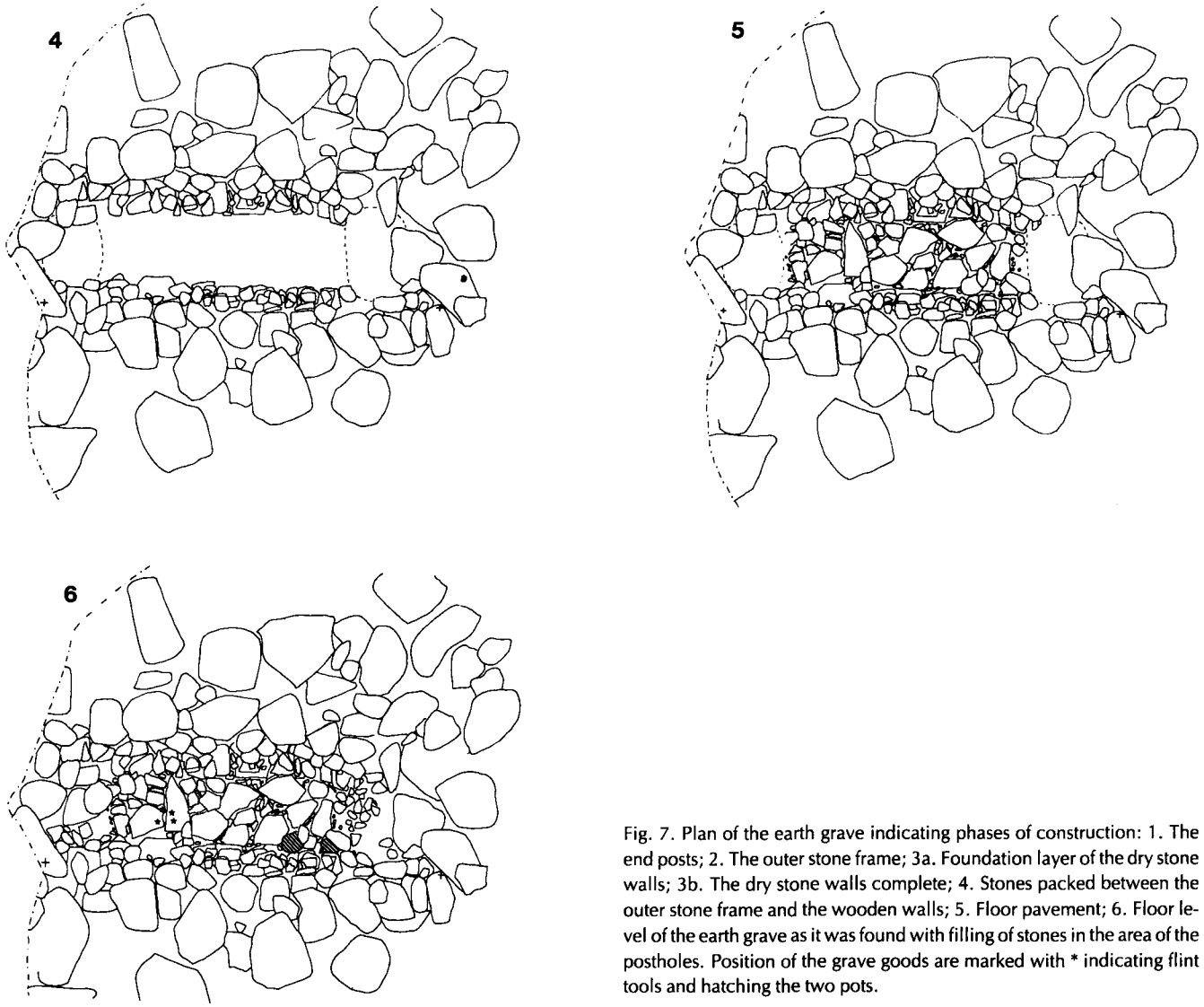



Fig. 7. Plan of the earth grave indicating phases of construction: 1. The end posts; 2. The outer stone frame; 3a. Foundation layer of the dry stone walls; 3b. The dry stone walls complete; 4. Stones packed between the outer stone frame and the wooden walls; 5. Floor pavement; 6. Floor level of the earth grave as it was found with filling of stones in the area of the postholes. Position of the grave goods are marked with * indicating flint tools and hatching the two pots.

holes, together with unburned crushed flint. However, it is unlikely that these flakes should be considered as grave goods. The flint flakes might derive from later flintknapping at the site and could be accidentally mixed with the filling of the holes during the removal of the posts.

*Reconstruction of the Burial Structure*

The stone foundation of the grave was constructed of a heavy outer frame of boulders, low flagstone side walls, and a floor pavement. One or two posts were raised at either end of the grave. Given the depth of the postholes, the posts themselves would have been 1.5–2.0 m above floor level of the grave. The posts would have formed the ends of the grave chamber. The side walls were made of horizontal planks lying on the low flagstone walls and resting against the inner side of the end posts. On the outside the lowest plank was kept in place by a stone packing between the plank and the outer boulder frame. The distance between this stone packing and the posts, as indicated by the well preserved northern posthole, suggests that the planks used were about 0.25 m wide. Ground plan of the chamber measured 3.6 × 1.1 m on the outside and 2.4 × 0.7 m on

the inside. Thus the structure was heavily built and rather long and narrow.

The height of the wooden side walls and the appearance of a possible roof is uncertain. Vertical side walls of horizontal planks might have been raised to the top of the end posts perhaps 2 m above floor level. Any covering would have been a flat roof. It is perhaps more likely that the wooden walls were only partially raised against the end posts. In this case a flat roof might also have been constructed, resulting in a large coffin-like structure with free-standing wooden pillars at either end. It is also possible that a tent-like roof structure was built on top of the wooden side walls by connecting the end posts with a central ridge and leaning planks for the roof against the ridge, as suggested at other sites (Madsen 1972, 1979). However, the horizontal stone layers above the grave suggest that either a flat cover was made for the grave or a tent-like roof was torn down before the grave was covered by stones. The solid ends covering the full width of the interior of the grave likewise suggest a rectangular, rather than a tent-like, structure.

Most likely the grave at Asnæs was constructed as a low coffin-like chamber with freestanding wooden pillars at either end. Access to the chamber would have been possible from either the sides of the roof. The boulder frame around the chamber would inhibit possible entrances from the side. Thus the chamber might have been left open on top as long as access to the dead was desired. After a certain period of time, the end posts were removed and the grave closed almost forever by a stone cover.

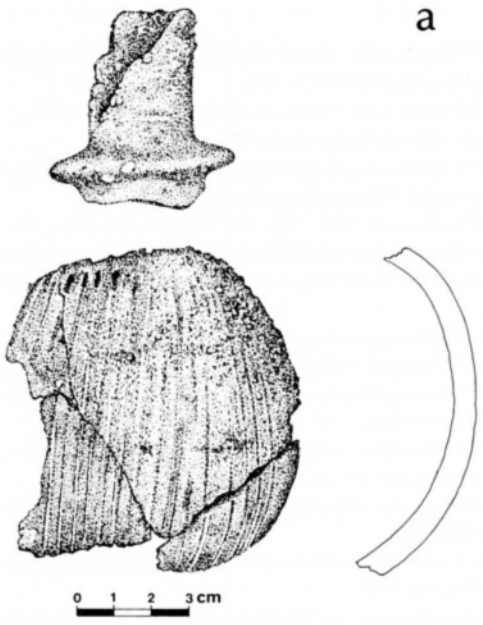
*Conclusion*

The Asnæs grave is an example of burial structures which combine wood and stone architecture. It is the first grave of the Konens Høj type to be found on Zealand. Konens Høj structures are characterized by solid ends, formed by posts or rectangular-hewn planks set in deep stone-packed foundation pits, at either end of the burial floor (Madsen 1979: 309). By comparison with graves where large triangular megaliths constituted one of the gables, a tent-like structure has been suggested with side walls leaning against a central ridge supported by the gables. Access to the chamber likely would be through an opening in the side. These selfsupporting wooden structures are sparsely furnished with stones. The structures are deliberately destroyed, usually by fire. In some cases, however, the posts were removed and the structure itself torn down. Most of the pottery found in the Konens Høj burials belong to the megalithic C-style. Radiocarbon dates from Hejring with a mean value of 2655 ±100 b.c. suggest a date late in Early Neolithic TRB at the transition to MN I for this type of structure (Madsen 1979). A similar date for the Asnæs grave is suggested by the shape and decoration of the two clay flasks (Becker 1947, Ebbesen og Mahler 1980, Madsen og Petersen 1984).

Construction of the Asnæs grave is unique in the combination of the Konens Høj type layout with a heavy stone structure and a delicate floor pavement. After erecting the end posts an outer frame of boulders was built around the chamber area. The chamber itself was constructed with a stone foundation of low dry stone walls and a floor pavement and with a wooden superstructure of vertical sidewalls partially raised against the end posts. The wooden structure itself seems more massive than those found at other sites of the Konens Høj type. Also, the Asnæs grave seems to have a coffin-shaped chamber with freestanding wooden pillars at the ends rather than a tent-like superstructure. No indications of a facade was found with the grave, but it might have been removed by the sea like the rest of the dolmen to the south of the grave. The wooden superstructure was destroyed by removing the end posts and no traces of fire was found in relation to the grave itself. However, a few concentrations of charcoal near the grave suggest some use of fire at the site. Graves of the Konens Høj type are usually placed longitudinally in a mound. No trace of a mound was found with the grave at Asnæs, only two or three layers of stones were applied as a cover. Both the stratigraphy and the asymmetrical location of the grave in relation to the mound indicate that the long dolmen north of the grave was added at a later stage.

The Asnæs grave is an example of the overlap in the types of earth graves (Thorvildsen 1941, Madsen 1979). Local differences might be involved, but to date little is known about earth graves on Zealand. In case of the Asnæs grave, the availability of raw materials such as the red sandstone flags and the stones and boulders along the seashore could have directly influenced the final appearance of the structure.

Several aspects of the construction of the grave at Asnæs recall similarities with megalithic chambers. Boul-



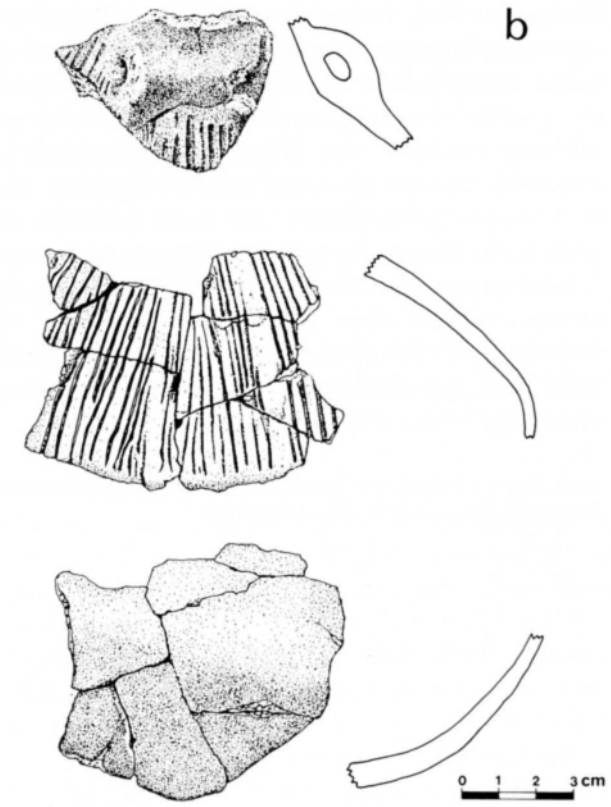




Fig. 8. The two vessels, a collared flask (a) and a lugged flask (dolmen flask) (b) found in northern end of the grave. Both vessels were decorated with vertically incised lines on the upper part of the belly arranged in a continuous row at the collared flask and in groups on the lugged flask. (Drawn by Kurt Petersen) 1:2.

ders used in the outer frame and to support the posts were almost of megalithic size. The floor pavement and the dry stone walls are elements normally included in megalithic tombs. Combined wood and stone structures such as the Asnæs grave emphasize the similarities between megalithic and non-megalithic chambers (Kjærum 1971, Madsen 1979). The layout of the burial itself with pottery in one end and flint tools at the other – as well as the inclusion of clay flasks typically found in Zealand dolmens – also implies a parallel between the two types of chambers (Thorvildsen 1941, Becker 1947).

The distribution of Early Neolithic earth graves has exhibited a clear concentration in Jutland (Thorvildsen 1941, Madsen 1979). Earth graves found in recent excavations at Lindebjerg (Liversage 1980) and Onsved (Kaul 1988) on Zealand, however, suggest that this pattern might be the result of archaeological research strategies. Megalithic chambers are more easily recognized during survey and excavation. Often these chambers are the only part of the monument that has

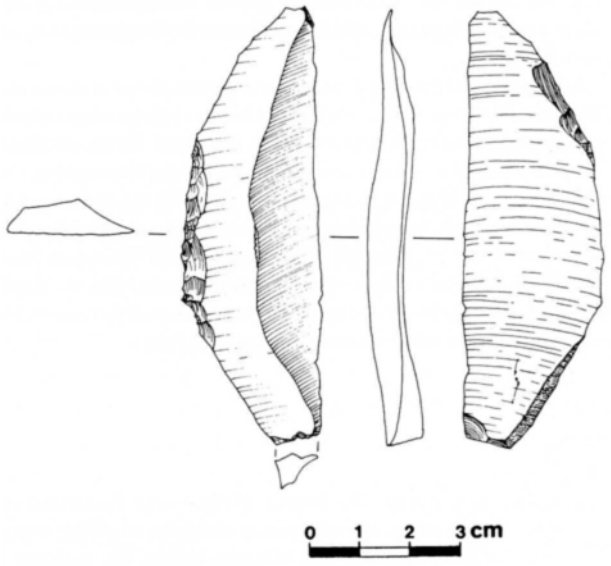



Fig. 9. Blade knife showing microwear after meat cutting. (Drawn by Kurt Petersen) 2:3.

been excavated. Today roughly 3000 dolmens of the early type is known from Zealand. Many of these sites might originally have been built as earth graves prior to more substantial constructions. Thus an earth grave tradition similar to what is found in Jutland may have existed in eastern Denmark before megalithic chambers became predominant. The Early Neolithic earth grave from Dragsholm and the relatively high number of earth graves from Middle Neolithic TRB on Zealand further support this assumption (Petersen 1974, Hansen 1974). Certainly a continuous burial tradition with both non-megalithic and megalithic chambers seem to be evidenced by the Asnæs dolmen.

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I want to thank the owner, Lerchenborg Gods, for permission to work in Asnæs Forskov and Chr. Preetzman for his support on practical matters; Svend Hansen, *Fredningsstyrelsens 5. department,* for his collaboration on excavating and restoring the monument; Peter Rasmussen, Copenhagen National Museum 8. department, for doing the microwear analysis; Kurt Petersen, *Kalundborg og Omegns Museum,* for drawing the illustrations; and finally T. Douglas Price, University of Wisconsin-Madison for revising the final stages of this paper and correcting my English. I am particularly grateful for the assistance provided by Lisbeth Pedersen, *Kalundborg og Omegns Museum,* during the project.

## NOTE

1. Sb. 325, Årby parish, Ars herred, Holbæk amt. Excavated by the author as part of a project for young unemployed people organized by Kalundborg and Omegns Museum during the summer 1986. KAM J. No 1/86; KAM Inventory No 18455. National Museum J. No 520/69.

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Journal of Danish Archaeology vol. 7, 1988, pp 53–69

# *The Long Dolmen at Grøfte, South-West Zealand*

by KLAUS EBBESEN

The region around the Sorø lakes in southwestern Zealand contains a very large number of megalithic graves, especially dolmens. They were already mentioned in the early antiquarian literature (Molbech 1811) and have been an object of interest since.

Thus at the village of Grøfte, which is situated a good 3 km south-west of Lake Sorø (fig. 1), three long barrows lying close together were recorded during the extensive prehistoric monument survey carried out in 1892/1893. Two of them were scheduled for protection as early as 1894, but the third one was considered doubtful and therefore not protected. They lie in a relatively elevated position, on cultivated land but with the woods Treskel Skov and Nyrop Skov to the west and east, respectively.

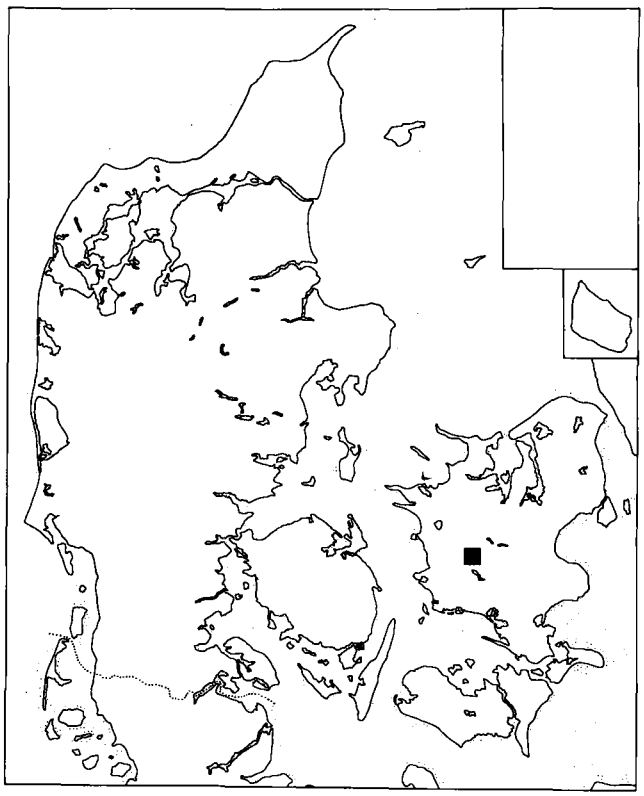


Fig. 1. Topographical location of Grøfte.

In 1946 the farmer was not aware that he was destroying an ancient monument when he began to remove boulders which were constantly impeding ploughing at the spot. In the middle of the oblong ridge, in which guise the barrow now appeared, a very large boulder was encountered. When the farmer dug beneath it, he found that it covered a cavity devoid of soil. The National Museum were informed, and a member of their staff, Harald Andersen, sent to investigate. It was immediately clear to him that it was a question of a ploughed-over long barrow. An investigation was carried out in 1946–47 (1), and revealed that the barrow contained two burial chambers and a stone-setting.

## THE INVESTIGATION

Before excavation, the structure appeared as a NW-SE oriented long barrow, at least 80 m long and 9 m wide. Few of the kerbstones were visible, but during the perambulation of 1893, 5 overturned kerb-stones and two other stones were visible, at least.

### *Burial chamber A*

To begin with, an excavation area was laid out around burial chamber A. The capstone that had been partly exposed by the farmer was surrounded by a packing of head-sized stones, which had, though, to the south-west been removed by him. The edge of the stone packing was in most places highest, so that the packing sloped down towards the capstone, rather like a shallow funnel. It extended down, mixed with a good deal of soil, to the base of the capstone, thus resting in the mound fill where it cannot have been placed until the soil had been cast up around the chamber.

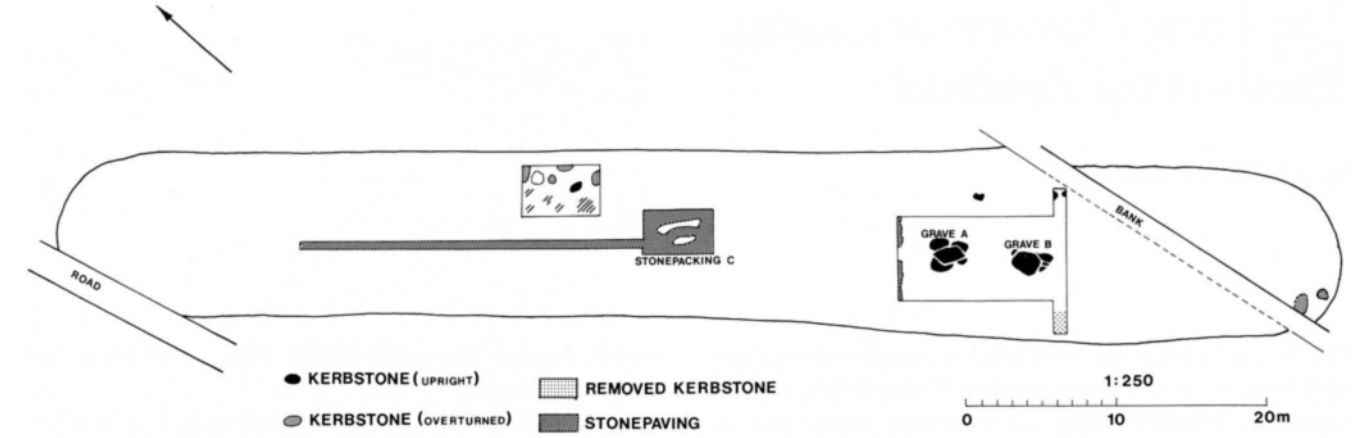



Fig. 2. The long barrow at Grøfte.

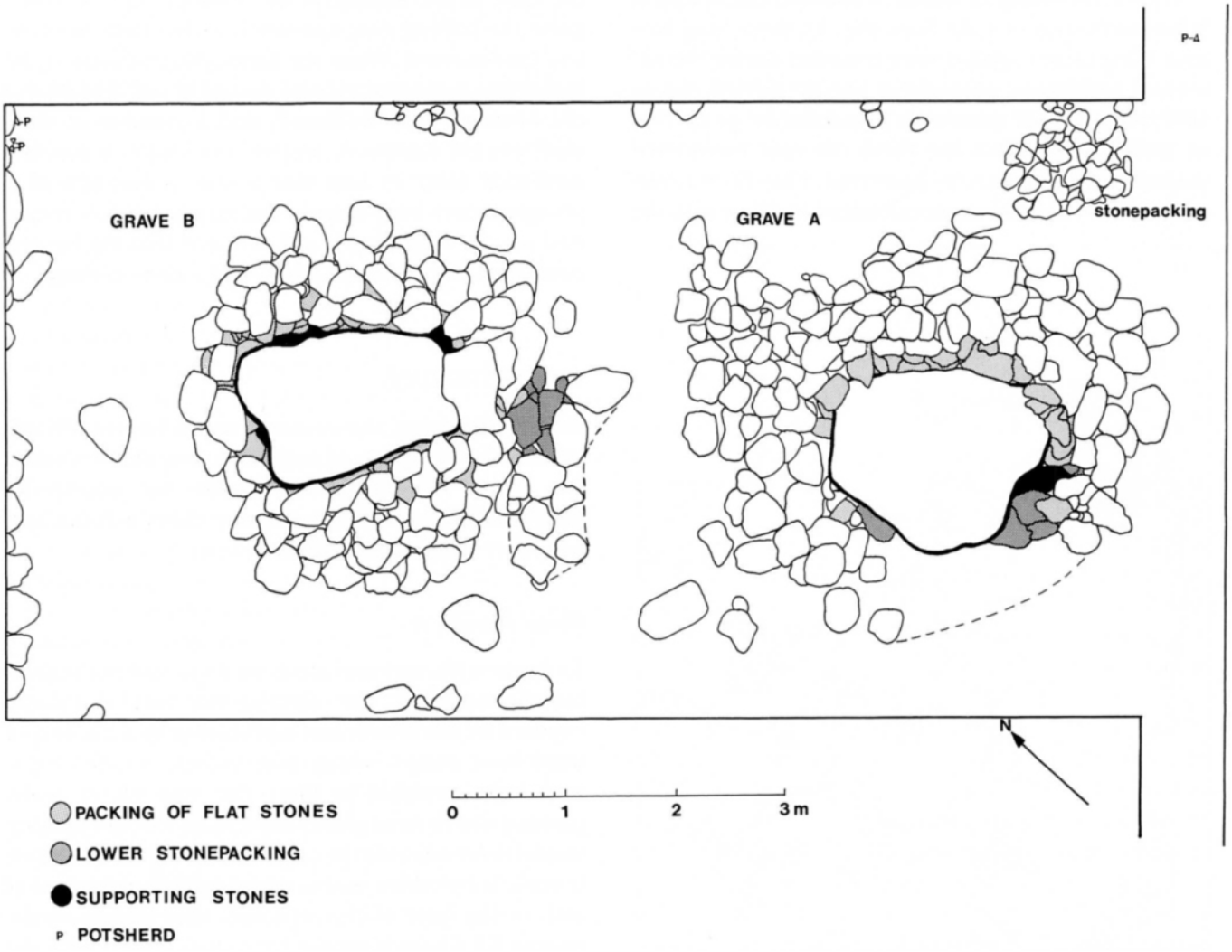



Fig. 3. The two burial chambers from above, before broaching.

Fig. 4. Capstone and upper stone packing of chamber A, viewed from the south-east.

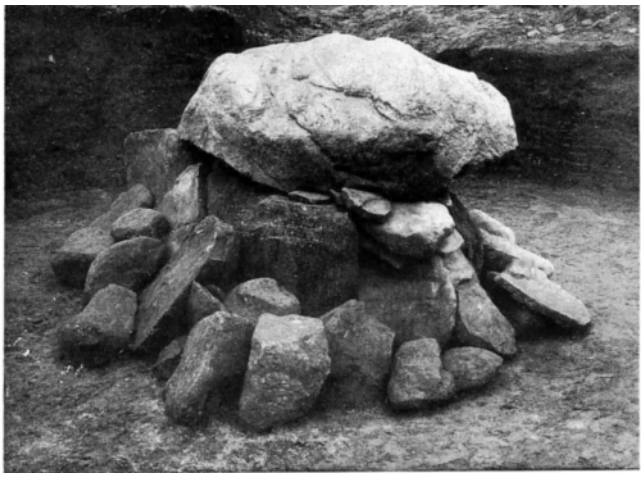


Fig. 5. Chamber A exposed, viewed from the north.

All around the capstone and in the angle between it and the orthostats was a special packing of flat, cloven stone of a reddish kind of rock with marked cleavage. This packing, too, was placed after soil had been piled up around the chamber (figs. 4–5).

Around the chamber, the following strata were observed in the measured sections (figs. 6–7). At the base, subsoil consisting of almost pure sand or reddish-yellow gravel of varying stone content. The orthostats were set into the subsoil and buttressed on the outside with a stack of rocks. On the subsoil rested a c. 15 cm thick layer of grey sand, here and there with pale reddish-yellow sand, obviously the otherwise quite thick topsoil of the Stone Age. At the surface of this layer, in front of the southeastern end of the dolmen, was a layer of charcoal, about 1–3 cm thick. It extended in under the chamber's supporting stones, but above the orthostat foundation trench. A fire must have been lit after the chamber had been erected, but before it had been buttressed on the outside.

The mound fill itself, which lay above the old topsoil, consisted of subsoil gravel. In the area close around the chamber, the excavator thought he could discern two layers: a lower grey to light-reddish layer of almost stoneless, horizontally striped material, and an upper more uniform and heterogeneous layer with only a very few stripes. The by no means sharp border between the two layers was roughly level with the deepest stones of the upper stone packing. In this very border, a large and a small patch of charcoal were seen in front of the dolmen's northwestern end and a patch of red-burnt clay at the southeastern end. It is likely that the line separating the two layers marks the height to which the mound was built before the two top stone packings were added. At this juncture, too, a fire had apparently been lit around the chamber.

Chamber A (fig. 8) was 1.7 m long, 0.8 m wide and 0.9 m high. It was constructed with six orthostats, two on each side and one at each end. The side-stones are inclined and are set in stone-lined foundation trenches. The two northwestern stones are of the same kind of rock and probably parts of the same boulder, cloven specially for the purpose. The capstone had a convex top and flat base. When it was removed, the chamber was found to be practically devoid of soil, only the floor being covered by a 10–15 cm thick layer of intrusive, topsoil-like fill, above which the rim of a lugged flask could already be seen. In several places along the walls of the chamber, furrows were seen, doubtless collapsed mouse runs. Mice had in fact almost undermined the entire burial chamber. Their activity was also documented by the presence of collected acorns and by two very well preserved mummified mice.

The intrusive fill was removed, revealing at the centre of the chamber a more compact surface – the original surface of the Stone Age field. In the northwestern part, a 1–2 cm thick layer of reddish-yellow subsoil material lay above the old surface, spoil from the orthostat foundation trench. This trench was clearly visible all along the wall of the chamber and contained, especially at the

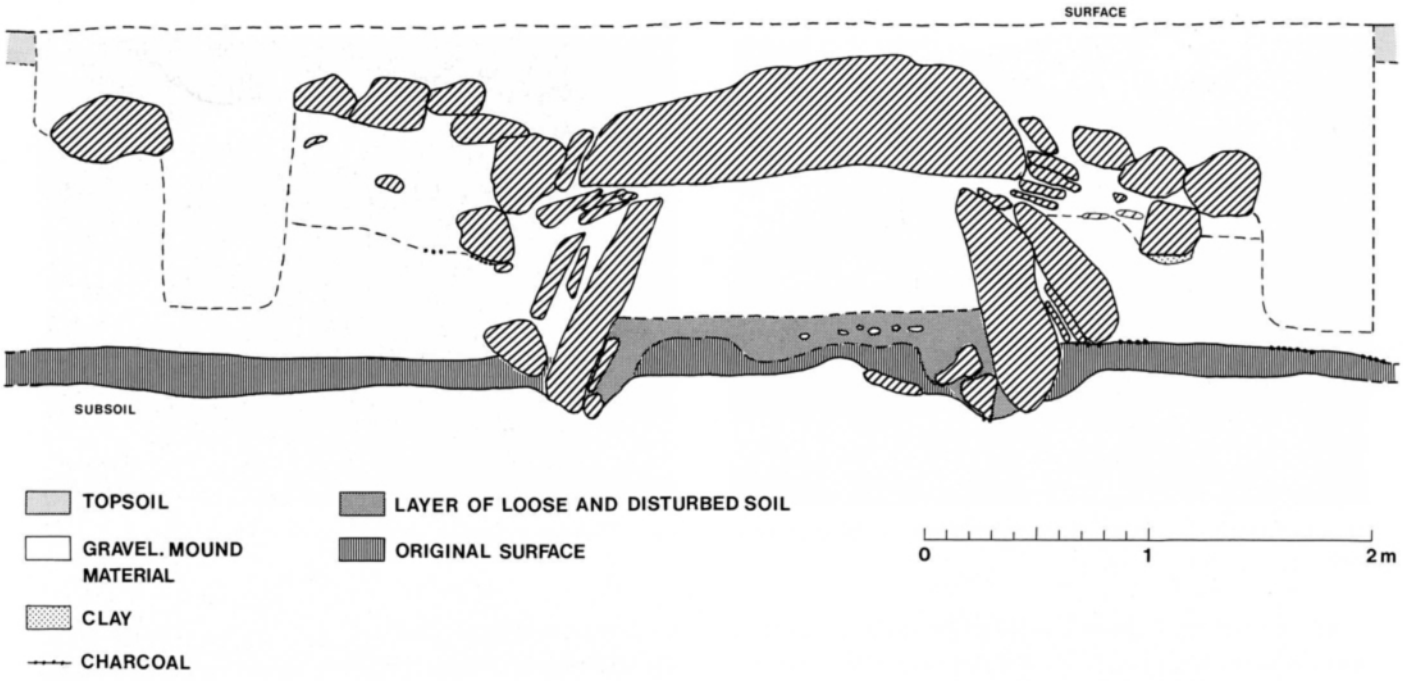



Fig. 6. Longitudinal section through chamber A.

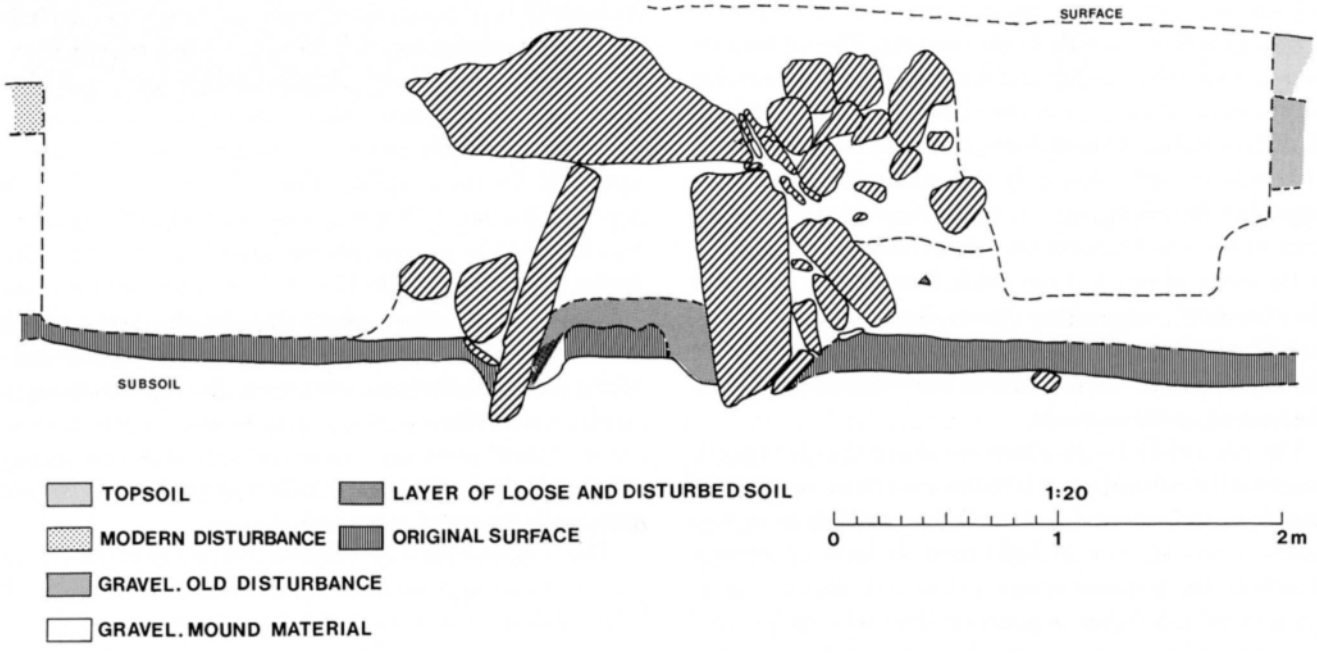



Fig. 7. Cross-section through chamber A.

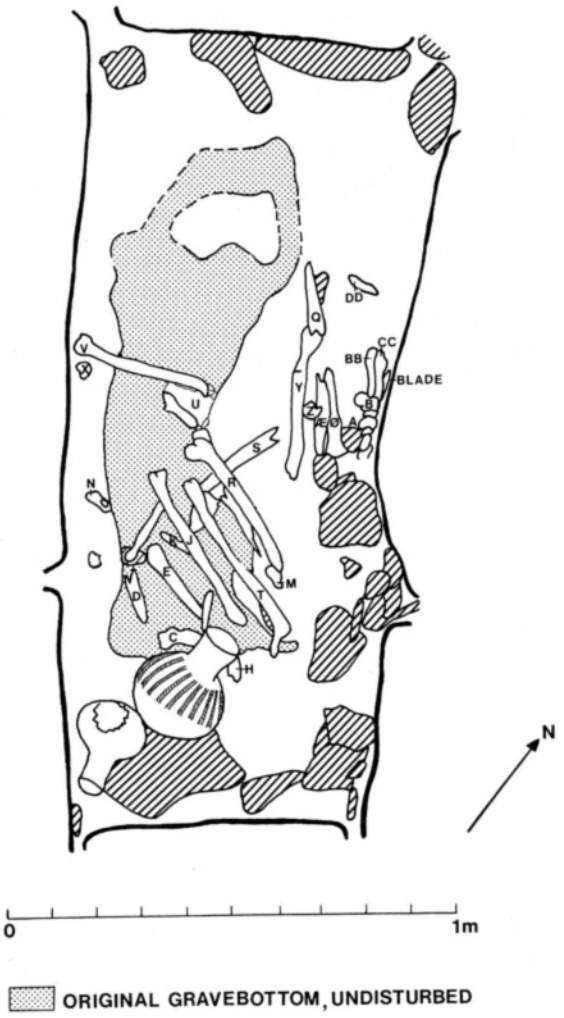



Fig. 8. Bottom layer of chamber A.

Fig. 9. Pots and bones in chamber A.

ends, a number of packing stones to support the orthostats. Here there were also flat, cloven pieces, which had doubtless originally filled the gaps between the orthostats. Many similar stones were found during the excavation in place in the supporting wall construction. The fill in the trench was of the same open consistency as the rest of the chamber fill. As the excavator remarks in his report: this is apparently due to the mice having found it easier to work in soil worked over by the Stone Age people than in the compact soil of the centre.

On the floor of the burial chamber (fig. 9) lay the bones of two human skeletons in total confusion due to the activity of the mice and a fox. At the southern corner of the chamber was a lugged flask, lying on its side. Another lugged flask stood next to it, leaning to one side. It was only partly full of soil and contained a mummified mouse. In this part of the chamber, two undecorated side-sherds were found, one of them under one of the flasks. Near the northeastern wall of the chamber, half a halberd was found, sunk into the orthostat foundation trench.

### *Burial chamber B*

About one metre north-west of this chamber, another burial chamber was exposed (figs. 2–3), almost untouched by the farmer. Chamber B corresponded in construction closely to chamber A (figs. 10–12), but dif-

Fig. 10. Chamber B, untouched, viewed from the wouth-east.

Fig. 11. Chamber B viewed from the south-east. The upper stone packing has been removed, while the lower packing is still in place.

Fig. 12. Chamber B exposed, viewed from the south-east.

fered in certain details. The upper stone packing was not funnel-shaped as in the neighbouring chamber, but sloped down gradually to all sides. It consisted of rounded fieldstones, at the southeast end supplemented by large stone flags. One of these lay in over the capstone, the top of which was otherwise free, without covered edges as in the other chamber. This is undoubtedly due to the fact that a large 20–25 cm thick stone flag of reddish rock had been used for a capstone in this chamber.

In the angle between orthostats and capstone was a packing of flat, cloven flags. Here and there they were supported by rounded stones which were an integral part of the upper packing. Both layers of stone, which had thus been placed simultaneously, rested in mound fill and were clearly first placed after soil had been cast around the chamber up to the middle of the orthostats.

The chamber had a lower supportive casing of large, rounded stones, but the northwestern side-stones were so massive that they needed no support, only here and there a flat stone being inserted to hold them in position. At the northwestern end of the chamber, the supporting stones were shaped like flags, reaching up and forming the foundation for the intermediate stone packing. A similar arrangement was seen at the southeastern end, but here the flags were cased with rounded supporting stones.

The layers of soil around the chamber (figs. 13–14) were essentially as around chamber A. In the original topsoil layer a very few pieces of charcoal were observed south-west of the chamber. The gravel of the mound fill was as elsewhere of varying shape and stone content. The lower layers were generally mostly sandy and often striped. At a level corresponding to the base of the upper stone packing, large and small patches of charcoal were found. In a cavity at the south-west side of the chamber, lying directly above the orthostats, there were also pieces of charcoal of varying size. A strong fire must thus have been lit around the chamber after the earth had been thrown up around the orthostats, and presumably after the capstone was placed, but before the mound was covered with the upper stone packings.

Chamber B is 1.7 m long, 0.8 m wide and 0.8 m high. The orthostats are inclined towards the middle of the chamber and are set in stone-lined foundation trenches.

When the capstone was lifted away (fig. 15), the floor of the chamber was seen to be covered by a thin layer of

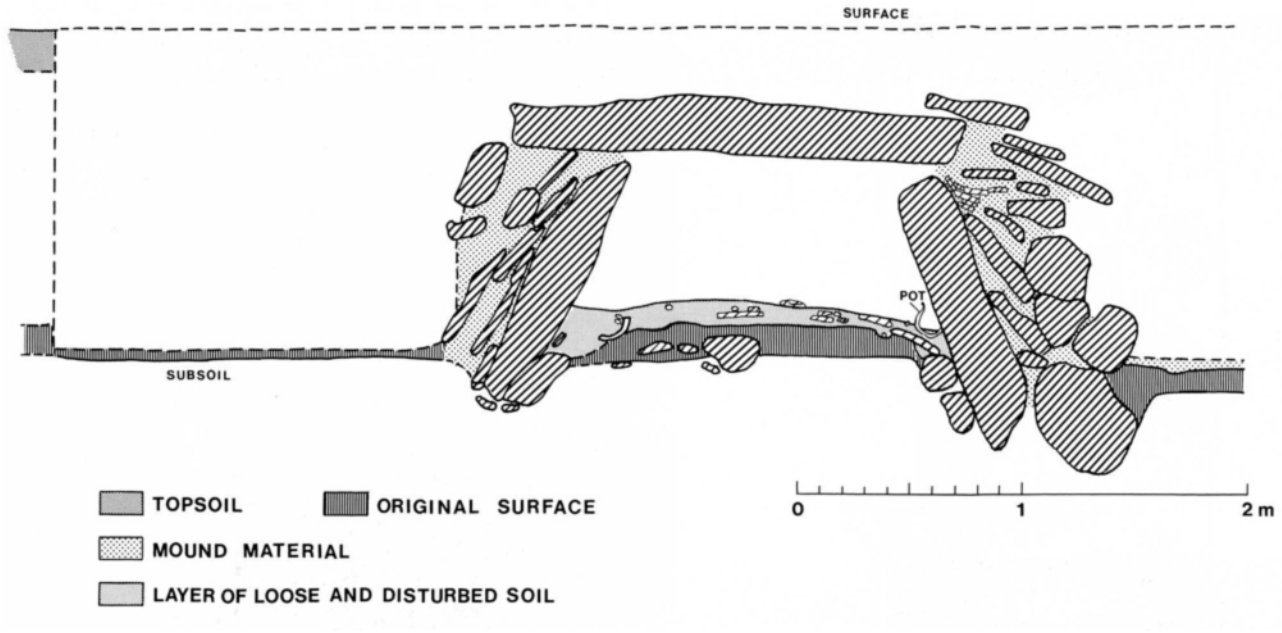



Fig. 13. Longitudinal section through chamber B.

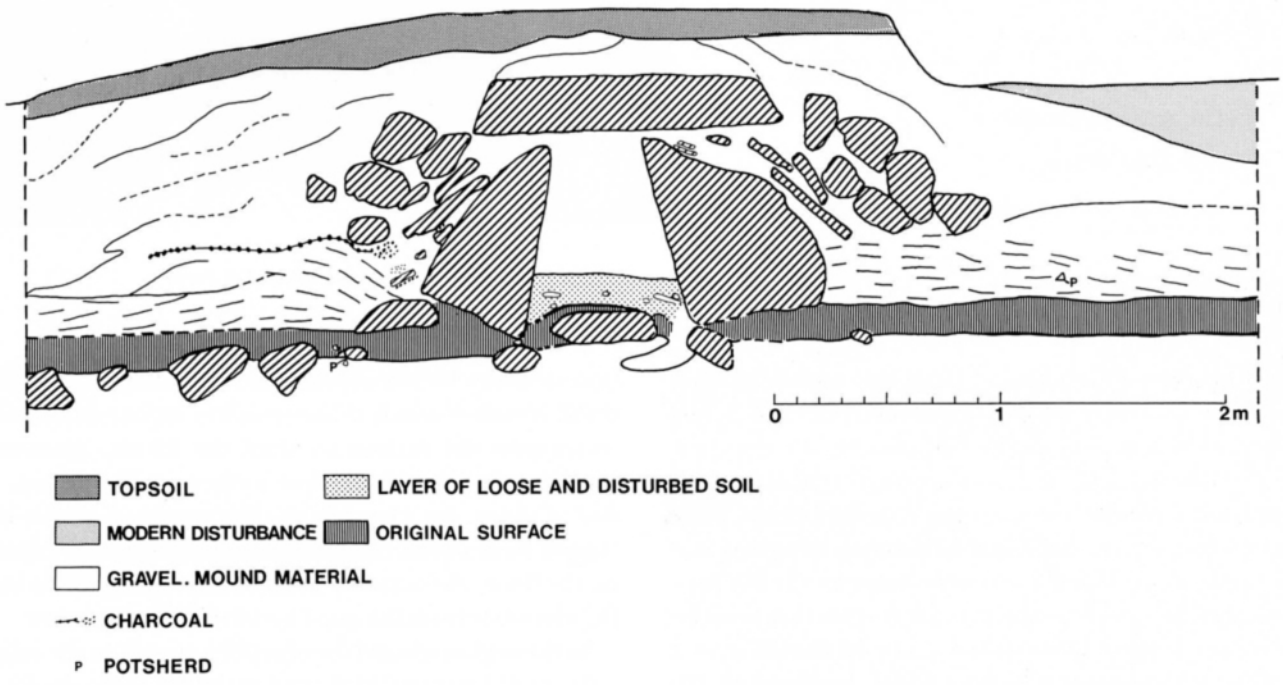



Fig. 14. Cross-section through chamber B.

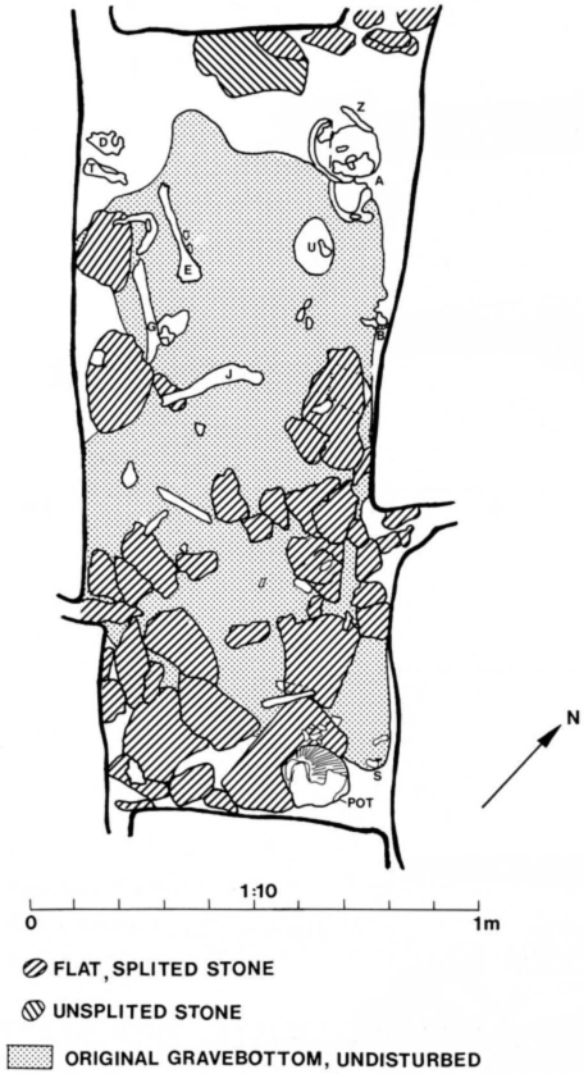



Fig. 15. Bottom layer of chamber B.

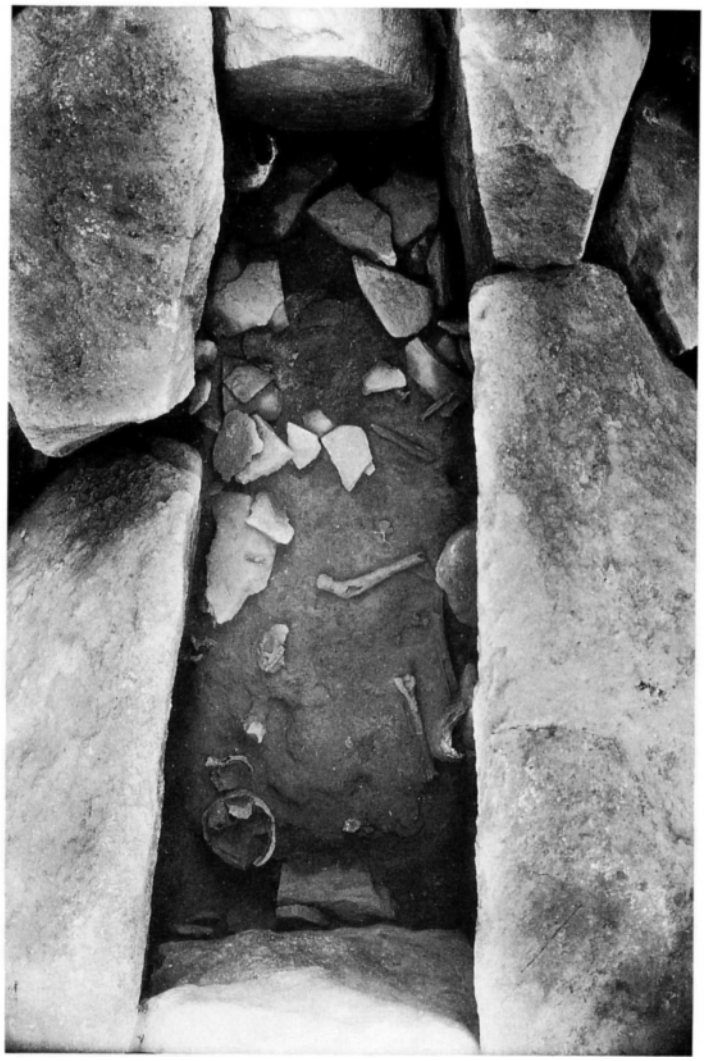


Fig. 16. Chamber B after clearing, seen from above.

loose intrusive fill. A lugged flask was visible; a skull could be discerned at the northwest end and a few bones lay on top of the loose fill, presumably the work of mice. The subsequent investigation revealed parts of a skeleton scattered all over the chamber floor. They also lay down in the orthostat foundation trenches, and one tooth lay outside the chamber between the flat supporting stones at its northwest end; its position must be due to the activity of the mice. Loose in the fill were a few pieces of charcoal. The floor of the chamber (fig. 16) consisted of the grey Stone Age topsoil layer, surrounded by loose soil along the sides; obviously foundation trenches for the orthostats. A number of large and small rounded stones in the trenches apparently served to support the orthostats from the inside. Scattered over the chamber floor were numerous flat stones. A few of these, for example the flat stone on which the lugged flask stood, could have been deliberately placed on the floor; the majority must be drywalling fallen into the chamber from the gaps between the orthostats.

In the region around the chamber, in and on the original topsoil layer and higher up in the fill, some sherds of a whetstone were found (fig. 27).

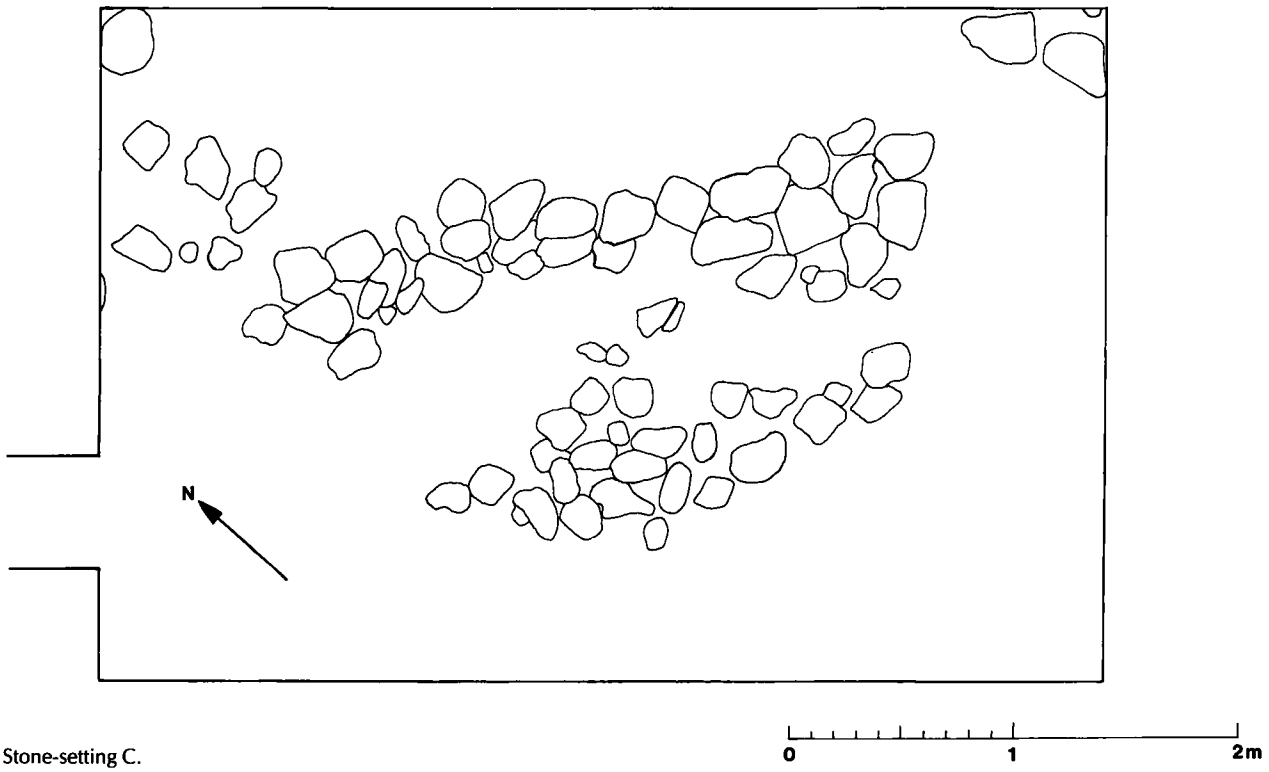



Fig. 17. Stone-setting C.

*Stone-setting C*

Along the crest of the barrow, a sounding trench, ½ m wide and a good 25 m long, was cut, revealing near the middle of the barrow a collection of head-sized stones. Around this an excavation area of 4.5 × 3.0 m was laid out. Here, two elongated, largely parallel stone-settings were exposed, the southwestern one being almost horizontal and the other sloping in towards the centre of the mound (figs. 17–18). The setting had possibly earlier been disturbed by fieldwork. In the middle of the mound, under this stone-setting, a patch of charcoal, a flint blade and the sherds of a funnel beaker were found. The excavator remarks that the patch of charcoal sloped in the same direction as the earth layers above the setting and assumes that there may have been a pit at this spot (fig. 19). The very carefully documented stratigraphy (fig. 20) should probably be interpreted as a collapse of a grave lying beneath the stone-setting.

Here and at other spots in the barrow, a bottom paving was observed, resting directly on the original topsoil layer (fig. 22). It seems to occupy all the northwestern and central part of the mound. It was not seen around the chambers, but stops apparently abruptly at a line crossing the barrow just in front of chamber B, in the northwestern corner of whose excavation it is also seen.

Fig. 18. Stone setting C, viewed from the south-east.

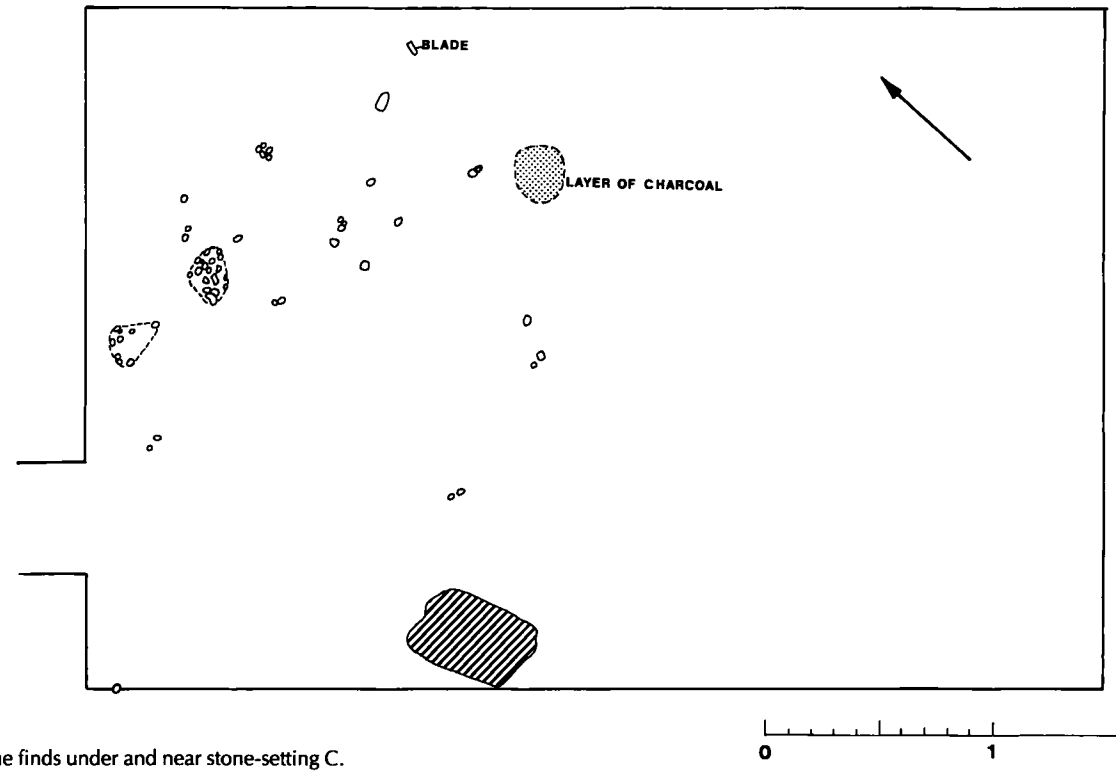



Fig. 19. The finds under and near stone-setting C.

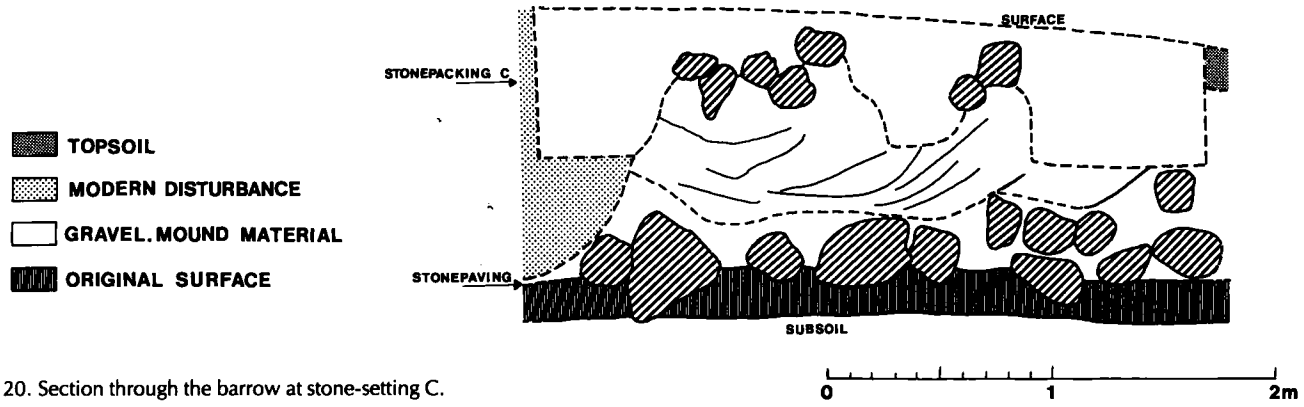



Fig. 20. Section through the barrow at stone-setting C.

*Stratigraphy*

In general, the stratigraphy of the barrow is as follows: at the bottom the reddish subsoil; above this the greyish gravel of the original topsoil; and above this the barrow itself with gravel fill of varying coarseness and colour, and more or less striped. Only near the chambers was any separation in the fill observed, to suggest that it had been thrown up in several stages (figs. 21–22).

*Kerb-stones*

Bordering the northeast side of the mound, a row of six kerb-stones was exposed, five of them fallen out.

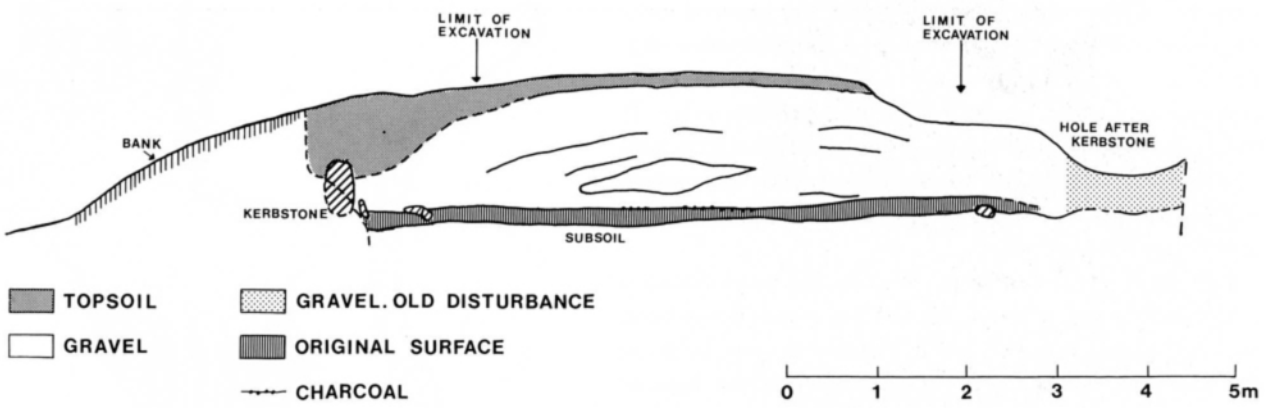



Fig. 21. Cross-section of the barrow.

Around them were numerous fist- to head-sized stones (fig. 23), possibly the remains of a more continuous layer, placed on the barrow foot to retain the fill. Further to the south-east on the same side of the barrow, three more kerb-stones were found. At the southeastern end of the barrow, two of the kerb-stones lay overturned and visible above ground. In general, the kerb-stones are small, but the farmer furnished the information that some of those he had split had been considerably larger. A stone at the northwestern end of the barrow had been called the Princess Stone, because tradition had it that a princess was buried under it.

After the investigation, the long barrow was restored and scheduled for protection, and can still be seen.

## CONSTRUCTION AND FINDS

When the Grøfte long barrow was excavated in 1946, nobody knew how complicated the history of the construction and destruction of the megaliths usually is. Interest was as a rule centred on the stone chambers, the mounds themselves and area around them being seldom investigated. A number of questions which would today be asked as a matter of course during the excavation of a long barrow could therefore naturally not be answered when the Grøfte barrow was investigated.

The finds under stone-setting C are thus probably the oldest. One may imagine that an earth grave or

Fig. 22. Bottom stone layer in the northwest wall of the excavation.

Fig. 23. Stones and stone concentrations around the kerb-stones, seen

wooden construction was built here. As grave goods, the deceased received a blade and a funnel beaker (fig. 24). The latter is a typical C-beaker with vertical belly striping and short applied fillets on the rim edge. It dates the presumptive earth grave – and first structure – to Early Neolithic C. It has been covered by an earthen barrow at least 40 m long, at the base of which was constructed a stone paving.

Later in Early Neolithic C, the mound was extended to the south-east, where 2.5 and 7.5 m respectively from the old mound foot two burial chambers were built on the old field surface. The stratigraphy of the barrow suggests that they both derive from the same building phase, although they were not necessarily exactly contemporaneous (cf. Liversage 1983: 5ff.).

Both the man-sized cist-shaped chambers have roughly the same orientation in the mound and are thus so-called parallel chambers (Aner 1963: 9ff.). In chamber A two men were interred: an adult and a young person aged between 15 and 25 years (Bennike, this volume). Each took with him in the grave a lugged flask placed at the southeast end of the chamber. The flasks differ slightly and thus hardly derive from the same pottery firing. They are both decorated at the top of the belly with vertical incised groups of lines, but these alternate on one of them with vertical rows of short strokes, on the other with vertical plastic mouldings (fig. 25: 1–2). The flasks can be assigned with certainty to the Virum style and date the structure to Early Neolithic C (Ebbesen & Mahler 1979: 11ff.). The grave also contained a whole or fragmented asymmetrical halberd (fig. 25:3). The break appears relatively fresh, but it cannot be decided with certainty whether the halberd was broken before or after deposition. It belongs to a type which should also be assigned to Early Neolithic C (Ebbesen, in preparation).

In all probability, only one person was buried in chamber B: a middle-aged woman (Bennike, this volume). She was buried with her head at the northwest end. A lugged flask was placed at the southeast end. All round the top of the belly, the flask is decorated with vertical incised lines. It can be assigned with certainty to the Virum style of the Early Neolithic C (Ebbesen & Mahler 1979: 11ff.).

Around each chamber, a strong fire has blazed in connection with the burial, before the extension of the barrow was completed. The new barrow was made considerably higher than the burial chambers. From the top of the barrow it was thus possible to look down on the chambers' capstones through stone-lined shafts.

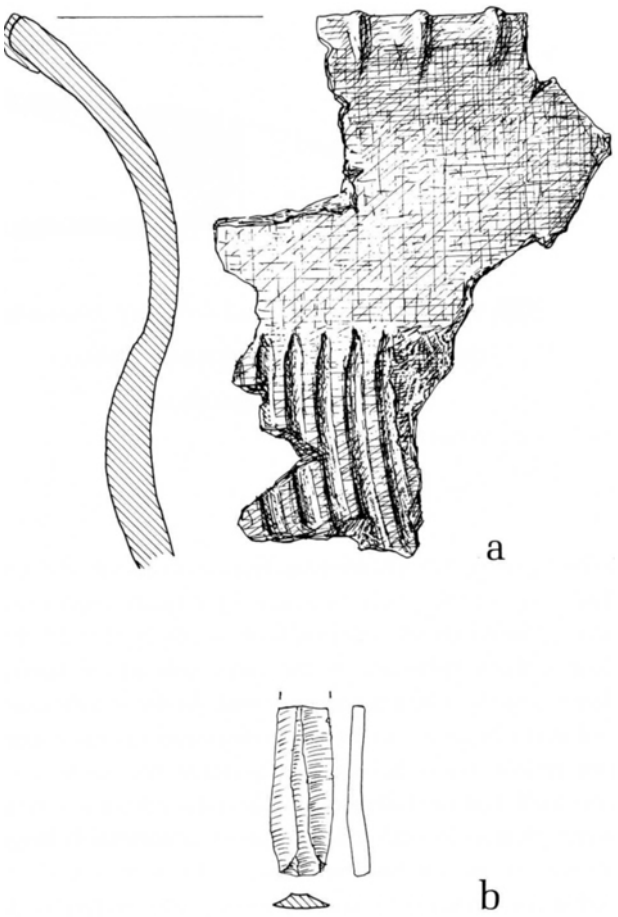
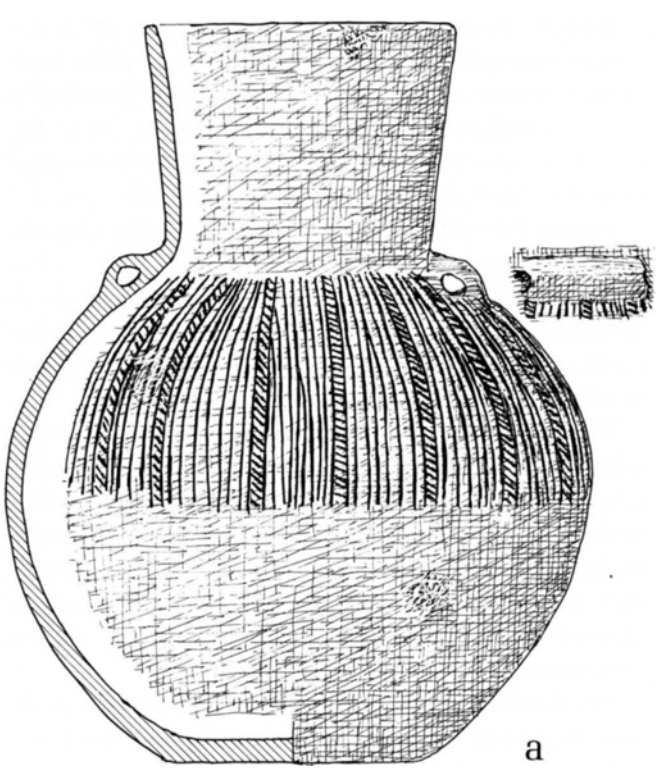



Fig. 24. Funnel beaker and blade from stone-setting C. 2:5. H. Ørsness del.

## DISCUSSION

The Grøfte long barrow is a typical Danish long barrow. Unlike the majority, it is in quite an elevated position in relation to the surrounding terrain and some distance from the big Lake Sorø. Typically, however, it is not alone, but close to and on the same contour as two other long barrows. In 1982 another long barrow was observed in the group.

One of the long barrows is found immediately east of the one described (fig. 28). It is oriented NW-SE and is about 31 m long and 8 m wide, but the southeastern end has been disturbed. 32 kerb-stones remain, some of



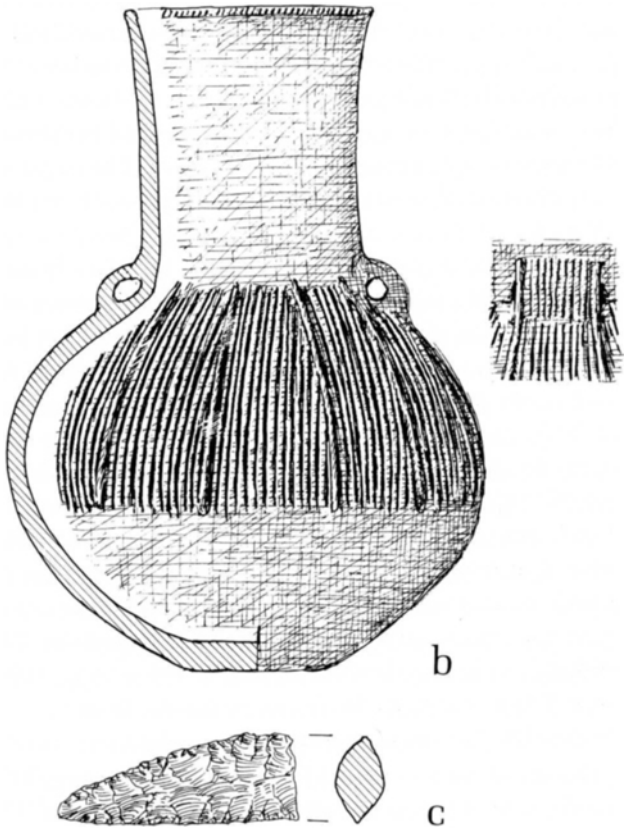




Fig. 25. Grave goods from chamber A. 2:5. H. Ørsnes del.

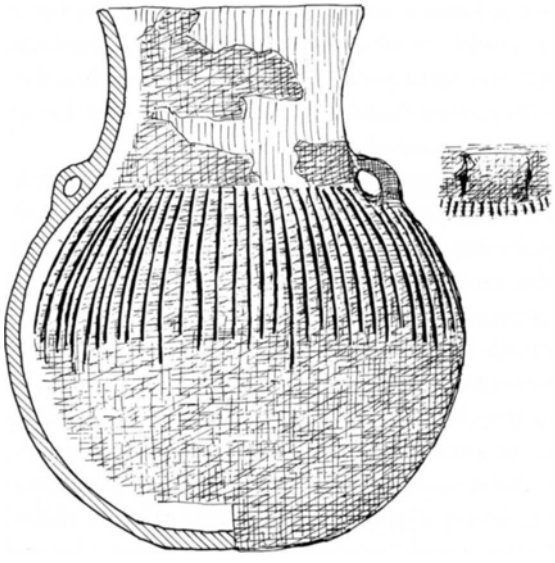


Fig. 26. Grave goods from chamber B. 2:5. H. Ørsnes del.

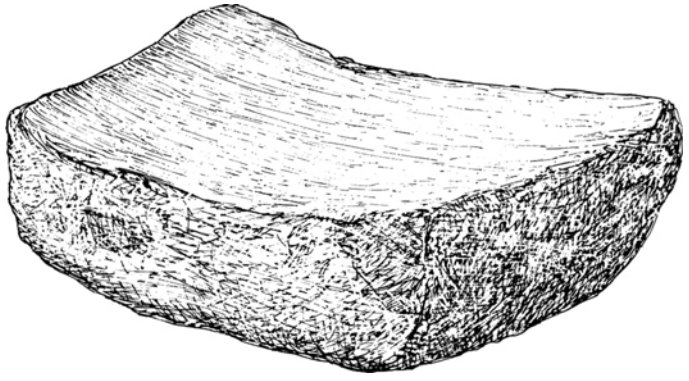


Fig. 27. Whetstone from the barrow.

them overturned. Along the crest of the barrow, two chambers can be discerned, 9.5 and 18 m from the northwest end, respectively, and with the same orientation as the barrow. They are both cist-shaped, and as long as a man. The northwestern one is 1.6 m long, 1.0 m wide and 1.0 m high. Only the two end-stones and a long side-stone in the southwest side are preserved. They are of equal height and stand erect. The capstone lies rolled off beside the chamber. The other chamber is 1.9 m long, 1.0 m wide and 1.1 m high. Here, too, the northeastern side-stones are missing, but the capstone is in place. No finds from this structure are known of.

About 40 m south-east of this barrow is another long barrow, also oriented NW-SE. It is about 26 m long, 8 m wide and 1.5 m high. At its foot are 47 kerb-stones, most of them overturned, those along the sides lower than those of the ends, which are about 1 m high. In the middle of the mound and slightly displaced from the centre towards the south-west is a cist-shaped chamber as long as a man (fig. 29). Four orthostats remain; the two short end-stones in NW and SE and one long one on each side. The southeastern stone has slipped out. This chamber is oriented NW-SE and is 1.8 m long, 0.9 m wide and 1.3 m high. No finds are known from it.

This very close proximity of three long barrows is, as mentioned above, typical of the Danish megalithic graves, which are nearly always clumped together. This applies in particular in the areas with many megaliths, for example the area around Lake Sorø.

The shape of the long barrow is not particularly remarkable. Long barrows from Early Neolithic C are known by the thousand all over the country, usually marked off with a row of metre-high kerb-stones, as at Grøfte.

The long barrow was investigated at a time when complete barrow excavations were a rarity. From the very beginning of megalith study, interest centred mainly on the stone-built chambers and their finds. Not until recent years has there been awareness that the long barrows may have a complicated and long building history, and that in addition to stone-built structures, they may also house wooden constructions (Madsen 1971: 127ff.; idem 1974: 24ff.; idem 1979: 301ff.; Jørgensen 1977: 7ff.; Rønne 1979: 3ff.; Liversage 1980: 85ff.; idem 1983: 5ff.; Kjærum 1977: 19ff.). It is not always possible, even in modern investigations, to acquire a proper understanding of these structures (Fisher 1975: 29ff.), and the misinterpretation of the so-called houses at Barkær, Djursland (Glob 1949: 5ff.; 1975: 10ff), is a classic example. It is now clear, however, that large grave structures could in Early Neolithic C be built in wood as well as in stone (Liversage 1983: 5ff.). The oldest wooden structures are moreover probably older than the oldest stone dolmens (Nielsen 1984).

During the exacavation of the Grøfte long barrow, the excavator was unable to explain stone-setting C. Nor has the present author been any more successful. In all probability, however, we are dealing with a so-called earth grave or other wooden structure, the proper shape of which cannot be determined.

The two stone-built burial chambers belong to a type which is, particularly in eastern and southern Denmark, very common: rectangular chambers as long as a man with two side-stones on each side and a single stone at each end (Aner 1963: 9ff.; Nielsen 1984). Typologically, they are reckoned among the oldest dolmens, but the chronological and chorological variation in dolmen construction has yet to be fully elucidated.

The burial chambers at Grøfte were as intact as the day they were covered, almost without disturbance; only mice, who had gnawed the bones and a fox (doubtless hunting them), had caused a deal of disturbance in the chambers. The good conditions of preservation make the find quite unique. Dolmen chambers, where the primary burials are in place and undisturbed throughout the Stone, Bronze and Iron Ages and historical times are extremely rare.

Unfortunately, the animal activity in the burial chambers had been so great that the original position of the bodies could not be determined. The find does not furnish positive information on the position of the skeletons in the closed chambers, although the skull lay at the northwestern end of chamber B.

A number of other finds from the Early Neolithic C show, however, that in this period the skeletons are always found stretched out on their backs (Becker 1960: 28ff.; Ebbesen 1981: 47ff.; Thorsen 1980: 132ff.). No other treatment of the corpse has been documented (cf. Skaarup 1985: 354ff.), so the bodies in the Grøfte long barrow were probably also stretched out in this way.

The fragmented halberd from chamber A is a very rare piece of grave furniture in the megalithic graves, although a few instances are known (Ebbesen, in preparation (b)), whereas it is common in the dolmen chambers of Zealand with rich grave goods to find a lugged flask at the feet of the skeleton (Thorvildsen 1941: 22ff.;

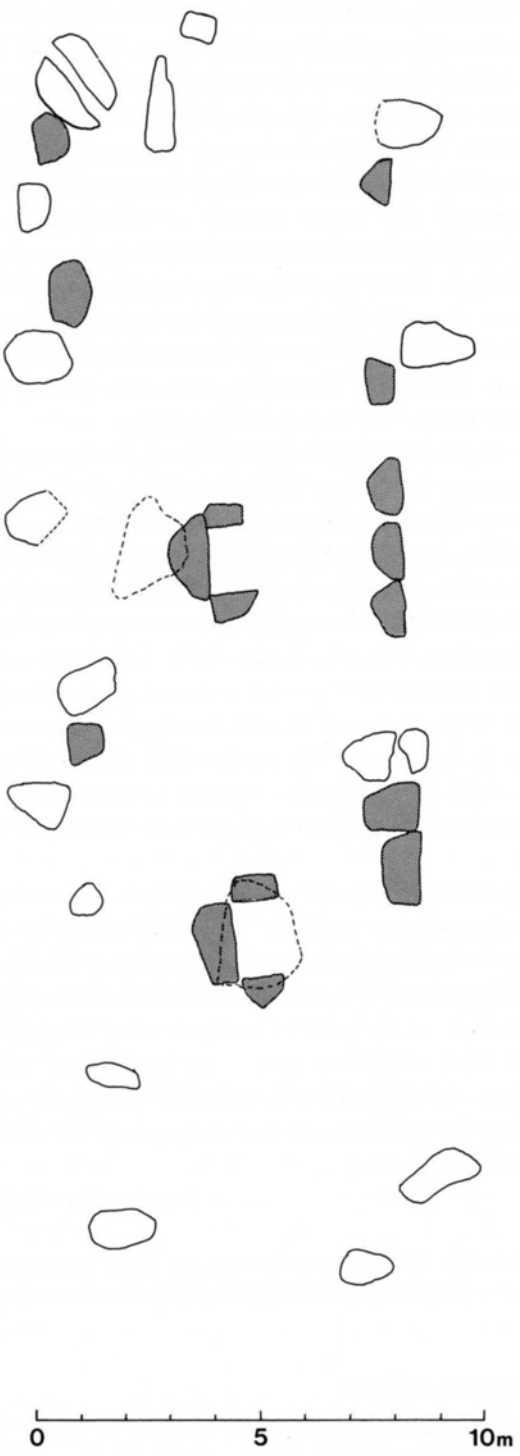



Fig. 28. Long barrow with two chambers, Grøfte.

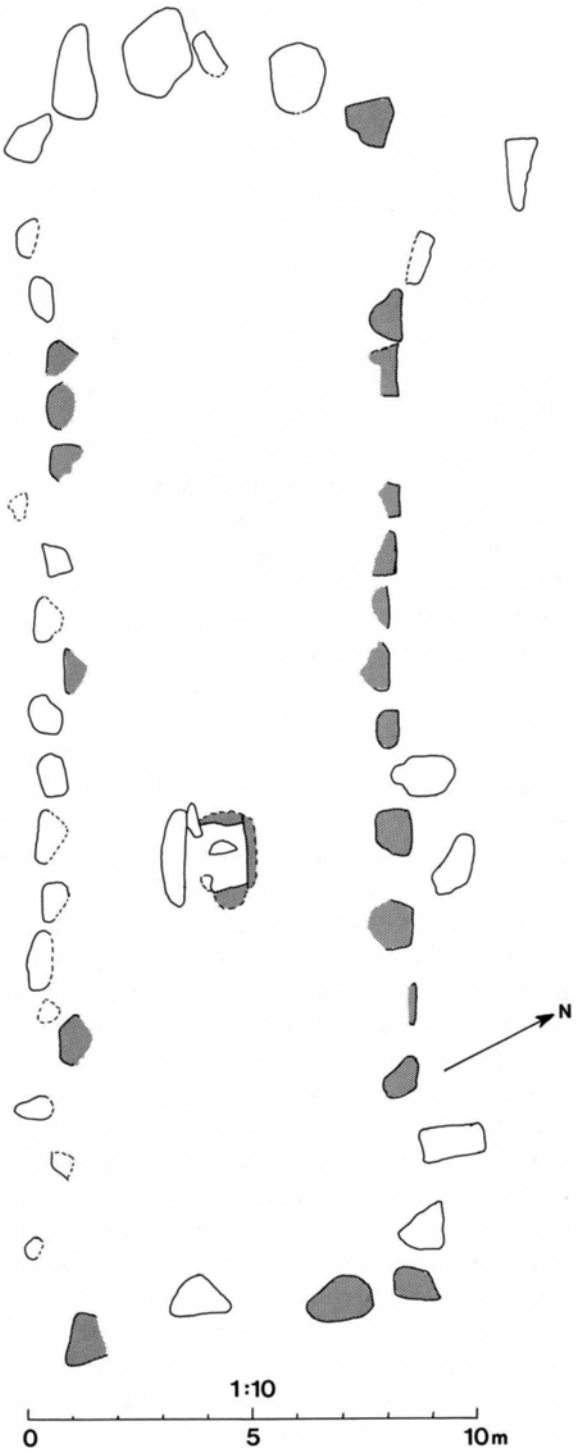



Fig. 29. Long barrow with one chamber, Grøfte.

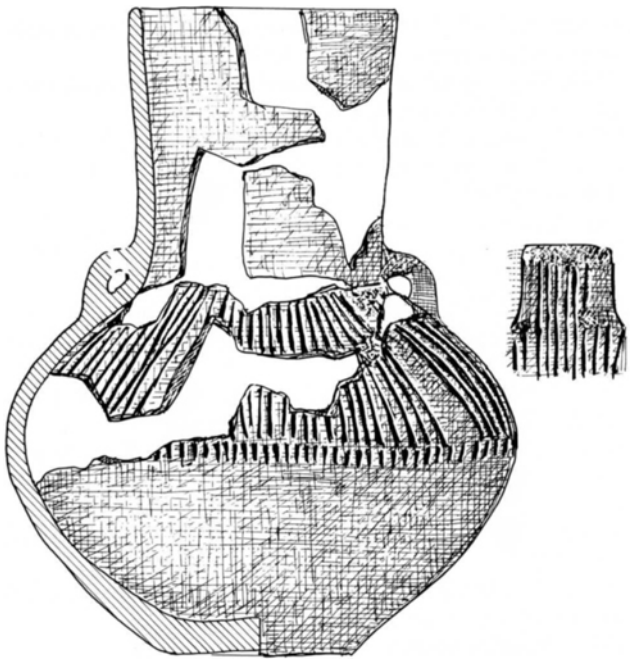


Fig. 30. Lugged flask from dolmen chamber at Brunemose, south-western Zealand. 2:5. H. Ørsnes del.

Thorsen 1980: 122ff.; Nielsen 1984; Ebbesen 1989; Ebbesen in prep. (a)) (fig. 30) (2). It should be emphasized, however, that the commonest burial custom in the early Zealand dolmen chambers was to leave nothing with the dead, or merely a blade.

The well-documented traces of fire around the chambers must also be associated with burial customs or the death cult. At chamber A, a fire had been lit twice, both before the orthostats were raised and after the deceased had been interred and the chamber closed with the capstone. The same probably also applied to chamber B. The building site on the surface of the old field could thus first have been consecrated with a purifying fire. After the interments, but before the construction was finished, the chamber was burned as part of the burial ritual, as was done with some of the wooden structures (Jørgensen 1977: 7ff.; Liversage 1983: 5ff.). Also at the coeval dolmen chamber at Ølstykke (Bahnson 1892: 180), traces were found of a ritual fire, just as traces of grave fires are quite common in the Danish megalithic graves (surveyed Ebbesen 1975: 326, note 32). These dolmen fires are best documented here at Grøfte, however.

The investigation also yielded a number of important architectonic details. It has long been known that the orthostats of the megalithic graves were set into stone-lined trenches; also that in some of the oldest dolmens there was dry-walling between them. Nor was it unknown that the burial chambers were on the outside supported and surrounded by a heap of stones (Ebbesen 1990). The observation of an intermediate heap of stones in the angle between the orthostats and capstone and namely the upper funnel- or pit-shaped stone-packing of the sides of the mound up to the capstone are new details. They must be compared to the so-called entrance pits which more recent investigations have revealed near some of the slightly later dolmen chambers (Eriksen 1980: 37). They have, however, not been seen with the early, closed dolmen chambers.

For understanding the function of the burial chambers among the living, this observation is of great importance. The Stone Age farmers of the dolmen period were able, due to the lining of the hole in the top of the mound with stones, to look down at the chamber capstones, but not in order to disturb the burials or employ the chambers for new burials. The structure was apparently constructed in such a way as to give the living a view of the house of the dead: a communication between the living and the dead which also within later parts of the Funnel Beaker culture seems to have been important to the Stone Age farmers (Ebbesen 1979: 47ff.).

In general terms, the Grøfte barrow must thus be characterized as one of the most illustrative in elucidating early Danish dolmen construction. And it says something about the care with which the investigation was carried out by Harald Andersen that although this find is first presented now – 40 years after the excavation – it still holds new valuable details for understanding the architecture and function of the dolmens in Stone Age society.

*Translated by Peter Crabb*

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## Description of finds

1. An entire lugged flask with smoothed surface, which is damaged in some places; with conical neck, sharp neck-belly transition and flat bottom. At the top of the belly, vertical groups of lines are seen, alternating with vertical rows of short transverse strokes. The line groups are of varying width. At one spot the decoration has been partly destroyed

where the potter has placed his finger in the wet clay, although fingerprints are not visible. The lugs are undecorated. Height 24.5 cm, rim diameter 10.0–10.5 cm, base diameter c. 8 cm, neck height c. 8.5 cm, lug width c. 5 cm. Fig. 25:2.

2. An almost entire lugged flask with smoothed surface. The neck is cylindrical, the neck-belly transition distinct, and the base flat with a smooth transition to the belly. The edge of the rim is slightly thickened and here a horizontal row of short oblique strokes is seen on the outside of the lip. At the top of the belly there are plastic mouldings at almost equal intervals, some of which have fallen off. Between these there is vertical striping. The lugs are c. 3 cm long. Their sides are slightly raised and from these plastic mouldings continue down the belly. The stroke ornament is carried up over the lug itself. Height 22.0 cm, neck height 9.5 cm, rim diameter 8.0 cm. Fig. 25:1.

3. Tip of an asymmetrical halberd, more than 8 cm long. Fig. 25:3.

4. 2 undecorated side-sherds.

5. The greater part of a lugged flask with smoothed surface. The neck is splayed, the neck-belly transition gradual. The base is rounded without a particularly marked standing surface. All the way round the top of the belly there are vertical incised lines. Height 18.0 cm, rim diameter 9.0 cm, neck height 6.0 cm. The lugs are 2.5 cm wide. Fig. 26.

6. 5 undecorated side-sherds, probably from no. 5.

7. Parts of a large funnel beaker with strongly splayed rim and clearly offset neck-belly transition. On the edge of the rim and a little way down the neck are short applied mouldings. The upper part of the belly is decorated with vertical incised lines, very broad and deeply cut. Fig. 24:2.

8. A fragmented A-flake. Broken above. More than 5.6 cm long, 2.2 cm wide and 0.6 cm thick. Fig. 24:1.

9. Fragment of a whetstone, made of sandstone. The working surface is smoothly curved. 28 × 13 × 8 cm. Fig. 27.

10. 36 undecorated side-sherds.

## NOTES

1. The author wishes to convey his warmest thanks to the excavator, Harald Andersen, for permission to publish the find. It is kept at the National Museum, Dept. I, under no. A45.030–45. The excavation was carried out before the radiocarbon method had been developed, so sufficient charcoal is not available for an analysis using methods known at the present day.
2. The lugged flask fig. 30 derives from a dolmen chamber at Brunemomose, Tystrup Parish, Sorø County. The find is mentioned several times in the literature, cf. Thorvildsen 1941: no. 131.

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# *Human Remains from the Grøfte Dolmen*

by PIA BENNIKE

The skeletons from the dolmen at Grøfte in Sorø county, excavated in 1946, derive from the Early Neolithic period (c. 3400 BC) (1). Until excavation occurred, the dolmen had apparently remained undisturbed since it was sealed 5,000 years ago. The two burial chambers also contained artefacts clearly dating them to the Early Neolithic period. Chamber A contained, besides two lugged flasks and half a halberd, 23 identifiable human bones and bone fragments. Chamber B contained, besides a lugged flask, likewise a score of human bones and fragments.

## *Chamber A*

The 23 bones and fragments from chamber A proved to derive from *at least two individuals.*

From both shape and size it was evident that the bones were from two men. One of these was in fact so heavily built that his bones could be isolated on appearance alone. The bones of the two skeletons are marked on the diagrams, fig. 1.

In addition to the 23 identifiable bones and fragments, 3 teeth were preserved, one of them in a piece of the lower jaw. This tooth, -7, was somewhat worn on the occlusal surface. It clearly belonged to an adult person, but the material unfortunately does not allow a more exact age determination. The other teeth consisted of two loose crowns of lower molars, almost without wear. They must have belonged to another person, hardly more than 20 years old. It cannot be decided to which of the two men the teeth belonged, and they could indeed theoretically have belonged to a third and fourth person. It is clear, however, that they come from two different persons, a young person aged between 15 and 25 years and an adult.

## *Chamber B*

20 identifiable bones and fragments were found in chamber B. All were slender, and there was no duplicates of either bones or teeth. This would suggest that only one person was represented, a woman. However, the difference in tooth attrition in the upper and lower jaws was so large, and largest frontally, that it became doubtful whether the two jaws were from a single individual. Both jaws were so slender that they must come from women, and a pronounced loss of teeth in the lower jaw and marked tooth attrition in the upper jaw suggest that they were from a middle-aged women aged between 35 and 55 years. Several specialists have offered opposing opinions as to whether the two jaws were from a single individual. However, after considering the circumstances of the find, the fact that both jaws were from middle-aged females and that the type of attrition showed a mechanical use of the teeth, this author has concluded that both jaws belonged to a single individual.

Several skeletal joints were marked by osteoarthritis and the vertebrae by spondylosis. These bones must also derive from a middle-aged or older individual. All bones from dolmen chamber B have therefore been marked on the same diagram, fig. 1, as belonging to one person.

In the above, it is apparent that at least 3 adult individuals were interred in the two chambers: 2 men in chamber A and 1 woman in chamber B, but both on account of the degree of fragmentation and the position of the bones, it is not possible to decide whether more persons were interred in the barrow.

## *Stature*

Only very few bones were fit for the usual anthropological measurements. Those measurements that could be taken must be treated with a certain degree of caution on account of the poor state of preservation. They will be included in a future survey of all Early Neolithic skeletal finds from Denmark.

The stature of prehistoric man is particularly interesting. The height of the heavily built man from

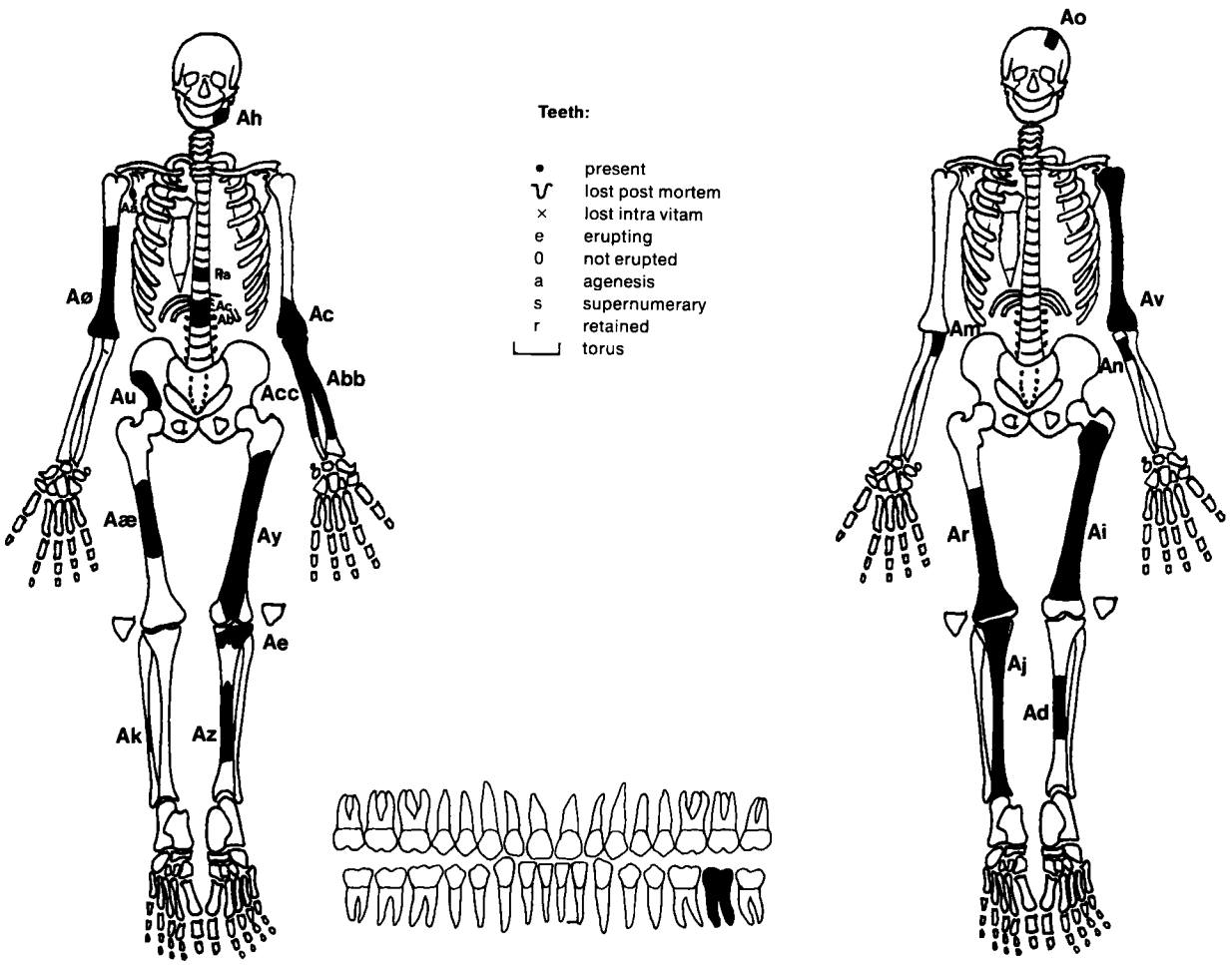


Fig. 1A. Diagram of skeleton with the individual bones from dolmen chamber A marked. The two skeletons both derive from adult men. Of the two detached molars, which cannot be assigned to either of the pair and are therefore not marked, one was from a young adult man, about 20 years old.

chamber A and of the woman from chamber B was in both cases derived from the approximate length of the humerus and femur, yielding an average figure.

Thus the man was quite tall, at least in relation to his contemporaries. He measured about 172 cm, whilst the average height for male Early Neolithic skeletons as a whole is only about 165 cm (Bennike 1985).

The woman from dolmen chamber B, however, does not differ from other Early Neolithic women – at least with respect to height. She would have been about 152 cm tall – the average height of the other female skeletons of the period.

Danish skeletal finds show that male stature gradually increased from the Mesolithic to the Bronze Age, whereas female stature seems to have fallen slightly through the two early periods of the Neolithic, after which it increased at the end of the Neolithic. It should be remarked, however, that the changes in stature in these earliest periods cannot be statistically confirmed, due first and foremost to the limited number of skeletons available for study.

### *Skull measurements*

An attempt was made to measure the length and breadth of the female skull from chamber B, and the measurements obtained, which are attended by some uncertainty, show it to be dolichocephalic, with a cranial index of 71.0. The average cranial index for skeletons from the Early Neolithic is within the dolichoce-

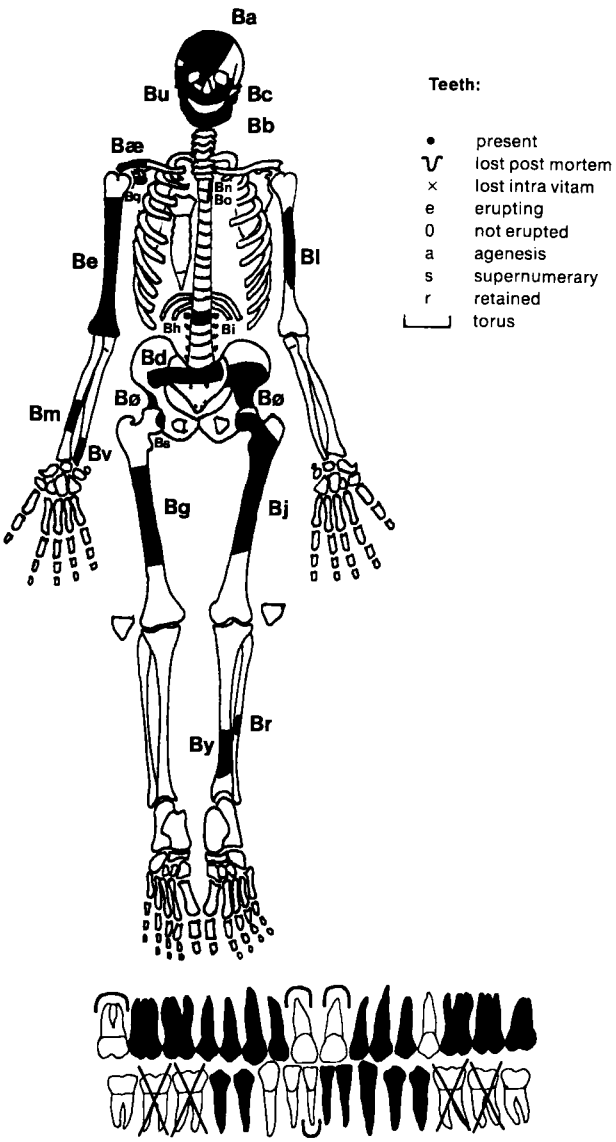


Fig. 1B. Diagram of skeleton with the individual bones from dolmen chamber B marked. All bones derive from an adult woman. There are no duplicates of bones. The dental wear on the two jaws differs so much that it has been doubted whether they represent one or two persons.

phalic category, so also in this respect, the skeleton from chamber B follows the averages of its contemporaries.

There seems to be a tendency for Mesolithic skulls to be shorter than the Early Neolithic skulls (but only mesocephalic). From the Early Neolithic to the Late Neolithic the skulls would again appear to have become shorter (but still only mesocephalic) (Bröste et al. 1956). Not until the Iron Age is there a change to a generally more dolichocephalic shape (Sellevold et al. 1984).

This shows that there have been continual changes in the shape of the skull throughout antiquity, and similar observations have been made with regard to stature.

*Position of the skeletons*

From the excavation report it is evident that the floor of the barrow was undermined by animal burrows. A glance at drawings and photographs from the barrow (Ebbesen, this volume, clearly shows the disturbed position of the bones, without any clear anatomical connection. The question therefore immediately arises of whether the corpses were interred after skeletonization or dismembered. The same question has previously been asked by archaeologists on numerous other occasions, when confronted by a similar picture with disarranged bones, scattered in the many megalithic graves. In the large passage graves with over 100 burials, a few skeletons or parts of skeletons are often found in correct anatomical position, probably having been buried last.

A detailed anthropological investigation of bones from a passage grave on Langeland (Hulbjerg) has provided a partial answer. It showed, namely, that bones belonging to the same person seldom lay far apart, although in incorrect anatomical position. The representation of the different bones also showed that taphonomic circumstances were responsible for the missing bones. There is therefore reason to believe that the cause for the disturbed position of the bones in the passage graves is not that they were interred as bones but that they were pushed aside when a new corpse was to be interred (Bennike 1985).

The explanation is not so simple where the bones from the Grøfte dolmen are concerned. Contrary to the passage graves, there are only a few burials, and there is no suggestion that the corpses were arranged in any particular way. An examination of the individual bones in relation to their position in the barrow was of little help. As far as could be ascertained, only two bones lay in anatomical relationship: the left radius and ulna, which lay parallel with their distal ends in the same rection. The two bones lay along the northeastern wall in chamber A (Ebbesen fig. 9), and belong to the lighter built of the two male skeletons.

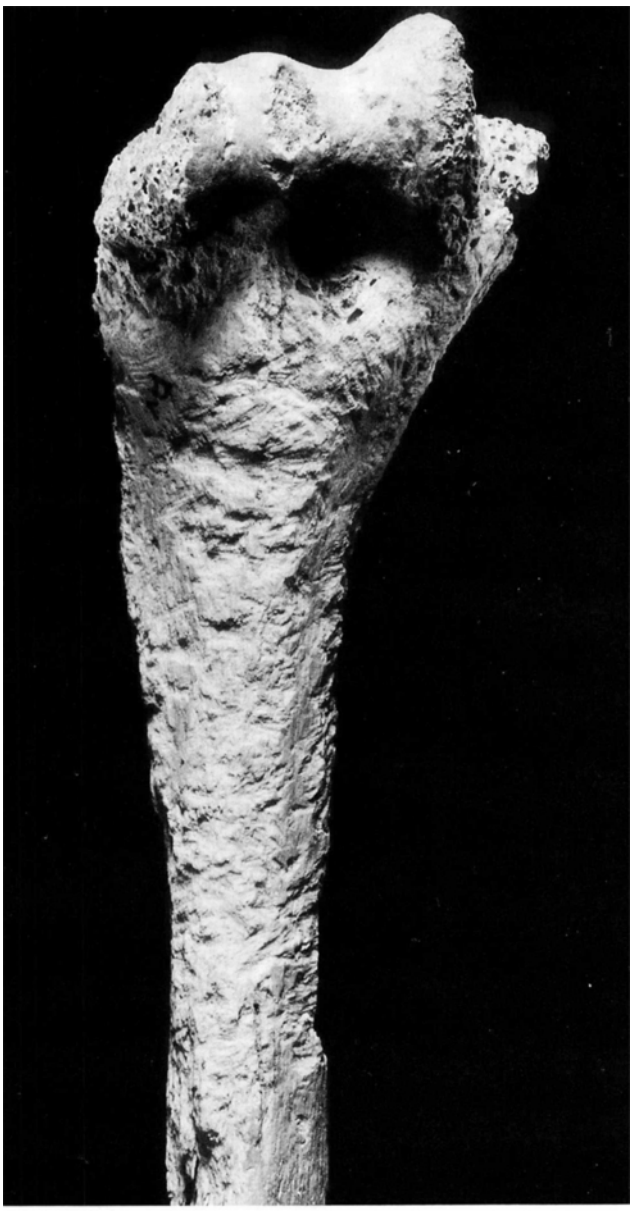

Fig. 2. Numerous "scratches" on the upper arm from Grøfte deriving from the gnawing of mice. Several other bones are similarly marked, suggesting lively mouse activity in the dolmen. This scanning electron exposure reveals traces of mouse teeth much enlarged (× 10). SEM: Lise Fredebo, Royal Dental College, Copenhagen; photo: Lennart Larsen.

From the plan (Ebbesen fig. 9), it looks as if the larger limb-bones were "collected" in the middle of chamber A. A few bones, for example the left and right thighbones of the same person, lay in this group, but this may be due to chance, and it cannot be decided from the plan whether the femoral heads are in the same direction. In chamber B, the lugged flask is at one end and the skull at the other, which is the most usual position, whereas in chamber A there do not seem to be clear traces of how the bodies were originally placed – if indeed they were interred before skeletonization.

Examination of the bones from the two burial chambers did not yield a single foot- and hand-bone or rib. This could suggest that the deceased were skeletonized before interment, and that the relatives gathered the larger bones for burial. But it cannot be ruled out that severe weathering is responsible for the absence of small bones. Examination of the bones from the Langeland passage grave yielded 62% of the expected number of femora, whilst only 28% of the full complement of metacarpals were preserved (Bennike 1985), and all bones from the Grøfte dolmen were much more poorly preserved than the above-mentioned bones from the Langeland passage grave.

A metacarpal bone from an adult is about the same size as the femur of an infant, and it is therefore clear how few interred child skeletons will actually be found, in relation to adult skeletons.

If we for the moment stick to the theory that it is weathering, and neither skeletonization nor dismemberment before interment that is responsible for the absence of certain bones, this still does not explain why the bones are so disarranged.

Scrutiny of the remaining bones shows, however, distinct traces of a lively animal activity in the dolmen, since there are marks caused by mouse teeth, fig. 2. In addition, several bones, including the lower jaw, have deep marks from the canines of a fox, fig. 3 (Aaris Sørensen, pers. comm.). It is quite likely that the small mice were better at destroying or eating the small bones of the skeleton. The energetic animals must have ob-

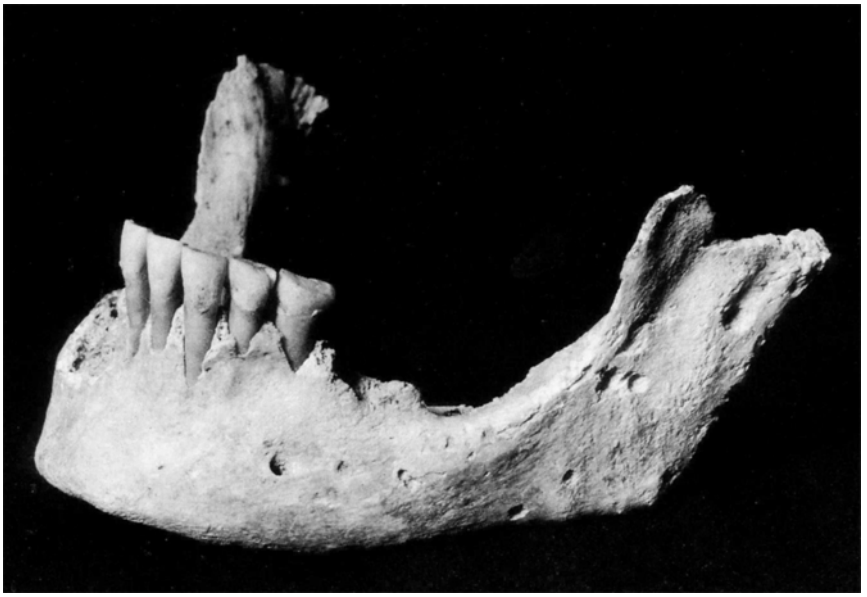

Fig. 3. The almost intact lower jaw from dolmen chamber B is characterized by extensive loss of the large molars. The weak wear on the front teeth is remarkable in contrast to the heavy wear on the upper incisors (see fig. 4). According to zoologists, the many circular depressions derive from the canines of a fox. Photo: Lennart Larsen.

tained from the bones large quantities of calcium, among other things, but whether they were active in antiquity or more recently cannot now be decided.

While there were numerous traces of rodent activity, there were no marks or traces of dismemberment around the articular surfaces. The conclusion must therefore be that animal activity, rather than dismemberment or prior skeletonization, is reponsible for the incorrect anatomical position of the bones.

*Teeth*

*Chamber A*

Chamber A contained 3 teeth in all, and one was, as mentioned above, still in position in a small lower jaw fragment from an adult person. The wear on this tooth was moderate, and there were no signs of dental disease on either tooth or jaw.

The two other teeth, a wisdom tooth from the lower jaw and another 7, were almost without wear, the wisdom tooth in particular exhibiting only a small and very weak wear facet on one of the crown cusps.

The 3 teeth belonged to two different people, presumably the two men whose bones were recovered.

*Chamber B*

Upper jaw. A total of 11 teeth were preserved from the almost intact upper jaw, fig. 4. 3 alveolae were open but without the teeth, which must have been lost post-mortem. This applies also to the two central incisors, but judging from the wear on the other incisors, only root stumps of these teeth would have been left.

One of the pre-molars, a +5, is completely missing. This is either a case of agenesis, i.e. it was never formed or never erupted, or of loss long before death. A neighbouring tooth, a +4, was rotated about 45°. It occupies most of the extra space in the jaw, fig. 5, and is without wear facets on the sides.

There are slight traces of periodontitis and on two teeth, a 4+ and a 3+, there is a small cavity on the distal surface between the enamal and the root, probably due to caries. The wear on the molars is heaviest on the first-erupted (6+6) of which about one third of the crowns is still left on the occlusal surface. However, the pre-molars, canines and not least the incisors, exhibit very marked wear. This is so-called flat wear, but a tendency to concavity may be seen on the occlusal surfaces of the small molars. Almost the entire crown is worn away on the two distal incisors. Unfortunately, the central incisors are no longer present, but judging by the wear on the other teeth, they must have been worn right down to the roots.

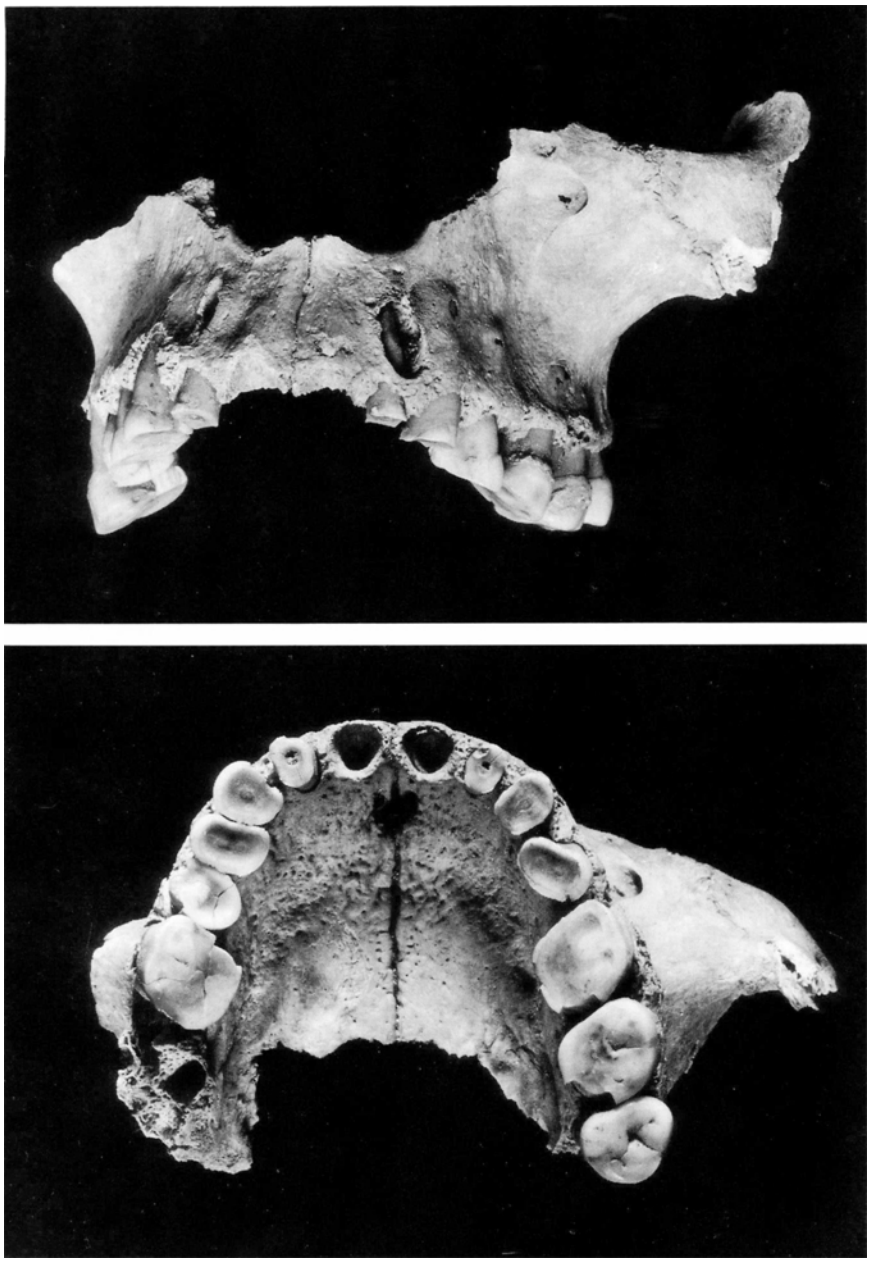

Fig. 4. On the upper jaw from dolmen chamber B dental wear is particularly marked in front, where, for example, only the roots of the teeth remain. The severe wear caused infection of the root cavity and resulted in the formation of dental abscesses at the root tips of both teeth. Drainage is seen as perforation of the bone tissue. Photo: Lennart Larsen.

On both distal incisors, the tooth cavity, the pulp, was exposed, resulting in infection of both pulp cavity and root canal. A smoothed cavity around the root tips with perforation of the osseous tissue was the centre of two chronic dental abscesses, fig. 4.

Marked wear on the front teeth is known from Eskimo studies, both in skeletons and the present population, and also from a number of Mesolithic skeletal finds from Denmark and Sweden. This wear is often attributed to the processing of hides, fig. 5, and the marked and "flat" wear on the incisors is seen most frequently in women. In anthropological studies of skeletons from Eskimo communities, this kind of tooth wear has actually been used as a criterion for sex determination. The upper jaw from Grøfte also belonged to a woman.

Lower jaw. In contrast to the teeth in the upper jaw, the

teeth remaining in the lower jaw from the same burial chamber are characterized by a much weaker, almost insignificant wear, fig. 3. This applies not least to the lower incisors, which are only very slightly worn, and so little in relation to the upper incisors that it has been doubted whether the two jaws belonged to the same person.

On the other hand, there are traces in the lower jaw of marked ante-mortem loss of all molars. Despite the limited tooth wear, this indicates that the person was middle-aged, like the owner of the upper jaw. The reason for the considerable tooth loss is not known, but since the small incisors of the lower jaw are only slightly worn, the extensive loss of molars is hardly due to wear. There are no carious teeth among those remaining in this jaw but it does not follow that those have fallen out were carious.

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Fig. 5. Hide processing can lead to extensive dental attrition in front, usually of both the lower and the upper jaws, which is frequent in Eskimos and in *i.a.* Mesolithic skeletons. The illustration shows an Eskimo woman using her teeth to stretch the hide during sewing, and the marked dental wear on the upper jaw from Grøfte may have arisen in this way (from Merbs 1983).

## NOTE

1. The investigation of the skeletons from the Grøfte dolmen was carried out within the framework of an archaeological-anthropological collaborative research programme, the purpose of which is to increase our knowledge of human development from the Mesolithic to the Early Neolithic. This programme resulted in a considerable increase in the number of skeletons from these two periods through examination of archives and bone collections and radiocarbon dating of hitherto undochmented finds. The Early Neolithic material today comprises about 40 skeletons.

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# *Pollen Spectra from the Double Passage-Grave, Klekkendehøj, on Møn*

## Evidence of Swidden Cultivation in the Neolithic of Denmark

by SVEND TH. ANDERSEN

### INTRODUCTION

August 1987, the southern chamber of the double passage-grave, Klekkendehøj, on western Møn (Fig. 1), was restored by the National Forest and Nature Agency, The Ministry of Environment. In that connection a radial section of the mound was excavated by the National Museum. The author visited the excavation in order possibly to collect soil samples for pollen analysis. The excavators had noticed that the original subsoil beneath the mound had been removed before its construction; however, they were able to point out thin stripes of dark material in clay layers forming part of the building material. Hence, although a distinctive turf structure could not be seen, suspicion arose, that the clay consisted of surface soil that had been dug up in the surroundings of the mound. This suspicion was confirmed by analysis of samples secured from the dark soil horizons and the clay itself showing them to contain ample charcoal dust and some pollen grains.

Waterbolk (1954, 1958), van Zeist (1955), Groenman-van Waateringe (1974, 1988) and Casparie and Groenman-van Waateringe (1980, in Denmark Jørgensen 1965) showed that pollen spectra from the soil surface beneath prehistoric barrows may be useful for elucidation of the contemporaneous vegetation around the site. Dimbleby (1962, 1985) developed this method further by analyzing pollen throughout the soil horizons preserved beneath barrows and in soil used for construction of the mounds. The pollen diagrams from the soil sections made it possible to reconstruct not only the vegetation contemporary with the barrow, but also to detect vegetational changes induced by man prior to its construction. In Denmark, soil sections beneath Single-Grave barrows in Western Jutland have been analyzed successfully by Odgaard (1985, Odgaard and Rostholm 1988). At Klekkendehøj, only soil from the building material was available for pollen analysis. As will be discussed below, these pollen analyses give unique and unexpected new insight into the way of life of the people who constructed the passage grave.

#### *Material*

The age of the passage grave at Klekkendehøj is around 3200 BC (Flemming Kaul, personal communication). The sections from the mound will be described later by the excavators. The clay used for construction of parts of the mound is grey, calcareous, clayey till. The dark stripes were a few centimeters thick and inclined radi-

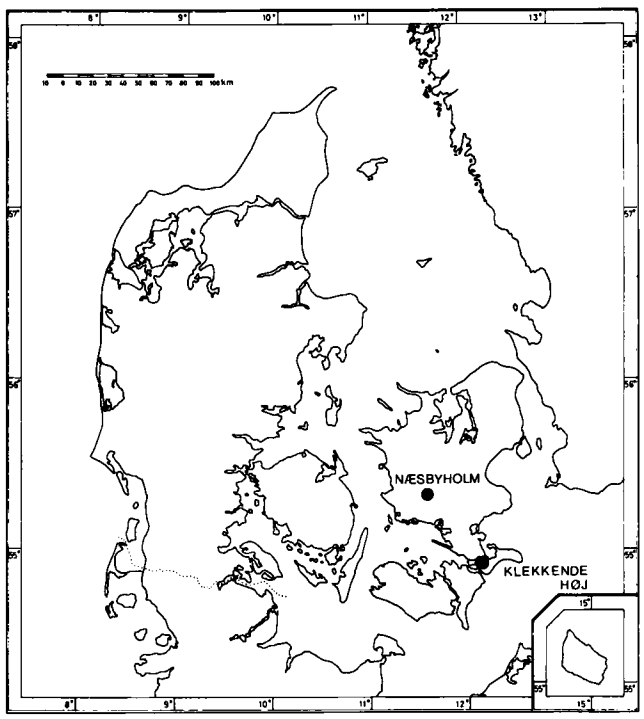


Fig. 1. The location of Klekkendehøj and Næsbyholm Forest.

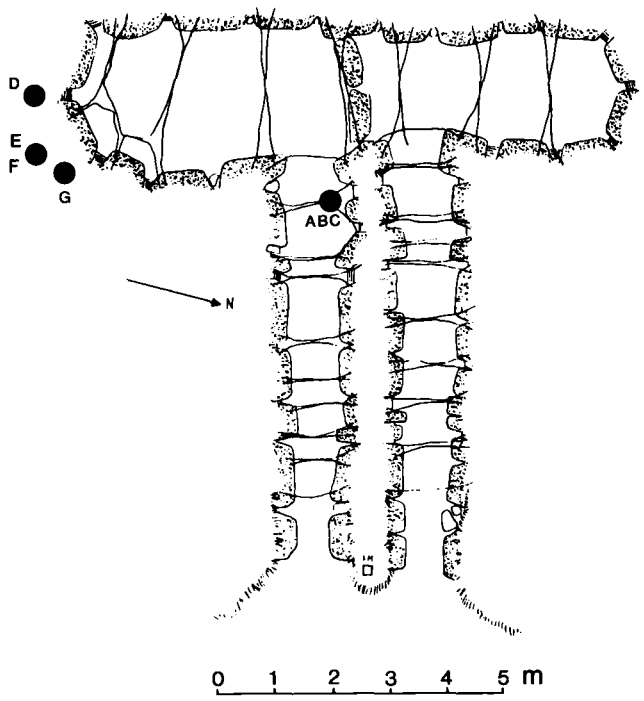


Fig. 2. Plan of the double passage-grave in Klekkendehøj with indication of the samples used for pollen analysis. The plan was measured by Svend Hansen.

ally from the centre of the mound. They contained slight amounts of alkali-soluble humus, which masks the mineral grains and produces the dark colour together with charcoal dust. The humous stripes were clearly delimited from the lighter clay. Such rendzinas used for building material of prehistoric earthworks have also been noticed by Dimbleby (1985). The residue after removal of the mineral matter was a solid mass of charcoal dust with scattered pollen grains. The samples also contained slight amounts of fragments of plant tissue, which may derive from young plant roots.

The location of the samples secured for pollen analysis in relation to the passage grave is shown on Fig. 2. Three samples (A, B and C) derived from dark stripes in a vertical section above the innermost part of the southern passage. Their depth was 0.8–1.0 m below the surface of the mound. Samples D, E and F were secured in sections immediately south of the southern chamber. Samples D and E were from dark stripes, and sample F from light clay 10 cm above sample E. Their depth was 1.5 and 2.1 m below the surface. Sample G, finally, was secured by the excavators from a 50 cm wide spot of dark material continuous with the dark stripe where sample E was taken.

Radiocarbon dating was not performed, because the soil samples contained fragments of plant tissue, which may be modern, and because a part of the charcoal may be older than the mound.

### *Methods*

The samples were prepared for pollen analysis with hydrochloric acid, potassium hydroxide, hydrofluoric acid and acetolysis mixture and were mounted in silicone oil. The residue from sample F (clay) was much smaller than in the other samples but otherwize similar to them.

Annulus diameter (anl-D) was measured for all grass pollen grains (size class 1.2 $\mu$m). In addition, the largest and the smallest diameters (M+ and M−) were measured in all grains with annulus diameters larger than 7 $\mu$m and sculpture (scabrate or verrucate) was determined with phase contrast equipment. All the grass pollen grains were more or less crumpled.

Species names for plants in latin follow *Flora Europaea.* English names are from Clapham *et al.* 1952. Species without English names are indicated in latin alone.

### *Pollen preservation*

Pollen grains with corrosion scars occurred occasionally, but corrosion did not hamper identification of the grains. In sample D, 43% of the alder pollen showed corrosion scars. Many of the grains were somewhat crumpled as often seen in soil pollen samples.

### *Identification of grass and cereal pollen*

Cereals have larger pollen grains with larger annulus diameters than most wild grasses, and various cereals can be distinguished by size, annulus diameter and sculpturing (see discussion in Andersen 1979, Kühler and Lange 1979). The average size of each grain (largest and smallest diameter divided by 2) is more or less modified in crumpled grains, whereas the original diameter of the annulus can be measured in nearly all grains. Due to overlap in the size ranges of the species, individual grains can rarely be identified, and size frequency distributions are necessary for distinction of the various

taxa. Pollen size is likely to be nearly the same as the figures stated in Andersen 1979.

Fig. 3. shows annulus diameter distribution for 237 grass pollen grains (topmost curve). Grains with annulus diameters smaller than 7 μm predominate. These grains are likely to derive from various wild grasses. The peaks for scabrate grains with annulus diameters at 8.4 and 9.6 μm, indicate presence of pollen of the barley group, which includes barley (*Hordeum vulgare*), einkorn (*Triticum monococcum*) and some wild grasses.

Fig. 4 shows the average size of the scabrate pollen grains with annulus diameters 7.2 and 8.4–10.8 μm (topmost curves). Of the grains with annulus 7.2 μm, two grains are distinctively of barley-type size, whereas the smaller grains are likely to derive from wild grasses. The size of the pollen grains with larger annulus (8.4–10.8 μm) is widely scattered, presumably because of crumpling, but are near the size-range of the brome species and barley and einkorn, except for one small grain, presumably a wild-grass pollen grain.

The annulus diameters of all grains referred to barley-type are very similar to barley and einkorn and are somewhat larger than those found in rye-brome (*Bromus secalinus*) and *Bromus hordeaceus* (Fig. 3). Rye-brome is very frequent in Neolithic seed material in Denmark (Jensen 1985), and was probably cultivated (Knörzer 1967), and *Bromus hordeaceus* occurred as a weed (Jensen 1985). These two species can only have been scarce, if present at all, in this material. Wild grasses of barley-type are couch-grass (*Agropyron*), which was identified only with uncertainty in Neolithic seed material, the sea-shore species lyme-grass (*Leymus arenarius*) and marram grass (*Ammophila arenaria*), and float grass (*Glyceria*), which occurs in swamps. It is therefore most likely that the barley-type pollen from Klekkendehøj belongs to barley or einkorn, both of which were cultivated in the Middle Neolithic (Jørgensen 1982).

The verrucate grass pollen grains with annulus diameters larger than 7 μm are mostly smaller than or fall within the size range of meadow oat (*Avenula pratensis*, Fig. 4), which has the largest grains within the wild grasses with verrucate pollen. These grains probably belong to that species and other wild grasses. Two grains with very large annulus fall within the size range of bread wheat (*Triticum aestivum*) and emmer wheat (*T. dicoccon*) and must derive from one of these species.

The wheat species release practically no pollen grains before threshing (Willerding 1986). The barley-type pollen from Klekkendehøj, therefore, presumably belongs mainly to barley. However, at least emmer or bread wheat were certainly also present. Emmer was the commonest crop in Middle Neolithic time (Jørgensen 1982).

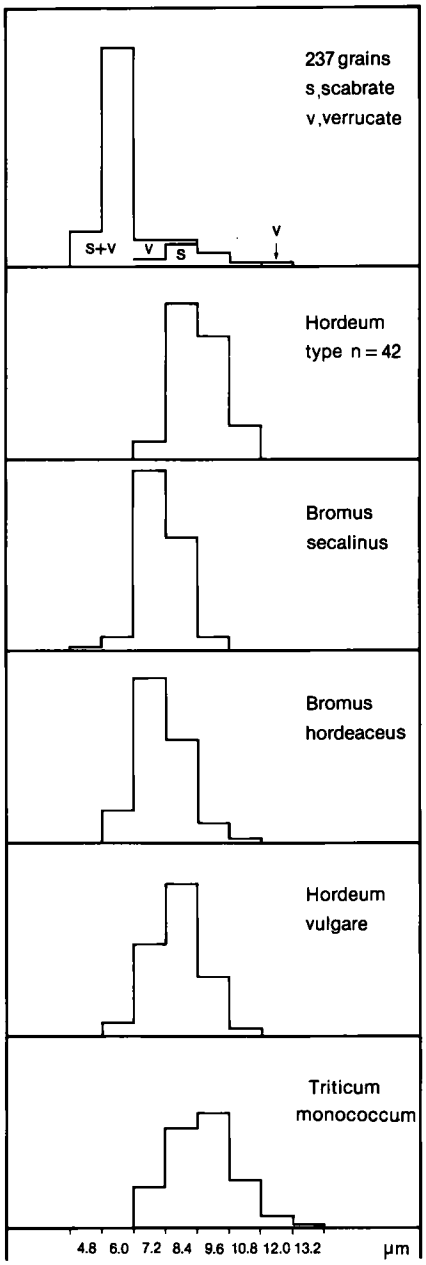


Fig. 3. Annulus diameter (anl-D) in 237 grass pollen grains and pollen grains referred to barley-type (*Hordeum*-type) from Klekkendehøj, and in modern pollen of rye-brome (*Bromus secalinus*), *Bromus hordeaceus*, barley (*Hordeum vulgare*), and einkorn (*Triticum monococcum*, from Andersen 1979).

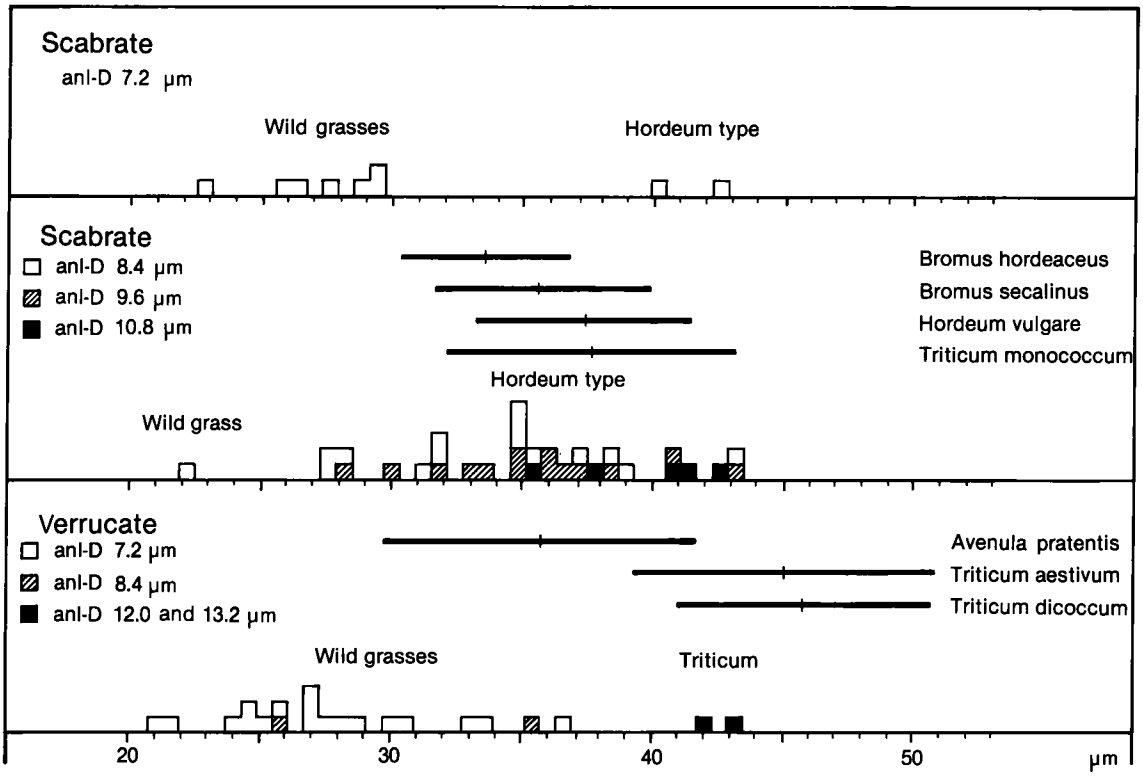


Fig. 4. Average size (M+ + M−/2) of individual grass pollen grains from Klekkendehøj and size range ($\bar{x}\pm 2s$) for modern pollen of *Bromus hordeaceus*, rye-brome (*Bromus secalinus*), barley (*Hordeum vulgare*), einkorn (*Triticum monococcum*), meadow-oat (*Avenula pratensis*), bread wheat (*Triticum aestivum*) and emmer wheat (*Triticum dicoccon*, from Andersen 1979).

*Pollen counts from the humic-soil and clay samples. Origin of the pollen floras (Table 1).*

Pollen counts from the samples from Klekkendehøj are shown in Table 1. Due to the low concentration of pollen grains, many slides were scanned for each sample. The figures for numbers of tree pollen and non-tree pollen grains and spores per slide give an impression of the pollen concentration in relation to the masses of charcoal dust. These figures are distinctively higher in sample D than in the other samples.

The taxa identified were divided into the groups trees, bare-soil plants, dry-meadow plants, other herbs, shrubs, and forest plants. These groups will be discussed further below. The numbers of pollen grains and spores in the samples A-F are too low for percentage calculation. Table 1 shows, however, that the pollen and spore floras of the samples A, B, C, E and G, from humic horizons, and sample F, from clay, are alike, whereas the tree pollen in sample D differs distinctively from the other samples. It may be concluded that the pollen flora of the samples A, B, C, E and G came from areas with similar vegetation, and that the pollen flora of the clay sample (F) was derived from a humic horizon with a similar pollen flora by down-mixing. The humic horizon, where sample D was obtained, must come from a place with a vegetation, which differed from the other samples.

One taxon, ligulate composites (Compositae, Liguliflorae), forms an exception, as these pollen grains occurred in highly varying numbers and were particularly frequent in the clay sample (F). The ligulate composites comprise a large number of genera and species, whose pollen is difficult to differentiate. The pollen grains found were rather uniform and not unlike those of dandelion (*Taraxacum*), however, several other genera could also be represented.

Pollen grains captured on a land surface can be trans-

ported into the soil by the soil fauna and by percolating water. Dimbleby (1985) found that a cover of 40 cm of soil is sufficient to give adequate protection of the pollen flora of buried soils against contamination with pollen from an exposed surface above. Hence, it is unlikely that the pollen floras of the samples from Klekkendehøj, at 0.8–2.1 m below the surface of the mound, were contaminated with younger pollen. They must consist of pollen and spores present in the soils at the time when the mound was constructed.

The pollen grains and the charcoal dust found in the shallow humic horizons from Klekkendehøj had presumably been mixed into the soil by soil fauna before the soils were dug up to be used for building the mound. Lesser amounts of pollen grains and charcoal dust were mixed into the clay. Dimbleby (1985) has shown that spores deposited on a chalk soil were transported downwards to maximally 20 cm depth in 4 years. After 9 years, the concentration of spores was highest in the topmost 2.5 cm of the soil, and the concentration of spores was 75% less at 2.5–5 cm depth. Pollen grains deposited on the surface of a calcareous soil are therefore buried to a shallow depth in a short span of years.

Pollen grains buried in calcareous soils vanish within a few years due to biological breakdown (Havinga 1971, Dimbleby 1985). The pollen grains from the soil horizons at Klekkendehøj must therefore have been derived and buried within a short span of time. Their preservation up til today must be due to low oxygen pressure in the dense clays and hence, absence of biological activity.

Much of the charcoal dust present in the soils was probably more or less contemporaneous with the pollen flora. Charcoal from former times may also be present, however, as charcoal is extremely resistant to decay.

The ligulate-composite pollen mentioned above, which occurred in varying amounts and was particularly abundant in the clay sample, must have been buried in a different way. High concentrations of pollen from insect-pollinated plants in soils have often been observed (Havinga 1963, Bottema 1975). These have been ascribed to burial by burrowing bees, and Havinga and Bottema both mention the preference of the digger bee (*Halictus*) to collect pollen from ligulate composites, in particular those with yellow flowers such as dandelion. The high concentrations of ligulate-composite pollen in the clay sample (F), where other pollen was particularly scarce, indicates that this pollen was transported into the soil by burrowing bees. As the depth of the burrows of European bees averages 25–50 cm (Bottema 1975), it is unlikely that the bee-derived pollen was buried after the construction of the mound, and it must be assumed that the pollen was present in the soil when the mound was built and was probably buried shortly before that time. As sample F does not contain particularly high numbers of other insect-pollinated plants, it is not likely that pollen other than the ligulate-composite pollen was buried by bees. The ligulate-composite pollen found in other samples was presumably buried in the same way.

### *Reconstruction of the vegetation around Klekkendehøj. Land-use*

The pollen spectra from the soil horizons in the mound of Klekkendehøj offer a unique possibility for reconstruction of the vegetation and land use around the mound at the time of its construction. Ordinary pollen spectra from lakes or bogs include pollen derived from large areas, probably around 300 square kilometers, which may comprise a variety of vegetation types and a mosaic of human activities, and the time span of each pollen spectrum may include several tens of years (cp. Groenman-van Waateringe 1988). Even in small hollows, where the pollen spectra may include pollen derived from less than 1 ha, difficulties occur because the transport of pollen from the terrestrial vegetation to the hollow by wind may cause underrepresentation of badly transported pollen, and because some pollen taxa may include plants from the hollow itself (cp. Andersen 1985). The pollen spectra from Klekkendehøj are narrowly focussed in time and in space; badly transported pollen may be registered because the samples derive from the spots, where the plants grew, and the pollen analyses include solely terrestrial pollen. Moreover, the pollen spectra from lakes and bogs, and small hollows in some cases, may not point to a definite archaeological context (cp. Madsen 1985). At Klekkendehøj, we know for certain, that the land around the mound was occupied by the passage-grave people.

The pollen and spore flora from Klekkendehøj was divided into groups of plants of common ecological significance (Tables 2–5). Comparison with present-day plant associations was avoided, because these may have differed from the past communities, especially cultural plant associations, which are strongly influenced by the

| Soil | Humic | | | | | Clay | Humic |
|---|---|---|---|---|---|---|---|
| Sample | A | B | C | E | G | F | D |
| Number of slides | 13 | 14 | 8 | 12 | 8 | 19 | 9 |
| Tree pollen per slide | 7 | 14 | 10 | 7 | 7 | 3 | 26 |
| Non-tree pollen and spores per slide | 4 | 2 | 2 | 1 | 1 | 2 | 66 |
| Trees | 92 | 202 | 82 | 82 | 56 | 55 | 232 |
| Hazel, *Corylus avellana* | 51 | 108 | 54 | 55 | 42 | 26 | 41 |
| Alder, *Alnus glutinosa* | 15 | 38 | 11 | 7 | 4 | 5 | 175 |
| Birch, *Betula* | 14 | 39 | 9 | 8 | 7 | 15 | 5 |
| Lime, *Tilia cordata* | 2 | 7 | 1 | 1 | – | – | 1 |
| Oak, *Quercus* | 1 | – | – | – | – | 3 | 3 |
| Elm, *Ulmus* | – | 2 | 2 | – | – | 3 | – |
| Ash, *Fraxinus excelsior* | 1 | – | – | – | – | – | + |
| Maple, *Acer* | – | 1 | – | – | – | – | – |
| Pine, *Pinus sylvestris* | 8 | 7 | 5 | 11 | 3 | 3 | 7 |
| Bare-soil plants | 7 | 8 | 1 | – | 1 | 6 | 76 |
| Barley-type, *Hordeum*-type | 2 | 1 | – | + | 1 | 1 | 37 |
| Wheat, *Triticum* | – | 1 | – | – | – | – | + |
| Wormwood, *Artemisia* | 3 | 3 | – | – | – | 2 | 1 |
| Sheep's Sorrel, *Rumex acetosella* | – | 2 | – | – | – | 1 | 23 |
| Cornflower, *Centaurea cyanus* | – | 1 | – | – | – | – | 3 |
| Goosefoot Family, Chenopodiaceae | 2 | – | – | – | – | – | + |
| Great Plantain, *Plantago major* | – | – | – | – | – | 2 | + |
| Stonecrop, *Sedum* | – | – | 1 | – | – | – | – |
| Sheep's Bit, *Jasione montana* | – | – | – | – | – | – | 1 |
| Perennial Knawel, *Scleranthus perennis* | – | – | – | – | – | – | 4 |
| Knotgrass, *Polygonum aviculare* | – | – | – | – | – | – | 3 |
| Persicaria, *Polygonum persicaria*-type | – | – | – | – | – | – | 1 |
| Corn Spurrey, *Spergula arvensis* | – | – | – | – | – | – | 1 |
| Field Madder, *Sherardia arvensis* | – | – | – | – | – | – | 1 |
| Dry-meadow plants | 9 | 2 | 3 | 4 | 2 | 6 | 48 |
| Ribwort, *Plantago lanceolata* | 6 | – | – | 4 | – | 5 | 39 |
| Adder's Tongue, *Ophioglossum vulgatum* | 1 | 2 | 2 | 1 | 2 | – | + |
| Greater Knapweed, *Centaurea scabiosa* | – | – | – | – | – | – | 2 |
| Red Clover, *Trifolium pratense* | – | – | – | – | – | – | 2 |
| St. John's Wort, *Hypericum* | – | – | – | – | – | – | 2 |
| Field Scabious, *Knautia arvensis* | – | – | – | – | – | – | 1 |
| Bellflower, *Campanula* | – | – | – | – | – | – | + |
| Bracken, *Pteridium aquilinum* | 2 | – | 1 | 2 | – | 1 | 2 |
| Wild grasses, Poaceae undiff. | 14 | 8 | 4 | – | 3 | 1 | 377 |
| Other herbs | 13 | 3 | 3 | – | 1 | 6 | 79 |
| Umbellate Family, Umbelliferae undiff. | 7 | 2 | 3 | – | – | 1 | – |
| Tubulate Composites, Tubuliflorae | 1 | – | – | – | 1 | 4 | 5 |
| Crucifer Family, Cruciferae | 4 | 1 | – | – | – | – | 4 |
| Pink Family, Caryophyllaceae | 1 | – | – | – | – | – | 1 |
| Buttercup, *Ranunculus* | – | – | – | – | – | 1 | 39 |
| Thistle, *Cirsium* | – | – | – | – | – | – | 16 |
| Bedstraw, *Galium*-type | – | – | – | – | – | – | 12 |
| Peaflower Family, Fabaceae undiff. | – | – | – | – | – | – | 2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Shrubs | 5 | 4 | 1 | 2 | – | 5 | – |
| Willow, *Salix* | – | – | 1 | 1 | – | 2 | – |
| Black Elder, *Sambucus nigra* | 1 | 3 | – | – | – | – | – |
| *Sambucus racemosa* | 2 | 1 | – | 1 | – | – | – |
| Spindle-tree, *Euonymus europaeus* | 1 | – | – | – | – | 1 | – |
| Hawthorn, *Crataegus* | – | – | – | – | – | 1 | – |
| Rose, *Rosa* | 1 | – | – | – | – | – | – |
| Forest plants | 2 | 5 | 3 | 3 | – | 6 | 14 |
| Ferns, *Dryopteris*-type | 2 | 3 | 3 | 3 | – | 6 | 10 |
| Stinging Nettle, *Urtica dioica* | – | 1 | – | – | – | – | – |
| Sanicle, *Sanicula europaea* | – | – | – | – | – | – | 1 |
| *Sphagnum* | – | 1 | – | – | – | – | 3 |
| Heather, *Calluna vulgaris* | 2 | – | – | – | – | 1 | 3 |
| Pollen and spores | 144 | 232 | 97 | 91 | 63 | 86 | 826 |
| Ligulate Composites, Liguliflorae | 43 | 17 | 17 | 1 | – | 489 | 57 |
| Ligulate Composites, numbers per side | 3 | 1 | 2 | 0.1 | – | 26 | 6 |

Table 1. Pollen counts from 7 soil samples from Klekkendehøj.

method of agriculture (cp. Willerding 1986). The percentages of trees were calculated separately, with corrections as suggested by Andersen (1970, 1980, note 1), and other plants were calculated in percentage of the non-tree pollen and spores. The ligulate composites were excluded from this pollen sum. Sample D was calculated separately, and the other samples were joined, because of their uniformity. Tables 2–5 also indicate presence or absence in the contemporaneous pollen flora from two small hollows in Næsbyholm Storskov 3400–2700 BC.

### *Trees (Table 2). Evidence of burning*

Tree pollen constituted a major part of the pollen flora in samples A–F (80%) and a minor part in sample D (28%). The tree assemblage in A–F is dominated by hazel (50%) with lesser amounts of alder, birch and lime (12–14%), whereas the other deciduous trees noticed were very rare. The pine pollen was presumably derived by long-distance transport. Alder dominates entirely in sample D (73%), hazel was present (17%), and other trees were scarce.

The tree assemblage in samples A–F differs essentially from the virgin forest known from Atlantic time by the scarceness of lime, oak and elm, whereas hazel and birch were more common than registered for the Atlantic forest (see Andersen 1985). The hazel-dominated woodland at Klekkendehøj was clearly secondary forest, produced by intervention of man. The alder-dominated woodland from sample D may have been more or less natural.

The tree pollen spectra indicate that the clays used

| Samples | A-F | D | N |
|---|---|---|---|
| Number of pollen and spores | 713 | 829 | |
| Trees, % of pollen and spores | 79.8 | 28.0 | |
| Number of taxa | | 9 | 12 |
| *Hazel, *Corylus avellana* | 50.4 | 17.2 | + |
| *Alder, *Alnus glutinosa* | 12.0 | 73.2 | + |
| *Birch, *Betula* | 13.8 | 2.1 | + |
| *Lime, *Tilia cordata* | 13.2 | 3.3 | + |
| Oak, *Quercus* | 0.6 | 1.3 | + |
| *Elm, *Ulmus* | 2.1 | | + |
| Ash, *Fraxinus excelsior* | 1.2 | | + |
| Maple, *Acer* | 1.2 | | + |
| Pine, *Pinus sylvestris* | 5.5 | 2.9 | + |
| Beech, *Fagus sylvatica* | | | + |
| Hornbeam, *Carpinus betulus* | | | + |
| Spruce, *Picea abies* | | | + |

* Deformed grains occur.

Table 2. Pollen spectra for trees from soil samples from Klekkendehøj (A-F without D, and D). Tree genera and species, corrected, in percentage of the tree pollen sum. N = sites in Næsbyholm Forest.

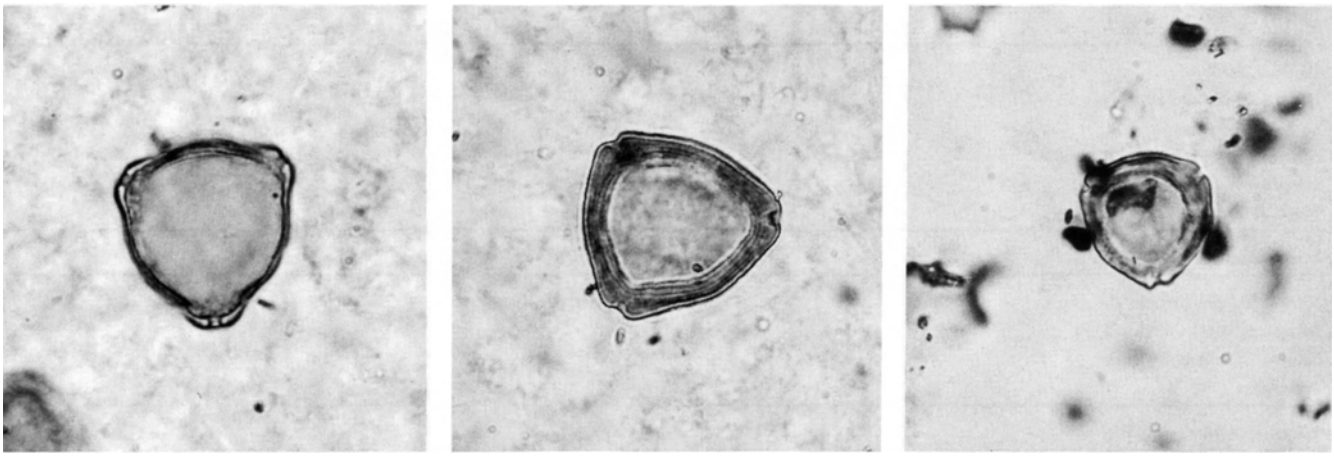

Fig. 5. Hazel pollen grains. Left: A normal modern pollen grain. Middle: A modern pollen grain heated to 300° C for 15 minutes. Right: A deformed hazel pollen grain from Klekkendehøj (the grain is smaller than the modern grain due to treatment with hydrofluoric acid).

for construction of the mound derived from distinctly differing habitats. Klekkendehøj is situated on a small hill, and wet areas occur within 100–200 m distance. The hazel-dominated samples may derive from the immediate vicinity, whereas the alder-dominated soil must have been transported from a wetter area, at least 100 m away. Dimbleby (1985) mentions similar examples of building material fetched at some distance from the barrows themselves.

An important feature was the peculiar appearance in most of the tree pollen grains. The author had difficulty in identifying several of them, hazel in particular, due to exceedingly thickened exine. Communication with B. V. Odgaard revealed that he had seen similar grains in a peat layer with much charcoal. Suspicion then arose that some of the pollen grains had become deformed by heating. Acelolyzed hazel pollen was therefore mixed with powdered lime and was heated at 300° for 15 minutes. The lime was then dissolved and the pollen mounted in silicone oil. Both normal and deformed grains, where the *tectum* had increased to twice or three times its original thickness, occurred. These deformed grains did not differ from the deformed hazel pollen grains from Klekkendehøj (Fig. 5). It can be concluded that this hazel pollen had been heated while incorporated in the soil. Deformed grains with thickened exines were also observed in alder, birch, lime and elm, but deformation was somewhat difficult to observe in the alder pollen because of the exine thickenings which occur naturally in this pollen. Deformed grains were less common in sample D than in samples A–F.

It is indicated that the hazel and alder woodlands at Klekkendehøj were burned so that the pollen grains already incorporated in the soil were heated and deformed to varying degree. It can be expected that the pollen in the alder-woodland soil was less affected by heating, because of greater wetness of the soil. Most of the charcoal dust probably derives from the same burnings.

None of the non-tree pollen grains or spores were deformed. It can be concluded that they were incorporated in the soil *after* the burning.

The same tree species were recorded at the sites in Næsbyholm and, in addition, a few represented by pollen likely to have been transported from a far distance (beech, hornbeam and spruce).

### *Bare-soil plants (Table 3). Swidden cultivation of cereals*

The bare-soil group comprises plants, which preferentially occur on bare mineral soil and avoid plant communities with a dence sward of herbs. A number of the bare-soil plants found at Klekkendehøj are annual or biennial, and a few perennial plants occur. The bare-soil plants constitute 16 and 13% of the non-tree pollen.

Pollen of barley-type is prominent (3–6% of the non-tree pollen) and a few wheat pollen grains occur. Barley itself is autogamous and is likely to be underrepresented in the pollen spectra. Vuorela (1973) found only 1–3% cereal pollen in present-day barley fields in a forested area in Finland. The wheats (einkorn, emmer, bread wheat) are even less likely to release pollen (see discussion above). It was concluded that barley was cer-

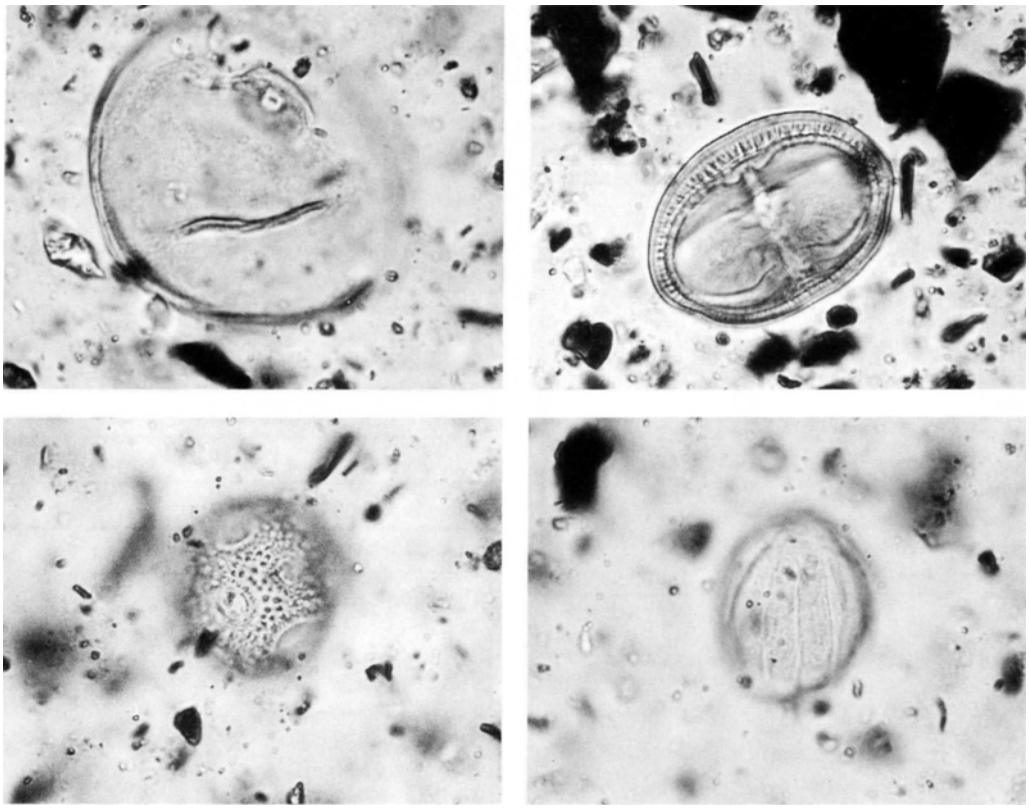

Fig. 6. Pollen grains of barley-type (*Hordeum*-type), cornflower (*Centaurea cyanus*), perennial knawel (*Scleranthus perennis*), and field madder (*Sherardia arvensis*) from Klekkendehøj.

tainly grown, possibly einkorn, and that emmer or bread wheat presumably were cultivated as well. It is a near conclusion that hazel and alder groves around Klekkendehøj were felled and burned and the bared soil then sown with cereals a short time before the passage-grave was constructed. Hence, we have evidence that swidden cultivation was in use. With swidden cultivation, the soil must not be heated excessively in order not to destroy soil organisms and humus (Steensberg 1955). This may explain why the tree pollen grains that were incorporated in the soil were not destroyed by the fire. Swidden cultivation of cereals is profitable only for a short time, even on fertile soils, as the crops then decrease (Reynolds 1977, Steensberg 1979). One advantage is, that natural weeds do not occur in the burned soil during the first crop years (Steensberg 1955). Hence we may conclude that the bare-soil plants listed in Table 3 were involuntarily introduced by man when sowing the grain. This almost certainly is true for the annual or biennial plants, cornflower, goosefoot, knotgrass, persicaria, corn spurrey and field madder. Great plantain and knawel, although perennial, also behave as annuals, as they produce abundant seeds and new plants during the first year's growth. It is less certain whether the other perennial plants in Table 3 (wormwood, sheep's sorrel, stonecrop and sheep's bit) occurred as weeds, as they are more ambiguous and may have occurred in denser vegetation. They may have invaded the fields after a few years' cultivation.

The weed flora from Neolithic time in Denmark known from macrofossils (note 2) is rather poor, comprising 14 species (cp. Groenman-van Waateringe 1979a). 9 species from Klekkendehøj are not represented there. Of these, wormwood, sheep's sorrel and great plantain occur commonly in pollen analyses.

Cornflower (*Centaurea cyanus*) occurred in Denmark in the Late-Glacial, but was extremely scarce with only three finds, of pollen grains, from the Neolithic, the Bronze Age and the Iron Age, up to the Viking Age, when it became more common (note 3, Mikkelsen

| Samples | A-F | D | N |
|---|---|---|---|
| Number of non-tree pollen and spores | 144 | 597 | |
| Bare-soil plants | 16.0 | 12.8 | |
| Number of taxa | | 14 | 7 |
| * Barley-type, *Hordeum*-type | 3.4 | 6.4 | |
| * Wheat, *Triticum* | 0.7 | + | |
| Wormwood, *Artemisia* | 5.6 | 0.2 | + |
| Sheep's Sorrel, *Rumex acetosella* | 2.1 | 3.9 | + |
| * Cornflower, *Centaurea cyanus* | 0.7 | 0.5 | |
| * Goosefoot Family, Chenopodiaceae | 1.4 | | + |
| (*)Great Plantain, *Plantago major* | 1.4 | | + |
| Stonecrop, *Sedum* | 0.7 | | |
| Sheep's Bit, *Jasione montana* | | 0.2 | + |
| (*)Perennial Knawel, *Scleranthus perennis* | | 0.7 | |
| * Knotgrass, *Polygonum aviculare* | | 0.5 | + |
| * Persicaria, *Polygonum persicaria*-type | | 0.2 | |
| * Corn Spurrey, *Spergula arvensis* | | 0.2 | + |
| * Field Madder, *Sherardia arvensis* | | 0.2 | |

* Annual or biennial.

Table 3. Bare-soil plants in percentage of non-tree pollen and spores.

| Samples | A-F | D | N |
|---|---|---|---|
| Dry-meadow plants | 18.1 | 8.0 | |
| Number of taxa | | 8 | 6 |
| Ribwort, *Plantago lanceolata* | 8.3 | 6.6 | + |
| Adder's Tongue, *Ophioglossum vulgatum* | 5.6 | | + |
| Greater Knapweed, *Centaurea scabiosa* | | 0.3 | |
| Red Clover, *Trifolium pratense* | | 0.3 | |
| St. John's Wort, *Hypericum* | | 0.3 | + |
| Field Scabious, *Knautia arvensis* | | 0.2 | |
| Bellflower, *Campanula* | | + | |
| White Clover, *Trifolium repens* | | | + |
| Great Burnett, *Sanguisorba officinalis* | | | + |
| Bracken, *Pteridium aquilinum* | 4.2 | 0.3 | + |
| Wild grasses, Poaceae undiff. | 20.8 | 63.4 | + |
| Other herbs | 18.1 | 13.3 | |
| Number of taxa | | 8 | 8 |
| Umbellate Family, Umbelliferae | 9.0 | | + |
| Tubulate Composites, Tubuliflorae | 4.2 | 0.8 | + |
| Crucifer Family, Cruciferae | 3.4 | 0.7 | + |
| Pink Family, Caryophyllaceae | 0.7 | 0.2 | |
| Buttercup, *Ranunculus* | 0.7 | 6.6 | + |
| Thistle, *Cirsium* | | 2.7 | |
| Bedstraw, *Galium*-type | | 2.0 | + |
| Peaflower Family, Fabaceae | | 0.3 | |
| Avens, *Geum* | | | + |
| Cinquefoil, *Potentilla* | | | + |
| Mint, *Mentha*-type | | | + |

Table 4. Dry-meadow plants, wild grasses and other herbs, in percentage of non-tree pollen and spores.

1986). Macroscopic remains are known from the Neolithic in Poland and Switzerland (see Jensen 1985), and a pollen grain from Holstein (Schmitz 1957). There can be no doubt that cornflower was introduced accidentally to Denmark by Neolithic people and has grown as a weed since then, although its pollen grains were spread only accidentally to lakes and bogs. Field madder (*Sherardia arvensis*) has not been found in fossil state, neither pollen nor macrofossils. It was still a common weed in cereal fields in the early twentieth century (Ferdinandsen 1918). Macrofossils of persicaria (*Polygonum persicaria*) have been recorded from the Bronze Age onwards, and no finds of perennial knawel (*Scleranthus perennis*) are recorded from Denmark and neighbouring countries (Jensen 1985).

The number of bare-soil plants found at Næsbyholm is distinctively smaller than that found at Klekkendehøj. This may be due to difficulty in the dispersal of their pollen.

### *Dry-meadow plants, wild grasses and other herbs (Table 4)*

The dry-meadow plants are perennial and have in common, that they are able to grow in dense swards of herbaceous vegetation. Bracken was referred to this group, because it may be common in grazed meadows. These plants constitute 18 and 8% of the non-tree pollen. The number of species is larger in sample D than in samples A–F probably because a much larger number of non-tree pollen and spores was counted in sample D (Table 3). Some of these plants, ribwort, greater knapweed, red clover and field scabious, occurred as weeds in Danish cereal fields in the early twentieth century (Ferdinandsen 1918), but if slash-and-burn cultivation was used at Klekkendehøj, it is not likely that they had sufficient time to establish themselves whilst the fields were still cultivated. The dry-meadow plants may indicate herbaceous vegetation in uncultivated places, between the fields or around large rocks that could not be removed from the fields, or, they may have spread after abandonment of the fields. Ribwort, the most frequent species, is presumably overrepresented due to its high pollen production and good pollen dispersal.

| Samples | A-F | D | N |
|---|---|---|---|
| Shrubs | 11.8 | | |
| Number of taxa | | 6 | 6 |
| Willow, *Salix* | 2.8 | | + |
| Black Elder, *Sambucus nigra* | 2.8 | | |
| *Sambucus racemosa* | 2.8 | | |
| Spindle-tree, *Euonymus europaeus* | 1.4 | | |
| Hawthorn, *Crataegus* | 0.7 | | + |
| Rose, *Rosa* | 0.7 | | |
| Rowan, *Sorbus aucuparia* | | | + |
| Bird-cherry, *Prunus padus* | | | + |
| Crap Apple, *Malus sylvestris* | | | + |
| Juniper, *Juniperus communis* | | | + |
| Forest plants | 13.2 | 2.4 | |
| Number of taxa | | 4 | 5 |
| Ferns, *Dryopteris*-type | 11.8 | 1.7 | + |
| Stinging Nettle, *Urtica dioica* | 0.7 | | |
| Sanicle, *Sanicula europaea* | | 0.2 | |
| Ramsons, *Allium ursinum* | | | + |
| Oak Fern, *Gymnocarpium dryopteris* | | | + |
| Polypody, *Polypodium vulgare* | | | + |
| *Sphagnum* | 0.7 | 0.5 | + |

Table 5. Shrubs and forest plants in percentage of non-tree pollen and spores.

Berglund *et al.* (1986) found much higher percentages of ribwort pollen in grazed meadows from to-day than found at Klekkendehøj. Besides ribwort, St. John's wort and bracken survive grazing because they are not eaten by cattle. The other dry-meadow species in table 4 are less likely to flower in pastures because they flower late in the summer, and would be eaten before that time. As ribwort and bracken were not very common, it may be concluded that extensive pastures were not present near Klekkendehøj, but light grazing may have occurred.

Dry-meadow plants were recorded in nearly the same numbers in Næsbyholm as at Klekkendehøj, probably because their pollen is dispersed better than that of the bare-soil plants.

The wild grasses constitute 21 and 63% of the non-tree pollen. They are certainly overrepresented. It is somewhat difficult to decide where they grew, because the wild grasses comprise species preferring bare soil and grass swards as well. It is probably most likely that they mainly belonged to the dry-meadow vegetation.

The group listed as "other herbs" comprises pollen types that could be identified only to plant families, subfamilies or genera, which comprise a variety of species. They constitute 18 and 13% of the non-tree pollen. Pollen of the umbellate family was particularly common in samples A–F (9%), and pollen of buttercup in sample D (7%). Some of these plants may have occurred on the bare soil of the fields, but it is likely that the majority belonged to the meadow vegetation.

A similar number of taxa was recorded in Næsbyholm.

### *Shrubs and forest herbs (Table 5)*

Shrubs are recorded exclusively in samples A–F, where they constitute 12% of the non-tree pollen. They include willow, two species of elder, spindle-tree, hawthorn and rose. Pollen of black elder has been recorded from the Early Neolithic in Denmark (Troels-Smith 1960) and seeds from the Late Iron Age and later (Jensen 1985). Pollen of *Sambucus racemosa* was recorded from recent time in Draved Forest (Aaby 1983). Fossil seeds are unknown in Denmark (Jensen 1985) and the species is considered recently introduced here but native to northern Germany. Fredskild (1978) found a wide variation in elder seeds from a Neolithic dwelling site in Switzerland, which includes black elder and *Sambucus racemosa* as well. Hence, *Sambucus racemosa* may have been introduced to Denmark by Neolithic people. The elder berries may have been favoured by the inhabitants at Klekkendehøj.

These shrubs from Klekkendehøj may have survived the burning of hazel woodland or may have spread to uncultivated places between the fields. A similar number of shrubs was recorded in Næsbyholm.

The forest plants include plants which may have grown in forest environment. They constitute 13 and 2% of the non-trees. Ferns of *Dryopteris*-type were the commonest; they may have occurred as relics from the hazel and alder woodlands or in sheltered places beneath shrubs. A similar number of taxa was recorded in Næsbyholm.

### *Vegetation and land-use around Klekkendehøj. Table 6*

The pollen spectra from Klekkendehøj contain at least two generations of pollen, as most of the tree pollen is likely to derive from shortly before the burnings and most of the non-tree pollen and the spores from a short

| | | | | Number of taxa | |
|---|---|---|---|---|---|
| Samples | | A-F | D | A-D | N |
| Trees | % of P | 79.8 | 28.0 | 9 | 12 |
| Bare-soil plants | % of NAP | 16.0 | 12.7 | 14 | 7 |
| Meadow (incl. grasses and others) | – – – | 56.9 | 84.4 | 17 | 15 |
| Shrubs | – – – | 11.8 | | 6 | 6 |
| Forest plants | – – – | 13.2 | 2.3 | 4 | 5 |
| Heath | – – – | 2.1 | 0.5 | 1 | 1 |
| | | | | 51 | 49 |

P = All pollen and pores NAP = Non-tree pollen and spores.

Table 6. Summary of plant groups from Klekkendehøj.

period thereafter. Hence, tree-pollen and non-tree pollen spectra were calculated separately.

Groves of hazel, with some limes, birches and alders and alder-groves with some hazels occurred around Klekkendehøj, and were slashed and burned before the sowing of cereal crops. The difference between the percentages of tree pollen in the two sets of samples (80% in A–F and 28% in D) is somewhat difficult to explain. The tree-pollen concentration in sample D was probably smaller than in the other samples before the burning.

Iversen (1941) suggested that swidden cultivation was used widely in Denmark in Neolithic time. He assumed that virgin forest was used for this purpose (Iversen 1949). However, his own quotation of Linkola describing swidden cultivation in Finland (1916, Iversen 1941, p. 47) says: "Der junge Wald, der meistens ausschliesslich oder haputsächlich aus Laubholz besteht, wird im Alter von 20–30 Jahren gefällt; dieses findet im Juni statt. Nach einem Jahre werden im Juni bei günstiger Witterung die dürren, am Boden liegenden Bäume verbrannt". The ground is then sown with grain crops for some years. "Ist der Boden ergiebig, so kann noch eine zweite, in Ausnahmefälle eine dritte, vierte usw. Haferernte folgen. Dann lässt man die Fläche sich begrasen und benutzt sie sofort als Weideplatz oder (bei fruchtbarerem Boden) eine zeitlang als Wiese. In kurzem entsteht dort, teils aus Wurzelschösslingen, teils aus Samenkeimlingen, meistens aus beiden zusammen, ein junger Wald. Der junge Wald wird so lange als Weide benutzt, bis man ihn weider niederbrennt".

Exactly this method seems to have been employed at Klekkendehøj using secondary woodland rather than virgin forest as assumed by Iversen (1949). The swidden rotation from Finland described by Linkola was based on regeneration of birch by seedlings, and by saplings and root-suckers from alder stumps, which survived the fire. At Klekkendehøj hazel and alder groves were burned and the ground used for growing of cereals. Hazel and alder are equally well suited for producing new saplings from the old stumps and can be coppiced for centuries (Worsøe 1979). Hence, the swidden cultivation at Klekkendehøj may have been one step in a regular rotation as described from Finland by Linkola, but using mainly hazel and alder rather than birch and alder, and barley and wheat rather than rye and oats for crops. The flint axes and ard type used at that time would have been suited for this type of agriculture (Hedeager and Kristiansen 1988).

It is difficult to say whether some of the tree pollen grains date from after the burning. As most of the hazel pollen grains, at least, were deformed, and hence have been exposed to heating, trees may have been scarce in the immediate surroundings of the passage grave.

The frequencies of plants from fields (bare-soil plants), are nearly the same in the two sets of samples (16 and 13%). They are definitely underrepresented in the pollen spectra, as most of them produce low amounts of pollen. Fields therefore were extensive around Klekkendehøj. Most of the field plants were probably introduced accidentally by man, when sowing the crop grains.

Dry-meadow plants, wild grasses and other herbs from Table 4 are included in the meadow vegetation in Table 6. This vegetation constitutes 57 and 84% of the non-tree pollen. Some of these plants are strongly overrepresented (grasses, ribwort). Nevertheless, uncultivated areas with dense herbaceous vegetation must have been widespread, probably between the fields and around large rocks within the fields. As mentioned earlier, the meadow plants may also have invaded fields where crop growing had ceased. The meadow plants probably spread from open habitats in the neighbourhood. The meadows do not appear to have been exploited heavily and it was concluded that extensive pastures were not present at Klekkendehøj, whereas light grazing may have occurred. Heavy grazing might have been unwanted, because it would have had an adverse effect on the tree regeneration after swidden cultivation (see Rowley-Conwy 1981).

Various shrubs are represented in samples A–F (12%)

but not in sample D. These shrubs are insect-pollinated and therefore strongly underrepresented. Accordingly, shrubs were quite abundant around Klekkendehøj. They may have been present in the hazel groves and been preserved for various purposes (food, elder berries, sheltering of the fields?, cp. Groenman-von Waateringe 1978), whereas shrubs were apparently absent from the alder groves and did not spread after the burning there.

The forest plants, which are particularly frequent in samples A–F (13%), probably survived in the shelter of the shrubs.

The low frequency of heath plants (heather, Table 1) indicates that heath had not developed at Klekkendehøj.

The numbers of taxa recorded in the small hollows in Næsbyholm Forest are very similar to those recorded at Klekkendehøj, except for the bare-soil plants, which were considerably scarcer in the hollows probably because of ineffective pollen dispersal.

### *Vegetation and land-use in Denmark in passage-grave time*

The hazel and alder groves recorded at Klekkendehøj together with cereals, ribwort, grasses and other herbaceous plants are very similar to the vegetation recorded during the so-called *landnam* phase of Iversen (1941). The landnam phase is reflected in East-Danish pollen diagrams by minimum for lime, low elm, maxima for hazel, alder and sometimes birch, and occurrence of cereals, ribwort and other herbaceous plants.

Iversen (1941) found a carcoal layer at the beginning of the *landnam* and he proposed that the maxima of birch, alder and hazel were due to forest regeneration after a clearance of the original woodland by the use of fire. Cattle then browsed the regenerating forest producing glades with ribwort and other herbs. Iversen also proposed that cereal crops were sown after the fire and grown for some years until the soil was exhausted in accordance with the swidden cultivation method practiced in Finland. But, as he wrote "This however is not easy to prove" (1941, p. 30, cp. Rowley-Conwy 1981, Groenman-van Waateringe 1988).

Iversen realized that the forest clearances may not have been synchronous, but connected them generally with the Dolmen Culture. Later, Iversen (1949) proposed that the land occupation phase might in some cases reflect a series of forest clearances and that the farmer people successively cleared new areas of primitive forest, because it was easier to burn than the secondary fresh vegetation. In 1967 (see Iversen 1973) Iversen realized that in some localities there was uninterrupted scrub pasture, and he suggested that hazel coppice with oak standards was maintained by suppression of the shade trees, lime and elm. These hazel groves might have been used as a food source.

Radiocarbon dating was not available at the time when Iversen proposed his *landnam* phases. Hence, it was not possible to date them and estimate their length in time. Some radiocarbon dates are now available.

Troels-Smith (1982) found that *landnam* phases with pasture may have started as early as 3200 bc (3800 BC) and could be connected with the non-megalithic funnel-beaker culture (B-type).

A pastoral phase can be recognized in a pollen diagram from a small hollow in Næsbyholm Forest on Zealand mentioned earlier (Andersen 1985). This diagram reflects vegetation on a small areal scale. Lime was suppressed in favour of hazel, alder, oak and ash, and there is a maximum for dry-land plants including ribwort and bracken. This stage is very similar to Iversen's *landnam* phase, but there is no birch maximum preceding the hazel-dominated vegetation. Field floras are weakly represented. The stage is radiocarbon-dated to 3400–2700 BC.

*Landnam* phases can also be recognized in pollen diagrams from Holmegård Bog on Zealand (Aaby in Andersen *et al.* 1983), and Fuglsø Bog and Elsborg Bog in eastern Jutland (Aaby 1986, Andersen 1984). There are minima for lime and in some cases oak and ash, maxima for hazel and alder, and slight maxima for land herbs including ribwort and bracken, which are preceded by more or less pronounced birch maxima. The radiocarbon dates are from about 3400 to about 3000 BC (2900 BC at Holmegård and 3200 BC at Elsborg). These hazel- and alder-dominated secondary woodlands were thus maintained for 200–700 years and were contemporaneous with the pastoral phase from Næsbyholm. In no case can they be connected directly with archaeological contexts, but they are synchronous with the Passage-Grave Culture.

Besides Iversen's pollen diagrams (1941, 1949) undated *landnam* phases can be recognized in many other east Danish pollen diagrams (Troels-Smith 1942, 1960, 1982, Mikkelsen, 1949, A. Andersen 1954). The *landnam* phase begins some time after the elm decline in most

cases, and immediately above the elm decline in some, giving support to Troels-Smith's contention (1982), that *landnam* phases may have been initiated as early as 3800 BC. Many of these *landnam* phases may, however, be synchronous with the Passage-Grave Culture. The *landnam* phase nearest to Klekkendehøj is found at Borre Mose on Møn, 20 km to the east (Mikkelsen 1949).

The *landnam* phase ends in many cases with renewed increase in lime (and sometimes elm), which indicates that the human activities were discontinued and the lime-dominated forest re-established. The herb pollen frequencies rarely exceed 10% giving support to Iversen's contention (1973) that extensive hazel coppices, not open pasture, characterized the Danish landscape.

Traces of cereal fields during the *landnam* are weak in the pollen diagrams from lakes and bogs and consist mainly of scattered cereal pollen grains. Shifting swidden rotation of the type suggested for Klekkendehøj would be smoothed-out in these diagrams. The extensive hazel and alder groves from passage-grave time in Denmark may thus have been used for large-scale swidden rotation. Göransson (1986) suggested a similar procedure in Sweden; however, there was no proof of this. The coppice groves may also have been maintained for other purposes. Iversen (1973) suggested food-gathering (cp. Jørgensen 1983), and Godwin (1975), Bartholin (1978) and Malmros (1986) suggested the use of piles for building purposes (trackways and pile dwellings) and for fences.

At Klekkendehøj there is no evidence of extensive pasture, but limited grazing as described by Linkola may have occurred. At one of the hollows in Næsbyholm Forest several minima for lime and maxima for oak, alder, hazel and ash, and ample charcoal dust, dated at 3400–2700 BC, indicate repeated burning of lime-forest. There are small peaks for herb pollen. Slash and burn was probably used irregularly for promotion of browsing by cattle. At the same time, permanently grazed glades with ribwort and bracken were maintained at the other hollow mentioned above (site 1) along with groves of hazel, alder, oak and ash, which were probably used for various purposes, whereas evidence of fields is weak.

The pollen diagrams from lakes and bogs also support Iversen's surmise that grazing occurred during the *landnam* phase and that no extensive pastures were present.

The evidence of swidden cultivation at Klekkendehøj is unique and needs support from other localities. Still, it can be suggested that groves of hazel and alder mixed more or less with other trees, were maintained by the passage-grave people to be used for slash-and-burn rotation and for production of food and wood. There is also evidence that glades used for pasture occurred in limited extent.

Averdieck (1980) mentioned pollen analyses of brown earths buried under Neolithic barrows in northern Germany. The age of these barrows within the Neolithic was not mentioned and no pollen spectra were shown. Wild grasses and ribwort seem to have been common and cereals scarce. Heather was frequent in samples from sandy soils underneath barrows from the Funnel-Beaker Culture in The Netherlands and northern Germany (see Casparie and Groenmann-van Waateringe 1980, and earlier litterature quoted there, Groenmann-van Waateringe 1979b, Averdieck 1980). Hence, this vegetation differed from that found on calcareous soils in Denmark. Heather was also prominent on sandy soils in western Jutland from about 3500 BC and onwards (Odgaard, in Andersen *et al.* 1983).

### *Conclusion*

The pollen spectra from Klekkendehøj have proved that useful information about the land-use of prehistoric cultures may be obtained by pollen analysis of soil horizons in barrows even in areas with calcareous soils. The experiences of Dimbleby (1985) have shown that prehistoric barrows were often constructed by using material from the contemporaneous land surface. Hence, such useful information can be obtained even in cases where the original soil is not preserved beneath the mound. Pollen diagrams from lakes and bogs provide a smoothed-out picture of vegetation on a large areal scale and in a datable time sequence. The pollen spectra from burial mounds are narrowly focussed in space and time and can be connected directly with prehistoric cultures. Such spectra are urgently needed for an understanding of the way of land-use employed by different prehistoric cultures. In the cooperation between the Geological Survey of Denmark and the National Forest and Nature Agency now in progress such investigations will be an important new activity.

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## NOTES

1. The tree pollen counts were corrected before percentage calculation with the following factors: pine, birch, oak, hazel, alder × 0.25, elm × 0.50, lime, ash × 2.
2. Species of weeds found as macrofossils from Neolithic time in Denmark and neighbouring countries (from Jørgensen 1982, Jensen 1985): Thyme-leaved sandwort (*Arenaria serpyllifolia*), black bindweed (*Bilderdykia convolvolus*), *Bromus hordeaceus,* shepherd's purse (*Capsella bursa-pastoris*), fat hen (*Chenopodium album*), hemp nettle (*Galeopsis sp.*), cleavers, (*Galium aparine*), scentless mayweed (*Matricaria perforata*), knotgrass (*Polygonum aviculare*), self-heal (*Prunella vulgaris*), wild radish (*Raphanus raphanistrum*), annual knawel (*Scleranthus annuus*), white campion (*Silene alba*), corn spurrey (*Spergula arvensis*), chickweed (*Stellaria media*).
3. Fredskild (Degerbøl and Fredskild 1979) noticed one pollen grain in a pollen sample ascribed by him to zone VIII (with low lime and elm, and high hazel and alder percentages). This sample may be contemporaneous with Klekkendehøj. Fredskild found that the cornflower-pollen grain might be due to contamination, however, in view of the finds from Klekkendehøj, this find may be considered genuine.

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# *Sarup*

## Two Neolithic Enclosures in South-West Funen

by NIELS H. ANDERSEN

### INTRODUCTION

In 1971–84 two neolithic causewayed camps dating from the latter half of the 4th millenium B.C. were excavated near the village of Sarup in southwestern Funen. The older and larger of them enclosed an area of about 9 ha., making it one of the largest ancient monuments in Denmark. The Sarup camps were the first of their kind to be recognized in this country, but subsequently a dozen more have been found, and the type is familiar especially in Germany, England, and France.

### TOPOGRAPHY

The site is situated on a sandy promontory in the outlying eastern part of the village of Sarup. This promontory has an area of about 9 ha. and rises about 9 m over two streams, which bound it on two sides (fig. 2). The streams meet at the southern extremity of the site and continue southwards about 2 km to Helnæs Bay. On the east and north the site is level with the surrounding land, and it is here that the enclosure systems were placed.

### THE EXCAVATIONS

The neolithic features survive as the soil marks of palisades, enclosures, isolated fences, and ditches. Inside it were found a large number of pits – especially from later settlement phases. Many years ploughing of the site made it an acceptable policy to remove the topsoil with earth-moving machinery. It was possible to expose and excavate about 1500 $m^2$ a week. All postholes and pits were totally excavated and most of the ditches and palisade trenches were examined by means of 1 m wide cross trenches. Sieving and flotation were carried out

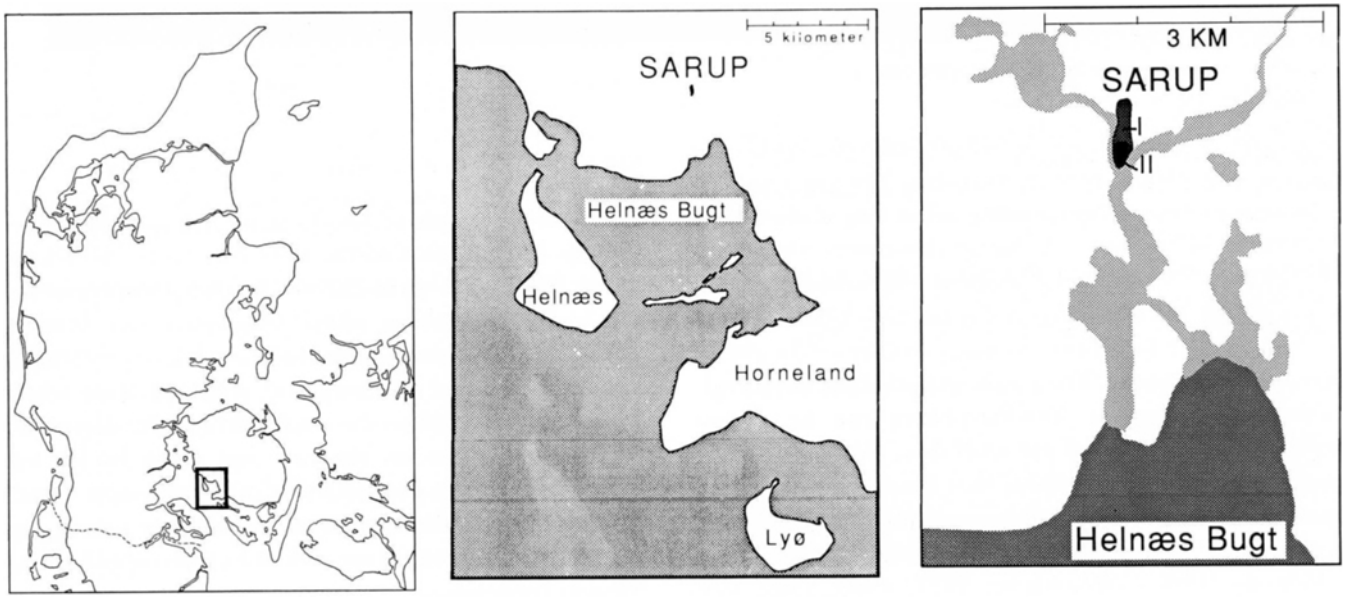



Fig. 1. Position of Sarup in western Funen.

Fig. 2. Sarup from the air, looking northwards.

regularly to obtain as much carbonised wood and seeds as possible with a view to revealing the surrounding natural conditions and finding what was gathered or cultivated at the time. At Sarup there were excavated 3228 features with finds and about 6000 without, and a total of 238,585 objects were found. One would expect to find three or four times as many features if the entire site were excavated. The whole material has been registered on computer. Eleven phases can be distinguished, of which five are neolithic, two with causewayed camps. As it is these that have given the most new information, they will be examined in greater detail under the names SARUP I and SARUP II (see also Andersen 1974, 1975a+b+c, 1977, 1980, 1982, and 1988).

## SARUP I

This was the largest and earliest, covering an area of 8.5 ha (fig. 3) and dated to ca. 3400 B.C. (carbon-14 from grain, 2630 ± 70 bc, K-2828). The camp was constructed in the Fuchsberg phase (Andersen and Madsen 1977) at the transition from the Danish Early to Middle Neolithic. Shaped as a long oval, it occupied the whole headland, bounded on the south and west by slopes and watercourses, and on the east and north by the enclosure. This latter consisted of the foundation trench of a palisade, fenced enclosures and other fences, entrances, and a double row of ditches interrupted by numerous causeways.


Fig. 3. Sarup I shown black, dots indicate ritual pits.

*The palisade*

This stood in a trench 40–130 cm wide and 50–110 cm deep, which could be followed for a distance of 572 m. The trench had vertical sides and flat bottom (fig. 4). The palisade planks, which stood in it with about 65 cm from the centre of one post to the centre of the next, were for the most part turned to soil and appeared only as dark patches in a horizontal surface, but in the damp northern area, where the ground water was high, they were still preserved as wood. Those surviving were split oaken trunks with diameters of up to 42 cm. On their lower ends were clear marks of cutting with an axe (Andersen 1980, 87), applied at an angle of 30°–45° to the direction of the trunk.

The decayed post moulds could be studied in ten vertical sections. In eight the post stood in the centre of the trench, and in two at its side against the edge of the trench. Naturally it was intended that the posts should stand vertical, but it could be seen that before finally decaying they inclined outwards or inwards. If a bank had abutted against one side of the palisade, they would all have inclined in one direction, away from it. If there had been banks on both sides of the palisade they would have remained vertical. One must therefore suppose that there had been no bank at all. The varying inclinations suggest that the palisade was not maintained and righted up to a vertical position before the earth had consolidated around the pots. None of the palisade post had been removed and all had decayed in place.

In the fill and especially at the surface of the palisade trench there were found 2261 objects (of which 85% were potsherds) in the 81 meters that were excavated. In some places there were concentrations of pottery near where the posts had stood, indicating that complete pots had been deposited deliberately. One should imagine a palisade of oak planks up to 42 cm wide rising probably 2–3 meters above the ground. Beside the palisade were placed various objects, some of them complete pots, clearly selected material. The palisade seems quickly to have become unfunctional, but it was not removed. It was big enough to have served as a defensive work, but none of the objects found looked like the remains of battles, but were more suggestive of ritual acts. Nevertheless the palisade must originally

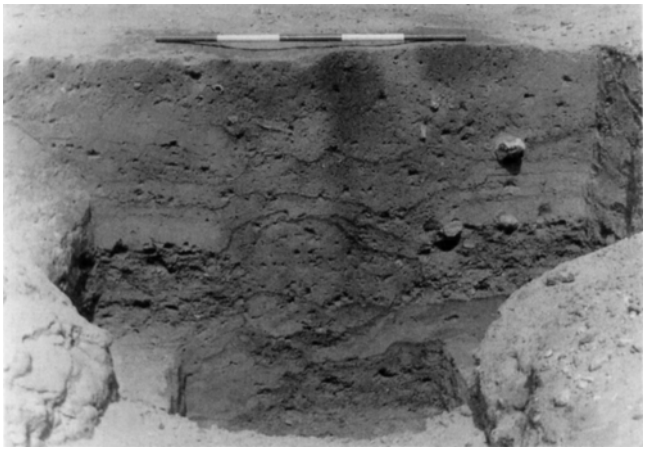


Fig. 4. Section across palisade trench of Sarup I.

have been an impressive sight, whose purpose must have been to call attention to something or other. It was also the structure which the other features followed, and they must all have been constructed at the same time according to a detailed design.

*Enclosures*

A characteristic feature of Sarup were the 19 enclosures joined to the palisade or placed in the gaps between the ditches. Those joined to the palisade followed a sequence like two squares, a rectangular, two squares, etc. (see fig. 3). The square enclosures ranged in size from 32 $m^2$ to 76 $m^2$ (figs. 5, 6C, 7A), the rectangular ones from 145 $m^2$ to 255 $m^2$ (fig. 6D). Between and in front of them and at varying distances from the palisade were unaligned ditch segments. Further enclosures were sometimes attached to their outer sides (fig. 7B and C). On the north of the site there was an enclosure in the form of two arcs – like crab claws – with two sets of ditches outside them (fig. 8).

The posts of the enclosures stood in trenches about 50 cm deep and were shaped sometimes as planks, sometimes as round timbers. In some places they stood close together, in others about a meter apart. Their probable height was about 1.5 m – about half as high as the posts of the palisade.

There is nothing to suggest that the enclosures were roofed. In a few cases only there was a gap in the trench as a sign where there had been an entrance. There are no finds that reveal the function of the enclosures. However they must have had some special significance as several times ditches respect their placing along the palisade. Some other European monuments, especially in the Rhineland, have very similar enclosures (Boelicke 1977 and Lehner 1910).

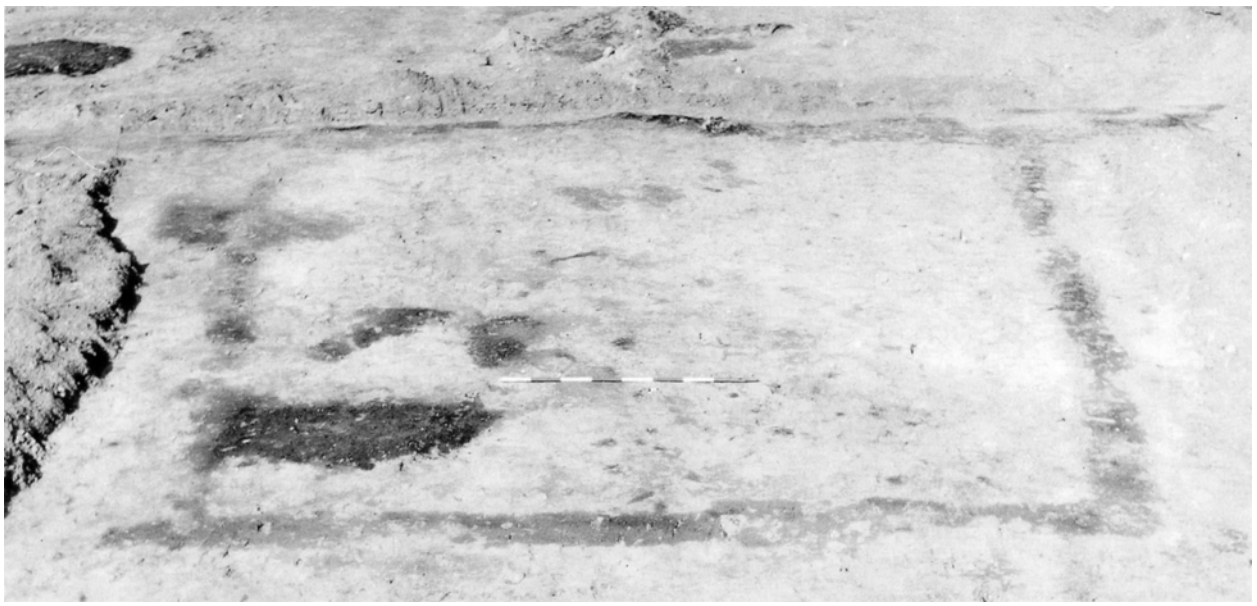


Fig. 5. Photograph of square enclosure (fig. 6C), with the palisade trench in the background.

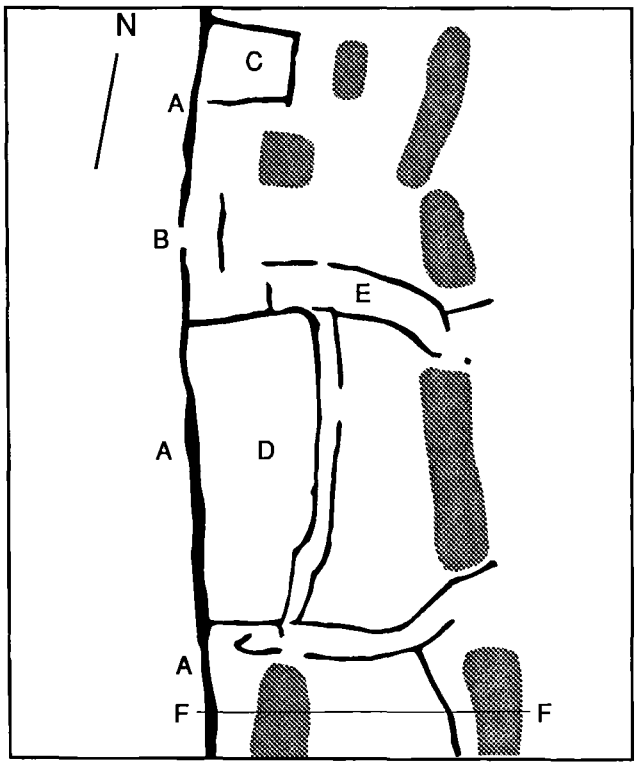



Fig. 6. Plan of area near entrance. A = palisade trench, B = entrance, C = square enclosure (see fig. 5), D = rectangular enclosure, E = fenced entrance passage, F = position of section fig. 12A.

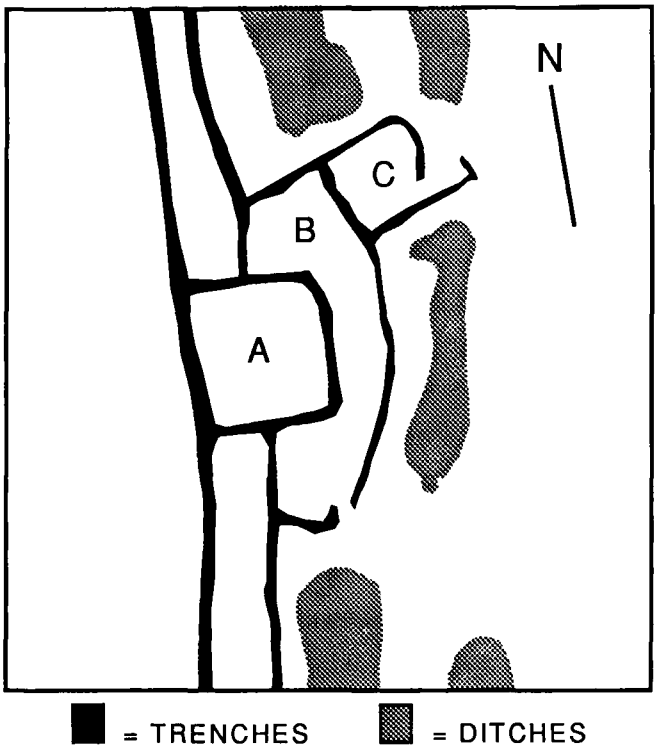



Fig. 7. Plan of the area with square enclosure with additional enclosure on its outer side. A = square enclosure, B = enclosure on outside of B, C = enclosure added to B.

*Fences*

Between the palisade with enclosures and the ditches were a series of trenches for further fences, some of which ran parallel with the palisade and others at right angles to it, leading to the area between the ditches (fig. 3 and 6). As they were only 20–50 cm deep, it seems that they can only have held short posts.

It is difficult to say anything about the function of these fences, but it may have been to show ways of access and delimit/separate areas within the camp.

*Entrances*

There are various gaps in the many fences, which are interpreted here as entrances. In the palisade there were two entrances, of which one is interpretated as the main

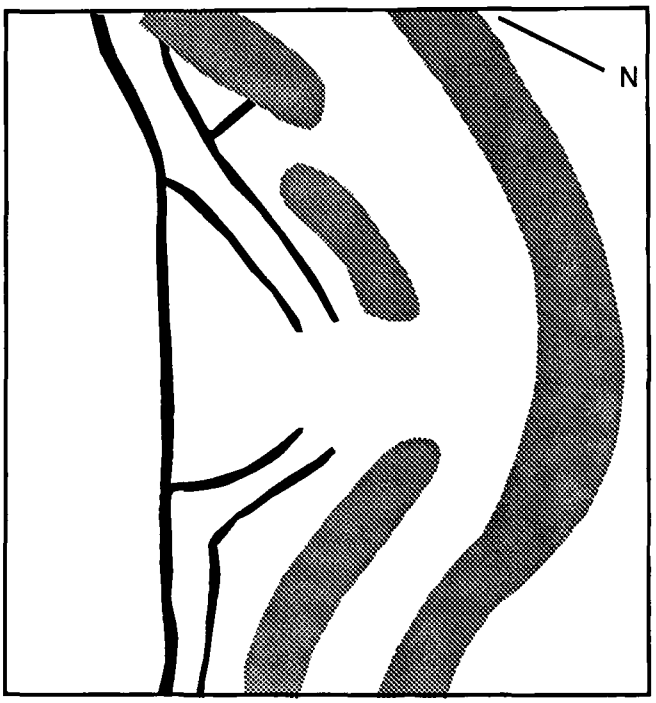



Fig. 8. The most northerly part of Sarup I with the "crab claws" expansion.

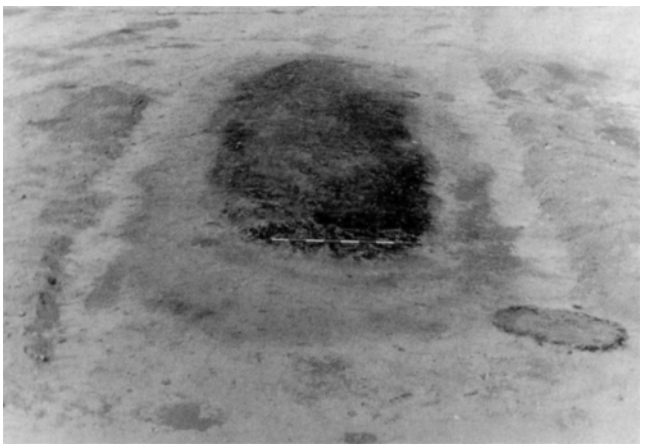


Fig. 9. Uncovered ditch of Sarup I with a later occupation layer.

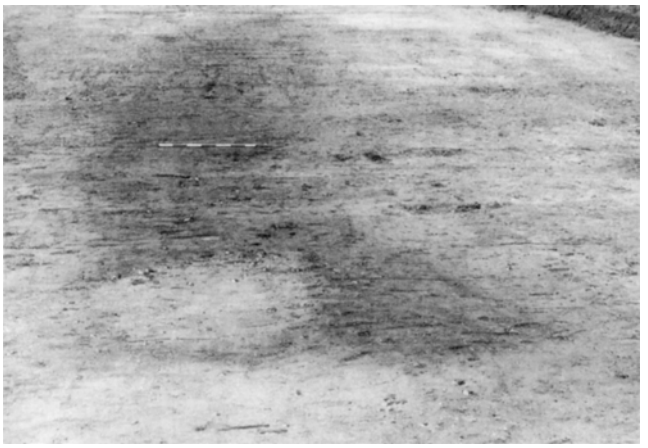


Fig. 10. Uncovered ditch of Sarup I with unexcavated block at one end.

entrance, while the other only led into an enclosure. The main entrance was a 1.6 m wide gap in the palisade (fig. 6B), placed about half way between the southern extremity of the sandy headland and the most northerly point of the enclosure – 300 m and 293 m respectively. It was shielded by a fence 6.5 m long standing about 3 m in front of it. Access to the entrance was along a 2–3.5 m wide path sheltered on both sides by fences, and at one place restricted by a crossfence to only 1.4 m, so nothing wider could come in.

It is remarkable that there should have been so small an entrance to an area measuring 8.5 ha! If there were many people at the site (and there is room for thousands) one would expect many entrances, or traces of a great deal of traffic at the only one, but this was not the case. No traces were seen at the main entrance of special activities, such as pottery offerings, etc.

*Causeways*

Outside the palisade ran two systems of ditches, which were not continuous, but were divided into sections by causeways of untouched natural deposit (fig. 3). The width of the causeways varied from a few centimeters to 13.5 m, average 5.4 m. The causeways give many ways of access, but fences and the palisade hindered further progress.

*Banks*

There is nothing to show that the site was fortified with banks. Examination of the ditch fills indicates that they had been refilled manually shortly after being made. It can be seen that the fill came from both sides, so the upcast must have been placed along both sides of the ditches. The variable depth of the ditches does not suggest that they were dug to provide earth for a bank, and two ditches had unexcavated blocks at one end (fig. 10).

*Ditches*

These were regular excavations with parallel sides and width at top of at least 2 m (average 4 m); lengths were from 5 to over 100 m, most frequently however around

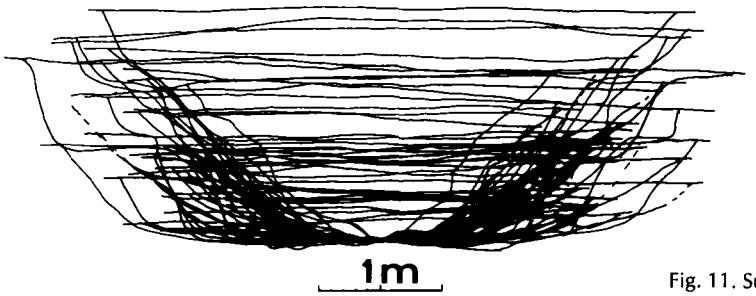



Fig. 11. Superimposed ditch profiles from Sarup I.

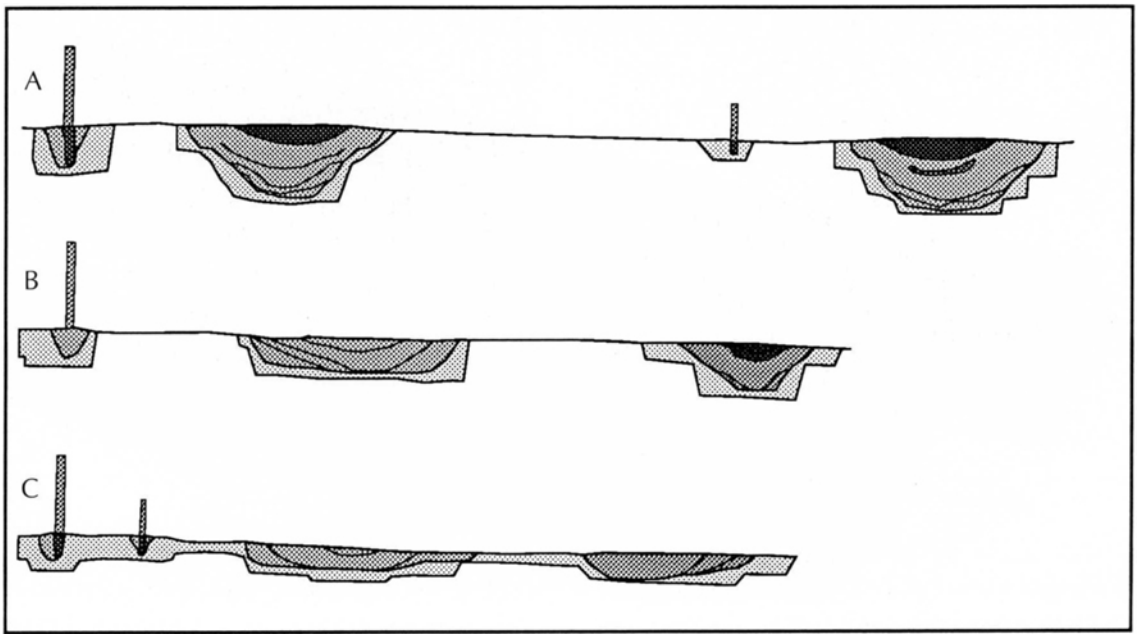



Fig. 12. Section through the palisade trench, two ditch segments, and a fence in the area south of the entrance (position shown in fig. 6F).

15 m, and depths were from 16 cm to almost 2 m, average around 1 m. The ditches lay in line separated by causeways. At Sarup there were two parallel rows of ditches (fig. 3), of which the inner one, which was nearest the palisade, followed a somewhat irregular course along the palisade and enclosures, while the outer one was more continuous. In the northern part of the site the ditches are less broken up by causeways, and one of them attained a length of over 100 m.

Forty-three ditch segments with a combined length of 608 m are recorded as being from Sarup I. Six have been more or less completely excavated, while trenches 1 meter or more wide have cases re-used. The superposition of all the drawn sections (fig. 11) showed that most had a flat bottom approximately 2 m wide (only two are pointed). Their depth varied from 16 cm to nearly 2 meters, average 83 cm. The deep segments are in the south, the shallow ones in the north, where ground-water probably also in the Stone Age prevented deeper digging. The angle between the flat bottom and the sides was 110°–120°. Longitudinally they always had a horizontal flat base. If their purpose had been to provide earth (as for a rampart) it is unlikely that a horizontal flat base would have been aimed at or that the different segments would have differed so much in depth.

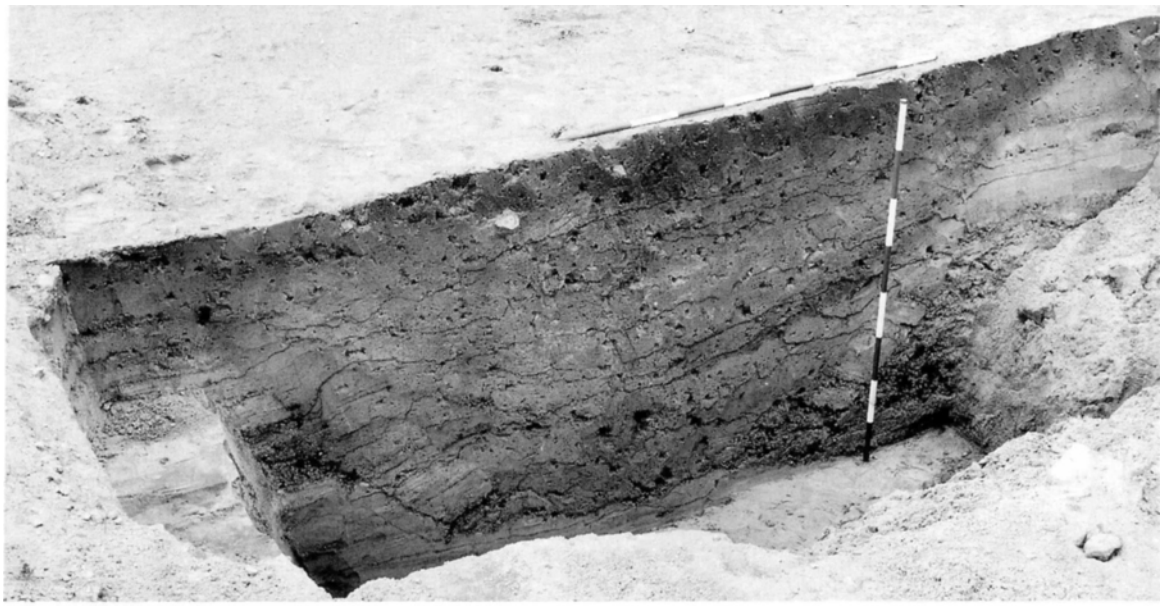
Examination of the inner and outer ditch segments in pairs (fig. 12) shows that the one closest to the palisade was often deeper and larger than the one further away.

It was sometimes possible to see traces of the original digging of the ditches in the form of steplike notches into the stratified natural sand and gravel. The depth of such notches was about 10 cm, no doubt the length of the blade of the digging implement.

In the northern part of the site the high level of the water table made the ditches damp and the fill correspondingly more peaty. There was no sign that water ever stood in the southerly ditches. In these there were only fine thin layers of sand that had blown and slid from the steep sides. There were no occupation or turf layers at the bottom of the ditches, which would have shown that they had remained open for some time and rubbish had been thrown into them.

In four cases at the bottoms of the ditches there were found animal bones and large pieces of pot, not ordinary settlement waste like small potsherds and flint chipping waste. In seven ditches concentrated layers of charcoal were found on or close above the bottom. Sometimes the surrounding earth was fire-reddened, which shows that the charcoal was burning or smouldering when buried.

At some places it could be seen that the sides of the



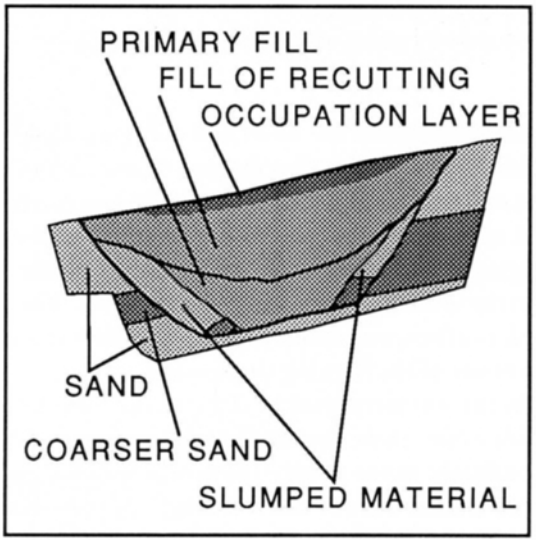



Fig. 13. Ditch of Sarup I with slumped layers at the sides.

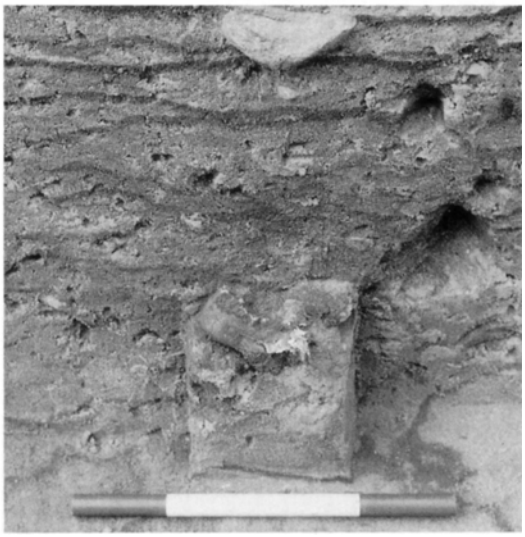
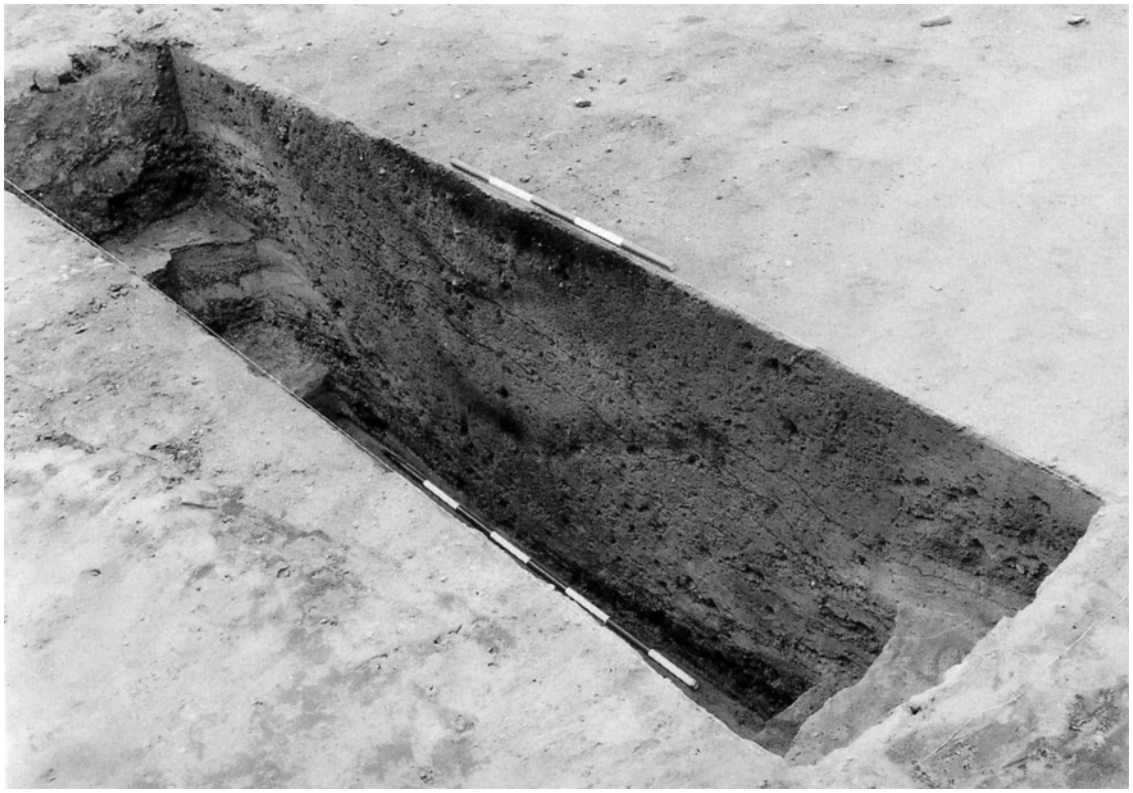


Fig. 14. Human jaw in ditch of Sarup I.

ditches had quickly collapsed, because lumps of the natural subsoil lay on the ditch floor (fig. 13). Collapse of the sides can occur very quickly, happening at latest when there is frost and thaw. Constructing the Sarup camp must have given the inhabitants many problems, but they made no attempt to keep the flat-based ditches clean.

From the deep layers in the ditches were recovered a total of 1343 finds, and they can be dated to the Fuchsberg phase. Only 210 of them were found in the southern ditches. Compared with the number found in the palisade trench (2261), the number found in the ditches is small, for six times as much earth was dug out of the them as out of the palisade trench. Those found at the bottoms of the ditches appear to have been placed there deliberately. There were animal bones and large sherds, in some cases covered by layers of stones. Especially in the northern part of the site the number of implements was large compared with the number of flakes. The average for the whole site was 14 pieces of



flint waste for each tool, but in the northern part there were only 3 pieces of waste for each tool! A use-wear analysis shows that these tools had been used primarily to work wood, but also hide and bone had been worked. There was a further tendency for tools used to work different materials to be found in different places. Another thing is that the sherds sometimes lay in separate heaps, as though representing single vessels broken at the spot (unfortunately preservation was very poor in the damp northern ditches).

It was a surprise to find human bones in the southerly part of the site. There was the mandible of an adult aged 25–30 years (fig. 14) and all the teeth of an 8–10 year child with traces of the skull preserved only as a dark decayed mass. The human bones did not lie together with other finds, and show only that also at Sarup there were performed acts connected with a skull cult, a thing which is well documented at certain comparable sites with optimal conditions for the survival of bones (e.g. Boujot 1985 and Mercer 1980).

Above the basal layers came a homogeneous fill made through the mixing of the earth that had originally been dug out. The fill is without internal stratification and

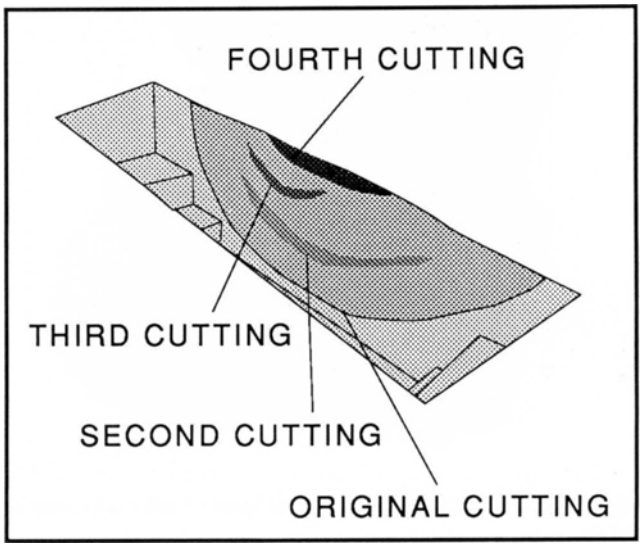



Fig. 15. Ditch of Sarup I with indications of having been recut and refilled three times.

must have been thrown back deliberately from spoil heaps on the sides of the ditch.

Recutting of the ditch was observed in in the fills of more than half of these features, all in the southern part

Fig. 16. Funnel beaker from the interior of Sarup I, containing further pots and carbonised grain. a-c: The three pots after reconstruction. a) 1:5. b) 1:2. c) 1:2.

of the site. The signs of recutting are sometimes hard to recognize (fig. 15), but show that it took place on several occasions – sometimes in the phase in which the camp was constructed, sometimes in later phases. All but one of the recuttings respect the basal level previouly dug down to. Recutting was not established as contemporary in all the ditch segments, in fact not even in adjacent segments. It was clearly done on special occasions and with particular aims in view. Finds were made in only a few recuttings and were of the same kinds as found at the original bottoms of the ditches. In one of the recuttings lay the sherds of a complete funnel

beaker. It was the many recuttings and the finds made in them that made it possible to distinguish the sequence of the neolithic occupations at Sarup.

In the upper layers of some of the ditches in the southern part of the site were found rich occupation strata (fig. 9), deposited in what was either a recutting or a hollow resulting from consolidation of the fill. In these layers (which date from MN II to V) there were found 41,157 finds, and five times as many could be expected if all the ditches were excavated.

*Labour requirements*

It is difficult to judge the labour required to construct the defences of Sarup I. However some hypothetical norms can be set up, with whose help the labour requirements of the different tasks can be estimated. For Sarup I the calculation is as follows:

| | posts | wood in $m^3$ | earth in $m^3$ |
|---|---|---|---|
| *palisade* | | | |
| digging 572 m of trench: | | | 350 |
| posts: split oak trunks | 1290 | | |
| 3 m long and 42 cm in diam. | | 268 | |
| *enclosures* | | | |
| digging 455 m trench: | | | 85 |
| posts: 1.5 m long, 30–40 cm | 1200 | | |
| wide and 15 cm thick | | 75 | |
| *fences* | | | |
| digging 401 m ditch: | | | 35 |
| posts: 1.5 m long, 30–40 cm | 1200 | | |
| wide and 15 cm thick | | 75 | |
| *ditches* | | | |
| digging ca. 600 m of 2.5 $m^3$ | | | |
| per metre: | | | 1500 |
| total | 3690 | 470 | 1970 |

If a Neolithic inhabitant could dig out 2 $m^3$ earth in a day, 985 workdays would have been needed. The posts involved the production of flint axes to fell them, felling, cutting off branches, splitting, and transport. We reckon with 3 work-days per trunk, which gives 11,070 work-days. Then altogether 12,055 work-days were used to construct Sarup I. This is equivalent to roughly 100,000 hours or 50 man-years. If Sarup was constructed in a single season it required the labour of 200 men for three months. On top of this comes refilling the ditches.

*The interior*

It has always been of great interest to know what went on in the area enclosed by the ditches of the Neolithic camps. One of the aims of the Sarup investigations was to see whether there were features that would support the discoveries and observations made in the ditch system. It was possible to investigate two thirds of the enclosed area of Sarup I, the remainder being under present occupation. The whole interior of Sarup II has been investigated.

In the interior were found 97 features of the Fuchsberg phase (fig. 3), which may be suppose to have been in use at the same time as the ditch system. Most of them were scattered postholes, but 19 were larger and had a special content of complete objects – therefore they are not rubbish pits. Nine of them held complete pots and one a complete axe. They are interpreted as ritual pits. Five of them lay less than 25 m from the palisade and the majority were situated at the southern end of the site.

In one of the ritual pits (Andersen 1976) there was a large funnel beaker (fig. 16) containing two other pots and a large quantity of carbonised grain, found to be 95.3% emmer wheat, 4% barley, and 0.7% other kinds of wheat (Jørgensen 1976). The crop was thus a monoculture, not even containing weeds. The pots bear characteristic Fuchsberg patterns (Andersen and Madsen 1977). Another ritual pit lay close by and also contained much grain (again a monoculture of emmer wheat), and the presence of sherds of the same pot in both pits show they were contemporary. Other pits contained a number of flint implements but scarcely any chipping waste, just like the basal layers in some of the ditches. For instance one group contained 7 pieces of flint waste and 10 implements. They were all scrapers that had had been used to scrape wood.

Thus the interior showed no traces of contemporary settlement with rubbish pits and house remains, but preserved instead in the ritual pits the remains of more exceptional activities. All in all it may be said that the main activity took place in the ditch system and not in the enclosed area. Also the difficult access to the interior shows that it was not much used.

## SARUP II

The other enclosure at Sarup was only about one third as large as the first, and covered about 3.5 ha. on the flat southern part of the headland (fig. 17). It has been dated to about 3280 B.C. (carbon-14 dated by corn to 2530 ± 90 bc, K-2767). It was constructed in the Klintebakken phase, MN Ib (Berg 1951 and Ebbesen 1975, 53), and was about 120 calendar years younger than Sarup I.

The site is enclosed by palisades, enclosures, and ditches which together start on the SE side of the headland and cut across the older site, which must at that time have been greatly decayed.

### *The palisade*

In contrast to the palisade of Sarup I with its substantial trench, the younger palisade was a lighter construction of parallel rows of small posts standing in a belt two meters wide (fig. 18A). The palisade can be followed for 159 meters, not along an even curve, but with two distinct bends. The postholes have an upper diameter of 20 cm and are 20 cm deep. The holes were made by posts that were hammered in, and were not dug. The poorly supported posts are unlikely to have been longer than a meter. There were about six posts to the meter, giving a total of about 900, and they were removed afterwards, with the result that the holes were often difficult to recognize. In some places it could be seen that posts had stood two, three, or four in line facing the ditches. The palisade, which was really not much more than a fence, was too weak to resist any force and no doubt served only as a boundary. Only a single small sherd was found in the postholes, and it gives no information about dating or function.

### *Enclosures*

Connected with outer side of the palisade fence was a series of rhombic enclosures with sides measuring 6–10 m (fig. 18B). In contrast to those of the earlier monument, whose posts stood close together in a dug trench, the posts of the younger enclosures stood in postholes with diameters of about 30 cm and variable depths ave-

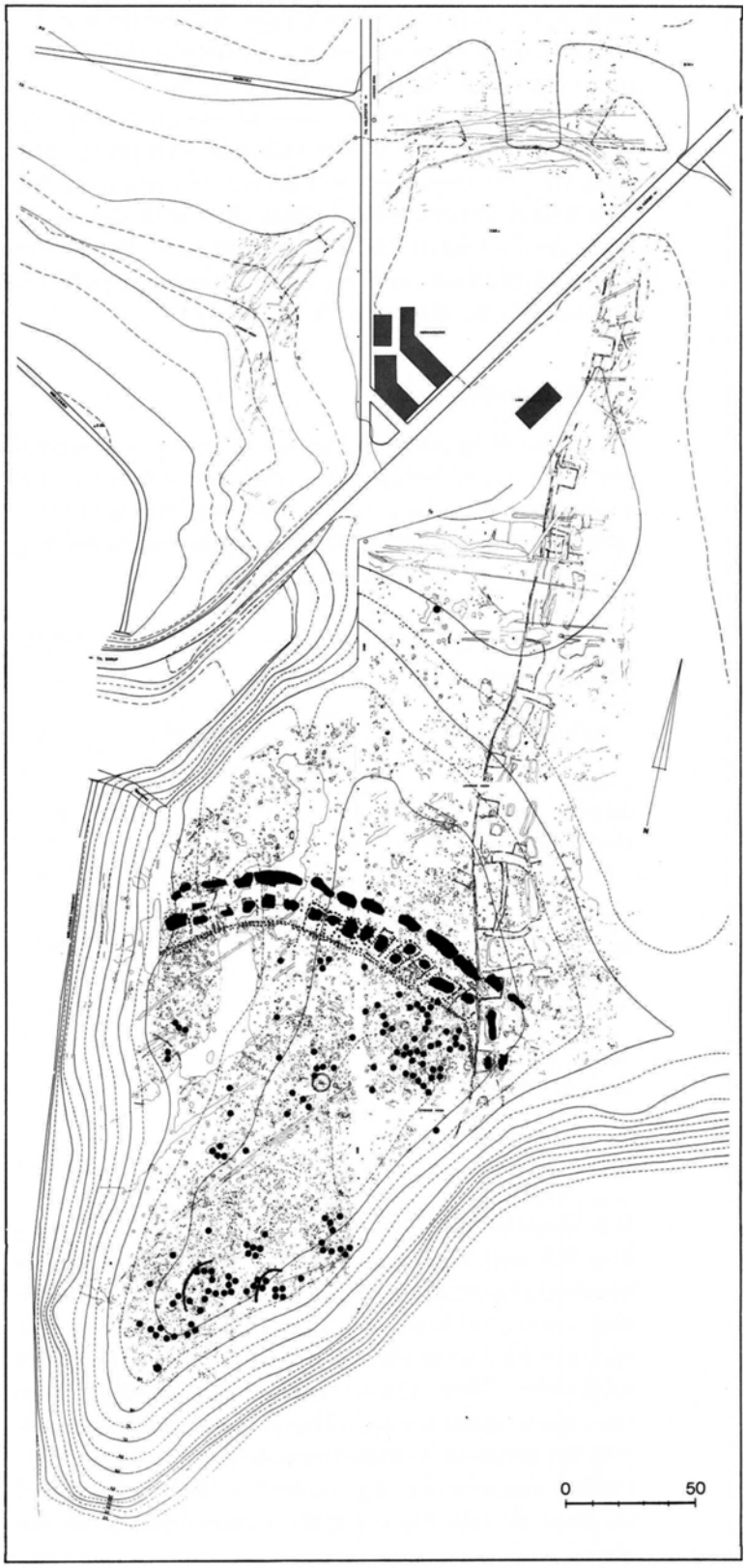



Fig. 17. Features of Sarup II shown in black; dots indicate ritual pits.

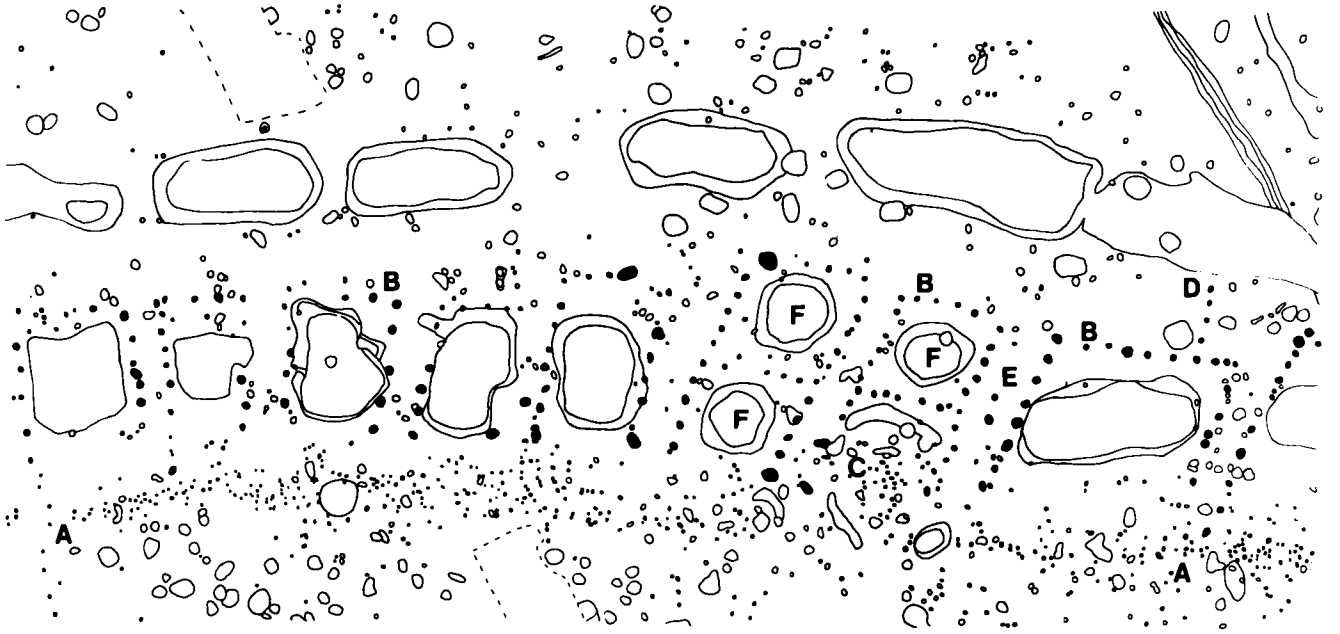



Fig. 18. Detailed plan from Sarup II's northern part. A, palisade postholes; B, enclosures; C, large tree-pit; D, other fences; E, fences in possible entrance way; F, undisturbed primary ditches.

raging of about 20 cm. The differences of depth may indicate that it was intended that the height to the top of the posts should be equal. It appears that the posts of the enclosures had the same height as those of the palisade – ca. 1 m. It can be estimated that 428 posts were used to build the enclosures.

Each enclosure surrounds a segment of the inner ditch, with a single exception (fig. 18C), which surrounded an undated tree pit (perhaps the enclosure surrounded a tree?). There were no enclosures around the segments of the outer ditch.

No ways of access into the enclosures could be seen, but the distance between posts may have permitted entry. Several re-diggings of the ditches in the enclosures shows that a lively activity took place (see below and fig. 22).

Altogether 23 sherds and flint flakes were found in the postholes, but tell nothing about their function.

*Fences*

At only a couple of places were any remains of fence structures observed. They joined the enclosures to the outer row of ditches (fig. 18D).

*Entrances*

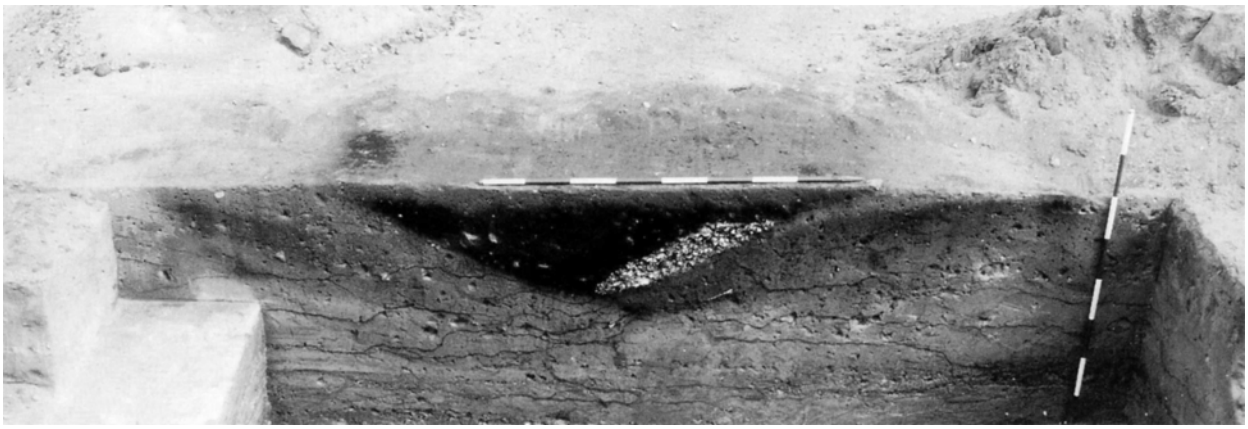
No indications of entrances were recorded at Sarup II. However the side walls of one enclosure sometimes run parallel with those of the next, suggesting perhaps that they marked out ways of access. This was supported in some cases by the presence of cross posts, whose purpose was possibly to block further advance (fig. 18E).

*Causeways*

It is characteristic of this type of site that the ditches are interrupted by causeways. In the inner ditch of Sarup II there was a causeway about every 6.5 m, in the outer ditch one about every 9.5 m. The width of the causeways was up to 5.9 m. No connection can be seen between the positions of the causeways of the inner and the outer ditches.

*Ditches*

Also at Sarup II there were two parallel interrupted ditches, this time 4 m and 16 m in front of the palisade (fig. 17 and 18). The length of the segments varied from 3.9 to 18.8 m, average 7.9 m. In the inner row, where they tend to be more square, the average length is 6.49 m, in



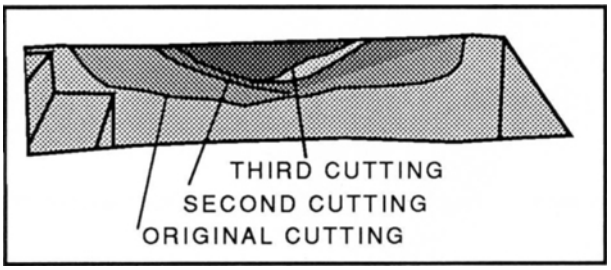



Fig. 19. Section across a ditch belonging to Sarup II.

the outer, where they tend to be more rectangular, the average length is 9.64 m. The width varied from 2.15 to 7.40 m. The largest widths are in the inner row, where in several cases the ditches have been widened by recutting.

Thirty ditch segments were recorded from Sarup II, with a combined length of 236 m, of which 57 m have been excavated. Only three segments were totally excavated, but trenches were cut across them all.

They showed up first as slightly darker soil changes, sometimes with black occupation earth from late deposits in the middle. Superimposed outlines of all the ditch sections (fig. 19) shows that they had flat to slightly concave bottoms at least 2 m wide, that the sides were originally nearly vertical, and that the depth ranged from 40 cm to 1.3 m, average 93 cm.

As at Sarup I there were no occupation or turf layers at the bottom of the ditches of Sarup II (fig. 19). At the edges of the bottom there were fine sand layers, probably blown in, and over this frequently collapse from the sides. This was all sealed by a fill of mixed sand and gravel derived from the material dug out of the ditch. An unstratified fill of this kind must be interpreted as a deliberate backfill. Backfilling took place from the sides of the ditchs, where the earth no doubt lay as at Sarup I as low spoil heaps rather than as banks proper.

Only 72 finds were made at the bottoms of the ditches – less than one object per meter of ditch. In three ditches there were found large pieces of pot, which belonged to the same vessel in two ditches. Noteworthy was a nicely ornamented bowl, sherds of which lay on the bottoms of three ditches and in four pits about 15 m inside the palisade (fig. 21). This showed that the ditches and the pits had all been open at the same time. On the bottom of three ditch segments there were found poorly preserved animal bones, including the skull of a pig set around with hand-size stones.

Recutting of the ditches became visible as soon as the surface was cleaned. It was especially clear in the inner row (see fig. 18), which seems originally to have consisted of fairly small (probably ca. 4 × 4 m) pits (fig. 18F),

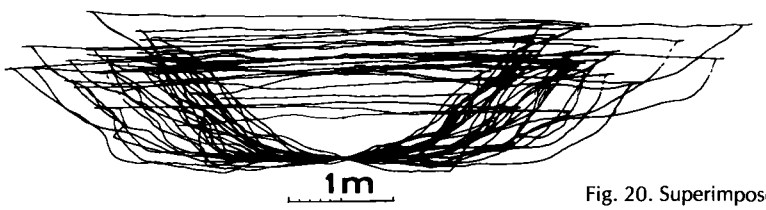



Fig. 20. Superimposed ditch profiles from Sarup II.

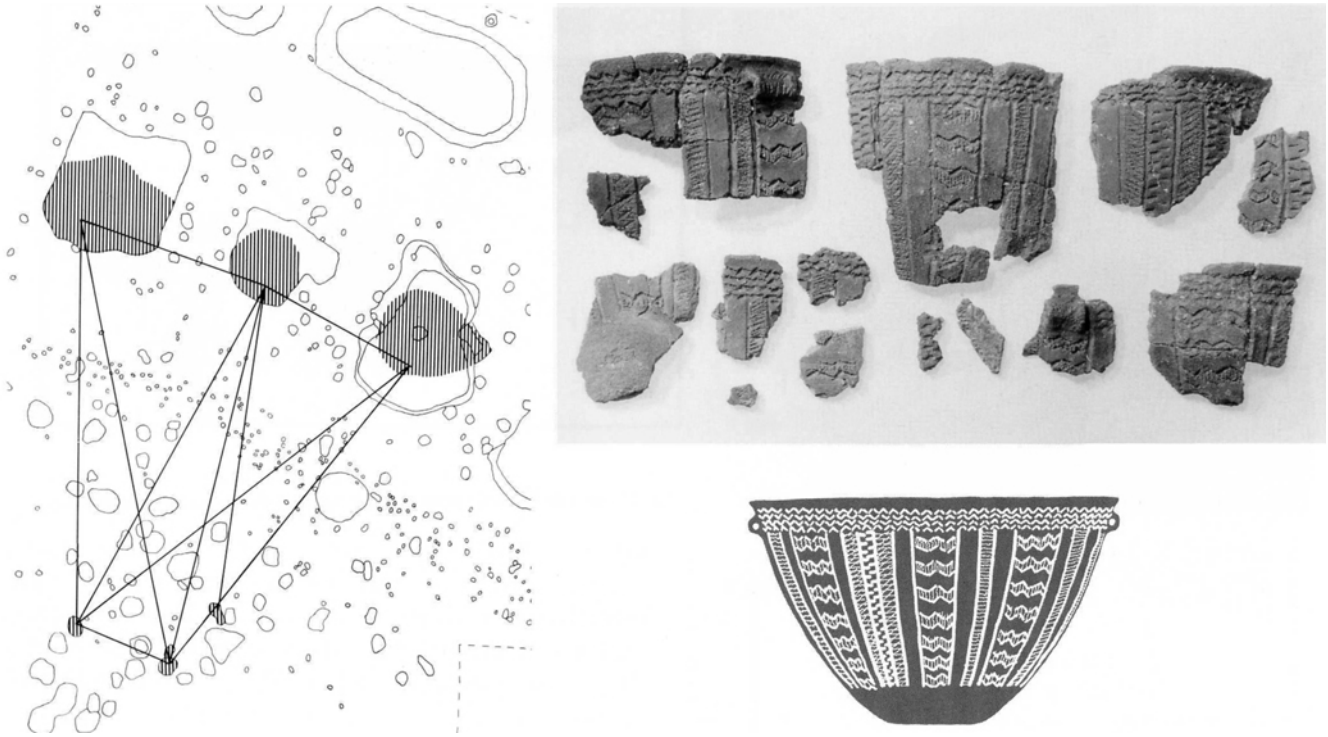


Fig. 21. Distribution of sherds of a decorated bowl from Sarup II, whose sherds were found in three ditch segments and four pits inside the palisade. The height of the reconstructed vessel is 18.4 cm.

which were enlarged and acquired their irregular from by recutting.

Two adjacent segments of the inner ditch showed particularly clear traces of recutting (fig. 23). In one case a recutting north of the original ditch could be seen at a high level. On that occasion some posts of the palisade were removed on the north and east. In the next ditch segment to the west (fig. 22) there were traces of three recuttings down to the original floor, but not touching any posts of the enclosure. It seems likely that the digging of that particular ditch segment, the building of a fence around it, the refilling of the ditch, and two further recuttings and refillings, all occurred during the lifetime of the enclosure fence, no doubt within a 20–30 year period. In both ditch segments there were later settlement layers from MN II and MN III/IV.

There were clear indications of recutting in only one of the segments of the outer ditch, where it was done parallel with the original ditch and had nearly the same depth.

The upper find-rich occupation layers were deposited 100–200 years after the ditches were dug. Some of these occupation layers were found in the recuttings. In 29 ditch segments there were recorded 114 occupation layers with altogether 40,503 finds. One ditch had occupation layers from four phases of the Neolithic, another had no less than eight occupation layers.

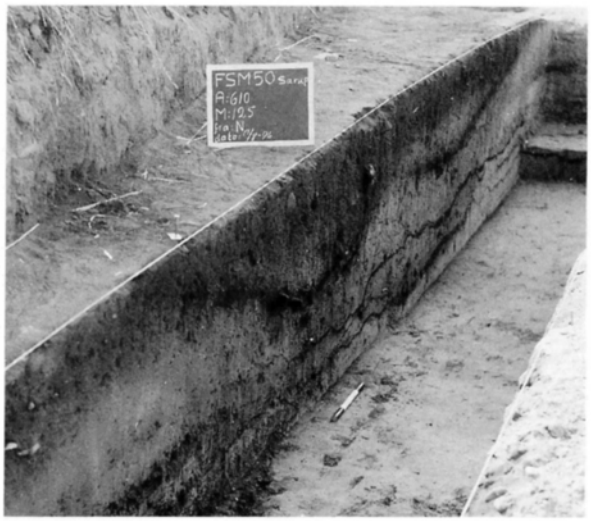
## *Labour requirements*

Estimate for Sarup II:

*Labour requirements*

*Estimate for Sarup II:*

| | *posts* | *wood in m³* | *earth in m³* |
|---|---|---|---|
| *palisade* | | | |
| posts | 900 | | |
| 1.2 m long, 20 cm thick | | 34 | |
| *enclosures* | | | |
| posts | 428 | | |
| 1.2 m long, 30 cm thick | | 35 | |
| *ditches* | | | |
| digging of ca. 236 m of 2.9 m³ per meter | | | 685 |
| total | 1328 | 69 | 685 |



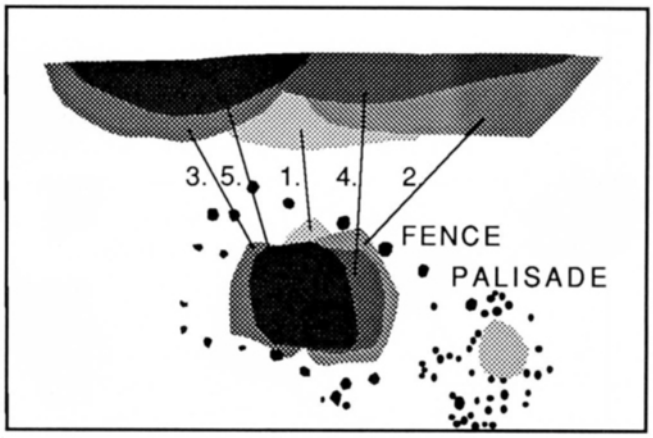



Fig. 22. Section through inner ditch of Sarup II showing recutting clearly.

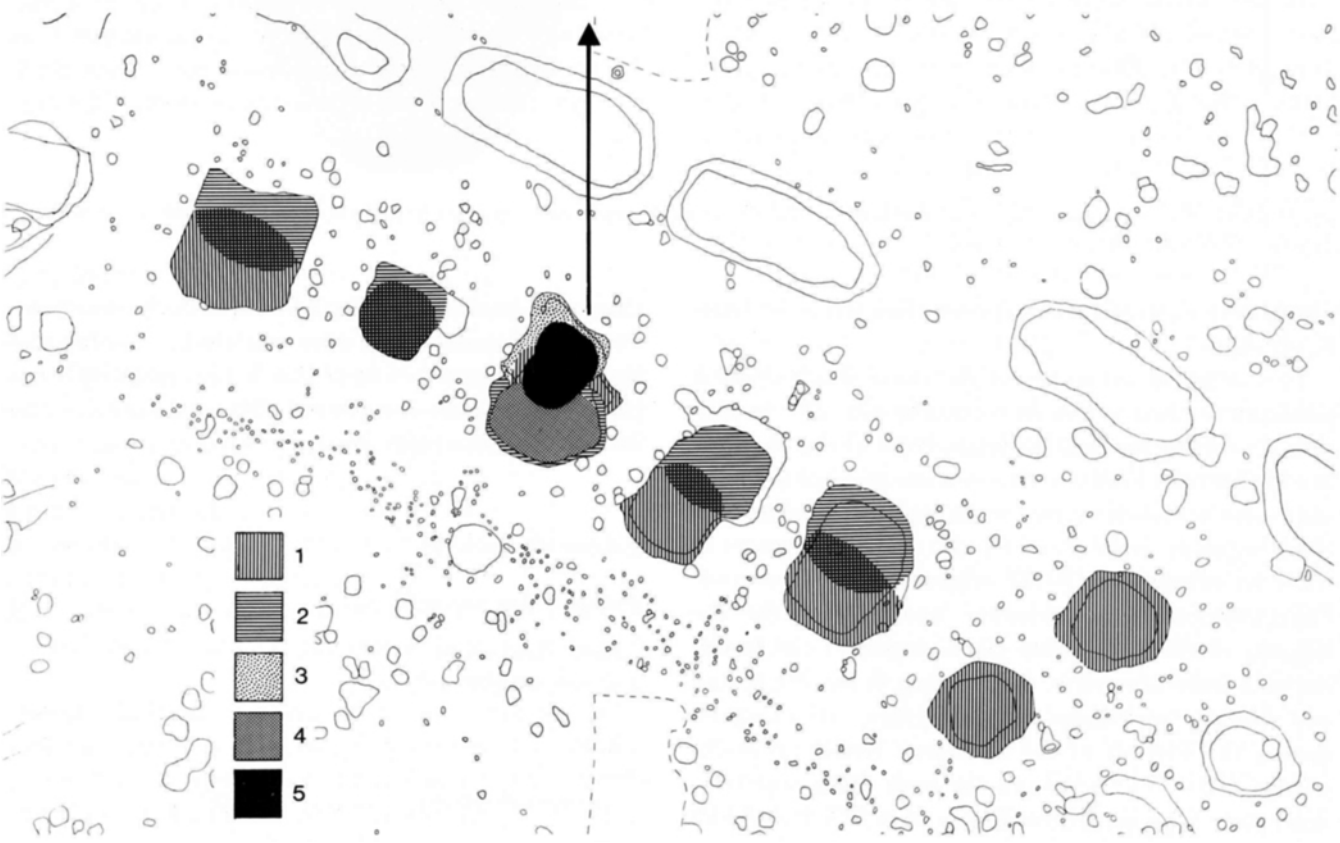



Fig. 23. Plan showing the sequence of recutting of two ditch segments.

Applying the same norms as at Sarup I (see p. 103), but allowing only 1.5 work-days for each of the smaller posts, the labour requirement for the entire work of construction would be 2300 work-days or 18,000 hours. Thirty men could have built Sarup II in three months, while the estimate for Sarup I was 200 men for the same period. Thus at Sarup II a monument one third the size was constructed for one sixth the effort.

*The interior*

In distinction from Sarup I and most other similar sites it was here possible to investigate the entire area within the enclosure. In this 3 ha. area there were recorded 154 features that were contemporary with the younger ditch system. Most of the pits contained no objects (they were often small postholes) or only the kind of waste that would be expected at a settlement. Some other pits had vertical sides and flat base, and contained carbonised grain (emmer monoculture) at the bottom, possibly silos (fig. 24 and Jørgensen 1981), and 34 features had special contents. Some of these features lay in groups.

Some of the groups (fig. 17) lay close inside the palisade, especially in the north-eastern and northern parts of the site. It has already been observed that in the northern part of the site sherds of the same bowl were found in a group of four pits and at the bottoms of three ditches (fig. 21). There were also pit clusters in the southern part of the area, close to some curved trenches (fig. 25). These trenches were 18 and 26 m long respectively, with a width of 50–70 cm and a depth of about 10 cm. No signs of posts were found in them, and the finds were few and uninformative. Near them were many pits, and central to the arc of the eastern trench were found four large postholes (fig. 25A), placed about 2 meters apart in a square. They were about 1 m deep and had substantial stones at the sides (fig. 26). No other postholes on the site were so strongly lined with stones. The posts of a large structure must have stood here. In the fill of two of the holes were found burnt bones, including remains of a human being.

In a pit near the western of the curved trenches was found what is probably Sarup's best find, a battle axe of banded sandstone or quartzite (fig. 27), which lay in a shallow pit without much else. Some of the other pits contained complete pots or axes (fig. 28).

Compared with Sarup I it seems that a larger number of activities were transferred to the area surrounded by the defensive works, for one in five of the pits contained especially selected objects, while at Sarup I this kind of material was found mostly at the palisade and ditches, and in only a few of the features in the interior. This material must be interpreted as the remains of ritual depositions. It was also observed that relatively much grain was preserved in proportion to the limited amount of normal settlement activity indicated. It is not possible to say whether all the pits belonged to the time when the defences were constructed, or whether some were contemporary with the recuttings, but a happy discovery in the northern part of the site showed that certain ditch segments and pits stood open at the same time (fig. 21).

Fig. 24. Section through supposed grain silo from Sarup II. The black layer near the bottom contained carbonised grain.

## SETTLEMENT IN THE SARUP AREA

The two Sarup sites are very much alike, but their purpose is not immediately understandable. By examining the traces of contemporary settlement in the surrounding area it may be possible to gain an insight into the society in which the camps had some function. In an area of 204 $m^2$ surrounding Helnæs Bay it has been possible to record 216 megaliths and 15 settlements (Andersen 1980, fig. 12, 14, and 15 and Andersen 1988b, 52). In continuation of the excavations an attempt is being made to examine a representative sample of the other sites contemporary with Sarup I and II, with the aim of casting light on any connections between them and the camps.

Four of the settlements have been partially excavated. The best finds come from a site on Helnæs, situated near the bog Skaghorn and contemporary with Sarup I. Here 200 $m^2$ were dug in 1985 and more than 16,000 objects were recovered. What is of most interest are the differences between the material recovered from that site and from Sarup. Clearest is the difference in the proportion of flint waste to tools. At Skaghorn there were ca. 14 flakes per implement – against 3 per implement at Sarup. Obviously implements were not made to any great extent at Sarup, but were brought to the site

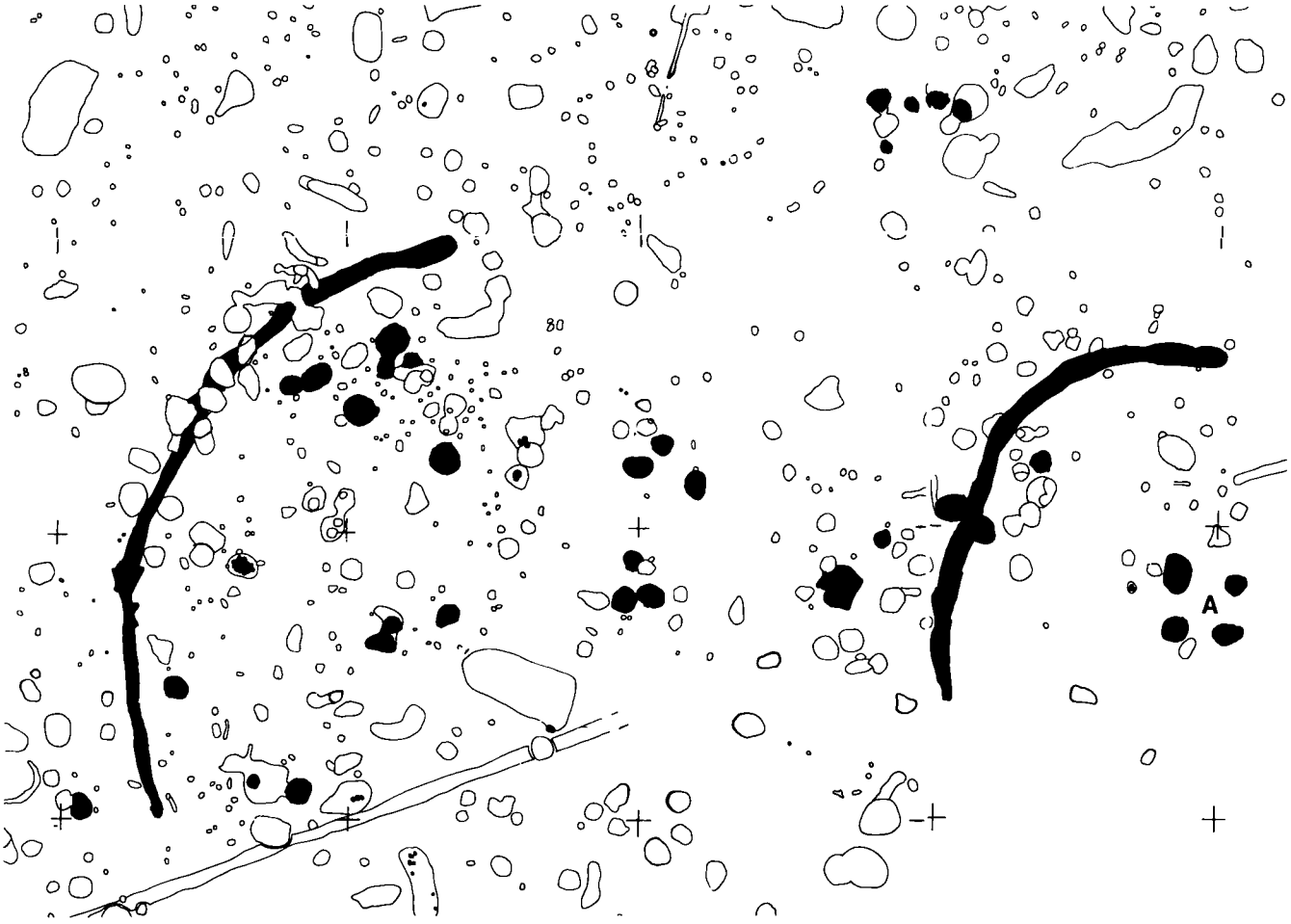



Fig. 25. Plan of area with arc-shaped trenches. Features belonging to Sarup II are shown black. A = square of large postholes.

from somewhere else. Knives were the commonest tools at Skaghorn, scrapers at Sarup (where they were used on wood). The pottery was of better quality at Sarup, although the same decorative patterns were used at both sites. Bones survived well at Skaghorn (not yet identified). The carbonised grain and seed at Sarup I indicated an almost pure monoculture of emmer (Jørgensen 1975), while the grain found at Skaghorn seems to have been half emmer and half barley. Was also selective grain placed in the pots at Sarup? Comparison of the two sites shows that their purpose must have been different. Skaghorn had the character of an ordinary settlement, while Sarup had more selected material.

Fifteen megaliths have been investigated, all of which were ploughed over and in process of being destroyed. In 9 of them there was found pottery contemporary with Sarup I, while in front of their facades there was pottery from the same period as Sarup II. The dolmens of south-west Funen must therefore be built in the same period as Sarup I, but were still in use at the time of Sarup II. They exhibit considerable variety of plan, with both small and large chambers, chambers with and without entrance, and with both round and long peristaliths. No chronological development from simpler to more developed types can be seen in this material from southwest Funen.

Most of the dolmens lay fairly close to the sea and had a tendency to be gathered in groups in a way which could reflect territorial divisions (Andersen 1980, fig. 13). Closer study of the pottery from all the megaliths in a group may later show traits linking graves together or allowing comparison with Sarup.

Preliminary analysis of the finds shows that pottery was placed in front of the tombs whose decoration cor-

responded to that of Sarup II (showing that the ritual depositions took place a few generations after the graves were constructed), but the forms chosen were different. Commonest at the dolmens were pedestal bowls, pottery spoons, shouldered vessels, and small funnel beakers, while in the pits of Sarup II the commonest were large funnel beakers and decorated bowls. A funnel beaker like the ones from Sarup I and the Skaghorn settlement had been deposited on the northern side of one of the dolmens.

Compared with the material so far recovered from the Sarup area it seems that the activities that took place at Sarup were of an unusual and special character. The material was different enough from that of the settlements to show that there was no settled occupation. It seems rather to indicate jointly performed acts of a character we would look on as ritual, and the size of the camps does more than imply that they were constructed in collaboration by a very substantial number of people.

## LATER AND EARLIER SETTLEMENT AT SARUP

In addition to the two causewayed camps there were three further phases of neolithic settlement, a burial structure from the Single Grave Culture (Andersen 1978, 7–16), a village with two houses from the end of the Bronze Age, settlement pits and wells from the beginning of the Iron Age, a village with seven houses from the middle of the Early Iron Age (Andersen 1984, 83–90), medieval field systems, and oldest of all, a pair of pits dated to the Maglemose Culture.

The three further neolithic phases are dated to the Middle Neolithic Funnel Beaker Culture, and are from periods II, III/IV, and V (Andersen 1980, 88–95). The remains of the settlements are found in the southern part of the headland and cover an area similar to that of Sarup II, i.e. between 3 and 4 ha.

The Neolithic settlements are indicated by occupation layers in the ditches and by many pits. It is interestering that up to 15% of the pits have selective contents suggesting that they were ritual pits. Others of the pits are large with kettle-shaped section (silos?), and others again are ordinary rubbish pits. The pits have yielded a rich material of more varied character than the finds from the two enclosure phases. Carbonized grain and seeds and animal bones have been recovered from the settlement phases.

Fig. 26. Section through one of the large postholes of A in fig. 25.

Fig. 27. Pit belonging to Sarup II with battle axe *in situ*.

Fig. 28. Pit belonging to Sarup II with three axes and a small potsherd *in situ*.

## CAUSEWAYED CAMPS OF SARUP TYPE

Even the earliest Neolithic cultures were familiar with causewayed camps. However the ditches were not interrupted by causeways, but were continuous, often with V-section. These sites only enclose small areas in the order of 60 × 80 m.

The first sites of the same type as Sarup, with ditches divided up by causeways, were found about a century ago in Germany. Subsequently 3–400 similar sites have appeared in much of western and central Europe. All the sites were erected between 3800 and 3250 B.C. (Boelicke 1977). They vary considerably, ranging in size from 1/2 to 107 ha and in shape from round to semicircular or rectangular. Sometimes the sites are as close as less than a kilometer apart (Scarre 1982, 1983 and Marsac/Joussaume 1977) but it is not certain in these cases that they were fully contemporaneous.

Common to them all was that there were at least one and more often two to three parallel ditches interrupted by causeways. In the majority of the German and French sites there were also palisades on the inner side of the ditch (Boelicke 1977, Toupet 1984, Vermeersch 1978 and 1980). Most of the palisades were constructed in the manner of Sarup I, with closely spaced massive posts. Only at Sarup I were there observed heaps of sherds at the palisade.

Fenced enclosures, a characteristic feature of Sarup, were found in nearly the same form at Urmitz in Koblenz on the Rhine (Lehner 1910 and Boelicke 1977), where they were placed on the causeways of the inner row of ditches. Gaps in the palisade behind gave direct access to the enclosures. Parallels to the fences around ditch segments at Sarup II are known from Büdelsdorf near Rendsburg (Hingst 1970, 1971, 1972), where three ditches close to the palisade were surrounded by powerful post-settings. Fences between the palisades and enclosures and the ditches have only been observed at Sarup. Entrances like that at Sarup I have been found at a few sites, including Büdelsdorf (flanked by posts – see Hingst, above) and Noyen-sur-Seine (Mordant 1980a and b, 1981, Mordant/Mordant 1972 and 1977).

The ditches have been thoroughly investigated at many sites. The crab-claws shape as in the northern part of Sarup I (fig. 3 and 8) is found at several western French sites (Marsaac/Joussaume 1977, Mohen 1984, Scarre 1982 and 1983). At the bottom of the ditches there is not found normal settlement debris, but selective material. Whole pots are sometimes found, singly or in concentrations, as well as unbroken implements, concentrations of animal bones, human skeletal material – most often only the head (Boujot 1985, Mazingue/Mordant 1980, Mercer 1980 and 1985), traces of fires (Biel 1987), and sealing layers of stones (Madsen 1977: 166). Some interesting observations were made at Etton in central England, where the material in the ditches of the western half of the site was sorted, so that some ditches held mainly pottery others flint flakes, and others again animal bones. In the ditches of the eastern half had been placed whole objects (Pryor 1985). The animal bones in causeway camp ditches seldom represent complete animals. At Boury-en-Vexin, northwest of Paris, a concentrated layer of beheaded sheep remains was found in a ditch (Lombardo/Martinez/Verret 1984). Humen skeletal remains are a curious element at many sites. Complete skeletons may be found lying at the bottoms of the ditches, or there can be remains of heads, the cranium without mandible or the mandible alone, as found in a couple of fortunate instances at Sarup. At Hambledon Hill in southern England 70 skulls were found in the 20% of the ditches that were excavated, so that the whole site ought to contain about 350 skulls (Mercer 1980). The skulls must have been separated from the skeletons somewhere else, and were sometimes placed carefully in position, for instance on small stone cobblings.

Examination of the sections across the ditches showed in nearly all cases that they had quickly been refilled – sometimes in the same year as they were dug (Smith 1966 and 1971). In the western half of the Etton site however it could be seen that bushes and small trees had first managed to grow in the ditches (Pryor 1985). Re-cutting the ditches took place at many sites, but only at Hambledon Hill and Sarup was it possible to see that also the material placed on the bottoms of the recuttings was especially selected.

The interior was completely excavated in only a few cases, including Etton (Pryor 1985), Offham Hill (Drewett 1977), and Sarup II. Two of the sites had pits in the interior with a remarkable content of especially selected objects, while other pits contained normal settlement material. At Offham Hill there were no interior features.

In the area of the northern Funnel Beaker Culture a number of sites like Sarup have been discovered in recent years (Andersen 1982, 1986, 1987, 1988a and b,

Hingst 1970, 1971a and b, Jørgensen 1983a and b, Larsson 1982 and 1984, and Madsen 1977, 1978, and 1988). All the sites seem to be contemporary with Sarup and to have basically the same plan. The finds are generally of a deliberately selected character, indicating that the sites had a special purpose.

## CONCLUSIONS

The many common traits of the two Sarups and similar sites show that they must have had similar or identical purposes in the various farming societies. Their use of topographical features might suggest that they were defensive structures, but the many causeways argue against this, as does the absence of a robust palisade at many sites (where pots were deposited at Sarup) and the small size and depth of the ditches, that at some sites were surrounded by low fenced enclosures (as Sarup II). Use as settlement is contradicted by the fact that some sites are situated on hills some kilometers from drinking water, while others are found in wet areas, that are flooded for half the year. The finds from the bottoms of the ditches and the interior areas shows only a limited amount of broken tools, flint chipping waste, and potsherds, whereas complete artifacts are overrepresented. Living structures of the same age as the camps have not been found at any of the sites. The specially selected finds, the large investment of labour in the construction of the camps, and the occurrence of human skulls and concentrations of animal remains suggest that the sites had a supra-regional significance for a population group of some size.

The Sarup sites were constructed and used at a time when big changes took place. The process of neolithisation was only completed when the sites were constructed, a process that brought about deep changes in the pattern of society, which also found expression in the construction of impressive megalithic tombs. The close contact in the Sarup area between megalithic tombs and causewayed camps should give rise to further studies of the relation between megaliths and causewayed camps in the whole west European area. The camps seem to have similar distribution to the megalithic complex, were approximately contemporary with the megalithic tombs, appeared at the same stage in the process of neolithisation, and had a ritual function in all the societies where they occur.

One can visualise an agricultural society living in small villages, whose families, or clans, buried chosen kinsmen in megaliths built near the centres of the area they inhabited. The megalithic tombs no doubt emphasised a hereditary right to the area cleared and made cultivable. Living in small territorial units gave a need for territorial markers at a superior hierarchical level where several clans together could cut a figure or show a profile in the face of the external pressures that may have been felt on the recently cleared and cultivated land. Perhaps Sarup was the place where the population of a more substantial area showed their common bonds by erecting a great structure and performing actions like sacrifices, burials, disposal of skulls. At intervals people met together to re-dig chosen ditch segments and perform such actions anew. Perhaps each clan had its own ditch segment. Where people met the occasion was also used to deal (in flint, amber, copper, livestock, grain, etc.), exchange information (perhaps patterns of pottery decoration which at that time spread rapidly across the country), settle disputes between groups, perhaps arrange marriages, etc.

Future studies of the finds from graves and settlements in a substantial area around Sarup will perhaps give an idea how large an area used a site, how often it was used, and what kind of activities were carried out.

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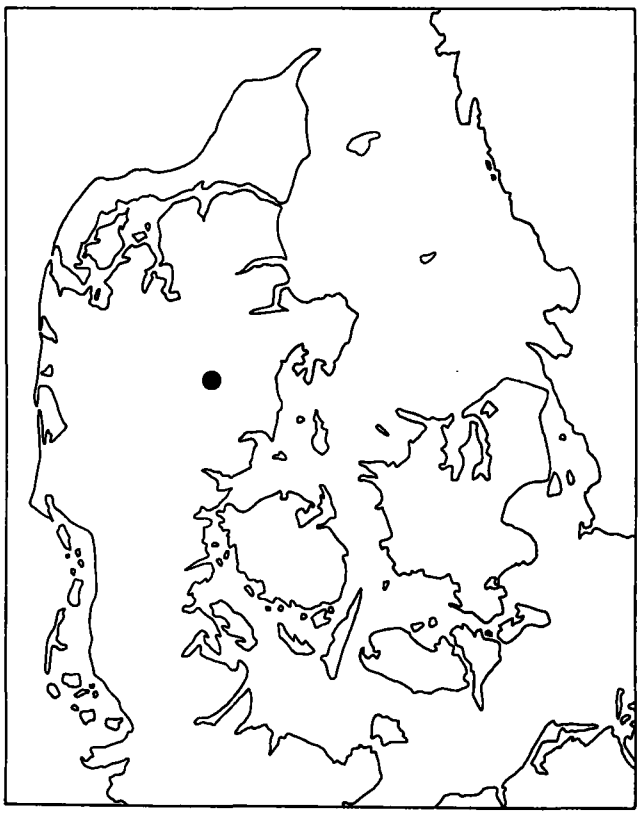
# A Late Neolithic Hoard with Objects of Bronze and Gold from Skeldal, Central Jutland

by HELLE VANDKILDE

## INTRODUCTION

Rich finds of metal objects from the early metal age are rare in south Scandinavia. Therefore, it attracted some attention when an unusually varied assemblage of Late Neolithic bronze and gold objects appeared in November 1982 at Skeldal (sb 147) in the parish of Rye, district of Tyrsting in Skanderborg County (1). The discovery (fig. 5; cf. Olsen 1984, fig. 7) comprises three flanged axes and the butt part of a fourth, one double-edged flanged chisel, one open oval solid-cast ring, one beehive-shaped box with lid, four spiral rings of the *Noppenring* type, one cylindrical spiral bead and one spiral armring. Two of the *Noppenringe* are made of gold, while the other objects are of bronze.

The objects were found by a pensioner from Silkeborg using a metal detector on a flat, sandy terrace between the lake, Salten Langsø, and the hilly country at Rye Sønderskov. The objects were lying at the west side of a track in the forest leading to a ford across Salten Langsø where the lake is at its narrowest (fig. 1). The distance to the lake shore is around 300 m. According to the finder the objects were lying close to the surface. No burial mounds have been recorded from the



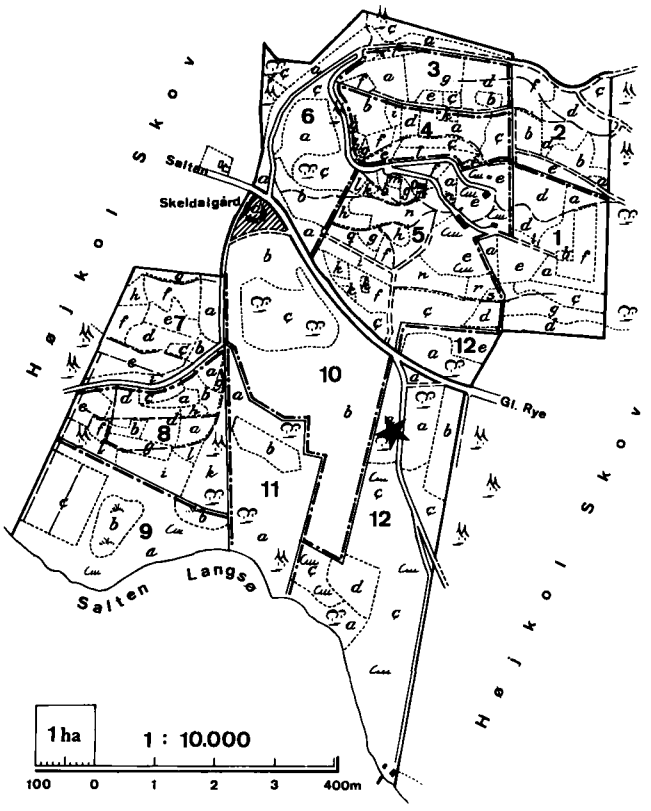



Fig. 1. Map with the find place indicated.

area, and the find no doubt belong to the hoard category. No stone or any other mark of recognition were present at the site.

The finder observed (fig. 2) that the two larger flanged axes lay on edge side by side, with their cutting edges towards the north. East of them and closer to the track was the beehive-shaped box, which was closed and upside down and contained the two gold rings. In front of it was the broken-off butt of another flanged axe. The pair of bronze *Noppenringe* and the spiral armring were found close south of these, while the chisel and the smallest of the flanged axes lay above them and the open solid ring was uppermost. No remains of organic material were noticed.

A few days after the discovery the objects were handed over to Silkeborg Museum (2), and an investigation of the site was carried out (Fischer 1983, 8). The excavation established (3) that the metal objects were found in a small oval pit (fig. 3), measuring at the top approximately 20 × 30 cms. The sides of the pit narrowed towards the bottom, which was 27 cms below the present surface. The upper part had clearly been disturbed by the finder, and the fill (layer 2) had a disturbed character and consisted of grey, sandy soil mixed with recent plant material and bronze scraps, especially from the pair of *Noppenringe* and the spiral armring. Also a fragment of a small spiral bead appeared. From the traces of bronze adhering to the pit wall, it was evident that the uppermost bronzes had been lying immediately below the recent surface layer (layer 1).

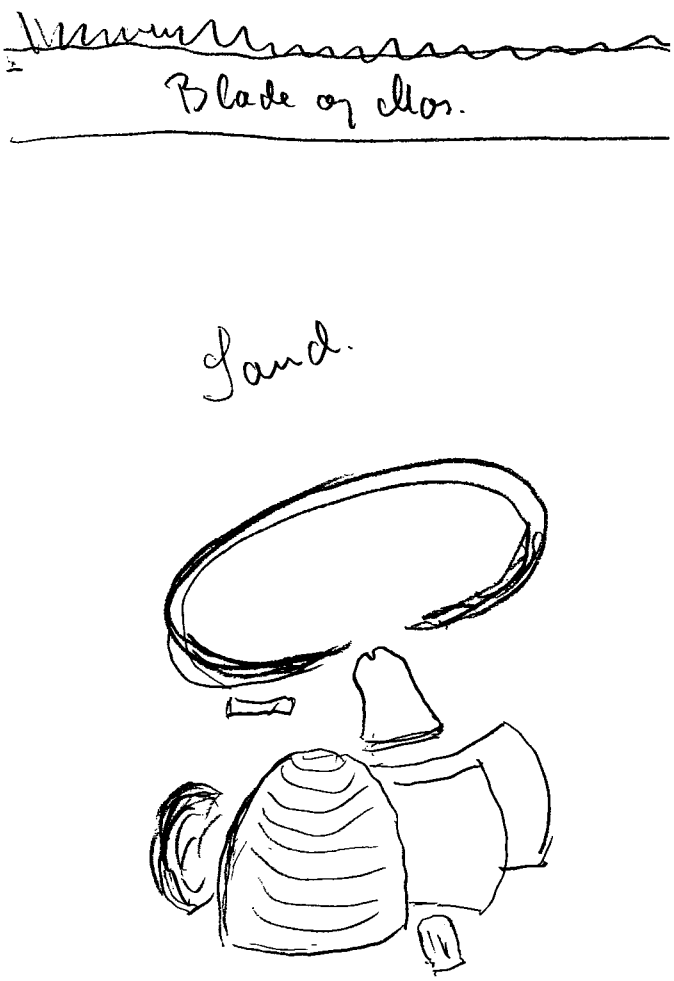



Fig. 2. The finder's drawing of the position of the objects. C. 1:2.

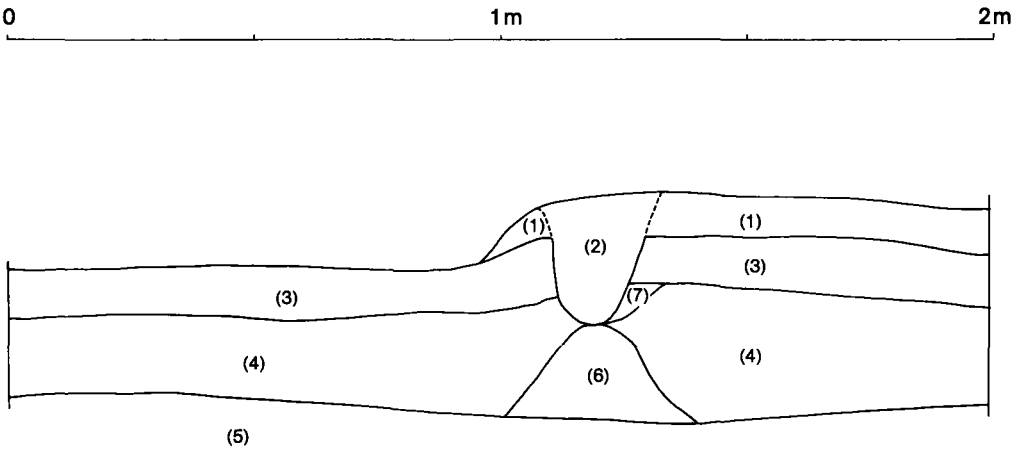



Fig. 3. Section through the pit and associated layers. The broad depression to the left is the track. (Chr. Fischer and Elsebet Morville *del.*).

Below the surface layer of leaves, moss, and small branches (layer 1) was a dark layer of raw humus (layer 3). The pit may originally have been associated with this layer. Then came a layer of bleached sand/podsol (layer 4), clearly older than the pit. Below this was a layer with scattered spots of hard pan (layer 5) and immediately below the pit a light brown precipitation, perhaps of hard pan (layer 6). A small pocket of grey sand (layer 7) – maybe somehow related to the pit – was situated on the right side of the pit close to its bottom. The nature of some of these layers may indicate that there was heath at the spot at the time of or after the deposition of the hoard. Judging from the section (fig. 3, left) through the pit and the track the latter must be of relatively recent date, which is in agreement with a statement made by the owner of the forest.

As the minimum space occupied by the largest axe and the spiral rings situated behind it is 23–25 cms across, the lower layer of objects must have filled the whole pit at their level. However, the vertical distance from the top to the bottom of the hoard need not have exceeded 11 cms, so there can have been unused space at the bottom of the pit. The general impression is that the objects were put carefully, one by one, in the pit or alternatively that they were deposited inside a box or a basket. If so it would explain the possibly unused space in the bottom part of the pit.

The Skeldal hoard must be characterized as an associated deposit. The stratigraphical data does not rule out the possibility that some objects could have disappeared, and so the hoard cannot in the strict sense of the word be characterized as closed, but in this respect it does not differ from the majority of Late Neolithic and Bronze Age hoards.

Two flanged axes have been found previously in the Skeldal area. One of these is now in America, and there is no further information about it. The other one was picked up from a path at Skeldal around 1900 (4) (fig. 4). This axe is made in a contemporaneous, but slightly different style than the axes from the hoard with a broad butt in relation to the width of the edge, a very thin blade and a protruding cutting edge. Whether or not these two axes originally belonged to the hoard cannot be decided.

The stouter of the objects in the Skeldal hoard are generally well preserved, whereas the slender bronze spiral rings are much corroded despite the relatively acidic soil conditions. The differences in preservation may mainly be due to differences of manufacturing technique. While the spiral rings have been hammered into shape the other objects are cast with presumably a minimum of after-treatment. The process of hammering means a decomposition of the structure of the metal. It is made brittle, and therefore it corrodes easily (5).

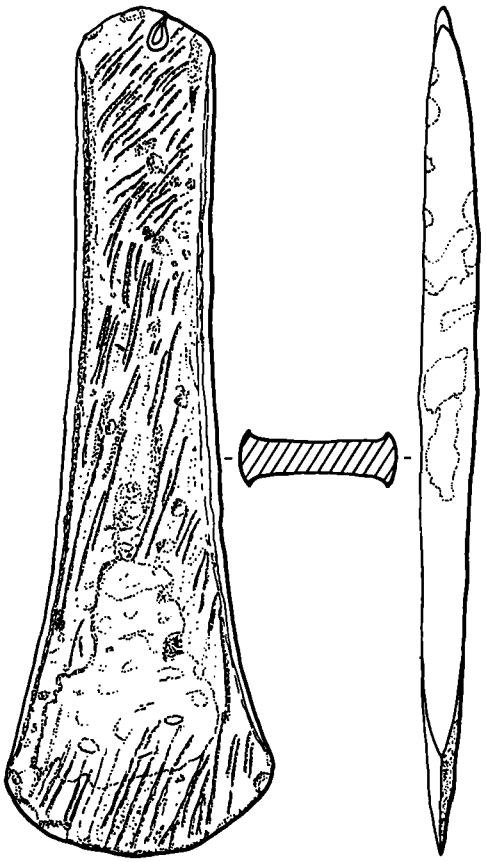


Fig. 4. Drawing of a low-flanged axe found in the Skeldal area around 1900. (David Graham *del.*). 2:3.

## DESCRIPTION AND CLASSIFICATION OF THE OBJECTS

### *The beehive-shaped box with lid* (fig. 5a and 6)

The round-based, lugged box is oval in section, has convex sides, and a flat lid. Without the lid the height is 5,6–5,8 cms. The width of the oval opening varies from 4,5 to 5,4 cms, and measured at the rim the thickness of the wall varies from 0,1 to 0,3 cm. Two opposed vertical lugs are situated on the maximum diameter, one springing directly from the flattened rim, the other from just below the rim. The exterior surface of the box is decorated with horizontal ribs that run circumferentially on the upper part, while the six lowermost ribs run in a spiral. Including

the bottom rib, one side has twenty ribs and the other twenty-one.

The six bottom, spirally arranged ribs, the two topmost ribs, and every second rib in between are ornamented with closely set, vertical strokes. The interior surface of the box is smooth.

The lid is composed of a flat and smooth oval disc with a flange that fits into the mouth of the box. It is decorated with vertical strokes on the edge. Half-way between the lugs of the box there are two opposite 0,2 cm wide holes corresponding to similarly places holes in the flange of the lid. A stick could have been stuck through both sets of holes to keep the lid safely in place. With the lid the height of the box varies from 5,8 to 5,9 cms.

The state of preservation is relatively good. Corrosion has caused minor damages on the base, on top of and at the edge of the lid, and sporadically also on the exterior of the box. The interior of the lid and the box is covered by a light green layer of corrosion. On the exterior parts a dark green patina is predominant. In a few places the copper colour is visible, possibly owing to recent injuries.

The box was cast in the *cire perdue* technique. This may also be true of the lid which, however, could have been cast in an ordinary mould. The stroke decoration is very homogeneously made, probably with a narrow punch. From a technical point of view the box is not without flaws and irregularities. At each end there is a slight, bulbous thickening of the wall from the base to below the lugs. Here the ribs occasionally run obliquely to each other, and twice a new rib branches off from a parallel lower one. The circumferential principle of the upper ribs has thus not been fully carried through. Such irregularities are not seen on the broad sides, but the distance between the ribs is not quite constant. Probably already during casting or during after-treatment the box wall broke through above one of the holes in the rim and twice near one of the lugs. The aperture closest to the rim has been repaired from the inside with a thin bronze plate, irregular in outline, so that hardly anything is visible from the outside. The other two holes are unrepaired and inconspicuous.

The only certain traces of wear are found on the upper sides of the perforations through the lugs. Here the edges seem to have been worn smooth, probably by a cord passing through the lug. Microphotography showed remains of organic material in one of the lugs as well as in one of the holes in the flange of the lid. All other edges are sharp, and the overall impression is, therefore, that the box was neither new nor very old when hoarded.

The cord lugs and the round base show that this box was meant to be suspended. It is tempting to compare the box with the belt ornaments of the Bronze Age, and so assume that it was worn with the flat lid against the stomach or the back (Broholm 1949, DO III, 228–229, 322–324 and 1952, DB IV, 318). If this were the case, however, the wear should be located near the middle and not at the top of the perforation. This suggests that the box hung vertically, perhaps from the belt. The contents of the box – the pair of gold *Noppenringe* – demonstrate that it was in this case used as a jewel-case, but undoubtedly it was designed to contain small things in general. There is only just enough room for the two gold rings inside the box.

As pointed out by Fischer (1983, 10), the shape and decoration of the box resembles the straw beehives made in the technique of coiled basketry, such as were still used in this century. The box may thus be seen as a miniature copy of such a beehive. It could also be interpreted as a translation into bronze of a small container made of narrow bands of straw.

The Skeldal box is unique, but its decoration makes it possible to identify its cultural origin. The cast rib style, occasionally with vertical or oblique strokes, has its origins within the Únětice culture of central Europe, where it is a common ornament for instance on dagger hilts, shafts of halberds and cuff-shaped bracelets. Especially in regard to size, technique and decoration the ribbed bracelets (fig. 7A-B) are close parallels to the Skeldal box. Sometimes these have strokes on some of the ribs (fig. 7A), as on the bracelet from the Scanian Pile hoard (Tygelsjö parish) (Oldeberg 1974, no. 832). As in the case of the Skeldal box irregularities in the circumferential course of the ribs are occasionally encountered on bracelets, for instance in the central German Griefstedt hoard (Kr. Sömmerda) (von Brunn 1959, Taf. 30:4). The ribbed bracelets have their main distribution in the north part of the Únětice culture, i.e. north Bohemia and central Germany, and in its Baltic periphery in Brandenburg and Mecklenburg (Gandert 1957, 41 ff.). The northernmost known is the one from the Pile hoard.

Most of the cuff-shaped ribbed bracelets, as well as the majority of the other rib style objects, belong to the classical phase of the Únětice culture, i.e. Br.A1b (6). The bracelets are, however, present in some finds that take up a late position within the classical phase or a transitional position between the classical and the post-classical phase, i.e. Br.A1b/Br.A2 (7). In the south Baltic region the rib style of ornamentation continues well into the Middle Bronze Age, where it is used on the Mecklenburgian type of neck collar, whose earliest appearance is in Pomeranian hoards like Stecklin and Babbin (Kr. Greifenhagen and Kr. Pyritz) (Kersten 1958, Taf. 61 and 63), datable to Br.B1 in the central European terminology.

The Skeldal box can thus presumably be identified as an Únětican product made somewhere in the north part of this culture or its Baltic periphery, most probably during its classical phase.

A box from Bordesholm (Kr. Rendsburg-Eckernförde) (fig. 8) offers a fairly good parallel to the one from Skeldal in regard to size, shape and technique. It is said to have been found in one of the largest burial mounds between Bordesholm and Neumünster several years before 1861. The Bordesholm box is vertical-sided and oval when seen from above. The base and lid are convex. The system with the lid flange and the corresponding holes in lid and rim is quite the same on the two boxes. However, the Bordesholm box has no lugs, but four suspension holes on the slightly flattened back of the box wall. This box may have been worn attached to the belt.

The decoration of the Bordesholm box is very different from the stroked ribs of the one from Skeldal. Simple geometric designs of bands of hatched triangles, of multiple lines and closely set, vertical strokes have been punched or engraved into the box wall, while the base and lid have concentric ovals. On the lid as well as on the base there is a row of triangles approximately along the axis.

Similar geometric patterns are found rather often on the bronzes of the Únětice culture and related Early Bronze Age (EBA) groups, though varying in frequency from region to region. Probably the best parallels to the Bordesholm box are Moravian and Lower Austrian cuff-shaped bracelets (fig. 7C), the geometric designs of which contain the same three elements as found on the Bordesholm box (8). The Fårdrup style of ornamentation may be another parallel, but here the bands of multiple lines and vertical strokes are seldom used (9). Both derivations are possible from a geographical point of view, as east Holstein is attached to the Baltic Únětice periphery during the later part of the

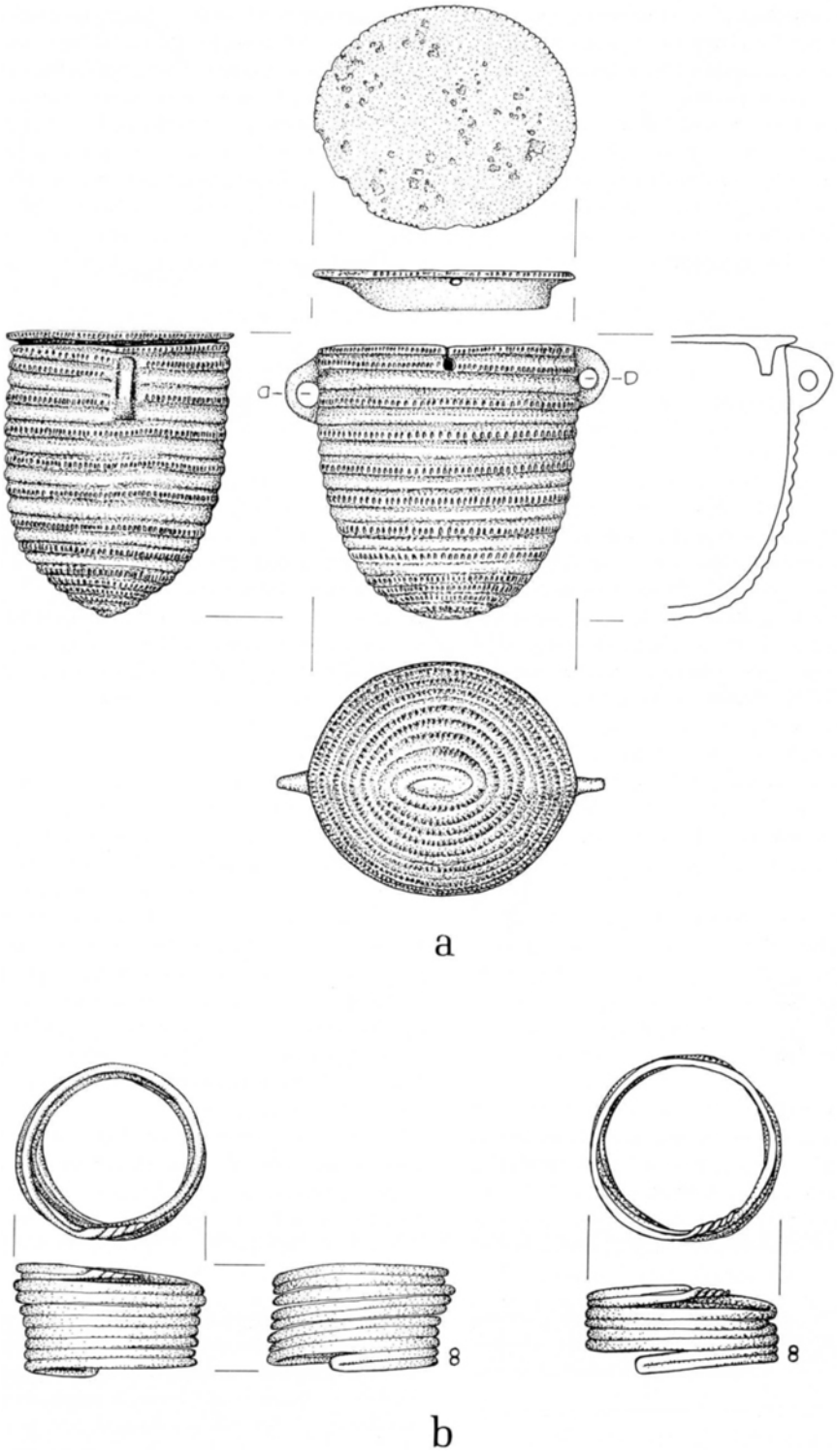



Fig. 5a-b. Objects of the Skeldal hoard: a) beehive-shaped box. b) gold *Noppenringe*. (Eva Koch *del.*). 2:3.

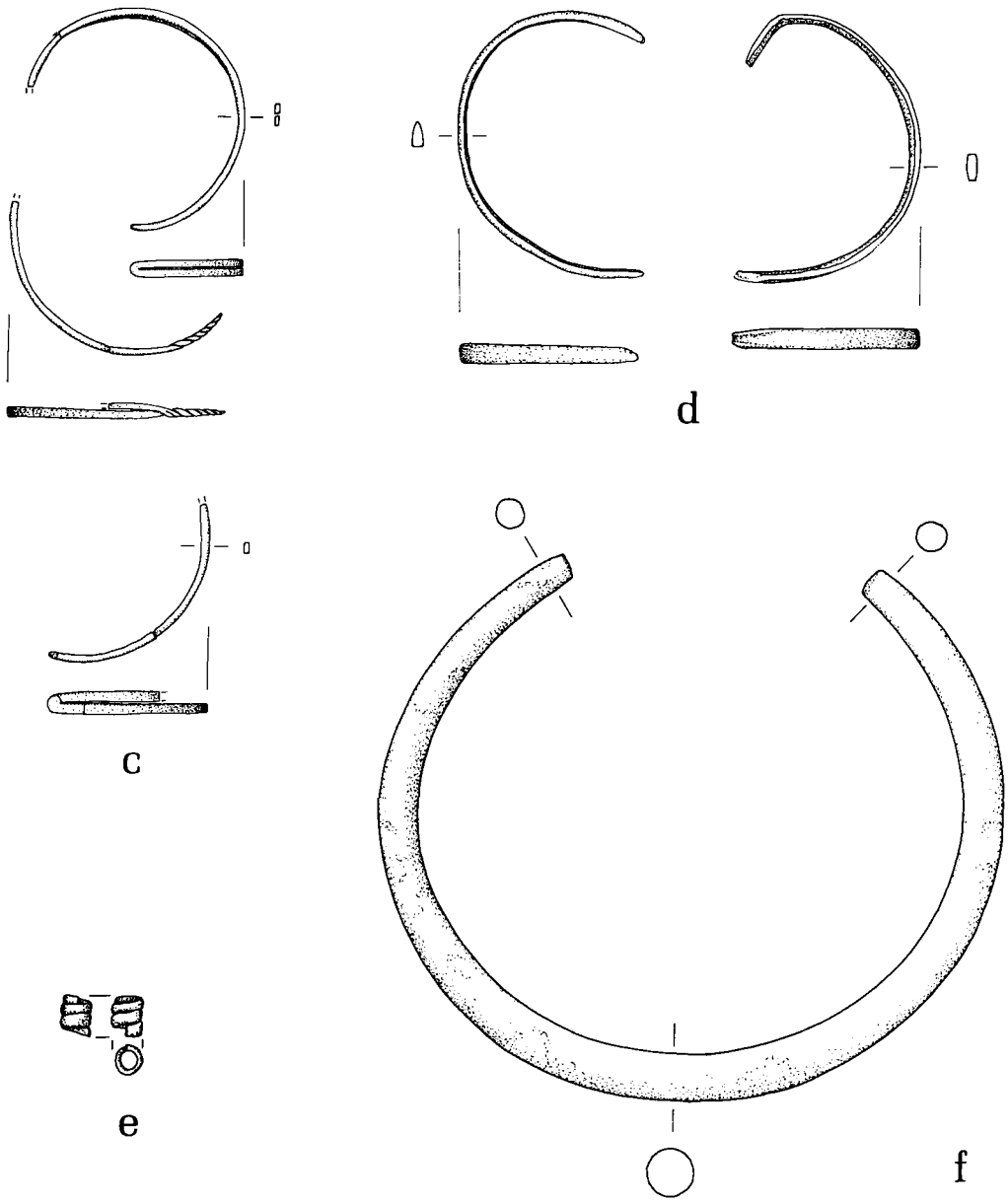



Fig. 5c-f. Objects of the Skeldal hoard: c) bronze *Noppenringe*. d) spiral armring. e) spiral bead. f) open, solid-cast ring. (Eva Koch *del.*). 2:3.

Late Neolithic (LN) Period (10), and to zone I of the south Scandinavian Early Bronze Age during Period I (Kühn 1979, 95). Thus it is difficult to specify the place of manufacture and the relative date of the Bordesholm box.

## *The pair of gold Noppenringe* (fig. 5b)

The two rings are made of gold wire that has been doubled up and wound into a close spiral of 3 and 4½ turns respectively. The doubled-up wire is closed in one end by a loop and twisted together in the other end. The thickness of the wire is 0,1–0,2 cm, and it is roughly circular in section except for the twisted end that has been hammered more or less flat, tapering to a point. The largest spiral is 2,2 cms long and has an exterior diameter of 3,9 cms. It weighs 43,4 gms. The length of the smaller ring is 1,8 cms, the diameter 3,9 cm and the weight 29,2 gms. The rings, especially the small one, have been squeezed slightly out of shape, but otherwise the state of preservation is very good.

The Skeldal gold rings belong to the *Noppenring* type of the central European EBA. Such rings are known in various forms and sizes in copper/bronze as well as in gold. They were used as ornaments for the fin-

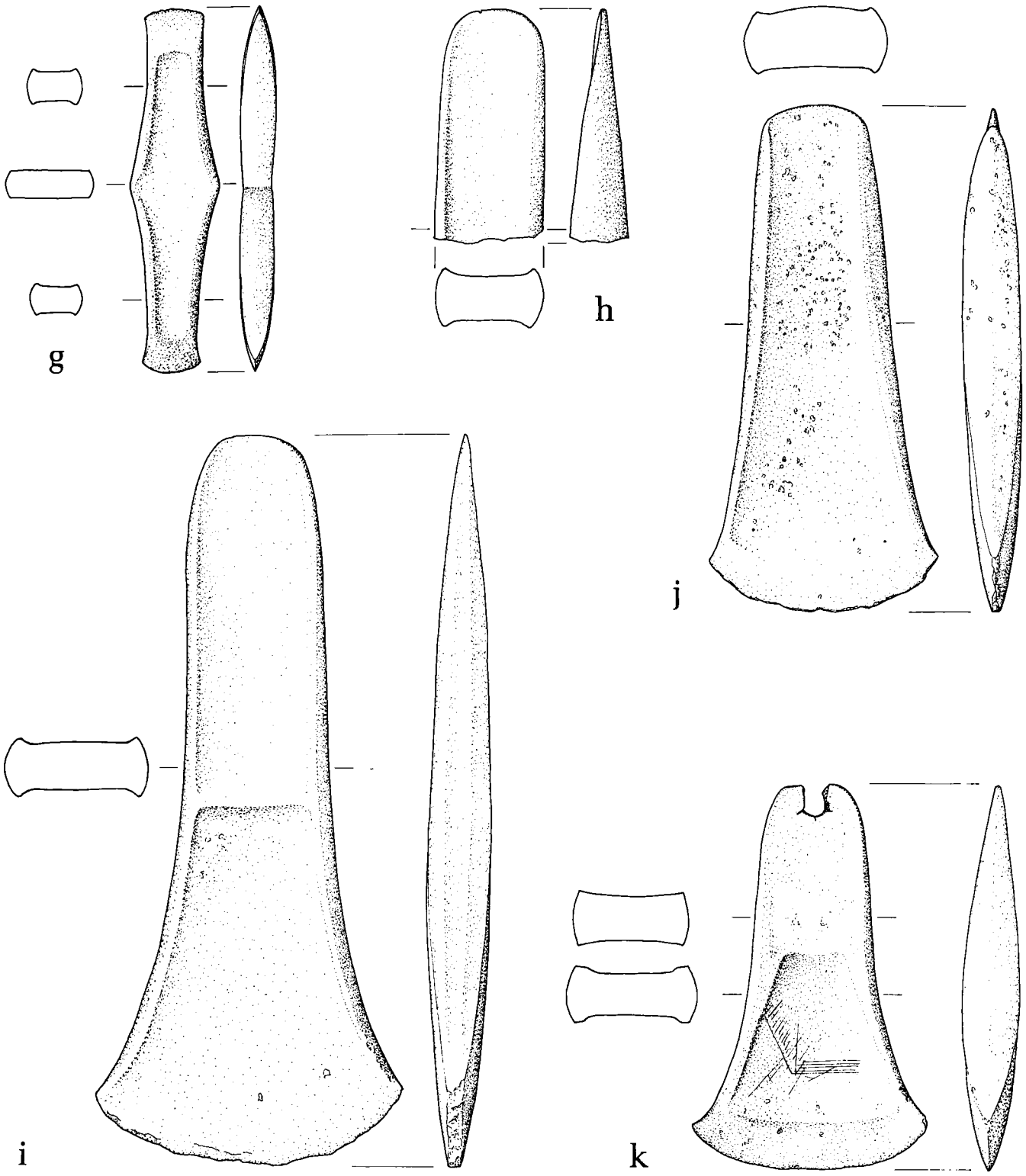



Fig. 5g-k. Objects of the Skeldal hoard: g) symmetrical, shouldered chisel. h) butt end of a flanged axe. i) large, parallelsided-curved flange axe. j) trapezoidal flanged axe. k) small, parallelsided-curved flanged axe. (Eva Koch *del.*). 2:3.

ger, the wrist, the ear or the hair/cap/frontlet, the clothes – the form and position varying with time and space (Stein 1970, 14 ff.; Ruckdeschel 1978, Bd. I, 166 ff.). Most of the *Noppenringe* either have one end twisted, or both ends may terminate in a loop or several loops in quite a complicated system.

The gold rings of the Skeldal hoard must be classified among the large *Noppenringe* with a diameter around 3,5–4,0 cms, and of the most simple form with a simple spiral, a single loop and one end twisted (Ruckdeschel 1978, 142–145, Abb. 11: type 2Gv, 166). This kind of *Noppenring* is made in copper/bronze as well as gold, the former being the most frequent. The type has three distributional centres: Lower Bavaria, south Moravia-Lower Austria north of the Danube and north Bohemia (Hundt 1961, Karte 4). The gold rings from Skeldal probably have their origin within one of these regions, as the gold version of the large simple *Noppenring* is found rarely or not at all (11) in the German Únětican group and its northern periphery. The large, simple *Noppenring* with twisted end is known throughout the central European EBA, but belongs primarily to Br.A1.

Different varieties of *Noppenringe* – large or small, simple or complicated, of gold or copper/bronze – did sometimes reach south Scandinavia, where they appear in graves of the LN Period and the first period of the Early Bronze Age. More rarely they are found in hoards. Large *Noppenringe* are, however, present in the Scanian hoards from Fjälkinge (Fjälkinge parish) (Oldeberg 1974, no. 152) and Pile. The two specimens from Fjälkinge are made of gold and belong to the same category as the Skeldal rings, although the wire of the former is thinner. The one from Pile is of bronze and belongs to a slightly different type.

A certain kind of *Noppenring*, sometimes called "ring gold", appears in the finds from late Period I of the Bronze Age onwards. The doubled-up wire, that is wound into a simple spiral, has either a loop in each end, or one end is kept open. The large *Noppenring* with one end twisted is, however, not known from south Scandinavian Bronze Age finds.

## *The pair of bronze Noppenringe* (fig. 5c)

Around twelve pieces of thin, flattened bronze wire, rectangular in section (c. 0,2 × 0,1 cm) can be identified as belonging to two large *Noppenringe* of the same type as the gold pair. The exterior diameter is approximately 4,5 cms. Preserved are one loop, half another loop, one twisted end and several wire fragments, that do not seem to fit. Thus some fragments must be missing. The fractures are all either new or due to corrosion. On parts not attacked by corrosion the wire has a fine, glossy, dark green patina without traces of wear. The impression is that the rings were new when hoarded.

The rings are undoubtedly shaped with a hammer. On well preserved parts a very slender, horizontal line of light green is visible, roughly parallel to the edge of the wire. This line may be interpreted as a kind of seam created when an originally thinner and broader bronze band was hammered into the present shape.

What was said about the gold rings is generally valid for the bronze rings too, but the latter may, contrary to the gold rings, have been manufactured somewhere in the central German Únětican group. Here such bronze *Noppenringe* occur in the hoards of Berlin-Lichtenrade (Gandert 1957, Abb. 1), Tilleda (Kr. Sangerhausen) (Billig 1963, Abb. 1–3), Halle-Giebichenstein (von Brunn 1959, Taf. 38) and Schollene (Kr. Havelburg) (op.cit., Taf. 88). These hoards belong to a rather small and special group of central German Úněticean hoards containing primarily thin ornaments or a mixture of such ornaments and more stout objects (Billig 1963, 256 f.).

Apart from Skeldal, large bronze *Noppenringe* of the simple type do not occur in combination with other objects in south Scandinavia. The northernmost assemblage is the south Holstein hoard of Ohlenburg (Hamburg-Rissen) (Hachmann 1957, no. 210, Taf. 31: 21–24), which is difficult to classify culturally, as well as chronologically. It may, however, be slightly earlier than the majority of the Úněticean hoards and be related to the *Blechkreis* finds of Br.A1a and the Early Barbed Wire Period of the northwest European Lowland region.

## *The spiral armring* (fig. 5d)

Five pieces of bronze band, rounded rectangular to rounded triangular in section (width = 0,4–0,5 cm; max. thickness = 0,2 cm) can be fitted together to three large fragments, very likely all belonging to the same spiral armring. The diameter was 5–6 cms. Only a little more than two turns of the spiral ring have been preserved. One fragment terminates in a point, which may be one of the original ends. The other end and other pieces as well are missing.

Probably the ring has been worked into shape with a hammer. All fractures and also part of the surface are much corroded. Better preserved parts of the band have a glossy, dark green patina.

As the other ornaments of the hoard demonstrably are of foreign origin this is probably valid for the spiral armring too. Spiral armrings have a wide distribution in time and space, apparently with little or no typological differences. The first spiral armrings occur in Chalcolithic central Europe, but during the EBA this type of ornament becomes very popular, and it is an ordinary component in some of the late Úněticean hoards. According to Ruckdeschel (1978, Bd. I, 162) spiral armrings with triangular, rectangular, or D-shaped band section are late in the EBA sequence, and although this is only a general tendency it may give some idea of the chronological position of the specimen from Skeldal.

Apart from Skeldal, spiral armrings do not occur in the south Scandinavian early group of hoards (12), but they are known in related finds from Lower Saxony (Hachmann 1957, no. 179 and 208).

## *The spiral bead* (fig. 5e)

The bead is made of a narrow and flat bronze band, which has a maximum thickness of 0,1 cm and a maximum width of 0,3 cm. The band has been wound into a tight spiral with a roughly circular section. The exterior diameter of the bead is 0,6 cm. Only part of the bead is preserved, i.e. two and a half spiral turns measuring 0,8 cm in length. There are fractures at both ends, one being corroded while the other one is of new date. The surface of the bronze band is covered by a relatively glossy patina of dark to lighter green.

Just like the spiral armrings the spiral beads appear during the Chalcolithic of central Europe. In the EBA this type of ornament is common in most central European regions in graves as well as in hoards. It occurs in the Middle Bronze Age too (Ruckdeschel 1978, Bd. I, 191). The beads are put on the dress or are used in necklaces (Gimbutas 1965, 257 f., fig. 166–167; Chropovsky 1960, Abb. 27). Usually more than one bead is deposited.

In south Scandinavia spiral beads never became frequent, and the one from Skeldal certainly is a foreign piece. Most probably it has its origin within the Únětice culture. None of the other early south Scandi-

navian hoards contain this kind of ornament, but it is occasionally seen in graves of primarily Neolithic character.

### *The open solid-cast ring* (fig. 5f)

The open, slightly oval ring is made of a solid bronze bar of circular section. The thickness of the bar varies from 0,6 to 0,9 cm. The ring tapers a little towards the ends, which are just slightly rounded.

The maximum diameter of the ring is 12,6 cms with an opening of 6,2 cms. From the position of two similar, but more closed rings in one of the rich Polish graves at Leki Male (woj. Poznań) it appears that such rings were sometimes worn as ankle ornaments (von Brunn 1959, 29; Gedl 1980, Taf. 30B).

The finder has cleaned and polished the ring so that the green patina has almost completely disappeared. The surface is uneven due to corrosion. The ring is no doubt cast.

Open, oval, solid-cast rings with "cut off" ends are among the most frequent types in the hoards of the northern Únětice culture (von Brunn 1959, 16) and its periphery in the Baltic region. Only occasionally do they appear in graves. The end parts of the bar may be decorated with closely set vertical ribs, and the width of the opening varies from almost closed to around 7 cms. The Skeldal ring belongs to the undecorated variant with a wide opening, which is much less frequent than the more closed variant.

Generally, rings of this type are of classical Únětican date, and almost exact counterparts to the ring from Skeldal are found in hoards like Neu Bauhof (Kr. Malchin) Mecklenburg (Schubart 1972, Taf. 103). The undecorated variant continues in the Baltic region for a long time and even occurs in Pomeranian Br.B1 hoards like Stecklin, Krüssow (Kr. Pyritz), and Bruchhausen (Kr. Saatzig) (Kersten 1958, Taf. 61, 66 and 72). These late rings seem, however, usually to be more closed than the Skeldal ring.

Open, oval, solid rings occasionally reached south Scandinavia. Apart from Skeldal and a few single finds the type is present in the Jutland hoards of Gallemose (Harredslev parish) (Neergaard 1897; Jensen 1979, fig. p. 75) and Lyngby (= Lyngby parish) (Jacob-Friesen 1967, no. 561), and in the Scanian hoard of Pile. The Skeldal ring especially matches some of the rings from Pile.

### *The double-edged chisel* (fig. 5g)

The chisel is symmetrical, double-edged, shouldered and flanged. It is 9,3 cms long and has a 1,5 cms wide cutting edge in each end. Seen from the face each side has a distinct angle or shoulder about half-way along, and the two trapeze-shaped halves are identical except that one half is just a little longer than the other. The course of each side is slightly concave. The flanges are low, i.e. around and less than 0,1 cm. The cutting edges are slightly convex and have broad, curved bevels.

The chisel has been cleaned and polished by the finder, and therefore the original surface is no longer preserved. That it has been sharpened is indicated by the edge bevels, but it was not necessarily much longer when new. Probably it was cast in a two-piece mould.

The Skeldal chisel belongs to a relatively rare tool type that has a scattered distribution primarily between *Thüringer Wald, Erzgebirge,* the Sudeten Mountains and the Baltic Sea. These shouldered, roughly symmetrical chisels occur in hoards and graves belonging or related to the Únětice culture in its classical and post-classical phase with a concentration of finds in the former phase.

Fig. 6. Photo of the beehive-shaped box. (Silkeborg Museum photo).

Two variants of the shouldered, symmetrical chisel exist (cf. Kibbert 1980, 124) (fig. 9). The first is short and broad across the middle like the Skeldal chisel (variant A). The other is longer with a tendency to parallel sides (variant B). Some definitions may be introduced here: Variant A has a length-width index less than 7, while variant B's index lies on or above 7. Variant B may be considered a typological link between variant A and the one-edged, shouldered chisel (variant C), the butt part of which is shorter in length as well as broader than the blade part (fig. 9). In fact several chisels of variant B are somewhat asymmetrical (13). Variant C may be further subdivided (cf. Willroth 1985, Abb. 1, Form 3–10), but this does not seem necessary, at least not for chronological reasons.

The chronological position of variant A lies within the classical phase of Únětice, except for its presence in the Brandenburgian hoard of Falkenwalde (Kr. Prenzlau) (Bohm 1935, Taf. 2: 11), which may possibly belong to the post-classical phase, i.e. Br.A2 (13). Variant B appears in finds of the classical as well as the post-classical phase. Among the former is the princely burial at Leubingen (Kr. Sömmerda) (Höfer 1906a, Taf. 2), and among the latter is the Mecklenburgian hoard of Ferdinandshof (Kr. Ückermünde) (Kersten 1958, Taf. 41, no. 423). Variant B is thus generally later than variant A, though with some overlap. Variant C is found primarily in finds belonging to or related to the early Tumulus culture, Br.B1 (Kibbert 1980, 125; Hachmann 1957, Taf. 33 and 40: 15–17), but its first appearance is in the Br.A2 Period (Hachmann 1957, no. 552, Taf. 55: 1–6; von Brunn 1959, Taf. 54–55). Variant

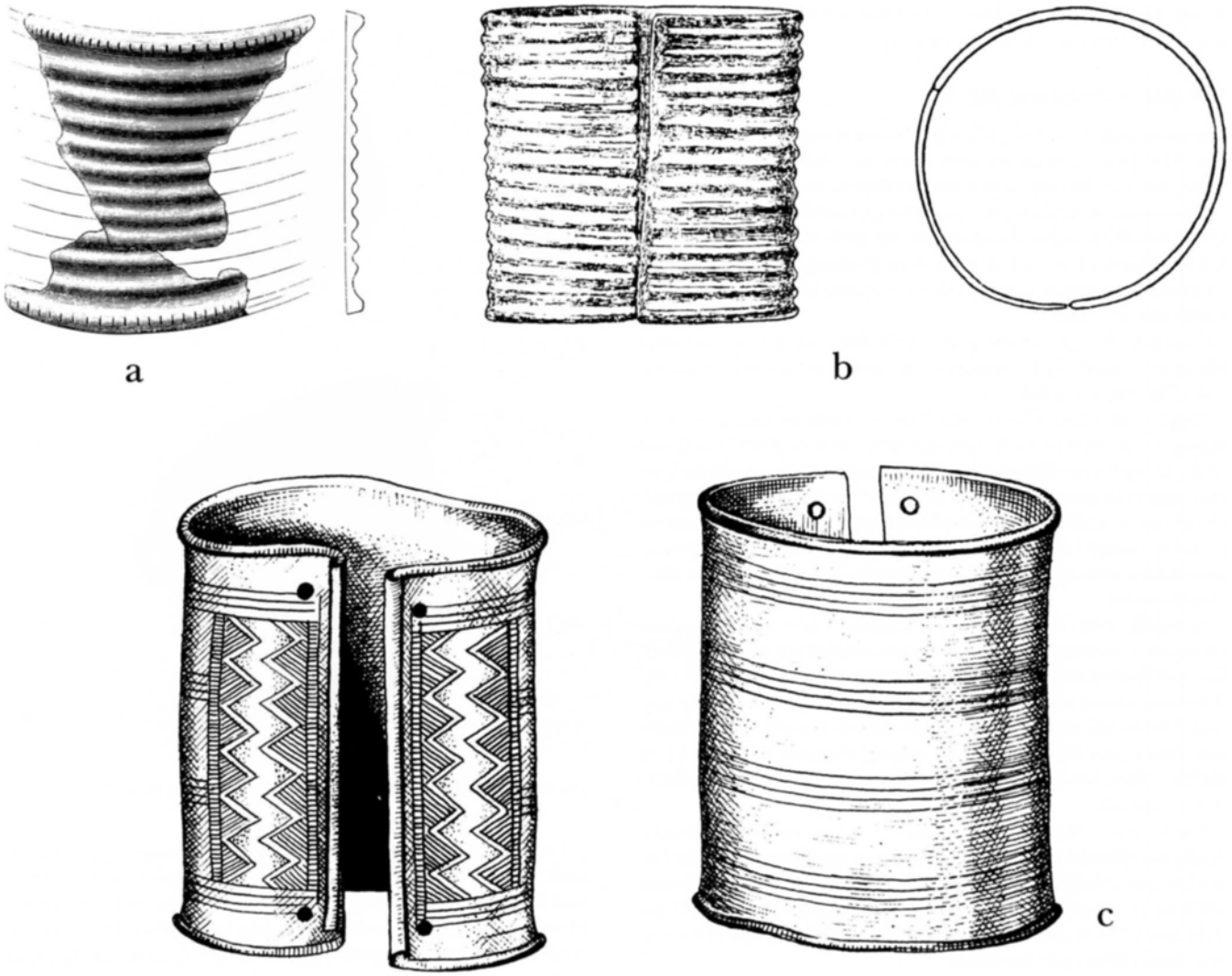



Fig. 7. Cuff-shaped bracelets of Únětican origin: a) Ribbed and stroked specimen from the Pile hoard, Scania (after Montelius 1917, no. 845). b) Ribbed specimen from the Berlin-Lichtenrade hoard (after Gandert 1957, Abb. 1:3). c) Specimen with geometric decoration from the Borotice hoard, Moravia (after Tihelka 1965, Taf. 3:2a-b). 2:3.

C is thus generally later than variant B, but they overlap during Br.A2.

Obviously the origin of the Sögel-Wohlde shouldered or nick-flanged axe is related to the shouldered chisels, and especially to variant C. The axe version seems to occur exclusively in finds from the Early Bronze Age, late Period I (P.IB) in the south Scandinavian terminology, corresponding to Br.B1 in central Europe (Vandkilde 1986). In fact, a few chisels of variant C are known from Sögel-Wohlde graves (Hachmann 1957, Taf. 9: 16–17; Aner and Kersten 1973 ff., Bd. IV, Ke. 2540).

In south Scandinavia variant A is combined with other objects only in the Skeldal hoard. Another specimen comes from Assentoft (Essenbæk parish) in east Jutland (NM B4020, Cullberg 1968, no. 145). It contains only 0,25% tin, which indicates an early date (14). Two Danish specimens of variant B are known, but both are without provenance (NM 8128, op.cit., no. 18 = 1,8% tin; NM B8118, op.cit., no. 198 = 6,7% tin).

Variant C is by far the most frequent type in south Scandinavia. Apart from many single finds it is found in three Period I hoards: The north Jutlandian hoard of Underåre (Serreslev parish) (15) (Hachmann 1957, Taf. 21, no. 68), the Scanian hoard of Orebäcken (Skegrie – V. Tommarp parish) (Oldeberg 1974, no. 692) and the Holstein hoard of Linden (Kr. Norderdithmarschen) (Hachmann 1957, Taf. 30, no. 198).

The distribution of shouldered chisels in Denmark and Schleswig is shown in fig. 10.

### *The trapeze-shaped flanged axe* (fig. 5j)

Seen from the broad side the 13,3 cm long flanged axe is basically trapeze-shaped, though the sides are slightly curved. The 2,9 cms wide

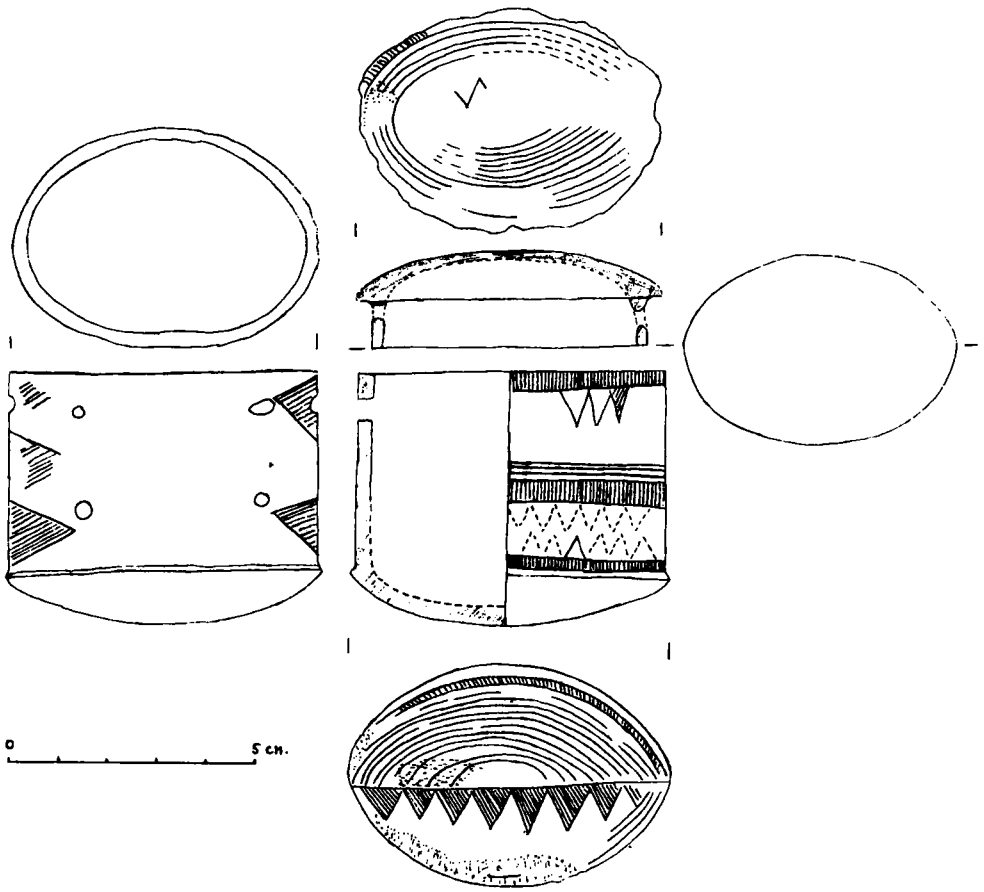



Fig. 8. Sketch drawing of the Bordesholm box (F.S. 5262, Gottorp). The geometric decoration is badly preserved. (Helle Vandkilde *del.*) 2:3.

butt end (measured 1 cm from the end) is moderately arched, and the convex cutting edge is relatively deep with a maximum depth of 1,4 cms. Measured from tip to tip the width of the cutting edge is 6,1 cms. The flanges are low, around 0,15 cm. In cross-section one face is concave and the other one concavo-convex.

The state of preservation is relatively good, although the glossy, dark green patina has been attacked by a light green layer of corrosion and small corrosion pits, which cover most of one face and the butt part of the other. The cutting edge itself has also been damaged by corrosion. A faint longitudinal bevel along the axis of each narrow side indicates casting in a two-piece mould.

Seen from the side the axe is symmetrically lenticular with the thickest place approximately at the centre. This suggests that the axe has not been extensively sharpened – a presumption that agrees well with the absence of distinct edge bevels. In addition the preserved parts of the surface are quite smooth and unspoilt. It is unlikely that this axe has ever been used.

Low-flanged, trapeze-shaped axes with slightly curved sides are typologically closely related to the thin-butted, curved-trapezoidal copper flat axes, that appear in the older part of the south Scandinavian LN Period (Vandkilde 1986 and in press). Both types are mainly a west European phenomenon. In west Switzerland and southwest Germany the low-flanged axes of trapezoidal shape are named type Neyruz (Abels 1972, 11 ff.), and in the lowlands of northwest Europe type Emmen (Butler and van der Waals 1967, 86; Kibbert 1980, 101 ff.). The Emmen and Neyruz axes are never decorated on the faces. They are manufactured during the later half of Br.A1.

Low-flanged, trapezoidal axes are not uncommon in south Scandinavia. Some might be imports from continental western Europe, but due to the simple form imports are difficult to distinguish from local products. Small (< 13 cm), undecorated specimens with a broad butt (> 2,1 cms) match Kibbert's "form Emmen" (1980, 101), while undecorated but larger and more narrow-butted specimens (< or = 2,1 cms) correspond morphologically to type Neyruz (op.cit.).

A local south Scandinavian production can be inferred from the existence of this kind of flanged axe decorated in the purely south Scandinavian Pile style, i.e. either with several rows of facets or punched lines parallel to the cutting edge on the blade part of each face (fig. 11). No doubt ornamented as well as unornamented trapeziform axes were made in south Scandinavia. Imports, of especially Emmen axes, are, on the other hand, to be expected, but axes formally belonging to this type do not show a distribution in Denmark (fig. 12) that distinguishes them

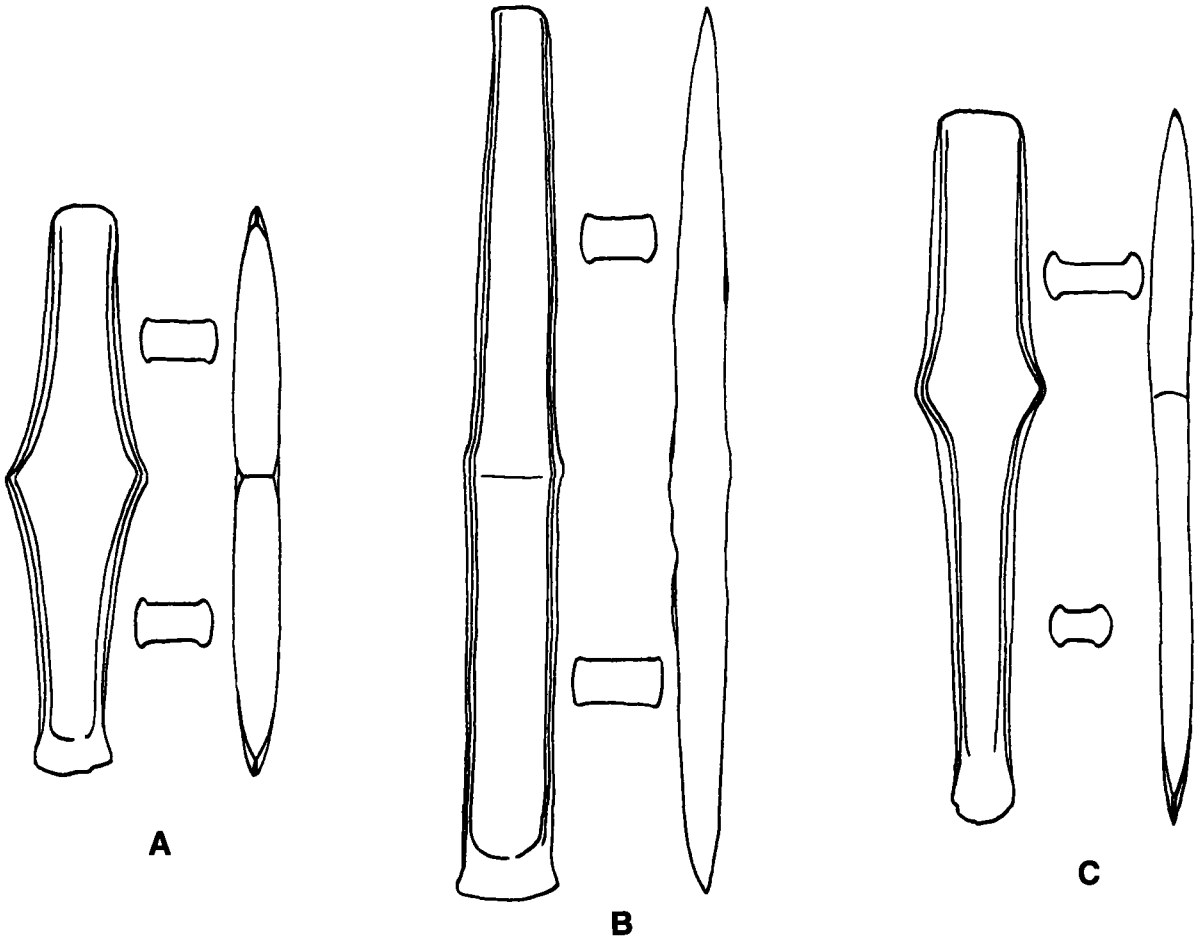



Fig. 9. Chisels of variant A, B and C (NM B4020, NM 8828, NM B13902) (Elsebet Morville *del.*). 2:3.

from the remainder of the low-flanged, trapezoidal axes, which have been named type Hjadstrup after the occurrence of this type of axe in the Hjadstrup hoard (Hjadstrup parish) (Aner and Kersten 1973 ff., Bd. III, Ke. 1797). Type Hjadstrup is taken to include both ornamented and unornamented trapezoidal axes. Among the latter may, however, be found imports of the Swiss-southwest German Neyruz class.

Possibly northwest Sealand is the main Danish place of manufacture of low-flanged axes of trapezoidal shape (fig. 12).

Like most flanged axes the type in question occurs first and foremost as singly deposited pieces. In addition it is found in five hoards: Hjadstrup, north Funen; 'Odsherred', northwest Sealand (op.cit., Bd. II, Ke. 720); Skivarp (Skivarp parish), Scania (Oldeberg 1974, no. 710); Egå (= Egå parish), east Jutland (Hachmann 1957, Taf. 21, no. 18), and finally Skeldal. Of these only the Skeldal hoard contains other objects than different types of locally made low-flanged axes, sometimes with the specific south Scandinavian multi-linear decoration. Their early chronological position within the large group of flanged axes is supported by a low percentage of tin.

### *The large parallelsided-curved flanged axe* (fig. 5i)

The sides of the 18,7 cms long axe are parallel from the butt as far as almost midway, whereupon they begin to flare quite widely and concavely towards the cutting edge. Thus the basic shape of the axe can be described as parallelsided-curved. The 2,8 cms wide butt end is distinctly rounded, and the 8,0 cms wide cutting edge is fairly convex with a present depth of around 1,8 cms. A straight transverse bevel is situated across the centre of each face. The height of the flanges is less than 0,2 cm, and the cross section clearly shows the slight concavity of each face. The narrow sides are decorated with two longitudinal facets, together forming a pointed oval that matches the contour of the profile itself. The faces are undecorated.

The axe is excellently preserved and is covered by a smooth and bright, dark to lighter green patina. The cutting edge, however, is much corroded indicating that it has received some different treatment than the rest of the axe, probably hammering. The relatively deep cutting edge without a bevel and the undamaged axe surface suggest that the axe was new when deposited. On the other hand it may have been shar-

pened, because seen from the narrow side the broadest point of the blade is closer to the cutting edge than to the butt. The question is, however, whether this argument is always valid, as the broadest point of the oval facet is in this case situated almost exactly in the middle of the narrow side.

The large Skeldal axe is a typical representative of the south Scandinavian low-flanged, parallelsided-curved, undecorated axes named type Gallemose after the hoard of that name (Vandkilde 1986 and in press). It is closely related to axes with the same formal characteristics but with the broad sides decorated in the Pile style; such axes are called type Værslev (op.cit.) after the Værslev hoard (Værslev parish), northwest Sealand (Aner and Kersten 1973 ff., Bd. II, Ke. 1017). The latter type makes up the essence of Forssander's "Pile axe" (1936, 169 ff.).

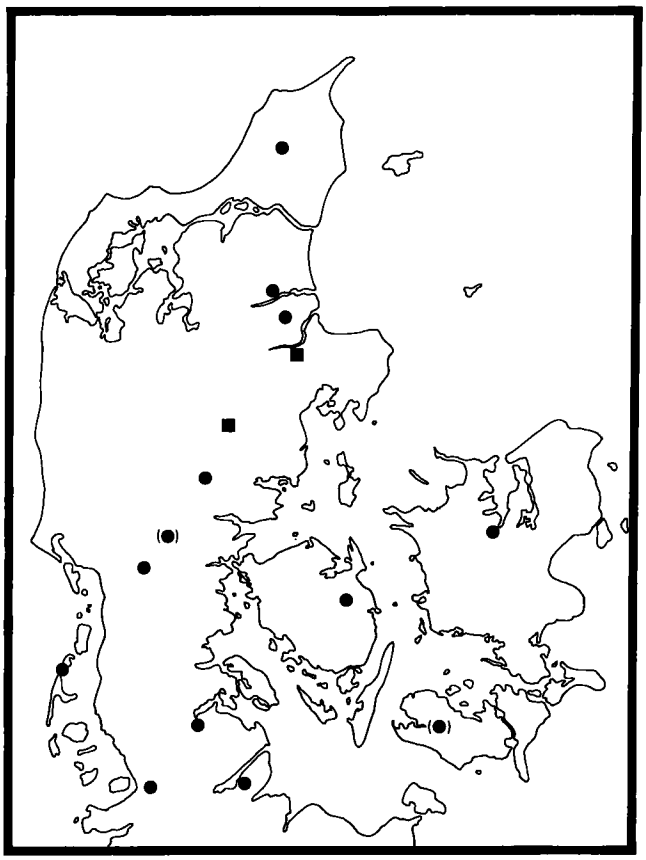
The transverse bevel of the Skeldal axe is an advanced feature, which is occasionally seen in the low-flanged axe group.

Among the typologically early group of flanged axes it is possible to separate five locally manufactured variants (Vandkilde 1986 and in press) using the classification system of Kibbert (1980, 88 ff., Tabelle 16) (16). Of these, type Gallemose is by far the most frequent, followed by type Værslev. The parallelsided-curved shape of the Værslev and Gallemose axes may be understood as specifically south Scandinavian, as it takes up a morphological and geographical position between the trapezoidal shape of the west European, early flanged axes and the slender, waisted shape of the Únětican axes.

Flanged axes of type Gallemose occur mainly as singly deposited pieces. They are also found in eight hoards: Lumby Torp (Lumby parish) (Aner and Kersten 1973 ff., Bd. III, Ke. 1805) and Hjadstrup in north Funen, Skeldal, Egå, Gallemose and Vrold Østergård (Skanderup parish) (NM B15812, unpublished) in east central Jutland, and Pile in Scania and finally Västra Frölunda (Göteborg parish) (Oldeberg 1974, no. 2405) in Västergötland.

The early chronological position of the axe type described is also indicated by the generally low percentage of tin.

Type Gallemose is represented in most parts of Denmark, but the centre of gravity is east Jutland and north Funen (fig. 12).



**flanged, shouldered chisels**
variant A = ■
variant C = ●
( ) exact find place unknown

Fig. 10.

## *The small parallelsided-curved flanged axe* (fig. 5k)

Seen from the broad side the 9,9 cms long axe is parallelsided-curved, like the axe described immediately above. The width of the rounded butt end is 2,6 cms. The width of the moderately expanding cutting edge is 6,2 cms, and the depth is 1,1 cms. The blade tips are rather prominent. The axe has a transverse bevel as well as a broad edge bevel. On one face the trapeze-shaped, slightly sunken area between the two bevels has a graffiti made of groups of parallel lines scratched obliquely and horizontally into the surface. The flanges are low, not exceeding 0,2 cm. On the blade the flanges have been flattened by hammering. Seen from the side the shape of the axe is asymmetrically lenticular with the broadest place towards the cutting edge.

The axe has been polished by the finder, and the patina has disappeared. The state of preservation is good apart from small pits near the cutting edge and the butt end due to corrosion. The faint, longitudinal facet on each narrow side may suggest casting in a two-piece mould. The notch in the butt end is due to a casting flaw. The fractures appear quite rough, and a repair of the damage has not been attempted.

The wide edge bevels, the tilted blade tips and the low point of gravity of each narrow side together indicate a large degree of resharpening. The transverse bevel, the flat lower flanges, and the sunken area of the blade are unlikely to have existed, when the axe was new. Traces of hammering are visible where the transverse bevel and the flanges meet, and also in the middle of one narrow side. One blade tip appears to be somewhat worn. In conclusion, the axe was an old damaged piece, although still serviceable when deposited in the hoard.

The axe may be classified among locally manufactured, low-flanged axes of type Gallemose.

## *The butt part of a flanged axe* (fig. 5h)

The 6 cm long butt fragment of a flanged axe has parallel sides and a distinctly rounded butt end. The flanges are low, less than 0,2 cm in height. It is undecorated.

The fracture is old and probably happened during casting. The state of preservation is fine, the surface being covered by a smooth and bright green patina. The fragment is apparently unused.

The butt fragment probably belonged to a low-flanged, parallelsided-curved axe.

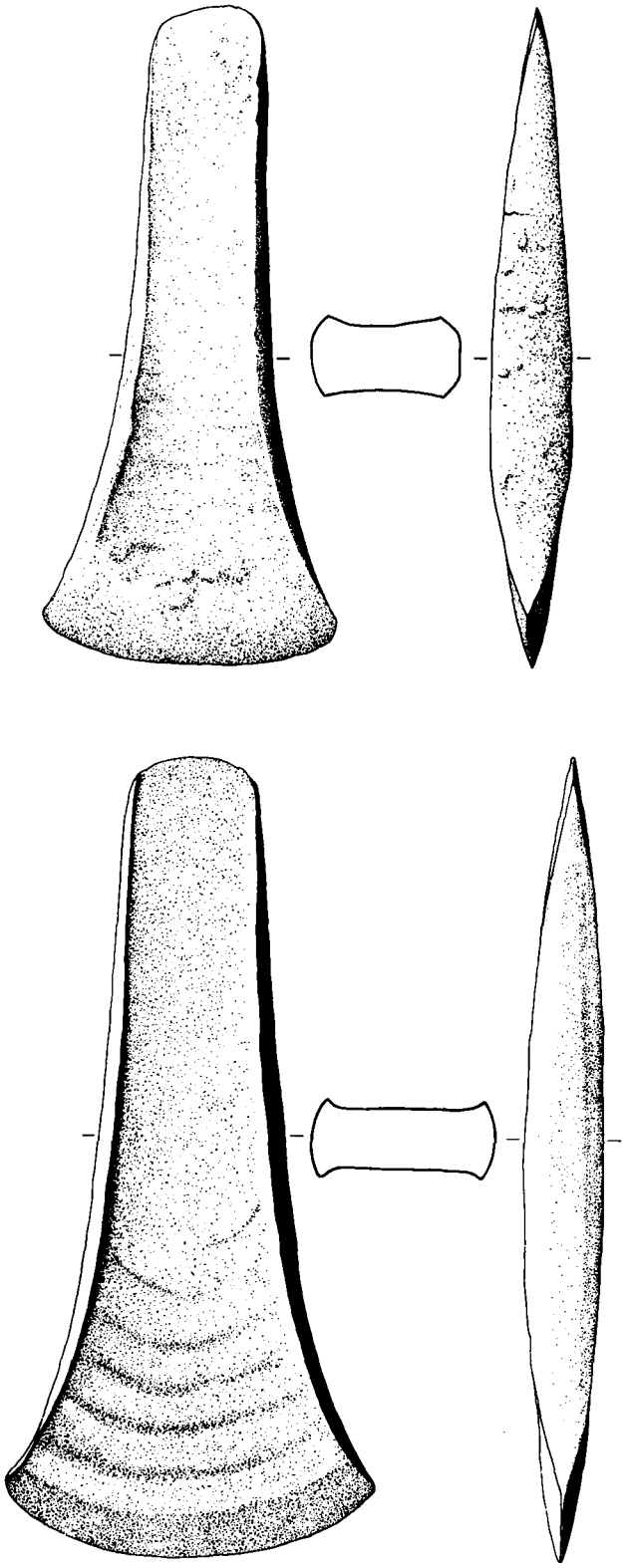
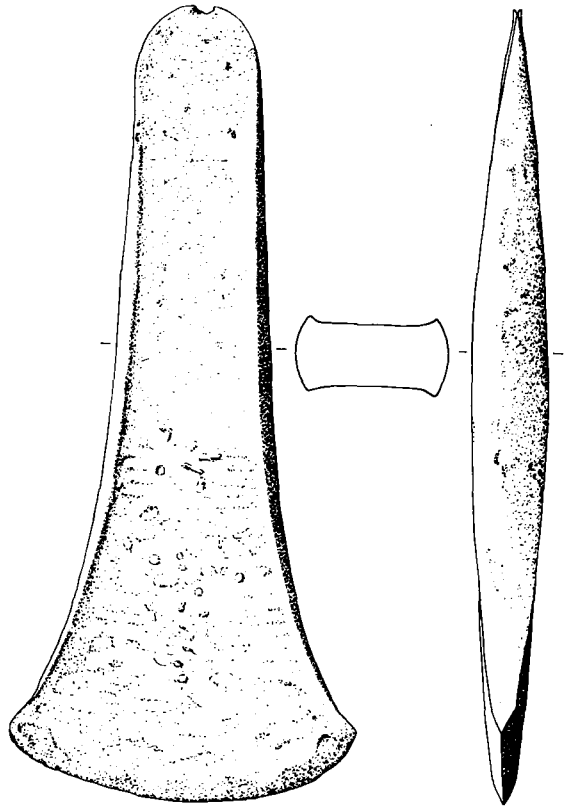


Fig. 11. Low-flanged, trapezoidal axes ornamented in the Pile style (after Aner and Kersten 1973 ff., Ke. 610, 637 and 753). 2:3.



## THE CHRONOLOGICAL POSITION OF THE SKELDAL HOARD

In the above description and classification of the objects it has been argued that the four flanged axes were of local manufacture, whereas all the ornaments and the chisel were foreign pieces.

The box, the chisel, the open solid ring, and the bronze *Noppenringe* most likely came from the north Únětican region or its Baltic periphery, and this was also the most probable place of origin for the spiral arm-ring and the spiral bead. The gold *Noppenringe* probably originated somewhere south of the *Erzgebirge*.

It has been shown that none of the foreign objects were necessarily later than Br.A1b or the classical phase of the Únětice culture, and Br.A1b is, in fact, the most likely date for the Skeldal hoard in the central European terminology. The chisel type seemed almost exclusively to belong to this period, and the *Noppenringe* were not likely to be later than Br.A1b. The rib style of the box and the open solid ring could not be dated quite as precisely, but a date within the classical Únětican

phase seemed not unlikely. The spiral bead and the spiral armring were determined as being long lasting types but were, however, also quite common in the hoards of the classical Únětican phase.

The chronology of the south Scandinavian LN Period is based on the typological development of flint daggers (Lomborg 1973). Since flint daggers never occur in combination with metal objects except small insignificant ornaments, it is impossible to date most of the metal objects directly within the south Scandinavian chronology. Lomborg has, however, shown that the youngest part of the LN Period (his LN C) is contemporary with the classical phase of the Únětice culture (op.cit., 142 ff.). This synchronization places the Skeldal hoard and related hoards within the LN C Period or, since the present writer prefers a division of the LN Period into two sub-periods, the Younger LN Period (Vandkilde 1986 and in press).

This conclusion is supported by the evidence of a find combination seriation of south Scandinavian and neighbouring early metal hoards. The seriation matrix (fig. 13), which has the assemblages on the left and the objects across the top, demonstrates a distinct diagonal distribution, that is interpreted as a chronological development with Ohlenburg as the earliest and Valsømagle I (Haraldsted parish) as the latest hoard. The same material has been computer analysed using a correspondence analysis (fig. 14). Here a very distinct parabola-shaped distribution was the result, clearly indicating a chronological explanation. Three groups can be separated.

The early group, which comprises the finds from Ohlenburg to Grönwohld (Kr. Stormarn) and which also includes the hoard from Skeldal, is a very homogeneous aggregate of closely related hoards. Their objects are primarily different kinds of locally manufactured, low-flanged axes, occasionally accompanied by imports from the Únětice culture in its classical phase, and sometimes also developed bronze flat axes characteristic of the Aylesford-Falkland phase in Great Britain and Ireland (Burgess and Schmidt 1981, 59 ff.), which is again contemporary with the Armorico-British phase of the Wessex Early Bronze Age culture (op.cit., 61, 68; Gerloff 1975, 92 ff.). The circle is completed by the presence of a developed bronze flat axe of type Falkland in the classical Úněticean hoard of Dieskau 2 (Saalkreis) (von Brunn 1959, Taf. 16: 3; Burgess and Schmidt 1981, 63).

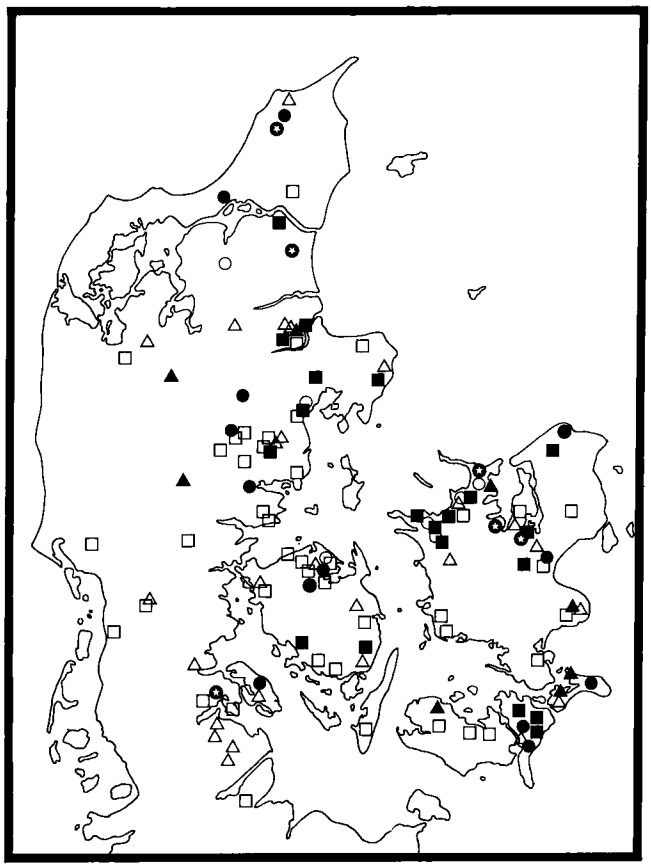



Fig. 12. The distribution of different types of locally produced, low-flanged axes in Denmark and Schleswig (cf. note 16).

This early group is named *the Younger LN hoard group* (17). Apart from being in accordance with the comparative-chronological evidence, the LN date is supported by the fact that the succeeding hoards belong to the first period of the Bronze Age. The hoards from Fjälkinge and Neu-Rathjensdorf (Kr. Oldenburg) take up a transitional position as they contain objects characteristic of the early as well as of the succeeding hoard group, that begins with Skegrie and concludes with the Torsted hoard (Bondesgårde, Torsted parish). The imports of this early Period I group (P.IA) relate it to central European Br.A2, while the late Period I group (P.IB) is contemporary with the earliest Tumulus culture,

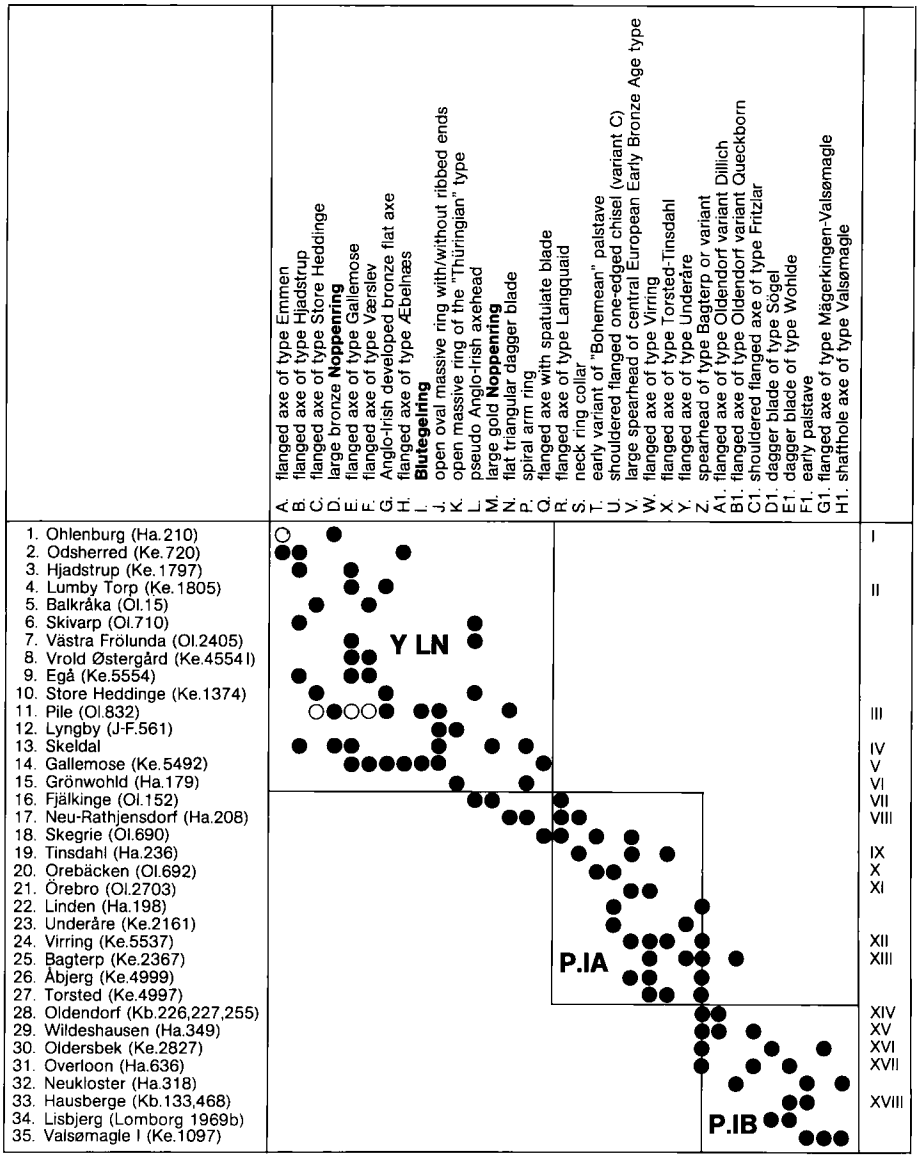



Fig. 13. Seriation based on the principle of find combinations in hoards from the LN Period and the first period of the Early Bronze Age. The names are shown in the column on the left and the object types across the top. To the right objects occurring only once have been listed. The numbering of finds and objects is the same as the one used in the correspondence analysis (fig. 14). The numbers following each hoard refer to the catalogues of Hachmann 1957 (Ha.), Jacob-Friesen 1967 (J.-F.), Oldeberg 1974 (Ol.), Aner and Kersten 1973 ff. (Ke.) and Kibbert 1980 (Kb.). An open signature indicates an uncertain typological classification. The diagonal distribution is interpreted as a chronological development.

I "barbed wire" beaker, sheet bracelet with overlapping ends of different sizes
II primitive flanged axe of type Lumby Torp (variant B)
III open cuff-shaped ribbed bracelet, bronze hilted daggers of "Saxon" type, **Rippenbarren**
IV spiral bead, beehive-shaped ribbed box, butt-part of a flanged axe, shouldered flanged double-edged chisel (variant A)
V giant waisted unornamented flanged axe, bronze hooks
VI flanged axe of type Únětice (variant Halle)
VII parallelsided flanged axe of type Fjälkinge-Kläden
VIII loop-ended neck ring, arm ring
IX pins with perforated spherical head and shaft torsion, arm rings with pointed ends, sheet ribbons with bosses, disc-shaped pieces of amber, pot
X originally more objects
XI butt-end of flanged axe
XII curved dagger blade of type Virring
XIII fragment of flanged axe
XIV bar-stop axes **(Halbstegbeile)**
XV arm ring wirh "wolf-tooth" ornamentation, chisel-awl, pin with wheel-shaped one-sidedly cast head of type Mollberg
XVI flanged axe of type Oldendorf without stop-bevel
XVII **Lochhalsnadel,** atypical spearhead
XVIII Parallelsided-curved flanged axe related to Kibberts type Nienborg

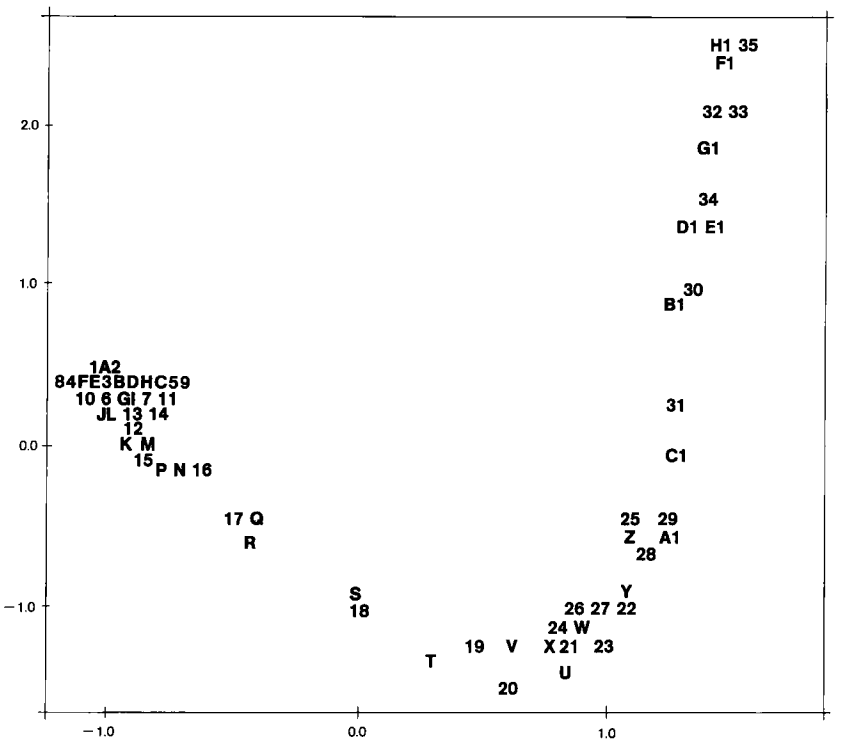



Fig. 14. Correspondence analysis of hoards from the LN Period and the first period of the Early Bronze Age. The same finds and types of objects as in the manual analysis are included; for the meaning of the codes see fig. 13. The first two analysis axes are illustrated, and with few exceptions the succession of the parabola-shaped distribution corresponds to the succession arrived at in the manual seriation.

Br.B1. Whereas the division between the Younger LN group and the Period IA group is clear-cut, the transition between the two period I groups is more vague (18).

## CONCLUSION

The Skeldal find combines foreign and local pieces, ornaments and implements/weapons, new and old objects. It also includes a fragment of an axe with no other value than the metal. There seem to be old and new pieces among the imports as well as among the local objects. All objects were carefully deposited in a small pit sunk into dry ground. In this respect the Skeldal hoard differs from the majority of the contemporaneous metal objects, which are derived from wet terrain. Such deposits are often interpreted in ritual terms. Thus the Skeldal hoard may have been deposited for other reasons.

Most metal finds of this age are singly hoarded flanged axes. Much less common are hoards with a few flanged axes. Usually the axes are locally manufactured, but occasionally different types of Anglo-Irish developed bronze flat axes occur. Waisted low-flanged axes of Únětican origin (Saxon type) are very rare in south Scandinavia and are not found in any find combinations.

The Skeldal find joins a small exclusive group of hoards, which consist of several types of objects with different functions: the hoards of Fjälkinge, Pile and Gallemose. These hoards are composed of local axes, sometimes a developed bronze flat axe of Anglo-Irish design or derivation, and Úněticean ornaments. The foreign objects are quantitatively dominant in all four hoards, making up between 55 and 70% of the objects. Although Skeldal has fewer objects than the hoard of Pile, the latter offers the best parallel in regard to range of foreign types. The contents of Fjälkinge and Gallemose are more uniform (leaving the three unique bronze hooks of the latter out of account). Whereas Skeldal and Pile contain seven and eight different types of imported objects, Fjälkinge and Gallemose contain three and four respectively (19). In conclusion, there are three kinds of metal hoards in the Younger LN Period of South Scandinavia, mentioned in regard to frequency: 1) singly hoarded objects, chiefly flanged axes of local origin. 2) one-type hoards with a number of flanged axes of mainly local origin and 3) multi-type hoards with local axes and especially foreign objects.

Most hoards north of the *Mittelgebirge* predominantly contain solid and stout objects such as flanged axes, different kinds of massive rings and ingots, daggers and halberds. Gallemose and Pile are closely related to this hoard group although Únětican, waisted flanged axes have been replaced by local flanged axes. Skeldal, however, does not fit into this pattern of generally solid and heavy hoards.

The best compositional parallels to the hoard from Skeldal is found in a small group of north Únětican hoards containing either small and thin ornaments like *Noppenringe,* spiral armrings, spiral beads and sheet-like ornaments for the body or the dress or a mixture of such ornaments and more solid objects. Hoards like Tilleda, Berlin-Lichtenrade, Ostro (Kr. Kamenz) and Kiebitz (Kr. Döbeln) illustrate this hoard group (Billig 1963, 256, Abb. 1–3; Gandert 1957, Abb. 1; von Brunn 1959, Taf. 50 and 75).

In spite of the affinities between the hoards of these two regions, the few south Scandinavian multi-type hoards are definitely not traded in – *in toto* – from the Únětican region. This is clear from the presence of locally manufactured flanged axes and the absence of the Únětican type of flanged axe, which is the most frequent object in the hoards of the north Únětice culture (cf. von Brunn 1959, 16).

The Skeldal hoard is situated in east central Jutland, which together with north Funen and northwest Sealand have a dense distribution of metal objects of the Younger LN Period (fig. 15). The majority of the metal finds in this period are concentrated within this area: Of fourteen hoards only three are located outside, and of these three only the axe hoard from Store-Heddinge (Store-Heddinge parish) (Aner and Kersten 1973 ff., Bd. II, Ke. 1374) in southeast Sealand contains more than two objects. Outside the distributional centre, west Jutland including the western Limfjord region has only little metal, whereas the remaining part of Denmark has a relatively even scatter of finds. Here the metal finds are primarily singly deposited flanged axes and an occasional halberd blade or triangular dagger (20).

Although a Beaker-inspired manufacture of metal objects was initiated in the Older LN Period (= Lomborg 1973: LN A-B) (Vandkilde 1986 and in press), it is not until the Younger LN Period that a local production on a large scale is reflected in the finds. The central area described above may be interpreted as a core area for the early development of a local metallurgy in Denmark. It still remains, however, to investigate if this metallurgical core is distinguishable from the rest of Denmark also in other respects. A systematic analysis of the contemporary grave finds and of the relationship between the flint and the metal industries have never been undertaken, but would obviously be required to determine the real and full significance of this area.

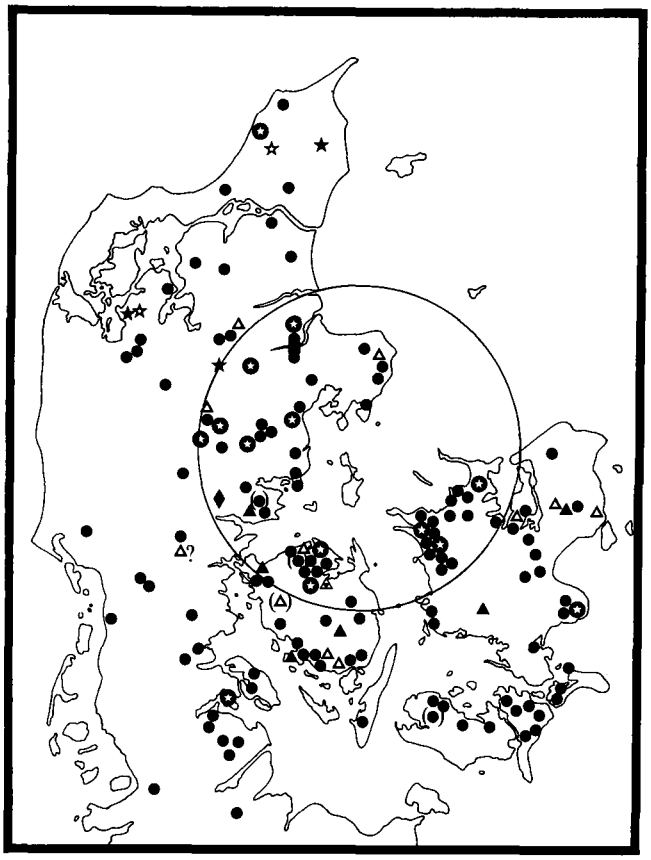



Fig. 15. The distribution of the Younger LN metal objects in Denmark and Schleswig (cf. note 20).

Compared to the number of metal objects in the preceeding period (Older LN) and in the succeeding period (P.IA), the local production of the Younger LN is surprisingly extensive, whereas imported objects are of

no large importance. At the same time this production is extremely one-sided in regard to the range of manufactured types, since almost exclusively low-flanged axes are produced. Only when the imports are included does a more varied picture emerge. In the EBA centres of metal production of western and central Europe, the low-flanged axe also makes up a large part of the total production, which, however, is far more varied and comprises many different kinds of weapons, implements and ornaments. This, undoubtedly stresses the still limited quantities of metal available in south Scandinavia compared with the metal producing and distributing centres to the west and south in Europe; but at the same time this situation may indeed reflect a particular need of metal axes in the northern periphery. The metal used is basically of central European origin, and most of it was transformed into low-flanged axes, and not, for example, into ornaments for the dress and the body. Though a closer examination of these matters is strongly needed, it may here be suggested that there is a connection between the predominance of flanged axes in the early metal finds, the quantitative decline in the manufacture of flint tools and weapons, especially in regard to daggers but presumably also to flint axes during the Younger LN Period, and the evidence from the pollen diagrams of an expansion of the agricultural area at the expence of forest (cf. for instance Aaby 1985, 70) in the LN Period.

The sudden boom in the South Scandinavian local production of metal objects coincides with the emergence of a powerful centre within the Únětice culture in central Germany along the rivers Unstrutt and Saale, around rich resources of copper and tin. In the early part of the EBA this was a backward 'stone age' area with only sporadic use of metals (Mandera 1953, 188 ff.; Moucha 1963, 53 ff.), but by the late EBA, at the beginning of the second millennium BC, the picture had changed completely. Now rich graves and bulky metal hoards suggest the presence of prosperous and highly stratified and specialized societies, which owed their success to control of metal resources and production and distribution of metals and metal objects. No doubt this development was directly connected with the metal demands of the peripheries including South Scandinavia. The Skeldal hoard demonstrates the closeness of this relationship to a particularly high degree.

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## NOTES

1. I am much indebted to Christian Fischer, Silkeborg Museum, who asked me to publish the Skeldal hoard. I also wish to thank:
The Carlsberg Foundation for a one-year scholarship to study the relations between the earliest metal culture in South Scandinavia and continental Bronze Age centres in Central and Western Europa and Greece from 2500–1500 BC. The present article is based on the results of this study, which were submitted as my master's thesis (Vandkilde 1986). *Dronning Margrethe II's Arkæologiske Fond* for financial support during the preparation of this paper. The Danish Research Council for the Humanities, which provided the financial background for the metal analyses, that will be published later. Elmer Fabech, Ølgod and Eva Salomonsen, The National Museum, for technical information on the bronze objects. Karl Kersten, *Schleswig-Holsteinisches Landesmuseum für Vor- und Frühgeschichte, Schleswig,* and Jens Poulsen, Institute of Prehistoric Archaeology, Moesgård for useful comments and for drawing attention to the box from Bordesholm, exhibited in the Gottorp Museum. Torsten Madsen, Institute of Prehistoric Archaeology, Moesgård for assistance with computer analysis. The staff of the National Museum 1st Dept. for help and advice during my visits there, and David Liversage for revising the English text.
2. The accession number in the register of Silkeborg Museum is SIM 217/1982. The find was later transferred to the National Museum as treasure trove and registered under the following numbers: NM B17061: The two bronze *Noppenringe.* NM B17062: The spiral armring. NM B17063: The box. NM B17064: The open oval solid ring. NM B17065: The chisel. NM B17066: The smallest flanged axe. NM B17067: The trapezoidal flanged axe. NM B17068: The largest flanged axe. NM B17069: The butt end of a flanged axe. NM B17070: The spiral bead. NM B17071: Misc. bronze bits, which have disappeared. Dnf 19/82: Gold *Noppenring.* Dnf 20/82: Gold *Noppenring.*
3. In the following description of the find spot I rely on the report written by Christian Fischer, who carried out the excavation, assisted by Knud B. Jensen.
4. Personal communication by David Graham, who has kindly provided a drawing.
5. Personal communication by Elmer Fabech, Ølgod.
6. For the chronology of the bronze and gold objects in the later part of the Únětice culture, see Moucha 1961, 33; 1963, 9 ff.; 1974, 241 ff.; von Brunn 1959, 16 ff. and Tihelka 1953, 327. The chronology used here combines Moucha 1961–1974, von Brunn 1959 and the general central European system of Reinecke (1924), which has been subdivided by several later authors. Br.A1a – A1b – A2 is used here. Hoards from the classical phase containing rib style objects are for instance: Göda Birkau (Kr. Bautzen), Griefstedt (Kr. Sömmerda), Naumburg (Kr. Naumburg) (von Brunn 1959, Taf. 29. 30, 63–64), Bresinchen (Kr. Guben) (Breddin 1969) and Neu-Bauhof (Kr. Malchin) (Schubart 1972, Taf. 103).
7. Hoards like Dieskau 1 (Saalkreis) (von Brunn 1959, Taf. 12) and Falkenwalde (Kr. Prenzlau) (Bohm 1935, Taf. 2–4) belong to this category.
8. See also Schranil 1921, tab. IV and VII; Schubert 1974, Taf. 26, 32 and 33; Tihelka 1965, Taf. 2–3 and 1953, obr. 20, 23 and 24 for several examples of this geometric style as applied to bracelets, belt plates, and disc-headed pins.

9. A few spearheads of the Torsted type, however, have multiple lines and triangles on the socket (Becker 1964, Abb. 5).
10. This is evident because of the presence of Únětice related hoards like Grönwohld (Kr. Stormarn), Klein Wesenberg (Kr. Stormarn) and Neu-Rathjensdorf (Kr. Oldenburg) (Hachmann 1957, Taf, 30 and 32). Such hoards are not found in the remaining part of Schleswig-Holstein.
11. The gold *Noppenringe* from the hoard of Röderau (Kr. Riesa) belong to the group of small *Noppenringe*. Two of the three gold rings of this hoard are of the simple type with one end twisted (von Brunn 1959, Taf. 81–82).
12. The occurrence of spiral armrings and spiral beads in some Early Neolithic finds is here left quite out of consideration.
13. Combination finds with double-edged, symmetrical shouldered chisels:
    1: *Kotla* (woj. Legnica), Silesia; grave or hoard of classical Únětican date (Gedl 1980, Taf. 29b). Variant A.
    2: *Przysieka Polska* (woj. Leszno), Silesia; hoard of classical Únětican date (op.cit., Taf. 32c). Variant A.
    3: *Słupy* (woj. Bydgoszcz) central Poland; hoard of classical Únětican date (op.cit., Taf. 33c). Variant A.
    4: *Leubingen* (Kr. Sömmerda), central Germany; grave of late classical Únětican date (Höfer 1906a, Taf. 2). Variant B.
    5: *Falkenwalde* (Kr. Prenzlau), Brandenburg; hoard of late classical or post-classical Únětican date (Bohm 1935, Taf. 2–4). Variant A.
    6: *Ferdinandshof* (Kr. Ückermünde), Mecklenburg; hoard of post-classical Únětican date (Kersten 1958, Taf. 41, no. 423). Variant B.
    7: *Lechow* (Kr. Schivelbein), Pommern; hoard of classical Únětican date (op.cit., Taf. 86, no. 780). Variant A.
    8: *Hindrichshagen* (Kr. Strasburg), Mecklenburg; hoard probably of classical Únětican date (Schubart 1972, Taf. 28A). Variant A (without flanges).
    9: *Brodek* (Bez. Prostejov), Moravia; hoard of classical Únětican date (Tihelka 1965, Taf. 10a and p. 4, mentions five more chisels from Moravia, but they are neither described nor illustrated). Variant B (somewhat asymmetrical).
    10: *Hedersleben* (Kr. Aschersleben), central Germany; grave of classical Únětican date (Höfer 1906b, Taf. 6). Variant B.
    11: *Gudensberg* (Kr. Schwalm-Eder), Hessen; grave of Br.A2 or Br.B1 date (Kibbert 1980, Taf. 13, 165). Variant B.
    12: *Kocise* (Bez. Kocise), east Slovakia, grave no. 146/66 (Novotná 1970, Taf. 25); Older phase of the Kost'any culture = Br.A1a. Variant A.
14. The chisel from Ingelstorp (Ingelstorp parish), Scania (Oldeberg 1974, no. 353, Cullberg 1968, no. 647) is classified by Willroth (1885, 395) among Únětican, double-edged chisels. It is, however, rather a strongly sharpened chisel of variant C. It is clearly one-edged, the blade part has a broad edge bevel and is longer than the butt part. Also the high content of tin (more than 10%) makes this classification the more likely.
15. The hoard of Underåre (Serreslev parish) (VHM 20066, 22365 a-b) consists of a chisel of variant C and two flanged axes of parallelsided-curved shape with very high flanges (0,6–0,7 cm), stop bevel and edge bevel. The butt end of these axes is flatly curved, and the cutting edge relatively protruding. The edge is at least two and a half times as wide as the butt. The tin value varies between 6,6 and 6,9%, and the SAM analysis group is the late FB1-2 (Cullberg 1968, no. 334; SAM II, 4, no. 11990). This type of flanged axes is definitely later than the »Pile type of axes«. Similar axes are found in the hoards of Bagterp (St. Hans parish) (Jacob-Friesen 1967, Taf. 1: 8–9), Øby (Viskum parish) (unpublished, VSM 7554–55) associated with an undecorated shafthole axe type Fårdrup, and Torslunda (Tierp parish) Uppland (op.cit., Taf. 25: 5). They probably cover the main part of Period I: Their shape varies from trapezoidal to parallelsided-curved, and they may be named type Underåre after the hoard (Vandkilde 1986). Hachmann (1957, 60, 64) and Willroth (1985, 399) classify the two Underåre axes as type Pile, and consequently arrive at too early a date for this hoard and its chisel.
16. 1: type Værslev, see text. 2: type Gallemose, see text. 3: type Hjadstrup, see text. 4: type Store-Heddinge, undecorated low-flanged axe with waist. 5: type Æbelnæs, as no. 4 but decorated (Vandkilde 1986 and in press).
17. The hoard of Ohlenburg is probably somewhat earlier than the rest of the hoard group, as the pottery vessel relates it to the early part of the Barbed Wire Period in the northwest European lowland region and the sheet bracelet has its closest parallels in the finds of the *Bleckkreis* prior to Br.A1b.
18. The subperiods P.IA and P.IB differ considerably from Lomborgs subdivisions of Period I in Fårdrup-Sögel and Valsømagle-Wohlde (1969b, 1973) in terms of contents of types and finds. A revision of the chronology of Period I of the Bronze Age is in preparation (cf. Vandkilde in press for a summary).
19. The following types are considered to be imports (cf. fig. 13): Gallemose: The Anglo-Irish, developed bronze flat axe; the *Blut-egel* rings; the open, oval, solid-cast rings; the low-flanged axe with spatulate blade; the hooks. Pile: The bronze *Noppenring;* the Anglo-Irish, developed bronze flat axe; the *Blut-egel* ring; the open, oval, massive rings; the flat, triangular dagger blade(s); the cuff-shaped bracelet; the bronze hilted daggers; the *Rippenbarren.* Fjälkinge: The gold *Noppenringe;* the flanged axe of type Langquaid; the flanged axe of type Fjälkinge-Kläden.
20. Grave finds with metal objects have not been included. They are very few, and most of them cannot be dated more precisely than LN – P.IA. Most frequent are *Noppenringe* and other kinds of small spiral rings.

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# *Danish Bronze Age Wools*

by M. L. RYDER

## INTRODUCTION

The wools preserved in the Danish oak coffins, although relatively late in date, are of immense interest in providing the first direct evidence of wool usage. Most appear to represent a primitive hairy medium fleece at a transitional stage between the 'hair' coat of Neolithic sheep (see below) and the typical hairy medium-generalised medium fleeces that emerge in the Bronze Age and remain predominant until after the Middle Ages (Ryder, 1983a).

The remains illustrate the biological changes taking place in the coat of sheep as a result of selective breeding for wool suitable for textile use and the lack of such remains from areas closer to the centre of domestication in the Middle East makes them doubly important.

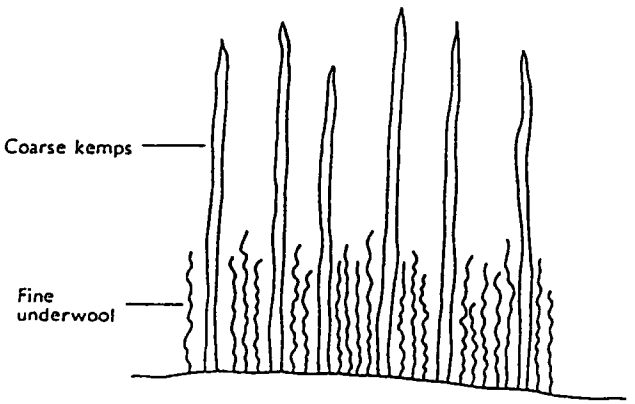


Fig. 1. Diagrammatic representation of the double coat of wild sheep and the first domestic type.

### *Neolithic 'hair' sheep*

It has long been known that the coat of the first domestic sheep of the Neolithic period would have been the same as that of the wild ancestor. This comprises an outer coat of bristly kemp fibres, which obscure very fine underwool (Fig. 1). What has only been realised more recently is the length of time it took for a fleece to develop. The evidence for this comes from the wild Mouflon sheep of Corsica and Sardinia. These are now thought to be not truly wild sheep, but feral descendants of domestic sheep introduced by Neolithic settlers about 6000 b.c. (Poplin, 1979). Since these have a coat that is apparently no different from that of other wild sheep, such as the Bighorn of North America, which was never domesticated, it appears that no change took place during the 3000 to 4000 years that elapsed between domestication and their introduction to Corsica and Sardinia.

Ryder (1984) identified 'hair' sheep in skin remains from Sudan dated about 2000 B.C. P. Walton has recently reported on eight raw wool samples of this type from Borremose, Denmark (e.g. ref., C26449). These were from sheepskin capes of the pre-Roman Iron Age (Hald 1980) and the nature of the material means that the entire range of fibre diameters was represented. The modal diameters ranged, form 15 to 22 microns and some of the kemps were over 200 microns in diameter.

This primitive type of coat also survives in the kempy 'hair' breeds of tropical Africa and India. Domestication resulted in the occurrence of black sheep and white sheep in addition to the brown of the wild ancestor (which is the only colour in the Corsican Mouflon). The retention of the kempy coat in tropical 'hair' sheep can be interpreted as being due to the lack of a stimulus to breed for wool in a hot climate. In fact, in some tropical breeds the underwool has actually become reduced presumably as an adaptation to heat loss brought about through natural selection.

Since this section was written, Bennike, Ebbesen and Bender Jørgensen (1986) have drawn attention to an early claim of 'woollen' cloth of the late Neolithic from Wiepenkathen in Lower Saxony. Since no evidence is given for regarding this as woollen as opposed to wor-

sted it would be better described as 'wool' and since no fibre measurements are given its identification as 'wool' is meaningless. My own experience of investigating such claims has been that the fibres have turned out to be of plant origin and not wool, or that the material is not as old as Neolithic. I have sought wool of Neolithic date for 30 years without success.

*Material investigated*

This account, in addition to presenting new measurements (Table 4), reassesses the previous findings of Ryder (1964) – one sample only from Guldhøj – Ryder (1969) and Ryder (1983b). The first unpublished material measured in 1985 comprised seven yarns from Early Bronze Age textiles in a woman's grave in Melhøj (Bender Jørgensen *et al.* 1982). These all had the reference number B12381–91 and came from four different types of cloth (A to D). They are listed at the end of Table 4 as numbers T530 to T536.

A further 27 yarns from E. Munksgaard were measured in 1986. These were all of early Bronze Age date (1800 to 1000 b.c.) and the sites and periods represented are shown in Table 1.

| | |
|---|---|
| Snoldelev, Copenhagen Co. | no. 6281-85 – per. III |
| Smørumovre, Copenhagen co. | no. B 2109-22 – per. II |
| Garderhøj, Copenhagen co. | no. B 3716-26 – per. III |
| Hagendrup, Holbaek co. | no. 13751-54 – per. II |
| Løserup, Holbaek co. | no. 9835 – per. II |
| Haraldsted, Sorø co. | no. B 9987-93 – per. II |
| Skallerup, Praestø co. | no. 6145-59 – per. III |
| Hejnsvig, Ribe co. | no. B 10584 – per. II |
| Torup, Ribe co. | no. 10089 – per. II |
| Briksbøl, Ribe co. | no. B 9175 – per. I |
| Melhøj, Aalborg co. | no. B 12381-91, samples from A5, A3, C33 and C34 – per. III |

Table 1. Sites and periods of yarns measured in 1986.

*Method*

The method has been described before, e.g. in Ryder 1969 and Ryder (1983b). It involves the use of whole microscopic mounts of the fibres in which the diameter of 100 fibres is measured using a projection microscope. The widths of fibre images magnified 500 times and projected on to a bench are measured with a mm scale. Doubling of the measurements obtained gives the fibre diameter in microns (thousandths of a mm).

The fleece type criteria have been summarised by Ryder (1969) and Ryder and Gabra-Sanders (1985). The skewness and the maximum fibre diameter in distributions like those in Figure 2 are used to define the type of fleece represented.

*The development of a fleece*

The main change involved in the development of a fleece involved the narrowing (thinning) of the outer coat kemp hairs, and it could be that selective breeding for a softer (and therefore finer) coat began while skins were still being worn as clothing. At the same time, the underwool coarsened so that the mean fibre diameter changed from about the 15 microns of the wild sheep and the Mouflon, to 20 microns, which has been the typical value for wool ever since (Fig. 2).

An intermediate stage can perhaps be seen in the wool used in some of the earliest textiles found in Denmark. This was originally thought to have been mixed with deer hair (Steensberg 1939) but it is now realised that the 'deer hairs' are really sheep kemps. Three of the Danish Bronze Age yarns described by Ryder (1969) – from Skrydstrup – appeared to be of this intermediate type in having only kemps and fine wool (Table 2). Red deer hairs are three times the width of sheep kemps.

The first Danish Bronze Age wool supplied for measurements comprised only one cloth (from Guldhøj ref. no. 5067). This was described by Ryder (1969) as a hairy medium wool (Fig. 2) and attention was drawn to the unusually high proportion of fine fibres (Table 3). The hairy Soay sheep surviving on St. Kilda off north West Scotland was later found to have a hairy medium type of fleece, while the woolly variety of the Soay has a generalised medium distribution (Ryder, 1966). The Danish textile evidence therefore supported skeletal evidence that the brown Soay sheep is a survival from the Bronze Age.

The remaining Bronze Age wools described by Ryder (1969) came from England, Germany, and Norway. These were all naturally-coloured and comprised one hairy medium wool, two with only fine fibres, which were interpreted as coming from a hair medium fleece, and four generalised medium wools.

Ryder (1983 b) described a further 12 Bronze Age wools from Denmark supplied by E. Munksgaard. The description, source and museum references numbers are given in Table 3 together with the fibre diameters

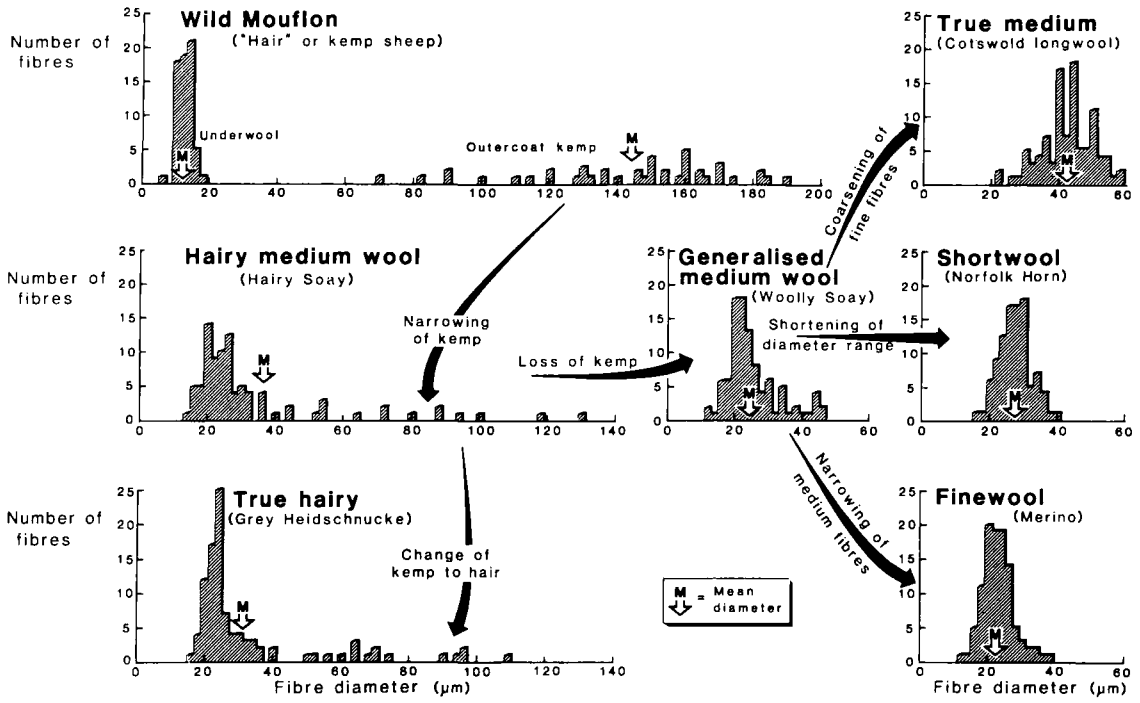


Fig. 2. Changes in the distribution of wool fibre diameter during fleece evolution. The diameter distribution of each main fleece type is shown as a histogram. The coat of the earliest domestic sheep would have been the same as that of the wild ancestor (top) having an outer coat of bristly kemps (to the right of the distribution). The first evolutionary change was a narrowing of the outer-coat kemps to give the Bronze Age hairy medium fleece which is characterised by a skewed distribution (i.e. most of the fibres are fine) with a few hairy fibres greater than 60 microns in diameter. Further narrowing of these fine kemps changed them into wool fibres of medium diameter and produced the generalised medium wool, which also appeared in the Bronze Age, and which is characterised by a skewed distribution in which the maximum fibre diameter is about 55 microns. Most of the material in the present investigation had not even reached the typical hairy medium stage of development. The changes leading to the modern fleece types around the edge of the diagram took place in later periods and will not be described again here. From Ryder 1983 a.

measured. Five of these were clearly hairy medium wools, while seven having only fine fibres were again interpreted as coming from a hairy medium fleece. The complete lack of any fibres of medium diameter indicates the absence of generalised medium fleeces.

Of the total of 23 Bronze Age wools measured up to that stage the hairy medium type predominated with 16, and there were three more with coarse kemps and fine wool, which could be regarded as an even more primitive intermediate type, whereas there were only four of the less primitive generalised medium type.

In addition to the lack of medium fibres in the hairy medium wools, another primitive feature was the predominance of samples in which the mode (most frequent fibre diameter) was less than the more recent value of 20 microns, and closer to the 15 microns of the wild ancestor. For example three quarters of those described by Ryder (1983 b) had finer values: 2 × 18, 5 × 16 and 2 × 14 microns.

The results of the 1985 and 1986 measurements are shown in Table 4. Unlike the samples of Ryder (1983 b) a high proportion of the fibres in nearly all samples contain natural pigmentation.

Bender Jørgensen *et al.* (1982) compared the Melhøj cloth with that from Skrydstrup. Only one example from the latter site has been measured (Table 2) and this had fine fibres with mean diameters of 20.5 and 24.2 microns (coarser than in the wild ancestor) and kemps ranging from 100 microns to over 200 microns (equivalent to the wild ancestor). Ryder (1969) interpreted this as being intermediate between the wild type and the hairy medium type of fleece.

| Source | Site | Date | Pigment | Diameter Range | Mean Diameter | Mode | Distribution | Fleece Type |
|---|---|---|---|---|---|---|---|---|
| K. Schlabow (Neumünster Textilmuseum) | Unterteutschenthal (Germany) | Early Bronze Age | xx | 12–32<br>36, 42, 46, 48 | 22·3 | 18 | skewed-to-fine | gen. medium |
| K. Schlabow (Neumünster Textilmuseum) | Harrislee (Germany) | 1600 B.C. | (a) xx | 8–26<br>2 of 32 | 16·6 | 16 | almost symmetrical | fine |
| | | | (b) xxx | 10–28<br>2 of 40 | 18·7 | 14 | skewed-to-fine | gen. medium |
| British Museum | Rylstone, Yorkshire (England) | — | (a) xxx | 10–30<br>44, 48, 62, 74 (fine, medium and hairy fibres) | 21·00 | 18 | skewed-to-fine | hairy medium |
| | | | (b) xxx | 10–34<br>42, 44 (fine and medium fibres) | 19·6 | 18 | skewed-to-fine | gen. medium |
| | | | (c) xxx | 12–30 (fine only) | 19·4 | 18 | symmetrical | fine† |
| Danish National Museum (B5067, Draegter T.244) | Guldhoj, Vester Varndrup (Denmark) [a] | 1200 B.C. | (a) xxx | 10–32 (96%)<br>40–44 (3%)<br>74 (1%) | 18·7 | 18 | skewed-to-fine | hairy medium |
| | | | (b) xxx | 8–28 (97%)<br>50 (1%)<br>62, 88 (2%) | 16·3 | 14 | skewed-to-fine | hairy medium |
| | | | | | wool / kemp | | | |
| Danish National Museum (B5067, Draegter T.244) | Skrydrstrup (Denmark) [b] | | head band xx<br>skirt xx<br>large cloth xx | 13–26 + kemp<br>+42–54 + kemp | 20·5 / 102<br>24·1 / 222<br>24·3 / 174 | —<br>—<br>— | apparently intermediate between wild type and hairy Soay | |
| Universitets Oldsaksamling, Oslo | Bloheia (Norway) [c] | 1200 B.C. | no info. | 8–27<br>35, 43 | 14·7 | 15 | skewed-to-fine | gen. medium |

In this and subsequent tables: the letters (a), (b), (c) and so on indicate different yarns; pigmentation is indicated as follows:
x slight
xx moderate
xxx heavy

* one micron = 0·001 mm.
† the three Rylstone yarns could be from the same fleece type, and the differences be due to the exclusion of coarser fibres from the sample. See discussion in text.

(*a*) Broholm, H. C. and Hald, M. (1940). *Costumes of the Bronze Age in Denmark*. Oxford.
(*b*) Figures from Steensberg, C. M. (1939). Undersøgelser over Harr fra Skrydstrupgraven, *in* Broholm, H. C. and Hald, M. *Skrydstrupfundet*. Copenhagen. pp. 31–41.
(*c*) Figures from Rosenqvist, A. M. (1964). Investigations of woollen fibres in the Oseberg find, *Proc. Int. Conf. on Conservation*. Delft. pp. 133–6.

Table 2. Wool fibre measurements (from Ryder 1969).

| Source and Museum No. | Range | Fibre diameter mode | Mean ± S.D. | Coeff. of var. | Pearson coeff. of skewness | Proportion medullated fibres | Proportion pigmented fibres | Fleece type |
|---|---|---|---|---|---|---|---|---|
| Lille Dragshøj – | | | | | | | | |
| Weft 19467 | 12–24, 70, 90, 138 | 16 | 18·5 ± 15·4 | 0·83 | 0·51 | 0·03 | 0·62 (DG) | HM |
| 19467 (a) | 10–22, 44, 80, 140 | 14 | 16·6 ± 14·6 | 0·88 | 0·51 | 0·04 | 0·26 (LG) | HM |
| Rønhøj | 10–24, 70 | 18 | 17·0 ± 6·2 | 0·36 | 0·25 | 0·00 | 0·56 (MG) | HM |
| Trindhøj (a) 19911–12 blanket | 10–22, 54, 72 | 16 | 16·7 ± 7·3 | 0·44 | 0·39 | 0·04 | 0·06 (WG) | HM |
| Blanket (b) | 10–24, 52, 92 | 16 | 17·8 ± 8·7 | 0·49 | 0·44 | 0·10 | 0·00 (W) | HM |
| Blanket (c) | 12–24, | 16 | 17·4 ± 2·5 | 0·15 | 0·22 | 0·02 | 0·00 (W) | (F) |
| Guldhøj B5074 – | | | | | | | | |
| Belt | 12–34 | 20 | 20·2 ± 3·6 | 0·18 | 0·25 | 0·05 | 0·00 (W) | (F) |
| Stocking top | 12–32 | 18 | 18·7 ± 3·6 | 0·19 | 0·35 | 0·00 | 0·92 (BG) | (F) |
| Stocking sole | 12–28 | 16 | 17·6 ± 2·8 | 0·16 | 0·78 | 0·00 | 1·00 (B) | (F) |
| Skrydstrup B12968 blanket B | 12–28 | 20 | 18·6 ± 3·1 | 0·17 | 0·24 | 0·00 | 0·52 (MG) | (F) |
| Borum Eshøj B686 net | 14–30 | 22 | 22·2 ± 3·3 | 0·15 | 0·11 | 0·00 | 0·97 (BG) | (F) |
| Sandbaek 25743 cloth | 10–20 | 14 | 14·8 ± 2·5 | 0·17 | 0·09 | 0·00 | 0·97 (BG) | (F) |

Colour: B = black; BG = black grey; DG = dark grey; MG = medium grey; LG = light grey; WG = white grey; W = white.
Fleece type: HM = hairy medium; F = fine fibre diameter distribution (but probably not fine fleece).

Table 3. Wool fibre measurements (from Ryder 1983b).

*Natural Colour*

Soay sheep, like the wild ancestor, have a white belly and the upper parts can be either dark brown (in animals carrying the black gene) or light brown (in animals carrying the brown gene). The self-colour gene produces a coloured belly, so that animals also carrying black gene appear all black, while those with the brown gene appear completely brown (Ryder *et al.* 1974); 11 of the 30 Bronze Age yarns measured up to 1985 were brown.

Black sheep are therefore not uncommon in the Soay, so it is interesting that three of the samples described by Ryder (1983 b) were white.

Grey sheep are unknown in the Soay breed, yet eight Bronze Age yarns described by Ryder (1983 b) had a mixture of coloured and white fibres, plus a further seven measured in 1985 in which the proportion of coloured fibres ranged from 47% to 93%. These were interpreted as a brown and white mixture since Soay sheep frequently have a scattering of white fibres in the brown fleece. It is true that grey can be produced by blending the black and white wool of a piebald fleece, which are common in the Soay, but the fibre diameter distributions support the assumption that the wool was spun direct from the fleece until the Middle Ages. In addition, in the Soay, white wool could have come from the belly, white wool however, did not become common until the Iron Age, when in fact grey predominated.

*Harvesting*

Also shared by the Soay breed with the wild ancestor is a natural spring moult. This meant that wool could be obtained by plucking during the moult before the invention of shears in the Iron Age. Such a method of harvesting a moulting fleece persisted until recent times in such places as Shetland. Because there is a risk that a moulting fleece will be shed and lost before the animal is plucked, once shears were available the way was open for sheep with a tendency towards continuous growth to be selectively bred. This led to the modern situation in which wool is harvested by shearing.

Since the hairy fibres tend to shed at a different time from the wool fibres, it is often possible to obtain by plucking, wool which contains fewer hairs than it would if shorn. The Guldhøj sample described by Ryder (1964) was interpreted as being obtained in this way, and the greater number of such samples described by Ryder (1983 b) supported this conclusion.

Another possible method of harvesting wool free from hair is by combing during the moult. This provides a possible use for the bone, so-called 'weaving combs' that have long been known to be unsuitable for use in weaving because of their concave section (Ryder 1983 (a) p. 750). Combing is the traditional method of obtaining the extremely fine underwool from cashmere goats in China. In Inner Mongolia sheep, too, are combed to obtain the finer wool in the same way (Ryder 1983 (a) p. 298). The comb used is like a small rake with a short handle, although a traditional Chinese design has hooked teeth.

Although I worked with goats as early as 1961, it was not until the spring of 1984, after I had started working on cashmere production, that I actually combed the underwool from British feral goats (Ryder 1985 a). Combing is relatively easy, but it appears virtually impossible to obtain underwool completely free from hair.

Modern de-haring of cashmere fibre prior to processing is a difficult process requiring complicated machinery. It is therefore most remarkable that shawls of a goat underwool from Kashmir dating from around 1800 are completely free from hair. One would not imagine that it would be possible to remove all the hair by hand yet an eye-witness description given by Moorcroft (1841) proves that this is actually what happened. It took a woman two hours to remove individual hairs by the fingers from 2 oz (56.7 g) of combed fibre. The similar complete lack of hairs from much of the material described in the present study leads one to suggest that this custom goes back to the Bronze Age.

The pre-requisites for combing are that the underwool moults at a different time from the hair, and that there is a relatively large difference in diameter between them. The fact that there is rarely perfect asynchrony in the moult explains why there is virtually always some hair in raw cashmere fibre today.

The need for a big difference in diameter between the hairy fibres and the wool means that the more primitive the fleece, going back from the hairy medium type towards the Mouflon, the more easy it would have been to comb, e.g. the Early Bronze Age or Neolithic sheep discussed above. On the other hand, the particular Mouflon sheep I worked with during the 1960's tended to shed their kemp hairs at about the same time as the wool so that separation was virtually impossible. This

| *Sample Identity* | | Fibre diameter (microns) *Range* | *Mean ± S.D.* | *Mode* | *Pearson coeff. skewness* | *Distribution* | *Percentage Medullated fibres* | *Percentage pigmented fibres* |
|---|---|---|---|---|---|---|---|---|
| T557 | (a) | 9–22, 26 | 15.8 ± 3.0 | 15&16 | −0.026 | skew fine | 0 | 1% |
| B9175 | (b) | 7–25, 30, 87, 169 | 18.5 ± 17.2 | 15&16 | 0.433 | skew fine | 3% | 1% |
| T549 | 2 ply | 6–19, 24 | 11.4 ± 3.4 | 12 | 0.365 | skew fine | 0 | 67% |
| B2019–22 | | | | | | symmetrical | 0 | 58% |
| T551 | wa | 8–21 | 13.9 ± 2.9 | 14 | 0.206 | skew fine | 1% | 65% |
| 13751–54 | we | 8–23, 26 | 15.0 ± 5.9 | 13&14 | 0.315 | skew fine | 0 | 54% |
| T552 | wa | 6–20, 24, 26 | 11.7 ± 3.5 | 11 | 0.388 | skew fine | 0 | 68% |
| 9835 | we | 7–19, 21, 62 | 12.9 ± 5.7 | 12 | 0.287 | skew fine | 2% | 50% |
| T553 | (a) | 5, 8–21, 25, 76 | 15.1 ± 6.9 | 15 | 0.119 | skew fine | 5% | 55% |
| B9987–93 | (b) | 7–28, 54, 61, 112 | 16.1 ± 11.9 | 14 | 0.472 | skew fine | 0 | 89% |
| T555 | (a) | 10–30, 33 (2), 36, 39 | 16.9 ± 5.4 | 13 | 0.616 | skew fine | 1% | 93% |
| B10584 | (b) | 9–28, 35, 74 | 17.5 ± 7.2 | 14 | 0.632 | symm./skew fine | 0 | 80% |
| T556 | yarn | 8–24, 29 | 15.9 ± 3.8 | 14&15 | 0.096 | skew fine | 0 | 71% |
| T548 | (a) | 7–20, 49, 54 | 14.1 ± 6.0 | 12 | 0.491 | skew fine | 0 | 74% |
| 6281–85 | (b) | 7–19, 23, 31 | 13.6 ± 3.7 | 12 | 0.478 | continuous | 31% | 4% |
| | cow | 11–37, 52 | 20.5 ± 7.5 | 15 | 0.616 | symmetrical | 0 | 79% |
| T550 | (a) | 8–21 | 13.4 ± 3.2 | 12 | 0.522 | symmetrical | 0 | 78% |
| B3716–26 | (b) | 7–18, 20 | 13.2 ± 2.6 | 11 | 0.077 | skew fine | 0 | 94% |
| T554 | Y1 | 10–29, 34, 40, 65 | 19.2 ± 7.1 | 17 | 0.656 | skew fine | 0 | 95% |
| B6145–59 | Y2 | 9, 12–27, 29, 37, 51 | 19.1 ± 5.3 | 16 | 0.225 | skew fine | 0 | 65% |
| A11 B1238–91 | (a) | 7–22, 24, 29 | 14.7 ± 3.8 | 12&13 | 0.492 | skew fine | 1% | 73% |
| T544 (A3) | (b) | 5–22, 25, 34, 53 | 14.5 ± 5.9 | 15 | 0.335 | symmetrical | 0 | 57% |
| T545 (A5) | (a) | 4, 6–19 | 11.8 ± 2.9 | 12 | −0.079 | skew fine | 1% | 64% |
| | (b) | 5–16, 20, 54 | 12.4 ± 5.0 | 11 | 0.427 | skew fine | 0 | 80% |
| T546 (C33) | (a) | 8–31, 67 | 15.9 ± 7.5 | 11 | 0.568 | symm./skew fine | 0 | 55% |
| | (b) | 4–19 | 10.5 ± 2.8 | 8 | 0.558 | skew fine | 0 | 63% |
| T547 (C34) | (a) | 6–18, 22, 36 | 12.3 ± 4.3 | 12 | 0.189 | skew fine | 0 | 48% |
| | (b) | 6–24 | 11.7 ± 3.1 | 10 | 0.273 | skew fine | 0 | 76% |
| pile | (c) | 8–23, 32 | 14.8 ± 4.0 | 12 | 0.708 | skew fine | 0 | 65% |
| T530 (A2) | | 8–33 | 15.6 ± 4.6 | 15 | 0.170 | skew fine | 0 | 84% |
| T533 (B5) | | 6–26, 29, 37 | 14.3 ± 6.2 | 11 | 0.844 | symmetrical | 0 | 47% |
| T531 (C27) | | 7–20 | 13.7 ± not calc. | 11&12 | 0.349 | skew fine | 0 | 57% |
| T532 (C42) | | 4–27, 29, 35 | 14.5 ± 5.4 | 11 | 0.775 | skew fine | 0 | 77% |
| T534 type C (pile) | | 8–26, 28, 31, 33 | 16.7 ± 4.5 | 13&16 | 0.360 | skew fine | 0 | 88% |
| T535 (D1) | | 7–26 | 13.1 ± 4.6 | 9 | 0.833 | skew fine | 0 | 93% |
| T536 (D3) | | 5–28, 32 | 12.4 ± 5.1 | 10 | 0.833 Sic | | | |

Table 4. Fibre measurements.

emphasises the fact that all animals vary, and indeed without such variation selective breeding would have been impossible.

*General discussion and interpretation*

Although only seven of the 34 wool samples shown in Table 4 have any hairs, it would be easy to identify all these as hairy medium wools, the inference being that those having a true fine diameter distribution, lacking even medium fibres, represent the underwool that has in some way been obtained completely free from hair.

There are four samples with a skewed distribution and single fibres over 50 microns in diameter which could be regarded as generalised medium wools. The remainder, with a symmetrical distribution, if not to be regarded as fine generalised medium wools, would be true fine wools. Since true fine wools are unlikely in northern Europe at this early date, an alternative explanation must be sought.

The fibres represented are finer than any wool fibres from domestic sheep measured before. The finest fibre is only four microns compared with ten in the relatively fine wools listed by Ryder (1983 b). The smallest mode is only eight microns compared with 14 microns, and the smallest mean is only 10.5 microns compared with 14.8 microns previously recorded.

Two possible interpretations come to mind: (a) that these fine fibres are the underwool combed from goats, and (b) that they were similarly obtained from the coat of a sheep more primitive than the hairy medium (i.e. intermediate between the Neolithic (Mouflon) type and the hairy medium) if not from the Neolithic type itself.

The idea that the fibres are from goats is supported by their relative straightness as well as their diameters (Ryder 1970; 1985 a). It is very likely that goats were run with sheep at this time (bone remains are frequently described as sheep/goat) and it could be that their underwool was harvested along with that of sheep. The two kinds of fibre could well have been mixed for usage, which would further complicate the picture. It is thought that animal fibres were first used as felt (Ryder 1983 (a) p. 735) a use which could have been suggested by the observation of matted fibres in a moulting coat. Spinning could have been suggested by a similar observation (Ryder 1983 (a) p. 736). I am not aware of any felt remains that could confirm its manufacture before that of cloth and the present material probably represents the earliest cloth. An explanation for the complete lack of hairs has already been discussed in the section on harvesting. Such careful removal would not have been necessary with felt.

Further support for the inclusion of goat fibres came from the surface cuticular scale pattern as seen with the Scanning Electron Microscope, which is a feature used in identification. Scanning Electron Micrographs were prepared by Mrs. T. Gabra-Sanders of samples T531, 534 and 536 as well as T544 to T556. Although a few apparently goat fibres were detected in this way, the majority of these fine fibres were from sheep. A few goat fibres could readily get into wool as contaminants from goats grazed with sheep, and so the exciting possibility that goat underwool was used in Bronze Age Europe awaits confirmation.

A major difficulty is that although cashmere used for comparison is quite distinct from wool, 'ordinary' goat underwool is less different from sheeps' wool and until work now in progress reveals what the detailed characteristics of ordinary goat underwool are, a conclusive investigation of this nature will not be possible. Another difficulty is that in much of the archaeological material the scale pattern is not clear owing to dirt on the fibre surface.

An unusual feature of these fine fibres is that some (less than 20 microns in diameter) had a medulla – the central hollow core, which is characteristic of hairy fibres, and invariably absent form the fine wool of modern fleeced breeds. That fine goat fibres sometimes contain a medulla cannot be taken as a conclusive feature for identification because modern 'hair' sheep, too, sometimes have a medulla in the fine fibres. This observation, however, supports the conclusion that where sheep are identified in this material, the fleece type cannot be far removed from the Neolithic 'hair' type. It also explains the mystery of medullated Bronze Age fine animal fibres quoted by Ryder (1963 p. 540). In fact, 20 years of selective breeding for medullation in a modern true hairy type caused the finer fibres to acquire a medulla, which was absent at the outset (Ryder 1985 b).

It can be recorded that from SEMs the Guldhøj sample (Ryder 1964) is definitely sheeps' wool, whereas one of the Melhøj samples (C27) and B3716 – 26 (a) from Garderhøj could contain goat fibres. In the latter (T554) as well as T548 and T554, there is close similarity in the fibre measurments between the two yarn systems.

The main conclusion that these wool samples represent the earliest stage in the development of a fleece is in keeping with the Early Bronze Age date. Typical hairy medium and generalised medium probably emerged in the Late Bronze Age and these predominate from the Iron Age until the Middle Ages.

*Summary and Conclusions*

(1) Most of the Danish Bronze Age wools examined contained very fine fibres completely free from hair.

(2) The fineness of the fibres leads to the interpretation that they comprise the underwool of a primitive type of fleece little if any different from that of the wild/Neolithic type.

(3) The nature of the samples indicates harvesting during the spring moult, possibly by combing, as with modern cashmere from goats.

(4) The complete lack of hair in many samples indicates painstaking removal of these with the fingers.

(5) The straightness of many of the fine fibres compared with wool suggested that some might be the underwool of goats and Scanning Electron Micrographs supported the identification of a very few fibres as being from goats.

(6) The majority of the fibres, however, were wool from sheep and so a few goat fibres could have got into the wool as contaminants from goats grazed with sheep. There is no suggestion that all the material was goat or that goat fibres were used as well as wool, either separately or as a blend (mixture).

(7) Some of the fine fibres had a central medulla, a rare feature of underwool from 'hair' sheep and goats, which has been reported previously in unidentified animal fibres of Bronze Age date.

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# *Dyes and Wools in Iron Age Textiles from Norway and Denmark*

by PENELOPE WALTON

## INTRODUCTION

In 1984 a pilot study was undertaken into the dyes and wools of selected textiles from Norway, Denmark and Germany. This initial survey was necessarily small, but produced some significant results. When added to the information collected by other researchers on weave, yarn-type, etc, the dye and wool analyses proved to highlight similarities between certain native products, and to suggest importation in others.

However, it was noted at the time that this work had raised as many questions as answers. The concluding words of the report were a call for "a widening of the database for both dyes and fleece-types" (P. Walton 1985 p 13; Bender Jørgensen and Walton 1987 p 187). In 1985 it proved possible to embark on just such a larger study, due to generous grants from the Danish Research Council (who funded the earlier work) and Queen Margrethe II's Archaeological Fund. The following is an account of the results of that work.

## THE SAMPLE

In Norway a selection of textile samples was gathered together by Bente Magnus (Head Curator, University of Bergen Historical Museum) from grave-finds housed in the Bergen, Oslo, Trondheim and Stavanger museums. In Denmark, Lise Bender Jørgensen (University of Copenhagen), who was the instigator of the whole survey, chose textiles from both graves and bog-finds. Only two German samples were included in this survey, both from the Thorsbjerg collection in the National museum, Copenhagen.

A summary of the textiles, their sites and dates is given in table 1. Further details of individual finds are to be found in L. Bender Jørgensen *Prehistoric Scandinavian Textiles* (1986) pp 243–272 and in M. Hald *Ancient Danish Textiles from Bogs and Burials* (1980); the Evebø/Eide burial is discussed in Magnus and Pedersen (1984). The terms used in this text, 'Haraldskjaer type', 'Virring type', 'Birka type' and 'Hessens-Elisenhof' type are defined in Bender Jørgensen 1986, pp 343–8, 358–62. 'Veka-type' is a new term, corresponding to the 'Norwegian type' described in Bender Jørgensen 1986 p. 361.

## METHODS OF ANALYSIS

The techniques used to identify the dyes and fleece types were the same as those applied in the earlier study. In brief, dyes were extracted with solvents and examined with a U-V/Visible spectrophotometer; paper and thin-layer chromatography were used to confirm positive results. Fleece types were identified by measuring the diameters of 100 fibres and plotting the results as histograms; according to the shape of the histogram, the wool could be allocated to one of the seven fleece-type categories.

## THE RESULTS

The results of both analyses are listed in Table 2. The statistics relating to the fleece types are given in Table 3. The most significant features of the results are discussed below.

## EARLY DANISH WOOLS

When examining the wool of a textile, it is difficult to know how accurately it represents the fleece as it grew on the sheep's back. The sheepskin capes from Denmark were therefore useful in establishing the nature of Pre-Roman Iron Age wool prior to processing for textile use.

Samples from eight different capes were examined

NORWAY

(i) *ZZ twills of the Haraldskjaer type* and an *SS twill of the Huldremose type*, Scandinavian or north European in origin, from late Roman/Migration Period sites:
Stallemo (Vennesla, Vest-Agder)
Veien (Ringerike, Buskerud)
Øvre Berge (Lyngdal, Vest-Agder)
Snartemo II and V (Lyngdal, Vest-Agder)
Saetrang (Ringerike, Buskerud)
Hallem (Verdal, Nord-Trøndelag)
Døsen (Os, Hordaland)
Evebø/Eide Gloppen, Sogn & Fjordane)
Veiem (Grong, Nord-Trøndelag)

(ii) Tablet weaves and some less common textile types, of uncertain origin, from rich graves of the late Roman/Migration Period:
Snartemo V
Evebø/Eide
Veiem

(iii) *diamond twills of the Virring type*, from sites of the Roman Period, probably imports:
Hallem (Verdal, Nord-Trøndelag)
Rønsberg (Selbu, Sør-Trøndelag)

(iv) *ZS twills of the Hessens-Elisenhof type*, probably imported from northern Europe, found in Viking Age sites:
Vinjum (Aurland, Sogn & Fjordane)
Sandanger (Sande, Møre & Romsdal)
Malsnes (Balestrand, Sogn & Fjordane)

(v) *ZZ twills of the Veka type*, possibly west Norwegian in origin, also from Viking Age sites:
Sandanger
Malsnes
Dale (Fjaler, Sogn & Fjordane)
Veka (Voss, Hordaland)
Skjervum (Vik, Sogn & Fjordane)
Kongsvik (Tysnes, Hordaland)
Skjervheim (Voss, Hordaland)
Hopperstad (Vik, Sogn & Fjordane)

(vi) *raw fibre* from 4th and 5th century sites:
Saetrang (Ringerike, Buskerud)
Midt-Salte (Klepp, Rogaland)

DENMARK

(i) *raw fibre* from sheepskin capes from sites of the Pre-Roman Iron Age:
Baunsø Mose
Borremose
Fraeer Mose
Huldremose
Karlby
Rønbjerg Mose
Tvede (St. Arden)

(ii) one *SS twill of the Huldremose type* from early Roman Period Tornbuskehøj

(iii) One *Virring type diamond twill* from Rovsbjerghøj and one *two-colour ZS twill* from Vrangstrup, both of the late Roman Period.

(iv) *Haraldskjaer-type twills* from sites of the late Roman and Migration Period:
Hejrhøj
Sejlflod
Corselitze
also one *tabby* from Corselitze
and *late Haraldskjaer types* from:
Nr. Sandegaard (Gr. 426)
Lousgaard (Gr. 26)

(v) *Hessens-Elisenhof type twills* from Viking Age sites:
Skringstrup
Gerlev-Draby
Nr. Sandegaard (Gr. 426)
Riis Fattigaard

(vi) *Birka type diamond twills* from the Viking Age:
Nr. Sandegaard (Gr. 397)
Lousgaard (Gr. 7)

(vii) an assortment of less common textile types from Viking Age sites:
Nr. Sandegaard (Gr. 426)
Lousgaard (Gr. 26)
Fløjstrup
Hvilehøj
Mammen

Table 1. Summary of textile types used in the study.

and all proved to be of the same type. The wool staples were straight, sometimes with a pointed tip, and measured 25–40 mm in length. The wool consisted of a fine undercoat (with mean diameters of 16.9–21.7 microns and modes of 15–22 microns), combined with an outer coat of the coarse fibres which are called 'kemp' (58–215 microns in diameter). The histogram of one of these kempy fleeces is given in fig. 2a.

Such a fleece is very like that of the present-day Mouflon of Corsica and Sardinia, *Ovis musimon*. This animal is thought to be a once-domesticated sheep, which has returned to the wild at an early stage in its history. Its fleece is therefore probably little different from that of the earliest sheep of Europe (Clutton-Brock 1981 pp 53–4; Ryder 1983 pp 14–17). The Mouflon is brown with a white belly and some of the patches which make up the capes from Huldremose and Karlby Mose are brown, others white. However, most of the sheepskin capes are white throughout, suggesting the beginnings of development away from the wild ancestor, at any rate in terms of pigment.

How do these wools compare with the fibres of textiles of the same date? A number of Pre-Roman Iron Age textiles were examined in the earlier study and

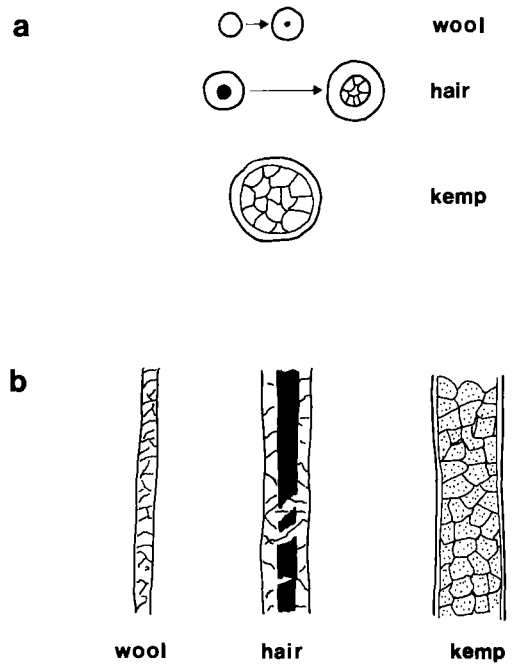


Fig. 1. The three main types of fibre in an adult fleece. a: in cross-section (from Ryder and Stephenson). b: in whole-mount.

without exception they proved to consist of the same fine undercoat but with only 1%–7% kemp – much less than in the skins (fig. 2b).

The reason for this is likely to lie in the method of gathering the wool. The coat of the wild sheep moults each year and the primitive domesticated breeds also tend to cast considerable amounts of fleece (Ryder 1983a p 45). However, the coarser fibres stay in the skin until after the undercoat is shed, and thus by plucking or combing the sheep in spring or early summer, the majority of the kemp may be left behind. In the northern isles of Britain, Shetland sheep were still being plucked, or 'rooed' as it is called, as late as 1892 (ibid. p 536).

M.L. Ryder has already pointed out that the plucking of sheep may account for the results he obtained from Danish Bronze Age textiles (1983b and forthcoming). Of the samples he examined, some did not even have 1 kemp per 100 fibres, others had 1%–5% kemp, but all had the same fine undercoat as in the Iron Age textiles at present under discussion.

The only major difference between Bronze Age and Early Iron Age wools has proved to be the predominance of natural pigment in the earlier finds. Although brown wool was still available in the Iron Age, most wools of that period prove to have been white. The change towards white wool seems to have been the first major development following domestication. The availability of both white and brown fleeces led to colour-patterning in Iron Age textiles, as for example in the checkered cloth excavated at Krogens Mølle and the striped weave from Haraldskaer Mose (Hald 1980 pp 15, 58; Walton 1985 table 1; Bender Jørgensen and Walton 1987).

## NATIVE DANISH WOOLS IN THE ROMAN AND MIGRATION PERIOD

During the Roman Period, Scandinavia may have been obtaining some of its better-quality textiles from trade with the Empire. However, the 1st century textiles from Lønne Hede and the late Roman and Migration Period textiles from Sejlflod are believed to be native products (Bender Jørgensen 1986 p. 346).

There are seven different fabric-types from Lønne Hede, of which Ryder and Hedges (1973) have examined five. These wools proved to be like those of the earlier period – fine, or fine with a few coarse fibres. It is not now possible to know which of the textiles were sampled on behalf of the earlier researchers, or indeed if they were provided with more than one sample from the same fabric-type. However, by scanning samples from the same textiles under a low-powered microscope, it was possible to see that at least five contained sparsely-distributed coarse fibres, which under higher magnification proved to be kemps. These wools therefore seem to be similar to those of the earlier period. The presence of kemp in some but not in others, suggests that the practice of plucking sheep may have continued into the early Roman Period.

By the 5th century, however, a change had occurred in Danish fleeces. The Sejlflod wools have a coarser undercoat and the kemps have given way to fibres of 60–100 microns, called 'hairs' (fig. 2c). There are three main kinds of fibre recognized in the fleece of the adult sheep (fig. 1): true wool, which consists of crimpy fibre, rarely with medullas; kemp, the coarse, seasonally moulted fibres with broad latticed medullas; and hairs or heterotypes, which have a narrow or interrupted medulla, and which are continuously growing (Ryder and

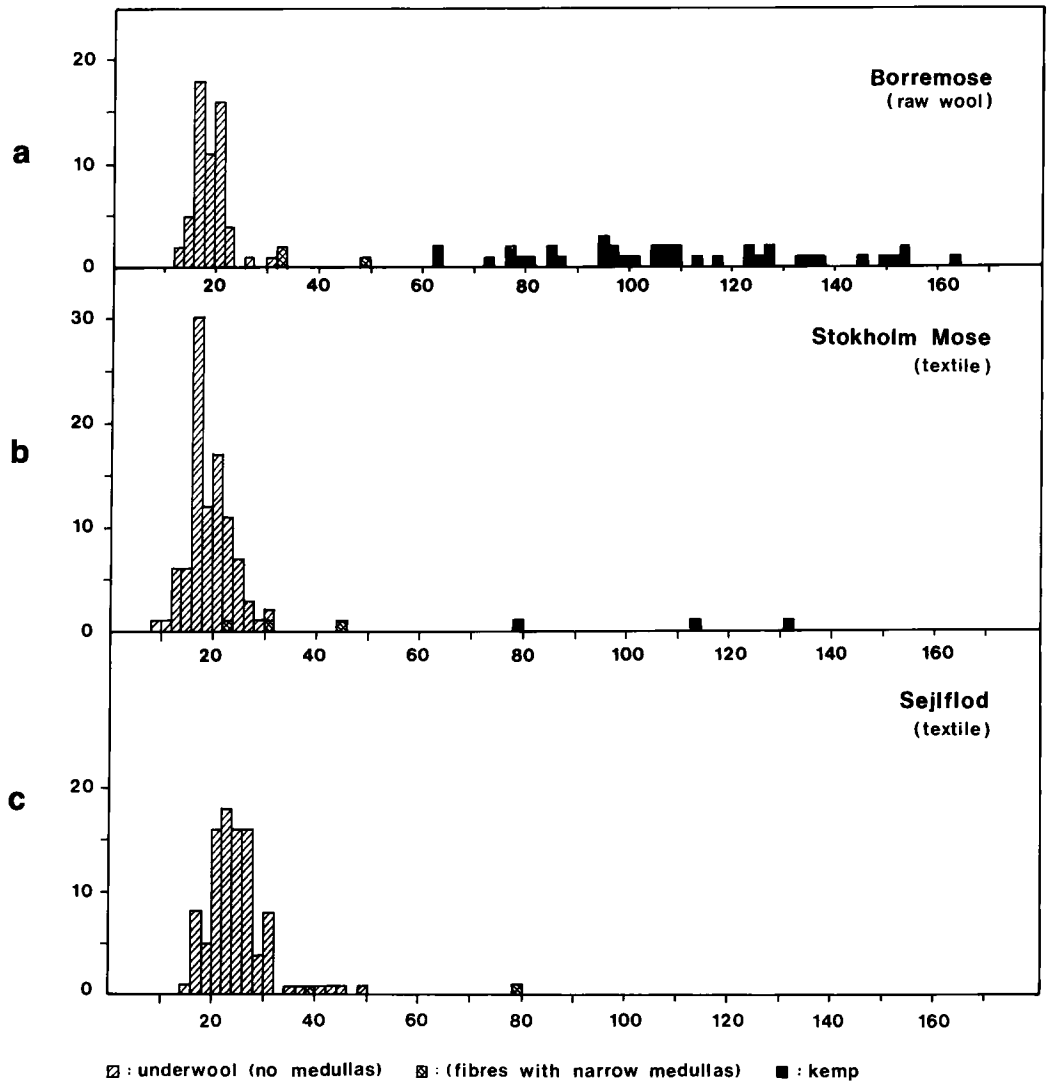


Fig. 2. Diameter of fibres measured in microns.

Stephenson 1969 pp 282–6). Despite careful scanning of all eight textiles from Sejlflod, there was no sign of any kemp and from the presence of hairs it must be assumed that the fleece was no longer moulting but was being sheared. The change towards a non-moulting fleece was of course of benefit to man, as it led to less wool-loss before shearing.

The Sejlflod wools with their hairs and coarser underwool are designated 'hairy medium'. This term is often extended to the more primitive types of the Bronze Age and Pre-Roman Iron Age, although Mouflon-type is perhaps more appropriate for the kempy wools of those periods.

## EARLY WOOLS OF NORWAY

The nature of early Norwegian wools is less well-established. Two samples of raw fibre from the 4th and 5th centuries were examined, but one, from Saetrang, proved to be goat, probably kid (identified by H.M. Appleyard). The second, from Midt-Salte, is sheep's wool; it has a pointed staple, 40–50 mm in length, and the fleece type is hairy medium, similar to the contemporary wools of Denmark.

As there is little other evidence, it is interesting to note that the present-day Spaelsau, the native sheep of Norway, seems to be predominantly hairy medium in

**NORWAY**

| SITE | TEXTILE NUMBER | TEXTILE TYPE | YARN | FLEECE-TYPE | DYE |
|---|---|---|---|---|---|
| Hallem | T 598 A | Virring type | both | – | n.d.d. |
| Hallem | T 598 B | Harald. type | dark | F | n.d.d. |
| | | | light | HM | n.d.d. |
| Hallem | T 598 C | Harald. type | grey | HM | indigotin |
| | | | light brown | HM | ?yellow |
| | | | red | – | unidentified |
| Hallem | T 598 D | Huldremose type | both | – | n.d.d. |
| Rønsberg | T 2012 | Virring type | dark S | GM, nat.pig | n.d.d. |
| | | | light Z | HM | |
| Stallemo | C 23141 f | Harald. type | green | HM | n.d.d. |
| | | | brown | HM | n.d.d. |
| Veien | C 348 | ?Harald. type | fine | M | Polish cochineal |
| | | | coarse | GM | |
| Øvre Berge | C 3534 A | tablet weave | green warp | M | indigotin |
| | | | beige warp | HM | n.d.d. |
| | | | weft | HM, nat.pig. | – |
| Øvre Berge | C 3534 K | Harald. type | dark | M, nat.pig. | indigotin |
| | | | light | GM | indigotin |
| Øvre Berge | C 3534 L | Harald. type | both | – | indigotin |
| Øvre Berge | C 3534 I-J | Harald. type | both | – | indigotin (faint) |
| Veiem | T 19624 F | Harald. type | a | M | indigotin |
| | | | b | GM | |
| Viem | T 19624 F | tablet weave | warp | M | madder (*R. tinctorum*) |
| | | | weft | M | |
| Veiem | T 19624 G | Harald. type | a | HM | indigotin & yellow 'X' |
| | | | b | HM | |
| Veiem | T 19624 G | tablet weave | warp | HM | madder (*R. tinctorum*) |
| | | | weft | HM, nat.pig. | |
| Saetrang | C 644 | raw fibre | – | Goat | n.d.d. |
| Saetrang | C 644a | Harald. type | dark | HM | indigotin & yellow 'X' |
| | | | light | HM | |
| Saetrang | C 617–44 | Harald. type | a | HM | n.d.d. |
| | | | b | HM | |
| Midt-Salte | S 79901 | raw fibre | – | HM | n.d.d. |
| Døsen | B 6091 (a) | Harald. type | dark | –, nat.pig. | n.d.d. |
| | | | light | – | n.d.d. |
| Døsen | B 6091 (b) | Harald. type | both | – | n.d.d. |
| Snartemo II | C 28026 B | Harald. type | fine | Sh | n.d.d. |
| | | | coarse | HM | |
| Snartemo II | C 28026 C | Harald. type | a | F/GM | n.d.d. |
| | | | b | GM | |
| Snartemo II | C 28026 F | Harald. type | both | – | n.d.d. |
| Snartemo V | C 26001 (a) | Harald. type | a | HM | indigotin |
| | | | b | HM | |
| Snartemo V | C 26001 (b) | tablet weave | all | – | indigotin & ?mordant dye |
| Snartemo V | C 26001 D (c) | Harald. type | both | – | n.d.d. |
| Snartemo V | C 26001 R (d) | ?spin-patterned | dark | M, nat.pig. | n.d.d. |
| | | | light | M | n.d.d. |
| Snartemo V | C 26001 R (e) | Harald. type | a | M | n.d.d. |
| | | | b | M | |
| Snartemo V | C 26001 R (f) | plied yarn twill | a | GM | madder (*R. tinctorum*) |
| | | | b | GM | |
| Snartemo V | C 26001 Ø (g) | plied yarn twill | both | – | madder |
| Evebø/Eide | B 4590 type 1 | striped twill-?Harald. type | ground | – | madder (*R. tinctorum*) & unidentified yellow |
| | | | stripe | – | indigotin |
| Evebø/Eide | B 4590 type 2 | Harald. type | both | – | n.d.d. |
| Evebø/Eide | B 4590 type 3 | striped twill-?Harald. type | ground | – | madder (*R. tinctorum*) |
| | | | stripe | – | indigotin |
| Evebø/Eide | B 4590 type 4 | napped textile | both | – | kermes or Polish coch. |
| Evebø/Eide | B 4590 type 5 | napped textile | both | – | indigotin |
| Evebø/Eide | B 4590 type 6 | striped textile-?Harald. type | ground | – | madder (*R. tinctorum*) |
| | | | stripe | – | indigotin |

**DENMARK**

| SITE | TEXTILE NUMBER | TEXTILE TYPE | YARN | FLEECE-TYPE | DYE |
|---|---|---|---|---|---|
| Baunsø Mose | D 11103 c | raw fibre | – | mouflon-type/HM | – |
| Borre Mose | C 26449 | raw fibre | – | mouflon type/HM | – |
| Fraeer Mose | 7142 | raw fibre | – | mouflon type/HM | – |
| Huldre Mose | C 3472 | raw fibre | – | mouflon type/HM | – |
| Karlby | D 4854 b | raw fibre, dark | – | mouflon type/HM, nat.pig. | – |
| | | raw fibre, light | – | mouflon type/HM | |
| Karlby | D 4854 d | raw fibre | – | mouflon type/HM | – |
| Rønbjerg Mose | D 2624-26 | raw fibre | – | mouflon-type/HM | – |
| Tvede | 462/42 | raw fibre | – | mouflon type/HM | – |
| Tornebuskehøj | C 2827 | Huldremose type | dark | – | indigotin (strong) |
| | | | light | – | indigotin (weak) |
| Vrangstrup | C 23594 c | 2-colour ZS twill | dark | HM, nat.pig. | n.d.d. |
| | | | light | HM | n.d.d. |
| Rovsbjerghøj | 1260 | Virring type | tablet warp | HM | madder |
| | | | cloth warp | F | indigotin & yellow 'X' |
| | | | cloth weft | – | |
| Corselitze | 7325 a-e | Harald. type | a | HM | ?yellow |
| | | | b | Sh | |
| Corselitze | 7325 b | ZZ tabby | a | HM | indigotin |
| | | | b | HM | |
| Hejrhøj | C 27423 | Harald. type | both | – | madder-type, not *R.tinc.* |
| Sejlflod | 669 × 1108 | Harald. type | both | – | n.d.d. |
| Sejlflod | 669 × 1160 | Harald. type | both | – | n.d.d. |
| Sejlflod | 669 × 1183 | Harald. type | a | Sh | n.d.d. |
| | | | b | HM | |
| Sejlflod | 669 × 1301 | Harald. type | a | HM | n.d.d. |
| | | | b | HM | n.d.d. |
| Sejlflod | 669 × 1445 | Harald. type | a | HM | n.d.d. |
| | | | b | HM | |

**KEY**

| | | | | | |
|---|---|---|---|---|---|
| Harald. type | = Haraldskjaer type | HM | = hairy medium | GM | = generalised medium |
| Hess./Elis. | = Hessens/Elisenhof | M | = medium | Sh | = shortwool |
| n.d.d. | = no dye detected | F | = fine | nat.pig. | = natural pigment |

Table 2. Results: dyes and fleece-types.

type, as is the wool of Icelandic sheep, which are descended from the same stock (Ryder 1968 pp 154–6; 1981a pp 394–7). It is probable that the hairy medium was a fleece type available to Norwegian spinners and weavers through much of their history.

As was to be expected, the textiles believed to be of native Norwegian manufacture (the Haraldskjaer type twills and at least some of the tablet-woven braids) were in many cases made from the same hairy medium fleece type. However, there were also several other types of wool, which require some explanation.

Table 4 shows that in Norway there was a greater range of fleeces available than in contemporary Denmark. The generalised medium fleece type (GM) is believed to have evolved from the hairy medium (HM) (fig. 1) and it is therefore no surprise to see it here. The shortwool (Sh) is a more evolved type of fleece, but although rare, it has already been recorded in Migration period Denmark (Bender Jørgensen and Walton 1987). The single fine (F) and fine/generalised medium (F/GM) may be from the occasional aberrant fleece within a predominantly HM/GM flock.

However, the large number of medium (M) wools is more significant. This wool is too coarse to be confused with the underwool of a HM fleece, nor can it be produced by blending other fleece types. The medium type was particularly rare in the textiles which are likely to be imports and it must therefore be regarded as a native Norwegian fleece-type.

The medium fleece type is the kind of wool which

**NORWAY**

| SITE, TEXTILE | YARN | RANGE | MODE | MEAN±S.D. | PEARSON COEFF. OF SKEW, DISTRIBUTION | MEDULLAS | PIGMENT | FLEECE-TYPE |
|---|---|---|---|---|---|---|---|---|
| Stallemo, C23141F | green | 13-53,104 | 22,23 | 26.0±10.7 | +0.60, pos.skewed | 2% | 0 | hairy medium |
| | brown | 17-42,77 | 23 | 26.7±7.5 | +0.79, pos.skewed | 1% | 0 | hairy medium |
| Veien, C348 | finer | 17-54 | 31 | 27.8±6.5 | +0.08, symmetrical | 0 | 0 | medium |
| | coarser | 14-38,51 | 22 | 24.9±5.4 | +0.51, pos.skewed | 0 | 0 | generalised medium |
| Øvre Berge, C3534 A | green wa | 17-58 | 23,28 | 28.9±7.7 | +0.08, symmetrical | 2% | 0 | medium |
| | brown wa | 15-45,65 | 26 | 25.7±7.0 | +0.20, symmetrical | 1% | 0 | hairy medium |
| | brown we | 17-58,68,81 | 24 | 32.8±10.7 | +0.74, pos.skewed | ≥5% | 100%, heavy | hairy medium |
| Øvre Berge, C3534 K | dark | 14-58 | 26 | 30.4±8.1 | +0.25, symmetrical | 2% | most, light | medium |
| | light | 14-38 | 22 | 24.2±5.0 | +0.55, pos.skewed | 1% | 0 | generalised medium |
| Snartemo V, C26001 (a) | a | 14-47,56,62,74 | 27,28 | 29.3±9.4 | +0.56, pos. skewed | 3% | 0 | hairy medium |
| | b | 19-54,58,63,82 | 23,24 | 32.2±10.4 | +0.83, pos. skewed | 11% | 0 | hairy medium |
| Snartemo V, C26001 (d) | dark | 13-50 | 27 | 28.4±6.3 | +0.33, symmetrical | 0 | 100%, heavy | medium |
| | light | 13-53 | 24 | 28.4±8.0 | +0.43, symmetrical | 0 | 18% | medium |
| Snartemo V, C26001 (e) | a | 15-47 | 22 | 29.1±7.4 | +0.11, symmetrical | 2% | 0 | medium |
| | b | 15-54 | 29,31 | 31.2±8.7 | +0.42, symmetrical | 6% | 1% | medium |
| Snartemo V, C26001 (f) | a | 12-47 | 24 | 25.9±7.1 | +0.50, pos.skewed | 0 | 0 | generalised medium |
| | b | 14-49 | 26 | 27.4±7.1 | +0.53, pos.skewed | 0 | 0 | generalised medium |
| Snartemo II, C28026 C | a | 12-32,38 | 18 | 20.6±4.9 | +0.46, pos.sk./symm. | 0 | 0 | fine/gen. medium |
| | b | 13-41,47 | 22 | 24.5±6.0 | +0.62, pos.skewed | 0 | 0 | generalised medium |
| Snartemo II, C28026 B | finer | 14-38 | 26 | 25.0±5.5 | +0.17, symmetrical | 1% | 0 | shortwool |
| | coarser | 14-36,88,92 | 24,26 | 24.8±10.4 | +0.29, symmetrical | 2% | 0 | hairy medium |
| Saetrang, C644 | raw fibre | 12-65 | 26 | 30.4±13.2 | +1.00, pos.skewed | ? | 100%, heavy | *goat hair* |
| Saetrang, C644a | dark | 13-40,71,79 | 23,26 | 24.5±8.9 | +0.41, symmetrical | 3% | 0 | hairy medium |
| | light | 12-38,45,71 | 22 | 23.1±6.9 | +0.48, pos.skewed | 1% | 0 | hairy medium |
| Saetrang, C617-44 | a | 13-38,64 | 22 | 23.8±7.4 | +0.80, pos.skewed | 1% | 0 | hairy medium |
| | b | 13-41,68 | 19 | 23.4±6.1 | +0.67, pos.skewed | 1% | 0 | hairy medium |
| Veiem, T19624 F | a | 13-49 | 23 | 29.9±6.7 | +0.33, symmetrical | 2% | 0 | medium |
| (twill) | b | 17-58 | 28 | 29.4±8.5 | +0.57, pos.skewed | 0 | 2% | generalised medium |
| Veiem, T19624 F | wa | 17-49 | 33,37,38 | 33.3±6.0 | +0.02, symmetrical | 2% | 0 | medium |
| (tablet weave) | we | 18-49 | 32 | 28.8±6.5 | +0.25, symmetrical | 1% | 11% | medium |
| Veiem, T19624 G | a | 17-54,88 | 22 | 27.1±8.4 | +0.57, pos.skewed | 3% | 0 | hairy medium |
| (twill) | b | 18-41,82-114 | 23 | 30.2±15.7 | +0.75, pos.skewed | 6% | 0 | hairy medium |
| Veiem, T19624 G | wa | 13-59,77,79 | 26,28,31 | 31.5±11.0 | +0.63, pos.skewed | 5% | 0 | hairy medium |
| (tablet weave) | we | 17-64,87 | 24 | 33.1±11.4 | +0.84, pos.skewed | ? | 100% | hairy medium |
| Hallem, T598 C | a | 12-44,63,67 | 26 | 28.1±8.2 | +0.31, symmetrical | 2% | 4% (coarse fibres only) | hairy medium |
| | b | 10-37,56,60, | 21 | 24.9±9.5 | +0.61, pos.skewed | 4% | 0 | hairy medium |
| Hallem, T598 B | dark | 12-29 | 18 | 21.2±3.9 | +0.29, symmetrical | 0 | 0 | fine |
| | light | 12-36,56,77 | 21 | 24.4±7.8 | +0.57, pos.skewed | 2% | 0 | hairy medium |
| Rønsberg, T2012 | dark S | 13-45,53,55 | 24 | 27.4±7.5 | +0.63, pos.skewed | 0 | 100% | generalised medium |
| | light Z | 12-47,65,72, | 19 | 24.2±12.0 | +0.85, pos.skewed | 5% | 0 | hairy medium |
| Midt-Salte, S7990 h | raw fibre | 14-54,81,86 | 23,24 | 25.9±11.1 | +0.63, pos.skewed | 3% | 4% (coarse fibres only) | hairy medium |
| Vinjum, B7731 | Z | 15-54 | 28 | 30.5±7.8 | +0.15, symmetrical | 0 | 0 | medium |
| | S | 14-47 | 23 | 29.3±7.7 | +0.43, symm/pos.skew | 0 | 0 | generalised medium |
| Sandanger, B10772 (a) | Z | 12-71,100 | 15,19 | 23.6±13.7 | +0.93, pos.skewed | 5% | 0 | generalised medium |
| | S | 18-51,56,59 | 26,28 | 29.5±8.1 | +0.77, pos.skewed | 1% | 0 | hairy medium |
| Malsnes, B12131 (a) | Z | 18-60,65,68,69 | 35 | 36.1±11.6 | +0.76, pos.skewed | 4% | 3% | hairy medium |
| | S | 12-50,62 | 19 | 24.3±9.9 | +0.70, pos.skewed | 1% | 0 | hairy medium |
| Sandanger, B10772 (b) | fine | 19-60 | 44 | 39.2±10.1 | −0.34, symmetrical | 21% | 0 | medium |
| | coarse | 19-50,72,79 | 27 | 29.5±9.2 | +0.71, pos.skewed | 4% | 0 | hairy medium |
| Malsnes, B12131 (b) | fine | 12-56 | 32.35,36 | 36.2±9.1 | +0.18, symmetrical | 1% | 0 | medium |
| | coarse | 14-49 | 22 | 27.1±6.8 | +0.29, symmetrical | 0 | 5% | shortwool |
| Dale, B5910 | fine | 17-59 | 29 | 38.1±10.1 | +0.07, symmetrical | 3% | 1% | medium |
| | coarse | 18-50,60-72 | 24 | 30.1±10.6 | +0.77, pos.skewed | 3% | 2% | hairy medium |
| Veka, B6228A | fine | 18-54 | 26 | 32.5±7.6 | +0.18, symmetrical | 0 | 5% | medium |
| | coarse | 15-46,67-74 | 28 | 29.9±10.7 | +0.48, pos.skewed | 4% | 5% | hairy medium |
| Skjervum, B6500 | fine | 24-56 | 36,37 | 40.2±6.2 | +0.14, symmetrical | 8% | 0 | medium |
| | coarse | 14-56,81 | 24 | 28.3±11.3 | +0.73, pos.skewed | 7% | 0 | hairy medium |
| Kongsvik, B7639r | fine | 14-56 | 29 | 32.8±9.2 | +0.47, symm/pos.sk. | 1% | 5% | medium |
| | coarse | 12-46,53,68 | 21 | 26.8±9.1 | +0.37, symmetrical | 2% | 2% | hairy medium |

| SITE, TEXTILE | YARN | RANGE | MODE | MEAN±S.D. | PEARSON COEFF. OF SKEW, DISTRIBUTION | MEDULLAS | PIGMENT | FLEECE-TYPE |
|---|---|---|---|---|---|---|---|---|
| Skjervheim, B7732 1B | fine | 14-59 | 40,46 | 38.8±11.3 | −0.31, symmetrical | 15% | 0 | medium |
| | coarse | 17-54,65,71,79 | 24 | 32.3±11.0 | +0.72, pos.skewed | 4% | 0 | hairy medium |
| Fjellsende, B7812 | fine | 17-55 | 27,28,32 | 34.1±8.6 | +0.40, symmetrical | 0 | 0 | medium |
| | coarse | 15-56 | 23 | 28.3±8.3 | +0.72, pos.skewed | 0 | 2% | generalised medium |
| Hopperstad, B9060 | fine | 18-62 | 29 | 38.9±10.8 | +0.60, pos.skewed | 19% | 0 | hairy medium |
| | coarse | 12-49,56 | 23,31 | 27.3±7.2 | +0.26, symmetrical | 0 | 3% | shortwool |

**DENMARK**

| SITE, TEXTILE | YARN | RANGE | MODE | MEAN±S.D. | PEARSON COEFF. OF SKEW, DISTRIBUTION | MEDULLAS | PIGMENT | FLEECE-TYPE |
|---|---|---|---|---|---|---|---|---|
| Corselitze, 7325 a-e | a | 13-46,65-104 | 26 | 28.4±12.0 | +0.66, lpos.skewed | 4% | 100% | hairy medium |
| | b | 14-41 | 28 | 27.0±5.0 | −0.16, symmetrical | 0 | 100% | shortwool |
| Corselitze, 7325 b | a | 15-46,68 | 23 | 26.2±7.4 | +0.60, pos.skewed | 1% | 0 | hairy medium |
| | b | 14-47,67,81,155 | 19 | 26.3±16.1 | +0.64, pos.skewed | 5% | 1% | hairy medium |
| Mammen, C135 | | 15-42,72 | 21 | 27.9±7.4 | +0.49, pos.skewed | 1% | 98% | hairy medium |
| Vrangstrup, C23594C | a | 13-44,49,65 | 24 | 26.1±7.2 | +0.56, pos.skewed | 1% | 100%, light | hairy medium |
| | b | 17-40,59,72 | 26,27,28 | 28.4±7.5 | +0.31, symmetrical | 2% | 0 | hairy medium |
| Baunsø Mose, D11103C | raw fibre | 15-36,55,106-210 | 22 | 47.7±53.7 | +1.44, discontin. | 28% | 0 | mouflon-type [or |
| | | undercoat only: | | 21.7±5.1 | +0.44, symm./pos.sk. | 8% | 0 | hairy medium] |
| Borremose, C26449 | raw fibre | 13-33,49,63-164 | 21 | 55.2±47.0 | +2.13, discontin. | 42% | 14% | mouflon-type [or |
| | | undercoat only: | | 20.2±5.4 | +0.56, pos.skewed | 3% | 10% | hairy medium] |
| Fracer Mose, 7142 | raw fibre | 9-56,72-109 | 17,19 | 26.0±22.5 | +0.93, discontin. | 9% | 10% | mouflon-type [or |
| | | undercoat only: | | 20.3±9.2 | +0.56, pos.skewed | 1% | 2% | hairy medium] |
| Huldremose, C3472 | raw fibre | 13-28,50,63-162 | 21 | 38.5±37.5 | +1.33, discontin. | 27% | 2% | mouflon-type [or |
| (light sample) | | undercoat only: | | 21.2±4.7 | +0.27, symmetrical | 7% | 2% | hairy medium] |
| Huldremose, C3472 | raw fibre | 12-26,35,44-118 | 15 | 29.8±30.0 | +1.27, discontin. | 18% | 100% | mouflon-type [or |
| (dark sample) | | undercoat only: | | 17.4±4.3 | +0.06, symmetrical | 2% | 100% | hairy medium] |
| Karlby, D4854b | raw fibre | 12-24,55-127 | 17,18 | 27.5±29.1 | +1.04, discontin. | 13% | 0 | mouflon-type [or |
| (light sample) | | undercoat only: | | 16.9±2.4 | +0.06, symmetrical | 0 | 0 | hairy medium] |
| Karlby, D4854b | raw fibre | 13-33,54-124 | 21 | 34.5±30.9 | +1.22, discontin. | 21% | 100% | mouflon-type [or |
| (dark sample) | | undercoat only: | | 21.6±4.0 | +0.57, pos.skewed | 7% | 100% | hairy medium] |
| Rønbjerg, D2624-26 | raw fibre | 13-32,42-132 | 18 | 40.1±35.3 | +1.75, discontin. | 32% | 0 | mouflon-type [or |
| | | undercoat only: | | 18.6±3.7 | +0.60, pos.skewed | 2% | 0 | hairy medium] |
| Tvede, St. Arden, 462/42 | raw fibre | 13-26,36,79-215 | 18 | 44.5±54.2 | +1.37, discontin. | 19% | 100% | mouflon-type [or |
| | | undercoat only: | | 19.4±3.1 | +0.67, pos.skewed | 0 | 100% | hairy medium] |
| Sejlflod, 669×1183 | a | 13-46 | 23,26 | 24.1±5.9 | +0.42, symmetrical | 0 | 0 | shortwool |
| | b | 14-37,50,51 | 22 | 26.3±10.9 | +0.53, pos.skewed | 4% | 0 | hairy medium |
| Sejlflod, 669×1301 | a | 15-38,69 | 26 | 26.7±6.3 | +0.39, symmetrical | 1% | 1% | hairy medium |
| | b | 15-33,85 | 21 | 22.9±7.3 | +0.53, pos.skewed | 1% | 0 | hairy medium |
| Sejlflod, 669×1445 | a | 15-49,79 | 26 | 26.1±8.0 | +0.36, symmetrical | 3% | 0 | hairy medium |
| | b | 17-50,62 | 23 | 26.9±6.5 | +0.52, pos.skewed | 2% | 0 | hairy medium |
| Sejlflod, 669×1463 | a | 14-36,42,76 | 21 | 23.9±7.1 | +0.35, symmetrical | 1% | 0 | hairy medium |
| | b | 17-50,63,74,87 | 22 | 27.3±10.8 | +0.87, pos.skewed | 3% | 1% | hairy medium |
| Sejlflod, 669×1509 | a | 18-41,91 | 22,28,31 | 28.6±8.3 | +0.19, symmetrical | 1% | 0 | hairy medium |
| | b | 12-46,60,62,69 | 15 | 24.9±10.0 | +0.68, pos.skewed | 4% | 0 | hairy medium |
| Sejlflod, 669×1531 | a | 12-38,77 | 23 | 22.7±8.0 | +0.18, symmetrical | 1% | 1% | hairy medium |
| | b | 13-41,54,60 | 28 | 26.5±7.7 | +0.57, pos.skewed | 2% | 1% | hairy medium |
| Sejlflod, 669×1533 | a | 13-36,63 | 23 | 23.5±5.6 | +0.38, symmetrical | 1% | 0 | hairy medium |
| | b | 13-36,78 | 22 | 23.8±7.8 | +0.49, pos.skewed | 1% | 0 | hairy medium |
| Sejlflod, 669×3602 | a | 12-51,65 | 23 | 25.7±8.7 | +0.44, sym/pos.skew. | 11% | 100% | hairy medium |
| | b | 13-38,46,91 | 28 | 25.7±9.0 | +0.34, symmetrical | 1% | 100% | hairy medium |
| Rovsbjerghøj | cloth wa | 10-33 | 21 | 19.0±4.1 | +0.14, symmetrical | 2% | 0 | fine |
| | tablet wa | 10-64 | 22 | 25.8±9.6 | +0.72, pos.skewed | 10% | 8% (coarse fibres only) | hairy medium |
| Skringstrup | Z | 19-79 | 23,27 | 38.0±14.6 | +0.84, pos.skewed | 6% | 31% | hairy |
| | s | 10-53 | 21 | 27.0±8.3 | +0.83, pos.skewed | 1% | 6% | generalised medium |
| Lousgaard, NMC5907 | ?wa | 18-40 | 32 | 27.7±5.4 | −0.06, symmetrical | 0 | 0 | shortwool |
| | ?we | 15-45 | 26 | 26.5±5.8 | +0.47, pos.skewed | 0 | 0 | generalised medium |

Table 3 (continued).

| SITE, TEXTILE | YARN | RANGE | MODE | MEAN±S.D. | PEARSON COEFF. OF SKEW, DISTRIBUTION | MEDULLAS | PIGMENT | FLEECE-TYPE |
|---|---|---|---|---|---|---|---|---|
| Lousgaard, NMC5667 (twill) | a | 13-51 | 23 | 27.6±6.7 | +0.68, pos.skewed | 6% | 0 | generalised medium |
| | b | 10-32,38,46 | 21 | 21.9±5.3 | +0.22, symmetrical | 2% | 0 | fine/gen.medium |
| Lousgaard, NMC5667 (tabby) | a | 12-45 | 32 | 27.3±7.2 | +0.11, symmetrical | 1% | 0 | shortwool |
| | b | 13-47 | 31 | 28.4±6.9 | −0.04, symmetrical | 2% | 0 | shortwool |

**GERMANY**

| SITE, TEXTILE | YARN | RANGE | MODE | MEAN±S.D. | PEARSON COEFF. OF SKEW, DISTRIBUTION | MEDULLAS | PIGMENT | FLEECE-TYPE |
|---|---|---|---|---|---|---|---|---|
| Thorsbjerg, 24824b | a | 14-38,46 | 19 | 24.4±5.9 | +0.57, pos.skewed | 1% | 0 | generalised medium |
| | b | 18-62 | 26,28 | 31.9±9.4 | +0.51, pos.skewed | 3% | 0 | hairy medium |

Table 3. Fleece types. Measurements in microns (0.001 mm).

| | |
|---|---|
| A. Probable native textiles (Haraldskjaer types): | |
| Denmark: | 20 HM, 0 GM, 0 M, 2 Sh, 0 F, 0 F/GM (total 22) |
| Norway: | 14 HM, 3 GM, 5 M, 1 Sh, 1 F, 1 F/GM (total 25) |
| B. Possibly native (tablet weaves, etc): | |
| Norway: | 4 HM, 2 GM, 5 M, 0 Sh, 0 F, 0 F/GM (total 11) |
| C. Probable imports into Norway and Denmark: | |
| Virring-type: | 7 HM, 3 GM, 1 M, 2 Sh, 5 F, 0 F/GM (total 18) |
| Dog-tooth twill: | 6 HM, 3 GM, 0 M, 4 Sh, 0 F, 3 F/GM (total 16) |

Table 4. Wools of Roman and Migration Period Scandinavia (including figures from earlier study).

| | |
|---|---|
| Birka type: | 3 HM, 1 GM, 0 M, 8 Sh, 0 F, 0 F/GM, 0 H |
| Veka type: | 7 HM, 1 GM, 8 M, 2 Sh, 0 F, 0 F/GM, 0 H |
| Hessens/Elisenhof type: | 4 HM, 2 GM, 1 M, 0 Sh, 0 F, 0 F/GM, 1 H |
| Other types from Denmark: | 1 HM, 1 GM, 0 M, 2 Sh, 0 F, 0 F/GM, 0 H |

Table 5. 7th–10th century wools from Norway and Denmark (including figures from earlier study).

eventually evolved into the lustre longwool. In earlier times the staple would not have been as long as in present-day longwool fleeces, but it was probably still of greater length than in other wools. It is interesting to note that the Gotland, one of the native sheep of Sweden, nowadays includes many medium-fleeced sheep (Ryder 1981a pp 393–7). The Gotland belongs to the 'northern short-tail' breed-grouping, to which the Norwegian Spaelsau also belongs.

In passing, it should be noted that there were a greater number of fine (F and F/GM) types of fleece among the textiles which are thought to have been imported from the northern Roman Empire, This agrees with the evidence from Roman Mainz, where F and F/GM accounted for 60% of the wool (Ryder 1981b).

## VIKING AGE WOOLS OF NORWAY AND DENMARK

In the 8th–10th centuries there seems to have been an area of quality textile production somewhere in western Norway (Bender Jørgensen 1986 pp 358–360). One of the products of this region was the fine Veka-type twill, which is limited in its distribution to Norway itself (Bender Jørgensen 1986 p. 361). More tentatively it is thought that the Birka-type diamond twill of Scandinavia and the northern isles of Britain may derive from the same source (Bender Jørgensen 1986 and 1984 p 132).

The Norwegian textiles of this period still made use of the HM and M fleece types, with a few GM (table 5). However, a fourth type, the shortwool (Sh) had now begun to appear in much greater numbers than previously. Although there are few shortwools present in the Migration Period textiles, the large number in the Viking Age is still surprising: there do not appear to be any shortwools recorded among any of the native Scandinavian breeds of sheep (Ryder 1981); and in Britain, where sheep farming and wool textile production were always important, the shortwool did not appear in any numbers until much later (Walton 1981 p 191). Again, it does not seem possible that the shortwool could be derived from any other fleece type by processing the wool in some way. If the fine quality wool textiles of Scandinavian graves are indeed West Norwegian products, then the evidence suggests that the shortwool fleece was available in Viking Age Scandinavia well before it appeared elsewhere in northern Europe.

One of the most significant features of these Viking Age wools is their arrangement within the two main textile-types. It was noted in the earlier study that the

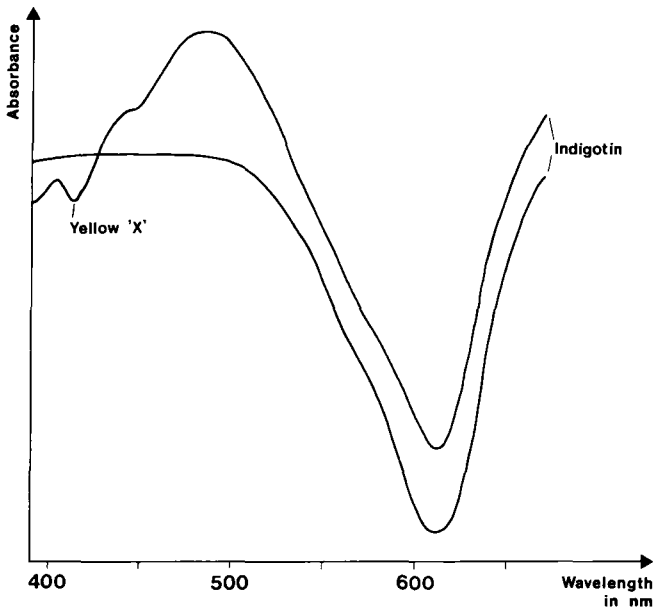


Fig. 3. Indigotin and indigotin plus yellow "x" (Sætrang C 644; in ether, ex pyridine).

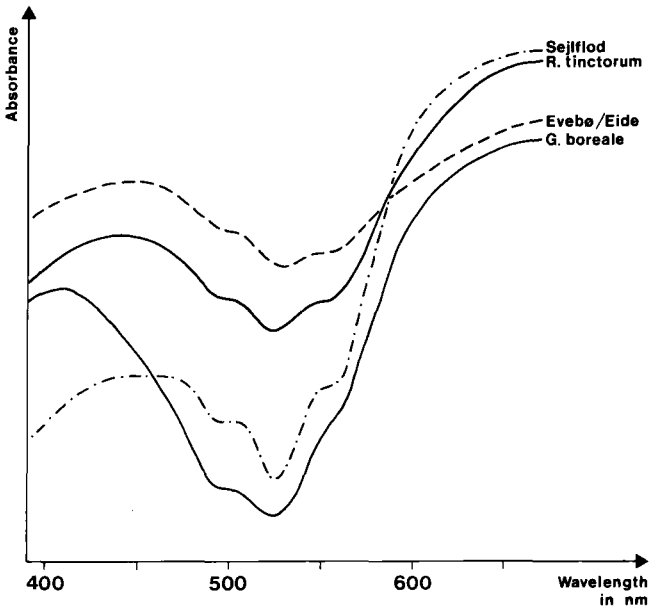


Fig. 4. *Rubia tinctorum, Galium boreale,* Evebø/Eide (3), Sejlflod (669 × 1531) in methanol plus magnesium acetate, ex IMS plus $H_2SO_4$.

shortwool was used almost exclusively in the Birka-type textiles. The Veka-type twills of the present survey instead proved to be medium in the warp and hairy medium in the weft: thus a smooth and firm long-fibred warp was combined with the softer, more crimpy underwool of the HM type of fleece, to give a strong, yet warm, fabric. This choosing of the right wool for a specific function, suggests a remarkably sophisticated approach to textile production.

In contrast, the coarser Hessens/Elisenhof type of textile, which probably derives from the Frisian region of North Germany and Holland (Bender Jørgensen 1984 pp 130–1) showed no pattern at all in the choice of wools. The fleece types were 4 HM, 2GM, 1M, 1H, which compares with the 11 HM, 1 GM, 4 M of the English examples of the same fabric-type (Walton forthcoming and Pritchard 1984 pp 53, 72–3). There is nothing in the wools to dispute a Frisian origin for these textiles, as the same fleece types have already been identified in textiles excavated in northern Germany (Ryder 1969 pp 514–5; Walton 1985).

The remaining wools of the Viking Age come from a variety of fabric types, whose origin is on the whole uncertain. However, it is interesting that the fine ZZ tabby from Lousgaard had the same arrangement of shortwool in warp and weft as was found in the Birka-type diamond twills. Lousgaard is a site which has produced five Birka-type textiles and it is possible that this tabby belongs with the same group.

## DYES: BLUE

It has already been noted (above) that patterning with the natural colours of wool was introduced in the Pre-Roman Iron Age. However, by at least the 1st century AD, dyes were also in use. The most common dye to be identified was the blue indigotin (fig. 3) which at this time almost certainly derived from the woad plant, *Isatis tinctoria* L. (the other possible source being the sub-tropical *Indigofera tinctoria* L). Although woad is not a native of northern Europe, archaeological finds of its seeds suggest that it had reached Scandinavia by the Roman Period (Hald 1980 p 137).

Indigotin was identified in fine and coarse textiles of all periods. In several of the Norwegian finds it seems to have been used for particularly dark shades: at Evebø/Eide it formed a rich, deep stripe on a red or orange ground; in some of the Veka-type textiles only the warp had been dyed, so that the diagonal lines of twill would have stood out as dark blue on white; and in the Birka-type diamond twills, the dye was so dense that it was al-

most black. Since woad is an especially difficult dye with which to work and the deeper shades of blue require repeated dyeings, this is yet more evidence that the makers of the Birka-types possessed considerable skills.

In a few textiles from Norway and Denmark (Sandanger B10772, Skjervum B 6500, Sandegaard C27726 B-G) the indigotin behaved oddly when tested. The colour remained firmly on the fibre in the test for vat dyes (of which woad is one) but was easily removed in the test for mordant dyes. This behaviour has been encountered before, when indigotin has been applied on top of a mordant dye (Dalrymple 1983 p4). Although, properly speaking, no second dye was detected in these samples, the yellow dyes are notoriously difficult to pick up in our tests, and it seems likely that in these particular cases, woad had been combined with a yellow mordant dye. Indeed, in several other textiles, indigotin was found in combination with another, more clearly defined, yellow dye.

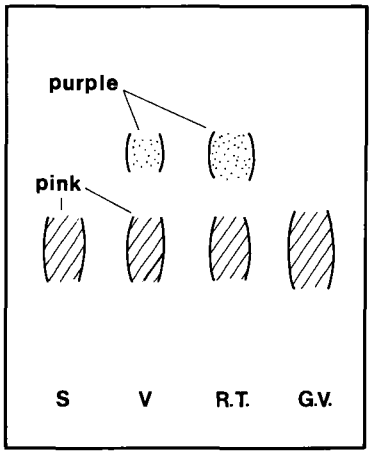


Fig. 5. Paper chromatogram of Sejlflod (669 × 1 533), Veien F, Rubia tinctorum and Galium verum (eluent IMS + $H_2O$; developed with KOH in methanol).

## UNIDENTIFIED YELLOW DYE

Although most yellow dyes are difficult to detect, there was one which gave a very clear 'fingerprint' (fig. 3). It was found in six textiles, one. from Rovsbjerghøj, probably a Gaulish import, but the remainder native Norwegian and Danish textiles. It was always combined with indigotin and appeared to be a dye which required no mordant.

The spectrum of this dye was not like any in our collection and an extensive search of less common dyeplants had to be undertaken. As the dye was only yellow on extraction into pyridine and may have been yellow, brown, or even green on the fibre, the possibilities were numerous. However, despite analysis of all the dyes listed in Table 6, 'Yellow X' still remains unidentified.

Commercial dyes:
*Reseda luteola* (weld)
*Genista tinctoria* (dyers' greenweed)
*Crocus sativus* (saffron)
*Rhamnus* spp (Persian berries)

Lichens:
*Xanthoria parietina*
*Hypogymnia physodes*
*Parmelia saxatilis*
*Lobaria pulmonaria*
*Pseudovernia furfuracea*

Barks, etc:
*Salix fragilis* (bark)
*Fagus sylvaticus* (nuts)
*Quercus robur* (galls)
*Corylus avellana*
*Malus sylvestris*

Scandinavian wayside plants:
*Potentilla anserina*
*Bidens tripartita*
*Chrysanthemum segetum*
*Myrica gale*
*Matricaria maritima*
*Cytisus scoparius*
*Equisetum arvense*
*Calluna vulgaris*
*Lythrum salicaria*
*Hypericum perforatum*
*Nymphum alba*

Table 6. Dyes eliminated in the search for Yellow 'X'.

## RED DYES: MADDER AND BEDSTRAW

Three of the wealthier graves of Norway, Snartemo V, Veiem and Evebø/Eide, included textiles dyed with a madder-type of dye (fig. 4). Chromatography showed that alizarin was present (fig. 5), indicating that the dye was probably derived from *Rubia tinctorum* L., Dyers' madder (Taylor 1983 p 159). This plant was widely cul-

tivated in several parts of the Roman Empire (Pliny *Nat.Hist.* Bk.XIX, xvii), although there is no clear evidence for it in Gaul at this date. By the 9th century it was certainly being grown in the Paris region and shortly afterwards in England (Walton forthcoming). However, its cultivation is not as easy as woad and although it may survive in very sheltered areas of Scandinavia, it is unlikely to have been grown there as early as the Migration Period. Since the dye has only been found in rich graves, two of which contained imported goods, it seems likely that ready-dyed textiles or garments were being brought in from abroad, perhaps as princely gifts – or that the dye was imported for use in the best quality textiles.

In Denmark on the other hand a madder-type of dye was found in some native textiles from less wealthy sites. Chromatography proved that in at least two instances (Sejlflod and Hejrhøj) there was no alizarin present, and *R. tinctorum* could therefore be dismissed (the remaining madder results were too weak to chromatograph successfully).

Although *R. tinctorum* yields the greatest quantity of dye, there are several native Danish plants which give a similar colour. Analysis of yarns dyed with three species of *Galium* showed that these had no detectable alizarin, although they gave spectra very like madder: they were *Galium verum* L., a plant from heathland and other dry soils, *Galium boreale* L., from lusher grassland, and *Galium odoratum* (L) Scop. (formerly *Asperula odorata* L.), a woodland plant. Any of these plants may have been used to dye the Sejlflod and Hejrhøj textiles.

## UNIDENTIFIED LØNNE HEDE RED

Another less commonly used orangey red dye was found at Lønne Hede. It was noted in the earlier study that this dye was difficult to extract and characterise, which hampered a search for its source. However, some of the dyes which can be eliminated are listed in table 7.

*Rubia* spp
*Galium* spp
Dyewoods, such as brazilwood or sanderswood
Insect reds, such as kermes, cochineal, etc
Fungus reds, such as *Dermocybe semisanguinea*
*Rumex crispus* (seeds)

Table 7. Dyes eliminated in the search for the Lønne Hede red.

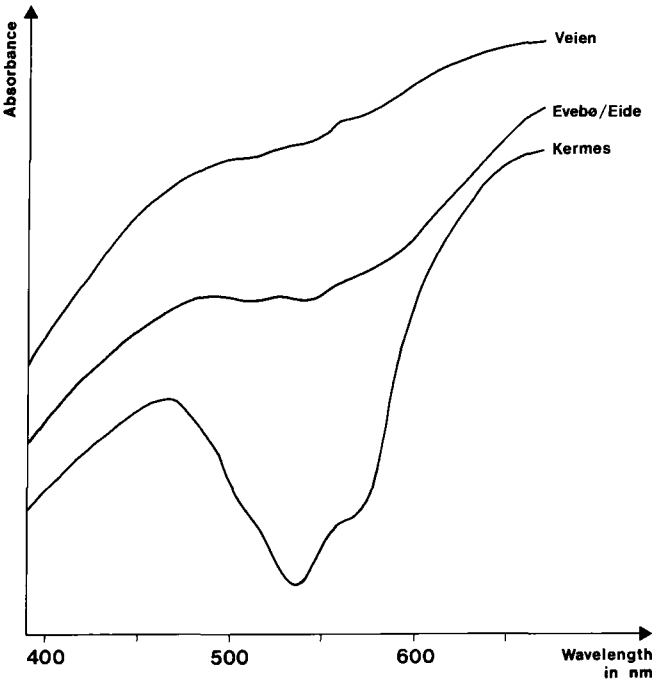


Fig. 6. Kermes, Veien C 348 and Evebø/Eide (4) in methanol plus magnesium acetate, ex IMS + $H_2SO_4$.

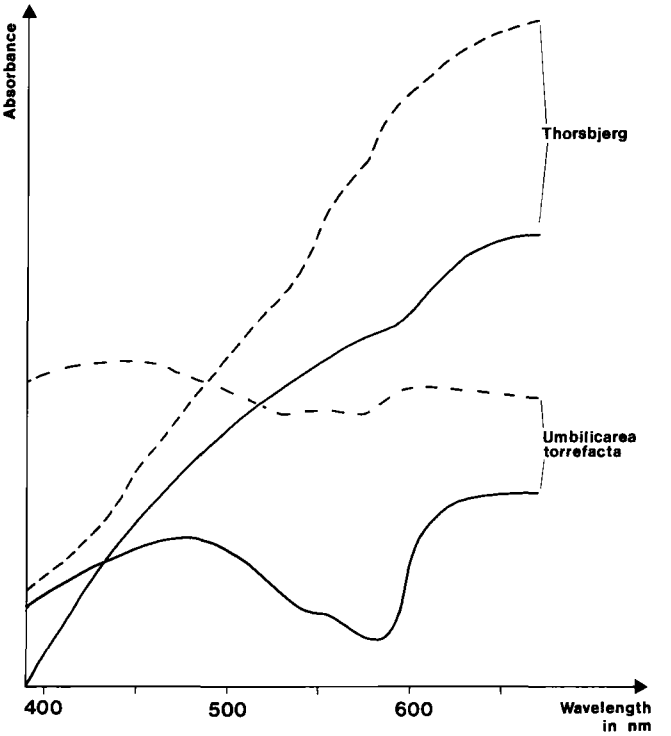


Fig. 7. Umbilicarea torrefacta and Thorsbjerg 248246b in methanol plus magnesium acetate (-) and in $H_2SO_4$ plus $H_2O$ (---).

L. Dokkedal and E. Skytte Jensen (1976) have obtained satisfactory chromatograms of the Lønne Hede dye, but they too have been unable to identify its source. Since the Lønne Hede textiles seem to represent some of the earliest dyed cloth in Scandinavia, it is possible that dyeing was still at its experimental stage and once the *Galium* dyes had been discovered, this unidentified red fell out of use.

## RED INSECT DYES

Although most natural dyes are obtained from plants and lichens, there is one group of reds, the cochineal/kermes/lac group, which derive from insects. All of these insect dyes give a similar graph in spectrophotometry, but may be distinguished from each other by their degrees of solubility in ether and by other characteristics.

Two Norwegian textiles, Veien C348 and Evebø/Eide B4590, again good quality products, gave the spectrum of an insect dye (fig. 6). In both cases the dye extracted, at least partially, into ether, which eliminated cochineal and lac as possible sources (and indeed geographically cochineal and lac were unlikely). However, the exact degree of solubility in ether was difficult to judge, as the aqueous residues were heavily contaminated with the organic substances which archaeological specimens collect from the soil. Nevertheless the sample from Veien certainly left an appreciable amount of dye in the aqueous residue.

This partial solubility in ether is characteristic of Polish cochineal, which contains both the soluble kermesic acid and the insoluble carminic (Taylor 1984 p 23). Although we have little experience of the chromatography of insect reds, when the Veien sample was chromatographed alongside cochineal (predominantly carminic acid) and kermes (kermesic acid) it behaved like a mixture of the two. It therefore seems safe to identify the Veien sample as Polish cochineal.

The results on the Evebø/Eide sample were unfortunately not so conclusive. Its solubility in ether and its behaviour in chromatography both indicated the presence of kermesic acid, but carminic acid could not definitely be excluded. This dye may therefore be either kermes or Polish cochineal.

Polish cochineal is obtained from the insect *Porphyrophora polonica* (L.) (formerly *Margarodes polonicus* L.), a parasite on *Scleranthus perannis* L. *S. perannis* is a plant of sandy regions, growing in central and eastern Europe, the Ukraine, Asia and the Caucasus, Turkistan and western Siberia (Donkin 1977 p 853). The eastern distribution accounts for findings of the dye in Egyptian and Syrian textiles of the Hellenistic-Roman period (Pfister 1935 pp 35, 39, 46: 1940 pp 26, 28, 67, 69). The dye is known to have been exploited in the past in Lithuania, Pomerania, Saxony, Prussia, Brunswick, Mecklenberg, Poland and the Ukraine (Donkin *op.cit.* p 854). In the 12th and 13th centuries it was subject to tithe in eastern and central Europe, and Donkin suggests that the *vermiculo* of Charlemagne's Capitularies should also be identified as Polish cochineal (*ibid*). Although rarely encountered in early European textiles, the dye may have been available to Scandinavian dyers via the Baltic trade routes. Alternatively, the textile itself may be an import.

The kermes insect, *Kermes vermilio* (Planch.) Targ. (for nomenclature see Schweppe 1986), lives on the leaves of the kermes oak, *Quercus coccifera* Planch., an evergreen shrub of the Mediterranean and S.W. Europe. It was well-known to the Romans and Pliny cites its use for the military cloaks of generals (*Nat.Hist.* XXII, ii-iii). However, it is rarely found in N. European textiles before the medieval period and if its identity in the Evebø/Eide textile is correct, it points to contact with some Mediterranean or near Eastern country (for background to the Evebø/Eide find, see Magnus 1984).

Finally, in passing, it should be noted that there are some Scandinavian mushrooms, e.g. *Dermocybe semisanguinea*, which yield a dye with a spectrum like that of the insect dyes. In chromatography the two groups of dyes may be easily distinguished, but this recent discovery is a timely reminder to researchers, not to rely on spectrophotometry alone.

## LICHEN PURPLE

Another rare dye of some significance is the lichen-derived purple found in textiles from Thorsbjerg in northern Germany and Fløjstrup in Denmark. This dye may be obtained from a range of lichens (Taylor and Walton 1983) including some, such as *Ochrolechia tartarea*, which are native to Scandinavia (Høeg 1976 p 63ff). However, although the dye was available in the north, knowledge of its use seems to have been rather limited.

The earliest record of lichen purple in Scandinavia

seems to belong to the 14th century, when Norway was exporting the dye under the name of 'lacmus' (Kok 1966 p 252). In Britain the dye has been found in one textile of Roman date and in several from the Anglo-Saxon period (Taylor and Walton *op.cit*), although all of the latter can be identified as imports: some were embroidery silks, probably from the Mediterranean, and the others were textiles of the Hessens/Elisenhof type (Walton forthcoming). If the Hessens/Elisenhof type of textile does originate in the Frisian area, as has been suggested, this would justify the comment of Ernoldus Nigellus, a 9th-century author, that there was a variety of colours in Frisian cloth which were not known in the upper Rhineland (van Uytven 1983 p 153).

It is tempting to suggest that the Thorsbjerg textile is evidence for a continuous tradition of lichen-purple dyeing in the Frisian region. However, it should be remembered that the Thorsbjerg relics are a collection of war booty, which archaeologists consider came from an area of Roman influence, probably somewhere between the Elbe and the Rhine (Ilkjaer and Lønstrup 1982 pp 98–9). Nevertheless, the textile itself is a typical product of northern Europe, and there is no real reason to suspect that it came from outside northern Germany.

The Fløjstrup find on the other hand is an unusual weave (Hald 1980 p 100) from the Viking Age, a period at which Scandinavia had trade contacts reaching into the Near East and beyond. Until the weave has been provenanced, no conclusion can be drawn on the origin of this particular dye.

## CONCLUSION

It is hoped that these results have shown how the analysis of wools and dyes can make a useful contribution to the study of early textiles. The survey has elucidated the early evolution of the fleece of native Danish sheep and has shown how the early weavers took advantage of their raw materials; it has also indicated the import of dyes, or perhaps the import of luxury textiles, into Norway during the Migration period; and, if the fine wool textiles of Scandinavian graves are indeed of West Norwegian origin, it has highlighted a very sophisticated approach in native textile production in the 8th to 10th centuries.

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Journal of Danish Archaeology vol. 7, 1988, pp 159–181

# *Borremose Reconsidered*

## The Date and Development of a Fortified Settlement of the Early Iron Age

by JES MARTENS

The western part of Himmerland forms a slightly hilled moraine plateau penetrated by many small rivers and creeks. The area is damp and changes between low dry hills and vast meadows. In the Early Iron Age this part of Denmark was perhaps one of the most densely populated. The hills were covered by celtic fields, and the villages were numerous (*e.g.* Hatt 1938a+b, 1949 and Vestergaard-Nielsen 1937). As a crescent the low lands of Borremose lies in the very heart of this moist country, a raised bog and one of the largest of its kind in the area. In the southern part of it a small islet of gravel moraine rises over the surface. Throughout prehistory bogs and lakes were sacred places, and it is no surprise that Borremose yielded at least four bog bodies (K. Thorvildsen 1947, E. Thorvildsen 1952, Tauber 1979) and several other things like pottery, clothes and wooden implements mainly dating to the Late Bronze Age and the Early Iron Age. It was, however, rather unexpected when – in 1929 – it was discovered that the tiny islet was not only strongly fortified but even inhabited through a period of more than two hundred years during the Pre-Roman Iron Age (fig. 1).

### AN OUTLINE HISTORY OF THE INVESTIGATIONS

The investigations of the Borremose Stronghold were carried out throughout more than two decades and remained for long the largest exploration of a single Iron Age site in Denmark. At the same time it yielded the first total plan of a prehistoric village not only in this region but in the whole of Northern Europe. The persons in charge of this great undertaking were Johannes Brøndsted and Peter V. Glob. Geobotanical investigations were carried out by Johannes Iversen and his assistant Alfred Andersen in close collaboration with the archaeologists. This became of great importance later when interpreting the site. Whereas the results of the geobotanical research already have been published (Iversen 1959, Andersen 1977) the archaeological material remained unworked for a long time except for a few generel statements by the investigators (see references).

The site was discovered in 1929 during works of drainage in the southern part of the Borremose fen, Lille Borremose. The workers had cut through the stone-pavement of an Iron Age road. The local museum leader, Sigvald Vestergaard-Nielsen, called upon the National Museum, and the initial investigations were

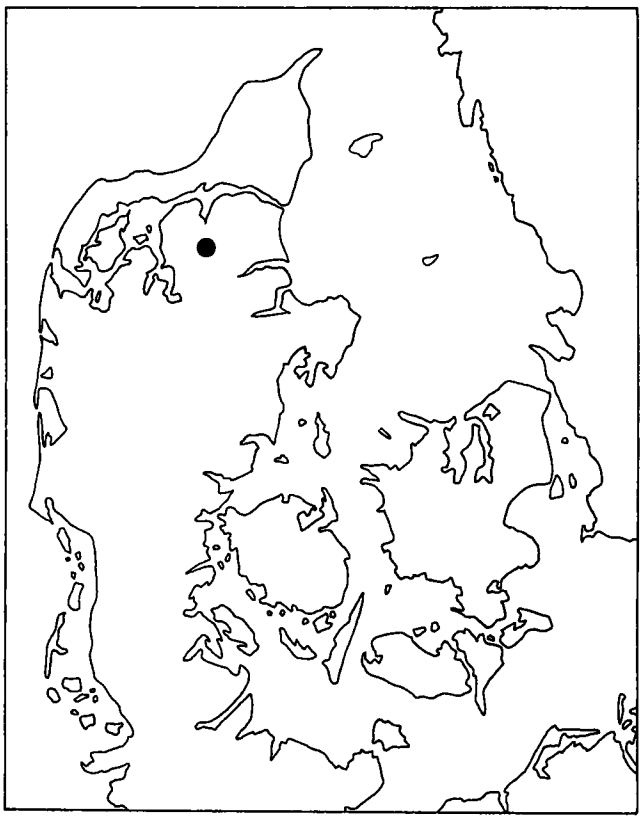

Fig. 1. The location of Borremose.

Fig. 2. The Borremose complex seen from the air. After the excavation the house-sites were marked out with earth banks.

conducted by Johannes Brøndsted assisted by P. V. Glob. Through this and the following season a well done and solid causeway was uncovered leading from firm ground to the small moraine islet in the middle of the fen. Minor sondage excavations proved that there had been a dwelling site here during the Late Pre-Roman Iron Age, the same date that was suggested for the road through the bog.

After a short break the archaeologists returned in 1935. Though Brøndsted was still in charge of the excavation, the daily leadership was from now on in the hands of Glob who under him had a large staff of students and workers. In the following 5 years they concentrated on the exploration of the moats which turned up to contain a lot of pottery from the Middle and the Late Pre-Roman Iron Age and a lot of so far unknown wooden tools. The total exploration of the moats was ended in 1939 leaving three minor parts untouched for future research (fig. 3).

From 1941 to 1945 the research concentrated on the village behind the ramparts. About 26 houses were discovered during the total unearthing of the village ground. The excavators provisionally dated the village to the third period of the Pre-Roman Iron Age and the beginning of the Early Roman Iron Age – the same date suggested for the upper part of the materials in the moats (Brøndsted 1936 p. 40). Later the date was modified to the Late Pre-Roman Iron Age "around the middle of the last century B.C." (Brøndsted 1960/1965 p. 90). The reason for this uncertainty was that the Pre-Roman pottery chronology at this time still was somewhat unknown.

From 1943 and onwards the geobotanical team carried out investigations of the moats and the surrounding bog. Two parallel ditches of about 30 meters each were dug into the bog at right angles to the moat east of the island. It appeared that the surface of the fen on this spot had been lowered by peat cutting during the Early Subatlantic. Archaeological remains found on the exploited surface related this event to the stronghold. In stead of using the pottery for a sharper dating, the researchers based their interpretation on the find of a so called 'wooden bayonet' (see Brøndsted 1965, fig. p. 52) which find its equals only in the bottom layers of the moats. Consequently it was believed that a shallow lake had been created by peat cutting around the islet at the time when the refuge was constructed *i.e.* in the Middle of the Pre-Roman Iron Age. Moreover a layer of

sterile sand in the moats separating older and younger material was taken as proof of an intermission between the stronghold period and the settlement period. This deserted period was further supported by pollen diagrams from the bog showing a short very high maximum of urtica which according to Iversen should prove that the islet had been deserted (Iversen 1959, Andersen 1977).

Also the newly founded Danish C-14-laboratory in Copenhagen became involved in the project. In 1951 Alfred Andersen carried out a minor additional excavation in connection with one of the bog sections in order to provide materials for a C-14 dating of the geobotanically dated layers. A series of wooden objects found on a so called ritual deposit supposed to be contemporary with the stronghold period gave the datings 310±110 BC (K-1399), 220±110 BC (K-751) and 20±100 BC (K-789). Another series made on peat found just below a sand horizon, assumed to mark the terminal date of the stronghold period (*i.e.* dating the intermission phase), gave the dates 230±100 BC (K-1398), 130±140 BC (K-828) and 40±110 BC (K-752). Due to the extreme dispersion those datings were never used (Andersen 1977 p. 116 f.).

The interpretation of the site, as it became known through literature, thus had to be this: In the middle of the Pre-Roman Iron Age a village or a group of villages around Borremose erected a refuge in response to the uncertainty of the times. The low hill in the fen was surrounded by walls and ditches, and the surface of the bog was sunk in order to create a lake around it. A subwater approach of pebbles connected the stronghold with the hinterland. The date was based on a presumably closed find of 12 pots found on a line in the north-eastern corner of the moat (fig. 18) and interpreted as a ritual deposit from just after the construction of the stronghold.

The use of the fortification became very short. Soon the ramparts collapsed and urtica took over the fertile soil. However the place did not lie deserted for long. Soon after the abandonment the site was used for a new purpose; as the foundations of a normal peace time Iron Age village. In order to make room for this the moats were filled up with the soil from the ramparts, and a stone-paved causeway was constructed in order to ease the access to the village. This happened in the late Pre-Roman Iron Age. The village did only exist through this period (Brøndsted 1965 pp. 48–55, 87–90, 388–391, 395, Glob 1943 pp. 103 ff., 1969 pp. 121 ff., 1971 pp. 237 ff. and 259 ff.).

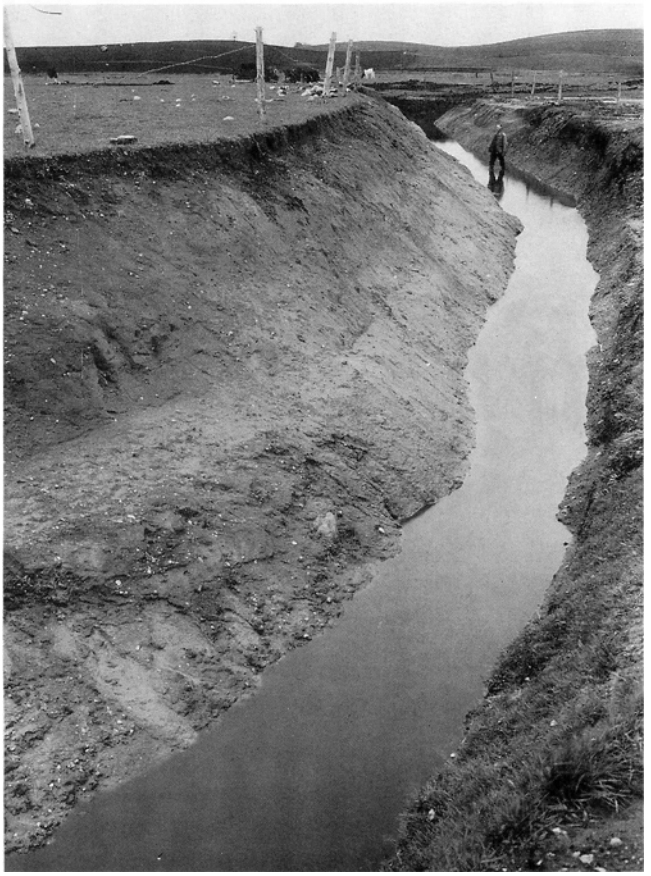

Fig. 3. A view of the excavated moat.

## THE EXCAVATION OF THE SETTLEMENT

The excavators never finished a report on the investigations. The documentation left over is confined to brief notes in the diaries, photos, plans and newspaper cutouts. Especially the observations concerning the materials deriving from the moats are not without complications. Therefore the following will mainly concern the settlement and only briefly touch the problems concerning the dating of the other parts of the complex.

The settlement area was excavated during three seasons: 1941 to 1943 plus an additional round-up season in 1945. From the photos it appears that large areas were unearthed at one time (fig. 4). No general system of co-ordinates was applied. Instead every object was given trigonometric measurements and treated independently with its own system of measurement. This makes the coordination of the various detail plans rather complicated, as there was no standard scale.

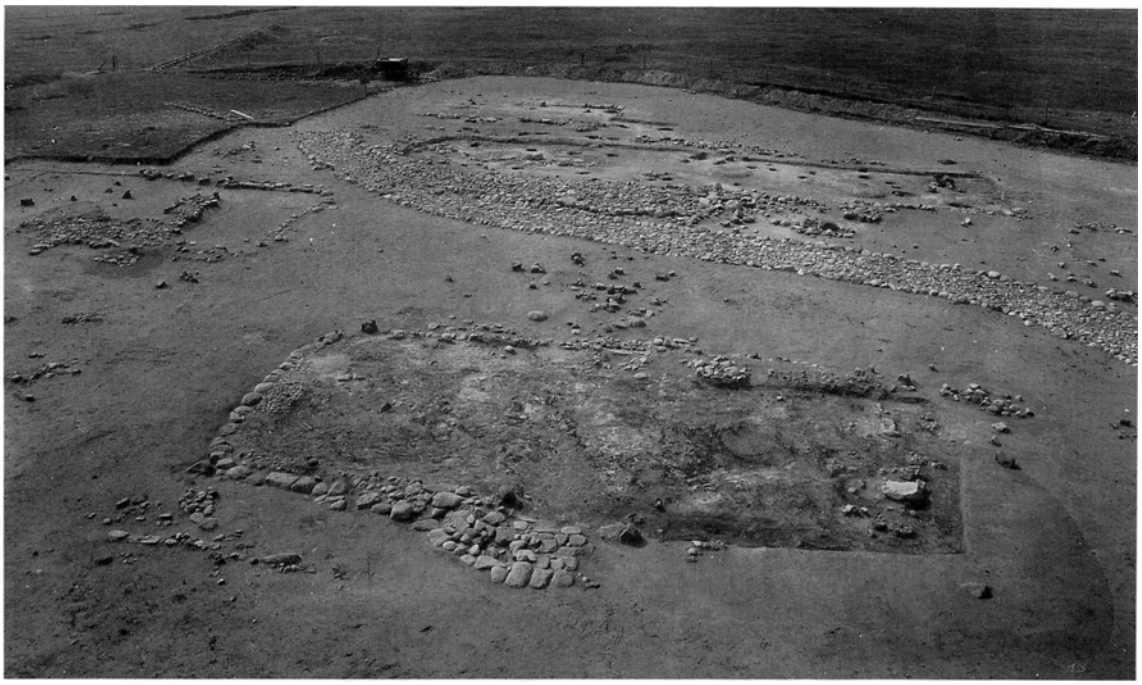

Fig. 4. Part of the settlement during excavation in 1942. House no. VIII is seen in the foreground.

Further some detail plans got lost and therefore could not be transferred to the general plan when constructing it from the measurements. This concerns house nos. XII, XVb, XVII, XIX and some smaller features about which we know the position but lack the plans. Finally some objects were even not given trigonometric measures, so they are today totally lost from the plan. This concerns some minor features and house no. XVIII from which we have only a photo and some finds.

Cross sections were not made either through postholes nor through any other of the smaller features on the site. The only cross sections made derive from the fen, the moats and the village pond. In all other cases the object was emptied from above. This was the usual method at that time, when dealing with settlement archaeology. Postholes were only sometimes registered. This must be due to the excavation method. The aim being to preserve as much as possible for the planned reconstruction of the site, floor layers and stone pavements were left untouched and used as indicators of the extent of the houses. Most likely therefore many buildings lack the eastern end which is normally without a clay floor. It has even been suggested that the investigators only uncovered the first preserved floor layer and never dug as deep as to the virgin subsoil. Consequently previous phases of the houses would only become apparent, if the buildings had been moved a little during reconstruction. As it appears, this was often the case, houses nos. II/III, V and IX/X being the most obvious examples.

If we count every phase of the sites there are about 32 houses, one stone-paved street, one village pond, one pit with bog iron ore plus several pits and stone-pavements without obvious connections to any of the major objects (fig. 5). It is without doubt that the village or at least some parts of it has more than one phase. But which of the houses that were contemporary in the strict sense of the word is rather difficult to judge as long as we lack constructions connecting the various buildings such as fences (*cf.* Hodde, Hvass 1975, 1985).

The information about the various features called houses is scarce and of varying precision. In some cases the description in the notebooks can be quite detailed, whereas in others it is confined to a photo or a plan. This is a problem, when it comes to judgements about the extent of a house, how many phases it consists of and which materials that belong to what phase. In the three cases dealt with below there is no information about the floor layers or how the excavators determined the extents of the houses. However, these house were

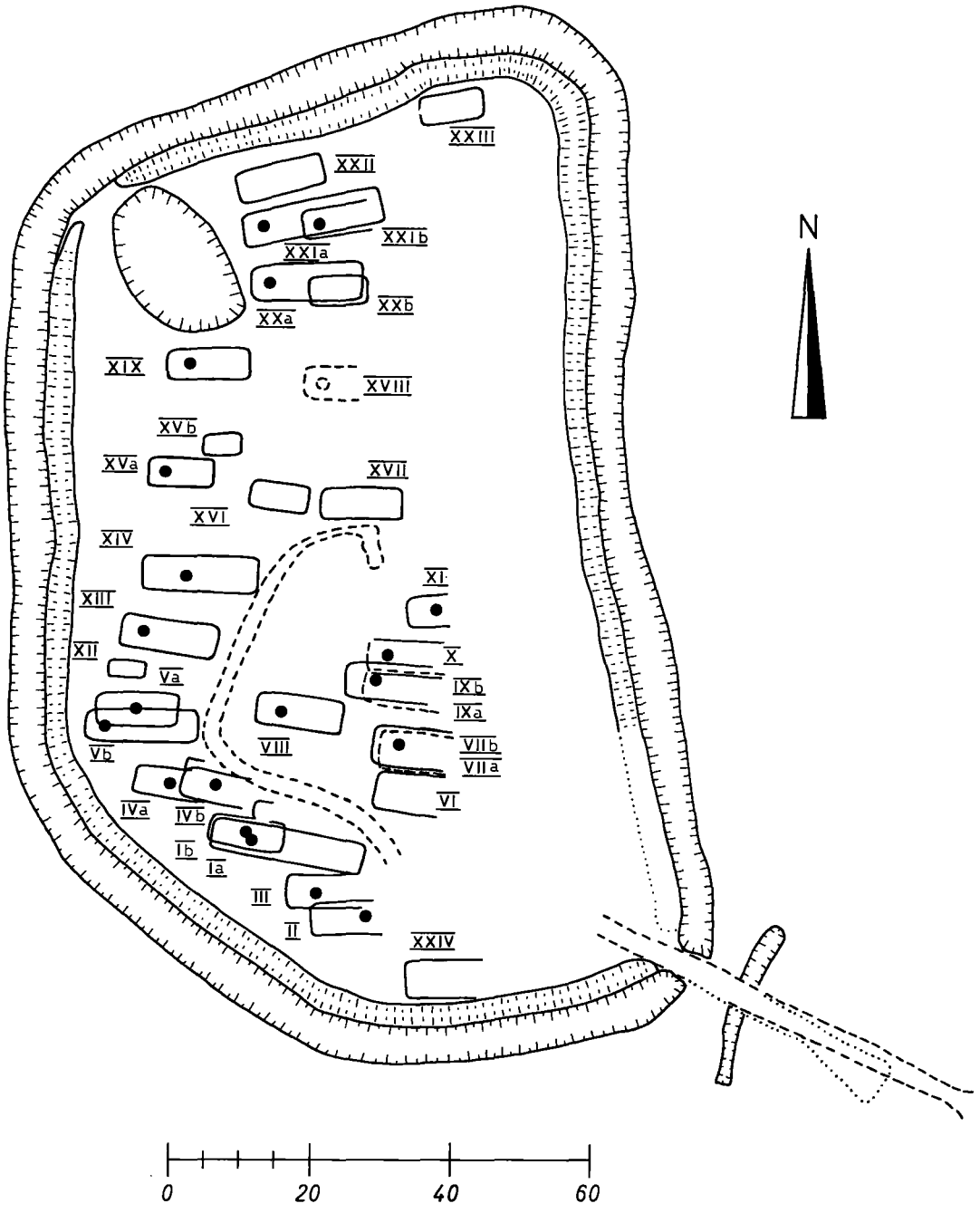


Fig. 5. Total plan of the settlement with all the investigated house-sites.

burned down and left with a thick occupation layer sealing them up to the day of investigation. Maybe even a fourth house (no. XV) has been burned down, but we lack more precise information. The majority of the other houses were covered by a thick occupation layer, and in many instances it appeared that the finds on the floor layers were found *in situ*. Of course only the pots dug down under the fireplace or found in a posthole can give some certainty about the dating of these houses. Even so an attempt has been done below to relate the

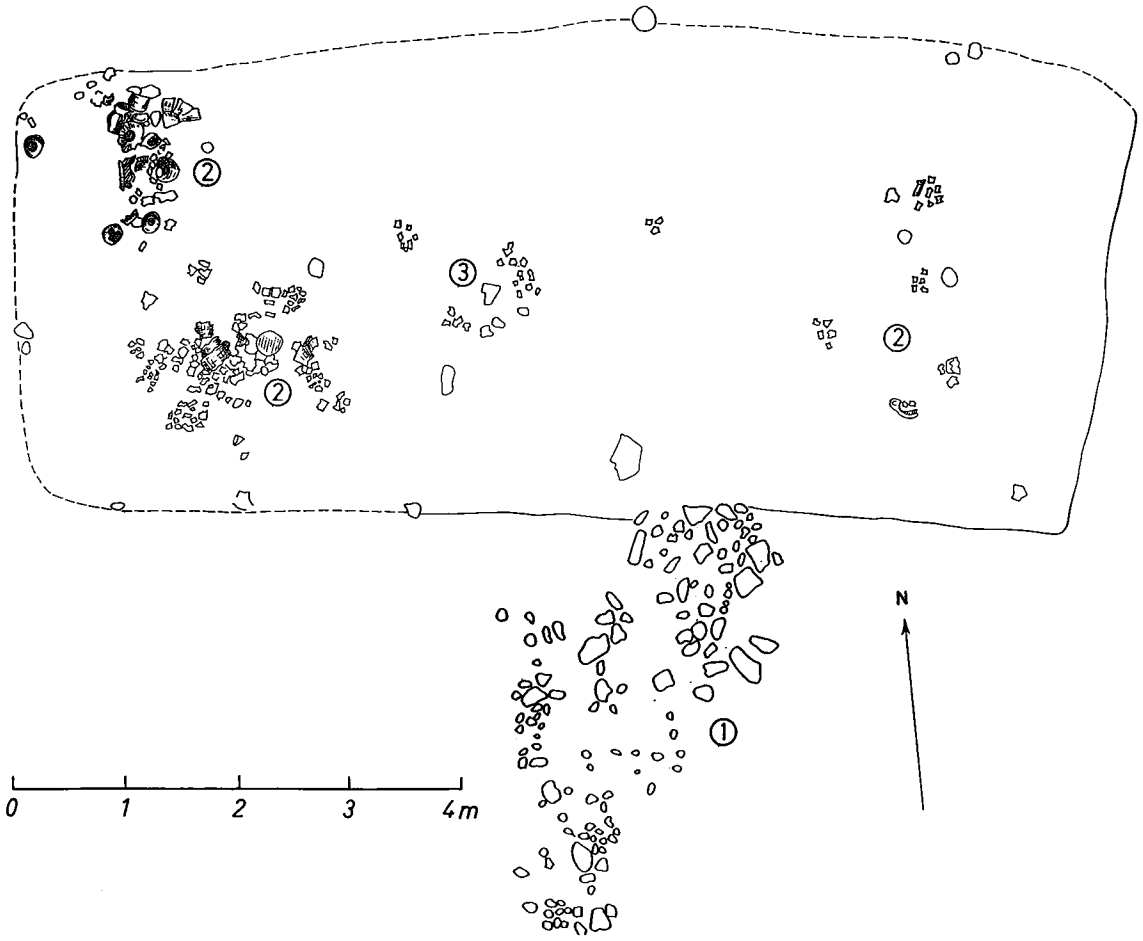


Fig. 6. Plan of house no. XXIII. Legend (figs. 6, 8 and 9): 1) Stone paving. 2) Whole vessel. 3) Potsherds. 4) Iron slag. 5) Fire-dog. 6) Post. 7) Wickerwork. 8) Quern. 9) Clay disc. 10) Hearth.

finds to the houses in order to illuminate the development of the settlement.

In spite of the shortcomings of the documentation, some general statements can be made. The house construction fits well with the North Jutland tradition of the Early Iron Age so well illuminated by the research of Gudmund Hatt (1938a). The houses are orientated east-west with entrances on the north and south side near the middle of the building. The average length is about 12½ meters, and the breadth is about 5 meters. The roof is carried by a double row of posts, and apparently the walls are made from turf covered on the inside by wickerwork. In the western end there is a clay floor and a hearth. The east end has an earthern floor

Fig. 7. Concentration of pottery in the west end of house no. XXIII.

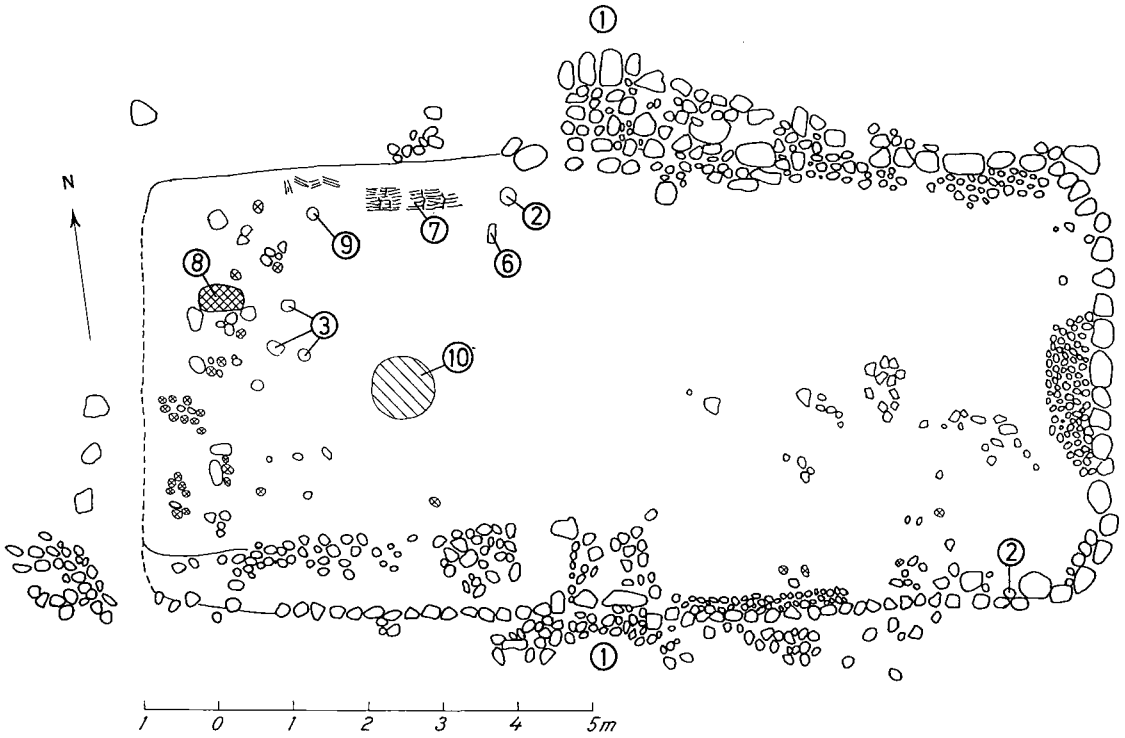


Fig. 8. Plan of house no. VIII (legend, see fig. 6).

and is in one case sunken (house no. XIV), but due to the lack of postholes its function is unknown. Most likely here was a cattle shed like in other houses of the same type throughout Jutland, but so far we lack the proof.

## THE DATING OF THE SETTLEMENT

Important for the dating of the settlement is the fact that three of the house sites show obvious signs of having been burned down, *i.e.* nos. VIII, XVI and XXIII. These sites appear to have no second phase and were abandonned after the fire. Thanks to their dramatic ends they contained a lot of pottery useful to illustrate the style variation during the existence of the settlement. Oldest is the material of house XXIII, as we always meet its counterparts in the lower layers of the multi-phased houses.

### *House XXIII.* (figs. 6–7)

The house is situated in the northeasternmost corner of the village so close to the rampart that the northern wall must have been affected by it and perhaps even built together with it. This is why the house only had a southern entry as indicated by a pebble pavement. The lines of the walls are marked by the extent of the floor layer measuring 9.3 m × 4.2 m. There are no traces of postholes, but most likely the house belongs to a minor group of buildings with only 2½ meters between the rows of the roof carrying posts, the standard being about 3 meters. The excavators found no trace of a hearth. The entry is so close to the eastern end that there seems no room left for a cattleshed. Even so the pottery is concentrated in the west end lying on the floor surface (fig. 7).

### *House VIII.* (fig. 8)

This house which is already known through literature (Glob 1942 photo 107, 1971 p. 238 f.) is situated in the centre of the village. The inside measures about 12 × 5 meters. It has a northern and a southern entrance almost exactly placed in the middle of the long walls as indicated by the entrance pavements. The thickness of

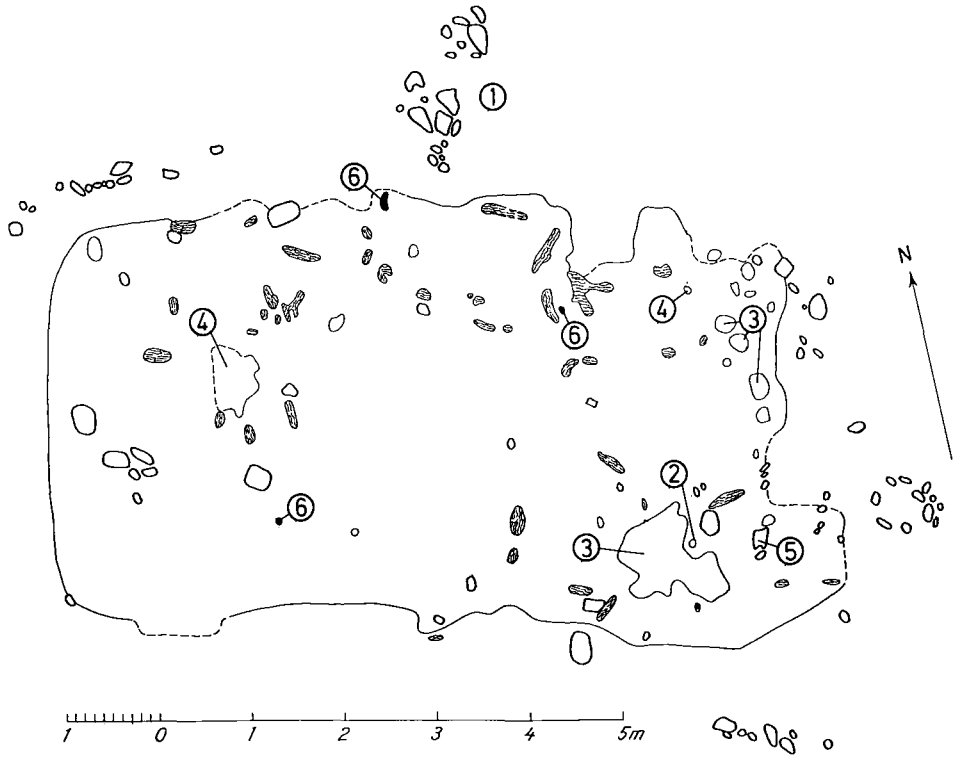


Fig. 9. Plan of house no. XVI (legend, see fig. 6).

the turf walls is suggested by a surrounding row of stones and "benches" of pebbles. A fragment of charred wickerwork illustrates how the earthern walls were supported from the inside. Postholes were not registered. The east end of the house was almost without finds except for the fragments of some handled cups and a large ornamented storage jar (VIII-1) sunken under the wall in the southern corner. There are no finds which could indicate the use of this end of the house. The hearth is found in the centre of the west end and west of this is a larger concentration of artifacts. A grinding stone, hammer stones and a lot of pottery were lying on the surface of the floor.

*House XVI.* (fig. 9)

The last house that became prey of fire is situated at the northern end of the village street in the centre of the islet. The building is as indicated by the floor layer of modest dimensions: 8 × 4½ meters. A few charred roof carrying posts were preserved in their holes suggesting a distance of about 2½ meters between the rows. The doorway in the centre of the northern wall is indicated by posts and a fragmentary pavement on the outside, whereas the position of the southern entrance is less conspicuous. If any, it might be indicated by a few posts and seems to be a little displaced in relation to its northern counterpart. The thickness of the earthern walls is distinctly marked by pebbles in the southeast and northwest corners and fits to the general pattern of about ½–1 meter. The house has no hearth, but on the spot in the west end, where the fireplace ought to be, a larger pit of bog iron ore was found. Another abnormality was that the pottery was concentrated in the east end of the house, where it was lying on the surface of the floor between pieces of charcoal. Most likely this house therefore did not have a cattleshed.

*The pottery of the oldest phase* (figs. 11–13)

Beginning with house XXIII we are provided with a wide and rich sample of pottery. The general traits are as follows: The brim is most often thin or is simply thickened and cut off at the widest point (fig. 10, upper

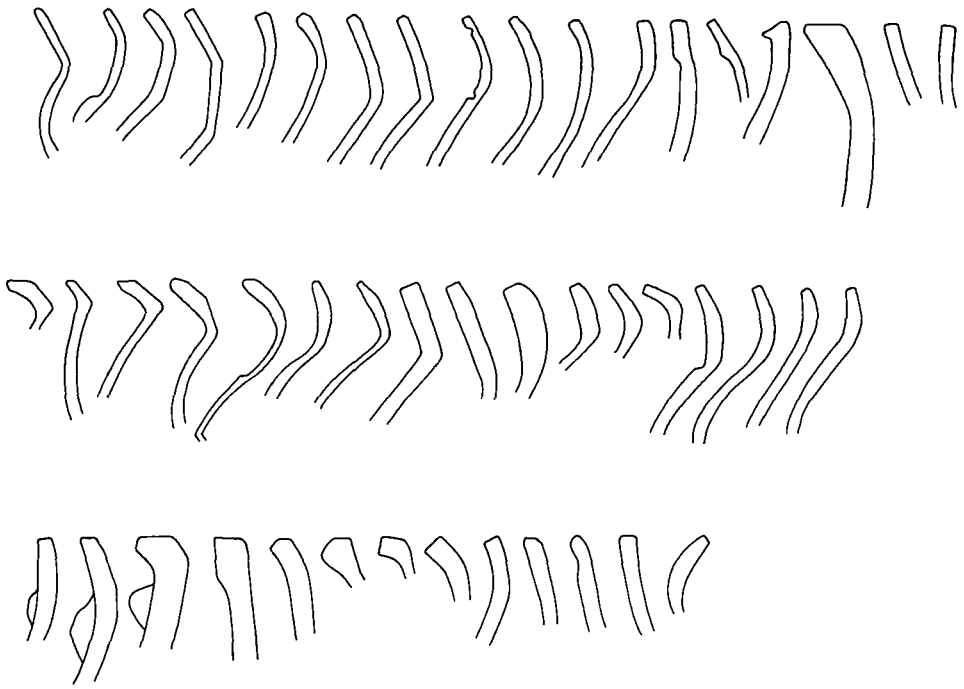

Fig. 10. Characteristic rim sections of the two ceramic phases. Upper row: House XXIII. Middle and lower rows: Houses nos. VIII and XVI. Scale c. 1:2.

row). The collar is broad and softly turned out into a wide mouth. The neck is narrow and might be indicated by a line or a ledge. The belly is softly rounded and might have a slight convex-concave profile. The base has generally a smaller diameter than the neck. The handles are broad and thin with parallel sides. Some have a slight depression on the back. One has a roof shaped back. The position of the handles varies with the type of the pot, but they are generally vertical and placed on the upper part of the belly. In one instance however the handle is horizontal, in another the handle is only a knob. Ornaments are rare and confined to hatching at the edge of the rim.

The single-handled vessel or cup is by far the most numerous type amongst the pots, represented by 12 specimens. Although the variation is considerable some common traits can be pointed out: the rim is as mentioned above, the neck is narrow and might be marked, the belly is round, the lower part can show up some concavity, and the handle is connecting the upper part of the belly with the collar (fig. 11). Similar forms are known from houses Ia and XXIa. An atypical specimen has a short collar sharply turned out and a handle with a roof-like back (XXIII-28). The latter is more typical of the following phase.

Well-done vessels without handle form a second major group (fig. 12, XXIII-2, -4, -20, -31). A softly curved belly is typical – the maximum width approximately placed on the middle of it. The wide collar is gently turned out. This type has no counterparts on the islet.

Storage jars are less numerous. The small version is only apparent as fragments (fig. 12, XXIII-16), whereas we have a complete example of the large type (fig. 12, XXIII-19a). This is a tall, beautiful specimen with a wide mouth, a simply thickened rim, slightly S-shaped profile, low, narrow shoulders and a narrow, concave foot. The rim is ornamented by finger imprints. Fragments of a rim of a further jar are depressed and hatched (fig. 12, XXIII-12). Only the lowest parts have been preserved of an extremely large specimen – the diameter of it's base being 45 cm! The shape of the vessel, the form of the rim and the height are unknown.

Double-handled jars are occuring in three examples (fig. 13, XXIII-9, -18b, -21). The profile is once again gently curved, the collar softly turned out. The handles are placed on the upper part of the belly below the neck.

They are narrow and thick – one with a depression in its back. Possibly related to this group are fragments of two further jars (fig. 13, XXIII-9b, -19c), but on these specimens the handle has an atypical position being directly attached to the rim.

The last form possible to reconstruct is a tall, open bowl with convex sides and a thin rim. It is found in two versions: one very open with a handle(s) formed as a flat knop (fig. 13, XXIII-8), the second more closed with a vertical handle(s) (fig. 13, XXIII-17).

The remaining pieces of pottery are too fragmentary to illuminate more than general traits of this the early style on the islet.

*The pottery of the later phase* (figs. 14–15)

Pottery from the houses no.s VIII and XVI have the following general traits: the rim is often thickened, either rounded or with broad facets (fig. 10, middle and lower rows). However thin rims are still occuring. The collar is short and sharply turned out. The neck is narrow but generally wider than the base and might be marked by a ledge. The body has a tendency to be shaped like a pear turned upside-down. The handle is mostly x-shaped and sometimes facetted. Handles of the older style are however still occurring. They have their outset from the rim or just below on the neck. Ornaments are becoming more popular in this phase and though hatching on the brim still occurs it expands to the neck as plastic cordons either hatched or with finger imprints. The belly of the storage jars is often roughened by applying extra clay, by mounting small knops, by finger imprints or by scratches forming a network pattern. More elaborate decoration is found on the well-made single-handled vessels, where it is carried out in a delicate scratch technique and forms metopic, geometric patterns in narrow horizontal friezes. Compared to the earlier phase the general impression is that of continuity and gradual change of fashion, although differences occur. Only a few new forms are introduced.

Single-handled vessels and cups are known in a number of four (figs. 14–15). One of these (VIII-9) belongs to a special group of well made black vessels which are found scattered on the settlement and in the moats. The surface has been specially treated, so it has become smooth and shining. Due to a reduced firing the colour is black. The rim is wide and thickened with broad facets. The collar is softly turned out from a narrow neck which is indicated by a ledge. The belly is shaped like a pear turned upside down with a strongly concave lower part. On the specimen from house VIII the lower part is not totally preserved, but on other pots of the same type the base is very narrow, and on the shoulder of the vessel (between the neck and the belly maximum) a horizontal band of metope-like geometrical patterns is found. A strongly x-shaped and broad facetted handle usually connects the collar with the upper part of the belly. Counterparts to this pot are found in houses Vb, X, XI, in the village pond and in the moats. A very similar shaped vessel is known from the remaining materials of house VIII (VIII-1a). It differs, however, on two points: the ware is not black and smooth, and the neck is not marked. A further specimen (VIII-1b) from the latter house related to the same group has a quite atypically shaped body. From the fragments it appears to be almost hemispherical with a low, marked foot. These vessels represent a form that is rather hard to derive from the older material. However the cup XXIII-13b (fig. 11) and a few cups from the moats might be pointed out as the 'ancestors'. In the Borremose material the narrow, concave and tall foot is, however apparently confined to the younger phase. The same goes for the slender body, the tall, rather sharp shoulders and the short, sharply turned out rim.

The single-handled vessel left over (fig. 15, XVI-5) has a short, sharply turned out rim, slightly thickened, and facetted. The neck is narrow but wider than the base, the belly has a curved convex profile. The handle is x-shaped and placed just below the collar. From houses nos IX and XV similar vessels are known. This type can easily be derived from the small handled cup XXIII-3, the only major difference being the shape of the rim.

Well-done vessels without handle are only represented by a single specimen (XVI-6, fig. 15). This is a low pot with an almost spherical body and a round base. The broad rim is sharply turned out from the body and is slightly thickened. The surface of the vessel is smooth and red. Counterparts are rare but may be found on the islet. This form is another novelty in the material, the earlier forms being taller and more narrow (XXIII-31, fig. 12).

A small amphora-like jar with a tall, cylindric neck and only one handle (VIII-6a, fig. 14) could be interpreted as a miniature of a form which is occurring in full-scale on the floor of house 1b (I-26, fig. 16) and in the

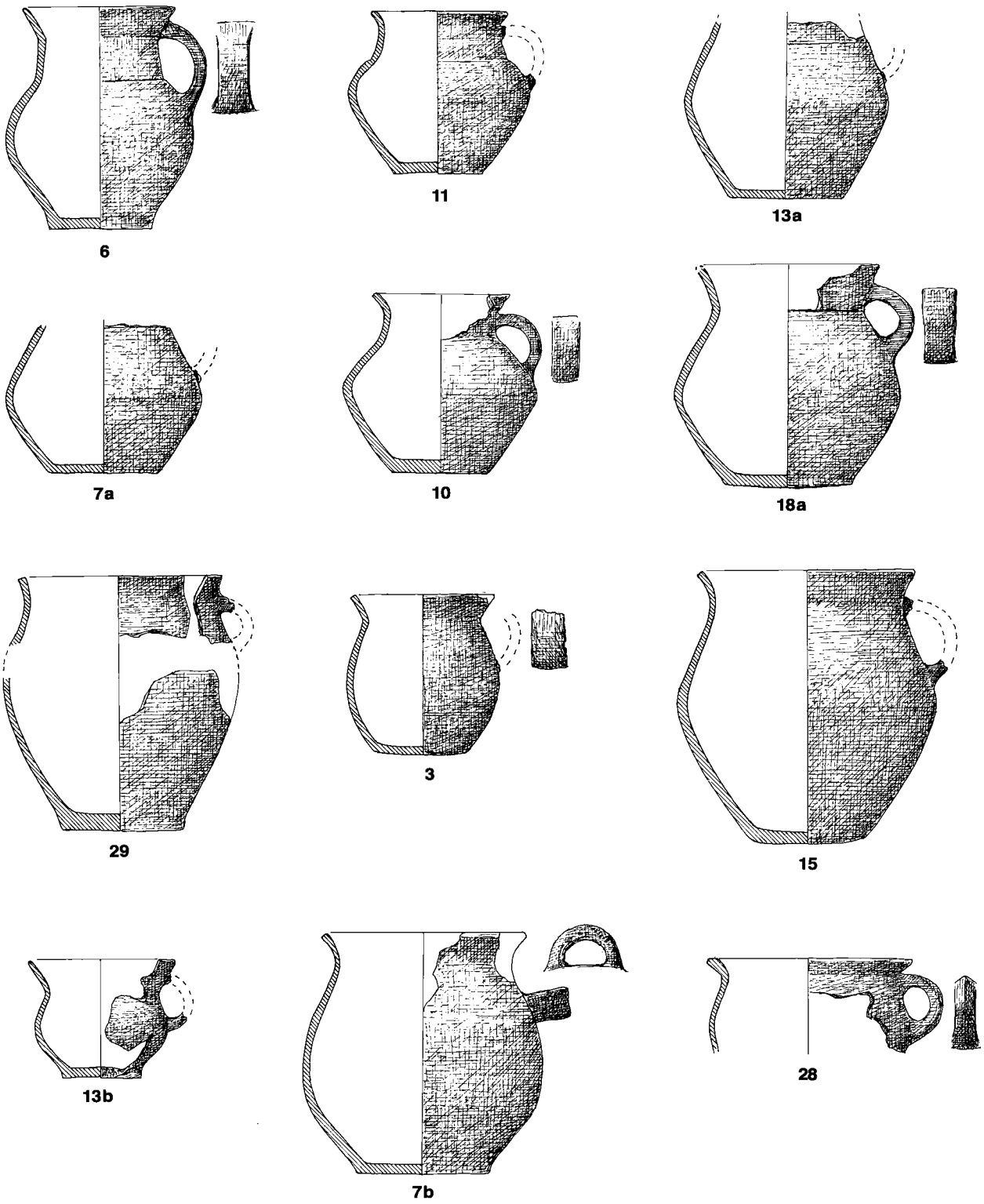


Fig. 11. Finds from the house no. XXIII; handle-cups and -vessel (H. Ørsnes *del.*). 1:4.

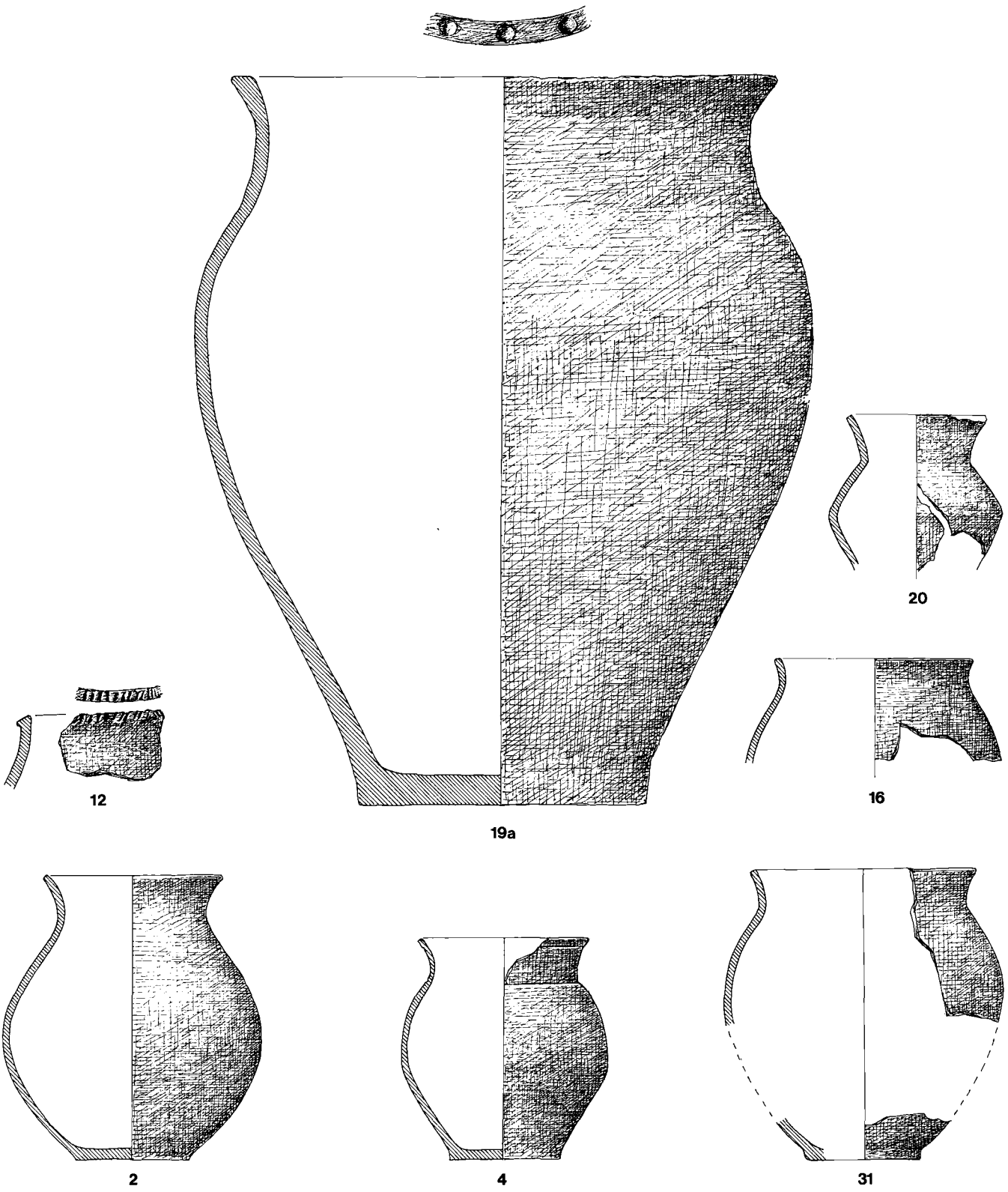


Fig. 12. Finds from house no. XXIII; storage jars and finer vessels (H. Ørsnes *del.*). 1:4.

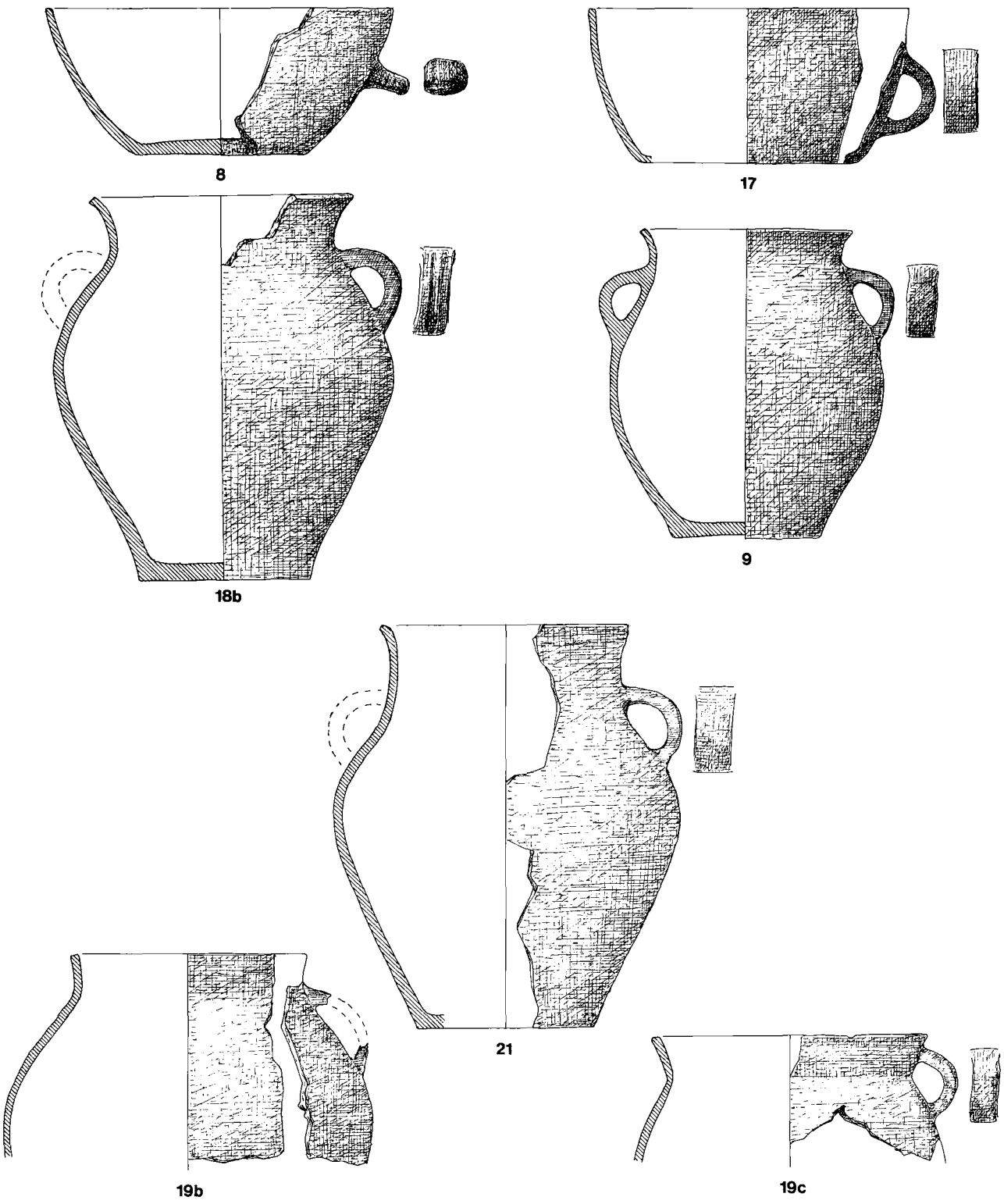


Fig. 13. Finds from house no. XXIII; bowls and handled jars (H. Ørsnes *del.*). 1:4.

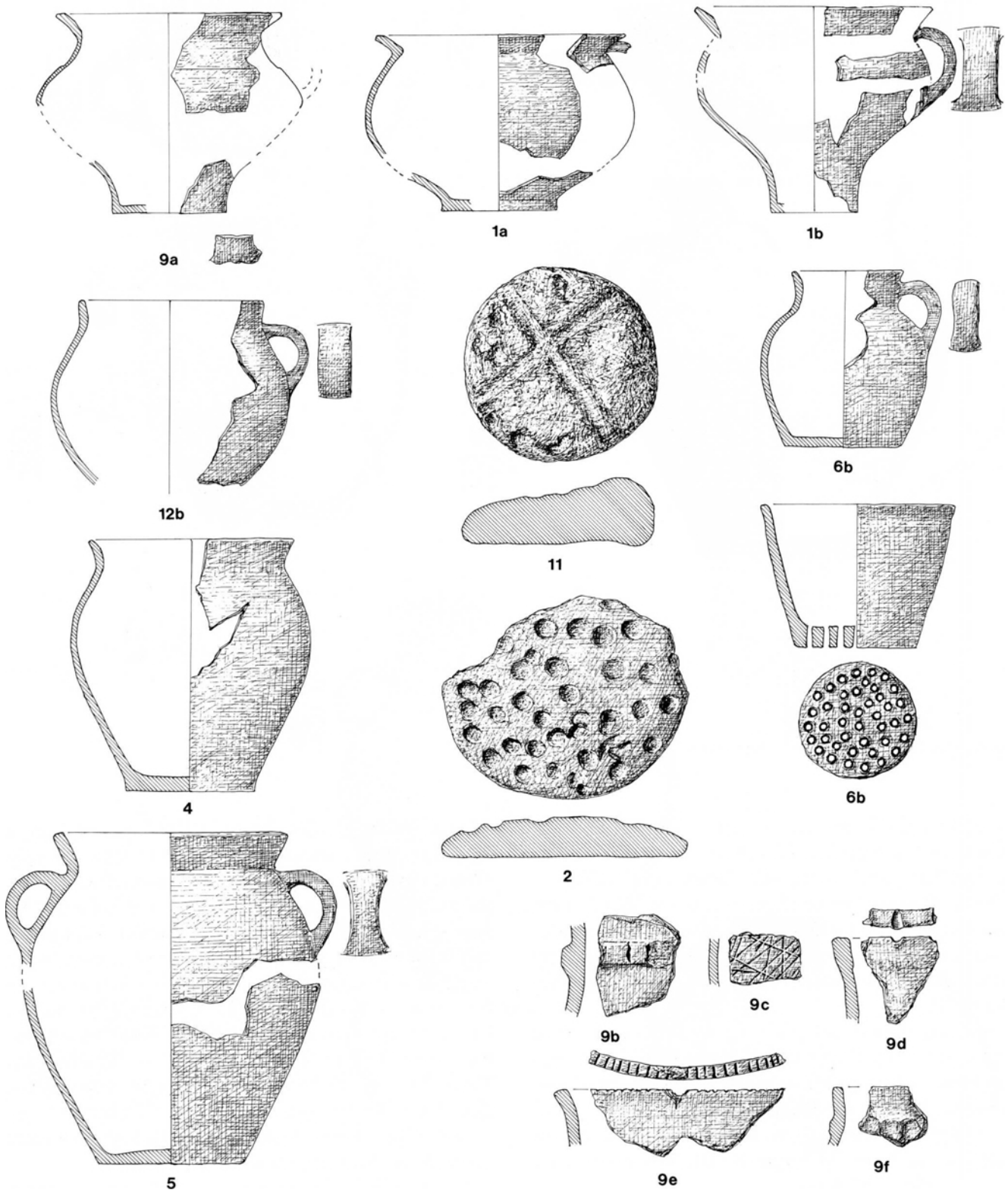


Fig. 14. Finds from house no. VIII (H. Ørsnes *del.*). 1:4.

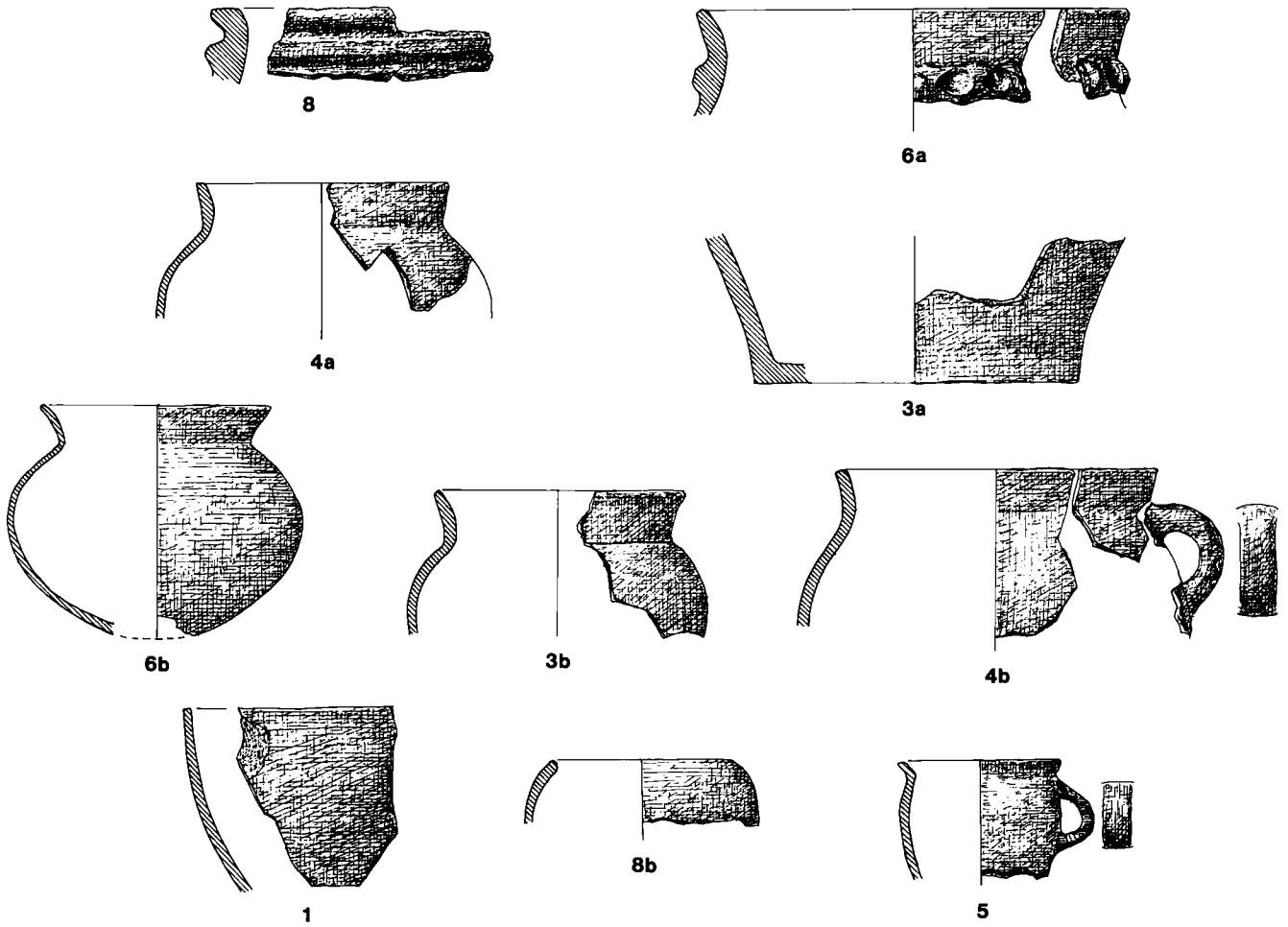


Fig. 15. Finds from house no. XVI (H. Ørsnes *del.*). 1:4.

materials from the moats. The highly placed shoulders constitute the broadest point of the body, the base is narrow. The profile of the belly below the shoulders is either a straight line or slightly concave. The handle connects the collar with the shoulder. It appears to be the later development of the jug-like handled vessel from the previous phase (XXIII-6 and S17-148/7, figs. 11 and 19).

Another special group are unhandled vessels with necks marked by a ledge (XVI-3b, fig. 15). Only the upper parts of the pots are preserved and show a low, rounded shoulder, a vertical, marked neck and a short rim which can be slightly thickened. Fragments of a similar pot is found in house XVIII. The type is not known in the early phase.

Storage jars possible to reconstruct only occur in the smaller version (VIII-4, XVI-4a). Unfortunately only a few of these are complete. The rim is short, sharply turned out and slightly thickened. The neck is narrow, the body is shaped like a pear turned upside-down. The base is not as wide as the mouth. The form is popular, and is found in several houses on the islet, even in the larger version (*e.g.* the two specimens sunken below the floor of house no. Ib, I-14 and -15, fig. 16). The latter is here only represented by fragments – but often with ornament in the way described above (i.e. XVI-6a + 8). These forms easily find their roots in the former phase (fig. 12), the difference again being that the late jars have a taller, more slender body with high shoulders and a short, sharply turned out rim.

Two-handled jars occur, but only fragmentarily (VIII-5, -3, XVI-4b). The mouth is wider than the foot,

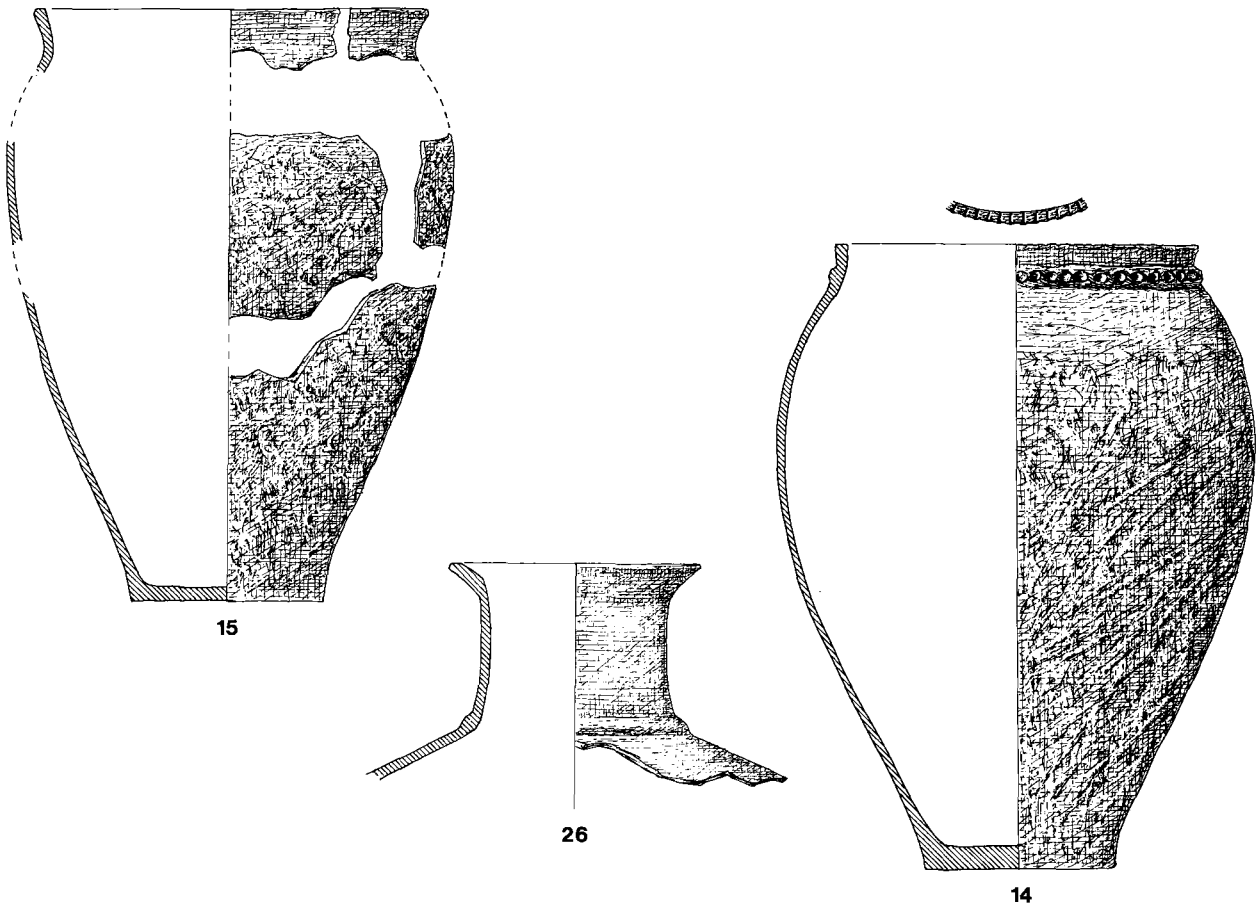


Fig. 16. An amphora and two sunken storage jars from house no. Ib (H. Ørsnes *del.*). 1:4, storage jars 1:8.

the collar being sharply turned out and slightly thickened. The neck is narrow, the shape of the body a little similar to an egg turned upside-down. The x-shaped handles are connecting the shoulders with the neck. This form is quite popular in the houses from this period. A familiar form, perhaps single-handled, has a shorter cylindric neck and rim (VIII-12a, -12b). Also this form has clear ancestors (fig. 13). The difference is again mainly the shaping of the rim and the handles.

Bowls are poorly represented in the two houses, but from other houses and the moats we have a type with straight sides, two-x-shaped handles and a large, concave base with a big central hole. Footed bowls with thickened rim also occur. Fragments of the former type are known from house XVI (XVI-1). Both types of bowls might be foretold from the two bowls of house XXIII (fig. 13).

Special forms are numerous, *i.a.* a sieve formed like a cup (VIII-6b), two ornamented plates (VIII-2, -11), and fragments of a cup with a thin rim turned inwards (XVI-8b). From house XVI we know about a firedog, but apparently it is lost. None of these forms have any counterparts in the earlier material.

### *A synchronization with the chronology of South and Central Jutland*

What remains is to date the two ceramic phases described above within the Pre-Roman Iron Age. In order to do this it is necessary to make a synchronization with the pottery chronology put forward by C. J. Becker for the southern and central parts of Jutland (Becker 1961).

The material from house XXIII does not in its tota-

lity fit in with his definition of per. I (Becker 1961, p. 203 ff.). However, some pots, like XXIII-21 (fig. 13), would, if not for the context, be ascribed to this period. In the other materials on the island such early traits are rather uncommon, but in the moats a few appear (see further below).

The general impression of the oldest phase has a lot in common with Becker's per. II (*ibid.* p. 224 ff.). This concerns the profile of the pot, the shaping of the rim and the handle, and the ornaments. Especially the single-handled cups and vessels find their equals for instance in the material from Gørding house III (*ibid.* pl. 72–74). The other types are less distinctly defined especially in relation to the pottery of per. I, but refering to their general traits they fit in with the just proposed dating.

The younger phase corresponds to Becker's per. IIIa (*ibid.* p. 232 ff.). This regards especially the general traits like the profile of the body, the shape of the rim and handle and the ornament style. The single-handled vessel or cup is once again the most significant type, when discussing the dating. Three of the examples easily find their equals in Becker 1961 fig. 205, 206 and 211. However, even the other types fit in with this dating finding counterparts many places in Southern Jutland.

Traits typical of Becker's per. IIIb do not occur in the materials either on the island or in the moats (*ibid.* p. 241 f.).

In conclusion the island has been settled from per. II to per. IIIa of the Pre-Roman Iron Age. The per. I traits in house no. XXIII suggests an early date in per. II – similar to the one Becker gives to the Gørding houses nos. II and III (*ibid.* pp. 90 f.). The sample of pots presented here is large enough to provide such a date but too small and too fragmentary to discuss local style deviation in comparison with the more southerly material. However, the moats contain so large an amount of vessels that this material might offer a key to the local chronology of Himmerland and its regional variation.

### *Comparison with the Early Iron Age Pottery of Himmerland*

Although Himmerland is one of the richest landscapes in Denmark, when speaking of the Early Iron Age, and was the scene of many of the earliest settlement excavations, little is published concerning its pottery. We only get an impression of it indirectly through the publications by Gudmund Hatt. Even in recent years only a few works have been published on ceramics from this region and they mainly concern the late Bronze Age and the transition to the Early Iron Age. In the following we are thus confined to scattered illustrations in works dealing with other problems.

Pottery corresponding to the early phase of Borremose is not so uncommon in Himmerland as it seems judging from literature. The majority of the material derives from refuse pits without connections to village structures and this might explain why so little has been published so far. Settlement material is not too well known either, but Gudmund Hatt (1938a fig. 111) and Jens N. Nielsen (1980 fig. 13) published a few fragments from Malle Degnegård. To this come some pots from a settlement near Gedsted (Bro-Jørgensen 1973 fig. 6–7). Further materials deriving from a settlement at Nørregård, Skals Parish, have recently been published (Mikkelsen 1987 pp. 289–91). To this must be added two pots from the Celtic field system at Vindblæs Heath (Hatt 1931 fig. 17).

Handled cups are published from Gedsted and Nørregård. These specimens represent both the type with a marked conical neck like XXIII-11 and the more simple ones like XXIII-13b. In the Nørregård material a jug-like vessel is found corresponding to XXIII-6 (fig. 11) and S17-148/7 (fig. 19). This might prove to be a local type confined to Himmerland or even the southwestern parts of this landscape. Storage jars are less well known. A specimen from Malle Degnegård (Hatt 1938a fig. 111) is however quite close to the jar from house XXIII (XXIII-19a). The two handled jars from Vindblæs Heath (Hatt 1931 fig. 17) resemble very closely several specimens from Borremose – among those published here especially XXIII-9 and -21a. To conclude the early Borremose phase appears to be fitting very well into the general view of the period in the landscape.

The later phase is represented rather well by finds from the village at Skørbæk Hede (Hatt 1938a fig. 18+28) i.e. houses nos. G and H. The materials from Malle Degnegård house P appear to be in the later per. IIIb/IV style, judging from the photo (Nielsen 1980 fig. 14). Typical specimens were found in two wells from the raised bog Lille Vildmose in eastern Himmerland (Marseen 1956 fig. 5), whereas the pots from Nørregård belonging to this phase are quite atypical (Mikkelsen 1987 p. 290). However, again the rather poor material that has been published certainly does not correspond

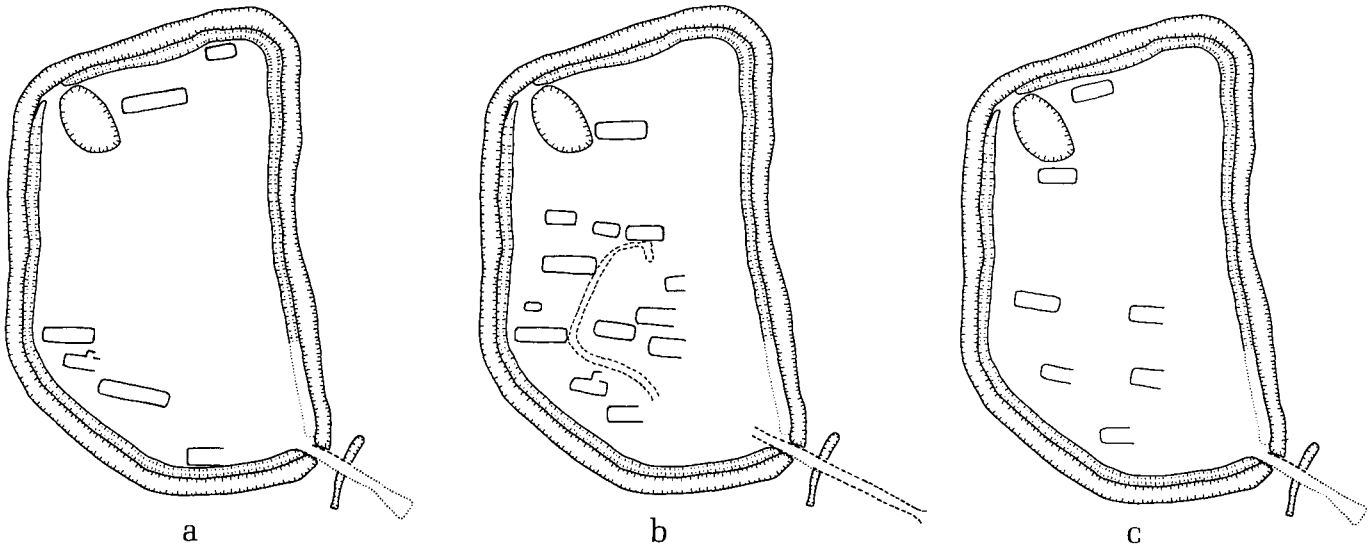


Fig. 17. Plan of the settlement according to ceramic phase, a) early, b) late, c) undeterminable.

to the amount that has been found. In this period the area was densely populated, and ceramics form the dominant type of artifact in the settlement material.

Handled cups of the specially treated kind like VIII-9 are found in Skørbæk Hede house G and H (Hatt 1938a fig. 28b and c). The type from house XVI (XVI-5) is less convincingly parallelled by a cup from Skørbæk house H (*ibid.* fig. 19) and Lille Vildmose (Marseen 1956, fig. 5). On the other hand the storage jar (fig. 16 I-14) is matched by a specimen from Skørbæk house H (Hatt 1938a fig. 18a), and the same goes for the two-handled jars (VIII-5) that find almost identical counterparts in Lille Vildmose (Marseen *op.cit.*) and Skørbæk house H (Hatt *op.cit.*). On the base of this scattered material there seems to be no basis for discussing local style. The most important result from this analysis is the negative statement that decoration on the pottery here is as rare as further south in Jutland thus leaving the more richly decorated Kraghede-group with its many special forms as a purely Vendsyssel phenomenon (Klindt-Jensen 1950, Becker 1980).

## THE HISTORY OF THE BORREMOSE SETTLEMENT

On the base of a pottery chronology one can determine the relative dating of a settlement feature, but it is impossible to give it an absolute date and to prove what is contemporaneous in the ultimate sense of the word. For such a purpose constructions like the fences in Hodde would be needed, but nothing of that kind has been recorded from this settlement. From our material we can only state which buildings exclude others, otherwise we are confined to the ceramic datings. Even these are not always too trustworthy, as one can discuss the way the pottery is related to the feature in question. In spite of these objections we shall make an attempt at describing the development of the settlement.

The older phase of the village includes houses nos. Ia, Va, XXIa+b, XXIII and XXIV. More doubtful are VIIa and IXa whose extensions are unknown. The buildings seem to follow the shape of the fortification leaving an open space in the center (fig. 17a). The younger phase includes the houses nos. Ib, III, Vb, VIIb, VIII, XIb, XI, XII, XIV, XV, XVI and XXa+b. The village plan is more closed now, leaving the north end of the islet almost uninhabited. Meanwhile the "central square" has become occupied (fig. 17b). The site of house XVII fits in with this village plan and is therefore suggested on the plan. The remaining houses show traits from both phases which can be due to mixed materials or perhaps a medium phase. These sites (houses nos. Ib, II, IVa+b, VI, IXb, X, XIII, XVb, XVIII and XXII) and two houses without materials are suggested on the last plan showing up a plan that is resembling the early village (fig. 17c).

Conclusions based on this cannot be far reaching, but one thing seems to be certain: the village has been re-

structured in the later phase, when the center of the islet is becoming occupied, creating a dense settlement to the south, leaving the north-end almost deserted. Most likely the village street is from this period. Comparing the village plan with other totally excavated sites from the same period it resembles the Grøntoft type (Becker 1965, 1982) rather than the Hodde type. The layout may, however, be determined by the restricted space on the islet.

## THE HISTORY AND DATING OF THE FORTIFICATIONS

The find of about 11 pots in the moat at the northwest corner of the islet has been ascribed great importance for the dating of the moats (figs. 18–19). According to the excavators the pots were put down on the very bottom of the moat as a ritual deposit made just after finishing the construction of the stronghold (1).

The general traits – thin brim, broad collar, wide and flat or narrow and thick handle with parallel sides and a softly curved profile – seem to correspond to the pottery from the older phase on the islet. Especially among the numerous single-handled cups and vessels there are specimens that are almost identical. The jug-like vessels (XXIII-6 and S17/148-7) have been mentioned above. The two-handled jars are not identical but the shape of their body is closer to those of the earlier phase (*e.g.* s17/148-11 and XXIII-18b) than the one of the later phase. Fragments of a small storage jar (S17-148/10) can be compared to XXIII-16. However, this form is not one of the types that provide an unquestionable date, as it could be compared to VIII-4 as well, but the shaping of the rim seems to support the early date.

The last form represented – a simple storage jar with three circular knops on the shoulder (S17-148/9a) – has no counterpart in the material from the settlement. According to Becker this ornament should be typical for the Late Bronze Age and per. I of the Pre-Roman Iron Age (1961 p. 245, pl. 49-f). Although it is an indication of an earlier date, further analysis is needed. It would not be justifiable to redate the settlement or the moats on the basis of just this one pot. However, it supports the early per. II date provided by parts of the material in house XXIII.

Fig. 18. The ritual deposit in the north-east corner of the moat, seen from the north.

### *The 'lake'*

The part of the complex remaining to be dated is the peat cut that was supposed to have created an open water around the fortification. As mentioned above, the geologists used a wooden "bayonet" as argument for dating this great undertaking to the phase of the bottom layer in the moats. Then it meant "before the village", now it should mean "during the early phase of the village". However, the reason why the wooden objects are confined to the lower layers of the moats can be several. The most obvious explanation is that the condition for preservation was better here, since it was still under water, whereas the upper levels could dry up during dry seasons. Thus it would be very uncertain to base a dating on wooden objects using the position of the finds from the moats as an argument. It would be more natural to use the pottery collected from the bottom of the peat cuts.

In 1951 Alfred Andersen made an additional dig in

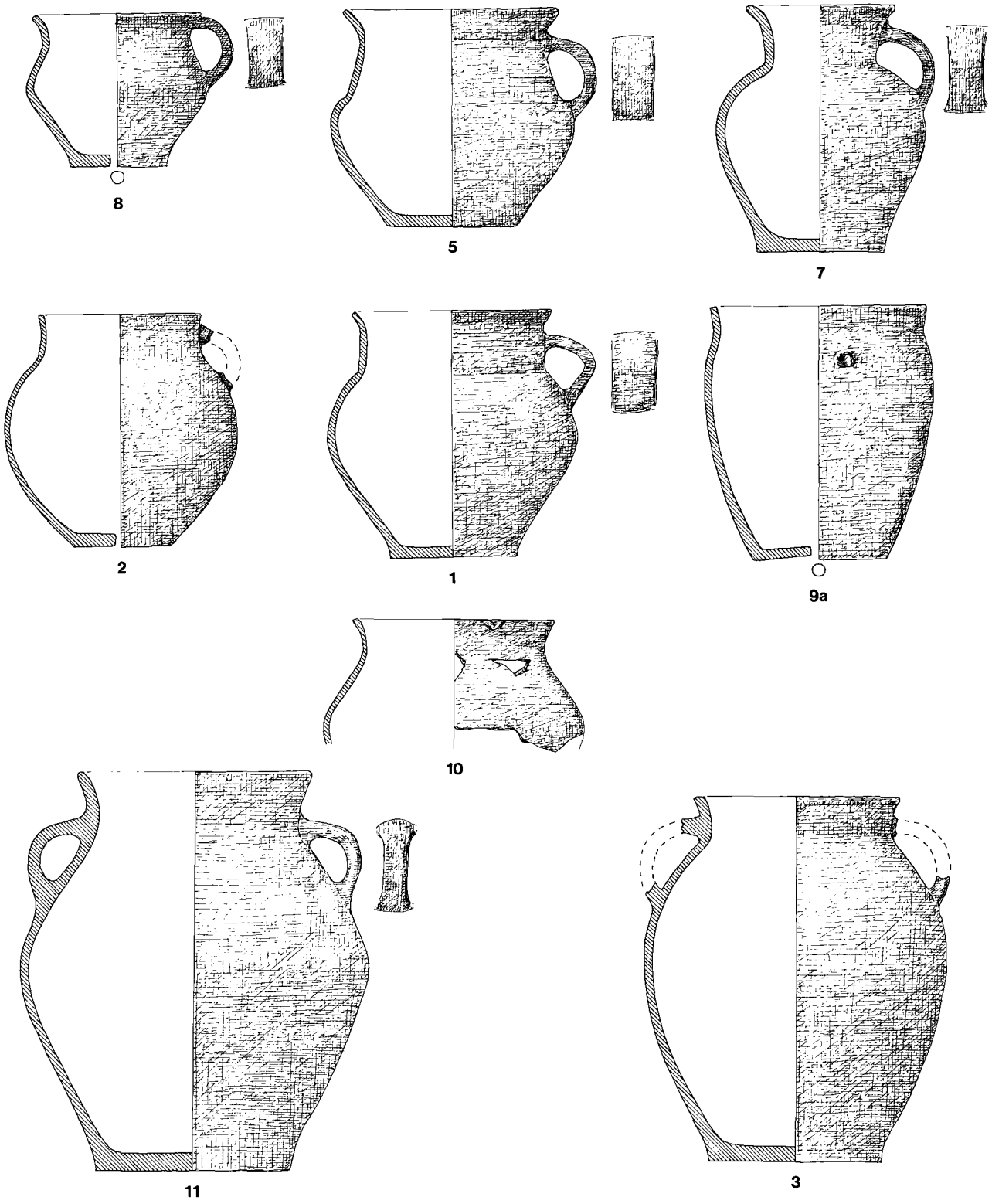


Fig. 19. Pottery from the ritual deposit in the north-east corner of the moat (H. Ørsnes *del.*). 1:4.

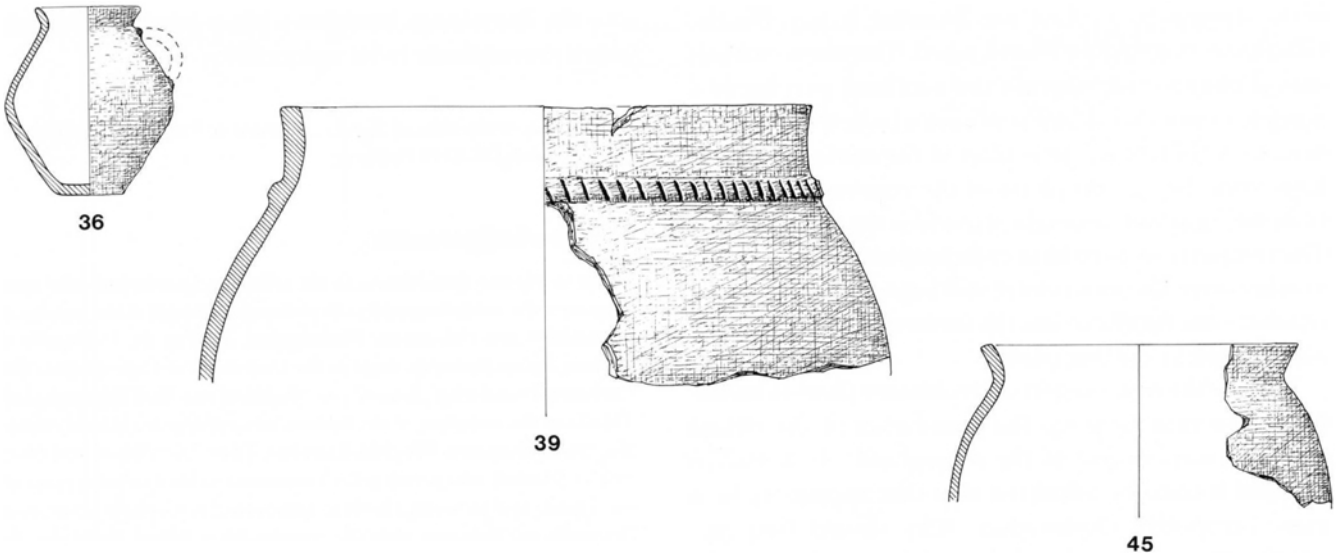


Fig. 20. Finds from the ritual deposit in the bog (H. Ørsnes *del.*). 1:4.

the bog and hit by accident a spot with a minor concentration of potsherds (fig. 20). The area was excavated very carefully and was by the investigator interpreted as a ritual site (Andersen 1977 p. 106 f.). This interpretation might seem a little too extensive when considering the material including just a few fragments of pots, some birch bark and an ox horn. After all, the place is close to a settlement and the finds could well be waste from this site. Three vessels could be partially reconstructed from the finds: The handled cup (B2-36) has a rim and a profile that strongly reminds us the younger phase on the island. The rim of a storage jar (B2-39) with a hatched plastic cordon on the neck supports this impression. The remaining fragments (B2-45) derive from a vessel of the type of small storage jars that could be dated to both phases.

From an earlier geological excavation in the bog derives a thickened, broadly facetted brim and the fragments of a black, smooth single handled vessel with similar outline of the rim (not illustrated here). Also these sherds point to the later phase of the settlement. If the lake or peat cut was dug in the early village period, we should expect to find waste on the lowered surface from that time as well, but this is not the case. In conclusion, it seems, we have to accept that the lake – if any – was created in the late village period. However, we still lack proof that there was a lake and that it surrounded the island.

A further point is the sand horizon which the geologists found in the bog some centimeters above the 'lake bottom'. The investigators related it provisionally to the intermission phase contemporary with the sand layers in the moat and interpreted it as a result of sand drift from the collapsing ramparts of the deserted stronghold. However, no artifacts have been found above this line, whereas several pieces of pottery of the late village style have been related to the layers below it. Besides the line is dated by C-14 to a time that must be later than the settlement. This confirms the above suggested date of the peat cut. As the archaeologists mention that the village was covered by a layer of drifting sand, it would be logical to relate the sand horizon to the same event, *i.e.* after the termination of the settlement. This date seems to be confirmed by other observations in the area suggesting a sandstorm around the birth of Christ (St. Borremose, Andersen 1977 p. 103 + pl. 1, Tholstrup, Hatt 1928 p. 248 and Mogens Hansen 1982 p. 255).

## CONCLUSION

As it appears from what has been said above, we have to rewrite the history of the Borremose settlement. Early in Becker's per. II a road was made of pebbles leading out to a dry hill in the swampy forest covering Borremose. Around the elevation moats were dug and ramparts erected from the soil deriving from these. In the center

of the stronghold a village was founded. In per. IIIa the village was thoroughly restructured. The north end was almost abandoned, whereas the southern part became densely populated. The street seems to be from this period, as it follows the new plan of the settlement. Perhaps even the second phase of the causeway is dating from this time as it strongly resembles the village street. The ramparts seem to have collapsed in some parts, but in other areas the moats were still kept open. In order to reinforce the fortifications the forest was cut and a lake was created by cutting peat.

Thus in the new version of the history there is no difference in time between the foundation of the village and the construction of the stronghold. As a second thought it must be admitted that this appears to be a more acceptable explanation: Why should Iron Age people choose a spot like a deserted stronghold in the middle of a bog for the purpose of founding a normal, peacetime village? There are several places in the surroundings that are much better suited for this!

## PERSPECTIVES FOR FUTURE WORK

Several questions remain unanswered. Some of them are due to the material being so large that much further work is needed. This concerns especially the materials from the moats. The sample of pottery deriving from these is so large that it can become of great importance for the understanding of regional variation in pottery style in the Middle and Late Pre-Roman Iron Age. Besides the large amount of wooden objects here left unmentioned may provide new insight in a still badly illuminated part of the Pre-Roman world.

The possibilities for carrying out new excavations at the site are, however, more important for the interpretation of the settlement. Many questions remain unanswered due to the excavation techniques of those times. Was there room for cattle in the houses? Were there fences on the site offering a possibility to decide what is contemporary? How were the fortifications constructed? Today there is no information at all available on this subject. Did the lake encircle the islet or did the geologists just by chance hit a prehistoric peat cut? These questions are of importance for understanding the nature of the site. Was it a stronghold or an ordinary village just extraordinarily situated? Only further investigations on the site can answer these questions and give the Borremose complex a place in our prehistory which corresponds to its uniqueness.

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## NOTE

The interpretation of this find as a ritual deposit has been strongly rejected by Becker (personal communication). He argues that such a deposit could not have been so well preserved, if it had been placed in open water and slowly covered with mud. He suggests that it is more likely that the pots, if they are to be considered as one single deposit, were dug down into the mud after a period of use.

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# *Rye in Viking Age Denmark: New Information from Øster Aalum, North Jutland*

by PETER ROWLEY-CONWY

## INTRODUCTION

The discipline of archaeobotany was first put onto a scientific basis in Denmark through the work of pioneers such as Hans Helbæk and Knud Jessen, and much work has been done within Danish archaeology to elucidate the history of crop plants. Nevertheless, samples of charred grain from the Viking Period are very rare, and the crops and agricultural practices of the period remain little known. The author was therefore very fortunate to be able to study the sample from Øster Aalum in order to contribute to an understanding of the agriculture of the period.

## THE ARCHAEOLOGICAL CONTEXT
by David Liversage

The site lies on the present west coast of Denmark where there is severe erosion just north of the Limfjord (fig. 1). In Viking times the North Sea undoubtedly lay some kilometers away, and the nearest water was the lake of Fladesø, deposits from the floor of which outcrop on the beach close south of the site. At the time of settlement there was only a very thin layer of blown sand, but now the site is sealed under several meters of dunes. The name "Øster Aalum" is an artificial one, being taken from the Nørre Aalum shown about a kilometer westwards on the eighteenth century Videnskabernes Selskab map.

The sample was recovered from a flat-bottomed pit about 3 m across and 25 cm deep. A photograph of a section through it is shown in fig. 2. It may originally have been a pit house or sunken shed of a kind common in later Iron Age contexts, but owing to the limited nature of the excavation its character is not known with certainty. There was, however, an agricultural settlement as several postholes, a hearth, an old ploughsoil, a field embankment and drainage ditches were observed. The pit fill was wind-deposited and must have formed after the supposed shed had been pulled down. It appeared in section as close irregular lenses of black-olive-brown, and reddish sand. Mixed throughout was a considerable quantity of charcoal, largely in the form of stems of heath plants, but also containing many charred cereal grains and other seeds. Examination showed about three quarters of the charcoal to consist of these stems. Somewhat over 10% was other wood charcoal, and rather under 10% consisted of charred cereal grains and other seeds. It should be emphasised that the charcoal was not from a primary deposit, where it would have formed a compact layer, but was a secondary deposit spread evenly through the whole 25 cm or so of streaky fill.

A few buckets of fill were water-sieved during the excavation, using a sieve with mesh size of about 1.5 mm, until it was thought that a sufficient sample had been collected. This mesh was coarser than ideal, and some small weed seeds were probably lost. If an exact record

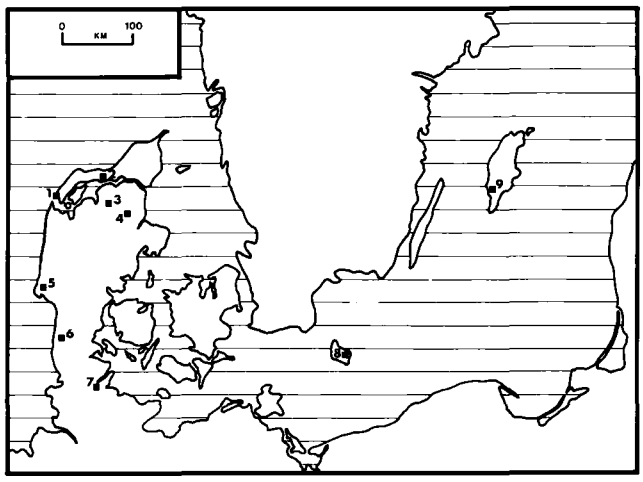


Fig. 1. Map showing locations of sites mentioned in the text. 1: Øster Aalum; 2: Aggersborg; 3: Østerbølle; 4: Fyrkat; 5: Oxbøl; 6: Drengsted; 7: Haithabu; 8: Sorte Muld; 9: Vallhagar.

had been kept of the amount of sand put through the sieve it would have been possible to calculate both the average number of grains in a liter sand and the expected total grain content of the pit. Even as it is it is possible to estimate that the average number of grains in a liter of fill was approximately 150–200, and that the pit held altogether a total of 4–10 liters of grain.

The excavator's opinion is that the grain is present in such quantity that it can only derive from a carbonized store (of which only a small part of course ended up blown into the pit). A hypothesis that seems to fit the observations is that a sod-built structure burned down and collapsed in such a way that the grain stored in it and the heather and other plants in the sods of which it was built were enclosed in the collapse and carbonized rather than totally burned away. It may be supposed that the ruin was later eroded by the wind, and some of its sand and charcoal ended up in a nearby depression. Such erosion is easily envisaged in an area of dune sand!

The result would be the deposition of exactly the mixture of black and red sand, carbonized heather stems, and cereal grains that was found. It is therefore important to remember that it is a secondary deposit, and it cannot be assumed that all the charcoal had a single source, and indeed it seems likely that there were secondary sources as well as the main one. This might apply particularly to the many *Chenopodium album* seeds, and it would be unwise to regard the full weed spectrum as necessarily belonging to the crop: but owing to the large number and high concentration of grains it may fairly safely be assumed that a burned store came somewhere into the picture as the main source.

A sample of the carbonized grain has given a radiocarbon date of 750 ad ± 70, or A.D. 780–855 calibrated (K-4642).

## THE SAMPLE

Approximately 0.75 litres of charred material was sent to the author. This consisted mainly of charcoal fragments and pieces of plant material such as small twigs etc. The sample was coned, and one quarter selected for further analysis. This was sorted, yielding 669 cereal grains or fragments of grains, and 259 weed seeds. These are listed by species in table 1.

Preservation of the material was generally poor. Individual cereal grains were sometimes well preserved,

| | | |
|---|---|---|
| Rye, *Secale cereale* | | 203 |
| Barley, *Hordeum vulgare*, | hulled | 24 |
| | indeterminate | 82 |
| Oats, *Avena* sp. | | 16 |
| Wheat, ?*Triticum* sp. (uncertain identification) | | 3 |
| Total identified cereals | | 328 |
| Unidentified cereals | | 341 |
| Total cereals | | 669 |
| *Chenopodium album* | | 177 |
| *Polygonum persicaria* | | 17 |
| *Rumex* sp. | | 1 |
| *Empetrum* sp. | | 10 |
| *Silene noctiflora* | | 2 |
| *Bromus* sp. | | 8 |
| Gramineae indet. | | 2 |
| *Galeopsis tetrahit* | | 2 |
| *Carex* eg *curta* | | 14 |
| *Carex* sp. (smaller seeded) | | 15 |
| *Carex* sp. (larger seeded) | | 11 |
| Total weeds | | 259 |

Table 1. Charred plant remains from Øster Aalum.

A. Rye, *Secale cereale* (N = 50)
length 4.7 mm, standard deviation ±0.6 mm (range 3.7 – 6.2 mm)
breadth 2.35 mm, standard deviation ±0.3 mm (range 1.7 – 3.1 mm)
thickness 2.1 mm, standard deviation ±0.3 mm (range 1.5 – 2.8 mm)

B. Hulled Barley, *Hordeum vulgare* (N = 21)
length 6.1 mm, standard deviation ±0.7 mm (range 4.9 – 7.5 mm)
breadth 3.3 mm, standard deviation ±0.4 mm (range 2.2 – 4.3 mm)
thickness 2.6 mm, standard deviation ±0.4 mm (range 1.8 – 3.3 mm)

Table 2. Dimensions of the Øster Aalum seeds.

but many had been much distorted during charring and heavily eroded subsequently. Identification was limited to grains which were more or less complete. This accounts for the fact that only 328 (49%) of the 669 cereal grains were identified.

Of the 106 barley grains, 24 were definitely hulled. The remaining 82 were undiagnostic in this respect, and so could have been hulled or naked. No definitely naked grains were seen, however, and traces of the hulls may very easily disappear from the grains especially when preservation is poor. It is therefore quite possible that the entire sample may originally have been hulled. The presence of numerous twisted, assymetrical grains indicates the six row variety. Measurements are given in table 2 and fig. 3.

Grains of rye were approximately twice as common as barley in the sample, and showed the typical dimorphic morphology of the species. Some grains were long, narrow and slightly curved, others shorter, more squat and straight. Measurements are given in table 2 and fig. 3.

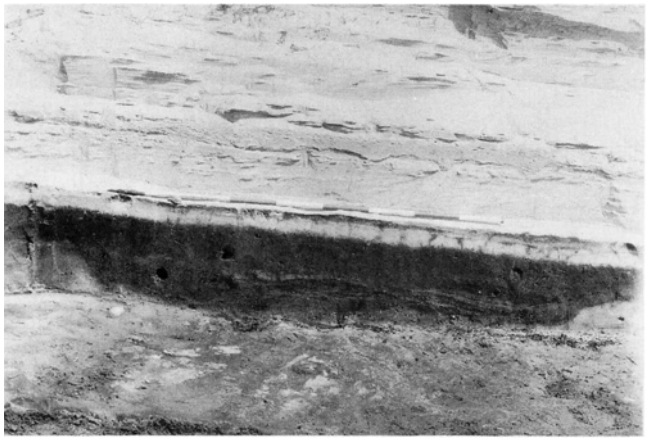

Fig. 2. Øster Aalum. Section through the pit with the grain. The grain came from the streaky lower half of the black layer. The upper half is the homoneneous old ploughsoil sealing the pit. Photo D. Liversage.

Oats were relatively rare. In the absence of the rachilla and lemma base, it could not be determined whether the grains were of cultivated or wild type.

Three grains are tentatively referred to wheat in table 1. These are very doubtful identifications, all the grains being distorted and eroded. They are included to make the point that the presence of the species cannot be excluded – particularly in view of the large proportion of unidentified grains.

These identifications present a similar picture to that from impressions in pottery from various sites examined by Sarauw in the last century (listed in Hatt 1937), and added to by Helbæk (listed in Jessen 1954).

The presence of numerous weed seeds is typical of many samples of charred plant remains from the Late Bronze Age and later periods in Denmark. The seeds of *Chenopodium album* were definitely charred, and were therefore not recent intrusions into the deposits. They were identified to species by comparison with the drawings of the sculpturing of the testa of various species given by Clapham, Tutin and Warburg (1962, fig. 36). Nutlets of *Carex* are often difficult to identify to species. Those listed as *Carex* eg *curta* could very well be of that species. The small seeded *Carex* sp. examples are similar to such species as *C. distans, C. hostiana* and *C. lepidocarpa*, and might be from these or another similar species. The other nutlets listed as *Carex* sp. are morphologically similar but larger, and could likewise be from a variety of species.

## COMPARISON WITH OTHER SITES

Few samples of crop plants are available from southern Scandinavia from the 1st millennium AD. Many of these are discussed by Helbæk (1970, 1974). The earliest find of rye in Denmark is from Østerbølle, dating from the 1st century AD; rye amounted to about 0.1% of the total cereals, and Helbæk concluded that rye was not grown as a separate crop, but appeared only as a weed in barley. The seeds were very small (fig. 4). From the 6th century AD, two samples are available from Denmark: at Oxbøl, rye amounted to 0.5% of the cereals (Helbæk 1958a, 1970), while at Sorte Muld on the island of Bornholm it formed 3% (see fig. 1 for the locations of sites discussed in the text). Rye was apparently still only a weed of cultivation. The grains from Oxbøl and Sorte Muld are, however, rather larger than those from Østerbølle, indicating that the plant "had adapted to the climate and soil« (Helbæk 1970, 284, my translation).

The first evidence for the separate cultivation of rye in Denmark comes from Drengsted, dating to the 3rd century AD. Mixed samples of straw, roots, leaf blades, internodes and grains indicated that »rye plants were pulled up by the handful« (Helbæk 1974, 14), apparently for use in connection with the iron smelters on the site. The sample is small, but the seeds correspond in size to those from Østerbølle; Helbæk concludes that »although it was grown separately, it was not an established and respected crop at Drengsted. Possibly it was grown as an experiment with a foreign bread corn recently introduced from the south" (Helbæk 1974, 15).

In Denmark, rye first becomes important in the Viking period. Apart from Øster Aalum, two samples are known. One comes from the village underlying the Viking fortress at Aggersborg. This was recovered from a series of pits, and consisted of a mixture of barley and rye, with a trace of oats, rye amounting to 31%; many weeds were also present (Jessen 1954). From the Viking fortress of Fyrkat came a very different sample. This consisted of some 70,000 grains of rye recovered from a burnt building. There was a very slight admixture of hulled barley (0.15%), and a small number of weed seeds (Helbæk 1970, 1974).

This is a very small number of samples upon which to base conclusions. Under modern sampling strategies, each settlement may be expected to produce tens or hundreds of samples of plant remains, and yet only

seven samples (including that from Øster Aalum) are available from Denmark from the whole of the 1st millennium AD. This may be compared with the nine major samples of rye from the single site of Haithabu in northern Germany dating from the Viking period, where rye was second in importance to barley (Behre 1983).

Nevertheless, Helbæk pointed to a number of peculiar features of the sample from Fyrkat: (a) mean grain size is considerably larger than in any of the other Danish samples (fig. 4); (b) the find is remarkably pure, containing very few other items (111 barley and 280 weed seeds in about 70,000 rye grains); (c) among the weeds are a number of species not recorded from Denmark before (Helbæk 1970, 1974). Helbæk argued that the immediate environment of the sites could not explain this: if anything, the area round Fyrkat is less suitable for rye cultivation than that round Aggersborg, and yet the Fyrkat rye is much superior. The status of Fyrkat as a fortress is important in this connection. Aggersborg, a village, would see consumption of a locally produced crop, while the inhabitants of Fyrkat (argued Helbæk) would not be cultivating but *importing* crops, not necessarily grown locally. Concerning the peculiarities of the Fyrkat sample, Helbæk concludes:

"Two conditions must apparently be met before such a result can be achieved: a) a high agronomic level, with each cereal cultivated separately, carefully weeded, and carefully kept separate after threshing; b) a systematically organised trade, where the purchaser made high demands on the producers of a wide area, so that the purchaser could as a result buy a standard pure product of the quality he was prepared to pay for.

None of these conditions are likely to have been met in Denmark during the Viking period or for a long period into the Middle Ages" (Helbæk 1970, 289, my translation).

"Only one thing can be taken as given without further consideration: *[the Fyrkat rye] was not cultivated on Danish soil"* (ibid., 290, my translation, added emphasis).

Helbæk concluded that the sample represented a crop carried home from a Viking foray into eastern Europe, perhaps the Dvina or Dniepr region, because rye of the right size is known in these regions at this time (Helbæk 1970, 1974).

## ØSTER AALUM AND FYRKAT: THE IMPORT HYPOTHESIS RECONSIDERED

It is clear from the foregoing comparisons that the Øster Aalum sample resembles that from Aggersborg in (a) mean size of the rye grains (fig. 4), (b) the admixture of barley, and (c) the presence of a relatively large number of weed seeds. Fyrkat is clearly distinct from both sites in these respects.

It is open to question whether these are sufficient grounds to assume a long-distance import of the Fyrkat sample, however. Recent work suggests a simpler explanation, which will be examined here.

This recent work has taken place in the field of ethnographic study of crop husbandry and processing. Recent studies make clear the fact that each crop goes through a series of threshing, winnowing and cleaning processes between harvest and consumption. At various points in this sequence, the composition of the crop is significantly altered. Residues and products from various stages in the sequence may be recognized in the archaeological record (Hillman 1981, 1984; Jones 1984).

The stages of the process relevant to this discussion occur quite late in the sequence. Stages 12 and 13 in Hillman's model involve fine sieving the crop; this occurs after threshing, winnowing and coarse sieving (Hillman 1981 figs. 5–7, 1984 figs. 2–4). During fine sieving, prime (i.e. larger) cereal grains stay in the sieve, together with any larger weed seeds. Tail (i.e. small) cereal grains and most weed seeds pass through the sieve. These are sometimes stored for animal fodder or human famine food; ethnographic observations reveal another possible fate, however:

"But when – as in wet climates – cleaning with sieves is undertaken in small batches, especially in winter when fires are burning in the hearths, it is usual for the waste from the later sievings... to be tossed straight into the fire. Here, many of the denser items will trickle down into the ashes and char. It is not surprising, therefore, that the type of charred remains most commonly recovered from sites where wide-ranging sampling strategies have been applied consists – in the case of Iron Age and Roman sites at least – of smaller weed seeds, tail grains, glume bases and the occasional straw node, i.e. precisely those components generally separated from the prime grain in step 12..."

(Hillman 1981, 155–156)

The two products can thus be distinguished in the archaeological record. Thorough fine sieving would theoretically remove all grains below a certain size, while leaving only grains larger than this. In normal practice, however, sieving is rarely so thorough, and many of the smaller grains will remain in the sieve, although these will be fewer than the larger grains that

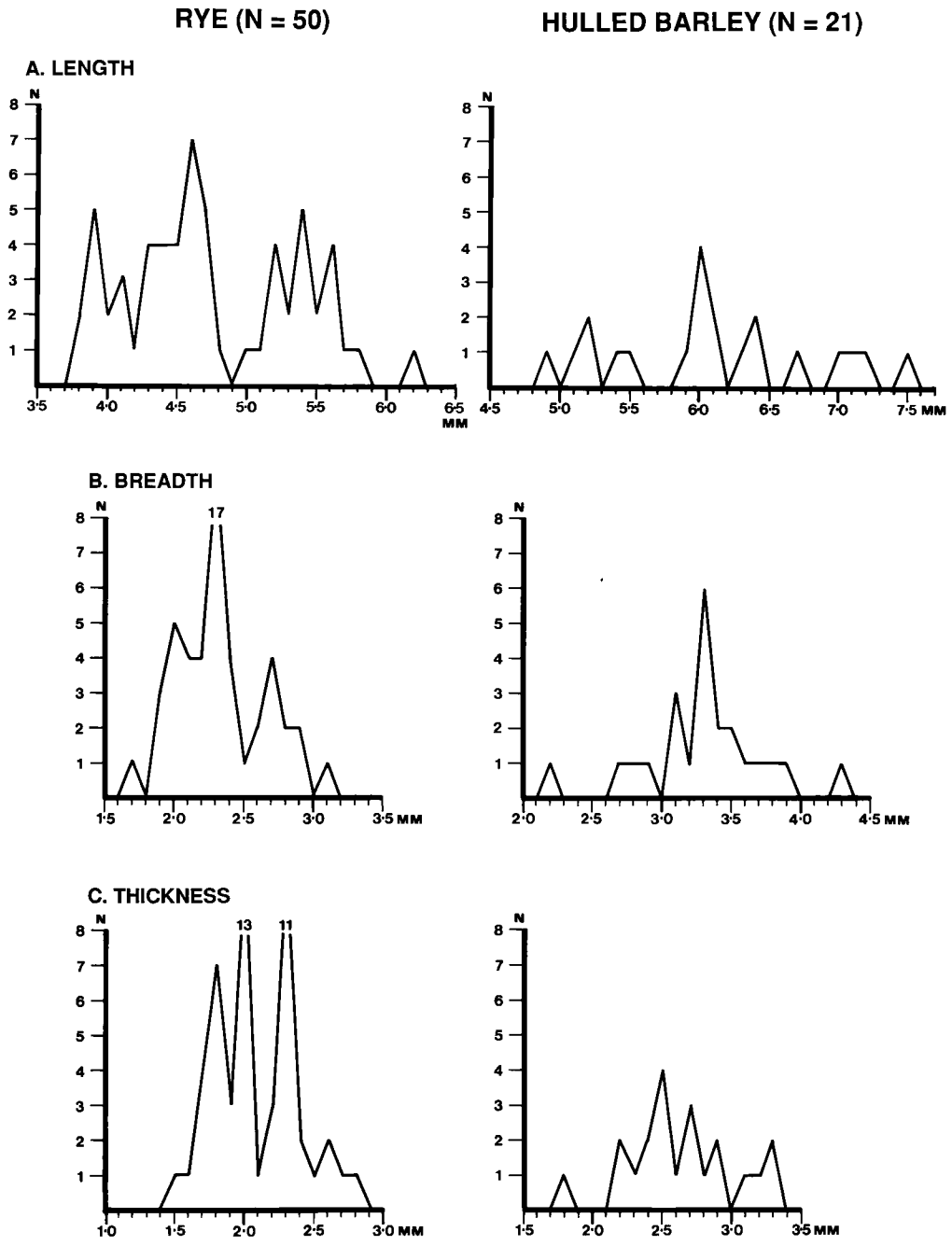


Fig. 3. Dimensions of the rye and hulled barley grains from Øster Aalum.

cannot pass through. The result is that the grain remaining in the sieve will contain the full size range of grains in the crop, but that smaller grains will be relatively less frequent. Only small grains will pass through the sieve, so the waste fraction will consist only of the lower part of the size range (Hillman 1984, graph C on p. 23).

Fig. 4 shows that the size differences between Øster Aalum and Aggersborg on the one hand, and Fyrkat on the other, conform to those expected from fine sieving.

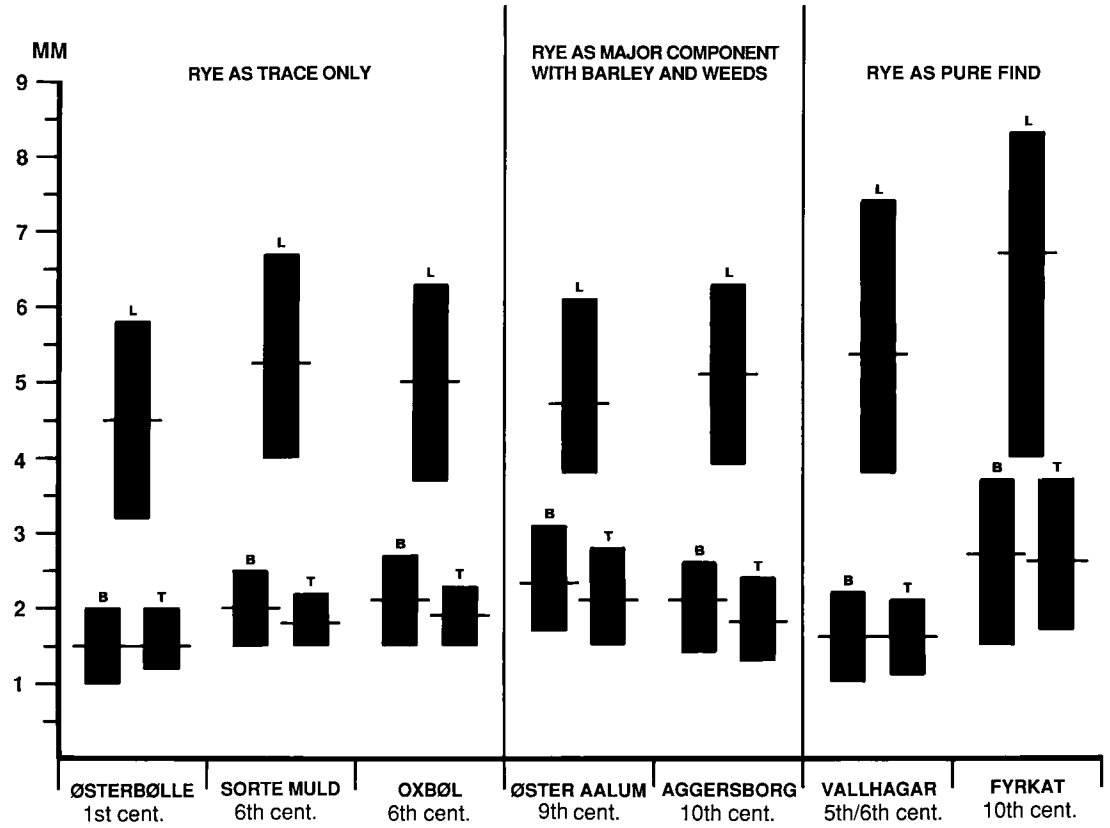


Fig. 4. The Øster Aalum rye grains compared with other finds, showing length (L), breadth (B) and thickness (T). The horizontal lines mark the means. Details of other sites from Helbæk (1970, fig. 3; 1974, fig. 10), except Vallhagar, from Helbæk (1955).

The smallest Fyrkat grains are closely similar to the smallest from the other two sites, but at the top end the Fyrkat range extends much higher. The Fyrkat grains *could* thus be larger on average because the sample represents the grains retained in the fine sieve, while Øster Aalum and Aggersborg represent those that have passed through it.

Although the size ranges are correct, however, there are difficulties with this argument. It takes no account of either: (a) changes through time or space in the size of rye grains, or: (b) variations in conditions of carbonisation. Regarding (a), it would be preferable to argue from a series of crop samples from a single site, grown in the same region over a limited time period. However, Helbæk's import argument was put forward on the basis of a few samples from the whole of Denmark, and any further argument must of necessity be similarly based. It must be *assumed* that 9th and 10th century rye crops at Øster Aalum, Aggersborg and Fyrkat all had similar sized grains – an assumption that future work may prove false. On the other hand, studies of present day populations of primitive races of rye in areas such as Turkey reveal remarkable uniformity in the size of rye grains compared to those of wheat and barley. Indeed, even the weed races produce grain of precisely the same size range as the cultivars (Hillman 1978). Regarding point (b), in view of the small changes that occurred in the sizes of the rye grains carbonised by Renfrew (1973 fig. 4) (less than in any other cereal except hulled barley) it is probable that the major differences between Fyrkat and the other two sites were *not* caused by the carbonisation processes alone.

Other factors must thus be called upon to contribute to the argument of import against different processing stage. The first of these is the *context of the samples*. Ethnographic studies have shown that, particulary in wetter areas where sieving is undetaken indoors, the waste from fine sieving is often thrown on the fire (see the

quote from Hillman, above). If Øster Aalum and Aggersborg are to represent waste, and Fyrkat storage, then this would be supported if the find contexts corresponded to this.

The excavator's description of the find (see above) states that the Øster Aalum sample was recovered from a large, shallow pit. He stresses that the material was not in a primary context, and suggests that it was redeposited by wind action from a burnt building nearby, although other sources are not excluded. In the absence of direct evidence of the original primary context, is is suggested that one other possibility is that the material is waste from a nearby hearth or hearths, either blown or deliberately dumped into the pit, probably over a period of time. This would not conflict with the secondary context of the material, and could also account for the lenses in which it was deposited. The stems of heather and the wood charcoal would in this view represent the fuel burnt in the hearth. The Øster Aalum sample *could* therefore represent waste material.

The Aggersborg sample was amalgamated from a series of pits associated with the village, described as containing much charcoal, "food waste" (Jessen 1954, 125) and "kitchen waste" (Helbæk 1970, 287) (author's translations). Both Øster Aalum and Aggersborg *could* thus represent material from fires into which waste material from fine sieving could have been dumped. Fyrkat is very different. The grain covered a large area of the eastern end of house 4S (Helbæk 1974 fig. 2), and Helbæk was in no doubt that it represented the destruction of a "quartermaster's store" (ibid., 5).

The contexts of the three samples may thus support the argument that (a) Fyrkat could represent grains retained in a fine sieve and subsequently stored; and (b) Øster Aalum and Aggersborg could represent waste material from hearths, consisting in part of material which had passed through sieves as fine cleanings.

The *degree of purity* of the samples also supports this explanation. There is no reason to suppose (cf. the quote from Helbæk, above) that only mixed crops could have been grown in Viking age Denmark. This seems an unreasonably harsh judgement on farmers who were, after all, the heirs of some four millennia of agronomic experience within Denmark. There is clear evidence that bread wheat, emmer (or spelt), and barley were grown as three separate crops by the later 2nd millennium bc (Rowley-Conwy 1984), and that emmer (or spelt) and barley were grown as two separate crops as early as 1500 bc (Rowley-Conwy 1978). The degree of crop purity achieved as early as the Neolithic has been stressed by Dennell (1974). The admixtures of barley (60% at Aggersborg, 32% at Øster Aalum) might equally well derive from the repeated throwing of waste from two separate crops into the fire, and the subsequent sweeping out of the ash into the locations where the samples were found.

The *weed seed proportions* are also suggestive: there was 1 weed seed for every 1.3 identified cereal grains at Øster Aalum; 1 for every 0.6 identified cereal grains at Aggersborg (Jessen 1954); but only 1 for every 250 cereal grains at Fyrkat (Helbæk 1970, 1974). This relative scarcity of weeds at Fyrkat is most likely to result from their removal during fine sieving.

The *size of weed seeds* in the samples is also relevant. Among the relatively few weed seeds at Fyrkat, Helbæk identified about 39 species (1974, 26–7). Those represented by more than 10 seeds are listed in table 3, along with the sizes given by Helbæk (op. cit.). It can be seen that these include large seeded species, with at least one dimension comparable to the breadth and thickness of the Fyrkat rye grains (fig. 4). Such seeds would thus be expected to remain in the fine sieve along with the prime grain. Helbæk (1970, 1974) also stresses the rarity of seeds of *Chenopodium album* (6 seeds only) and the absence of *Spergula arvensis* at Fyrkat. These are very small seeds, of a size that would easily be removed during fine sieving. In contrast, *Chenopodium album* was the most common weed at both Øster Aalum (see table 1) and Aggersborg (Jessen 1954).

The *sample of rye from Vallhagar* is also relevant. This site is on the Swedish Baltic island of Gotland (fig. 1). The sample dates from the 5th or 6th centuries AD; it was published by Helbæk (1955), but not considered by him in his reviews of rye in Denmark (1970, 1974). The sample (find no. 16.5) corresponds to that from Fyrkat in a number of ways. It was recovered from the floor of a destroyed house, not a rubbish pit; it was remarkably pure, consisting of 326 cc rye, no other cereals, one seed of *Polygonum convolvulus* and three of *Galium* sp. (relatively large seeded weeds); and grain length (though not breadth or thickness) extends above all the other sites except Fyrkat itself (fig. 4). This sample could represent grains retained in the fine sieve and stored, just as at Fyrkat. It makes the point that the Fyrkat sample is not unique in Scandinavia: any argument applied to Fyrkat should also apply to Vallhagar.

Trade in Scandinavia for most of the 1st millennium AD involved luxury goods; only in Viking period VIII (AD 750/800 – 1000) did utilitarian items such as quernstones, soapstone bowls and whetstones spread widely from their points of origin (Näsman 1984). In northern Europe as a whole, more mundane objects like cooking pots were seldom traded before the 12th or 13th centuries AD. There is hardly any documentary evidence for the movement of basic foodstuffs, which are likely to be one of the latest commodities to be traded (Hodges 1982). Fyrkat thus falls in the period when trade in compact utilitarian objects (but not foodstuffs) was starting; Vallhagar dates well *before* this, to a time when only luxury goods are documented. In view of this, the likelihood that the few available 1st millennium samples include *two* imports is minimal.

In conclusion, therefore, various attributes of the samples support the hypothesis that crop processing, not local against foreign origin, created the differences between the Øster Aalum and Fyrkat samples. These are summarised here.

| | Øster Aalum | Fyrkat |
|---|---|---|
| (a) grain size range | lower part of Fyrkat range only | wide range |
| (b) context | ?rubbish from hearth (but see excavator's comments above) | storage |
| (c) purity | mixed with weeds and barley | very pure |
| (d) size of weed seeds | smaller predominate | larger predominate |

This supports the alternative suggestion that the Fyrkat and Øster Aalum samples are two different products of a single crop processing system, using similar crops of rye. This is a much simpler explanation of the differences than the import theory, which is not necessary to explain the archaeologically visible facts.

Realisation that many archaeological plant samples in fact reflect various stages in crop processing activities, and not intentional end-products in their own right, may alter many previously held views. A good example relevant to Denmark concerns the bodies of the bog corpses from Tollund and Grauballe. Their gut contents (Helbæk 1950, 1958b) have often been regarded as "ritual" meals. However, their contents conform so closely to the by-products of the fine sieving stages that a more likely explanation is that these people were simply fed on the poorest food available, namely waste products (Hillman 1986, 102–3; also Hillman 1981, 156–8; 1984, 13).

| Species | Number of seeds | Size (mm) |
|---|---|---|
| *Rumex crispus* | 62 | L: 1.06–1.25, B: 0.69–0.88 |
| *Centaurea scabiosa* | 38 | L: 3.25–4.63, B: 1.25–1.75, T: 1.25–1.56 |
| *Rumex maritimus* | 30 | L: 1.06–1.25, B: 0.69–0.88 |
| *Polygonum convolvulus* | 20 | not stated (relatively large) |
| *Polygonum lapathifolium* | 16 | not stated (relatively large) |
| *Aethusa cynapium* | 15 | L: 1.19–2.06, B: 0.81–1.50, T: 0.56–0.81 |
| *Melandrium album* | 10 | L: 1.30, B: 1.20, T: 0.95 |
| *Vicia cracca* | 10 | spherical, diameter 2.00–2.50 |

Table 3. Weeds at Fyrkat represented by 10 seeds or more, with sizes (from Helbæk 1974).

## CONCLUSIONS

Øster Aalum provides important information concerning crop husbandry in Viking Age Denmark, both because it provides data on the crops themselves, and also because it has given rise to a re-interpretation of other finds of rye in Denmark.

It also stresses one aspect of current Danish archaeological work, namely that it is at present purely up to excavators to notice and recover samples of plant remains. Had the excavator of Øster Aalum been less alert and interested, the sample might never have been recovered. It was mentioned above that Haithabu *by itself* has produced more samples of Viking rye than are known from the whole of the 1st millennium AD in Denmark. This is an example of the sort of data that can be recovered using modern sampling strategies and recovery methods. For the Haithabu remains, much information is presented concerning the various samples (Behre 1983, 19–20, and diags. 8–10), and it would be interesting to know whether contexts, sample compositions etc could be examined using the methods developed by Hillman (1981, 1984) and Jones (1984).

Archaeobotanical work could answer many interesting questions. If one hundred samples (rather than one) were available from Fyrkat, it might be possible to decide whether the site really was just a consumer (as Helbæk suggests), or whether it was also a centre for culti-

vation. There is no way this can be determined on the basis of the single sample available – if the above arguments are correct, then this sample represents just one stage in the crop processing sequence. We have no way of knowing whether or not the preceding stages were carried out at Fyrkat, as would be expected if it were a "primary producer" farming settlement.

Danish archaeology currently displays little interest in archaeobotanical studies. This is particularly unfortunate, since Denmark was where archaeobotany first emerged as a regular scientific discipline. Crop plants still tend to be viewed as typological attributes, not as a source of much useful archaeological information. This may be why Denmark currently lags behind much of the rest of Europe and does not always employ modern methods in archaeobotanical studies. From the typological point of view, it may not be important that detailed sampling of (say) a Viking Age site would produce more samples of rye, because we already know that the crop was present. From the perspective of settlement archaeology, however, the plant remains can provide a great deal of information concerning human behaviour on every site where they are preserved.

Each settlement excavation that takes no interest in plant remains is therefore indulging in the destruction of irreplaceable data highly important to the interpretation of the settlement. It is hoped that current developments signal a change of course.

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# A Viking-Period and Medieval Settlement at Viborg Søndersø, Jutland

by HANS KRONGAARD KRISTENSEN

In 1981 and 1984–85 archaeological investigations were undertaken in Viborg, near the lake Søndersø. An urban settlement was discovered here dating from the period *circa* 1000–1300. The evidence of the excavations is important both for indicating well the scope for archaeological work in the area and for giving a basis for a new perception of the age and topographical development of the town.

## INTRODUCTION

Viborg, once the seat of the North Jutish *thing,* and cathedral city since 1065, lies in the centre of Jutland at the crossing point of a number of the most important routes in central Jutland (including the Military Way), then as now. The town is situated on the west side of one of the subglacial stream valleys of the Ice Age, the mouth of which outside the town today is filled by the two lakes, *Viborg Nørresø* and *Søndersø*. In modern times these have been separated by a causeway built in the 1850's; previously the lakes were joined. In the postglacial period the stream valley's sides were scored by transverse eroded valleys and by Danish standards the urban area is thereby markedly divided. However 1,000 years unbroken work at levelling the site has softened the uneven terrain to a degree.

Alongside the lakes is a relatively flat area, as there is in the area of the current town centre west of the cathedral, lying on a plateau above the subglacial valley. Between these quite even areas we find the subglacial valley's greatly corrugated sides. These have never been particularly densely settled, nor in recent times has been the flat land alongside the lakes.

Up on the plateau are the only preserved churches of the town, the cathedral and the Dominican cloister church, now the parish church. Here also are the preserved remains of a long series of late medieval stone buildings (Krongaard Kristensen 1981). This is the area of the town where the earliest urban foundations have been sought (Levin Nielsen 1966, with references). Viking-period building plots were found in Store Sct. Peder Stræde in this area in the 1960's (fig. 1). However all the indications are that this Viking-peirod settlement is part of a major farm settlement and that urban settlement in this area began about the middle of the 11th century (Noe 1976 p. 59). The culture layer was thin and the extent of the early medieval settlement was small, and it has been supposed that the settled population of Viborg was quite small in this period (Levin Nielsen 1966 p. 154; 1968 p. 65).

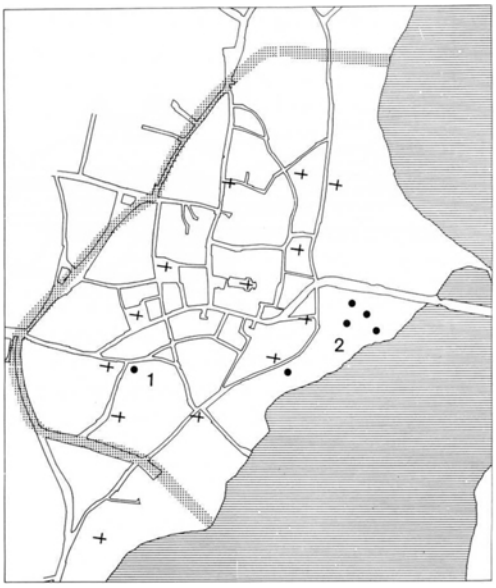



Fig. 1. Viborg's Romanesque churches and the defences of 1151. The southernmost church lies outside the rampart and shows that the structure of the town may have been somewhat different before it was fortified. It is evident that many of the churches are located along the throughways in the eastern town. 1: the excavation of the Viking-period settlement in Store Sct. Peder Stræde; 2: the excavations by Viborg Søndersø.

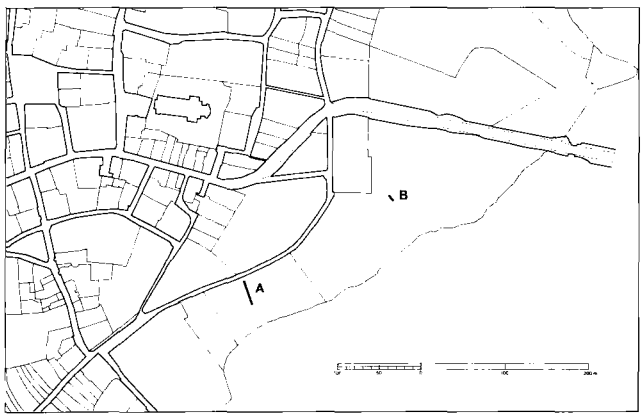



Fig. 2. Section of the Survey Map of 1866 with the locations of the sites dug in 1981. After Krongaard Kristensen 1982.

## EXCAVATIONS 1981

In the meantime it has been clear for several years that in theories concerning the development of the town one ought to pay attention to special circumstances in the lower-lying part of the town alongside the lakes. In the late Middle Ages the town's Øster Algade, one of the main roads of the town, ran here, probably at one time carrying all traffic from the north and south, east and west and drawing the old town along the west side of the lakes. It also transpires that possibly as many as seven of the town's twelve medieval parish churches were placed along this route (see fig. 1).

Out of the work of 'Projekt Middelalderbyen' on Viborg came several indications that the area down towards Viborg Søndersø should be subjected to more detailed scrutiny (1). Registration showed that in the course of time a number of loose finds had turned up in this part of Viborg, and core samples showed that the thickest culture layers in the town were here. When the project came to organize excavations it was therefore natural to give priority to the area alongside the upper Søndersø, and the investigation here was in fact one of Projekt Middelalderbyen's most productive.

A site was selected first which had not been built on in the last 200 years and where it was therefore considered possible to lay down a long trench through undisturbed layers out towards the lake (site A on fig. 2). However extensive levelling layers limited the length of the trench so that the lakeside areas were not touched

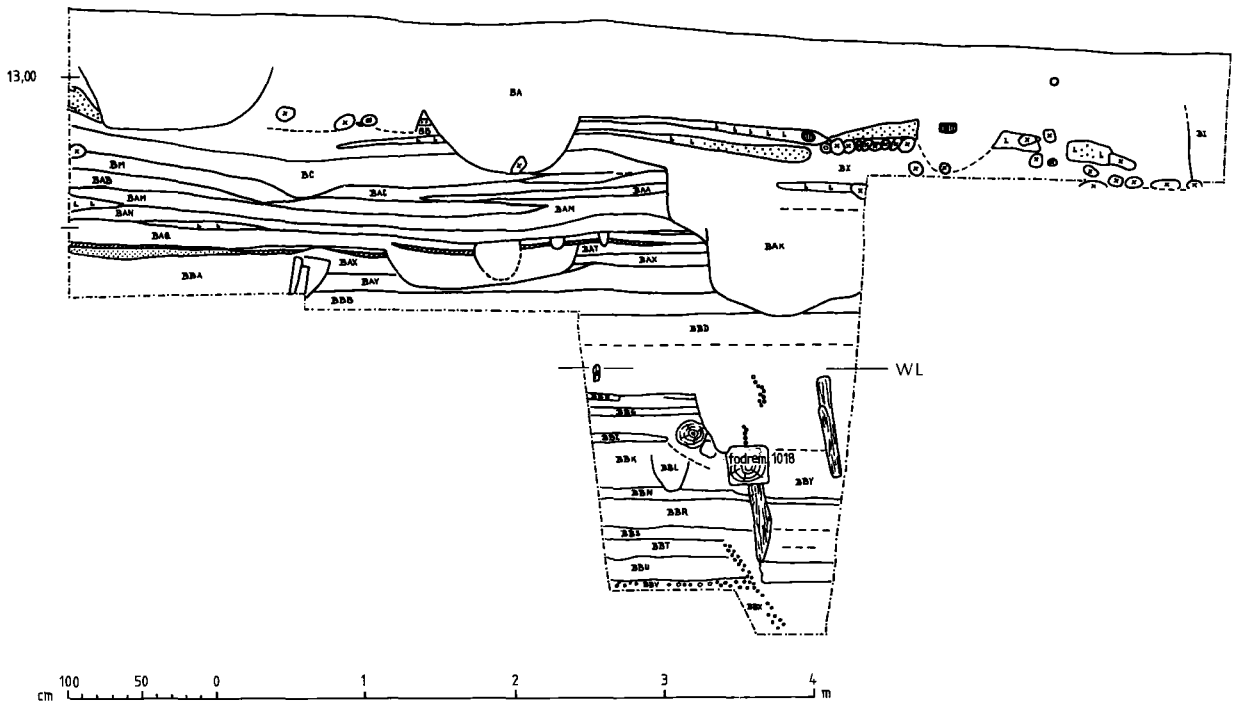



Fig. 3. Drawing of the northern section of site B, 1981. 69 separate layers were distinguished on the site. Many of these were of limited extent (hearths and floor patches) and do not therefore appear in the section. After Krongaard Kristensen 1982.

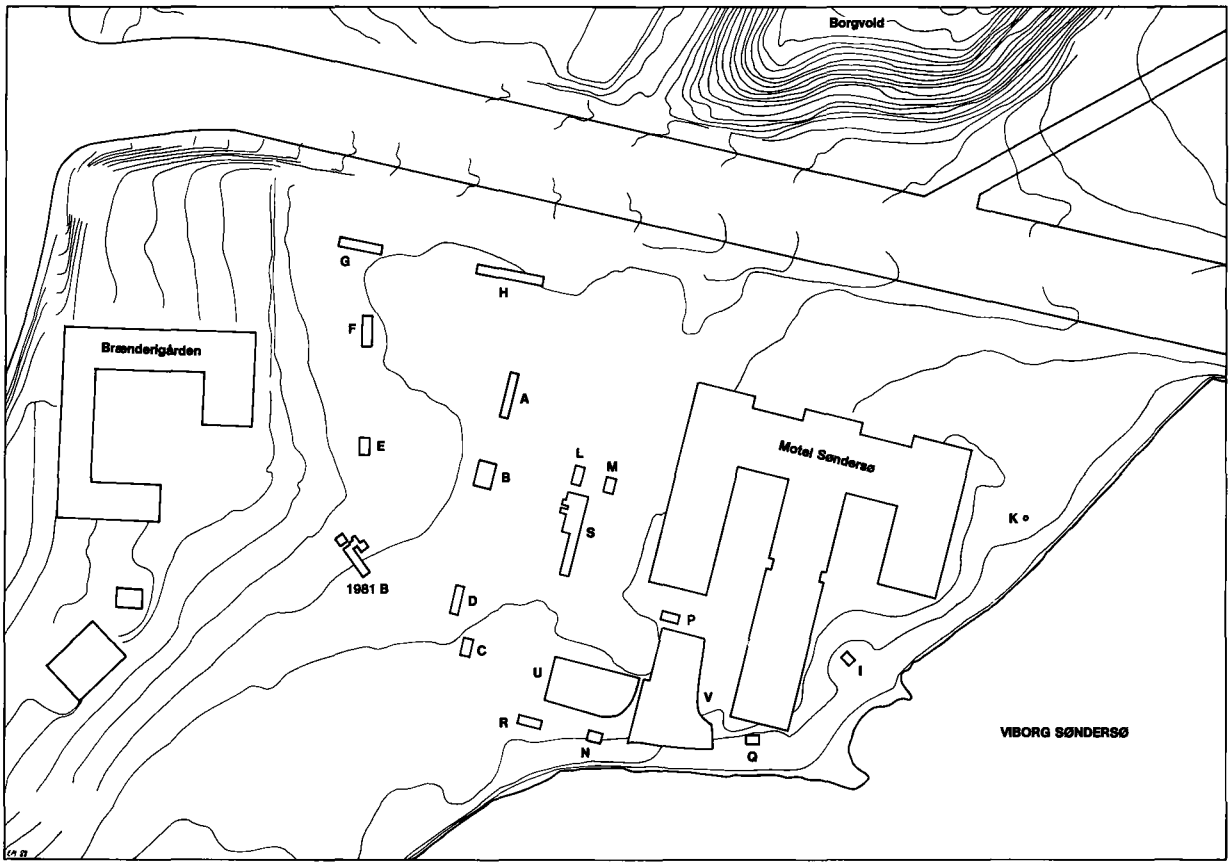



Fig. 4. General plan of the various sites dug. Site A, 1981, falls outside the map. Drawn onto a section of an aerial photographic survey of Viborg. Viborg kommune.

(2). Up by Riddergade bronzecasting industry from the 12th and 13th centuries was discovered. Further down towards the lake beneath a thick levelling layer a clay floor from the High Middle Ages was found. No particularly intensive settlement had taken place on this site which no doubt reflects the previously steeply sloping character of the area, now less marked thanks to up to 4 metres of levelling. But that the floor lay at the lake's current water level was an impetus for further studies.

For the next site a more even area east of Brænderigården, for centuries the easternmost holding of the town, was selected (site B on fig. 2). The results of the excavation were remarkable, giving a fairly certain picture of the development of the area despite the smallness of the site (fig. 3). Sometime around 1000 (perhaps in the end of the 900's) a layer of branches and faggots was first spread out over a meadow area and over that a layer of sand mixed with clay. This layer lies about 1.5 metres below the present level of Søndersø. The purpose of the branches and sand layer was to improve the ground on the site. It was not entirely clear whether the layer immediately above was a floor, but the next one up (BBT) was; and for the whole series of layers thereover, the majority are floor layers, intermittently separated by demolition layers from burnt or collapsed buildings.

Three-quarters of a metre above the branch layer was found a sill beam of a building. The beam, which had rods in it around which was wattling, is dendrochronologically dated to 1018 (3). The latest building on the site had earthfast posts, between which was a base of poorly burnt tile. In the floor layer and the demolition layer of the building were found eight "civil-war coins", the latest of which was a Roskilde coin of Erik Menved (1286–1319) (4). This building from about 1300 was the last on the site, which has been open since then.

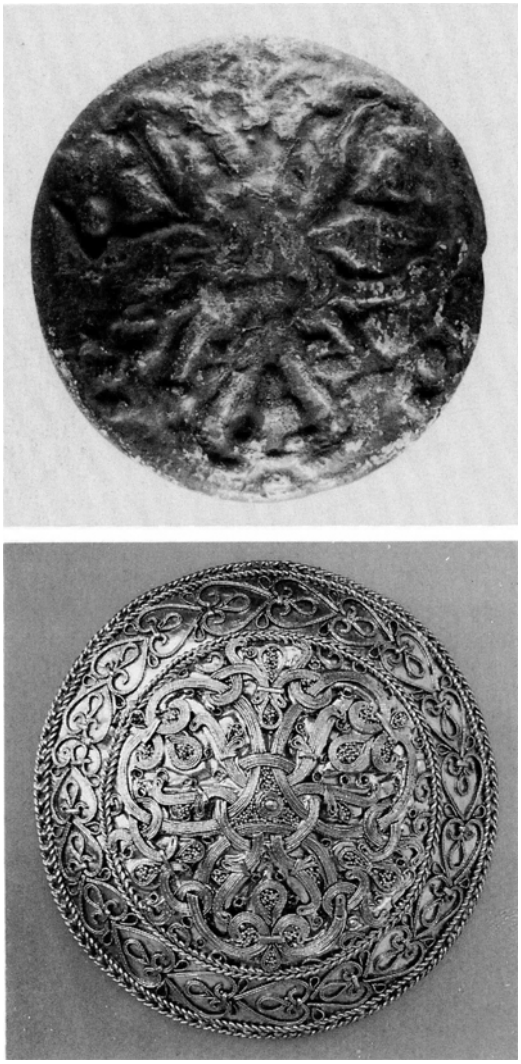


Fig. 5. The jeweller's patrix-die from Viborg and a gold ornament found at Hornelunde by Varde which was probably formed in some association with the patrix. The similarity is hidden a little by the filigree ornament which is soldered onto a gold plate, the middle zone of which was hammered out over the patrix. A closer examination shows that the pattern on the patrix is identical with that on the gold plate, although the goldsmith has not slavishly followed it when applying the decoration. The ornament is provided with a flat gold plate at the back so that one cannot test whether the patterns fit together. Drawings of the basic design on both the ornament and the patrix show however that a little twist in the tripartite composition is repeated on both pieces. Photo: Arne Vindum, Viborg Stiftsmuseum, and Lennart Larsen, The National Museum.

A number of hearths were located inside the excavated area: through several consecutive building phases the hearth has only been shifted within a small area. The sill beam of 1018 however shows that the buildings do not lie on precisely the same lines through all of this 300-year period. On the other hand this beam lay parallel with the northern wall of the latest building, so it is nevertheless clear that quite fixed lot boundaries and street lines must have existed through the whole period on this site which determined the placement of the buildings.

The artefacts showed that at least in the first phase the settlement was a craft quarter. Shoemakers and combmakers especially were clearly represented by detritus from their crafts. There is thus a clear case for urban economy and urban settlement.

## EXCAVATIONS 1984

With evidence for the existence of comprehensive culture layers in this area, Viborg Stiftsmuseum was able to go into action when in the spring of 1984 plans for the building of a hotel by the lake were put forward. As a result the municipality of Viborg financed a series of investigations in order to find out what the archaeological situation was on the proposed building site – and later to find possible alternative locations for the hotel. Thus during 1984 11 different sites in the area were dug (A-M on fig. 4). These were small sites of slightly varying sizes. Thick culture layers of an urban settlement were identified over an area which has been free of building through more than 500 years since. The water table has also risen together with the level of the lake so that the conditions for preservation, of organic material especially, are unusually good. Building remains were found in sites B, D, E, F, G and M.

In *site B* settlement began upon boggy ground. Above a thick natural peat layer a layer of small logs and substantial branches of birch and alder was laid out which in turn was again covered by a layer of sand. Over this a building was constructed the northern wall of which, at least, rested upon a sill beam (the other walls of the building were outside of the excavated area). The building is dated by dendrochronology to 1015 (5). Sawdust and flakes of antler which were found in a small hole (a posthole?) in the trodden earth floor of the building show that the building was used by a combmaker. In the demolition layer of this building an ornament patrix was found (fig. 5).

This building had no immediate successors: for nearly two centuries the place was open. Repeatedly re-

newed fences found on the site indicated a change in the structure of the locality. However there were undoubtedly buildings in the vicinity, and a thick layer of detritus, most of slags, showed that a coppersmith was resident nearby in the 12th century.

About 1200 the site was built upon again. The building from this phase was greatly disturbed and is difficult to date precisely. Despite the disturbance clear floor layers and traces of a hearth were found, and it could be demonstrated that the building was burnt.

It would be too much here to give more detail about all the excavated sites of 1984, but it may be mentioned that buildings with wattled walls were found on *sites D* and *F*. Remains of a stave-built building were found on *site G* (fig. 6). The walls were formed of thick, wedge-shaped, tongued-and-grooved planking.

Some geological data emerged from the investigations of 1984. At the eastern end of *site H*, in *site I* and *core sample K*, a subsoil of glacial alluvial deposits was discovered (at the 10.30, 10.40 and 10.70 contours respectively), and in *site M* the subsoil came right up to 12.30, 75 cm below the surface. In other places were digging continued to the natural the base was peat, and on *site G* it was found that under the peat layer were deposits of lake marl. In the late glacial period there was probably an island in the subglacial valley around the area where the hotel was built and the area to the north where the medieval defence work Borgvold was placed. Thus in the post-glacial period a fen was formed between this island and mainland at the western side of the valley. This bog formed the ground for a great part of the settlement discovered.

*Site C* turned out to be a place which had earlier been under the lake, and was reclaimed in modern times. The site was dug by machine as the old lake bottom was quite saturated, but there were clearly well-preserved culture layers beneath this level. It is thus clear that in recent times the edge of the lake lay between sites C and D, but that before the water level in the lake was raised it lay further off from the town.

Fig. 6. Section of a stave-built building on site G. The wall is seen from the inside, where two roof-bearing posts stand hard by the wall. A row of slender posts in the foreground may have bounded a wall bench. All timbers have rotted up at the original ground surface so that only the buried sections are preserved. Photo: the author, 1984.

Fig. 7. The wicker-lined well on site U. Two of the wooden planks in the bottom are dendro-dated to 1015 and 1017 respectively. Photo: the author, 1985.

## EXCAVATIONS 1985

With regard to the important culture layers in the area, in 1985 the hotel plans were altered so that the existing motel was developed and the new sections were constructed contiguous to the existing ones. In order to ensure that the new plans were acceptable in light of the archaeological interests (as they were thought to be) six trial trenches were dug (O-S on fig. 4). In these, culture

| | | A | | B | | C | | D | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **layer no.** | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | **total** | **reg.no.** |
| **Horizon V** | BB | | 21 | 3 | | | 2 | | 2 | 28 | 881D220 |
| | BH | | 24 | 13 | | | | | | 37 | 221 |
| | BK | | 16 | 8 | | | | | | 24 | 222 |
| | BU | | 46 | 11 | | | | | 1 | 58 | 181 |
| | BX | 1 | 35 | 3 | | | | | | 39 | 189 |
| | BAK | 4 | 89 | 5 | | | | | | 98 | 223 |
| | BC | | 133 | 62 | 6 | | | | | 201 | 197 |
| **Horizon IV** | BL | 5 | 7 | | | | | | | 12 | 224 |
| | BF | 2 | 112 | 5 | | | 1 | | | 120 | 201 |
| | BE | | 1 | 1 | | | | | | 2 | 225 |
| | BD | | 27 | 1 | | | | | | 28 | 186 |
| | BG | 1 | 126 | 2 | | | | | | 129 | 226 |
| | BM | | 143 | 2 | 1 | | | | | 146 | 211 |
| | BO | | 2 | | | | | | | 2 | 227 |
| | BAJ | | 5 | 3 | 2 | | | | | 10 | 228 |
| | BAD | 1 | 9 | | | | | | | 10 | 229 |
| | BAH | | 7 | 4 | | | | | | 11 | 230 |
| | BAC | | 2 | | | | | | | 2 | 231 |
| **Horizon III** | BAA | 2 | 12 | | | | | | | 14 | 205 |
| | BAB | 1 | 42 | | | | | | | 43 | 232 |
| | BAG | | 28 | 9 | | | | | | 37 | 233 |
| | BAM | 13 | 129 | 1 | | 1 | | | | 144 | 212 |
| | BAN | 2 | 27 | 1 | | | | | | 29 | 234 |
| | BAQ | 1 | 19 | | | | | | 1 | 21 | 235 |
| | BAR | | 1 | | | | | | | 1 | 236 |
| | BAS | | 4 | | | | | | | 4 | 237 |
| **Horizon II** | BAV | 21 | 13 | | | | | | | 34 | 254 |
| | BAX | 225 | 231 | | | | | | | 456 | 185 |
| | BAY | 143 | 19 | | | | 1 | | | 163 | 199 |
| | BAZ | 2 | | | | | | | | 2 | 238 |
| **Horizon I** | BBA | 1 | 13 | | | | | | | 14 | 239 |
| | BBB | 13 | 1 | | | | | | | 14 | 240 |
| | BBC | 3 | | | | | | | | 3 | 241 |
| | BBD | 5 | | | | | | | | 5 | 242 |
| | BBE | 3 | 2 | | | | | | | 5 | 243 |
| | BBF | 21 | | | | | | | | 21 | 244 |
| | BBH | 6 | | | | | | | | 6 | 245 |
| | BBG | | 10 | | | | | | | 10 | 246 |
| | BBI | 3 | 1 | | | | | | | 4 | 247 |
| | BBM | 7 | | | | | | | | 7 | 248 |
| | BBO | 6 | | | | | | | | 6 | 249 |
| | BBR | 24 | 2 | | | | | | | 26 | 250 |
| | BBT | 74 | | | | | | | | 74 | 251 |
| | BBY | 11 | | | | | | | | 11 | 192 |
| | BBU | 10 | | | | | | | | 10 | 252 |
| | BBV | 13 | | | | | | | | 13 | 253 |
| | BBX | 7 | | | | | | | | 7 | 191 |
| | | 631 | 1359 | 133 | 9 | 1 | 4 | | 4 | 2141 | |

Fig. 8. Pottery diagram, site B, 1981. A1: reduced, soft-fired; A2: reduced, hard-fired; B1: oxidized, red-fired, lead glazed; B2: oxidized, red-fired, lead glazed and with pipeclay fabric; C1: oxidized with pipeclay fabric; C2: oxidized with pipeclay fabric and lead glaze; D1: almost stoneware, Pingsdorf ware; D2: almost stoneware, remainder.

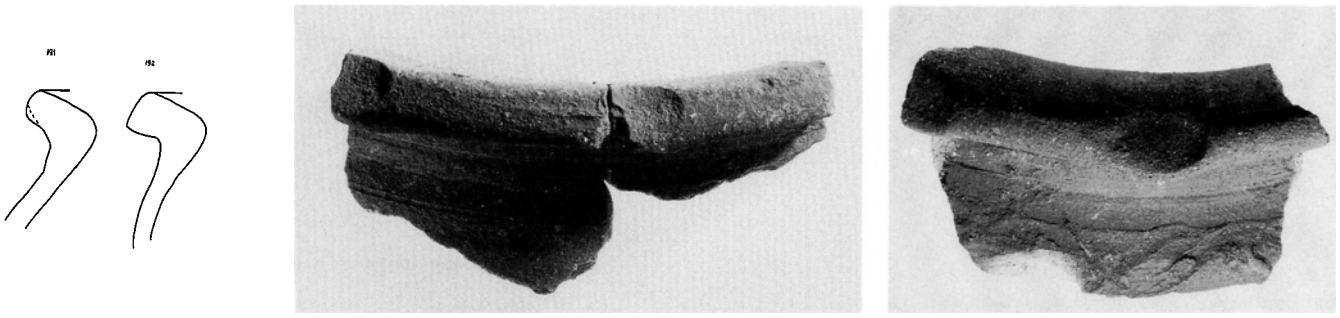


Fig. 9. Anglo-Saxon pottery, rim profiles (2:5) and photo (2:3).

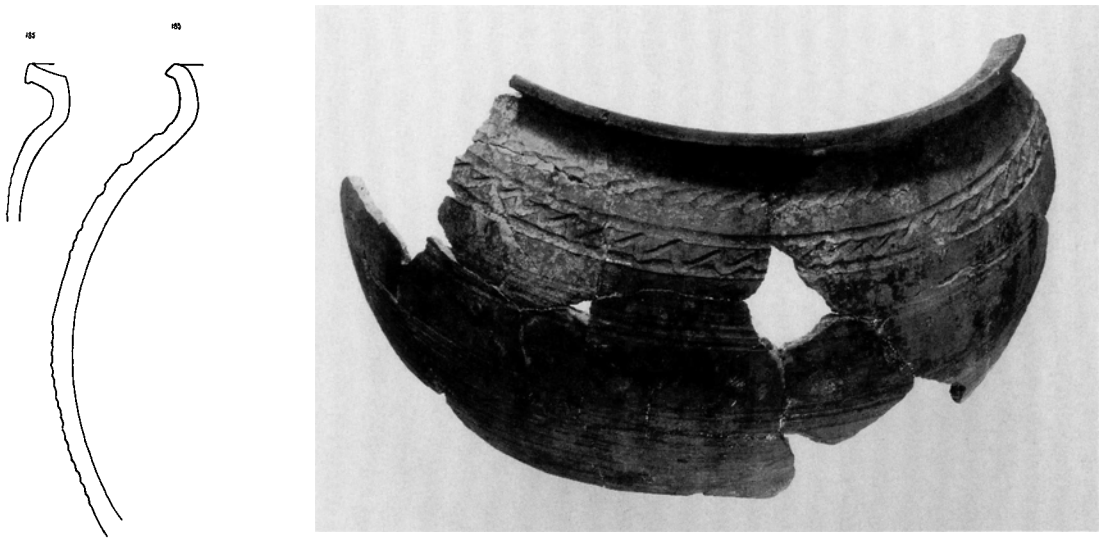


Fig. 10. Baltic ware, rim profiles and photo (2:5).

layers of interest were found only in site S. On this basis the proposed development was accepted with the condition that an archaeological excavation should precede. The excavation was carried out in the autumn of 1985 and comprised sites U and V.

To the north in *site S* were found remains of a structure which were probably fragments of a timber roadway. At the southern end were generally disturbed remains of a building from *circa* 1200. A fire had destroyed the building but it was rebuilt on the same site, in connection with which daub from the burnt building was simply levelled out on the burnt site and sealed with a new floor layer of clean clay. The burnt daub clearly showed that the building had been whitewashed. A few traces of the hearth showed that this had been a covered oven, with a domed clay top over a circular, burnt clay base.

All of *site U* had been under water and much had been washed away: the natural was washed clean over most of the site. There was a comprehensive system of postholes and a few surviving remains of the posts themselves. Without question they belong to repeatedly renewed fences. Within the site had been two or three wells, of which one, a wicker – lined well, was quite well preserved. Only one metre's depth remained, but a great deal of the top had been washed away after the inundation so that the original depth cannot be estimated (fig. 7).

On *site V,* the southern part had remains of several buildings. On top of a thick natural peaty soil a series of mats were laid out, formed of basketwork hurdles. Above this a thick layer of sandy soil of a very sterile character was deposited. The intention presumably was to prepare the site for building; a building, 4.5 m broad

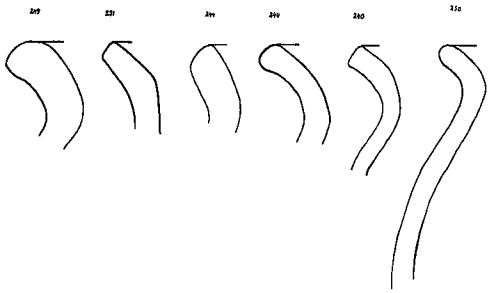


Fig. 11. Rim profiles of globular pots in phase I (2:5).

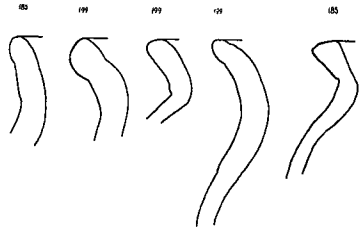


Fig. 12. Rim profiles of globular pots in phase II (2:5).

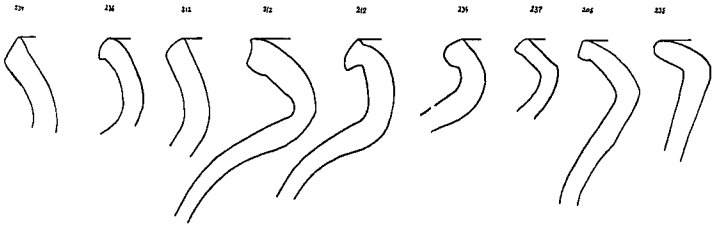


Fig. 13. Rim profiles of globular pots in phase III (2:5).

Fig. 14. Rim profile of bowl from phase III (2:5).

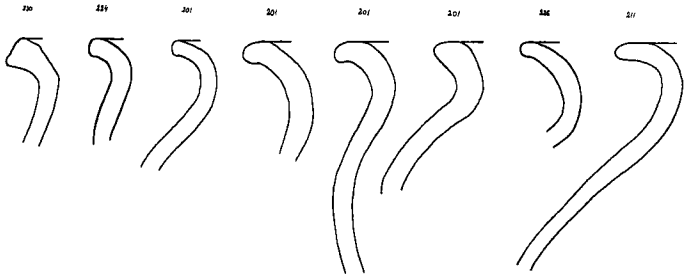


Fig. 15. Rim profiles of globular pots in phase IV (2:5).

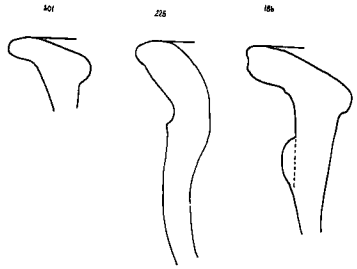


Fig. 16. Rim profiles of dishes from phase IV (2:5).

with a clay floor and wattled walls, was raised here. The dampness was clearly a constant problem on this site as, when a later building was constructed, a frame of untreated tree trunks filled with sand was laid out. Unfortunately the associated building was substantially demolished.

The earliest building of the early 11th century, of which only the northern part came into site V, was 4 m broad at the northern end and about 4.5 m broad in the middle. It lay in an area fenced off with basketwork hurdles which was traceable on three sides of the site: the plot was 14 m wide. When the later building mentioned here, also of the 11th century, was built, the placement of both buildings and fencing was altered.

Many artefacts were recovered from this site, such as weights and heating plates. Besides this a great part of the finds consisted of organic material such as leather, rope and wood.

## THE POTTERY

The excavations produced an important and substantial collection of pottery. Sherds from the most recent excavations are not yet fully processed, so the following account is based particularly on the excavation of 1981 (6). As far as can be seen, however, the material from the latest excavations corresponds closely to this material, although the quantity is very much greater.

The pottery from Viborg Søndersø is important on

two levels. Firstly it gives quite a good local chronology for black ware in Viborg. Particularly with the globular pots, it is possible to follow development through 300 years.

Much more important however is the establishment of pottery securely dated to the 11th century from a Jutlandic settlement. What has been found shows that the overwhelming majority of 11th-century pottery is from globular pots. The same ware appears to be in use from 1000 to well within the 1100's, so that one cannot differentiate 11th- from 12th-century pottery. Remarkably there are no sherds of Viking-period hemispherical vessels, not even in the early 11th-century layers.

On site B of 1981, 69 different layers were distinguished, of which some were of limited extent and therefore not visible in the sections. 47 of these layers contained pottery. The volume of sherds varied greatly from layer to layer. In 14 of the 47 layers less than 10 sherds were found. No whole pots were found and only in a few cases could larger sherds be reassembled.

The 47 layers are arranged here into 5 phases (fig. 8). This organization is undertaken, amongst other things, because a number of the uppermost layers are of quite small horizontal extent and can therefore not be certainly located in a relative chronology against other layers within the phase. Thus the dividing lines are placed at BC and BAA, which for the most part run unbroken across the site.

Phase II is distinguished partly by forming a comprehensive series of layers and partly because here in layers BAV, BAX and BAY many Baltic-ware sherds were found, a ware which is otherwise almost unknown in other layers. Baltic ware has previously been found in Viborg, but must still be regarded as a rather rare type in the town.

*Phase I.* The lowest horizon includes many layers which belong to the period from *circa* 1000 to some point within the 12th century. Only small areas of these layers come into the excavated site, and apart from BBT (figs. 3 and 9) sherds appear only in small quantities in these layers.

The phase was characterized above all by soft-fired black ware, group A1. In the upper part of the horizon there was also a little hard-fired black ware, group A2. The distinction of soft- and hard-fired is admittedly relative, as sherds which are classified as group A2 in this phase are not entirely identical with the very hard-fired ware with a sandpaper-like surface which forms group

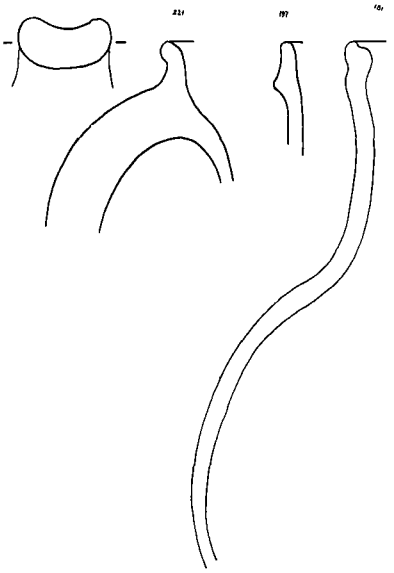


Fig. 17. Jugs from phase V. No. 181 is a black-ware jug from layer BU (2:5).

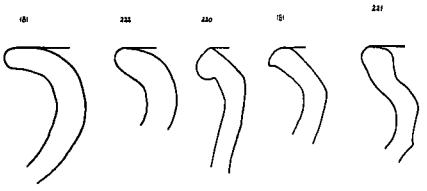
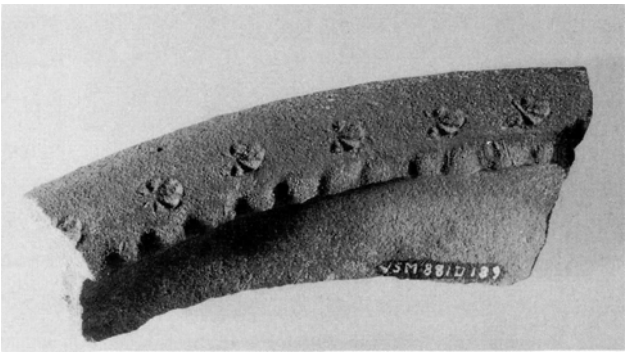


Fig. 18. Rim profiles of globular pots in phase V (2:5).



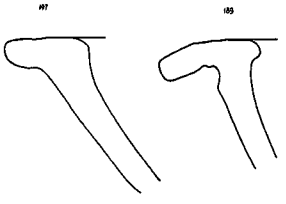


Fig. 19. Rim profiles (2:5) of dishes from phase V and photograph (2:3) of the rim (no. 189) with stamped decoration.

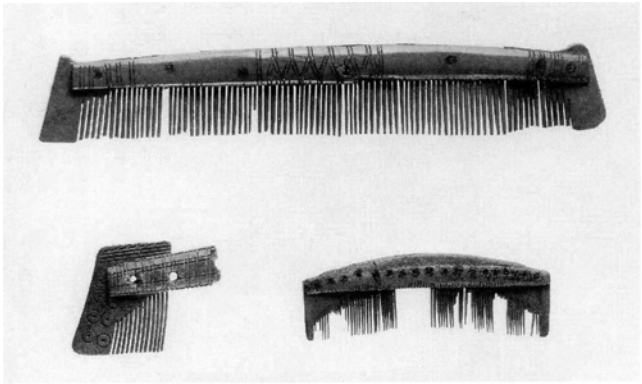


Fig. 20. Comb from the middle of the 11th century. Photo: Arne Vindum.

Fig. 21. Two top boots with laces from the 11th century. Photo: Preben Dehlholm, Moesgård.

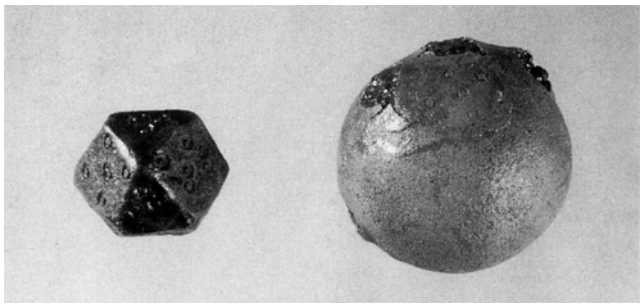


Fig. 22. Weights. An octahedron of bronze and a brass-inlaid iron weight. The two weights belong to different weight systems. Photo: Arne Vindum.

A2 in, for example, layer BC. On the other hand group A1, which here is described as soft-fired, does not include the coarse-tempered sherds of 'archaic character' which are known from the Viking Period.

Two characteristic rim sherds from large vessels with wide mouths were found in layers BBX and BBY (fig. 9). The rim is outturned, and has finger impresses at about 5 cm intervals. This type is believed to be Anglo-Saxon (7). Two further rim sherds of the same type were found in the 1985 excavations.

The other rim forms are slightly outturned, and the sherds must come from globular pots (fig. 11). Rims from hemispherical pots were not found (nor in the later excavations), although this pottery is quite dominant in most of Jutland in and before the 10th century.

*Phase II.* This phase includes only a few layers. Conversely the volume of pottery is quite large. However a lot of the sherds have been assembled into larger sherds from a smaller number of vessels which were found on the one burnt site. This includes, amongst others, at least 6 Baltic-ware vessels. The pots were carefully made and very confidently decorated. The form and decoration correspond closely to late Slavic vessels of Type Vipperow (fig. 10) (8). The professional finish makes it reasonable to interpret these as imports from Slavic areas. They were certainly not made in Viborg. A few other Baltic-ware vessels however are of a very different, coarse finish and decoration. Baltic-ware was also found in layers of the early 12th century in the later excavations, but not in the same concentration as in 1981.

This phase also included sherds of globular pots corresponding to the pots of phase I (fig. 12). The rim is slightly outturned, the colour grey-black, but very uneven. The pots are coarse-tempered, and formed by hand. The rim however is reworked. It is not possible to differentiate the globular pots from phases I and II.

*Phase III.* The layers run consistently over the whole of site B and are horizontally deposited. The phase is characterized by black-fired globular pots. Some of the pots have faceted rims (fig. 13). The ware is fine-tempered, and the pots seem to have been formed on a fast wheel. Not all pots were regular globular pots: in layer BAN a pot with a convex base was found.

Fabric type A1 is still represented in this phase. This could be caused by residual material from earlier layers, or by the existence of ceramics of a more 'domestic-craft' character alongside the professional products.

In layer BAB a single rim sherd of a large, black-ware dish was found (fig. 14). The sherd is very thick and has a very rough surface.

In the upper layers of this horizon are found the first glazed sherds. These are red-fired jugs with finger im-

presses along the foot. The phase cannot be precisely dated, so one cannot say exactly when the glazed jugs appear in Viborg. Probably it was in the beginning of the 13th century.

*Phase IV.* This phase comprises many small layers, and certainly represents no very long period. Most of the pottery is hard-fired black ware with a sandpaper-like surface. Most sherds of this are from globular pots (fig. 15). A few of these have wavy lines on the body. Rim sherds from three dishes are also included (fig. 16). One dish has a collar with finger-impress just below the mouth. The dishes are types which have previously been recognized in Viborg and Århus (Andersen, Crabb and Madsen 1971, 90f; Seeberg 1962, 99).

Glazed pottery, from jugs, is found in most layers, but always in small quantities. Three glazed sherds have pipeclay decoration.

*Phase V.* The uppermost horizon comprises many small layers, apart from layer BC which covers almost the whole site and separates phases IV and V. There seems to be rather more glazed pottery in this phase than in the previous. But the black ware still dominates. Here this ware is almost light grey. The unglazed black-ware jug is also found in this phase (fig. 17). Dishes and globular pots have received a rounded profile (fig. 18). This feature also holds for pots in the uppermost layers of phase IV. The rim of one dish and a body sherd from a globular pot are stamp-ornamented (fig. 19).

From the coins found this phase must be dated to the end of the 13th century and the period around 1300.

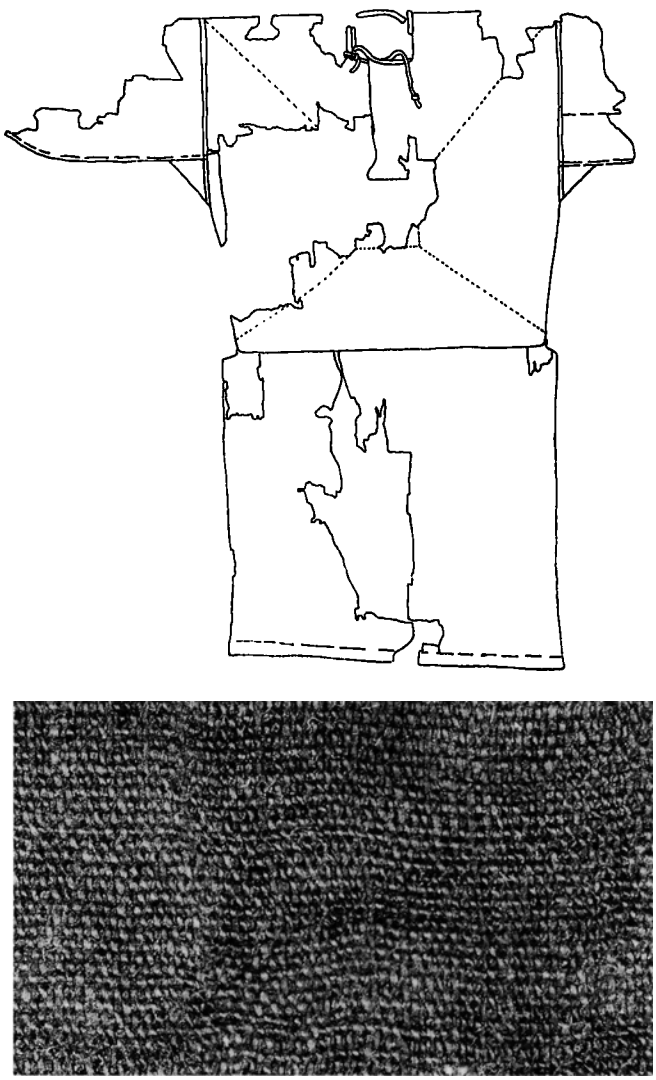


Fig. 23. Linen shirt from the middle of the 11th century. Photograph of texture and drawing of the front. Drawing and photo: Eli Andersen (photo 2:1).

## OTHER ARTEFACTS

The finds in this category are not yet fully processed and only general aspects of the material shall be indicated here. After the pottery, the largest class of finds is antler and bone offcuts and manufactured goods. Antler is dominant here, and combs the most common product (fig. 20). The detritus is found in great quantities, and the size of the cast-off pieces indicates that the raw material was in copious supply in the earliest period. Supplies of deer antler clearly became sparser as time went on, and in the course of the 13th century,the comb-makers went over to use bone instead.

A third large group of finds is leather offcuts and products, especially shoes. The detritus shows how the material was used, both the newly-tanned hides and the secondhand leather artefacts which could be re-used. The completed shoes can tell of the types in use and of changing fashions (fig. 21).

Not a great deal of textile was found in the excavations; as a rule only small fragments. But remains of an almost whole linen shirt were found (fig. 23) (9).

Other crafts are represented by the finds albeit with smaller amounts of detritus. For example the turner has made small wooden bowls, and as waste from this characteristic lathe cuttings are found. There are also various metalworkers. The goldsmith's patrix-die has al-

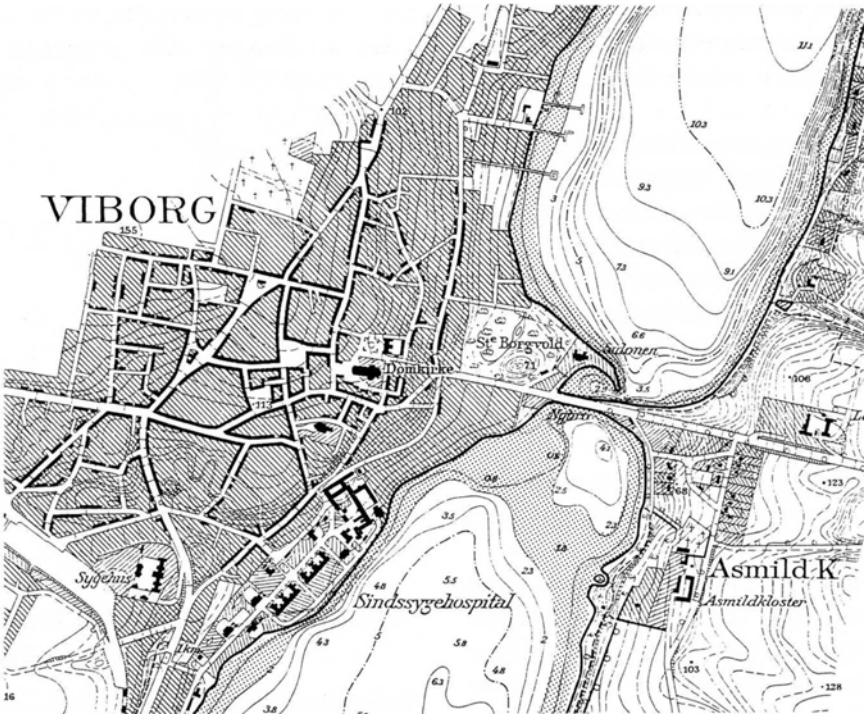



Fig. 24. Chart of the Viborg lakes with depths shown. Because of the damming there is today a drop of 2.2 m by Søndermølle at the outlet from Søndersø. If the water level in the lakes were reduced by 2 m, the area of the lake would be a little smaller, and between the excavated area and Asmild cloister a broad spit would stand clear, as marked upon the chart. Section of the Geodætisk Institute's detail map of Viborg Nørre- and Søndersø, 1934. After Krongaard Kristensen 1985.

ready been mentioned (fig. 5). Further finds include a number of heating plates employed in precious metalwork. The bronzecaster left behind small crucibles and broken moulds.

Some finds show trading contacts. The tools of trade itself are represented by finds of balance-arms and weights. The weights are few in number, but both an octahedron of bronze and a brass-inlaid iron weight have been found (fig. 22).

Imported goods include whetstones, soapstone vessels and quernstones presumably from Norway, western European and Egyptian glass, and pottery from England, the Rhineland and Baltic areas. Amongst the coins are several German examples (10). The foreign objects are of course not always evidence of direct contact between Viborg and the places concerned, but they show that foreign wares left a creditable mark upon the town, which must have been mediated by some form of trade.

## THE DAMMING OF THE LAKE AND THE EARLY TOPOGRAPHY OF THE TOWN

The investigations have shown that there was an urban settlement in Viborg about the year 1000, with closely spaced buildings and craft activities. The extent of the settled area is not known, but traces of structures are found over a substantial area in the vicinity of Viborg Søndersø (see figs. 2 and 4).

In certain places settlement began at a level which is 1.5 m below the present level of the lake. Similarly the excavation of sites U and V showed that parts of the settled area had been flooded. The settlement remains must run on some way under the lake.

Thus a marked rise in water level has been seen in the lake. How great a rise cannot be precisely determined from the archaeological studies undertaken to date. By the outlet from Viborg Søndersø there stands a mill, Søndermølle, where today there is a drop of 2.2 m. Presumably the drop is the same height as the dam which was constructed in the Middle Ages.

Both Viborg Søndersø and the contiguous Nørresø are quite deep, so that even before the damming there were two large lakes. At many places along the lakes there is no very great difference between the present water edge and that that one would have if the level were 2 m lower. There is however one place – right outside the excavated area – where the situation would be radically changed with a lower water level. As fig. 24 shows a 2 m lower level would leave a tongue of land about 100 m broad across the lake. Naturally the raising of the water level has itself affected the submerged land forms, but the tongue crossing the lake seems to marked that it must be presumed to reflect some original situation. Before the damming the lakes were probably divided by this broad spit and conversely connected by a little watercourse.

The existence of this tongue opens the possibility of a road connection east from Viborg: the little watercourse between the lakes can have been no great obstacle. Thus the location of Asmild church at the east side of Søndersø right opposite Viborg is explained. The original basilican church from *circa* 1100 from the outset lay at the edge of Viborg town, about 15 minutes' walk from the cathedral. Asmild church and the later cloister, together with the old Bishop's palace in Asmild east of the church thus originally were closely connected to Viborg. Only after the lake was dammed up and the roadway between Viborg and Asmild flooded did the cloister come to be eccentrically located relative to the town.

The postulated road east has not yet been confirmed by excavation but the road is probably the true basis for the location of this quarter of the town. As has been demonstrated in several places the physical starting-point of the settlement was not especially favourable: the wet areas required the expenditure of extra labour before the ground was fit. The site must have been attractive for some other reason: for example because of its good situation for communications. As mentioned before there was an important north-south routeway in the eastern part of the town. The crossing point of the north-south and east-west roads probably lay at the south-western corner of Brænderigården, whence still in the last century a road ran east to the ferry point for a connection to Asmild.

This crossroads at Brænderigården is probably the cause of the late Viking-period settlement in Viborg. Here was a tolerably firm building area, but rapidly in the beginning of the 11th century it was necessary to bring the damper areas to the east into the expanding town. Most probably the first urban settlement in Viborg was formed in the late 900's around this crossing point.

## WHEN WAS THE LAKE DAMMED UP?

We still have no secure dating for the damming. Søndermølle, where the lake was dammed, is first mentioned in 1488 but can easily be much earlier. According to the investigations reported here, the settlement was abandoned about 1300, and the reason was presumably that the water level had risen so that some of the settlement was drowned and some deteriorated because of the higher water table. On top of this the routeway eastwards was destroyed so that the favourable position for traffic was no more.

The damming was a serious development, and one is reluctant to believe that it happened solely in order to establish a water mill. To say the least the mill cannot have been established with particular regard to the burgers of Viborg since the road connection to it was lost with the damming.

Perhaps the damming is connected with a serious event in the year 1313. In this year open strife broke out in Jutland, fostered by men of first rank and leading farmers at the *thing* in Viborg (Hørby 1977, 124–9). The uprising was surpressed, not without difficulty, by King Erik Menved with the help of German mercenaries. To prevent recurrences, in the same year, some new fortifications were founded in North Jutland, including one in Viborg which was placed close by the Nørresø – see A. N. Jaubert, this volume. The rampart Borgvold just north of the excavated area is a memorial of the fortification (11). Perhaps the lake was dammed in order to bring water into the moat around the fort. Since the fortification was undertaken in an abnormal political situation, the king could well have taken a long view of the burgers' rights (12).

Whatever the reasons were, and whenever the events took place, it is clear that a quarter of the town of Viborg from the late Viking Period and early Middle Ages disappeared. The inhabitants moved – gradually or at once, we don't know – but we do know where they went. The defences of the town of 1151 (cf. fig. 1) were laid out according to the defensible properties of the natural

terrain rather than according to the settled area, so that while some area of settlement to the south may have been excluded there was plenty of space within the ramparts to the west and north. Only after *circa* 1300 was there settlement in the outermost streets to the west and north. Here, probably, the burgers from Søndersø found themselves.

*Translated by John Hines*

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## NOTES

Preben Dehlholm produced the photographs of the pottery (1982) and Joan Nielsen drew the profiles of the vessels' rims (1982).

1. Olaf Olsen has given an account of the goals and methods of the project in the foreword to the project's local publication, see e.g. Krongaard Kristensen 1987, 5–7.
2. The trench was largely dug by machine. The excavations in 1981 were undertaken by stud.mag. Jesper Hjermind and the author.
3. 1081±1 A.D. The dating was undertaken by the Wormianum laboratory.
4. The coins are identified by Jørgen Steen Jensen, Den kgl. Mønt- og Medaillesamling.
5. The date is taken from a section of timber with surviving bark found in the settlement layer immediately under the clay floor of the building. The dating was undertaken by the Wormianum laboratory.
6. The pottery from here is published in Krongaard Kristensen 1982. All the ceramic finds are dealt with in a specialist dissertation in Medieval Archaeology of Århus University in 1987 by Jesper Hjermind: *Keramik fra udgravningerne ved Viborg Søndersø 1981–1985.*
7. The sherds are of the late phase of Anglo-Saxon pottery, known as Saxo-Norman pottery, and seem to be most like the Torksey type. Hurst 1976, 326–7.
8. The pottery appears to belong to Reihe 1 of the Vipperow group. Schuldt 1956, 44–9.
9. The shirt was found crumpled up in a posthole. In the course of time the material has been broken in many places, where it was folded. Conversation and restoration is not yet completed (Fentz 1989).
10. Magdeburg bracteate, archbishop Wichmann (1152–1192); probably Erfurt bracteate, archbishop Adalbert II (1137–1141); Osnabruck, bishop Konrad I of Rietberg (1270–1297). The coins were identified by Jørgen Steen Jensen, The Royal Coin Cabinet, Copenhagen.
11. A stake removed from beside the entrance way to Borgvold is dendro-dated to 1314. Vellev 1985, 76–8; Krongaard Kristensen 1987, 35–6.
12. The new interpretation was first published in Krongaard Kristensen and Vellev 1982. It was subsequently expanded in Krongaard Kristensen 1987. The book is provided with an English summary.

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# *Margrethehåb*

## A Settlement Site of the Early Middle Ages at Roskilde, Zealand

by TOM CHRISTENSEN

In the last 10 years the source material from a series of Danish medieval towns has been thoroughly examined in the grandly named 'Projekt Middelalderbyen' (Nielsen and Schiørring 1982). The results of this are now coming in in the form of publications which can form a basis for further investigations.

The importance of the town for medieval society was naturally great. It is worth remembering that far and away the greatest part of the population still dwelt on the land, and medieval rural settlement forms have not been made the object of systematic investigations to the same extent as the towns. In the years 1984–86 Roskilde Museum had the opportunity to excavate two such sites of the early Middle Ages in an area west of Roskilde, called Margrethehåb (Roskilde Museum j.nr. 623/84) (Fig. 1–2).

Typical of the terrain at Margrethehåb are small banks surrounded by meadow and bogs cut by minor watercourses. To the north the land falls sharply towards a larger bog area which is connected to the nearby Roskilde fjord. The sites lay upon heavy clay which offered good conditions for preservation of, for example, bone, but which, however, as far as excavation was concerned, was hardly so pleasant in the dry summer months.

### MARGRETHEHÅB I

On the western side of a small banked plateau about 2,500 sq.m. of a settlement including three buildings and a fence were excavated (Fig. 3).

Two of the buildings were longhouses (building I and II), one a little outhouse of 7 × 4 m. with three sets of roofbearing posts, the other a rather larger building at least 12 m. long and 5 m. broad. The latter must certainly be interpreted as a dwelling house as trial trenches showed that other buildings which could be associated with this settlement were not found in the area.

Building I was connected to a minor sunken hut (building III), 2.5 m. square, by a 20 m long fence. This had no visible timber structure but traces of a hearth were found in the north-western corner of the pit.

The buildings reported here must represent the greater part of an integrated farmstead. The artefact material is no more than a few sherds of Baltic ware and the local coarser ware. From the sunken hut, further, came a simple comb (Fig. 4) and a fragment of a loomweight. An archaeological dating to the late Viking Period is therefore probable. This is supported by a C-14 dating of bone material from the sunken hut (building III) which places the settlement in the 11th century (K-4692, Fig. 19).

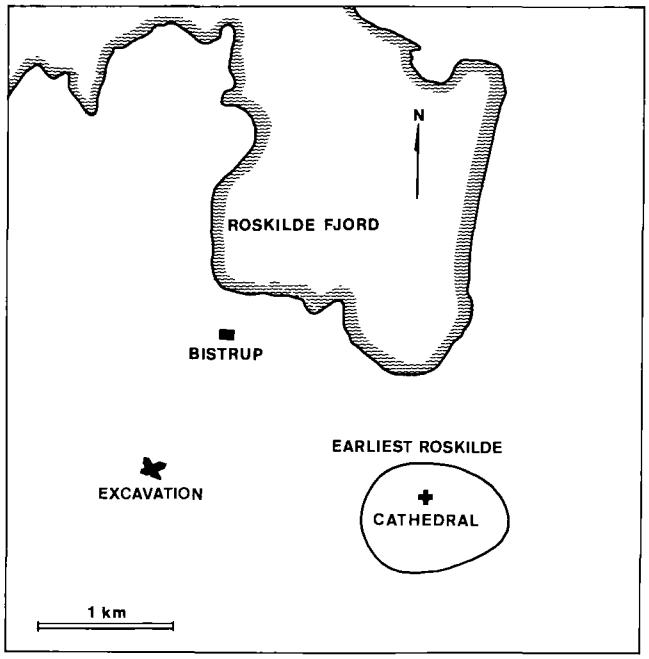


Fig. 1. Map showing Roskilde, Bistrup and the excavations at Margrethehåb.

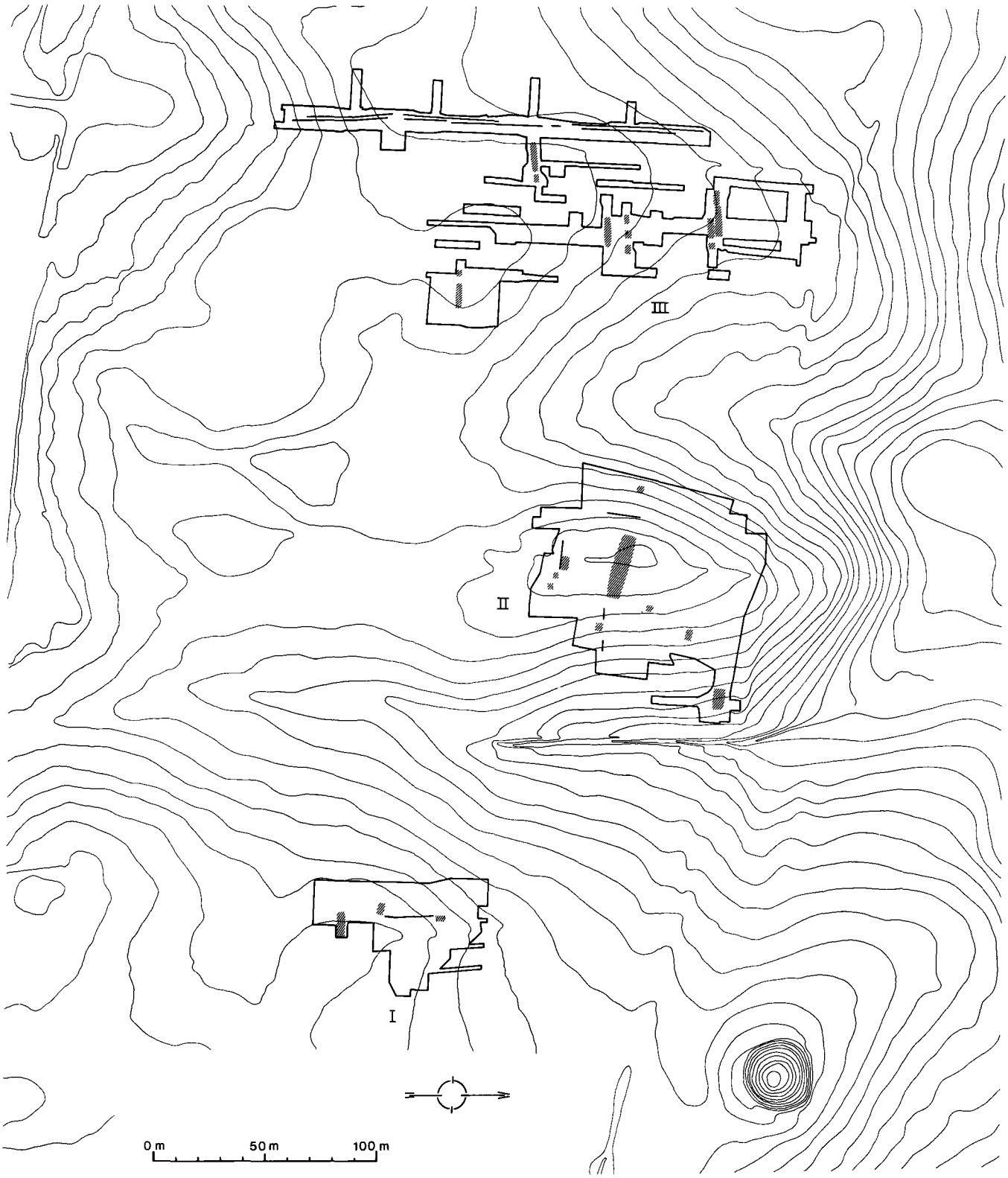


Fig. 2. The Margrethehåb area with the settlement complex (III is not mentioned in the article).

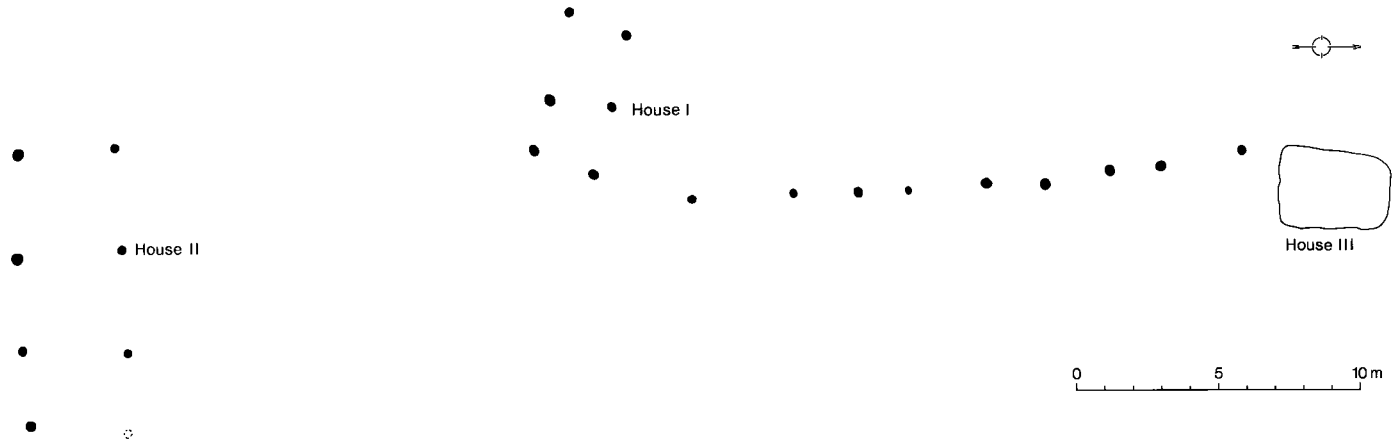


Fig. 3. Plan of Margrethehåb I, showing the late viking/early medieval settlement.

## MARGRETHEHÅB II

On a clear bank about 100 m. west of Site I and separated from it by a minor watercourse lay Site II (Fig. 5). In the area of about 10,000 sq.m. excavated a few neolithic and early Iron-age pits appeared, but the majority of the structures, including all the buildings and fences, could be dated to the 11th and 12th centuries.

### *Small buildings*

Scattered across the excavated site were found three minor buildings between 5 × 2 and 9 × 4 m. large (buildings IV-VI). These were usually simply constructed with three sets of roofbearing posts. How far these were located in the wall line or were internal roofbearing posts cannot in all cases be determined. Some of the buildings could be dated to the 11th-12th centuries by finds of Baltic ware in the postholes. The postholes in the buildings which could not be dated directly were filled with a light grey fill with fire-crazed stones. This was a general characteristic of the postholes of the early medieval structures.

One of these minor buildings, building VI, had a rather peculiar construction (Fig. 6). The building measured 9 × 4 m. and was placed at the foot of the bank at the edge of a little watercourse. The walls were composed of two quite irregular rows of posts which were paired across the building. To the east the end seems to have been rounded, but the structure was open to the west. In the eastern end two postholes/-pits were found filled with crushed chalk. A post in the middle of the house was possibly part of the structure, if so as a roofbearing post.

The dating of this building is based upon finds of Baltic ware in the postholes together with a C-14 dating of bone material from a pit which cut the north-western corner of the building (K-4695, Fig. 19).

### *Longhouse*

In the centre of the settlement and on the highest point of the bank a longhouse was found, 27.5 m. long and 6 m. broad (5 m. at the ends), with curved sides, building VII (Fig. 7). There was a clearly distinguishable entrance at the west end of the northern side of the building. This lead into an end-room which was divided from

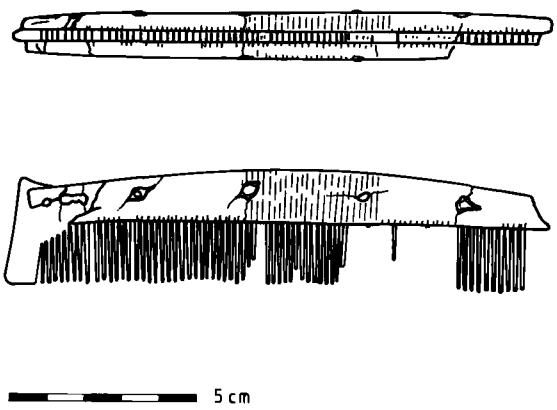


Fig. 4. Comb found in the pithouse (House III).


Fig. 5. Plan of Margrethehåb II, showing the medieval farm.

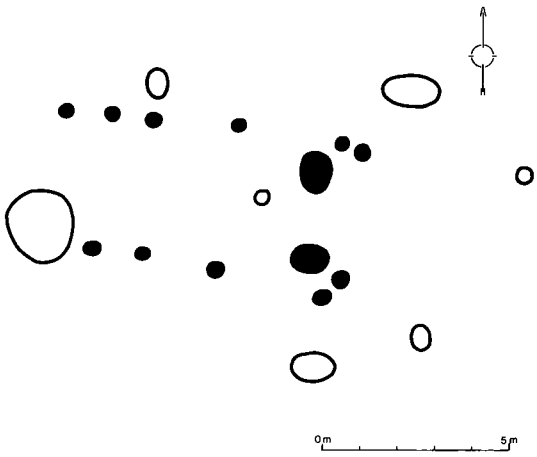


Fig. 6. House VI at Margrethehåb II.

the remainder of the building by a partition visible as two wide plank traces in the ground. The building had no internal roofbearing timbers, so that the walls alone carried the roof. The wall posts were very strong, on the whole of the same dimensions as one would expect of internal roofbearing posts. In some of the wall posts, which were of very varied depths, a sill-like construction was used where large stones were placed as packing for the posts. One was placed above a flat boulder (Fig. 8).

The walls were probably constructed in log-technique with 3.5 m. intervals in the south side. In the middle of this line is a 6 m. gap between the posts: there was perhaps another doorway at this point. Thus the wall posts in the building are not placed in pairs opposite one another, which must mean that they were not internally linked by tie beams. No traces of a hearth or further room divisions were found in the building.

The building can be dated by finds of Baltic ware in the postholes. A C-14 dating of bone has come from a pit which cut the east end of the building (K-4694, Fig. 19).

*Other structural types*

Small structures consisting of two pairs of posts forming a square ground area of between 5 and 10 sq.m. are often identified in the literature as raised granaries. At

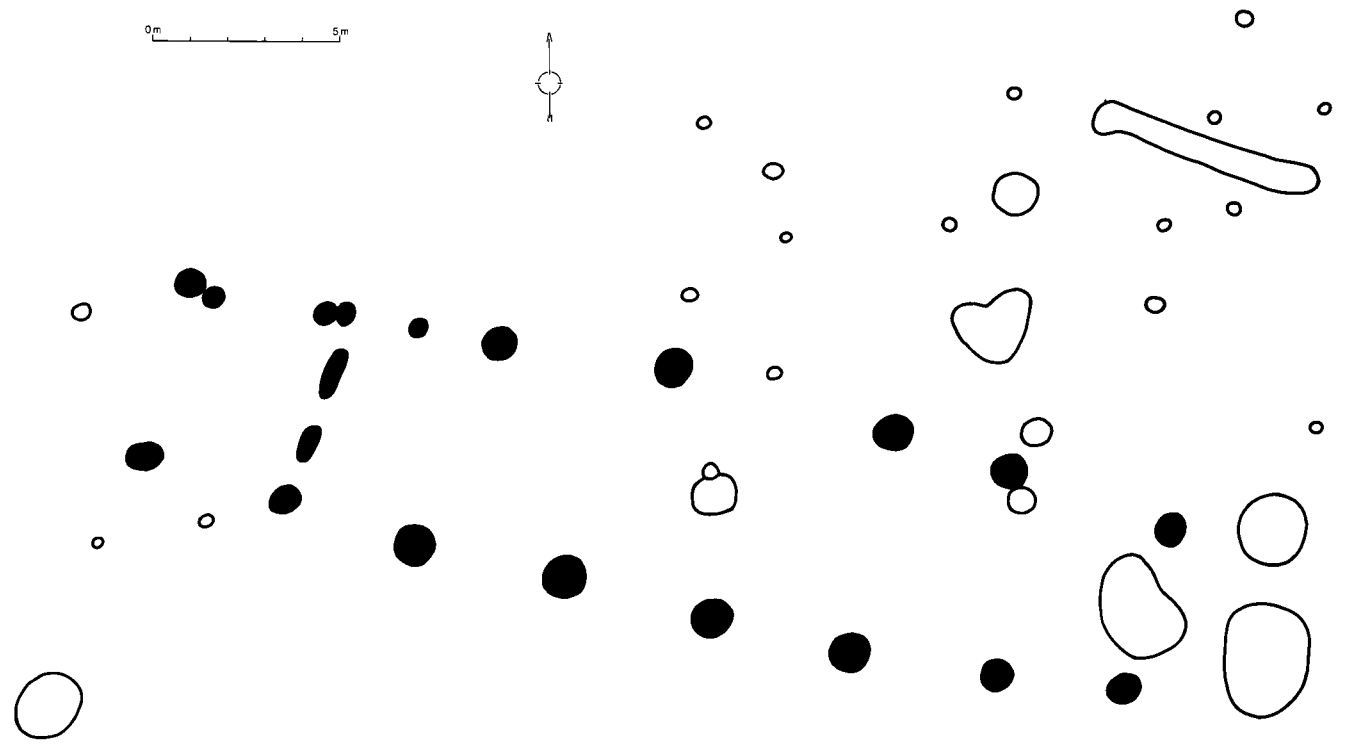


Fig. 7. House VII at Margrethehåb II.

Fig. 8. Wall post with boulder from house VII.

least five structures of this kind were found spread across the excavated area (buildings VIII-XII).

Naturally a large number of pits were found – usually common rubbish pits. One type distinguished itself clearly from the others. These were stone-filled features up to 6 m. long and 50–75 cm wide, varying in depth between 20 and 50 cm. The few finds in these pits can be assigned to the 11th and 12th centuries. The function of this particular type is not immediately obvious but that it is a specifically determined structural type is beyond doubt.

*Artefacts*

The artefacts from Margrethehåb II are rich and varied and include pottery, bone and metal.

Pottery

The material consists apart from one single piece entirely of sherds classifiable as Baltic ware. Out of a collection of fully 300 sherds it has only been possible to collect two vessel profiles (Fig. 9). These and the other classifiable sherds can be attributed to Dagmar Selling's group AII:3: flat bottomed vessels with raised, rounded shoulders and inturned rim-sections (Selling 1955, 89 ff.). In the contemporary material from Sjælland vessels with inturned mouth rims, Dagmar Selling's type AII:3a (Liebgott 1979 and 1982), dominate, often forming two-thirds or more of the sherd material. The same seems to be the case with the rather sparse material from Margrethehåb, when 28 of 47 rim sherds (57%) can be attributed to this group. The remaining rim sherds are of various types: most however come from vessels with vertical mouth rims.

In by far the majority of cases the decoration comprises horizontal grooves which cover greater or lesser parts of the vessel. The rim zone may be undecorated, or the grooved decoration carried right up to the rim. Wavy lines are the second most commonly occurring decorative element and always appear round the shoulder and rim and often together with horizontal grooving. Other elements such as comb and nail impresses, and diagonal slashes, appear in some cases, always around the shoulder of the vessel.

Besides the Baltic ware just one single rim sherd of grey-fired ware was found.

Bone artefacts

Five bone artefacts were found: two pins, half a knife handle, two bone splints riveted together and a comb case (Fig. 10).

The 16.5 cm long comb case is held together by bronze rivets and undecorated apart from a groove running along the mounted splint. An almost identical example from Lund is dated to the first half of the 12th century (Mårtensson 1975, 325, fig. 292.37B), a dating which fits the period of use of Margrethehåb II.

The other bone artefacts are not dated of themselves, but were found together with other artefacts which belong to the period.

Metal objects

In all 38 iron artefacts could be collected, of which the majority are identifiable as nails, rivets and horseshoe nails. Ten knives or knife-fragments were found, all small, one-edged knives with pointed tangs.

The 14.5 cm long artefact in Fig. 11 may look like a spearhead but a corresponding find at Trelleborg is identified as an arrowhead (Nørlund 1948, pl.XLI.1). The lock cylinder in Fig. 12 is also best compared with a find from Trelleborg (Nørlund 1948, pl.XXXII.1) but only the central cylinder is preserved of the copper-inlaid piece from Margrethehåb. A 15 cm long pointed oval firesteel with a suspension hook has a rather special form, but corresponds essentially to firesteels from Trelleborg (Fig. 13) (Nørlund 1948, pl.XXIX.14). The 4.5 cm long padlock (fig. 14) is a close parallel in

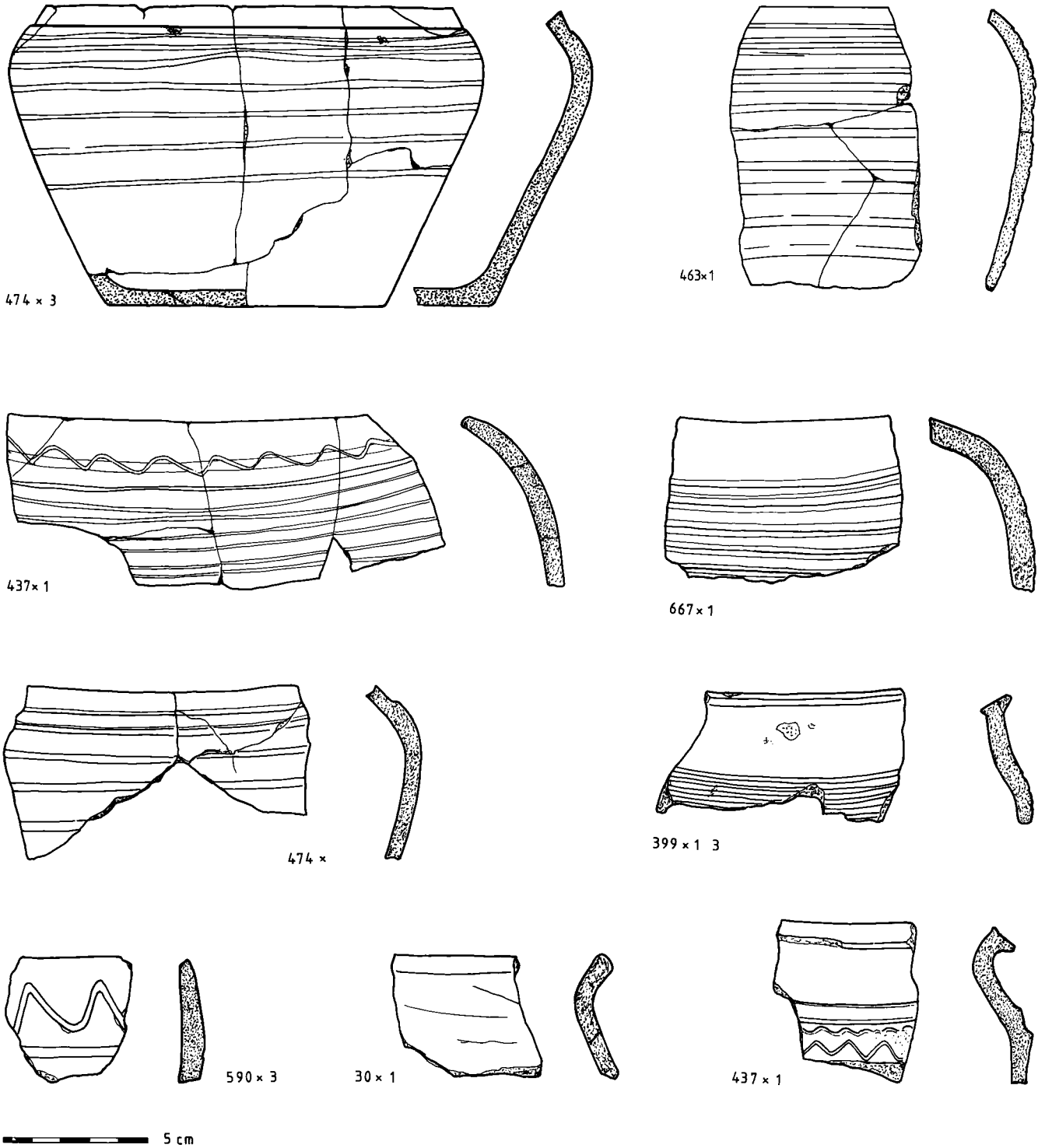


Fig. 9. Pottery (Baltic ware) found in postholes and pits at Margrethehåb II.


Fig. 10. Combcase made of bone.

Fig. 11. Arrowhead of iron. Length 14,5 cm. Photo by Fl. Rasmussen.

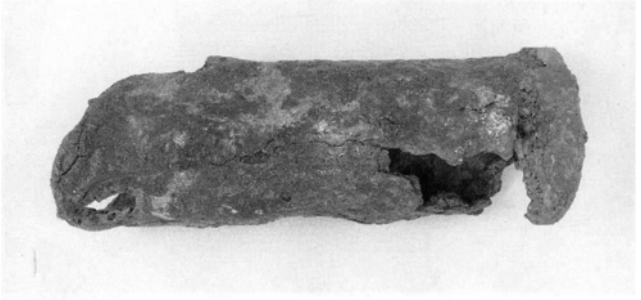

Fig. 12. Lock cylinder from a horsechain. Length 20 cm. Photo by Fl. Rasmussen.

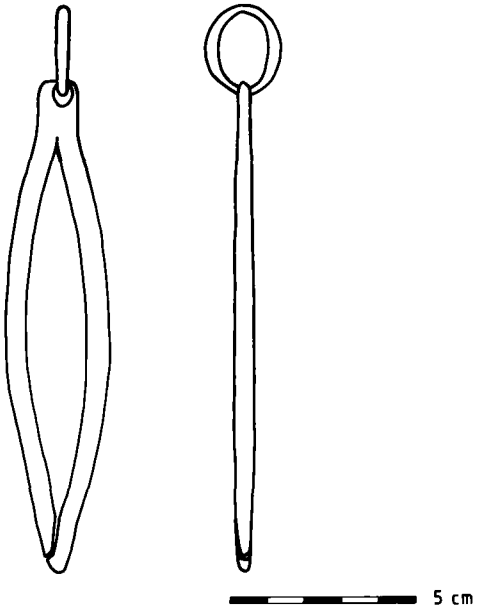


Fig. 13. Firesteel.

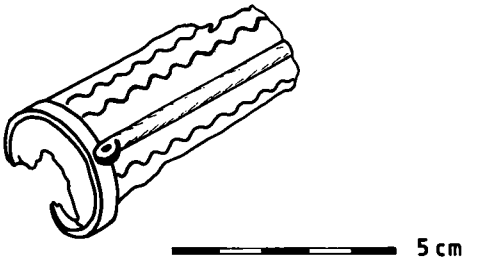


Fig. 14. Small ironpadlock.

form and decoration to a piece from Lund dated to the 11th century (Mårtensson 1976, fig. 359).

Other metal finds consist of just two mounts of bronze foil with stamped decoration. A gilt medallion with an incised cross was found in the ploughsoil, but must be contemporary with the settlement site.

Decorated bone plates

The excavation produced one find quite unique in the broader context. Scattered in the fill of pit were whole and fragmented parts of decorated bone plates and splints (fig. 15). After conservation the material could be assessed: 15 pieces of millimetre-thin bone plate, the largest measuring 8.4 × 8.3 cm and the smallest 5.2 × 3.9. Bone plates of this size probably come from the lower jaw of horse, which is suitably flat and of the necessary size. By removing the back of the bone piece the desired thickness is obtained. Are all bone splints and shafts formed from rib bone? The decoration on both plates and splints comprises a complete covering of ring motifs which are varied in such a way that no two pieces are quite the same. All bone plates have perforations in the form of small nail holes for fastening the plates on some underlay, and some round ornamental holes through which the backing material showed (Figs. 15–16).

The most probable explanation of this enigma is that the plates and splints come from a house-shaped shrine

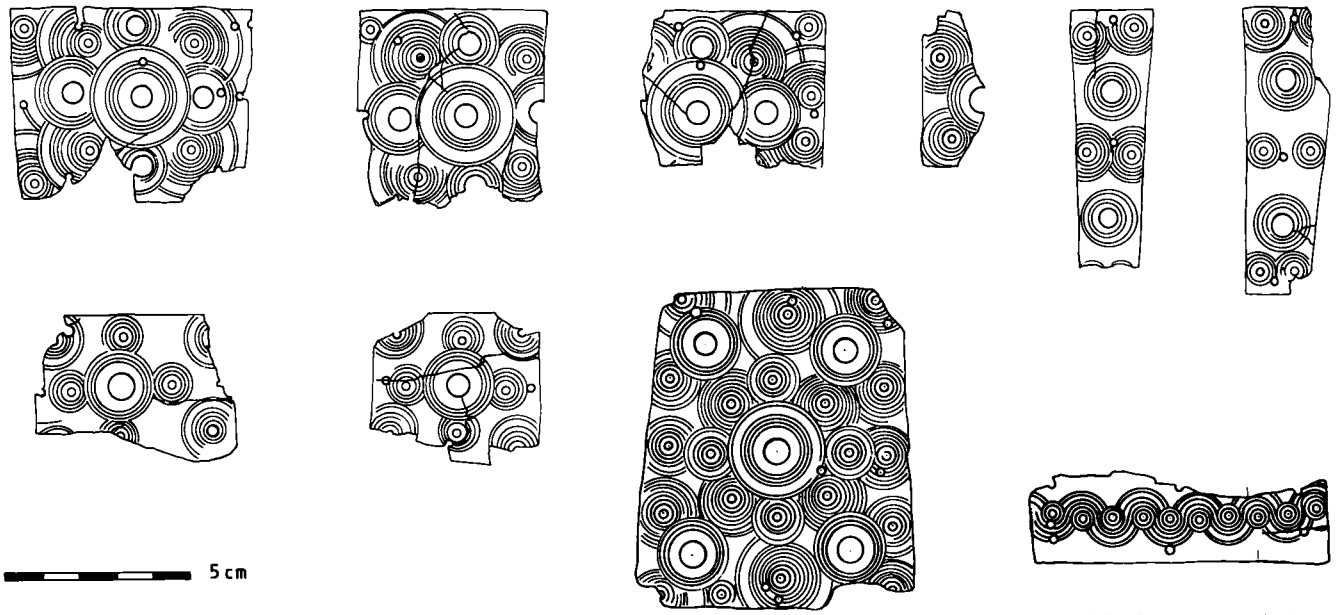


Fig. 15. Some of the decorated bone plates.

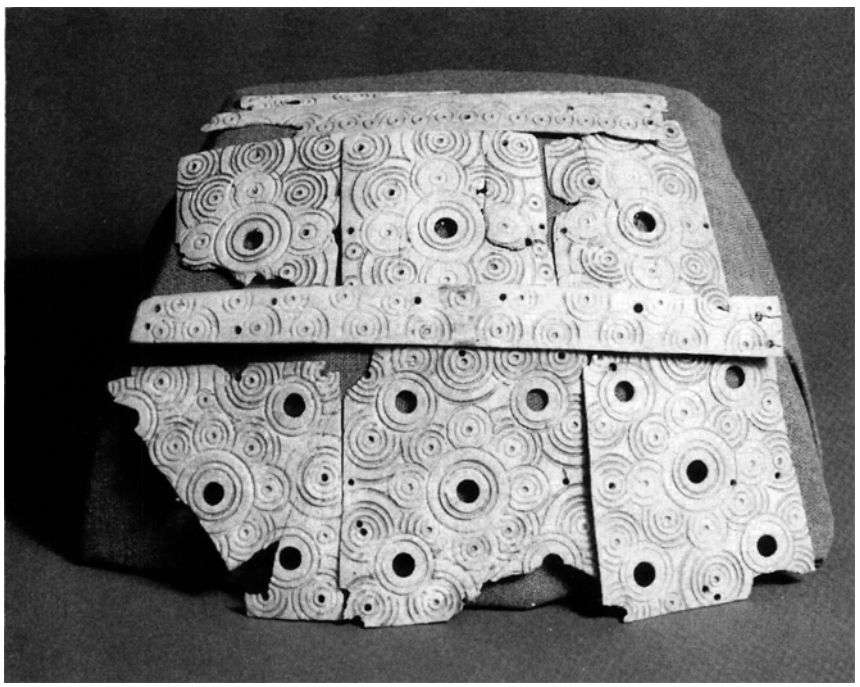

Fig. 16. Tentative reconstruction of the shrine. Photo by Fl. Rasmussen.

of the same form as those known from Cammin and Bamberg, albeit in a less ambitious version. It may also be noted that in some European cathedrals there are shrines which without being direct parallels are strongly reminiscent of the Margrethehåb find (Andersen 1987, Gabriel 1988 p. 151 ff.).

## DISCUSSION

The most interesting peculiarity from Margrethehåb is the bow-sided building. Buildings of this type have been discovered at a series of sites in the present area of Denmark in recent years. This includes the principal

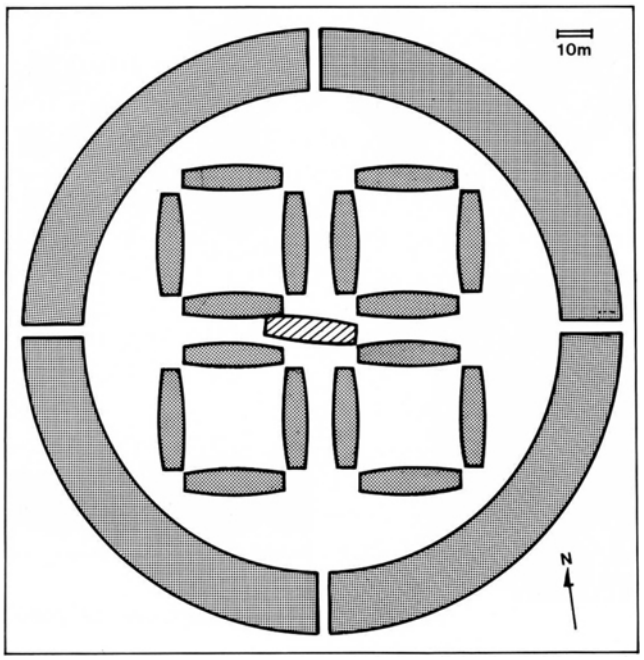


Fig. 17. Trelleborg with the central building outlined.

buildings of the latest farmsteads at Vorbasse, some of the buildings from a newly discovered site at Vilstrup by Ribe and Hampegård on Lolland (Hansen 1983, Jensen 1987, Hvass 1980).

The best parallel however is a building which was found in the excavation of Trelleborg (Nørlund 1948, 25, fig. 26). Sited in the middle of the site, between the four barrack blocks and thus in the centre of the ring-shaped rampart was a building which corresponds closely in dimensions and construction to that from Margrethehåb. The Trelleborg building was 25 m long and about 6 m broad with seven sets of roofbearing posts in the wall line (Figs. 17–18). The dimensions and varying depths of the postholes correspond well with the observations at Margrethehåb. At Trelleborg too large stones seem to have been used in the postholes' fill. The Trelleborg building was considered by the excavator to be earlier than the fort but there is no stratigraphic evidence for this, as the building respects the barrack blocks. It may however appear that the bow-sided building's postholes removed some of the foundation-stakes of the fortress's roadway. With the well-dated Margrethehåb building it might be reasonable to redate the Trelleborg building to the early Middle Ages, to the second half of the 11th or 12th centuries. It is possible that other such structures with their foundations in the soil are hidden elsewhere in the fortress area, contemporary with the central building. It is tempting to interpret the building as the principal building in a high-status settlement, with the ring rampart still in use.

With the findings at Margrethehåb and the other settlement sites longhouses of this construction may be placed within an early medieval context, in which they supersede the classic 'Trelleborg halls'.

The settlement site at Margrethehåb was not fenced in but the natural, topographical bounds – the watercourse and wetland on three sides – confirm that the settlement has effectively been fully excavated. The site is hardly a part of a larger village but must be viewed as an individual major farmstead.

The site of Hampegård, mentioned above, which is dated to the early Middle Ages, seems to involve a settlement structure corresponding to Margrethehåb, al-

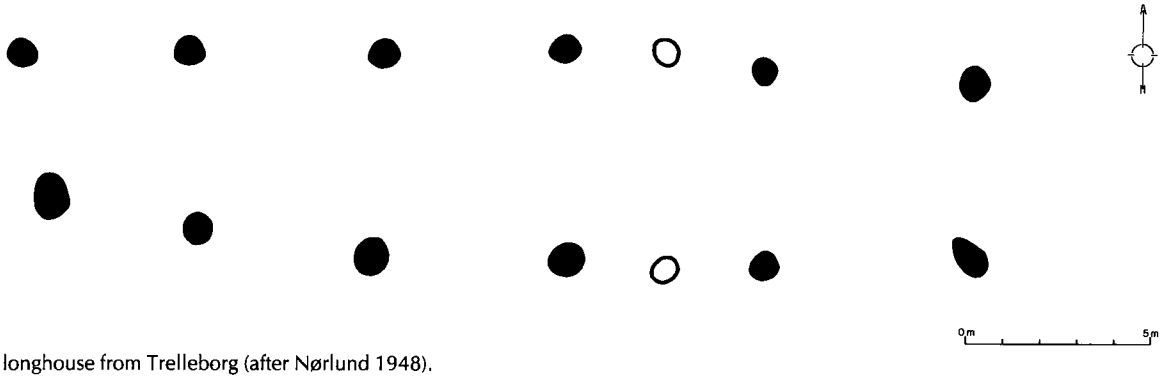


Fig. 18. Plan of the longhouse from Trelleborg (after Nørlund 1948).

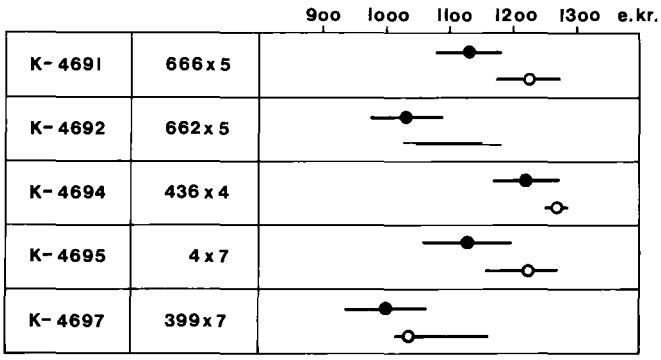


Fig. 19. Radiocarbon datings from Margrethehåb I and II. Filled signature: conv. C-14 years, unfilled signature: callib. C-14 years (Stuiver and Pearson 1986).

though in this case with several building phases. One of the major buildings – IIA – corresponds in a rather less imposing manner to the central longhouse at Margrethehåb. The large number of granaries and small buildings in three sections fit closely with the situation at Margrethehåb (Hansen 1983, fig. 20).

One form of specialization at Margrethehåb can be inferred from the location and finds of the site. The large meadowlands and wetlands which surround the settlement must have been ideal pastureland. That animal husbandry was the essence of the economy is underlined by the 26 kg of animal bone which were recovered. These were found some in 'common' rubbish pits and some closely packed in large pits which only held animal bone. How far this reflects butchery detritus cannot be decided before a detailed study of the bone is undertaken but it seems clear that the quantity of bone is greater than one can expect to find on a settlement site of this size and length of life.

In the remaining find material the absence of certain categories is noteworthy. This includes all sorts of raw materials and half-products: only two bones had preparation marks and no smithing slag was found. Nor were there tools for production such as spindle-whorls and loomweights. Many of the objects found, such as the padlock, comb case and decorated bone plates testify to specialized craftwork which has hardly been undertaken at the farmstead.

Just 2 km east of Margrethehåb is Roskilde (Fig. 1) which at this time was one of the nation's largest towns. An obvious interpretation of the finds from Margrethehåb is as a sign of a relationship, in which the farmstead marketed its products – meat – in the town and bought there ready-made goods.

The farmstead itself lies just 1 km south of the palace of the Bishop of Roskilde, Bistrup (first mentioned in 1277 but certainly older) and may have belonged to it. The Bishop of Roskilde was without rival as the country's largest landowner and one of the most powerful men in the kingdom. In the 12th century the position was held by the famous Bishop Absalon. It was under him that the construction of one of the nation's first brick building, Roskilde cathedral, began: a building project the residents of Margrethehåb would have been able to follow at the closest hand.

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The artefacts were drawn by Anne Pedersen.

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# The Royal Castles during the Reign of Erik Menved (1286–1319)

by ANNE NISSEN JAUBERT

The military and economic role of castles in medieval society was such that it is interesting to examine their existence during a limited period, without a chronological or typological selection of the monuments, with the objective of examining their function. In this case the royal castles in function during the reign of Erik Menved (1286–1319) will be discussed. During this period castles played an increasing role in the maintenance of power. Furthermore the severe charter imposed on Christopher II, 1320, is a natural limit, since it included a paragraph which demandes the demolition of several royal castles: *Item ut omnia castra in Nøriucia destruentur exceptis Ripis, Kolding et Scandelburgh* (1). Only castles in medieval Denmark are considered, although Erik Menved built some fortresses in Northern Germany e.g. Warnemünde 1312. In order to clarify the development of the castles during Erik Menveds's reign, they will be analysed in context with the surrounding periods and their own history – from the Valdemarian kings (1157–1241) to Erik Menved, as well as with Valdemar Atterdag's (1340–1375) castles (2).

## HOW OLD ARE THE CASTLES?

The castles cannot be examined without considering major methodological problems, especially concerning the dating of the monuments. The poverty of the written sources is well known and there are no documents on even such impressive castles as Bastrup and Borren in Northern Sealand. However the situation is improving throughout the Middle Ages and the sources, mainly epistles, charters and annals, are rather numerous about 1300. Still they do not exist on a larger scale untill the end of the fourteenth century.

Archaeological evidence presents similar difficulties. Several monuments have disappeared, others have never been examined, some – generally the large and famous castles – have been partly excavated. But most of these excavations are old and incomplete. Nor is the typological way of dating sufficient when working on a limited period, especially when numerous castles were erected in the period following Erik Menved's death, either by the Holstenian creditors or by Danish noblemen, or later by Valdemar Atterdag. Nor are anachronisms unknown in military architecture, as illustrated by the late-medieval tower-keeps, and in Denmark by the "motte-like" fortifications, of which not a single example can be shown to have been built earlier than about 1300. Even when earlier in existence, the Danish castles were only used in war at a late stage compared with Western Europe (3).

Several royal castles are completely unrecorded prior to the second half of the fourteenth century, even those connected with a town. In fact, several important urban communities never had a castle (e.g. Århus and Lund), or only had it at a distance from the town (e.g. Roskilde and Odense). Some castles are currently dated as built in the earlier part of the Middle Ages, e.g. Gurre, Sjørring Volde and Ålborg, but a critical examination shows that none of them can be proved to be as old as supposed. It has earlier been suggested convincingly that Valdemar Atterdag built the whole of Gurre, and not, as often supposed, only the surrounding walls (4).

Is it by mere chance that Christopher II's charter only exempts the castles of Ribe, Skanderborg and Kolding from destruction, or does it indicate that they were the only old and well established castles in Northern Jutland? As so far nothing final can be said about the age of several castles, it would be more prudent to wait for sure evidence before using them in this connection.

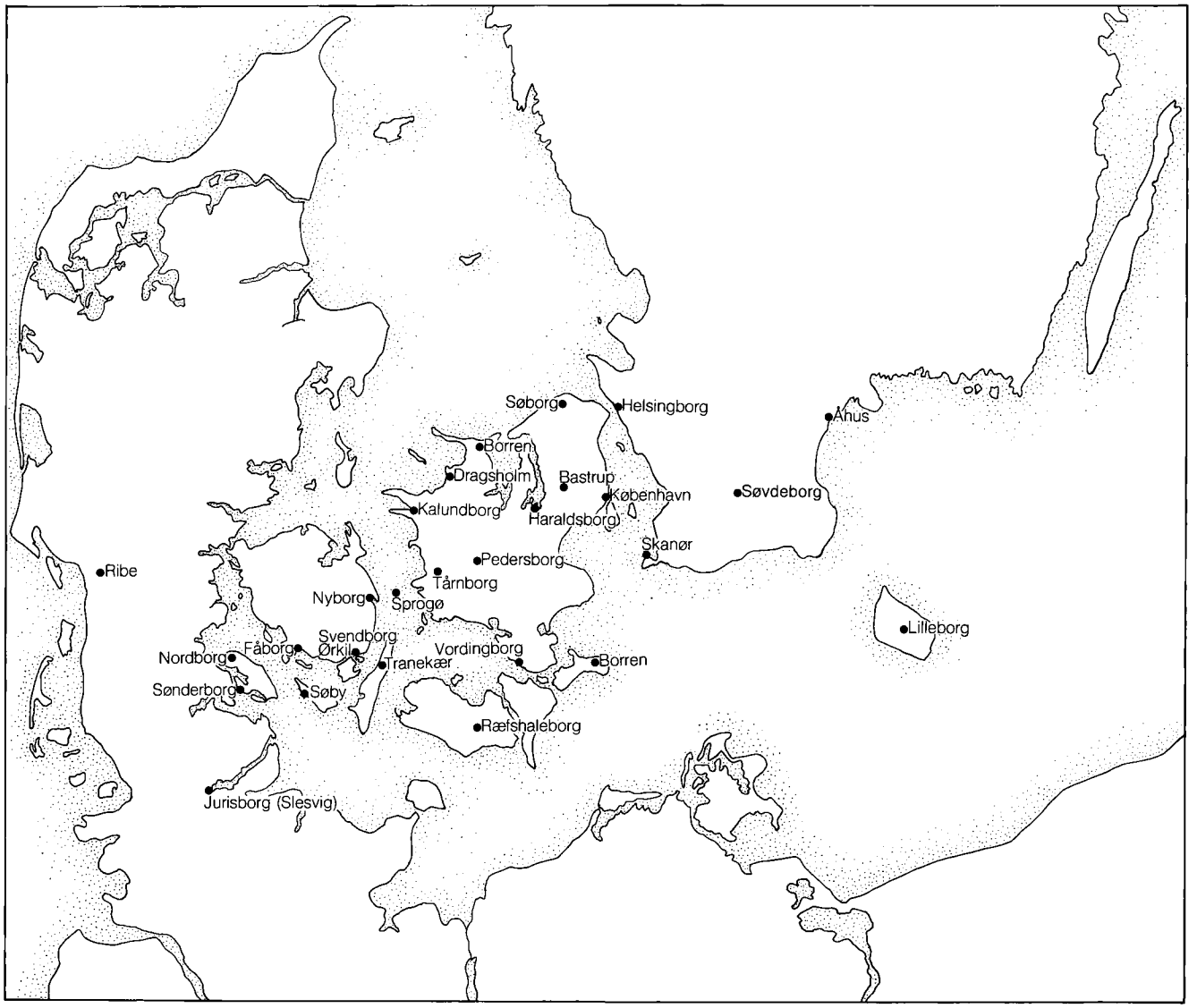


Fig. 1. Map of castles during the Valdemarian period (1157–1241).

## THE DISPERSION OF THE CASTLES

The building of castles was very expensive and so was their maintenance and their garrisons. The geographical dispersion of the royal castles to a large extent reflects the important regions and those that the central power throught were threatened.

During the *Valdemarian period (1157–1241)* the crown had become rather strong. It was supported by the mighty Hvide family and the majority of the Church. Politically and military the main involvement was with the southern countries. First the sea coast was threatened by the Slavic pirates, later the Danes attacked and conquered the Slavic areas. Furthermore Valdemar I (1157–1241) had become the German Emperor's vassal, and the king's need to maintain relative independance from his feudal lord is easily imagined (5).

The map (fig. 1) shows the distribution of known castles during the Valdemarian period. Even if some of the castles were erected by the Hvide family or the Church, they served in most cases as public fortifications. The majority of the fortresses are situated on the seacoasts in the southeastern parts of the kingdom. It is interesting to observe the case in Jutland. All the castles

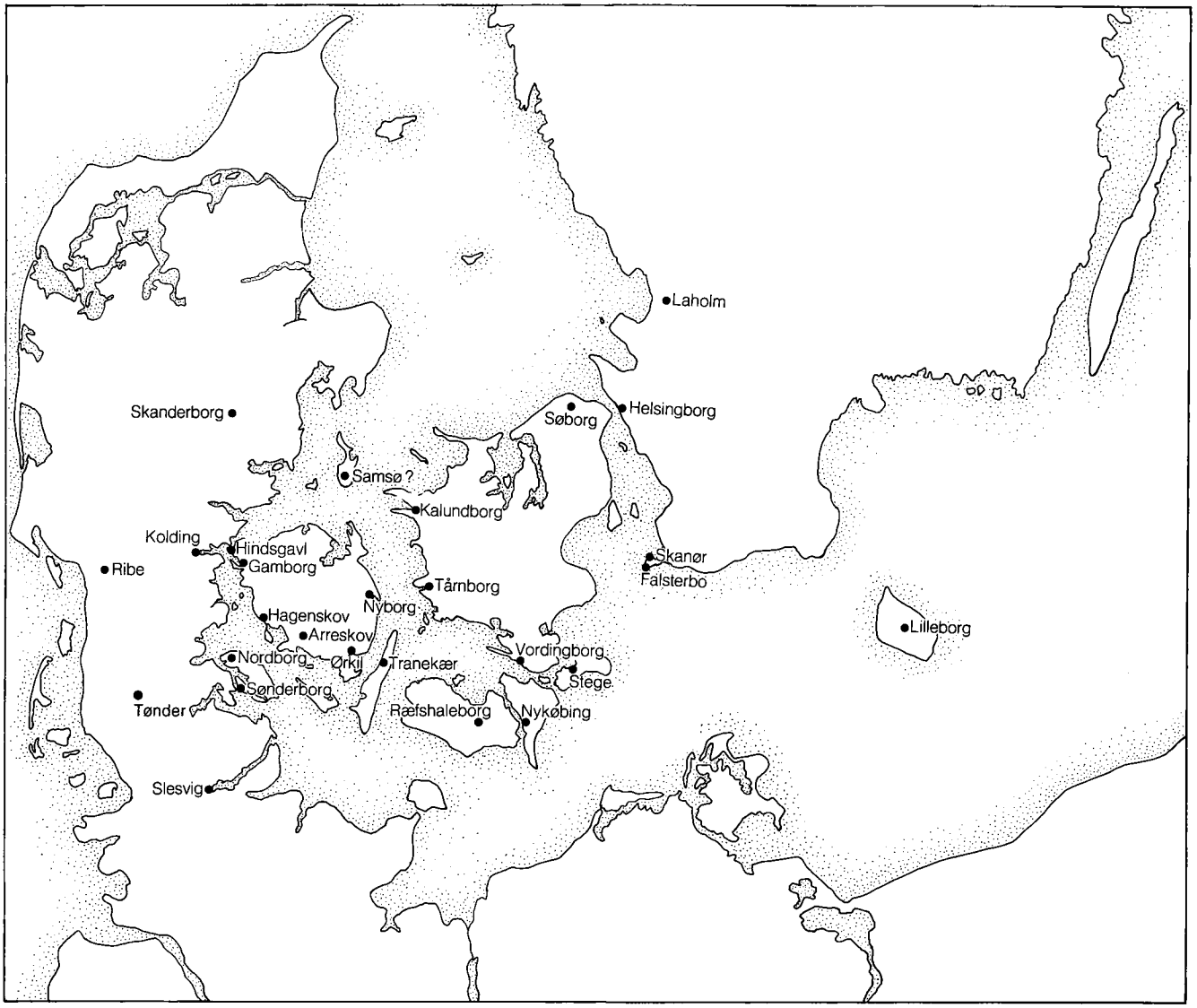


Fig. 2. Map of castles during the period 1241–1286.

except Ribe are concentrated in Southern Jutland. The island of Als was hard hit by the Slavic raids and is protected by two castles – Sønderborg and Nordborg. Anyway the Valdemar's wall at Dannevirke was hardly meant as a protection against the Slavs, but must have been built in view of the German danger. The location of the castles fits very well with the historical context. It is obvious that they were meant to defend the crown against external dangers. It might be due to the new fortifications that Knud VI (1182–1202) was able to refuse to accept the German Emperor's feudal sovereignty. This does not exclude an internal use of the castles in other situations. but it was not their main purpose.

*When Valdemar Sejr died 1241*, he left several sons. Only one of them could become king. The others were expected to be satisfied with a duchy, or if illegimate with a minor territory. However they were not satisfied, and this involved serious internal conflicts. Each legitimate son succeeded in becoming king, and afterwards their male heirs fought for the royal title. In this context the South Jutland duchy rapidly became a constant and serious threat to the crown. Besides, the archbishops and an important part of the Church came into often violent conflict with the king (6).

In this period we learn about a number of previously unrecorded castles, especially in Funen and Jutland (fig. 2). Certainly we do not know all of them, as some of them lost all military importance once conquered and destroyed, e.g. Arreskov (1264), which only reappears as a manor. Some of the old castles were also abandoned, generally being replaced by new ones more concordant with the existing situation. Probably this explains almost neighbouring large castles like Gamborg and Hindsgavl, Stege and Borren, and perhaps Ræfshaleborg (1255†) and Nykøbing Falster. In the same period castles in Northern Jutland appear for the first time in the sources, and Ribe has been reinforced (7). Most likely they are contemporany with and owe their existence to the establishment of the South Jutland duchy.

## ERIK MENVED'S PERIOD

Erik Menved's reign started very dramatically, his father being murdered in a barn at Finderup. Some of the magnates were sentenced to outlawry for the murder – probably unjustly. They took refuge with the Norwegian king, and with his assistance they built castles in northern Halland and on the small island of Hjelm. From these strongholds they organized raids with the Norwegians in Denmark. In addition came a violent conflict with the archbishop, Jens Grand, the increasing hostility of the king's brother, Christopher, and of course of Valdemar, the duke of the South Jutland duchy (8). However Erik Menved was able to start warfare in Sweden and particularly in Northern Germany. Although a succesful warrior, the expenses of his ambitious military policy provoked several revolts at home. The most serious revolt took place in Northern Jutland 1313. Its organization seems to indicate the participation of important magnates, especially the bishop of Århus, Esger Juul. When the revolt was crushed, new castles were built and others were reinforced to assure the dominance of the crown. We know several of the castles by name, yet the sources are not explicit enough to exclude the building of others, now unknown (9). At the end of Erik Menved's reign, one especially notices the struggles with the duke of southern Halland, Christopher.

In spite of the numerous internal and external conflicts, the crown had surprising strength. It must mainly have been due to the king's military superiority based on the castles and German mercenaries. In the long run this method was too expensive, and gradually it obliged the king to pawn the crown's lands to his creditors. The true frailty of the crown became obvious at Erik Menved's death, 1319, when to become king Christopher II was forced to accept a charter. It is significant, that the charter prohibited German castle tenants and demanded the destruction of the north Jutland castles (1).

The map (fig. 3), showing the castles' dispersion during the period 1286–1319, also includes the magnates' and the Church's known fortifications. In the beginning it was mainly enemies who built castles, particularly the outlaws in northern Halland and on Hjelm. The royal castle of Stege was enlarged, starting in 1307–1310, no doubt in connection with the military involvement in Northern Germany. This may also be the case of Glambek, which is first known from 1307. In Scania we learn about the castle of Örkelljunga, 1307, and the erection of the big tower, Kärnan, in Helsingborg castle is dendrochronologically dated to 1317–1318 (10). Taking the historical context into account, Örkelljunga was probably a new fortress. Christopher became duke of Southern Halland in 1306 and immediately began conspiring against the king (11). The fortifications are probably related to the brothers' struggles. It is also characteristic that the south Halland fortifications are better known from this period.

The most important phase of the building of castles was certainly provoked by the Jutland revolt (12). The known castles were rather widely dispersed. Ulstrup near Limfjorden is certainly identical with the large manor, Volstrup, belonging to the Ribe-bishops in western Jutland, and is likely to have been built by bishop Kristian, the king's faithful ally. The new castle in Viborg probably controlled the "landsting" connected with this town. Documents testify that the "landsting" played an important role in the revolt (13). Two castles were built in the bishopric of Århus – Bygholm and Kalø. The latter is one of the largest Danish castles ever built. Kalø seems very isolated but it should be noted that the distance to Århus by sea is very short. Probably this impressive fortification was meant to control Århus from the sea, so the castle confirms the presumed role of the Århus-bishop in the organization of the revolt. Perhaps the nobility had Borgvold in Viborg and Kalø most in mind, when it demanded the demolition of the castles. Archaeological and written sources indicate

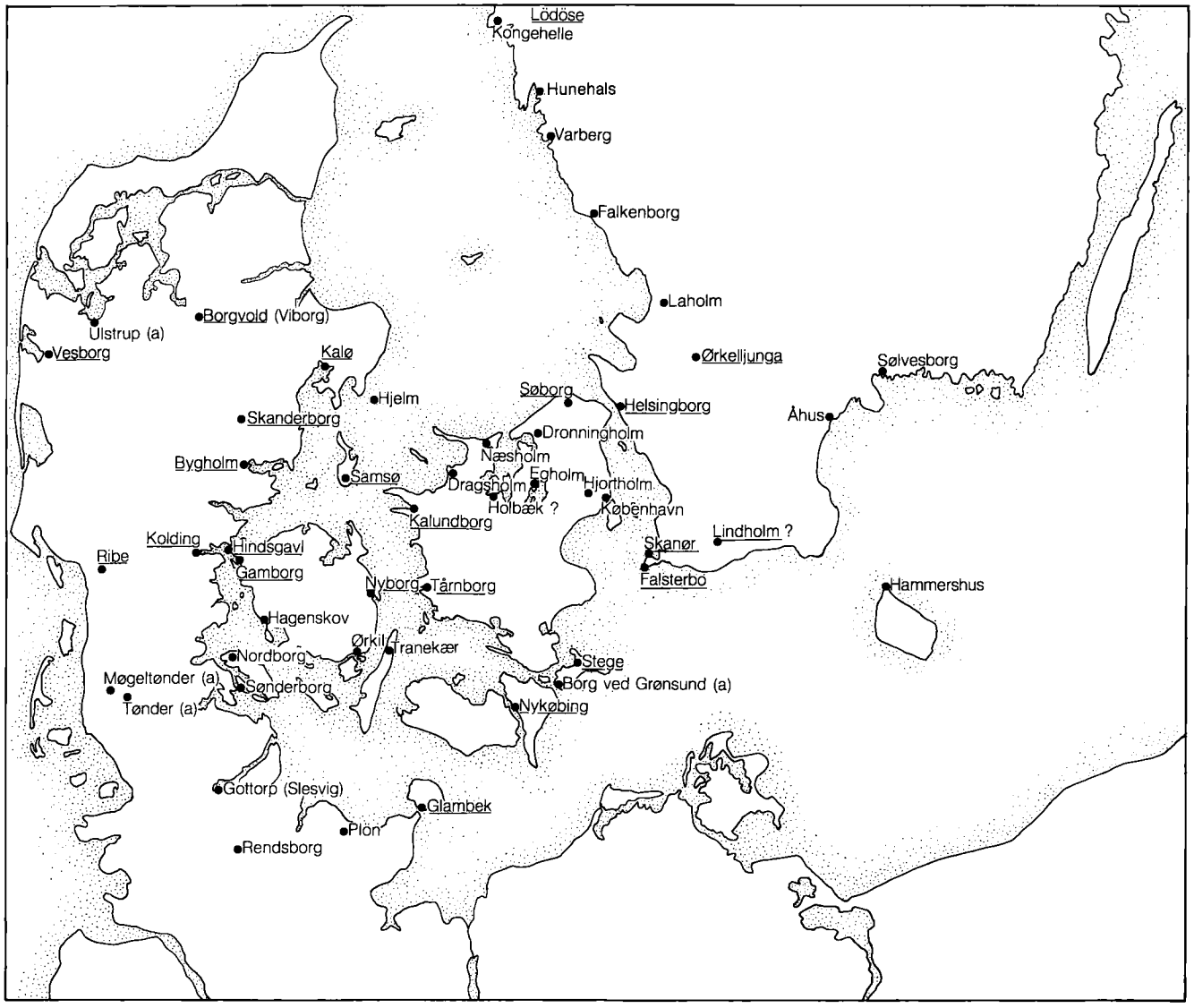


Fig. 3. Map of the known castles at the time of Erik Menved (1286–1319). Hindsgavl: royal castle. – Tønder (a): castle of the King's allied. – Hammershus: other castle – often of the King's enemies.

that Kalø was destroyed at least to a certain degree – though in the end it survived (14). The large castle of Hald near Viborg perhaps owes its existence to the destruction of Borgvold, but in reality nothing certain can be said. Unlike the majority of the older fortresses these castles clearly had an internal function. Lindholm in Scania was equally built to assure internal domination. This castle is not recorded before 1332, but the context in the charter and the archaeological remains indicate that it was built in about 1300. Lindholm may be one of the castles the nobility wanted destroyed in the charter of Valdemar III, 1326 (15).

Finally it can be observed that even if the building of castles increased considerably during Erik Menved's reign, their location is, to a large extent the same as before and the defences were still mainly based on the old fortifications. Economically it is striking that the majority of the castles built in these periods, were connected with urban societies: e.g. Vordingborg, Søborg, Nyborg, Kalundborg, Ribe. But these castles date mainly from the Valdemarian period and in many cases encouraged the establishment of the town. The castles built by Erik Menved at Horsens (Bygholm) and in Viborg (Borgvold) were made for other reasons and were

apparently not naturally integrated with the towns. The country was still mainly not administered from the castles.

The topographical protection was generaly based on wet and boggy areas, if possible combined without any chronological distinction with a minor mound. However, a surprising consistency in the topographic choice of the seashore-castles can be observed. Nearly all the old fortresses were hidden from the open sea behind an isthmus, a little island, or – in the absence of these possibilities – retired on a hilly range. If the castle was replaced by a new one, this will now be situated very exposed on the point of an isthmus or penensular e.g. Borren – Stege, Tårnborg – Korsør (only about 1340) and most probably, Gamborg – Hindsgavl, Brattingborg – Vesborg and Ræfshaleborg – Nykøbing Falster. Is this motivated by changing harbour conditions, related to the use of the cog – or should it, more likely, be explained by en evolution from a protection against the sea to domination of the sea and its traffic? Anyhow, this evolution is not connected with one king, but seems to have taken place from about 1250 to at least about 1350.

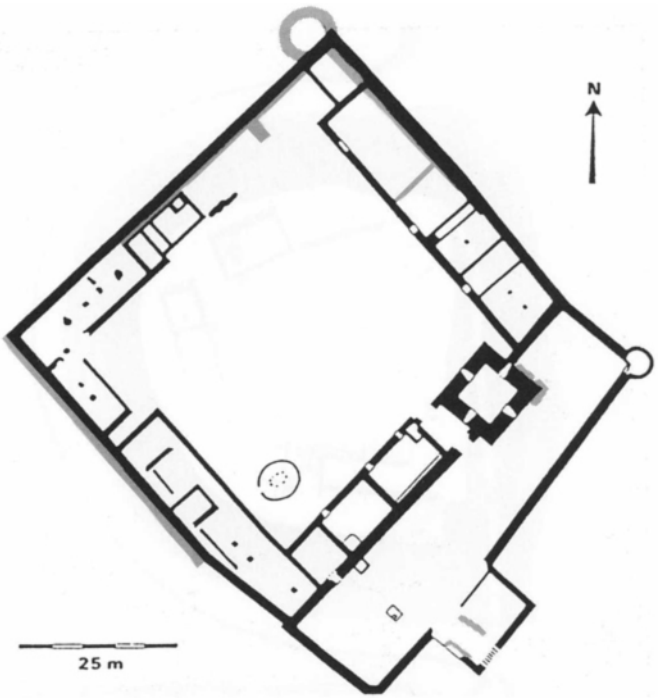


Fig. 4. The traces of older walls (grey tone) under the curtain walls of Kalø show that from the start the castle was planned on a large scale. The size of the fortress superpasses far that of the other castle-constructions from 1313; it is actually one of the largest castles in Denmark.

## THE LAY-OUT AND CONSTRUCTION OF THE CASTLES

As has been indicated, the majority of Erik Menved's castles were in fact constructed by his predecessors (c.f. figs. 1 and 2). It is therefore not surprising that the ground-plans and construction-methods of the royal fortresses show wide-ranging differences. This observation, however, is also valid for those of the building-works which can with reasonable certainty be ascribed to Erik Menved – as regards both new castles and modernigations of older structures.

A comparison of the Northern Jutland castles built by forced labour in 1313 reveals major differences between them (16). Even the differences in terms of size alone are striking: the surface areas of Borgvold and of Bygholm could be fitted inside the curtain-wall of Kalø (fig. 4) 3 and 5 times respectively. Information about the construction of the castles is rather more sparse, but here too the differences seem considerable. The remains of the earliest structure at Kalø show that here from the start a strong up-to-date curtain-wall was planned. The original Borgvold and Bygholm are little-known, but in all probability they would have been surrounded by palisades. It cannot be established whether they included a stone house or two on the castle-mounds, or whether there were only wooden constructions in the beginning. Similarly, there are differences of emphasis as regards the castles' outworks. Kalø is constructed on a small island, on which the bailey also stands. The castle itself sits at the crest of the island, where it is cut off from its surroundings by deep dry moats. The connection to the mainland is provided by a stone- built causeway, 500 metres long, which is undoubtedly original (17). Borgvold also seems to have had rather substantial outworks. This castle-structure moreover wrought significant changes in the topography of Viborg, where a milldam intended to provide water for the rampart-ditches brought about a partial flooding of the town-area near the lake-side (18). Against this background Bygholm appears in a much more modest light.

Erik Menved was probably also responsible for the erection of the conventional curtain-wall structures of Glambek and Lindholm, together with the later Falsterbo. In other cases earlier buildings such as Stege, Hel-

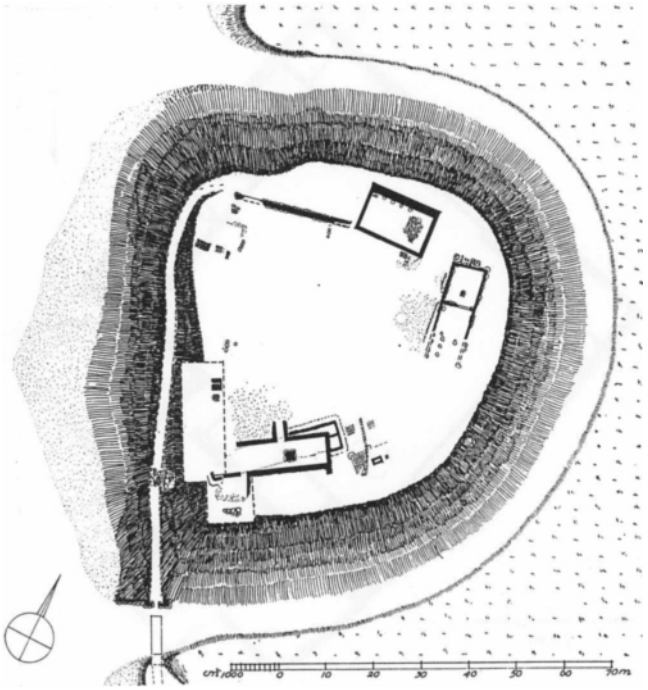

Fig. 5. Hindsgavl on Funen stands on the shore of Lillebælt, at a point where it could also control the seaward approach to Kolding Fjord. The castle is first mentioned in 1295, when Erik Menved made peace with the outlaws there. The castle cannot be dated more precisely. Probably it superseded the older fortress of Gamborg, which stands further back in the fjord of the same name. Apparently there was neither a curtain-wall nor a palisade at Hindsgavl. On the other hand the high castle-mound is surrounded by water-logged salt marshes. As in the case of Kalø, the castle was connected with land by a causeway. (Ill. from Elna Møller, 1944).

singborg and probably Søborg were modernised during Erik Menved's reign (19). The latter two were extended with new curtain-walls, whereas Helsingborg was given an impressive keep, "Kärnen". It is not possible to distinguish significant common features in these fortresses which could categorize them as genuine royal military architecture. European examples of a specific royal architecture can be found e.g. in the castles built in Wales by Edward I (1272–1307), or in particularly distinguished form in the almost stereotyped fortress-building of the slightly earlier French king, Philippe Auguste (1180–1223). It is not possible either to ascribe to Erik Menved a smaller group of typical buildings, as was done in the case of Valdemar Atterdag, with the curtain-walls of Vordingborg, Kalundborg and Helsingborg (20). Erik Menved's master-builders to a great extent fitted in with the opportunities of the moment and with local requirements and thus there is no typological basis for differentiating between his royal fortresses and the other castle-building of the high Middle Ages (21).

The majority of the royal castles can however be described in the same general terms. On the whole the castles are rather large, often ringwalled as at Kalø, Stege, Søborg and Glamek, or more modestly only surrounded by palisades. Sometimes they have neither, as in the case of the very important castle of Hindsgavl (fig. 5), perhaps because the site was thought sufficiently protected by nature.

## VALDEMAR ATTERDAG'S PERIOD

In reality Denmark was governed by the Crown's creditors during the period 1320–1340, and in several years was without any king at all. Numerous castles were erected during this period. When Valdemar Atterdag became king in 1340, he began an impressive re-establishment of the power of the crown from an almost hopeless situation. He regained the country bit by bit, either by redeeming the pawned territories, or very often by military strength. The war about the castles was more intense than ever.

The map (fig. 6) of Valdemar Atterdag's castles reveals a much more complete geographical distribution than in the earlier periods, even if some were only under the Crown for a short time. For the first time strongholds are reliably known North of Limfjorden. Valdemar Atterdag's castles are thus clearly distinguished from those of the former kings by their dispersion and number, but also by their even greater variety. Valdemar Atterdag built the very large ringwalls around Vordingborg, Helsingborg, and Kalundborg, as well as small castles like Torp, probably Gurre, and Aggersborg. This should certainly be explained by differences in the structure of society and government. The administration of the castles was very important in Valdemar Atterdag's rule of the country, and several of them more likely to have been administrative centres than military fortresses (22).

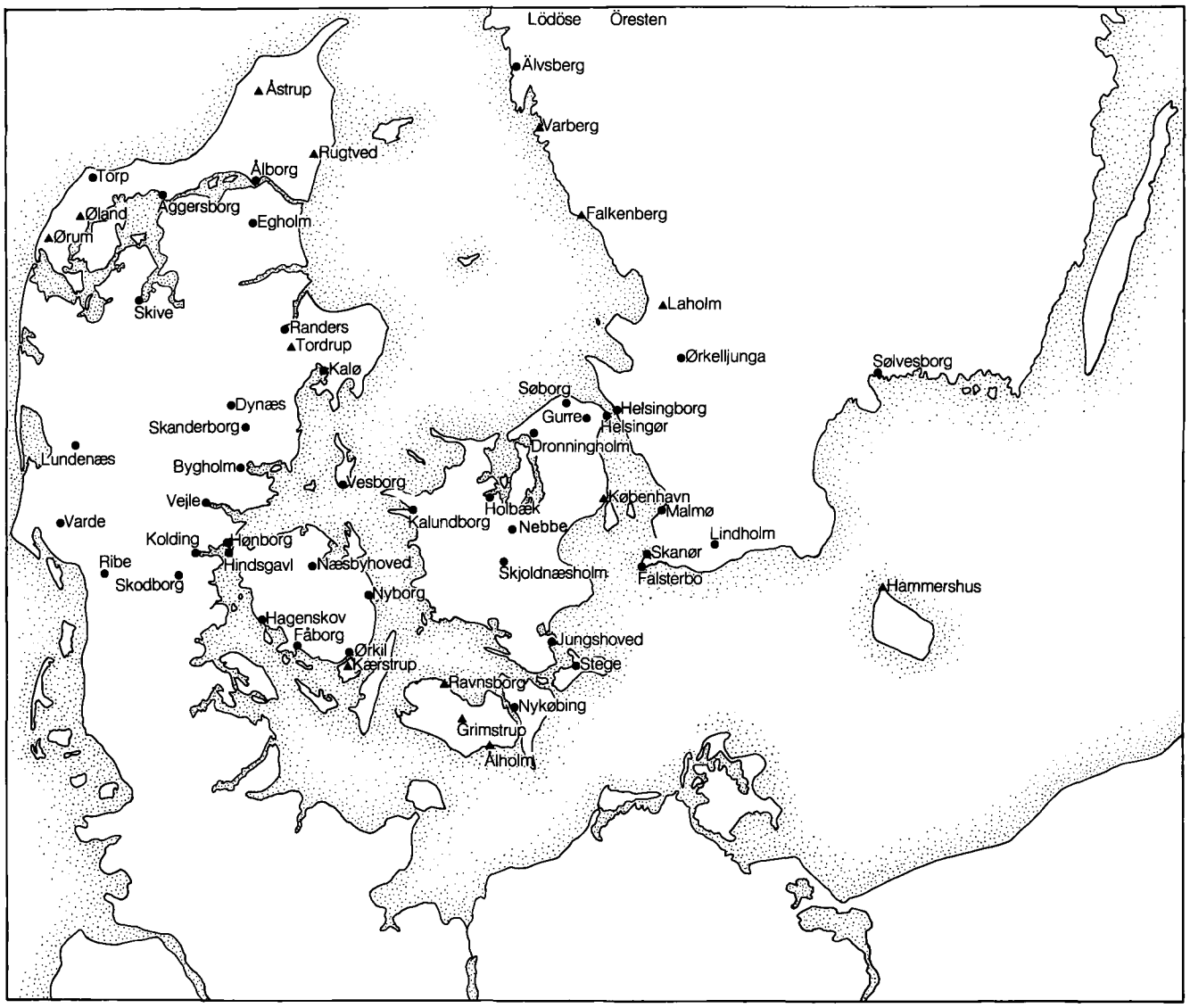


Fig. 6. Map of King Valdemar Atterdag's castles (1340–1375). ▲ private castle acquired by the Crown.

## CONCLUSION

Even if Erik Menved's reign showed an important increase in the building of castles, exaggeration should be avoided. The majority of the castles were built by his predecessors, and to a large extent, Erik Menved's castles are more in the Valdemarian tradition than in that of Valdemar Atterdag. That is: rather few castles, but of great military superiority. This does not exclude an administrative use of the existing fortresses, but this was hardly the reason for their construction, and the territories were generally not governed from the castles at that time. This was the case only in Valdemar Atterdag's period, which in many respects differs fundamentally from the previous ones, It is also worth noticing that Erik Menved's and the other kings' tours around the country were more associated with the towns and political events than with the castles. Some of the very large castles seldom or never housed the king e.g. Skanderborg and Kalø, whereas towns without any important royal castle like Roskilde, Lund, and Copenhagen, were very often visited (23). So the royal tours, even if numerous, are not sufficient to indicate the existence of a castle.

The analysis that has been made depends naturally on present knowledge drawn from different sources, and the maps of the castles cannot claim to be complete. But even if some of the late recorded castles were really built earlier, it would hardly change the tendency proposed here.

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## NOTES

The manuscript was submitted in March 1988.

1. H. Paludan in A.E. Christensen 1977, p. 466–471. Dipl. Dan. 2. rk. VIII nr. 176 § 15, § 14 about castle tenants.
2. E. Kroman 1980, p. 209 Ann. Ryenses. The maps fig. 2 and 3 are results of my own work on the written and archaeological sources, whereas the other maps are revisions of other authors' works. Fig. 1 is thus based on R.A. Olsen 1980, p. 20 and V. la Cour 1972 II, p. 201; and fig. 4 is based on the list of Valdemar Atterdag's castles in A.E. Christensen 1968, p. 190 n. 3, p. 246.
3. R.A. Olsen 1982.
4. A. Tuulse 1952, p. 204–205.
5. A.E. Christensen in do. 1977, p. 333–334, p. 342–343.
6. A.E. Christensen 1968, p. 68–93.
7. E. Kroman 1980, p. 105 (Ann. Sorani), p. 174 (Ann. Ryenses). p. 276 (Ann. 980–1286), p. 318 (Ann. 1246–1265).
8. K. Hørby 1977, p. 82–90, p. 93–106, p. 129–138. H. Paludan in A.E. Christensen 1977, p. 453–454.
9. K. Hørby 1977, p. 124–129. H. Paludan in A.E. Christensen 1977, p. 455. E. Kroman 1980, p. 266 (Ann. Ripenses), p. 283 (Ann. Essenbecenses).
10. T. Bartholin 1978. J. Bekmose & S. Nielsen 1978 (Stege). Dipl. Dan. 2 rk. VI nr. 63, nr. 85 (Glambek). A. Wihlborg 1981, p. 37 (Kärnan).
11. Dipl. Dan. 2. rk. V nr. 52, nr. 62.
12. A.N. Jaubert 1987.
13. Dipl. Dan. 2 rk. VII nr. 89. H.K. Kristensen 1986.
14. C.M. Smidt 1944, fig. 2 p. 96–98. E. Kroman 1980, p. 283 (Ann. Essenbec.)
15. Dipl. Dan. 2. rk. X, nr. 403. E. Kroman 1971 nr. 23 § 13 S. Skansjö 1981, p. 115–120.
16. A.N. Jaubert 1986 a, p. 91–96. Ibidem 1987.
17. R.A. Olsen 1982 a, p. 12–13.
18. H.K. Kristensen & J. Vellev 1982, p. 7–9.
19. T.S. Bartolin 1978. A.N. Jaubert 1986 b, p. 67. A. Wihlborg 1981, p. 37.
20. A. Tuulse 1952, p. 206–207.
21. E.g. R.A. Olsen 1986, p. 24–88.
22. R.A. Olsen 1985, p. 66–68. K. Hørby in A.E. Christensen 1980, p. 66–67.
23. T. Riis 1981.

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# Debate

## The Stratigraphy and Dating of 8th Century Ribe

by MOGENS BENCARD

In Vol. 6 (1987) of this periodical Lene Frandsen and Stig Jensen (hereafter referred to as Fr & J) published an interim account of their important excavation at Nicolajgade 8 in Ribe, which has complemented the results of the previous excavations in the area in many respects. The excavation was situated some 30 metres from the site in *Kunstmuseets Have* which was excavated in 1975, with the present author as leader.

There are certain differences between the two investigations, but stratigraphically they have such great similarities that they can usefully be compared. This became evident even at the trial excavation, and the discussions which were held when Helge Brinch Madsen and I visited Ribe were therefore very worthwhile for all of us. In order to widen these discussions, which have continued since, and to prevent them becoming merely internal "Ribe-talk", it may be of benefit to others to put forward some comments on the article at the present point in time.

In their introduction Fr & J touch on the fundamental problem: "The time dimension is a significant factor. How many years did it take to accumulate the series of layers we have looked at? Did the site have a long or a short functioning period?" This question was crucial also in the excavation in *Kunstmuseets Have,* partly with respect to general interpretation, and partly because certain datings were difficult to reconcile with others.

The article first gives an account of the stratigraphy, then an evaluation of the dating based on the finds made, and finally discusses the function and character of the site.

To illustrate the stratigraphy a simplified section of the order of the strata was given (fig. 6). In addition a map and a clear account of the individual layers were supplied. Discussion is facilitated by the fact that Fr & J have restricted themselves in this way to the fundamental structure of the stratigraphy and have not become lost in its details. In the following commentary I shall focus attention on the distinctions between the individual layers.

1. Immediately above the natural surface there is a layer of refuse (the term "settlement layer" may be slightly misleading, in that the layer presents only indirect evidence of settlement); the finds from this layer, in contrast to those from the layers above, do not include evidence of trade or crafts. No equivalent layer was found in *Kunstmuseets Have,* but this layer could well correspond, chronologically, with the ard traces in the natural surface which were there designated "Phase 1". The same ploughed surface was also found during the investigation in *Kunstmuseets Kælder* (area 5) in 1973, and in *Dommerhaven* on the opposite side of Nicolajgade in 1974.

2–3. Immediately above this is a layer of turf, or where this is non-existent, the lowest workshop level (VH1). Where both layers are present, VH1 lies directly above the turf. There is thus a direct continuity between these and the underlying layer – a fact to which Fr & J also draw attention.

4. VH1 and another contemporary level, referred to as VH1a, lie on both sides of a "ditch" (G1), which is flanked by the turf-layer in such a way that the turf has to be interpreted as having been laid up to G1, i.e. it must be supposed that G1 is contemporary with the turf and with VH1-VH1a. The ditch is therefore not a dug-out trench, but should rather be seen as an open area between the two workshop levels. The excavators interpret G1, very convincingly, as a trace of an original parcelling-out (tenement division) of the site. Corresponding "ditches", but without the surrounding turf-layer, could be seen in *Kunstmuseets Have.* There they could only be viewed as possible indications of a parcelling-out, whereas the results in Nicolajgade 8 can be taken as confirmation of this theory. Our "Phase 2", which was not found in Nicolajgade 8, is a layer of undecomposed or mineralised manure, recorded in *Kunstmuseets Kælder* and in *Dommerhaven* as well as in *Kunstmuseets Have.* Since the manure could be seen on one side to have been ploughed down into the ard-furrows of Phase 1, and since on the other side it partly made up the workshop layers and partly continued without interruption into our Phase 3 workshop-layers, we could clearly assume that there was direct continuity between these phases. Despite the difference in sequences of layers there is therefore a parallel in that the close chronological linkage is identical.

5. "After some time", write Fr & J, without attempting any more precise estimate, G1 was filled in, and then a layer ("VH2") spread over the whole area of the excavation. Here it is important to note that the finds in VH2 do not differ significantly from those in VH1 – or even as a matter of fact from those in VH3 (see the tables of pottery elements, and pp. 179 concerning the relationship between VH1 and VH2, and 180 concerning casting moulds). VH2 therefore does not represent a chronological break.

This continuity is supported by the relationship between G1 and the above "ditch" G2, which clearly respects the course of G1. In other words the original parcelling-out was not forgotten, even if the traces were apparently obliterated. It should be

mentioned that no ditches, either here or in *Kunstmuseets Have,* held remains of posts. There were no traces to be found. In Area 1 (a trial excavation in *Kunstmuseets Have*) the conditions for observation were so remarkably good that even individual spade-marks could be seen. There can be no doubt that this was a genuine ditch, which was dug through Phase 1A down into the subsoil. At that time we cut sections in the ditch in all imaginable directions in order to find traces of either posts or stakes which could have supported a wattle structure, but there was nothing to be found – except traces of the spade. One can therefore only speculate as to how G1 could have been rediscovered when G2 was being established. It is crucial to the present discussion that the area did not change character or sub-division, and that one cannot therefore imagine that there could have been a great difference in time between G1 and G2.

6. Immediately above VH2 (or so one must suppose since Fr & J do not indicate otherwise) the rest of the workshop levels (VH3–6) are accumulated. The fire-places can be seen in the middle, and the layers decrease in thickness in the direction of G2 (and G3 to the other side). We are here dealing with a continuous development of workshop levels ("activity horizons" were what we called them during the excavation in *Kunstmuseets Have*), and intervening layers of sand mixed with varying quantities of refuse (then called "levelling horizons"). The phenomenon is seen in completely parallel form in *Kunstmuseets Have* ("Phase 3"). At the time of the first excavation, and also during the one at Nicolajgade 8, there was much discussion concerning whether there had been breaks (e.g. in the form of vegetation horizons) observable in these layer-sequences, but this does not appear anywhere to have been the case. Fr & J do not mention anything of this kind, and if they have results which demonstrate this one must regret, for the sake of the discussion, that they have not been made explicit.

My argument has consistently been that we are here dealing with an unbroken sequence, and that a break of even a decade would be discernible. In support of this it can be pointed out that an individual activity-horizon could not have had a long life-time – in fact it could not have survived even one winter. The workshops were not protected by a roof, since there are no traces of house-construction. Tents or flimsy windscreens leaving no traces which archaeologists can register are the only possibility, if the activities did not actually simply take place under the open sky. Even the most solid of the examples of fireplaces consist of thin, more or less scorched layers of clay, sometimes with an under-layer of stone. Frost and rain would have worn them away if they had not been covered relatively rapidly by a new layer.

This has forced me to conclude that Phase 3 covered a very short span of time – and that in fact a workshop level must correspond to the duration of a market. If there had been a market once a year on the site, a workshop layer (with related levelling) would represent a "year-ring". The continuity in any case is quite clear. Not only is the parcelling-out of the land respected, but even the fireplaces are sited in the same spot in succeeding layers. Transposed to Nicolajgade 8 this would imply that the shop-levels strictly speaking need not represent more than 5 years, to which should be added the time which elapsed between G1 and G2.

7. The ditch G2 also has a parallel in *Kunstmuseets Have* (as does G3), although not as clear as here. G2 is also significant for the judgement of the time-factor. Again it is important to stress that this is not a matter of a dug-out ditch, but rather of an area which has been open while the surrounding horizons have risen on each side. In the light of this Fr & J also speak of G2 as a "cavity" (p. 179). Apparently they conceive of the filling-in of G1 and G2 as having taken place independently, at different times. On the basis of the finds, however, they also consider the lapse of time between the uppermost workshop levels and the filling-up of G2 to have been of short duration (p. 179).

An open ditch presents in itself a considerable interpretation problem. The VH levels on both sides consist to a large degree of loose sand, which easily shifts out to the sides. To this it should be added that the light sand of the Ribe plain is often stirred up by the wind to end up trapped in a ditch. Blown-sand layers were in fact found in *Kunstmuseets Have.* It therefore follows that the longer the time-span one wants to connect with the establishment of the workshop levels, the more difficult it is to explain how the ditch could have remained empty. Our own observations of the conditions in *Kunstmuseets Have,* together with the presented description of the stratigraphy of Nicolajgade 8, do not give me reason to alter my basic position, which is that we are here dealing with a short lapse of time.

Taking the stratigraphy on its own as departure-point, I therefore have great difficulty in accepting the time-span which Fr & J have assumed, i.e. c. 100 years from VH1 ("first quarter of the 8th century", p. 182) to G2 ("early Viking Period", p. 182).

If I am right, there thus appears to be a built-in contradiction, in these two investigations, between the stratigraphy and the current dating of the finds, not least in the layers which contain the mould-fragments of Berdal brooches.

Where I have used an explanatory model which puts weight on the testimony of the stratigraphy, Fr & J have chosen one which accords primary importance to the finds. Their long time-span is bounded at the lower end by the first coining of the *sceattas* found, c. 720, and at the upper end by the dating of the Berdal brooch gripping beasts to the early Viking Age (p. 181), i.e. c. 100 years. They use an examination of the pottery in support of this long development. *Sceattas,* which are a completely dominant basis for dating in both excavations, were found in Nicolajgade 8 in the workshop levels, but not in G2. In the other excavations they occurred in both Phase 2 and Phase 3, and also in the Phase 4, which is probably either contemporary with, or later than, G2. The presence of casting-mould fragments, combined with an absence of *sceattas* in G2, leads Fr & J to conclude that the conventional dating of the Berdal brooches to the beginning of the Viking Age can be sustained. Strictly speaking the absence of *sceattas* need not be anything other than chance, and thus the two mould-fragments mentioned (reproduced in fig. 9) take on special significance. Fr & J themselves in their text are in doubt as to what object has been cast in the fragments. They suggest that the gripping beast of the fragments has long ears similar to the Borre style. The illustration text states, however, that they

come from brooches of the Berdal type, and they are inserted into a drawing of such a brooch. There is no specific reference, but the drawing appears to be identical with Berdal brooch "Type 2" from *Kunstmuseets Have* (see *Ribe Excavations,* vol. 2, p. 46). Mould fragments of this type were found in the two upper concentrations (8 and 9, op.cit. pp. 88–89). Concentration 7, immediately below, likewise produced Berdal brooches, but of other types (p. 87). The contents of concentration 7 also included the layer QD, and those of concentration 8 the layer AAE. As is apparent from Kirsten Bendixen's table (*Ribe Excavations,* vol. 1, p. 90)one *sceatta* was found which can be attributed either to layer QD or to AAE. Furthermore one *sceatta* was found in layer CØ which is contemporary with these concentrations, and two come from layers KZ and KÆ of Phase 4. Thus here we have a clear case of contemporaneity between Berdal brooches and *sceattas.* As is made clear by Kirsten Bendixen (*Ribe Excavations,* vol. 1), these *sceattas* were struck in Europe until 755. Bendixen at the same time put forward the theory – a seemingly accepted one – that *sceattas* had been in circulation in Denmark up to c. 800, when they were superseded by the earliest Hedeby coins.

On the basis of the find-frequency (highest in the lower layers, decreasing through the upper ones), Fr & J build up a case that the coins occur most frequently in the layers from the time of their circulation in Europe, while the layers where there are fewer of them are supposed to correspond to the period when they were only in circulation in Denmark – i.e. the second half of the 8th century. This might well be presumed to be the case in a situation where coins occurred in the upper layers which were in common circulation elsewhere in the world. There are no such finds here. One can therefore equally well maintain that all the *sceattas* come from a time when they were only in circulation in Denmark, i.e. the second half of the 8th century.

It should be noted, in parenthesis, that precisely the absence of European coins in Ribe after Pippin's coin reform of 755 makes Kirsten Bendixen's theory about circulation of *sceattas* in Denmark in the second half of the 8th century rather difficult to apply. The way *sceattas* were found in Ribe, spread over a large area and at varying depths, makes it impossible to see them as a scattered treasure-hoard; they must be taken as evidence of a coin-based economy. Kirsten Bendixen bases her theory about the prolonged circulation on the appearance of the Wodan/monster as a type of the earliest Hedeby coins. It has a larger flan, which Kirsten Bendixen associates with Charles the Great's coin reform in 794. Much would fall into place in the event that the numismatists could consider it possible to redate the Wodan/monster Hedeby-coin back to the middle of the 8th century, i.e. seeing it as an unbroken continuation of the corresponding *sceatta.* On the other hand this would make the dating of the Berdal brooches even more problematic.

As the discussion appears now it seems best to maintain Kirsten Bendixen's extended circulation theory, according to which both the earlier excavations' Phase 3 and the workshop levels in Nicolajgade 8 are dated to within the period 720–800. The style D mould fragments found mainly in VH2 and VH3 (pp. 180 and 182) can in any case be dated to within that period.

As far as the pottery is concerned, it is worth noting that all the comparative material to which Fr & J refer is dated to the "later Germanic Iron-Age", i.e. the period already mentioned. They use the statistical account of the differences in rimsherd shapes as an argument in favour of a long time-span. Personally I find this difficult to accept, partly because of what has already been mentioned about the dating of the comparative material, and partly because statistics based on 189 pieces from many different types seem to me too flimsy.

There is thus a large gap between Fr & J's find-based time-span of 100 years and my stratigraphy-based contention that the layers in Nicolajgade 8 need not represent more than e.g. a decade. This short period could, as I see it, be placed at any time between 720 and 800, e.g. at the end of the century. The only certain date that has been fixed is a dendrochronological dating of c. 710, which Fr & J also mention. This comes from a well in *Dommerhaven* Phase 1, and is thus probably contemporary with the lowest "settlement layer" in Nicolajgade 8.

How can one view the standard dating of the Berdal brooches if the layer which contains the mould for casting them is dated before the year 800? This question is indeed a significant underlying cause of Fr & J's argument in favour of the long time-span.

While stressing once more that *sceattas* were found in the bronze-casting workshops with Berdal brooches in *Kunstmuseets Have,* I should like to state the following: This is the first time that we have been faced with casting moulds for Berdal brooches, and therefore the first time we have evidence about the actual production of these brooches. Their dating has hitherto depended on the finished brooches, chiefly from grave-finds. It stands to reason that there would be a time difference between these two stages of the life of the brooches. How large a difference would be dependent on how many generations had used the same brooch, and it is difficult to make any meaningful conjecture about such a question.

The dating of the Berdal brooches to the early Viking times, i.e. in the 9th century, which is a fundamental point for Fr & J, is based on a dating of the beginning of the Viking Age to around the year 800. This date, however, is no longer as unquestioned as it once was. In his book on *Ovala Spännbucklor* (1985), Ingmar Jansson, in the chapter "Den absoluta kronologien" (the absolute chronology) (p. 176 ff.) reviews the discussion and calls attention to the finds from recent years which could contribute to an altered evaluation. Jansson reachs the conclusion (p. 186) that in the light of up-to-date knowledge the beginning of the Birka time (the "archaeological Viking Age") should now in fact be situated before the 8th century.

From the point-of-view of style Signe Horn Fuglesang (Proceedings of the Tenth Viking Congress, Universitetets Oldsakssamlings skrifter 9, 1987, p. 219) makes a clear distinction between the Ribe beasts and Oseberg: "The Ribe excavations also reactivate the question of dating the early types of Viking brooches. This should not be confused with a re-dating of the Oseberg style, since one must distinguish between the various types of gripping beasts and the Oseberg style proper. The Ribe moulds found so far do not include examples of the latter." These quotations should suffice to demonstrate that the dating of the Ribe moulds is not so uncontroversial, as Fr&J

seem to think. Thus they cannot be used as a solid basis for a 9th century date.

As the reader may have observed, there is much to discuss concerning the exciting finds in Ribe, even as far as dating alone is concerned. Without doubt there will be much more discussion to come before we reach agreed explanations. In conclusion here there is one factor to be mentioned which should be taken into consideration: are there chronological differences between the workshop layers that have accumulated on the "stall-sites" at Nicolajgade 8 and the bronze-casting layers at the stall-site furthest distant in *Kunstmuseets Have?* This can only be decided when a detailed study and publications of the finds and stratigraphy of *Kunstmuseets Have* is available. On the other hand, it is of great benefit that Lene Frandsen and Stig Jensen have presented their deliberations as clearly as they have done.

The above has been produced so that others can be aware of what the Ribe discussion is about, and so that the general lines of debate do not crystallize prematurely. It can also be made known that a grant from the Research Council has made possible continued publication of *Ribe Excavations* 1970–76. Vol. 3 is now ready for immediate printing. Vol. 4, which will contain an account of the stratigraphy of the excavations, is now in preparation.

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# *The Dating of Ribe's earliest Culture Layers*

by LENE B. FRANDSEN and STIG JENSEN

It is with great interest that we have read the comments by Mogens Bencard on our article about the excavations in Nicolajgade 8 in Ribe. We agree with Mogens Bencard that it would be best to avoid internal "Ribe-talk" about the chronological questions relating to the earliest culture layers in Ribe, and it was actually for that reason that we prepared the article under discussion only 5 months after the close of the excavation. In Danish archaeology, taken as a whole, it is unusual for the same important site to be excavated by two different archaeological teams with an interval of so few years between. As can be seen, this has already given rise to fruitful discussion.

We were glad to note that there is no overall disagreement between Mogens Bencard and ourselves concerning the basic stratigraphy in Nicolajgade 8. Mogens Bencard states that the sequence of layers is unbroken, and on that point we are in complete agreement with him. The disagreement relates – as far as we can see – exclusively to the question of the time-period which the build-up of layers represents, and is therefore fundamentally a matter of the extent to which one should base one's work on an interpretation of the excavated layers or should instead rely on a chronological analysis of the objects found in those layers.

Since the previous article in JDA was written, we have had the opportunity to go through the *entire collection of find-objects* from the excavation, with a view to future publication (1). This has not changed our opinion about the chronology, but has made it possible to enlarge the basis for discussion of the dating. In order to make this evidence accessible we have worked out a schematic presentation of a number of different types of object and their siting in the layer-sequence.

Before we discuss this table in detail, we would however like to add some clarification on one point where Mogens Bencard has evidently misunderstood us. Our subdivision into workshop levels (VH1–6) does not represent six separate workshops, but on the contrary is simply a practical subdivision of the sequence of layers – a chronological work-tool. To stress this point it can be mentioned that even taking only the span between the top of VH2 and the top of VH6 there are 142 recorded layers, of which 52 lie directly one on top of another.

Let us begin by looking at the *domestic pottery.* As is apparent from the table, pottery vessels with everted rims dominate in the sequence in VH1. In VH2 the inverted rim (semi-spherical pot) occurs, and thereafter it occurs with increasing frequency throughout the layer-sequence to become completely dominant in G2. Correspondingly, flat bases are replaced by globular ones. In addition, the semi-spherical pot develops so that pots with a groove on the outer side under the rim appear in

seem to think. Thus they cannot be used as a solid basis for a 9th century date.

As the reader may have observed, there is much to discuss concerning the exciting finds in Ribe, even as far as dating alone is concerned. Without doubt there will be much more discussion to come before we reach agreed explanations. In conclusion here there is one factor to be mentioned which should be taken into consideration: are there chronological differences between the workshop layers that have accumulated on the "stall-sites" at Nicolajgade 8 and the bronze-casting layers at the stall-site furthest distant in *Kunstmuseets Have?* This can only be decided when a detailed study and publications of the finds and stratigraphy of *Kunstmuseets Have* is available. On the other hand, it is of great benefit that Lene Frandsen and Stig Jensen have presented their deliberations as clearly as they have done.

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Since the previous article in JDA was written, we have had the opportunity to go through the *entire collection of find-objects* from the excavation, with a view to future publication (1). This has not changed our opinion about the chronology, but has made it possible to enlarge the basis for discussion of the dating. In order to make this evidence accessible we have worked out a schematic presentation of a number of different types of object and their siting in the layer-sequence.

Before we discuss this table in detail, we would however like to add some clarification on one point where Mogens Bencard has evidently misunderstood us. Our subdivision into workshop levels (VH1–6) does not represent six separate workshops, but on the contrary is simply a practical subdivision of the sequence of layers – a chronological work-tool. To stress this point it can be mentioned that even taking only the span between the top of VH2 and the top of VH6 there are 142 recorded layers, of which 52 lie directly one on top of another.

Let us begin by looking at the *domestic pottery.* As is apparent from the table, pottery vessels with everted rims dominate in the sequence in VH1. In VH2 the inverted rim (semi-spherical pot) occurs, and thereafter it occurs with increasing frequency throughout the layer-sequence to become completely dominant in G2. Correspondingly, flat bases are replaced by globular ones. In addition, the semi-spherical pot develops so that pots with a groove on the outer side under the rim appear in

VH5, and pots with a thickened bevelled rim occur in G2 (JDA vol. 6, p. 183).

The most reasonable explanation for this development in the pottery is that the excavated culture layers represent a considerable number of years. How many years are involved is impossible to establish, but it stands to reason that it must be significantly more than the 10 years Mogens Bencard suggests – a view which is not in itself weakened by the fact that the leading chronology-concepts concerning the 8th century so far have been largely based on the grave-finds from the period. Mogens Bencard correctly points out that the 189 rimsherds which belong to the layer-sequence form too small a base for statistical treatment. For that reason we have also refrained from calculating percentage frequencies of individual types, but instead observed their presence in the levels. Moreover, it can hardly be by chance that there are no inverted rims among the 40 rims which appear in VH1, while 22 out of 29 rims from G2 in fact are inverted. (JDA vol. 6, pp. 183 ff.).

The *glass fragments* similarly imply a period of development. Fragments of at least three different types of glass were found, all belonging to the 8th century: reticella glass, palm-cups and funnel beakers. The reticella glasses occur together with the funnel beakers in all levels. The palm-cups, however, are not represented later than VH4, and this could support the theory which has been put forward from many quarters that the palm-cups are the typological forerunner of the funnel beakers (U. Näsman 1986, p. 73).

Among the locally produced beads distinct changes and permutations of types are to be seen in the layer-sequence between the bottom and the top. Since it is meanwhile an open question whether these changes reflect general chronologically reliable shifts of style, or whether they are simply the result of various craftsmen's differing production-habits, we have excluded them from consideration in this context. Instead we demonstrate how different types of *imported beads* occur in the layer-sequence.

In the lowest levels some distinctive beads, black or brown, barrel-shaped with yellow spots, were found. Similar beads are known from the Merovingian serial graves near the Rhine. Those from the grave-site at Schretzheim, where they primarily occurred in the late graves from the period 630–680 (U. Koch 1977, Farbtaf. 1, nr. 2, 5), are the best described. These Merovingian beads were found in Nicolajgade 8 in the following contexts: L (1 example), VH1 (2 examples, and VH2 (2 examples), which would contribute to situating the lower part of the layer-sequence in the time around 700. In VH4 a so-called "Mosaikaugenperle" was found; this type has been intensively studied by R. Andrae (1973). These beads were first produced in the last third of the 8th century. This signifies that VH4 could not have been deposited before 760–770 at the earliest. In the latest workshop levels, VH5–6, "wasp-beads" were also found – beads with a yellow encircling thread – as were gold-foliated beads. Both are well-known Viking Age types. The gold-foliated beads are also known from the Roman and early Germanic Iron Ages, but apparently they were not imported to Scandinavia between 600 and 750/800, and in any event it must have been after this temporary cessation of supply that the type occurs in this layer here. The imported beads alone demonstrate, therefore, that the layer-sequence in Nicolajgade 8 covers the period from around 700 until at least around 800 or possibly even longer.

The *comb material* from Nicolajgade 8 is too slight to permit an independent categorization, but here again it is useful to take the well-defined layer-sequence as point of departure. Our combs can best be compared with the material from the North-West German settlement-mound Elisenhof, which W. D. Tempel (1972) divides into nine groups, A-I, on the basis of the stratigraphic layer-sequence through the mound. The combs from Nicolajgade 8 have parallels among Elisenhof's six oldest groups, A-F, and in Nicolajgade the same typological development is seen as in Elisenhof (c.f. diagram). Combs of type A are dated on the basis of the find-circumstances in Elisenhof to around 720, while combs of type F are dated to the time just before 800 and the whole of the 9th century, but with stress on the first half of the century (W. D. Tempel 1972, p. 58). Tempel mentions, as the earliest dating of the F group, that the type occurs in the oldest deposits within the semi-circular rampart in Hedeby, which indicates the beginning of the 9th century. A dating-frame for the Ribe combs would therefore situate them in the period c. 700/720–800, or possibly later.

About 200 *casting-moulds* were found during the excavations in Nicolajgade 8. The majority consisted of fragments which could not be further identified, but 18 had significance in the context of the present chronological discussion. Three kinds of style are represented: South-Scandinavian style D, gripping-beasts and the Borre style. Style D occurs on two types of objects: keys (2 examples) and male masks (7 examples) (JDA vol. 6, p. 180). Seven of the style D objects were found in VH2 and two in VH3. Casting-moulds for Berdal brooches with gripping-beast decoration are represented by seven pieces, all from G2 (JDA vol. 6, p. 181). In addition there were two rectangular brooches with typical Borre-style face-masks which were also found in G2. These, as Mogens Bencard rightly points out, are not illustrated in our JDA article, but it can be said that they are closely similar to a corresponding piece from Birka grave 539 (H. Arbman 1940, Taf. 83:2a-b).

Where the relative chronology is concerned, it is generally accepted that style D is earlier than the Berdal brooches, and to our knowledge they have never been found together. With regard to the absolute dating of the Berdal brooches we share the uncertainty expressed by Mogens Bencard and others, and we intend to leave it to specialists in this subject to decide whether the type occurs around 800 or a couple of decades earlier. On the other hand it would no doubt be too daring to place the Borre style before 800. In any case the casting-moulds from Nicolajgade 8 indicate that the latest of the excavated layers must date from the time around 800 or later, and that taken as a whole the deposits must represent a rather long period.

In conclusion mention should be made of a casting-mould for an early tortoise brooch. This is an Ørsnes type N 1 (1966, p. 149) – "small, oval, tortoise fibulae" – a type which, in a larger context, has most recently been dealt with by Karen Høilund Nielsen (1987). The type in question belongs to her phase 2A, which covers the time-span 680/700 – 720/730 (2). The casting-mould fragment was found in a disturbed layer, but

| | POTTERY | | | | GLASS | | BEADS | | COMBS | MOULDS | | | SCEATTAS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE / HORIZON | Everted rims | Flat base | Inverted rims | Globular base | Palm cups | Funnel beakers | Imports | Number | W.D.Tempel types | Style D | Berdal brooches | Borre style | |
| G2 | 3 | | 22 | 4 | | 2 | | | F | | 7 | 2 | |
| VH6 | 7 | | 2 | | | 2 |  | 3<br>3 | E/F | | | | 3 |
| VH5 | 4 | | 19 | 2 | | 2 |  | 3 | D/E | | | | 1 |
| VH4 | 7 | 1 | 5 | 3 | 3 | 7 |  | 1 | D/E | | | | 5 |
| VH3 | 9 | 1 | 6 | 2 | 4 | 1 | | | | 2 | | | 4 |
| VH2 | 5 | 1 | 1 | 2 | 1 | 1 |  | 2 | C | 7 | | | 6 |
| G1 | | | | | | | | | | | | | 1 |
| VH1 | 24 | 8 | | | 3 | 1 |  | 2 | A | | | | 12 |
| L | 6 | | | | | |  | 1 | | | | | |

Diagram showing sequence of levels and artifact types at Nicolajgade 8, Ribe.

presence alone in the excavated area shows that jewellery was produced in the area in the period mentioned.

This survey of the occurrence of a number of types of objects in the layer-sequence in Nicolajgade 8 can finally be *summarized* as having two main results. First and foremost it must be incontestable that there is a change in the find-objects as one goes up through the layer-sequence. This change is so marked and further covers such a broad range of types of object that the creation of the layers must have taken place over a considerable period of years. If we then turn to the absolute chronology, it must be reasonable to conclude that the layer-sequence covers the time-span from around 700 until at least around 800, i.e. 75–100 years or possibly more.

Mogens Bencard argues convincingly that the questions of dating with regard to the *sceattas* found are so complex that this material cannot be used for narrower dating. We have therefore in this connection tried to set up a chronological framework on the basis of the other types of material. One could, however, turn the problem around and ask "How can the chronology in Nicolajgade 8 contribute to clarifying the dating of sceattas and of their period of circulation?" And the latter question is by no means insignificant. In 1986 in all 32 sceattas were found which could be related to layers in the defined sequence. 23 of these came from the layer sequence VH1–3 and nine from VH4–6, but none belonged to G2. It should be mentioned that sceattas were not found in the very deepest workshop layers in VH1. This supports the dating of sceattas earlier suggested by Kirsten Bendixen on the basis of the older finds (1981, p. 76), in that she argues for the sceattas being struck in the period from 720 to 755, but possibly circulating in the period up to around 800. Seen in that context it would in no way have been shocking if we had found individual sceattas together with casting-moulds for Berdal brooches e.g. in G2. The most important point in this connection is that there is evidence of a long layer-sequence with sceattas *before* the Berdal brooches crop up, and that it can otherwise be shown that this layer-sequence covers a significant number of years.

One must therefore conclude that sceattas occur over a long time-span, but at the same time it must be maintained that individual coins cannot be used for precise dating. When one adds that major disagreements govern the dating of the earliest Berdal brooches, we have to repeat our insistence, stated already in the introduction, that all parts of the historical find-material should be brought to bear on the chronological discussions as their primary basis.

We have therefore in this context avoided going into a dis-

cussion of the questions relating to interpretation of the formation of the layers, the function of the ditches and their filling-in, etc. The dating propounded does not make such a discussion any less necessary, but we have chosen to wait for the final publication to embark on it.

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## NOTES

1. To be published in Jutland Archaeological Society Publications.
2. Information on the absolute dating of the boundary between phases 2A and 2B has been supplied by Karen Høilund Nielsen, since this is not explicitly covered in her article (1987, fig. 18).

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# *Archaeology: Science or Politics?*

## An Interview with Colin Renfrew

by FELIPE CRIADO BOADO
and CHARLOTTE DAMM(1)

For several decades now archaeologists have been concerned with constituting their subject as a science. This was especially so within New Archaeology, which narrowed the gap between archaeology and the natural sciences in an attempt to lead archaeology towards objectiveness. At the same time there is an awareness that archaeology can be (and perhaps inevitably is) political. The political potential in prehistoric studies is clear in for instance explicit marxist archaeology or in the increasing interest in the past seen in many third world countries. But is any archaeology objective? Can we help but impose our personal standpoints on our research? Is archaeology science or politics? This is a central question throughout this interview with Professor Colin Renfrew.

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He has all along been a central character in theoretical archaeology, and is influential far beyond Britain.

When asked who has been influential on the development of his archaeological approach, Renfrew first mentions discussions in physics classes at school about laws and the evidences for them. He was stimulated also by the teachings of Prof. Braithwaite in philosophy of science, whose ideas were similar to those of Karl Popper.

"My own theoretical framework comes from an attempt to look at society and see how one can conveniently describe it and then look for sources of change. I am influenced by modern thinking about change in many directions. Especially I think the biologists have made real progress, when they talk about morphogenesis. I think it is important deliberately not to stand apart from the developments of thought in contemporary science, where there are many useful concepts, e.g. the language of morphogenesis or of information science. I certainly looked in those directions. But they do have difficulties in coping with the role of the individual in relation to the aggregate. What happens in society is often not really the product of individual will. In aggregate human volitions end up with many unintended consequences.

cussion of the questions relating to interpretation of the formation of the layers, the function of the ditches and their filling-in, etc. The dating propounded does not make such a discussion any less necessary, but we have chosen to wait for the final publication to embark on it.

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## NOTES

1. To be published in Jutland Archaeological Society Publications.
2. Information on the absolute dating of the boundary between phases 2A and 2B has been supplied by Karen Høilund Nielsen, since this is not explicitly covered in her article (1987, fig. 18).

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# *Archaeology: Science or Politics?*

## An Interview with Colin Renfrew

by FELIPE CRIADO BOADO
and CHARLOTTE DAMM(1)

For several decades now archaeologists have been concerned with constituting their subject as a science. This was especially so within New Archaeology, which narrowed the gap between archaeology and the natural sciences in an attempt to lead archaeology towards objectiveness. At the same time there is an awareness that archaeology can be (and perhaps inevitably is) political. The political potential in prehistoric studies is clear in for instance explicit marxist archaeology or in the increasing interest in the past seen in many third world countries. But is any archaeology objective? Can we help but impose our personal standpoints on our research? Is archaeology science or politics? This is a central question throughout this interview with Professor Colin Renfrew.

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"My own theoretical framework comes from an attempt to look at society and see how one can conveniently describe it and then look for sources of change. I am influenced by modern thinking about change in many directions. Especially I think the biologists have made real progress, when they talk about morphogenesis. I think it is important deliberately not to stand apart from the developments of thought in contemporary science, where there are many useful concepts, e.g. the language of morphogenesis or of information science. I certainly looked in those directions. But they do have difficulties in coping with the role of the individual in relation to the aggregate. What happens in society is often not really the product of individual will. In aggregate human volitions end up with many unintended consequences.

In relation to the notion of evolution, I have no doubt, that there are significant similarities between the development of e.g. complex societies and the formation of new species. But it seems to me that if we are talking about the development of culture, we are not talking about genetic material, which is handed on by specific mechanisms from generation to generation. The language of science can be useful, because it has talked about some aspects of the individual versus the aggregate problem with more success than any other language. But they are not dealing effectively with human will and activities."

Renfrew has been one of the most prominent European archaeologist connected with New Archaeology.

"New Archaeology, as I see it, was a major break that took place, best described in Clarke's "A loss of innocence" (2). People realized that they had to examine the methodologies and philosophies they are working within, and had to be more explicit and more willing to define and defend those. This is New Archaeology in a broad sense. Some people have a very narrow notion of New Archaeology, exemplified by the unfortunate book by Watson, LeBlanc and Redman (3). What happened was much broader than the attempt to pour all of archaeology into that narrow view of philosophy of science.

In addition to the North Americans and the British it has been the Dutch and the Scandinavians, who have participated actively in the development of the New Archaeology. North Americans sometimes imagine that it was all an American happening, but many of the foundations were laid in Europe. If we look at archaeology in general, the underpinnings in archaeological science or excavation method, I would say that the Americans are far from pre-eminent. We are much more sophisticated in Europe, where there has been a long tradition for an archaeology that could be called scientific in various ways. So I find that Scandinavia, Holland, Britian and America participated together in the revolution of New Archaeology."

New Archaeology is more or less explicitly linked with positivism. Colin Renfrew has in some papers argued, that a positivist methodology is the only alternative to subjective or idealist analyses. And he also seems to accept the link made between positivism and capitalism: "If to pursue a positivist strategy of verification or testing is seen in some quarters as tantamount, philosophically, to upholding capitalism, then, as far as I am concerned, there are worse things which one could uphold, and worse ways of upholding them." (4)

"It is not I who have made that link. It has been used in a pejorative sense by some of these structural-marxists and others to suggest a rejection of both capitalism and Western science. I am not shocked or annoyed by being called a capitalist, but I do not think it is a relevant point. The notion that science is a capitalist product seems first of all stupid, but if it comes from a marxist it is even more so, as Karl Marx himself saw his own project as one that was eminently scientific. It so happens, that capitalism and Western science developed in the same areas. But the development of science is an attempt to produce information or knowledge systematically and to seek to verify or question it. In that statement I am not saying "I am a capitalist, so I am a scientist". Whether or not one is a capitalist is irrelevant, but one has to be a scientist, because science simply means systematic knowledge as separated from revelation."

Colin Renfrew advocates systems theory and although he does not object to the term materialist, he prefers to stress his interest in the workings of the social aspects of society (a recent collection of articles is titled "Approaches to Social Archaeology"(5)).

But does he agree that systems theory and marxist archaeology have elements in common?

"It is true, that there are many points of equivalence in the systemic framework and marxist analysis, to the extent that they are descriptive of society. But a systemic framework allows you to talk about the past without strong political preconceptions. It seems to me no formula for advanced knowledge to assume from the start what you want to know. It may be, that we cannot expect to be objective in trying to learn about the past, but I think there are risks in choosing a strong political position at the outset. It is no doubt true, that many standpoints have associated with them unconscious as well as conscious political preferences and preconceptions. But any framework that succeeds in being more value free is a better framework.

Scandinavia is one of the few regions, where Marxism has been coherently applied in archaeology and the approach does have its positive merits. The main one, I think, is that it allows you to take a fairly holistic approach, to look at the way the whole society is changing, and how changes in one aspect would affect other parts. This could easily be paraphrased in systemic terms. Secondly it focuses on social issues.

The great pitfall of marxism, I think, is the concept of contradiction. Although it is an interesting concept, that can also be expressed in systems theory (if Marx had been aware of the concept of feedback, he would have used it), it involves temporal circularity. They speak of contradictions explaining something, but when you ask for evidence, they have to make references to following events. They don't really get at what are the dynamics of change.

The problem with marxism is that it prescribes how you should tackle a problem rather than invite you to think on your own about it."

In later years there has in archaeology been an increasing interest in the symbolic aspects of society. Professor Renfrew too is concerned with the projective or symbolic subsystem, including religion, art, language and science. His inaugural lecture was titled "Towards an Archaeology of Mind"(6). What is his opinion about structuralist archaeology, and why did he in his inaugural lecture say that "the archaeology of mind is too important to leave to the structuralists alone"?

"The structuralist approach is often interesting and in some ways very productive. For instance Ian Hodder has emphasized the active role of material culture. That is a sound point. Material culture does not simply reflect other realities. Material culture is part of the reality and helps to shape itself and other realities. Some have seen material culture as a projection of other realities, a very useful perception I think. Furthermore the structuralists have contributed to archaeology in a positive way by discussing areas of human experience and areas of the archaeological record, that have been neglected somewhat in

contemporary archaeology, e.g. by New Archaeology. But I do not think these valuable points necessarily emerge from a structuralist framework, as I understand it. In the end so much seem to come down to an individual claiming to recognize and proclaiming certain categories in the world, which he then seeks to divide the world into. Prof. Gellner (7) made the sound point, that if you lock up a number of structuralists in separate cubicles, they might well come up with different categories, and where do you go from there? The approach lacks system and method, which is why I do not think the archaeology of mind should be left to the structuralists alone."

"Do you recognize any of the New Archaeology in structuralism?"

"Yes, in as far as one sees New Archaeology as an awareness of the methodologies and philosophies we employ, rather than a specific theoretical framework, then contemporary approaches are much influenced by it. I am well disposed to some of the strukturalist work, as some people overcome or bypass some of its limitations. Its merits, indeed, is that it is not purely structuralist. When these people undertake some systematic analysis, they will use a computer program, indeed often the same package as a New Archaeologist, and they employ the same critical criteria, coming to pretty much the same conclusions from the same data. The methodological sophistication in handling the data that came with New Archaeology, has happily not been thrown overboard by the various post-archaeologists."

It is a general problem that there are very few women employed in archaeology, especially in the more influential positions. This is not due to a lack of female students, who are in majority at least in the lower degrees. What causes this picture and what could be done to change it? And in relation to this, what does Professor Renfrew think of Feminist Archaeology?

"It is a real problem, but not just in archaeology or in Britain, I think. I mean, there must be a larger proportion of women in archaeology than in natural sciences. And the problem is not in the order of magnitude it used to be.

One part of the problem is that women are accepting genderdefined roles, and therefore to a large extent are not applying to do research at the Ph.D. level. That perpetuates itself at the post-doctoral level; as you know there are ludicrously few female teachers and fellows. Some colleges in Cambridge are trying to do something about it, but there are few highly qualified graduates to draw from. We might try to encourage the girls more, but whether they are able to continue is determined by the number of grants, which in turn is determined by their performance, their exams.

I think Feminist Archaeology does explore important areas. There clearly are preconceptions, and some models do contain assumptions about gender, which are very questionable. It is worth looking at the evidence, first of all from sexually determined finds.

But if Feminist Archaeology implies that people have got their solutions to the wrongs of the world in this area and are trying to impose them on archaeology, I don't think it is a good research design. I am not terribly keen on any -ism in archaeology, in the sense that I feel we should be looking at problems, rather than bringing solutions."

Throughout the above Colin Renfrew has stressed his preference for a valuefree, objective archaeological science. Does this mean that politics and science can be separated?

"There is a connection. We can not define science, including archaeology as a world apart from the real world of contemporary political thought and action. I myself regard archaeology as primarily the pursuit of knowledge, as research. The end-goal of that is information. Of course one has to choose what one wants information about. That your research questions are influenced by your political standpoint is unavoidable and not desirable to avoid. People have different poliical standpoints and are seeking to change the world in various ways. That is perfectly legitimate. But when people in that sense come to achaeology, probably already knowing the answer to a particular problem, they are very often only seeking to document that answer by means of the archaeological record.

It is true that in various areas the past and the view of the past is a very active force in discussion of the present. I fully accept that the past is of great significance, particularly in countries, for instance, where they are seeking to define their image of themselves, where it is not already fixed and defined (8). For them it is very important to establish their own identity. Each country is trying to do so and distance themselves from former colonial identify, almost inevitably a Western identity. I am very sympathetic towards that, and it represents fascinating problems. I well see that archaeology is of great significance there.

My own reason for finding archaeology interesting is more an existential one, to try and understand where we are in the world, to understand what it is to be a human being, and where we situate ourselves in the pattern of human existence in a broader way."

"What is or should be the position of Cambridge in the archaeological world?"

"In response to the postulate that the Americans were not terribly good excavators, one shocked American archaeologist once exclaimed: 'But, but... we lead the world!' I would not want to make the same claim for Cambridge. There is no a priori reason why Cambridge should be pre-eminent in any sense, although historically it has had a central role in British archaeology, and British archaeology no doubt has been influential on a wider platform. But there are now several good departments in Britain, where original thought about the methods of archaeology (not just the rather straight forward digging type) is going on. But the department at Cambridge try to have a global view, which not every department can do. We teach most areas of the world, and have many foreign students passing through. Hopefully it will continue to have that global awareness and that methodological concern, which is its hallmark. I am sure that what this department ought to be able to contribute is people who are trained and able to work in different areas, who are not just specialists in one area, and with a very strong methodological awareness. This is what Cambridge has build up to doing in the past 60 years, and if it continues to do so, then it ought to remain one of the more interesting places at a world level, where archaeologists would go to meet other archaeologists."

"How do you defend archaeology in the present day context of financial cut-downs?"

"Archaeology is increasingly seen, especially by archaeologists, as one of the major historical disciplines, and it is the one historical discipline, that allows one to take a global (chronologically and spatially) view. There is no doubt that if we are asking questions about the human species and its past, archaeology is very well placed to answer those. There are those of course, in the modern world, who are concerned only with increasing the production, the gross national product, manufacturing of goods and so on, but they aren't that numerous. Nearly every country realizes that it needs a view of its past, and even if we are talking about material production, it is understood, that productivity is determined not only by technological efficiency, but by how people look at their place in society, and at what work means to them, and how they feel about the world in general. I think archaeology has a vital role in situating one self in the world.

This is recognized by governments, not only in a university context. The growth of rescue archaeology in most parts of the world reflects an awareness by governments, that to salvage part of their nation's past is part of their responsibility. I feel quite optimistic! We should not be defensive about the role of archaeology, but should be more bold and insisting on giving it its due place among the historical disciplines and in the society as a whole."

(1) This interview took place in November 1986.

(2) DAVID CLARKE 1973: A loss of innocence. *Antiquity* 47 p. 6–18.

(3) P.J. WATSON, S.A. LEBLANC and C.L. REDMAN 1971: *Explanation in Archaeology: An explicitly scientific approach.* New York, Columbia University Press.

(4) C. RENFREW 1981: Space, Time and Man. *Transactions of the Institute of British Geographers* 6, p. 257–78.

(5) C. RENFREW 1984: *Approaches to Social Archaeology.* Edinburgh, Edinburgh University Press.

(6) C. RENFREW 1982: *Towards an Archaeology of Mind. An inaugural lecture.* Cambridge University Press.

(7) E. GELLNER 1982: What is Structuralism? In C. RENFREW, M. ROWLANDS and B. SEGRAVES (eds): *Theory and Explanation in Archaeology.* London, Academic Press.

(8) In reation to the Nordic countries one might think of the Saami and the indigenous people of Greenland.

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# Reviews

G. de G. SIEVEKING and M.B. HART (eds.): *The Scientific study of flint and chert. Proceedings of the fourth international flintsymposium held at Brighton Polytechnic 10–15 April 1983.* Cambridge University Press 1986, 290 pp., 208 ill.

The International Flint Symposium, a long established institution soon celebrating it's 20th anniversary, held it's fifth meeting at Bordeaux last year. The concept of the Symposium has for at least a decade manifested the rapidly growing interest for research across the boundaries of several branches of natural science and archaeology. It has as well been a catalyst for the development of new disciplines working in the ecotone between sciences, as the editors rightly states. The meetings, held about every 4th year since the first in Maastricht 1969, have evidently broadened the scientific base of the institution. The actual book includes, as well as papers by geologists, a number of technical and analytical papers from physicists, geochemists, material scientists and engineers.

The results of the Brighton Symposium are published in two volumes. The papers commented in this review published in *The Scientific Study of Flint and Chert* are, or derive from, those presented at the scientific seminars of the symposium. The companion volume *The Human Uses of Flint and Chert* is planned to follow.

*The Scientific Study of Flint and Chert* includes no less than 32 papers covering a wide range of comprehensive subjects. This might have been the natural reason not to divide the many papers into groups or sections in the book. The papers are of course well organized and numbered continously throughout the book, but a framework would have been a benefit to the reader. The introductonary paper by *Schmid* on the relevance of flint-stratigraphy to archaeology is an intended key for the nonspecialist to the reading of the socalled lithostratigraphical papers. The review of the following 31 papers is, due to practical reasons, approximately divided into six sections.

*The stratigraphical provenance and geological distribution of flint (papers 2–3):*
Both papers are geological "case studies" by respectively *Mortimore* and *Wood* and crops at Brandon, Suffolk. This flintmaximum is correlated from the south coast of England up to Yorkshire over a distance nearly the length of Jutland. The flint shifts from giant nodular in the south to continous tabulars in the north. The authors present evidence that the flintmaximum is essentially the same contemporaneous formation.

*Processes in relation to the formation of flint and fabric in the chalk (papers 4–11):*
The origin of flint is the subject of the paper by *Clayton* on the chemical environment in the Upper Cretaceous chalks. The presented geochemical approach is not new in this field. It has long been known that the formation of flint was caused by organic factors which led to concretion some depth below the floor of the cretaceous sea. Clayton's recent theory comprises that an early diagenetic reduction of sulphate ions to produce hydrogen sulphide followed by the oxidation of the hydrogen sulphide produced, at the interface of reducing and oxidising conditions, crates ideal conditions for the dissolution of calcium carbonate and the precipitation of silica. Voila! – *Kolodny* reflects on the origin of levantine flint based on new isotopic evidence whereas *Williams* describes the cherts of the upper Greensand of Devon. A comprehensive, thoroughly documented study on a classical subject is presented by *Bromley and Ekdale*, demonstrating an up-to-date investigation of flint and fabric in the northwest European chalk. *Felder* has delivered a very short, descriptive paper on rythms, flints and mesofossils in the Maastrichtian Cretaceous in the Netherlands. *Hart, Bailey, Sweiciky and Lakey* are exploring a small, but extremely informative world of microfossils, namely the finds from the fine "chalky" powder often present within cavities in the interior of chalk flints. This study also provides information on the process of flint formation. And besides is illustrated with an excellent "montage" of SEM-photos. *Curry* has investigated the content of foraminiferids in flint pebbles originating from decayed chalk whereas *Glasser and Smith* ask: How did silicious coatings arise on fossil cocoliths? Part of the answer comes from the application of scanning electron microscopy, novel in this field.

*Rawmaterial studies in the archaeological perspective (papers 12–14):*
The study of flintsources, raw flint and its diffusion through the human network in the past, is an old research tradition within stone age archaeology and traditional etnography. Since the last century interest has been directed into the tracing of flint quarries and regular mines, especially with reference to evidence of "trade" and exchange systems. Again this study is in full bloom. Apropos *Larick* has investigated the types and sources of flint and chert in Dordogne and compared his observations with the scatter of flint types in the palaeolithic strata of the stations in the region. The archaeological application of Larick's work is published in the second volume of the Brighton Symposium. Larick's work is very promising and the same time very problematic. Modern mapping of raw-flint-resources is linked to modern quarries and road-cuts as

well as to accessible farmland. It is still difficult to estimate what was accessible during the upper-palaeolithic. A welcome east European contribution comes from *Takágs-Biró* on raw materials used for the manufacture of stone artefacts in Hungary. The first systematical survey. The use of geochemistry for raw-material-tracing of flint axes by *Bush and Sieveking* is as classical a theme as petrography itself. The subject is of great importance also to Scandinavian scholars, as the neolithic raw-material supply-system here is somehow a pendant to the situation in England, with the exception of the long flint-rich Danish littorina coasts. The hopefully fruitful work carried out nonethe-less faces methodological problems, some clearly pointed out by the authors: "The use of the geochemical technique for determining the provenance of flint axes is based on a number of assumptions some of which can be tested and others accepted" (p. 137). The three basic assumptions are 1) within one mine site the material is reasonably homogeneous geochemically, 2) regional variations occur, and 3) most of the flint axes are derived from a restricted number of mine sites and not from a multiplicity of local sources.

*Geological "case studies" (papers 15–21):*
These investigations from specific areas in England and Sweden include the study of cretaceous sediments and flint in secondary deposits. The only exception being a paper by *Lidmar – Bergström* on flint and pre-Quarternary geomorphology in south Sweden and south-west England. We are informed that primarily Scanian Cretaceous sediments indicate at least three trangressions from Early Cretaceous to the Turonian. Early Maastrichtian chalk is the source of the well known (local) Kristiansstad-flint. *Gibbard* has studied the flint pebbles in the Quarternary gravels of south-east England. *Catt* has investigated the nature, origin and geomorphological significance of clay-with-flints. Beside the evident geological aspects, clays-with-flint have been a rather rich resource for prehistoric man because of their great range of flint types. *Williams* contributes with a comprehensive study of the periglacial phenomena in the South Downs, drawing our attention to the many factors which have affected the location of flints. *Waton's* preliminary paper deals with the palynological evidence for woodland on the chalk of central Hampshire. *Ellis* reports on the postglacial molluscan succession of the South Downs dry valley. Ireland comes into focus with the paper by *Briggs*. From a middle Scandinavian viewpoint the author deals with an interesting field; transported flints in areas marginal to the chalk outcrops. Concerning this recycled flint, the author brings along one observation, important for rawmaterial classification: "The hard nature of this flint is due to a process of natural selection within the ice, flawed or cracked nodules being broken down to their smallest indestructible particle, both thermally and by percussion. This ensured survival of none but the most stable nodules".

*Qualitative studies of flint, quartz, and obsidian (papers 22–29):*
These technical and analytical investigations, expressions of frontier research, apply a number of new techniques and terms quite new to archaeologists like for instance nuclear magnetic resonance and plasma spectrometry. *Krinsley and Trusty* have dealt with sand grain surface textures using scanning electron miscroscopy. The method, controlled by laboratory simulation, must be judged as an important tool in the environmental reconstruction and even gives clues to the (quite exotic) interpretation of the socalled fine particles on Mars (p. 205). *Linde* has worked in the same field with specific interest in quartz, flint and obsidian grains in experimental glacial, water or wind transportation. The paper by *Bull* is purely procedural and is also dealing with environmental reconstruction by the study of sand grains using SEM. As a small curiosity he believes possible not only to detect but also to compare the grain surface textures produced by experimental grinding to those found in glacial-ground sediments. *Shalley and Marshall* are with the help of SEM focussing on the simulation of aeolian quartz grain surface textures. With respect to environmental geology this refined identification is most promising to future studies of archaeological sites. *Whalley and Orford* deliver new practical methods with the aid of microcomputers – analysing and quantifying two-dimensional images. Plasma spectrometry as a method of flint-source determination is introduced by *Thompson, Bush, and Ferguson*. The method appears promising being both accurate and efficient! It seems much more difficult to evaluate the potential in the study by *Symons* on the application of Magnetic Resonance in the investigation of cherts. *Griffiths, Seeley, and Symons* report on electron spin resonance (ESR) signals in chert. ESR is a refined technique for determining past heating temperatures. The last paper in this round by *Ögelmann* deals with thermoluminiscence dating. TL dating of burned flint is a developing technique. More accuracy can be expected in the near future.

*The impact of frost on flint (papers 31–32):*
These two studies have an evident value for future environmental interpretation naturally with special regards to palaeoclimatic factors. *Lautridou, Letavernier, Lindé, Etlicher, and Ozouf* have studied porosity and frost suspectibility of flints and chalk based on laboraory experiments and field investigations. Finally *Sieveking* together with *Clayton* has investigated the question of frost shatter and its effects on flint microstructure.

As mentioned, the volume covers empirically and methodologically a subject, which regarding techniques is extremely varied. This of course influences it as a book, some of the papers could as well have appeared in specialised periodicals. Anyway, it also demonstrates the effect of what could be described as the continuous conceptual undulations of archaeology. The growing interest in technical research in archaeology must be seen in contrast to two decades of (necessary) hyper-theory. Technical studies such as these, which are also now expanding within the important field of experimental archaeology, have acquired considerable importance and it is hoped they have come to stay.

The papers are altogether an indispensible contribution to the ongoing clarification of the many "maybe's" in the archaeological study of flint. Besides, thanks are due to both editor and publisher for the solidly equipped and well printed book. It will be used.

Bo Madsen

KARL-ERNST BEHRE (ed.): *Anthropogenic Indicators in Pollen Diagrams.* A. A. Balkema, Rotterdam 1986, 232 pp., 22 foldout diagrams.

It was Johannes Iversen, in his paper from 1941, Landnam i Danmark's Stenalder, who was the first to show that man was responsible for the vegetational changes which can be detected in pollen diagrams at the beginning of the Sub-Boreal period. In 1981 Behre published an article concerning which pollen types can be used as indicators for various kinds of cultural landscape in the past. In 1982 a working group was formed with the aim of further improving these criteria and they presented their results at a symposium in Wilhelmshaven in 1985. This book contains 17 papers from the symposium, 12 in English and 5 in German.

The papers cover research carried out in Scandinavia, Germany, Poland, Czechoslovakia, Holland and England and are concerned exclusively with the problems of detecting and demonstrating agriculture. The much weaker, but still fascinating interactions, between mesolithic hunter/gatherer populations and the vegetation do not get a mention. The book is clearly intended for pollen analysts and I will therefore try summarise and comment upon some of the aims and results in the articles which will be of interest to archaeologists interested in interpreting pollen diagrams for themselves. All the radiocarbon dates given are uncalibrated.

Four papers are concerned with Northern Scandinavia. K. D. Vorren claims to be able to recognise an early phase of human activity in northern Norway beginning as early as 5500 BP, whilst the archaeological evidence clearly demonstrates barley cultivation and pastoralism at around 4200 B.P. Vorren presents a list of the few often rather uncertain indicators in this, in agricultural terms, marginal area.

P. E. Kaland's research is concerned with the origin of heath in western Norway. It was around 4300 B.P., or perhaps earlier, that the first woodland clearances took place and from that time onwards the heath which replaced the woodland was burnt on a regular basis and used for grazing. This was the case for the whole of the heath area which at one time extended along Western Europe's coast (including western Jutland). Kaland rejects the idea that the heath has a climatic origin.

I. Vuorela's work shows that slash and burn started in southern Finland around 4000 B.P., but that even later, when much larger areas were affected, the evidence for this in the pollen diagrams is very weak due to the poor pollen dispersal (filtering) from the clearances to the lakes and mires from which the pollen samples were taken.

Y. Vasari and K. Vaananen describe another technique used in Finland during recent times, whereby the the water level in mires is raised during the summer by means of dams. The aim is to promote the growth of rushes and grasses for harvesting as hay. This technique could quite easily have been used here in Denmark in the past.

B. Aaby's paper 'Trees as anthropogenic indicators in regional pollen diagrams from eastern Denmark' is the only Danish contribution in the book and therefore demands a more detailed treatment. Aaby discusses pollen diagrams From Holmegårds Mose (South Zealand), Fuglsø Mose (Djursland) and Bundsø (Als). The first two are raised bogs and as such can be used to produce radiocarbon-dated pollen diagrams; something which is all-important in studying vegetational history.

Pollen analytical investigations in recent years (Andersen et al. 1983) have shown that subsequent to the introduction of agriculture, the development of the vegetation is very different from one part of the country to another. The time is past when Denmark's vegetational history could be presented with one diagram from eastern Denmark and one from western Jutland.

The so-called elm decline occupies a significant part of the discussion in Aaby's paper. At Holmegårds Mose there is an elm decline at about 4800 B.P. and agricultural activity is apparent in the centuries which follow until a near total regeneration of the woodland takes place around 4200 B.P. Strikingly, there is a second elm decline at 3100 B.P., something which is unique to Holmegårds Mose. There may be some reason to doubt the dating of the first elm decline to 4800 B.P., which is 200–300 years later than in the rest of Northern Europe. It may be that raised-bog peat can produce anomalous radiocarbon datings. The development of the vegetation in the early Sub-Boreal at Holmegårds Mose corresponds closely to that in St. Åmose, another inland site on Zealand (Troels-Smith, 1960) where new radiocarbon dates place the elm decline around 5100 B.P. whilst the subsequent 'Iversen's Landnam' begins around 4800 B.P. Aaby argues that both elm declines seen at Holmegårds Mose are due to human disturbance of areas with damp soil where elm in particular grows. He discounts the involvement of climatic change, soil deterioration and, in part, elm disease. The latter, particularly in view of its present devastation of the elm population in northern Europe, should probably be ascribed greater significance. Can anything other than a widespread disease explain that: –

1. The elm decline is synchronous across northern Europe.
2. It lasts a very short time (50–100 years).
3. It is preceded by very different vegetational development from one locality to the next.
4. If elm regenerates at all in an area, it is usually several centuries later.
5. It occurs in areas regardless of whether agriculture had been introduced by that time or not (H. J. B. Birks 1986).

I should perhaps also be mentioned that there is a record of Scolytus, the beetle responsible for spreading Dutch Elm Disease, from St. Åmose in deposits dating to immediately prior to the elm decline (Stockmarr, cited in Robinson and Dickson 1988).

Aaby describes the importance of the major tree species as anthropogenic indicators and concentrates in particular on the expansion of beech. Beech reached Denmark around 3100 B.P. but its frequency in a specific area subsequent to this is very much dependant on agricultural activity within that area. It grows on well-drained soils, the same soils that are so well-suited to cultivation.

At Holmegårds Mose, where the accumulation rate of the peat can be determined by means of radiocarbon dating, it has been possible to construct an absolute pollen diagram, which in contrast to a traditional percentage pollen diagram, shows

directly how many pollen grains fall on a square centimetre of bog surface in a year. It appears that the Atlantic primaeval forest with its closed canopy had a low pollen production which increased when the clearances in the forest began and the individual trees received more light. This resulted in the few herb pollen grains, which are indicators for the first tentative agricultural activity, being further under-represented in a normal percentage pollen diagram. It is only when the landscape became completely open that tree pollen production begins to fall again. It is therefore very difficult 'in interpreting a pollen diagram' to evaluate the changing relationship with time between areas of woodland and open land.

H.-J. Beug has investigated the earliest agriculture (around 6400–5900 B.P.) at Luttersee near Göttingen. The very abundant Linear Band Ceramic sites on the European Loess are normally not registered in pollen diagrams. He has found evidence for arable agriculture, but that there is nothing which suggests pastoral activity. As elm rises during the period of human activity, it cannot have been used as a source of leaf hay. It is only later that a 'normal' elm decline appears.

W. Groenman-van Waateringe continues the traditional Dutch activity of investigating buried soils under burial mounds. In order to find out more about the possibilities for grazing animals during the Neolithic, she collected surface pollen samples from nature reserves grazed by domesticated animals and compared them with the vegetation in the area. Cattle and sheep are grazers and they tolerate only small amounts of woody (lignaceous) material in their food. In contrast, red deer and especially roe deer are browsers and they can digest much greater quantities of woody material. When she compared the modern pollen spectra with fossil spectra from under Funnel Beaker Culture burial mounds, she found that the potential grazing available for cattle was very limited. The burial mounds lie in areas of disturbed open woodland on dry sandy soils, where woody heath species made up a large part of the ground cover. In areas which were not disturbed grass was very rare on the dark woodland floor. Grazing must, therefore, have been limited to river valleys and other low-lying areas, although the heather-dominated open woodland was an important area for winter grazing.

It should be added that the Dutch investigations have shown that specific agricultural practices are not linked to particular neolithic cultures (Casparie and Groenman-van Waateringe, 1988) as has been proposed by Troels-Smith for example.

K.-E. Behre and D. Kucan recount the pollen analytical investigations associated with the extensive interdisciplinary research project at Flögeln which lies between the mouths of the Weser and Elbe. This is a low-lying sandy area surrounded by mires. Excavation has produced evidence of occupation from the Neolithic through to the Middle Ages. Pollen diagrams have been constructed from raised bogs at various distances from the settlement and from kettle bogs within the occupied area itself. The first clear occupation of the area is registered in the pollen diagrams around 4400 B.P. This is the advent of the Funnel Beaker Culture and it corresponds to Iversen's Landnam phase in Denmark. There are indicators of both arable and pastoral agriculture. Heather expanded in the area as early as the Neolithic, a phenomenon also known from western Jutland (Andersen et al. 1983). It should be made clear however that Iversen's Landnam phase is not synchronous in its expansion. It has been dated variously from the early Neolithic right up into the Bronze Age and is therefore connected with several cultures.

What is remarkable about this research is how poorly the settlement shows up in the pollen diagrams from outside the occupied and cultivated areas. Just 100 metres from agricultural fields, indicators in the pollen diagram are rare and in another diagram, some 3 km distant, evidence for the presence of a large medieval village is completely absent. All this must be taken into consideration when choosing sites for pollen analysis. Without pollen diagrams from small mires and lakes, it is not possible to gain information about human influence on a local scale.

The best indicator of human occupation and activity is Plantago lanceolata (rib-wort plantain), but Behre and Kucan point out that in many cases its affiliation is with arable fields rather than common and pasture grazed by cattle. Plantago lanceolata is actually a common weed of fallow fields.

E. Lange has analysed pollen samples from a ditch surrounding the Slavic fortifications in northern East Germany. The samples were taken respectively from north, south, east and west of the sites and those samples lying closest to the potential arable land, clearly show the highest values of cereal and Plantago lanceolata pollen. It is also striking how quickly the values of the two indicators fall away with distance from the cultivated areas (100% of tree pollen down to 3% over a distance of 270 metres). It should however be added that no account is taken in the research of the prevailing wind direction. Lange uses the relationship between values of cereals and Plantago lanceolata as a simple indicator for the relationship between arable and pastoral agriculture. Behre (1981) doesn't recommend the use of this and other more complicated indices, in particular because the pollen production and distribution of the various indicator species is unknown.

B. Berglund *et al.* have examined recent pollen spectra from sites in southern Sweden which are exploited in various ways with regard to grazing and harvesting of hay. Pollen analysis was carried out on samples from moss polsters and the surrounding vegetation was recorded at various distances from the sampling point. Various computer-based methods were used in comparing the pollen spectra and the vegetation, but is was not possible to differentiate between the two types of cultural landscape. Additional landscape types must be investigated in future research before it will be possible to use numerical methods to interpret fossil pollen diagrams. Berglund's research also gives the possibility of assessing the pollen productivity of common agricultural indicator species. An important result of the research was to show Plantago lanceolata to be greatly under-represented.

Computer analysis has also been utilised by Judith Turner in order to study the variations in anthropogenic indicators from seven European sites. The analysis do not help directly in the interpretation of the pollen diagrams but they do concentrate attention on the relationships between the occurence of some less common indicators.

The last two articles which will be commented upon here

concern the relationship between pollen analysis and plant macrofossil analysis and their respective potential for giving information about various forms of past land use. U. Willerding lists the range of methodological problems involved. First and foremost there is the difference in the level to which pollen and macrofossils can be identified. Seeds and fruits can normally be identified to species, whereas pollen is more commonly only possible to genus. Broadly speaking, pollen diagrams give an impression of the extent of the occupation, duration and land use, but if we want precise information about which crops were grown or which wild plants were exploited, then it is plant macrofossil analysis to which we must turn. The problems can be illustrated by considering the possibilities for identifying cereal species. Only rye pollen can be identified with certainty whereas the other cereals can be assigned to one of two groups. The first includes some wild grasses, barley and one species of wheat (einkorn), the second includes the other wheat species plus oats. In addition, rye is wind-pollinated and produces large quantities of pollen, whereas the other cereal species are self-pollinating and their pollen is first released on threshing or grinding. Accordingly they only register in pollen diagrams from within the settlement area. On the contrary cereal grains can usually be identified to species.

Behre (1981) presented 30 pollen indicators (identified to species, genus or family) for various forms of land use. According to Willerding, 300 macrofossil species can be determined within these indicator groups. On the other hand, the limitations in the use of plant macrofossils clearly lie in the preservation conditions. Seeds and plant remains can only be preserved under waterlogged conditions or by charring.

Willerding's final point is to outline difficulties in reconstructing former cultivation methods. The use of different types of plough in the past has, for example, resulted in a different weed flora composition from that we know from modern agriculture.

K. Wasilikova has investigated the relationship between charred plant remains from archaeological layers and pollen analysis from lake and peat deposits from a large number of Polish sites. She finds that the frequency of certain macrofossils in many cases act to highlight the corresponding pollen type's value as an anthropogenic indicator. As an example of this she presents an investigation of the charred plant remains from a pit from a settlement dating to the Lenyel Culture, together with pollen and plant macrofossil analyses of contemporary uncarbonised material form an adjacent small lake in a river valley. In this way she is able to separate plants that are closely associated with human presence and plants that appear as a result of natural changes, in water level for example.

In short, pollen analysis and plant macrofossil analysis have both their advantages and disadvantages, but if they can be used together, then it is possible to reach a much better understanding of the part played by human populations in the development of the vegetation and landscape through time.

This important book contains papers covering methodical reviews through to specific investigations. Something which would have been desirable is a chapter which tried to put the individual articles into context, whilst outlining the present state of the art within this research area and pointing the way forward. Apparently no-one dared! [Translated by David Robinson].

Charlie Christensen

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COLIN RENFREW: *Archaeology and Language. The Puzzle of Indo-European Origins.* Jonathan Cape, London, 1987. 346 pp.

This book exemplifies what happens when a systemic theoretical framework of autonomous social change is applied to "solve" the puzzle of Indo-European origins. It illumintates more clearly than previous works by Colin Renfrew not only the the potential, but also the limitations of such an approach.

Colin Renfrew has played a major role in transforming the perception of european prehistory by drawing the methodological and theoretical consequences of the breakdown of the traditional chronological framework triggered by the radio carbon revolution. This happened mainly during the 1960's and was summarized in the now classical book from 1973 "Before Civilization". As a result migrations and diffusion were more or less abandoned from the scene of European prehistory. The locus of change was rather to be sought in internal conditions, whereas information exchange accounted for major cultural innovations, such as the Corded Ware Culture. This approach, however, was not accepted in most of Central Europe, and among those who studied Indo-European language there developed a research tradition which still tried to identify language, ethnicity and migrations in terms of material culture.

In "Archaeology and Language" Colin Renfrew attempts to incorporate this last bastion of more traditional research into his systemic framework of internal forces of change. After having presented the problem in a short history of the study of indo-european origins and language, he presents a number of theoretical models to account for social and language change. Since migrations on a priori grounds are not accepted as having played any major role, except in the initial expansion of agriculture, the final model for the spread of indo-european languages is predictable in terms of the theoretical framework chosen. Indo-european language was linked to the expansion of agriculture and developed its various typological branches in the continued process of expansion and transformation of the Neolithic and Bronze Age societies. The model is a logical outcome of the approach presented, which remains its prime justification, since there is no closer empirical examinations of the complex relationships between social and economic change and changes in material culture and language.

Colin Renfrew has to be congratualated, however, not so much for presenting a convincing case, but for insisting on understanding language in terms of its social environment, and by raising the issue of the relationship between the two. Personally I have serious doubts as to the possibility of tracing language change on archaeological grounds, and I have very mixed feelings about the potential ideological uses and misuses of such studies, although Renfrew clearly distance himself from such positions. Since language after all is an essential part of cultural identity, and also of etnicithy, it is indeed important to develop a framework to replace the traditional and simplistic correlations between culture and language. Renfrews study, however, does not itself move far beyond such simplistic models, except that they are of a different, and more sophisticated nature. In one chapter about the Celts, where historical sources makes it possible to talk more firmly about some of these problems, he tries to expose in more detail the relationships between etnicity and language, but even here the examination remains at a rather general level.

Since the book has already been extensively reviewed, I shall rather point out what I consider to be the significant, and implicit message of Colin Renfrews study. It demonstrates more clearly than before the limitations of an internal social framework of change, and of a simplistic evolutionary perception of prehistory. It rests on the basic assumption that with the exception of the spread of agriculture there were no migrations until European societies reached a level of social organisation that allowed conquest migrations to take place. Since we have ample written evidence of migrations from the Celtic period onwards, this level of archaic state formation was not reached until that time. The history of european social evolution is seen as progressing from stable tribal societies to more turbulent archaic state formations in a rather linear fashion, the Iron Age establishing an evolutionary fixpoint.

It is indeed remarkable that a theoretical archaeologist like Colin Renfrew, a firmly believer in the priority of internal forces of change, uncritically accepts that the appearence of the first written accounts from classical civilizations about European societies marks a significant evolutionary change within these societies, rather than within the societies producing the texts. And it is indeed remarkable that these accounts are taken on evolutionary face value to such a degree, that Renfrew excludes himself from raising the question if such a level of social organisation could not have been reached at a much earlier time in European prehistory. The fact that migrations flourish as soon as we have written evidence, and continue to do so, should lead not only Colin Renfrew, but a whole generation of British archaeologists, to ask themselves if this might not be a rather normal state of affairs, also before the time when written records give testimony to them.

What I suggest then, is that it is not possible to progress any further in understanding the relationship between language, ethnicity and social change before we are able to identitify in a much more convincing way the arthaeological correlates of social change in space. And such an understanding is not possible before we include migrations as well as information exchange in our theoretical and methodological framework. Only by considering all possible mechanisms of change can we choose between them. (It ought to be unnecessary to stress, that I do not propose to explain change by reference to migrations, but rather see migrations as important symptons of certain processes of change, due to internal contradictions, a necessary addition to the model of peaceful change, due to information exchange, which presently dominates).

The fact that Colin Renfrew on *a priori* grounds precludes himself from asking some of the most pressing questions arising from his study, is a logical outcome of remaining faithfull to his own paradigm. This, however, is also the strength of the book, since it exposes the limitations of its underlying theoretical assumptions.

One may ask if there is a deeper logic or ideology behind Colin Renfrew's perception of European prehistory. There is in two important aspects. First, it can be argued that the model of peaceful internal change and information exchange arose as a reaction against the militant migration model, that was politically and historically discredited after two world wars. In much the same way as the migrationist pardigm reflected dominant perceptions of its own time, so does the "welfare" model of Colin Renfrew (and of most of New Archaeology). It corresponds to dominant perceptions of peaceful change through information exchange and international cooperation in the period after World War Two. I suggest that time is now ripe to consider the world from a more balanced perspective of both conflict and harmony, information exchange and migrations.

Colin Renfrew's perception of European prehistory also in other important aspects reflects present ideological trends, especially the programmatic stressing of Europe as an area of independent development from the earliest times. Like Gordon Childe he is a firm believer in the prehistoric roots of European progress and civilization, which ultimately explains industrialization and the european expansion over the globe. We do not owe our identify or our historical abilities to either Asiatic nomads or Near Eastern civilizations, except in a very remote past. But after that historical incident such influences were internally transformed and remained genuinely european. Althouth Renfrew is careful to stress that such processes were the outcome of shared environmental conditions, and shared experiences over the millennia, there is (at page 6) a

moment of emotional outlet that reveals his dedication to a common European ancestry: "These lands have been our lands, and those of our forefathers, for thousand of years longer than is widely thought. Many of the features, then, which define the Irish, or the Spanishness of the Spanish, or the Britishness of the British, go back very much deeper . . . This, I think, is a fundamental change in perspective, and one which carries many interesting implications with it." I should replace "interesting" with "dangerous". Here Renfrew is not far from Kossinna and he would do well in rethinking its implications.

In conclusion I find "Language and Archaeology" an extremely important book in its paradigmatic exposure not only of the limitations of what has been and still is a dominant theoretical framework, but also of its underlying ideology. It will be interesting to see what effects this will have when the battle of Indo-European origins is over.

Kristian Kristiansen

KLAUS RADDATZ: *Der Thorsberger Moorfund. Katalog. Teile von Waffen und Pferdegeschirr, sonstige Fundstücke aus Metall und Glass, Ton- und Holzgefässe, Steingeräte.* Offa-Bücher, Neue Folge Bd. 65 (127 text pages with 50 text figures and 109 full-side plates with drawings and photographs of artefacts.

Klaus Raddatz's work is one of those good books which is not to be read but simply used. It comprises a complete and fully illustrated catalogue of the artefact classes noted in the title, and for each of the 1,111 finds which the catalogue lists there is a thorough description and informative illustrations. References are also given to catalogues and registers in which the material has previously been included together with the key points in archaeological literature where the objects in question are depicted or discussed. The foreword informs us that a further catalogue volume is to be published, covering the "Gürtelteile und Körperschmuck" of the Torsbjerg find, and although these classes were comprehensively discussed in the author's well-illustrated study of 1957 (Offa-Bücher, Bd. 13) it is certainly desirable that they too should be presented in a full catalogue following the same clear lines as this one, for with these catalogues available future research will have easy access to a find-group which is as important for Iron-age studies as it is difficult to approach in the storerooms and exhibitions of the museums in which it is kept. Thus there is good reason to be grateful to the author because he, with a lifelong study of the material finds of the period at his back, has taken upon himself this great and quite altruistic task.

By way of introduction Raddatz informs us that the catalogue originally should only have included the metal artefacts in the Torsbjerg find which represent a soldier's armour and weaponry, but that he was forced to recognize in the meantime that leather and wooden objects which fall into this category must also be included. Just as well, because the extraordinary preservative conditions in Torsbjerg mose have indeed delivered to us quite unique artefacts of organic material. Pottery and wooden vessels too have found a place in the catalogue although there cannot really be shown to be any necessary connection between pottery- and weapon-deposits in the bog, but other important find classes are still kept out of the study. This includes the coins from the site, and textiles and leather objects "which do not belong to the warriors' gear or whose function is indeterminable". It is difficult to see any real logic in this selectivity, and many will search in vain for catalogued information about the costume pieces and leather footwear from Torsbjerg mose.

Something crucial and new is that in preparing these catalogues Raddats has had access to Engelhardt's diaries from the excavations in Torsbjerg in 1858 and 1860 and to the handwritten and fully illustrated archive with which Engelhardt, from 1852 to 1864, spanned the accession list of 'Den Kongelige Samling af nordiske Oldsager i Flensborg'. From here many valuable items of information concerning finds and contexts have been taken which are supplied as verbatim quotations in connection with the descriptions of objects; similarly a majority of the text figures are reproductions of Engelhardt's drawings. Various mysteries in the registration of the finds hitherto can now be cleared up on the basis of the original descriptions, and one must join Raddatz in deploring that they have been made available to research so late. The cause of this is not however as stated in the introduction, that they lay neglected in the archives of the National Museum in Copenhagen "an unerwarteter Stelle – falsch abgelegt". This is a misunderstanding, for the history of the missing archives of the Flensborg collection is more peculiar (M. Ørsnes, Foreword to C. Engelhardt, *Sønderjyske og Fynske Mosefund,* bd. 1, Kbh. 1969; J. Ilkjær and J. Lønstrup, Flensborgsamlingens skæbne, *Hikuin* 1984). Just as Engelhardt got the major part of the Flensborg collection transported to a hiding place on Sjælland in 1864 when an Austro-Prussian army invaded Denmark, so too he took care of the diaries and catalogues which he personally had written through twelve busy years' work. But while the collection of archaeological material was subsequently found and handed over as stipulated in the terms of the peace treaty, the archives unquestionably remained in his possession. In 1935 his daughter delivered a sealed package to the National Museum with the condition that it might first be opened after her death, and when the seal was broken in 1966 it proved to include Engelhardt's surviving writings. With a liberal interpretation of the conditions which were still attached to the use of these the results of Engelhardt's labour could finally be made available for continued research upon the great southern Jutish votive sites. In Volume 1 of this periodical Ilkjær and Lønstrup showed how the evidence of Engelhardt's diary can contribute to a reassessment of the character of the deposits in Torsbjerg mose, and the essence of the diary and catalogues' data is now made immediately accessible in Klaus Raddatz's large, indispensable Torsbjerg catalogue. [Translated by John Hines].

Mogens Ørsnes

KRISTIAN KRISTIANSEN (ed.): *Archaeological Formation Processes. The representativity of archaeological remains from Danish Prehistory.* Nationalmuseet, Copenhagen, 1985. 280 pp.

This book sets out to examine in very considerable detail the post-depositional factors that have affected the archaeological record of Denmark. It does not discuss the actual formation processes of that record, the ancient deposition of material culture, and in this the title of the book is perhaps a little misleading; the sub-title is accurate. The idea behind the book is laudable – it is high time that at least some of the bias in the archaeological record that we work with is examined in depth. There are so many factors that operate in the formation of the record and in its gradual or sudden decay, that every effort should be made to comprehend some of the actions and processes. Of course, it is not enough to state baldly that all our distributions of ancient activities are incomplete, we have known that for over 200 years ever since the first antiquarians began to comment on something more than mere pots and bronzes. So some of the comments in this book are blindingly obvious – we have what we have found, we do not have what we have not found.

Archaeology in recent years has gone into, and perhaps through too fast, the source critical analysis approach, probably because such analysis reacts against two concepts. The first was antiquarian archaeology, the random opportunistic collection of data and the acceptance that they all must mean something, and we could ignore the gaps, inconvenient although they were at times. The second was processual archaeology, where again data were collected, but selectively, and were manipulated by applying rules of behaviour into yielding a picture without gaps. This is perhaps too abrupt a dismissal of both approaches, but the book's contents apply so firmly to both that perhaps an assertion here will in fact make the point. Each of these camps works by its own rules, of what it can do, and it cannot therefore admit that its data base is fundamentally flawed; incomplete it can be, partial even, but basically unreliable and primarily unusable, never. To accept this last would be to render illogical and unintelligible any conclusions or theses advanced by either camp. The obvious example for each is the distribution maps so beloved by archaeologists of whatever persuasion, or generation. How many times have we seen maps, not only devoid of landscape constraints or encouragements, but blithely, blandly and blatently interpreted as if gaps never existed, if indeed gaps there were. That is the problem for maps, if gaps there were.

Source critical analysis is in essence a destructive game. The players arrive, enthusiastic and optimistic. After the game, which they always lose, they are dispirited and deeply pessimistic. They can be no other if they are true believers in the reality of the archaeological record. It is my belief that many archaeologists have taken one look, played one game, and have abandoned their high-flung optimism about rewriting human prehistory, and retreated into the antiquarian pursuit of basic raw data, manipulating these only so far as they can see them; when tempted to pursue the data into the unknown, they fear to step into the dark court. This book may help them to take that step.

Of the contents of the book I will say little except that it is a standard layout, with historical introductions, then discussions of agrarian developments, and examinations of the archaeological data by period or monument type. It might have been instructive to conduct this examination by region, over time, by antiquarian presences or absences, by the social conditions, rather than by artificial archaeological types. Most chapters are illustrated by various diagrams arranged by decades, showing not what happened to the monuments or artifacts in question, but what was going on around and sometimes on them. So if, for example, an artifact type was consistently found through the first half of the 19th century, and not thereafter, there must be some reason why this is so. It could be any combination of several reasons, of course, from removal of the deposits in which the artifacts lay, to changes in the way the deposits were worked, to loss of antiquarian interest, and so on. All of this is quite straight-forward and we have known most of it, conceptually, for a long time. We have not, however, known much of it in detail, in the particular, which is why the book is a catalogue and an encyclopedia, to be consulted at the moment of research into any of the special periods or any of the artifact types.

So far so good, but can we take the process further? We probably can, and if we cannot, a policy of despair will have triumphed over the innocent yearnings of most archaeologists, to understand the past. It is not the aim of the book to advance new theories about how such an approach might develop, but the seeds are planted throughout the book. Individually, each area of archaeological enquiry should be able to devise a set of rules and possibilities, to be applied before a single word is written on the culture-history, or the processes at work, of any particular episode of the past. Predictive archaeology is the name of the game, and one loosely constrained by general concepts, but tightly controlled at places within these concepts by the particular characteristics of the evidence. Just as the individual chapters of the book reflect not only the archaeological evidence, and the cultural milieu in which it was found, but also the preoccupations of the particular author, so too will the assessment of the evidence be influenced by future authors as individuals and as a part of a society going through its own episodic and ill-controlled evolution. The reflection of this is seen throughout the book, in the TRB, in the Bronze Age burial, and in other chapters. Social, political, economic and religious factors were all at work here, unevenly and unequally through Denmark, and it might well have proved instructive, if not constructive, to have asked some authors to develop models of uncertainty levels for their data that were more specific than those presented here. The result would of course be a reverse model of reliability.

This book should not be dismissed because it uses a sledgehammer to crack an old nut. The nut was big enough to deserve it. The book poses old questions once again, but now examines them in depth. If post-depositional factors can be identified in such a way as to make it possible to quantify and define the archaeological record, new opportunities for interpretation will be created. If as a result of this work, archaeologists still feel in their bones that quantification and qualification are not possible no matter how one analyses the factors, then it is back to

opportunistic antiquarianism. Some of course will never admit it, and will go on as blind optimists – a dangerous combination of the two approaches, antiquarian processualism.

J. M. Coles

PETER UCKO: *Academic Freedom and Apartheid. The story of the World Archaeological Congress.* Duckworth 1987. 305 pp. 16 plates. Price in UK: £ 9.95.

This book presents the history of the Southampton World Archaeological Congress in 1986 as seen through the glasses of Peter Ucko. Thus it is a highly biased personal experience, as the author clearly states in the preface, but also a highly interesting and important book, well written too. It gives a fascinating inside view of how unprepared archaeology was to the political realitites of the present. As a testimony of that it provides an important snapshot of some of the major transformations archaeology is undergoing in the 1980's.

The background to that is the explosive global expansion of archaeology, especially within conservation archaeology. The economic motor of archaeology today throughout the world is national legislative and political frameworks for rescue and conservation. Consequently most archaeology today is taking place in political/administrative – that is non-academic – environments. That goes hand in hand with a renewed significance of archaeology as creator of cultural and historical identity for many new nations around the world, and for ethnic groups and indigenous peoples. This latter development, which has taken place within the last 20 years, has many parallels to the expansion and consolidation of archaeology in Europe in the late 19. and early 20th century.

Since however the existing world archaeological organisation, IUPPS, is governed mainly by european archaeologists with little or no insight into these processes, the organisation has been unable to adapt to the changes and new developments. Thus Southampton revealed the clash of contradictions within the world archaeological community – between Europe/North America and Africa/the Third World, between old and new archaeological traditions and between old and new realities of archaeological practice. (As a consequence of that a new archaeological world organisation has now been established, along the old one). Although academic freedom was the issue, a lot more was hidden behind the controversy. Thus when the increasing international pressure against South Africa finally in 1985 reached and interferred with the Southampton conference, it acted rather as a catalyst to set in motion these wider contradictions. This is not to deny the significence of the problem of academic freedom, but the way the various actors handled the problem suggests that there was more to it than ethics and principles.

The problem of archaeological and political practice has undoubtedly come to stay, and we now have to learn to handle it in a conscious and responsible way. It can be regretted that so much personal antagonism had to accomplish the controvery, and the book testifies that all sides are to be blamed for overreacting, rather seeking to establish positions than to compromise. But then, it can be hoped that it sharpened the consciousness among archaeologists about the realities of principles, practice and politics, none of which can stand alone.

Southampton may thus be said to represent the real loss of innocence – the loss of political innocence. Peter Ucko's book has captured some of the drama that this created, which makes it an interesting historical document, and as such also a subject for historical source criticism.

Kristian Kristiansen

*Fennoscandia Archaeologica,* published by the Archaeological Society of Finland. Editor J.-P. TAAVITSAINEN.

In 1982 a new archaeological periodical, *Fennoscandia Antiqua,* was initiated in Finland. Its first and only volume contained five articles dealing with finds from a Stone Age site in Lapland, Stone Age economy in Finland, a Comb Ware pot ornamented with a human figure, a copper ring obviously found on a Stone Age site, as well as a report on excavations on a hill fort.

In 1984 the Archaeological Society of Finland took over the publication of the periodical, which was renamed *Fennoscandia Archaeologica.* Before looking more closely at the contents it may be appropriate to give some bare facts about this new publication.

So far four volumes have appeared containing 32 articles: 21 articles are in English, eight in German, two in Swedish and one in Finnish, but all of them are furnished with an English abstract. Thus it is the hope of the editors that this series will serve to establish contacts also with scholars abroad. Most of the articles deal with archaeology, but also such topics as geology, palaeobotany, protection, linguistics, numismatics, ethnology/anthropology and arctic seafaring are represented. The bulk of these contributions discusses subjects dealing with Finland, but there are also several papers by Russian scholars about Russian archaeology.

In *Fennoscandia Archaeologica,* volume one 1984, there are articles on Comb Ware pottery with bird motifs in Finland, on some Finnish Bronze Age finds, as well as a survey of swords and daggers from the Finnish Bronze Age, including neutron activation analyses. Five new finds of skis from Finland are published with $^{14}C$ datings showing that they belong to the late Iron Age. Two contributions deal with palaeobotany, i.e., pollen-analytical records of cereals in Finland and their dating as well as examination of grain from an Iron Age site.

Palaeobotany is also the subject of two papers in volume two (1985). Palaeobotany is a highly developed discipline in Finland, and the Finnish capacity within pollen analyses and the study of prehistoric grain seems imposing, at least viewed from a Danish angle.

The volume in question also contains an article on the history of protection in Finland, as well as an excavation report of a late Iron Age site. The late Iron Age in Karelia is also discussed in a survey of the present state of research. Finally a 12th century coin hoard is reconsidered; the hoard containing

imports from both Karelia, Russia and Scandinavia was found already in the first half of the 19th century.

In volume three (1986) there are articles on clay figurines from Åland, an early Iron Age cairn and a Medieval stone church. There is also an interesting article on the technique used in carving rune inscriptions, from a geologist's point of view. But attention should also be drawn to several articles dealing with "eastern connections", as well as to some contributions by Russian scholars. At least eastern connections is still a sadly neglected field of research within European Prehistory. Here, however, Pyheensilta pottery is seen from a Russian point of view, and the eastern contacts of northern Fennoscandia in the Bronze Age is discussed. A paper treats prehistoric lacustrine pile dwellings in north western Russia whereas another contribution discusses environment and settlement in the same area during the Holocene. The problem of the discovery of Spitsbergen, who did it and when (?), is seen from a Russian angle and it remains to be seen how Scandinavian scholars will react towards the proposals put forward here.

Volume four of *Fennoscandia Archaeologica* (1987) is the last volume which has so far appeared. Again, there are several interesting contributions by Russian scholars, including an article dealing with the new excavations of the Ryurik Gorodishche near Novgorod. This was an important trading center during the 9th-loth centuries A.D.

Among the articles there is one deserving mention of its own. It is a discussion on human expansion into northern Europe, including Finland, after the Ice Age, dealing with archaeological, anthropological, genetical and linguistic evidence. Especially the question of the origin of the Finnish language is interesting. Such an approach may look old fashioned or even far fetched within modern archaeology. Yet, thinking of Colin Renfrew in his new book, *Archaeology and Language: the Puzzle of Indo-European Origins* (1987), it seems that there is now again an interest in combining archaeology and linguistics, and the article in question should be welcomed, since it is certainly also worth considering why such areas as Finland and Esthonia did not become Indo-European.

Finally it is worth drawing attention to an article dealing with A. M. Tallgren in *Fennoscandia Archaeologica* volume two (1985). This distinguished Finnish archaeologist was the editor and contributor to the periodical *Eurasia Septentrionalis Antiqua* which appeared between the two world wars. He did more than any other archaeologist to inform scholars all over Europe about the prehistory of eastern Europe, and thus his life-work may serve as an example to the present periodical. Considering Finland's geographical position this would only be natural. Yet, Finland is not only situated between east and west, but also between the Continent and the Arctic region and there are thus many other archaeological phenomena which might be considered in this new periodical.

Svend Nielsen

*Documents d'archéologie française* (*DAF*), Nos. 1–6. Editions de la Maison des Sciences de l'Homme. Paris 1985–.

We would like to call attention to this new series, which in every respect meets the standard that can be expected of the best modern archaeological reports. Its aim is to present monographs, theses, and conference reports on themes relating to French archaeology. Also more general topics like archaeological prospecting (as in vol. 3) enter the scope of the series. Quick publication at moderate costs is intended, all of the volumes being paperbound and in quarto. Five regional committees choose the works for publication, backed by the ministries of culture, education, and technical science, as well as the French central research agency, the CNRS. From the series we quote the following titles:

No. 1. Jean Gascó: *Les installations du quotidien.* – Domestic structures of two rock-shelters in Languedoc ranging from the Mesolithic to the Bronze Age.

No. 2. Jaques Lasfargues (ed.): *Architectures de terre et de bois.* – Private estates of the western Roman sphere.

No. 3. Alain Ferdière & Elisabeth Zadora-Rio (eds.): *La prospection archéologique.* – Papers presented at a conference on landscape archaeology in Paris in 1982.

No. 4. Patrice Brun: *La civilisation des Champs d'Urnes.* – A critical study of the Urnfield Culture in the Paris Basin.

No. 5. Jean-Luc Fiches: *Les maisons gallo-romaines d'Ambrussum.* – The excavation and analyses of a Gallo-Roman residence inside the oppidum of Ambrussum.

No. 6. Colette Bémont & Jean-Paul Jacob (eds.): *La terre sigillée gallo-romaine.* – A remarkable systematic presentation, by more than forty archaeologists, of the terra sigillata industries in France (with notes on Swiss and German sites).

At least three of these volumes are concerned with problems of general interest to the European archaeological forum. A more consistent use of summaries in English (only supplied in vol. 3) would make the series even more useful. However, it is to be welcomed as a handy and up-to-date source of information that is very close to the focus of present French archaeology.

P. O. Nielsen

# *Recent Excavations and Discoveries*

The following survey is based on summary reports of archaeological activities in 1987 submitted by the Danish museums to the State Antiquary. A review of all field investigations and major finds, including Treasure Trove and 469 notes on excavations is published in Danish in *Arkæologiske Udgravninger i Danmark* 1987 (Det arkæologiske Nævn, Copenhagen 1988).

Please observe the following abbreviations:
s. sogn, Danish parish
a. amt, Danish county
The places mentioned in this list are shown on the map on p. 256, where they can be identified by their number.

## PALAEOLITHIC

1. HASSELØ, Falster, Væggerløse s., Maribo a.
**Settlement site.** On the west side of the former island, Hasselø, there was investigated a concentration of late Palaeolithic flint, lying close to the straight of Guldborg Sound. Twenty $m^2$ were investigated, finds being collected from both the plough layer and from primary position. The flint inventory consisted of many blades, bi-polar unifacial cores with facetted platforms, burins, a blade scraper, and a point which was probably of Federmesser type. – *Museet Falsters Minder,* Nykøbing, 057/1987. [Peter Vemming Hansen].

2. RAMSGÅRD I–II, northern Jutland. Bjergby s., Hjørring a.
**Settlement sites.** During reconaissance there were found 7 flint scatters from the Bromme culture. The scatters measured about 20 × 20 m and occurred on sandy peninsulas and slopes along the S and W sides of a large meadow area, that in prehistoric times was a lake. As the area is under intensive cultivation exploratory excavations were carried out in the autumn of 1987 at two of the most vulnerable sites, Ramsgård I and II. No structural features or original strata from the Bromme culture were found. The flint inventory, obtained partly through reconaissance and partly by sieving the cultivation layer, attaches clearly to the Bromme culture, tending to an early placing within it. – *Vendsyssels historiske Museum,* Hjørring, 285–186/1986. [Torben Nilsson].

## MESOLITHIC

3. SPANGKONGE, western Zealand. Stenmagle s., Sorø a.
**Settlement site.** Excavation of a small, clearly delimited settlement in Store Åmosen bog. Part of a refuse layer was preserved with a large faunal material. It is a single-period site with much pottery, which is typical of the late Ertebølle period with S-profiled vessels and blubber lamps, while the flint shows a number of typological traits characteristic of the early Funnel Beaker Culture. – *Museet for Holbæk og Omegn* 146/87. [Anders Fischer/Else Asmussen].

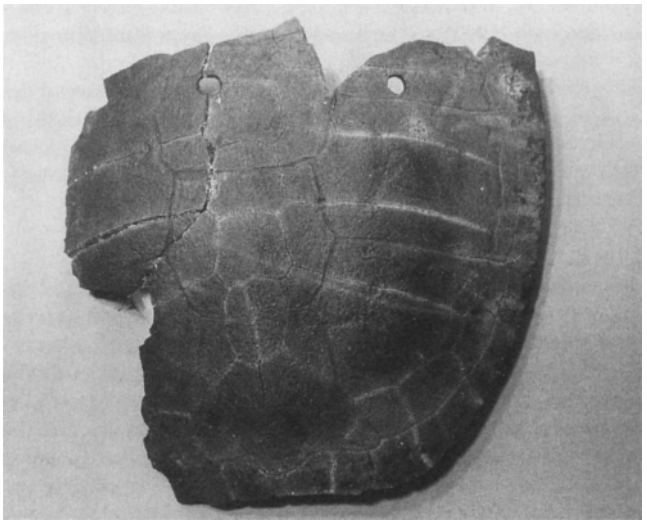


Fig. 1. Perforated shield of marsh turtle found at the late Mesolithic site of Agernæs, Funen (no. 4). 1:2.

4. AGERNÆS, north Funen. Krogsbølle s., Odense a.
**Settlement site.** In autumn 1984 in connection with draining in the fossil part of the fjord "Nærå Strand" there was found worked antler, pottery, and bones, and trial exavations in 1985 and 86 established that the material came from a late Ertebølle settlement. The site has no shell midden, but there is a rich refuse layer. In 1987 about 80 $m^2$ were excavated and the total area investigated now amounts to c. 200 $m^2$.

Thick deposits of lake mud give good conditions for the preservation of organic material. There is much wood, a considerable part of it worked. Mention may be made of parts of a dugout canoe, half a paddle, a complete bow, and many leister prongs. There was also an extensive wood-bearing layer with 25–30 cm long chippings interpreted as remains from making dugouts. Of antler there were a number of axes, fabricators, picks, and harpoons. The large faunal material included the shield of a marsh turtle with four holes in it (fig. 1), a complete eagle claw cut off close under the knee joint. The flint inventory includes both flake and core axes, the latter often with specially worked edge, a few transverse arrowheads, and only a few burins. There are also many sherds of pointed-base vessels and lamps. The excavation will continue in 1988. – *Fyns Stiftsmuseum,* Odense, and *Nordfyns Museum,* Bogense, 5563. [Anders Jæger].

5. BJØRNSHOLM, northern Jutland. Ranum s., Ålborg a.
**Settlement site** (kitchen midden). The systematic excavation of the midden was continued from 1986 and is expected to be finished in 1988. The aim is to obtain a representative sample of finds from top to bottom at three different places and to investigate the sandy deposits underneath. The midden lies on a 1–3 m thick layer of marine sand containing flint artifacts, oyster shells, and scattered bones. These must derive from a settlement earlier than the midden, i.e. younger Kongemose or early Ertebølle. Especial attention was given to the stury of the uppermost clam-rich layer with artifacts of Early Neolithic Funnel-Beaker type. – *Forhistorisk Museum,* Moesgård, 2911 and *Aalborg historiske Museum* 972. [Søren H. Andersen/Erik Johansen].

6. ÅLE, northern Jutland. Ranum s., Ålborg a.
**Settlement site** (kitchen midden). A large as yet unfinished excavation was carried out in one of the recently discovered large kitchen middens in the stone age "Bjørnholm fjord". Excavation will continue in 1988. The extent of the midden in the ploughed surface has been planned and a number of test pits have been dug to establish its depth and condition, but the main emphasis in 1987 was on three 4 × 4 meter squares around a large stone fireplace lying centrally in structural traces interpreted as remains of a hut. Around the fireplace was examined a pronounced activity layer. The finds include much flint, some mammal bones (but no fish bones), and extensive material for scientific study and C-14 dating. The investigated parts of the Åle midden can be dated to the early Ertebølle culture. – *Forhistorisk Museum,* Moesgård, 3521 and *Aalborg historiske Museum* 2304. [Søren H. Andersen/Erik Johansen].

7. FANNERUP, eastern Jutland. Ginnerup s., Randers a.
**Settlement site** (kitchen midden) and **graves.** During earth moving operations an ochre-bestrewn skeleton was found buried 0.4 m in the subsoil. It was well preserved and sealed by a layer of shells, and lay supine orientated NE-SW. The skeleton was that of a 20–40 year old male, buried with a decorated antler axe at the head and a blade knife and a small blade at the right hip. A little further south were recorded the remains of Fannerup shell midden F, of which a portion measuring ca. 2 × 9 m and 0.4 m deep survived. The flint inventory showed that it was approximately contemporary with the grave. Further earth moving has revealed what seems to be another grave, and this will be investigated in 1988. – *Djursland Museum,* Grenå, 2233. [N. A. Boas].

8. NORSMINDE, eastern Jutland. Malling s., Århus a.
**Settlement site** and **grave.** Systematic excacation of the midden continued from 1986 and involved a 3 × 6 m square in its the western part. A partially disturbed inhumation grave was encountered. The skeleton, which lay NE-SW with head to the SW, lay in a layer of gray greasy ash under the shells and immediately above the natural ground. Around it were 11 large stones. There were remains of neither coffin, grave goods, nor ochre. As a consequence of secondary disturbance only some of the bones were in articulation – chiefly those of the upper part of the body – while the remainder lay scattered in the grave fill. The stratigraphical conditions show that the grave is certainly Stone Age and probably late Mesolithic. – *Forhistorisk Museum,* Moesgård, 1734. [Søren H. Andersen].

9. MØLLEGABET, off Ærøskøbing, Svendborg a.
**Submarine settlement.** The earliest submarine settlement to date in the south Funen archipelago. During diving near the well known submarine Ertebølle settlement in the passage, Møllegabet, freshly exposed artifacts belonging to an Early Ertebølle or Kongemose settlement were found at a depth of 5–6 m. The finds were assymetric core axes of rhombic section, burins, knives, scrapers, flakes and cores, two early antler axes, various worked antler pieces, bones of wild boar, red and roe deer, nut-shells, acorns, and 4 human bones. Two of these probably came from the same individual and may represent the remains from an eroded grave. The investigation will continue in 1988. – *Langelands Museum,* Rudkøbing, 12123. [J. Skaarup].

10. MEJLØ NORD/KORSHAVN off the coast of Funen. Stubberup s., Odense a.
**Submarine settlement** and **dugout canoe.** During marine reconaissance between Mejlø Klint and Korshavn a dugout canoe of limewood 4.2 m long and 0.5 m wide was found. C-14 dating (K-5040) showed that it was Denmark's oldest craft with a calibrated age of ca. 5250–5180 B.C. The area contains many freshly eroded-out artifacts, including about 20 core axes and some blade implements found by sports divers. These suggest a placing in the late Kongemose or early Ertebølle culture. The boat will be taken up in 1988. – *Langelands Museum* and *National Museum, Department of Marine Archaeology* 209. [Flemming Rieck].

## NEOLITHIC

11. ONSVED MARK II, north Zealand. Skuldelev s., Frederiksborg a.
**Non-megalithic burial structure.** Ca. 100 m west of a dolmen investigated in 1986 appeared an Early Neolithic structure consisting of a E-W orientated grave with somewhat east of it a N-S orientated trench in which substantial posts had stood. The grave survived as a paving, pointed oval in shape and measuring about 1 × 2 m, laid of flat stones resting on the subsoil surface. In the western part of the grave were at least 11 amber beads and in the middle were two beads and two retouched blades. The trench to the east was 3.7 m long and filled with stones, through which penetrated four deep postholes. Among the upper stones were the remains of a type B funnel beaker and the body of a large beaker or bowl. There were no traces of a barrow, though this could have been removed in antiquity. Across the structure were postholes from a late pre-Roman Iron Age occupation. – *National Museum, Prehistoric Department* 6561/87. – Lit.: *Aarbøger for nordisk Oldkyndighed* 1987, 58–83. [Fl. Kaul].

12. ST. VALBYVEJ, north Zealand. Himmelev s., Københavns a.

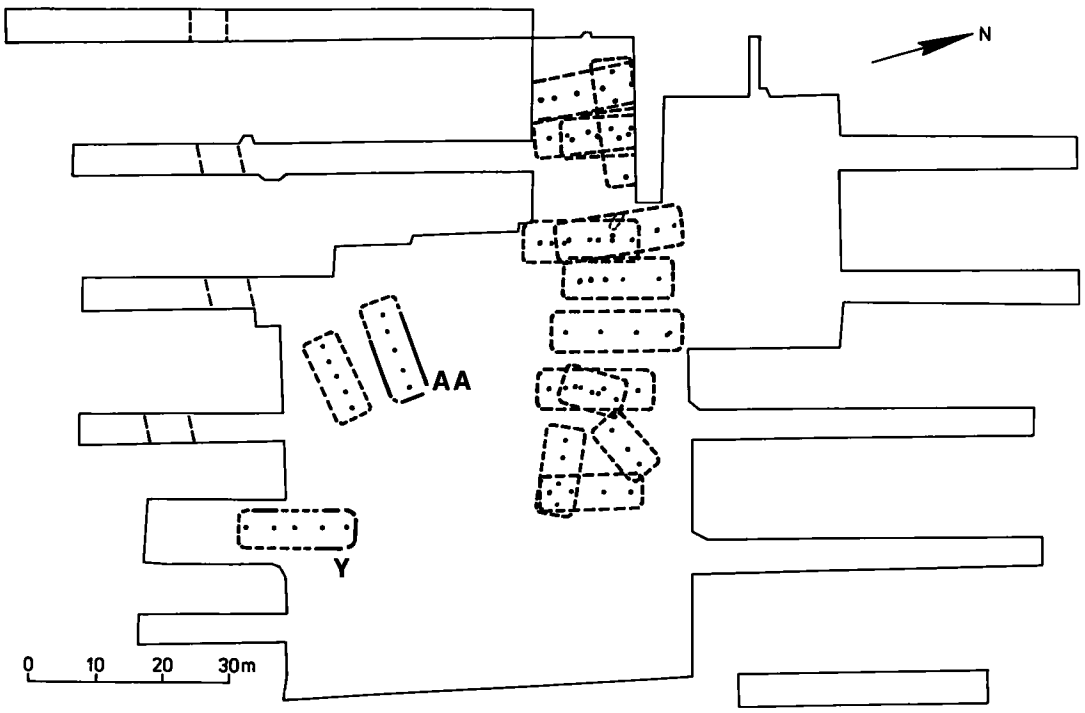



Fig. 2. Plan of the Middle Neolithic settlement at Limensgård, Bornholm (no. 15), showing the reconstructed outlines of 16 houses with one row of central posts.

**Grave mounds** and **stone cists.** As a consequence of large-scale gravel exploitation there was excavated a double-barrow with two stone cists, one of which was intact and the other partially disturbed.

In barrow I were recorded three phases consisting of round "stone carpets"; around these were kerbstones and traces of a fence. At the centre was a stone cist of "Zealand type", inserted into the natural subsoil and sealed by a layer of clay. It contained at least three individuals, including a child. At the west end was placed a small beaker with constricted foot. In the throwout was found a type I flint dagger and bones derived from at least two individuals.

Barrow II was "hooked" on to barrow I and consisted of four constructional phases, likewise consisting of "stone carpets". The cist in this barrow was also inserted into the subsoil, but owing to disturbance only two capstones remained in place. It contained at least two individuals, of whoch the last buried was a woman 1.60 m tall and ca. 30 years old. There were no artifacts in the cist, but in the throwout were found fragments of an egg-shaped storage vessel with three cordons under the rim. There was also a fragment of a thin-bladed axe with curved blade.

The finds indicate that the features were constructed in the Late Neolithic A period.

South of the barrow was found an urn burial from period III of the pre-Roman Iron Age, containing two fibulae; there was also kerb stones probably from a ploughed-out Bronze Age barrow that originally covered the two above-mentioned ones; an urn from period V of the Bronze Age was also found close to the barrows. – *Roskilde Museum* 659/86. [Palle S. Schiellerup].

13. SKRÆPPEKÆRGÅRD, north Zealand. Sæby s., Københavns a.

**Settlement** and **house site.** On a low plateau was found an occupation layer with remains of an E-W orientated house. The house had slightly convex sides with 8 wall postholes surviving on the southern and 3–4 on the northern side. There was a single row of roof-bearing posts down the middle. The house had been ca. 13 m long and ca. 4.5 m wide. The western part was covered with an occupation layer that fanned out to the south. It seemed to come to an end inside the house at a place where there was a transverse feature consisting of 3–4 postholes, perhaps an internal partition. Pottery in the occupation layer and some of the postholes gives a dating to non-megalithic C (Svaleklint group). There were also flint artifacts and much burned daub, sometimes with wattle impressions.

Close north appeared a smaller number of postholes probably indicating another house with the same orientation. Ca. 25 m west of the first house was a new area with occupation layer and postholes, but it was not possible to disentangle a building from them. It seems that each settlement event in the field is represented by small areas of occupation layer mea-

ring about 20 meters square and postholes, between which there are quite sterile areas. – *National Museum, Prehist. Dept.* 6418/86. [Fl. Kaul].

14. KLEKKENDEHØJ, Møn. Damsholte s., Præstø a.
**Passage-grave.** Owing to danger of collapse the southern chamber has long been closed to the public. In connection with the restauration of this monument a 2 m wide trench was dug through the barrow and over the chamber, making possible various observations about the construction of the monument. Around the chamber was a massive clay packing and a packing of shattered flint, enclosed by a packing of stones. The last packing was built up stepwise and held in place by boulders laid as concentric circles inside the barrow. The lowest step is visible on the surface as a platform and this is widest at the entrance to the chambers. Pollen samples were taken from soil deposits in the barrow and have given a detailed impression of the local flora when the barrow was built (see Sv. Th. Andersen, this volume). The work was carried out by the Forestry and Nature Agency, the Geological Survey of Denmark, and the National Museum in co-operation. – *National Museum, Prehist. Dept.* 6579/87. [Fl. Kaul].

15. LIMENSGÅRD, Bornholm. Åker s., Bornholms a.
**Settlement site.** In continuation of excavations in 1984 and 1985 an area of ca. 1600 $m^2$ was excavated in the central part of the site. There were found remains of houses from the late Funnel-Beaker culture (fig. 2), the Late Neolithic, and the Early Iron Age. There were found 9 new houses from the late Funnel Beaker culture, of the type with big central posts. The excavation of three Late Neolithic longhouses was completed, showing that they were respectively 27 m, 25 m, and 23 m long, and three new Late Neolithic houses were dug. The excavation of three Iron Age houses was finished and four new ones were found, and also the remains of a post fence. A small number of inhumation burials were encountered, including one from the Late Neolithic with upside-down pot. 450 meters of trial trenches were dug north and south of the main excavation, establishing the extent of settlement. They revealed Early Neolithic, late Funnel Beaker, Late Neolithic, and Early Iron Age features, and the trial excavation was carried out of an Early Iron Age occupation layer. See *JDA* vol. 4, p. 101–114. – *Bornholms Museum, Rønne,* and *National Museum, Prehist. Depart.* 5166/83. [F. O. Nielsen/P. O. Nielsen].

16. STORE MYREGÅRD, Bornholm. Nylars s., Bornholms a.
**Settlement site.** NW and W of the passage grave, Lille Myregård near Arnager, were found remains of two settlements from period I of the Middle Neolithic. 529 $m^2$ of a very rich occupation layer were excavated at the more northerly of them. The finds include the following: of local pebble flint, small knives and scrapers; of imported flint, fragments of thin-butted axes, blades, blade knives, and blade and flake implements; of stone, hammerstones and crushers, polishers, querns, and thin-butted axes. The extensive pottery included sherds of large and small funnel beakers, bowls, pedestal bowls, spoons, and clay discs. Bone was only present if burnt, and the amount of organic material was slight because of the sandy soil. – *Bornholms Museum,* Rønne, and *National Museum, Prehist. Dept.* 5839/84. [F. O. Nielsen/P. O. Nielsen].

17. HULSØ, Falster. Falkerslev s., Maribo a.
**Settlement site.** On a prominent plateau near the lakes Hulsø and Møllesø in central Falster were investigated part of a large Middle Neolithic settlement. In the ca. 20 × 20 m excavation there was a marked concentration of pits, which were unusually rich in finds. There was much "settlement ware", but also fine decorated wares were well represented. There was also much struck flint, and some of the pits contained a varied and well-preserved faunal material. Provisional dating MN II/IV. – *Museet Falsters Minder,* Nykøbing, 731/1986. [Peter Vemming Hansen].

18. SVENDEKILDEGÅRD, Lolland. Musse s., Maribo a.
**Passage-grave.** Ploughed-over remains of a passage-grave with small oval chamber. The type is characteristic of eastern Lolland. The internal dimensions of the chamber were 6 × 3 m (WNW-ESE). The outline was indicated by stone-holes and by yellow clayey fill overlying a packing of broken flint. From the south side of the chamber near the eastern end issued a 5 m long and 0.75 m wide passage indicated by 8 stoneholes on the west and 3 on the east. In the chamber were found concentrations of human bone and the following objects: – from the Middle Neolithic MN II–IV pottery, from the Single Grave Culture two late battle-axes (found during the initial investigation), and from the Late Neolithic two flint daggers, one of early type, and a flat-flaked arrowhead. Also amber beads and transverse arrowheads were found. – *Lolland-Falsters Stiftsmuseum,* Maribo, 800-1984-18. [Jens Nyberg/Karen Løkkegaard Poulsen).

19. HYGIND, western Funen. Husby s., Odense a.
**Causewayed enclosure.** A trench measuring 23 × 2 m was cut through two of the ditch segments. Matters were complicated by the fact that into these had been dug pits from later phases of the Funnel Beaker Culture. There were abundant finds, amounting to 4476 items, of which 2075 were well-preserved animal bones. These had in some places been deliberately sorted, for instance ribs had been laid in one place and skulls in another. The skulls include a number from cattle, a wild ox, sheep/goat, and two human fragments (one with distinct cutmarks). Also bone implements (including new types) and a bear canine. The site is notable for the good conditions for the preservation of organic materials. – *Fyns Stiftsmuseum,* Odense, and *Forhistorisk Museum,* Moesgård 3246. [Niels H. Andersen].

20. HELLIGSØ, north Jutland. Helligsø s., Thisted a.
**Passage-grave.** Remains of a passage grave with accessory chamber. The main chamber was orientated N-S with exit from the E and measured 7 × 2.5 m. In its southern part was found an intact flooring consisting of flat, fist to saucer sized pieces of chalk. The accessory chamber measured 2.5 × 2 m and was also floored with flat pieces of chalk. The entranceway consisted of two pairs of stones, and the course of the passage could be followed for about 2.5 m. The entire structure was symmetrical around an axis passing through passage, main

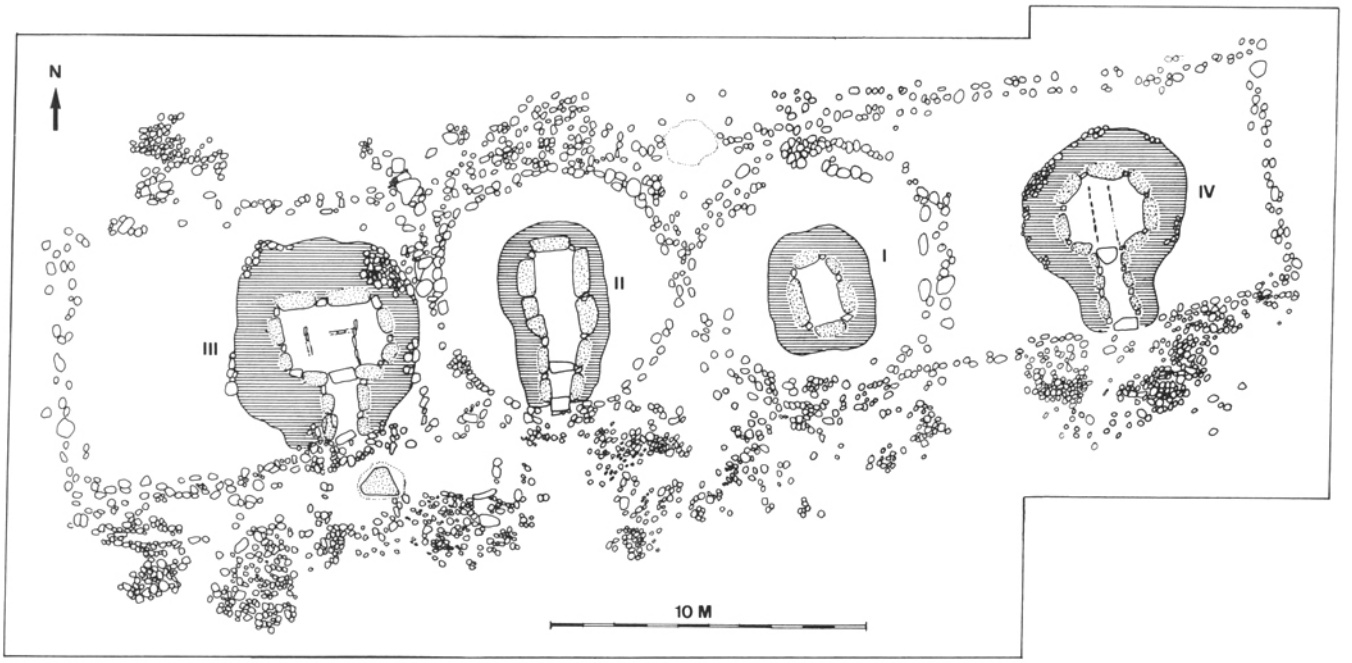



Fig. 3. Excavation plan of the long barrow at Lønthøje, south Jutland (no. 24), with the remains of four megalithic graves.

chamber and subsidiary chamber. All the finds were from the floor and a 2.5 cm thich layer resting on it: 7 polished thick-butted flint axes and 5 stone axes, of which 3 were Middle Neolithic battle-axes. There were also found about 30 blades, 40 club and double-axe shaped amber beads, and some pot-sherds, including a few from a hanging vessel. There were also skeletal remains. Around the barrow were found a number of graves from period III of the pre-Roman Iron Age and the later Roman Iron Age. In a nearby area were found settlement traces which are probably from the Late Bronze Age. – *Museet for Thy og Vester Hanherred,* Thisted, 2350. [Jytte Nielsen/Jens-Henrik Bech].

21. ØSTER TØRSLEV, eastern Jutland. Ø Tørslev s., Randers a.
**Stone-packing graves.** Below a Bronze Age barrow were found 12 stone-packing graves and 5 "mortuary houses", arranged in two overlapping N-S rows. The finds to date are 2 thin-bladed and 1 thick-butted flint axes, which date the features to MN IV–V. Also some remains of teeth were found, of which one was determined as ox. The excavation will continue in 1988. – *Kulturhistorisk Museum,* Randers, 260/87. [Ragna Stidsing/Niels Sterum].

22. LOKES HEDE, north Jutland. Nørre. Onsild s., Randers a.
**Causewayed enclosure.** Part of the site was excavated in connection with construction of the Jutland motorway. It lies on a sandy peninsula bounded on three sides by low wet areas. To the west lie 16 protected barrows, including a long barrow. About 20,000 $m^2$ were excavated, and the Neolithic enclosure is estimated from surface finds to occupy between 25 and 40 Danish acres. Six ditch segments following an arc were excavated. Inside the ditch alignment a number of pits with much pottery were excavated. Some of them contained burned daub and are interpreted as a kind of oven. The pottery dates the feature to the early Middle Neolithic Funnel Beaker Culture. – *Aalborg historiske Museum* 2145. [Peter Birkedahl].

23. ELBÆK, eastern Jutland. Gårslev s., Vejle a.
**Grave mound.** A ploughed over barrow was totally excavated to make way for a building. On a slight natural hill was found a roughly rectangular mortuary structure measuring 260 × 210 cm. The wall timbers had stood in a footing trench about 60 cm deep, and at each corner there had been a now carbonised plank 50 cm wide and 10 cm thick, which survived to a hight of about 70 cm. From one of the walls also survived some thin, 30 cm wide carbonised boards, and traces of further boards were found. In the middle was a grave measuring 20 × 100 cm, containing the following grave goods: – a large battle-axe, a large polished flint axe, a smaller flint axe, and two pots. Inside the mortuary house beside this grave was another, containing a smaller battle-axe and a single pot. Both graves are from the ground-grave period of the Single Grave Culture. Above this structure was a younger grave measuring 400 × 100 cm with a row of stones along each side. The grave goods consisted of a pot at each end, three triangular arrowheads, and an upper-grave battle-axe. Just outside the partially surviving kerb was found a smaller footing-trench structure measuring 130 × 100 cm. *Vejle kulturhistoriske Museum* 1329. [Lone Hvass].

24. LØNTHØJE, south Jutland. Sønder-Starup s., Haderslev a.
**Megalithic long barrow.** Ploughed-over long mound 40 m long and 8 m wide covering remains of four megalithic structures (fig. 3). Earliest was structure I, a round dolmen with a closed 1,9 m long rectangular chamber. Close outside its kerbstones were found sherds of 9 pots from MN Ia. Structure II was a round dolmen contiguous to structure I, containing a 3,5 m long chamber with passage. In the chamber were found human bones, amber beads, Store Valby pottery, a thick-butted flint axe, and three flint chisels. Outside the passage entrance were found large quantities of pottery. Structure III was a passage grave built close beside structure II and enclosed by a rectangular extension of the barrow. The chamber was rectangular and measured 3 × 2 m and was subdivided into at least four sections. Some sherds from MN Ib and Store Valby pottery were found, as well as blades, etc. Outside the barrow was found much pottery and material thrown out of the chamber. Structure IV was a rectangular enlargement of the barrow contiguous to structure I. The chamber was polygonal, measuring 2.3 × 2.1 m, and had a passage. It contained human bones, a few potsherds etc., a flint halberd, and a double-bladed battle axe. Outside the entrance to the passage lay many sherds of ritually placed vessels and material thrown out of the chamber. The old soil under structures I and II contained sherds assignable to the Fuchsberg phase. – Lit.: *Nationalmuseets Arbejdsmark* 1988, pp. 195–208. – *National Museum, Prehist. Dept.* 6574/87. [Erik Jørgensen].

## BRONZE AGE

25. GANLØSE MOSEVEJ, north Zealand. Ganløse s., Frederiksborg a.
**Settlement.** In continuation of earlier investigations a 6,000 $m^2$ area was trenched. There were found further remains of an Early Iron Age settlement parts of which were excavated in 1986, and of a later Bronze Age settlement found in 1984 when a natural gas pipeline was laid. In 1987 a further pair of Early Iron Age farmhouses were excavated and also some pits from period IV of the Bronze Age. One of these produced a large amount of pottery, animal bones, antler, bone implements, moulds, crucibles, and two antler axes, one of them with circle ornament. – *Gilleleje Museum* 3192. [Steffen Stummann Hansen].

26. BRUNSVANG, Lolland. Vesterborg s., Maribo a.
**Bronze neckring** with twisted hoop and pointed-oval terminal plates with spiral extensions (Baudou's type XVI C 3) (fig. 4). This is the largest example of this type hitherto found in Denmark. Received as treasure trove from Lolland-Falsters Stiftsmuseum, Maribo. – *National Museum, Prehist. Dept.* 6637/87.

27. LERBJERG, Funen. Håstrup s., Svendborg a.
**Burial mound.** Completion of the excavation of a large barrow, diameter 38 m, covering four separate crematorium features. Three of these were surrounded by stone settings, the third was without stones. In each feature were found either 3 or 6 stakeholes. The barrow and the crematoria are datable to period VI of the Bronze Age. Ard marks under barrow. Close by were found pits with pottery of the same period. – *Fyns Stiftsmuseum,* Odense, 6201. [Claus Madsen].

28. ÅS, northwest Jutland. Skjoldborg s., Thisted a.
**Settlement.** Partial excavation of a site with separate groups of Late Bronze Age houses. Houses were found at five places within an area measuring about 300 m from N to S, the groups consisting respectively of 1, 2, 2, 4 and 1 houses. The area excavated was 17 m wide so that only 3 E-W orientated three-aisled buildings could be fully uncovered. At one of the localities a thin occupation layer still survived, where at the western end of a house measuring ca. 13 × 6 m (house IX) there was found a paved fireplace with west of it a sunken storage vessel. House II measured 15 × 7 m with entrance unusually far east, with the result that the western part was twice as long as the eastern part. House VII measured about 20 × 7–7.5 m with entrances slightly west of the middle. – *Museet for Thy og Vester Hanherred,* Thisted, 2354. [Martin Mikkelsen].

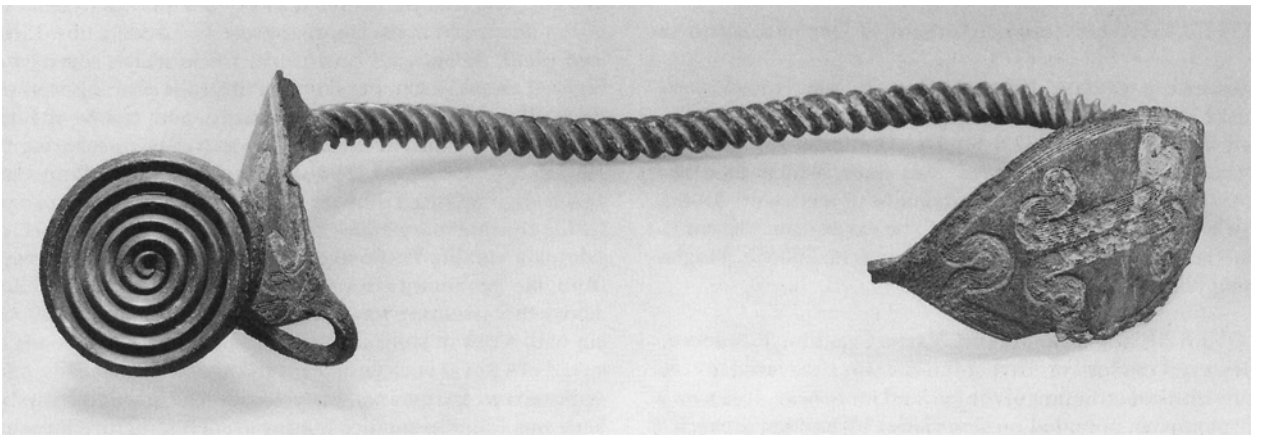


Fig. 4. Large bronze neckring from Brunsvang, Lolland (no. 26). L. Larsen photo.

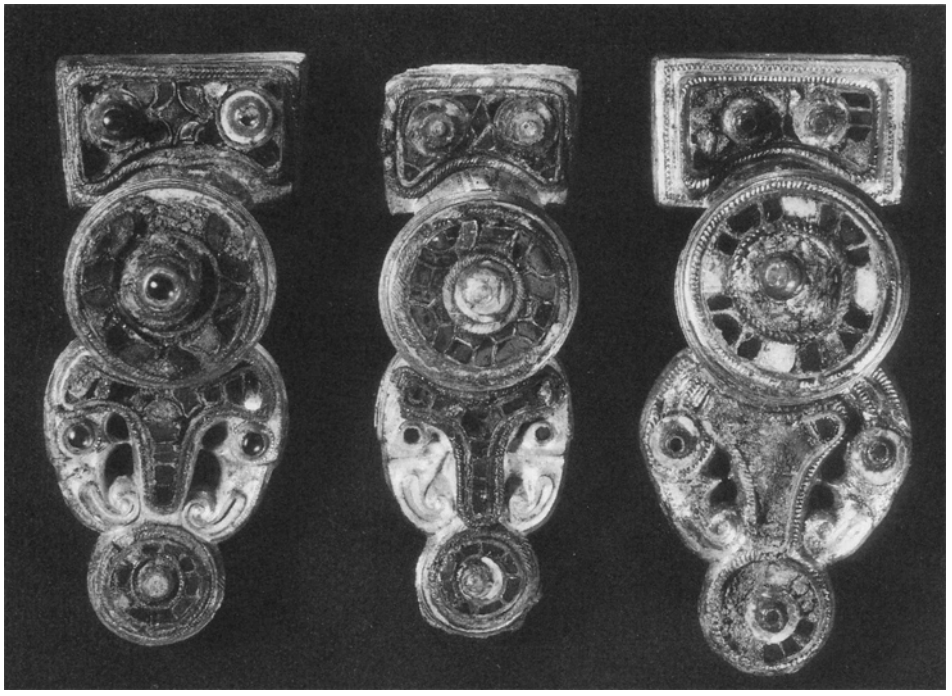


Fig. 5. Three disc-on-bow fibulae of gilt bronze from three female graves at Nørre Sandegård, Bornholm (no. 33). L. Larsen photo.

29. HEMMED CHURCH, eastern Jutland. Hemmed s., Randers a.
**Settlement site.** Middle Bronze Age house with surviving clay floor. The dimensions of the house were ca. 11 × 31 m. Below it were found settlement remains from the Single Grave Culture and the Late Neolithic. There were also remains of Late Bronze Age houses, occupation layers, deposits of burnt stones, and traces of metalworking. – *Djurslands Museum*, Grenå, 2051/87. [N. A. Boas].

30. HØJGÅRD, south Jutland. Gram s., Haderslev a.
**Settlement site.** Furher excavation of the Early Bronze Age settlement excavated in 1984 (cf. *JDA* vol. 5, pp. 152–167). In 1987 yet another cluster was exposed consisting of a large three-aised longhouse (32.8 × 8.4 m) with internal partitioning and the characteristic accumulation of stone-filled cooking pits between the last two pairs of roof-bearing posts in the west. Also a smaller, ploughed down building with no sign of internal roof posts or cooking pits. In connection with this a further sunken building. Close west of this was found a pit containing a type A beaker of the Single Grave Culture. West of this group of houses appeared 11 longhouses of which all that survived was indications of the roof-bearings posts. These antedated the Early Roman Iron Age, from whose early part there were excavated 9 inhumation graves divided into two groups of 4 and 5 graves respectively. An area of 118.000 $m^2$ has now been excavated. – *Haderslev Museum* 1706. [Per Ethelberg].

## IRON AGE

31. DAMGÅRD I, eastern Zealand. Herstedvester s., Københavns a.
**Settlement site.** A total of 39 buildings were excavated, including barns, extending over at least three major phases. The greatest intensity of occupation seemed to lie in later Roman/early Germanic times, but pottery from rubbish pits shows that there was also activity at the site in early Roman times. It is possible to distinguish eight different house types, some with and some without surviving wall postholes. The development goes from straight rows of roof-bearing posts to curved rows, and from long to short span between the posts in the transverse pairs. Altogether about 20.000 $m^2$ were investigated. Damgård is the first site with intensive Iron Age occupation to be excavated in Copenhagen county. – *Søllerød Museum* 297. [Eliza Fonnesbech-Sandberg].

32. VEMMETOFTE, eastern Zealand. Hylleholt s., Præstø a.
**Roman bronze saucepan.** Acquired from private owner. From early Roman Iron Age cemetery. – *National Museum, Prehist. Dept.* 6630/87.

33. NØRRE SANDEGÅRD, Bornholm. Østerlars s., Bornholm a.
**Graves.** In 1987 there were found 50 ploughed-through inhumation graves, most of which can be dated to the younger Ger-

manic period. They were all unusually richly equiped and were evenly divided between male and female graves. Among the grave goods was typical male gear consisting of single or double edged swords, lance, and shield. In connection with certain of the male graves were found horse burials with harness mounts. The female graves held typically 3 fibulae (disc-on-bow, zoomorphic, and saucer), strings of glass beads, spacers, pendants, bronze chains, bracelets, etc. (fig. 5). Also a large number of textile fragments were found, and in a grave from the later Roman Iron Age was found a glass beaker. – *Bornholms Museum,* Rønne, 1409. [Lars Jørgensen/Margrethe Watt]

34. STÆRKÆRVEJ (GUDME III), Funen. Gudme s., Svendborg a.
**Settlement site.** Continued excavation of an area where a hoard of siliquae had been found as well as dwelling structures from the end of the later Roman Iron Age and the beginning of the Germanic Iron Age. In 1987 about 2000 $m^2$ were excavated and 11 houses from the 4th-5th centuries were found. Eight of them were E-W orientated longhouses, some with the walls surviving as double post rows. With up to six pairs of roof-bearing posts they are the longest houses to date in Gudme, and six of them appear to represent rebuildings of a single dwelling, which was 37 m long in its earliest phase. Around this main structure were smaller N-S orientated buildings and many pits with cultural remains – pottery, beads of glass and amber, iron objects, etc. In a more restricted area there were pits with crucible sherds, tuyères, fused lumps of metal, and other waste from metal working. Especial mention may be made of a denarius, a fragment of a relief fibula of gilded silver, and sherds of four Roman drinking bowls – *National Museum, Prehist. Dept.* 6320/85. [Peter Vang Petersen]

35. LUNDEBORG, Funen. Hesselager s., Svendborg a.
**Settlement site.** Continued investigation of coastal settlement and trade mart from the 3rd-4th centuries A.D. Rich occupation layer with bronze, iron, glass, pottery, bones, coins, gold and silver objects, and iron slag. It was found that the site extends about 250 m along the coast and 50 m inland – the area covered by the occupation layer, whose depth varied from 40 to 70 cm. About 100 m to the north is another similar area, separated from the southern one by a marshy depression. Soundings in this area have revealed a culture layer similar to that at the southern site. It extends about 150 m along the coast and reaches 25–30 m inland. It may reasonably be supposed that there is a connection between some old discoveries of gold ornaments and the northern site. – *Svendborg og Omegns Museum,* A 2–86. [Per O. Thomsen]

36. HEJRHØJ, northeast Jutland. Thisted s., Thisted a.
**Settlement.** Excavation of a site from the later Roman/early Germanic periods with occupation layer surviving to a maximum depth of 0.5 m. Fifteen houses were excavated, including parts of 4 E-W orientated three-aisled longhouses with sod walls; also 2 smaller houses had sod walls. As an example can be described house II, 12 meters of the eastern part of which have been excavated. The sod wall was 1 m thick and there was a paved doorway through the eastern end and probably doorways through the sides about 10 m from the east end. Immediately inside the eastern doorway was a probable hearth with around it stone mullers, stone sinkers, pieces of iron, a pot, and lumps of clay. The smallest of the houses with sod walls probably only measured 2.2 × 3.3 m with posts at the two ends only and entrance in the middle of the northern side. Remains were also found of at least three and probably five E-W orientated three-aisled longhouses with post walls. Probably these belonged to a later phase than the houses with sod walls. Finally there were found two houses from the Late Bronze Age and three graves from the later Roman period. – *Museet for Thy og Vester Hanherred,* Thisted. [Martin Mikkelsen]

Fig. 6. Large bird fibula from Kumlhøj, eastern Jutland (no. 37). L. Larsen photo.

37. KUMLHØJ, eastern Jutland. Albøge s., Randers a.
**Large bird fibula** from the later Germanic Iron Age (fig. 6), found with metal detector together with other metal ornaments from the later Iron Age and Viking period. Submitted as Treasure Trove by Djurslands Museum, Grenå. – *National Museum, Prehist. Dept.* 5990/85.

38. JELLING, south Jutland. Jelling s., Vejle a.
**Grave** found during trial trenching around the two large farmhouses from the Early Roman period that were excavated in 1986. Further trenching showed that the grave lay alone on a little rise only 50 m from the farmhouses, with which it was contemporary.

The grave pit measured 460 × 280 cm and contained remains of a wooden cist or chamber which measured 400 × 165 cm and was at least 70 cm high. In the western part of the grave was found a man in a crouched position. He had a gold-mounted fibula at his shoulder, a silver fingerring, a belt buckle with iron belt-end mount, and had by his feet the poorly preserved remains of spurs. In the exact middle of the cist was a shield with a diameter of 120 cm. Along much of its circumference there were edging mounts, and it had a very large, spiked iron

umbo with domed silver-mounted rivet heads. There had probably been three silver discs applied to the wood. Under the shield was found an iron knife. Beside the person buried were found a lancehead and spearhead of iron and a table set of eight pottery vessels. The grave must have belonged to one of the farms, one of which in view of its size and number of outbuildings is the largest known from this period in Denmark. Its size and equipment link this grave with a small number of similar richly-furnished graves from a restricted part of Vejle county. – *Vejle Kulturhistoriske Museum,* 1262. [Dorthe K. Mikkelsen]

39. STORE SKINDBJERG, western Jutland. Dejbjerg s., Ringkøbing a.
**Graves and settlement.** Less than 1 km west of the place where the Dejbjerg carts were found extensive trial excavations have revealed a concentration of burials with urn or cremation pit. Seven graves have been found on a slight rise in the terrain, and six of them have been excavated. The size of the cemetery is estimated as 50 × 50 m at the most. East of the cemetery appeared a contemporary settlement covering an area of about 100 × 100 m. One of the longhouses was fully exposed. It was a well preserved house with wall trenches and byre with stalls, much like the chieftain's farm at Hodde. However it was rebuilt so many times that excavation will be very complicated. The excavation of the cemetery at Store Skindbjerg will continue in 1988 as part of the current investigations around the site of the Dejbjerg carts. – *Skjern-Egvad Museum* 270. [Torben Egeberg Hansen]

40. VELDBÆK IV, western Jutland. Esbjerg s., Ribe a.
**Graves.** A small excavation at a moundlet cemetery revealed many features that were not fully investigated in 1983. There were found ca. 15 urns, three of them containing metal objects. The two excavations showed that the cemetery began at a row of barrows in the north and extends southwards. Its limits are known on three sides and are unknown only on the east. The area investigated measures about 100 × 100 m. A total of about 90 features with ring-ditch have been uncovered, and one separate urn. The urns in the graves are usually in fragments. Seven urns contain metal objects, usually pins, but a lugged ring of bronze with a little chain has also been found. The cemetery can be dated to periods I and II of the pre-Roman Iron Age. – *Esbjerg Museum* 1357. [Palle Siemen]

41. HJEMSTED BANKE, western Jutland. Skærbæk s., Tønder a.
**Graves and settlements.** Since 1977 a total of nearly 90.000 $m^2$ has been excavated and fieldwork can now be said to have been brought to an end. The discoveries include a tent circle from the Maglemose culture; a large stone with cup-marks; a village from the Bronze/Iron Age transition; six urn cemeteries from the Early Roman Iron Age (a seventh was excavated back in 1919); five inhumation cemeteries from the 3rd-4th centuries; and two large inhumation cemeteries from the 5th-6th centuries. There are a few farmhouses from the 3rd century, but the main part of the excavated settlement remains (34 farms with over 100 longhouses, wells, pit huts, pits, ritual pottery deposits, and fences) are from the second half of the 4th to the 6th century. Important for dating purposes are the many wells in which wood is preserved. At present the relative chronology has been set up, but absolute chronology is still lacking. Also excavated were a limited number of pits from the later Germanic and Viking periods, but no houses contemporary with them. Finally there were some houses and many pits and ditches from the 11th-12th centuries. – *Haderslev Museum* 1004. [Per Ethelberg]

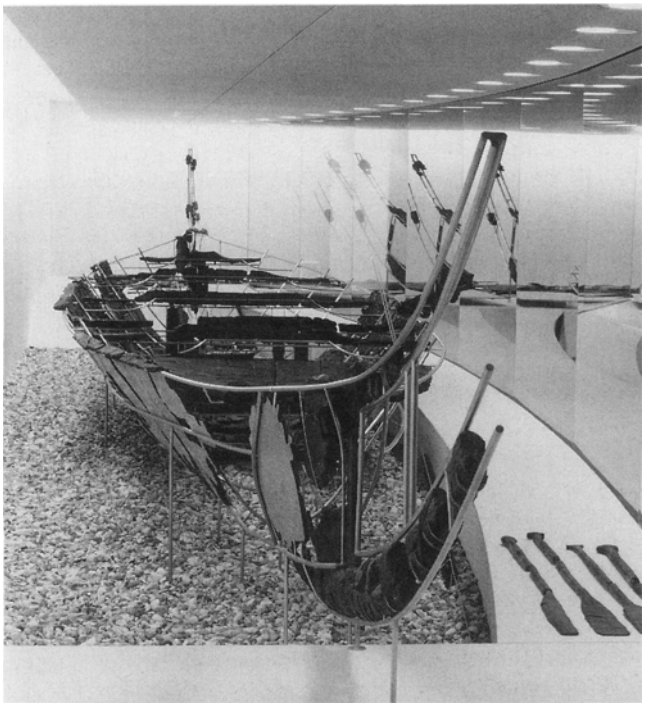


Fig. 7. In 1987 the site of the Hjortspring weapon deposition (no. 42) was reexcavated. Samples for radiocarbon dating were obtained and three such dates place the deposition around 300 BC. In 1988 the Hjortspring boat was presented to the public at the National Museum after total reconservation. Leif Hammelev photo.

42. HJORTSPRING, Als. Svenstrup s., Sønderborg a.
**Ritual weapon deposit.** Supplementary investigations at the site where the 19 m long Hjortspring boat was found accompanied by weapons and other equipment from the pre-Roman Iron Age. The deposit was excavated in 1921–22 and in 1986–88 was subjected to reconservation at the National Museum in preparation for re-exhibition (fig. 7). The aim of the 1987 investigation was to obtain material suitable for radiometric dating (untreated wood). The date of the boat has been controversial. The new results place the deposition at about 300 B.C. – *National Museum, Dept. of Marine Archaeology and Prehist. Dept.* 6555/87. [Flemming Rieck]

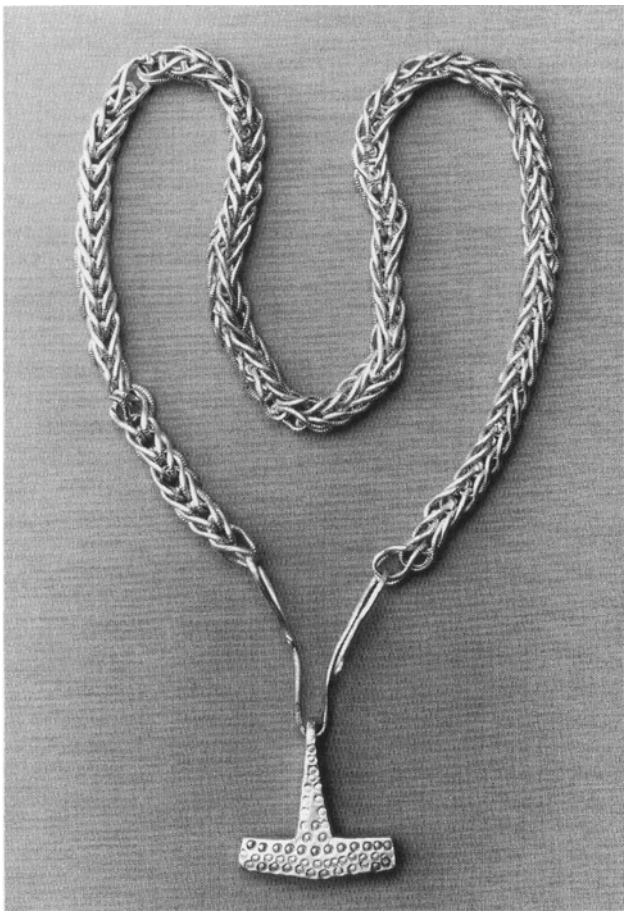


Fig. 8. Thor's hammer from Tågemosen, eastern Zealand (no. 43). L. Larsen photo.

Fig. 9. Reverse of Thor's hammer from Tågemosen with net pattern. L. Larsen photo.

## VIKING AGE

43. TÅGEMOSEN, eastern Zealand. Spjellerup s., Præstø a.
**Thor's hammer** of silver, decorated on the front with stamped circles and on the back with cut net pattern (fig. 8–9). The hammer was hung in link-in-link cable made with beaded silver wire. Single find. – *National Museum, Prehist. Dept.* 6590/87.

44. BØGELUND, eastern Zealand. Varpelev s., Præstø a.
**Settlement.** 20.000 $m^2$ have been excavated with 8 longhouses, 7 small houses, and 10 barns. The houses were about 30 m long and 6–7 m wide. One was a "Trelleborg house" 30 m long and 7 m wide. The houses are grouped in three farmsteads. Pottery from the houses and pits is datable to the late Iron Age or the early Viking Age. In the southern farm was found a little Baltic ware. In the middle farm, which consisted of three longhouses, the youngest being of "Trelleborg type", there was found quite a lot of Baltic ware and also loom weights, spindle whorls, iron shears, a bronze finger-ring, and iron knives. In the third, northern, farm were excavated two longhouses surrounded by smaller buildings. Also here the pottery was mostly of Baltic type. – *Køge Museum* 1200. [Svend Åge Tornbjerg]

45. GJERRILD KLINT, eastern Jutland. Gjerrild s., Randers a.
**Silver hoard.** During the excavation of a long barrow there was found a hoard containing the following items: – fragments of Kufic coins, namely 3 dirhems minted under the Abbasids and 64 from the central Asian Samanids (or of indeterminate origin). The last coin seems to be 334 or 335 on the Islamic calendar (945–47 A.D.). Also a fragment of a Hedeby coin and cut pieces of plaited wire torques. Acquired as Treasure Trove from Djurslands Museum, Grenå. – *National Museum, Prehist. Dept.* 6249/87. – *Royal Coin Cabinet* 4527.

46. LANGVANG, eastern Jutland. Randers s., Randers a.
**Settlements.** In Randers' northern margin 24.000 $m^2$ were uncovered with settlement traces from various periods ranging from early Neolithic to Medieval. The most important settlements were late Bronze Age/early pre-Roman Iron Age, Viking period, and Medieval. From the Bronze/Iron Age were excavated two houses, a fence, and 49 find-bearing pits with much pottery, among them one with quantities of pale grey, lightweight slag. The Viking settlement was parts of at least three farmsteads. The well preserved houses were all of the familiar types with curved sides and straight ends often with a pair of the roof-bearing posts in the end-wall. One house had a length of at least 47 m, but most were 15–25 m long and 6.5–8 m wide. Twenty-one sunken huts lay in groups of two to four. It was in these that the largest number of Viking finds were made – pottery, burned loom weights, spindle whorls, fragments of metal, a glass bead, iron slag, and some animal teeth. The Medieval settlement takes the form of two parallel rows with pronounced remains of settlement. Between them is an area with thin settlement. – *Kulturhistorisk Museum,* Randers, 351/86. [Hugo H. Sørensen]

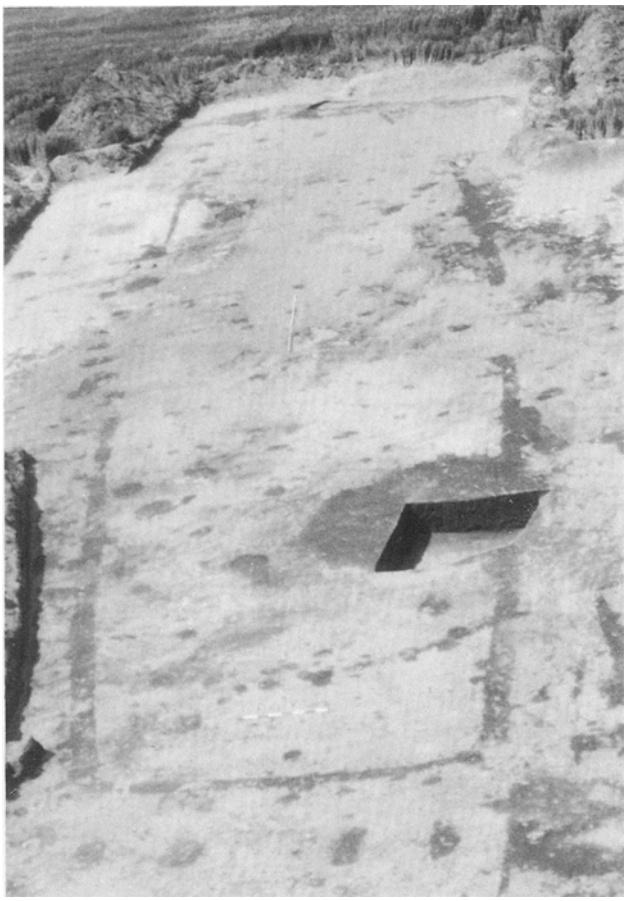


Fig. 10. Aerial view of the Viking Age farm at Gammel Hviding, south Jutland (no. 48). The 40 m long and almost 11 m wide main building is seen from the east. Stig Jensen photo.

47. MALT, south Jutland. Malt s., Ribe a.
**Runestone.** A large stone, ca. 220 × 85 × 60 cm, with runic inscription on one side. The inscription consists of 153 letters arranged in horizontal and vertical bands. On the same side as the inscription is a small, incised male head. The stone was found close north of the Kongeå river and near a system of old road tracks. Excavation provided indications that the stone was found where it originally stood. – *Egnsmuseet Holsted-Brørup-Vejen* 169 and *Esbjerg Museum* 1592. [Svend Aage Knudsen]

48. GAMMEL HVIDING, south Jutland. Hviding s., Tønder a.
**Settlement.** Continued excavation of a large Viking farm west of Hviding church. In 1986 a 35 m long Trelleborg house with associated outbuildings was excavated. In 1987 a further 3.500 $m^2$ was cleared. In addition to outbuildings a second main dwelling appeared – presumably the successor of the Trelleborg house. It had curved walls and there was no sign of internal roof-bearing pots (fig. 10). The northern wall line was cut by a well, the lining of which was a hollowed-out log felled at about 1100 A.D. At the bottom of the well was found an Urnes brooch of bronze. – *Den antikvariske Samling,* Ribe 440. [Stig Jensen]

## MEDIEVAL

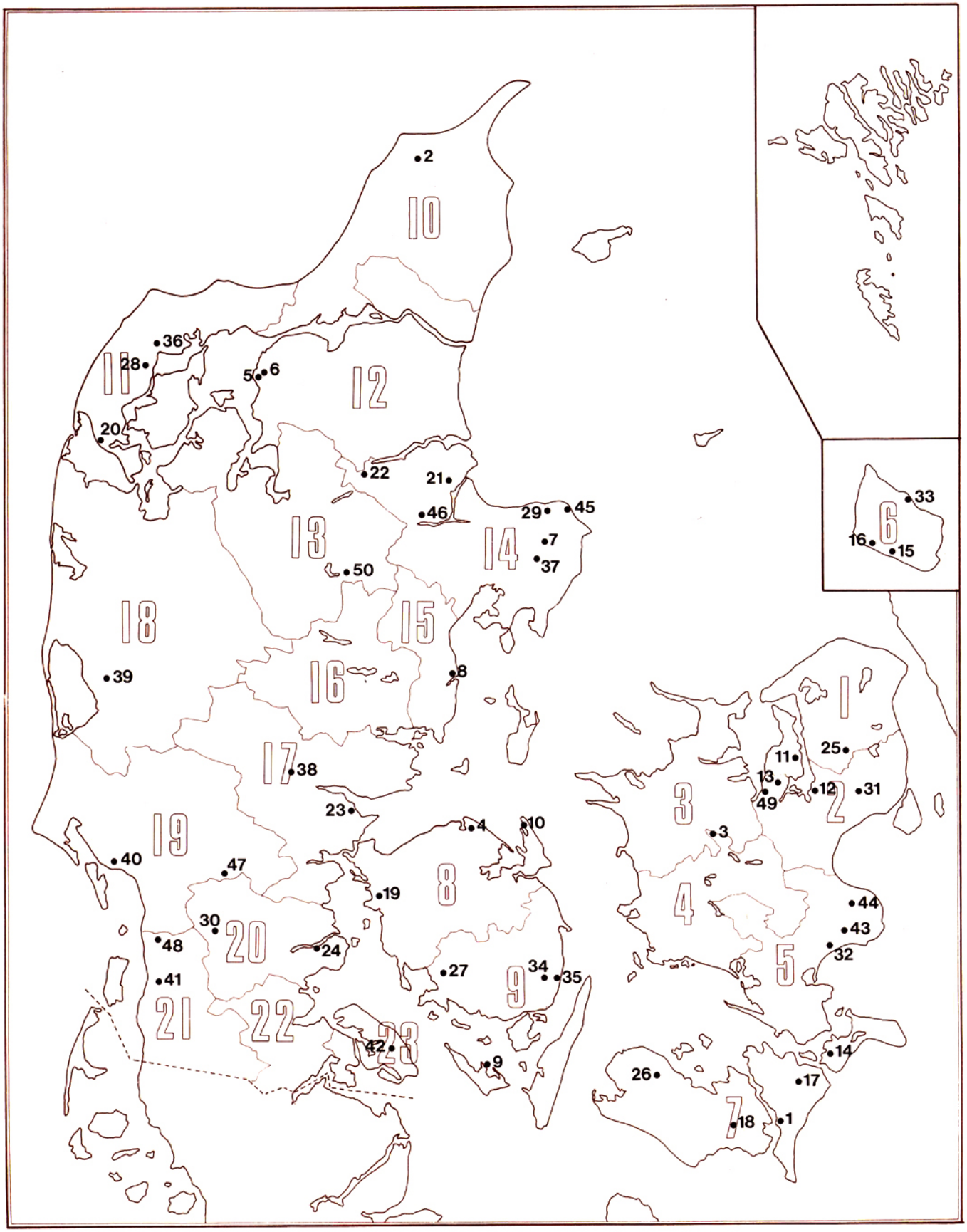
49. RYE, north Zealand. Rye s., Københavns a.
**Manor house.** Close west of Rye's medieval church a trial excavation has been carried out on the site of Ryegård, a medieval manor thought to have been in use in c. 1100–1575. Oldest were two walls of cut tufa blocks, preserved as two courses on boulder foundations. The walls belonged to separate buildings. Of later date is the boulder foundation of a round tower, from which issued a covered brick drain. There were also recorded a number of postholes which may be older than the stone buildings. The position and character of the manor indicate that it should be seen in connection with the church. It may be the dwelling of the founder. The excavation will continue in 1988. – *Roskilde Museum* 1304/87. [Michael Andersen]

50. VEJERSLEV, central Jutland. Vejerslev s., Viborg a.
**Water mill.** In 1986 there was excavated part of a mill dam reinforced with a strong piling of oak planks. These have been dated dendrochronologically to about 1185 A.D. Also the millhouse itself was found. Its excavation was completed in 1987. It appears to have been in use for only a short time. As well as unusually well preserved foundations and remains from the mill works there was found a little millhouse with earthfast posts, measuring only 7 × 7 m. Various components such as paddle blades, gear wheels, and teeth from gear wheels, show that the millwheel had been of the vertical type with a single felloe and transverse paddles. Of other finds may be mentioned fragments of millstones of Norwegian mica-schist and of Rhenish basalt, bone combs, bone pins, awls, ornaments, a hoe or ploughshare of iron, and refuse from a wood-turner's workshop. – *Silkeborg Museum* 88/1981. [Chr. Fischer/Knud Bjerring Jensen]

*Translated by David Liversage*

The map on page 256 shows the location of sites mentioned in the section 'Recent Excavations and Discoveries'. The counties (Danish *amter*) are numbered in the following way:

1. Frederiksborg
2. København
3. Holbæk
4. Sorø
5. Præstø
6. Bornholm
7. Maribo
8. Odense
9. Svendborg
10. Hjørring
11. Thisted
12. Ålborg
13. Viborg
14. Randers
15. Århus
16. Skanderborg
17. Vejle
18. Ringkøbing
19. Ribe
20. Haderslev
21. Tønder
22. Åbenrå
23. Sønderborg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