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Jels I –
the First Danish Site of the Hamburgian Culture

A Preliminary Report

by JØRGEN HOLM and FLEMMING RIECK

During the last decade a boom has occurred in the study of the late glacial period in Denmark. The studies have chiefly been concerned with the Bromme Culture which has been elucidated by a series of new sites and single finds. Besides the well-known sites Bromme (Mathiassen, 1946), Engkrogen, and Smedemosen (Mathiassen, 1959) around fifty sites have been discovered all over the country. On Zealand they are chiefly located around Holmegård bog, at Stoksbjerg, and at Knudshoved (1). In Funen and surrounding islands they are represented by sites at Bro (Andersen, 1972), Ejby bog, and the strange site at Ommels Hoved, in the island of Ærø (a kill-site? Holm, 1972). There seem to be fewer in Jutland, but recently sites have been investigated at Løvenholm and Langå (Madsen, 1983), and in southern Jutland at least seven sites have been recorded on the surface.

Furthermore can be added at least two hundred individually recorded tanged arrowheads of the Bromme type.

Tools of organic material are rarer, but at intervals reindeer antler implements are found (Skaarup, 1974). It has been impossible to date these scientifically, but they are supposed to belong to the Bromme and/or Ahrensburg Cultures.

This last mentioned culture is probably also represented on one single site in Denmark (Fischer, 1982), and by a few individual tanged points (Becker, 1971) and uniserially barbed harpoon-heads with a pointed spade-shaped base (Andersen, 1974).

Finally it should be mentioned that the Federmesser group is also represented by a few but extremely characteristic finds (Petersen, 1973; Andersen, 1977).

But ever since Alfred Rust conducted his epoch-making excavations in the Hamburg area we have been on the look-out for the Hamburgian Culture in Denmark. A reindeer antler tool dredged from *Middelgrunden* off Copenhagen (Mathiassen 1938) displays a certain similarity to a tool from Meiendorf, but the similarity is too superficial for us to assign it to that culture. However, this item has with some reservation been pollen-analytically dated to early Dryas (Degerbøl and Krog 1959), and is interesting in that it might bear witness to a continuation of the Hamburgian Culture into this period.

Then in 1969 a break-through occurred when C.J. Becker presented an indiusputable shouldered point (*Kerbspitze*), a single find from Bjerlev heath between Vejle and Horsens (Becker, 1970).

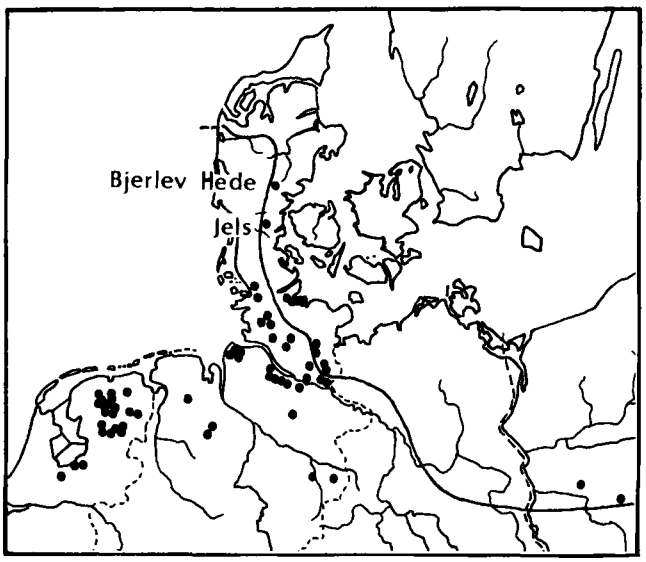

Fig. 1. Finds of the Hamburgian Culture in Northern Europe. The full line indicates the maximum extent of the ice sheet during the Weichsel glaciation.

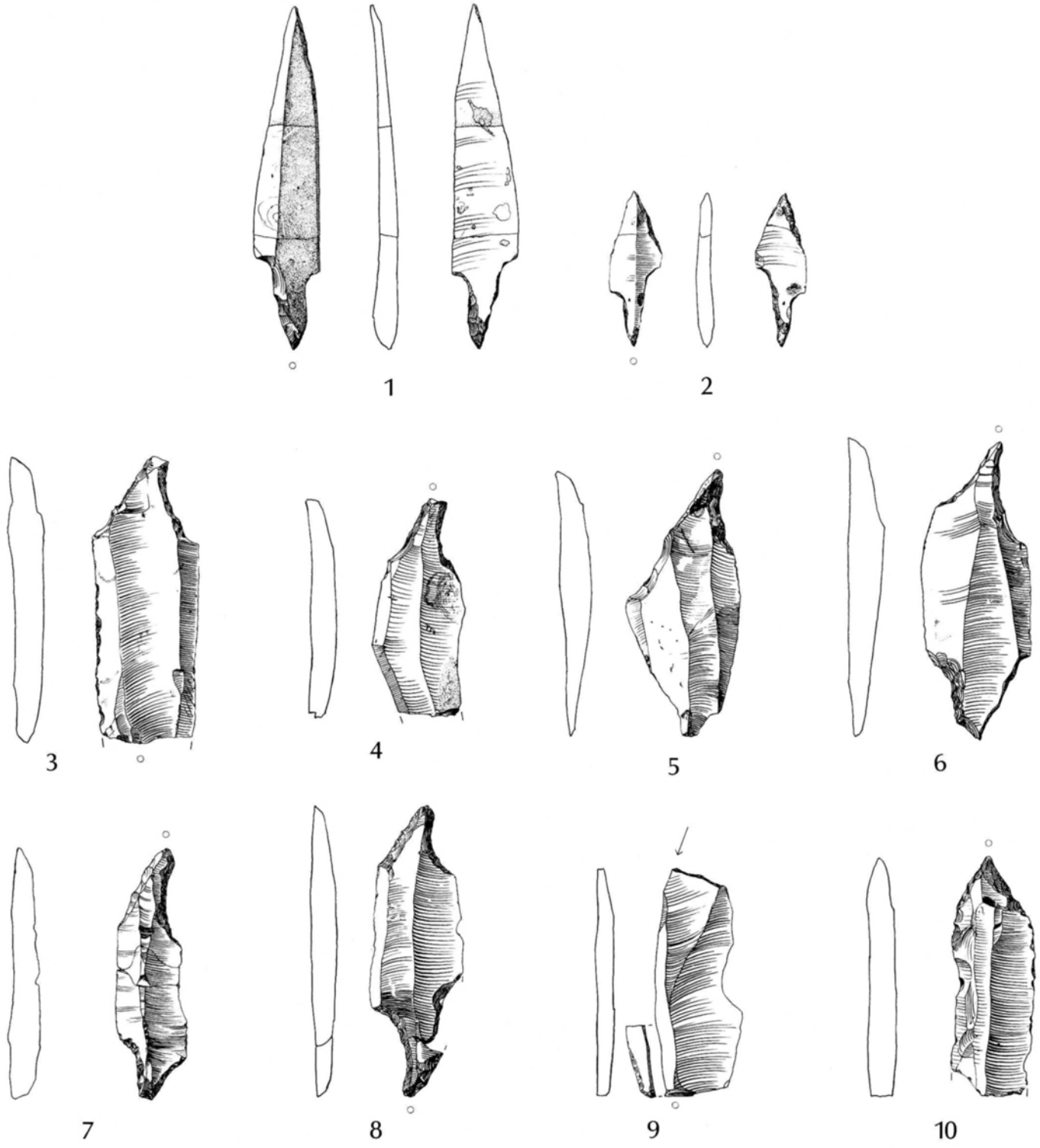

Fig. 2. Flint artefacts from Jels I. 1–2, shouldered points; 3–5, *Zinken*; 6–8, double *Zinken*; 9 angle burin; 10, *Kratzer* (Jørgen Andersen *del.*). 3:4.

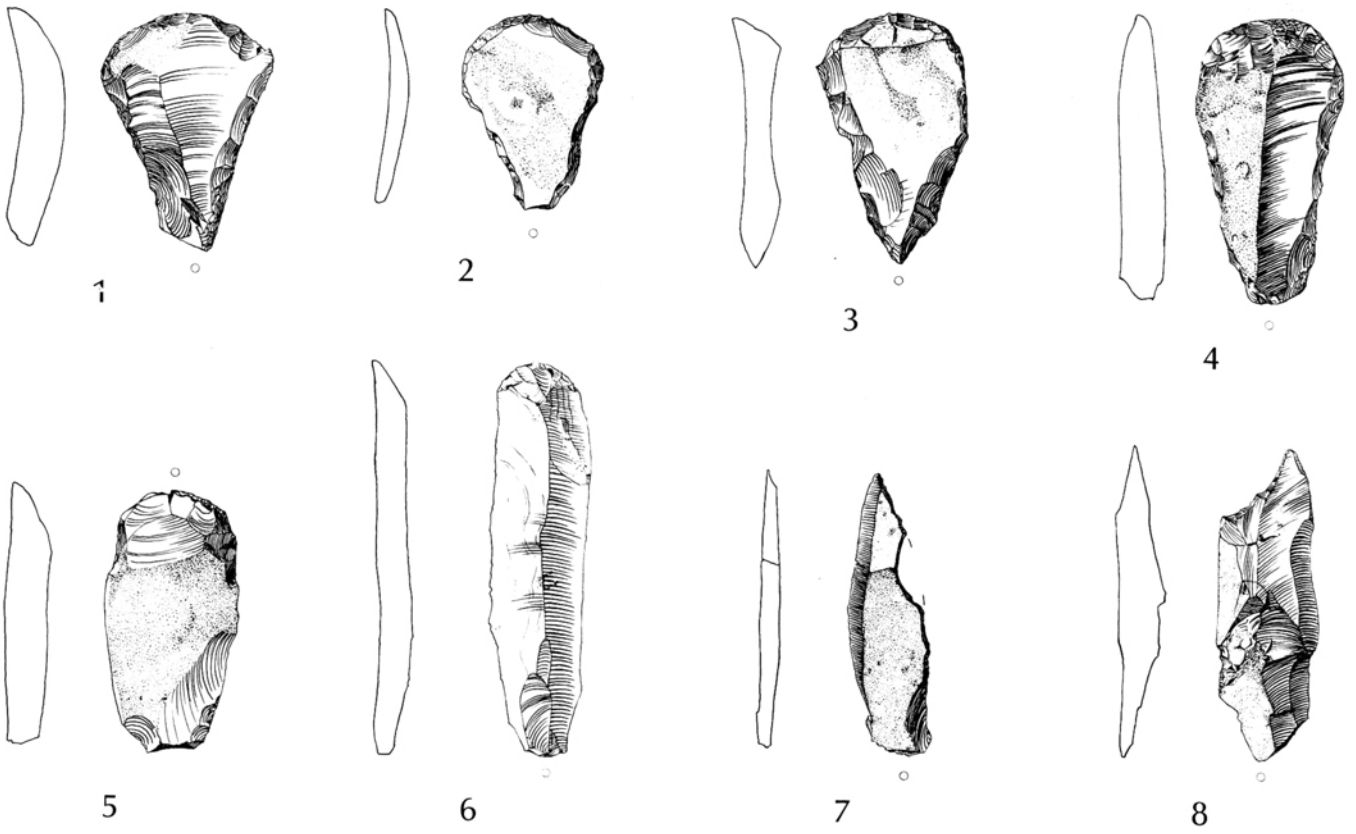

Fig. 3. Flint artefacts from Jels I. 1–4, scrapers with laterally retouched edges; 5, double scraper; 6 scraper on blade; 7, Gravette point; 8, flake with an oblique terminal retouche (Jørgen Andersen *del.*). 3:4.

THE JELS I SITE

Now the presence of the Hamburgian Culture in Denmark has been established beyond any doubt by the discovery of a site at the Jels lakes in southern Jutland. This site, optimistically called Jels I, was discovered as early as 1968 by the amateur archaeologist Jørn Fynbo, but not until 1980 did archaeologists from Haderslev Museum determine the material and assign it to the Hamburgian Culture.

A trial excavation in 1981 confirmed this supposition, and its correctness was firmly established by further investigations in 1982.

On the edge of an elevated sand terrace south of Oversø, the northernmost of the three small lakes at the bottom of the Jels tunnel valley, an area of 239 square metres has so far been excavated and has yielded a material including several of the types characteristic of the Hamburgian Culture.

The site is located in a late moraine formation east of the main stationary line of the Weichsel glacial period.

The artefacts were found partly in the ploughed topsoil and partly in the underlying sand. Periglacial soil movements might have been expected but have only been recorded on the slope north of the site. However, the stratigraphy of the site, and thus also the position of the artefacts, is characterized by secondary recent disturbance caused by trees felled by high winds, and animal activity.

THE MATERIAL

The material recorded so far consists of flint only and seems rather homogeneous. However, the ploughed topsoil also contained a few tools of a later date (a. o. tools of the Maglemosian Culture).

All the earth was passed through a sieve to ensure that even very small flakes were not overlooked.

The following list of finds is based on a preliminary classification of the material as of 1 Jan. 1983:

Cores:	44
Flakes:	8902
Shouldered points, intact:	2
Shoulderet points, fragments:	5
Zinken, single:	17
Zinken, double:	6
Zinken, single, retouched on one side only:	2
Perforators:	3
Zinken/perforators (combination tools)	3
Scrapers with laterally retouched edges:	10
Scrapers without lateral retouch:	6
Double scrapers without lateral retouch:	1
Gravette points:	1
Kratzer:	3
Flakes with an oblique terminal retouch (*Schrägendklingen*):	8
Angle burins:	6
Dihedral burins:	1
Retouched and notched pieces:	171
Total flint material:	9191

Clearly identifiable tools:
74 = 0.8% of the entire material.

CULTURAL RELATIONS AND CONCLUSION

As appears from the above the majority of the lithic tool-kit of the Hamburgian Culture is represented in the find. In our opinion especially the presence of the double zinken – a type that appears neither earlier nor later – determines the culturel relations of the site. The two intact shouldered points are not of the common type, but in spite of the large difference in size they are quite identical as regards production technique (double-sided with alternating retouch along the edge).

Gernot Tromnau has suggested a subdivision of the Hamburgian Culture into four chronologically or regionally determined groups (Tromnau, 1981): 1) Meiendorf, 2) Poggenwisch, 3) Havelte, 4) Teltwisch. If we accept this subdivision for the time being, though it seems to be based on intuition rather than scientific dating, and compare the Jels material with the tool-kits and the technical characteristics of the four groups, there is little doubt that the Jels site should be assigned to the Havelte group (references in Tromnau, 1975: 84–93). Especially the shouldered points point in this direction, but the total absence of microlithic types that are represented in some measure in the other groups, should also be taken into consideration. However, the presence of at least one gravette point – a type that is only known from the neighbouring Teltwisch group – is also interesting.

On the Jels I site the tools were found closely together in the centre of the site immediately under the tilled topsoil. In accordance with the general research tradition one is tempted to regard this area (measuring 6 × 6 m) as the »shadow« of a hut or tent. As might be expected the flint waste is much more widely distributed (in an area measuring 15 × 15 m).

The southern, western, and eastern parts of the site have been thoroughly excavated (2), but the northern part near the banks of the lake and the steep slope and the depression below the site have not yet been excavated. In 1981 in this area trial excavations have already established the presence of a refuse zone with a high flint frequency.

Further trial excavations have been planned with a survey of the total late glacial settlement of the Jelssø basin in mind. Four sites of the Bromme Culture have already been recorded by surface reconnaissence.

Latest news: In the autumn of 1983 another settlement site of the Hamburgian Culture (Jels 2) was located just 30 m. from Jels 1.

Translated by Ul S. Jørgensen

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NOTES

[1] Mostly unpublished or only briefly mentionned in literature. Excavations by E. Brinch Petersen and A. Fischer. Cf. also Bo Madsen 1983, with distribution map.

[2] The excavation was supported by grants from the Danish Research Council for the Humanities.

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New Evidence of Late Palaeolithic Settlement in East Jutland

by BO MADSEN

This review presents a series of newly discovered late palaeolithic finds from Jutland. Some of the provisional conclusions presented suffer from problems due to the absence of scientific dating, stratigraphy, and representativeness. Interpretations must therefore often be based on indirect evidence, as has been the case with earlier work on the subject. This is so far the state of affairs for this branch of stone age studies throughout Scandinavia. Aspects of the Bromme culture will here be discussed against this background, the starting point being two newly excavated complexes of finds in eastern Jutland.

RESEARCH BACKGROUND

The publication of the settlement Bro I over ten years ago was the first presentation of excavated settlement material of the Bromme culture west of the Great Belt (Andersen 1970: 85–100, 1972: 6–60). Almost at the same time a general review of more recent finds from the Danish late palaeolithic was also published (Becker 1971: 131–139). Since then there has been a marked upsurge in the intensity of research into late palaeolithic settlements. Thanks to the systematic work of in particular one very active researcher, the number of known late glacial settlements in the Zealand area has increased by several times (Fischer 1976: 95–115).

The Jutland peninsula on the other hand has for long been an area from which late palaeolithic finds seemed to be very rare. The material was almost solely single finds. In 1971 C.J. Becker could thus only list one settlement from Jutland, namely that at Fjellerup Mark. This distributional picture is now changing. A vastly increasing quantity of finds is now known both from eastern and southern Jutland (Andersen 1977: 18–27). An ever increasing number of single finds is being recorded, mainly tanged points. In several places the main late palaeolithic types have occurred together. Finally, four settlements of late palaeolithic date have now been excavated in Jutland. Most noteworthy is the so far unfinished excavation of a settlement at Jels in southern Jutland, with a late Hamburgian inventory, making it the oldest known settlement in Scandinavia (Holm and Rieck this volume).

CLASSIFICATION OF THE MATERIAL

The material to be presented consists exclusively of finds of flint which from their morphology and technique can be referred to the late palaeolithic (Taute 1968). Recording has mainly included flint projectile points, particularly tanged points. The geographical area covered includes mainly the central part of east Jutland, namely the Djursland peninsula, the Randers area and the lower Gudenå River area, in fact the former county of Randers. Archaeologically, this area is administered in two districts, respectively by Djurslands Museum in Grenå and by the Culture Historical Museum in Randers (1).

The appearance of the increased quantity of material is mainly due to a network of good contacts, primarily amateur archaeologists. Systematic surveying by the museums has only been carried out in connection with the excavated settlements. Corresponding well-established contact with amateur archaeologists formed the basis for recording finds in southern Jutland, Fyn and Zealand.

It has proved practical to make a simple classification of the late glacial material according to the quantity and composition of the type-defined artifacts and other tools. Earlier reviews have divided material up into single finds and settlement finds. In this way, findspots with only two late glacial tool types have sometimes been called »settlements« (Clark 1975: 80). It has, un-

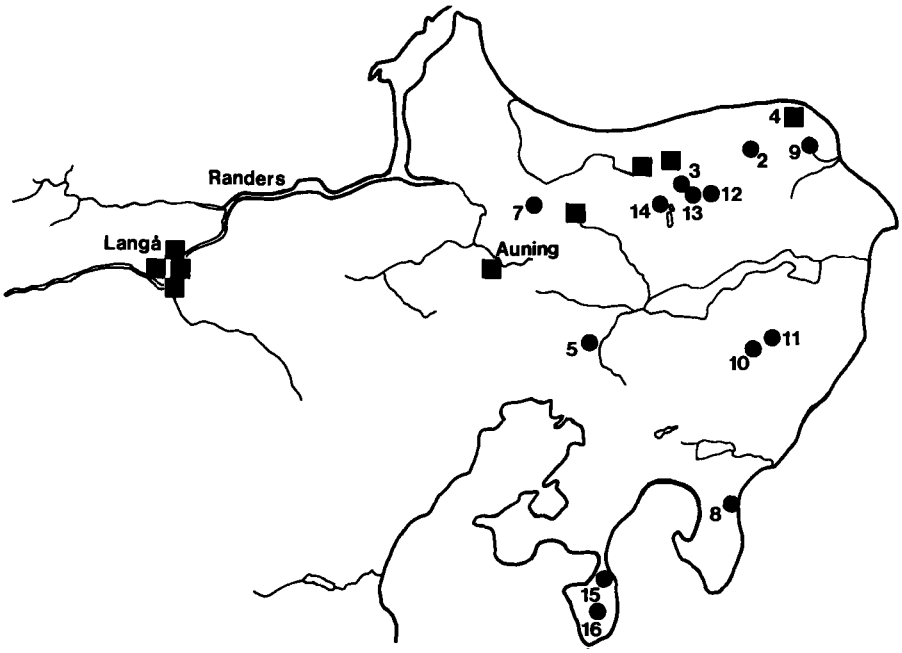

Fig. 1. Late glacial settlements, find assemblages, and stray finds (circles) in Randers Amt.

derstandably, been difficult to establish definite criteria for defining the term »settlement«. In this work, a purely practical although subjective division is made, according to the number of artifacts. As most of the material consists of surface finds, the number of finds from any locality is often proportional to the intensity of surface collection, agricultural activity and soil type. It may at a later date be necessary to change this grouping in the face of more information.

In the following, the terms single find, find accumulation, and settlement will be used. Single finds have in several instances been the starting point for locating find accumulations. By find accumulation is understood a surface find with 2 to 4 tools, not accompanied by other characteristically worked flint. It transpires that these find accumulations consist most often of tanged points or fragments thereof. If, for example, the combination tanged point – scraper – burin occurs, it is almost always possible to demonstrate the presence of characteristic flint débitage at the same spot.

The term settlement is used for both surface and excavated finds, where characteristic by-products of flint working appear, such as blade cores, blades, core trimming blades, flakes, microflakes, burin spalls etc. If the find is not from a secure, excavated context, at least one datable artifact must also be found. The term is also used for sites where more than 4 tools have been found, even if there is no flint débitage. The find of Ommelshoved is a good example, with about 100 tanged points as the total inventory (Holm 1972: 5–15).

SINGLE FINDS

In the publication of the Bromme settlement, single finds were for the first time mentioned of tanged points of late glacial type from Djursland (Mathiassen 1946: 168). In more recent years the number of finds has increased a great deal, so that 16 single finds are now known, these being 15 tanged points and 1 scraper of late glacial type (fig. 1).

Earlier recording:

1. Anholt	NM A 38078	(Mathiassen 1946)
2. Hemmed.	NM A 39384	(Mathiassen 1946)
3. Stenvad.	NM A 16300	(Taute 1968)
4. Fjeldholm.	KHM 5275	(Mathiassen 1946)
5. Astrup Mark.	KHM (missing)	(Mathiassen 1946)
6. Grenå region	FHM 5424	

Recent recording:

7. Porsbakkerne.	KHM j. no. 5/83
8. Dråby.	Ebeltoft Museum 3645

9. Sostrup.	DJM 1960
10. Obdrup Mølle.	DJM 1889
11. Trustrup.	DJM 1883
12. Løkken.	DJM 1952
13. Stenvad Kær.	DJM (registered priv. collection)
14. Ramten.	DJM (registered priv. collection)
15. Vænge Sø.	DJM (registered priv. collection)
16. Ellemandsbjerg.	DJM 1956

(Abbreviations: NM = National Museum, KHM = Culture Historical Museum, Randers, FHM = Museum of Prehistory, Moesgård, Århus. DJM = Djurslands Museum, Grenå).

The recorded tanged points are all quite heavy, powerful pieces, with a length of over 6 cm. The largest is from Dråby north of Ebeltoft. With regard to morphology, size and weight, this point is comparable to the very large point from Viby on Fyn (Taute 1968, tafel 92). The other single finds fall within the range of variation in size and morphology of the tanged points from the Bromme site including an unusually narrow, regular example from Sostrup near Gjerrild. This corresponds closely to several of the narrow points from Bromme (Mathiassen 1946, fig. 6, no. 1). An unusual scraper type was found at Stenvad Kær. This tool is 5.2 cm long, made on a blade and equipped with a convex scraper edge at its distal end. The edge is made with flat, lamellar retouch. The lateral margins are shaped with a more steep retouch which extends right up to the proximal end. The remains of the striking platform shows clearly that removal was effected by means of the so-called »hard percussion technique« (Madsen 1981: 16–20). The distribution of heavy tanged points of Bromme type in northern Djursland partially corresponds with the distribution of Pitted Ware sites (Rasmussen and Boas 1982: 104–114). In this area, middle neolithic single finds of tanged points of type A 1 might in theory be expected. The question arises whether it is possible to confuse heavier type A 1 points with light tanged points of Bromme type.

Both V. Nordmann (1936) and T. Mathiassen (1946) present finds of heavy tanged points of »Lyngby« type from postglacial settlement deposits. V. Nordmann thus describes »Lyngby points« from an Ertebølle shell midden. In such contexts, tanged point-like blade tools are not uncommon. These appear in the form of blade borers in the earlier part of the Ertebølle Culture (Andersen 1965: 68). Similarly, T. Mathiassen refers to some heavy points from a collection from Hesselø (Mathiassen 1946: 171). Most of the finds from Irisdammen, as it is known, derive from the middle neolithic (Nielsen 1979: 23–48) although the finds are an open accumulation.

Pitted Ware A 1 points differ from Bromme type tanged points first and foremost with regard to technique of production. A 1 types are made on blades removed from bipolar, cylindrical cores by means of the so-called »soft percussion technique«. Bromme tanged points show the diagnostic traits of blades produced by »hard percussion technique« from conical blade cores, the blades all being struck in one direction (Madsen 1981: 16–20). The late glacial tanged points have a series of morphological elements which can be seen on whole examples. An intact, smooth section of striking platform can often be seen, where the point of percussion is clearly visible as a ring-shaped break above a well-developed bulb of percussion. On some points the proximal end is subsequently removed during the making of the tang. The negative scars on the dorsal surface, and the curvature of the blade, show whether these blades are of neolithic type. Neolithic blade points, even heavy A 1 types, are generally smaller and lighter than late glacial ones; their tangs are shorter and lighter in proportion to the blade. Bromme tanged points most commonly have a longer tang, and it is always broad regardless of how short it might be (Taute 1968, tafel 11, 12).

FIND ACCUMULATIONS AND SETTLEMENTS

At 9 localities within the former Randers county, surface collection has established traces of late glacial settlement. Two of these are now excavated. Of the remaining 7, 4 are categorised as settlements, while the other 3 are find accumulations which have not so far produced finds of associated flint working. The find from Fjellerup Mark (Taute 1968: 95) consists of 4 tanged points, and belongs to the last category. The find was in the National Museum as early as the 1890's, but it has still not proved possible to pinpoint the findspot more closely than a 0.5 km^2 area, within which one additional late glacial find is now known. Another surface find, which belongs to the Djursland cluster, comes from Ring, south of Auning. The find includes 1 tanged point, 2 blade scrapers, 2 dihedral burins and some typical blades. The tools are typical of the Bromme culture, but

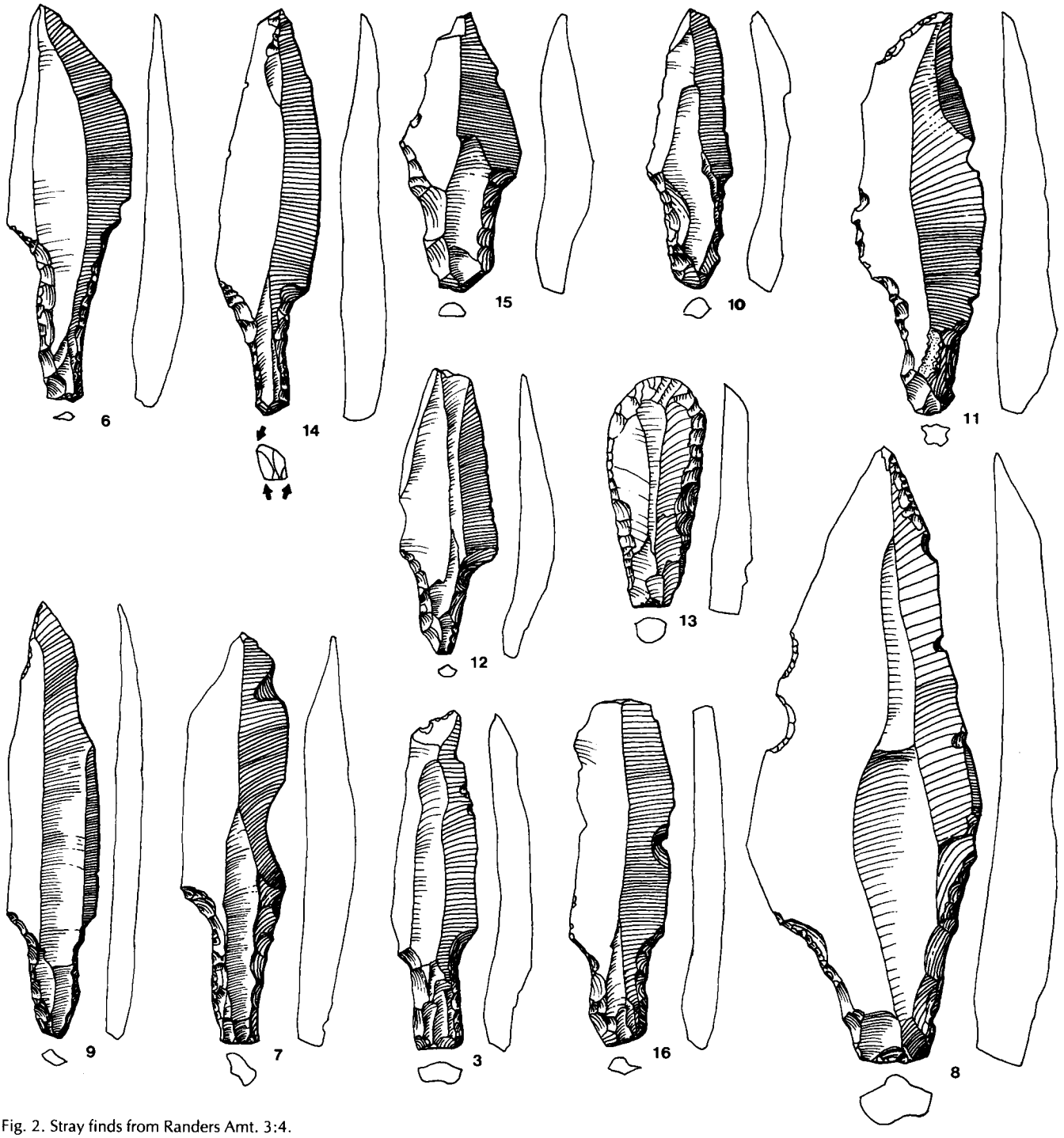

Fig. 2. Stray finds from Randers Amt. 3:4.

were collected from an area with post glacial occupation mainly of neolithic date.

Most notable is the western grouping of late glacial settlements on the Gudenå River immediately north of Langå. That the area was occupied in the late glacial has long been known. During peat cutting in a bog near Hjorthede west of Langå the palmate part of a reindeer antler was found, which had traces of working. The

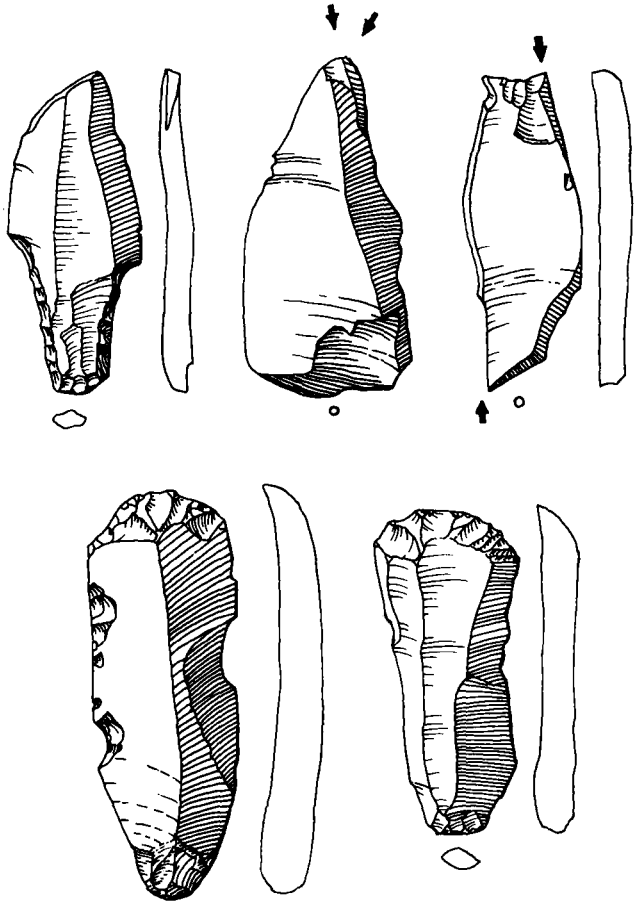

Fig. 3. Selection of surface finds from a settlement at Ring, Randers Amt. 3:4.

antler is pollen dated to the Younger Dryas (Degerbøl and Krog 1959: 17). In the period 1977–1980 4 definite settlements were located near Langå, as well as one site with blades and flint waste. The settlements lie together on a late glacial terrace c. 15 m above the Gudenå River. In the lower areas nearer the river, many settlements of early and late mesolithic date were already known. Despite repeated surveying, it was not previously possible to establish the presence of earlier finds in the area. The first settlement appeared only in connection with draining and deep ploughing, in an area which had earlier been extensively surveyed. Single finds of tanged points are still not known from the area of the lower Gudenå. In addition to this the finds collected from the late glacial settlements at Langå show that the inventory was dominated by scrapers and burins. The following list includes, apart from the local east Jutland finds, all other finds which have been published or are otherwise accessible from the rest of Jutland (fig. 13). It must be emphasised that the distribution is still very incomplete. Among other things, the number of late glacial settlements known through surface collection in southern Jutland is now increasing greatly (2).

Excavated settlements:

1. Søvind.	FHM 2174
2. Løvenholm.	KHM 27/74
3. Langå I.	KHM 30/77
4. Jels I.	Haderslev Museum 1356

Settlements known by surface collection:

5. Hjarup.	(Andersen 1977: 18–27)
6. Silkeborg.	(Silkeborg Museum no. 2–4/78)
7. Ring.	KHM 163/81
8. Langå II	KHM 100/80
9. Langå III	KHM 355/82
10. Langå IV	KHM 356/82

Find accumulations:

11. Fjellerup Mark.	NM A 16296–16299
12. Fuglsø Mose.	KHM 140/78
13. Fjeldholm.	KHM 1/83
14. Refshalegård.	(Mathiassen 1937: 150)

15. Hjarnø, submarine find (Fischer 1978) (7).
16–19. Jels (2).
20. Aaes (8).

THE LØVENHOLM SETTLEMENT

The site is situated in a high area of bogs, about 30 m above sea level. The area, which today is heavily wooded, is sandy, and cobbles and larger stones are scarce; several waterfilled kettle holes are in the immediate vicinity. The settlement was discovered during the surveying of a peat-litter harrowed area. This harrowing had removed most of the secondary peat formation which originally covered the settlement. Geological conditions indicate that the settlement is of late glacial age, although scientific dates do not yet exist for the settlement horizon or the secondary peat. Conditions of deposition, with a considerable vertical spread of flint items, are regarded as the results of permafrost phenomena. Microwear analysis of the surfaces of the

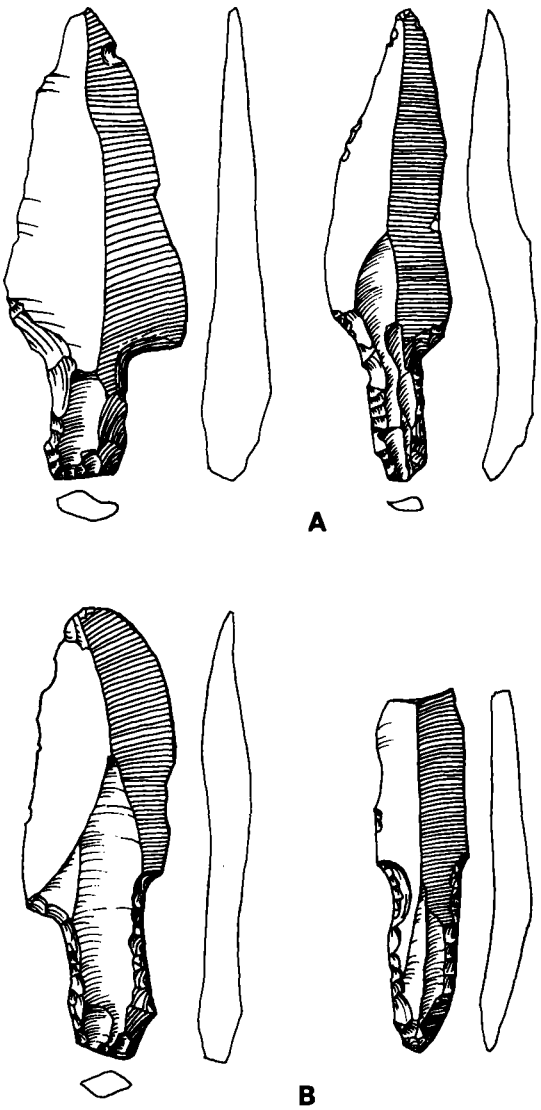

Fig. 4. Tanged points collected from the surface. A, Fjeldholm. B, Fuglsø Mose. 3:4.

flints show the characteristic polish caused by freezing and melting.

Two separate areas of worked flint, measuring 6 × 8 and 3 × 2 m^2 respectively, were uncovered within the excavated area which amounted to a total of 130 m^2 (fig. 8). Find area I, the larger of the two, produced all the tools and most of the other pieces of worked flint on the site, 465 pieces of worked flint in all. A concentration of burnt flint marked a possible hearth. Find area II produced no typical flint tools, only a few pieces of flakes and cores, 28 in all. Two hammerstones were also found, as were many small fragments of frost-shattered

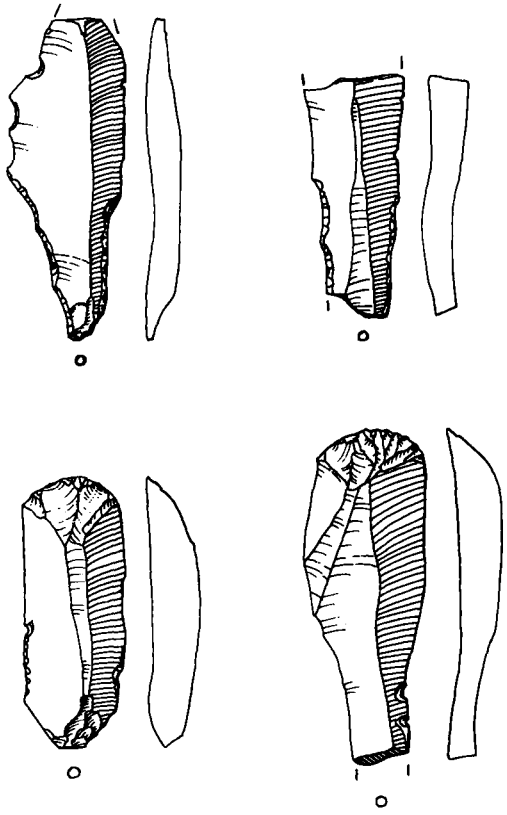

Fig. 5. Selected tools from the Langå II settlement. Surface finds. 3:4.

flint nodules. The contemporaneity of the two find areas is shown by the fact that pieces from area II can be joined to pieces from area I.

The Finds

Twenty four tanged points dominate the inventory, and display considerable size variation (fig. 6). They include both typical, large and heavy tanged points, and smaller, lighter pieces of similar size to points of Ahrensburg type. Length varies from 8 to under 4 cm, breadth from 2.6 cm for the heaviest to 1.3 for the lightest. Technically they are all similar, with the tang shaped from the ventral side. Several pieces have oblique retouch at the point. The tang retouch must be described as steep and rather rough, although in a couple of cases, where the blade was already of the desired breadth, only very limited modification of the proximal end is seen. On two of the tanged points, retouch here is less than 2 mm high. All points have relatively broad tangs. Most are wider than 1 cm. This is partially re-

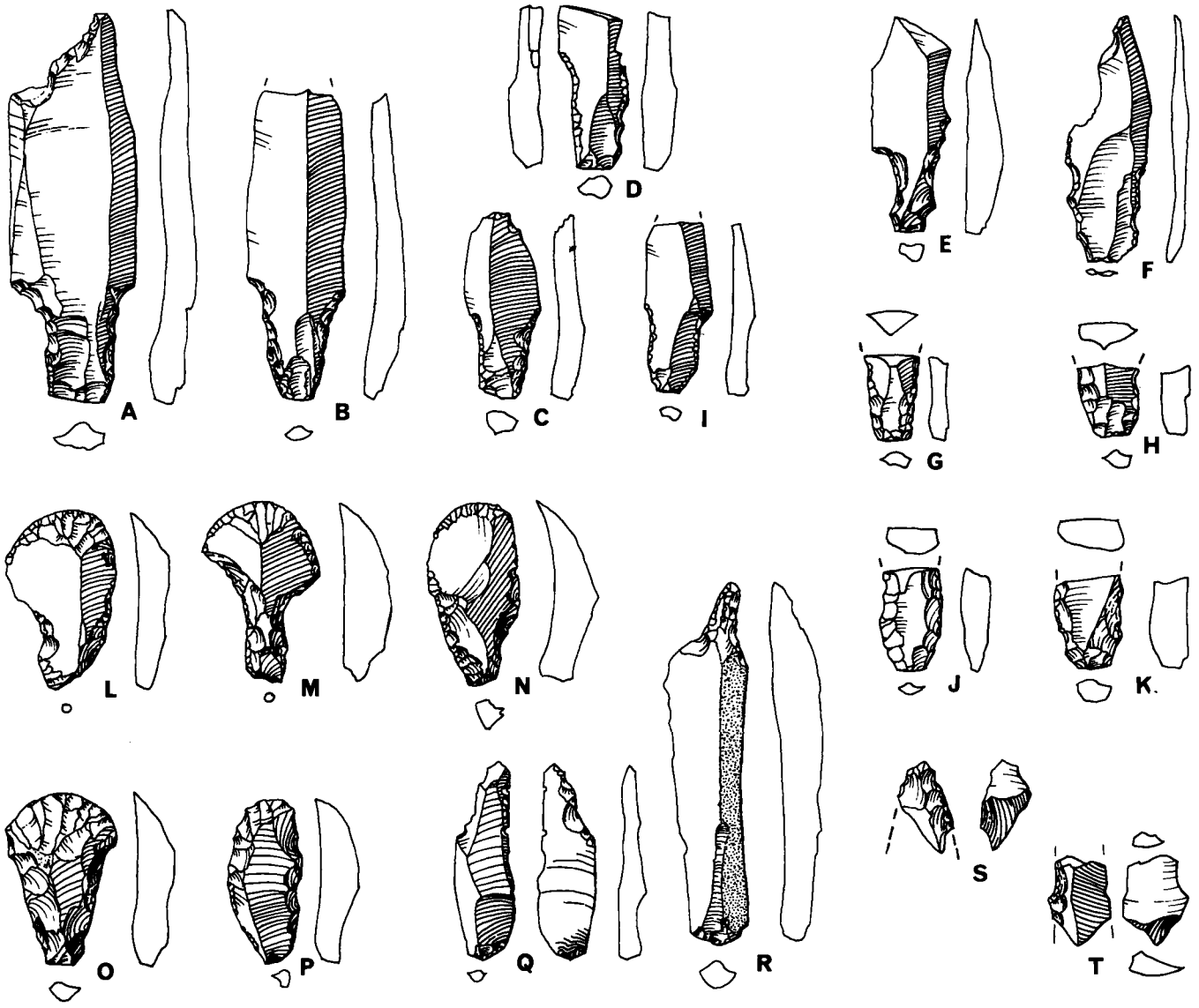

Fig. 6. Flint tools from the Løvenholm settlement. 3:4.

sponsible for giving them their powerful feel. About half the points have typical macroscopic traces resulting from the penetration of meat or bone (Barton and Bergman 1982: 237–248). Several points are also broken across between blade and tang in a way suggestive of hunting damage. In 6 cases, only the tang itself is present.

The find includes 16 scrapers (fig. 6), all being end scrapers with convex edge, produced on blades or oblong flakes. They can be divided into four groups: 1) Blade scrapers with edge on the distal end, and no further retouch. 2) Double scrapers with or without partial edge trimming. 3) Scrapers with double edge trimming to form a thick, pointed tang at the proximal end. (Only two of the 8 scrapers in this category could from a morphological point of view be made from broken tanged points). 4) Scrapes with parallel, double edge trimming.

The scrapers are small, only 3.5 to 6 cm in length. 3 showed a relatively steep scraping edge. Most of them are, however, shaped with unusually fine and regular flat and lamellar retouch. There are two edge fragments

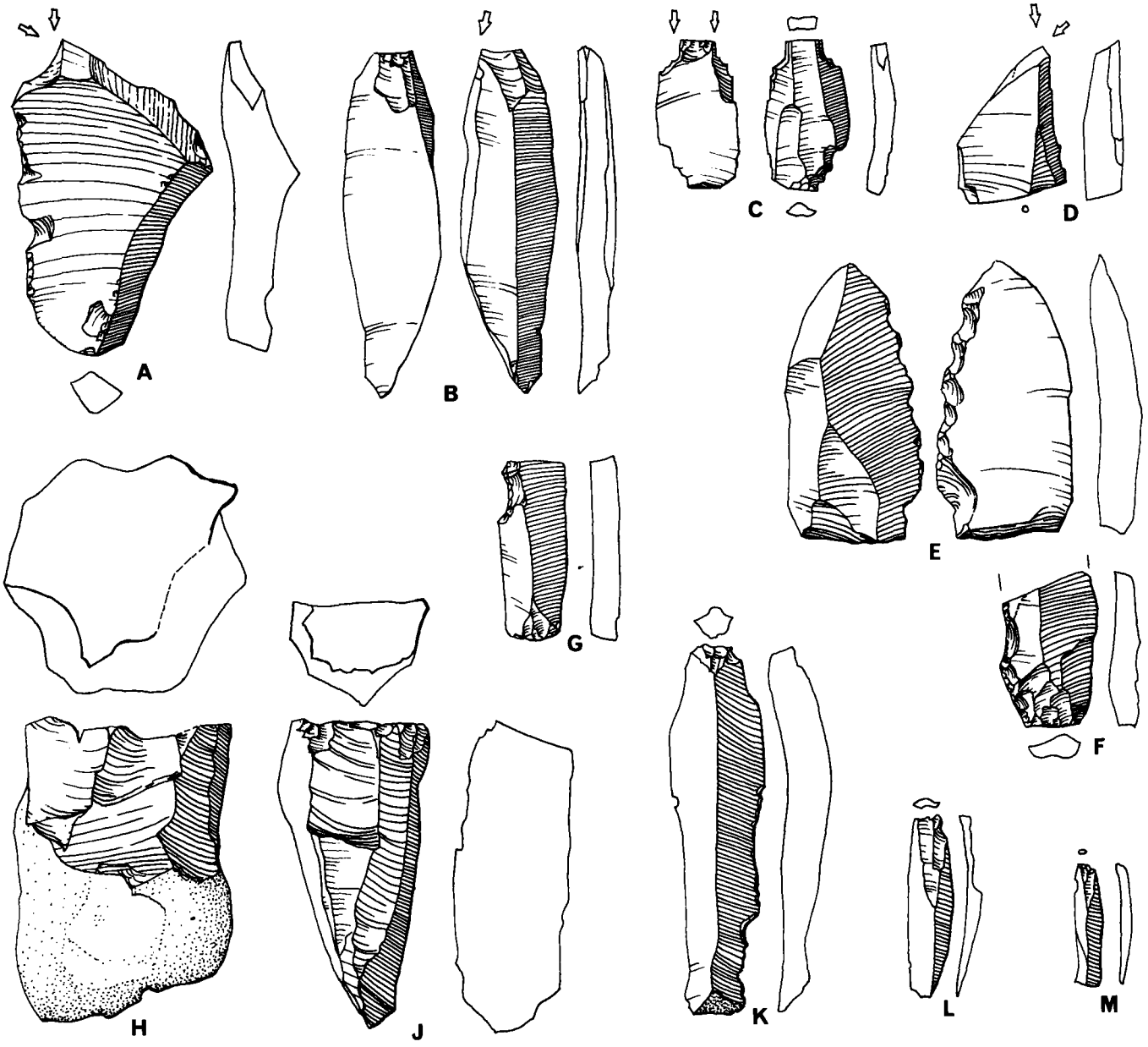

Fig. 7. Flint tools and various artefacts from the Løvenholm settlement. 3:4.

suggesting a »nosed« edge (Tixier 1980: 85), and a blade scraper (fig. 9, A) which is double edged, and where the oblique, rather steep edge (fully preserved at the proximal end) has a hint of a shoulder. The tool can best be described as a »kratzer« (Rust 1958, Taf. 53,5).

There are 7 burins (fig. 7). 2 are dihedral, one being a typical double blow burin. Two made on broken pieces are unusually small, being respectively 2 and 3 cm long. The longer is made on a blade, where the burin blow is made from the distal end »sur un talon« (Tixier 1980: 77), and runs along one side (fig. 7, B). 9 burin spalls were recovered, all with remnants of a smooth striking platform.

The tools also include 3 borers, from 7.5 to 3.5 cm long (fig. 6, Q, R). The longest has a shape characteristic of the so-called »zinken«. Another corresponds in

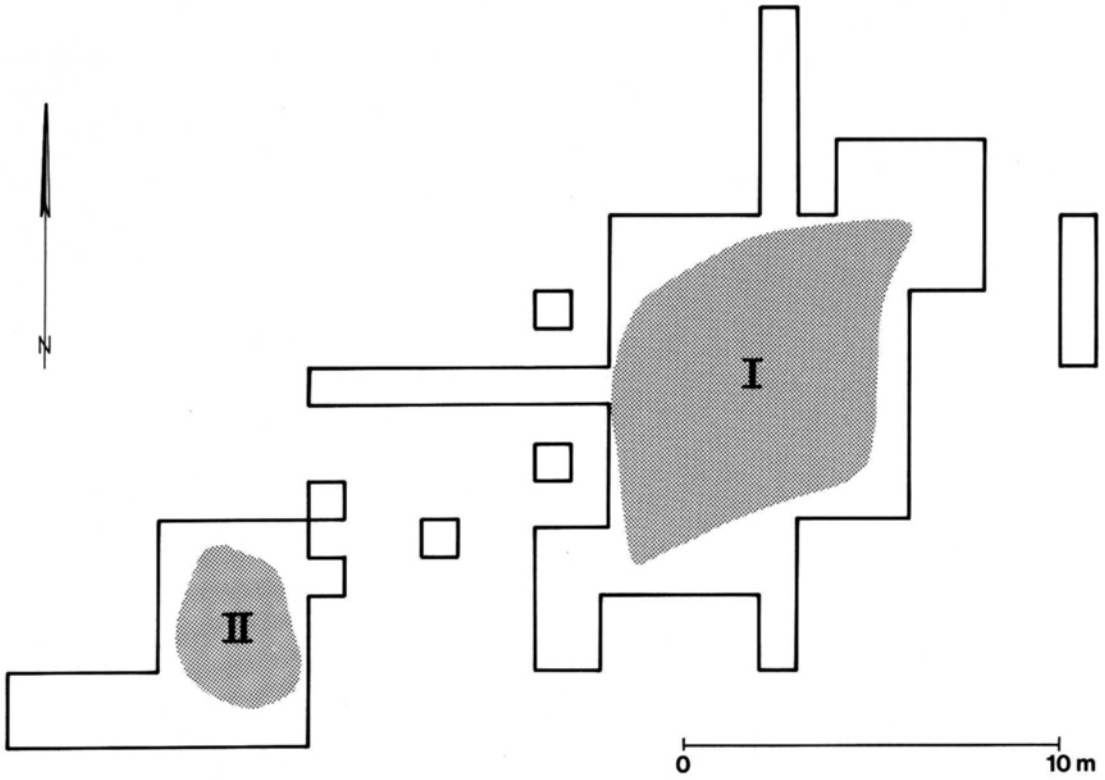

Fig. 8. The distribution of worked flint at the Løvenholm settlement.

shape and size to an example from Bromme (Mathiassen 1946, fig. 9).

The rest of the inventory consists of 3 blades with trimming along the long edge (fig. 7, E, F). One has denticulate retouch. Another has retouch that can best be described as wavy (Rust 1958: 33). Besides these, several blade fragments with partial retouch were found, including 5 notched pieces.

Two pieces have a particular shape (fig. 6, S, T). Both are flakes removed from the sharp end of a worked point. The points is formed by flaking from the ventral surface. The retouched side then formed the striking platform for the removal of the flakes in question, which were detached by means of so-called lateral transverse flaking (Tixier 1980: 67). There is a superficial similarity between the byproduct of the so-called microburin technique and these »pseudo-microburins«. The latter are merely removed from the outermost part of a blade retouched to form a point. This could happen if a borer or »zinken« was used with a seesaw or wrenching motion. Either these are broken during use, or the technique is some kind of sharpening.

Evaluation

The Løvenholm inventory is characterised by many small, lightweight tools. Consumption of flint was limited, blade and flake cores being used to the very end. Blade production is shown by the presence of 37 unretouched blades and fragments of 70 more. The starting point was conical, monopolar cores (fig. 7, H, J). Judging from size and cortex type, these are produced from the very rare, locally available ice transported flint. The quality of the utilised flint can be said to be relatively good; it is homogeneous, and as far as the tools are concerned, translucent. Some cores and flakes show, however, that attempts were made to work frost shattered and inferior flint.

Many of the flakes, blades and cores, and a few of the tools could be joined together. The analysis (cf. Cahen et. al. 1980: 209–259) is not yet complete, but one main conclusion is that some of the big tools were brought to the site from elsewhere. Examples are found among the tanged points, burins and unworked blades. None of the burin spalls fit onto any of the burins, and so

could belong to burins produced on the site but not left there. They could have been taken along to the next campsite as replacements for the worn out burins left at Løvenholm. It has already been mentioned that two of the scrapers could be on old tanged points, reworked into a new form and function. This intensive use of flint is also shown by the fact that many of the scrapers' edges show signs of having been sharpened (Håland 1979: 85–94).

Microwear analysis

The flint tools from Løvenholm have been examined for traces of microwear (4). The examination (Madsen 1982a: 11) showed that most surfaces of the flint tools have secondary polishing. In only a few cases is definitely identifiable microwear present. A tanged scraper with flat, lamellar retouch shows wear from scraping on dry skin. A so-called blade scraper with steep retouch (the above-mentioned »kratzer«) has wear along its long edge from cutting siliceous plants – it was presumably used for cutting grasses. In both cases the tools have been in contact with materials which leave the strongest traces of wear (fig. 9).

THE LANGÅ I SETTLEMENT

The site is located at the foot of an east facing slope, 15 m above sea level. The excavated site is the southermost of a group of 4 known late glacial settlements. The first finds were made following draining and deep ploughing (5). Since then intensive collection has been undertaken on the site. The archaeological investigation was carried out to save the threatened settlements.

The excavation confirmed that much of the settlement layer remained in existence. Before cultivation began, the findspot was a wet area in which water often stood. The settlement layer had been protected by a 10–15 cm thick layer of waterborn clay, and above that various peat formations. Under the clay lay finegrained late glacial sand, in the upper part of which lay the finds.

No scientific dating of the site has yet been carried out. A provisional evaluation of a single sample from the overlying clay suggests that postglacial pollen is absent. In the finds horizon, it was noted that some of the objects had been moved by what was interpreted as permafrost action.

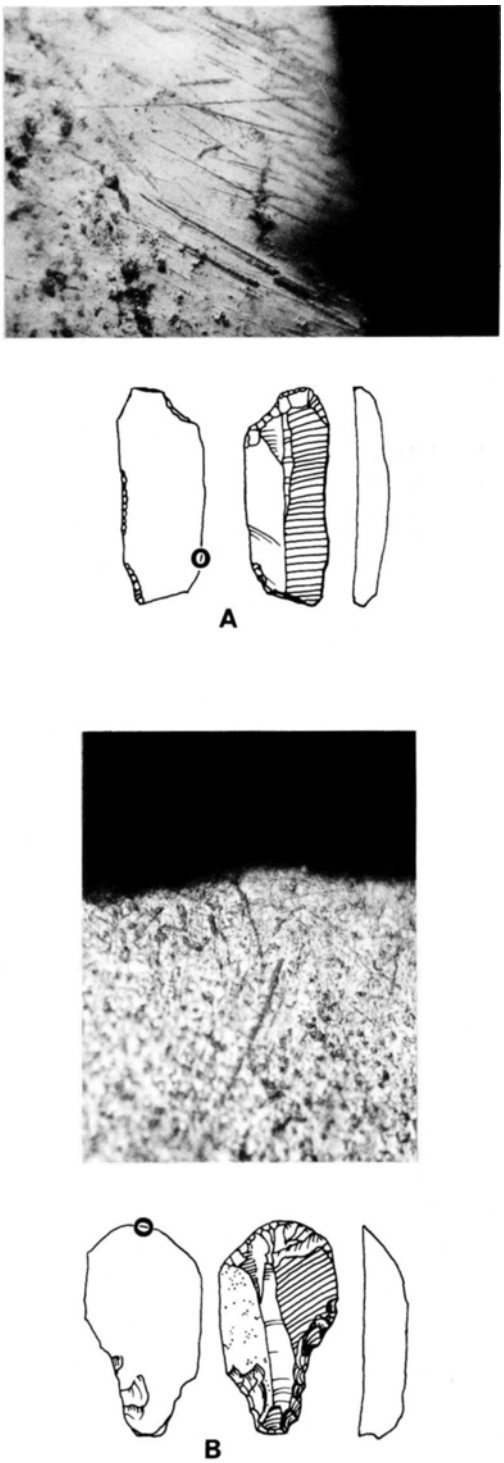

Fig. 9. Micro-wear on flint tools from the Løvenholm settlement. A, scraper on blade, or *Kratzer*, used for cutting plant fibres. B, scraper used on dry hides. Drawings 3:4. Microphotography: Peter Rasmussen. Magnification c. 240 x.

Thanks to the damp conditions, it was possible to recover faunal remains for the first time in Jutland, although these were scarce, consisting of a few whole teeth, and some fragments of bone or antler. This material has not yet been identified.

160 m^2 were excavated. In this area on oval concentration of finds was uncovered, oriented NW–SE and measuring about 8 × 5 m (fig. 12). In the centre of this was a small (0.3–0.4 m across) deeply dug fireplace, clearly marked by an area discoloured by sooty, washed out charcoal. 2 distinct flint working areas were recognised within the finds concentration, marked by many microflakes and a few scale-like slivers from bulbs of percussion. The 2 areas were particularly visible because of their concentrations of blade cores, core trimming blades and many heavy overpassed blades. In the southeastern area a hammerstone of porous sandstone was also found. Even during advanced preparation it could be seen that many of the flints could be rejoined, so that little horizontal disturbance had taken place.

The Finds:

2100 pieces of worked flint come from Langå I. There are 40 tools, 1 hammerstone and some blades with retouch acquired during use. 850 worked flints come from the surface collections and from the lower part of the ploughsoil, including 13 tools. These show virtually no plough damage, and occurred in a remarkably concentrated area, all within 5–6 m. The find is treated as a unit, and will be described as such in the following.

The largest tool group is the scrapers (fig. 10, F, L). All 18 have convex edges, which are generally made with flat, lamellar retouch. The blade scrapers, totalling 10, are made on long, regular blades; the longest scraper measures 9.9 cm. The sizes of 2 flake scrapers (5.5 × 4.5 cm and 6.5 × 4 cm) are similar to those of neolithic flake scrapers, and in accordance with the scrapers from the lower level at Bromme (Mathiassen 1946: 145). The other flake scrapers are small, down to 3.5 cm in length, with edge proportions similar to those of the blade scrapers.

The 14 burins are typical, heavy pieces with broad burin edges. They can be divided into 4 groups according to method of production: 1) Doubleblow burins, including 7 dihedral and 2 angled burins. 2) Burin blow on retouch, 2 examples. 3) With transverse burin blow, 2 examples. 4) Burin blows on breaks, 1 example. Three burins are produced on blades, the rest on oval flakes. 17 burin spalls were recovered, and several of these can be joined with particular burins.

The material includes 1 typical tanged point (fig. 10, D), which was found in the ploughsoil. This is a heavy piece with a length of 7.1 cm and a breadth of 3 cm. Another piece was found during surface collecting, being a pointed blade with very slight proximal modification (as Andersen 1972 fig. 69). From the bottom of the ploughsoil, just at the northwest edge of the finds concentration, a lanceolate point was recovered. The tool was produced on a macroblade, is thick and broad, and shaped with heavy retouch at the points. It is 3.6 cm long, 1.4 cm broad and 0.4 cm thick (fig. 12).

The remaining lithic items comprise 412 blades, 168 blade fragments and 15 blade cores (fig. 11, A–B). Besides these, there are also the characteristic waste products associated with blade production: 13 platform rejuvenation flakes and 19 heavy, overpassed blades (Andersen 1972: 25). The blade cores are dominated by 12 examples of the conical form with a single striking platform. The rest are subcylindrical with two platforms. The blade material can be divided into three groups: 1) large, heavy blades, often running down the whole side of the core from platform to distal end, with large remnants of the striking platform. In cross section they are thick, polygonal and lumpy or triangular. Length is up to 15 cm. 2) Narrow, often barely curved blades, often tending to hinge fracture at the distal end, and often, because of the core shape, naturally pointed. Length from 4 to 12 cm. 3) Microblades. These are closely associated with the area where flint working took place. There are about 150 microblades at Langå I.

Several flint nodules up to 20 cm in diameter were found, which still had their primary cortex. Several of the flakes weighed up to 500 g, and derived from »opening« or »quartering« (Clarke 1935) such nodules.

Evaluation

In summary, the find is characterised by few, but powerful and relatively large tools. Flint working is completely dominated by blade production, to the extent that the flake: blade ratio is 5:1. The utilised flint is not only of good quality but also demonstrably local in origin. The immediate environs of the site have much icetransported flint, within a couple of hundred metres of the settlement.

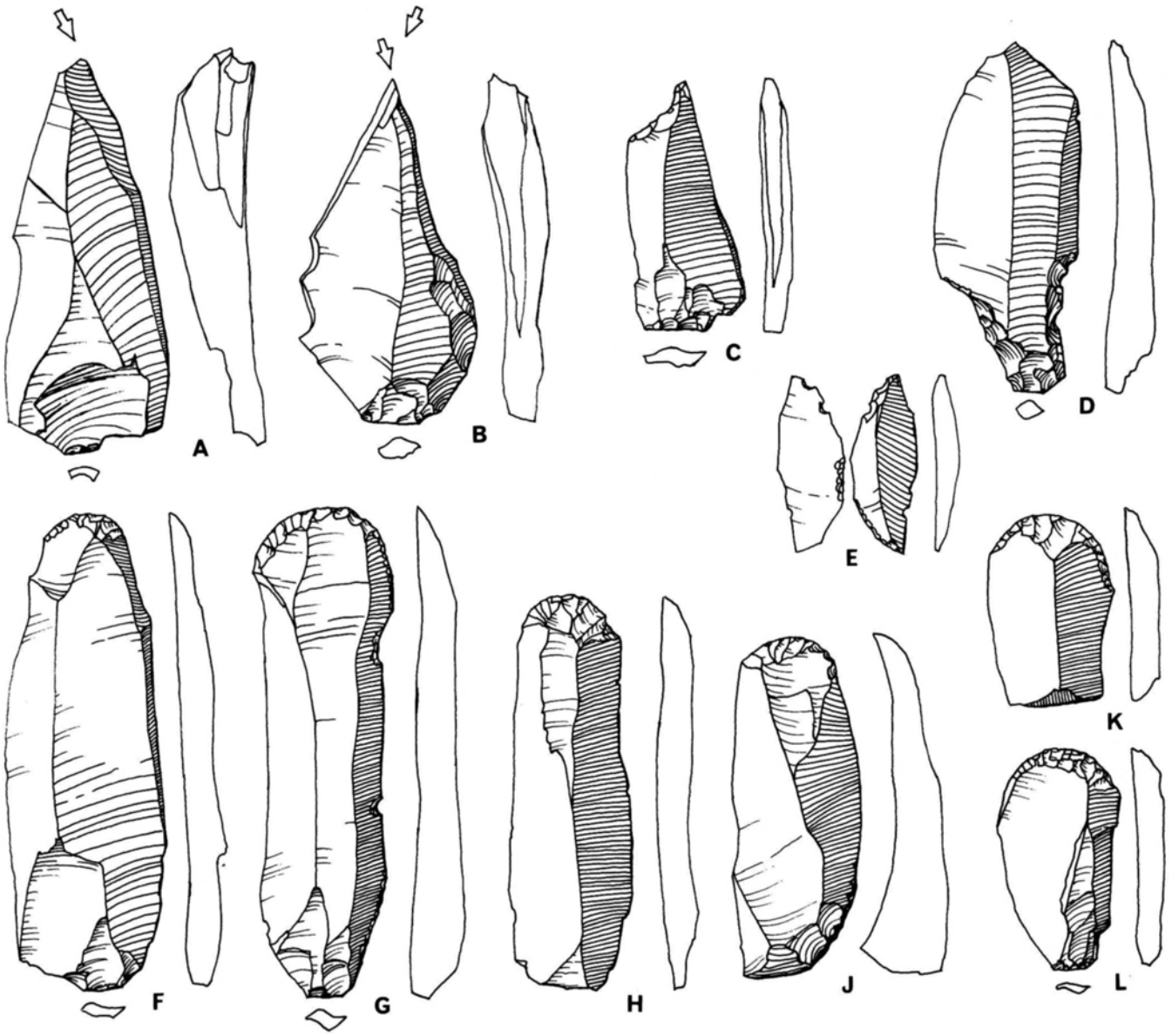

Fig. 10. Flint tools from the Langå I settlement. 3:4.

FLINT TECHNOLOGY AND THE SUPPLY OF RAW MATERIAL

Tools of the Bromme culture are made on blades or blade-like flakes (length 1.5–2 times the width). The blade cores are either conical with one striking platform, or subcylindrical with striking platforms at both ends. The cores have a rear side from which no blades have been removed, and a »front« covered in negative blade scars. On the edge between the striking platform and the scarred front there are most commonly traces of heavy trimming. The striking platform consists of a flat flaked surface. The method involving the production of a carinated blade was not employed. The only tendency in this direction was the use of partial, monofacial trimming at the distal end. The first stage in the blade producing process was the establishment of a proper striking platform, from which the first 3 or 4 blades or

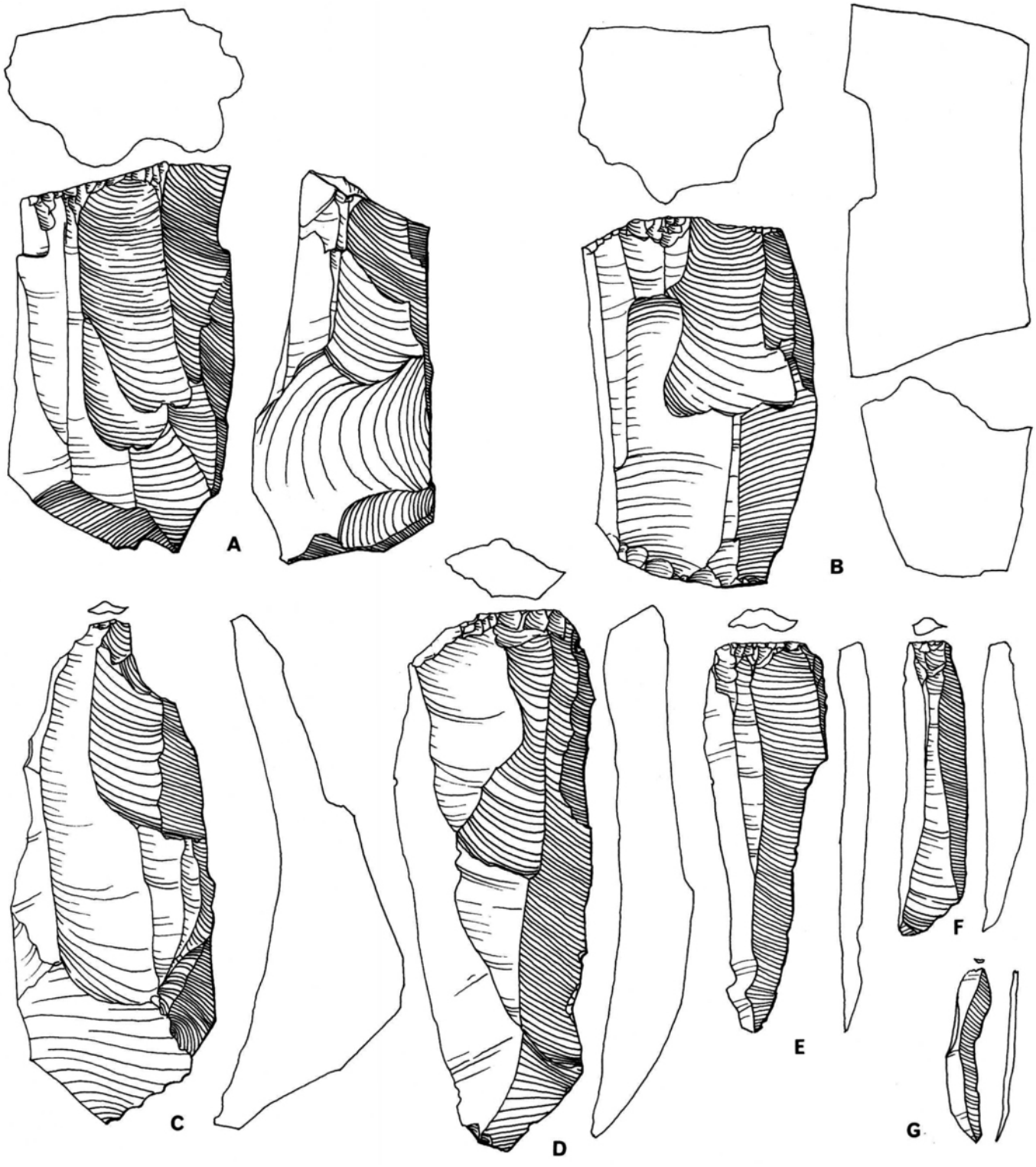

Fig. 11. Flint artefacts from the Langå I settlement. 3:4.

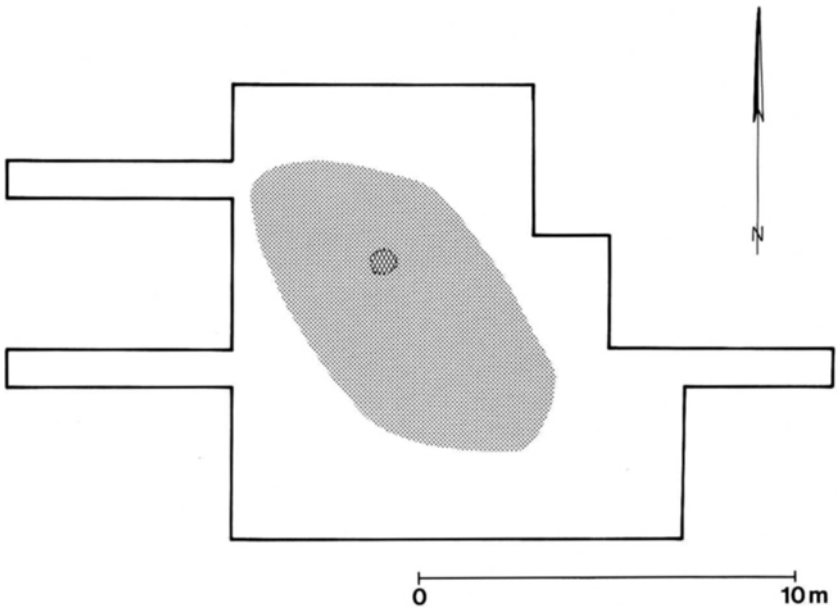

Fig. 12. The distribution of worked flint at the Langå I settlement.

blade-like flakes were struck. This operation produced the facets necessary for the production of further blades. These large removals often take off up to half the weight of the core. Trimming of the angle of the blade core before each blade was struck produced microblades and microwaste. Experimental replication of the flint technique of the Bromme culture (Madsen 1981) showed that the striking of blades and flakes was carried out with hammerstones in the size range 300–800 g. Not only is the morphology of the blades and cores evidence of a »hard percussion technique«, but certain evidence is also found at knapping sites like Langå I, with the common occurrence of flakes with »accident siret« and blades with »languette«-like breaks (Tixier 1980: 103, 108). T. Mathiassen (1946: 144) noted at an early stage that edge working of the Bromme scrapers differed from that known from mesolithic and neolithic types. Langå I scrapers are typical of the Bromme type. They have a very regular, convex edge, on which the retouch is flat and lamellar. It is typical of most of them that the angle of the scraper edge is below 60° (Andersen 1972: 28). Even the large flake scrapers can easily be distinguished from e.g. early neolithic scrapers, on the basis of the negative scars on the scraper edge alone. On scrapers of Bromme type these are always clearly bounded with a clear parallel/converging tendency, and the edges themselves are sharp. This edge morphology is a typical product of the »soft percussion technique«.

Most of the Løvenholm scrapers show the extremely fine application of lamellar retouch, with long, parallel negative scars. Almost no signs of edge damage are visible. The scraper edges are remarkably small, about the size of a thumbnail. Scar morphology on these scrapers is typical of flat flaking undertaken with the pressure technique with an antler or bone flaker (6).

Langå I is a settlement where blade production has clearly been of superior importance. The proportion of blades and blade tools to flakes was, as mentioned above, 1:5. In other words, the so-called »lamellar index« (Bordes 1970: 322) is about 20%, which is very high compared to Løvenholm, Bromme (layer A) and Bro I, where 8–10% of the material is blades. Løvenholm's flint objects have a diminutive feel. The amount of waste products are in themselves sufficient evidence of intensive use of flint. The settlement is located in a fairly high region, and local supplies of flint are very scanty. There is plenty on the north coast of Djursland, about 25 km northeast at Gjerrild and Fornæs, but this only became accessible in postglacial time due to erosion by the Litorina Sea. The Langå I find is distinguished by its content of many regular, unworked macroblades, which together with the flint nodules on site reflect the local abundance of flint. The settlement is in an

area subjected to considerable glacial activity in the late Weichsel. In the late and post glacial period the area was cut by large watercourses. Erosion by these along many sloping hillsides must have exposed the local deposits of moraine deposited flint.

ARTIFACT ASSOCIATION AND TYPE VARIATION AT LØVENHOLM AND LANGÅ I

Compared with other late glacial finds, the newly discovered settlements have modest amounts of worked flint. Langå I is the same size as Segebro (Taute 1968: 154). Løvenholm is rather different, being proportionally one of the richest in tools of the tanged point groups. About 10% of the total inventory consists of characteristic tools. Exactly the opposite is the case at Trollesgave I, which contained under 1% tools. In size, Løvenholm is parallelled by the Ahrensburg settlement of Borneck-Nord (Taute 1968: 82), which contained about 600 worked flints, of which about 5% were tools. A Federmesser site by Schalkholz (Dithmarschen) exposes a similar amount of tools and artifacts (Bokelmann 1978: 36).

Løvenholm and Langå I are linked by some common features such as similar blade and flake technique, and the appearance of some identical tool types. The predominant tool at Løvenholm is the tanged point, of a type which has hitherto been regarded as a type artifact of the Bromme Culture. The scrapers and burins at Langå I are of classic form, and correspond to those from several Bromme culture settlements which have many scrapers and burins but few points.

The things which distinguish Løvenholm from Langå I and the other traditional finds must be conditioned partly by different activities and variable access to raw materials, and partly by chronological factors. Low availability of raw material influences the degree of utilisation of the blade cores, the size of the tools, and the degree of modification and reworking of the tools. Lack of raw material may have been a crucial influence on the decision to resharpen scrapers and re-use tanged points. As far as Løvenholm is concerned, this intensive tool use at least reflects practices in which the collection of raw material and production of blades were given a low priority. The find gives an episodic impression, the main activities having been connected with hunting and in particular with its products. For example, projectile points must have been changed on the site, because of the many fragments of points, which were presumably brought to the settlement still attached to their shafts. Butchering of animals can be inferred from the presence of a number of points with impact damage; these might have been lodged in joints of meat brought from a nearby kill site. The many scrapers, of which only one has microwear, and that from dry skin, may have been used on fresh skins; this would produce such faint wear traces that they might have been removed by the secondary »solifluction polishing«. The few burins, borers and other retouched pieces represent ancillary activities, for which other parts of the Bromme culture's basic tool kit was used.

SETTLEMENT PATTERN

From the Løvenholm area, a number of large bogs extend northeast towards the northern coast of Djursland; these are Gjesing Mose, Fuglsø Mose and Stenvad Mose (mose = bog). It is believed that these bogs in the late glacial period formed a virtually interconnecting system of lakes. The area is bounded to the west by the Gudenå valley, and to the southeast by the Kolindsund fiord. Most of the finds described here, namely 2 settlements, 3 find accumulations and 6 single finds, derive from this area.

Despite the fact that the finds, like those on Zealand, group along small rivers and lakes, the sites are still »inland« and relatively high-lying (by Danish standards), and some distance from the major rivers.

The Langå settlement group are the first true terrace sites known. They are placed so that they have an excellent view, and are near a T-shaped river confluence (Gudenå and Lilleå rivers); their location is reminiscent of French late Magdalenian sites (Schmider 1982: 260). Further up the Gudenå near Silkeborg is another findspot with a nearly identifical location (fig. 13,6).

This picture is however provisional; it presumably reflects both real patterns in the prehistoric data (clustering of late glacial finds), and also the tendency of amateur archaeologists to collect flints near their own homes and in places which have already produced finds. Djursland is a good example of this.

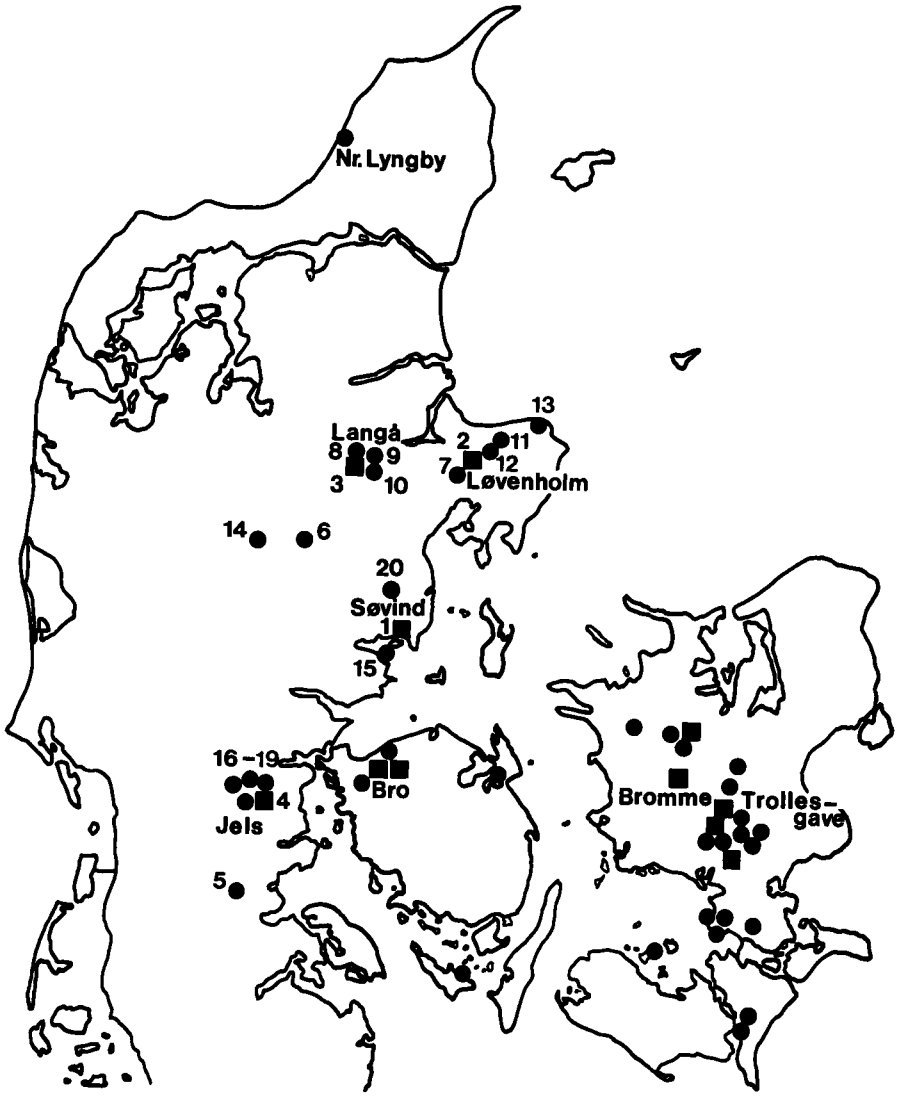

Fig. 13. Late glacial settlement finds from Denmark. Square signatures indicate excavated sites.

DISCUSSION

With the publication of the settlement of Bro I, distinguished by its very detailed description of the lithic inventory, the Bordes-type statistical and typological methodology arrived on the scene. The internal chronology of the Bromme culture was analysed by means of the statistical treatment of three settlement finds: Bromme, Bro I and Segebro (Andersen 1972: 49). Internal variation in the frequencies of scrapers and burins were said to be chronologically determined variables. The proportion of dihedral burins to those of other types was also viewed as chronologically significant. This has most recently been discussed by A. Fischer (1978: 33), who has gone a step further with a technological-typological seriation of different types of tanged points. As the descriptions of Langå I and Løvenholm hopefully indicate, considerable variations in the assemblage composition and size can occur between certain Bromme culture sites. Certain technological and typological factors imply that this variation is chronologically determined, while others suggest that it is determined by different activities being carried out. The large increase in the number of settlements now per-

mits synchronic studies to be applied to a greater extent. Availability of raw material, for example, would be expected to vary between settlements. The type combination from different settlements must reflect different activities, and cannot only be chronologically determined.

Using ethnoarchaeological observations as a basis (Binford 1978: 330–361), it still seems reasonable to speak of general patterns, which reflect structures and strategies in the settlement pattern of the late glacial North European Plain – an approach already adopted by D.A. Sturdy (1975: 55).

A group of finds, called the Bromme culture by archaeologists, now includes over 50 settlements in Denmark alone (7). This is a considerable concentration within a geographically limited area, which is reflected by the scatter of Bromme-Segebro group finds in Schleswig-Holstein, southern Jutland, eastern Jutland, Fyn, Zealand and Scania. This area also has many finds of cast antler, particularly of younger dryas date (Degerbøl and Krog 1959). The Zealand concentration can perhaps be seen as an expression of the importance of the area as a corridor for migrating animals leading towards the periglacial zone of central Scandinavia (Sturdy 1975: 70).

Different settlement inventories seem now to be visible in the finds. If a model was to be put forward on this basis, it would have to include various settlement types carrying out different activities: 1) Base camps, represented by large settlements, possibly with evidence of repeated settlement, where a combination of most of the artifact types would be expected, but particularly those connected with permanent activities – for example burin types connected with bone and antler working. 2) »Quarry« sites. These would have a high lamellar index and many waste products resulting from blade production, and few tools. 3) Hunting stands, sites with indirect evidence of hunting: many tanged points with impact damage, tang fragments, many scrapers. Few other tools, and those mainly of »light duty« types. 4) Kill sites, with large numbers of tanged points, and also blades (knives). No, or very limited, traces of an accompanying flint industry.

The establishment of 4 settlement types is best taken as support for what G. Clark described as »optimistic archaeology« (Clark 1975: 5). We must of course expect that our view of what constitutes an activity indicator will be somewhat blurred. First and foremost, not enough is known about the actual use to which late glacial tools were put. There is still a dichotomy between the need for an archaeological type classification (whether it is used for normative or statistical typology), and the need to understand the function of the artifacts, their degree of use, and their modification. The problems involved can be fully appreciated by studying the present day hunter-gatherers who still use stone tools to a certain extent (Gould et al. 1971: 149–169). The tools called burins by archaeologists may rather be the expression of a particular mode of manufacture than of a particular function. One example from the Løvenholm settlement is the archaeologically-termed scraper, which on the basis of microwear study can be shown to have been used for cutting plants!

Some sites are used more than others (preferred sites), and some were used as transit camps. In the former case, it is difficult to distinguish phases of occupation and activity areas by archaeological means. This is due both to the field methods in use and to the nature of the prehistoric remains. It must be realised that occupation of the preferred sites could have had different functions at different times of the year. For example, it might be that transit sites could be on the same spot as a base camp. Evidence of the different activities would appear mixed to archaeologists, unless ideal conditions of stratigraphy existed. Behaviour of late glacial hunters is unlikely to have been as rigid as archaeologists could wish. Despite this, the existing material does admit to some classification. Bromme and Stoksbjergbro I must primarily be base camps. Trollesgave I, Søvind and Langå I are regarded as sites where manufacturing activities played the most important part. Løvenholm is viewed as a hunting stand. The unique find from Ommels Hoved I would follow J. Holm in regarding as a kill site.

CHRONOLOGY

Langå I shows close agreement with another lateglacial find from Jutland, namely Søvind near Horsens Fiord (8). Søvind, like Langå I, has many scrapers and burins, lacks tanged points, has about 30–35 flint tools and a high lamellar index as evidence that intensive flint working took place (»quarry« site activity). The same burin types occurs as at Langå I, the latter having, however, a large number of dihedral burins. Both sites have

many scrapers, both on blades and on oblong flakes. Both sites produced a blade scraper with the edge at the proximal end. In the find from Søvind occurs i.a. a curved blade with lateral retouch of a form which is known from a number of the Ahrensburg sites. The combination in the Langå find of a tanged point of Bromme type and an asymmetrical, lanceolate point is also known from the typologically early sites at Ahrensburg (Tromnau 1975). In traditional terms, both sites »have later characteristics« (Fischer 1978).

A very provisional evaluation of the accessible finds does lead to the recognition of older and younger traits in the Bromme culture. In particular, the finds of Løvenholm and Jels have established contact back to the pre-Allerød single finds, and not least to the Hamburgian Culture (9). Løvenholm plays a key part in the discussion of Brommean chronology and origins.

The little hunting stand displays a mixture of traits characteristic of the Bromme culture and of older elements known from the Hamburgian. This culture has long been known via several single finds, such as the Refshalegård find, the Hvejsel point (Becker 1970) and most recently by the scraper from Stenvad Kjær on Djursland. Of similar age are worked reindeer antlers from Allerød and Middelgrunden (Degerbøl and Krog 1959: 9).

Among the Løvenholm scrapers are some that correspond in every detail with those from Jels (9), namely the type with flat, lamellar, pressure flaked edge and tang-like retouch along the sides. In Northern Germany this type has long been known within the so-called »Wehlener-federmesser gruppe« (Schwabedissen 1954). These scrapers appear here alongside examples with older traits such as »Gravette types«. Scrapers of Wehlen type are generally larger and heavier than those so far known from Denmark. In two surface collections from Brunsmark southeast of Hamburg, tanged scrapers of Wehlen type occur together with zinken and burins of Hamburgian type, with tanged points of Bromme type and with dorsally trimmed blades of Federmesser type (Trölsch 1976: 5–42). It would not be advisable to talk of »Federmesser influence« in Denmark on the basis of the Løvenholm find. The so-called Federmesser complex is in strong need of revision. The datings of the excavated finds rests mainly on typology, together with ambiguous geological factors. Schwabedissen (1954) concludes that a dating to both Allerød and younger dryas is likely. The latest, very secure, dates for the Tjongerian are, however, surprisingly late (Cahen et al. 1979: 662). There have long been good grounds to believe that dorsally trimmed flakes of Federmesser type have a wide chronological and geographical spread (Paddayya 1971: 257–70). As for blade scrapers with convex end retouch, this might be a case of a technological stereotype, where a technological need results in the development of a basic type which has no fine chronological value. The Federmesser complex should perhaps be regarded as a »quasi-culture« in the same way as the so-called »Gudenå culture« of Jutland (Mathiassen 1937).

The Løvenholm borers similarly find their closest parallels in the many »zinken« types in the Jels inventory. In this connection it is interesting to note that the so-called »pseudo-microburins« from Løvenholm are a detail which also occur at Jels. The flint technologies are generally similar, both being based upon a combination of »hard percussion« within the blade producing technique and pressure flaking on the scraper edges. The tools from both settlements are lighter than typical Bromme types. Due to the many typical tanged points the Løvenholm find must nevertheless be classified as Bromme culture. All the tanged points are furthermore of the type that A. Fischer seriates at an early point in the Bromme culture (1978: 32). In this connection it is notable that several are relatively small and light, a characteristic that was earlier (Taute 1968: 247) regarded as a chronologically late trait. It is probably more important to do as A. Fischer has done, and analyse details of shape and production technique of these points.

The Hamburgian points of Havelte type (Tromnau 1975: 40), known from Jels (Holm 1982) are technologically and typologically very close to the narrower versions of Bromme tanged points. They underline the close connections seen between the oldest Bromme and late Hamburgian in Jutland.

PERSPECTIVES FOR THE FUTURE

In Denmark the new evidence of late glacial settlement in Jutland has not only supplemented the already greater amount known from Zealand, but hopefully has also shown the way to a new understanding of the Bromme culture. The settlement material shows clear variations between settlements of the inland late glacial hunters. We still do not know what took place on the

coasts. Many unsolved questions remain regarding settlement pattern and economy. We look forward eagerly to the appearance of the first settlement with preserved faunal material.

It is still difficult to disentangle the chronological situation between the late glacial and post glacial cultures. The solution is probably not to be found in the excavation of a single settlement find. Discussion to date really consists of no more than suggestions based indirectly on the German chronology, despite the fact that it is based on settlements outside the core area of the Bromme Culture. It is necessary to understand the full range of variation in the local material before the hunt starts for »missing links« (Fischer 1982: 99).

There is a perspective for research strategy in the fact that the oldest settlements in Denmark are quite amenable to archaeological research. This is thanks to their limited size, and to a settlement pattern which put settlements in places that were rarely occupied later. The excavations at Langå I go together with the recently published excavations at Bonderup (Fischer 1982: 98) to emphasise the great value that lies in allowing rescue excavations to include palaeolithic settlement sites.

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NOTES

[1] The author did the collecting on behalf of the Culture Historical Museum, Randers.

[2] Personal communication from Fl. Rieck and J. Holm, Haderslev Museum.

[3] Investigated in 1980 and 1981 by the author on behalf of the Culture Historical Museum, Randers (J. no. 27/74, Gjesing parish, Sønderhald region).

[4] Thanks are due to Peter Rasmussen, of the Department of Natural Sciences at the National Museum, for undertaking the examination of the finds.

[5] Investigated by the author in 1982 on behalf of the Culture Historical Museum, Randers (J. no. 30/77, Langå parish, Middelsom region). Most of the material collected from the surface is still in a private collection. In the first published description the total artifactual material was incorrectly stated to be 3000.

[6] The scrapers were examined by Jacques Pelegrin CNRS, Paris.

[7] Anders Fischer of the Ancient Monuments Protection Department is thanked for freely allowing the author to use his maps of late glacial settlement in eastern Denmark. They will shortly be published (Fischer n.d.).

[8] Søvind was excavated by S.H. Andersen, Institute of Prehistory, Moesgård, to whom thanks are due for permission to examine this and other finds in the collection at Moesgård.

[9] The author is grateful to the excavators of Jels, J. Holm and Fl. Rieck, for valuable assistance on two fronts: for displaying the material from the 1981–1982 campaigns at Jels, and for discussing the implications of the Løvenholm find.

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Social Behaviour and Settlement Structure

Preliminary Results of a Distribution Analysis on Sites of the Maglemose Culture

by OLE GRØN

INTRODUCTION

A problem in recent mesolithic research is the striking discrepancy between the information we want to extract from the archaeological material, and the information the material actually reveals by conventionel archaeological methods. It is thus obvious that to achieve specific results of any significance an analysis of the social structure, the group structure etc. of prehistoric hunter-gatherer communities, must be based on novel theories and methods.

In the current discussion this has readily been realized. Binford a.o. has critizised the archaeological »mining« of »cultural items« that to a large extent have been regarded as equivalent with the cultures they represent. In opposition to this he regards archaeological sites as »the result of cultural activity performed by social units within restricted spatial bounds« (Binford, 1964: 431 ff.). In 1973 Newell, in accordance with this conception, proposed that the mesolithic sites he was working on be defined as: »settlement units having finite borders within which a finite number of people, organized into a social structure, performed a specific and finite range of activities by means of an equally specific and finite range of tools (tool-kit)« (Newell, 1973: 400.). The problem so far has been to develop methods that might translate such abstract ideas into concrete results.

This preliminary analysis is the result of an attempt to achieve concrete knowledge about the social structure of the Maglemose Culture. The basic thesis is that the individuals have been placed in the dwellings according to a specific pattern reflecting their age, sex, and social status.

From an anthropological point of view it is highly probable that this may actually have been the case. According to Jørgen Meldgaard it is customary for Eskimos and Canadian Indians to observe such fixed patterns – and to observe them with a pronounced degree of conservatism (Meldgaard, pers. information). Thus Rogers writes about the Mistassini Indians: »Inside a lodge, for purpose of sitting, sleeping, and eating, individuals were placed according to age and sex. In single family dwellings at feasts and when visiting, the men were at the rear and the women and children were along the sides. The place of honour, occupied by the eldest male member, generally the leader of the hunting group, was in the right rear if the stove was to the left. His wife occupied the right or left side depending on the position of the stove. In general, the family members slept at the rear with a separation of siblings of opposite sex who had reached puberty. In two-family communal lodges, the leader and his family were on one side and the second family was on the other. The women and children were located nearest the door and the men towards the rear.« (Rogers, 1967: 21). A thorough study of Mistassini placing patterns is published by Tanner (Tanner, 1979: 73 ff.). It must be underlined that the patterns can vary from culture to culture; Eskimos for instance are normally sleeping at the back of the dwellings, whereas the Canadian Indians usually have their sleeping-places along the sides (Meldgaard, pers. information).

If such fixed patterns of position can be deduced from the traces of activities found on Maglemose sites, it should be possible to obtain an insight into the group structure.

The investigation is based on a comparison between the horizontal distributions of various tool types on a

series of sites. The actual comparison has been made in the following way: the distribution of any one type inside an excavation area is graphically expressed by equidistant »contour lines« drawn by interpolation based on the frequency with which the type appears in each square metre. The distance between the lines is chosen small enough for the distribution pattern to appear in detail, and yet so great that the lines do not blur.

It has been necessary to use a square metre unit, as part of the flint material from the sites in question has only been measured to the square metre. In the material from Duvensee *Wohnplatz 6*, where all flint has been measured in great detail, only the specific number pr. square metre has been taken into consideration to avoid a distortion of the lines due to a difference of methods.

THE SITES

The analysis is based on the following Maglemose sites: Ulkestrup I, Duvensee *Wohnplatz 6*, and Svanemosen 28 (1). Furthermore, Sværdborg II has also been taken into consideration.

Ulkestrup I: The site is located in the Åmose bog, West Zealand. It was excavated in 1947 by Knud Andersen for the National Museum. A rectangular bark floor measuring approx. 6 × 4½ m was observed. Apart from a refuse layer in the south-eastern part of the excavation the flint was found inside the rectangular floor. Above the floor was a 5 cm thick culture layer containing charcoal, and hazel-nut shells besides flint. The hearth, centrally placed in the south end of the hut, was circular, and had a diameter of approx. 1½ m, and consisted of sand, a little clay, ashes, and charcoal. Its outline was blurred, the sand spreading over the floor layer (Andersen, 1982: 10 ff.). The material seems typologically clean and most probably indicates that these are the remains of one single stay (Andersen, 1951: 73; 1982: 79). The hut has been C 14-dated to 6190 ± 100 B.C. in conventional C 14-years (Andersen, 1982: 77).

Duvensee Wohnplatz 6: The site is located in the Duvensee bog east of Lübeck. It was excavated during 1975–78 by Dr. Klaus Bokelmann for the Landesamt für Vor- und Frühgeschichte von Schleswig-Holstein. There was no regular hut floor. Only pieces of split logs and strips og birch bark were preserved (Bokelmann, 1981: 181). Remarkable are two rather large concentrations of sand, charcoal, and charred hazel-nut shells inside the central area of the settlement. These are probably »roasting-places« where hazel-nuts were roasted. In connection with the largest concentration the following was observed: in a small depression in the peat was a layer of dark, brown sand. On top of this were alternating layers of charcoal and sand bleached by heat (Bokelmann, 1981: 183). The material seems typologically clean (Bokelmann, 1981: 183 f.). The roots of a number of fir trees were also found. These may be contemporaneous with the settlement and may have been part of the hut structure. However, the latest results indicate that they were stumps already at the time of the settlement (Bokelmann, pers. information). The site has been C 14-dated to 7105 ± 130 B.C., 6860 ± 110 B.C., and 7110 ± 130 B.C. in conventional C 14-years (Bokelmann, 1981: 181).

Svanemosen 28: The site is located a few kilometres south of Kolding. It was partly excavated by Erik Jørgensen and Flemming Rieck in collaboration with The Amateur Archaeologists of South Jutland for the National Museum. The site has a 10 cm thick culture layer and is located on the bank of the former lake in the Svanemose basin. Inside the central area of the settlement the subsoil revealed some rather large, 5–10 cm deep »bloches« of dark, brown sand. They may be remains of »roasting places« like those known from Duvensee W.6. The material appears to be typologically clean, and everything seems to indicate only one rather small concentration (Rieck and Jørgensen, pers. information). Typologically the microlithic material from Svanemosen 28 must be placed between Ulkestrup I and Vinde Helsinge (Grøn, in prep.).

Sværdborg II: The site is located between Vordingborg and Næstved in the Sværdborg bog. It was excavated by Mogens Ørsnes for the National Museum. Neither fireplaces nor remains of a hut were observed during the excavation (Brinch Petersen, 1972: 45). The investigation yielded some 750 pieces of unworked bone and a good many tools (Brinch Petersen, 1972: 44). The material seems to be typologically clean, and according to Brinch Petersen it must be contemporaneous with Ulkestrup II, which has been C 14-dated to 6230 ± 100 B.C. in conventional C 14-years (Andersen, *et al.* 1982: 77; Brinch Petersen, 1972: 72).

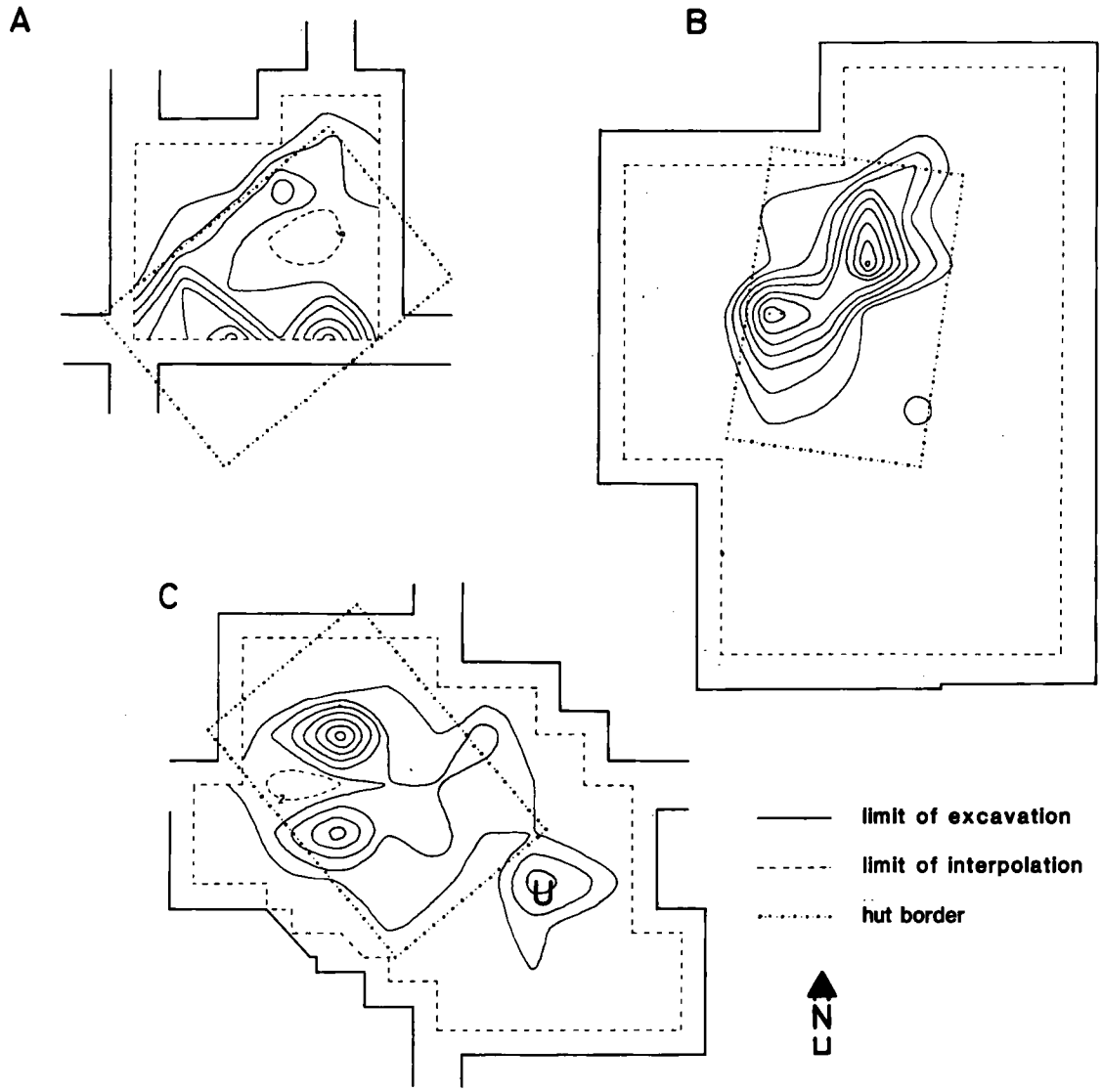

Fig. 1. Microlith distribution maps of Svanemosen 28 (A), Duvensee *Wohnplatz 6* (B), and Ulkestrup I (C). The distance between the lines on maps A, B, and C is respectively 3, 2, and 2. The U on the map of Ulkestrup I indicates the refuse layer the most western part of which was covered by the floating island on which the hut was located (Andersen, 1982: 14).

FLINT DISTRIBUTION

The lines for the distribution of microliths are shown in fig. 3. The drainage ditch that originally led to discovery of Ulkestrup I, and which has removed between 2/5 and 3/5 of each square metre between 9 and 10 south (fig. 1), has been taken into consideration. In each case the number of microliths has been multiplied by the reciprocal of the remaining fraction of the square metre. The result has been rounded off to the nearest integer. The fact that the two microlith concentrations are separated does not reflect that material in between has been removed by digging of the ditch. The northern concentration contains 15 microliths in one square metre, and the southern one 11; the square metre between them, exactly half of which had been removed, yielded only one.

As it is impossible to interpolate lines for the outermost half metre of an excavation, fig. 3 does not show whether the concentrations at Svanemosen 28 continue

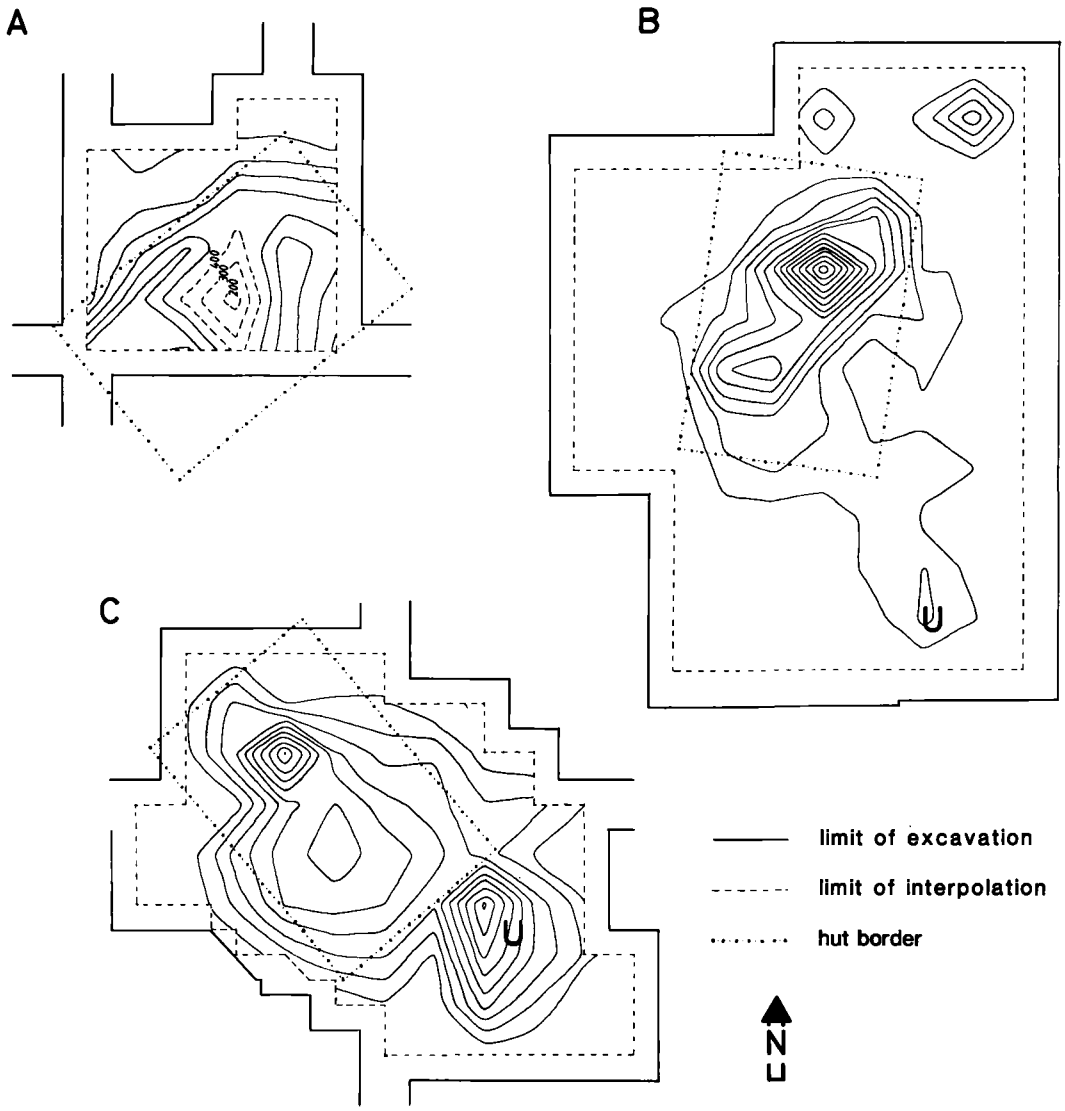

Fig. 2. Flint waste distribution maps of Svanemosen 28 (A), Duvensee Wohnplatz 6 (B), and Ulkestrup I (C). The distance between the lines of maps A, B, and C is respectively 100, 50, and 77. The U on the map of Ulkestrup I indicates the refuse layer the most western part of which was covered by the floating island on which the hut was located. The U on the map of Duvensee W.6 indicates the supposed refuselayer.

outside the limits of the excavation. However, the position of the measured microliths indicates that this is not the case.

The three sites seem to show uniform patterns of distribution: two heavy concentrations with a distance of approximately 2 metres between their centres. Based on the supposition that the two concentrations may be the remains of activities that have had their finite position inside the huts, the rest of the material from the three sites has been regarded as »oriented« alike in relation to 1) the distribution pattern of the microliths and to 2) the bank of the nearby lake.

During the excavation of Duvensee W.6 no lake bank contemporaneous with the site was observed. The small concentration of a.o. flint waste marked U in fig. 2B should probably be regarded as a refuse layer. According to the excavator, Dr. Klaus Bokelmann, wood and shavings were considerably better preserved here than on the rest of the site (Bokelmann, pers. information).

In fig. 2 the outline of the hut found at Ulkestrup I has

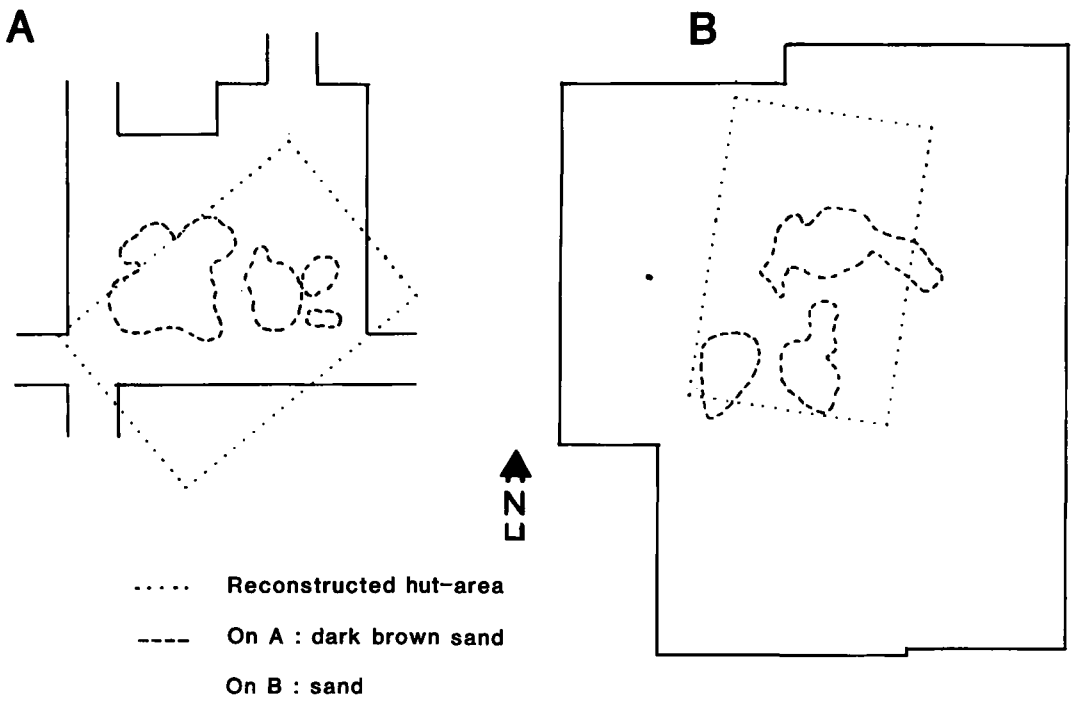

Fig. 3. Map of »blotches« of dark, brown sand on Svanemosen 28 (A) and sand concentrations on Duvensee W.6 (reproduction of Bokelmann, 1981, fig. 1.) (B).

thus been transferred to Duvensee W.6 and to Svanemosen 28. In the following lines this transfer will be evaluated on the basis of the entire material from the three sites. It should be underlined that the rectangles are only models indicating the approximate expected position of the hut walls. The important thing in this connection is the supposition that the huts at Duvensee W.6 and at Svanemosen 28 were approximately rectangular (about 6 × 4 m) and located roughly like the Ulkestrup hut in relation to the microlith concentrations and the lake bank.

The first part of the evaluation rests on the supposition that a hut wall prevents the spreading of objects beyond it. This seems to have been the case at Ulkestrup I. Knud Andersen writes: »The distribution of flint was very characteristic. Flint abounded on the floor but stopped abruptly on a line that could be drawn just inside the post-holes. This probably indicates that the walls were so tight that they blocked the flint spreading« (Andersen, 1982: 12).

As regards the distribution of flint waste Duvensee W.6 is almost a copy of Ulkestrup I (fig. 2B and 2C). It should be noted that the approximately 500 blades have not been included among the waste at Duvensee W.6 as a distribution map for them has not yet been drawn. The inclusion of the blades will not change the distribution pattern significantly, as they are generally following the distribution of the rest of the waste flint (Bokelmann, pers. information). As appears the lines follow the hypothetical hut wall rather nicely. At the southern corner however, a »tongue« penetrates the rectangular outline. As already mentioned it is tempting to believe that this is a counterpart to the small refuse layer at Ulkestrup I. It should be noted that the waste at Duvensee W.6 need not have been deposited in open water but may very well have been trodden into the humid bank area. The western part of the Sværdborg II excavation may contain such an area (Brinch Petersen, 1972: 52).

From fig. 2A it appears that the flint waste at Svanemosen 28 also agrees pretty well with the hypothetical outline of a hut. Fig. 1A actually shows that the spreading of the microliths may have been prevented by a wall closely following the hypothetical rectangular outline.

When the lines indicating the flint distribution sometimes go beyond the hypothetical rectangular outline, it probably only reflects the fact that the flint density is

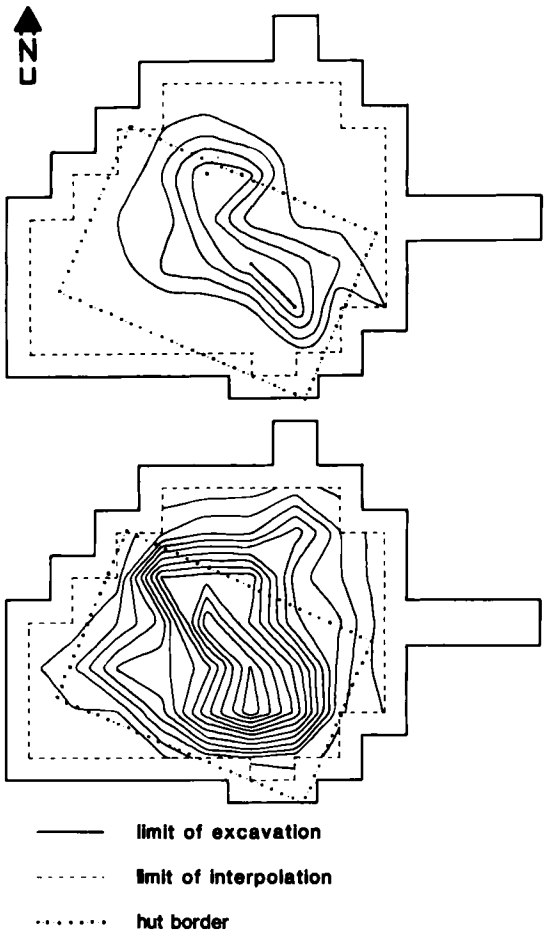

Fig. 4. Distribution maps of microliths (top) and flint waste (bottom) at Sværdborg II. The distance between the lines is respectively 2 and 100. Drawn on the basis of Brinch Petersen, 1972: 46 and 50.

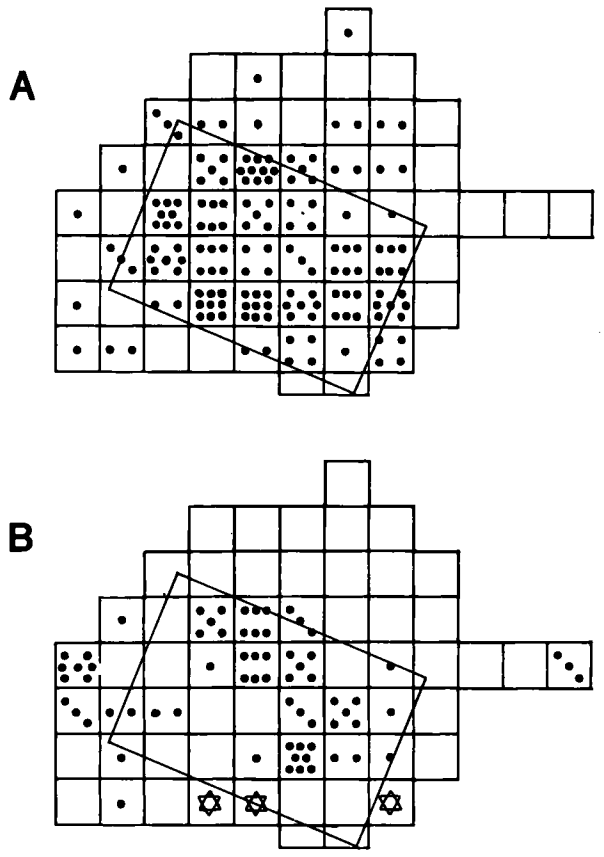

Fig. 5. Distribution maps of cores (A) and bone tools (B) at Svaerdborg II. Drawn on the basis of Brinch Petersen, 1972: figs. 4:2, and 8:1. The asterisks indicate the squares where the culture layer displayed clear lines of demarcation (Brinch Petersen, 1972: 48).

indicated pr. square metre. A square metre with a hundred pieces of flint concentrated in one corner inside the hut wall, and otherwise devoid of finds outside the wall, will appear on the map with a hundred pieces evenly distributed. On Duvensee W.6, where the position of all flint is exactly measured, the accordance between waste flint and the hypothetical hut area is better than indicated by the distribution-plans published here (Bokelmann, 1981: 182).

As regards the distribution of other types of objects besides microliths and flint waste can be said that they agree reasonably well with the reconstructed huts. Apart from micro-burins distributed roughly like the microliths, they appear in so small numbers pr. square metre that it would be unwise to employ their distribution as an argument in the discussion of the position of the huts.

It should be mentioned that the »blotches« at Svanemosen 28 and the sand concentrations at Duvensee W.6 seem to be located more or less alike in relation to the two reconstructed huts (fig. 3). This similarity is probably greater than appears from the illustrations. According to the excavators the dark, brown blotches at Svanemosen 28 were not recognized until the excavation of the main area. It is likely that they have been overlooked in the east-west oriented trial ditch (Rieck and Jørgensen, pers. information).

The refuse layers at Ulkestrup I and Duvensee W.6, emerging like tongues from the main concentrations, indicate that the entrances to the two huts were placed

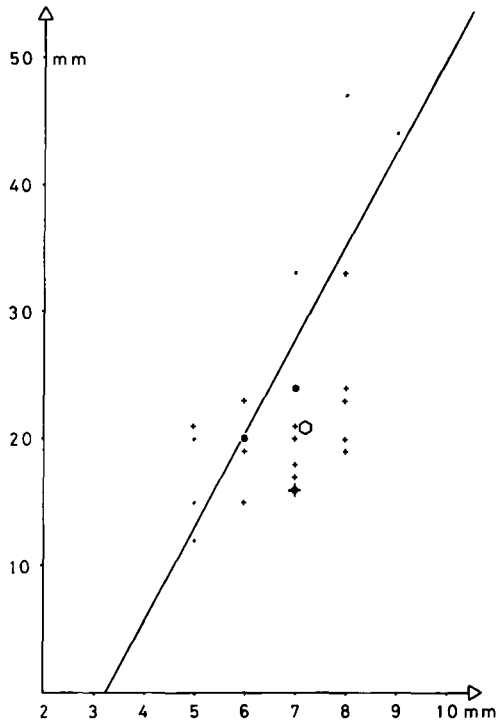

Fig. 6. Corresponding length-width ratios of microliths from Ulkestrup I. Dots indicate measurements from the southern concentration. A small dot indicates an individual set of measurements. A large dot indicates two congruent sets of measurements from the northern concentration. The straight line is the result of linear regression of the measurements from the northern concentration. The illustration is based on measurements made by Knud Andersen.

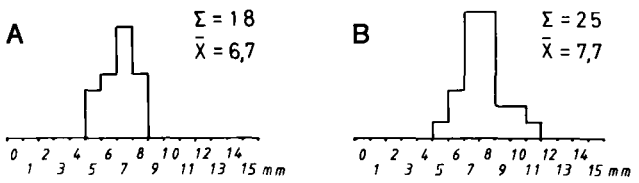

Fig. 7. Widths of micro-blades from the southern (A) and the northern (B) microlith concentrations at Ulkestrup I. The measurements were made by Knud Andersen.

in the same corner in relation to the interior lay-out of the huts and in relation to the lake bank. The small part of the refuse layer covered by the excavation of Svanemosen 28 apparently reveals the same basic pattern. Observations made during extensive investigations in the Åmose bog during 1939–45 indicate that the Maglemose huts generally had an entrance facing the lake (Andersen, 1978: 106).

In view of the anthropological knowledge about hunters and gatherers it seems likely that the hut-entrances should have a specific orientation with regard to the water or the four points of the compass. Rogers e.g. writes about the Mistassini Indians: »Lodges at base camps and the summer encampments were generally oriented with the entrance facing approximately southeast. This was true even though the camp-site was situated on the south-east shore of a river or lake. Shelters erected when the group was travelling did not adhere to this orientation. Instead, the entrance generally faced the shore of a river or lake, although it was considered »bad« if at any time the entrance faced west. Nevertheless a few lodges are today erected with this orientation«. (Rogers, 1967: 11).

The material from Sværdborg II differs from those already treated in that the distribution of the microliths into two concentrations is barely traceable. At the ends of the long concentration the density is 10 pr. square metre, and in the middle it is 9 pr. square metre (fig. 4, the top).

In this case the tools have only been assigned to the respective square metres in which they were found (Brinch Petersen, 1972: 44). An unfortunate position of the square metre grid may make two separate close-lying concentrations merge. This explanation seems likely as the distribution of the Sværdborg triangles, the prevalent type of microlith on the site (Brinch Petersen, 1972: 50, 70) shows the well-known pattern of two concentrations. Though they figure only in small numbers, the retouched pieces show the same tendency (Brinch Petersen, 1972: 49). Fig. 4 shows a tentative reconstruction of the outline of the hut based on the distribution of the microliths. As appears from fig. 4B the distribution of flint inside the hut area resembles the distributions at Ulkestrup I and Duvensee W.6 (fig. 2B and 2C). Furthermore, fig. 5A shows that the distribution of the cores is limited to the reconstructed hut. The position of the hut wall is also in accordance with observations made during the excavation. It was noted that in squares 6C, 6D, and 6G (marked with an asterisk in fig. 5B) the culture layer displayed a clear line of demarcation south of which practically no tools were found (Brinch Petersen 1972: 48).

The fact that the refuse layer at Sværdborg II lies in the western part of the main excavation (Brinch Petersen, 1972: 53) supports the suposition that this site displays a state of affairs similar to that found on the

three sites previously dealt with. The distribution of the bone tools (fig. 5B) indicates that the entrance was placed exactly as it is supposed to have been at Ulkestrup I and Duvensee W.6.

In the cases of Duvensee W.6 and Sværdborg II it should be noted that nothing in particular seems to indicate that the huts were rectangular. They might for instance have been oblong, with more or less rounded ends of generally the same size. However, the best preserved bark floors from the Maglemose culture being rectangular (Schwantes, 1939: 90; Becker, 1945: 63; and Andersen, 1982: 11), all the huts seem likely to have had a rectangular form.

INDIVIDUAL DIFFERENCES OF THE FLINT TECHNIQUE

It would be natural to regard the two microlith concentrations on each of the sites as the result of the activities of two individuals. On Duvensee W.6, Ulkestrup I, and Svanemosen 28 technical differences actually exists between the microliths from the two concentrations.

The technical differences between the two concentrations at Duvensee W.6 appear from Dr. Bokelmann's measurements. He is of the opinion that it is rather a question of individual differences than »changes due to structural modifications of the hunting weapons« (Bokelmann, 1981: 185). It seems unlikely that the obvious differences in the indexes and widths of the triangles (Bokelmann, 1981: 185) should be due to a difference in the raw material employed. Especially the differences in index must reflect different working methods.

At Ulkestrup I corresponding length-width ratios of intact microliths indicate that also technical differences come into play (fig. 6). The measurements from the southern concentration can be approached to a straight line with the slope of 7.2 (the correlation coefficient is 0.8). The optimal approximation to the measurements from the northern concentration at a similar linear regression is a straight line with a slope of 1.6. The tendencies in the two sets of measurements are clearly different. However, as the latter has a correlation coefficient of only 0.4, it should be stressed that the »pivot« of the latter set of measurements is at a considerable distance from the line of approximation arising from linear regression to the first set. The widths of the microblades from the two areas also show different tendencies (fig. 7). The average value of the northern concentration is 7.7 mm; in the southern concentration the corresponding value is 6.7 mm.

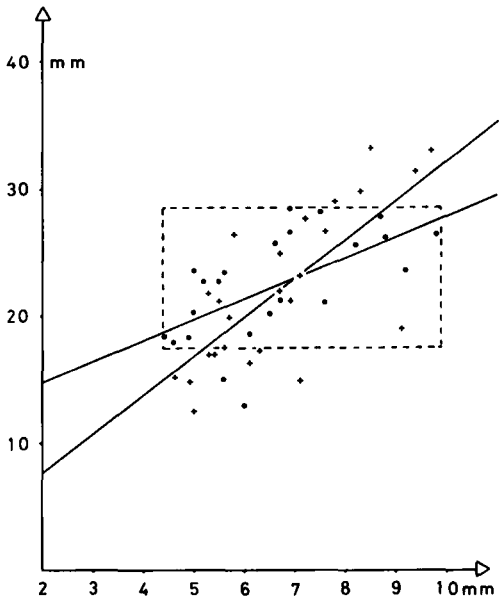

Fig. 8. Corresponding length-width ratios of microliths from Svanemosen 28. Circles indicate sets of measurements from the northern concentration. By linear regression the measurements from the northern concentration have been approximated to the straight line that forms the narrowest angle to the x-axis. Crosses indicate measurements from the southern concentration. By linear regression the measurements from this concentration have been approximated to the straight line that forms the widest angle to the x-axis. The measurements have been made by the author.

The length-width ratios of the microliths from the two concentrations at Svanemosen 28 are shown in fig. 8. The approximation by linear regression of the western ratio is a straight line with a slope of 1.6 and a correlation coefficient of 0.6. The corresponding values for the measurements from the eastern concentration are 3.1 and 0.8 respectively. The different tendencies of the two concentrations are also reflected by the fact that 91% of the measurements from the western concentration are inside or touch the sides of the chosen rectangle. This is true of only 48% of the measurements from the eastern concentration. Furthermore, the measurements of the maximum thickness of the lanceolate microliths in the eastern concentration give an average of 2.57 mm (fig. 9A), whereas the corresponding measurements of the triangles give an average of 1.76 mm (fig. 9B). For the western concentration the corresponding values are 2.15 and 2.00 mm (fig. 9C and 9D). Con-

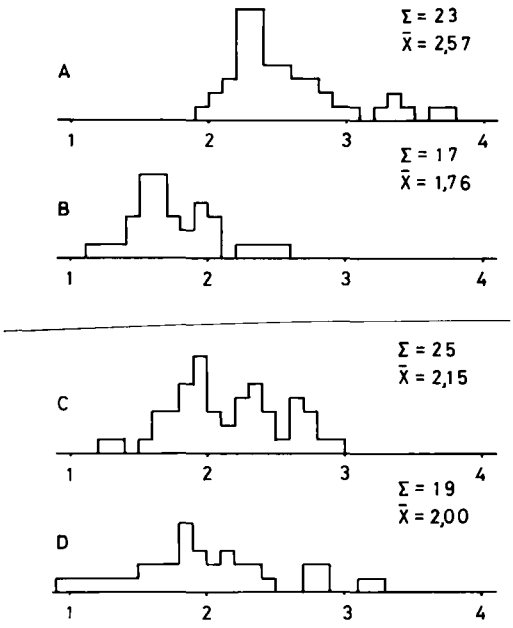

Fig. 9. Maximum thickness of lanceolate points and triangles from Svanemosen 28. A: max. thickness of lanceolate points from the southern concentration. B: max. thickness of triangles from the southern concentration. C. max. thickness of lanceolate points from the northern concentration. D: max: thickness of triangles from the northern concentration. The measurements have been made by the author.

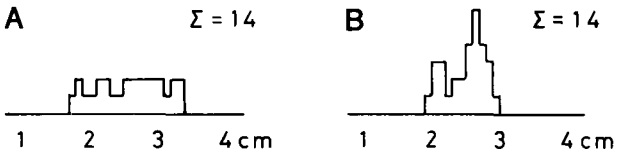

Fig. 10. Lengths of lanceolate points from the southern (A) and the northern (B) concentrations at Svanemosen 28. The measurements have been made by the author.

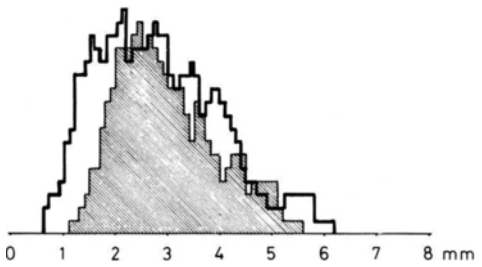

Fig. 11. Thickness of micro-blades from Svanemosen 28. The line showing the measurements from the southern concentration is in heavy print, and the line showing the measurements from the northern concentration is hatched. The measurements have been made by the author.

sequently in the last instance there is clearly less variation of the maximum thickness of the microliths in general. The lengths of the lanceolate points in the western concentration concentrate in two peaks (fig. 10), whereas the lengths from the southern one are more evenly distributed. I have noticed that the lengths of the individual types of microliths in typologically clean Maglemose materials often concentrate around two or three values that may vary from site to site and from type to type. Knud Andersen has noticed the same tendency in material from Zealand (Andersen, pers. information). We both think that this reflects the production of arrow-heads according to a fixed pattern with microliths of the same type but varying in size. Lars Larsson's assumption in connection with Ageröd I:B (Larsson, 1978: 66 f., 140) that the lengths and the widths of the microliths concentrating around certain values, indicates that the site is mixed, must be regarded as untenable. On the basis of the above observations I do not think that the tendency in fig. 10 is arbitrary, though it is based on only 14 length measurements from the western concentration. Fig. 12 shows the difference between the corresponding length-width ratios of blades from the two areas. In the western concentration 75% of the micro-blades measured are inside the chosen rectangle or are touching its sides. This goes for only 40% of the micro-blades in the eastern concentration. Furthermore, in the first instance the blades and micro-blades are far more easily distinguishable than in the latter. In the southern concentration the thickness of the micro-blades is also more evenly distributed than in the northern one (fig. 11). In conclusion it must be said that the measurements of the Svanemose 28 material clearly support the subjective impression that the two concentrations are due to two flintknappers of differing ability, the eastern one being actually not very good.

FURTHER CONSIDERATIONS

The four sites analysed cover a period of roughly a thousand years. The results seem to indicate that during this period of the Danish and North German Maglemose

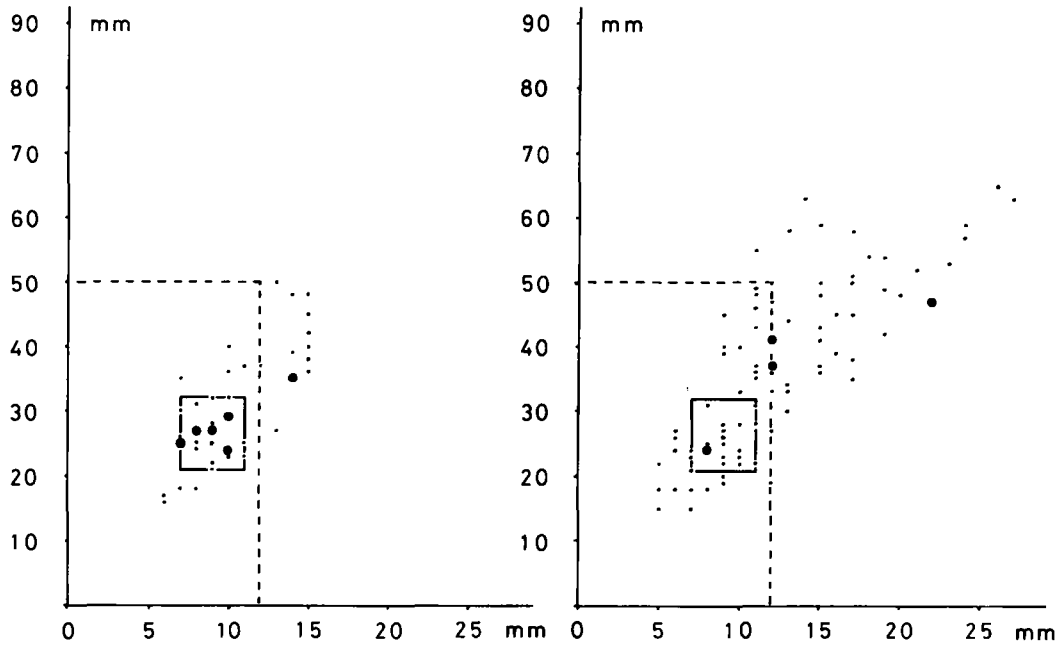

Fig. 12. Corresponding length-width ratios of blades from Svanemosen 28. Measurements from the northern and the southern concentrations to the left and right, respectively. A large dot indicates two congruent sets of measurements. A small dot indicates an individual set of measurements. The measurements have been made by the author.

Culture certain activities have been allocated to certain areas of the dwelling according to fixed rules.

The pattern with two microlith-concentrations was probably present on the hut floor at Duvensee W.1. According to the excavator, Gustav Schwante's notes the flint was divided into two »nests«. However, it is not possible to reconstruct the distribution pattern (Bokelmann, pers. information).

At Lundby II we probably find the same pattern in connection with the two close-lying fireplaces that are very much like the »roasting places« from the Duvensee sites (Bille Henriksen, 1980: 57). The microlith distribution map from Lundby II shows a concentration at each of the two fireplaces. As there are two layers on this site, the concentrations might belong to layer 2, unlike the fireplaces. However the flint mainly belongs to layer 1 (Bille Henriksen, 1980: 56 ff.).

It should be noted that other hut types than the one known from Ulkestrup I, may also have been used. In the Duvensee basin a hut site (W.8) has recently been investigated. Judging by the size of the preserved hut floor, the hut was only about half the size of the Ulkestrup hut. It is interesting that in connection with the floor of W.8 only one microlith concentration and a »roasting place« have been found (Bokelmann, 1982: 23). This hut may have housed the smallest unit of the »Maglemose Society«, whereas the Ulkestrup huts may have housed two. In support of this theory it should be stressed that two fire- or roasting-places were observed at Duvensee W.6. According to Jørgen Meldgaard it is customary among recent and prehistoric Eskimos and Canadian Indians for each household to have one cooking place when two or more households are sharing a dwelling (Meldgaard, pers. information).

At the moment a survey of a series of early Maglemose excavations is in preparation. It is hoped that this survey, combined with new excavations, will make it possible to render a reasonably concise description of the groups that inhabited the Maglemose huts. If successful, this information will serve as a key to the understanding of the cultural conditions proper of the Maglemose period.

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Addendum: During 1983 further excavation at Svanemosen 28 gave support to the above reconstruction of the hut area, the distribution of flint tools and waste being as expected. Furthermore, the sections allowed the hut area to be seen as a 30 cm. thick, grey layer.

NOTE

I wish to express my gratitude to Knud Andersen, Klaus Bokelmann, Flemming Rieck, and Erik Jørgensen for the extraordinary kindness with which they have made unpublished material available to me during my initial work with this analysis of Maglemosian sites.

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Flint Axe Manufacture in the Neolithic

An Experimental Investigation of a Flint Axe Manufacture Site at Hastrup Vænget, East Zealand

by PETER VEMMING HANSEN and BO MADSEN

This study presents the results of an excavation of an axe manufacturing site of the Funnel Beaker Culture. Interpretations and hypotheses were experimentally tested in qualitative and quantitive investigations of process and product, by means of replicative manufacture of thin-butted, square flint axes and analysis of flake distribution patterns. Design and execution of the experimental activites took place at Lejre Research Centre in Denmark in 1982, performed by a group of archaeologists including two experimental flint workers: Peter Vemming Hansen (University of Copenhagen), Bo Madsen (University of Århus, Denmark) and Jacques Pelegrin (CNRS, France).

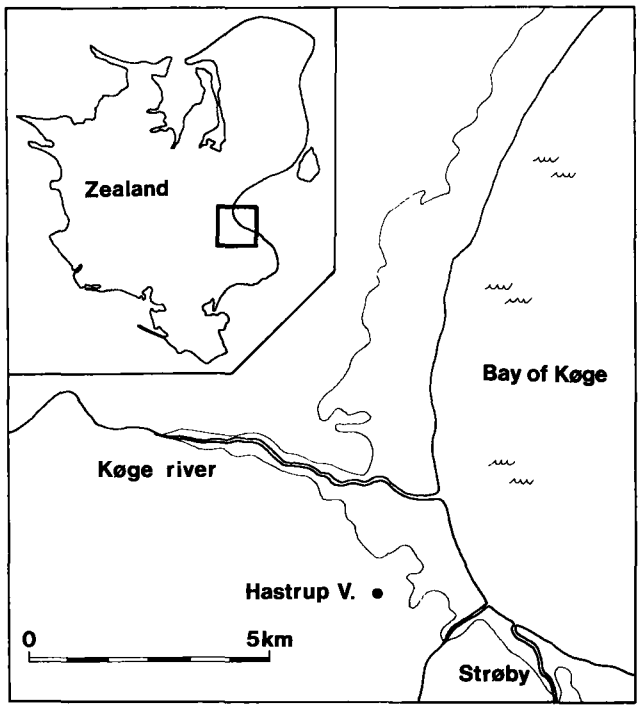


Fig. 1. The location of the Hastrup Vænget site.

THE HASTRUP VÆNGET FIND

The site was excavated in the summer of 1980, lying just south of Køge at Hastrup Vænget (1). It was situated in quite high terrain, on the east side of a gently sloping morainic hill and with a view over the former coast of the Litorina Sea at Køge Bugt (fig. 1).

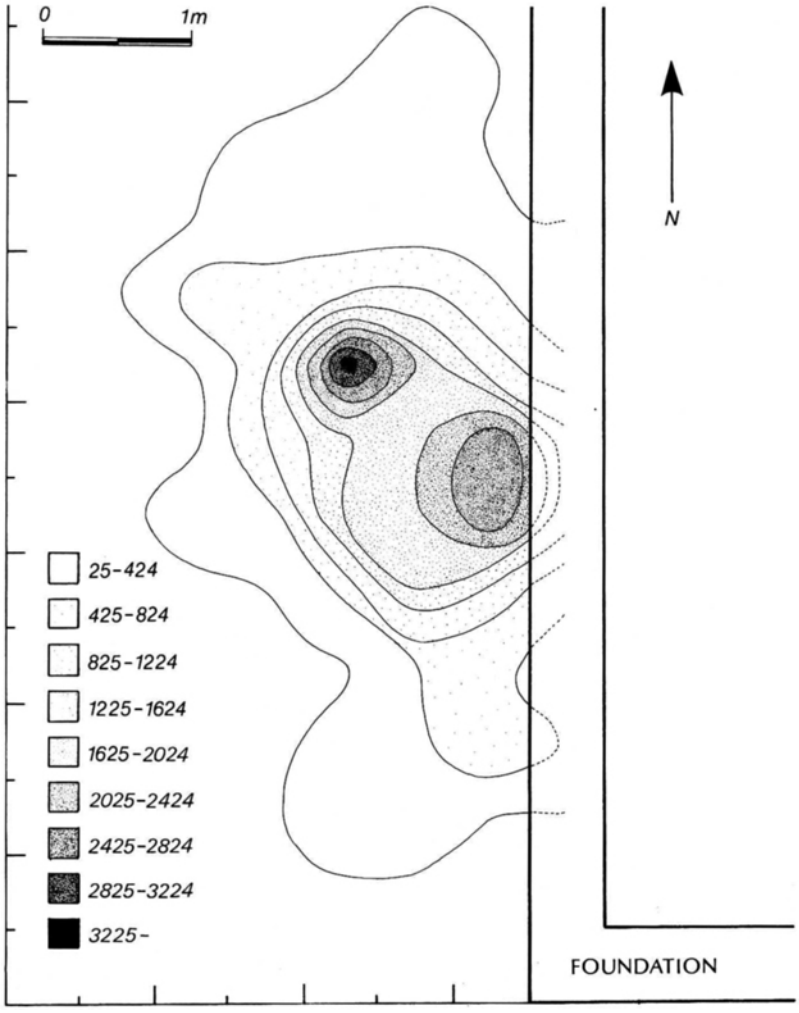
Immediately north of Hastrup Vænget, the Køge River runs out into what was a former Littorina period fiord. The area round the site is still rich in flint, secondarily deposited both in morainic deposits and raised beaches. The Stevns peninsula is only 10 km to the east; since the early Atlantic period, the sea has there been uncovering the chalk bedrock and thereby has opened the way for exploitation of the richest primary sources of flint known in Zealand.

The Hastrup Vænget find (Hansen 1983) consisted almost entirely of waste flint (a total of 30,487 flakes weighing 168 kg). The flakes were discovered under a secondary, waterdeposited layer of clay, and lay clustered in an area of 6 × 4 m. Traces of normal settlement activities or definite features were not observed either at the find site or elsewhere in the vicinity.

The few other finds discovered consisted of sherds of a funnel beaker of type C or D (Becker 1947), and resharpening flakes from the edges of thin-butted polished flint axes, the narrow sides of which were polished. A few tools were also found: flake scrapers, a curved knife, borers and a transverse arrowhead.

The find is regarded as a single, closed unit, and the finds indicate a dating in the later early neolithic or middle neolithic I, around 3200 BC (calibrated).

The flint waste flakes were excavated using the »Lejre Method« (Fischer et al. 1979), i.e. collected up in units of 1/4 m^2. The map (fig. 2) shows the distribution of the find's flakes. There is a clear bimodal distribu-



					20	
				13	50	30
			83	69	94	14
		17	225	216	144	32
		540	525	625	831	484
			804	3446	1906	928
		4	853	1573	2005	2722
		82	174	1679	2013	2782
			21	462	1642	1002
					421	508
				61	367	789
				154	77	

Fig. 2. Map. showing the distribution of all the flakes at Hastrup Vænget. Right: flakes per ¼ sq.m. unit.

tion, with two almost identical scatters. Each has a centre with a large number of flakes, away from which the intensity gradually decreases to the northwest and southeast respectively.

During classification, it became clear that the overwhelming majority of the finds were waste products from the production of foursided axes (Arnold 1974). The diagnostic debitage from the bodies of axes showed (Hansen 1981) that thin-butted axes had been produced from flint blanks; these blanks had been brought to Hastrup Vænget from elsewhere. This is supported by the presence of a flint blank, rejected because of frost damage. Remains of cortex on some of the flakes suggested that these were most probably produced from flint which had been strongly rolled, in just the way which is now characteristic of material deposited in raised beaches both in Køge Bugt and on Stevns.

The observations from Hastrup Vænget raised a number of questions:

1) Can the flake distributions mapped in fig. 2 be interpreted as a site specialising in the production of thin-butted axes?
2) Is it possible to say how many axes the Hastrup Vænget waste material might represent?
3) What does production on this scale mean in terms of work effort, if it is assumed that flaking was a continuous process?

4) Can the waste flakes generated during the production of flint blanks and axes be used to make smaller tools?

The experiments which took place at Lejre Research Center in August 1982 were designed to answer among other things these questions (2). In the following, the lithic experiments will be described. The main emphasis is laid on the general aspects which have primary importance for an understanding of Hastrup Vænget and future finds of a similar type. Detailed descriptions of the technical methods behind foursided axe production are beyond the scope of this work.

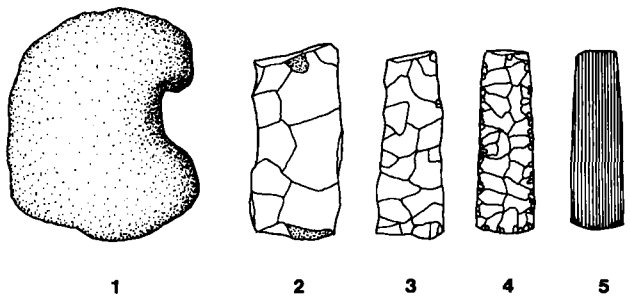


Fig. 3. Stages in the manufacture of thinbutted flint axes.

THE LITHIC EXPERIMENTS

Experimental replication of prehistoric flint tools is an old tradition within archaeological research. In the last 10 years it has gained a place as a recognised mode of analysis, alongside other branches of experimental archaeology (Johnson 1978).

Modern production of foursided axes has already been described by Kragh and Meldgård (1964). Since then, the German flint knapper Harm Paulsen has been active in this field, and among other things demonstrated his results at the flint seminar at Lejre Research Centre in 1979 (3).

In 1981 the quadrifacial method was the main subject examined at a similar seminar at Lejre. Among others, E. Callahan, B. Madsen and J. Pelegrin produced an experimental series of thin-butted axes in order to study the length of time involved, the distribution of waste products etc. An interpretation and demonstration of the stages involved in producing a thin-butted flint axe was also presented by Bo Madsen (Callahan 1981, Wickham-Jones 1982). This interpretation was the result of several years experimenting with quadrifacial technique and studying of the TRB material (4).

Recognition that the more thorough-going preparation of the body of the flint took place in stages is not new, and has been experimentally shown by Crabtree (1966), Callahan (1975), Burton (1980) and Stahle (1982). It has turned out that experimental observation can elucidate missing stages in prehistoric production methods, not least with regard to TRB culture axe production. Production of a thin-butted flint axe thus goes through five stages (fig. 3).

STAGES IN THE MANUFACTURE OF THINBUTTED SQUARE AXES

1) Obtaining the Raw Material. This either comes from coasts and fiords where marine erosion has exposed flinty deposits, or from regular mining in the chalky bedrock. The quality is tested; the nodule may be cleaned of any chalk adhering to it, and is »opened« by removal of the first flake; rejected if the quality is too bad, i.e. if it contains concretions of crystal and impurities, or is damaged by ice pressure, transport or frost action.

2) Making the Blank. This takes (and took) place at the flint source, in order to minimise the weight before further transporting the blank, and also to check the quality of the flint. Blows from hammerstones of various weights (such as may be collected along the tideline) reduce the weight of the roughout in some cases to under half – and the removal of large, clean flakes shapes the blank's main proportions: square shape, and the correct longitudinal cross section. This must be regular, as near as possible to the shape of the finished axe, as thinning on the broad sides will be difficult later on. Preparation of flint blanks needs much experience and practice. Each removal must be »economic«. The flake size must be calculated against the likelihood of hinge fractures, i.e. flakes which do not »go far enough«. Other risks are that overenthusiastic flaking may spoil the square shape, or that the blank may break with an orthogonal fracture because of an incorrect striking angle. This seems to have been much the riskiest stage in the production of prehistoric axes. Many rejected blanks, found a flint sources, show just these problems.

3) Preforming the Axe. The blank is now prepared with greater precision, using indirect percussion with antler

Fig. 4. Blank with tools made of flakes: 5 flake axes, 8 disc scrapers, 1 backed knife.

flakers, so-called punches. The flakes become smaller and thinner. The impact points are placed closer together and nearer the edge of the piece. As a result, the size of the platform remains are reduced. The axe width and the inclination of the lateral sides are corrected. A decisive operation is now the flat flaking of the broad sides. The flakes should reach in to near the middle of the face, without meeting any obstacles which would remain as raised areas. These are inexpedient as they increase the time which later has to be spent polishing the broad sides. Finally the edge and butt are roughed out.

4) Final Shaping of the Axe. The edge is finally formed either by direct blows from an antler hammer, or by indirect flaking using an antler flaker. The angle and splay of the edge is shaped. The angle of the edge may be completed with very precise pressure flaking. Longitudinal seams are made, either with fine, indirect percussion with a hard, pointed antler flaker, or with pressure flaking which gives the most precise finish. This treatment increases the angle between the broad and narrow faces to over 90°, giving rise to the strongly arched cross section. Stages 3 and 4 require the most time.

5) Polishing the Axe. This takes place on the edge and the broad sides, sometimes also the narrow sides. Nearly all the negative scars from the previous stages are removed. The better the execution of the previous flaking, the quicker the physically demanding polishing can be completed.

That these stages in fact correspond with the prehistoric mode of manufacture can be demonstrated archaeologically by finds of axes at varying stages of manufacture. Roughed out blanks (stage 2) are common from northeast Denmark (Mathiassen 1934, Ebbesen 1980). Axes in stage 3, where the negative scars have not yet been removed by the zig-zag flaking which produces the seams, are more rare, while complete but un-

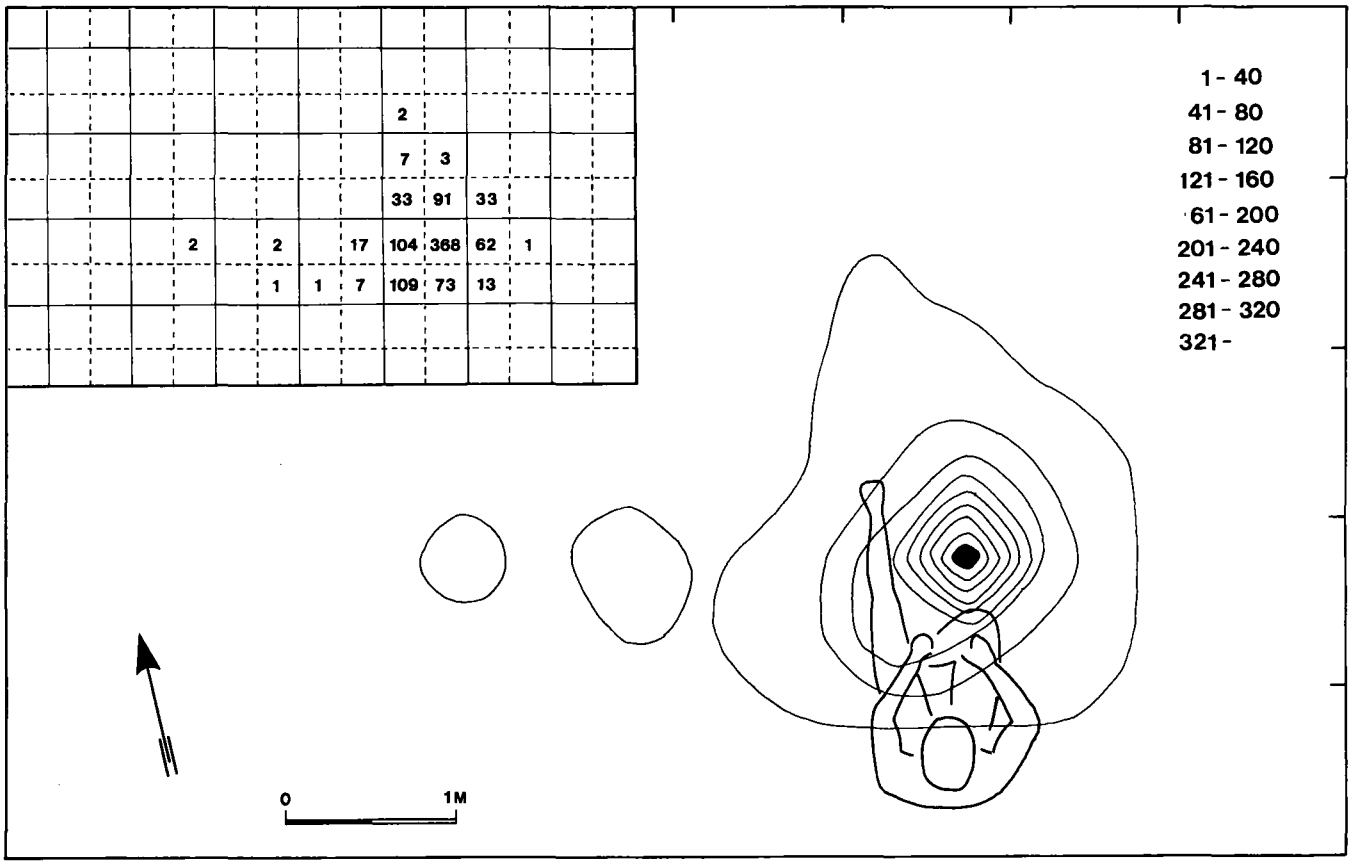


Fig. 5. Map showing the distribution of all the flakes from making the blank (Exp. II A,B,C,D,E).

polished axes (stage 4) are known from numerous hoards in southern Scandinavia and northern Germany.

One factor supporting the interpretation of the process as a series of stages is that the fabricators employed change between the stages. Techniques also change during the process, from direct to indirect blows. The position in which the object is held changes. Last but not least, the flint debitage changes character, at least in a statistical sense, from stage to stage (6).

ESTABLISHING THE EXPERIMENTAL AREA

The experiments were carried out at the Lejre Research Centre. In a landscape corresponding to the topographic conditions at Hastrup Vænget, a rectangular area 5 × 8 m was laid out oriented east-west at the foot of a gentle slope. The area was cleared of vegetation, and covered with a smooth layer of light beach sand c. 10 cm thick. The north-south angle of slope was 3–5°, but the surface was even, without any depressions. The aim was to produce exact agreement between the excavation and the experiment.

A fixed position was adopted. The flint knapper faced north throughout. Both the participating knappers are right handed, and were therefore placed in the south-eastern corner of the area so that the flakes could spread freely to the left (west) for 7 to 8 m. Subsequent procedure was: exact time measurement of the work, and documentation of the tools used, the positions in which objects were held, and scatter pattern for each test. Altitude measurements were taken whenever the work produced heaps of waste. All flakes within the 40 m^2 area were collected by ¼ m^2, and the sand was then sieved through a 0.5 mm mesh.

THE RAW MATERIAL

The raw material used for the experiments was good quality east Danish flint, similar to that from Stevns used at Hastrup Vænget. The flint chosen was a local type from the island of Falster, in which both knappers had confidence. This type is notable for the large size of its raw nodules, its homogeneity, and ease of access. The raw material is nodular in form, often broken (the so-called »jambons«), with a thin, primary chalk cortex and often with a clear, subcortical opalescent layer. It has few macrofossil impurities, and is in secondary deposit, eroded out from the nearby chalk bedrock by marine and agricultural activity.

Over 50 kg of nodules were selected for the roughing out experiments. For the axe production experiments, 6 already prepared blanks of the same flint type were used, weighing a total of 40 kg.

Thus a good 90 kg flint was used to produce experimentally 6 blanks of stage 2, 6 thin-butted axes ready for polishing (stage 4), and 26 small tools; this took in all 13 hours and 11 minutes. More than 11,000 waste flakes were produced, weighing c. 62 kg.

TOOLS USED FOR FLINT WORKING

Organic fabricators are rarely found. Such tools were, however, described in the last century by Müller (1888, 1896). These strongly curved antler tines were linked with flint working, and were believed to have been used as billets, pressure flakers, or indirect flakers. Antler fabricators of the strong, straight type used in the experiments are very similar to those from the Bundsø settlement on Als (Mathiassen 1939).

THE EXPERIMENTS

Experiment I A (flintworker: BM). A nodular fragment weighing 8250 g was made into a blank of stage 2. Direct percussion was used, with a medium hard sandstone hammer weighing 820 g. It was ovoid, measured 12.5 × 7.5 cm, had a smoothly rounded surface, and was collected from a beach on Stevns.

During work, the knapper sat on the sand with his left leg extended, and his right leg bent (fig. 5). The object was rested directly on the sand and supported with the left hand. The hammerstone was held in the right hand, with a precision grip using the thumb and first two fingers; striking involved moving the forearm, while holding the elbow fixed. Precision rather than power was the aim. The blank was ready in 11 minutes, and weighed 4000 g. During the work, a total of 14 disc-shaped flakes were put aside for use in the flake scraper manufacturing experiment, no. I B. 291 flakes remained on the ground.

Experiment I B (flintworker: BM). 14 large discoidal flakes were selected during experiment I A, and were worked into 8 disc scrapers, 5 flake axes and 1 backed knife (fig. 4). Direct percussion was employed, using a sandstone fabricator weighing 160 g, measuring 6 × 4.5 cm. The scraper edge was produced using a club of elk antler tine, weighing 265 g. This work took 15 minutes and was conducted outside the experimental area.

Experiment II A, B, C, D, E (flintworker: BM). This was a continuous experiment, producing 5 blanks (stage 2) in the same way as in experiment I A. The intention was to create a stronger and more reliable scatter pattern. 34,240 g of nodular flint were used. The 5 completed blanks weighed a total of 20, 287 g; 929 waste flakes were produced. The work took 38 minutes, i.e. rather over 7.5 minutes per blank; the quickest one took only 4 minutes. The waste flake distribution can be seen in fig. 5. It must be noted that here, as in experiment I A, efforts were made to keep the working area where the blank rested during preparation, free of waste – out of consideration for the knapper's hands. Waste from here was moved to the right or east.

Experiment III A (flintworker: JP) A flint blank weighing 5500 g was worked from stage 2 up to being ready for polishing in stage 4. The intention was to produce a more developed type of thin-butted axe, the so-called type VI (Nielsen 1977), characterised by a relatively thick blade and a flat butt. The knapper was seated on a 30 cm high section of oak, in the southeastern part of the experiment area. Throughout, he sat with thighs horizontal and legs a little bent. The item was mainly held between the thighs in the area above the knees, supported by the slightly flexed muscles of the inner thighs. His legs were protected by pieces of leather. The item was thus about 50 cm above the experimental area surface. When the narrow sides of the axe was being

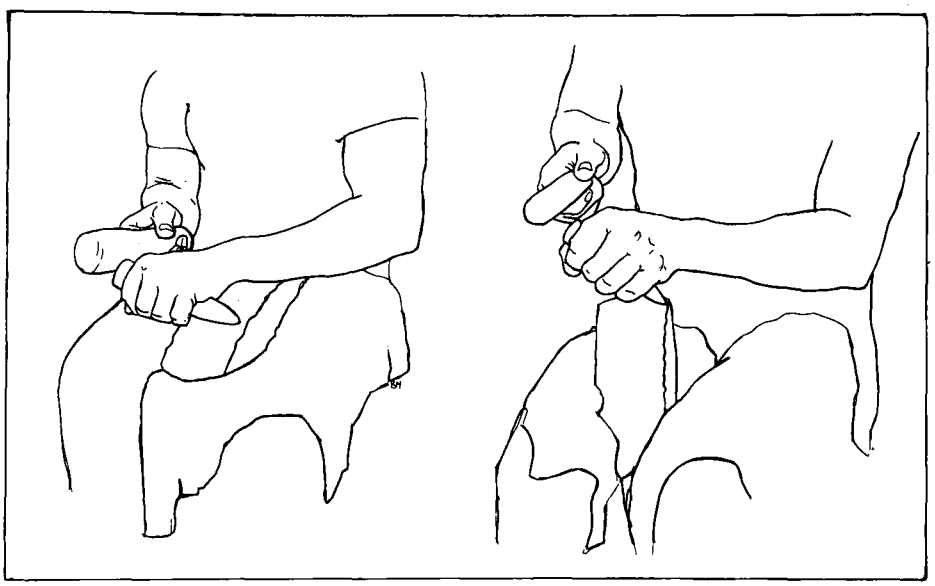


Fig. 6. Holding positions for making a thinbutted axe, stage 3&4.

worked, it usually rested lightly on the left thigh, but supported by the right thigh. Raising and lowering the thighs in relation to one another altered the angle from the horizontal at which the piece rested. Indirect percussion was used. The fabricator was held in the left hand, the whole hand gripping it. The blow was delivered with a light wooden club.

Direct percussion was used only for the bifacial method of working the edge. At this point the piece was held in the left hand, supported on the outside of the left thigh. The waste flakes fell in a group, partly underneath, partly immediately to the left of the knapper; this is usually the case when bifacial work is carried out by a right-handed knapper.

When flakes were removed from the body of the axe, this took place on its left side, the piece continually being rotated through 180°. As a result, the waste flakes were mostly projected to the west, the left hand side of the knapper. In a few cases flakes flew more than 7 m from the knapper. During indirect flaking, a fairly light wooden club was used, in order to have maximum control over the speed of the fabricator at the moment the flake was removed. This was often attained by means of a rapid swing of the forearm. It was particularly important that the strength and direction of the blow was closely controlled during working of the narrow sides; if this was not the case, overpassed flakes could spoil the foursided shape; or the opposite could occur, namely the production of too short, so-called »diving flakes«, which also spoiled the shape.

5 antler fabricators were used in experiment III A and are listed below. The heaviest piece, A, was used for indirect removal of large flakes from the broad side of the axe during the early part of stage 3. A was also used as a billet, delivering direct blows during the forming of the edge area. The flakers B, C and D were used later for indirect flaking. The small flaker E, made of hard elk antler, was ony used for the completion of the seams, between stages 3 and 4. The »retoucheurs« F and G were used to prepare special platforms. H functioned as a whet stone, for resharpening the points of the flakers. The wooden club J, which was used to strike the flakers, was made from the trunk of a boxwood.

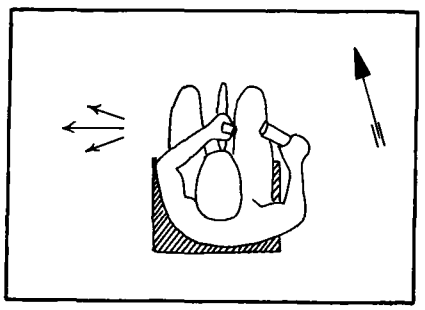


Fig. 7. The spreading direction of flakes when making the axe.

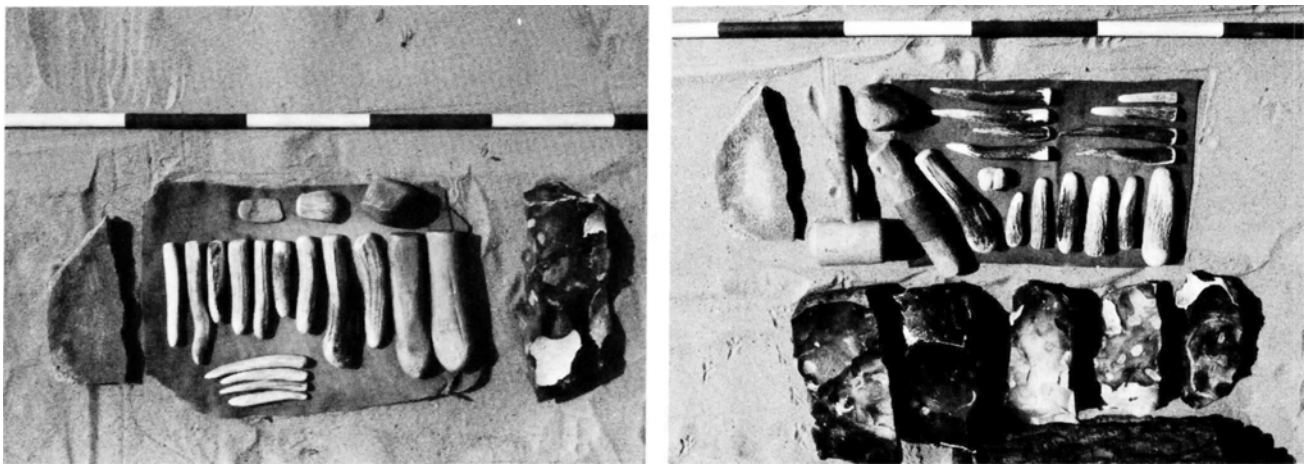


Fig. 8. Fabricators used at the axe experiments (left: J.P., right: B.M.).

A: billet/flaker of antler base (*Rangifer tarandus*).
22 × 5 – 3.5 cm. Weight 350 g.
B: flaker of antler base (*Rusa unicolor*?).
19 × 4 – 2.5 cm. Weight 230 g.
C: flaker of antler base/tine (*Rusa unicolor*?).
16.3 × 2.5 – 2 cm. Weight 110 g.
D: flaker of antler tine (*Rusa unicolor*).
17 × 2 – 1.5 cm. Weight 70 g.
E: flaker of antler tine (*Alces alces*).
14.5 × 1.2 cm. Weight 40 g.
F: hammerstone (retoucheur) of sandstone.
7 × 5.2 × 3.8 cm. Weight 200 g.
G: hammerstone (retoucheur) of sandstone.
7.5 × 4 × 1.1 cm. Weight 50 g.
H: whet stone, fragment of flat sandstone.
25 × 15 × 3 cm.
J: club of boxwood (*Buksus sempervirens*).
23 × 7 cm. Weight 510 g.

The general tendency during the work was for progressively lighter and more pointed flakers to be used as the work progressed. Impact points were often placed in series, ever closer both to each other and to the edge of the piece. This resulted in a gradual diminution of flake size, and in the size of the striking platform remnant (6).

In experiment III, a typical, heavy, thin-butted axe was produced, 28 cm long, 9 cm wide and 2.5 cm thick, weighing 2250 g. The work took 1 hour 56 minutes. 1234 flakes were produced. 14 of these were put aside as the raw material to be used in experiment III B. The scatter of the remaining waste flakes, together with those from experiment IV, can be seen in fig. 13.

Experiment III B (flintworker: BM). The object of this experiment was the production of smaller tools from waste flakes resulting from experiment III A. 14 flakes were used, from which were produced 4 disc scrabers, 2 backed knives, 1 blade sickle, 1 flake burin, 1 borer and 3 transverse arrowheads; 2 further transverse arrowheads were failures. Working took place outside the experimental area, but was carried out in the same way as in experiment I B. During the making of the transverse arrowheads, a wooden branch was used as an anvil. Direct percussion with a hammerstone was used. The work took 19 minutes.

Experiment IV A, B, C, D, E (flintworker: BM). Five flint blanks with a total weight of 39,880 g were worked through from stage 2 to stage 4, axes ready for polishing, in one continuous process under the same conditions as experiment III A.

During this experiment, the same types of fabricator were used, with a few exceptions. Firstly, only flakers made from elk and red deer antler were used (7). Furthermore, the largest elk antler flaker, 18 × 5 cm, had a rather larger weight, namely 430 g. Use of this piece was deemed necessary because several of the blanks were rather large. Working of the seam, near the end of stage 4, was done with not one but two light, pointed flakers with lengths of 19 and 14 cm, and

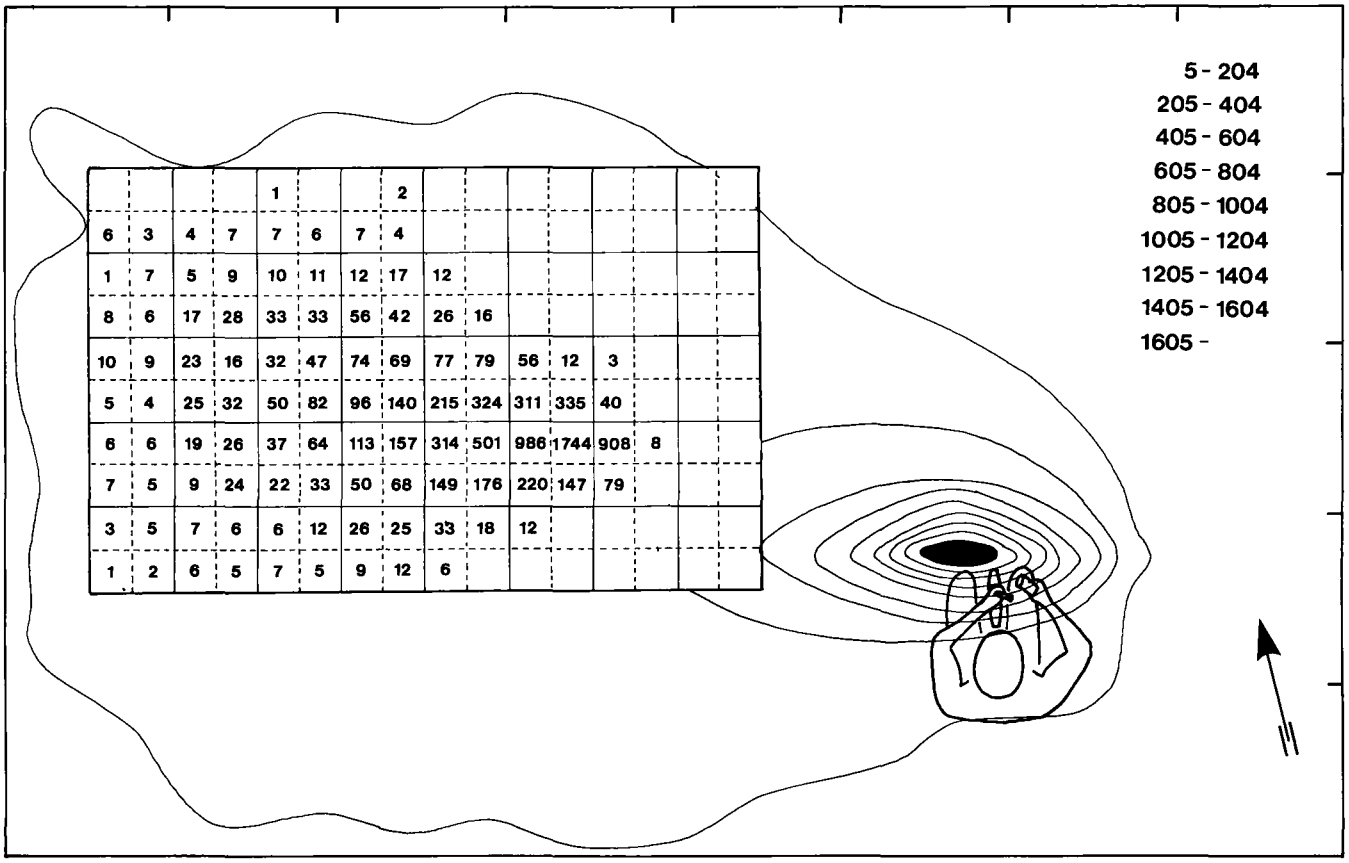


Fig. 9. Map showing the distribution of all the flakes from making the axes (Exp. IV A,B,C,D,E).

weights of respectively 50 and 30 g. These two pieces were also used as pressure flakers during the final treatment of the edge. During this work, the axe was held in the left hand, which had a leather protector, and the pressure flaker was used with the right.

As the fan-shaped scatter developed during the experiment, more and more qualitative tendencies appeared in waste distribution. In some cases, however, it was noted that some of the flakes were trapped by the knapper's left leg, while others, particularly during the working of the seams, spread as far as the western edge of the experiment's area even though these were of small size and weight (fig. 9).

On average, each axe took 2 hours. Time taken for the individual type VI replica axes was as follows:
Experiment IV A: 1 hour 48 mins.
Experiment IV B: 1 hour 20 mins.
Experiment IV C: 2 hours 12 mins.
Experiment IV D: 2 hours 17 mins.
Experiment IV E: 2 hours 15 mins.

A total of 9 hours 52 minutes was involved in producing the 5 axes, which between them weighed 6760 g. 8636 waste flakes were produced.

COMPARISON BETWEEN EXCAVATION AND EXPERIMENTS

The waste flake scatters from the experiments is seen in fig. 9. It can be seen that the fan is rather larger than at Hastrup Vænget, and the limit of the distribution is much more uniformly convex. These differences could be due to several things. If the knapper, for example, had worked directly on the ground in all the experiments, not just in the one for blank production, a smaller scatter fan would probably have resulted among the larger flakes – but not for the smaller ones resulting from forming the seams of the axes, which are often projected a long way, high into the air (Newcomer and Sieveking 1980: 345–52).

The distribution of flakes at Hastrup Vænget could

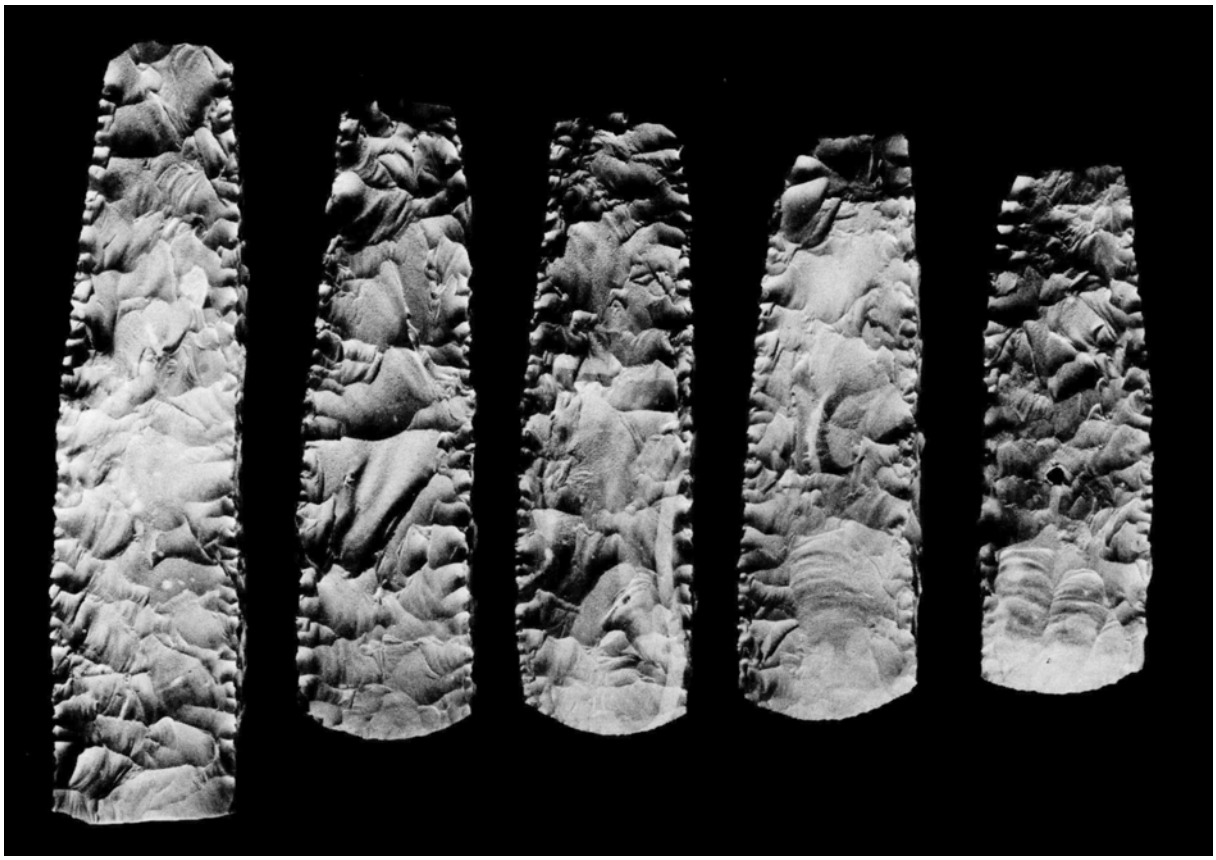


Fig. 10. Five type VI flintaxes from exp. IV A,B,C,D,E, ready for polishing. Photo: L. Larsen.

be due to factors which have interfered with the spreading of flakes. Vegetation in the form of grasses and small bushes could trap flakes, creating a »wall effect«. Nor is it without significance that the find was in a slight depression in the subsoil surface, a factor which preserved the find but may also have influenced the spread of flakes. Finally, it must be noted that the Hastrup Vænget flakes were not collected by sieving. Many small peripheral flakes may therefore have been missed.

Horizontal distribution of flakes from the experiments did, however, show a clear similarity to the Hastrup Vænge find. Classification of the flake types showed further parallels between the diagnostic wasters from experiments III A and IV, and Hastrup Vænget.

The percentage distribution of flake sizes agreed particularly closely (Table I), so that the experimentally produced axes really can be regarded as true replicas. Not only were the axes made to the correct proportions, established by means of a large measured sample of prehistoric axes (Nielsen 1977), but the attempt to mimic the method of production was also successful.

The experiments with the production of flint blanks revealed first and foremost the differences in the size distributions of waste flakes from producing blanks and true axes (Table I). Most of the weight produced in blank production is concentrated in a few large, round flakes. This showes that the Hastrup Vænget wasters are not in this class. It was clearly not flint blanks which were being produced at Hastrup Vænget. The size distribution of flakes, together with the scatter analysis, can clearly be interpreted as a workshop, where the primary task was the production of flint axes, working from stage 2 through to stage 4 items, ready for polishing.

Experiment no.	flake categories (D = maximum dimension in cm) 0<D≤1	1<D≤2	2<D≤4	4<D≤6	6<D≤8	8<D	total number of flakes	weight of blank (g)	weight of product (g)
I A	181	65	20	11	9	5	291	8250	4000
II A,B,C,D,E	311	252	142	66	85	73	929	34240	14400
III A	299	459	306	108	34	14	1220	5500	1630
IV A,B,C,D,E	3301	2551	1925	573	179	107	8636	39880	6760

Axe manufacture site	flake categories (D = maximum dimension in cm) 0<D≤1	1<D≤2	2<D≤4	4<D≤6	6<D≤8	8<D	total number of flakes	flakes, total weight
Hastrup Vænget	11289	10696	6087	2225	176	14	30487	168050

Average values used in calculations:
Weight
Stage 1: 8–12 kg
Stage 2: 4–6 kg
Stage 4: 1.5–1.7 kg

Number of flakes
Stage 2 yields 2–300 flakes in total (with 150–200 < 1 cm).
Average number of excavated flakes: c. 100.

Stage 3,4 yield 1650 flakes in total (with 600 < 1 cm).
Average number of excavated flakes: c. 1000–1100.

Table I. Comparison between the flakes from the experiments and from the site at Hastrup Vænget.

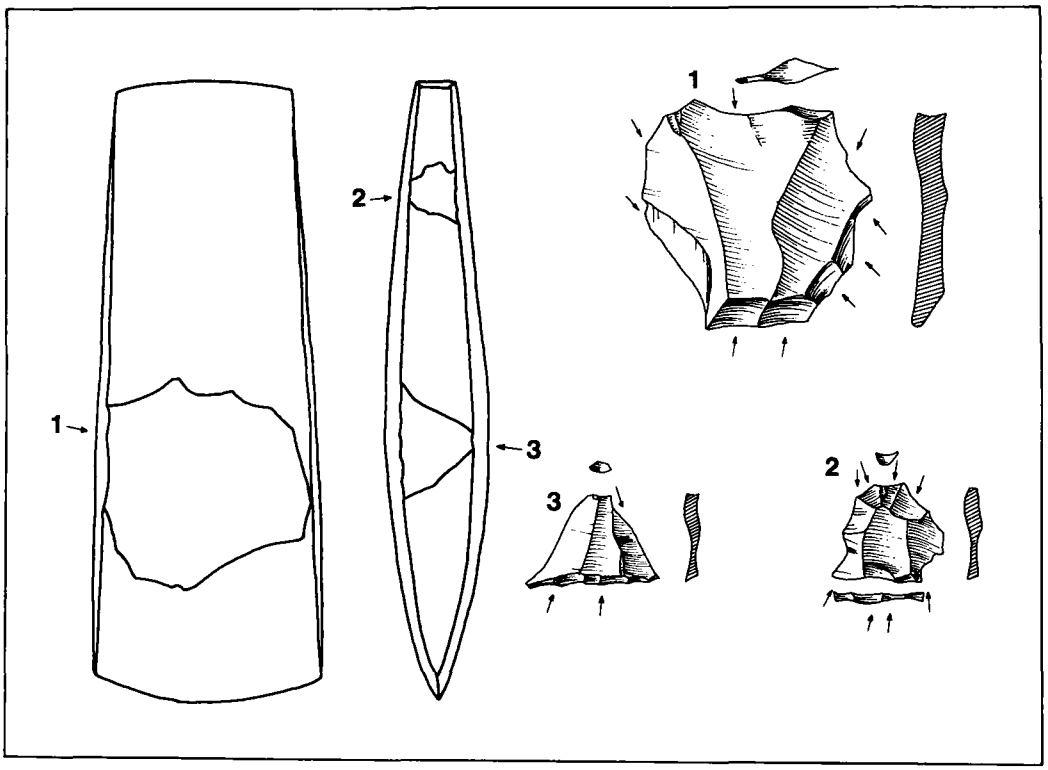
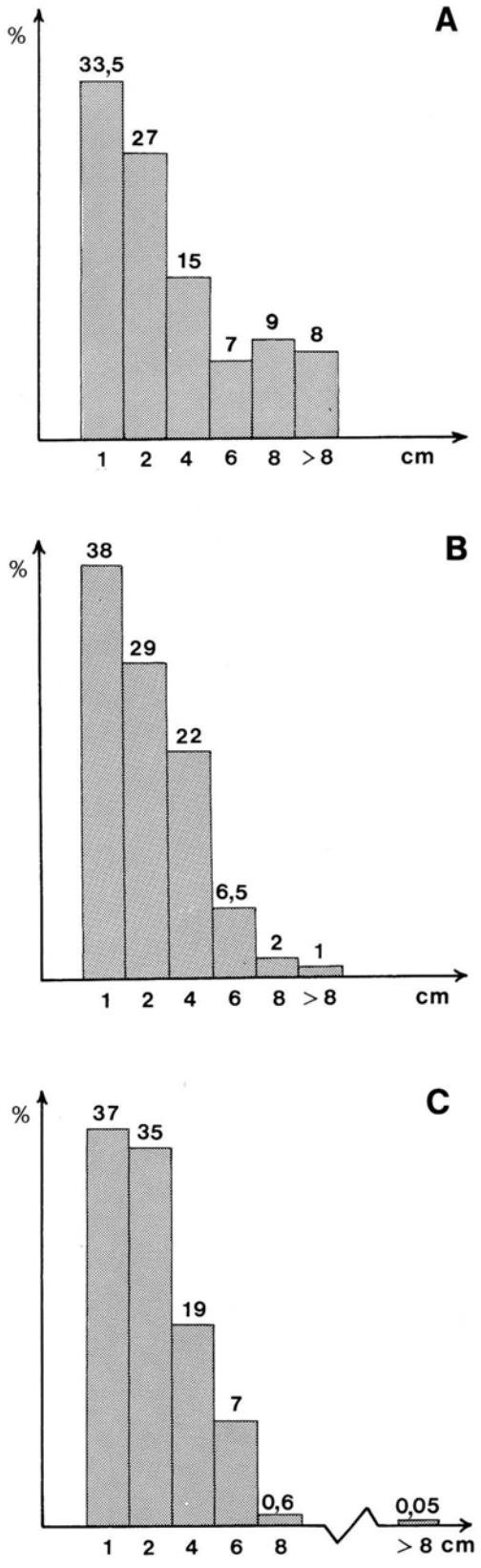


Fig. 11. Diagnostic flakes from axe production. Note the following characteristic elements: platform remnant with facets; counter flake negatives; frequent occurrence of overpassed flakes (*outre passage*).



HASTRUP VÆNGET – THE SCALE OF AXE PRODUCTION

An interpretation of the Hastrup Vænget flake distribution pattern is given in fig. 13. The bimodal scatter is explained by there having been two working areas close together. Either the same knapper had changed position, or else two knappers were at work at the same time.

What was the scale of axe production at Hastrup Vænget? How many axes were produced? Fig. 12 shows the size distribution of the flakes, and agreement can be seen between Hastrup Vænget and the experiments. One difference, however, is the relative lack of large flakes (over 7–8 cm) at Hastrup Vænget. If it is assumed that the experiments represent a »normal« situation, the following interpretations are possible for the prehistoric workshop:

1) It might be that the axes produced at Hastrup Vænget were worked so as to produce proportionally fewer large flakes – which is to say, the blanks used may have been lighter and narrower than those used in the experiments.

2) The difference could also be due to the removal of these large flakes from the site in order to make them into flake tools.

The most likely hypothesis is that Hastrup Vænget's waste represents a production episode with a »normal« distribution of flake sizes. No other axe workshops are, however, known from the early TRB for comparison.

In the experimental production of thin-butted axes, thick and heavy blanks were used (6–9 kg apiece). This is at the upper end of the range of the stage 2 flint blanks so far known from Danish hoards of blanks (Mathiassen 1937, Ebbesen 1980). In the experiments, many large, heavy flakes were produced at the start of the reduction process. These the prehistoric flint-workers would presumably have left at the place where the blanks were roughed out. Hastrup Vænget and experiments III A and IV are assumed, despite quantitative differences, to represent a real range of variation, which would also have occurred in prehistory, depending on whether the intention was to produce large or medium axes.

The experiments at Lejre Research Centre in 1981 and 1982 showed that there is a clear connection between the number of waste flakes, weight of flakes, the

Fig. 12. Graphs showing the size distribution of flakes. A: Exp. II A,B,C,D,E. B: Exp. IV A,B,C,D,E. C: Hastrup Vænget.

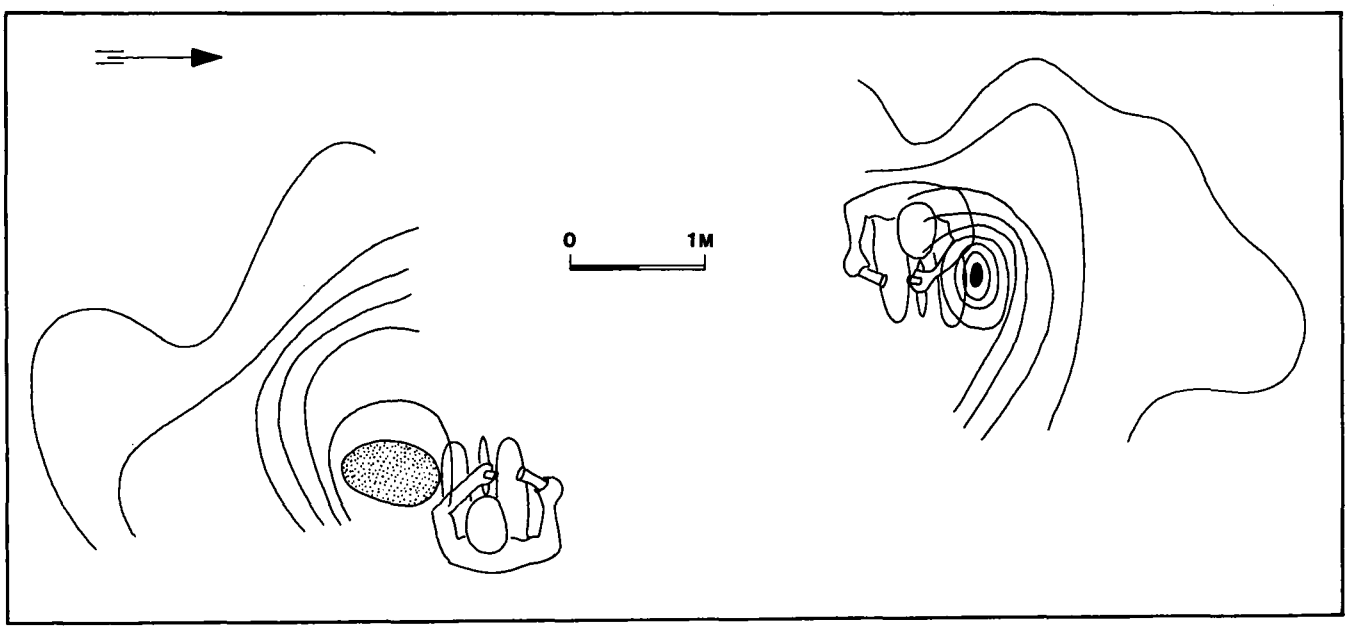


Fig. 13. The hypothetic position of the flintworker at Hastrup Vænget.

blank and the finished axe, at least in the case of the experimentally produced axes. No finds of prehistoric workshops have yet been published at which it was possible to join up the flakes, in order to get an idea of the size of the axe. But the known material, with hoards of unpolished, thin-butted axes (Nielsen 1977) does suggest that production was uniform, even though some stylistic differences can be seen between one hoard of axes and another.

If the average value for weight of waste flakes per axe (c. 6200 g) is used, a rough calculation demonstrates that at least 27 medium sized thin-butted axes were produced at Hastrup Vænge. If the average number of waste flakes per axe is used (c. 1650), the result is that at last 18 medium sized thin-butted axes were made there.

THE TIMESCALE OF AXE PRODUCTION

The purpose of these rough estimates is to do no more than give a rough *order of magnitude* of production at Hastrup Vænget. If we continue in this vein, and assume that production took place continuously over a number of days (8), and that the experimental times are roughly similar to those of prehistoric knappers at around 2 hours per axe, then the minimum work time involved at Hastrup Vænget is between 40 and 60 hours of concentrated work. Maybe 8 to 12 man/days at 5 hours per day? If the raw flint was collected from raised beaches on Stevns, where the flint is suitable for axe production, then about 250–350 kg of selected material would be needed to produce 30 thin-butted axes. The blanks, which had to be transported to the workshop, would weigh in the region of 120–180 kg, if the correct blank weight is 4 to 6 kg. Only 10–20% of the original raw material would have been used as finished axes. Another 10% would have been usable for flake tool production.

FLINT ON NEOLITHIC SETTLEMENTS

In the introductory presentation of Hastrup Vænget the question was raised as to whether waste from axe production could be used to make smaller tools. Experiments I B and III A attempted to examine this. It is noted that the waste from blank production gave many more possibilities of producing large flake tools like flake axes, disc scrapers, borers etc. Some of the flakes produced during blank production are indeed big enough to be used for producing flint halberds or very small, thin-butted, four-sided axes.

The waste from true axe production is also a source of potential raw material for rather smaller flake tools and transverse arrowheads. By examining the flint inventory from neolithic settlements, it should be possible to evaluate the scale of axe production in the settlement sphere. This waste from the working process has in some cases accompanied the finished product, whether this was an early neolithic axe or a late neolithic dagger, when these were exchanged far to the north, as far as the flintless areas of middle Scandinavia (Becker 1952).

PRODUCTION AND DIFFUSION

It is interesting to note that Hastrup Vænget is close to Stevns, a raw material source of a scale comparable to the largest exploited in Europe during the neolithic, such as: Grand Pressigny, France; Spiennes, Belgium; Ryckholt, Holland; Lousberg, W. Germany; Krzemionki, Poland; and Grimes Graves, England. At all these sites is evidence of flint extraction in the form of mines, pits etc., with an associated production system and distribution network based on roughout workshops and axe workshops, with nearby hoards of roughouts and axes.

The Stevns area is noted not only for the presence of many finds of finished axes and daggers, but also qualitatively because of many large artifacts from hoards and single finds. What is of particular interest in this connection is the evidence of nearby finds of hoards of stage 2 roughouts. An important discovery was the open find of hundreds of faulty stage 2 roughouts in a Litorina beach at Strøby (Mathiassen 1934, Ebbesen 1980), 10 km east of Hastrup Vænget. This suggests that these beaches, very rich in flint (and now removed by gravel digging) were the sites of mass production of blanks in the middle neolithic. Production of axes ready for polishing took place close to the same area. Excess production is shown not only by the depositing of so-called overlarge polished axes of very fine quality in boggy areas, but also by the hoards of axes ready for polishing. In a diachronic perspective, the Hastrup Vænget workshop was in an area which was an important centre of production throughout the neolithic, despite several changes in the directions in which the axes spread to areas without flint. According to Becker (1947), a change in the »flint trade« is visible during the middle neolithic, when distribution to the north German area becomes more important. In middle neolithic B, finds of finished axes become more common to the east; Zealand and Scania in particular must have been of central importance to the production of flint (Nielsen 1977). In the late neolithic, distribution of Danish flint again includes north Germany, and in the course of this period achieves a continental distribution as wide as that of Grand Pressigny blades.

Understanding the difference between the diagnostic waste from blank and axe production is of decisive importance for an understanding of workshops like Hastrup Vænget. The absence of associated features and settlement deposits means that these workshops have a rather modest appearance, and during a rescue excavation might be mistaken for a chance collection of flakes. Such isolated piles of unretouched flakes can on the other hand be the most important indicators of how raw material collection and supply occurred. Hastrup Vænget can be seen as an intermediate link both in the production and in the distribution of thin-butted axes in the area round the estuary of the Køge River; production of the blanks would have taken place at the flint source, and production of the finished axes closer to or at settlements, where they would be polished or distributed further.

Archaeology testifies to the existence of large scale blank production sites at other coasts as well as Stevns. From east Jutland, a find is known at Rugård Strand yielding hundreds of flint blanks in a raised beach (9). Blank production is also known in connection with neolithic hunting stands on islands with flint sources, such as Hesselø (Becker 1950, Skaarup 1973) and Anholt. The extent of axe production on the larger inland settlements associated with agricultural activities and megaliths is as yet unknown. Such excavations often took place some time ago, when unworked flint flakes were often discarded or not regarded as significant in the report.

How large a role the collection of flint and manufacture of axes might have played in the »site catchment« for a given settlement on Stevns is still unknown. It is likely that several settlements here would be located with a view to combining several resources, so that flint would be one determining factor. Just the realisation of the amount of flint that must be collected to produce a single hoard of axes is thought-provoking, not least if the »Hastrup Vænget model« should be applied to the late neolithic, when increased demand for the best

Archaeological find contex	Many large flakes with a high percentage of cortex Flakes from blanks Fragments of blanks Hammerstones Raw flint nodules	Assemblage like the Hastrup Vænget site – also occurring with preserved fabricators of antler and hammerstones	Assemblage as found at a hunting site (i.a. Hesselø), associated with a type I or type II production	Assemblage as found on larger base camps, associated with axe production (i.a. Bundsø) The assemblage includes grinding stones, antler fabricators, unpolished axes (fragments), and used/discarded axes
Flint production	Blank production	Axe production	Blank production Axe production Production of cutting and scraping tools Blade and arrowhead manufacture	Final preparation of axes Polishing of axes Resharpening of axes Production of 'basic tool kit', besides axes
Topographical position	Close to natural flint sources (coast – mine)	Near natural flint sources	On islands, on coasts, and in fiords, near natural flint sources	Inland location, on lakes, rivers, and fiords
Type of manufacturing site	I	II	III	IV

Increasing exploitation of the flint material —▷

Table II. Four types of find accumulations with evidence of axe production.

quality flint led to the establishment of mines in north Jutland and Scania. Several of the known mines could by themselves hardly have produced much more flint than was needed for the work carried out at Hastrup Vænget.

From this superficial perspective, use of flint mines seems irrational. The large amount of work involved would have produced only a limited quantity of relatively irregular and small nodules. The north Jutland flint mines cannot be compared, for example, with the English ones, either in size or in production quantity. A copying of the Grimes Graves 1971 shaft took 6–7 people about 6 months, removed 800–1000 tons of sand and chalk, and produced 8 tons of flint! As far as north Jutland is concerned, it must be remembered that the long neolithic coastlines were close to the mines and had large amounts of easily accessible flint. One wonders whether this coastal flint was monopolised by others, and inaccessible either physically or economically to those who established the mines. A more likely explanation is that the north Jutland mines are an expression of the need for raw flint of the best quality, regardless of nodule size. The late neolithic mines show just this need of top quality flint, which was an essential precondition for the pressure flaking of the various bifacial tool types.

In connection with mining and axe production in Papua, Flemming Højlund (1979) has suggested that

these activities cannot be regarded as specialisations. Anyone can make an axe, participate in raw material procurement etc. One is tempted to draw an exact analogy with prehistoric European mining areas, and maintain that the main picture here is one of resource exploitation by the local inhabitants, who owned the land and the resources – specialists to a considerable degree, but not at the level of the individual; everyone in the local group took part in the production process. This could not only manifest itself in the form of a raw material monopoly, but would also explain concentrations of highly developed flintworking »know how«, as shown by e.g. the Livre de Beurre production in Touraine, and in the Danish dagger production in areas like north Jutland.

EPILOGUE

The lithic experiments at Lejre Research Centre in 1982 tested hypotheses that were formulated as a result of the excavations at Hastrup Vænget, the first detailed examination of an axe workshop in Denmark. It is clear that many questions remain to be answered. As Hastrup Vænget is the only find we have with stage 3–4 axe working, we have no idea how representative it might be. Another question concerns the validity of the research model, which involves several untested assumptions – which cannot be examined until more finds are available. Finally, there are questions which in a general way apply to the theory and method of experimental archaeology: can one copy a product if one does not closely copy the method of production? (10)

The practical experiences on which this study was based have been a twofold exercise; both to train manual skill and to investigate the archaeological context of the thinbutted flintaxe. It is important that replication in the true sense of the word (Crabtree 1966), rests on a feedback system between the two aspects.

Translated by Peter Rowley-Conwy

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NOTES

[1] The investigation has Køge Museum no. 687. Carried out be Peter Vemming Hansen and Flemming Kaul.

[2] The experiment could be carried out thanks to a grant from the Lejre Research Centre. Thanks are due to Hans Ole Hansen (director), and Dorthe H. Nielsen (area administrator) for economic, practical and scientific support.

[3] Harm Paulsen of Schleswig has worked on experimental flint manufacture for several years. See e.g. Bokelmann and Paulsen 1973, 1974 and Broadbent and Knutsson 1979.

[4] The practical conclusions and results were developed by Bo Madsen together with the flint knapper Thorbjørn Petersen from Copenhagen, who together with Ivan Andersen of Jutland has specialised in the foursided technique. The basic work was however undertaken at the Culture Historical Museum, Randers, in close collaboration with Jacques Pelegrin. A »lithic workshop« has operated here since 1975 under the auspices of B.G. Stürup.

[5] The documentation is kept at Lejre Research Centre.

[6] In connection with the Lejre flint seminar in 1981, flakes from the bodies of several experimentally produced thin-butted axes were analysed. Graphic plotting of among other things the width of the remains of the striking platform against flaking sequence showed clear steps corresponding to manufacture stages.

[7] The fabricators of the two knappers differed in that Jacques Pelegrin, who did not have access to large quantities of elk antler, used pieces cut from antlers of deer of Asiatic origin (maintained in Paris Zoo).

[8] An idea inspired by the description of work organisation among several stone using groups in Australia and New Guinea. See particularly Højlund 1979 and 1981.

[9] Rugård Strand, Rosmos parish, Djurs Sønder district. Culture Historical Museum, Randers, J. no. 91/76.

[10] *Replication* is seen as opposed to *simulation*, for example when flint tools are made with the aid of copper fabricators (i.e. Olausson 1983: 24–35).

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A Neolithic Vehicle from Klosterlund, Central Jutland

by PER OLE SCHOVSBO

Klosterlund, situated near the edge of the now dried-up Bølling lake, has become renowned in Danish archaeology. This is the place where, in 1936, habitation layers were discovered which dated from the Early Stone Age (Mathiassen 1937), i.e. slightly later than the site at Star Carr (Eastern England), which dates from the 8th millennium B.C. Similarly, Bølling lake has become a classic locality for studying the history of climatic developments since the last Ice Age (1). Here the first traces were found of the Late Glacial climatic amelioration around 10,000 B.C. which is named the Bølling period (pollen zone I b) (fig. 1).

At the edge of Bølling lake an excavation was carried out in 1961 which had relatively little impact on archaeological research, but which nevertheless yielded a remarkable object unknown elsewhere in Western Europe: a natural fork of oakwood (Quercus sp.), just over three metres long, shaped by an axe into a cross section which is rectangular to square throughout its length (fig. 2). We shall demonstrate that the object is probably the undercarriage and shaft of a two-wheeled cart similar to the one depicted in Scandinavian rock engravings. Wheels from this type of vehicle have been found both in Denmark and North-West Europe but not on the British Isles. They have been dated to the late period of the Middle Neolithic, the Single-Grave culture, which is an offshoot of the Corded Ware Culture complex, and to the Late Neolithic/Early Bronze Age.

CIRCUMSTANCES OF THE FIND

To drain the water away from the peat bank near the dried-up lake a ditch was dug towards the south. The shaft was found at a depth of approx. two metres, together with scattered pieces of unworked wood, Neolithic potsherds and Waste flint. Silkeborg Museum was notified of the discovery and the shaft was taken to the Museum, where it was placed in dry sand for a year, then treated with a fungicide and coated with varnish (2). The shaft retained so much dry matter that the conservation treatment was successful, and only a few shrinkage cracks and some slight deformation are visible. The object was thought to date from the Iron Age or possibly a later period, but a radiocarbon dating in 1965 demonstrated that it is much older. The discovery at Foerlev Nymølle near Skanderborg (Central Jutland), during the same years, of a worked wooden fork of similar dimensions but with a different appearance (Becker 1970: 162, Abb. 10; Becker 1972: 48, fig. 20), which was rightly interpreted as a crudely trimmed female figure, changed the attitude to the fork from Klosterlund. It was believed that it too might be a female figure.

The locality

The dried-up lake filled a depression in the south-west corner of the old county of Viborg. This is where the watershed extends along the Jutland ridge, and the depression is drained off through an enormous system of subglacial stream trenches reaching from the area around Århus and Silkeborg in the east to the Karup moorland plain in the west. The pollen analyses published by Johannes Iversen in 1975 have illuminated environmental changes in Bølling lake since the last Ice Age. During the Early Stone Age the water level of the lake may have followed the 65 m curve, since the settlement was located on an adjacent plateau of post-glacial fresh-water sand. Yet the surface relief has altered so much over time that a contour map is insufficient and has to be supplemented by a geological map (fig. 1). This shows that lower areas have filled up with washed-down sediments from the slopes of the morainic hills and with deposits of organic material. Judging from the pollen diagram the organic material provided a suitable soil, even during the time of the settlement, for alder

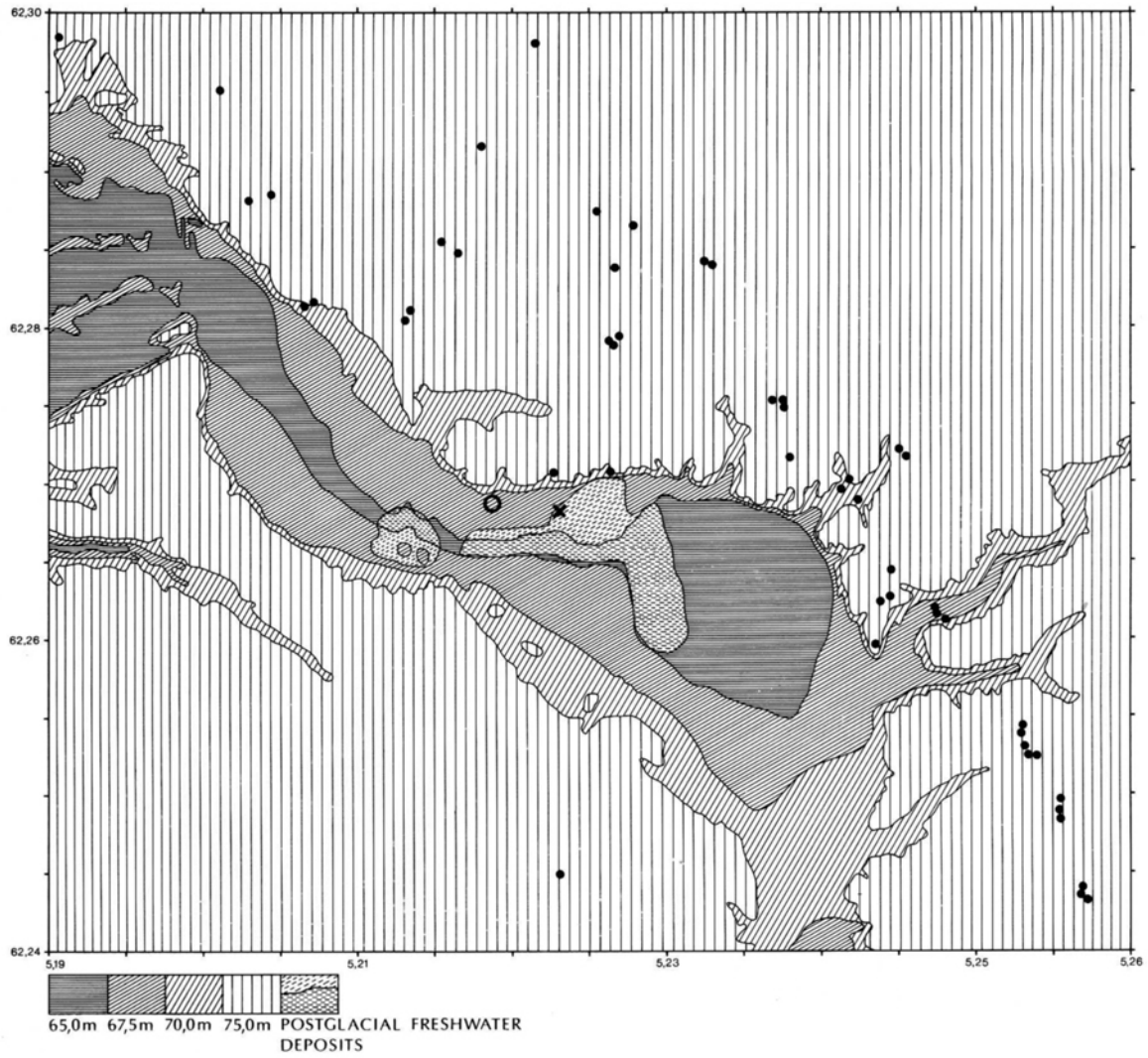

Fig. 1. Bølling lake and its vicinity. Contour lines indicated up to 75 m above Danish ordnance datum. The Mesolithic settlement is marked: o, the site where the vehicle shaft was found: x, and prehistoric mounds: ●. Broken hatching shows the distribution of post-glacial fresh-water peat, which may indicate the extension of the lake during the Stone and Bronze Ages. Drawn by Orla Svendsen on the basis of a 4 cm map from the Geodetic Institute and soil map No. 1214 IV NE Bording, Geological Survey of Denmark.

thickets and peat moss. During the Late Stone Age and the Bronze Age the lake was surrounded predominantly by forest trees, such as lime, oak and elm, while grasses, sphagnum and heather became more common during the Pre-Roman Iron Age.

The only parts of the depression which are known to have been water-logged in prehistoric times are those filled with post-glacial fresh-water peat. This is suggested not merely by the discovery of a dugout canoe from the Early Neolithic, period B, in the southern part of the lake (Tauber 1971: 136, K–1214), but also by the follow-up excavations of the site where the vehicle shaft was found. These revealed a mixture of water-deposited artefacts, floating wood and worked wood, most of which probably date from the Late Stone Age (3). The peat formations do not go above the 75 m contour. However, there is a preponderance of morainic deposits and post-glacial fresh-water sand, on which the Stone Age and Bronze Age burial mounds were built. If the mounds were strung out along the side of ancient trackways, as Sophus Müller has suggested (1904: 1 ff.), these would have passed east of Bølling lake, not – as one might have expected – west of the lake where the tunnel valley narrows, and where in later times the Jutland 'military road' (the ancient arterial road through Jutland) and the present main road from the south to

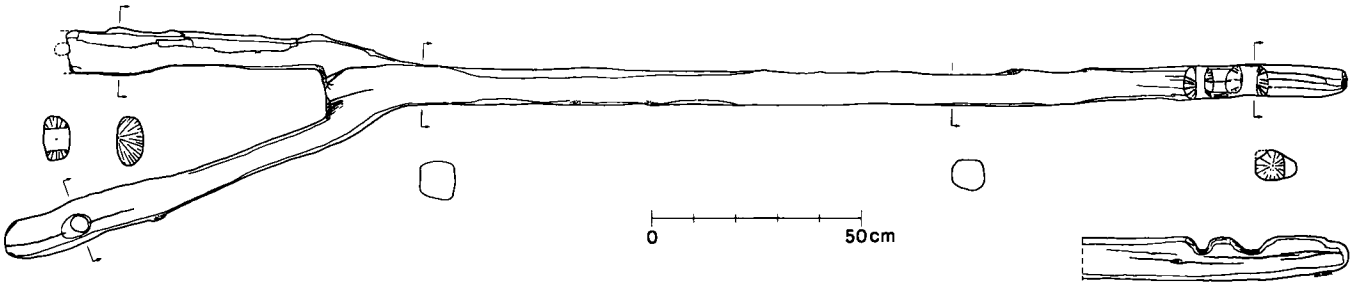

Fig. 2. Measurement and drawing of the vehicle shaft from Klosterlund by the author (autumn 1976).

Viborg passed. Incidentally, another branch of the 'military road' leads past the burial mounds (Mathiessen 1959: 38 and maps). Thus the known as well as the suggested road communications curve around Bølling lake and its vicinity.

DATING

The vehicle shaft from Klosterlund was radiocarbon dated in 1965, which resulted in a date of 1560 ± 110 B.C. (uncalibrated) (Tauber 1967: 109, K–1009). The wood is fairly young, hardly more than 50 years old, so it may be possible to advance the date towards 1500 B.C., a conventional C^{14} year. It is a risky undertaking to assign a find to any cultural context on the basis of a single C^{14} date, but judging from Ebbe Lomborg's account (1977, fig. 9) the Klosterlund shaft may date from the Late Neolithic, period C, i.e. the latest period of the Danish Stone Age. If the dating is calibrated, it results in a calendar year of approx. 1900 B.C.

THE VEHICLE SHAFT (fig. 2)

The shaft is fashioned from a natural oak fork, with all the heartwood still present. One branch was damaged on recovery but was restored after conservation. The tip of the branch is missing as it was used for radiocarbon dating. The slant of the fork in relation to the longitudinal axis is probably not an original feature, but was caused by deformation as a result of dehydration or soil pressure. Consequently, the object can be reconstructed symmetrically without any problem. The cross sections of the branches are flattened while the shaft itself has a nearly square cross section, with two notches cut at the edge. If the notches are turned upside, the shaft is orientated horizontally as it probably was in prehistoric times, and the underside of the branches now shows signs of wear. It is impossible to determine whether these marks occurred in prehistory or when the shaft was recovered in 1961. The whole surface of the shaft has been examined under a horizontal light beam to detect signs of wear and pressure, but all that was discovered were marks of rope lashing on the branch that was glued together, and the impressions are clearly a result of the conservation process, and do not date from prehistoric times. Thus the whole surface of the shaft was probably trimmed.

Natural forks of wood have been used for numerous construction purposes through much of prehistory and right up to our time. Shipwrights selected bent wood for joints and ribs so that the fibres of the wood followed the shape of the finished product and thus gave it greater strength than if the fibres had been cut across. Similarly, bent trunks, branches and forks were used for house building and for tools. Prehistoric farmers used wooden forks when they made their ards (Glob 1951): the crook ard was made from a wooden fork, and the sole of the bow ard consists of a bow-shaped, bent piece of wood – hence the name. Forks and branches may have anthropomorphic features – they especially suggest the pelvic region – and this is presumably the reason for the crudely carved wooden sculptures known from several sites. Apart from the above-mentioned find from Foerlev Nymølle near Skandeborg, which probably represents a woman, a male counterpart (Feddersen 1881: 369 ff.), the date of which is uncertain, was found in 1880 at Broddenbjerg in Asmild parish east of Viborg. Others are known from North Germany and Poland. We know for certain, then, that carved natural forks serving non-utilitarian purposes have been found

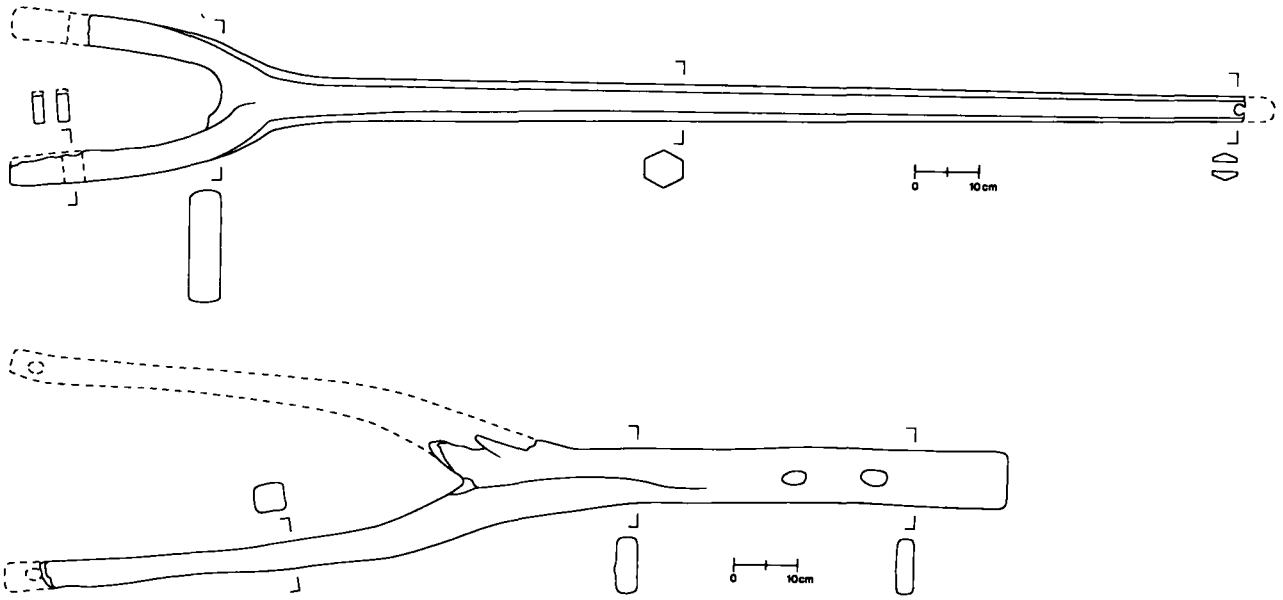

Fig. 3. Vehicle parts from natural forks of wood. *Above* a vehicle shaft and *below* a chassis from Tranbær bog south of Vejle (Jutland) dated to the Early Roman Iron Age. Measured by the author (autumn 1976) and drawn by Orla Svendsen.

in Danish bogs. It is therefore essential to be able to distinguish, with a resonable degree of certainty, the wood used for implements and construction from that used for sculptural purposes. Theoretically, wood used for construction may have been designed to contain anthropomorphic features, as Georg Kunwald has suggested was the case with the chassis from Rappendam near Hjørlunde on Zealand (Kunwald 1970: 42 ff.), which has been dated, together with a number of other vehicle parts, to the Pre-Roman Iron Age. However, in this particular case the »sexual characteristics« of the chassis fork were probably not carved deliberately, as suggested by Kunwald (1970: 63 ff., Abb. 13). There is every reason to believe that it arose from the particular fibrous structure of the wood and the resulting breakage. In other words, the fork is a purely structural part of a four-wheeled vehicle with discoid wheels, very similar to the chassis from the contemporaneous find at Dejbjerg bog near Ringkøbing (Petersen 1888) and the slightly more recent find from Tranbær bog near Vejle (Schovsbo 1983) (fig. 3) – both in Jutland.

It is different with two wooden forks published by C.J. Becker and apparently dating from the Early Neolithic. They were found in a little bog at Sørbylille, Sorø county (Zealand) and are described as fork-like wooden implements, carefully shortened, de-barked and trimmed. At the root end the cross section is nearly circular, but flattens at the branches. The original length was almost two metres, and the objects are completely devoid of incised notches or drilled holes for rivets. When recovered they were at some distance from each other, buried in the peat so that the crooks of the forks intersected at right angles. At the same level as the fork ends there were potsherds dated to the Early Neolithic, period B. C.J. Becker has refrained from interpreting the function of the forks, and a comparison with other finds does not help to answer the question. But it is unlikely that they are vehicle parts.

According to the latest estimate, we know of 15 fork-shaped chassis and vehicle shafts made from natural forks of wood found in nearly ten Danish bogs (fig. 3). To this figure must be added finds from Western Europe, especially Germany (Schleswig-Holstein and Niedersachsen), dating from the Early and Late Iron Age. This material falls into two main groups:

1) forks with horizontal holes drilled in the two branches, usually with a vertical hole drilled at the root end or a cut and notch for lashing. Owing to their functional and morphological similarity with the shaft of the Dejbjerg find, this group can be identified as *vehicle shafts*, an interpretation supported by their often uniform length and elegant execution. They belong to a four-

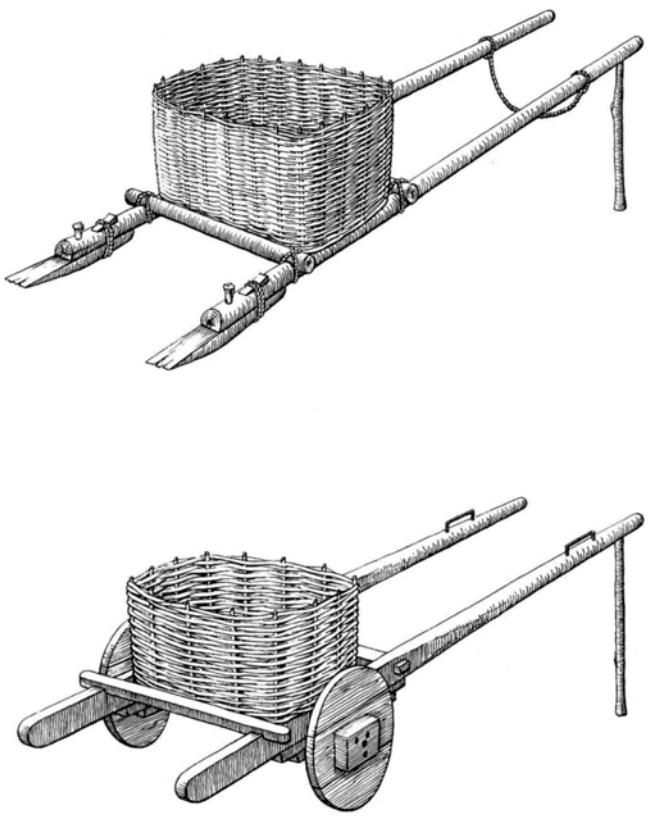

Fig. 4. *At the top* a sledge from Co. Antrim, *below it* a two-wheeled cart with disc wheels (sledge with wheels) from Co. Tyrone – both from 20th century Ireland (after Mogey and Thompson in *Man* 1951: 3–5, fig. 3).

wheeled type of vehicle with a revolving front end, which was probably familiar in Scandinavia as early as the Late Bronze Age, judging from the rock engravings and the finds of imported vehicle fittings at Skerne on Falster, and Egemosen (Jacob-Friesen 1970) and Lusehøj near Voldtofte on Funen (Thrane 1977, fig. 8). It is possible that the Niedersaxon find from Glum indicates that the four-wheeled waggon with discoid wheels was known here in the Early Bronze Age. However, only the wheels have been recovered, not the remaining parts of the waggon.

2) Wooden forks with *vertical* holes drilled in both branches and one or two vertical holes drilled at the root end. Because of their resemblance to corresponding objects from Dejbjerg they are identified as *chassis* (undercarriages) characteristic of the so-called »European« vehicle with four wheels and a revolving front end – just like the vehicle shafts (Witt 1970: 111 ff.). In Denmark they can be traced back to the Pre-Roman Iron Age and, as already mentioned, the type is represented by the vehicle from Dejbjerg and the waggons from Rappendam. In contrast to the forked vehicle shaft, the forked chassis has persisted till this century in Scandinavia. A well-known specimen from Norway is the Oseberg behicle, the chassis of which is not made from a natural fork but from a partially split plank. This is also encountered in the Danish Roman Iron Age (Tranebær) (4). The Dejbjerg find is a good example of the difficulty in distinguishing these two types of chassis forks, the natural and the artificial. Both the vehicle shaft and the chassis were probably made from bent wood which was either assembled or shaped by heating to form the finished pieces. Unfortunately, we have no detailed studies of this matter (5).

The Klosterlund fork (fig. 2) is obviously an intermediate type. It exhibits the vertical holes drilled in the branches typical of the chassis, and the length and lashing notch typical of the vehicle shaft. Considered as a vehicle shaft, however, it is longer and sturdier than that of the Iron Age, just over 3 metres long as opposed to slightly under two. Its robust dimensions make it well suited to carrying cargo, whereas Iron Age shafts were slender and only meant for drawing and steering the vehicle. One possibility therefore would be to interpret the Klosterlund object as the combined chassis and shaft for a two-wheeled cart: the drilled holes in the branches contained rivets to secure the axle, and the incisions at the end of the root held the lashings strung round the yoke (see reconstruction, fig. 5). Axle and yoke are thus related forms of suspension, between which the fork supported the body of the vehicle, as with ox carts and sledges from this century in Scandinavia and the British Isles (fig. 4).

That two-wheeled carts were known during the Scandinavian Bronze Age is demonstrated by rock engravings (fig. 6) which, according to Gösta Berg, show two different groups: 1) a fast light chariot, the body of which is balanced slightly forward over the axle, drawn by two horses with a yoke (Kivik, Frännarp and Villafarasten in Scania) (6). 2) a slow heavy cart with a circular outline, which may suggest a curved body, positioned between axle and yoke and drawn by two oxen – which thus pull and partly carry the load (Sannesund and Begby, Østfold in Norway; Disåsen and Rished, Bohuslän in Sweden) (7). In other words, this cart resembles the type from Klosterlund.

It is possible to view in this light the many pairs of disc wheels found in several parts of Western Europe (8) and often dated to the Late Mid-Neolithic, the end of the TRB culture and related groups, and especially the Single-Grave culture (van der Waals 1964: 51 ff. – Rostholm 1978: 204, fig. 8). It has even been suggested that the Mid-Neolithic stone-packing graves known from Jutland may be parallels to the Central European ox graves known from the Globular Amphora culture (Rostholm 1978: 202). The former normally consist of two parallel, oblong graves and an almost rectangular so-called mortuary house. Piggott thinks the graves might have contained the oxen and the mortuary house may have been a symbolic vehicle (Piggott 1968: 308). Hans Rostholm has extended this idea to include Central and East European vehicle graves, particularly the South Russian pit graves containing disc wheels of exactly the same type as the Neolithic ones from Holland and Denmark (9). So far the parallels are too tenuous, however. Western Europe possesses no actual vehicle graves, and affinities in the construction of disc-wheeled carts may easily be deceptive. This is clear from the fact that typologically very ancient forms were still in use at the beginning of this century in the Mediterranean area, the Far East, and the Spanish-speaking parts of Latin America, and also in isolated cases in large parts of Western Europe, especially in mountainous regions but also in the lowlands (fig. 4). These types of vehicles were used primarily for heavy transport, but were also made by local people for their own transport needs.

VEHICLE AXLES

So far there are no definite finds in Denmark of vehicle axles older than the Pre-Roman Iron Age, but there are some potential candidates. Parts of a vehicle axle of oak (Quercus sp.) were found in 1943 at Knudmose near Herning (Central Jutland). They have not survived physically, but are retained in the records of Herning Museum. It appears that the central part of the axle had a rounded cross section, contracted at the middle, and a length of 82 cm. The partly preserved axle arm had been sharpened and was 32.5 cm long – which gives a minimum gauge of 114.5 cm. It is very similar to the axle

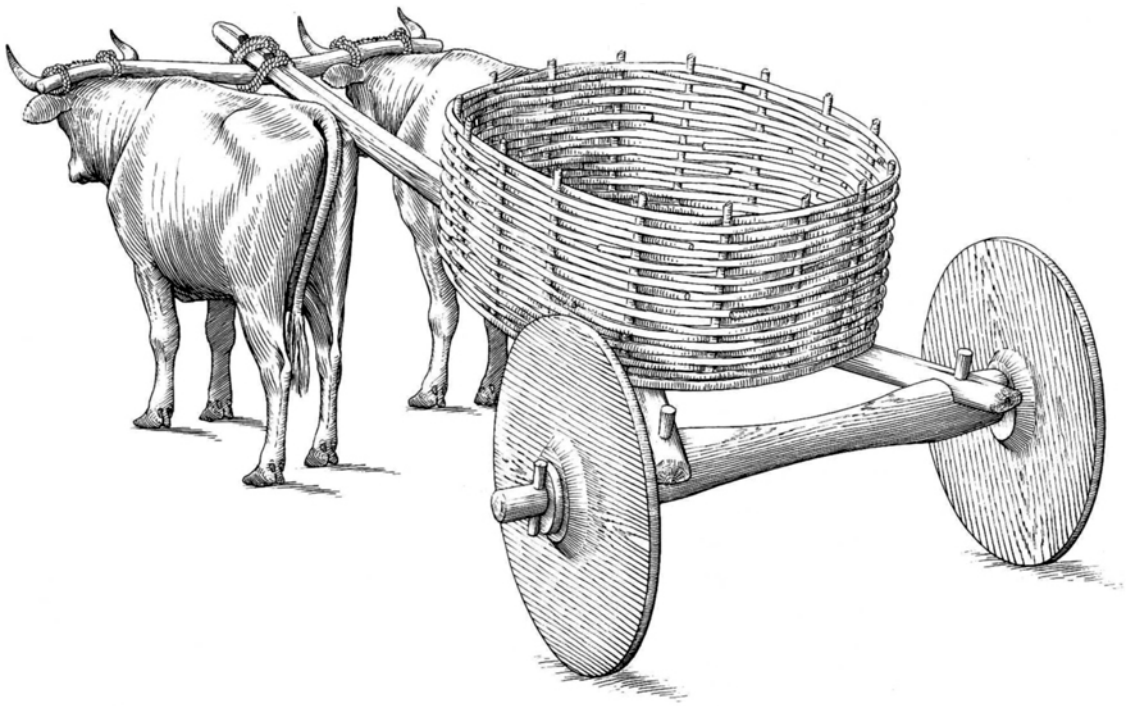

Fig. 5. Attempted reconstruction by the author of the type of vehicle which the shaft from Klosterlund may represent. Drawn by Orla Svendsen.

from Buchau (Wasserburg) in Baden-Württemberg, which is dated to the Urnfield culture, Hallstatt A–B (fig. 7) (11). There may be other parallels in Niedersachsen, but they are hard to assess because of lack of publications. The axle from Knudmose near Herning has been dated by pollen analysis to the Sub-Boreal period, probably the Late Stone Age (12).

It is probably characteristic of vehicle axles from North-West Europe that pre-date the Iron Age that, in contrast to later types, they have a rounded or circular cross section, the central piece is contracted at the middle and the top side at either end has a rectangular notch, often with vertical holes drilled in the centre. In many ways this shape is very similar to the yokes found in bogs. Unfortunately, far too few of them have been dated, and we do not have a scientific study of yokes found in bogs, despite the introductory papers by Alexander Fenton (13).

DISC WHEELS

The type of disc wheel that was used in Holland, Niedersachsen and possibly in adjacent regions of the North German lowlands extending east towards Poland and north towards Denmark is solid, with a fixed hub made from oak (Quercus sp.), or in a few cases alder (Alnus sp.), cut at a tangent (van der Walls 1964, fig. 17). Their dates range from the Late Stone to the Early Bronze Age, the majority belonging to the Corded Ware culture. The wheel diameter is between 60 and 80 cm and the length of the hub between 20 and 30 cm. Strangely enough, this type of wheel is absent from the British Isles, as is the following type with a solid wheel disc and with a moving tubular hub, which in Niedersachsen is dated to the Early Bronze Age and in Denmark to the Late Pre-Roman Iron Age (Rappendam) (Piggott 1979: 3 ff.). There is a simultaneous occurrence in Denmark of the disc wheel with a compound wheel disc and with crescent-shaped carvings, combined with a moving tubular hub. Apart from Denmark and Niedersachsen this type is also found in Holland and the British Isles (Doogarymore, Ireland and Blair Drummond Moss, Scotland) (14). The type belongs to the Pre-Roman Iron Age or the European la Tène period, though in Baden-Württemberg it apparently dates from the Bronze Age (Buchau). There are sporadic traces of disc wheels through the Iron Age up to the Middle Ages in Scandinavian finds and, as mentioned above, they are also found in more recent times in very much the same forms as those known from prehistory. Frankly, there is not much scope for variation, so it is not inconceivable that different types of disc wheels appeared spontaneously.

Until further evidence is available, therefore, the demonstrable patterns in the chronology and typology of disc wheels must be attributed to general technological conditions, economic requirements and the topographical possibilities of building and using a disc-wheeled vehicle. The vehicle material from Central and Eastern Europe implies social status, since it appears that the vehicles from these regions were not designed to carry heavy loads but were used for personal transport. In other words, they were prestige vehicles (Piggott 1968: 266 ff.) like the much later vehicles of the Dejbjerg type found in cremation graves in Northern Jutland (Kraghede) and on Funen (Langå) – or the Viking Age vehicle from Oseberg in Norway.

VEHICLES, SLEDGES AND PLOUGHS

A collation of finds and depictions from the Neolithic and Bronze Age in Scandinavia reveals a characteristic set of implements used in connection with teams of oxen. Most important is the plough (or ard), which P.V. Glob has analysed and interpreted in the light of finds and rock engravings, and which Gösta Berg has previously associated with the two-wheeled cart and with a plough-sledge which are said to be integrated parts of early agriculture in Europe (Berg 1935: 101). Even Sophus Müller entertained related ideas (1900: 203 ff.). It has been shown that the plough was frequently made from a natural fork of wood like the cart from Klosterlund, and both were drawn by a yoked pair of oxen. The pronounced signs of wear on the Klosterlund find, though they may not be prehistoric, nevertheless suggest that if the axle, and therefore the wheels, is removed, the cart may easily function as a sledge, just like the Irish specimen (fig. 4). The only difference is that the Irish sledge was drawn by a single horse between two poles, while the Klosterlund vehicle was drawn by a team of oxen. If this supposition is correct, the distinction between vehicles and sledges can be removed, since it seems likely that people used wheels whenever the terrain and climatic conditions made it practicable,

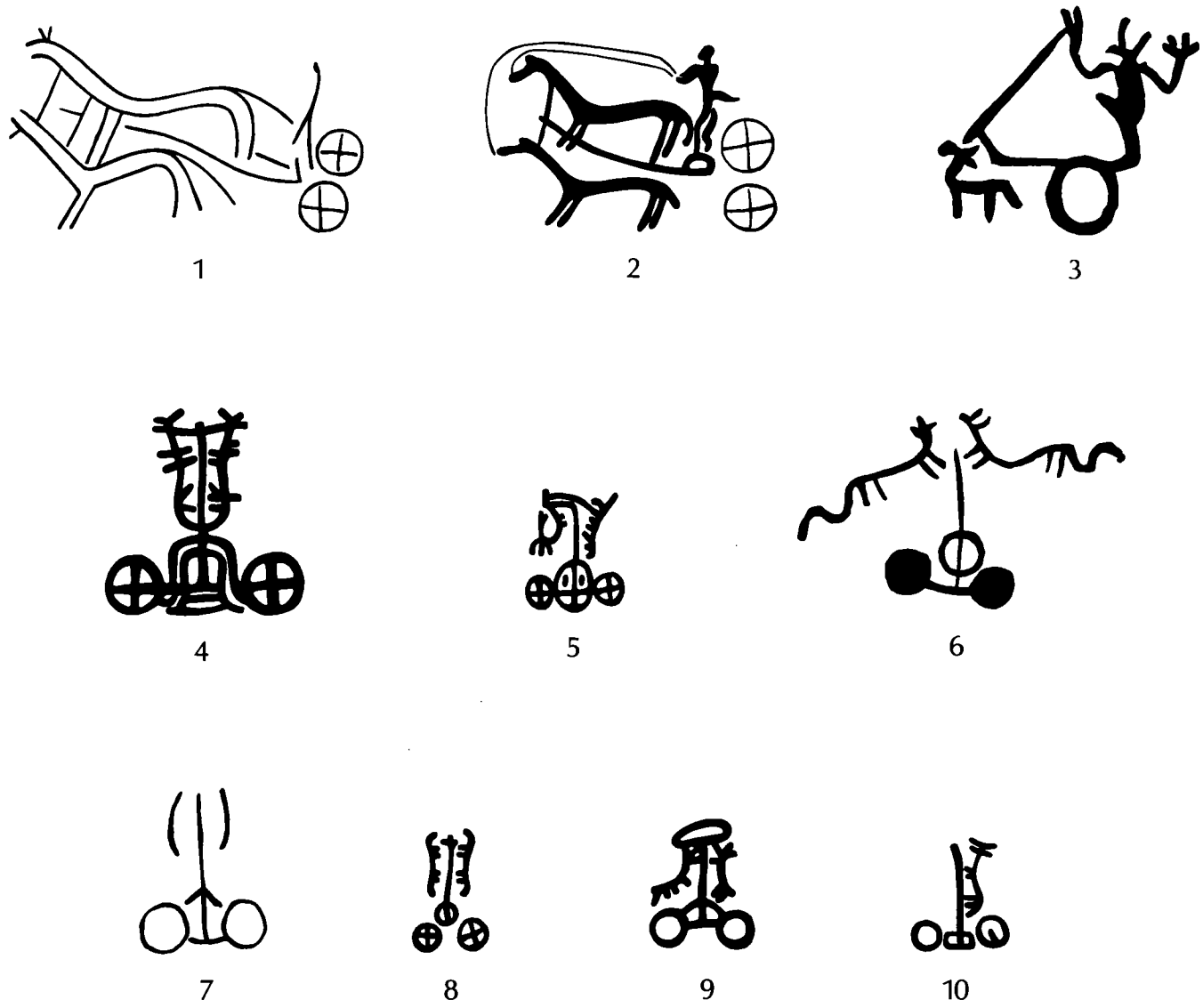

Fig. 6. Swedish and Norwegian rock engravings of two-wheeled carts. 1–5, *chariots* of a light and fast construction, often with four-spoked wheels known from Danish finds such as the sun-chariot from Trundholm (Zealand), Early Bronze Age, period II. The same dating may apply to the engraving from the Kivik grave in Scania (2). 6–10, *carts* with forked shaft of the Klosterlund type (7, 9) and probably a round wickerwork basket (6, 8). The wheels appear to be disc wheels, with one exception (8). Drawn by Orla Svendsen after Sverre Marstrander 1963, figs. 44–46.

but let the oxen draw the vehicle, after the wheels had been removed, in other areas and at other times.

This may explain the difficulty in distinguishing furrows from wheel tracks and the possible tracks of sledges in the Neolithic and Bronze Age. It also suggests why disc wheels have been found in pairs, sometimes probably also together with their axle, in peat bogs that contained no other vehicle remains.

VEHICLE AND PLOUGH AS BOG FINDS

It is unlikely that the motives underlying the deposition of wooden objects, such as vehicles and ploughs in bogs, lakes and streams were the same as those governing the deposition of other artefacts in similar localities. It is evident that, with a few exceptions, these wooden objects cannot be interpreted as votive finds as a number of special factors point in an entirely different direction.

A great number were simply rejected or lost during traffic or work in swampy areas, near streams or other areas which accidentally preserved the objects. This is particularly true of broken axles, ruined wheels, loose parts of ploughs and many other wooden objects found isolated and broken. It is also true of the worked pieces for hubs, rims, possible vehicle axles, boats, and a great many other objects that most resemble unidentifiable worked timber. Until recent times people in Scandinavia and the British Isles have submerged unfinished wooden hubs under water in order to leach the nutrients from the wood, presumably in an attempt to make it more resistant to dry rot and fluctuations in humidity. It is possible that the blackening of oakwood in acid bog water was particularly sought after because it apparently increased the strength and resistance of the wood. When the opposite happens, it is because the cellulose chains break down and the strength of the fibres is reduced (15).

Yet another factor is probably of greater significance for an understanding of the many bog finds. Prehistoric technology was »wet« in the sense that the wood was worked while it was completely fresh and full of nutrients, especially water. In this condition wood is flexible and can be easily bent into shape and worked. This condition can be prolonged by keeping the wood wet. If the wood dries out, it loses its flexibility, becomes harder to work and cannot be bent into shape. Soaking the wood again only results in a partial recovery of these properties. It is therefore expedient to keep the fresh wood wet until the working is over: the »wet chain« must not be broken. Similar conditions apply to the osier used for wickerwork, and the building of dugout canoes and Scandinavian clinker ships, as demonstrated in trial experiments.

There may also have been an attempt to preserve some of the »green« qualities of the wood for when it was put to use. This consideration may prove stimulating when dealing with the ploughs, yokes, vehicle axles and peat spades found in bogs. A problem of paramount importance, however, may have been shrinkage and deformation resulting from complete drying. Oak, in particular, splits easily when being dried, and this may be the reason why so many Neolithic disc wheels of oak cut at a tangent were deposited under water. There are examples of ruined disc wheels which had been joined together by means of dovetailed slips of wood (Kideris), so the problem was real enough.

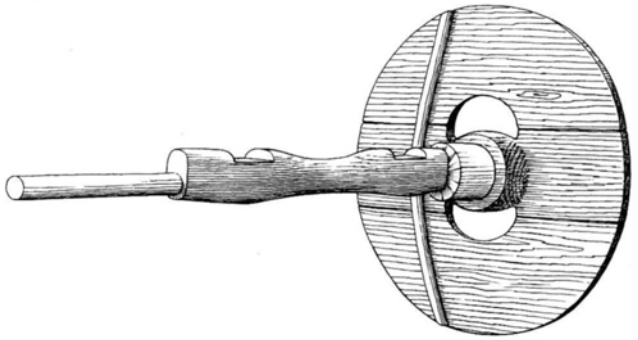

Fig. 7. Vehicle axle from Buchau, Baden-Württemberg, West Germany, dated to Hallstatt A–B. Drawn by Orla Svendsen after W. Treue 1965: 184.

Vehicle parts that were actual votive offerings were deposited for reasons other than rejection, manufacture or storage, and in Denmark this group constitutes a small but significant component in the range of characteristic types from the Early Iron Age (Dejbjerg, Rappendam and Tranbær). These finds tell us nothing about the Neolithic bog depositions of disc wheels and other vehicle parts, which suggests that Neolithic and Bronze Age wooden objects from bogs, apart from the anthropomorphic wooden figures, cannot be associated with prehistoric religious cults.

CONCLUSION

Accordingly, we may assume that bog finds of vehicle parts and wooden ploughs that can be dated to the Scandinavian Stone Age and Bronze Age are all for everyday use. The earliest vehicle parts from North-West Europe can definitely be assigned to the Corded Ware culture which, as far as Scandinavia is concerned, signifies renewed contacts with the rest of Europe, to some extent in contrast to the conditions obtaining during the late Funnel Beaker culture. European trends clearly influenced Scandinavian burial customs, weapons (battle axes), pottery types and probably also agricultural methods. It may be that these changes reflect a new orientation in religious cults and social structure, but we do not know, and we cannot use the finds of vehicles and wooden ploughs as evidence in the debate. What they show are parts of the technology which, as a result of stockbreeding, achieved crucial importance in agriculture.

Postscript

During the winter 1982–83 three different prehistoric vehicles were reconstructed at Forhistorisk Museum, Moesgård near Århus, Jutland. The first is a four-wheeled waggon with spoked wheels from the Roman Iron Age based on the find from Tranbær. The next a disc-wheeled waggon from the Pre-Roman Iron Age based on the finds from Rappendam. The third is, of course, the Neolithic vehicle from Klosterlund. The reconstruction-work is being continued, and in co-operation with other Danish Museums we are trying to learn more about land transport in prehistoric times by using the replica in systematic experiments.

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NOTES

I would like to thank the Danish Research Council for the Humanities for supporting the costs of illustrations.

[1] Iversen 1975: 362. Bølling lake was drained at the end of the last century, which resulted in the recovery of large quantities of bones and antler, especially from adult red deer. It is possible that the inhabitants of the adjoining Mesolithic settlement exploited the deer migrations at this narrowing of the subglacial trench (Mathiessen 1959: 25–26).

[2] Silkeborg Museum No. 231–1966. The site is located in Engesvang parish, Hids district, Viborg county.

[3] Follow-up excavations of the site by Silkeborg Museum in 1969 (No. 2–1969) and in the summer of 1976 by Christian Fischer.

[4] The Tranbær find, the National Museum, Copenhagen, No. C4972.

[5] It is not impossible that the objects were made from a partially split plank with a bent end, resulting in the characteristic »knee« at the end, covered by cast bronze mountings. Such a procedure suggests deliberate deformation of young trees for a special purpose, not just selection of naturally deformed trees.

[6] Mötefindt 1917: 209 ff.; Berg 1935: 99 ff.; Hagen 1955: 9 ff., and others.

[7] Berg 1935: 101 ff. See also Marstrander 1963: 167 ff. and 1966: 103 ff., and Thrane 1970: 102 ff. For an interpretation of rock-engraved ship depictions, see also Schovsbo 1980: 15–16.

[8] See e.g. Mötefindt 1918: 31 ff.; van der Waals 1964; Rostholm 1977: 185 ff., and references.

[9] Rostholm 1978: 197–98. Similar viewpoints are found in earlier writers, especially Piggott 1968 and van der Waals 1964, and were originally advanced by Childe 1954: 1 ff.

[10] Herning Museum No. 10–1944. Information kindly supplied by Hans Rostholm.

[11] The axle is depicted in Treue 1965: 184, fig. 7. The dating was kindly supplied by the curator, Mr Ladenburger, Buchau.

[12] Letter from J. Troels-Smith to Herning Museum, 1943. The axle from Knudmose and several others were found in 1983 in storage at Herning Museum (No. 54–41). The axle is neither Neolithic nor Bronze Age, but must be dated to the Pre-Roman Iron Age. Its peculiar shape is due to secondary use as a double paddle-spade (Grit Lerche: Double Paddle-Spades in Prehistoric Contexts in Denmark. *Tools and Tillage*, vol. 3,2, 111*ff.* Copenhagen 1977).

[13] See Müller 1900: 223 ff.; Balslev 1940: 3 ff.; Fenton 1972: 69 ff. Cf. also ethnological literature from Europe, e.g. Jacobeit and Kramarik 1969.

[14] Doogarymore, see Piggott 1979: 9. Blair Drumond, see Piggott 1957: 238–41.

[15] These questions have been discussed with Mr. Thomas Thomassen of the Technological Institute, Tåstrup and Professor Peter Moltesen of the Royal Veterinary and Agricultural High School, Copenhagen. I am very grateful to both.

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Kalvø – *A Coastal Site of the Single Grave Culture*

by SØREN H. ANDERSEN

During the study of the archaeology of Norsminde Fjord (south of Aarhus in eastern Jutland – S.H. Andersen 1976) a significant number of flint artifacts of Middle Neolithic types were collected on the surface of the large, sandy holm called Kalvø (fig. 1).

This led to the excavations carried out in 1963, 1968, and 1975, which showed that there on the flat top and NE slope was a mixed occupation layer with finds from both the Store Valby phase of the Funnel Beaker Culture (MN V) and from the Single Grave Culture.

On the top of the holm the settlement layers were much compressed, but the different occupations became easier to separate when followed down the slope (fig. 2). At the foot of the slope the occupation layer continued as a small and clearly demarcated shell midden with finds of the Single Grave Culture (layer 3 in fig. 2). Under the midden came a black sandy occupation layer with animal bones, flint, and pottery from the Store Valby phase of the Funnel Beaker Culture (layers 5 and 7 in fig. 2). The site thus shows a stratigraphical sequence with final Funnel Beaker occupation overlain by Single Grave Culture.

The site aroused interest, as settlements of the Single Grave Culture are still very uncommon, and this one also offered favourable conditions for the preservation of bone, a fact which might give important information about this cultural phase.

Kalvø is a prominence measuring about 100 × 200 m, built up of outwash sand. Today it is surrounded by drained low-lying grazing land, but in the Stone Age it was an island with shallow water on the south and east but deeper water on the north, west, and south-west. Old erosion cliffs are seen on the northern, western, and south-western sides, but there is a gentler slope on the east and south. The highest point of the flat top is 10.7 m over D.N.N. Today there is no fresh water on the island.

The actual Single Grave settlement lay on the flat top of Kalvø and spread down the north-eastern slope. This area has been subjected to fairly extensive excavations, and from the distribution of characteristic artifacts it is judged that this particular settlement may have occupied an area of about 10 × 40 m but was hardly larger. At the foot of the slope, on the shoreline of the period, was found a little shell midden taken to belong to this not very large settlement higher up. It measured 8 × 8 m with a thickness of up to 40 cm and a volume of about 12.8 m^3.

The shells were 68% oysters (*Ostrea edulis*), 20% mussels (*Mytilus edulis*), 4.5% clams (*Cardium edule*), and 2.5% perwinkles (*Littorina littorea*). A few shells of dog whelk (*Nassa reticulata*) were also found. Mixed with the shells lay charcoal, flint tools and chipping debris, numerous animal bones, artifacts of bone and antler, potsherds, and burned stones (cooking stones). There was no clear or consistent stratification within the midden. The small size of both settlement layer and midden and the fact that sherds belonging to only a small number of pots were found at all levels in the latter, show that the settlement was what may be called unitary, being the rubbish either of a single household or of a limited number of short visits – perhaps both. Also in agreement with this is the observation that only a few rather scattered Single Grave finds were made on the plateau.

THE FINDS

Tools of flint and stone

The following material was systematically measured in during excavation. There were also less characteristic objects with more random flaking, wear, or retouch. At the present moment the chipping debris has not been

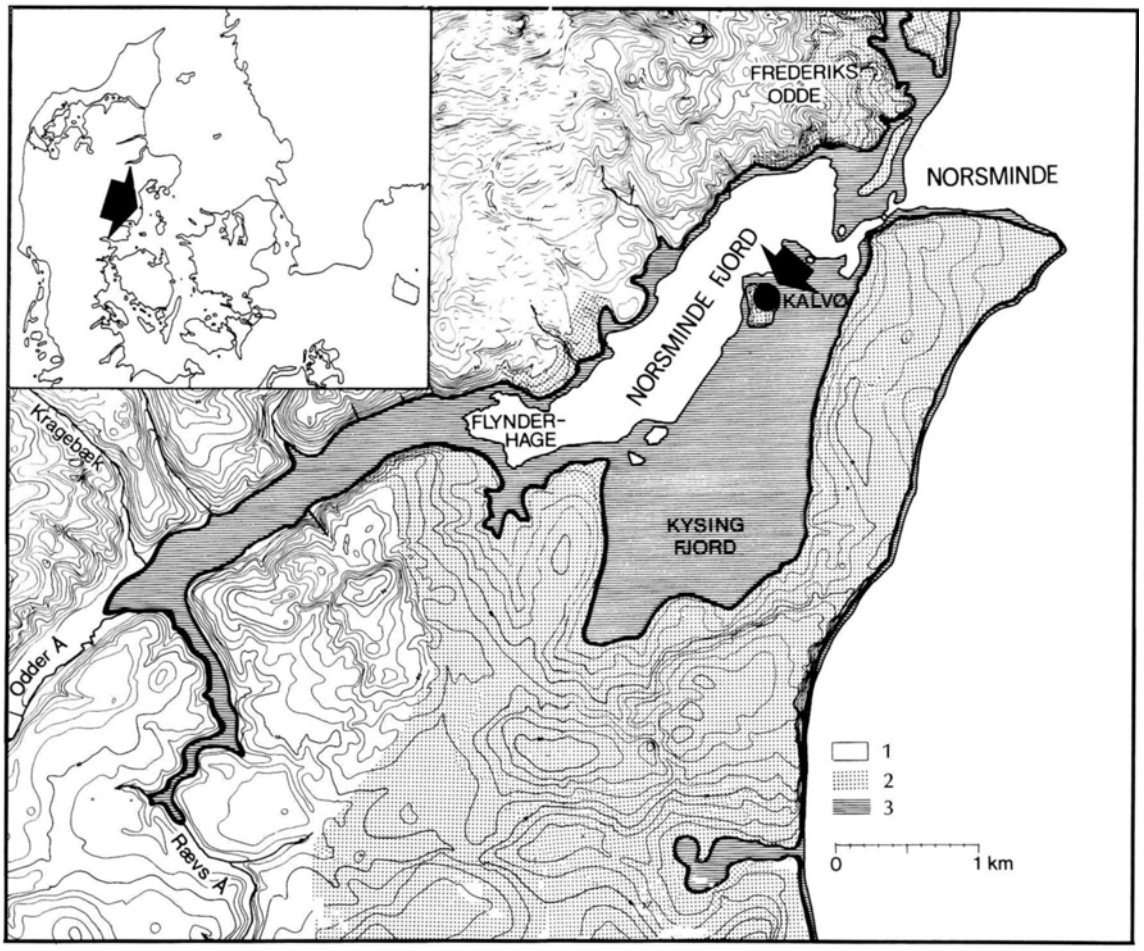

Fig. 1. Orohydrografic map of the Norsminde Fjord area showing site and coastline of ca. 3,000–2,000 bc (in conventional ^{14}C years). 1, clay; 2, sand; 3, raised sea-bottom.

fully studied, but it appears that flake technique dominates. Regular blades occur, but are few in number.

Flake scrapers are the commonest tool type (15 specimens). They are regular round/oval scrapers, half with corticate dorsal surface. Seven are »thick«, i.e. more than 2 cm, while eight are on thin flakes (under 2 cm).

Borers are fairly common (7 examples). Four are small and short, with retouch right down the sides (drills); one is a regular flake borer; and two are irregular borers on longer flakes.

There is one median burin, made on a short thick flake with lateral retouch. The burin edge, formed by two blows, is at the proximal end.

Knives, or pieces with retouched back and oblique or curved distal end, are present with five examples. Four are on regular blades and two on more irregular flakes.

In addition to a number of spalls and flakes from polished axes the material includes two incomplete thick-butted axes (fig. 3). One has partial grinding of the two faces of the butt, deep grinding near the working edge, and rectangular butt section (fig. 3, bottom). The other is a thick-butted gouge with deep grinding of all four sides as well as on the slightly rounded butt (fig. 3, top).

The axe, fig. 4, is also from the Single Grave occupation. It was found in the actual settlement area on the top part of the holm and can therefore be assigned to the culture only from its shape and workmanship, which is somewhat related to that of the axe, fig. 3, bottom, and clearly different from that of the axes known from the other Neolithic periods represented on the island. It seems to be complete except for a missing corner, and must have been a little irregularly flaked out,

which gave it a slightly crooked outline. In a few places the sides have been prepared by a technique usually described as »crushing«. The section is rectangular, and the butt has a narrow rectangular section. The only deep grinding is on the upper and lower faces near the working edge, but the sides and butt show more scattered traces of grinding. The butt measurements and proportions of this axe agree with those of fig. 3, bottom.

There are two axe roughouts, both roughly hewn on four sides out of nodules without fresh cortex. In one case only the outer surface of the nodule has been removed, but the other had come a stage further in preparation. These finds show that the production of axes took place on Kalvø.

Another common flint artifact is the trihedric arrowhead with equilateral triangular section of Becker's type D, fig. 5 (Becker 1951). There are six of them, and a further seven uncompleted specimens show that they must have played an important part in the inhabitants' activities, as indicated as well by the number abandoned during stages of preparation.

Examination of the waste flakes and cores shows that the blanks for the arrowheads were struck from special short cylindrical cores, which could give short powerful blades with a keeled dorsal surface and an equilateral triangular section.

Among the more diagnostic finds are three fragments of stone battleaxes (fig. 6). Two are from the settled area on the slope (fig. 6, above), while one is from the midden (fig. 6, bottom, left). The raw material is a fine-grained blackish-green rock. All three are broken through the shaft hole and are worn and strongly resharpened, so that their original type characteristics are hard to recognize. One also bears traces of re-shaping by flaking, perhaps an attempt to rejuvenate the edge before the axe broke. The axes can be determined as of Glob's types G and H (Glob 1944). Both the fact that they were found in settlement debris and their worn condition shows that they must have been used as ordinary tools.

Tools of bone and antler

Thanks to the favourable conditions for preservation a number of these were found (fig. 7).

There are three bone artifacts, two of them broken ends of bone points, while the third, with a broad tongue-shaped end, is probably a chisel. The chisel and one of the points were made on parts of long bones, while the second points is on a smaller fragment.

There is a well preserved fabricator of deer antler, (fig. 7, left), with a longitudinal burin groove on its outer side, no doubt intended to split the tine.

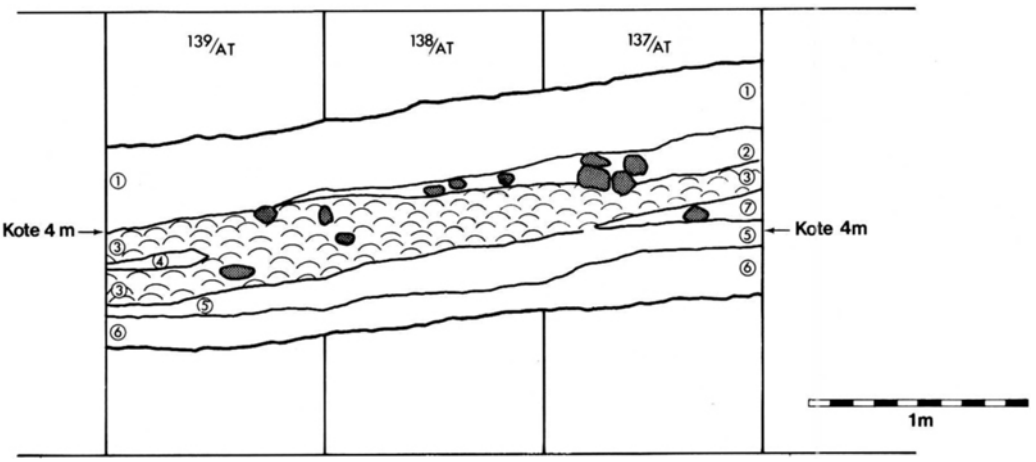

Fig. 2. Section through midden (at right angles to shoreline).
1. Plough layer.
2. Black sand, rich in charcoal and with some communited shells and gravel. Contains many burned stones (cooking stones).
3. Shell midden. Shells and shell debris mixed with charcoal, burned stones, flint waste, animal bones, and pottery. Shells lie flat, flints belong to the East Danish Single Grave Culture.
4. Homogeneous black-grey sand with charcoal.
5. Homogeneous grey-black sand with a little shell debris at top. Contains flint, bones, and charcoal. Finds of late Middle Neolithic Funnel Beaker type (MN V).
6. Homogeneous yellow-grey sand (outwash sand) with a few flint objects of Ertebølle type.
7. Black-grey sand with charcoal and a little shell debris.

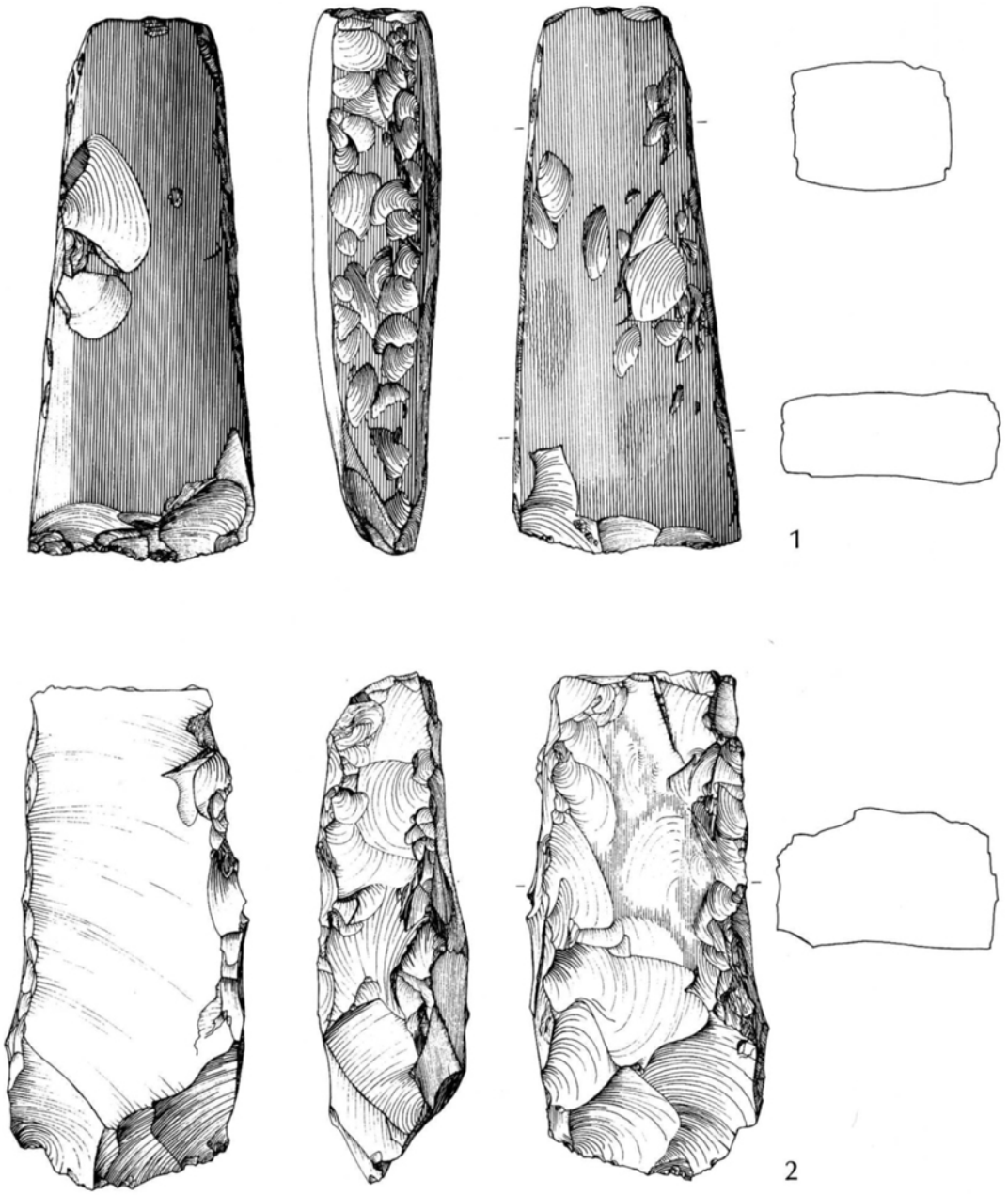

Fig. 3. Above, thick-butted gouge from the midden. Below thick-butted axe (?) found immediately below the midden in a layer with Single Grave pottery. Drawn by Elsebeth Morville.

As with similar finds from the Ertebølle Culture this is probably an example of intended re-use of a fabricator to make a harpoon, whose place in the site's inventory is thereby indirectly indicated. This interpretation is supported further by the presence of a piece of split and partly smoothed antler, which is either a stage in the production of a harpoon or else is waste from harpoon making. Thus the production of harpoons is included among the activities carried out.

Pottery

Sherds were scattered evenly in the midden and the settlement area above it. The material is small, con-

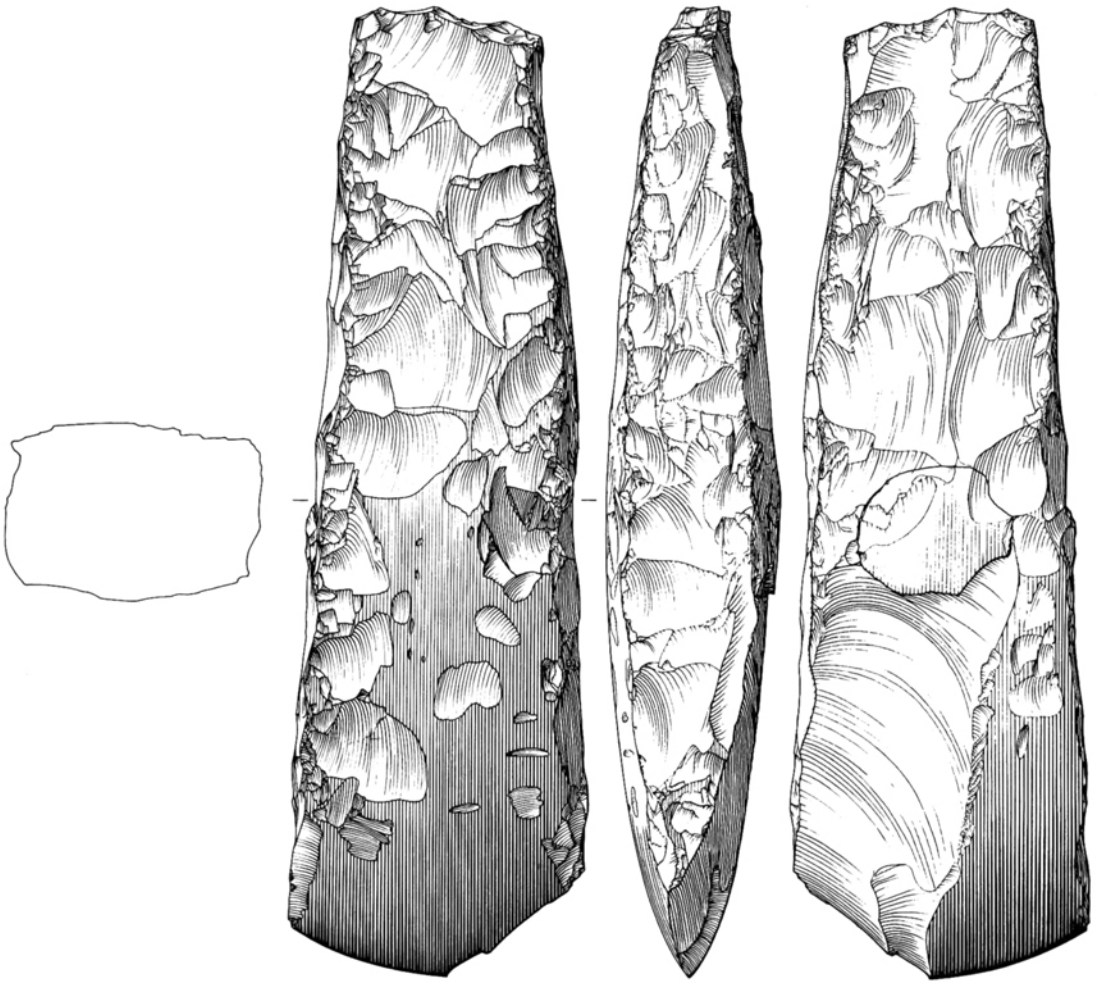

Fig. 4. Polisheld flint axe with narrow rectangular butt section. Drawn by Orla Svendsen.

sisting of sherds of only 8–12 vessels, among which are decorated thin-walled beakers and other small vessels, and also storage jars (fig. 8). The finer wares include rim sherds of at least three pots of Glob's groups C and E/H, and there are sherds of about five larger »dwelling-place« vessels (Glob 1944; Becker 1956 and 1957).

A sherd found up the slope is ornamented on the neck with three horizontal rows of curved impressions (fig. 8d). It is probably a beaker of Glob's group C. A large number of sherds of a beaker with hollow collar and gently curved profile were found scattered in the midden (Glob's type E or H) (fig. 8:2–3). It is ornamented on the collar with a carelessly drawn chevron band, while lower down are two separate cross-hatched zones.

A good deal of a beaker of Glob's group C was found in the midden and elsewhere. It bears a carelessly drawn continuous herringbone pattern covering the whole neck. Near the rim are two holes from an attempt to repair a crack (fig. 8, top).

There are in addition sherds of at least five larger »dwelling-place« vessels. Fig. 8:6 shows a rim sherd of a globular pot with short, sharply upturned rim (Glob's group I). It was ornamented with a multiple chevron pattern close to the rim.

There is furthermore a rim-sherd of a large vessel with finger impressions on the outside of the rim and a finger-impressed cordon 4 cm lower down (fig. 8:5). The ornament recalls the so-called »short-wave« ornament characteristic of several of the Single Grave Culture's larger vessels from settlements (Becker 1956).

Yet another slightly splaying rim-sherd bears finger impressions on the lip, and ca. 4 cm below the rim is

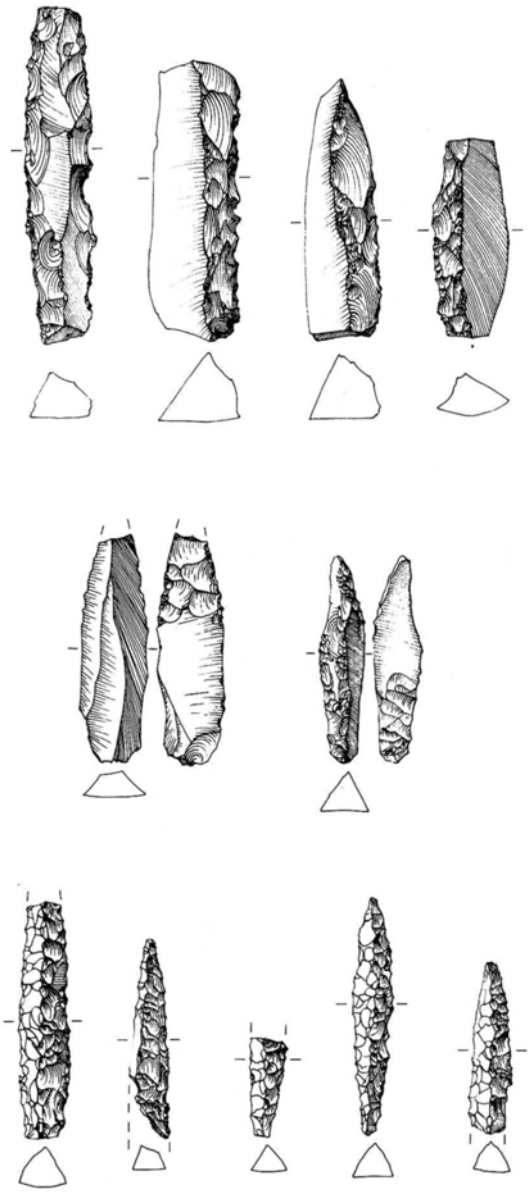

Fig. 5. Trihedric arrowheads. Bottom row type D, top and middle rows various stages of manufacture. Drawn by Elsebeth Morville. 2:3.

seen a single horizontal row of finger impressions. Despite the simplicity of the decoration also this rim is related to those with short-wave ornament.

Also from storage jars are 30 body sherds with a characteristic scored or »swept« exterior – a feature that has been singled out as especially typical of a series of larger vessels from the Single Grave Culture (Becker 1956 and 1957). These sherds, most of which could be fitted together, were found in the midden and apparently come from a single storage jar.

The limited nature of the ceramic material emphasises the short duration of the settlement. All the finds are fully typical of the Single Grave Culture, and some, including the thick-butted gouge and the battle-axes of type G/H, are characteristic of the so-called »East Danish« group, to which the Kalvø site may be assigned (Glob 1944). As already said several times, the conditions show that the discovery represents a small occupation, but it is not possible to say whether the occupation layer is the result of a single or of several short stays on the island.

DATING

The whole find is datable, but the battle axes and pottery give the closest date. The battle axes clearly indicate the Ground-Grave Period. The ornamented rim sherds, fig. 8:1 and 8:4, point to the same period, but fig. 8:2–3, on the other hand are from the late Upper-Grave Period (Mogens Hansen 1977). The pottery appears thus to suggest two separate settlement phases, but we should bear in mind the possibility of regional divergences and remember that our reference material is mainly from graves.

Oyster shells taken from the base of the midden beside the battle axe fig. 6, bottom right, gave a dating of 1900 bc (^{14}C years) (K–2508) (C. Malmros and H. Tauber 1977, 80 and 89). This is the first Single Grave settlement site to be radiocarbon dated, which adds to its interest. In comparison with other dates from the Ground and Upper Grave Periods the result seems very late. The ^{14}C result seems to relate best to the hypothetical late phase based on the pottery.

All in all the results seem to indicate that the settlement on Kalvø represents one – or perhaps two – short settlements in the Ground Grave (battle axes and pottery like fig. 8:1 and 8:4 and in the late Upper Grave periods (pottery like fig. 8:2–3 and 5, and perhaps the ^{14}C date as well).

ECONOMY

The animal bones have been identified by U. Møhl, University Zoological Museum, Copenhagen, and P.

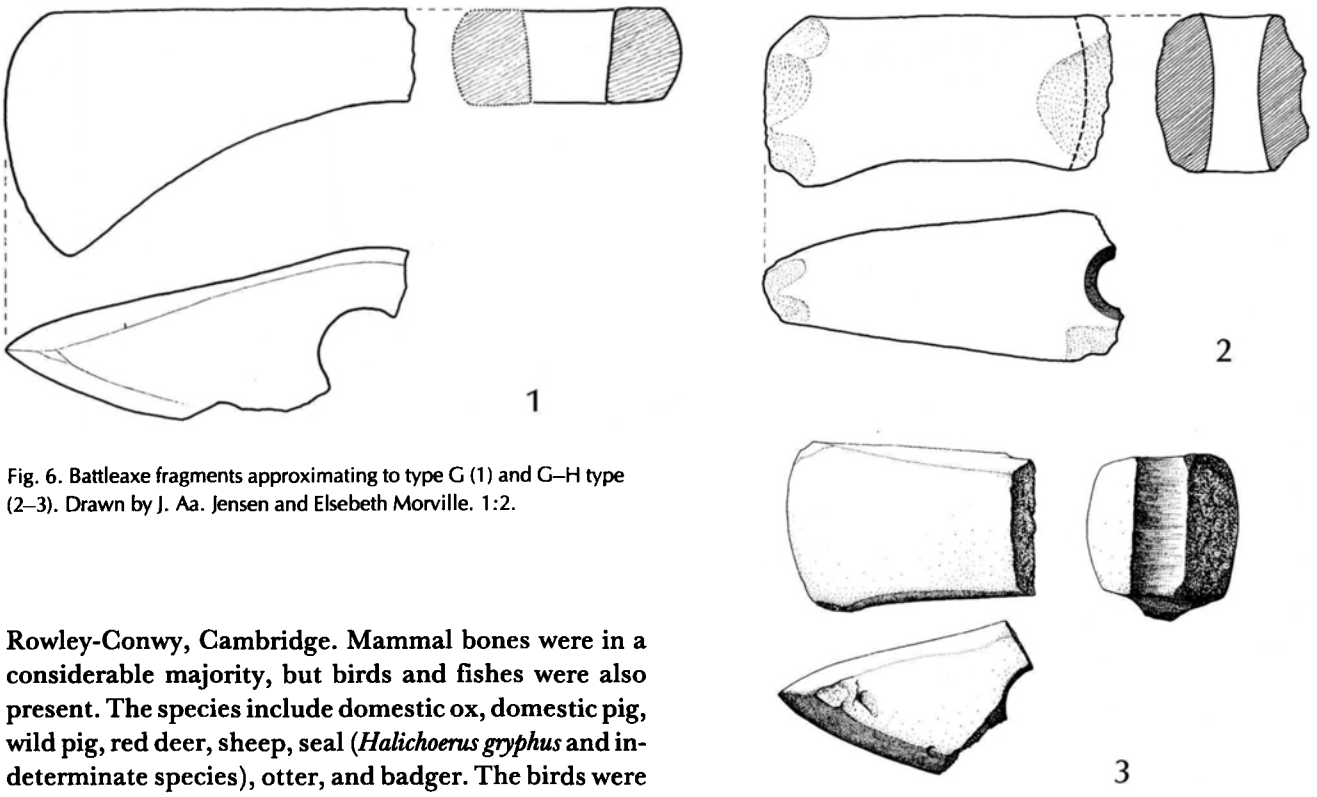

Fig. 6. Battleaxe fragments approximating to type G (1) and G–H type (2–3). Drawn by J. Aa. Jensen and Elsebeth Morville. 1:2.

Rowley-Conwy, Cambridge. Mammal bones were in a considerable majority, but birds and fishes were also present. The species include domestic ox, domestic pig, wild pig, red deer, sheep, seal (*Halichoerus gryphus* and indeterminate species), otter, and badger. The birds were swan (*Cygnus sp.*), common gull (*Larus canus*), red-throated diver (*Gavia stellata*), mallard (*Anas platyrhynchos*), velvet scoter (*Melanitta fusca*), scaup (*Aythya marilla*), great crest grebe (*Podiceps cristatus*), and great black-backet gull (*Larus marinus*). Fish were represented by the cod family.

Cattle provided about half the mammal bones. As these have a higher meat ratio than the other species domestic cattle must have provided the major part of the meat consumed. In addition there were many bones of pig, but fewer of sheep.

It can be seen also that hunting played an important role in the economy. Bones of red deer were the next most common after those of cattle. Also wild pigs were hunted in the neighbouring forests, where otter and badger were caught, too, presumably for the sake of their fur.

The importance of marine hunting is indicated by the many seal bones, and also by the remains of harpoons, which we have seen were made at the site. Fowling and fishing also played a part in the economy and must have taken place on the fjord or in the adjacent Kattegat (fig. 1). The shells indicate the collecting of molluscs, chiefly oysters and mussels, but on a smaller scale also clams and periwinkles.

A sample consisting of ca. 260 liters of earth from the midden was washed for seeds and fruits. Surprisingly enough no corn was found, but there were many seeds of *Chenopodium album*, *Stellaria media*, and *Polygonum aviculare*. Also elder (*Sambucus nigra*) was present. Not too much stress should be laid on the absence of corn. Many causes can have contributed, but its absence could be genuine and indicate that the economy of this particular coastal site was based exclusively on a combination of herding, hunting, and collecting. It should be added that no grain impressions were found on the pottery and that neither sure sickle blades nor querns were found. In this last respect Kalvø differs from a number of other sites of the same culture, e.g. Vorbasse (S. Hvass 1978), Blegind, and Myrhøj (J. Aa. Jensen 1973), where querns were a characteristic element of the assemblage.

Kalvø is thus one of the few sites in Denmark with indications of the economy of the Single Grave Culture. The other sites however are even smaller or are »mixed« settlements, and we lack, to the best of my knowledge, adequate comparative material. It is therefore still unsure how far Kalvø is typical. It may be noted that cattle

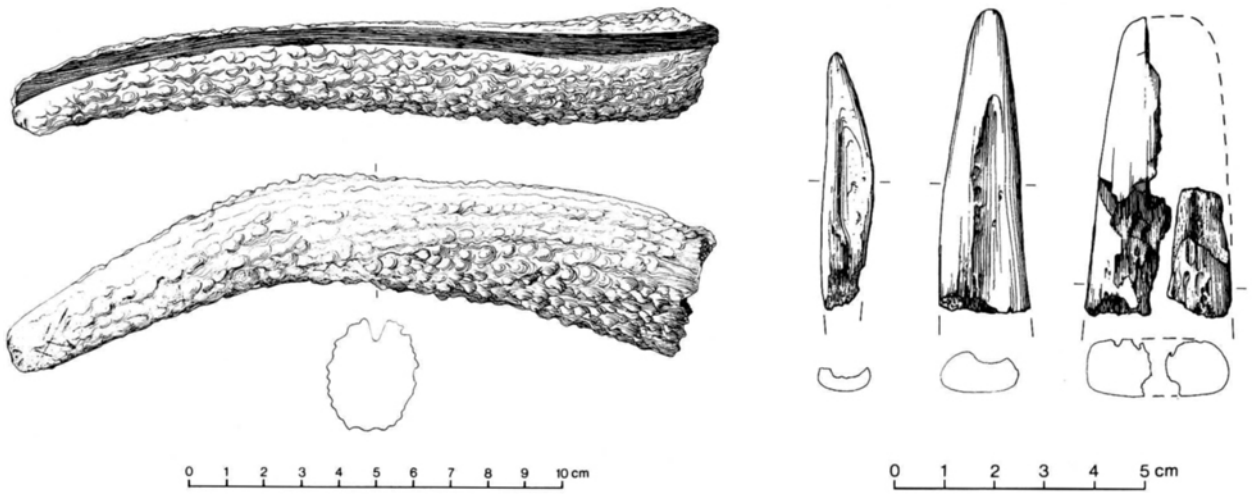

Fig. 7. Objects of antler and bone. Left: a fabricator (scale 1:2). Right: two bone points and fragments of a chisel (scale 2:3). Drawn by Elsebeth Morville.

dominated at the few Single Grave sites in Europe with a statistically reliable faunal material (K. Davidsen 1977, p. 68 and note 125).

Another problem in the evaluation of the Kalvø site is that we cannot judge of its place in the total pattern of Single Grave settlement. At first glance there seem to be two possibilities:

1. Kalvø may have been what is termed a base site, as the island's size (2 hectares) and soil quality do not exclude year-round occupation by a small unit with economy based on livestock, possibly corn growing, and hunting.

2. It may have been a specialised seasonal site (herding combined with hunting, fishing, and collecting) and been part of a wider settlement system in eastern Jutland having other specialised and permanent sites.

It seems the most natural to see the settlement as a small combined herding and hunting site, probably seasonal, where possibilities for grazing stock were combined with exploitation of the surrounding biotopes.

OTHER SINGLE GRAVE SETTLEMENT SITES

There is very little other Single Grave material around Norsminde Fjord. North of it was found part of a thick-butted gouge, and a type D arrowhead comes from the floor of the earlier fjord close NE of the island – perhaps a strayed shot. There are no other finds within 1–2 km of the fjord.

The same story is told by a new regional survey of Stone Age settlement in Hads Herred (S and SW of Norsminde Fjord), which shows that there was a much thinner occupation in this than in early periods, i.e. in the Early and Middle Neolithic Funnel Beaker Culture. Six Single Grave settlement sites were recorded, of which three were situated in the hilly moraine country west of the long NE–SW valley that divides the area into two quite different pedological and topographical zones. Two settlements have been found in the flat country east of the valley and one site on the island of Alrø (J. Skamby 1978).

A parallel to Kalvø is a Single Grave Culture coastal site near Holme Skanse in south Mols, on the other side of Århus bay. This was also from the Ground Grave period and yielded a thick-butted flint axe of Single Grave type and an arrowhead of type D. The economy was indicated by bones of cattle, ovicaprids, red deer, wild pig, bear, and seal. Comminuted shells in the occupation layer showed the collecting of oysters, clams and periwinkles. A single grain of six-row barley was found by washing (unpublished, FHM j. no. 1852).

Parts of two late Single Grave beakers were found during an old excavation of a coastal site at Voldbæk in what was formerly Brabrand Fjord (Davidsen 1978, p. 41 and Pl. 67, d, and i).

Many type D arrowheads have been collected from a

small area ca. 2 km further west along the old fjord (at Årslev Enge). They probably also indicate a coastal site.

Also several type D arrowheads have been collected from a small area near Brigsted on the north side of Horsens Fjord (private collection).

Coastal sites with finds from the Single Grave Culture have been found at a number of further places in Jutland also. The best known is Selbjerg on the Limfjord (Marseen 1953, Becker 1954), with remains of at least 8 Single Grave pots. The Single Grave finds, which can be assigned to the Upper Grave period, appear mostly to have lain in the upper part of the layer and been associated with a »pavement«, giving a stratification of Single Grave Culture over Pitted Ware Culture with types A3 and B arrowheads, Unfortunately the many interesting animal bones cannot be assigned to the separate occupations, but the whole geographical situation emphasises the importance of hunting/gathering.

These examples show that sites from the Ground and Upper Grave Periods can be found scattered along the northern and eastern coasts of Jutland. To the sites already mentioned may be added finds of type D arrowheads (see Becker 1951).

All these sites appear to belong to the Ground Grave and Upper Grave Periods, while so far there are no sites from the Undergrave or early Ground grave periods as defined for the graves (Glob 1944).

Though only of a preliminary character, these observations show that coastal hunting sites of the middle and late Single Grave Culture are not uncommon. Unfortunately there have been few systematic excavations of settlement sites. To acquire a better understanding of the various forms of settlement and economy it will be necessary to carry out new excavations, which must be either of known sites or of new ones on the coast and along the lakes and watercourses.

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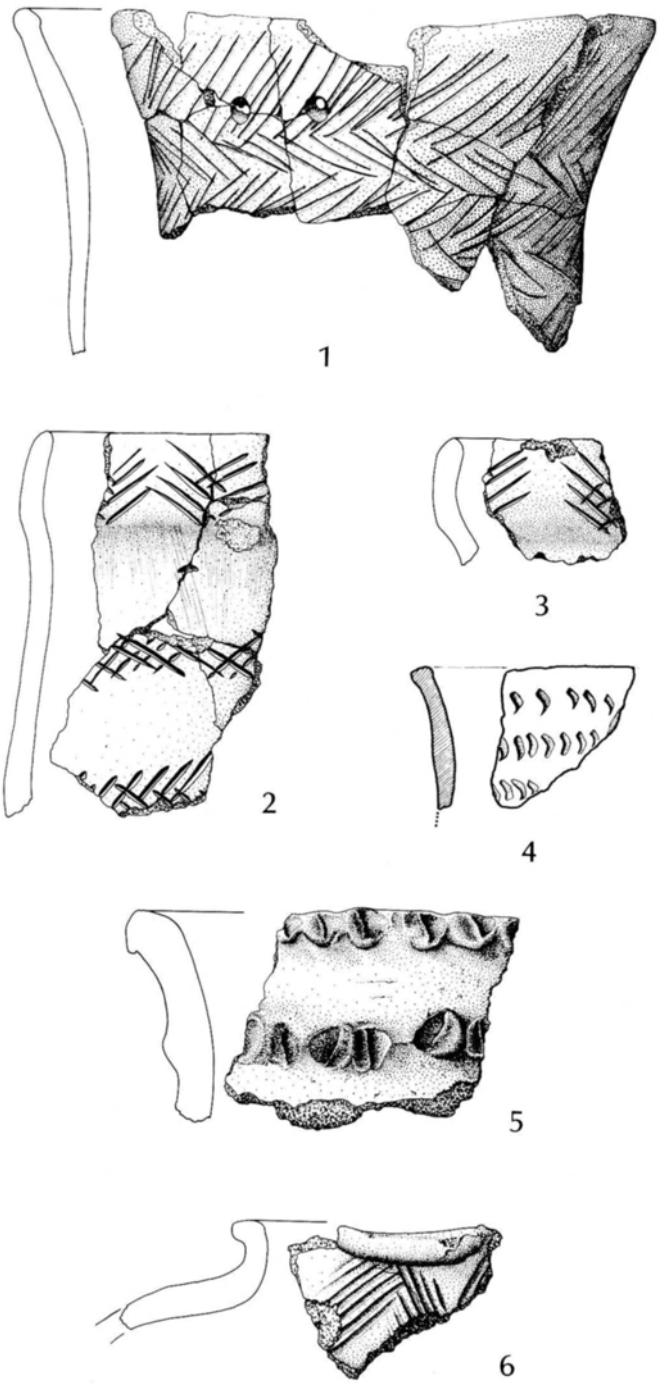

Fig. 8. Decorated rim-sherds. 1–4, thin-walled pottery; 5, a large »dwelling-place« vessel; 6, a vessel with globular body. Drawn by Elsebeth Morville and J. Aa. Jensen. 1:2.

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A Late Neolithic House Site at Tastum, Northwestern Jutland

by JOHN SIMONSEN

Excavated houses from the Late Neolithic Period in Denmark are extremely few in comparison to the evidence of population density given from the thousands of graves dating to the period (in conventional carbon fourteen years approx. 1900 to 1500 b.c.). For this reason the main types of the Late Neolithic (abbr. LN) graves are fairly well known while the knowledge of the houses is quite limited in several respects. Thus a recent discovery and excavation of a house from this period might still add some new information.

The settlement is situated 5 km south of Skive on a hill near the southwestern edge of the now drained lake, Tastum Sø. 200 m south of the settlement a brooklet flows into the lake.

The site is situated in a modern ploughed field, but no traces of the house on the surface caused the find. This can be explained by the fact that later wind-deposits of sand had accumulated on the site and in this way increased the actual distance between the soil surface and the remains underneath. So this physical factor helps to preserve such remains from being destroyed by modern agricultural activities. On the other hand, however, this factor also works against discovery of the remains. It is then often quite incidental circumstances that finally lead to discovery. At Tastum the house was found in connection with road works, where machines had cut a cross-section of the western end of the sunken floor.

After a minor trial excavation near the roadside, the topsoil was remowed with machine over an area of approx. 200 m^2 (later the excavation was extended to a somewhat larger area). Thereby the sunken floor of the LN-house was uncovered[1]. It generally appeared as a rectangular, dark mould, about 11 × 5 m, contrasting with the surrounding yellow moraine sand.

Traces of a settlement from the Late Bronze Age were also documented on the site. A longhouse and some pits were excavated. The longhouse lies almost E–W and measures 19.5 × 6.2 m. It is placed in such a way that it covers a large part of the LN-house. The Bronze Age house belongs to the now well known type with two inner rows of bigger (wooden) posts carrying the roof. These deep postholes have an internal distance of 3.4 m (measured from the centers of the holes). The distance between the two rows of postholes is 3 m.

The walls of the Bronze Age house were constructed by means of regularly placed posts. The holes are smaller and not particularly deep. Normally the distance between each hole is about 1.4 m.

The Bronze Age settlement naturally caused some disturbance to the LN house. Problematic are some of the smaller postholes, because it is difficult to determine whether they belong to the LN settlement or are later.

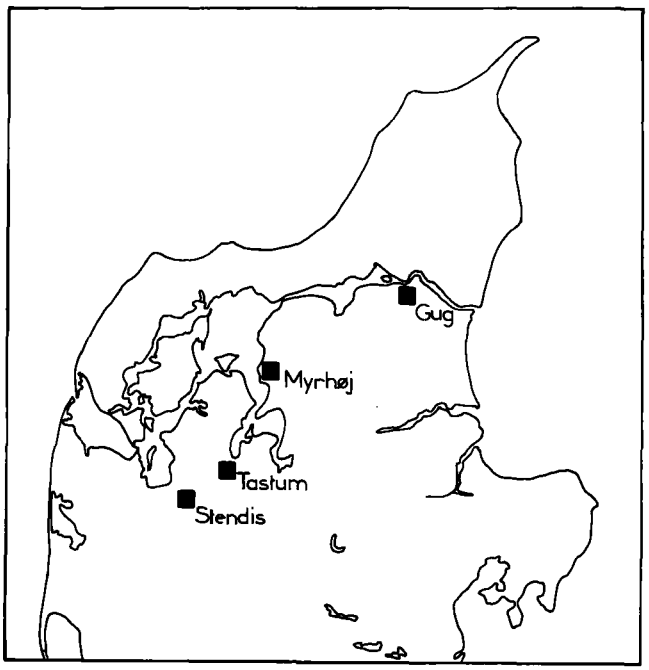

Fig. 1. Map of Late Neolithic settlements in Northern Jutland with houses with sunken floors.

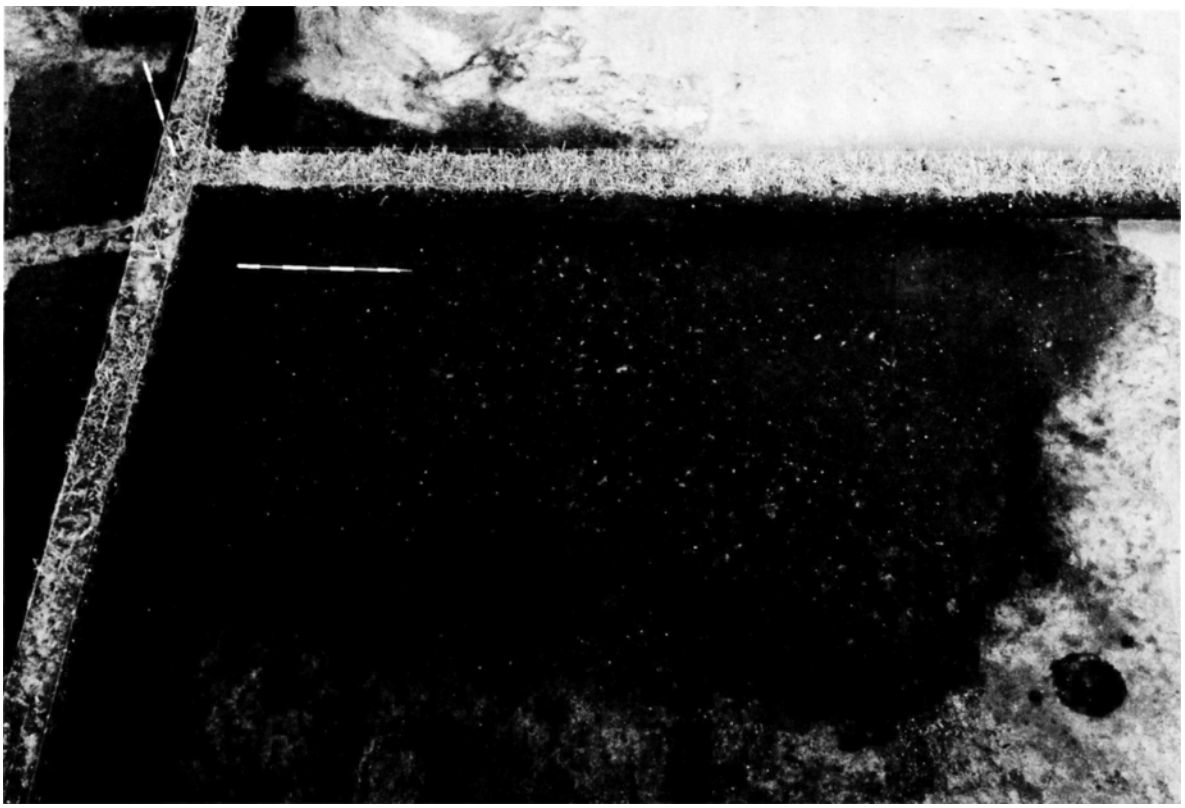

Fig. 2. Tastum. The house-site seen from the south after removal of the topsoil.

STRATIFICATION OF THE HOUSE

The mould in the LN-house seems to belong to two main strata. The lower part represents the floor layer, while the upper part is interpreted as a secondary filling of the »pit« after the house ceased to function. This interpretation is supported by the ceramic finds. The way of depositing seem different. In the floor layer the potsherds generally lie almost flat. In contrast the potsherds in the upper part are often found turned in different directions and the ceramic sherds are fewer and scattered. In the floor they are often found in concentrations.

The E–W baulk gives some more details about the floor (fig. 4). The floor layer above the moraine sand (6) can be subdivided in three layers (3, 4, and 5). Layer 5 is a dark, brownish, and sandy soil with a few traces of charcoal. This layer does not seem to be present in the western end of the profile. It must represent the oldest sedimentation in the floor stratum.

Most of layer 5 is covered by a thin layer of yellow sandy soil (4). Presumably it had been spread here to renew the floor surface. It cannot be excluded, however, that it could also have been deposited here by wind.

Above layer 4 and 5 is a dark, almost black, sandy soil colored by some admixture of charcoal. This layer (3) seems to be present in the whole length of the baulk (except perhaps in the eastern end, where it is not possible to distinguish between layers 3 and 5).

Outside the earth bench it is not always possible to distinguish between the sublayers of the floor. Particularly it is very difficult to discern between layer 3 and 5 near the edge of the pit and in some other places where layer 4 does not occur. From the Bronze Age settlement there are also some intrusions in the LN floors (postholes etc.).

The high content of charcoal (as dust and very small pieces) in layer 3 is remarkable. This layer is present over most of the sunken floor. It is likely that the house finally burned down with the charcoal in layer 3 being remains of this fire.

When the house had been demolished it presumably

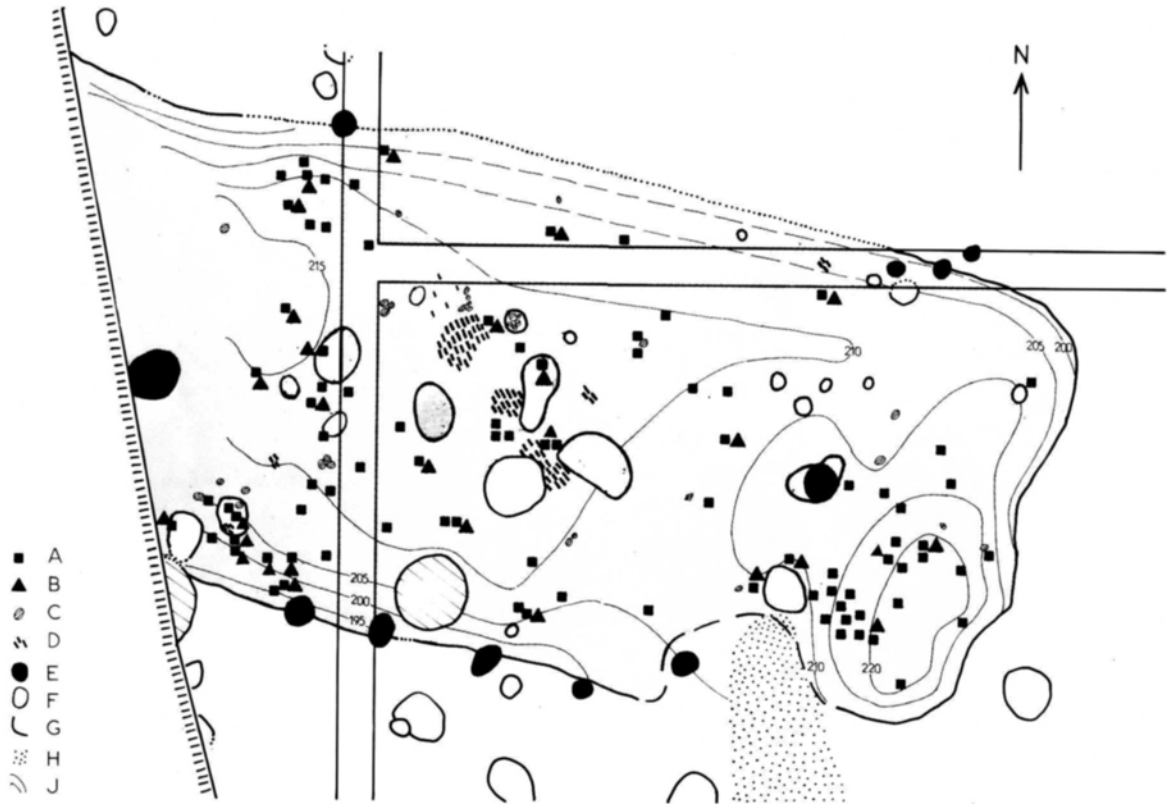

Fig. 3. Tastum. Plan of the Late Neolithic house with finds in the floor layers. A,1–10, potsherds. B, worked flint. C, stone. D, charcoal. E, postholes belonging to the Late Nolithic house. F, postholes belonging to the Bronze Age house or of uncertain age. With oblique lines: Bronze Age cooking pits. G, shallow depression with darker mould. H, coarse sand with gravel stones. J, contours with 5 cm interval. 1:80.

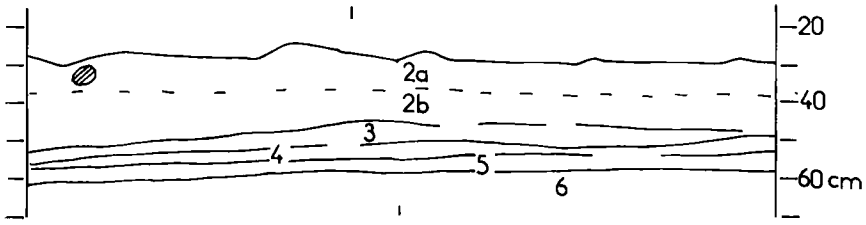

Fig. 4. Tastum. Part of the E–W section with the stratigraphy of the floor (description in the text). 1:20.

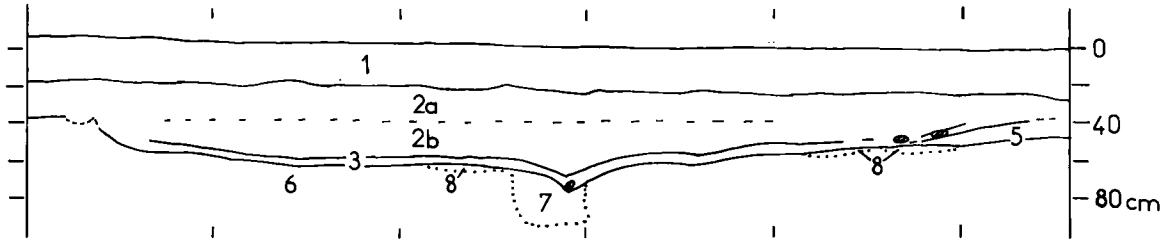

Fig. 5. Tastum. Transverse section N–S. Cf. fig. 3 (description in the text). 1:40.

appeared as a shallow pit in the terrain. It was then filled with some different garbage. Layer 2b represents this phase of the pit. It is a light, brownish sandy soil with small stones, scattered potsherds, worked flint, and small pieces of charcoal. It is implied in this interpretation of the stratification of the house that life continued near the house after it had ceased to function as such. Above this layer is found an almost similar, but somewhat darker soil (2b). It contained only a few sherds, some of them belonging to the LN period and others to the Bronze Age. Uppermost layer 1 represents the modern ploughed layer.

From the western part the N–S section have the layers 1, 2a, 2b, 3 and 6 represented what is described in the foregoing (fig. 4 and 5), but layers 7 and 8 are new. Layer 8 consists of thin spots of brownish sand and seem to be moraine sand colored by precipitation. The same seems to be the case with layer 7. It is yellow-brownish sand.

TRACES OF THE CONSTRUCTION OF THE HOUSE

A shallow depression in the western part of the sunken floor can be seen in the N–S section (fig. 5). Layer 3 is significantly sunken in the middle, but does not seem to be penetrated. A wooden post might have been placed here to support the roof. It is found approximately on the axis of the house, about 2.5 m from the northern and southern edges of the sunken floor. There are a few other shallow depressions in the floor, but presumably they are not traces of the construction of the house.

In the western end is found a posthole, about 20 cm deep (in the moraine sand). It is not unlikely that a roof-supporting post could have been placed here, but the posthole is not found precisely on the long axis. In the eastern part of the house a second posthole is found on the long axis. It consists of a brown soil, where the inner part is dark brown. The depth is only 20 cm. Like the posthole in the western end it would be deep enough to prevent the lower end from creeping but it seems far from deep enough in itself to stabilize the construction of a house.

The edge of the house-pit is fairly steep in the northern side, while in the southern side it is less clear-cut, because the terrain is slightly sloping. Along the edge in this side there are some smaller postholes up to

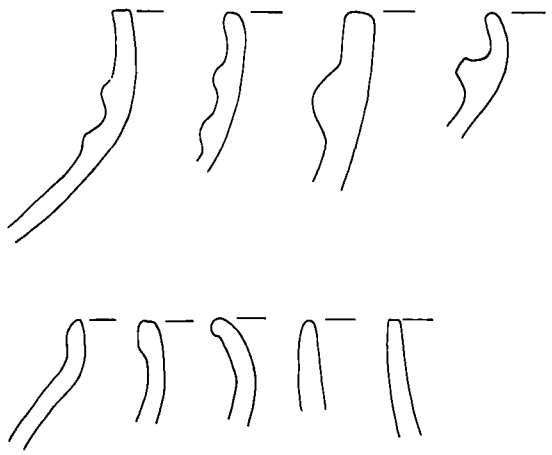

Fig. 6. Tastum. Rim sherds without decoration and sherds with cordoned rim. 1:2. Jan Opstrup *del.*

20 cm deep and they must be traces after the construction of the walls (fig. 3). At the northern edge there are also a few postholes. The hole in the N–S section is dubious since it is only a few centimeters deep.

Near the eastern end of the house there is an area with very coarse, brownish sand. It can be followed across the edge of the house some meters south[2]. It is possible that there was an entrance here with the path covered with well-drained sand[3]. This area continues into the house as a slight elevation, which would be a gradual passage to the sunken floor in the middle of the house or to the small deep area in the south-eastern end.

The question of house-construction will be discussed later.

THE FINDS

Apart from a few small fragments of burned bones, some small pieces of charcoal and a few fragments of cooking-stones, the main finds in the house are potsherds and worked flint. The following is based on a preliminary examination of the find material.

In the house approx. 1380 potsherds are found. About half of them belongs to the floor stratum, the rest to the layers above as part of the secondary filling. A few potsherds from the upper layer are from the Bronze Age. The Neolithic sherds from the floor and the secondary filling of the pit do not seem to have any observable differences and will here be described as a whole.

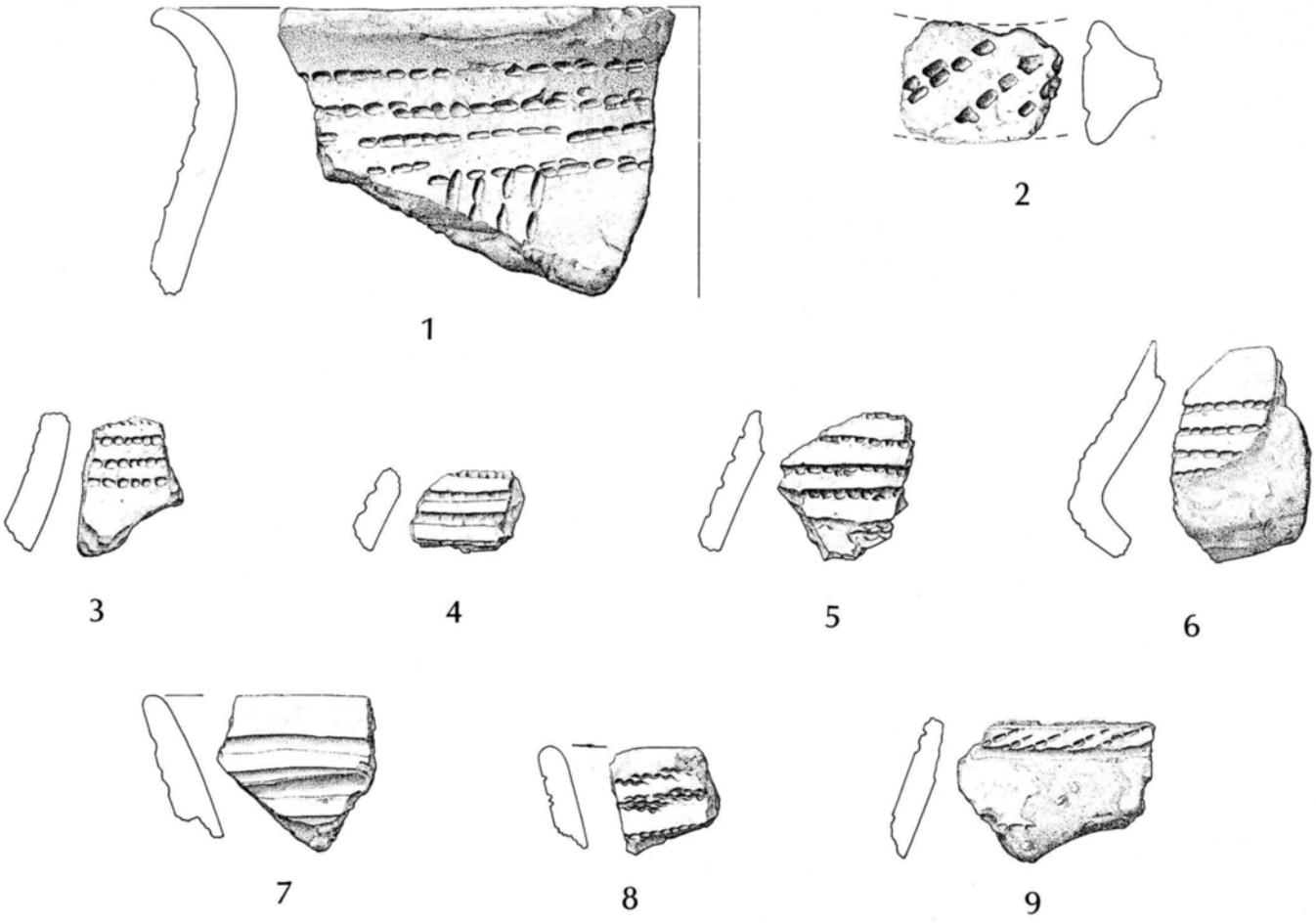

Fig. 7. Pottery from the house-site: Rim sherds with notch-stamped decoration (1–2) and examples of sherds with horizontal decoration of notch-stamped lines (3–6), grooves (7), cardium (8), and zones with short oblique notch-stamped lines (9). 3:4. Orla Svendsen *del.*

Sherds from varying forms of undecorated pottery are found. Another group of pottery is vessels with cordoned rim (fig. 6).

Bell-beaker influence can be seen in the ornamented potsherds. The beaker, fig. 7:1, has a zone of notch-stamped lines under the rim combined with a »picture area« with oblique, notch-stamped lines. Other sherds have zones of parallel cardium impressed lines. There are also sherds with horizontal zones with short oblique, notch-stamped lines (fig. 7:9).

Another group of decorated beakers is formed by potsherds with several horizontal grooves (fig. 7:7).

Remarkable is a small sherd with oblique notch-stamped lines on the top of the rim (fig. 7:2). Such decoration is normally connected with the Single Grave Culture and its presence in the Late Neolithic milieu is unusual.

Most of the worked flint are flakes of different size and shape. About 400 pieces of worked flint are found. A fragment of the shaft of a flint-dagger and a preliminary shaping for a triangular flint-arrowhead are from the secondary filling.

The find material dates the house to the older part of the Late Neolithic. Primarily this is shown by the ornamented sherds with affinity to the bell-beakers, which belong to a horizon in the early part of the danish LN (cf. Ebbesen 1978, Lomborg 1977).

The beakers with horizontal grooves support this dating[4]. The sherd with oblique notch-stamp on top of the rim also indicates an early dating within the LN because of its relation to certain types of Single Grave pottery.

The dating is to some degree supported by the beakers with cordoned rim, but such plastic decoration

cannot be confined to the older part of LN alone. The varying forms of undecorated potsherds can only be dated to LN in general.

For the time being a more definite dating than to the older part of the Late Neolithic cannot be presented. The fragment of the flint-dagger and the triangular arrowhead cannot contribute to a more detailed dating, but their presence confirms the exclusion of a dating of the house to the period previous to LN (Lomborg 1973: 84).

LATE NEOLITHIC HOUSES IN THE LIMFJORD AREA

The excavated houses with sunken floor from LN in Denmark are so far concentrated in the northern part of Jutland, near the Limfjord (figs. 1 and 8). From this area are known three other sites with houses with sunken floor:

In 1952 the first house was excavated at *Gug*, Sdr. Tranders parish by the amateur-archaeologists A. Strøbye and J. Fønss (in cooperation with C.L. Vebæk, The National Museum, Copenh.).Unpublished, but briefly referred to at several places in the literature[5].

In 1968–72 a site with three houses was excavated at *Myrhøj*, Strandby parish, by J. Aarup Jensen for Aalborg Historiske Museum and Forhistorisk Museum, Århus (Jensen, 1973).

In 1973 a house was excavated at *Stendis*, Ryde parish, by T. Skov, Holstebro Museum (Skov 1978 and 1982). In the following some of the characteristics of these houses will be discussed.

Dimensions of the sunken floors

Generally, the sunken floors become gradually deeper near the middle of the houses and only a minor part of each floor is quite flat (fig. 8).

House EAB at Myrhøj has a length of 14 m and a breadth of 7 m. This house has the deepest floor with 0.6 m below the prehistoric top soil. The dimensions of house GAB are 12.5 × 6 × 0.5 m. The dimensions of the sunken floor, house D, are 14 × 7 × 0.5 m.

At Stendis the dark area is very long, about 15 m, while the breadth is only 4–5 m. The excavator is probably right when he points out that the irregular shape of the dark area might be due to the existence of more than one phase of the house. It does not seem possible therefore to determine the original length of the house. The recorded depth of the house is only 25 cm, but the top of the feature may possibly have been cut off by modern agriculture.

At Tastum the depth of the floor below the ground surface is about 25 cm. Corresponding to this the other dimensions of the sunken floor are also smaller. The breadth is about 5 m and the length is hardly much more than 11 m.

At Gug the sunken floor seems to be about 9 m in length and 5 m in breadth. The recorded depth of the sunken floor is about 35 cm.

From the above can be seen that there are some variations in the dimensions of the floors of the six houses. The depth of the floors seem to vary between 0.25–0.6 m, the length between 9–14 m and the breadth between 5–7 m. But at the same time there seems to be some regularity in the dimensions. Generally, the length of the sunken floors are about twice the breadth. And, the larger floors also seem to be the deepest.

Construction of the houses

With only one recorded phase of the floor, house GAB at Myrhøj seems to be the most regular. Along the northern edge there is a row of postholes with an equidistance of 2.5 m and along the southern edge there is a row almost as regular. No doubt wooden posts placed in these holes constitute the framework of the walls. In the long axis near each end of the sunken floor there is a larger posthole. It is likely that wooden posts placed here have supported the roof.

The other houses conform more or less to this scheme. At Gug, Tastum and Myrhøj house EAB, are found smaller postholes along the edges of the sunken floor, but not quite regular. At Stendis there are many postholes around the dark area, but it is not possible to say anything certain about the wall line. Only at Myrhøj, house D, no row of postholes is recorded around the sunken floor.

More problematic are the postholes in the interior. Smaller postholes in dry sand may easily avoid the attention of the excavator, but this would probably not be the case with larger and deeper postholes. At Gug, Stendis, and Myrhøj, house D, no larger postholes in the length axis of the sunken floor were recorded. This is an interesting trait and it seems to indicate that the construction of the houses can have been of such a cha-

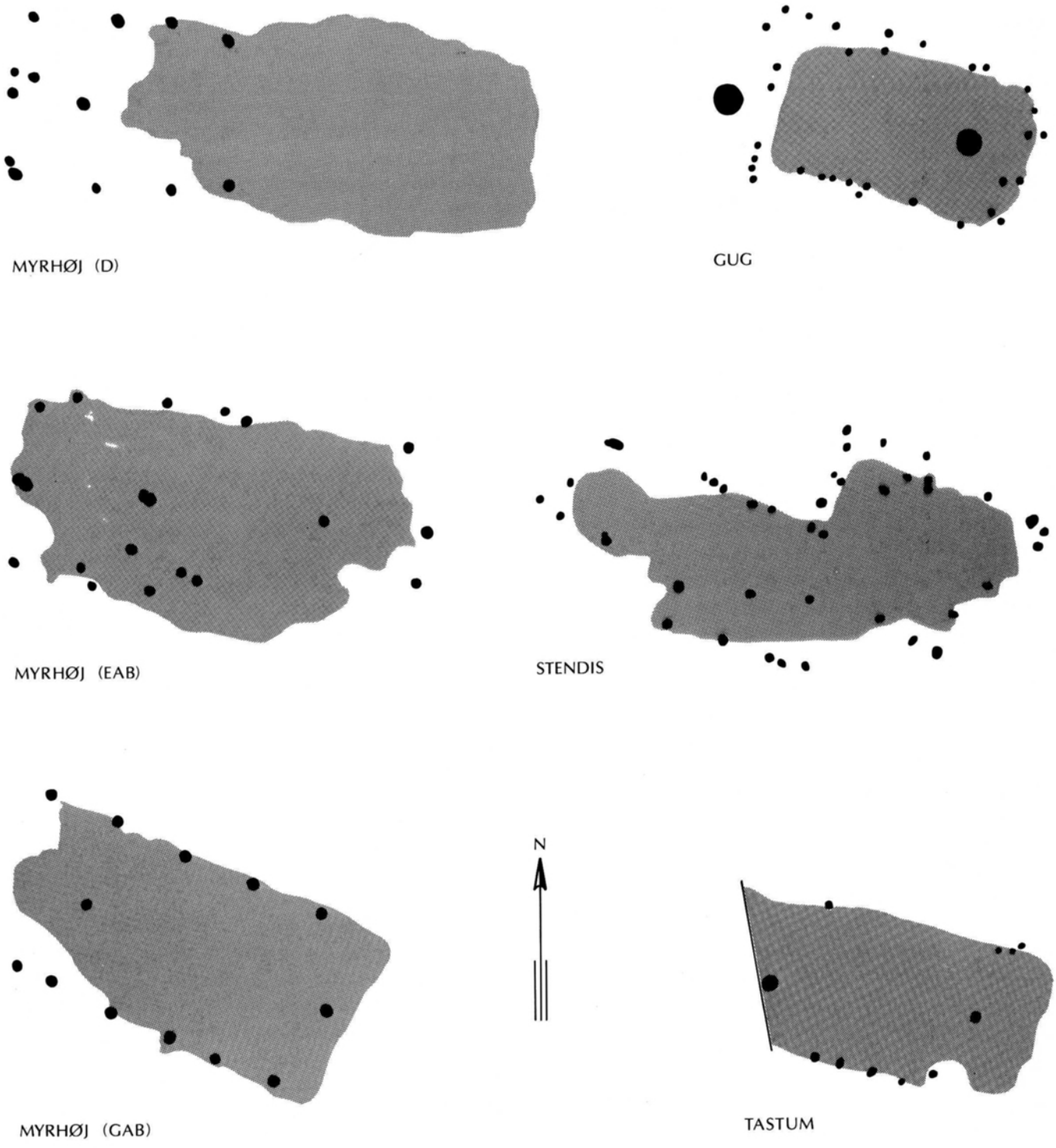

Fig. 8. Plans of the six Late Neolithic houses from the Limfjord area: Myrhøj (drawn after Jensen 1973), Stendis (after Skov 1982), Gug (based on the original drawing by Axel Strøbye and drawing by Catharina Oksen), and Tastum. 1:200.

racter, that deep holes for wooden posts to carry the roof are not always absolutely necessary. If there were roof-carrying posts in the long axis without the lower end placed in a (stabilizing) hole, they would at the most have left some shallow depressions and maybe stone slabs (cf. Calmer 1973: 126 and Strömberg 1971: 239–40). In the foregoing was shown a shallow depression in the long axis of the house at Tastum, which might be interpreted as the vestige of a wooden post supporting the roof.

In continuation of the sunken area of house D at Myrhøj two rows of postholes in alignment with the edges and a row of postholes in the middle were found. Such features are not recorded in connection with the other houses at Myrhøj, where only the sunken floors were excavated. Therefore it is not possible to determine, whether such structures are present in connection with the other houses[6]. At Stendis this possibility is mentioned by the excavator (Skov 1978: 43). At Tastum it could not be determined, since the area west of the sunken floor was cut off by the modern road works.

At Tastum there are two phases of the floor separated by a thin layer of sand. Similar observations are made at Myrhøj, where two phases are separated in house EAB. In house D are even indications of three phases of the sunken floor. In the foregoing it was mentioned that there is possibly more than one phase of the house at Stendis, but in contrast to the other houses the phases of the sunken floor seem to be somewhat displaced. Whether the phases of the floor at Tastum and Myrhøj are combined with a renewal of the construction of the houses is difficult to say and none of the houses seems to give a definite answer to the question.

The entrance to the houses seems to be problematic. No entrance was demonstrated to the houses at Myrhøj, Gug or Stendis and the observations in the house at Tastum are unparallelled in the Danish finds.

Function of the houses

In this short note it is not possible to deal with the many problems connected with the understanding of the use of the interior of the houses. The different activity areas as reflected in the distribution of the finds cannot be discussed here.

There are no signs that separate parts of the houses has been used as cattle shed like in longhouses in the same geographical area in later parts of prehistory. The finds of pottery, worked flint, and charcoal, etc., in the floors indicate that the houses primarily may have been used as human habitation. The house at Gug has till now been considered as a »flintworker's hut« (Brøndsted 1957: 311–12), but in the opinion of the author there are indications that a large part of the finds of worked flint and potsherds should be interpreted rather as part of a secondary filling of the pit. The house at Gug does not seem to deviate from the other LN houses concerning the function.

As human habitations the orientation and placing of the houses in the terrain is of great importance.

An orientation between E–W and WNW–ESE is common for the houses. This is probably in order to get the greatest advantage from the direct heat of the sun, which most likely was appreciated in the sub-boreal, temperate climate. Since maximum effect is attained a little while after the most southern position of the sun, this seems to give some explanation of the small deviation from the E–W orientation. Concerning protection from the wind the orientation of the houses also seem appropriate.

The houses are situated in slightly south-sloping terrains. This is probably also out of regard to the heat. Thereby the northern (cooler) side of the houses is lower than the southern side in relation to the terrain, making the houses more sound.

The careful selection of the placing of the houses supports the assumption that the houses were human habitations.

CONCLUSION

It is likely that it is a matter of coincidence that the excavated LN-houses with sunken floor cluster in the Limfjord area. Probably future excavations will show that the distribution is not limited to this area alone.

The houses seem to have been used for human habitation and vary somewhat in size. They have, however, several common features and it seems evident that they belong to a well established type. Even though the existence of other sorts of structures are known[7], the houses with sunken floor may prove to have been predominent as human habitation in the Late Neolithic.

Dating from the preceding period, the later part of the Single Grave Culture, a house was recently excavated in Vorbasse, Central Jutland (Hvass 1977). This

house also has a sunken floor and a construction similar to the LN-houses. Apparantly the Vorbasse house and the LN houses belong to the same tradition. This tradition even seems to extend into the Early Bronze Age as can be seen from the excavation at Egehøj, East Jutland (Boas 1980. See also this volume). Thus we might speak of the same tradition for this type of houses over several hundred years.

An important problem to be solved by future excavations is the question of the size of the settlements. At Myrhøj two of the three houses may have been in function at the same time, but it is not possible to be definite. To solve questions like this it is also important that the methods of dating especially of the Late Neolithic ceramics are improved.

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NOTES

[1] Skive Museum 219A. Kobberup parish. – Skive Museum is much indebted to several free-time-archaeologists for their friendly assistance during the excavation (Sept.–Oct. 1981).

[2] In front of the supposed entrance (see fig. 2) were some dark postholelike markings. They were very shallow (only a few cm in depth) and they were not registered as postholes.

[3] Traces of an opening in the southern side of an LN house are found at Stockholmsgården in Scania (Strömberg 1971). There are, however, some doubt about the size of the house (Jensen 1973: 105), which also may have significance for the entrance.

[4] The ornaments belong to the B_3 beakers (Glob 1944: 67 and fig. 33, 3), which are now dated to the older part of LN (Becker 1957: 20).

[5] I wish to thank the National Museum (1. Dept.) for permission to use the material for this article.

[6] An excavation of the areas around and especially West of House EAB and GAB at Myrhøj would naturally be of much value.

[7] In the Limfjord area a house was resently found under a burial mound at Nautrup. Ten deep postholes constitute the traces of the construction of the house, which measured 6 × 4 m. Radiocarbon-dated (in conventional C 14 years) to 3510 ± 85 before 1950 = 1560 b.c. (Simonsen 1982).

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Egehøj

A Settlement from the Early Bronze Age in East Jutland

by NIELS AXEL BOAS

The following article will briefly present one of the earliest bronze age settlements so far excavated in Denmark.

The settlement was discovered during excavation of the Egehøj barrow, which contained a bronze age period IIbc/III central grave. The mound consisted largely of settlement material of flint, pottery, cooking stone etc. Similar material was found about 50 m south of the barrow, giving the location of the settlement (1).

The settlement lies some 4 km south of the modern coastline of north Djursland, a little to the northwest of Hemmed village in a hummocky morainic landscape, on a south-facing slope. The natural boundaries of the settlement's region are: to the north, the Kattegat; to the west, a flat lowland, formerly a bay of the Litorina Sea; and to the south and east the waterways of the Hemmed River and Brøndstrup River systems. The effects of windblown sand on the landscape are marked just to the east of the settlement. The soil varies abruptly from light sand (late glacial windblown sand) to very clayey morainic gravel.

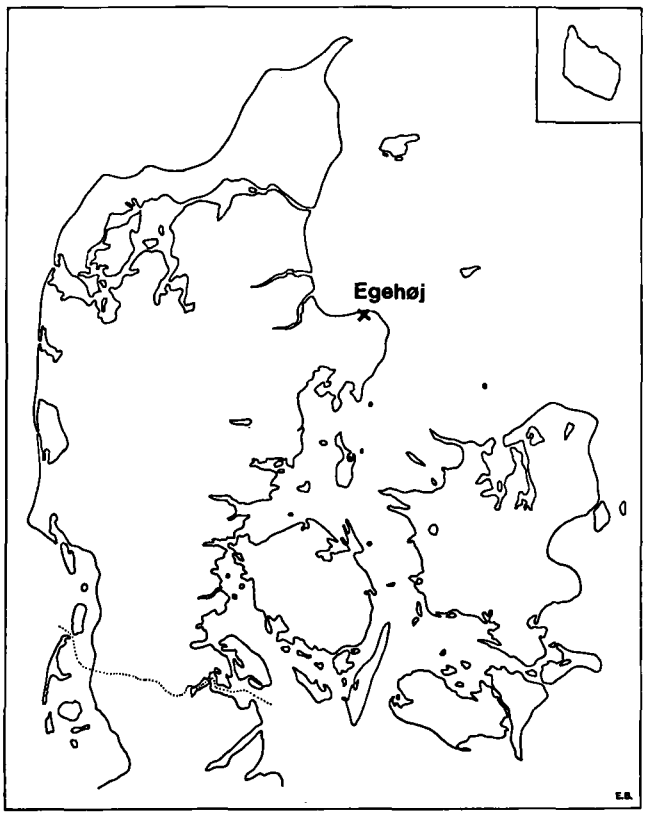

Fig. 1. The location of the Egehøj settlement.

The investigations were carried out on the basis of a small test excavation, phosphate analysis and an intensive survey, which limited the settlement to an area measuring 350 m NE–SW and 50–100 m SE–NW, a total of 15–20,000 m^2. 1225 m^2 of this was excavated.

THE HOUSES

Underneath three large areas of cultural deposits, the remains of three east-west oriented houses were found. They were rectangular and postbuilt, having a single row of roof-bearing posts spaced 4–5 m apart. The less massive wall posts were placed in a rather irregular line, at intervals of 1½ m. No clearly defined entrances were visible. But slight depressions where the ground was worn away indicated their position.

House I. The westernmost house was 21 m long and 6 m wide. Its area was 126 m^2. The western end appeared about 0.10 m below the topsoil as a rectangular depression measuring c. 9 × 6 m. After the cultural deposits that overlay this western depression were removed, about 100 postholes were seen to belong to the house. Of these, about 50 were from their positions regarded as outer wall posts, and 4 as roof supports. The lastmentioned appeared as large holes, in a straight line along the central axis of the house, set at 5 m intervals. The

Fig. 2. The situation of the early bronze age barrow 'Egehøj' and the excavated parts of the settlement. Contour interval 0.5 m. 1:2000. Drawn by Grethe Rasmussen.

roof-bearing posts were dug some 0.60 m into the underlying soil. The diameter of the individual holes was about 0.50 m. Basal support in the form of a stone lining appeared in and over the postholes. The walls were marked by rows of smaller posts. The distances between these postholes varied between 1 m and 2 m, occasionally a little more. The postholes were 0.30 m in diameter and 0.40 m deep. – two of them were, however, dug 0.75 m down into the soil. The row of postholes forming the northern wall varied in depth more than those of the southern, three of them being particularly deep. Some of the other posts forming the northern wall were so poorly dug down that the postholes could only just be recorded. The postholes of the southern wall were of uniform depth. Some postholes were scattered at random throughout the interior of the house. Between the two central roof-bearing posts, 4 smaller posts were placed in line; they might have formed a transverse partition wall. The dark feature covering the western end turned out to be a depression dug 0.30 m

into the subsoil. Within this feature, a relatively high frequency of fragments of burnt stone was observed in a zone 0.5 m wide along the inside of the western end of the house.

House II was placed immediately adjacent to house I's east end, but offset to the north so that the ends of the two houses overlapped each other. It was c. 18 m in length, c. 6 m in breadth, and had an area of 108 m^2. The eastern end appeared about 0.10 m under the topsoil as a rectangular feature, orientated E–W and measuring about 7.5 × 5 m. In the western end was another feature, somewhat irregular in outline, orientated E–W and measuring c. 6 × 5 m. After the overlying cultural deposits were removed, some 50 postholes could be ascribed to the house. 30 of these were, because of their positioning, regarded as forming the side walls. Four powerful posts located in a straight line along the central axis of the house were interpreted as those supporting the roof. The westernmost three were set at intervals of c. 4 m, the easternmost one c. 2 m from the nearest of these. Average diameter of the postholes was c. 0.40 m, average depth 0.30 m.

The postholes of the walls were biggest along the southern side, where they were 0.30–0.40 m in diameter and 0.20–0.30 m deep. In the northern wall they were rarely above 0.25 m in diameter and 0.20 in depth. A narrow ditch, 5.50 m long and 0.14–0.22 m wide, started at the northeastern corner of the house and ran along just inside the northern row of postholes. At its western end it turned through almost 90° in towards the middle of the house. This feature defines the eastern end of the house, making internal subdivision visible. The western end of the house also seems to be divided off from the rest. About 1 m west of the second roof-supporting post from the west, three postholes were placed in a straight line across the house. Taken together with a slightly offset post near the northern wall, these probably represent an internal partition wall.

The feature forming the eastern end turned out to be a 0.30–0.40 m deep depression. A layer of burnt stones (»cooking stones«) was found in this area. The layer was in the form of a compact, slightly uneven heap, which diffused out towards the sides of the house. The western feature turned out to overlie two large and a few small pits; apart from these, the depth of the feature was 0.10–0.15 m.

House III was positioned parallel to house II, c. 3 m from it, and was connected with its east end by a transverse feature 1 m wide. It was 19 m long, 6 m wide, and encompassed 114 m^2. About 0.10 m under the topsoil, the eastern end appeared as a large feature, c. 7.5 × 5 m in extent and bounded to the north and east by a charcoal zone 0.30–0.50 m wide. At the western end was a feature measuring 5.5 × 3.5 m. After the removal of the cultural deposits, about 40 postholes were seen to belong to the house. About 25 seemed from their positioning to be wall posts, 4 to be roof supports. The rest were scattered apparently at random throughout the interior of the house. The roof-supporting posts were placed in a straight line down the middle of the house. The distance between the three westernmost ones was c. 4 m, between the two western ones c. 5 m. Their diameter was 0.30–0.40 m, their depth 0.30–0.60 m. The wall posts were about 0.25 m in diameter and 0.30 m deep.

A rectangular area of burnt stones, 1.50 × 0.40 m, was placed along the northern wall in between the postholes. Due to an absence of postholes, the southwestern edge of the house was indistinct.

The feature at the east end of the house revealed itself as a depression 0.30 × 0.40 m. At a height of 0.10–0.20 m above the bottom appeared a layer of burnt stones (»cooking stones«). This took the form of a compact, uneven heap which spread diffusely out towards the sides of the house.

Along the north side wall and the eastern end wall of House III was a zone of charcoal, and high concentrations of charcoal seen in some postholes suggest that the house was burnt in antiquity. The lower 0.1–0.2 m of the cultural deposits overlying the depression in the east end of the house contained carbonised grains of wheat and barley.

PITS AND FEATURES INSIDE THE HOUSES

Between the northern wall and the westernmost roof support of house I was a roughly circular pit, 1 m in diameter and 0.4 m deep. The bottom was covered with a 0.05 m thick layer of compressed, unfired clay. Small postholes were visible near the edge of the pit; together with finds of a loom weight under a metre from the pit (fig. 9), this suggested that the feature should be interpreted as a weaving area. Near the second roof support, two complete pots were found, dug down into the sub-

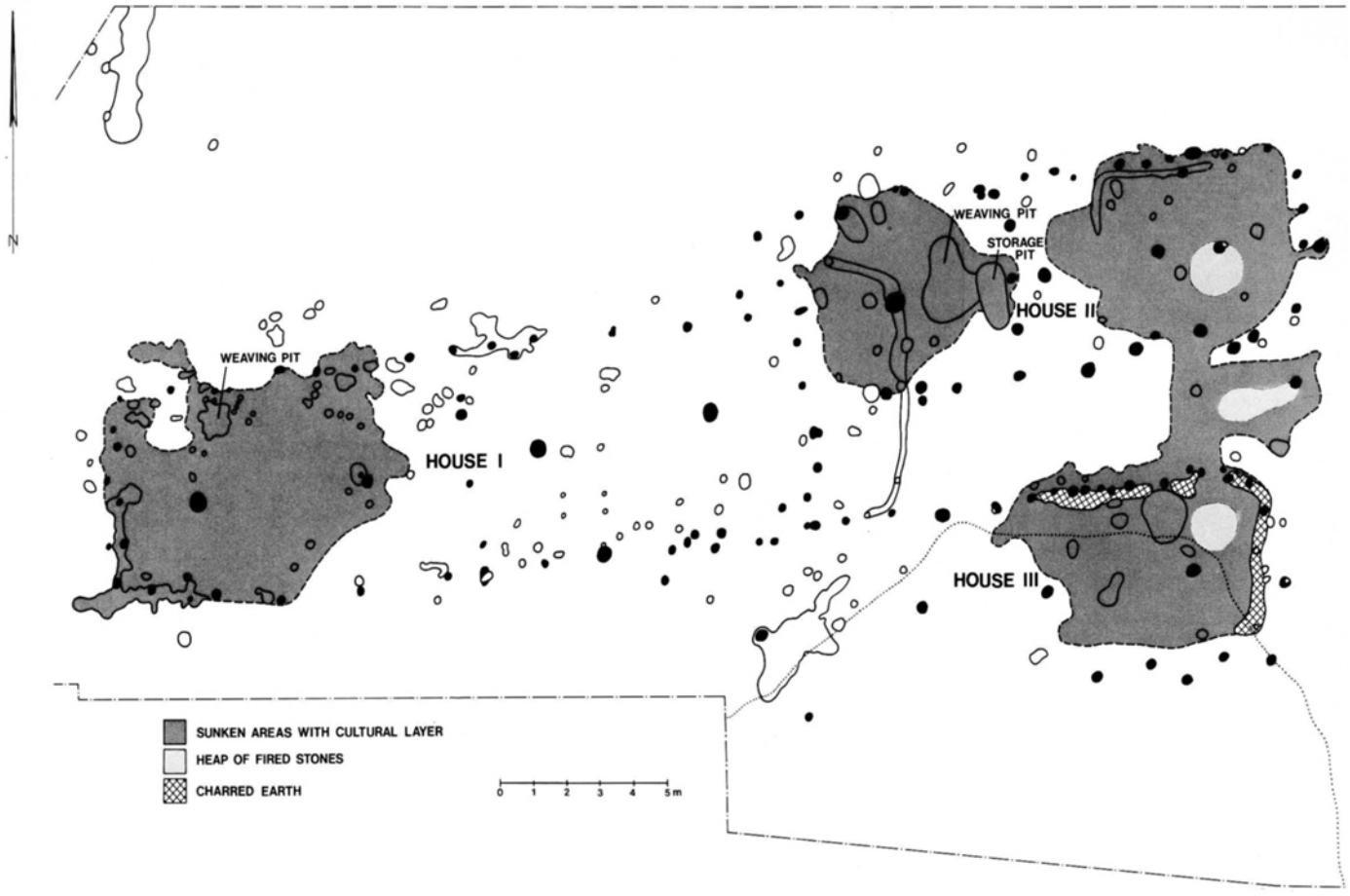

Fig. 3. Plan showing the three early bronze age houses at Egehøj. The fine dotted line in the southern part of the area indicates the limit of the clayey subsoil. Drawn by Grethe Rasmussen.

soil. In the weaving pit and in one posthole large sections of pottery vessels were uncovered.

Two metres within the eastern gable walls of houses II and III were two similar, low circular mounds of cooking stones; these were 2 m in diameter and about 0.3 m thick, and were positioned in the cultural deposits c. 0.1 m above the subsoil.

Between the first and second roof supports in house II was a pit similar to the weaving pit in house I, but somewhat less regular. Just to the east of this pit and almost touching it was a regular oval pit with roughly vertical walls. Two brown circles inside this pit might be traces of wooden containers. Several sherds were also found.

A little to the southeast of the first roof support in house III was an irregular pit, 4 × 2 m in size and filled with stones. It was 0.3 m deep and contained some derived, burnt pottery and a dagger-shaped strike-a-light.

FEATURES OUTSIDE THE HOUSES

Between the eastern ends of houses II and III and connected with the narrow depression between the houses was a 2.5 × 1 m oval pit, oriented E–W. One large post had been set into it, and the fill contained much pottery and many cooking stones as well as burnt fragments of bone.

4–5 m east of house II, two pits were investigated; these were regular and circular, contained cooking stones, and had flat, rounded bottoms. They were 1.2 m in diameter and 0.4 m in depth. From the bottom upwards, the fill consisted of the thin layer of sand with charcoal fragments; then a layer of fractured, burnt stones; and finally a layer of cultural deposit similar to that overlying the houses.

Two wells were excavated at the eastern and southern edges of the excavated area, some 20 m east and

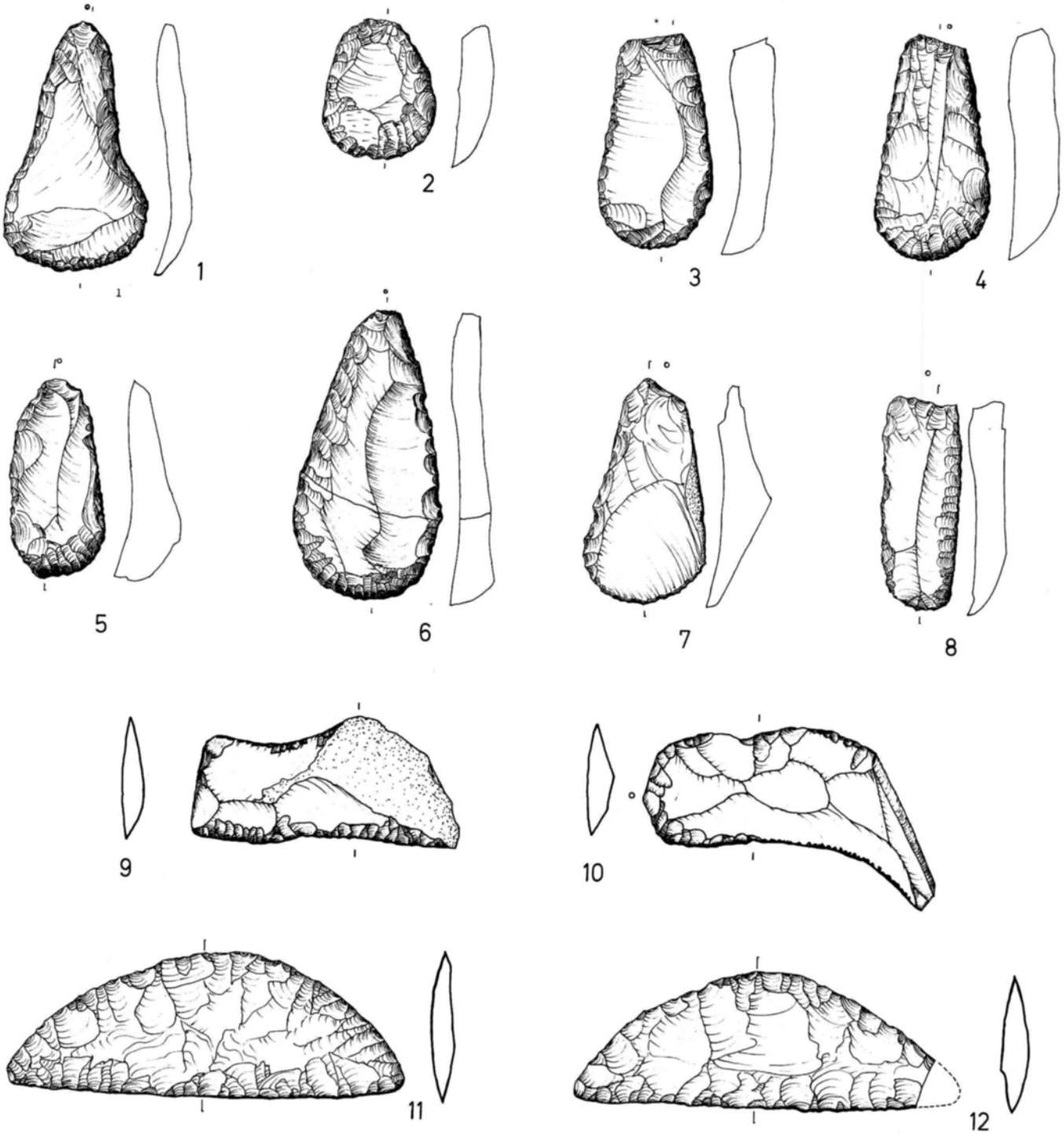

Fig. 4. Scrapers (1–8), knives (9–10), and sickles (11–12). 1–3, House I; 4–6, House II, 7–8, Huse III. 1:2.

southeast of house III. They were above 2 m in diameter, 1½ deep, and more or less funnel-shaped. Both dug through the sand, down to the surface of the morainic clay, and would therefore hold water periodically. They contained many finds. In the southeastern well was a black, charcoal-filled layer of rubbish with fragments of cooking stone; this could represent clearance from house III.

FINDS

The cultural deposits over the houses and the features described above contained an even scatter of finds. Of the 120 kg of *flint*, 100 fragments are of cores, more than 20,000 are waste flakes, and 13 are hammer stones. Almost all flint tools and roughouts were fragmentary, as was to be expected from a settlement. The largest category was the hollow-based arrowhead, of which 90 examples were recovered (including roughouts) (fig. 5). Hafted scrapers (fig. 4) dominate with 27 examples the scraper category, which contains 50 tools all told. Flakes with edge retouch total 35. There are 21 daggers (including roughouts), some of which are probably strike-a-lights. Three of the daggers were complete; these were recovered from houses II and III. They are all of the small variety (i.e. under 13 cm) (fig. 6).

Different types of strike-a-lights, on flakes, blades and pressure-flaked pieces, total 19 pieces (fig. 6). Over 20 symmetric, crescent shaped sickles were recovered, including fragments and roughouts. Two unused sickles (fig. 4: 11–12) were found together, lying crosswise in contact with each other, near the northern wall of house II. Groups such as burins (most of which are on pressure-flaked pieces), knives, and borers (both drills and on flakes) are each represented by about 10 examples. Finally, two hollow-based spearheads (fig. 6: 12–13) and two rough, unpolished thick-butted axes were also found (fig. 6:11).

The flint is of high quality when compared with e.g. that from the early late neolithic settlement of Myrhøj in western Himmerland (Jensen 1973). Roughouts are found at all stages of manufacture. The weight of barely worked nodules is above 1 kg. The degree of utilisation is 8% by weight, but only 2% by numbers of pieces, a percentage which is however similar to that on mesolithic settlements (Blankholm *et al.* 1967). Much high quality flint was apparently available – only 18% of the

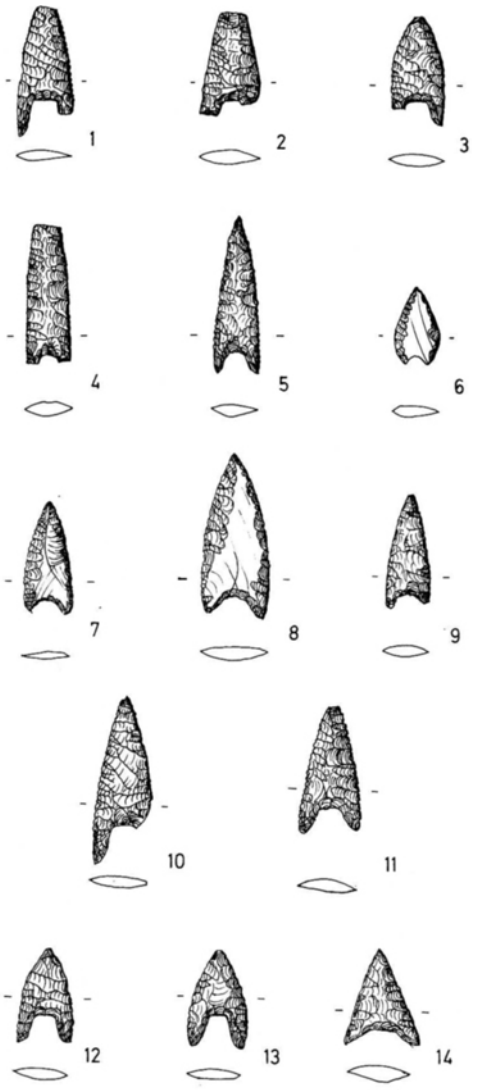

Fig. 5. Barbed arrowheads. 1–6, House I; 7I–9, House II; 10–14 House III. 1:2.

scrapers, for example, have any cortex on their dorsal surfaces, while at Myrhøj 80% did. Flat polishing did not occur, while basal wear was common. Blades do not seem to have been produced on the settlement. The proportion of burnt flint is high, being 14% as opposed to only 3% at Myrhøj. This might be due to several reasons, but is not an integrated part of the technological process.

The short, wide flakes which are characteristic of the waste products from axe manufacture, form under 1% of the waste on the settlement. At Myrhøj this type formed 26%, corresponding to the high number of axes found.

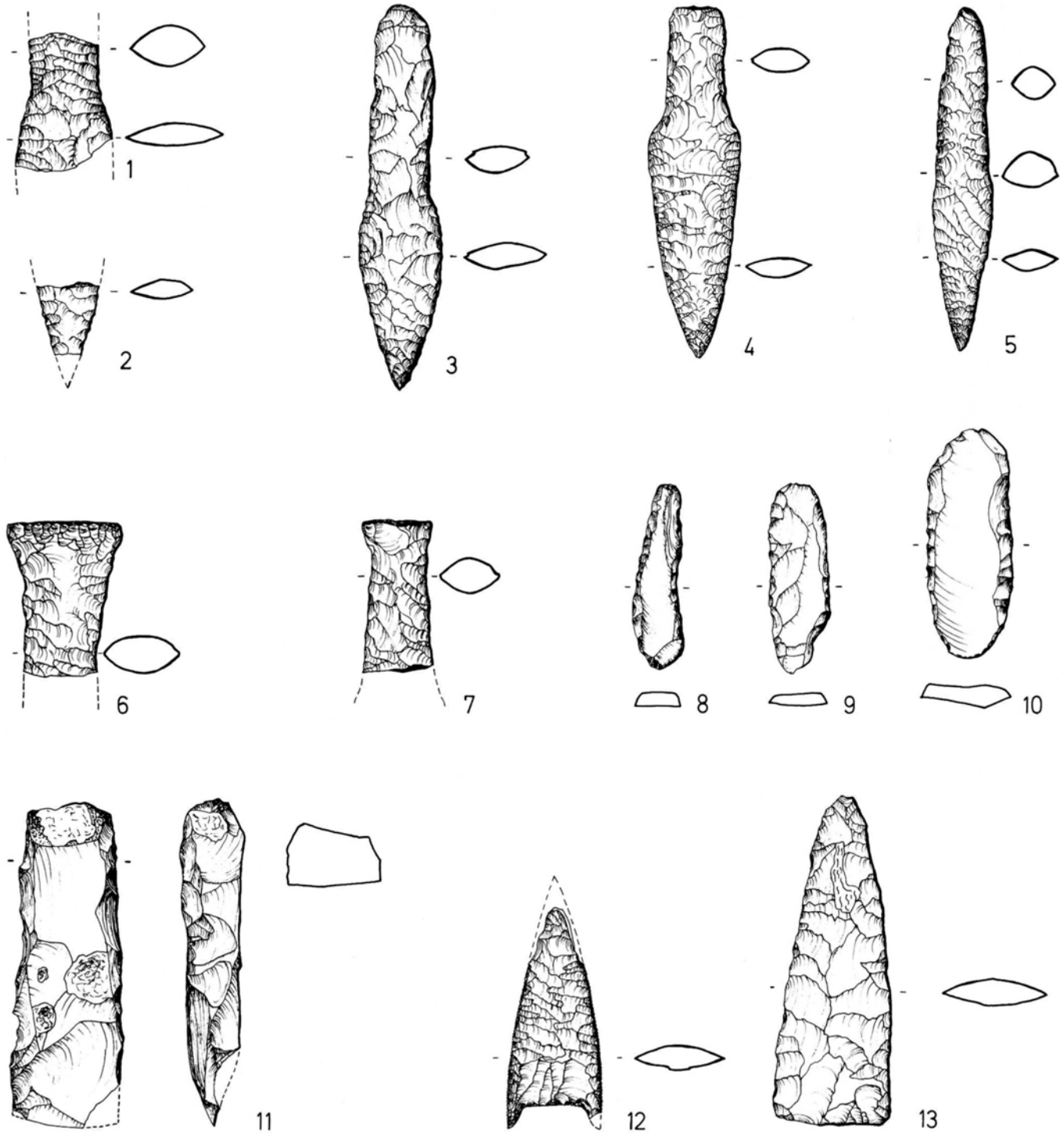

Fig. 6. Dagger fragments (1–2, 6–7), strike-a-lights (3–5, 8–10), axe preform (11), and spearheads (12–13). 1, 2, 8, 11, House I; 3–7, 9–10, House II; 12–13, House III. 1:2.

Some of the hammerstones are of *stone*, as are two whetstones, 1 drill, 1 grinder and 5 fragments of querns. Two unworked fragments of *amber* were also found.

Pottery (fig. 7–11). In a total of over 2000 potsherds, 60 rim sherds and 30 basal sherds were found, as well as sherds of 7–8 beaded pots. Nine tenths of the sherds are coarsely tempered with sharp-edged fragments of stone (1–3 mm), similar to the large amounts of pulverised cooking stone found throughout the cultural deposits. The colour is red to golden brown. Blackening occurs on the inner surfaces. The pottery fragments either have greyish black cores, or are of uniform coloration. Rim diameter of the vessels is between 0.10 and 0.35 m. The height of the nearly complete pot from house I (fig. 7) is 0.16 m, and the weight over 1.5 kg. Shapes vary between bucket type pots with almost straight or slightly convex sides, and vessels with more pronounced bellies, which either have a slightly offset »direct rim« or a proper lip flared outwards beyond the vertical. The latter type of mouth is about 1–2 cm high, and appears in both strongly and weakly developed variants. A slight thickening often occurs just above the point where the tangent of the curve is vertical, sometimes combined with a slight concavity on the inner surface. 15 of the 25 basal sherds show a slight foot. In general there is no decoration, apart from the probably functional addition of beading. Three sherds have beading actually on the rim, while four more have it a centimetre or more below.

At the bottom of house III was a lump of kneaded and tempered fired clay. Its weight of 1.6 kg corresponds to that of the larger of the two nearly complete pots deposited under house I. Other clay finds consisted solely of the abovementioned loom weights in house I.

Burnt bone and *charcoal* appear throughout the cultural deposits. The bone fragments were most common in the pit between houses II and III and in the southern well. Most informative is the high frequency of *carbonised cereals* in house III. A provisional analysis of material from a small sample of earth by H. Helbæk shows that the grains were distorted by a violent fire, so only a few could be identified. Most of the grains seem to be of naked barley. Emmer and bread wheat were present in the proportions 1:2, the latter type in different forms (*Triticum aestivum*, *T. compactum* and *T. vulgare*) which are hard to distinguish as no rachis fragments are present. All the small seeds were apparently completely destroyed in the fire, and the only weeds found were of black bindweed (*Bilderdykia convolvulus*) and pale persicaria (*Polygonum lapathifolium*). Flotation of a large part of the collected soil samples has recently been undertaken by P. Rowley-Conwy. This has produced much material, details of which will shortly be available. The large amount of material may result from an accident during drying, which is necessary to free emmer and einkorn from their glumes. Perhaps the heaps of »cooking stones« in houses II and III should also be viewed from this perspective?

FIND DISTRIBUTION AND ACTIVITY AREA ANALYSIS

The flint items can be divided up into three groups on the basis of primary functional criteria, in order to make possible an examination of specific activities. A comparison between the three houses is possible, because the volume of cultural deposits over them is about the same in each case, namely 18 m^3. *The first group* consists of »simple« tools on flakes. These include what one might call everyday items. These scatter relatively evenly inside and outside the houses. The only noteworthy concentration is of hafted scrapers in the east end of house II and around the third roof-bearing post in house I. *The second group* consists of »finished« pressure-flaked tools. Clearer clustering is visible. Daggers (mainly miniature daggers or strike-a-lights of Lomborg's type A and B) concentrate strongly in house II, arrowheads in the west end of house I and the east end of house III. *The third group* may be called »workshop« flint and in this group of raw materials and unfinished tools emerge the clearest clusters. If these are taken together with the distribution of waste flakes, quite clear production areas or workshops are visible. One of the biggest concentrations is in the gable end region of house I; this consists almost entirely of arrowhead roughouts. Just inside the end of the house is a corresponding scatter of small fine waste flakes. A group of large, coarse flakes can also be seen a couple of metres further east inside the house. This, therefore, seems to be an example of specialised arrowhead production, with rough shaping taking place near the first roof-bearing post, finer working between this post and the gable wall, and the apparently rejected examples of roughouts being disposed of against the end wall itself. To this may be added the high frequency of completed arrowheads in this whole part of the site.

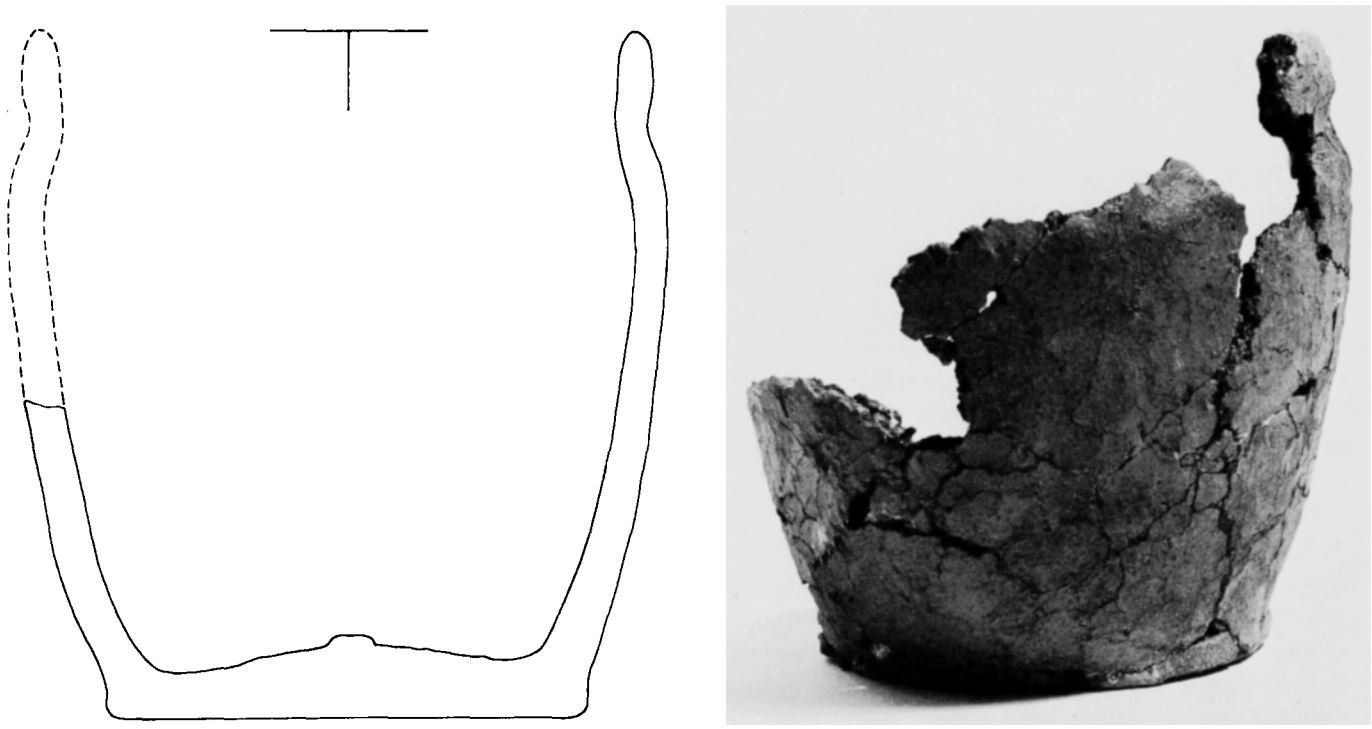

Fig. 7. Pottery vessel from House I. 1:2.

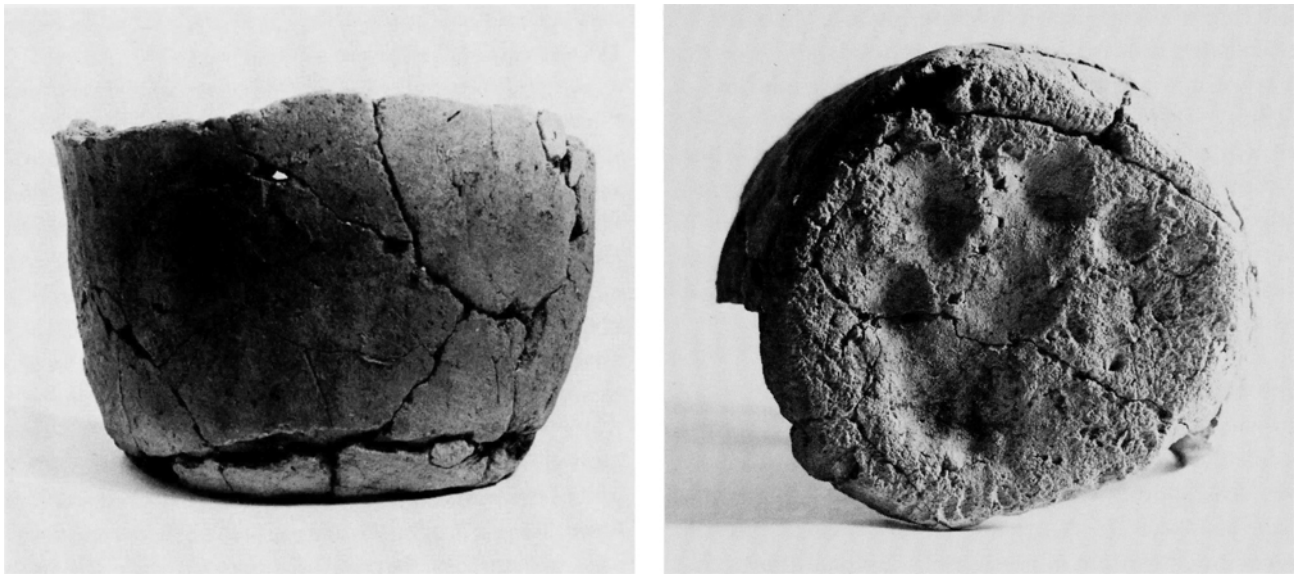

Fig. 8. Lower part of pottery vessel from House I. 2:3.

A similar situation is visible in the west end of house II, and traces of specialised production of daggers and sickles can be seen in the east end of this same house.

Whether or not production and use was regulated by age or sex, there is a clear tendency for scrapers, borers and strike-a-lights to avoid the area where arrowheads were produced. Workshop flint is clearly restricted to particular loci, more so than either finished tools or

everyday implements. The amount of cultural deposits remaining outside the houses is little more than that associated with any one of the houses themselves. Despite this, many flake scrapers, borers and sickles were found, which must be regarded as evidence of »outdoor activities«.

Use of the hafted scrapers seems to be closely connected with house interiors, from where 5/6 of the total of 27 pieces were recovered. More than 1/3 of the flake scrapers (oval scrapers) were found outside houses. Differences in the usage of the two types of scrapers seem thus to be visible.

A strightforward cumulative division of tools and roughouts over a schematic east-west section, with cultural deposits marked in, shows that the quantity of finds is not directly proportional to the thickness of the cultural deposits. In houses I and II, clear drops in frequency occur over the partition walls. The extremely low values for the west end of house III cannot be explained only by a lack of cultural deposits. Could the house have had grain storage space or a threshing area here?

It is thus possible to distinguish specific activity areas by a simple analysis of distribution. Unfortunately the results are somewhat limited by the thinness of the cultural deposits outside the houses. It is also difficult to be sure how much of the cultural deposits in the houses might have been transported in from outside, and how much the original workshop or activity areas might have been moved as a result.

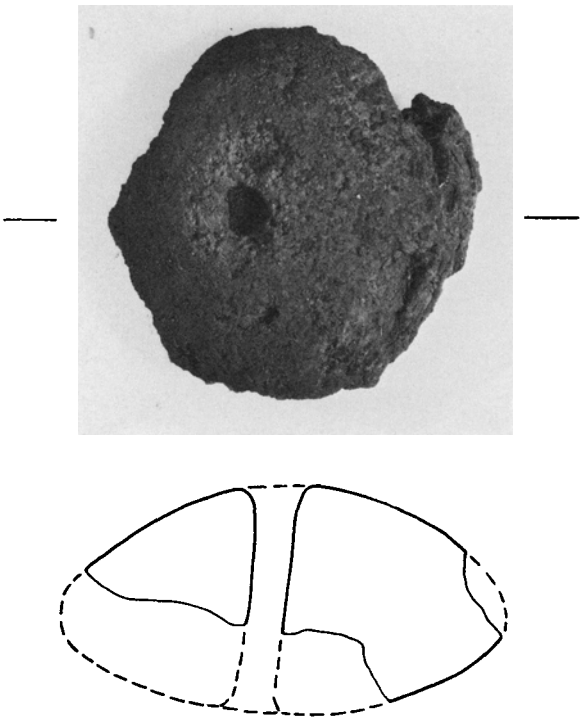

Fig. 9. Loom weight from House I. 2:3.

CHRONOLOGY

If we examine the internal relative chronology of the settlement, there is a notable constructional synchroneity between all three houses. The stratigraphic separation of more recent elements was simple and sure. These elements consists largely of remains from the later bronze age (2) and they are excluded from the plans and figures of this publication.

If we return to the positioning of the houses, it is clear that houses II and III are contemporary. This is emphasised both by their placing, and by the details of features such as the depression connecting the two houses. A slight depression, which runs along the eastern end wall of house I, is clearly cut by the first roof-support of house II, which must therefore be later. On the other hand, there is such a degree of parallellism between the walls and rows of roof supports of all the houses when viewed together, that the most likely explanation is that the eastern end of house I was pulled down, and replaced by (or rebuilt as) houses II and III. It is not unlikely that all three houses are partially contemporary.

The undisturbed layers of cooking stones in houses II and III, together with the certainty with which disturbances in the cultural deposits could be separated out, enable the finds from here to be regarded as »pure« and uncontaminated. The corresponding artifact groups may thus be used for a typological dating of the site. An established flint typology for most types is unfortunately lacking.

Three complete miniature daggers from houses II and III are daggershaped strike-a-lights of type A and B (Lomborg 1959; for dagger chronology in general see Lomborg 1973). They are all copies of type VI daggers (fig. 6: 3–5). The remaining dagger handles from the houses are all miniature daggers of type V. They must thus be placed in the typology before the dagger-shaped strike-a-lights of type A. The only regular type V dagger

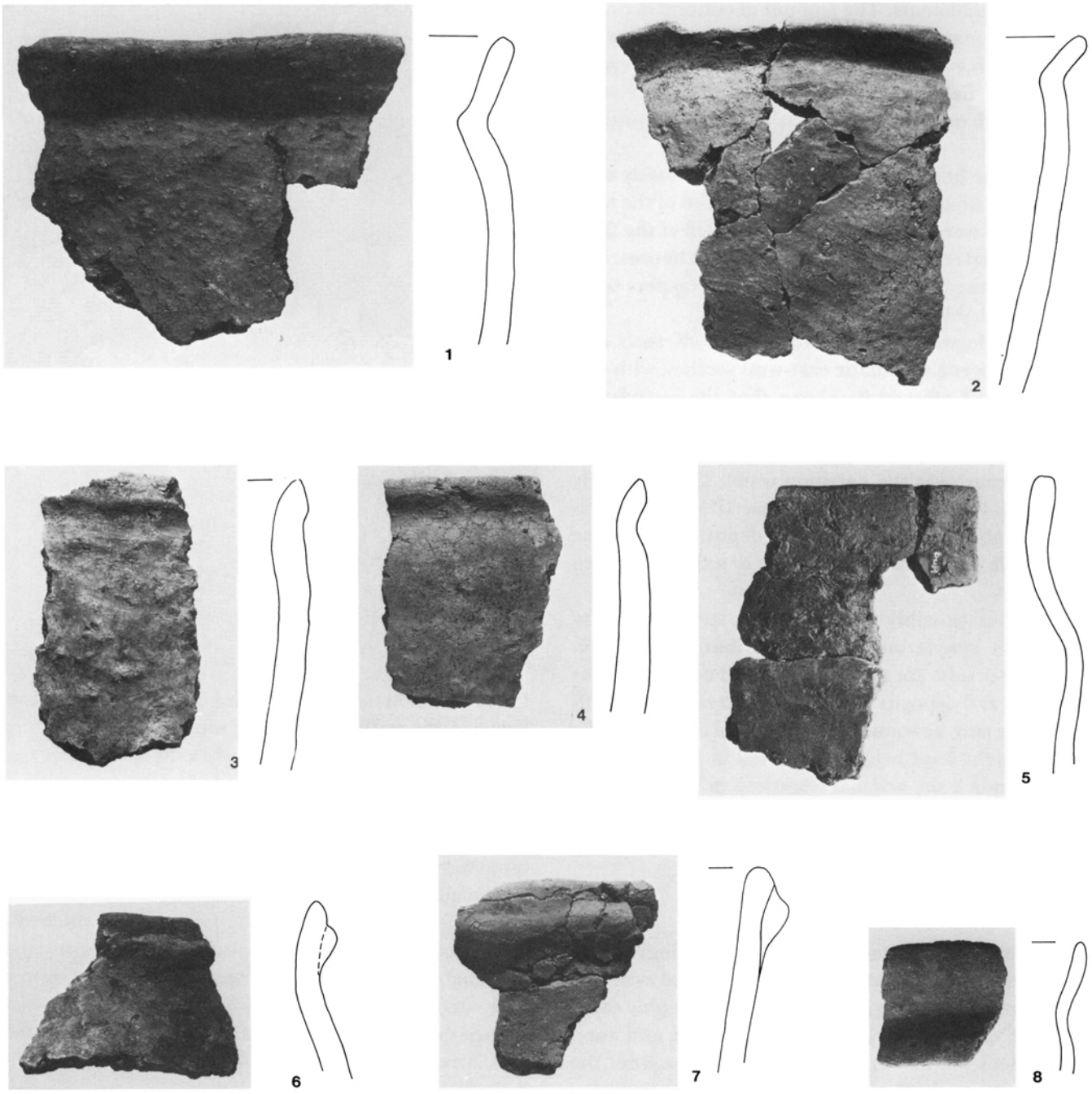

Fig. 10. Pottery. 2:5. (Kirsten Nijkamp photo).

handle (fig. 6: 6) has much basal wear. The combination of type V dagger handles, miniature daggers of type V and VI, and dagger-shaped strike-a-lights of type A and B must date the settlement to period I of the early bronze age; perhaps even to an early part of this, as daggers of type V have not yet been found together with metal items of period I. Associations of type V daggers and miniature daggers of type VI are known from graves (Lomborg 1959: 159).

None of the Egehøj flint sickles resemble the long,

narrow, denticulate type which occurs most frequently in period II grave contexts such as Ballermosen (Lomborg 1956). The sickles are morphologically very like those found from e.g. Schleswig-Holstein in period I grave contexts (Hachmann 1957, find 212, with a hafted scraper). Association of sickle, hafted scraper and dagger such as that from house II is also known from the Gjerå hoard (Brøndsted 1957: 333). Hollow based arrowheads occur in graves throughout the early bronze age. Those from Egehøj do not differ from those from period I graves in N.W. Germany and Denmark (Laux 1971: 90).

No pottery typology has been established for the early bronze age, so all that can be said is that pots and sherds from the settlement do not differ from the very few pots known from period I graves.

In summary, we have three long houses, all of which can be dated to period I of the early bronze age. In terms of construction, the houses are closer to Myrhøj, Stendis (Skov 1982), and Tastum (Simonsen, this volume) than to Vadgård (Lomborg 1973) or the Trappendal house (Andersen & Boysen, this volume). In terms of flint technology, Egehøj is at a level no worse than what is known from the late neolithic. Production of true axes, and polishing of stone, do however seem to have more or less stopped.

The typological dating to period I is supported by C14 dates from house III and the two wells (3).

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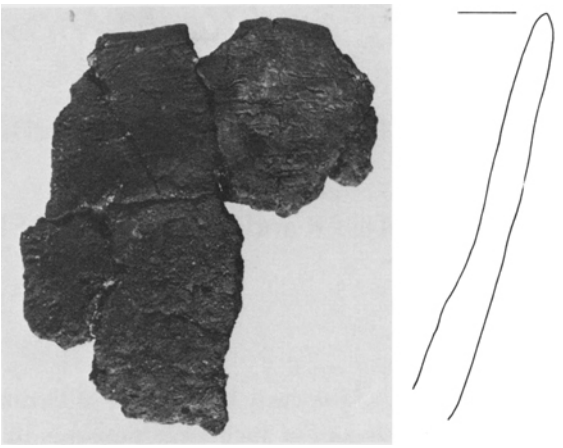

Fig. 11. Fragment of bucket-shaped vessel. 2:5. (Kirsten Nijkamp photo).

NOTES

[1] The barrow and settlement were excavated under the direction of the author in 1969–1973 with the support of the Danish Research Council for the Humanities. Culture Historical Museum, Randers, J. no. 160/69. Hemmed s., Djurs Nørre h., Randers amt.

[2] The secondary features are:

a. Oven bac, cut down through the cultural deposits in house I. The pottery dates from the later bronze age periods V–VI, C 14 dated to 450 bc (see note 3).

b. Burnt pit cir, cut down into house III's cultural deposit. The pottery dates from period V–VI of the later bronze age.

c. Cooking pit bzå, a double pit with among other things a large blade sickle. C 14 dated to 600 bc.

d. Small ship-shaped stone setting, built over the southeastern well. Pottery dated to period V–VI of the later bronze age.

e. Four postholes cut down into house I and two into house III, together with a group of postholes around the cooking pit bzå and the stone setting. Distinguishable from the older postholes by their dissimilar fill and finds of pottery dating to the later bronze age.

[3] The following radiocarbon dates are available:

K–2238 charcoal from posthole in house III	1210 ± 100 b.c.
K–2239 charcoal from bottom of well I	1390 ± 100 b.c.
K–2240 charcoal from bottom of well II	1290 ± 100 b.c.
Secondary features (cf. note 2):	
K–2223 charcoal from oven bac	450 ± 100 b.c.
K–2241 charcoal from cooking pit bzå	600 ± 100 b.c.

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Lindebjerg and Røjle Mose

Two Early Bronze Age Settlements on Fyn

by ANDERS JÆGER and JESPER LAURSEN

INTRODUCTION

The large barrows of the early bronze age of Denmark are known so widely and in such large numbers that it seems the country would have resembled a single, enormous bronze age cemetery. In contrast to this, settlements from the period were for a long time almost completely unknown (1). In recent years, some regular settlements with houses have, however, begun to appear.

An extensive settlement area with three long houses and dating from the beginning of the early bronze age has been excavated at Egehøj on northern Djursland (Boas this volume). All the houses have a single row of roof-bearing posts, and a partially sunken floor. In terms of construction, these houses are reminiscent of those from the earlier late neolithic at Myrhøj in northern Jutland (Jensen 1972, p. 61 ff.).

The settlement at Vadgård in north Jutland consists of two settlements, from periods I and II of the bronze age respectively. The older settlement consists of three so far unpublished houses (see Lomborg 1980 p. 122). They do, however, appear to be the same type of house as those from the period II settlement, which consists partly of post-built houses with sunken floors (perhaps like the Egehøj structures), partly of the so-called O and C shaped turf-walled houses, and partly of post-built houses with two rows of roof-supporting posts. Traces of a presumed ritual area were also observed (Lomborg 1973 p. 5 ff., 1976 p. 414 ff., and 1980 p. 122 ff.).

Finally, a large post-built domestic structure has been found under a bronze age barrow at Trappendal near Haderslev; this probably dates from period II (Boysen and Andersen 1981 and this volume). This regular aisled longhouse bears comparison with the now numerous settlements of the late bronze age (Becker 1968 p. 79 ff, 1972 p. 5 ff, Lomborg 1977 p. 123 ff) (2).

This picture will be extended below by the publication of two recently excavated early bronze age settlements from northern Fyn. Both are on the northwest part of the island; Lindebjerg is near Bogense, and Røjle Mose is near Strib (fig. 1).

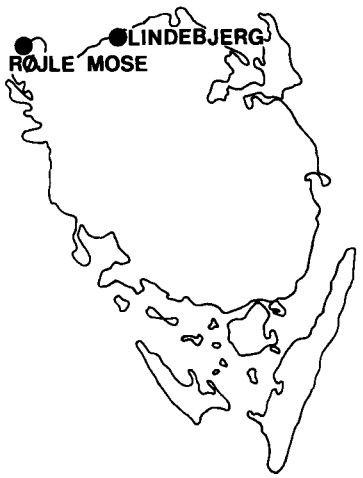

Fig. 1. The location of the two settlements.

THE LINDEBJERG SETTLEMENT

In the mid 1970's many flint implements, particularly scrapers and fragments of pressure-flaked sickles and daggers, were collected from a field at Lindebjerg, about 2 km south of Bogense.

The site was registered by the North Fyn Museum in 1974, as a settlement with surface finds of late neolithic/early bronze age type (3). The settlement apparently covers most of a low, 3000 m^2 sandy rise, surrounded on all sides by low, boggy ground (fig. 2). An ashy area measuring about 6 × 8 m was visible in the centre of the site. This area had a concentration of flint waste, tools and potsherds, and in the southeastern part several large fragments of loom weights.

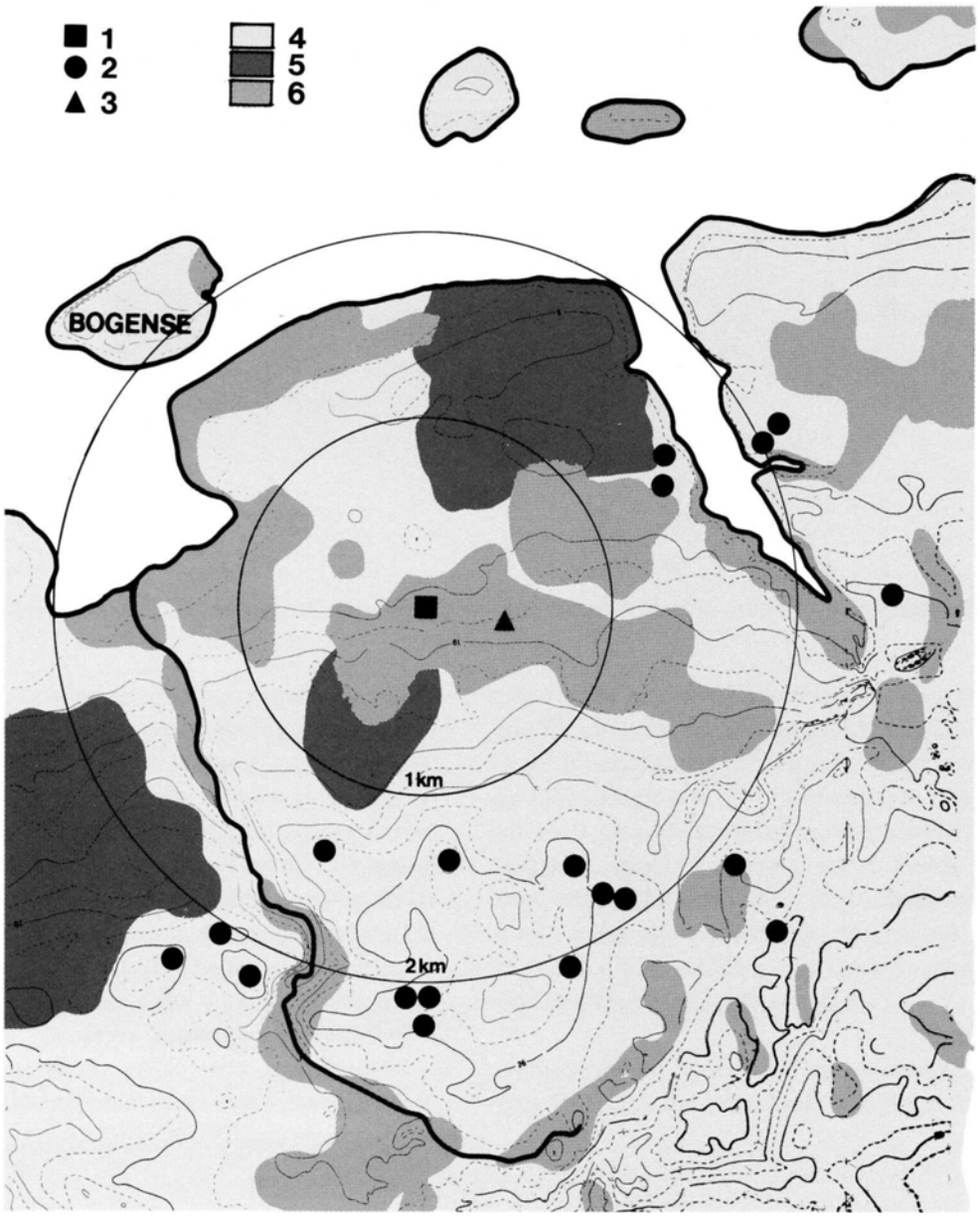

Fig. 2. Contour map of the area round Lindebjerg. 1, the settlement; 2, barrow; 3, hoard; 4, sandy soil; 5, clay soil; 6, wet area. The wet areas are defined on the basis of historical sources of around 1800 AD, and also of the soil maps of the Ministry of Agriculture. Drawn by Elsebet Morville (Reproduced by permission of the Geodetic Institute A. 524/83. Copyright). 1:40,000.

A trial excavation was carried out in the area of ash, and a pit-like structure was found; this had a row of posts along its north and west sides. The row to the north continued eastwards beyond the area of excavation. Single postholes could also be seen under the central part of the ashy area, but none were visible further south (fig. 3).

The area within the rows of posts appeared as a minor depression containing cultural deposits. Many pieces of flint waste, flint implements, pottery, burnt granite cobbles and charcoal were found in its upper part. In the southeastern area, one loomweight and fragments of others were found; these proved to belong to the pieces collected from the surface. Under this upper cul-

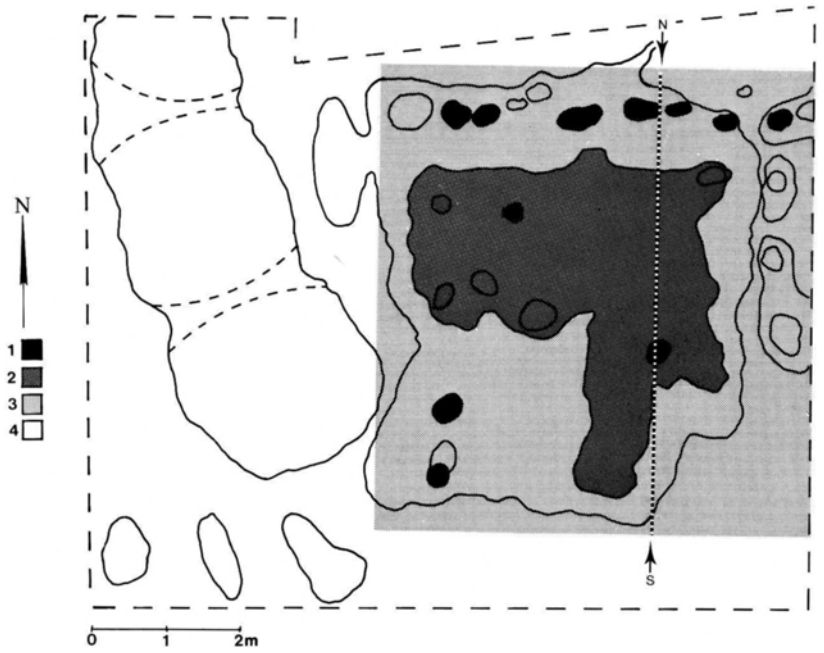

Fig. 3. Plan of the Lindebjerg house and pits. 1, posthole; 2, layer of carbonised cereal grains; 3, west end of the house; 4, pit. Drawn by Sven Kaae. 1:100.

tural layer and sealed by it was a 15–20 cm thick burnt layer. This contained charcoal fragments and carbonised cereal grains in such enormous quantities that they could literally be recovered by the shovel-full (fig. 4). This layer covered a somewhat smaller area than the cultural layer above. It was angular in shape, one portion projecting southwards to the area where the loom weights were found (fig. 3). Around the edge of the layer, particularly to the south, a zone of reddened sand testified to the existence of a major fire – but no proper hearth was found.

The feature is interpreted as a house, which seems to extend to the east beyond the excavated area. One possible explanation is that it is the west end of a longhouse with a sunken floor (Boas this volume). One or more of the central postholes, which are up to 60 cm deep, could be traces of roof-bearing posts. The layer of charred cereal grains indicates the floor level at the time the house was burnt down. Later the layer was covered by settlement material redeposited from nearby. 33 litres of carbonised cereals show the location of a major grain store in the northwestern part of the house, while the place where above 8 loom weights were found presumably indicates a spinning area.

Immediately west of the house a number of steep-sided pits were found, with depths of up to 90 cm. They

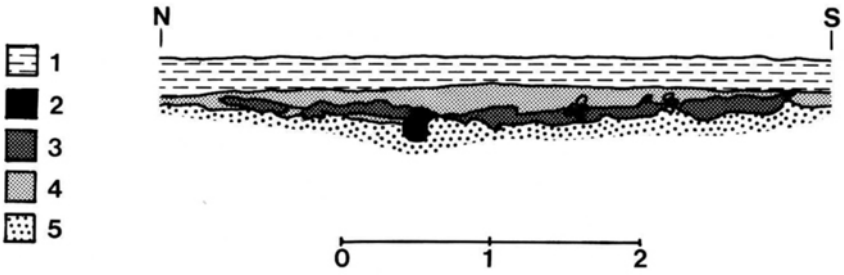

Fig. 4. Transverse section of the Lindebjerg house. 1. topsoil, 2. posthole, 3. layer of carbonised cereal grains, 4. upper cultural layer, 5. subsoil. Drawn by Sven Kaae. 1:50.

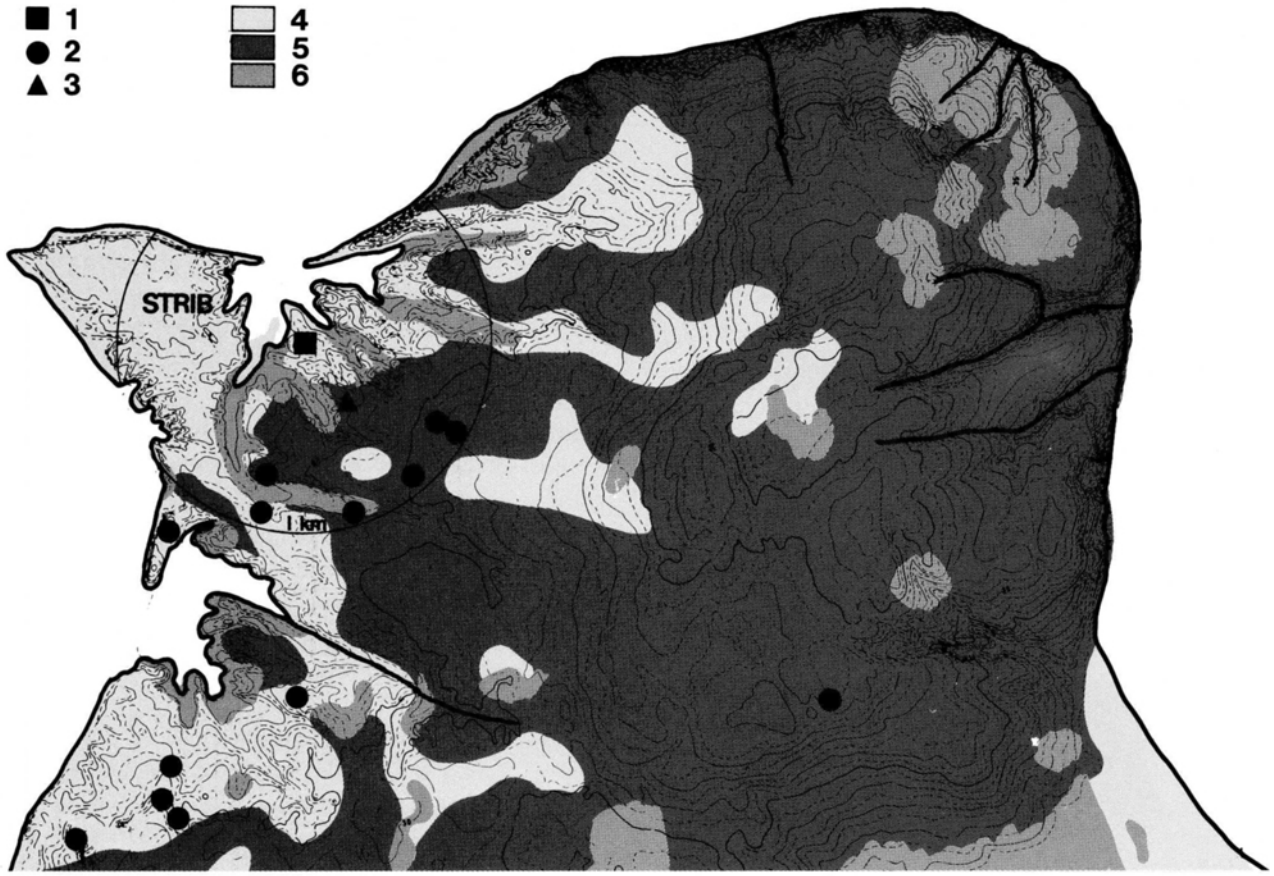

Fig. 5. Contour map of the Røjle peninsula. 1, settlement; 2, barrow; 3, hoard; 4, sandy soil; 5, clay soil; 6, wet area. The wet areas are defined on the basis of historical sources of around 1800 AD, soils also from Nordmann 1958 and the soil maps of the Ministry of Agriculture. Drawn by Elsebet Morville (Reproduced by permission of the Geodetic Institute A. 524/83. Copyright). 1:40,000.

contain largely the same sorts of finds as the house, but the quantity of carbonised cereals was considerably less. The pits are apparently linked to the structure, and are covered by the same layer of cultural deposits. The pits may have been used in connection with grain drying (Rowley-Conwy 1978 p. 162).

The excavated features, with their traces of grain storage and spinning, and the large numbers of surface finds, together suggest a permanent settlement which probably consisted of more than one household.

THE RØJLE MOSE SETTLEMENT

The second early bronze age settlement from Fyn lies on a field near Røjle Mose (mose = bog) (fig. 5). Large numbers of flints had been collected from the surface over the years, and because of plans to build on the land, rescue excavations were carried out in 1974–77 (4).

In all, 5000 m^2 were excavated; several areas of cultural deposits and about 650 features were investigated (5). Two of the areas of cultural deposits, and many of the features (some of which grouped into 3 structure-like systems), could be dated to the early bronze age (fig. 6). The 3 structures were placed on a long hill running east to west; the land slopes evenly down to the north, more steeply to the southwest.

Construction A (fig. 7) was immediately under the ploughsoil and had a 5.5 × 3.5 m C shaped groundplan. The north side consisted of an irregular oblong feature; this curved round to the south-southeast to form the eastern side of the construction. A row of postholes marked the western side. A centrally placed pit with

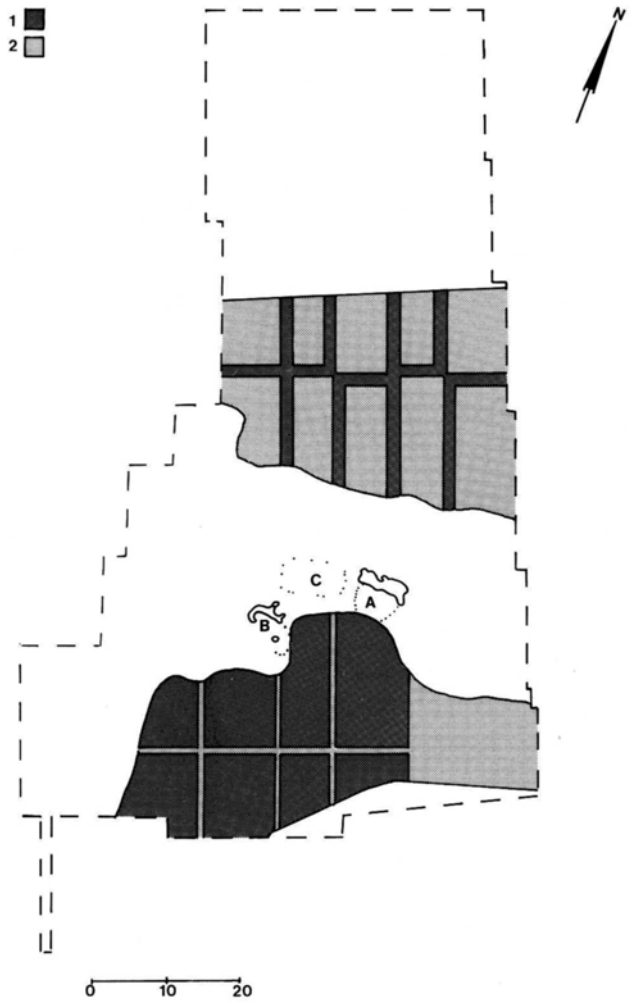

Fig. 6. Plan of the excavated part of the Røjle Mose settlement. A, B, and C, constructions; 1, unexcavated area of cultural deposits; 2, excavated area of cultural deposits. Drawn by Sven Kaae.

sides burnt red contained some charcoal and a complete flint sickle.

When viewed in section, the large northern feature turned out to be 120 cm deep; the south side was vertical, the north stepped. The bottom was flat in the centre, from where it rose sharply and then levelled out towards east and west (fig. 8). At a lower level, the east side of the construction was visible as a row of small posts.

Construction B had a similar C shaped plan, measuring 6.5 × 3 m and with its opening to the south (fig. 9). The northwest and west sides were marked by a curved, oblong feature, the others by a curved row of posts. In the eastern end was a possibly contemporary cooking pit.

In section, the large feature again had a vertical southern side and a stepped northern side. Its greatest depth of 55 cm was in the middle, from which it rose steeply and then levelled out towards the ends. Two deep postholes were visible in the bottom of the feature (fig. 10–11).

Construction C lay between the first two, in an area with a close concentration of postholes and pits (fig. 12). A number of postholes could be linked together to form the groundplan of rectangular shape, measuring 8 × 4 m and orientated east-west. The southwest part appeared immediately under the topsoil as a curved feature, in which postholes were visible at a lower level. None of the many postholes and pits inside the posthole setting could definitely be linked with it.

The closest parallels to constructions A and B are on the Vadgård settlement, mentioned in the introduction. C shaped constructions are represented there by one complete system, interpreted as the foundation trench of a turf-walled house (Lomborg 1973 p. 6 ff, 1976 p. 416 ff.).

However, in neither construction A nor B was any trace of turf walling observed in connection with the large ditches, and a foundation trench with a depth of up to 1.20 m seems excessive for a turf wall. As postholes were observed in the bottoms of these features, they should probably rather be seen as excavations to take a system of large posts; together with the rows of lighter posts which abut them, they would have formed wooden structures of curious irregularity. The absence of roof supporting posts and the fact that they are open towards the south does not offer any great support to the notion that they were used as dwellings; but the presence of a possible fireplace in construction A and of a cooking pit in construction B does suggest that they were used for some form of occupation or activity.

The closest parallels for post construction C are also at Vadgård, where several similarly lack roof-supporting posts (Lomborg 1976 p. 419 ff) (6). Despite this, they must be regarded as dwellings.

The 2 areas of cultural deposits which were mentioned above as being dated to the early bronze age, lie immediately below the constructions described above, one on the north slope and one on the south slope (fig. 6). The layers average 20 cm in thickness and together cover c. 2000 m^2. Of this, 400 m^2 were excavated by metre squares in 10 cm spits, while a further 150 m^2 were excavated by removing thin layers with a shovel. The layers

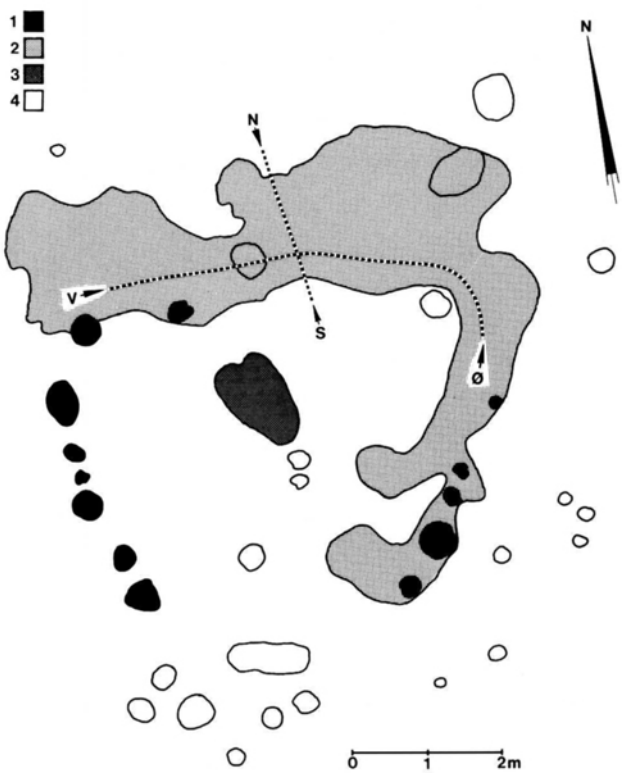

Fig. 7. Plan of construction A. 1, posthole; 2, main feature; 3, fireplace; 4, pit. Drawn by Sven Kaae. 1:100.

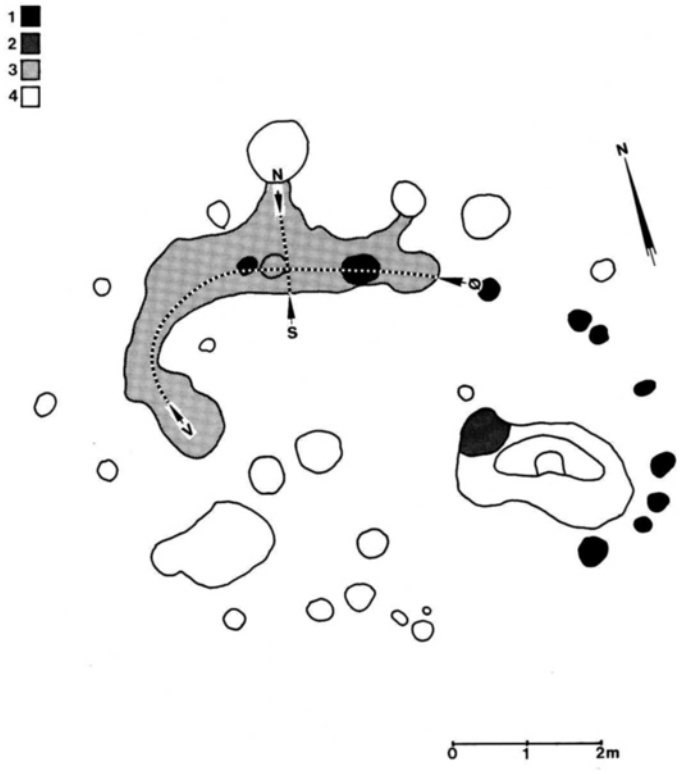

Fig. 9. Plan of construction B. 1, posthole; 2, fireplace; 3, main feature; 4, pit. Drawn by Sven Kaae. 1:100.

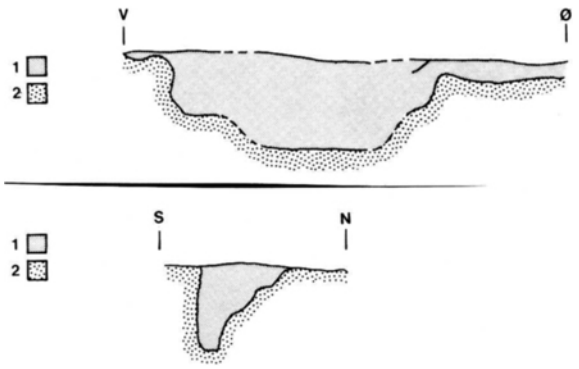

Fig. 8. Transverse and longitudinal sections through the main feature in construction A. 1, ditch; 2, subsoil. Drawn by Sven Kaae. 1:100.

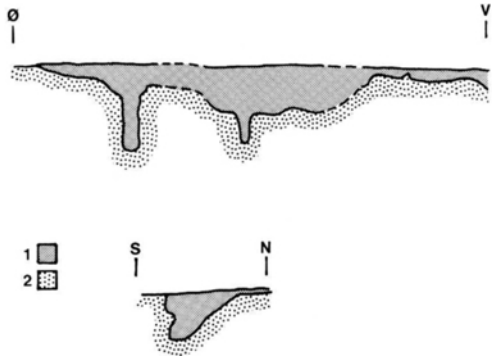

Fig. 10. Transverse and longitudinal sections through the main feature in construction B. 1, ditch; 2, subsoil. Drawn by Sven Kaae. 1:100.

contained many finds, in the form of flint artifacts and waste, pottery, stone tools and many burnt stones, see the inventory, Table I.

Spatial analysis of the distributions of individual tool types revealed no significant horizontal or vertical patterns; in both dimensions, flint waste, tools and pottery all had uniform and even distributions.

This type of distribution does not suggest that the layers were formed primarily by direct activities on the spot, or by natural erosion from the higher ground. It

Fig. 11. Section through a posthole in the bottom of the main feature in construction B.

seems more likely that they developed from the continual deposition of rubbish from clearing and cleaning the settlement and activity areas.

The presence of such extensive layers of cultural deposits with a large though chronologically homogeneous find inventory, as well as a settlement and activity area (all of which could well be part of a larger area of settlement extending east and west beyond the investigated area), testifies therefore to a permanent settlement of some duration, and presumably consisting of several households.

THE FINDS

The finds from Lindebjerg and Røjle Mose will in the following be treated together for practical reasons. The number of finds within each type from the two settlements is given in the inventory, Table I. The finds comprise in all respectively 1,119 and 14,704 items. To this must be added charcoal samples, burnt bone and carbonised grain.

Flint

Objects of flint form the most common find group. The raw material consists apparently only of small, locally available natural cores, mainly in the form of nodules.

The waste material is almost entirely irregular waste flakes. Only rarely are pieces found with the proportions of blades, and they are almost all irregular. Most

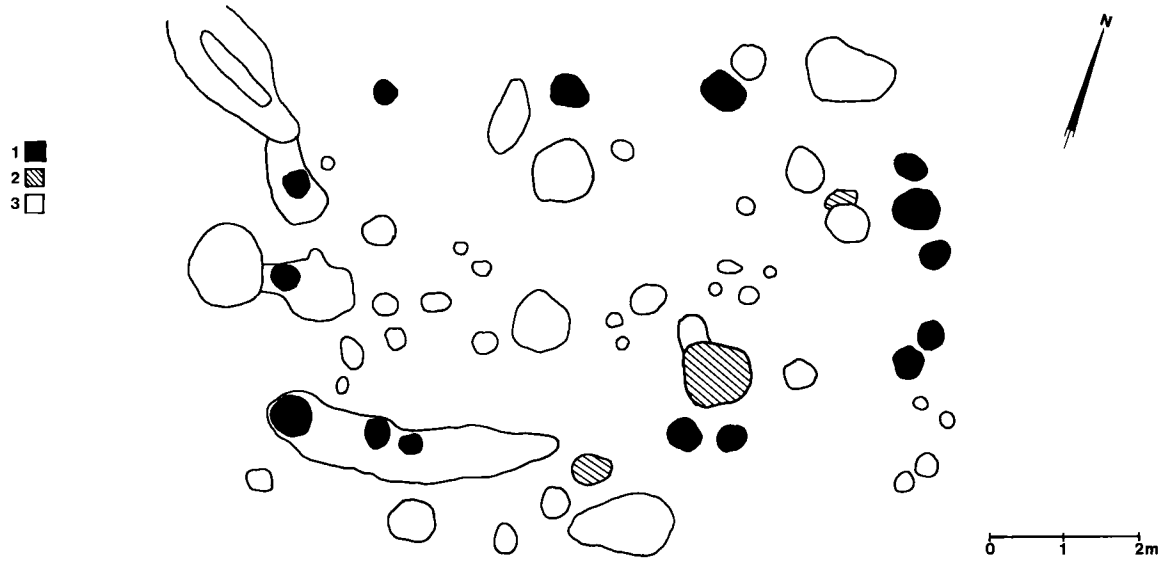

Fig. 12. Plan of construction C. 1, posthole; 2, stone; 3, pit. Drawn by Sven Kaae.

LIST OF FINDS	LINDEBJERG House	LINDEBJERG Features	RØJLE MOSE Culture layers	RØJLE MOSE Features
FLINT				
Scrapers	5	6	128	8
Borers	1		67	
Burins			4	
Flakes with edge retouch	1	2	98	3
Multiple purpose tools			2	
Flakes, toothed or notched	11	12	403	18
Flakes with transverse retouch			7	
Flakes with continuous edge retouch	2	5	331	10
Daggers, strike-a-lights, spearheads	5	3	45	1
Sickles	1	1	14	6
Arrowheads	1	2	52	1
Hammer Stones			81	4
Other			28	3
Total tools	27	31	1260	54
Cores	13	15	168	8
Flakes	474	290	11677	549
Total flint	514	336	13105	611
STONE				
Tools			24	3
POTTERY				
Rim sherds	17	6	92	10
Side sherds	138	75	762	60
Base sherds	13	16	30	3
Other	4			
Total pottery	172	97	884	73
OTHER			4	
TOTAL	686	433	14017	687
OVERALL TOTAL	1,119		14,704	

Table I. Inventory of finds.

of the flakes resulted from direct, »hard hammer« blows. Small, thin waste flakes with very small striking platforms were presumably produced by indirect of pressure flaking.

The cores are generally very irregular, and are dominated by examples with three or more flake removal scars.

These factors give an impression of a direct, rather coarse and apparently unsystematic flaking technique, combined with a finer indirect or pressure technique. This impression is supported by the artifactual material, which is mostly made on irregular flakes quite heavily worked with angled or flat retouch.

Tools form about 10% of the total flint. In the following the most characteristic tool types will be briefly described (7).

Scrapers are characterised by pieces with and without partial edge retouch, and by spoon and pear-shaped hafted scrapers (fig. 13 h–i).

Borers are mainly produced on flakes with or without a shoulder, but narrow and broad types are also found.

Flakes with worked edges are a quite common but variable type, dominated by pieces with partial retouch along the long edge.

Notched or toothed flakes form the most common type. Most are characterised by one or more notches formed by a single powerful blow; these can be so widespread that the upper or lower face of the item is more

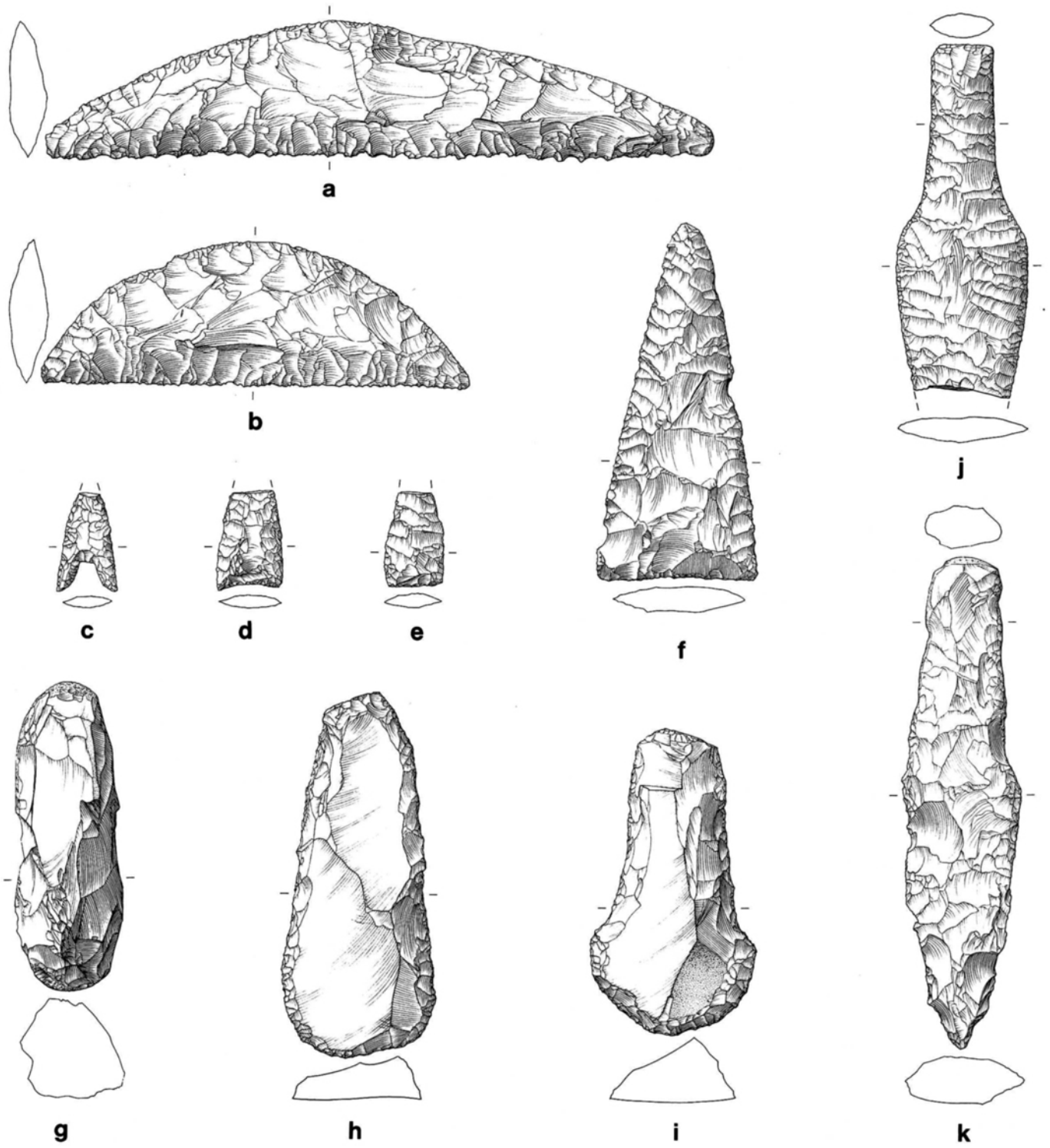

Fig. 13. Flint artefacts from Røjle Mose. a–b, sickles; c–e, arrowheads; f, spearhead; g, hammerstone; h, oval scraper; i, hafted scraper; j, dagger fragment; k, dagger roughout. Drawn by Orla Svendsen. 2:3.

or less completely covered by secondary flake scars. In such cases they are similar to the so-called roughouts.

Flakes with continuous edge retouch (the second most common tool type) consist mainly of quite small, thin flakes with irregularly placed fine retouch. They are presumably tools primarily used for cutting.

Daggers and pressure-flaked strike-a-lights all have one end shaped for the hand, with more or less parallel sides and lentoid cross section. The greatest width of the blade is towards the end nearest the hand (fig. 13 j).

Spearheads are all characterised by a triangular outline, with a wide, straight base and straight sides (fig. 13 f).

Pressure-flaked sickles appear in two forms; short, broad examples with straight, untoothed edges, and long, narrow types with straight or slightly concave edges which are often toothed (fig. 13 a–b).

The arrowheads are characterised by triangular or leaf shaped types with total or partial flat retouch, and/or nearly complete edge retouch. They occur with straight bases, or with rounded or angled basal notches (fig. 13 c–e).

Hammerstones may be either spherical or ovoid. The latter (which form one of the most common types at the Røjle Mose settlement) are flaked from 2 or 3 longitudinal edges and are pitted at one or both ends (fig. 13 g). The removals are generally fine, on some examples virtually smooth, and are often grouped round an unworked central area. On many pieces the smoother type of pitting continues up the adjacent long side surfaces. These hammerstones were most probably used for working stone (8).

In the category labelled »other« are among other things flakes with symmetrical, two-sided retouch on the long edges, and in a few cases with some rough polishing at one end.

Stone

Worked stone only forms a small part of the inventory. Hammerstones, arrow shaft smoothers, fragments of querns, grindstones and shafthole axes were found; besides these, mention must be made of two stones, oval in outline and cross section, with two grooves running round them parallel with the long axis (fig. 14). These

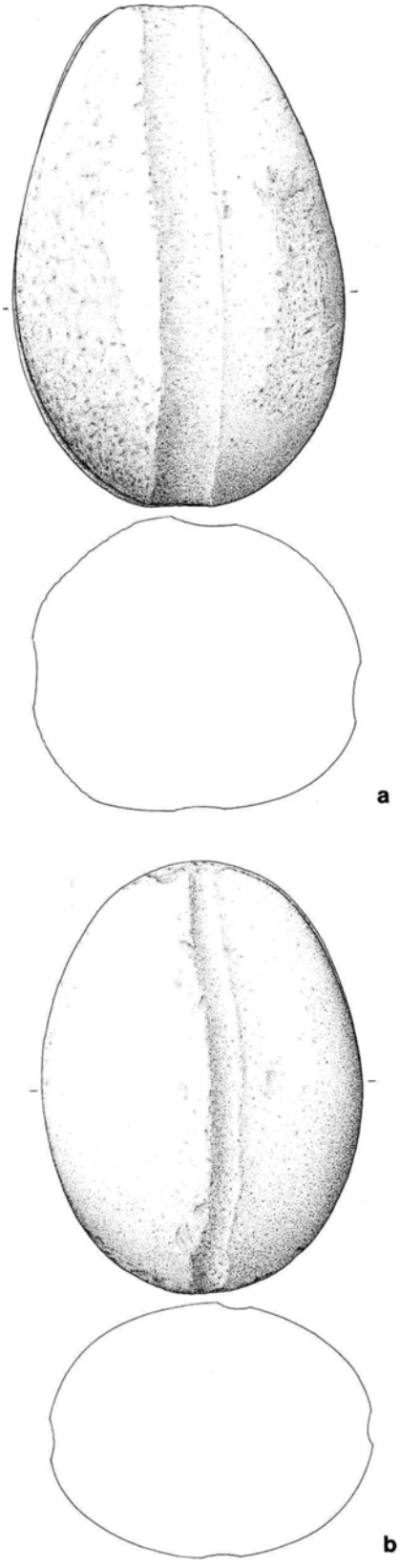

Fig. 14. Stone weights from Røjle Mose. Drawn by Orla Svendsen. 1:2.

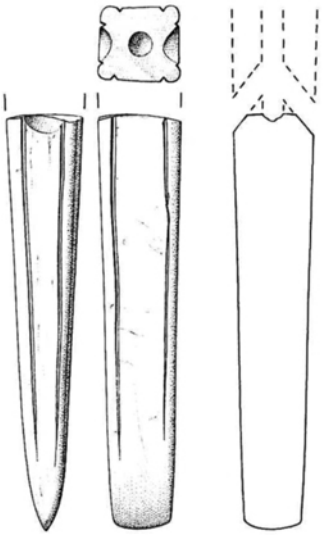

Fig. 15. Slate pendant from Røjle Mose. Drawn by Orla Svendsen. 1:1.

stones have weights of c. 1 and 1.5 kg, and are too heavy to be net weights. They were presumably used as weights in longline fishing in deep or running water (cf. Svabo 1959 p. 96, Petersen 1951 p. 263 ff.).

A decorated, chisel-shaped slate pendant was also found at Røjle Mose. It had a Y-shaped perforation in the now broken end from which it was hung (fig. 15).

Pottery

Most of the pottery consists of sherds characterised by an uneven, bumpy surface, caused by the usually very coarse tempering material – apparently mainly crushed stone. Thickness is generally about 1 cm, is rarely above 1.5 cm and never below 0.5 cm. Besides this, there are also a few sherds of finer thinwalled pottery, with even and relatively smooth surface, and finer tempering material.

The sherd material is very fragmentary, so vessel shapes cannot be distinguished. From Røjle Mose alone, the rim sherds probably represent more than 100 pots.

The rim sherds fall into the following types: 1. everted rim with sharp angle immediately below the rim itself; 2. everted rim with even curve below; 3. everted rim with step immediately below; 4. vertical rim with straight and/or convex sides; 5. vertical rim with step immediately below; and 6. inverted rim (fig. 17).

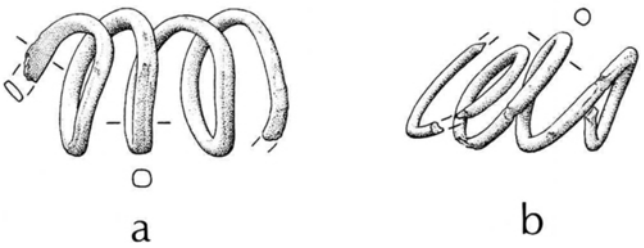

Fig. 16. Spiral finger ring of bronze from Røjle Mose. Drawn by Orla Svendsen. 1:1.

The shape of the basal sherds suggests that about half the pots were footed.

Finally, 8 loom weights were found in the Lindebjerg house; these were elliptical in cross section. 4 had a diameter of 8.5–9 cm, the rest of above 10 cm. The clay is coarse, tempered with quite large pieces of crushed flint and stone, and contains impression of straw etc. (fig. 18).

Metal

In one of the areas of cultural deposits at Røjle Mose two spiral bronze finger rings were found; both were wound 4 times (fig. 16). They were made of a thin piece of tubing, D-shaped in cross section and hammered flat at the end.

Organic materials

Both settlements produced carbonised cereal grains, and also scattered pieces of charcoal and burnt bone.

The grain find from Lindebjerg, one of the largest of its type, comes from a store inside the house and from presumed drying areas immediately to the west. The grain from the house consists of naked 6-row barley and emmer in the proportions 3:1, and a few grains perhaps of bread wheat; the material from the pits on the other hand is dominated by emmer (Rowley-Conwy 1978 p. 159 ff.). The composition and nature of the find clearly implies systematic agricultural practices; the absence of weeds and chaff indicates that winnowing had already taken place, the pits are probably where the cereals were dried, and the processed crop was finally stored in the building.

The cereals from Røjle Mose come from the two large

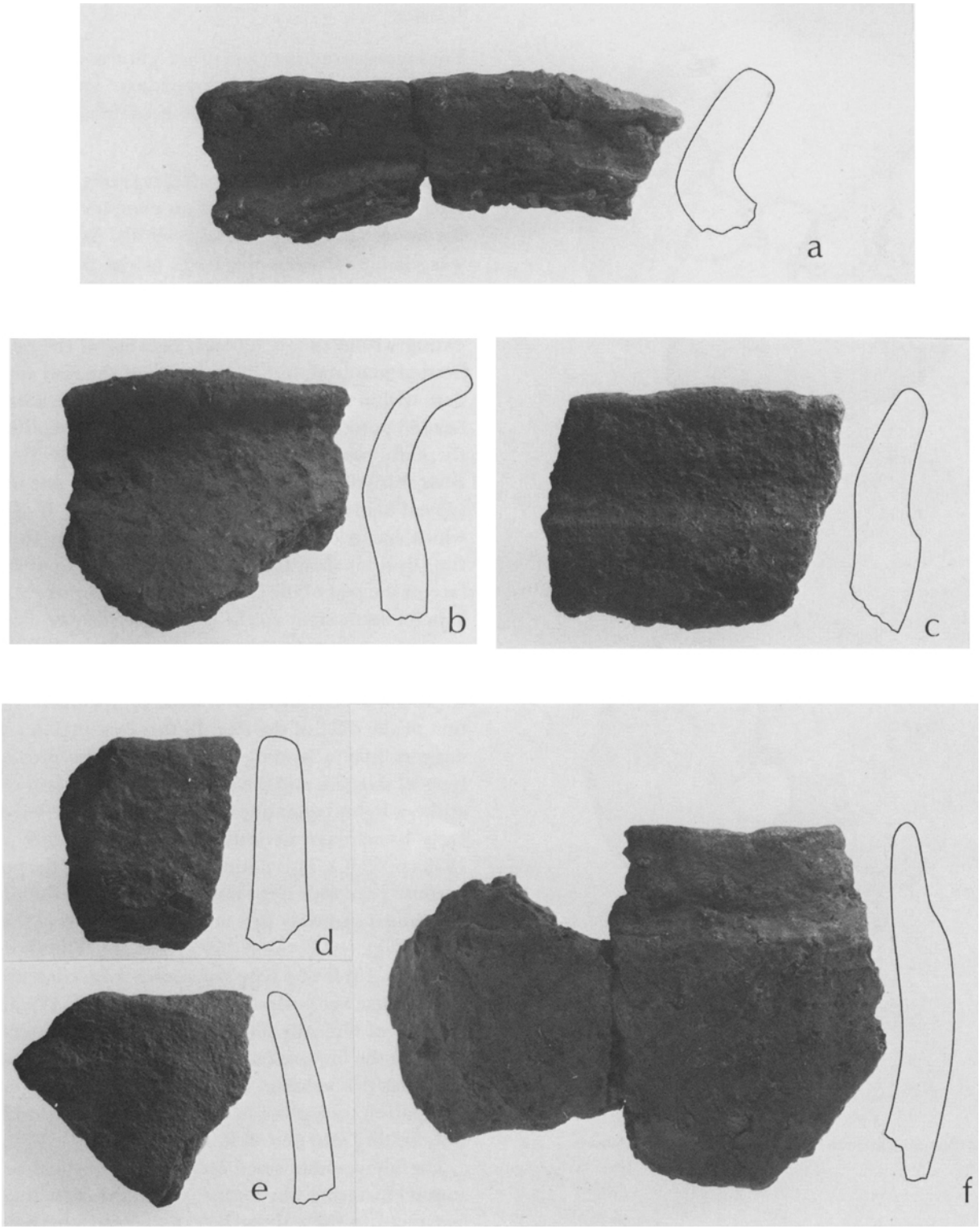

Fig. 17. Rim sherds from Røjle Mose. Photo: Mette Sommer. Drawing by Orla Svendsen. 1:1.

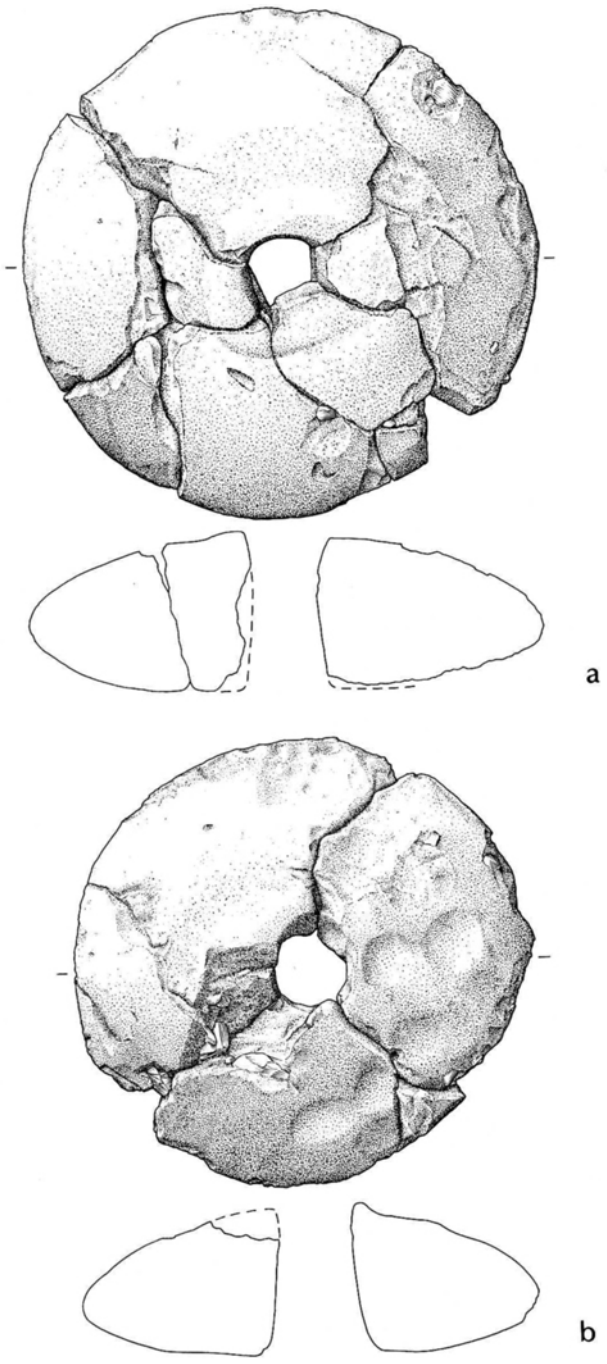

Fig. 18. Loom weights from Lindebjerg. Drawn by Orla Svendsen. 2:3.

features forming the main parts of Constructions A and B, and consist of 11 grains of naked barley and 1 of hulled barley (9).

DATING

The layers, structures and other features described here are all referred to the early bronze age. This section presents more information about the datable objects.

Lindebjerg. The dating of Lindebjerg rests primarily on a type VI dagger found in the pit complex to the west of the house (Lomborg 1973a p. 69 ff.). As no difference was visible between the finds in the pits and in the house, it is reasonable to refer the whole settlement to an early stage of the early bronze age. More precise dating within this is difficult because of the relatively limited material, but two aspects of the find suggest a date within the later part of period I: 1) the absence of beaded pottery, which belongs to the late neolithic and the early part of period I (Persson 1975 p. 31 ff. and Boas this volume); 2) the presence of only one not very typical sherd of pottery of mainly period II–III date, which has a characteristically shaped step under the rim. Besides this, the material collected from the surface of the rest of the low hill shows that there was only a major settlement on the site in the early bronze age.

Røjle Mose. The finds from the rich cultural layers at Røjle Mose provide a good basis for a closer examination of the date of the site. In this connection the flint daggers play a leading role, because the presence of type VI daggers and the closely related pressure-flaked strike-a-lights unanimously place the settlement in early bronze age periods I/II (Lomborg 1959 p. 161, 1973a p. 69 ff.). This dating is supported by the pottery, because pots with steps immediately below the rim (fig. 17) almost certainly first appear at the start of the early bronze age (cf. Persson 1975 p. 33 ff.). The slate pendant (fig. 15) is of a type not known from contexts later than bronze age period I (Hasselmo 1972 p. 17); and the absence of typically late neolithic beaded pottery (still in use in the first part of period I) (Persson 1975 p. 31 ff. and Boas this volume) combines with it to suggest that occupation took place in the later part of period I, possibly lasting into period II.

The above-mentioned fact that no vertical or horizontal clustering was visible within the individual artifact types in the culture layers suggests chronological homogeneity.

Constructions A–C are to all appearances contemporary with the areas of cultural deposit. The finds from

the features making up the structures are identical with those from the cultural deposits. Again, the nearest parallels are with the early bronze age (see above).

A thermoluminescence date of 1860 B.C. from burnt stone from one of the areas of cultural deposit confirms the archaeological dating (Mejdahl, Bell and Winther-Nielsen 1979 p. 150). Considering that there is an uncertainty margin of around 200 years, there is reasonable agreement between the TL date and C14 dates from other early bronze age contexts (op. cit. p. 150, Boysen and Andersen 1981 p. 27 note 9).

THE SETTLEMENT

Lindebjerg. The settlement is, as mentioned, located on a low rise in the ground (fig. 2), measuring 85 m east-west and 60 m north-south and covering about 1/3 ha. The rise is in the western part of a large wet area, which in prehistory was probably watermeadow or bog, and probably flooded periodically. In this area a hoard of early bronze age date has been found (Aner and Kersten 1977 p. 135 no. 1890) (10).

On three sides the settlement area is naturally bounded at a distance of about 1.5–2 km from the site. The sea forms the northern margin, a narrow fiord the east, and a steep-sided river valley the western boundary. Along the southern edge of a circle of the same radius are about 10 grave mounds, which may be partly contemporary with the settlement (11). If this is so, it would seem reasonable to suppose that at least the more intensive exploitative activities took place within this radius. Here the landscape is quite flat and has numerous wet areas; apart from these the soil is mainly sandy, but in the northeastern part of the area and also immediately south of the settlement are large areas of more clayey soil (fig. 2).

The resource potential of this limited territory, the settlement location, and the artifactual material combine to give some indication of the economic basis of the settlement.

The large grain find shows that cultivation was carried out from the site. The low rise in the ground would have presented limited possibilities for arable, as its small area would not provide space for other than domestic activities. Cultivation must therefore have taken place on the dry sand and/or clay areas away from the wet patches which surround the settlement. Within a radius of 1 km the maximum area of sandy soil is 156 ha, and of clay soil 50 ha.

The site location and artifact inventory suggests that hunting and gathering would have been of low importance. In order to exploit coastal and marine resources, it would be necessary to travel more than 1.5 km from the settlement (12).

Neither arable agriculture nor hunting and gathering can have been the main reason for placing the site on a low rise in the middle of a wet area. Factors such as defence may have played a part, but it seems most reasonable to suggest that stock keeping was the dominant economic activity. Both the extensive wet areas round the site and the presumed existence of woodland would have provided much grazing and the potential for hay and leaf fodder collection.

Røjle Mose. The settlement lies on a promontory projecting into the Røjle Mose bog (fig. 5). The bog is cut off from the sea by a large dune to the north, and in prehistory would probably have been a shallow fiord. The settlement would therefore only have been immediately accessible from the south. The bog at the time extended further inland to south and east, and so further cut off the settlement area; within a radius of 1 km, it would only have opened onto dry land to the southeast.

It is noteworthy that all the known barrows in the area group along the periphery of the 1 km radius (13). One of these can definitely be dated to the beginning of bronze age period II (Berglund 1978 p. 43 ff.), so that possibility cannot be dismissed that barrows and bog between them give the limits of at least the most intensively exploited area. It must also be mentioned that a large bronze hoard dating from period II was found a few hundred metres south of the settlement (Thrane 1972 p. 17 ff.).

As can be seen from fig. 5, the area round the settlement is strongly hummocked. About 250 m to the south the terrain becomes more even, and at the same time changes from morainic sand to heavy morainic clay.

The resource area delimited above presented a number of economic options. The coastal location allowed several kinds of hunting and fishing. For example, the stone weights suggest that line fishing was carried out. That this fishery had a degree of importance is suggested by the unusually large numbers of ovoid hammer stones, which could, as mentioned above, have been used to produce the stone weights.

Cereal cultivation, the existence of which is suggested both by the carbonised cereals and sickles with gloss, could have been carried out both on small areas of gently sloping sand around the site and on the areas of morainic clay further south. When wet and steeply sloping areas are excluded, the potential arable area amounts to 15 ha sandy soil and 47 ha clay soil. The possibility of grazing and fodder collection would have existed in the wet areas in the woodland presumed to have grown around the site.

CONCLUSION

These two settlements from Fyn, dating from the later part of bronze age period I and possibly extending into period II, are both so located that consideration of the contemporary situation allows a reconstruction of the site territory, and thus of the nature of the sites themselves. Both Lindebjerg and Røjle Mose are in areas which are naturally bounded on three sides by the sea, a steep valley and wet areas, at distances of 1.5–2 km and 1 km respectively. As the adjacent and perhaps partly contemporary barrows cluster at about the same distances on the »open« sides of these territories, it seems reasonable to view them as territorial markers (14). This is not to say, however, that all activities were necessarily carried out within these areas. Presumably the territories only represent those over which the group had inherited particular rights. The barrows might thus have lain at the edge of (for example) larger areas of woodland with common access (15).

Taking the above-defined territories, the site locations and the finds into account, it seems possible that the economy at Lindebjerg was based upon agriculture, particularly domestic stock; while fishing probably contributed an important supplement to the stock rearing and presumably less important arable economy at Røjle Mose. A similar combination of activities probably took place at near-coastal Vadgård (see above), while Lindebjerg's stock and to a lesser extent arable based economy also occurs at Egehøj (see above) and in the area of inland settlement in northwest Jutland (Kristiansen 1978 p. 328 ff.).

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NOTES

[1] Until the discovery of the Egehøj settlement (Boas this volume) in 1969, the only published »settlement« of early bronze age date was the flint-knapping site of Mellemholm (Grantzau, Marseen and Riismøller 1953 p. 121 ff.). Besides, this, another flint-knapping site, Fornæs on Djursland (Glob 1951 p. 23 ff.) probably also includes finds from the early bronze age.

[2] A similar and approximately contemporary house is known from Handewitt near Flensburg (Bokelmann 1977 p. 82 ff.).

[3] Skovby parish, Bogense commune, Odense county. Fyns Stiftsmuseum journal no. 1701.

[4] Strib-Røjleskov parish, Middelfart commune, Odense county. Fyns Stiftsmuseum journal no. FSM 1304.

[5] The other features and cultural deposits date from the late Single Grave and Pre-Roman iron age periods. It is intended that the settlement should be completely published in a forthcoming volume of Kuml.

[6] See also the house from Hemmed Kær (Boas 1980).

[7] The flint material has been typed in accordance with Tixier's criteria and terminology (Tixier 1963 p. 24 ff.). Additional definitions have been necessary in some cases.

[8] Personal communication from Bo Madsen, who is of the opinion that they could among other things have been used to produce the grooves in the stone weights.

[9] Recovered and identified by Peter Rowley-Conwy, Cambridge.

[10] The point in the bog where the find was made has since been established. Similar spearheads are often found in hoards (Becker 1964 p. 115 ff.).

[11] The National Museum's list by parishes, Skovby parish no. 3–4, 33–40 and Guldbjerg parish no. 15 and 2. Near the last-mentioned barrow, traces of a period I flat grave have been found (Aner and Kersten 1977 p. 133 no. 1882).

[12] A stone weight found in the wet area just below the rise could be contemporary with the site.

[13] The National Museum's list by parishes, Vejlby and Strib-Røjleskov parish nos. 17, 20, 21, 27, 30 and 31. 6 other mounds – parish list nos. 1 and 8–12 – which cluster around a similar area of branched fiords and wet areas a little further south, may indicate another settlement area (cf. fig. 5). A find of a period III grave is believed to derive from the northernmost of these (Aner and Kersten 1977 p. 143 no. 1932).

[14] Furthermore, a barrow functioning as a territorial marker need not be contemporary with a known settlement, because a group of barrows may indicate the cemetery area of both older and younger settlements (cf. Strömberg 1975 p. 35 ff., and the flat grave mentioned in note 12).

[15] Similar factors were presumably operating in northwest Jutland, where there seems to be a clear connection between the settlements, which are probably mainly on sandy soils near watercourses and wet areas, and the barrows, which cluster along the transition to the higher clay hinterland; the clay is largely devoid of finds and therefore was presumably wooded (Mathiassen 1948 p. 97, 100 ff., Pl. XXIV–XXV, Kristiansen 1978 p. 328 ff.).

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Trappendal

Barrow and House from the Early Bronze Age

by AAGE BOYSEN and STEEN WULFF ANDERSEN

INTRODUCTION

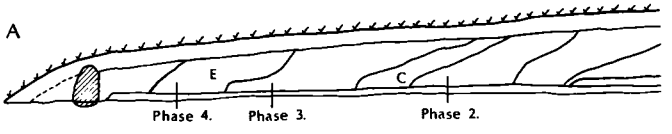
The first Danish bronze age houses were excavated as late as the mid-1950s (Thorvildsen, 1960), but they were soon to be followed by others, and today far more than a hundred have been excavated. This is primarily due to the extensive investigations carried out in West Jutland by The Danish Research Council for the Humanities and the National Museum (Becker, 1968, 1972; Davidsen, 1982), but during recent years bronze age houses have been discovered in North Jutland and on Zealand as well (Lomborg, 1973, 1976, 1977; Boas, 1980, 1983). An important material that significantly changes our perception of the living conditions during the bronze age has thus been brought to light, but surprisingly, nearly all the houses date from the late bronze age. Only at Vadgard near Løgstør, Egehøj in Djursland, Lindebjerg and Røjle Mose on Fyn (see Jæger and Jeppesen, this volume), have houses from the early part of the period been found, and houses from this period are very rare in our neighbouring countries as well.

The find from Trappendal south-east of Kolding which is presented here belongs to this exclusive circle. However, the excavation was initiated as a matter of routine and with a quite different purpose in mind. In January 1975 the amateur archaeologist and farmer Frederik Klestrup, Kær Mølle, notified Haderslev Museum about ploughed up kerb stones at the cultivated barrow »Sejlshøj« west of Trappendal near Hejlsminde (1). This is a rather large barrow heavily eroded by ploughing, so it was decided to investigate it before it disappeared completely. At this point nobody dreamt that the barrow might contain anything else besides burials, so it came as a surprise when it turned out that the barrow had been built on top of the site of a regular long house whose position indicated that it must have been built before the end of the early bronze age.

THE BARROW AND THE GRAVES

The barrow had a diameter of 26½ m, but about two thirds of the kerb stones had already fallen victim to ploughing. Most stones remained at the north and north-east sections and along a small section towards the south-west, but some of the removed stones had left clear imprints in the clay underneath. The stones varied in height from 50 to 70 cm. In several places gaps between the stones were filled with smaller, mostly cleft stones. Originally the barrow must have been quite tall, probably between 3 and 4 m, but at the beginning of the excavation only one metre was left. It turned out that the barrow must have been built in four stages. At all stages or building phases turf had been used with a varying admixture of the clayey subsoil. The transitions between the individual phases were manifest as colour differences of the filling and as thin stripes of hard pan and clay. The kerb-stones clearly belonged to the fourth and latest building phase.

The barrow contained three single burials and one double burial. The north-western quarter contained a southeast-northeast oriented cremation grave (grave 13), cp. fig. 4. The grave was built of generally fist-sized stones that have probably served as support for a wooden coffin containing the cremated bones. The



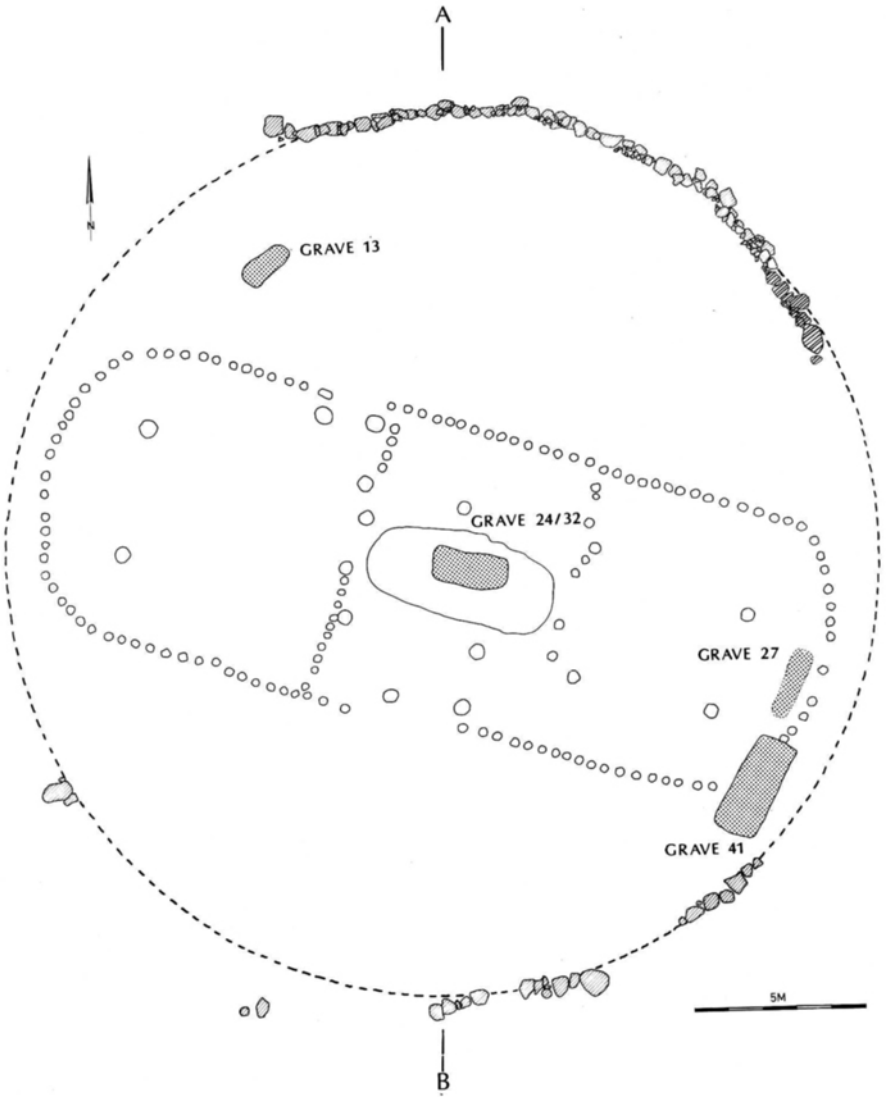


Fig. 1. Slightly simplified map of the excavation. The kerb stones are hatched and the graves screened. The post-holes are indicated without signature. Drawing by Lars Kese. 1:200.

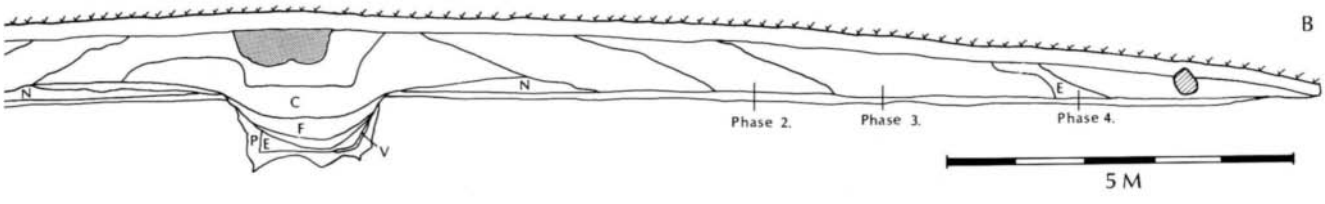


Fig. 2. Northsouth cross section of the barrow. The exact position of the cross section is indicated by perpendicular strokes in fig. 1. Drawing by Lars Kese. 1:100.

Fig. 3. The excavation seen from the south after the barrow has been removed. Only the partly preserved kerb stones can be seen at the edge of the light area. In the centre of the picture the site of the house with the big pit can be seen.

stone lining of the grave had an overall length of approx. 150 cm and a width of 60 cm, and the layer of cremated bones measured 80 × 22 cm and had a thickness of 8 cm. The grave clearly belonged to the third building phase. In the middle of the layer of cremated bones was a bronze razor, and close to it lay a 6 cm long bronze awl, cp. fig. 5. The presence of the razor shows that this must be a man's grave, and the examination of the cremated bones indicates that he must have died at the age of 30–50 (2).

The central part of the barrow contained a double burial consisting of two heavily disintegrated log coffins placed side by side (graves 24 and 32). They were deposited in the same grave, so we must assume that they have been buried at the same time, cp. fig. 6. The coffins were eastwest oriented with a slight twist towards the south, and they were both 190 cm long. The northernmost grave (grave 24) had a width of 30 cm and the southernmost one (grave 32) was 40 cm wide. The double grave had been dug down into the oldest barrow, so at the earliest it must have been made in connection with phase 2. In spite of the length of the coffins they were both cremation graves. Approximately in the middle of each of the graves was a heap of cremated bones whereamong some grave goods were found. In grave 24 was a partly molten piece of bronze. It is probably an ornament for a piece of garment as the back side showed traces of an eye. Grave 32 was more copiously equipped. Close to each other were a razor and a pair of tweezers, cp. fig. 7. The razor was surrounded by thin wooden flakes, probably the remains of a holster. Next to the bronze artefacts were furthermore small pieces of leather that may be the remains of a sack or bag that has contained these toilet requisites. A little north of these lay pieces of a single-edged bronze knife.

Judging by the razor grave 32 must be a man's grave, and the examination of the skeletal parts indicates that he must have died at the age of 20–35 (2). Neither the cremated bones nor the artefacts of grave 24 give us a hint as to the sex of the deceased, but the examination of the skeletal parts yielded the astounding result that two people must have been buried here: a child of around two and an adult at the age of 30–50. This double burial may bear witness to a family tragedy!

In the south-eastern quarter, at the transition between ploughed layers and the filling was a heavily di-

sturbed grave (grave 27). Approximately oriented northsouth was an extensive layer of cremated bones measuring approx. 100 × 38 cm, but the stones that must have surrounded the grave had already gone. On the west side, however, were 5 head-sized stones. Among the cremated bones were the remains of a bronze awl (?), and at the bottom of the grave were a few sherds. Little can be said about the sex and age of the deceased, apart from the fact that it was an adult person. The grave rested in filling mixed with clay and must belong to the third phase of the barrow.

The last of the graves (grave 41) was immediately south of grave 27, cp. fig. 8. The grave appeared as a big stone lining measuring 200 × 80 cm, that had supported a now completely disintegrated wooden coffin. It seems as if the grave has been entirely covered by stones as the transition to the ploughed layer showed obvious traces of the missing stones. Most of the stones employed were cleft. Like the other graves this was a cremation grave. The cremated bones lay in a 5–6 cm thick layer measuring approx. 125 × 25 cm. The grave contained a few very fragile fragments of a fibula.

Scattered in the filling were furthermore a great many artefacts of various kinds mostly made of flint, but there were also sherds and a couple of crushing stones. Most of the flint pieces were large and irregular flakes that leave the impression of a rather rough flint technique. Of proper tools were only a few large scrapers, bladeknives, a core-axe, a flake-axe, and a small fragment of a polished thin-butted axe. The sherds in the filling consisted of a small number of fragments of sides and bottoms of thick-walled vessels made of coarse-tempered clay. Apart from a concentration of flint flakes in a small area in the north-western quarter the artefacts were scattered all over the barrow. This seems to indicate an arbitrary admixture, so they are of little interest in this connection. They probably derive from one or more stone age sites in the neighbourhood and have been brought to the barrow along with the turf used for its construction.

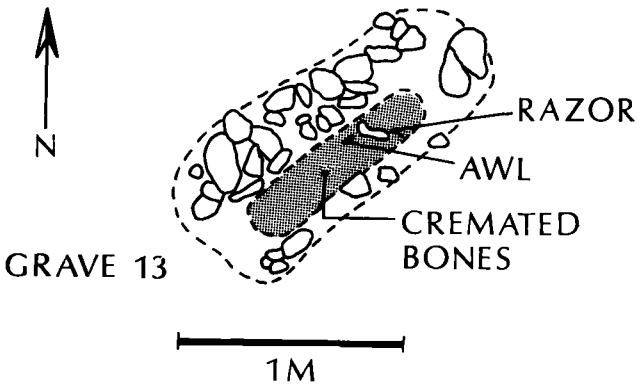


Fig. 4. Grave 13. The position of the artefacts is shown.

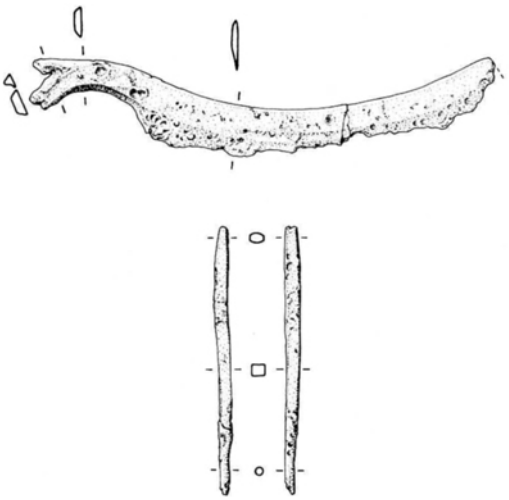


Fig. 5. Razor and awl from grave 13. Drawing by H.H. Steen. 2:3.

THE HOUSE

As already mentioned it was primarily the presence of a well preserved site of a house below the barrow that caught our attention (fig. 9). It appeared as rows of post-holes that were clearly visible in the prehistoric surface. The house was oriented eastwest and measured approx. 23½ × 8½ m. It has had rounded ends and the walls have consisted of posts standing close together. The roof has been supported by 10 heavy posts in two rows along the house. The rows are almost parallel and the distance between them is approx. 3.75 m. However, the post-holes furthest to the east are a little closer together than the others. Each long side has had an entrance in both cases reinforced by a set of powerful posts slightly withdrawn from the wall-line. The two entrances are staggered. The northern entrance is in the west end of the house, and the southern entrance is roughly at the middle. In front of the northern entrance was a paved area measuring 4 × 1 m.

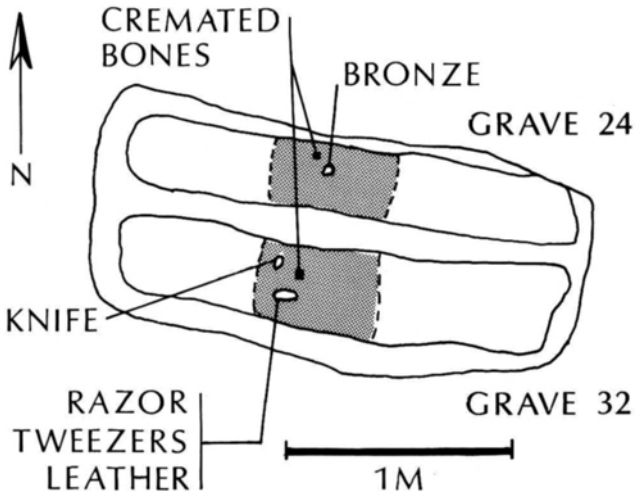


Fig. 6. The double graves (24 and 32). The extension of the cremated bones and the position of the artefacts are indicated.

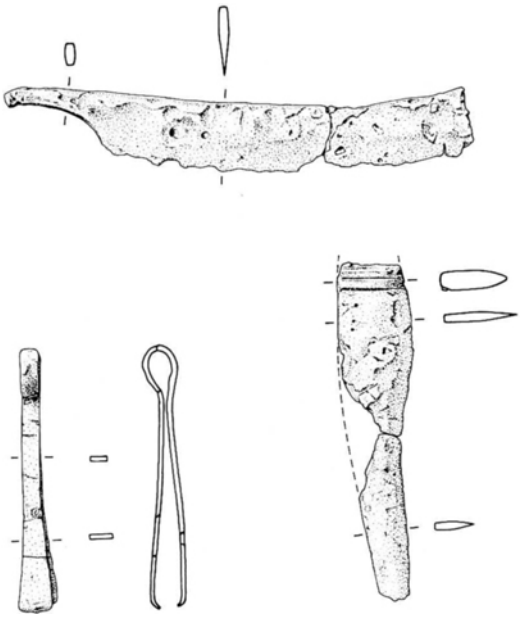


Fig. 7. Razor, tweezers and knife from grave 32. Drawing by H.H. Steen. 2:3.

The house has been divided by transverse walls into three rooms respectively approx. 9, 6½, and 7½ m long. The division between the western and the central room is clearest. It appears as a row of post-holes from south to north with an opening in the middle. As appears from the drawing (fig. 9) the dividing wall in the eastern part of the house is somewhat problematic. The post-holes are somewhat scattered and irregular, but it can hardly be doubted that they must indicate some sort of subdivision. Besides the post-holes that could be interpreted as roof supporters or part of the subdivision there was a small number of holes inside the house whose function was not self-evident. Between the roof supporters furthest towards the west were four post-holes forming a crescent, and at the easternmost supporters there were also some »extra« post-holes. Perhaps these post-holes are the remains of a small room at the end of the house or perhaps they have supported benches or cots.

The house has no less than two fireplaces, one at either end. This seems to indicate that both end-rooms have been used as living quarters. The fireplaces appeared as depressions in the original surface, filled with dark earth containing charcoal. At the edge of the western fireplace was a stone-lined pit dug approx. ½ m into the subsoil. The bottom as well as the sides were lined with stones. The stones had obviously been made brittle by fire, and between them was dark earth containing charcoal. This may be a kind of earth oven or a place where embers were kept.

To all appearances the house has been burned down. Charcoal was found in many of the post-holes, especially in the south-eastern part of the house, and several spots inside the house showed signs of a fire.

THE CENTRAL STRUCTURE

In the centre of the barrow and the house was a big, oblong pit measuring approx. 4½ × 2 × 0.85 m. When first discovered it was interpreted as a grave, but ensuing investigations showed that it called for a far more intricate interpretation. Besides some small, scattered potsherds and a flint flake no artefacts at all were found in the pit. Some almost completely disintegrated wood fragments and some heavily disintegrated bone fragments that unfortunately could not be determined were also found scattered in the filling. Along the sides and the bottom of the pit was a lining of yellow clay succeeded on the inside by a some cm thick layer of dark, greasy earth with traces of disintegrated wood, cp. layer V in the section in fig. 2. To all appearances this is the remains of a wattled wall along the edges of the pit. The section furthermore shows that this wooden structure

Fig. 8a. Grave 41 seen from the southwest.

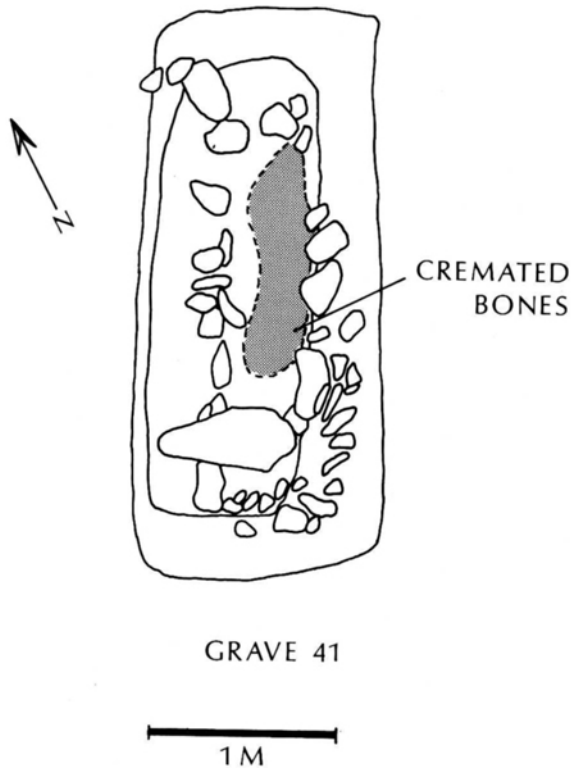


Fig. 8b. Grave 41.

has had some sort of cover, and that this has been topped by clay like along the sides of the pit. At some point of time after the erection of the oldest part of the barrow the wooden structure has no longer been able to support the pressure of the topsoil and the whole affair has collapsed. Thus the covering layer of clay has fallen into the pit and has deposited itself along the sides (fig. 2, layer E), and in the fall it has carried along the dark layer with charcoal, heavily disintegrated wood and lumps of burned clay probably deriving from the burning of the house (fig. 2, layer F). Above a corresponding collapse of the filling from the oldest phase has ensued (fig. 2, layer C).

INTERPRETATION

As shown on the key map (fig. 1) the house is placed symmetrically under the barrow, and the above mentioned pit is in turn symmetrical in relation to the barrow and the house. There must undoubtedly have been some sort of connection between the three structures. They cannot possibly have been placed with such symmetrical regularity by mere chance. Of course the barrow must be later than the house and the pit. However, the temporal relationship between the house and the pit seems somewhat more complicated. In the first place clay dug up from the pit lay in a thick layer around it (fig. 2, layer N), but the layer stopped at the wall-line of the house. This must mean that the house has been standing when the pit was dug, and that the earth dug up from the pit has been thrown against the walls of the house. In the second place, on top of the earth from the pit was a layer of charcoal that must derive from the burning of the house. The fact that the earth dug up from the pit has been allowed to remain lying in the house shows that it cannot have been in regular use after the pit was dug.

As already mentioned the pit contained nothing that

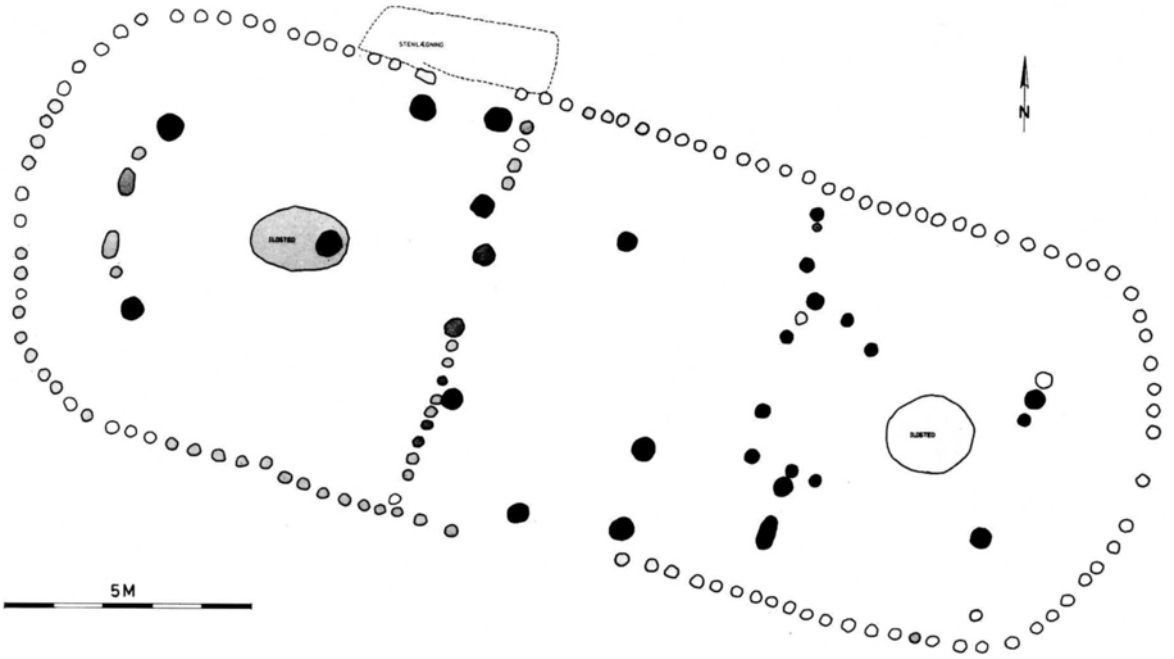


Fig. 9. Plan of the house. The difference in depth between the different post-holes is indicated in the screening. Drawing by Lars Kese.

might associate in with a burial. The actual bottom of the pit (the transition between layers E and P, cp. fig. 2) yielded no finds of any kind. Furthermore, the bottom was strangely uneven and full of small depressions into the underlying clay. It is of course possible that the skeleton has disintegrated completely, and that all grave goods have been of perishable material. There are absolutely no signs of maraudering.

What has been the purpose of the wooden structure and the pit if it is not a grave? One explanation is obvious: it might simply be a cellar. But that does not square with the above mentioned pile of earth, unless the house was burned down before the inhabitants had time to remove the pile of earth. The only explanation left open to us is that the structure has served some sort of religious purpose in connection with the conflagration of the house and/or the erection of the oldest barrow.

Let us try to recapitulate the course of events: the first thing must have been the construction of the house. Furrows in the original surface show that it has been erected in a tilled field. It is difficult to say for how long the house has been in use, but the two fireplaces seem to indicate that it has been used for habitation. At some point of time the oblong pit has been dug in the middle of the house, the mud and wattled structure has been inserted, and the whole affair has probably been covered by mud and topped by a lid or roof.

Immediately hereafter the house was burned down and charcoal and other remains from the fire have been deposited on large areas of the site. Immediately thereafter the oldest part of the barrow has been built symmetrically on top of the house and with the pit as its centre, and this has happened before the cover over the pit collapsed.

DATING

The dating is important for an understanding of the house in a wider context, and in this matter the superjacent graves may be of help. Three of the graves contained artefacts that can be dated to a particular period of the early bronze age. Razors with formalized horses' heads like the one found in grave 13 are characteristic of the end of the early bronze age (period III) and so are the razors and the tweezers from grave 32 (figs. 5 and 7). Thus grave 24 has also been dated, as it must be contemporaneous with grave 32. It is difficult to determine the heavily disintegrated fibula from grave 41, but from the fragments appears that the fibula has a round cross

section and is decorated with oblique lines (false twisting). The end plates are made of coiled thread hammered flat. It is probably a cross shaped fibula from period III. The dating is in accordance with the type of grave; cremation graves with coffins the size of a human body are characteristic of this transition period between the early bronze age with its inhumations and the cremation customs of the late bronze age.

The filling of the mysterious pit under the barrow and the post-holes also contained artefacts – flint flakes of the same rough character as in the filling of the barrow, a few uncharacteristic potsherds, and a crushing stone – but none of these could be dated with any certainty.

Though neither the house site nor the central structure bellow the barrow can be dated by the artefacts found, grave 32 shows that they cannot be later than the end phase of the early bronze age. From an archaeological point of view it is difficult to say how much older than the grave these structures are, all the more so since we have no definite dating of the oldest phase of the barrow. But the structure of the barrow does not in any way suggest that a particularly long span of time has passed between its separate phases. So everything seems to suggest that the barrow belongs in the early bronze age. This is in agreement with the C 14-datings of charcoal from the post-holes (4). Admittedly these datings are somewhat spread out, but this may be due to the individual age of the separate samples. It is, however, important to note that the four samples examined all belong to the early bronze age, and three of them more specifically to the 2nd period of the early bronze age, i.e. the time span between approx. 1450 and approx. 1200 B.C. (in calender years).

So there is little doubt that the house was built during the early bronze age and to all appearances around the middle of this period. It should furthermore be noted that a dating of charcoal from the pit also points to this period though it is somewhat later than the datings of the house proper. This is also in agreement with the archaeological observations.

OTHER EARLY BRONZE AGE HOUSES

As already mentioned only few houses from the early bronze age are known. During the early 1970s a settlement from the middle of the period was examined at Vadgård near Løgstør (Lomborg, 1973, 1976). A series of different types of houses were represented: houses with turf walls, and a pit house, and houses with mud and wattled walls supported by posts. Among the latter one, possibly two, had two rows of posts supporting the roof, rounded ends and two entrances, like the Trappendal house. However, they differ from the Trappendal house in that they are somewhat smaller, and in structural details. It should also be noted that several of the Vadgård houses, like the Trappendal house, contained pits, many of them with stones made brittle and cracked by fire.

Another site with early bronze age houses is located at Egehøj in north-eastern Djursland (Boas, 1980, 1983). Some ten years ago three eastwest oriented mud and wattled long houses with rounded ends were found here. However, they only had one row of posts supporting the roof, so they were obviously of a markedly different construction. The houses were dated to the earliest phase of the early bronze age and were thus older than both Vadgård and Trappendal.

In the Northern culture area outside Denmark there are only two indisputable early bronze age houses, both of them in southern Schleswig. The first one was excavated in 1953–54 in the dunes on the isle of Amrum (Struwe, 1954). Unfortunately the house was very poorly preserved, but it was obviously a three-aisled long house measuring approx. 10 m × approx. 4 m.

The other one was found roughly at the same time as the Trappendal house and under quite similar circumstances. In 1974 a cultivated barrow was excavated at Handewitt immediately south of the Danish-German border (Bokelmann, 1977). The barrow only contained one grave roughly at its centre. It was obviously a burial in a log coffin, but there were no traces of the deceased and no grave goods. However, bellow the northern part of the barrow was the rather well-preserved site of a eastwest oriented long house. Not only its position but also its construction was very similar to that of the Trappendal house. It is of roughly the same size, approx. 25½ × 9½ m, has two rows of posts supporting the roof and rounded ends, is subdivided into 3 rooms, and its door posts are slightly withdrawn from the wall-line. But unlike the Trappendal house this house had a deep wall ditch with traces of perpendicular, tightly packed wall planks, and no less than three, possibly four entrances. An important difference between the two houses is furthermore their position in relation to the barrows. Whereas the Trappendal house was sym-

metrically placed in relation to the centre of the barrow, the Handewitt house was placed under the northern part of the barrow with its eastern end beyond the kerb stones. It seems as if its position under the barrow is quite incidental. Perhaps it had already been demolished and levelled when the barrow was erected. As regards the dating of the Handewitt house the grave was of little help, but fortunately a couple of charcoal samples could be C 14-dated. They both show that the house must have been built during the early bronze age.

Though the parallels are few they do show that the Trappendal house is not an isolated phenomenon. The closest parallel is the Handewitt house, but the Amrum house and some of the mud and wattled houses from Vadgård display important similarities. All the houses are eastwest oriented long houses with two rows of posts supporting the roof and rounded ends. It is a type of house that clearly foreshadows the houses of the late bronze age, on which the prevalent house types of the iron age were modelled.

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NOTES

[1] Haderslev Museum, parish register no. 27, Hejls s., Nr. Tyrstrup h., Vejle amt (county).

[2] Bones determined by Pia Bennike, the Anthropological Lab., the University of Copenhagen (letter of 21/7 1980).

[3] The excavation only covered the barrow proper, so it is uncertain whether it was a solitary house or part of a settlement.

[4] A total of five charcoal samples were examined of which four (K–3475 – K–3478) derive from different post-holes, whereas the last (K–3479) derives from the pit in the centre of the house. The samples yielded the following results:

K–3475: 1100±80 b.c. – 1385±80 B.C.
K–3476: 1350±80 b.c. – 1650±80 B.C.
K–3477: 1110±80 b.c. – 1395±80 B.C.
K–3478: 1180±80 b.c. – 1475±80 B.C.
K–3479: 970±80 b.c. – 1205±80 B.C.

The dates are stated in C 14-years (b.c.) and calender years (B.C.). The calibrations are based on the tables in R.M. Clark, Antiquity XLIX, 1975 p. 251. I wish to thank Dr. Henrik Tauber, the Copenhagen Radiocarbon Laboratory, for permission to publish the results.

For purposes of comparison should be added that 8 oak coffins from the early bronze age period II have been C 14-dated to 1450–1190 B.C. (stated in calender years. Information kindly made available by Ebbe Lomborg, keeper at the National Museum, 1st Dept.).

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Vorbasse

The Development of a Settlement through the First Millenium A.D.

by STEEN HVASS

Between the towns of Grindsted and Kolding in central Jutland lies the village of Vorbasse. It was near this that the National Museum carried out extensive excavations from 1974 to 1978. The investigations were initiated in 1974 by the Archaeological Settlement Committee set up by the National Research Council for the Humanities, in collaboration with the National Museum. Since 1979 the excavations have continued as a collaboration between the National Museum and Vejle Kulturhistoriske Museum.

The total area excavated is now ca. 150,000 m^2. The original intention was to excavate in full a well preserved settlement of Late Roman and Early Germanic date (Hvass 1979), but in the course of this work remains of Late Germanic and Viking age also turned up. The excavation was extended to include these as well, as total excavation could be expected to produce the clearest plan to date of a Viking village as well as of a settlement from the transition to the ensuing Middle Ages (Hvass 1980b). Incidentally there have appeared settlement remains from other prehistoric periods, of which the most important are from the Single Grave Culture (Hvass 1977). In 1981 five Late Bronze Age houses were dug under the eastern part of the Viking settlement. They were found on the central part of a low hill named Lille Bavn, and consisted of two 22–24 m long long-houses and three smaller houses of similar construction. The houses are of the usual Late Bronze Age type, fig. 1.

There were remains of settlement from many different sections of the Iron Age in the large area cleared. To acquire a more complete knowledge further trial trenches were laid out in 1980. With their help it was established that there within an area measuring 900 × 700 m were villages from the first century B.C. to the 11th century A.D. From the information available there appeared to have been continuity of settlement throughout this period, and the Iron Age occupation probably continued as the present village of Vorbasse, the oldest building of which is the Romanesque church. During these 1200 years there had existed 8 villages, which replaced one another after being moved a few hundred meters. It seems clear that it was the same rural community throughout.

In the same area there have been found 5 small cemeteries. One is from period IIIb of the Pre-Roman Iron Age and the early part of the Early Roman Period. A second is from the later Early Roman Period (2nd cen-

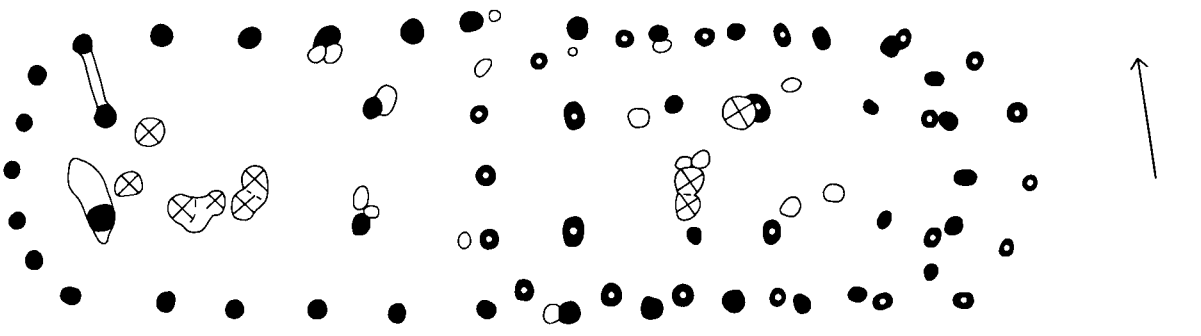

Fig. 1. A long-house from the Late Bronze Age at Lille Bavn, Vorbasse. 1:200.

Fig. 2. Aerial photograph taken in 1970 of the Vorbasse area. The 1974–82 excavations have been added (black). Air photo by the Geodætisk Institut (flight no. D380 E no. 283). Reproduced with permission (A. 339/83) of the G.I. Copyright.

tury), and three small cemeteries are from the Later Roman Period.

The earliest Iron Age settlement found is from period IIIa of the Pre-Roman Iron Age, 1st century B.C. The village covered an area measuring at least 80 × 20 m, and 9 long-houses and 7 smaller houses have been excavated. The long-houses lie in two close rows with the smaller buildings near the long-houses. Fence remains were only found at the two ends. This was in the most easterly of the large excavated areas.

From about the time of Christ and the first century A.D. have been excavated two separate but contiguous farmsteads (fig. 3). Each farmhouse is a 16 m long building of the usual early Iron Age type with dwelling

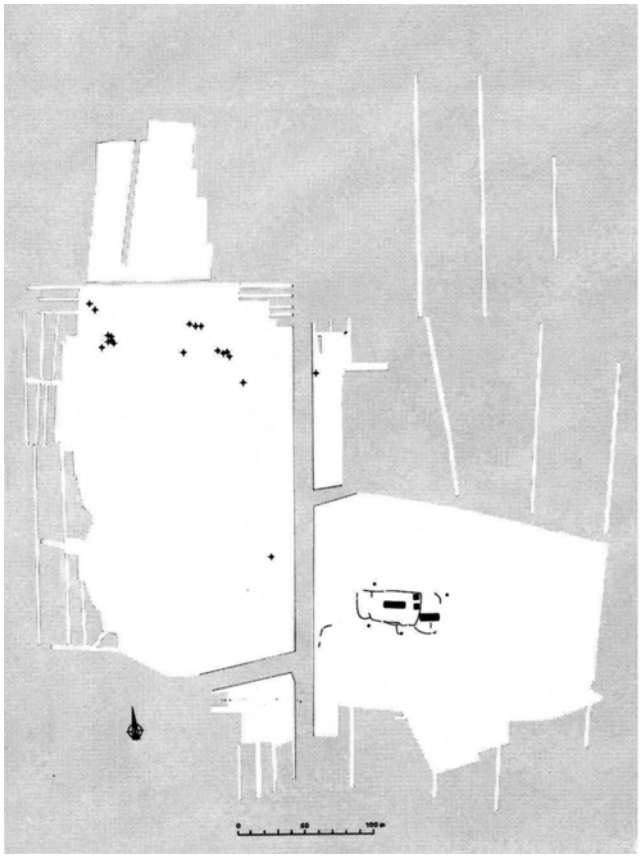

Fig. 3. Plan of the excavated area with the two separate farms and the graves from the time of Christ and the 1st century A.D.

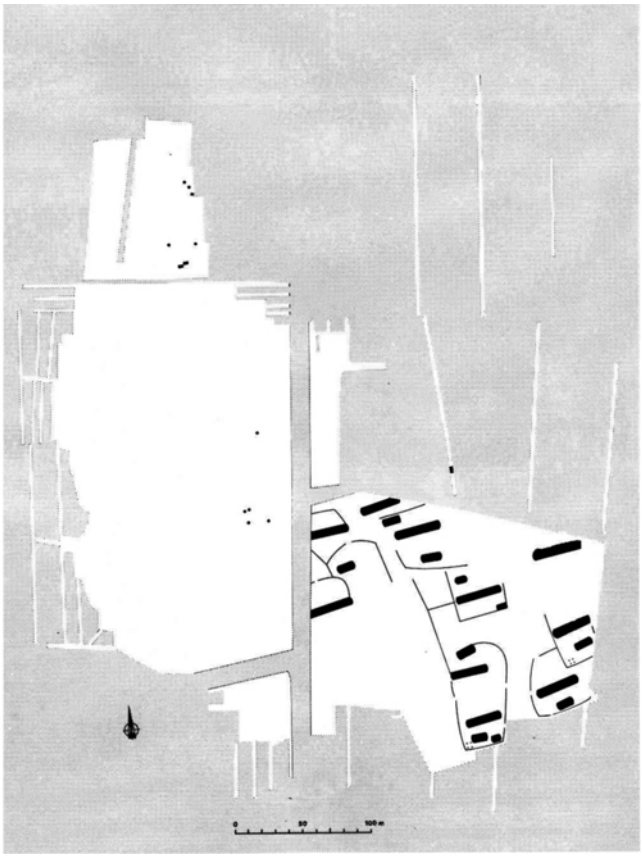

Fig. 4. The village in the 3rd century A.D.

room at one end and byre with stall partitions at the other. One of them had two smaller buildings as outhouses. Each was surrounded by its own fence of closely-placed vertical stakes. The arrangement of the fences shows that one farm was built first and the other added shortly afterwards. There are openings in the fences opposite the doorways of the houses. Outside the fence were found four iron-smelting furnaces, among the oldest so far found in Denmark.

About 70 m NW of the western farmstead was found a burial urn with the cremated remains of a man, and 130 m beyond it a further 18 urn burials of the same age. The eighteen were all female according to both grave goods and the anthropological determinations, and had died at ages of from 20 to 60 years. They fall into three groups, probably showing three separate cemeteries in simultaneous use.

Probably contemporary with these two farmsteads was a settlement with houses and fences found ca. 600 m further east. It is not yet clear whether this was just a number of scattered farmsteads or a sizeable village.

The next following settlement was not at the same place, but a settlement of the 2nd century A.D. has been found ca. 300 m to the north. It occupied an area of about 150 × 150 m with a number of groups of houses. These probably represent several farms conglomerated as a village. The cemetery belonging to the settlement is known too. Its remains were excavated in 1939 by P.V. Glob, and it lay about 200 m south of the settlement (unpublished).

In the third century the village was moved back to where people had lived in the first century (fig. 4). Unfortunately its buildings are not very well preserved as they are obscured by later remains. There was a row of farms, consisting each of a long-house and 1–2 smaller buildings surrounded by a fence. At one of the souther-

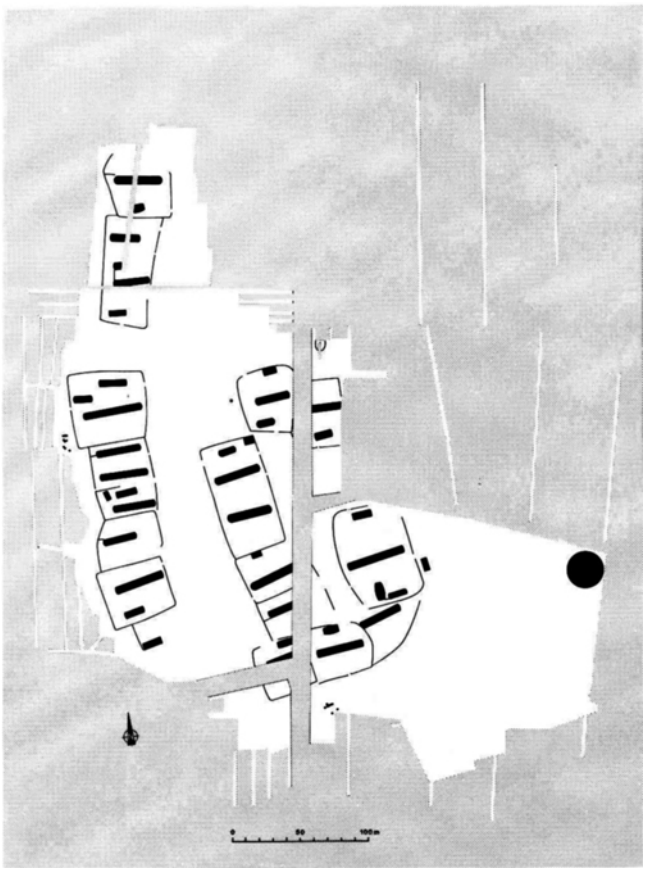

Fig. 5. The village in the 4th century A.D. The black dot indicates the position of the cemetery.

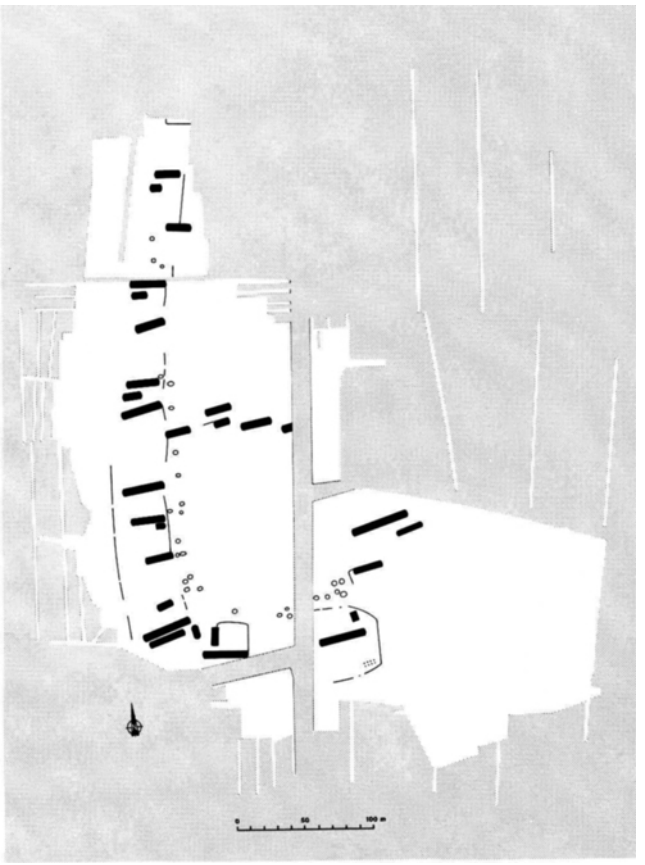

Fig. 6. The village in the 5th century A.D.

ly farmsteads a fence surrounded two separate farms.

Compared with the earlier farms a number of changes can be observed in the third century. The most important was that the long-houses became considerably longer, with a length of 20–48 m, but with the same width as before, 5,5 m. Sometimes the new houses are divided by internal partitions, and it is common to find up to five rooms, with dwelling quarters occupying 2–3 rooms at the western end, doorways in the middle of each side, and byres with accommodation for between 15 and 30 beasts in the eastern third of the buildings. In the longest houses there is often a further room at the east, but nothing can be said about its use.

Another difference compared with earlier is that the individual compounds are on the average considerably larger in the 3rd–4th centuries. Their average area is about 2000 m^2, or about four times that of even the largest farm at Hodde.

Also a new type of building appeared. The sunken »pit-house« is first seen in the 3rd century. These various developments in settlement structure can be followed in this area up into the 5th century.

The third century settlement covers an area of 250 × ca. 300 m, and about 10 farms have been excavated, all of different sizes. The placing of the farms in relation to one another seems not to indicate any definite plan.

This 3rd century settlement was succeeded by a large village in the 4th century, which gradually – one or two farms at a time – was moved westwards (fig. 5). Finally it came to cover an area of 400 × 250 m with a fixed plan. The farms were placed in three rows with entirely free areas between. Most of the farmsteads had separate fences, but also in this village there were signs of agricultural co-operation as two of the farms shared a compound. A particularly large farmstead is distinguishable in the eastern part of the village. In this

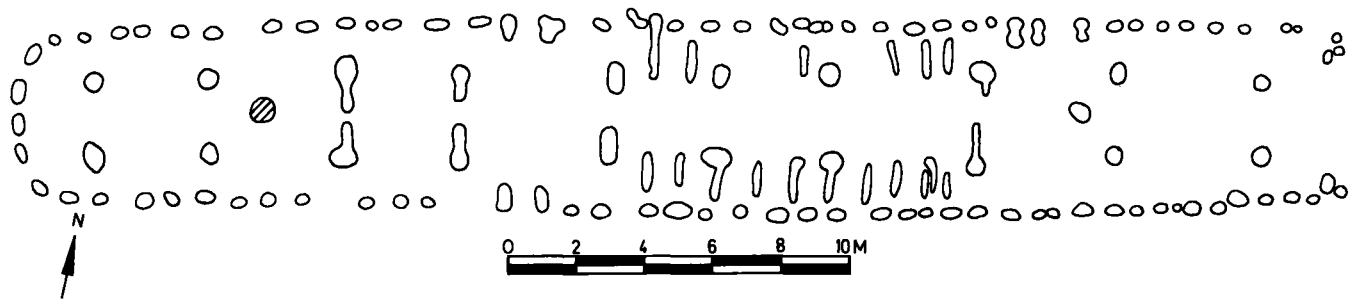

Fig. 7. Plan of a 38 m long-house of the 4th century A.D.

period about 20 farms existed at one and the same time.

In the 5th century the settlement plan was again completely altered (fig. 6). The houses stood at the same place and were of the same size as before, but now there was a large central open area measuring 150 × 120 m. Just as in the 4th century the largest farm lay furthest to the east. This was certainly the same farm continuing on into the 5th century.

To judge from the large byres in the 3rd to 5th centuries production was probably based chiefly on cattle, as nearly every farm had stall partitions giving space to between 15 and 30 animals (fig. 7). Also the topographical placing of the village suggests stock farming, as it adjoins what would then have been lowlying meadow areas; but of course there was also the possibility of some agriculture on the slightly more clayey areas south of the village.

The inhabitants must have been selv-sufficient with respect to iron. Every settlement had one or two smithies, and smelting pits were found outside every one of them (fig. 8). It can be seen that the smith was not an independent craftsman, but was attached to a larger farmstead, as the smithy was always one of the smaller buildings belonging to one of the large long-houses with byre.

Also the stonecutter can be distinguished. At two places in the open central area there were found concentrations of roughouts for rotary querns.

From the systematic placing of the farms in the 4th century and the changes made in the 5th it can be seen that there at that time anyway must have been a fixed authority or organization in the background, and the big farm in the eastern part of the settlement can be seen as the instance possibly organising the village plan.

The biggest change took place during the last phase of the village in the 5th century and is best understood as a major planned rearrangement of nearly all the farms (fig. 6). They were given a very definite arrangement with a large open area in the middle.

Also the examination of the individual farms shows that important changes took place at the start of the final phase. The farmsteads became smaller in area, and it is particularly important to note a decline in the number of stalls in the byres. This must show that the village faced an agricultural crisis in the 5th century, and perhaps the re-arrangement of the farms was part of a wider structural change connected therewith.

Three cemeteries have been found belonging to the 3rd and 4th century settlements. One of them lay immediately east of the 4th century village and had 16 graves. It has been excavated in full. To judge by the size of the graves both adults and children were buried. In all the

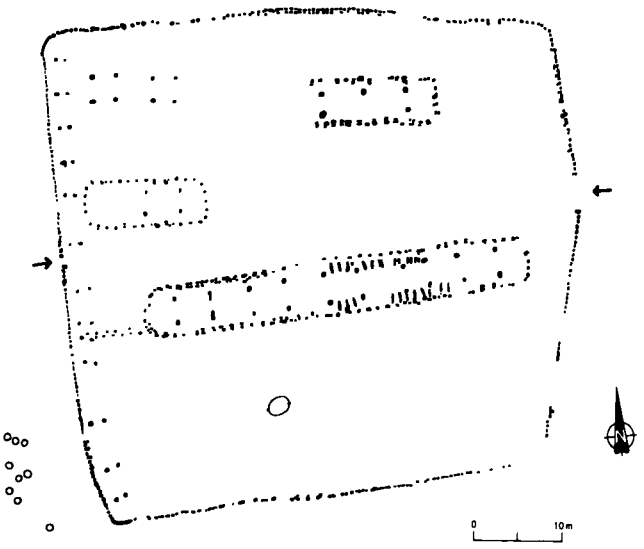

Fig. 8. Plan of a 4th century farm. Bottom left a concentration of slag-pits.

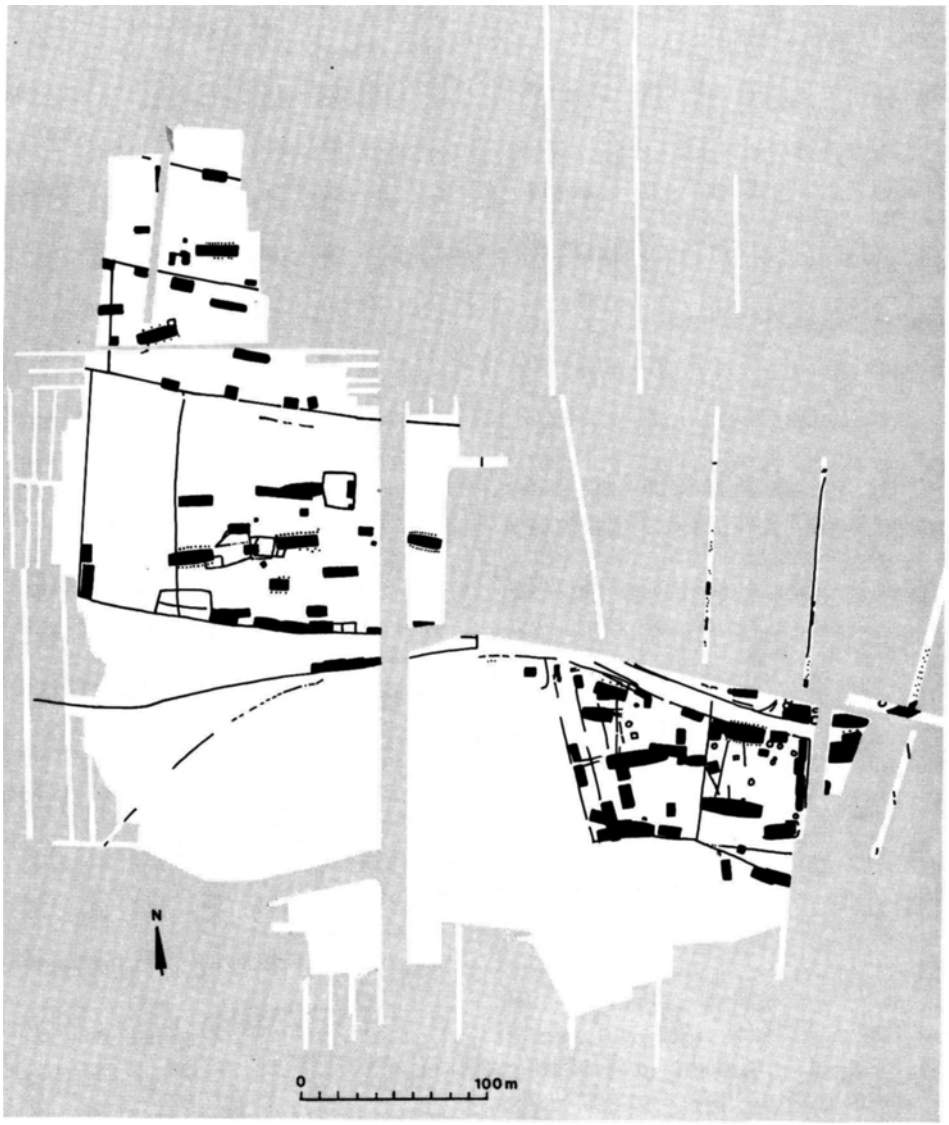

Fig. 9. Buildings and fences from the Viking period, excavation 1974–79.

graves there were 3–5 pots, and in all but one there were also 1–5 fibulae. In the middle lay two weapon graves. In one of them two spearheads stood point downwards at the side of the grave, and a shield had stood on edge. Its remains showed that it had originally had a diameter of 1,30 m with central boss. There had been a pot at the end of the grave beyond the head. At the neck was a silver fibula, and across the corpse lay a large sword with remains of a suspension belt with ornamental tin nails. There were two belt buckles, two belt-end pendants, and several small rods. At the foot of the grave was found a Hemmoor pail. The other weapon grave had likewise two spearheads point downwards at the side and a shield standing on edge. In this case there were 4 pots near the head of the corpse. In the thoracic region were found silver rivets and in the pelvic region a large iron dagger and several objects that are still undergoing conservation treatment.

There were also 4 very rich female graves with very similar equipment. Over the upper part of the chest they had a large plate fibula of bronze with applied silver and gold sheeting and cloisons with stones. There were strings of 150–250 glass and amber beads, and at the chest and neck 3–5 fibulae. In addition there was a

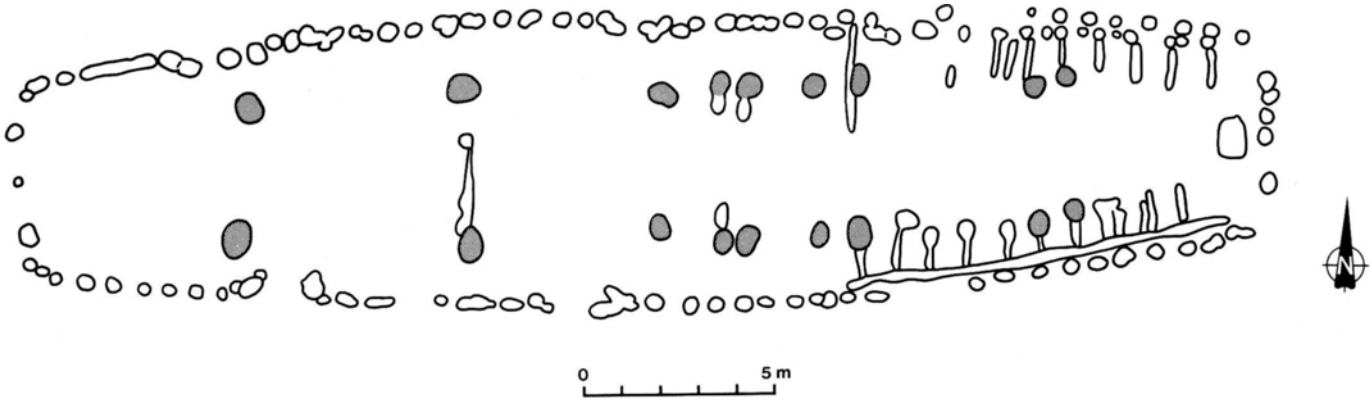

Fig. 10. Plan of a long-house with byre from the 9th and 10th centuries. 1:200.

knife and a little ornamented pot in each grave. At the head of each there was also a single small vessel and at the foot two or three others. One of the graves also contained a little thick-walled beaker of clear glass. All the graves are from the 4th century. From its character this is probably the cemetery belonging to a particular farm in the village, and as the grave goods are richer than normal in Jutland in this period it probably belonged to the large dominating farm.

The other cemetery connected with the settlement of the 3rd to 4th century was found on a rise in the land 300–400 m east of the village. Here there were six cairns from the Early Bronze Age, and adjacent to them 4 inhumation and 2 cremation graves. One of them was richly furnished like the rich female graves of the other cemetery. The third Later Roman cemetery lay right to the north, immediately outside the fences of some farms. This and the farms will be excavated in 1983.

Close to this third cemetery and ca. 100 m north of the 4th–5th century village, fig. 5 and 6, the trial trenches have revealed a new settlement covering an area of about 400 × 100 m and having very well preserved buildings and fences. This one could be from the 6th and perhaps 7th centuries. The eastern part of it will be excavated in 1983. A pollen series extending from the 4th–5th to the 11th centuries shows that there must have been continuous settlement during that time with the existence of much grazing land and rough pasture (Brorson Christensen 1981).

Inside the large total area of the excavation there have also been found well preserved remains of Viking date, fig. 9. There are really two Viking settlements. The first is found in the southern excavated area and begins in phase 2 of the Later Germanic Iron Age, continuing throughout most of the Viking Age; the other extends over the whole of the excavation and is from the end of the Viking Age continuing into the Early Middle Ages – the 11th century (Hvass 1980b).

In 1983 and 1984 excavation will be completed of the 8th–10th century settlement, whose southern part has

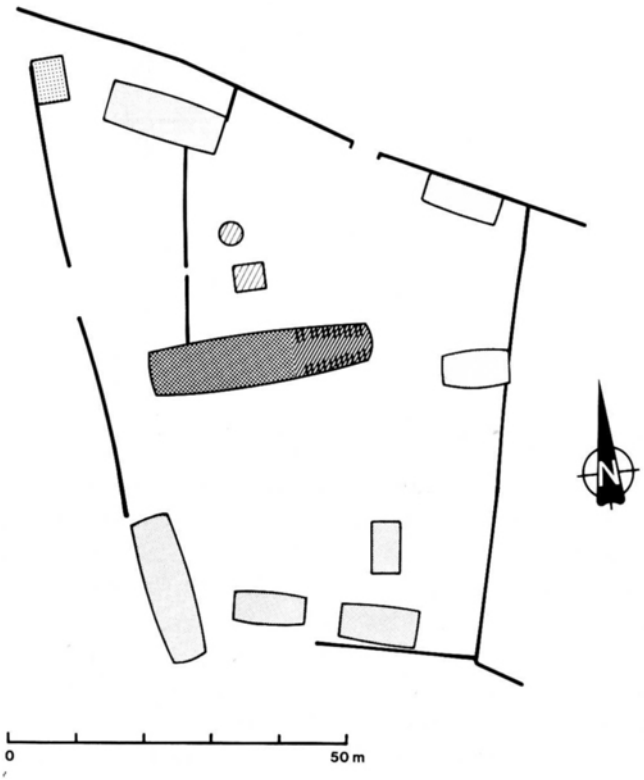

Fig. 11. Plan of a 9th–10th century farm. The smithy is at the top left. North of the main building in the middle are two sunken-huts.

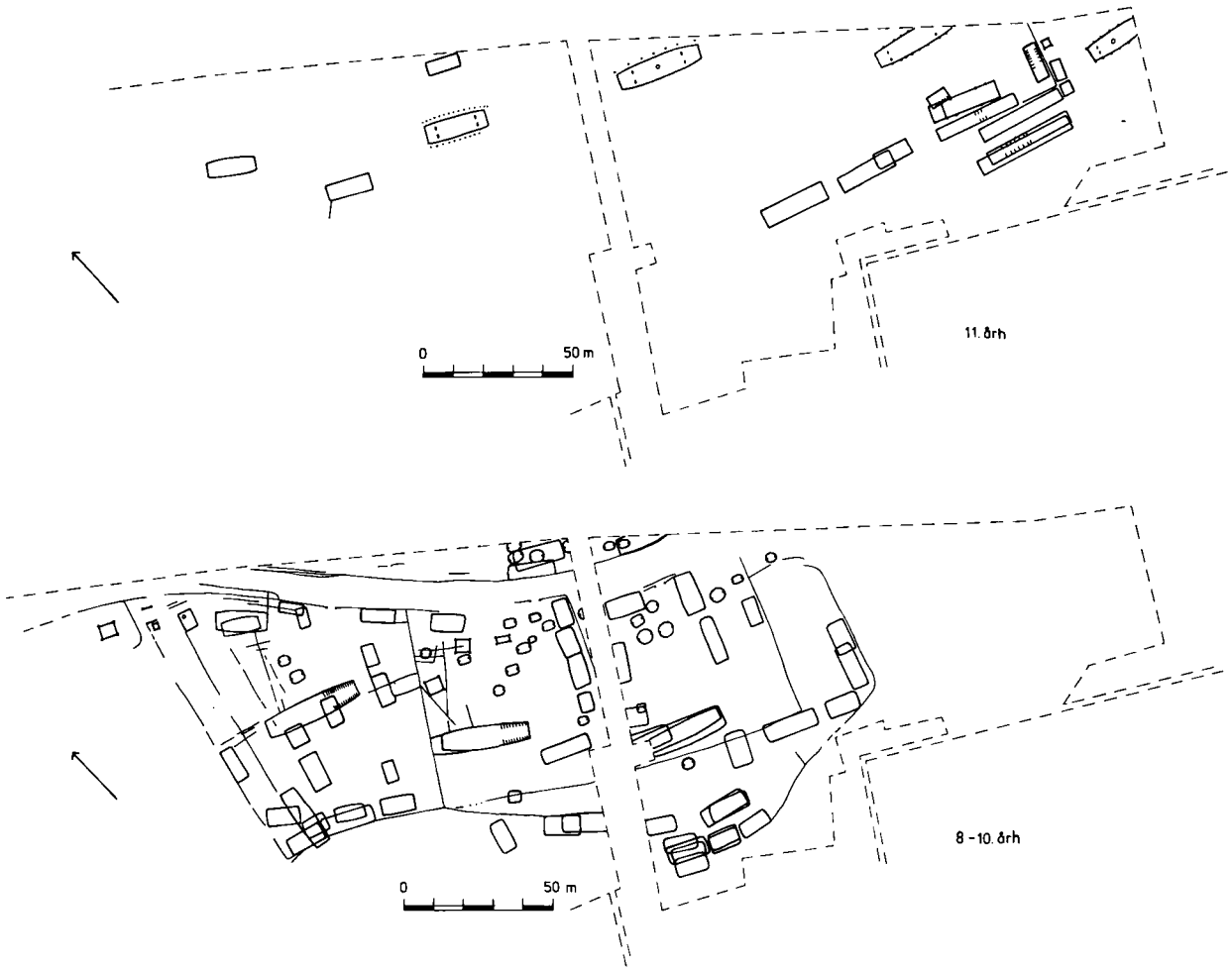

Fig. 12. The southern excavation area: below the 8th–10th century settlement, above the 11th century settlement. 1:2500.

already been dug. It was composed of farms placed along both sides of an 8–10 m wide roadway enclosed by fences. South of this roadway three complete farmsteads have been uncovered, each consisting of numerous buildings. In its middle each had a main building about 32 m long, divided by internal partitions into three rooms of nearly equal size (fig. 10). Two had byre at the eastern end with stall partitions along both the north and south sides exactly as in Early Iron Age houses. They had room for about 22 beasts. Probably the rest of the house served as living quarters. These long-houses differ from earlier ones in their massive curved sides. The two long-houses with byre in the eastern part are the only ones known so far from the Scandinavian Viking Age with byre and living quarters under the same roof.

Surrounding each main building were several smaller houses, placed about the inside of the fence, which enclosed an area measuring ca. 80 × 80 m (fig. 11), but none of the smaller buildings had byre. In the free space north of the long-house was an open yard, near the edge of which there had been a number of pit-houses, nearly all of which yielded loom weights. A gap in the fence leads from this open space to the village street. One of the small houses in the corner of the farmstead was a smithy with finds of slag and hammer scale.

How many of the buildings in the three 8th–10th century farms stood at one time is difficult to say before the

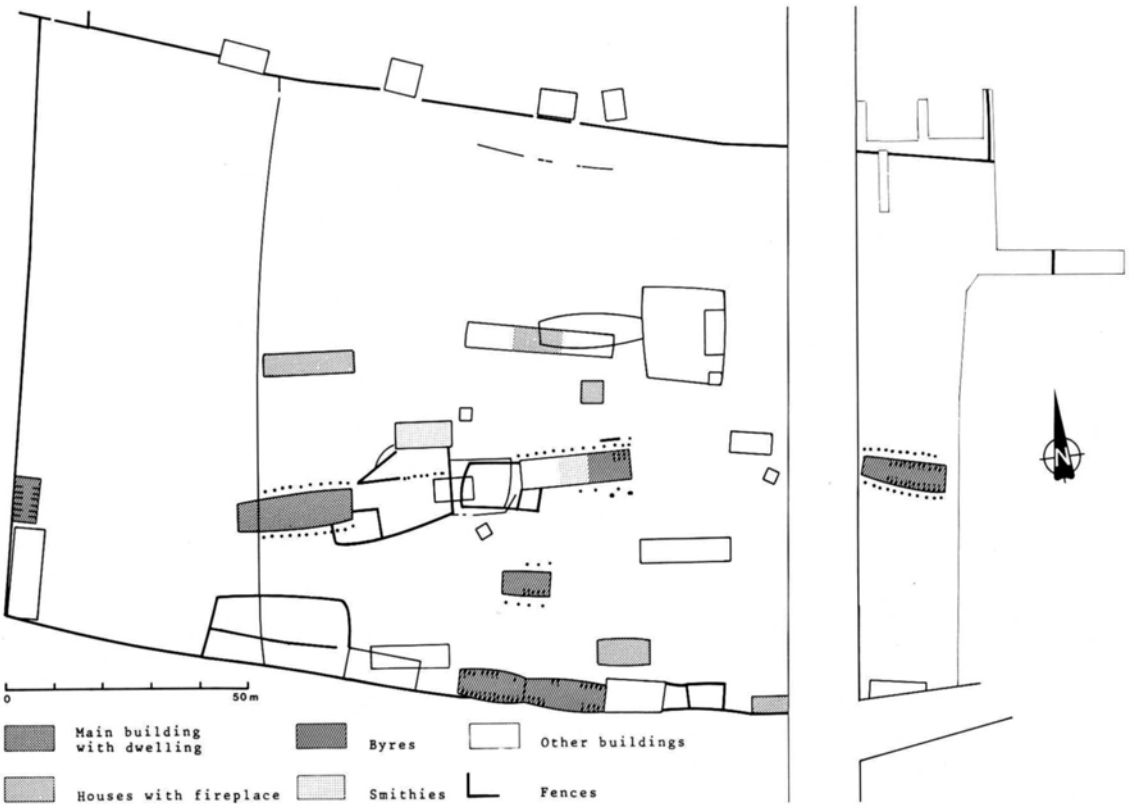

Fig. 13. A large farm from the 11th century.

finds have been studied further. Both the size of the farmsteads and the construction of the houses had changed since the 5th century. The farms are now consideraly larger and both the large and the small buildings are in a distinctive new building style.

Later, probably in the 11th century, this settlement was radically altered, fig. 12, above. The existing buildings must have been razed to the ground. The new settlement on the site had a quite different arrangement and community structure. Probably at the same time occupation was extended westwards to co-incide with the whole of the excavated area, fig. 9. This late settlement apparently only lasted for a short time and came to an end about the year 1100.

The eastern part of the late settlement, fig. 12 above, had in the middle three houses of the same type as found in the strongholds of Trelleborg, Fyrkat, and Aggersborg (Olsen and Schmidt 1977). Around the most easterly of them was an enclosing fence and several buildings whose function must have been outhouse or stable. They probably stood successively, as they are absolutely alike. They were 30 m long and about 4.5 m wide with partitions indicating altogether 50 beasts. In the same corner were found a further two smaller byres or stables.

In the western part of the excavated area was built a very large farm (fig. 13), Its fenced area measured 120 × 210 m. The main central building was a 24 m long »Trelleborg house« (fig. 14). At its eastern gable was a small closed yard leading to a building that was both smithy and bronze foundry. Around about were further houses of different sizes. Five buildings had stalls along both sides, i.e. they were byres. If the 5 byres all stood at the same time there would have been accomodation for altgether 100 beasts. Other buildings have a single fireplace and must have been dwellings. Finally there were buildings of indeterminate function. There were altogether twenty buildings in the fenced area belonging to this farm, but it is still difficult to decide whether any of them were replacements or not. North of this 11th century farm were found two similar farms, also each with its »Trelleborg house« as main building. The fenced

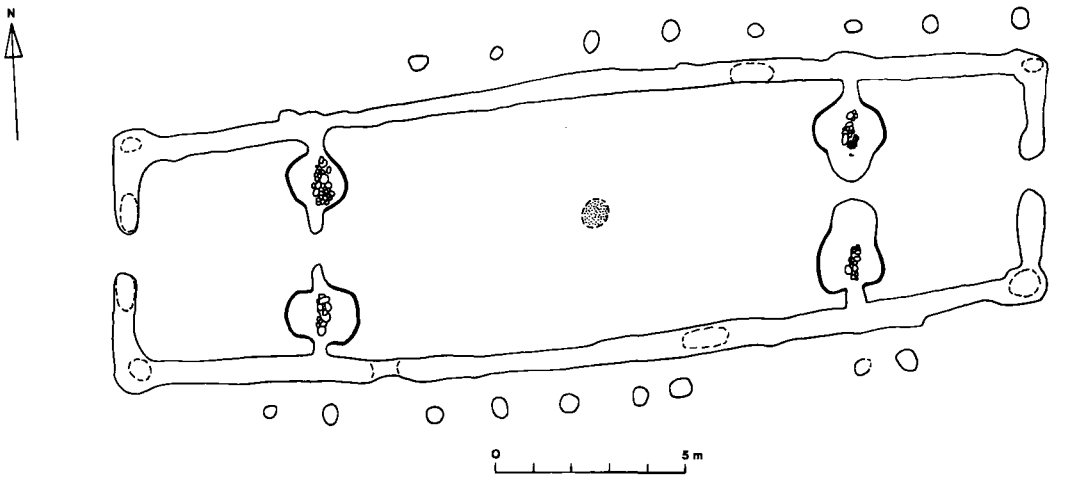

Fig. 14. Plan of the main building of the large 11th century farm, a house of the so-called 'Trelleborg-type' with sloping external posts. 1:200.

area of each was exactly half the size of the big one just described.

These Viking farmsteads have an arrangement that we did not earlier know. They help show that much of the domestic background of the great expansion of the Viking period was large evolved farms, whose byres suggest that stock keeping was an important factor in Viking economy.

The 9th and 10th century Viking settlement produced many finds showing connections with areas outside Denmark. There are soapstone vessels from Norway, rotary querns of Mayen basalt from the Rhine, sherds of imported pottery of Pingsdorf type, and Wendic pottery. It is remarkable that all the querns found were made of basaltic lava from the Rhine and not one was of Scandinavian granite or gneiss. In one of the houses there were found two silver coins – a half-bracteate struck in 975–80, probably at Hedeby, and a north German coin from Stade, struck between 1038 and 1040. There is also a large native material including pottery and iron ingots. The finds from the eleventh century settlement are substantially fewer – only pottery and a few slate whetstones. No graves of the Viking period have so far been found.

Research at Vorbasse has revealed settlements lasting from the last century before Christ until the 11th century. A number of them have been fully excavated and combined with their cemeteries give a unique opportunity to follow the development of a village community for 1200 years. They tell how settlement evolved for a thousand years previous to the stationary medieval village (Hvass 1982). The excavations indicate that one can expect a single rural community to have had area-continuity throughout most of the Iron Age.

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A Viking Age Settlement at Runegård (Grødby), Bornholm

An Interim Report of the Investigations 1979–82

by MARGRETHE WATT

INTRODUCTION AND BACKGROUND

The island of Bornholm in the Baltic has had a long and at times chequered history. To some extent this also applies to its history of archaeological exploration. Much of the basic research and material owe their existence to the work of one man, E. Vedel, chief administrative officer on the island of Bornholm during the 1860s. He based his work almost entirely on grave finds, and did not have the background, or interest, to tackle the problem of the associated Iron Age settlement sites.

Since about the turn of the century field research on Bornholm has been sporadic and has included few major excavations. The breakthrough of settlement archaeology in Denmark came during the 1960s, and far from Bornholm, where large settlement sites were revealed in Jutland under the auspices of the Research Council of the Humanities (»bopladsudvalget«) (Becker 1980). Since then settlement archaeology has lept into a new era. It was no longer just houses which came to light, but village after village and with them an abundance of new observations and theories of societies with a complex social structure.

For mainly practical reasons this extensive research programme was largely limited to West Jutland, where physical conditions offered the best possibilities for fast and spectacular results. It has, however, left us relatively ignorant of contemporary development in the eastern part of the country. Individual house sites have been excavated, and some house plans have been published, also from Bornholm (Klindt-Jensen 1957: 175–208), but up to now none of the large settlement sites, some of which have been known about for over a century, have been fully excavated (1).

A chance came in 1979 when the owner of Runegård, one of the three Grødby farms, reported the presence of abundant charcoal, fragments of daub and sherds of pottery scattered over a large area (2). Helped by the fact that the site was in danger of being worn down by continuous cultivation, it provided the stimulus and excuse for a renewed effort to gain more substantial information about building style and settlement patterns on Bornholm in the Iron Age (3).

The present paper is intended as an interim report of the results of the investigation still in progress of the Iron Age and Viking Age settlements, as these at the moment provide a more coherent picture than the settlements from earlier periods in the area (Watt 1980a,b).

The settlement site at Runegård may, without exaggeration, be characterised as complex. Its favourable situation on a low, sandy ridge, has attracted settlers throughout prehistoric times, resulting in a confusion of superimposed house remains and other structures.

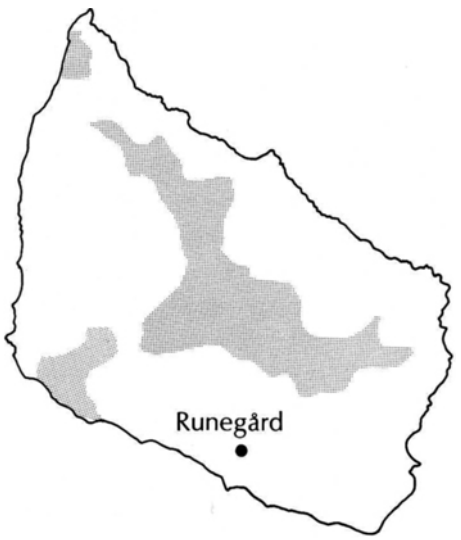

Fig. 1. The location of the Runegård settlement on the island of Bornholm.

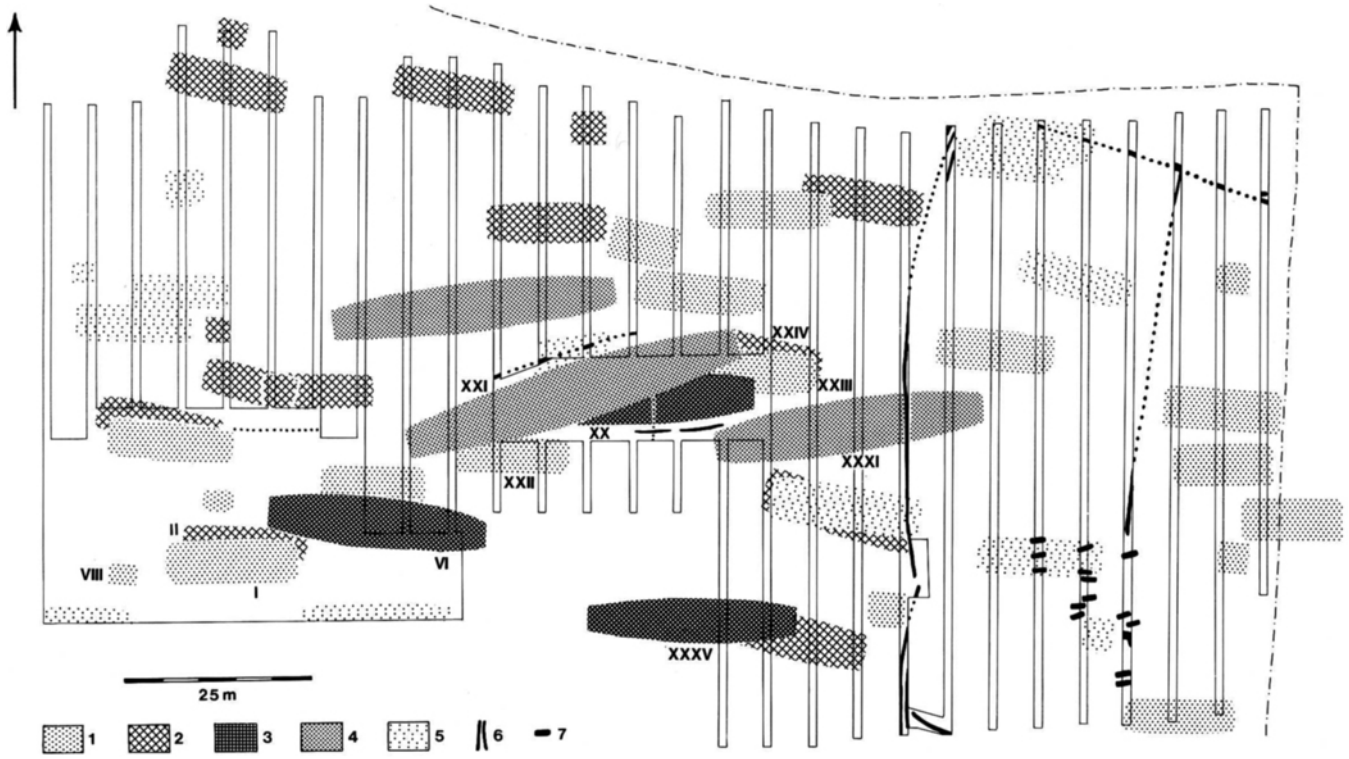

Fig. 2. Generalised plan of the settlement site at Runegård showing the net of survey trenches and totally excavated areas. Minor enlargements of the survey trenches are not shown. 1. Houses of Early Iron Age type, unburnt. 2. Houses of Early Iron Age type, burnt. 3–4. Viking Age houses. 5. Houses of uncertain age and type. 6. Fencing ditches. 7. Viking Age inhumation graves. 1:1000.

Fortunately the sandy sub-soil offers the best possible conditions for observing what structures of houses, however indistinct, may have survived at sub-surface level.

Up to now the excavation has stretched over three short seasons, totalling only 15 weeks. During this time an area of nearly 15,000 m^2 has been covered, of which approx. 2000 m^2 have been excavated in a conventional manner, the rest »trenched« as described below.

As the method of excavation employed on this site in some respects differs from the standard – a factor which will influence the discussion of the results – some initial remarks should be made about it.

METHOD OF EXCAVATION

On the large settlement sites in Jutland no culture layers have been preserved, allowing fast mechanical stripping of the top-soil down to a sub-surface working level.

On the site at Runegård, as well as on other known settlement sites on Bornholm, extensive old soil horizons and regular, find-bearing cultural layers have for some reason been preserved over large areas. It is not entirely clear what has caused this preservation as most of the known sites on Bornholm have been under plough as long as those in West Jutland. Careful surveying of the base of the prehistoric soil layers at Runegård shows that the old surface must have been fairly irregular in prehistoric time compared to the smooth, present-day surface. Hence prehistoric soil accumulation of up to 30–40 cm in thickness has been preserved in the depressions and along the base of slopes. As the old soil horizons often contain traces of important structures, they present the excavator with the nasty option of slow and costly manual labour, or the risk of destroying both valuable information and find material by removing everything down to sub-surface level already in the first round.

Facing this dilemma with the limited funds available for emergency excavation, the problem was considered best tackled through partial excavation (4).

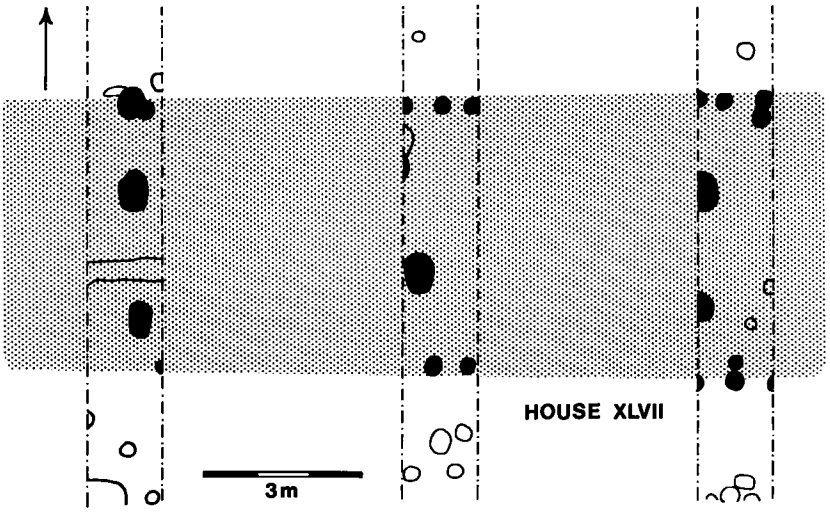

Fig. 3. Example of excavation plan resulting from partial excavation (drawn at sub-surface level). The house is of Early Roman Iron Age type.

Between half and a third of the area was stripped mechanically of its top-soil in a net of closely spaced »survey trenches«, 1.5 m wide and 6 m apart, leaving baulks of 4.5 m untouched. At intervals the trench system may be broken by the clearing of larger sections for a more detailed study of individual buildings or other structures of interest (fig. 2).

The main and obvious advantage is that a large area may be covered in a short time and uncomplicated or structureless sections may be quickly abandoned. It also reduces the transport of top-soil to a minimum, and – provided that spoil heaps are placed systematically on every other baulk – leaves the excavator free to return to any part of the area with a machine, if further stripping should be required. The distance between trenches is largely determined by the space required for the manoevering, without risk of collapse, of a small, caterpillar digger or an earth scoop.

Undetermined structures or particularly promising ones are investigated, while those considered to present no problem are abandoned after surface registration. Documentation and drawing are carried out in a conventional manner.

It is obvious that this method of partial excavation must carry quite a few elements of uncertainty and some problems of interpretation. The trenches may, but do not always, provide sufficient material for an exact or even satisfactory dating of any given structure. Faced with the uncertainty of whether even total excavation would remedy this, ignorance has often been accepted, at least in the first round.

Where old soil horizons or cultural layers are present, a house site is not easily missed, and its size and orientation normally fairly clear. Remains of burnt-down houses are usually easily identified by large amounts of orange-red daub concentrated on and around the site.

The long houses of the Early Iron Age normally span two or three trenches (fig. 3), while the larger Viking Age ones may stretch over as many as six. Most of the small buildings or sheds of a few metres will be revealed statistically over a large area of investigation. Unbroken fencing ditches present no problem, while shorter lengths of fences made up of slender posts are more difficult to follow in the trenches.

The experience gained after an area had previously been trenched and interpreted and then later checked through normal excavation was that around 90% of the structures in the trenches had been registered in the first round. One out of five houses had been missed or misinterpreted, and one remains uncertain.

It is clearly *not* a method which can replace conventional investigations of settlement sites, but it may serve as an alternative (particularly at a time of restricted economic means), and as such augment existing material and put to the test some of the results and theories drawn from full scale excavations. As much of the site is left untouched by the excavation it can at any

time be converted to a more conventional excavation provided, of course, that at least some of the site itself is still reasonably intact. It may be regarded as an alternative and cheaper way of dealing with some of the numerous, large settlement sites threatened by agricultural wear, which time and cost would otherwise leave uninvestigated.

The partial method is not believed to be equally suitable or rewarding on all soil types but, as will be shown below, it has given promising results on the homogeneous sandy soil of Runegård.

As a preliminary account of part of the Early Roman Iron Age settlement has already been published (Watt 1980a,b, 1981) it will only be dealt with briefly and brought up to date, while the Viking Age settlement and graves will be treated in more detail.

EARLY ROMAN IRON AGE

Houses of Pre-Roman or Early Roman Iron Age occur throughout the area, and so far no limit to this settlement has been established (fig. 2).

The houses believed to date from this period now total about 40, of which 13–14 have been burnt down and probably immediately replaced by others. These houses are, with one possible exception, situated in a way which suggests that they belong to the same settlement phase. Another 26 or 27 houses (besides those of much later date) are unburnt (5).

The houses are of two distinct types. The long-house, oriented near E–W, is typically 15–18 m in length and 5–6 m wide (M. Watt, 1980a, fig. 2). In none of the houses investigated have the actual floor levels been preserved, and no unambiguous traces of internal structures such as fireplaces, room divisions or stalls for cattle or other livestock seem to have survived.

Several of the houses are dated by pottery either from post holes or from the immediate surroundings of the house to the transition period Late Pre-Roman – Early Roman Iron Age.

A C-14 date of A.D. 135 has been obtained on charcoal from an oak door-post in one of the burnt houses (house II) and of 135 B.C. on charcoal (oak) from a compact layer of burnt daub of another house (house XI) (6). All burnt houses so far registered precede the others, and hence these dates are believed to represent the beginning of the Early Iron Age settlement.

The second house type associated with this settlement is a small »outhouse«. This type is of a very consistent description, made up of six solid posts of »roof-carrying« type arranged in pairs to form a rectangle of an average 2.5 by 3.5 m. No smaller posts of »wall-type« have ever been observed in association with these outhouses. No finds indicating a specialised function have so far been made.

Meantime the most likely function of the small buildings is believed to be that of a raised barn or storage house. The massive posts would give sufficient strength to carry a raised platform on which the harvest or supply of fodder could be stored without rotting too quickly by direct contact with the damp ground.

The »barns« have provided very little datable material, but what there is, combined with the distribution and a number matching that of the Early Roman Iron Age houses, speaks for a date about this time, as does the fact that they occur both burnt and unburnt. However, it cannot be excluded that some of them belong to the later settlement.

It is too early to make any definite statement about the total size of the Early Roman Iron Age settlement at Runegård as the greater part of the site still remains to be investigated. It is, however, safe to conclude that the Iron Age population of Bornholm at that time lived in at least fairly large communities. This agrees well with the theory put forward by C.J. Becker (1975: 36) based on the contemporary burial custom of extensive cremation grave fields. The tradition of large grave fields had already developed during the early part of the Pre-Roman Iron Age. In this context it is of interest to note that a few cremation pits scattered thoughout the eastern part of the settlement area (but outside the area of the earliest settlement phase) can be dated to the end of the Bronze Age or the very beginning of the Pre-Roman Iron Age, a period from which no houses have so far been documented.

During the late 1870s and early 1880s E. Vedel registered and excavated well over one hundred cremation pits from different localities mainly to the north, east and south-east, and all lying within 200–300 m of the settlement site (Vedel 1886: 355–59). These grave fields, of which at least one is believed from recent reconnaissance to include several hundred cremation pits, support the evidence of an unbroken settlement in the area from at least the later part of the Pre-Roman Iron Age until the end of the Roman Iron Age. It also

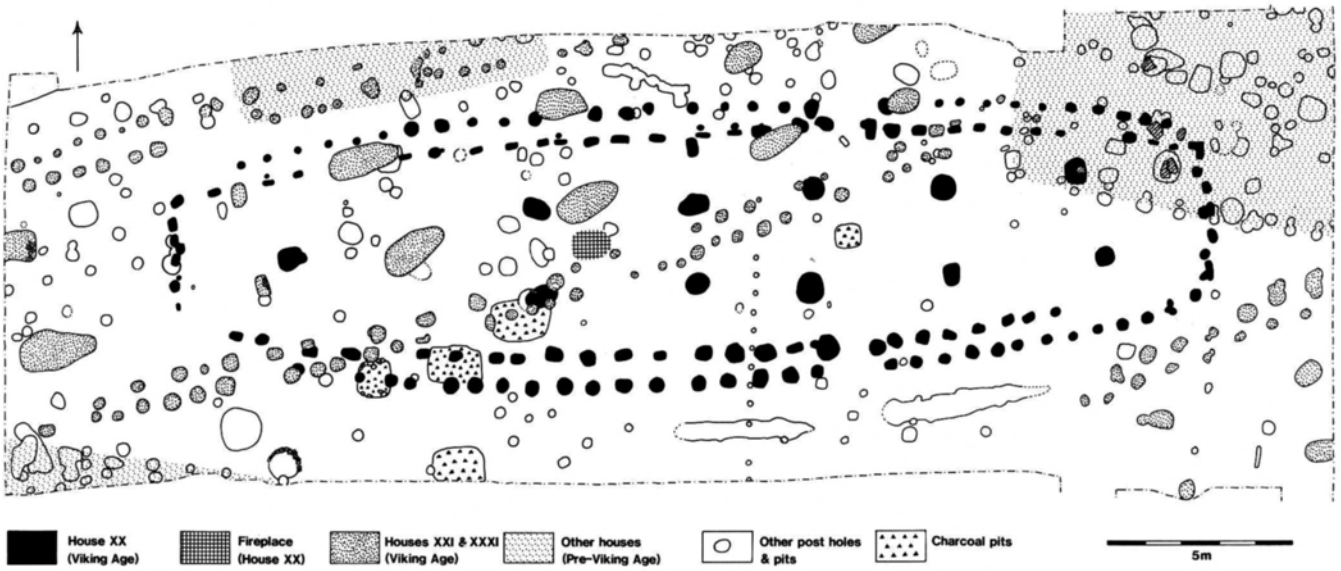

Fig. 4. Plan of the totally stripped area of 1982 (with remains of 3 Viking Age houses (XX, XXI and XXXI) and at least 3 of Early Iron Age type (XXII – XXIV)). 1:200.

proves that the settlement pattern of the Iron Age differed markedly from that of historic times, where farmsteads were – and still are – strung out across the countryside instead of being huddled together in villages as in the rest of Denmark.

It seems likely that a number of other uninvestigated sites, which from stray finds and reconnaissance are known to be large, will show the same pattern (see note 1).

THE VIKING AGE SETTLEMENT

During the excavation in 1979 and 1980 of a totally stripped area parts of a large, but superficially preserved long-house with curved walls came to light (house VI) (fig. 2). As the outlines of similar houses appeared in the trenches to the north and east it was decided to examine at least one of these in more detail. Besides being situated in a complex part of the site which in itself was in need of closer examination, house XX had survived in a reasonable state of preservation, its central and north-western end being protected by an overlying house (house XXI). At the north-east corner of the stripped area both these houses overlapped two successive Early Iron Age houses (XXIII and XXIV) which were only examined superficially. The longitudinal north wall of yet another Early Iron Age house was revealed in the south-west corner. Finally, part of a third, but poorly preserved house of Viking Age type, could be distinguished in the south-east corner.

House XX

House XX was oriented almost exactly E–W, 28.5 m long and 7.7 m at the widest point with strongly curved longitudinal walls narrowing to 3.5–3.6 m at the gable ends (fig. 4).

Forty-two post holes or just over a quarter of the total number were examined in cross section, the rest left untouched. In most post holes an imprint of the post itself had been preserved as a negative of almost pure yellow clay sunk in from the once overlying clay floor.

The roof had been supported by five pairs of apparently vertically placed posts with spans of 3.5 to 4.5 m between the pairs, closest at the eastern end of the house. Only to some extent does the line of roof supports follow the curve of the longitudinal walls. At the western end of the house the roof appears to have been supported by a single post, placed centrally 3.1 m from the west gable, leaving a span of 6.6 m to the westernmost of the five pairs of posts. If the single, centrally placed post is to have had a function, it suggests that the house, in addition to being a traditional »three-

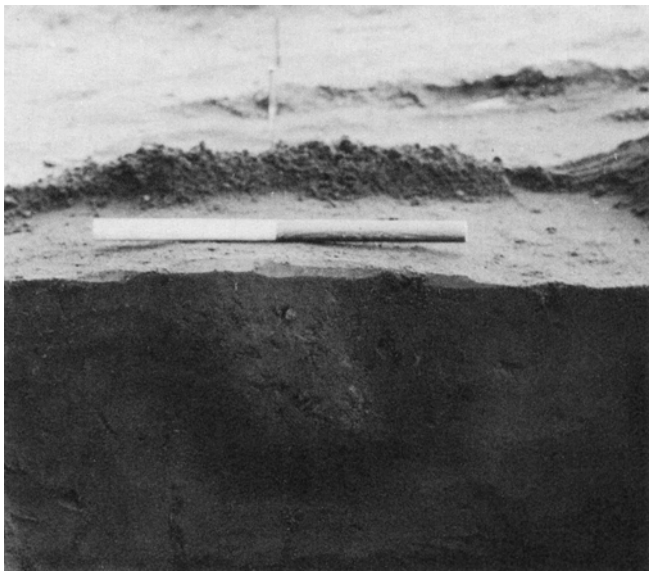

Fig. 5. House XX. Slanting post in outer longitudinal wall.

aisled« house must have had a substantial ridge-beam.

The longitudinal walls consisted of two parallel rows of posts, both placed at regular intervals of 80–90 cm, and diagonally opposite each other. The clay-filled negatives of the outer line of struts or rafters showed that they were more or less rounded in cross section, 12–15 cm in diameter and placed in a slanting position (fig. 5).

The inner row consisted of planks with a rectangular cross section, set lengthwise on edge with gaps of approximately 60 cm between. The cross section of the planks measured 5 cm by 25 cm on average. Most of the holes for the internal planking were fairly shallow compared with the outer row of posts, which were placed 10–20 cm deeper.

As in houses of regular Trelleborg type, where internal roof supports are reduced to one pair at each end, the outer line of struts must have carried the main weight and stress of the building (Olsen and Schmidt 1977: 124–5).

The narrow gables, of which the eastern end was examined in detail, consisted of seven shallow set planks (fig. 6). In the gable corners, which were in line with the internal planking of the longitudinal walls, two planks were placed at a slightly obtuse angle. The central plank appears to have been supported on the inside by a post, but neither this, nor the somewhat flimsy character of the gable, suggests that the post had any structural function.

The house had two entrances, placed exactly opposite each other a little to the east of the centre of the house. The doors themselves were drawn back so as to be almost in line with the inner rows of planks. They were flanked on each side by broad frames set about 10 cm deeper than the internal planking. In the doorway on the south side of the house the door itself appears to have hung on the eastern side of the entrance, marked by a single, solid, deeply dug post. A broad plank, placed at right angles to the longitudinal wall (similar to the situation in the Early Iron Age houses) probably served as a windbreak.

The door in the north wall seems to have hung on the same side as the internal windbreak (i.e. the eastern), judging from the arrangement and depth of the posts.

The house plan shows no unambiguous traces of interior room division. However, the position of the fireplace could be seen as a red discoloration of the old soil preserved below the house floor, close to the western-most pair of roof supports.

A large, almost circular and nearly flat-surfaced saddle quern lay half buried in the north-east corner of the house. Its association with this house is not absolutely certain.

The house shows very few signs of repair and no indication of any alteration. All the roof supports which were cross sectioned had a uniform fill of sandy or gravelly subsoil mixed with turf or old plough soil while the upper part was largely filled with almost pure clay. The absence of clear post negatives suggests that at least some of the large roof supports may have been extracted and probably re-used in some other building.

House XXI

Obliquely overlying the north-western half of house XX were the remains of an even larger house, XXI. Due largely to a time factor this house was the subject of a more cursory investigation, particularly since only part of the central and eastern end of the house lay within the totally stripped area (fig. 4). Judging from observations made in seven different trenches, this house appears to have exceeded 40 m in length and to have had a maximum width of 8.6 m.

The house is essentially of the same type as the one described above, but is oriented ENE-WSW. Four of the post holes for roof supports as well as a number of wall posts were cross sectioned.

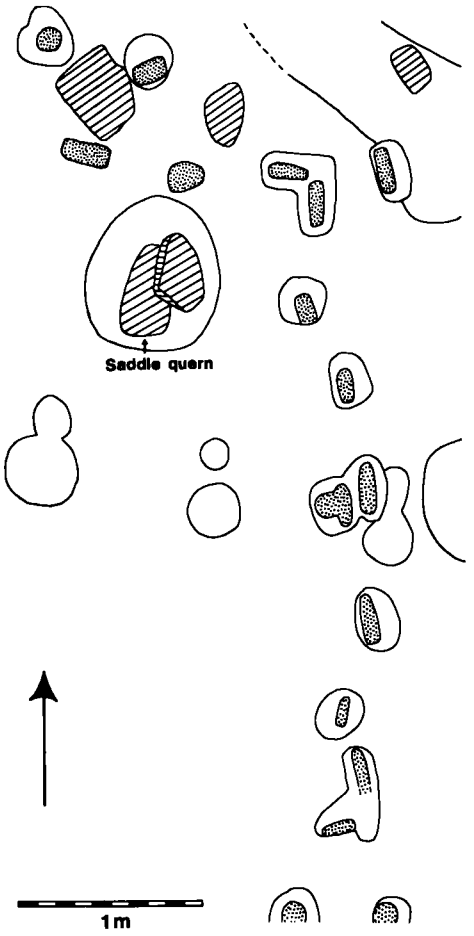

Fig. 6. House XX. Detailed plan of east gable.

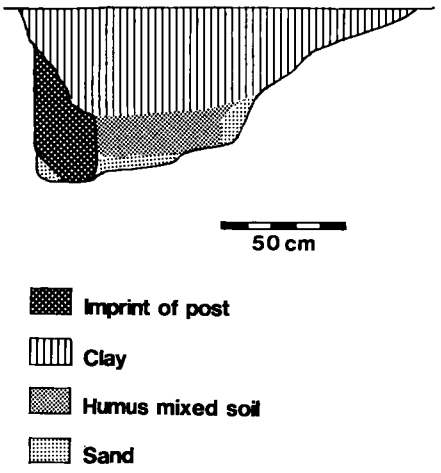

Fig. 7. House XXI. Section through post hole for large roof support.

The walls were curved, but not as strongly as those of house XX, and likewise were made up of two rows of posts placed in the same way. As in house XX the outer posts were slanting and set deeper than the inner row. Almost half the post holes of the inner row had disappeared and very few of the surviving ones had preserved clear negatives of the posts or planks themselves. One or two, however, indicate that the inner wall was at least partly made up of planks.

Five pairs of large holes for roof supports lay within the stripped area. They were placed 2.1–3.1 m apart, following the curvature of the longitudinal walls. The span between the pairs ranges from 4 to 10 m. The holes for the roof supports were elongated, almost pear-shaped, and very large, up to 2 by 1 m at sub-surface level. In longitudinal cross section they were seen to be asymmetrical, the western side being near vertical and up to 80 cm deep, the eastern sloping gently. In one of them a well-preserved negative of the large post itself shows that it had been propped up against the vertical side, the eastern end probably serving as a ramp during the house construction (fig. 7).

Two quite shallow posts placed within the largest span, and in line with the other large posts, may be a later addition to help support a sagging roof. They may also have served as part of a partition wall.

A doorway was placed in the south wall opposite the middle of the largest span. As in house XX the door was pulled back to the line of the inner wall. The posts on both sides of the doorway were more massive and deeper than the neighbouring ones, but there was no trace of an internal windbreak.

A similar doorway could be detected in the north wall a little further east, cutting through a solid clay floor of an older, as yet uninvestigated house.

No internal divisions or traces of a fireplace were observed in the part of the house investigated.

Signs of repair, including a number of »extra« posts and possibly the additional roof supports, suggests that house XXI may have had a longer life than the underlying house XX.

A third house of which only a small portion of the north-west corner lay within the stripped area is somewhat superficially preserved, but appears to be of the same general type as the others (house XXXI, fig. 4). The gable of the western end is now missing and, judging

from observations in the trenches covering the relevant area, the same may apply to a large part of the eastern end of the house.

House VI (fig. 2) which was partly investigated in 1979 and 1980 together with two others so far only known from the trenches (houses XXV and XXXV) all share the same characteristically curved walls, made up of two rows of diagonally arranged posts.

DISCUSSION

From their orientation and position in relation to each other these Viking Age houses probably represent two successive settlement phases, of which the houses of the earlier seem to be slightly smaller (fig. 2). It should be stressed, however, that much still remains to be confirmed either by spot checks or by fuller investigation.

The major problem affecting all the houses described above, and hence the settlement as a whole, is a sparseness of finds which hardly even permits dating to the Viking Age as a whole. Some sherds of plain, undecorated vessels, sometimes with in-turned rim, and other sherds of coarsely tempered and relatively well-fired clay from post holes and the shallow ditch in front of house XX are too inconclusive for a more accurate date (fig. 8). An examination of all the finds from the site, which is not yet completed, may still provide material for a narrower date. It is noteworthy, however, that with the exception of the grave described below, there is a significant absence of pottery of the characteristic »Baltic« type (*Østersøkeramik*).

Meantime the best date may be obtained from the plans of the houses themselves and particularly that of house XX.

Compared to Viking Age houses elsewhere the Runegård houses show a number of common traits supporting the impression of a widespread uniformity in building tradition during this period. The positioning of the exterior wall posts in relation to the interior planking has close parallels in several houses at Fyrkat dated to the second half of the 10th century (Olsen and Schmidt 1977: figs 112–5; Roesdahl 1977: 170). The width of these bays or panels is only fractionally narrower in the Runegård houses (80–90 cm), and even the angular arrangement of the planks in the corners seems to be matched at Fyrkat (e.g. Olsen and Schmidt 1977: fig. 114). As far as the longitudinal walls are concerned the observations made at Runegård support Holger Schmidt's tentative reconstruction of the typical Fyrkat buildings (Schmidt 1982: fig. 13). The absence of exterior posts along the gables may indicate slight constructional differences here.

The pattern of the doorways with an interior windbreak may prove to be a local trait with predecessors as far back as the Early Iron Age.

The centrally placed roof support at the western end of house XX is clearly an original feature, and as an extension of the »normal« pairs of roof posts it seems so far to be unique in Danish Viking Age houses. The roof supported by a single row of posts is essentially a Medieval trait, coinciding with a general straightening of the walls. The combination of single posts and pairs of roof supports *does* occur, but only sporadically and seemingly in different types of houses (7). In Gasselte in north-east Holland a long-house with slightly curved walls and even exterior posts superficially resembling the Runegård houses has been loosely dated to the 10th century (Waterbolk and Harsema 1979: 240 and fig. 14, no. 77). However, all the interior roof supports are placed in quite shallow holes and the houses are described as of essentially »single-aisled« type.

The Viking Age settlement at Runegård has no parallels on Bornholm. No settlements have been dated to the early part of the Viking Age (9th century) and even remains of single houses datable to the following centuries are rare.

The absence of Baltic-type pottery from the house site at Runegård suggests that both houses XX and XXI were built before the appearance of this characteristic type of pottery.

Judging from the lack of signs of repair, house XX probably had a relatively short life while house XXI may have been in use for a much longer period.

Remains of at least two slightly younger houses have been investigated at Gadegård, Poulsker parish (Vensild 1975: 181–2 and fig. 9). Apart from the fact that one of them must have been a three-aisled long-house, 22–24 m long and 6 m wide, their ground plans are rather uncertain. The finds of pottery consisted entirely of Baltic ware, dating this settlement to the 11th–12th centuries.

The relatively frequent occurrence of the easily recognisable pottery of Baltic type on Bornholm has probably distorted the impression of the settlement pic-

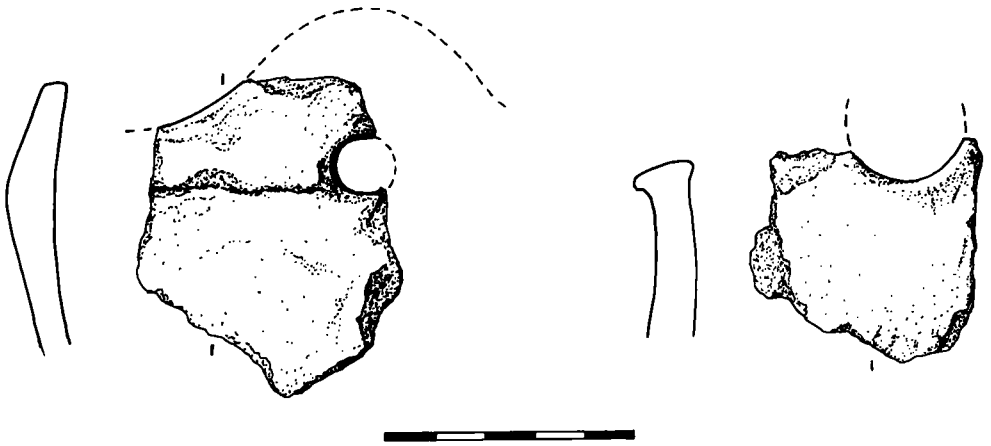

Fig. 8. Sherds of coarse pottery from ditch and post holes of house XX.

ture of the island. The task of locating and verifying the settlement sites of the 6th to 9th centuries is not an easy one, and may well go via a more thorough study of Germanic and Viking Age pottery.

It is remarkable that no »pit-huts«, which are such an important element in nearly all other Viking Age settlements, have been recorded at Runegård. Even taking the method of partial excavation into account, they should have been disclosed in the trenches, had they existed. It is all the more surprising, as in neighbouring Skåne pit-huts have, until recently, been the sole representative of Viking Age buildings (Strömberg 1979: 42). However, pit-huts are also absent from the 10th–11th century farm complexes at Vorbasse in Jutland (Hvass 1980: 148–9), which may be regarded as a late chronlogical trait.

THE FENCING DITCHES

On some of the more fully investigated settlement sites in Jutland the presence of fencing ditches are crucial to the discussion of contemporaneity and attribution of individual buildings to larger farm units.

At the site of Runegård small ditch lengths may be attached to individual buildings, while the most coherent part of the ditch system lies east of the main settlement area (fig. 2). Here it forms a N-S oriented rectangle, 30 by 80 m. The ditches run in a single, double or even treble line and appear to cut the easternmost, poorly preserved Viking Age house (house XXXI).

The width of the individual ditches is relatively constant around 70–80 cm, while the depth varies considerably from a few centimetres to 75 cm, probably largely due to the later levelling of the terrain. The filling, particularly in the upper part of the ditches, is very homogeneous and strongly mixed with clay which matches in colour and texture that of house XXI and its associated ditch. The lower part of the ditches is filled with a more sandy, obviously partly wind-blown soil, suggesting that the ditches had been open for some time.

No traces of any structures have been observed in the short stretches of the ditches which have been investigated. On the western long side of the rectangle the ditch is broken by an entrance. On the eastern side it stops just north of a small grave field which appeared in the trenches towards the end of the 1982 season.

THE GRAVES

Up to now the outlines of 14 east–west oriented graves have been registered in the survey trenches, but the actual number is believed to be at least twice that. Only two graves have so far been investigated due to the advanced time of the excavation.

The grave pits were slightly irregular with approximately vertical sides. Rectangular, dark brown markings showed that both graves had contained wooden coffins, one of them held together with 18 iron nails (grave 1279, fig. 9). This one was made of oak planks, 180 cm long and only 32–33 cm wide (8) and contained the remains of a poorly preseved skeleton lying on its back with the head towards the west. The skeleton was

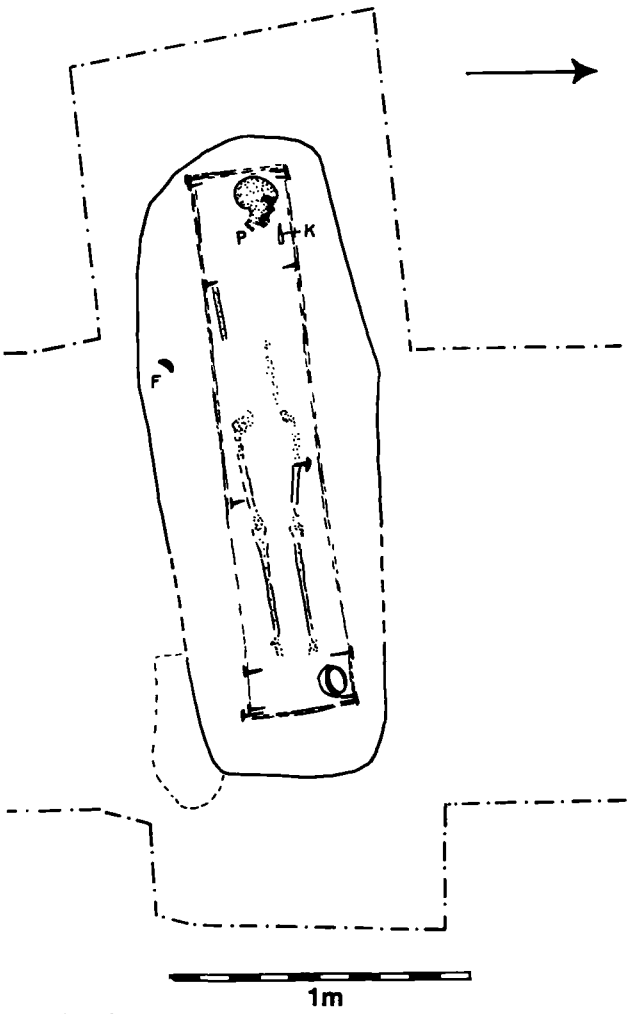

Fig. 9. Plan of grave 1279.

about 20 cm shorter than the coffin, leaving room at the feet for a small pot of Baltic type. Three glass beads, a white, a green and an orange lay by the neck, and in front of the face an iron knife with a long shaft and a short blade.

Outside the coffin itself a small flint axe was found standing vertically with its hollow-ground cutting edge upwards. Whether or not the latter had been placed intentionally is difficult to prove, but from its size and upright position it seems unlikely to have been dropped in unnoticed during the burial ceremony.

The beads and knife are of little use for dating the burial. The small vessel of Baltic ware bears, with its marked shoulder and its ornament band of combed crosses, a close resemblance to Slavic pottery of the Menkendorf group (»Reihe 3«, Schuldt 1956) (fig. 10). It is entirely hand made and rather poorly fired. Some shallow strokes on the bottom of the vessel may be the potters mark, and the circular impression possibly of a technical nature (fig. 11). In spite of the fact that bottom marks of this sort are often placed off centre (as on the Runegård pot) they have been interpreted as marking the axis of a slow moving wheel (Schuldt 1956: 12). The Runegård pot, however, shows no sign of ever having been near a potter's wheel. In size and shape it closely resembles a pot found in a grave at Slamrebjerg, also on Bornholm, with which it shares the short, oblique impressions along the line of the shoulder (Brøndsted 1936, fig. 117). The combed-cross ornament band on the shoulder is very common south of the Baltic Sea (e.g. Schuldt 1981). A Danish example of this ornament type is found at Trelleborg in a pit prior to or contemporary with the building of the fortress (Nørlund 1948: 119 and fig. 108a) late in the 10th century (Bonde 1979).

The chronological significance of Baltic type pottery in a South Scandinavian context is closely tied to the problem of determining the boundary between imported and locally made ware (Liebgott 1979: 493). Much of the abundant pottery of Menkendorf »Reihe 3« type south of the Baltic seems to belong in the 10th century (Schuldt 1956). Hence a tentative date in the second half of the 10th century seems reasonable for the Runegård grave.

Traces of the coffin in the other grave (1289) were only preserved at its eastern end. It had been somewhat wider, 50–53 cm and may have been held together by wooden pegs. The very faint traces of the skeleton suggest that it may have lain on its side. This grave contained no grave goods to give an indication of its date.

Simple east–west oriented burials in narrow, wooden coffins have previously been investigated at two main localities on Bornholm: Slamrebjerg in Bodilsker parish and Munkegård in Poulsker parish (Vedel 1886: 391–2). The Slamrebjerg graves, six in number, were covered by low mounds, while the 25–27 graves at Munkegård were situated on a low, sandy ridge like those at Runegård. At neither locality did the graves provide material for more than a general assignment to the Viking Age (Brøndsted 1936: 210–2).

Whether any of these unpretentious graves could be regarded as Christian, as suggested by Vedel (1886: 186–7), seems doubtful. On Bornholm heathendom is known to have lingered well into the 11th century (9).

Fig. 10. Pot of Baltic type from grave 1279. Height: 9 cm. Photo by Dorte Passer.

Fig. 11. Markings on the bottom of the pot from grave 1279. Photo by Dorte Passer.

For the country as a whole the change of religion made surprisingly little impact on burial practices apart from the gradual and somewhat inconsistent disappearance of grave goods (Roesdahl 1980: 201). At what time and to what extent this process showed itself in the grave finds on Bornholm still remains to be documented. In this connection it is worth noting that a large runic stone with a »Christian« inscription, datable to about the middle of the 11th century, was discovered only about 300 m from the Runegård settlement site (10). Until about the middle of the 19th century the stone served as a bridging plank where the road crosses the small river of Grødby Å. Its original position is unknown, but it is tempting to imagine it standing near the old river crossing in full view of the settlement, commemorating one of its first Christian inhabitants.

It is too early to make any reasonable guesses about the relationship between the burial place and the enclosure. A superficial similarity to the much larger Early Medieval grave field at Löddeköpinge in Skåne may be incidental, but is worth bearing in mind (Cinthio 1980). The buildings inside the enclosure at Runegård still remain to be investigated, but most of them appear, at a first impression, to pre-date the Viking Age.

CONCLUSIONS

For a preliminary evaluation it would seem justified to conclude that the burial place had served a small or even a medium sized farming community over a limited span of years. How many farm complexes were functional at any one time at Grødby is impossible to answer at present, where probably less than one third of the total settlement area has been investigated.

Today the hamlet of Grødby consists of three farms, as it did also in 1746 (11). There is no reason to suspect that this number had not been constant even further back in time. From a parish report, dated 1624 (»præsteindberetningerne«), Runegård is known to have existed at that time, and from evidence of older buildings below or close to the modern ones, it lay much in the same place as today. An early site of one of the other Grødby farms, moved some time after 1746, lies immediately north-west of the present excavation area, and would seem a worth while object for a future investigation of settlement continuity on Bornholm into the Middle Ages.

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NOTES

[1] For example Sylten, Smørenge and Sandegård (Vedel 1886, 399–400). Sorte Muld probably also belongs in this category, though it appears not to have been fully appreciated when two houses were excavated there in 1949 (Klindt-Jensen 1957: 175f.).

[2] The settlement site has parish register no. sb.202, Åker parish, Bornholm.

[3] The excavation is largely carried out in accordance with §49 of the Ancient Monuments Act (*Naturfredningsloven*) and was led by the author.

[4] Runegård as an example of a complex settlement site has previously been discussed in relation to excavation economy (Watt 1981).

[5] Eight or nine long-houses and three smaller buildings, all from the trenches, are meantime of undetermined type and age.

[6] K-3965: 1890± 70 BP. The date in the text is calibrated according to Clark, *Antiquity* 1975 and Stuiver, *Radiocarbon* 1982. K-3966: 2080± 70 BP. calibrated in the text according to Clark, *Antiquity* 1975.

[7] On Bornholm a house with a combination of two pairs of massive roof supports and four more slender, centrally placed posts was examined in 1974 at Krusegård (Vensild 1975, 176–80 and fig. 5). The relationship and structural significance of the posts were not entirely clear, and the house was of a somewhat different type and age (late 13th century).

[8] The determination of the wood has been carried out by cand.mag. Kjeld Christensen, National Museum, Copenhagen.

[9] The main source of information about the change to Christendom in Bornholm is: Adam of Bremen, *Descriptio Insularum Aquilonis*, written about 1075. Danish translation by A.A. Lund, Wormianum 1978.

[10] »Åker-1« (Jacobsen and Moltke 1941, 422–23).

[11] On an early, but very reliable map of Bornholm, compiled and drawn by Bernhard Frantz Hammer in 1746, the three farms at Grødby are shown lying close together. Original at Bornholms Museum.

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Søby – a Viking Age Settlement on Samsø

by PETER BIRKEDAHL CHRISTENSEN

Samsø consists of two raised morainic islands, forced together between glacial streams, and subsequently conjoined by marine deposits from the Tapes/Litorina Sea. The Viking Age settlement of Søby is situated in between Nordby and Mårup on the north island of Samsø, about 1 km. from the east coast and 2 km. from the west, on the gently sloping section east of the raised morainic ground on the west of the island (fig. 1).

To the east of the site is a substantial area of meadow, surrounding Søby Kær, a pool now covered up, which had a tributary to the west. The site is thus provided with water, pasture and arable lands, so that it fulfils the criteria as an ideal position for an agricultural settlement.

About 1,100 sq.m. of the site have been excavated, partly in two extensive areas, partly in long trenches (1). 19 sunken-huts were found, of which 16 were wholly or partially investigated. None of the post-holes on the site could be interpreted as the remains of larger dwellings. The site extends at least 230 m. from east to west, and a minimum of 60–70 m. from north to south, without doubt, in fact, a little more. It is believed that the main area of settlement lies around the covered watercourse south of the excavated area (cf. fig. 2).

I shall concentrate here on two of the sunken-huts, because with regard to both construction and finds they display so many characteristics that they provide a good dating and characterisation of the site.

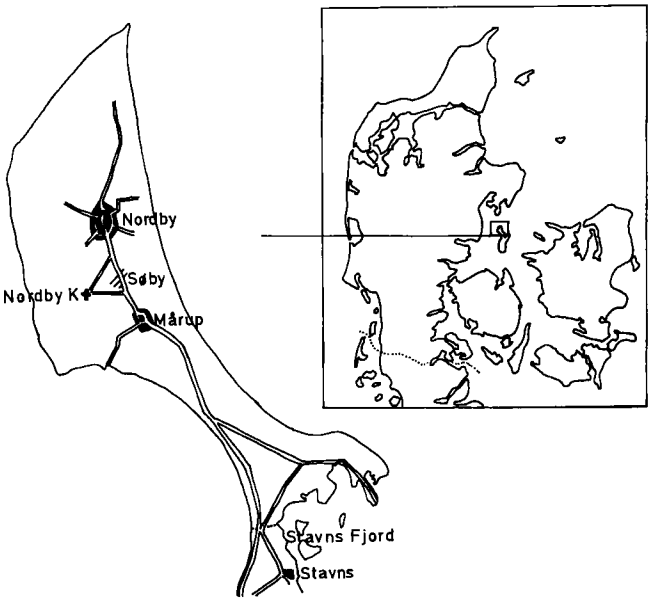

Fig. 1. The situation of Søby on northern Samsø.

THE SUNKEN-HUTS

Sunken-hut EO was four-sided, measuring about 3.5 × 4.0 m., with its longer axis aligned east-west, and dug 45 cm. into the ground (fig. 3). There were 6 post-holes, one in each corner and one in the centre of either shorter side. No wall trench was discovered in the building, and therefore no inset planks, and no stake-holes or wattle either. The post-holes in the corners were not especially deep, which could indicate that the posts were firmly fixed, either connected to a log-built construction or a stave-built construction with a sill. The posts in the middle of either end indicate that the building had a pitched roof. But since these posts were sunk no deeper than the corner posts, one must suppose that the roof could not have rested upon them, but upon the whole wall structure.

The building had a bench built into the ground along the north and west sides. In the south-west corner a heap of flat stones, about 20–25 cm. large, was discovered. Beneath these were several larger stones, standing on their edges. Loose stones fanned out from here into the building. Below the stone layers, a layer of soot and charcoal was observed, together with four

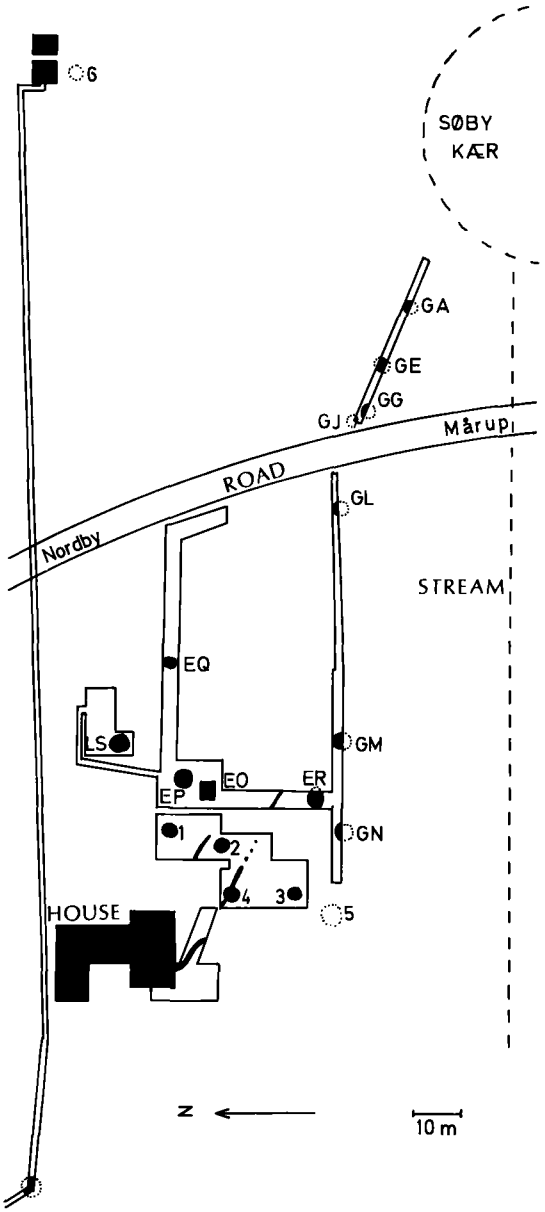

Fig. 2. Excavated areas. Sunken-huts are shown with numbers and letters.

small post-holes. The ash layer and the stone construction make an interpretation of the feature as an oven probable.

Four-sided sunken huts with three post-holes along the gables are known from north-western Germany and Jutland. Examples with ovens are known from Århus, Hedeby, and South Hedeby. Huts DAQ and DKR at Århus Søndervold had stone-built ovens in the southern corner, while hut CJR had an ash layer in the same corner (Andersen, Crabb and Madsen 1971). Building EO is closely related to sunken-hut DAQ at Århus Søndervold. On the basis of this similarity, a dating of sunken-hut EO to the 10th. century, the date of Århus Søndervold's sunken-huts, appears reasonable.

Sunken-hut EP, situated immediately to the north of hut EO, was round, about 3.5 m. in diameter, and dug about 45 cm. down into the ground (Fig. 4). To the WNW and ESE of the base were found the holes of two roof-bearing posts. A further two large post-holes appeared about 40–50 cm. on either side of the eastern of these post-holes, but these were shallower. Small stake-holes bordered the whole of the north side, probably remains of a wattled wall. On the south side was a single wall trench and two stake-holes. But construction features were lacking in most of this section. Small stake-holes were found scattered across the middle of the floor.These holes were seen in several of the sunken-huts at Søby, but here is the evidence that they were associated with a construction or activity in the building. A bone comb (1651, fig. 6,a) was placed vertically in one of them.

The building was filled with several light layers of sand, alternating with darker layers containing humus and clay (fig. 5,A). Tom Ohlsson has interpreted this phenomenon as seasonal use of a single building (Ohlsson 1976: 92). He believes this to be several floor layers alternating with blown sand layers. Märta Strömberg notes the phenomenon from Hagestad no. 19, where the floor layer is gradually raised, probably for reasons of hygiene (Strömberg 1963: 7f.). Ingrid Stoumann mentions thin, washed out sand layers and thick blown sand layers (1977). She reckons this as evidence of the building filling up in several stages. The phenomenon was observed in several contexts at Søby. In the southern part of hut EP was a layer of daub, lying within that part of the building (fig. 5,B). This layer was covered by several of these 'seasonal floor layers'. A supplementary point is that many of the dark and light layers were deposited only by the sides of the pit (fig. 5,A). This rejects Märta Strömberg's 'hygiene theory' of layers lying on the base. An interpretation of these as back-filling layers, where partly the sand that was dug up during the construction of the building, and partly earth and rubbish, was thrown into the hole, seems reasonable. This could perfectly well have happened in several stages, as Ingrid Stoumann believes (1977).

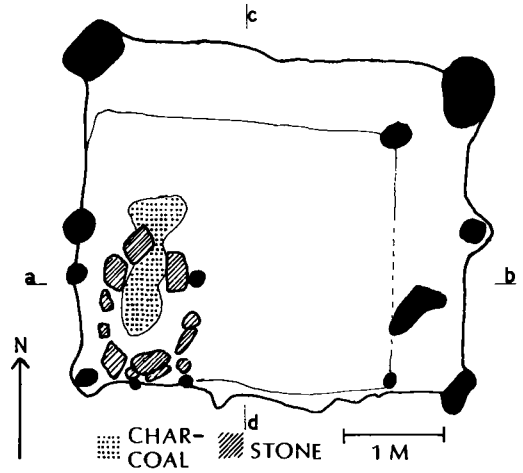

Fig. 3. Plan of sunken-hut EO.

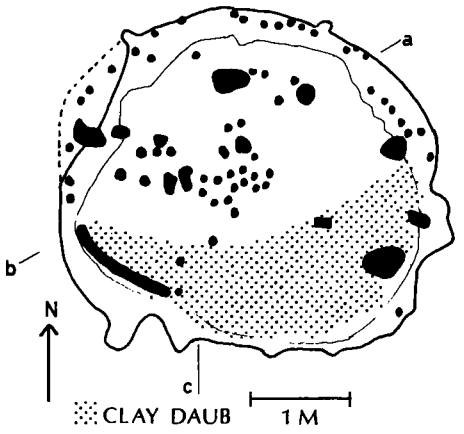

Fig. 4. Plan of sunken-hut EP.

FINDS

Combs

The find-material includes three decorated bone combs (nos. 1594, 1651, and 1655, fig. 6) all from hut EP. These therefore combine to date this building. Concurrently they provide some evidence concerning comb-dating in general, in that each of them is of a different type.

The first comb, no. 1651 (fig. 6,a), is typologically the oldest. It was found standing in one of the stake-holes in the bottom of sunken-hut EP. It is a comb of the composite type, i.e. with two side-plates and middle plates.

The comb was originally about 21 cm. long, but one end is broken off and it now measures only 19.4 cm. The surviving end is formed into an animal's head, with an iron nail marking the eye. The decoration of the side plates consists of a vertical central panel and two wedge-shaped side panels filled with interlace. Both the central and the side panels are bordered by a groove, which follows the contours of the side plate around the side panels. The areas between the interlaced ribbons are also hatched with a single line, giving a clearer ornamental effect. This is the most common form of ornament on combs with animal-head terminals. Combs of this type are found in the whole area of Viking settlement. The type is dated to the 9th., and possibly into the 10th., centuries. It is known from a 9th.-century grave from Barre in the Hebrides (Brøgger 1930:231). It was found at the settlement site of Jarlshof on the Shetlands, with a dating of the first half of the 9th. century (Hamilton 1956: 124, 134, & pl. XXII). In York it was found in a context dated to the late 9th. or early 10th. century (Waterman 1959: 87). It is also known from the Oseberg grave from Norway, dated to the middle of the 9th. century (Brøgger and Shetelig 1928: 205; cf. Peter-

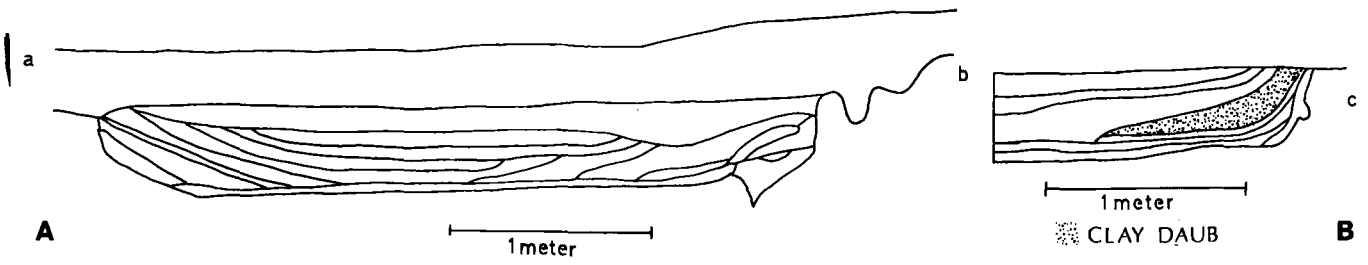

Fig. 5. A: Cross-section of sunken-hut EP, showing layers of fill. – B: Cross-section of the southern part of sunken-hut EP, showing the daub layer.

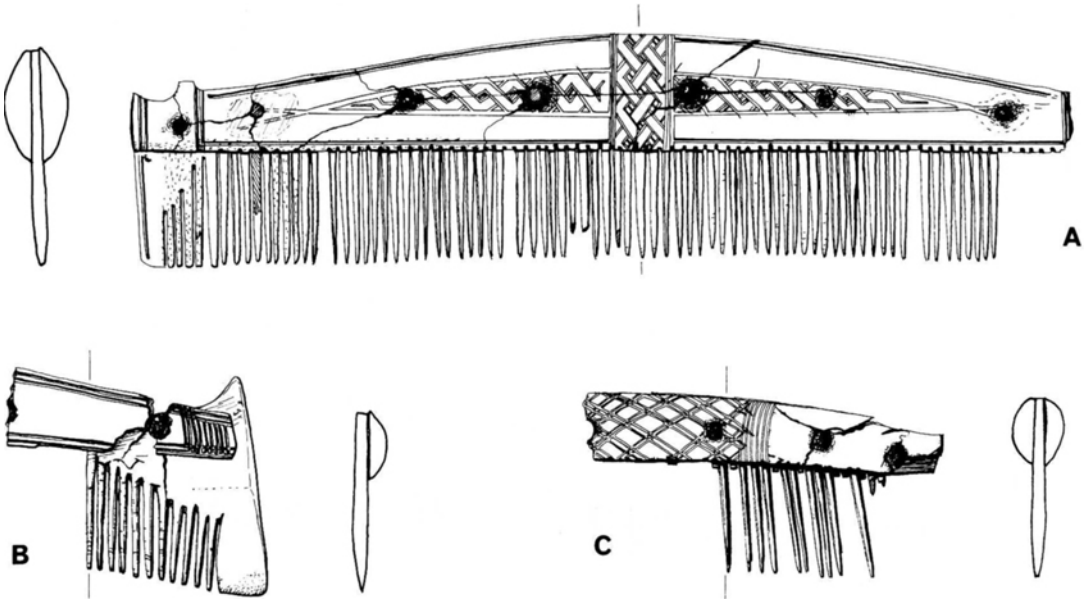

Fig. 6. Bone comb and bone comb fragments from sunken-hut EP (drawn by Jette Bang). 2:3.

sen 1951: 486). It appeared in graves at Birka dated to both halves of the 9th. century (Arbman 1939 pl. 159). Hedeby and Wollin have produced examples (Jankuhn 1943; Wilde 1953: 67–83). Finally, two fragments have been found in Århus (Andersen et al 1971: 146f.). One of these has animal head terminals, and the other has the terminals broken off, but is decorated with a central panel and two wedge-shaped side panels. The combs here are typologically dated to the 9th. century, and perhaps down into the 10th. century. This dating seems satisfactory. A dating to the 10th. century too is supported by a comb with broad, flat side plates from Trondheim (Moen 1971: 82). According to provisional results, dates here go back no further than around the year 1000 (Long 1977).

Comb-fragment 1594 (fig. 6,b) was found in the fill of hut EP. As far as the side plates are concerned this comb is connected to the group with broad, flat side plates, which nearly always have the contours emphasized by one or more grooves inside the edge. The middle plate has a characteristic upward-projecting point. This type has been found, *inter alia*, at Trelleborg (Nørlund 1948 pl.XXX: 2), Okholm (Andersen 1968: 25), Hedeby, and Wollin. At Hedeby it was dated to the first half of the 10th. century (Jankuhn 1943: 156), and at Wollin to the second half of that century and down into the 11th. century (Wilde 1953). The broad, flat side plates draw it to the 9th. century, and perhaps down into the 10th. (see the dating of comb 1651). Thus the dating of the comb lies from around 900 some way down into the 10th. century.

One detail on the comb tells us something of the production technique. By the side of the last tooth-slot, and at the same distance as between the other teeth, a thin line may be seen: a marker for a further tooth. Above the last slot a similar line is visible. Thus the distance between the teeth and their number were determined before the sawing began.

Comb-fragment 1655 (Fig. 6,c) was found in the bottom layer of hut EP. Both side plates have terminals at one end, but the middle plate's end is broken off. The appearance of the end of the comb can not therefore be reliably determined. The side plates are narrow, rounded, and lightly curved. The decoration consist of six lines across the plates, followed by a network of double lines.

The decoration is identical with that found on combs PN and DQR from Århus Søndervold (Andersen et al 1971: 147, 149) and the comb from matr. no. 264 in Randers (Velley 1977: 119, fig. 17). It is also known from Wollin and Hedeby. Fragments of a similar comb were found in Lindholm Høje grave 1446 (Ramskou 1976).

An incision towards the end of one of the plates could show that this comb, like no. 1594, had an upward-projecting point on the middle plate. Such an incision appears on comb 1594. Five of the seven combs from Århus Søndervold with narrow, rounded side plates showed some form of excrescence on the end of the side plate (2). Combs with excrescences are found from the first half of the 10th. century at Hedeby (Tempel 1970: 40). A rather feeble example from post-980 is from Trelleborg (Nørlund 1948 fig. 76). There are five combs from Wollin, dated 900–950, but one further example dated to the 11th. century (Wilde 1953). Altogether the comb seems to have had a long period of life.

Pottery

A comparison with the pottery from Århus Søndervold shows that the pottery from Søby can entirely be grouped in ceramic horizon I. Sherds from Søby which can be grouped with Århus Søndervold's characteristic groups comprise 18.12%; the corresponding figure for Århus Søndervold is 18.31% (3). These two figures are so close that a comparison of the individual groups can be made immediately. As far as rims are concerned the proportions are the same, except for groups d and e, which are not found at Søby. These two groups are dated late in ceramic horizon I at Århus Søndervold, i.e. to the 11th. century, and their absence from Søby can be attributed to this date. One might expect that flat bases, an eastern characteristic, should be more common at Søby than at Århus Søndervold, but that is not the case.

Slavic influenced pottery (fig. 7) comprises a slightly smaller percentage of the material at Søby than at Århus Søndervold. It is concentrated in sunken-hut EO to the extent that it is predominant in the bottom layer. The models for this pottery are to be found in the ceramic groups Teterow and Vipperow south of the Baltic, and dated on this basis to *circa* 1000. This is the latest dating from Søby. At Århus Søndervold Slavic pottery is especially associated with rim forms d and e, and therefore placed in the 11th. century. Here again the difference between Søby and Århus Søndervold can be attributed to their relative dates.

Otherwise, Jutish hemispherical vessels are predominant in the pottery material. The comparison with Århus Søndervold makes it clear that Søby is associated with Jutland as far as the pottery goes.

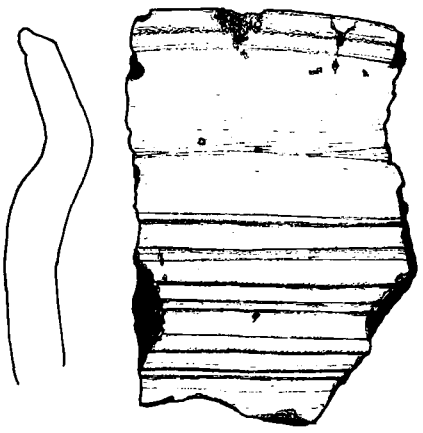

Fig. 7. Rim-sherds of Slavic influenced pottery from sunken-hut EO (drawn by Jette Bang). 2:3.

Other finds

Amongst other finds from the site should be mentioned articles employed in textile production: loom-weights, spindle-whorls, and a weaving-comb.

A great number of *loom-weights* were found, both burnt and unburnt. Two from sunken-hut EO were decorated by stabbing with a comb-like instrument. This is a north-west European feature, also found in several Jutish Viking Age settlements, especially to the south. These have also been found at Trelleborg (Nørlund 1948) and Menzlin (Schoknecht 1977 pl.34).

The *spindle-whorls*, with one exception, are of the conical Jutland-Fyn type. The exception is a spindle-whorl of thin burnt clay, not well-bodied like the others. It was found in sunken-hut ER. It is most reminiscent of the bee-hive-shaped sandstone spindle-whorls known *inter alia*, from Trelleborg.

The *weaving-comb* (fig. 8) was found in sunken-hut GG. Only one half was recovered. There were four nail holes at the top. The comb now has four 4 mm. long, worn teeth; the original number was seven or eight. On

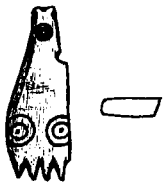

Fig. 8. Bone weaving-comb, no. 1154, from sunken-hut GG (drawn by Jette Bang). 2:3.

both sides the comb is decorated with a dot at the centre of two concentric circles. There are now one and a half of these motifs on either side, but there were originally three. Comparable weaving-combs with handles have been found at Oseberg (Brøgger and Shetelig 1928: 193, fig. 126c), Birka (Geijer 1938: 57), and Sigtuna (Floderus 1941: 89). The comb from Søby is most reminiscent of that from Birka.

Two decorated *bone pins* were found, one each in sunken-huts EP and LS, no. 1641 (fig. 9,a) from the former, no. 1656 (fig. 9,b) from the latter. The latter can be placed under Schwarz-Mackensen's type 4: 'Pins with an eye or a marked-out plate at the head' (Schwarz-Mackensen 1976: 9). They compose a small group of pins only known from Birka (5 examples) and Hedeby (10 examples). The decoration of the cross-hatched belt is also known on those pins.

Other finds to be mentioned are *glass beads*, *soapstone vessel* fragments, *iron knives*, *iron nails* and *bolts*, and *whetstones*, of which one had a suspension hole.

Altogether the finds provide a date range from the end of the 9th. century to shortly after the year 1000.

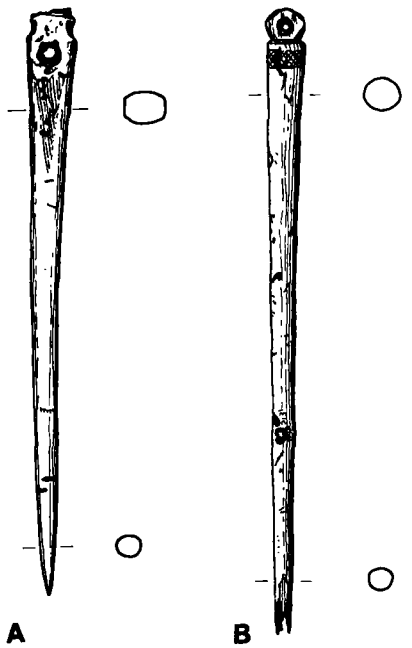

Fig. 9. a: Bone pin 1641 from sunken-hut EP. b: Bone pin 1656 from sunken-hut LS. (drawn by Jette Bang) 2:3.

VILLAGE ECONOMY AND TOWN ECONOMY

If we accept that Søby is a village, then the possibility of comparison with Århus, interpreted as a town, presents itself (Andersen et al 1971: 267).

If we compare the different artefact groups, we find, for a great part of the material, that they are divided between Århus and Søby in a proportion of 6:1. Groups which diverge from this proportion on the side of the town are goods associated with crafts, such as glass beads, bone combs, bone pins, nails, and moulds. The groups which are relatively more common in the village are loom-weights and spindle-whorls. This indicates that weaving is not a town occupation, but something that dominates in the village. It is an occupation for which the raw material, wool, is ready to hand, unlike the raw materials for the town's craft products, which in themselves are trade goods. In the urban communities we know from Viking Age Scandinavia, craft articles were produced from imported materials and subsequently exported. The village, indeed, exported goods, but not goods produced from imported raw materials, only goods produced from home-produced raw materials.

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NOTES

[1] One area was published in Nancke-Krogh 1978. The remainder was excavated for Fortidsmindeforvaltningen, partly by the author, and partly by Jette Bang, whom I thank for permission to use the material, and for drawing figures 6–9.

[2] Andersen, Crabb, and Madsen 1971: 147. Combs PN, TA, ADU, BTE, and CXM with excrescence; AOJ and DMY without.

[3] Søby 125 from 690, Århus Søndervold 1300 from 7100.

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Excavations in Ribe 1979–82

by STIG JENSEN, PER KRISTIAN MADSEN
and OLE SCHIØRRING

Archæological investigations in the town of Ribe commenced with an excavation in Grønnegade (Stiesdal 1968) undertaken in 1955–56 by the National Museum. Since then an almost continuous series of investigations has been carried out by *Den Antikvariske Samling* in Ribe. In recent years these were undertaken in a most profitable co-operation with »The medival town«, a project sponsored by the Danish Research Council for the Humanities (Olsen 1981; Schiørring 1982), and in one other instance with the National Museum.

The purpose of the very first excavations was to establish the origin of Ribe and its further evolution from the Viking Period up through the Middle Ages – an intention which has been of continual interest up to this day.

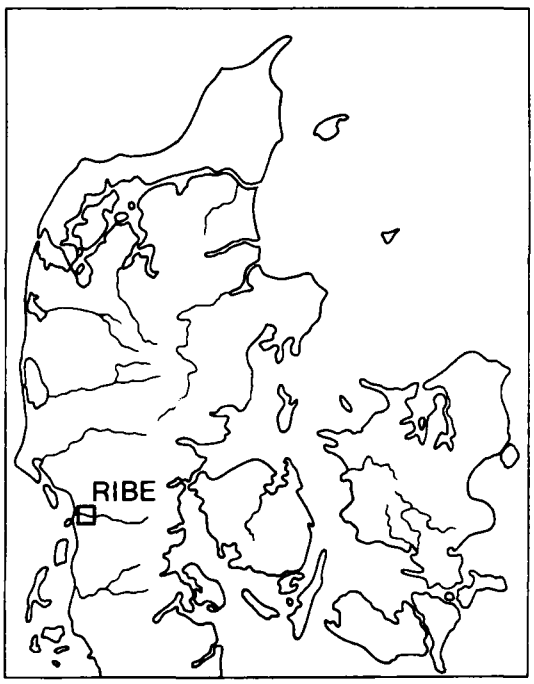


Fig. 1.

In the years 1979–82 twenty-three excavations were effectuated in Ribe (fig. 3), ranging from rather extensive investigations to smaller, less comprehensive ones. Two of these have been published elsewhere (Madsen and Schiørring 1981; Madsen 1982), and it is to be hoped that additional articles will be prepared independently later on. The intention of this article is to go briefly over the results we have so far gained, placing them in relation to the various periods and to the areas of the town, hereby seeking out spheres for our future work.

THE BACKGROUND

For many years the aim of the archæological investigations has been to find the Ribe of the Viking Era. The town is mentioned in written sources from the 9th, 10th and 11th centuries, and this leads us to believe that there was – and still is – a reasonable chance of finding traces from this period, although the preserved sources only give us scanty information about the town.

These written sources have been published and commented on by Inge Skovgaard-Petersen in 1981 (*Ribe Excavations* 1970–76, vol.1, 21ff); therefore, only the most important facts are mentioned here.

Ribe is first mentioned in Rimbert's *Vita Ansgarii*, where there is a description of how the Danish king in approx. 860 granted Ansgar permission to erect a church in Slesvig/Hedeby, after which it continues: »He also presented another plot of land elsewhere in his kingdom, namely in a town called Ribe, upon which a church might be built, and, by virtue of his royal power, he granted permission for a priest to take permanent abode there« (*Ribe Excavations* 1970–76, vol.1, 39f). Whether this church was ever built, or where, and whether Ansgar or his emissaries ever came to Ribe we do not know, but the fact that Ribe was chosen on a level

Fig. 2. The Cathedral from the south-west, with the apse, the transept and nave of the 12th–13th century. The outer naves were added in the 14th and 15th century, the Great Tower shortly after 1300. From a drawing by Harald Bruun 1906, after conservation works 1904 by H.C. Amberg. Photo: The National Museum.

with Slesvig/Hedeby, as a place from where the missionary work could emit, indicates the significance of Ribe. The king's right of disposal, which lies behind his presentation of a plot of land in Ribe, can also be interpreted as proof of a royal execution of power in the town itself, called *vicus* by Rimbert.

Several accounts of Ribe's bishops have been handed down from the 10th century. Bishop Leofdag of Ribe is named as a participant of the synod in Ingelheim in 948, and *Ribe Bispekrønike* (The Chronicle of the Bishops of Ribe), from shortly after 1230, states that he died in Ribe as a martyr for his faith (*Ribe Excavations* 1970–76, vol.1, 41f and 59). Two imperial letters of immunity from 965 and 988 to the contemporary Danish bishoprics include Ribe, the latter also naming special trade privileges for the bishop in Ribe (*Ribe Excavations* 1970–76, vol.1, 43f).

From the beginning of the 11th century another type of source appears, namely coins. King Canute the Great (Knud den Store) (1018–1035), his son Harthacnut (Hardeknud) (1040–42) and Svend Estridsen (1047–74) all struck coins in Ribe, likewise King Niels (1104–34). A work from the 1070'ies by Adam of Bremen on the history of the archbishops of Hamburg refers to Odinkar, who was bishop in Ribe at least from 1005 until his death in 1043 (*Ribe Excavations* 1970–76, vol.1, 45ff). Furthermore, Adam describes the town of Ribe, which he characterizes with the Latin denomination *civitas*, as being surrounded by a river which flows out to the ocean, and on which ships can navigate out to Friesland or to England, or at least to our Saxony (*Ribe Excavations* 1970–76, vol.1, 51). From the 12th century and onwards the written sources become more abundant and also start giving topografic information that can be localized. *Ribe Bispekrønike* states that Ture († 1134) was the first bishop to let the Cathedral be built of stone, and in 1145 two parish churches, St. Clemens and St. Peter, are also mentioned for the first time, apart from the Cathedral (*Ribe Excavations* 1970–76, vol.1, 60; *Diplomatarium Danicum* 2, II, 87). The building of the present

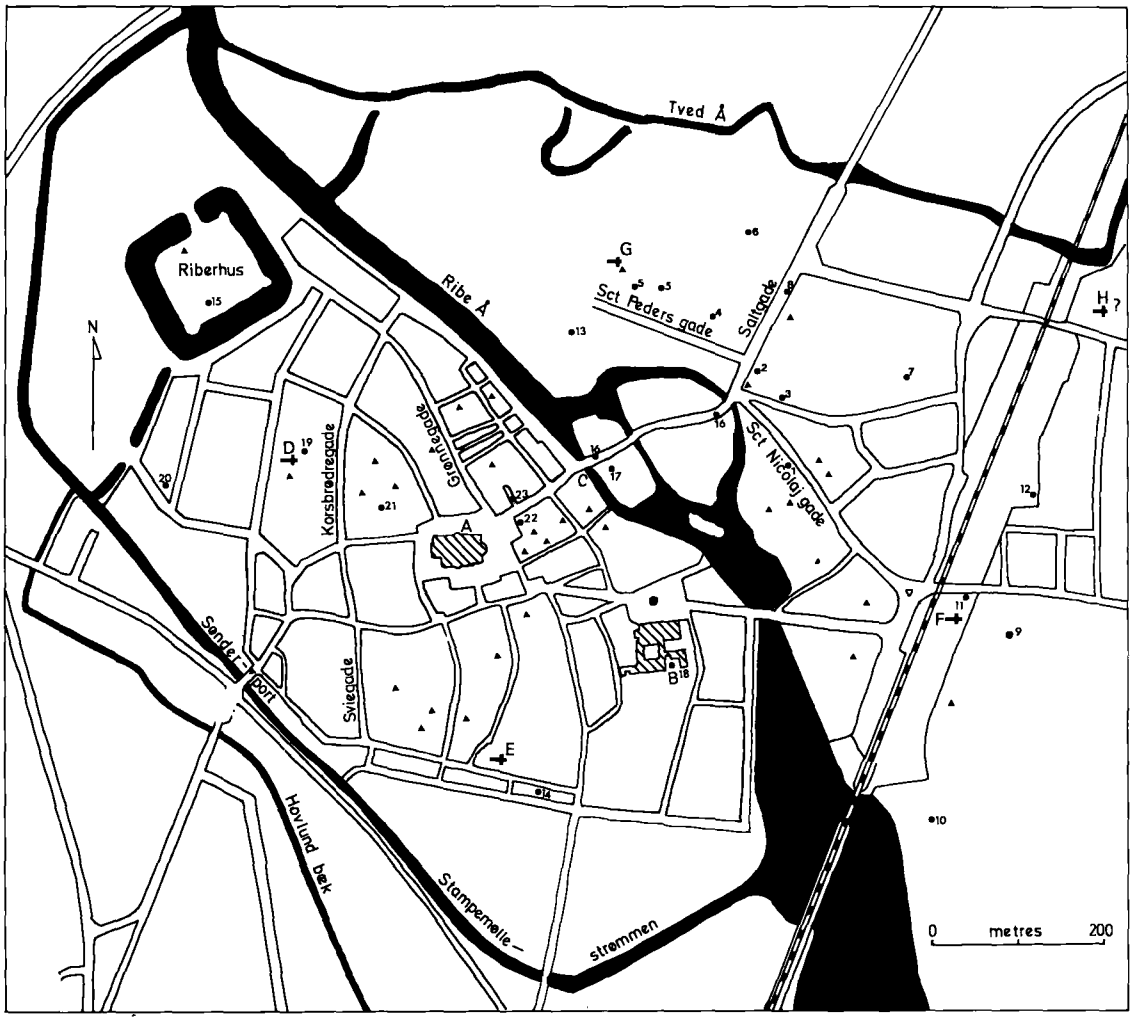


Fig. 3. Map showing the excavations in Ribe. ▲ indicates those prior to 1979, ● the 23 excavations in the period 1979–82. The numbers on the map are referred to in the text. A: The Cathedral. B: The Monastery of St. Catharinae, of the Dominican Order. C: The King's Mill. D: Parish church of St. Clemens. E: Parish church of St. John. F: Parish church and Monastery of St. Nicolas. G: Parish church of St. Peter. H: Parish church of the Holy Sepulchre, probably identical with that of St. Bartholomew (Nielsen 1980). Drawing: Børge H. Nielsen, 1983.

Cathedral (fig. 2) can however not have been commenced before 1150–1175 at the earliest, maybe then replacing an older, smaller, stone-built church (*Danmarks Kirker*, Ribe amt 3–4, 160; Møller 1979). It is noteworthy that the two parish churches referred to in 1145, together with three or four others mentioned later on, lie on either side of Ribe Å (fig. 3). We are aquainted with both St. Clemens and St. Peter from earlier diggings, but it has not been possible to date their founding (cf. *Danmarks Kirker*, Ribe amt 1, 112ff).

It was in the hope of being able to trace the town of Ansgar and the Vikings, that the excavation in Grønnegade, north of the Cathedral, was started in 1955. However, neither this nor nigh on 20 years of ensuing excavations in the medieval town on the south bank of Ribe Å (fig. 3) resulted in findings that could be dated earlier than the 12th century. It was by pure chance that the attention was drawn to the north bank of the river, where the present buildings are not much more than 100 years old.

During an excavation-campain in the years 1973–76 led by Mogens Bencard (fig. 3) both sides of St. Nicolaigade were investigated and yielded a great number of finds. These objects must however, especially as a re-

sult of the coins found there, be dated to the 8th century (*Ribe Excavations* 1970–76, vol.1, 7 and 63ff). The archæologists thus proved that Ribe must be at least a hundred years older than we first had been led to believe, judging from the earliest preserved reference from the middle of the 9th century. None of the diggings revealed buildings, other than a couple of pithouses but there were, however, a lot of findings in the waste from artisans' workshops.

One of the main purposes of the investigations carried out in the more recent years has therefore been to locate and examine the habitation of the 8th century and the subsequent Viking Age.

The medieval findings, especially ceramics, cannot, apart from a very few samples, be dated earlier than the second half of the 12th century, at which time the present Cathedral was under construction. The continued investigations have thus not only been aimed at searching for the settlement of the Viking Age, but just as much at finding out where the town of the Earlier Middle Age was situated.

It has also been important – and still is – to find out when the present township emerged. The townscape, as we see it today, is to a large extent medieval, but we do not know whether it came into being in one or more stages. Middle Age written sources concerning Ribe's topography and history are very numerous, compared with material on other Danish towns. Never-the-less, most of the sources are from a time when most of the decisive functions had already started up. This applies for instance to the placing of the churches, most of the monasteries, part of the fortifications, the watermill, and the street pattern.

Finally, a general theme throughout all the investigations has been to collect information about the area's original topography, i.e. what it looked like before any settlement took place, and how the landscape influenced the placing of that settlement.

THE NORTH-TOWN

The excavations under and near the Kunstmuseum (The Museum of Art) in the middle of the 1970'ies (fig. 3, 1) led to new, unique information about the oldest Ribe, a trading centre on the north bank of the river (*Ribe Excavations* 1970–76, vol.1). The massive deposits with their thousands of finds, have in turn posed new questions, which are roughly outlined in the following.

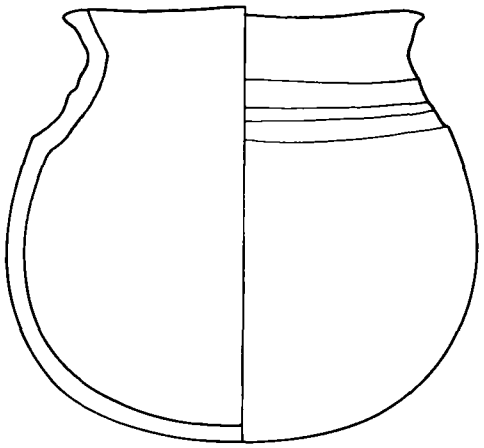


Fig. 4. A globular pot from the dendrochronologically dated well beneath Pajpøt. Drawing: Jens Kirkeby. Scale c. 1:2.

As mentioned, the excavations did not expose any buildings other than a couple of pithouses. Thus we do not know much about the nature of the buildings. Findings of sheep-bones, spinding-wheels and loom-weights prove that the population was settled, but we do not know whether their main pursuit was agriculture or trade and handicraft. A large number of findings have been extracted from the layers of refuse, and these indicate extensive trade connections with northern Europe, e.g. steatite and whet-stones from Norway, pottery from the Rhineland, and Friesian coins. A number of handicrafts are moreover represented in these layers, e.g. comb making, shoe making, amber cutting and polishing, smith's work, bronze-casting, and the fabrication of glass beads. The workshops of the two latter professions have even been found represented in the uppermost layers; the bronze-founder and the bead-maker worked side-by-side, and seem to have settled down on the same spot on several occasions.

The question is therefore, whether the settlement exposed during these excavations is a combined trade- and handicraft centre, located on the outskirts of an actual urban settlement, or whether it is a marketplace with a small resident population. If the latter is the case, the many findings of artisan and commercial objects must originate from recurrent market situations. In both cases, one would expect that some form of local ruling would be necessary to sustain law and order for the trading to take place, and to assign the same working places to the artisans over and over again.

Fig. 3 shows the location of the investigations carried

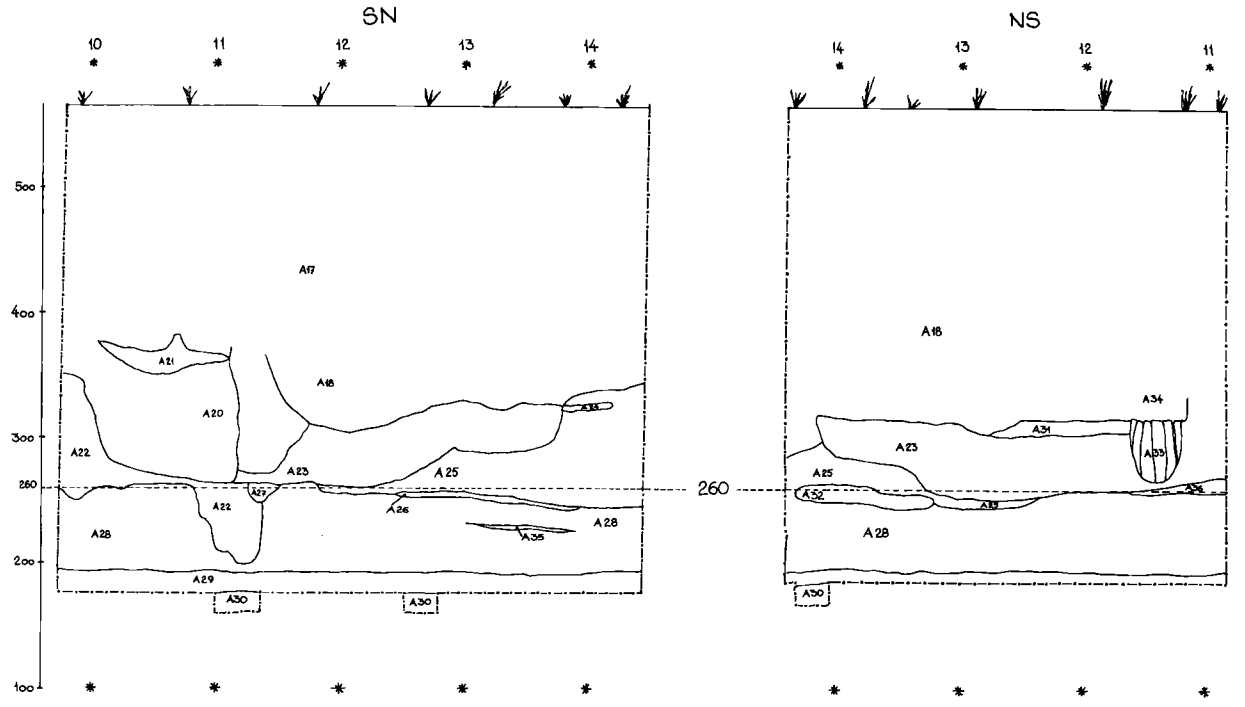


Fig. 5. The western section of the trench in Tvedgade, fig. 2, no.3. A25 is the mire-deposits of Pajpøt, lying on top of A28, which constitutes a series of layers from the 8th century. A25 has been partly removed by much later pits, but Pajpøt has hardly gone much further southwards. Drawing: Mogens Bundgaard.

out on the north bank of the river since 1979. They have been implemented partly as a result of the fruitfulness of the diggings in 1973–79, and partly in connection with the construction of new buildings.

1. While new foundations for the steps to Ribe Kunstmuseum (The Art Museum), facing Sct. Nicolaigade, were being built in April 1981, there was again an opportunity of viewing the conditions in this area (fig. 3, no. 1). As was to be expected, heavy dung layers were found, with layers of activity resembling the ones found earlier. The findings consisted mainly of sherds from earthenware pots – including imported ceramics – but also contained remnants from the fabrication of combs and glass beads.

2. A small trial excavation north of Tvedgade, in the western end of this street, executed in 1976, showed that the waste-layers from the 8th century extend to this area (*Ribe Excavations* 1970–76, vol.1, 6f). Construction work was to take place just north of this plot (fig. 2, no. 2) in 1979. A series of trial ditches proved that the patch of mire deposit called Pajpøt, which is mentioned in the Late Middle Age as lying east of Saltgade, and which has previously been shown to lie further to the north, also extended to this area. When the construction work started, it was supervised by the museum; some wells made of barrels were excavated, and a dendochronological analysis dated them to be after the year 1200 (1). The wells were not sunk through the deposits of Pajpøt, which covered them. According to this, the formation of Pajpøt cannot have taken place earlier than after 1200. The ceramics that were found in the wells confirmed the above dating (fig. 4).

3. The Pajpøt plays an important role in the understanding of the topography of the region north of Ribe Å, both from the Viking Age, the Middle Age and the present. The character and dating of Pajpøt was further investigated in April 1981, when a house at the west end of Tvedgade was demolished (fig. 3, no. 3). A trench 1.75 m wide was excavated by machine, exposing a profile stretching from the side-walk on the northern side of Tvedgade and 14 m northwards. In the southern end of this profile a layer of dung from the 8th century was to be seen, and above this a layer from the Middle Ages. In the northern end (fig. 5) a layer (A28) from the 8th

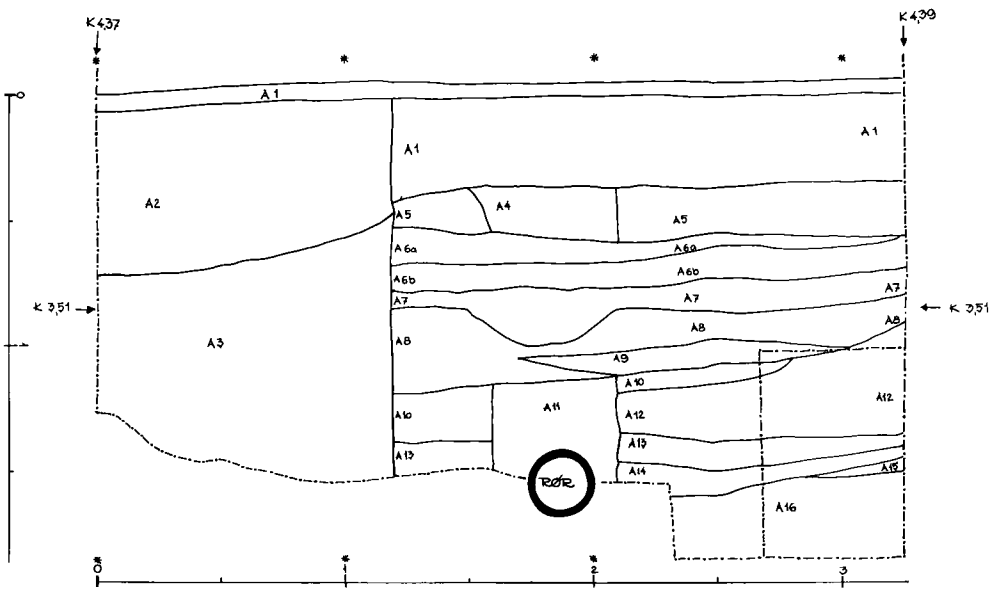


Fig. 6. The northern section of the excavation in Saltgade, fig. 2, no.8, A16 is the subsoil, A15 is bleached sand. The layers A12, A13 and A14 have been deposited during the 13th and 14th centuries. Drawing: Mogens Bundgaard.

century was likewise established above the subsoil. On top of this was a silt deposit (A25), similar to Pajpøt on the adjoining plot towards the north.

According to this excavation, the age of Pajpøt may be considered established; it is later than the 8th century activities on the site, and it has not, in agreement with the written sources (Nielsen 1979 (I): 55), reached further towards the south than the northern edge of Tvedgade. The relative dating is further confirmed by the dendrochronological dating of the wells found on the adjoining plot to the north. Finally, it must be pointed out that the profile (fig. 5) renders probable that Pajpøt was artificially made, by the removal of some topsoil, and not a natural phenomenon, as previously suggested (Nørnberg 1979: 60).

4. In the area west of Saltgade a sequence of diggings has likewise taken place, in the continued search for the Viking Age Ribe. In April 1981 an east-west running trench (fig. 3, no. 4) was dug between St. Pedersgade and the foundry (*Jernstøberiet*). This did not expose any culture-layers, but a thick layer of recently deposited soil directly on the subsoil, which fell steeply towards the east. The original layers seem to have been removed some time or other, and only a few small pits in the subsoil were left. In one of these, some Badorf-ceramics were found – dating from the 8th–9th century – similar to the finds in the layers around the Kunstmuseum (The Art Museum), (fig. 3, no. 1).

5. Two trenches (fig. 3, no. 5) were likewise dug further westwards, immediately south of the site of Sct. Peters church, which was excavated in the middle of the 19th century. Contrary to expection these disclosed neither culture-layers nor graves, but only waterlogged layers with a few scattered finds from the Middle Ages. An observation in connection with some construction work in the spring of 1982 has confirmed this – by all accounts the church was situated quite close to the river, probably on a small hillock.

6. A small trench north of the foundry buildings (fig. 3, no. 6) failed to show any culture-layers from either the Viking Age or the Middle Ages.

Thus, the many investigations in the north part of the town revealed no trace of a settlement which could be connected with the refuse-layers of the 8th century or with the Viking Age at all. The most surprising result is probably, that the excavation west of Saltgade did not disclose culture-layers from the Middle Ages, in spite of the fact that *Ribe Bys Jordebog* (The Cataster of the Town of Ribe) from the 1450'ies states that the town »had« streets – although not inhabited in that district (Nielsen ed. 1979 (II): 37f). The question is, whether the *Jordebog* should be interpreted as stating that the area was divi-

ded by streets, so enabling smaller sites to be rented, for instance when a market was held here. But if this is the case, it is difficult to imagine where the parishioners of St. Peter's church lived in the late Middle Ages.

Never-the-less, the investigations have certainly cast new light upon the dating and character of Pajpøt. We now know that its southern boundary flanked the north side of Tvedgade. It has likewise been documented, that Pajpøt was formed later than the 8th century. Barrel-wells were found below the bottom of Pajpøt, and they must have been there before Pajpøt appeared. As they are dendrochronologically dated to the beginning of the 13th century, Pajpøt cannot have come into existence earlier than this date.

The trench north of Tvedgade (fig. 5) seems to reveal that Pajpøt has been formed by human deposits in a man-made, water-filled excavation and not by sedimentations from the meandering river. The issue is then, whether the removal of soil seen west of Saltgade can have any connection with the removal of soil that led to the formation of Pajpøt. If this is so, we are dealing with an impressive and comprehensive piece of construction work.

7. Geological drillings followed up by further trenches in the autumn of 1981, show that the deposits of Pajpøt, and probably also the preceding removal of soil, extend eastwards as far as the Health Centre (*Lægehuset*) (fig. 3, no. 7). It has therefore been suggested, that this very extensive removal of soil might have a connection with the construction of the dam, built when the King's mill was established (Schiørring 1982). This will be dealt with later, but this theory explains the missing Viking Age, in that its evidence has been removed and now lies in the embankment, which carries the main street of medieval and modern Ribe (fig. 3).

8. In October 1981 there was an opportunity of following some construction work in Saltgade (fig. 3, no. 8). Nearby – just east of Saltgade – a three-foliated buckle from the 10th century had previously been found (Bencard and Wiell 1975), so the issue was, whether some layers were preserved under Saltgade, with either material from the 8th century or the Viking Age proper. The investigation showed Saltgade to be an earthen balk – a northern extension of the built up mill embankment – with the previously mentioned earth removals on either side (fig. 6). The subsoil lay at 2.92 m above sea level with podsol bleached sand as the top layer (A15). Above this followed three layers (A12–A14), which must be regarded as primary, not disturbed deposits. The finds in these layers – for instance glazed ceramics – can be dated to the 13th or perhaps the 14th century. It is noteworthy, that no traces of road construction were found in these layers. This could indicate that Saltgade did not become the main radial road out of town from Nørreport (the northern gate) before after the year 1300, and that the traffic going north followed Tvedgade instead, running south of Pajpøt, as commented upon in the above.

9.–10. The various fruitless efforts to locate the Viking settlement in the Saltgade quarter led to excavations in the eastern area of Ribe (fig. 3, no. 9–10) in August 1981. The investigation took place a little to the east of the site where a grave from the 8th century and scattered finds of the same period were discovered in 1970 (Rasmussen 1971). However, neither of these excavations brought forth findings from the Viking or Middle Ages.

11. Observations in the spring of 1982, to the north-east of this area, during work at the railroad crossing (fig. 3, no. 11), also gave negative results. The elevation of the subsoil here was c. 3.50 m. above sea level.

12. The most recent excavation north of the river in the summer 1982, took place east of the railway, north of Tangevej (fig. 3, no. 12). The elevation of the subsoil here was 3.23 m. above sea level, and there were no culture-layers from the Viking or Middle Ages.

13. The layers in the eastern part of the meadow (*Hovedengen*) in front of the dam were examined with the help of two machine-dug trenches (fig. 3, no. 13). The sections were excavated as deep as the penetrating ground water permitted, i.e. to approx. level 0.20 m. above sea level. The profile showed that the layers must have been formed in the course of a stagnation process, while salt marsh clay (Danish *klæg*) was being deposited in the area. As the lowest of these layers contained fragments of medieval bricks, the deposits cannot have been formed before about the year 1200.

Considering the above results, there is every probability that *Hovedengen* was formed after 1200, and that the area was much more waterlogged than it is at present. Whether this fact applies only to this area, or shows a general tendency, cannot as yet be ascertained. But the possibility of the marsh-formations around Ribe – or at least some of them – being as recent as indicated above, ought to be considered, when discussing the primary settlement and the later urban development (2).

Fig. 7. The earthworks of the castle of Riberhus. Photo: Hans Stiesdal 1959 (The National Museum).

THE MEDIEVAL FORTIFICATIONS

Actual fortifications usually only appear in Danish medieval towns when the town in question is of importance for the defence of the country in general. This seems to be the case in Ribe, which was strongly defended, with moats, canals and the royal castle, Riberhus. In an attempt to explain how the partially still existing system of moats and dams, including the mill-embankment, has come into existence, a series of investigations has been carried out.

14. The first of these took place in Gravsgade in 1979 (fig. 3, no. 14). A letter from 1394 mentions »the new ditch« (*fossura nova*), and from this and other sources, the position of this stream or moat can be affirmed to the south side of Gravsgade (Thorup 1833, supplement p. 3).

The excavation revealed that the ditch and its ram-

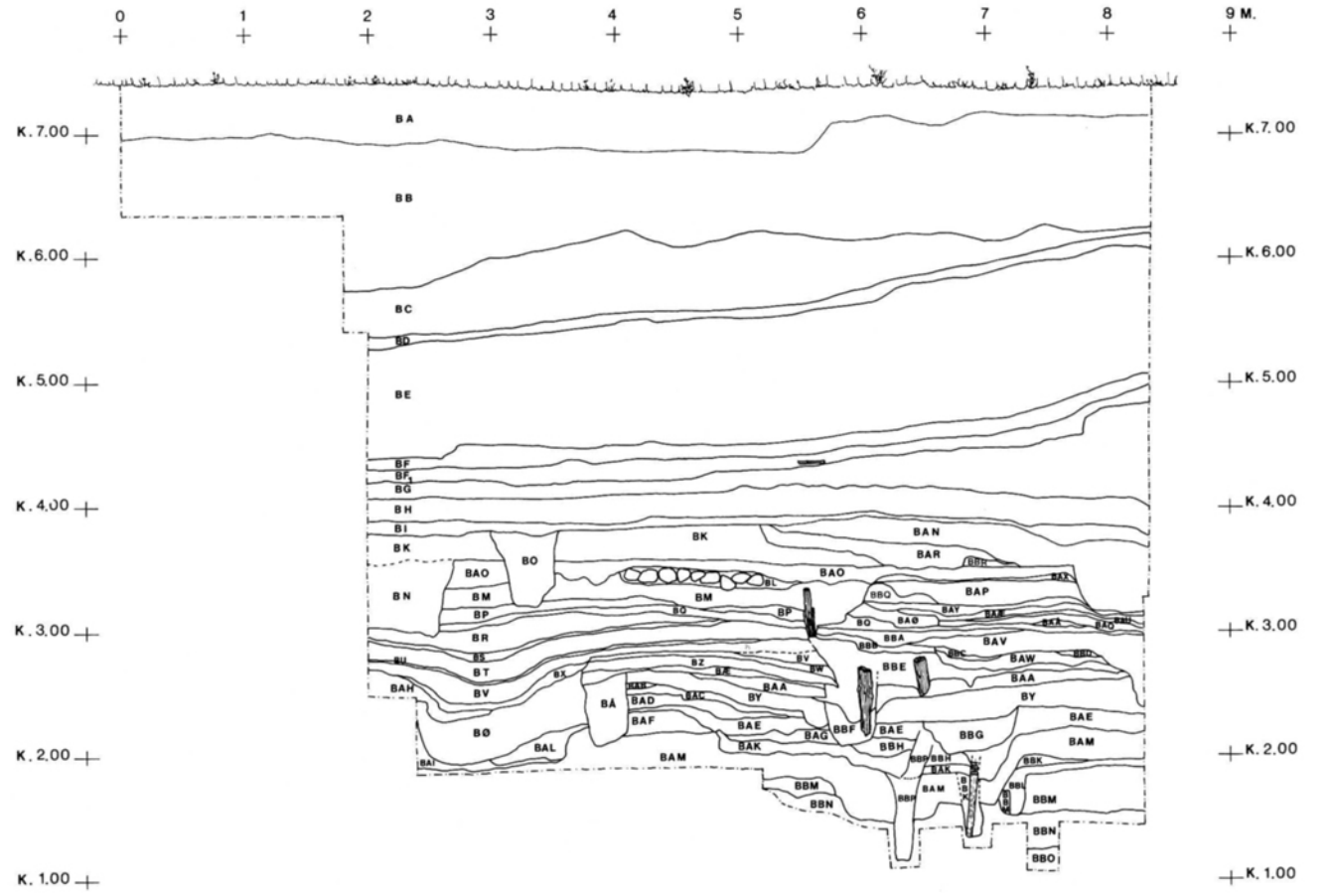


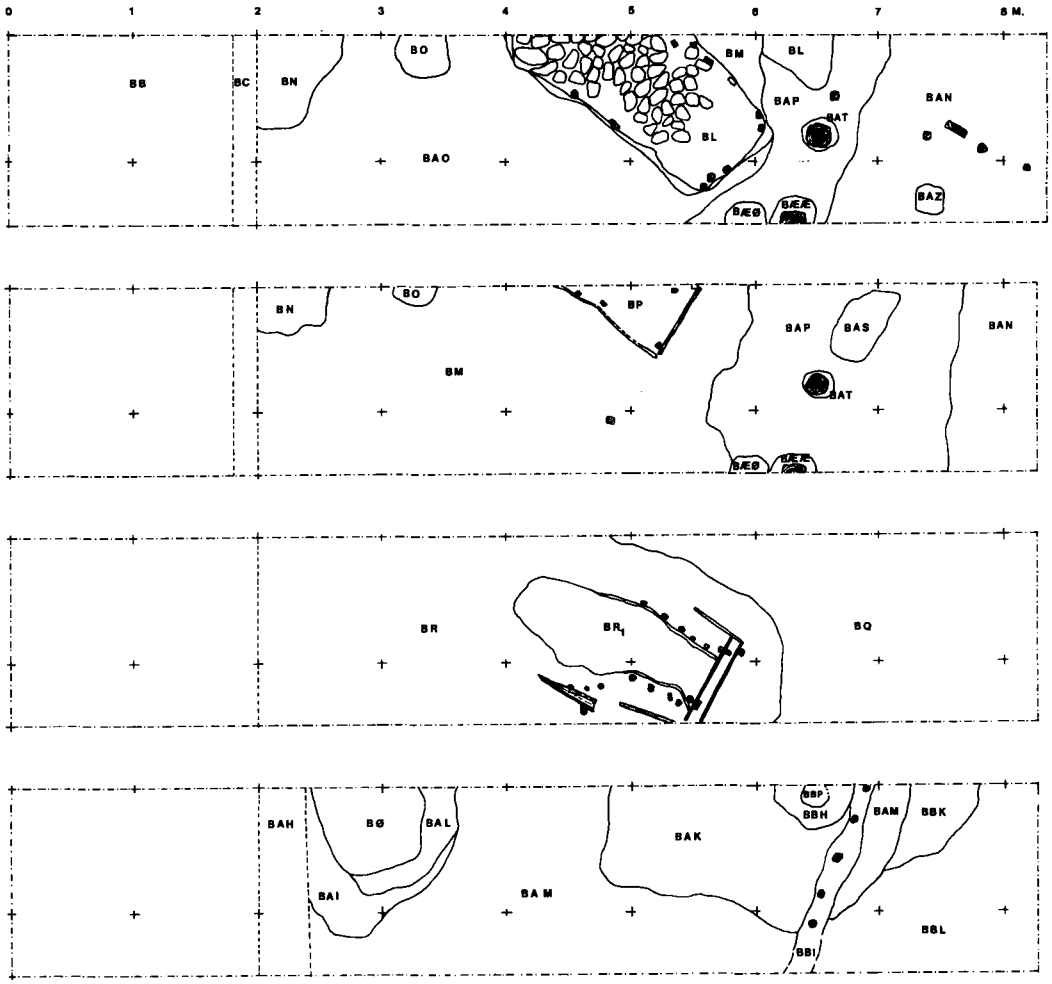
Fig. 8. The northern section of the excavation on Riberhus, fig. 2, no. 15, with plans of 4 of the layers of activity. These contained, amongst other items, traces of wooden boxes for refuse, e.g. BP and BR1. BBM and BBN are subsoil, but BAM, BBK and BBL represent earlier activities, though these lacked finds that could date the layers. Survey and drawing: Søren Gottfred Petersen, 1980.

part or dam must have been built at the earliest about 1300 (Madsen and Schiørring 1981). The dating is concluded from some sherds in two pits, found underneath the embankment. The rampart on the southern side of the ditch, that is »outside« it, which seems irrational if it was intended for defence; the reason is maybe, that the stream was also meant to serve as an overflow-channel between Ribe Å and the Stampemølle stream. This idea is supported by the fact that the bed of »the new ditch« lay at level 1.00 m. above sea level which is fairly high.

As already mentioned, this stream was called »the new ditch«, so it must have replaced or supplemented an older ditch or moat. The first to come to mind here is obviously the Stampemølle stream, the southern boundary of the town, which, like »the new ditch«, has a rampart or an embankment on its southern side.

Stampemøllestrømmen was probably constructed before the year 1224, when Sønderport (the Southern Gate) (fig. 3) is mentioned for the first time; it lay next to the stream (*Diplomatarium Danicum* 1, VI: 30; Bencard 1979; Madsen and Schiørring 1981). Stampemøllestrømmen and the *Tilløbskanal*, which leads water from the Stampemølle stream to the moats around Riberhus, must be parts of a joint plan.

15. Riberhus is first mentioned in written sources in 1320 (*Diplomatarium Danicum* 2, VII, 176). Today, only the ruins of the altered castle, made by Christian III in the 16th century, are to be seen (fig. 7). A dating of Riberhus was considered to be of vital importance for the understanding of the part that the castle and its founder (undoubtedly the King) played in the overall planning of Ribe. To establish this an investigation, lasting most of the summer in 1980 (3), was brought about through



a collaboration between Ribe Amt (the county of Ribe), the National Museum, and Den Antikvariske Samling.

The most significant results were obtained in the middle of the earthwork (fig. 3, no. 15), where the excavation went 6m. vertically down, through thick culture-layers (fig. 8). The oldest layers containing finds were from around 1200, but we cannot be certain that these were traces of the earliest activities in the castle. The layers in question did not have remnants of any buildings, but the fact that there were alternating layers of refuse and levelling of the surface, indicates that the area was intensly made use of. Here the question has not only been one of filling up a low-lying area – the layers levelling the ground show that one has moved back and forth and worked here; this is furthermore confirmed by some wooden containers used for collecting refuse in.

The excavation showed clearly, that the site on which Riberhus was founded was low-lying, even after Ribe-conditions. The subsoil sand lay around 1.9m above sea level, and it is astonishing, that the founder of the castle did not choose to place the fort elsewhere, for instance near St. Clemens church, where excavations in the bishop's garden have testified a much higher level (see below).

Maybe the purpose was to be as close to the river as possible. In this way the castle could control the trade and collect duties. Irrespective of whether Riberhus was founded around 1200 or maybe still earlier, it seems most likely that it was crucial to the defence of Ribe. The Crown had its base here, corresponding to the bishop's Cathedral; incidentally, the Romanesque, western part of the Cathedral was probably arranged

precisely for the king's use (Vellev 1981: 135; *Danmarks Kirker*, Ribe amt 3–4: 180).

Another royal construction to be included in the investigations was »Dammen« (fig. 3, nos. 16 and 17). The »Dam« is first mentioned, indirectly, in 1255, where the bishop is granted damages, as his meadows in Lustrup, south-east of Ribe, were flooded, due to the river being dammed-up for the King's Mill (*Diplomatarium Danicum* 2, I: 156). A claim such as this has certainly been raised without delay, so there is reason to believe that the King's Mill, situated where the *Toldbod* now lies (fig. 3, C), and the »Dam«, where founded shortly before 1255.

A series of drillings in the Dam and observations during the autumn of 1981, show that it was constructed on low-lying, probably marshy terrain, between 0.7m.–1.0m. above sea level. The Dam is thus a very comprehensive construction, and the earth-filling has undoubtedly been supported by wooden bulwarks. Additional filling-in, to render housing possible, has been carried out later.

An embankment of these dimensions has needed an enormous amount of earth, and this can, as mentioned in the comments on Pajpøt, have been obtained north of the river. The dating of the removal of earth in the Pajpøt area corresponds with the assumed building of the Dam.

17. An effort to solve the problem of whether the filling in the Dam contains displaced finds from the Viking Age, was attempted at in an excavation of the *Mellemdam* in October 1981 (fig. 3, no. 17). Furthermore, one hoped to find evidence that could date the founding of the Dam archæologically. However, penetrating ground-water prevented the digging from reaching the bottom of the embankment, and no layers of the Dam itself could be examined. It is therefore still an open question whether layers from the Viking Age were removed from north of the river, when material was needed to build the Dam.

The establishment of the Dam has enabled defence purposes to be co-ordinated with the purpose of regulating the level of the various water-ways, in order to work the mill. It is also conceivable, that the king has enforced his authority by compelling the people of Ribe and the vicinity to let their corn be ground in the King's Mill. Such a monopoly was granted by the king in 1175 to the monastery of St. Canute in Odense, and investigations made in Aalborg show that here, as in Ribe, a water-dependant defence-system was combined with milling-plants (*Diplomatarium Danicum* 1, III:49; Møller Knudsen 1980: 10f). The stemming-up of water behind the Dam must have flooded the riverbanks, and, as previously stated, »the new ditch« was probably constructed to remedy this.

18. An excavation in the summer of 1982 near the east wing of St. Katharinæ Monastery (fig. 3, no. 18), showed that the base of the earliest building-phase on this spot was around 2.60m. above sea level. The monastery was founded 1228 at the latest, presumably before the Dam was built (Madsen and Schiørring 1981), and the oldest, still standing parts of the eastern wing are dated to the second quarter of the 13th century. The excavation revealed that the ground outside this wall had been heightened by a 40cm. thick layer of clay – which leads us to consider the possibility of this being done to counteract problems due to the water level of the river rising.

THE WEST-TOWN

This heading implies the region west of Korsbrødregade-Sviegade (fig. 1). Towards the south-west, west and north-west it is bordered by fortifications, including Riberhus. Several of the medieval ecclesiastical institutions were within this area: the parish church of St. Clemens, the monasteries of the Franciscans and of the order of St. John of Jerusalem, and The Hospital of The Holy Spirit, which lay in a street that used to go from *Horstorv* (i.e. Horse-market) near Sønderport to Riberhus. St. Clemens is mentioned already in 1145; the Franciscan monastery, from 1232, was situated near Horstorv, where it could benefit by some income from the traffic and trade. The same applies to the Monastery of St. John of Jerusalem, which lay where the present bishop's residence now lies, and even moreso to The Hospital of The Holy Spirit, both of them facing onto the road that lead to Riberhus, which must have been very lively and busy (*Diplomatarium Danicum* 2, II: 87; Nielsen 1981: 17ff).

Apart from St. Clemens, these ecclesiastical institutions did not appear before the first part of the 13th century, or later. Horstorv is first mentioned, together with Sønderport, in 1224 (*Diplomatarium Danicum* 1, VI: 30), but the market place, and dealings with horses, can have existed before the ecclesiastical institutions

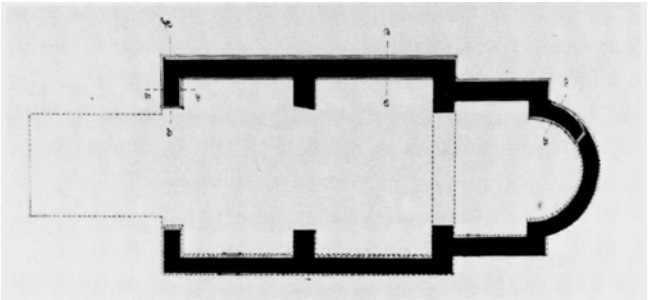


Fig. 9. Excavation-plan of the parish church of St. Clemens (above), and floor of re-used tufa-blocks, probably from the church excavated in the Bishop's garden, fig. 3, no. 19 (to the right). Only the northern part of the church-foundations was excavated. After Termansen 1905 and photo by Per Kristian Madsen, 1980.

turned up, and given the urban life a background of a different nature than the clergy. In any case, the placing of a parish church here implies the existance of, or the expectation of, a population of a certain size.

19. In the above, the excavation at Riberhus is commented upon. Simultaneously, an excavation was performed in the garden of *Korsbrødregård*, the present bishop's residence (fig. 3, no. 19). The excavation was placed north of the site of St. Clemens, known to us from excavations in 1902 (fig. 9), and far from existing streets, in order to avoid as many recent disturbances of the layers as possible. Traces of brick-built houses were found, and also, in the southern end of the field, the corner of a timber-framed house, the floor of which had been relaid four times. Coin findings date this series of layers to be from about 1250–1400 (4).

The lowest activities, underneath this series of layers, were characterized by deep pits. The original level of the subsoil has been at least 3.40m. above sea level, which is remarkably high, according to Ribe standards.

These results indicate that a radical change in the use of the area has taken place no later than approx. 1250. Several of the finds point at an activity on the site before the time of the preserved layers; one is tempted to assume that the alterations were in some way connected with the clergy's taking over the area. If this was the case, it must almost have required the participation of either the town as such, or rather maybe of the king himself, who must in any case have played an important role, especially in the West-town, just outside the castle. In this connection it is worth noting that the founding of the St. Clemens churches is perhaps mostly due to the king (Cinthio 1968: 107).

20. To gain more knowledge of the West-town, quite a small hole was dug in a garden on the corner of Kongensgade and Albert Skeelsgade (fig. 3, no. 20); this was in the late summer, 1981. The site was only 50 m. from the town's western moat, *Tilløbskanalen*, and disclosed a culture-layer more than one meter thick, from approx. 1250–1350 (Madsen 1982).

Both in this layer, in filled-in pits above this, and in the more recent layers which covered these, there was a pronounced occurence of older ceramics, namely sherds of grey-fired globular pots. Presumably, this pottery has come from disordered layers that were formed in the 12th century, but it is still too early for us to really draw conclusions regarding these finds. There is reason to believe that further research in the West-town would give valuable results, particularly concerning how this part of the town was made use of before the church started to dominate it (5).

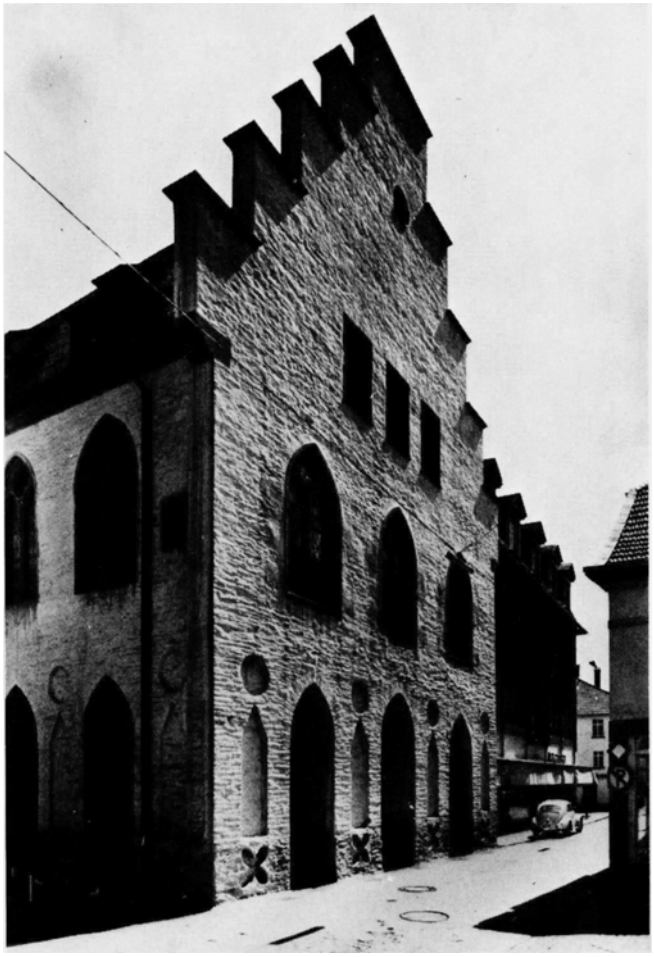


Fig. 10. The Town Hall in the German town Attendorn, from the middle of the 14th century. After Meckseper 1982.

THE AREA AROUND THE CATHEDRAL

21. One often hears postulated that the Cathedral (fig. 2) is situated on what was originally the highest point in the town, and that the reason why it now lies so relatively deep down, is because refuse has accumulated around it. The latter is correct, but there are some facts that point at the area north-west of the Cathedral having been higher than the actual site of the church, although it seems to be part of the self-same sandbank or inland dune. The level of the subsoil in the garden of the bishop's residence was min. 3.40m., and a digging (fig. 3,21) north-west of the Cathedral showed that the subsoil here was 3.90m. above sea level.

Surprisingly, there were hardly any culture-layers to be seen here. One would think there had been an intense activity so close to the Cathedral, at least from the period when the present church was commenced upon in 1150–1175 (*Danmarks Kirker*, Ribe amt 3–4: 160). The lack of findings can be due to the removal of some soil, maybe when earth was needed to fill up the river, to form the *Slippe*-area in the 15th century (cf. Bencard 1977: 61f). However, in another part of the town, namely the Cathedral-school quarter, it has been demonstrated how the inner part of a block was not built up, but was presumably used as a garden most of the Middle Ages (Madsen 1978: 27). This can also have been the case in this investigation.

22. Another, later, alteration in the urban picture was shown by a minor excavation underneath Hotel Dagmar (fig. 3, no. 22). The results correspond with observations from the plot directly east of this site, which was investigated in the mid-1960'ies. They suggest that the area south of *Overdammen* was a market place until the middle of the 15th century. Written sources name buildings on this site in the middle of the 1450'ies, so the market must have been closed down by then, only to reappear to a certain degree in the second half of the 16th century, when the present *Torv* was laid out (Nielsen 1981: 24f and 27).

23. North of the medieval market place, in *Tingslippen* (fig. 3, no. 23), during drain-work in the autumn 1981, parts of a medieval street appeared. On the west side of the alley-way two heavy pillars, laid with the big bricks characteristic of the Middle Ages, were disclosed; they were presumably part of a construction supporting a brick-built house, maybe a wall dealt up in arches, forming an arcade, as seen elsewhere (fig. 10) (Meckseper 1982: T68).

About 2m. down, roughly in the middle of the alley, a gutter made of wood was found, and also some wooden paving, consisting of a very stout oak plank, laid down flat. Marks from fire and chopping show that this was a piece of reused wood, maybe a plank from a stave-built house. When sewers were being established in Ribe, in the 1880'ies, several such pavings were found (Kiær 1888). Up till now, the age of these wooden pavings has not been known, but a dendrochronological examination of the plank from Tingslippen was able to date the year that this piece of timber was felled to precisely 1233 (6).

It was presumably not laid down before the last half of the 13th century. We do not know if the other pavings of such wooden planks are from the same period, but it

seems quite plausible that one, during the 13th century, when Ribe Town Council and Town Law manifested itself (*Ribe Stadsret*, the Town Law of Ribe, was given 1269), started to bring such things as paving in order.

CONCLUSION

The continuing urban-topographical investigations in Ribe will be based partly on some of the same questions as mentioned above, and partly on an entirely new set of problems. The question of where the settlements from the 8th century and the Viking Age were situated is still not answered. The possibilities inside the medieval town seem nearly exhausted. Evidently, it would be desirable to carry out more investigations in the areas east of Pajpøt and east of Nicolaigade. Maybe, with the help of special drilling equipment, it will be possible for us to examine the earth in the Dam, and see whether there are Viking Age findings here, in order to verify the theory of the destruction of the Viking Age settlement north of the river.

It would also be of great significance to locate graves from the 8th century and onwards. An examination of these would probably be able to cast light on whether the population of the earliest Ribe was settled, or maybe came in to the town in seasonal fluctuations.

It is important, in the continued search for the Viking and Early Middle Age town, to collect data about the original terrain, in particular about the marshlands. Such investigations have, as already mentioned, been commenced.

As far as the Middle Ages are concerned, Ribe is the most intensly investigated town in present Denmark, seen from an archaeological point of view. There are, however, still considerable tasks left to carry on with.

Concerning the High Medieval town, a number of the main topographic problems seem to be nearly solved. Because of this, and because we have quite a number of facts on this, also from written sources, it is now possible to go thoroughly into the individual districts of the town, and to compare them. It should not be taken for granted that changes in the overall topography will influence or alter all areas of the town to the same extent. In the coming years, the collected results must be gone over thoroughly, particularly the archaeological findings, which are of vital importance in the search for the Ribe of the Early Middle Age. These findings can also tell us about social and economic conditions in the urban community.

The increased insight into the general topographic outlay of Ribe in the High Middle Age, impells us to go into »cause and effect«, to seek out which factors cause the changes to occur. In the above, the Crown has been pointed out as being the most likely incentive, at least as far as we can judge up till now. But we might have underrated other instances, e.g. the church, or, with regard to the Late Middle Age, the town itself. In making these assumptions, we might even have neglected to take some influential elements from outside the country into consideration.

In all circumstances, we must remember that one cannot just draw comparisons between the 8th century Ribe, the still unknown Ribe of the Viking Age, and the Middle Ages. The urban communities of the various periods had entirely different possibilities and demands on their functions. In the course of time, the authority of the Crown and the municipal administration also underwent changes.

It is still almost impossible to find an archaeological common denominator for the concept: a town, if it is to be valid for such a long spell of time, as the more than 1000 years it has taken for Ribe to develop.

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NOTES

This article is an extended version of Jensen, Madsen and Schiørring 1982.

[1] The analysis was performed by Skalk's dendrochronological laboratory.

[2] Scientific investigations of the age and development of the marshlands have currently been started, in connection with a project that is examing the history of settlements in the Ribe area from the Stone Age to the present day. This is being carried out with the support of the Danish Research Council for the Humanities and under the direction of Stig Jensen.

[3] The excavation was conducted by Hans Stiesdal on behalf of The National Museum, and the daily management was attended to by architect Søren Gottfred Petersen.

[4] Identification by Kirsten Bendixen, The Royal Collection of Coins and Medals, The National Museum.

[5] A new excavation campaign is to be started in the spring, 1983, with the support of Queen Margrethe II's Archaeological Fund, in the western part of Ribe.

[6] The analysis was performed by Skalk's dendrochronological laboratory.

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A French Connection:

Danish Funerary Pots – a Group of Medieval Pottery

by PER KRISTIAN MADSEN

This article discusses a small number of medieval Danish graves which, unlike the common medieval burial, contain one or several funerary pots (Madsen 1977; 1980 (I); 1980 (II); 1981) (1). One of the best examples of this type of grave was found in Roskilde Cathedral in 1823 by workmen who were breaking up the floor at the entrance to a new royal chapel (*Antiqvariske Annaler* 1827: 400 f.; *Danmarks Kirker, Københavns Amt* 4: 1969). The discovery was immediately reported to the Antiquities Commission (*Oldsagskommissionen*) in Copenhagen, who subsequently received all the finds, together with a set of very precise measurements of the grave itself (fig. 1).

The grave was constructed of great bricks and mortar and was of oblong trapezoid form, with a niche to accomodate the head. The roof of the grave was made of specially cut bricks, resting on a rebate on the upper edges of the long sides. This type of trapezoid or body-shaped grave, which before the introduction of brick had been made of stone, was relatively common in Denmark in the Middle Ages and is also to be found throughout the greater part of western Europe. In Denmark the trapezoid grave seems to have been used mainly amongst the upper classes and the grave-type appears to go out of use during the last quarter of the 13th century (Worsaae and Herbst 1858; Gay 1931; *KLNM* 5: 438ff.).

The Roskilde grave contained the undisturbed remains of a high-ranking prelate, who was buried in accordance with his ecclesiastical privileges, dressed in his vestments and accompanied by a chalice and paten (Ruland 1901: 172f.; Friedberg 1879, 1: col. 720–732; Mackeprang 1906: 80; Kornerup 1873: 262f.). A more unusual feature was, however, the presence of four clay pots, which were placed in small niches on each side of the body and at both ends of the grave. The pots contained charcoal and some earth from the grave-fill and were very well preserved.

The Commission's published report of this find (*Antiqvariske Annaler* 1827: 400f.) states that other medieval

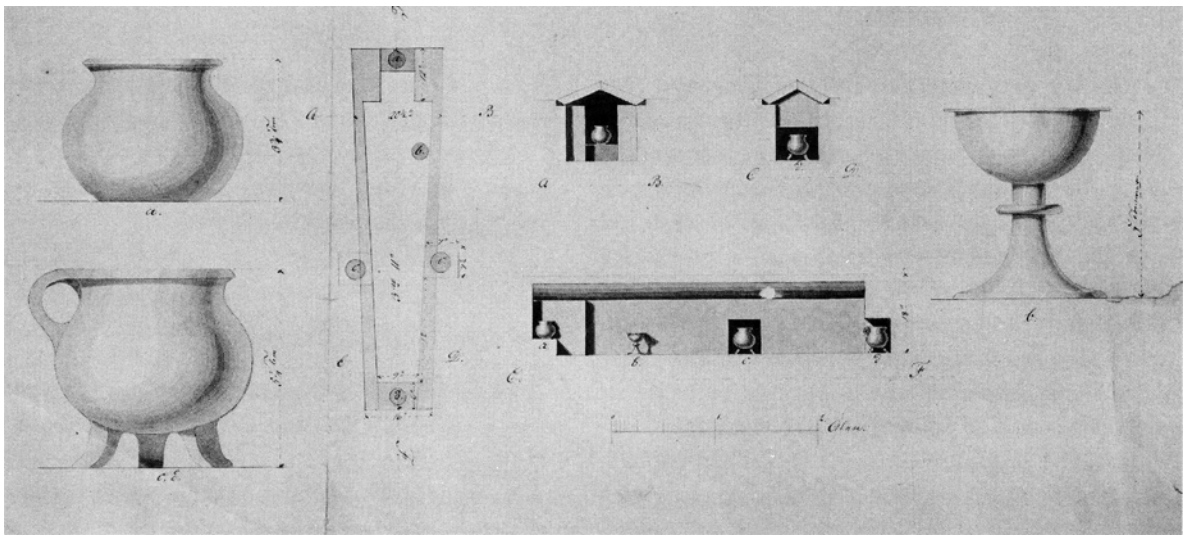


Fig. 1. Plan of the brick-built grave with funerary pots found in 1823 in Roskilde Cathedral. National Museum Copenhagen, 2nd Dept. Photo: National Museum.

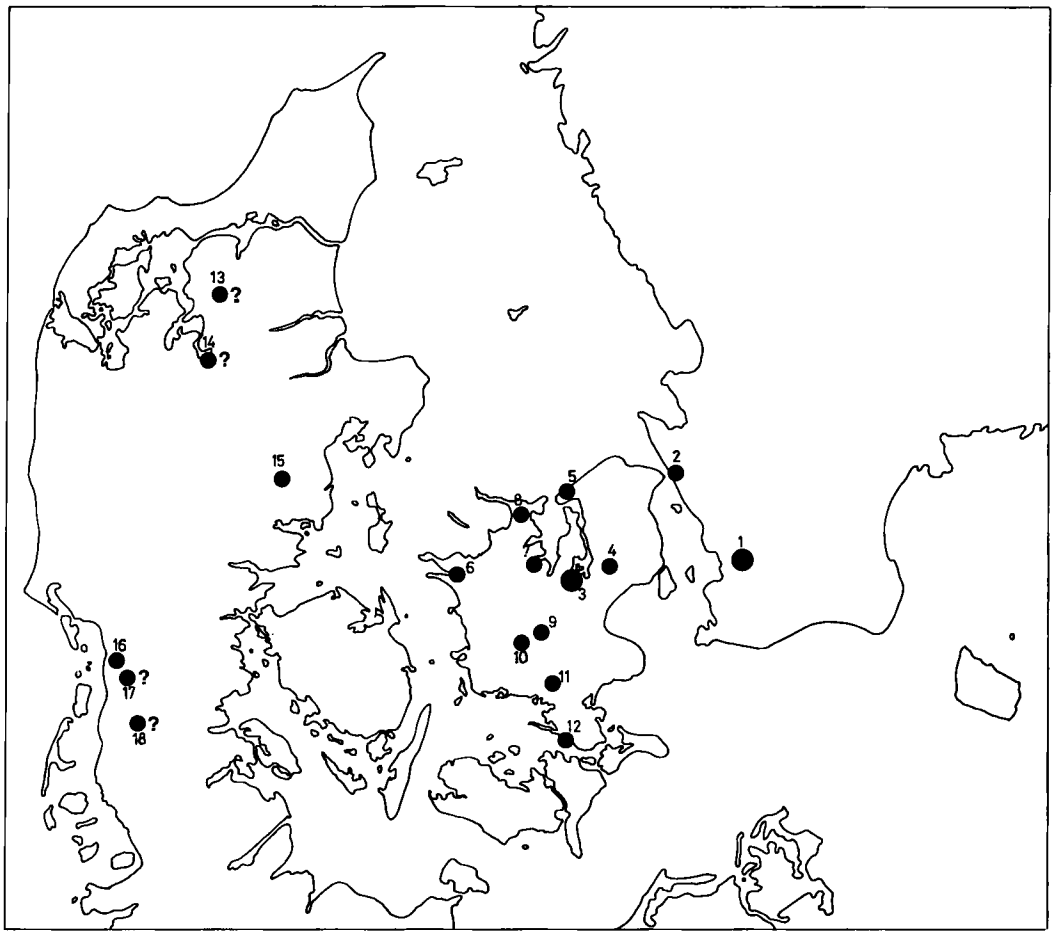


Fig. 2. Distribution of medieval Danish graves with funerary pots. ? denotes presumed finds, 1: Lund. 2: Helsingborg. 3: Roskilde. 4: Smørum. 5: Melby. 6: Kalundborg. 7: Labæk. 8: Asnæs. 9: Ringsted. 10: Vester Broby. 11: Næstved. 12: Vordingborg. 13: Gislum. 14: Navntoft. 15: Øm. 16: Ribe. 17: Løgum. 18: Roager. Drawing: Jens Kirkeby.

graves with clay pots were known from Ribe and also from Lund, which in the Middle Ages was the residence of the Archbishop of Denmark. None of these finds survive today. The present known material consists of *c.* 75 graves with *c.* 200 pots of different types. The latest find was made in 1978 during excavations in St Peter's churchyard in Helsingborg (Wihlborg 1979). A number of finds and funerary pots are known only from find-reports or other documentary evidence, but 144 funerary pots survive and are kept in various collections. The greater number are in the National Museum in Copenhagen and in Kulturen in Lund and these two collections together constitute the largest coherent group of complete or almost complete medieval Danish pottery. All the finds were surveyed in 1978 (Madsen 1978), when the material was discussed with reference to the European background for the burial custom and with particular concentration on the pottery itself. This article presents the more important results of that survey. It must be noted that the term »funerary pot« here corresponds to the Danish *gravpotte*.

DISTRIBUTION OF THE FINDS

All known finds are marked on fig. 2. The map shows the area which was under Danish rule until 1658, including Skåne, Halland and Blekinge, now parts of Sweden. Very few finds have been made in Jutland and the distribution map gives the immediate impression that the use of funerary pots was predominantly an east Danish phenomenon, especially common in Sjælland

parish churches		cathedrals		monasteries		Total
20	13	13	12	7	24	89

Table I. Finds of funerary pots as distributed among the three types of ecclesiastical institution from which they are known: parish churches, cathedrals and monasteries. The first figure in each column represents finds inside the church, the second finds in the churchyard. The number of finds exceeds the number of registered graves.

(Zealand) and concentrated in Roskilde and Lund, the two most important towns in eastern Denmark. Naturally, the map only shows the known finds and the great number of pots found in Lund and Roskilde may simply be the result of the intensive archaeological research to which the many churches in the two towns have been subjected. It must be borne in mind that only a few churches have been excavated on Fyn and that the island has not yet been included in the inventory in *Danmarks Kirker*. Parts of Jutland are, however, covered by the inventory and it should be noted that there are only two possible finds in the part of South Jutland which is now Danish. On the other hand, if one views the distribution of finds in the light of the reasons that lay behind the use of funerary pots (*cf.* below) it is very likely that their known distribution may yet be of significance and that the finds from Ribe Cathedral also fit into the pattern.

Graves with funerary pots are known from nearly every form of ecclesiastical institution, in town as well as country (Table I). In Lund they were found in all parts of the town, although most occur in burials at the two major foundations, the cathedral and the Dominican monastery. The monastery was founded in 1223 at the latest, as the first of that order in Denmark, (*SRD* V: 501) and almost 20% of all known Danish funerary pots come from graves in its churchyard, immediately east of the monastery church chancel (fig. 3), where they were excavated by G.J. Karlin in 1906 (Blomqvist 1944). Virtually the same pattern can be seen in Roskilde, where we know of 8 graves with a total of 21 pots in the churchyard to the north of the cathedral (fig. 4). Altogether, these two towns have mustered 57 graves and 111 funerary pots: about 75% of all the graves with funerary pots and 82% of all surviving funerary pots.

In only one, or perhaps two cases is it possible to make a comparison between the total number of graves in a cemetery and the number of graves that contained

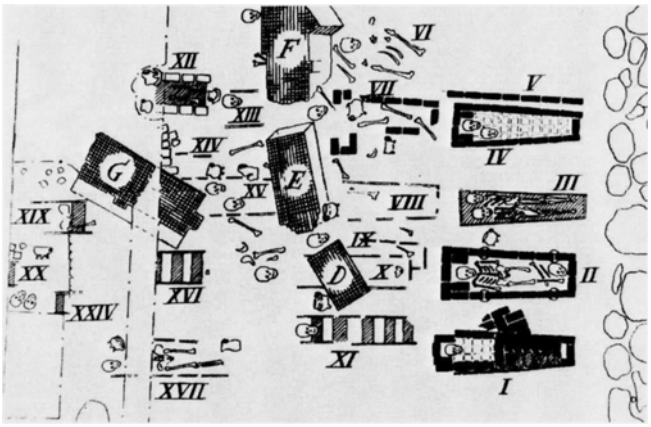


Fig. 3. Part of plan of excavations at the churchyard east of the Dominican monastery in Lund. From: Blomqvist 1944.

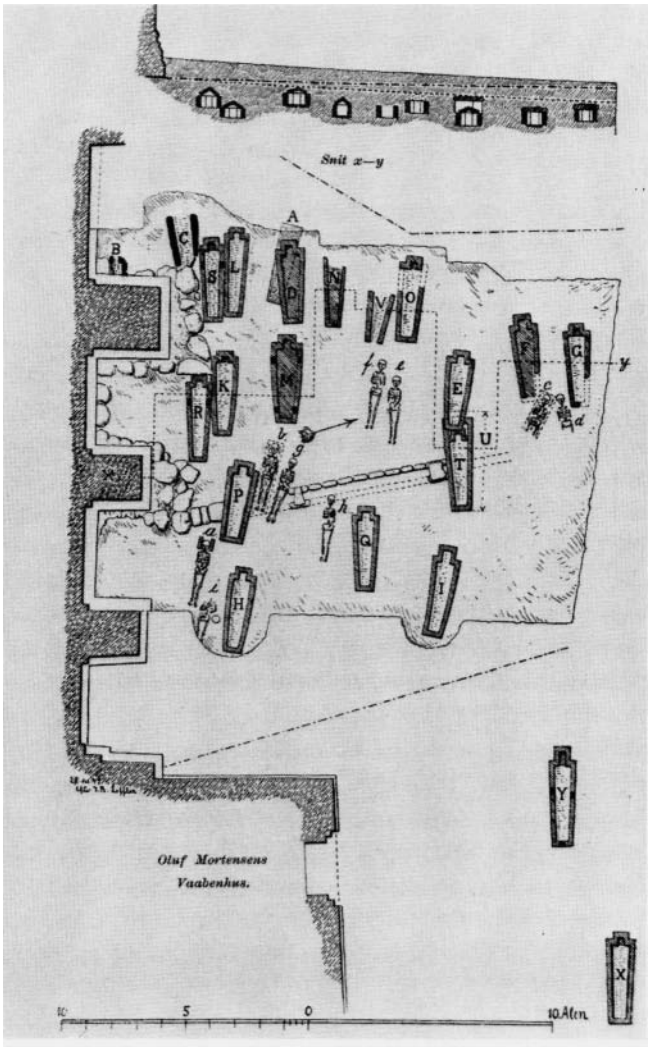


Fig. 4. Plan of excavations at the churchyard north of the northern transept of Roskilde Cathedral. From: Løffler 1897.

Fig. 5. Metal censer containing charcoal, found in a child's grave in Smørum churchyard. Height: 10.5 cm. National Museum Copenhagen, 2nd Dept., mus. no. 19939. Photo: National Museum.

funerary pots. St Stephen's Church and churchyard in Lund, which were completely excavated in 1977–78, contained the burials of more than 3200 individuals, which must be taken to be the minimum number of people buried there during the Middle Ages (Persson and Persson 1980: 151f.). Funerary pots were found in only four of the graves and these were all situated inside the church, where only 34 burials were made during the entire period of its active use (Mårtensson 1980: 100ff.). Being buried with funerary pots seems to have been a prerogative of the select and this impression is strengthened by the results of excavations in the churchyard at St Peter's parish church in Helsingborg, where only one of the 1447 excavated graves was found to contain funerary pots (Wihlborg 1979). Finally, among the *c.* 900 graves in the church and churchyard at the Cistercian monastery in Øm in Jutland (fig. 2) only one contained funerary pots, namely the grave of a bishop found in the chancel in front of the alter (Madsen 1977; Olsen 1979).

The distribution of the finds thus indicates that we are dealing with a predominantly eastern Danish practice and demonstrates that the use of funerary pots was

29	4	5	13	Total 51

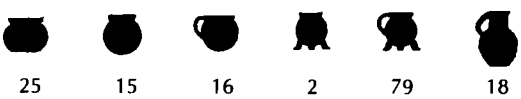
Table II. Graves with funerary pots where the grave-type is known.

only practiced by a limited number of people. It is, however, possible that sources other than the archaeological finds may throw some further light on the subject.

GRAVE-TYPES

Table II shows the graves with funerary pots where the grave-type is known, compared with the grave-types in common use in Denmark in the Middle Ages. It can be seen that funerary pots occur in all types of grave. The comparatively large number of brick graves, and in one case a stone grave, in all *c.* 45, which have been found to contain funerary pots, may attest that the custom of using such pots was associated with the higher social classes – even though we must take into account that brick-built graves were overrepresented in earlier investigations of medieval graves, when insufficient attention was given to traces of wooden coffins or uncoffined burials. On the other hand, we may safely assume that wooden coffins were also used for upper class burials. Wooden coffins, as well as coffins of lead plates, occur in the brick graves and a wooden coffin or bier may also have had some decorative function in the funeral procession and during the funeral mass.

There seems to have been no general rule that governed either the position or the number of funerary pots in a grave. They were usually placed close to the body and only in the bishop's grave in Øm and in three or four of the graves in Lund do we know that the pots were placed outside the brick grave (Madsen 1977: 149). In 27 of the brick graves there were niches made specially for the pots, as in the example from Roskilde Cathedral (fig. 1). Here the funerary pots were obviously intended to remain inside the grave and they must have been placed there during the burial ceremony at the latest.



25	15	16	2	79	18	total 144

Table III. The 144 surviving funerary pots can be divided into six types as shown. Drawing: Jens Kirkeby.

Fig. 6. Four glazed jugs, presumably used as funerary pots in Ribe Cathedral. The height of the jug to the left is 13.5 cm. National Museum Copenhagen, 2nd Dept., mus. no. D 7901 and D 7902. Photo: Preben Dehlholm.

THE FUNERARY POTS

The known Danish funerary pots are, with one single exception, made of clay. The exception is a metal censer (fig. 5) from a child's grave in the churchyard at Smørum on Sjælland (fig. 2). Like the other funerary pots, whose contents are known, this contained charcoal.

The 144 surviving pottery vessels can be divided into six types on the basis of their shape (Table III): flat base pots, globular pots, globular pots with handle, globular pots with three feet, globular pots with handle and three feet, and jugs. Apparently, fairly small vessels were preferred for use as funerary pots, especially globular pots of various types, no doubt partly because of the confined space in the grave. That this was so is confirmed by the fact that on several pots the feet had been broken off to make them fit into the niches in the brick graves. Although the finds include both glazed and unglazed pottery, as well as a few examples of imported stoneware, the group as a whole does not represent the entire range of pottery types from the period during which funerary pots were used. It seems unlikely that pots were made specially for the purpose, as far too many similar pots have been found in purely secular contexts (Madsen 1978: 3ff.; Liebgott 1979). On the other hand, a closer inspection of the funerary pots reveals that several had suffered greater or lesser damage during manufacture and they must thus be seen as second-rate goods. This is the case with four glazed jugs from Ribe Cathedral (fig. 6) (Madsen 1980 (I) and (II)), a couple of pots from Lund (Wahlöö 1976: no. 167) and a flat base pot from Roskilde which had split from top to bottom during firing (fig. 7).

It has been assumed that it would be possible to classify the graves with funerary pots in a typological and datable sequence on the basis of the grave-types, so as to establish an instructive series of well dated and well preserved pottery (Madsen 1977 with references). On examination of the material this has, however, not proved possible; at least not at the present stage of research. In several cases we have to date the graves by the pots rather than vice versa. But the funerary pots are still important to the study of medieval pottery in Denmark, particularly of local groups. The development and the dating of the pottery must, however, still be established on the basis of well documented stratigraphical contexts (Madsen 1982).

The jugs from Ribe (fig. 6) belong to a local group of jugs which probably cannot be dated any earlier than *c.*

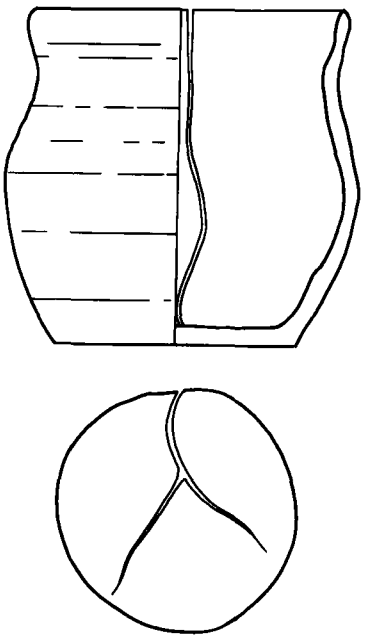


Fig. 7. Funerary pot from Roskilde, Our Lady's churchyard. During firing the pot has split from top to bottom. 1: Roskilde Museum, mus. no. RM 31–33. Measurement: Per Kristian Madsen. Drawing: Jens Kirkeby.

1300 (Bencard 1979; Madsen 1980 (I)). Similarly, the jugs used as funerary pots in the Dominican monastery in Lund belong to a group which has been demonstrated to be particular to that locality (Mårtensson 1973). The very characteristic tripod globular pots, which were found with the jugs, may also be thought to be local products. Sherds from jugs, which correspond to those found in the Lund graves, have turned up in other places, for example in Oslo, where they have been dated by stratigraphy to the beginning of the 14th century (Molaug 1977: 99; Molaug 1979: 42). The Oslo finds demonstrate that funerary pots were not made specifically for the purpose, but that everyday pottery was used.

The same applies to the finds from Roskilde, and in this material it is furthermore possible to detect some workshop connections. Pots of the type shown in fig. 7, which have a flat base and characteristic surface smoothing and bear some resemblance to the so-called Baltic pottery, also occur in finds from the town (Liebgott 1979). A pot of this type was found in a brick grave together with two handled globular pots, one of which had been splashed with glaze. These globular pots correspond to wasters found in a workshop at Farum Lillevang in North Sjælland – the marks made to attach the handles on these pots are identical to those made on the pots from Roskilde (fig. 9).

The grave was found in the churchyard north of Roskilde Cathedral (fig. 4, M) (Løffler 1897: 233ff.; *Danmarks Kirker, Københavns Amt* 3, 1951: 1320ff.). Some of the other graves in this cemetary, one with funerary pots (fig. 4, Y), were situated above the foundations of the projecting northern transept, which was never completed. These foundations were probably laid at the end of the 12th century and the plans for the building were changed in *c.* 1220 (*cf.* Héliot 1964). The *terminus post quem* for the graves is thus around 1200 or rather 1220. As mentioned above, the trapezoid grave went out of use during the third quarter of the 13th century at the latest.

As regards Farum Lillevang, this means that at least some of the products from the workshop there must be dated to that period. As traces of glazing occur on one of the pots which have been thought to come from Farum, it is, moreover, possible that glazed jugs were produced at Farum Lillevang already before 1250. The Farum finds comprise a large number of jugsherds and it must be noted that the floor of just that Roskilde grave which contained the presumed Farum pots (fig. 4, M) was made of re-used glazed tiles.

At the same time as Farum Lillevang, another workshop in or near Roskilde was producing pots such as those shown in fig. 9 (Liebgott 1979 and 1982). Two of these pots come from a woman's grave in the churchyard north of the cathedral (fig. 4) and bear identical marks stamped on the base before firing (fig. 10). Sherds from pots of this type have been found at Jernløsegaard and these are dated to the first half of the 13th century. Niels-Knud Liebgott (1982: 153ff.) has pointed out that this group of relatively low-fired, unglazed pottery must probably be seen as a connecting link between older, mainly Baltic, traditions and the new influence from the West.

Bishop Peder of Århus (Øm Monastery, fig. 2, 15) . .	died 1246
King Christoffer I (Ribe Cathedral, fig. 2, 16)	died 1259
Queen Agnes (Ringsted, St Bendt's Church, fig. 2,9) .	died 1304
Queen Ingeborg (Ringsted, St Bendt's Church, fig. 2,9)	died 1319
Archbishop Karl (Lund Cathedral, fig. 2,1)	died 1334
Archbishop Magnus (Lund Cathedral, fig. 2,1)	died 1390

Table IV. Danish graves with funerary pots dated by the known identity of the deceased.

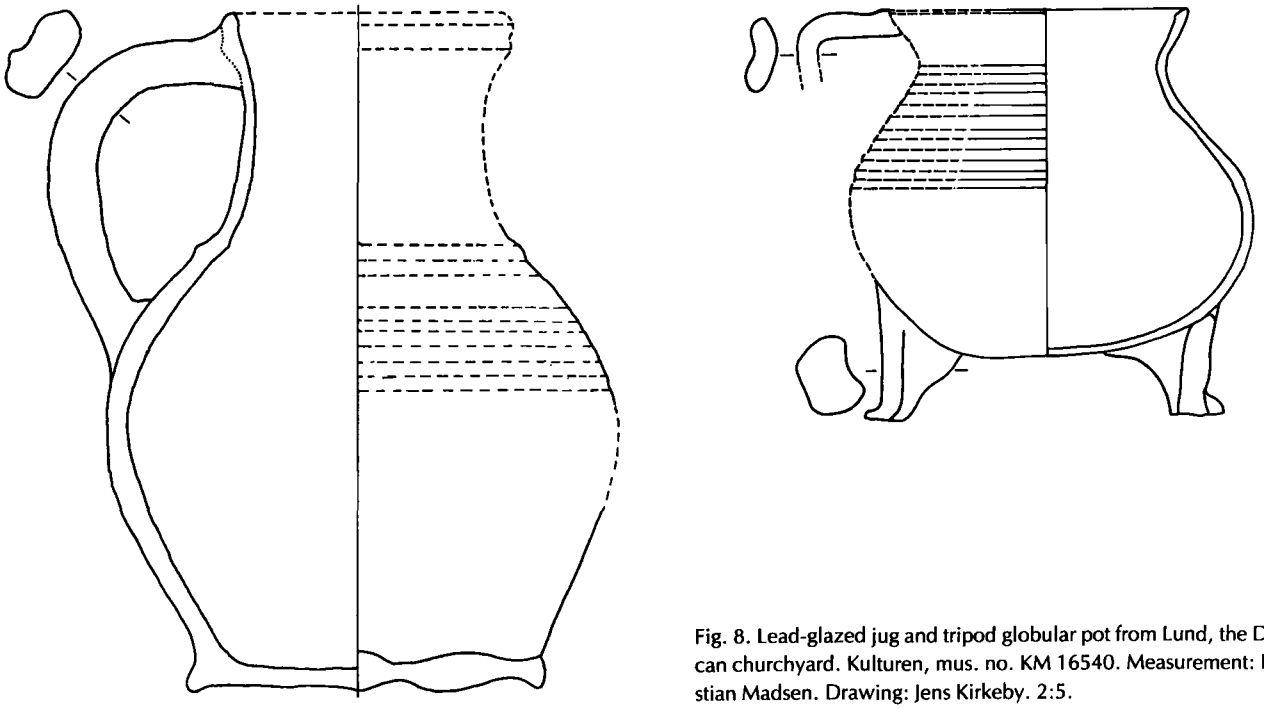


Fig. 8. Lead-glazed jug and tripod globular pot from Lund, the Dominican churchyard. Kulturen, mus. no. KM 16540. Measurement: Per Kristian Madsen. Drawing: Jens Kirkeby. 2:5.

DATING

The dating of medieval grave-types, be it relative or absolute, is a very difficult matter. As mentioned in the introduction, the trapezoid grave with head-niche seems to discontinue in the third quarter of the 13th century and this provides a basis for dating part of the material.

Six of the graves, or at least the interments, can be dated precisely, as we know the identities of the deceased (Table IV) (Madsen 1977 and 1980 (II) with references). It would, however, be too optimistic to assume that just those graves represent the development of the burial custom in the period they cover. King Christoffer II was presumably buried in a re-used sarcophagus of sandstone, for example, and the graves dated by identified persons do not help us either, when it comes to dating those graves about which we only know that they contained a wooden coffin, were uncoffined burials, or simply that one or more pots with charcoal were excavated with a skeleton. In most cases we do not even know the position of the skeleton in the grave.

In one of the graves with funerary pots in St Stephen's Church in Lund a coin was placed in the mortar between the bricks. This was minted in Lund for Erik Plovpenning, who ruled 1241–1250, but it only gives us a *terminus post quem* for the dating of the grave, as its circulation period cannot be determined (Mårtensson 1980: 103f.; Jensen 1980: 148). As mentioned above, it may be presumed that the graves in the churchyard north of Roskilde Cathedral (fig. 4) date from between *c.* 1200/1220 and the third quarter of the 13th century. The graves in the Dominican churchyard in Lund cannot be from before 1223 and one's immediate impression is that they are contemporary with the graves in the cemetary at Roskilde Cathedral. If it were not for the graves from Ringsted (1304 and 1319) and especially those from Lund (1334 and 1390), which are dated by known persons, we would probably not have hesitated in dating the greater part of the material to the 13th century. That this period is too limited is emphasized by several of the tripod globular pots from the Dominican churchyard: they bear a striking resemblance to a pot from the grave of Archbishop Karl the Red who died in 1334. Similarly, the characteristic glazed jugs (fig. 8) that were found with the pots in the Dominican churchyard seem to date from the 14th century (Mårtensson 1973; Molaug 1977: 99 and 1979: 42f.). A fairly recent

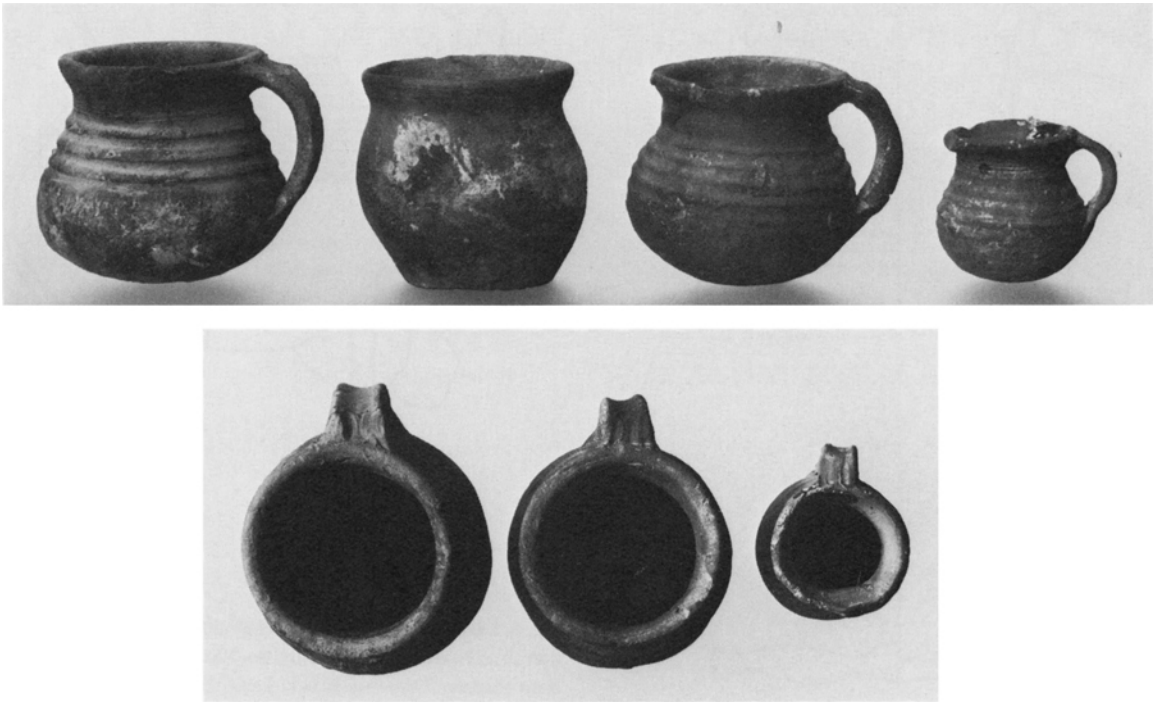


Fig. 9. 4 funerary pots from a grave north of Roskilde Cathedral's northern transept. The marks on the top of the handles correspond to marks on wasters from Farum Lillevang. The smallest of the pots is oxydized and has patches of lead glaze. National Museum Copenhagen, 2nd Dept., mus. no. 2694a–d. Photo: Lennart Larsen.

find in Lund may confirm this last dating, as a jug of that type was here found together with a kidney dagger (Wahlöö 1981).

The datable material – and particularly those graves which can be dated absolutely – thus places the custom of using funerary pots in Denmark within a comparatively long period, from the first half of the 13th to the end of the 14th century. Or perhaps even a little later, as we cannot take it for granted that Archbishop Magnus (died 1390) was the last to go to his grave accompanied by a funerary pot.

A BURIAL CUSTOM FOR KINGS, BISHOPS, AND NOBLEMEN?

The material, as we know it, points to a burial custom practised by a few, all of whom were of the elite in medieval society: kings and queens, archbishops, bishops and prelates. Both sexes are represented among the unidentified people who were buried with funerary pots and we know of one child's grave – the one from Smørum that contained a censer (fig. 5). St Stephen's Church in Lund may have enjoyed a special relationship with an aristocratic family (Mårtensson 1980: 45ff. and 78ff.). Such connections may partly serve to explain the presence of anonymous graves with funerary pots in various parish churches.

It is clear that the custom was not exclusively to royalty and it also seems to have been rare within that circle. Indeed, as far as we know, only two royal personages – Queen Agnes (died 1304) and Queen Ingeborg (died 1319) – were buried with funerary pots. The two queens were laid to rest in similar, brick-built graves in Ringsted, whereas King Erik Menved, son of Agnes and husband of Ingeborg, who died only a few months after his queen, was buried at her side in a wooden coffin without funerary pots. The splendid brass that adorns their graves shows that, when it came to commemorating the royal couple, restraint was certainly not a governing factor.

This example makes it difficult to come to any final decision about the extent and continuity of the practice. Were funerary pots, for example, only used on certain occasions, in some churches, or within certain circles or families? Is it possible that pots were used at Erik

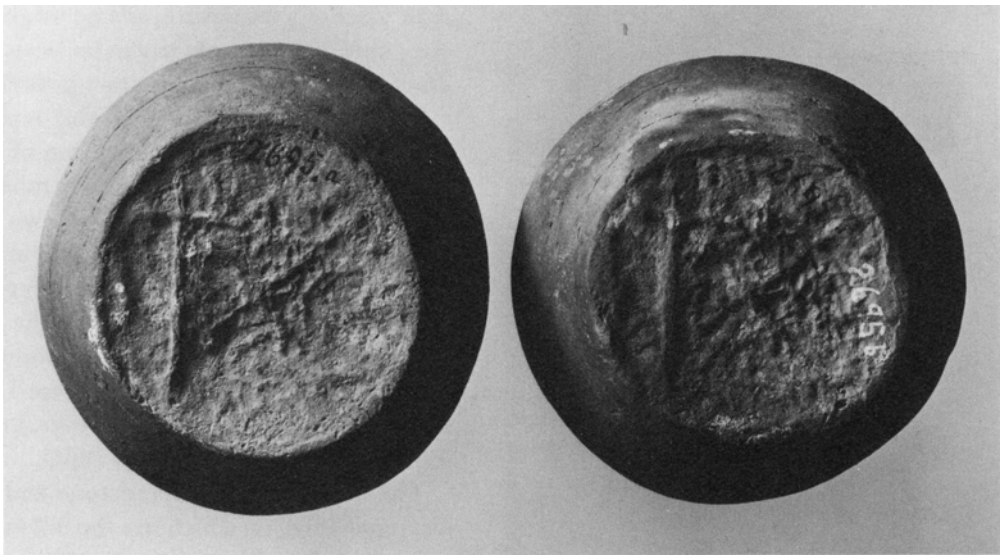


Fig. 10. 2 funerary pots from a grave in the churchyard north of Roskilde Cathedral's northern transept, *cf.* fig. 4. The pots, which are of the same type as that in fig. 7 and one of the pots in fig. 9, are stamped on the base with the same stamp. National Museum Copenhagen, 2nd Dept., mus. no. 2596a–b. Photo: Lennart Larsen.

Menved's burial and were simply removed from the grave before it was closed? An explanation of the background for the use of funerary pots will help to explain at least some of these questions.

THE FRENCH CONNECTION

The only known parallels to the Danish funerary pots, i.e. vessels containing charcoal, found in medieval graves, occur in France. In the middle and second half of the 19th century L'Abbé Cochet, from 1849 Inspector of Ancient Monuments in Normandy, examined and published a large number of churchyards and cemetaries in the area. Among his finds were many graves with funerary pots. Since then similar finds have been made in other parts of France as well, including Paris. The custom seems to have been practiced in Paris during the 13th and 14th centuries (Cochet 1857: 339ff.; Nicourt 1974) although pots also occur in graves dating from later centuries. The earliest dated grave is said to be from 1180, the latest from 1688 (Cochet 1857: 356ff. and 383).

The pottery used as funerary pots in France was, as in Denmark, of everyday character. But in France, unlike Denmark, it was common to break some holes in the sides of the pots. In only very few cases were the holes made before firing. The purpose of these holes was, no doubt, to provide a sufficient airsupply to enable the charcoal to burn, or rather to glow. That this was so, appears from the sooting of the holes.

L'Abbé Cochet refers to two authorities on liturgy in his attempt to interpret the funerary pots, namely Johannes Belethus of Paris (died after 1165) and Gulielmus Durandus of Mende (died 1296). Durandus's book *Rationale Diuinorum Officiorum* from *c.* 1290 was and still is a normative work on liturgical practice, as it summarizes the earlier traditions, including Beleth, and gives a symbolic interpretation. On the basis of Beleth's text, Durandus writes the following concerning burials (2):

> *Then [the deceased] is put in the grave, and holy-water and glowing charcoal with frankincense are put there in certain places. The holy-water is put in order that the demons, who are very afraid of it, may not approach the corpse; for they will make furious attacks on the corpses of the dead, in order that they may at least do after death what they could not do in life. The frankincense is put there to remove the stink of the corpse, either so that it may be understood that the deceased has offered the acceptable odour of good actions to his creator, or to show that the assistance of prayer helps the deceased. The charcoal is put there to testify that this ground can no longer be turned to ordinary use; for charcoal keeps better in the earth than other things.*

Fig. 11. Funeral mass with three funerary pots standing beside the bier. From: Bibliothèque Nationale, Paris, Man. latin 18014, f° 134v°. Photo: Bibliothèque Nationale.

This passage explains the function of incense and charcoal, both practically and symbolically, but does not necessarily imply the employment of pots. The incense may have been placed on small heaps of glowing charcoal inside the grave, as was possibly the case in two graves in Øm. That pots could be used is, however, demonstrated by archaeological finds in both Denmark and France, though funerary pots with vents have not yet been found in Denmark. On the other hand, niches for pots have apparently not been found in France, and only in Denmark has a grave been found to contain a real censer. To judge by the archaeological finds the practice was probably never common in France.

L'Abbé Cochet reproduces a drawing of a 14th century miniature, which shows funerary pots with vents and glowing charcoal placed beside a bier during a funeral mass in a church (reproduced in Madsen 1977: fig. 10). Funerary masses and various depictions of burials and churchyards are virtually standard forms of illustration in the beautifully illuminated books of hours, which emanated from the Flemish and French workshops during the 14th and 15th centuries (Meiss 1968 and 1974 vol. I: 271; Panofsky 1964). However, other than Cochet's miniature, whose original does not survive, only one example has so far been discovered of an illumination depicting funerary pots (fig. 11).

The most impressive pictorial representation of a burial, which includes a depiction of funerary pots in use, is to be found on the funerary monument raised by Louis the Pious to his young crown prince Louis of France (died 1260), which originally stood in the Abbey of Royaumont. The monument suffered some damage during and after the Revolution – the gable ends were, for example, for a time used as a monument to Abelard and Héloïse in the cemetary of Père-Lachaise in Paris. Its original appearance is, however, known from drawings (Vitry 1973: 78f.; Pradel 1964).

The monument is of sandstone and is in the form of a sarcophagus, on which lies the full length effigy of the young prince. On the long sides is a procession of mourners, but it is especially the picture on one gable which is of present interest (fig. 12). Here the prince is shown lying on a bier and from an account by Guillaume de Nangis we learn that one of the bearers was King Henry III of England (ed. Daunon and Naudet 1840: 421f.; Carolus-Barré 1970: 591ff.). Guillaume makes no mention of the funerary pots – which on the monument are shown beneath the bier, though their function in the procession is not made clear – perhaps because the author thought them too commonplace. None of the other, very detailed, accounts of the ceremonial funerals of French kings in the 14th and 15th centuries mention funerary pots either. Nor are they depicted on any other surviving monument from the period (*cf.* Giesey 1960: 23ff. and Brown 1980). Angels carrying censers are more or less obligatory figures on the many, more ordinary, medieval French gravestones and monuments, but so far no known example depicts funerary pots (*cf.* Adhémar 1974).

French finds of funerary pots, as well as French pictorial representations, thus demonstrate that such pots were used, not only in graves, but also during the funeral mass and possibly during the funeral procession. The pots were presumably used in the same manner in France as in Denmark, but is it possible that only in certain cases were they left behind in the grave? Was the Church in charge of the pots and were they generally removed before the closing of the grave, except in the case of certain people of high standing, or is it possible that the burning of incense in the quantity, which would require the use of a pot, was only necessary when the con-

dition of the body was such that a great deal of fragrance was called for? On the other hand, incense was, then as now, an established element in the Catholic burial ritual and we know that Prince Louis was interred on the day following his death and that part of the funeral procession started during the night. In Denmark the custom of using funerary pots did not, in my opinion, spread beyond the upper classes. Pottery was, no doubt, not so costly that people could not afford to leave behind in the graves those frequently crooked and unsuccessful pots with which we are dealing. Whether the price of incense played any role, we do not know.

The funerary pots are evidence of a French connection in Denmark in the High Middle Ages, but they are far from being our only evidence – French pottery has, for example, been found in several parts of Denmark (Bencard 1972). From the 12th century there were many personal and official contacts between the two countries. Many Danes went to France to study and particularly to Paris, among them Absalon, later Bishop of Roskilde and Archbishop of Denmark, his successors in both Roskilde and Lund, and emissaries from the Cistercian and the Dominican houses. The visitors could not have avoided noticing the use of funerary pots, particularly in the monastery at Ste.-Geneviève, where many of them went and where funerary pots have been found in the graves (Jørgensen 1915 and 1917; *KLNM* 17: 330ff.).

After their return home these people kept up their connections with France and were *inter alia* inspired by French church architecture. French ideals of style predominate in Roskilde Cathedral after *c.* 1200 and it was the connection with France that led to the radical change in its building programme, namely the abandoning of the planned projecting transepts; a similar change of plan was made at Nôtre Dame in Paris at about the same time (Héliot 1964). In 1193 Ingeborg, the daughter of King Valdemar I, married Philippe-Auguste, King of France, – who incidentally cast her off immediately for hitherto unexplained reasons – and in the second half of the 12th century one of the most prominent churchmen in Denmark was Abbot Vilhelm of Æbelholt (died 1203, canonized 1224), who was a native Frenchman and who played an important role in Denmark's relations with France. Not one funerary pot has, however, been found in the completely excavated churchyard at his monastery in Æbelholt. The connections with France were ever lively. For example, several

Fig. 12. The gable end of the funerary monument raised to Crown Prince Louis, who died in 1260. Beneath the bier of the dead prince are depicted three funerary pots with vents in their sides and with burning contents. 62 × 64 cm. Musée Carnavalet, Paris. Photo: Françoise Rivière, Musée Carnavalet.

learned Danes made their name in Paris and achieved high standing in the academic world. The traffic went in the other direction too. At the cathedral in Lund manuscripts containing the works of Beleth and Durandus were handed down through several generations of canons and bishops, as can be seen from their testamentary provisions (Erslev 1901: 120,5: 142,3: 179,2–3: 136,4 and 176,7) and the same two authors also crop up in the late medieval Scandinavian library inventories.

Denmark was not the only country that was strongly influenced by France during this period and it is something of a mystery why she alone adopted the custom of the funerary pot. The presence of those pots in Denmark does, however, emphasize the French influence in that country – however scattered the finds are – and the reasons underlying their use may be that the grander members of society wished to be buried »à la française«, in keeping with the symbol-laden liturgy of the period.

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NOTES

[1] A number of museums have kindly allowed the investigation and publishing of the material. It was collected on journeys paid by *Ludvig Zincks Legat* and *Den Svenske Femte-Maj Fonden i Göteborg*. Mogens Bencard, Rosenborg, kindly handed over his drawings and other material about funerary pots from present time Denmark. I am most grateful to Anders Wihlborg for his permission to investigate the find from the Church of St. Peter in Hälsingborg.

[2] Professor, dr. Holger Friis Johansen, University of Aarhus, has kindly translated Durandus' text.

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Environment and Man

Current Studies in Vegetational History at the Geological Survey of Denmark

By SVEND TH. ANDERSEN, BENT AABY and BENT VAD ODGAARD

Very soon after its establishment 1888, the Geological Survey of Denmark employed a young botanist, N. Hartz, whose primary task was to investigate the plant remains found in peat bogs. This initiative should be seen on a background of the great attention paid to the geology of bogs in Denmark during the 19th century. The interest in peat bogs was promoted by concern about the fuel supply, especially due to overexploitation of the forests and the loss of Norway 1814. The government therefore initiated a survey of the Danish peat resources, which resulted in the first scientific description of bogs in Denmark: *Über die Torfmoore Seelands* published by J.C. Dau 1829. Dau's work was continued by Japetus Stenstrup, and later by C. Vaupell and other famous botanists. It was therefore natural for the new Geological Survey to include bog investigations in its activity.

N. Hartz extended the study of peat bogs to comprise interglacial deposits; his work at the Geological Survey was continued by K. Jessen and J. Iversen. Jessen introduced pollen analysis in Denmark, and Iversen elaborated this method to a high degree of perfection. Their work is being continued at the Geobotanical Department. J. Troels-Smith, originally a collaborator of Iversen's, transferred to the National Museum. There he founded the Department of Natural Science, where archaeology and natural sciences work closely together.

The study of plant remains in Quaternary deposits thus has a long tradition at the Geological Survey. The methods employed have, however, improved continuously, and the objects and potentials of the studies have been increasingly widened.

Today, the primary purpose of the geobotanical studies at the Geological Survey is to elucidate vegetational change throughout the Quaternary, and to understand their underlying causes. Whereas peat-bogs at first were a main object of investigation, the studies now also comprise plant remains in lake deposits, marine deposits, and in terrestrial soils.

Changes in vegetation have proved useful for the establishment of chronologies for the Quaternary and the dating of deposits; this purpose has been greatly advanced by the introduction of methods of absolute dating, of which the radiocarbon dating-method extends 30–40,000 years back in time, and newly developed methods even 200–300,000 years (Vogel 1982).

Reconstruction of former vegetation provides a picture of former landscapes and environments. Changes in landscape and environment – including climate and soils – can therefore be elucidated by studies of vegetational history. At times when Man was present, studies of the former vegetation thus highlight his living conditions. As originally shown by J. Iversen, Man has actively interfered with plant life in Denmark throughout 6,000 years and has changed the vegetation to suit his purpose. The changing methods and intensity of human exploitation, and the response of vegetation, are, therefore, inevitable facets of the geobotanical studies.

The landscape in Denmark today reflects former and modern exploitation in varying degrees. The vegetation thus reflects past and present interaction between Nature and Man. Studies of current vegetation types and their history therefore provide a basis for the conservation of vegetation, which today illustrates conditions of the past.

STUDIES OF VEGETATIONAL HISTORY AT THE GEOBOTANICAL DEPARTMENT

Throughout nearly a hundred years geobotanical studies at the Geological Survey of Denmark have elaborated the knowledge of Quaternary vegetation in the

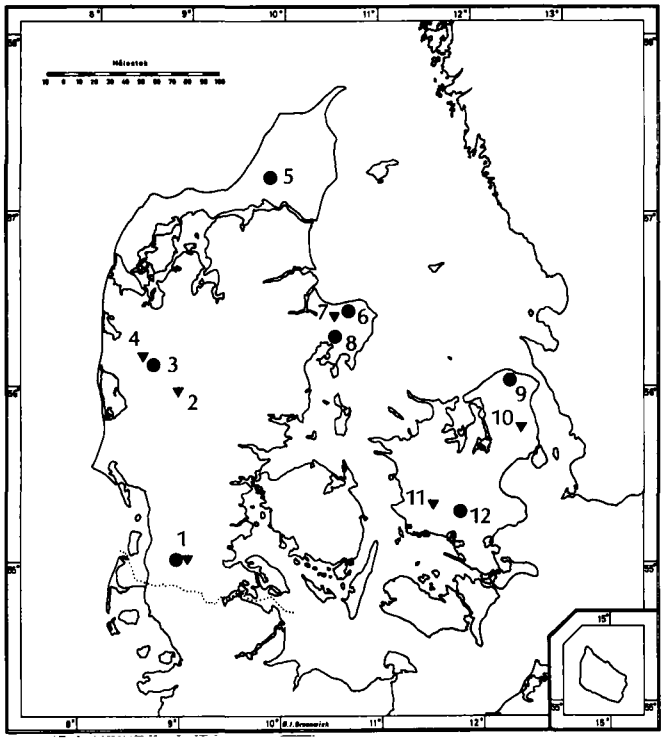

Fig. 1. Sites currently under investigation by pollen analysis at the Geobotanical Department. Dot: regional pollen diagram (bog or lake); triangle: local pollen diagram (wet-hollow site or soil). 1, Draved Bog and Forest. 2, Skarrild. 3, Lake Solsø. 4, Grøntoft. 5, Store Vildmose. 6, Fuglsø Bog. 7, Løvenholm. 8, Korup Sø. 9, Søborg Sø. 10, Geel Forest. 11, Næsbyholm Forest. 12, Holmegård Bog.

light of new discoveries and improvements of methods. General surveys of the subject were presented in 1967 in *Danmarks Natur* (Andersen 1967, Iversen 1967). Since then, new developments and discoveries have revealed that our picture of the past is still imperfect and can be greatly improved. In 1967, only a few pollen diagrams which illustrate the general development of vegetation since the last ice age existed; none of them were dated by the radiocarbon method. Furthermore, better understanding has been reached of the transfer of pollen from vegetation to deposit and better tools have been evolved for the quantative reconstruction of vegetation. Finally, new potentials for studying narrow-scale vegetational change have been discovered.

Pollen diagrams reflect the vegetational development on varying areal scales, according to the object chosen for study (see also Andersen 1970, 1978, Janssen 1973, Webb *et al.* 1978). Pollen diagrams from sites with a large receptive surface – lakes or bogs – and distant from local vegetation (100m or more) reflect vegetation on a large scale, probably within up to ten kilometers. On this scale an average of the vegetation mosaic in a large area, about 300km^2, is obtained. General trends in vegetational change – and intensity of human occupation – are revealed; however, vegetational diversity, dependant on topographical variation, is masked, and human activity cannot be localized or described in detail.

In recent years it has proved possible to elucidate vegetational change on a narrow areal scale by the study of very small ponds or bogs, and soil sections. Sites in woodland covered by tree canopy – small wet hollows or soils – receive pollen from a very narrow range of vegetation, within 30m. In this way only a single forest community, the one which prevailed around the site, is recorded. Furthermore, new correction factors make it possible to reconstruct the areal composition of the tree community precisely (Andersen 1970, 1980). If the forest around such a site was changed by Man or cleared, these events will manifest themselves clearly in the pollen spectra. One can say, accordingly, what the composition of the forest was on uplands in contrast to low-lying areas at varying times, how Man changed the vegetation, what purpose he possibly had with his activity, and for how long he persisted. Studies from small kettle-holes and soil sections can therefore pinpoint the activity of Man and elucidate its nature; the extent and intensity of human activity must, on the other hand, be traced at the sites that record vegetation on a large scale.

At the Geobotanical Department it has been a major task in recent years to study regional vegetational development especially in the Holocene and to study local sequences at small-hollow sites and soil sections. The former activity of Man and its interaction with nature are inevitable features of these studies.

As lake deposits often are unsuitable for radiocarbon dating, regional vegetational change is being studied at the raised bogs Draved Bog, Store Vildmose, Fuglsø Bog and Holmegård Bog (B. Aaby, Fig. 1). Furthermore, regional vegetational history is studied in marine deposits at Søborg Sø and Korup Sø (H. Krog). Pollen diagrams from soils and wet hollows are worked out from Draved Forest (B. Aaby), Løvenholm (Eldrup Forest), Geel Forest and Næsbyholm Forest (S.T. Andersen). The history of the heaths in western Jutland is studied at Lake Solsø and in soil sections at Skarrild and Grøntoft (B. Odgaard, Fig. 1). Some results from these investigations will be mentioned below.

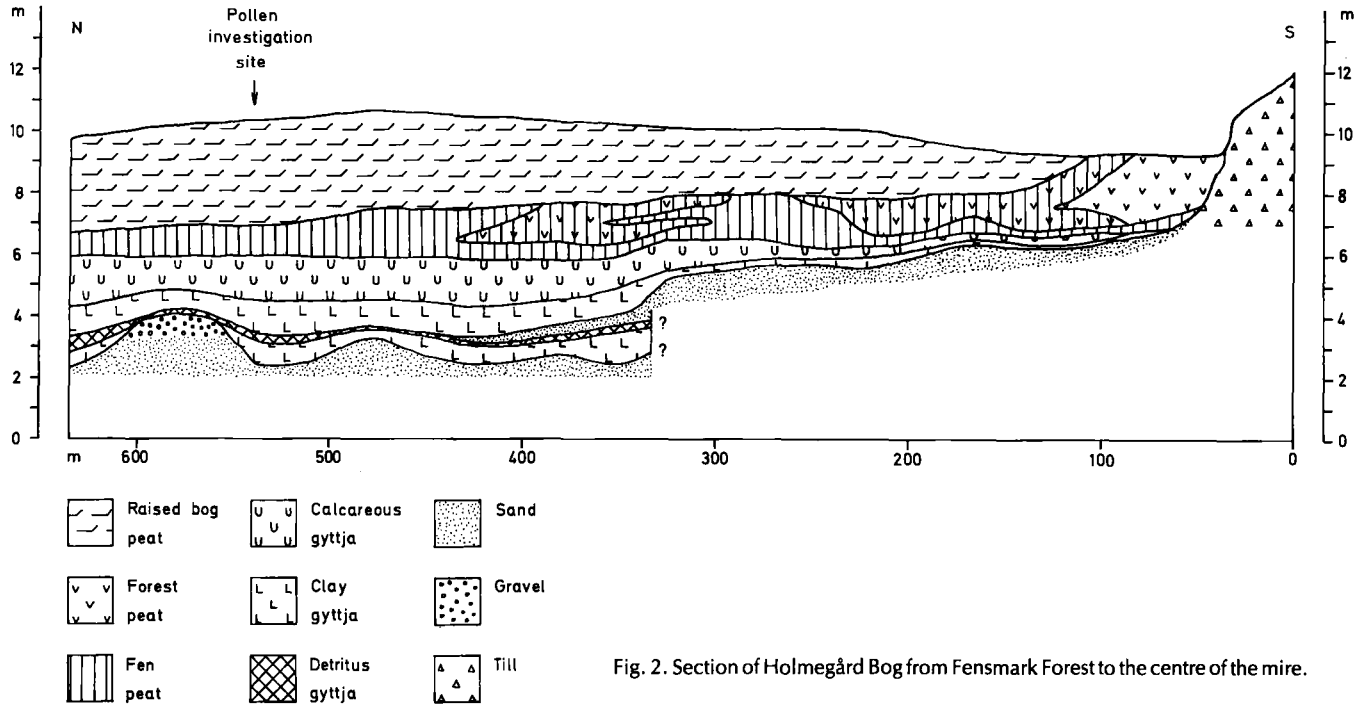

Fig. 2. Section of Holmegård Bog from Fensmark Forest to the centre of the mire.

REGIONAL POLLEN DIAGRAMS

Holmegård bog

In the need for accurate dating of the Holocene vegetational development in eastern Denmark, attention was drawn to Holmegård Bog, an extended raised bog in southern Zealand (Fig. 1, 12). The bog is part of a larger mire complex in a glacigenic landscape, with deposits dominated by clayey till.

The bog has previously been analysed from a pollen-analytical point of view and knowledge about the vegetation in limited periods has been published by Jessen (1925, 1935) and Nilsson (1937). Indeed, the Holmegård Bog was among the first sites, where co-operation between archaeology and geobotany was practiced, providing important knowledge and inspiration to both subjects.

A transect from the southern border to the centre of the bog is shown in Fig. 2. In late Weichselian and early Holocene time a lake was found in the area. Sheltered areas along the margin of the lake were overgrown by mosses, sedges, and grasses in the early Preboreal. In early Boreal time, a peat zone, 2–300m wide, was formed along the southern margin of the lake. The overgrowing of the lake was completed in the early Atlantic; alder forest occurred along the marginal part of the bog, whereas the central area remained treeless. In late Atlantic time, raised bog vegetation was established in the central part of the mire, and gradually expanded to form a large pillow-shaped bog, which was surrounded by birch and alder carr, as also seen today.

The pollen diagram, derived from the central part of the bog, illustrates the vegetational history throughout the Holocene (Fig. 3). The chronology back to the early Atlantic is based on 26 radiocarbon dates, whereas older calcareous sediments are tentatively dated by correlation with well-dated vegetational events within the same region (Krog 1973, Fredskild 1975). Juniper, crowberry (*Empetrum nigrum*), and meadow-sweet (*Filipendula ulmaria*) characterized the vegetation at the transition from the late Weichselian to the Preboreal. The ground flora was still favoured by ample light in the preboreal birch-pine forest. Hazel immigrated in early Boreal time and soon became the dominant tree species. Pine and birch are light-requiring and could not hold their ground against the advancing hazel. The luxuriant herb flora also vanished and was of no regional importance until the Subboreal.

Elm was the next tree to arrive followed by lime, oak,

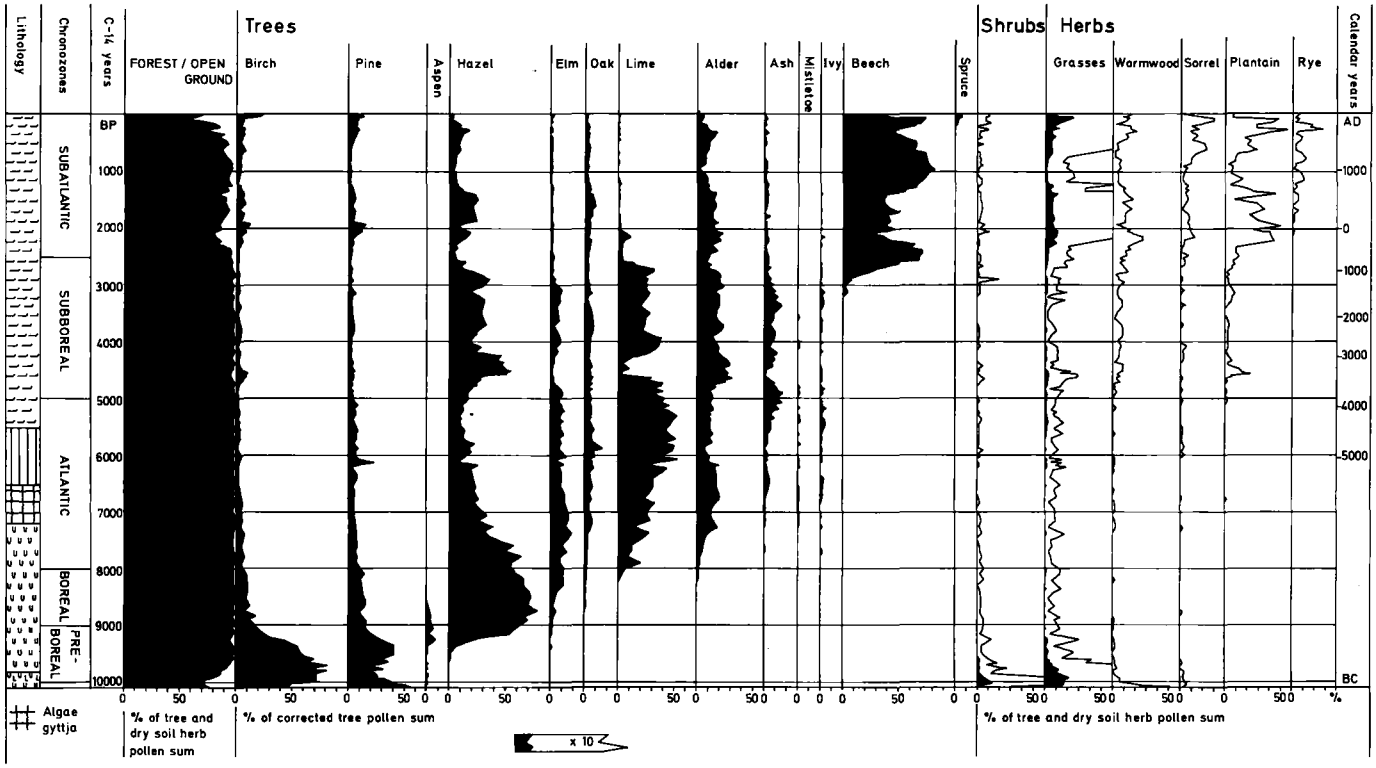

Fig. 3. Holocene pollen diagram from Holmegård Bog. The diagram shows the occurrence of trees and open land (survey diagram) and separate curves for trees and categories of herbaceous plants. The tree pollen frequencies were corrected according to Andersen (1970, 1980). Calendar years are calibrated according to Clark (1975).

ash, and alder and the Boreal hazel forest was gradually succeded by a more complex tree vegetation. The pollen curves stabilize by the middle of the Atlantic, indicating that a competitive equilibrium between the various species or plant communities was established. The spatial distribution of the tree species was possibly determined mainly by the soil conditions, as they are today, but the regional pollen diagrams allow only little insight into the forest structure. No doubt lime was dominant on well-drained soil, whereas hazel, elm, oak and ash probably were found mainly on damp ground, and alder exclusively on peaty soil (compare Iversen 1960, Andersen 1980).

The occurrence of Man in Atlantic time and earlier is very difficult to detect outside dwelling places. A few peaks in the grass pollen curve and the finding of microscopic charcoal may reflect the presence of the Maglemose people in Boreal-early Atlantic time, when open water still occurred.

In early Subboreal time, definite signs of human activity were registered. Pollen of plantain (*Plantago lanceolata*), was found at three levels below a well-marked decline in the elm pollen curve. The amount of grass pollen also increases before the elm decline, which was dated to 3600 B.C. (in calibrated calendar years). This date is later than the elm decline elsewhere in Denmark (Andersen 1978) and southern Sweden (Nilsson 1964). The herb pollen found below the elm decline at Holmegård may be due to long distance transport, reflecting neolithic clearances, but may also be considered local, indicating cultural influence in the vicinity of the bog.

An increase in the herb pollen curve shows that larger areas were cleared shortly after the elm decline and the landscape attained a nemoral character. Plantain (*Plantago lanceolata*), bracken (*Pteridium aquifolium*) and grasses were common on open ground. A few cereal pollen grains indicate the presence of fields. The early peasant culture strongly hampered the lime, elm, and ash populations and their pollen producing capacity remained low, whereas birch and especially hazel were favoured and probably occurred also on the dry soil. The cultural disturbance was low in the moist and peaty areas with

oak, pine, and alder, as their pollen curves remain almost stable from the end of the Atlantic. The nemoral character of the vegetation was maintained for about 500 years (34–2900 B.C.).

The progress of the early Subboreal vegetational development in the Holmegård area is similar to most other regions in eastern Denmark, indicating common farming practice at that time.

After 2900 B.C. the Holmegård area was abandoned by Man and the forest adopted a composition similar to that of Atlantic time, except that hazel stabilized on a higher level and pine became a subordinate element. The original ecosystem equilibrium thus remained stable although the peasants had strongly interfered with the vegetation for five hundred years.

Beech immigrated about 15–1400 B.C. and expanded about 2–300 years later, reaching values unique for Danish and even northwest European pollen diagrams in the Subboreal. Beech forest thus occurred earlier than formerly supposed. The composition of the forest on high ground was drastically changed at the expansion of beech, as lime and especially hazel were suppressed.

The pollen diagram next reflects distinct changes in the landscape about 5–400 B.C. The beech forest was strongly reduced and extended open areas appeared for the first time. Perennial weeds, such as plantain, sorrel (*Rumex acetosella*), wormwood (*Artemisia*), and grasses, were common, indicating extensive land-use. Cereal pollen, mainly of barley-type, is scattered in the pollen spectra. Rye appeared about 2000 years ago but was of little importance during the Iron Age.

The landscape again changed radically about A.D. 4–500. The beech forest expanded contemporaneously with a lowering in the frequency of weeds. These vegetational variations signify a depopulation of the Holmegård area. The same phenomenon also occurred in other regions in eastern Denmark (Mikkelsen 1949, Andersen 1954).

There is good evidence that the Holmegård area was settled again in early Medieval time, A.D. 11–1200. Rye was commonly grown, and grassland occupied larger areas. Buckwheat (*Fagopyrum* sp.) and cornflower (*Centaurea cyanus*) were found somewhat later, about A.D. 1400. The well-documented desertion of farms in late Medieval time (Gissel *et. al.* 1981) is rather difficult to trace in the Holmegård area, and the farming intensity seems to have been almost stable throughout the Middle Ages and until about A.D. 16–1700. At that time the frequency of weed pollen rose to a significant maximum, which lasted until modern time. Intensified farming in the 18th century thus had a distinct influence on the landscape. The low herb pollen values in the uppermost pollen spectra reflect the major influence of modern agriculture on the weed flora.

The Holmegård area has possibly been a marginal area from an agricultural point of view. Colonization and desertion have been registered in the pollen diagram several times since the first large land occupation, six thousand years ago. Stages with cultural influence occurred particularly during the Neolithic (34–2900 B.C.), the early Iron Age (500 B.C.–A.D. 400), and in Medieval to modern time (after A.D. 1100). In order to gain a fuller insight into the development of agricultural expansion and vegetational development, the Holmegård pollen diagram should be compared with a regional diagram from a more central settlement area, e.g. western Zealand.

Our knowledge as to the size of the area represented in regional pollen diagrams is imperfect. The vegetational development in the Præstø area (Mikkelsen 1949) has differed essentially in some periods. This site is about 20km away from the Holmegård Bog area; thus half this distance is possibly the outermost limit for the Holmegård area. Tentatively, the regional pollen diagram therefore reflects vegetation in an area between 80km^2 (radius 5km) and 300km^2 (radius 10km).

Although the regional pollen diagram obviously reflects cultural stages, the analyst is faced with the problem of describing the farmland in detail. Pollen grains of cereals, spurrey (*Spergula arvensis*) and cornflower (*Centaurea cyanus*) are indicators of cultivated fields, but these plants are sparsely represented in pollen diagrams the only exception being rye. Most of the herb pollen recorded originates from weeds with a high pollen producing capacity, such as wild grasses, wormwood (*Artemisia*), plantain (*Plantago lanceolata*), and sorrel (*Rumex acetosella*). These plants are often considered good indicators of pasture, used for grazing and hay collecting. However, they may also have occurred in the fields and on the banks which separated the fields. These weeds may therefore indicate fields as well as permanent pastures (Behre 1981).

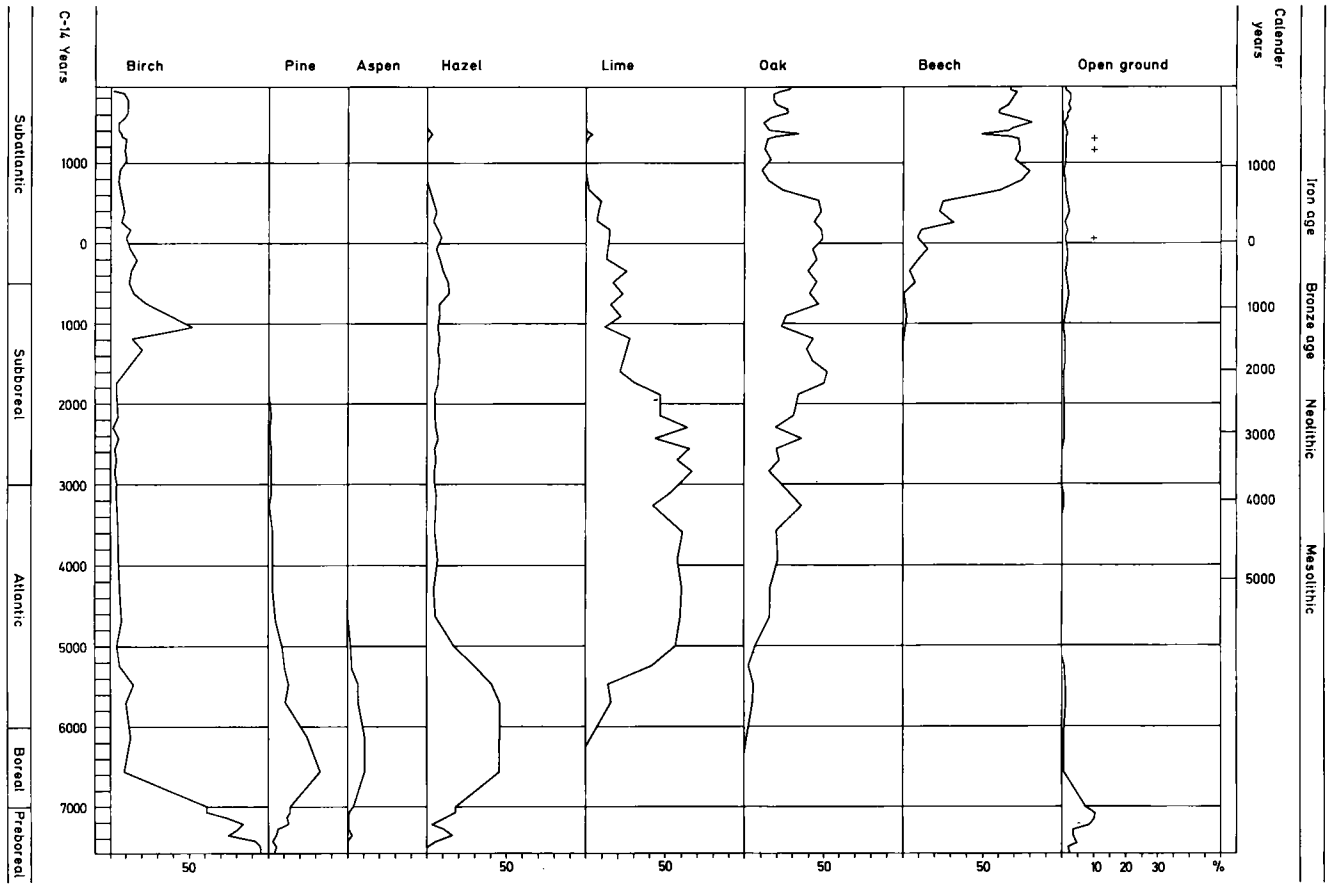

Fig. 4. Pollen diagram from small wet hollows in Eldrup Forest, Løvenholm, Djursland (from Andersen 1978). The diagram shows local forest development throughout the Holocene. The area was never cultivated, but the forest was exploited in the late Neolithic, Bronze Age and early Iron Age (felling of lime, see the text). Tree pollen frequencies were corrected according to Andersen (1970, 1980). Calendar years are calibrated according to Clark (1975).

POLLEN DIAGRAMS FROM SMALL HOLLOWS

As described previously, small wet hollows have proved to be extremely useful for the study of vegetational development on a narrow areal scale. Furthermore, it has turned out that small hollows with well-preserved deposits are numerous in Danish woodlands. In farmland, however, small hollows have often been disturbed by peat digging.

Eldrup Forest, Løvenholm

Small hollows were first investigated in the Løvenholm forests on Djursland (Eldrup Forest, Andersen 1973, 1978, Fig. 1). These woodlands are situated in a hilly area, which was marginal to dense settlements in prehistoric and historic time. The pollen diagrams, therefore, show the composition of the forest on upland soils and illustrate how uninhabited areas were exploited in the past. A pollen diagram which shows the vegetational development throughout the Holocene is shown in Fig. 4 (Andersen 1978).

Birch was dominant in Preboreal time, before 7000 radiocarbon years bc, and pine and hazel had just immigrated. There was a peak for open-land plants in the late Preboreal, indicating temporary opening-up of the tree canopy. Hazel then expanded and dominated the forest in Boreal and early Atlantic time (7000–5500 bc), with scattered birch, pine and aspen. Lime became dominant in Atlantic time, oak was scattered, and hazel was scarce. The lime-oak forest was dense, and open-land plants were extremely rare. A few peaks on the oak curve in late Atlantic and early Subboreal time may have been due to human activity (felling of lime trees).

In middle Subboreal time, around 3000 B.C. (in calendar years), lime decreased strongly, and oak expanded; birch also expanded, showing several peaks. Oak remained dominant for several millenia, during which beech immigrated, but remained scarce. These changes cannot have been due to natural causes, as oak and birch cannot compete successfully with lime in undisturbed forest. Hence, there can be no doubt that Man caused these changes in the forest. The pollen diagram thus reveals that Man felled lime in favour of oak, and that birch expanded temporarily due to clear-cuttings. Plants from open-land vegetation increased slightly, but remained scarce, indicating that open ground grazed by cattle cannot have occurred near the site. The pollen diagram does not show what the purpose of Man's activity was. The nearest possibility is swine husbandry, as pigs feed well on oak mast, and do not require extensive clearings.

Man apparently maintained oak woodland in Eldrup Forest for several millenia, from the late Neolithic till the middle of the Iron Age, around A.D. 400. This practice was then discontinued, and beech became a dominant tree until today. A few peaks for oak indicate intermittent human activity (the felling of beech trees) in Medieval and recent time.

The pollen diagram from the small hollow in Eldrup Forest thus shows that lime succeded birch and hazel forest, and became dominant on upland soils in Atlantic time. These marginal woodlands were inextensively exploited in Subboreal and early Subatlantic time, probably for swine husbandry. Beech forest prevailed from the middle Subatlantic till to-day.

Geel Forest, Zealand

In Geel Forest, a small wood north of Copenhagen, an extensive Iron Age field system was mapped by Viggo Nielsen (Nielsen 1970, Fig. 1). In order to investigate the impact of cultivation on a locally influenced pollen diagram, a small hollow situated within the field system was examined (Figs. 5–6).

The sediment in the hollow was just over 1m deep. The uppermost 30cm were very soft and contaminated; below, a clayey sediment with numerous stones occurred.

Fig. 6 shows a simplified pollen diagram and curves for ecological groups. The diagram indicates two periods with predominant open-land vegetation: one below 95cm in depth, and one at 55–80cm. Bracken (*Pteridium aquilinum*) predominated in the first period, and open-ground herbs and grasses in the second. Bracken is indicative of grazing; this fern is not eaten by cattle and sheep and often expands as a weed on pastures. Hence, it can be assumed that clearings with pasture occurred around the site during the first stage. Sorrel (*Rumex acetosella*), plantain (*Plantago lanceolata*), wormwood (*Artemisia*), grasses and other weeds were frequent in the second stage. These plants indicate that large open areas existed around the site for some time; they reflect the time when the field system around the site was in use. Pollen grains of annual weeds and cereals were scarce; perennial weeds with a large pollen production thus reflect the cultivation stage better than annual weeds and cereals do (see also Behre 1981).

The pollen diagram also shows that forest regenerated around the wet hollow in Geel Forest between the two periods with intensive cultural influence, and again after the abandonment of the fields. Woodland of lime, hazel, oak and beech regenerated after the first cultural stage, and beech forest expanded after the second stage (Fig. 6).

The age of the pollen diagram is not quite clear, due to difficulties in radiocarbon dating. The first cultural phase was probably neolithic, whereas the field systems belong to the early Iron Age (Nielsen 1970).

SOIL SECTIONS

Pollen diagrams from small wet hollows may elucidate local vegetational development for an extended time, in favourable cases the entire Holocene. Such sites are, however, not always available, and former soil conditions are not recorded directly. Pollen diagrams from undisturbed soil sections, on the other hand, may be found in areas where hollows are missing, and may reflect soil evolution.

Iversen (1958, 1964) found that pollen was excellently preserved in raw humus layers and he showed that pollen diagrams from such terrestrial deposits are useful for illuminating local vegetation history and former exploitation by humans. Pollen may also be preserved in acid mineral soils (with pH lower than 6). In brown earth (in Danish: *Muld*), pollen deposited on the surface is transported downwards and mixed with the mineral soil by burrowing earthworms. One can, there-

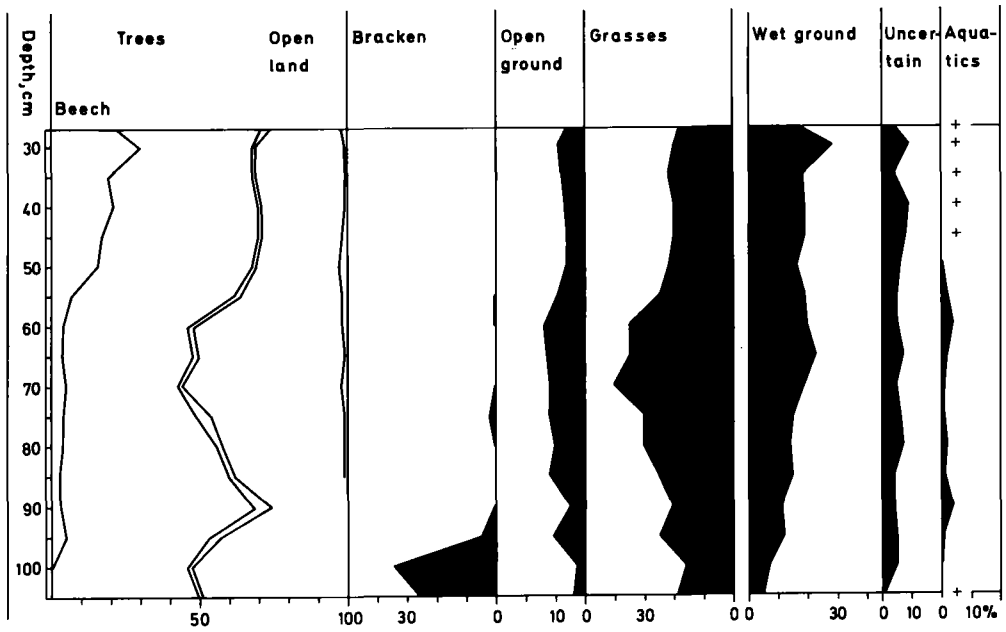

Fig. 5. Pollen diagram from a small hollow inside an Iron Age field system in Geel Forest, north of Copenhagen. The diagram shows the occurrence of trees and open land, and categories of herbaceous plants (bracken, open-ground plants, grasses, wet-ground plants, plants of uncertain significance, and aquatics); the three last-mentioned groups were not included in the pollen total). The diagram shows two periods of deforestation (below 95cm and at 55–80cm depth).

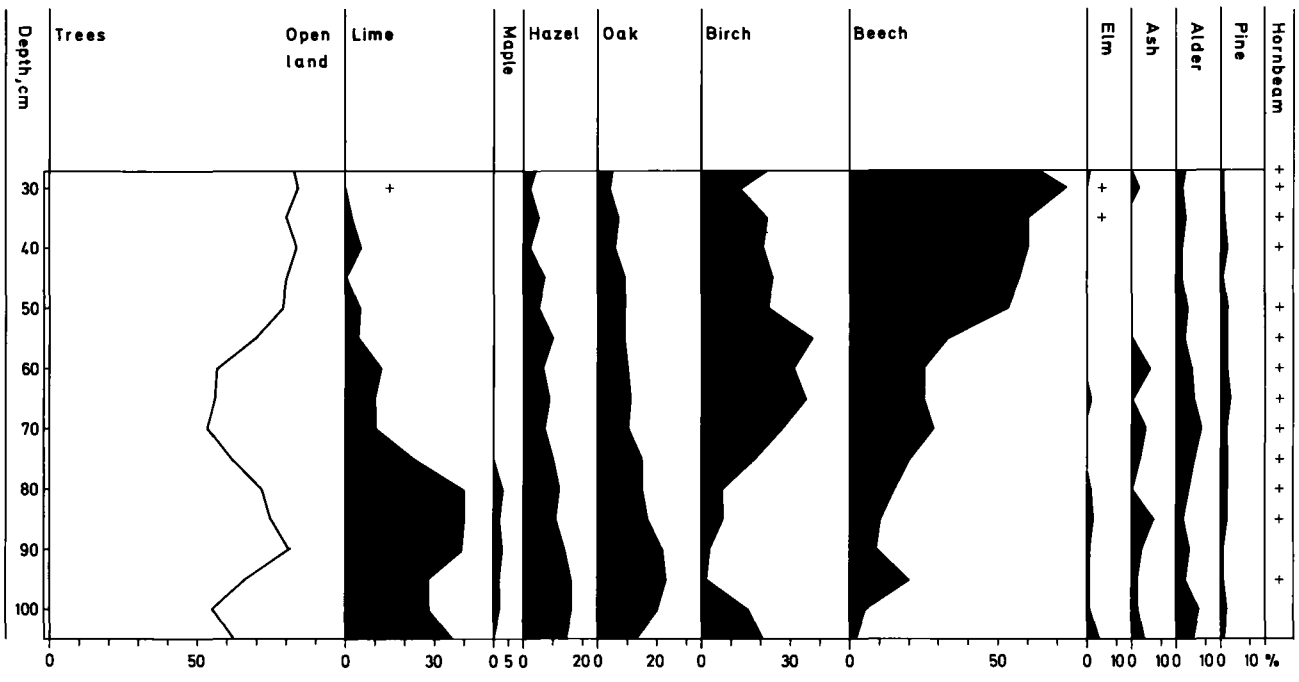

Fig. 6. Pollen diagram from Geel Forest showing the composition of the tree vegetation. The tree pollen frequencies were corrected according to Andersen (1970, 1980).

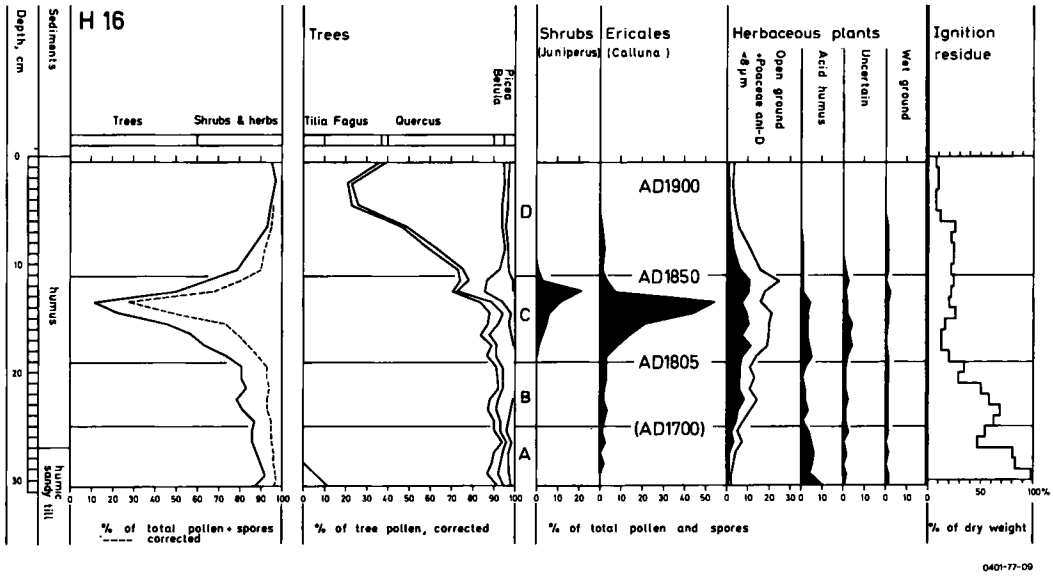

Fig. 7. Pollen diagram from a raw humus layer in Eldrup Forest, Løvenholm. The diagram shows the occurrence of trees and non-tree plants, corrected tree pollen frequencies, and categories of non-tree plants. A grazing stage about 1700–1800 and regeneration of forest are recorded. From Andersen 1979.

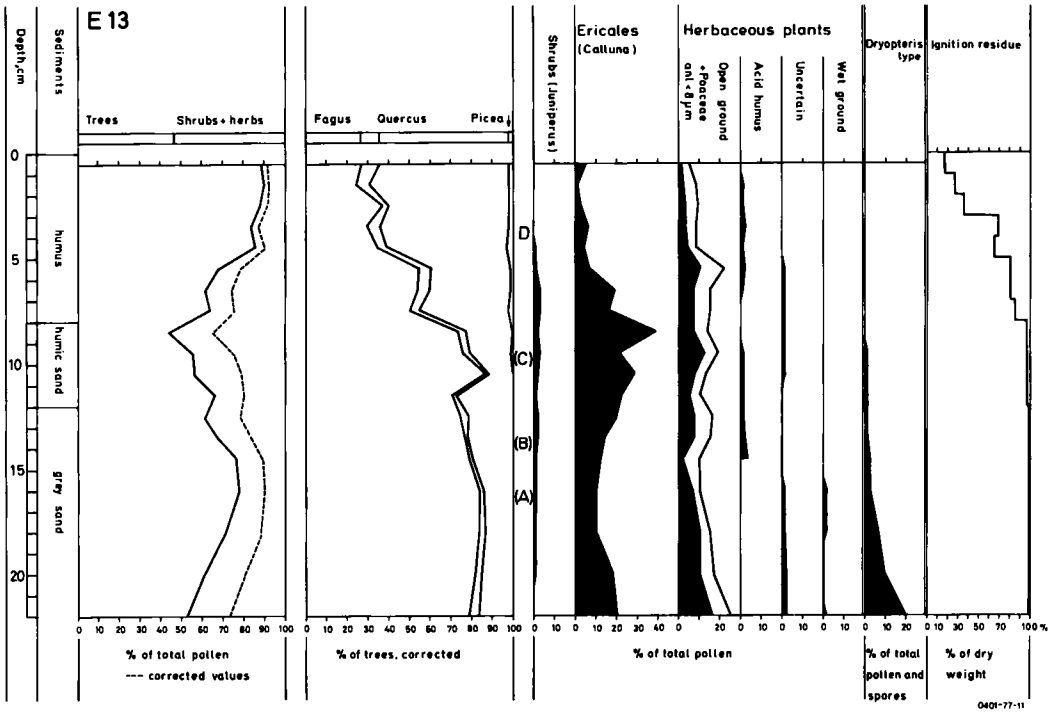

Fig. 8. Pollen diagram from podzol with a shallow raw humus layer near the section shown in Fig. 7. The pollen curves in the layers are similar to those in Fig. 7 but are smoothed due to mixing during the burial by soil fauna. From Andersen 1979.

fore, find pollen from former acid brown earth stages buried in soils, which have later developed into podzols.

Fig. 7 shows a pollen diagram from a raw humus layer in Eldrup Forest at Løvenholm (from Andersen 1979). The vegetation was originally beech forest, which was grazed in the 18th century. Cattle grazing was abandoned after the passing of the Forest Protection Law (*Skovforordningen*) of 1805; heather and juniper invaded the former glades, which, somewhat later, changed into oak forest.

A similar development was traced in pollen diagrams from podzols with thin humus layers and in a brown earth from the same forest. In these sections, however, the pollen curves were smoothed out, because the pollen assemblages, which were originally deposited on the soil surface, became mixed vertically during the transportation into the soil by the soil fauna. Pollen diagrams from the podzols thus reflect the vegetational development in the brown earth stage, which preceded the podzolization, however, in a modified way, because of the mixing activity of the earthworms (Fig. 8).

Undisturbed humus layers and soils which record local vegetational development may still be found in forests, where the soil has not been ploughed. Outside the forests, in arable land and in heaths, undisturbed soils may be preserved beneath prehistoric monuments, and may reflect natural vegetation and the exploitation by Man prior to the erection of the monument.

THE HISTORY OF THE HEATH IN WEST JUTLAND

Until the end of the 19th century, vast areas of western Jutland were covered by heaths dominated by heather (*Calluna*) but devoid of trees, except for scattered small copses of crooked oaks. Today most of the heaths have been converted into arable land, but the oak-copses still exist.

The origin of this strangely attractive vegetation – heathland and oak-copses – has been discussed for almost two centuries. Contributions to the debate have come from widely different branches of science and the conclusions arrived at were equally divergent. Jonassen (1950) conclusively showed by several pollen diagrams that the 19th century heathland was once covered by forest. He imagined that prehistoric fields in western Jutland could only be cultivated for a short period due to infertility of the soil. Heather would then conquer the abandoned fields and the heathland expansion observed in the pollen diagrams was a reflection of this process. Jonassen thought that the heath expansion took place in the Subatlantic period. In his opinion, the vast heathland was the result of extensive agriculture combined with a climate unfavourable for trees in Subatlantic time.

Since the time of Jonassen's work pollen analysis has been strongly refined. Furthermore, accurate methods of dating non-calcareous organic deposits are available and our knowledge about heathland ecology is more complete. On this background the Geobotanical Department has initiated an investigation of the vegetational history of western Jutland, of which some preliminary results – a regional and a local pollen diagram – are presented here.

Lake Solsø (Fig. 1) was chosen as a site for a regional pollen diagram. Lake deposits are preferable to raised bog deposits in this connection, since pollen from local heather growing on the bog surface may obscure the regional heathland development in pollen diagrams from bogs. As Lake Solsø was oligotrophic, the sediments are suitable for radiocarbon dating. The lake is situated in a depression in sandy till from the Saalian (second-last) glaciation. Until an artificial lowering of the water table in the beginning of the 20th century it was probably about 200m in diameter. Groups of megalithic tombs and other burial mounds are indicated near Solsø on the map in Brøndsted (1966), but H. Rostholm, Herning Museum, has not been able to relocate the megalithic monuments in the present landscape. Until the end of the 19th century the area was almost totally covered by heath. The nearest oak-copses are about 4km away.

Fig. 9 shows a pollen diagram from Lake Solsø covering the entire Holocene. The open birch forest that established itself in the Preboreal, was soon invaded by pine. Later hazel arrived and became the most common tree in the Boreal and early Atlantic periods. Elm arrived during the Boreal and oak, alder, lime and ash during the early Atlantic. By the middle of the Atlantic, stable vegetation of these trees had developed. This early Holocene forest development in western Jutland resembles the development in eastern Denmark, but the less fertile soil induced a more open forest type where heather was able to grow and flower on the forest

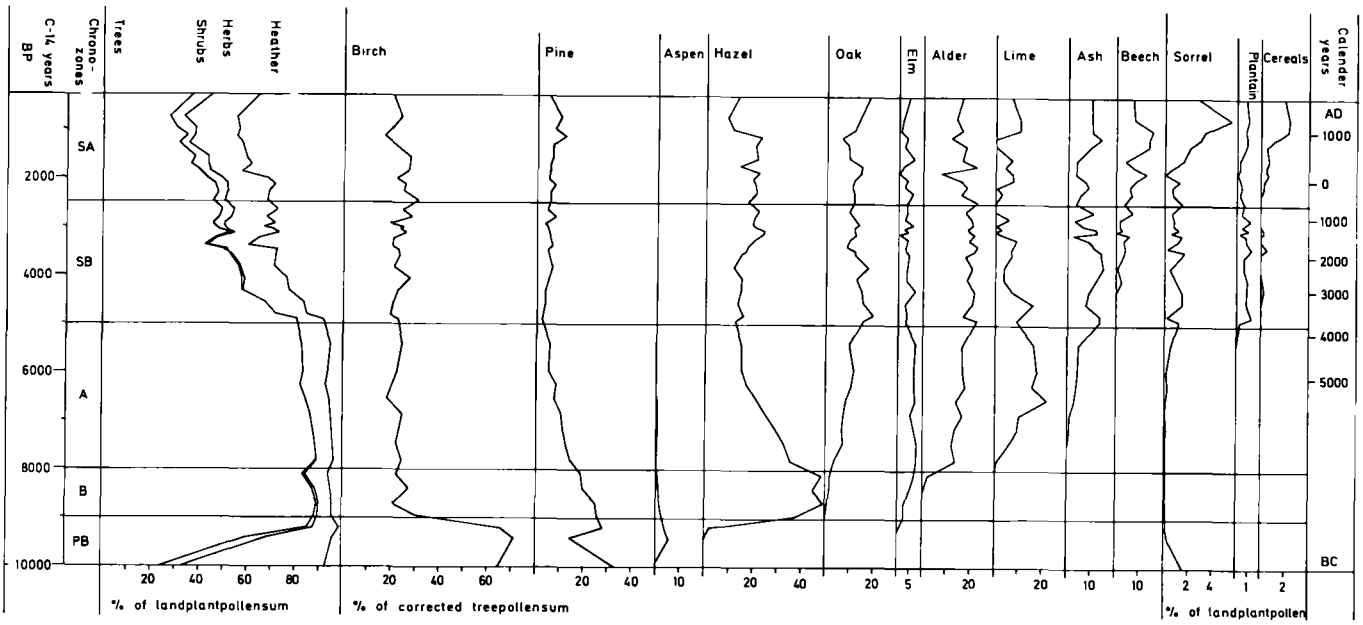

Fig. 9. Holocene pollen diagram from Lake Solsø including a survey diagram, a corrected tree pollen diagram (correction factors according to Andersen 1970, 1980) and separate curves for three components of the herb curve of the survey diagram (note different scales). The chronology of the the diagram is based on C-14 datings, and the convertion of C-14 years to calendar years is according to Clark (1975).

floor. Furthermore, the demanding trees, elm and lime, were less frequent in Western Jutland than in eastern Denmark, while birch was more common.

In the early Subboreal, the vegetation changed dramatically. The first pollen grains of plantain (*Plantago lanceolata*) document the introduction of farming, and heathland expanded at the expense of the forest. In the middle of the Subboreal, the heathland expansion stopped and an equilibrium was reached. Thus the pollen diagram reflects essentially unchanged vegetation from this time until the Birth of Christ. During this interval of about 2000 years (2000 B.C.–0) large areas were covered by young *Calluna*-heaths, whereas others bore forest, which differed from the Atlantic forest by, *i.a.*, the sparseness of lime. Grassland may also have been present, but fields were scarce.

Shortly after the Birth of Christ a new heath expansion started and continued nearly until today. Increasing frequencies of rye (included in the cereal curve) and sorrel (*Rumex acetosella*) reflect more intensive agriculture from the beginning of the present millenium.

Purely natural heaths can only exist in very rough climates like today on the Faroe Islands; there is no indication that the Danish climate was that severe at any time during the Subboreal and Subatlantic periods. Heather expands on abandoned sandy fields, but if the heath is not rejuvenated by new cultivation, or nursed by grazing or burning, it will after a few decades turn into grass- crowberry (*Empetrum*) heath and eventually be invaded by shrubs and trees. The prehistoric heaths must therefore have been nursed by Man, but with which method and for what purpose?

Ample charcoal dust throughout the deposits of the heathland period in Lake Solsø indicates frequent burning of the heathland. This is in accordance with the almost total absence of juniper-pollen in the pollen diagram. This wind-pollinated shrub can be effectively spread by sheep and is today almost exclusively found on pastures and grazed heaths. However, juniper does not tolerate burning; frequent heath fires would therefore have impeded the introduction of juniper to the area.

The pollen diagram from Lake Solsø shows that heathland expanded already in early Subboreal time and persisted in the area until quite recently. The regional diagram also gives indications of the prehistoric use of the heaths, but local pollen diagrams from buried soil sections may get us closer to an answer to our question.

Fig. 10 shows a pollen diagram from a podzol preserved beneath a burial mound at Skarrild (Fig. 1). The mound was excavated by H. Rostholm and the oldest grave has been radiocarbon dated to 2550 B.C. (calendar years, Rostholm 1982).

The lowest pollen spectrum, at 15cm, reflects the vegetation in the brown earth stage. The site at that time was covered by alder-birch forest with occasional lime trees, and ground vegetation of grasses and herbs like devil's-bit (*Succisa*). The precise age of this vegetational stage is not known; it probably persisted until a few centuries – or perhaps decades – before the erection of the mound. The topmost pollen spectrum reflects the vegetation at the site – now a podzol – just prior to the making of the mound. The vegetation had changed to heath totally dominated by heather, but alder-birch forest was still present in the vicinity. Due to earthworm activity in the brown earth stage, the pollen spectra between the lower and the uppermost samples are mixtures of spectra from the forest and the heath stages.

The only logical explanation to this local vegetational change is that the forest was destroyed by Man and replaced by heath. Furthermore, vast amounts of microscopic charcoal in the topsoil show that the heath was maintained by burning. This is a perfect parallel to the forest clearence followed by heather expansion, which was demonstrated in a raw-humus pollen diagram from Draved, southern Jutland, by Iversen (1969). At this site the clearence took place in the Viking Age, but the heath in Draved was also nursed by burning.

The diagram from Draved (Iversen 1969) and the present one from Skarrild clearly do not support the view of Jonassen (1950) that the reason for the prehistoric heath expansion was heather invasion on abandoned fields. Pollen grains of cereals are absent from the soil section at Skarrild, and neither of the sites has ever been tilled.

The results presented here are few and limited geographically. Nevertheless, they do suggest the following answer to the question how and why the prehistoric heaths were maintained. *Calluna*-heaths were not primarily the accidental result of extensive short-time agriculture followed by abandonment; they were deliberately produced and maintained by prehistoric Man. The heather was nursed by regular burnings, probably with the object of producing grazing and fodder – both amply provided by young heather – for cattle and sheep.

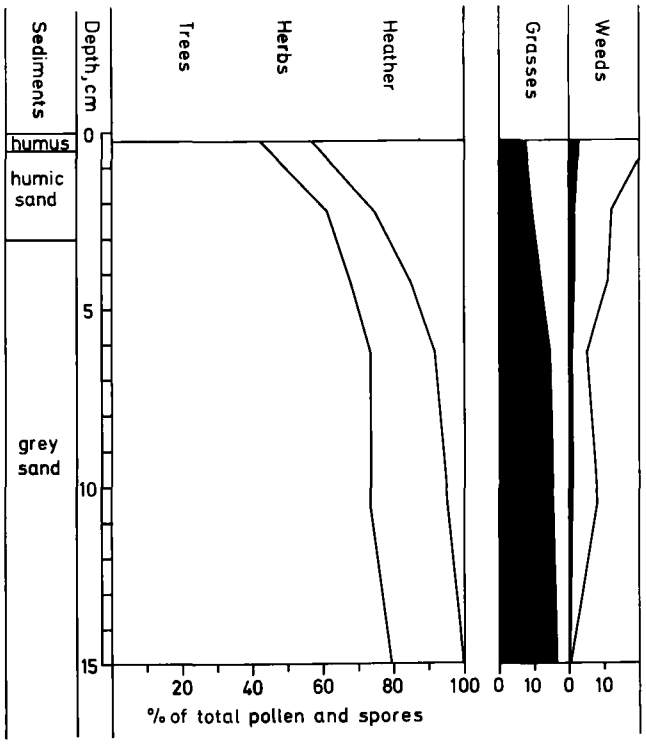

Fig. 10. Pollen diagram from a podzol located beneath a Single Grave mound at Skarrild. A survey diagram and separate curves for components of the herb curve are shown. The weed curve includes sorrel (*Rumex acetosella*), plantain (*Plantago lanceolata*), sheep's bit (*Jasione montana*) and wormwood (*Artemisia*).

CONCLUSION

Although the primary aim of the geobotanical studies at the Geological Survey of Denmark is to describe and understand vegetation in the past, the results presented here in a brief form give instances how these studies provide information about the vegetation and landscapes where Man lived in prehistoric and historic time. It is shown how human interference with nature and the vegetation in various ways can be traced on varying areal scales. Thus, the history of the vegetation is also the history of Man's changing environment and his interference with it, and is, therefore, not without interest for the archaeologist and the historian.

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Rescue Archaeology in Denmark 1970–1982

by KRISTIAN KRISTIANSEN

INTRODUCTION

In 1937 ancient monuments were for the first time generally protected by law in the Conservation of Nature Act (section 2). Previously protection had been voluntary and by 1937 approx. 7,000 monuments had been protected in this way. But now all visible monuments were automatically protected without compensation. The National Museum was given responsibility to decide which monuments were comprised by the law – in principle all those monuments that up to 1937 had remained untouched by cultivation, generally 25% (today 29,000 monuments). However, many exceptions were made by which ploughed monuments were protected and vice versa. Also private excavations of ploughed monuments and sites were prohibited. However, no economic means were ensured to excavate such threatened sites, nor were there any legal means of stopping the destruction of such monuments e.g. by road building. It was not until the revision of the Conservation of Nature Act in 1969 that these monuments were safely protected against destruction without previous rescue excavation. This was secured in the section 49 of the Conservation of Nature Act which runs as follows:

»When during earth work there are found barrows, burial places, settlement sites, ruins or any other fixed monuments, the work shall be suspended in so far as it affects the ancient monument. The find shall forthwith be reported to the Keeper of National Antiquities and the objects found shall be handed over to him on request. The Keeper of National Antiquities shall as soon as possible inform the person who carries out the work whether this may continue or shall be suspended until an excavation has been made or – if steps are taken to acquire the ancient monument in pursuance of subsection (3) hereof – until the question of acquisition has been finally decided. Any excavation shall be completed within twelve months after the date on which the find was reported. The Keeper of National Antiquities shall defray the expenses of the excavation. If the work is carried out on behalf of a public authority, that authority shall defray the expenses.«

Thus, the law calls for a balanced defrayal of expenses – with respect to private landowners the state will have to pay, in all other cases the responsible public authority whether local, regional or other ministries or sections of the central administration, will have to pay. Excavations can only be carried out by the Keeper of National Antiquities or by state-supported museums with professional archaeologists. Any other excavation, e.g. by universities or amateurs needs approval by the central authority, which will normally prescribe the supervision of an authorized museum and an agreement about the preservation of finds.

During the first 5 years section 49 was administrated by the Keeper of National Antiquities, as indicated in the text. But from 1975 it was administrated by the National Agency for the Protection of Nature, Monuments and Sites in the Ministry of Environment which had been founded 2 years earlier and where all administration of the planning, protection and exploitation of our physical environment were brought together in several agencies. However, from January 1st, 1983 it has been decided that the administration of rescue excavations returns to the Keeper of National Antiquities, whereas all other ancient monument administrations remain with the National Agency for the Protection of Nature, Monuments and Sites. This is a result of 3 years of commission work dealing with these problems (note 1).

As the section 49 has now been at work a little more than 10 years, we have a suitable interval for an analysis of how it has worked in practice, just as the return of the administration from the National Agency for the Protection of Nature, Monuments and Sites to the Keeper of National Antiquities offers an opportunity to look back and take stock[2].

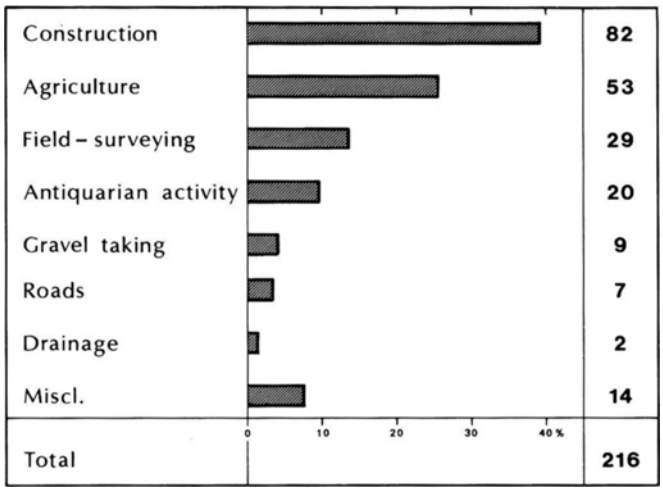

Fig. 1. Diagram showing the most common activities leading to rescue excavations according to section 49 based on the reports of the year 1980. The natural gas project is excluded. *Construction* also includes sewers, etc., but not road building. *Agriculture* also includes windbreaks and gardening. *Field surveying* is mainly linked to urban expansion. *Antiquarian activities* include the various activities that randomly lead to reports of potential section 49 excavations.

	1965	1970	1976	1982
Universities	4	8	10	9
National Museum	8	9	9	11
Ancient Mon. Adm.	3	3	4	8
Regional Museums	6(3)	11(5)	23(5)	41(6)
Total	21	31	46	69

Fig. 2. Prehistoric archaeologists with a major university degree in permanent jobs (full- or parttime) in Denmark in respectively 1965, 1970, 1976 and in 1982. To this should in 1982/83 be added 7 prehistoric archaeologists employed in other institutions, plus 2 in Greenland and 1 in the Faroe Islands. Furthermore, between 25–30 prehistoric archaeologists are employed in temporary jobs, mainly based on rescue archaeology, e.g. the natural gas project. Only 4–5 are working in pure research projects.

WHAT CAUSES RESCUE EXCAVATIONS?

In general we can distinguish between rescue excavations caused by agriculture on the one hand, and by construction works on the other hand.

For the first group no systematic administration can be carried out as agriculture is not regulated. Reporting of monuments under destruction depends solely upon the interest among farmers and their co-operation with museums. Destruction is very gradual and excavation therefore not acute, however, naturally depending on the state of destruction.

For the second group a systematic administration can be maintained as all use of land for construction or gravel taking needs approval either by regional or central authorities. This regulation is a vital part of the physical planning system that was developed during the 1970's in Denmark in the Ministry of the Environment. Destruction is normally absolute and excavation acute.

Rescue excavations caused by the destruction by agriculture represent an old tradition strongly related to the work of both regional museums and the National Museum, which is based on the archaeological goodwill that has built up among farmers throughout the last 150 years in Denmark.

In contrast to this, rescue excavations caused by construction etc. represent a rather new field of research linked to the expansion of towns and infrastructure since the 1950's. The basis for this work is closely linked to the development of the physical planning system throughout the 1970's. Thus its expansion has been linked to an integration with the national, regional and local planning systems which has only taken place throughout the late 1970's, and which has also demanded the development of a new large scale planning of rescue archaeology and the application of large scale excavation techniques. A very good example of this is the

	76/77	77/78	78(¾ year)	79	80	81	82
National Agency	14,1%	27,7%	27,2%	32,0%	12,2%	22,0%	20,1%
National Museum	21,0%	13,1%	17,3%	6,2%	4,8%	3,4%	4,0%
Regional Museums	64,9%	59,2%	55,5%	61,8%	83,0%	74,6%	75,8%

Fig. 3. The economy of rescue excavation since 1976/77 classified according to excavating institutions. In 1981 and 1982 the Natural Gas Project represented appr. 15% of the share of the National Agency.

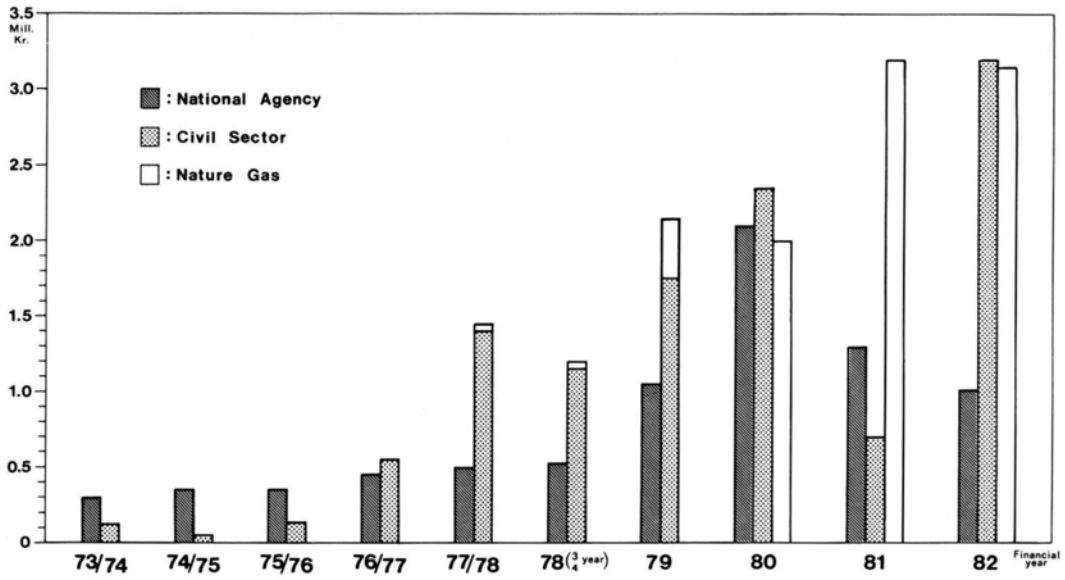

Fig. 4. The economy of rescue archaeology in Denmark since 1973/74 classified according to money paid by the National Agency to private landowners/companies and excavations paid by other public authorities. Among the latter the natural gas excavations have been singled out. Figures for the first 3 years have not been accessible, but conform to the period of 1973–76. The figure represents the official statistics. To this should be added several unemployment excavation projects carried out by regional museums throughout the last 3–4 years. Approx. 1 million D.kr. each year.

rescue excavations preceeding the 2,000 kilometers of gas pipe lines cross-cutting Denmark (3).

Thus, while the number of rescue excavations caused by agriculture has remained more or less stable throughout the last 10 years, the number of rescue excavations caused by construction works has been increasing rapidly since 1976. Fig. 1 gives a representative picture of the situation throughout the last 5–6 years.

ECONOMY AND RESOURCES

While economy is a matter of money, resources refer to the number of institutions, staff, administration etc. available for rescue archaeology. Here again we may distinguish between the archaeological capacity and the administrative capacity.

As section 49 only covers the actual excavation and the excavation report, but not conservation (4) or analyses and samples of e.g. soil, grain, bones etc. the resources of museums are decisive for the preservation and storing of find material. Consequently, the Museum Act of 1977 instructs museums to assist in rescue archaeology according to their capacity for doing so. Let us therefore consider their capacity in terms of professional archaeological staff.

On fig. 2 is shown the distribution of archaeologists in permanent jobs (full- or part-time) in Denmark respectively in 1965, 1970, 1976 and 1982. The figure very nicely illustrates the expansions of regional museums in terms of professional archaeological capacity. If we then take a look at the carrying out of rescue excavations in terms of money throughout later years (fig. 3) it will be apparent that the increase of professional archaeologists at regional museums corresponds to an expansion in the engagements in rescue excavations.

The background of this expansion in economy and resources is further illuminated in fig. 4 showing the total funding of rescue archaeology since 1972–73, classified according to excavations paid by the National Agency (private landowners/companies) and excavations paid by other public authorities/institutions. Among the latter the natural gas excavations have been singled out.

In the early seventies figures were rather low and most of the money was spent on private landowners, that is excavations of mainly ploughed barrows due to the reporting of landowners through their local and regional museums. In 1975 the administration of Ancient Monuments was transferred to the new Ministry of Environment and from 1976–77, and especially 1977–78,

the share of rescue excavations paid by other public institutions increased rather drastically. This reflects the first phase of a more systematic integration of the rescue administration in the physical planning system combined with an increasing awareness among museums of the potential of section 49. During the first years larger road projects were dominating, but in recent years also regional and local building and construction works carried out by county and municipal authorities have increased their share. This reflects an increasing engagement and co-operation between regional museums and counties and municipalities (5).

The decline in 1981–82 was mainly due to the economic recession and the increasing demands of the natural gas project on the regional museums, which carry out all final excavations.

Thus, figures 2–4 reflect the expansion of rescue archaeology in Denmark both in terms of administration and in terms of resources. During the first years, when the archaeological capacity was low both centrally and at regional museums, money was mainly channelled into traditional excavations of ploughed barrows due to agriculture – a continuation of a hundred year old tradition of rescue archaeology. With the increasing number of professional archaeologists employed at regional museums throughout the 1970's, the archaeological capacity for rescue archaeology was significantly raised. When from 1975–76 the rescue archaeology was systematically applied to and integrated in the physical planning system, at first at a national level and in later years also on regional and local levels, the foundation was laid for a significant expansion with the National Agency as administrative coordinator and regional museums as excavators. In terms of number of excavations they are generally carrying out 80–90% of all rescue excavations in Denmark, whereas the National Agency has mainly concentrated on planning, field surveying and test excavations on larger national projects such as the natural gas project.

Thus the very strong and old archaeological traditions for rescue archaeology at many Danish regional museums have been decisive for the de-centralized expansion of rescue archaeology in Denmark since its beginning in 1970. But to this should also be added the decentralized structure of the Danish physical planning system divided into a national level (Ministry of Environment), a regional level (counties) and a local level (municipalities). Although all authority has remained with the Keeper of National Antiquities, later the National Agency and now again the Keeper of National Antiquities, they have advised regional museums to cooperate directly with county- and municipal administrations in all matters that do not demand central approval in the Ministry of Environment, as this represents the larger proportion of land use for construction and building activities in Denmark. Such regional administrative co-operation, which in cases of actual rescue excavations needs central approval (6), has until now only been established in approx. 40–50% of all counties and municipalities. Thus, there is still potential for expansion at regional and local levels.

PLANNING AND PRIORITIES

Planning refers both to administrative and archaeological procedures. Administratively a major objective has been to develop a preventive practice by integrating rescue archaeology in the physical planning system. This implies that all construction plans have been subject to archaeological control before their approval by respectively the National Agency (large scale projects demanding central approval in the Ministry of Environment) and regional museums (small scale projects demanding regional approval in the county administration). To support this procedure EDP drawn maps of all registered monuments and sites (approx. 120,000) have been put at the disposal of the county administrations as a basis for their co-operation with museums. In this way potential sites may be pointed out already in the planning phase, making possible changes and adjustments in order to preserve archaeological sites, or – if that is not possible – long term planning of rescue excavations.

The subsequent archaeological planning normally includes three stages: Field surveying, test excavations and final excavations. Test excavations are carried out in order to determine the information value of the site. All sites that yield datable information on prehistoric constructions in a definable context will then be fully excavated within the exploited area. In general this represents approx. 20% of all recognized sites. Taken as a whole approx. 50% of all reports on potential section 49 rescue excavations have resulted in some sort of excavation, small or big. Between 1970–82 approx. 1,000 rescue excavations have been carried out. Today most excavations are carried out with the use of machinery of

various types, at settlements sites in order to strip large areas for house plans, pits etc., at barrows to reveal previous ritual activities – fencing, ploughing, wooden chambers etc.

The stepwise excavation procedure described above has been applied in order to maximize archaeological information and economic ressources through priorites at each level.

With respect to priorites section 49 does not require that all threatened sites must be excavated. It does say that all sites that are discovered and threatened must be reported immediately to the central authority which then decides if an excavation shall be undertaken. Three basic criteria have been employed for such a decision:

1) The actual threat against the site or monument (is it absolute or relative).
2) The actual condition of the site, which is decisive for the quality of the information that it holds.
3) and finally the scientific relevance of the site and its information.

Criteria 1 and 2 in combination are generally regarded as most decisive and criteria 3 is applied in situations where shortage of money or time pressure demands a priority between well preserved objects. Thus the general respect for the individual monument which is implied in section 49 combined with the need for a homogeneous administrative practice has been and still is the most decisive element. Priorities may, however, take place more indirectly as part of the planning process. Thus the general administrative practice – that field surveying and the pointing out of potential sites for rescue excavations takes place before the approval and carrying out of the construction work – has made it possible to influence and change the planning in such a way that certain types of monuments are preserved and others excavated. This preventive administrative practice has been most successfully employed in the natural gas project where it has been possible to curve the pipe lines in between all known monuments, mainly barrows which have been excavated by the thousands throughout the last 200 years. Consequently, only settlement sites are excavated, in many areas for the first time.

However, it should be remembered that priorities also take place even before reports reach the central authority, that is, when regional museums decide what to report. This is most pronounced in the case of rescue excavations on agricultural land where in principle all ploughed sites are under threat. But the increasing number of rescue excavations preceeding construction works has made such random priorities less dominant.

Burials	76/77	77/78	78	79	80	81	82
Stone Age	191	441	647	479	223	132	323
Bronze Age	127	14	80	162	126	45	98
Iron Age	9	330	10	311	704	354	199
Medieval/Hist. per.	47	117	30	5	1416	3	9
Total	374	902	767	957	2469	534	629
Settlements							
Stone Age	39	57	56	205	200	141	95
Bronze Age	176	275	360	115	26	20	32
Iron Age	193	244	343	555	1130	563	1727
Medieval/Hist. per.	100	145	80	171	432	249	1116
Total	508	721	839	1046	1788	973	2970
Miscl.	116	221	66	413	171	206	337

Fig. 5. The number of rescue excavations since 1976 classified according to period and type. Miscellaneous includes undated sites, but not field surveying. It should be noted that the number of excavations is defined by location, not by number of excavated objects. One excavation may include e.g. 3 ploughed barrows.

Let us, however, take a look at some general trends in the distribution of rescue money on the main archaeological periods and groups of finds (fig. 5–6). The basis of these figures is the annual statistics that have been worked out to serve as a basis for the priorities of the *Ancient Monument Board*, which was founded in 1976 in order to advise the National Agency with respect to the general planning and priorities of rescue archaeology. The board represents regional museums, the National Museum, and the universities and all reports on potential rescue excavations have been presented to them at their meetings 6 times per year since 1976.

If we first look at fig. 5 showing the number of excavations, several trends are discernable. For burials the number of excavations declines from the Stone Age to Medieval historical times, although Iron Age burials have increased their share in recent years. This is obviously due to the visibility of most Stone Age and Bronze Age monuments, mainly barrows, in opposition to Iron Age and Medieval historical burials below ground level. And in the case of Medieval burials most of them have been destroyed by the continuous use of the churchyards since Medieval times.

Burials	76/77	77/78	78	79	80	81	82
Stone Age	16	18	21	18	14	5	27
Bronze Age	11	2	4	11	11	9	7
Iron Age	5	8	1	18	21	11	11
Medieval/Hist. per.	5	1	2	1	2	2	2
Total	37	29	28	48	48	27	47
Settlements							
Stone Age	4	3	7	11	11	4	11
Bronze Age	3	4	3	4	3	5	4
Iron Age	7	11	15	21	34	23	24
Medieval/Hist. per.	4	5	7	12	13	7	13
Total	18	23	32	48	61	39	52
Miscl.	13	10	3	18	6	10	12

Fig. 6. The economy of rescue excavation since 1976 (in hundred thousands) classified according to period and type. The excavations of the natural gas projects are excluded from both fig. 5 and 6, just as money for conservation (7). Thus the total of each year does not correspond precisely with fig. 3. Miscellaneous include undated and atypical sites, field surveying/test excavations, underwater surveying.

The most pronounced trend among settlement excavations is the general increase since 1976–77 within all periods and compared with excavations of burials it becomes even more significant. This reflects the dominant interest in settlement archaeology today in combination with the planning procedures described above favouring settlement sites (it should be noted that the natural gas excavations are excluded from these figures. They would increase the numbers by several hundred percent since 1980).

However, the number of excavations will only give a hint of the importance and the extent of excavations. This is better reflected in their relative share of money, according to period and category of find (fig. 6).

Also here we see a trend towards a relative increase of settlement excavations, but not so pronounced. Most significant, perhaps, is the increase of Stone Age and Iron Age settlement excavations compared to Bronze Age excavations. This is to some extent also due to the character of the evidence. Whereas Stone Age and Iron Age settlements are rather easy to locate due to the preservation of, respectively, flint tools and pottery, fireplaces, hammerstones etc., Bronze Age settlements normally leave rather scanty traces. To this should be added that both Neolithic and Bronze Age settlements are often destroyed by a later more extensive Iron Age settlement. Therefore the rather big relative share of Iron Age settlements probably represents a consistent feature in years to come.

With respect to burial excavations the Stone Age and the Bronze Age are mainly represented by ploughed barrows and megaliths, whose relative share has decreased compared to Iron Age and Medieval burials, although the very high figure for Medieval burials in 1980 is due to one very large cemetery. The rather stable figures for Stone Age and Bronze Age burials, compared to the fluctuating figures for the Iron Age and the Medieval period, also reflect the different properties of the data. Burials and cemeteries below ground level from the Iron Age and the Medieval period are rather difficult to recognize in comparison to barrows and megaliths from the Stone Age and the Bronze Age. Consequently, some years will show very low figures and other years high figurs, especially in cases of big cemeteries.

Thus, it can be said that the general trends indicated in fig. 5 and 6 are due to a combination of the properties of the archaeological data on the one hand and an increasing priority of settlement excavations on the other hand.

Finally on fig. 7 is shown the cost levels of, respectively, burial and settlement excavations, plus unspecified excavations mostly with burials and settlement structures in combination. As seen, most burial and settlement excavations are small scale excavations, although settlement excavations tend to be more expensive. Very costly large scale excavations are rare. Thus fig. 7 illustrates both priorities and levels of destruction, only few sites deserving a full scale excavation.

SUMMARY AND CONCLUSION

The period 1970–80 was characterized by a rapid expansion of museums in terms of professional staff, resources for exhibitions etc. and an expansion of the administration of rescue archaeology, especially during the period in the Ministry of Environment. Quite evidently, this situation had a great potential for both conflict and co-operation in terms of the carrying out of excavations by the central authority or regional museums. While the central authority in the Ministry of

Environment from 1976 and onwards concentrated on developing the administrative basis for rescue archaeology – resulting in a rapid increase of economic resources – museums concentrated on carrying out excavations and on picking up potential rescue excavations through co-operation with the county and municipal administration.

Thus, rescue archaeology in Denmark is still in a state of expansion and has only recently developed a museum capacity and an administrative structure that can begin to cope with the rapid destruction of monuments in modern industrial society.

The rapid expansion of rescue archaeology throughout the last 10 years has also resulted in problems with respect to the conservation of finds and post excavation analysis of environmental and zoological data. Whereas the capacity and the facilities for conservation have increased rapidly in recent years, the capacity for environmental and zoological analysis is still very limited and has not been geared to the present volume of archaeological excavations. Therefore, it is vitally important to expand this field of research. Otherwise, the continuous accumulation of archaeological houseplans, pits etc. will soon become trivial.

Another major concern of rescue archaeology will be to continue the development of the methodology of field surveying and excavation, both in terms of applying new techniques (e.g. air photography, georadar etc.) and in terms of linking field surveying to the development of regional settlement models enabling us to predict the most likely locations of settlements within different regions.

Thus, in terms of developing a research structure that can cope with the scientific potential of rescue archaeology in Denmark, there is still much to be done.

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NOTES

[1] At the same time the administration of the Conservation of Historical Shipwrecks Act was transferred from the Keeper of National Antiquities to the National Agency. Thus protection in situ of cultural heritage lies within the responsibility of the National Agency, while the administration of (rescue) excavations is entrusted to the Keeper of National Antiquities.

Cost levels in Kroner	Settlements	Burials	Unspecified
< 15.000	32	35	3
15 – 25.000	8	6	2
25 – 50.000	11	2	1
50 – 100.000	4	1	1
> 100.000	2	3	2

Fig. 7. Settlements, burials and unspecified excavations classified according to cost level. 1980 has been chosen as a representative year. Unspecified mostly includes sites with both burials and settlement structures. Therefore figures do not correspond precisely with fig. 5.

[2] The following analysis is mainly based on the yearly report of the »Ancient Monument Board« published since 1976. The Ancient Monument Board was founded in 1976, after the transfer of the ancient monument administration from the *Keeper of National Antiquities* to the *National Agency for the Protection of Nature, Monuments and Sites*. In the yearly reports on the activities of the Ancient Monument Board the National Agency has provided statistics on rescue excavations and the distribution of rescue money.

The period 1973–76 is based on an unpublished analysis of rescue archaeology that was worked out in 1976 by Jens Bekmose for the National Agency.

Finally, a general account and discussion of rescue archaeology was given by Kristian Kristiansen and Mogens Ørsnes in 1980 for a government commission on ancient monument administration in Denmark founded in 1979. This account was published in 1981 by the National Agency in a conference report.

I want to thank Jens Bekmose and Torben Dehn for advice and critical comments.

[3] An account of the integration between the Danish Physical Planning System and the Ancient Monument Administration is given by Kristiansen (in press) and will therefore not be stated in this article. It is to appear in »*Approaches to the Archaeological Heritage*. A Comparative Study of World Cultural Resource Management Systems.« Editor: Henry Cleere. Publisher: Cambridge University Press.

[4] Normally a stabilizing conservation is provided by section 49. In general, however, museums carry out all conservation except in extraordinary cases. Full excavation reports must be delivered not later than one year after the completion of excavation. All reports are registered and stored centrally in the National Museums.

[5] This development is also reflected in the increasing economic share of municipalities compared to county and state institutions throughout the last 5–6 years in terms of money for rescue excavations, from 25% in 1976/77 to 60% in 1980. The increasing share of municipalities is mainly due to the expansion in land-use for urban purposes. In most cases land is prepared for development by the municipality (including rescue excavations) and is then later sold to the builder.

[6] The National Agency has devised provisional administrative regulations for museums in order to minimize central engagement and prevent parallel work being carried out centrally and regionally. This imp-

lies that central approval has normally been passive – positive action was only taken when problems arose. At the national/larger regional level – motorways, natural gas etc. – the National Agency made contracts with regional museums defining procedures and responsibilities. Here the Agency supervised all planning, economy and field surveying, while regional museums carried out final excavations. Thus the National Agency has aimed at an administrative divison following the structure of the physical planning system, but with the Agency as responsible authority according to the lawtext of section 49.

[7] In 1981 and 1982 conservation expenses at one large iron age cementery amounted to appr. 250.000 kr. each year, which is extraordinary. It should be noted that the figures listed in fig. 6 and 7 do not always include the full costs of an excavation. Often museums assist with their own excavators and counties or municipalities supply machinery and unskilled labourers. As it may be assumed that such invisible expenses are distributed at random the general trends in fig. 6 and 7 can be regarded as representative.

Reviews

THORLEIF SJØVOLD (ed.): *Introduksjonen av jordbruk i Norden. Foredrag holdt ved fellesnordisk symposium i Oslo april 1980.* Det Norske Videnskaps-Akademi. Universitetsforlaget, Oslo 1982. 282 pp.

MAREK ZVELEBIL: *From Forager to Farmer in the Boreal Zone. Reconstructing economic patterns through catchment analysis in prehistoric Finland.* BAR International Series 115 (i-ii), Oxford 1981. 472 pp.

The two works display superficial similarity, both being reproduced typescript. In other ways they are very different. *Introduksjon* offers a series of papers by Scandinavian scholars, while *Forager to Farmer* is the result of a PhD thesis by a non-Scandinavian.

Introduksjon is well-organised, and goes a long way towards summing up the current state of research, an unusual achievement for an edited volume. The English summaries of the papers are, however, usually too brief to do justice to the originals, which may deflect some of the attention this volume undoubtedly deserves. One immediately noticable point concerns the breakdown of papers: two (Hagen and Waterbolk) discuss the development of agriculture outside Scandinavia. Although interesting in their own right, they contribute little to the main theme of the volume. Two more papers deal with Denmark, while a full 15 cover Norway, Sweden and Finland. The impetus of research, anchored in Denmark in the middle years of the century, now seems to have moved to the north.

The Scandinavian papers may be divided into 2 categories. From southern Scandinavia, there is much archaeological evidence of early agriculture, and pollen analysis attempts to understand *what kind* of farming was practiced. From the boreal zone, however, there is virtually no archaeological evidence, so pollen is usually also the only source of information on *whether* agriculture was practiced.

The two papers from Denmark are by Troels-Smith and Steensberg, neither of them describing very recent work. Troels-Smith provides a resumé of his major article in *Aarbøger* 1953, describing the results of the Aamosen investigations, and compares the Danish and Swiss evidence. The various types of agriculture discerned in the pollen diagrams are linked to particular archaeological cultures; economic change thus takes place by invasion or influence. The linking of agricultural type to archaeological culture is sometimes rather roundabout – the elm decline (believed to result from fodder collection) in the Neverkær pollen diagram is ascribed to the Ertebølle culture because of a thick-walled potsherd found at the same level. Cereal type pollen also appears at this level. The Muldbjerg settlement is also dated to this phase with its neolithic A pottery. The Muldbjerg C14 dates of around 2800 bc thus date a post-elm decline Ertebølle/neolithic A complex with domestic livestock. However, some pollen analysts have argued that the elm decline all over north-western Europe should be dated to 3100/3000 bc (Smith and Pilcher 1973). Skaarup (1973) has shown that the later shell middens are to be seen as neolithic hunting stations, not as late Ertebølle survivors alongside immigrant farmers, and the many C14 dates now available suggest that the Ertebølle ended around 3200/3100 bc (Tauber 1972, S.H. Andersen 1973). Not all the evidence is therefore in favour of an Ertebølle responsibility for the elm decline (which may not have been caused by man at all – Rowley-Conwy 1982), or for that matter for an Ertebølle/neolithic A overlap. The major landnam clearances (sometimes regarded as evidence of swidden cultivation) are attributed to neolithic B immigrants. Whether it is justifiable to ascribe agricultural types to archaeological cultures in this way is uncertain. Becker's (1947) neolithic A–B–C sequence is not supported by radiocarbon, and it is doubtful whether an ethnic interpretation of these groups can be sustained. Nevertheless, the results of the Aamosen project remain central to any discussion of early agriculture in Denmark.

Steensberg describes the important slash and burn experiments from Draved, carried out in the 1950's and published in 1979. He suggests that the major landnam features in the pollen diagrams resulted primarily from efforts to provide grazing for cattle, one or two cereal crops being taken first. Particularly striking is the generally low yield produced by the experimental slash and burn fields, suggesting that (if this really was the neolithic method) cereal cultivation would have been precarious indeed.

Turning now to the papers about southern and central Sweden, Jennbert-Spång suggests that there was considerable continuity between the Ertebølle and the neolithic, and so provides an alternative to the immigrations of Troels-Smith. Welinder briefly describes a computer simulation of a forest clearance pollen diagram, and concludes that the elm decline may be no more that a statistical creation caused by the regeneration of birch. The simulated diagram is »fairly similar« to the actual one. Built into the model are certain assumptions such as slash and burn agriculture, and that the pollen in the sample derives from a 2 km circle round the sample point. It

would be interesting to know how similar the model diagram would be to the real one if other assumptions were used.

Göransson's article is probably the most original and provocative in the book. His most important suggestion is that the middle neolithic »regeneration« of the forest in fact represents the development of coppiced or pollarded woodland, used cyclically to provide grazing, wood and small areas for cultivation. This would explain why grasses etc. are much more common in this »regenerated« woodland than in the undisturbed woodland of earlier periods. Göransson's explanation is at least as likely as the development of areas of permanent pasture (Troels-Smith 1953), or the decline of agriculture due to climatic fluctuations (Gräslund 1980) or soil exhaustion due to too short a fallow period (Whittle 1978). Göransson's theory is particularly attractive because of the likelihood of areas of coppice developing »by accident« close to a settlement. As trees were felled to provide building material, and/or were ringbarked to provide agricultural plots, so more light would reach the forest floor and encourage ground vegetation. We may assume that neolithic farmers were perfectly well aware of the ability of the stumps of many tree species to produce new shoots after felling. The need for a supply of easily cut timber of uniform development would be likely to result in some areas being protected from grazing animals for the first few years after felling, so that this growth of new shoots could become useful timber. Cyclical use of the woodland would result. It is significant that Göransson finds some evidence of ringbarking in his pollen diagrams: after ringbarking, trees produce a large amount of pollen before dying, and the uneven values of some trees could be interpreted as evidence of this. Göransson suggests a period of shifting fire clearance between the ringbarking and coppicing phases, but this would seem hardly necessary in ecological terms: the initial ringbarking could lead straight into the coppicing phase as suggested above. Thus Göransson's work raises some problems, but does succeed in airing some exciting new ideas about the neolithic use of forests. It is hoped that these ideas will be further developed in future.

In southern Scandinavia, therefore, there are still some problems in the palynological diagnosis of agricultural type. Further north, the problems seem even greater. Most of the *Introduksjon* papers deal with areas north of the temperate zone, so comparisons with *Forager to Farmer* are particularly relevant. A good point about *Introduksjon* is that several of the papers are in pairs, being pollen analytical and archaeological commentaries on early agriculture in particular areas. This enables comparisons to be made between the two lines of evidence, and a major problem appears: the pollen analysts are unanimous in claiming evidence for neolithic agriculture, while the archaeologists are unable to provide any supporting evidence. Archaeological evidence has been specifically looked for – Baudou's archaeological commentary on north Sweden mentions the Norrböle area, where pollen evidence of neolithic agriculture has been claimed. Excavation of 7 contemporary sites within a few km of the pollen sample point has however produced nothing but *wild* animal bones. Engelmark, describing the pollen evidence from the same area, does have the advantage of being able to point to the only neolithic site in northern Scandinavia with evidence of domestic animals: Bjurselet. Several contributors to *Introduksjon* mention it as the kind of neolithic site to be looked for in other areas, but the evidence is far from convincing. The domestic animals (mainly sheep) form under 2% of the fauna, and at least some of them are recent intrusions (Lepiksaar 1975). This is scarcely sufficient basis for the »large scale sheep farming« sometimes suggested. Future excavations will hopefully provide more information; but in the meantime we may speculate whether anyone would go to the trouble of keeping domestic animals if they were to provide only 2% of the kill – or for that matter whether such small numbers of animals would cause vegetational changes visible in pollen diagrams.

The other northern areas do not have sites like Bjurselet. The history of neolithic agriculture is written entirely from the pollen diagrams for east Norway (Mikkelsen, Høeg), north Norway (Vorren and Nielsen) and Finland (Huttunen, Tolonen, Vuorela). One exception is the paper by Aalto, where agriculture is claimed on the basis of plant macrofossils – but the associated pollen core has no agricultural indicators. Much is often based on minor components of the diagrams. The reviewer is probably not alone in feeling some disquiet when permanent settlement is claimed on the basis of a single pollen grain of *Plantago major* (Vuorela and Aalto 1982). »Cereal type« pollen is often assumed to be evidence of cereal cultivation, although S.T. Andersen (1978) emphasises the overlap between pollen from cereals and wild grasses.

A point made by several contributors (Mikkelsen, Engelmark, Tolonen, and indeed Zvelebil in *Forager to Farmer*) is that many of the claimed »indicator plants« are in fact native to northern Scandinavia, particularly the coastal regions. Discussion of this by Vorren and Nielsen in their paper on north Norway would have been welcome – their claimed grazing horizon on the Lofoten Islands at 3560±80 b.c. is both the earliest and the most northerly of those discussed in *Introduksjon*. Johansen's archaeological commentary points out that no neolithic sites of anything like this antiquity are known, and he mentions elsewhere (1979) that only two early neolithic finds (thin-butted axes) are known from the whole of Norway north of the Arctic Circle. The conventional limit of farming at around 3500 b.c. is the Rössen culture, which extended about as far north as Hamburg, some 1600 km south of the Lofoten Islands. The presence of domestic animals so far north so early seems from an archaeological point of view very unlikely.

Several of the Finnish papers (Huttunen, Aalto, Vuorela) note that the appearance of culture indicators is often contemporary with that of spruce. One explanation is that early farmers exhausted the soil, allowing spruce to immigrate. Variations in the spruce pollen curve, and increases in herbs etc., thus indicate subsequent human clearances for agricultural and/or pastoral purposes.

Other possible causes of such phenomena do come to mind, however, and it would be interesting to know how palynologists distinguish anthropogenic from other causes. An important point in this connection is that fire is a natural component of spruce forest ecology. Much work has been done in North

America demonstrating that the boreal woodland mosaic is a product of numerous forest fires, so that the forest consists of patches burnt at different times and in different stages of post-fire succession (e.g. Bloomberg 1950, Heinselman 1973, Rowe and Scotter 1973, Swain 1973). Bloomberg (op. cit.) stresses that fire is important because little undergrowth (even spruce saplings) can flourish under spruce forest. Periodic burning removes the spruce, allowing pine to colonise the area. These pines create a suitable environment which spruce may re-invade. Because so little light and heat reach the ground beneath dense spruce stands, decomposition of dead, dry vegetable matter on the forest floor is slowed. Spruce stands thus become increasingly combustible with age (Bloomberg op. cit.).

The importance of the early post-fire successional stages for grazing wildlife is stressed by all the authorities quoted above. »Vigorous growth of grasses, sedges and other herbs characteristically succeeds fire in many areas of the boreal forest« (Rowe and Scotter 1973, 449), which provides excellent conditions for wild ungulates. This has great importance for boreal hunter-gatherers in the New World (Winterhalder 1981). Other factors which can clear areas of spruce and initiate post-clearance succession are snow-throw (Pruitt 1958), wind-throw (Sernander 1936) and beaver activity (Coles and Orme 1983).

North Scandinavian spruce forests show similar evidence of repeated burning, the fires often being caused by lightning strikes, but also by campfires etc. (e.g. Saari 1923, Siren 1955, Uggla 1958). Of particular interest are the plants which recolonise the burnt areas. In northern Scandinavia these include many of the plant types regarded as evidence of human activity, such as Gramineae, Polygonaceae (including *Polygonum* spp. and *Rumex acetosella*), Plantaginaceae (including *Plantago major* and *P. media*), Chenopodiaceae, *Urtica* (nettle) and ferns etc. (Buch 1945, Fagerström 1942–43, Petterson 1931). It would therefore seem that there might be considerable problems in distinguishing between a natural fire succession and one caused by human clearance, let alone between different kinds of human clearance (e.g. for swidden agriculture, for permanent arable, for domestic animal grazing, or for that matter for increasing graze for wild mammals – the last-named is widely documented ethnographically). The regularity with which »culture indicators« first occur at the same time as the appearance of spruce (see above) emphasises the problem.

Periods of apparent stability in boreal pollen diagrams do not necessarily indicate that areas of the forest mosaic were not being burnt; the balanced turnover of mosaic elements can lead to unchanged regional pollen representation (Wright and Heinselman 1973). Charcoal is not necessarily an indication of human activity: »Most of the forests in northern Sweden have been devastated by fire, and particles of charcoal from ancient forest fires are very common in the humus cover« (Uggla 1958, 99, reviewer's translation). Charcoal is found continuously in North American lakes from the early post-glacial (Heinselman 1973).

The above discussion of spruce and fire is put forward by the reviewer (who is neither an ecologist nor a palynologist) as a question which others are more competent to discuss. In view of the replacement of spruce by other trees after forest fires, and the growth of plants such as Gramineae, Chenopodiaceae, *Urtica* and *Rumex* in naturally burnt areas, ecological and palynological discussion of, for example, the following quote would be interesting.

> »From a botanical point of view it is logical to interpret a horizon as a cultivation phase if e.g. the natural Gramineae pollen proportion and quantity increases, and if there appear among the weeds e.g. Chenopodiaceae, *Urtica* and *Rumex acetosella*. This is particularly the case if a contemporary drop in spruce and rise in birch and alder can be observed from the tree pollen.«
>
> (Vuorela, *Introduksjon* p. 255, reviewer's translation).

Pollen evidence for agriculture in areas such as north Scandinavia where there is no independent evidence for or against farming seems thus somewhat problematic. The impression gained from *Introduksjon* is of current deadlock: in the absence of archaeological evidence, claims put forward by pollen analysis are hard to assess. The importance of Zvelebil's *Forager to Farmer* in this context is that it develops a methodology for breaking this deadlock, and examining the economies of south west Finland.

Zvelebil's method is to develop a General Model Strategy (GMS); this is based on a reconstruction of the prehistoric environment. Optimal settlement locations are predicted. An optimal location is one »where all the vital resources can be exploited proportionately to their sustained yields« (p. 71) within the terms of minimising effort and risk. As population pressure develops, groups may have to increase their work effort and their risk factor. This should be visible as a departure from the GMS; in other words, sites will be found in suboptimal locations regarding effort and/or risk minimisation.

Essentially, the approach succeeds. For it to do so, reconstruction of both the environment and of likely human exploitative abilities must be sufficiently reliable to allow the rest of the process to be based on it. Any reconstruction of this kind remains to some extent hypothetical, but the thoroughness of Zvelebil's treatment is reassuring. Each resource is considered against each environmental zone, and annual productivity for each zone is calculated from the biomass, meatweight and calorific value of each resource. The *accessibility of this annual productivity* is the key to the GMS. This is estimated with reference to resource reliability, resource value, energy expenditure in procurement, and energy return. The result is an estimate of the resource value for each zone and season. This approach seems preferable to that of Jochim (1976), which is based on quantification of such factors as resource agglomeration and mobility. The relevance of these factors to human exploiters clearly varies between species, making interspecific comparisons difficult. Zvelebil gets round this by ranking resource *accessibility*: although the results are explicitly estimates, the values for the various resources are comparable in a way that Jochim's are not.

Once optimal site location is predicted, it is tested against actual site location. This actual location is examined by means

of site catchment analysis. The various problems with this are discussed, and the technique made more flexible by using circles of varying sizes for different activities. For arable, a 1.5 km circle is used, for fishing 5 km, for hunting 10 km and for swidden 15 km. These values are based on ethnographic and historical sources. This makes the technique more flexible, and the detailed environmental treatment makes it more precise, than many earlier applications.

The various environments are examined, by season, to see how close they are to the ideal strategy of the GMS – that all resources should be exploited in proportion to their accessibility. The resulting prediction for early settlement in southwest Finland involves summer use of coasts for fish, and winter residence on the large inland lakes with seal populations, with some elk hunting also being carried out. When population rises to a point where it is no longer possible to minimise effort and risk, specialisation is predicted: all-year occupation of the coasts adds a winter seal specialisation, and all-year settlement on the interior lakes adds a fish specialisation in summer. Risk increases correspondingly. The third stage is for relatively increased mobility, involving special purpose camps in less favourable locations. The fourth possible stage predicted is the emergence of a fully mobile economy, with small groups occupying areas just inland from the coasts, and inland areas not on major lakes – i.e. a high work-input economy filling the less favourable interstices between the more sedentary specialists.

The assumption has to be made that sites are logically located regarding the resources, that human beings do the reasonable thing. This could be seen as a weakness, but the clear trends that emerge when Zvelebil considers the known sites of each culture and period more than justify his use of the technique of site catchment analysis. The Combed Ware I sites on the coast and lakes are located to exploit resources as the GMS predicts – coastal sites are in areas suitable for summer fishing, not for winter sealing, for example. Specialisation on seal takes place early, with Jäkärlä culture sites located in places where seal availability is on average double the mean value for the whole coast. The appearance of sealing technology supports the interpretation. Seal specialisation increases with time, as seal availability is even more above average at Kiukais sites. Particularly interesting is the result from the Corded Ware, usually regarded as a farming culture (see above). Some sites are just inland from the coast, but have much lower seal potentials than those of the specialist groups. Osteological evidence, such as it is, suggests a generalised sealing/fishing/fowling economy, carried out in spring and early summer. Corded Ware inland sites have their highest potential in summer, suggesting inland fishing. Sites away from waterways have their highest potential as winter hunting sites. Thus the Corded Ware seems to have been a highly mobile foraging adaptation along the lines of the GMS stage 4 (above) – no adequate weighting for increased arable soils can be seen, and no domestic animals or cultivated plants are known. (Zvelebil put large quantities of earth from two Corded Ware sites through a froth flotation system in an effort to find carbonised cereal grains and recovered none). Bronze Age sites are in the same area inland from the coast as the Corded Ware, but are (a) not found in the other typical Corded Ware locations, and (b) are clearly located with a view to maximising arable land within 3 km. This is particularly the case for the Late Bronze Age, and this is the earliest evidence for the appearance of a mixed farming/foraging economy. This conclusion is supported by the sporadic finds of domestic animal bones from Late Bronze Age settlements.

Zvelebil explicitly follows Finnish practice and regards the different cultures as different ethnic groups. This sort of equation has become rare in the last decade or so, and the whole concept questioned. In the Finnish case, however, the suggestion appears to have some justification, because the models of economy produced for each culture are so internally coherent that each is able to stand by itself as a complete economy viable all year round. A more serious problem is Zvelebil's assumption that group size in all cases approximates the hunter-gatherer band, around 15–35 people. Demographic aspects of mobility and sedentism are hardly discussed, and it would have been interesting to see whether larger group sizes might be an aspect of the sedentary coastal specialists, for example.

More detailed discussion of the integration of farming and hunting in the Late Bronze Age would have been of interest. Zvelebil concludes that both swidden and arable would have played a part at an early stage. He is able to demonstrate the Late Bronze Age preference for locations with high arable values within 3 km, so arable receives support. The status of swidden is more problematic. In more recent times, manure for the arable necessitated grazing domestic animals on regenerating swidden, and this could have been an important factor. If elk were still numerous enough to be widely hunted, however, would swidden clearings not be likely to be closer to the settlements than 15 km? The need to guard against the depredations of grazing animals would be a likely factor limiting the viability of far-flung swidden fields.

In general, however, *Forager to Farmer* succeeds in presenting a convincing picture of economic change in southwest Finland in the period under review. Only when this is done does Zvelebil put Finland in a wider context. The sequence of change in Finland is quite closely parallelled in Latvia and Estonia, and in general terms in the whole of boreal Eurasia. A useful review is presented of the ethnography of the northern rim of the continent, an area usually beyond the reach of those who do not read Russian. The whole picture is one of »progressive subdivision of an originally unspecified economic niche through the specialisation on marine resources, anadromous fish and reindeer on the one hand, and through a further diversification of economy by the addition of farming and herding on the other« (p. 151). The most likely reason for this to occur is population pressure. Ethnographically known hunter-gatherers do not usually approach carrying capacity; and the number of sites in Finland declines between 1800 and 1200 b.c., the period in which farming first appears. Both of these factors lead Zvelebil to look for an environmental reduction in carrying capacity rather than an increase in absolute population numbers. The decline from the postglacial climatic optimum and the deteriorating climate in boreal Eurasia as a whole is the im-

portant factor: »The adoption of agriculture during a period of climatic deterioration may seem paradoxical, but this is not so when it is viewed as part of a complex economy, aimed more likely at minimising risk rather than increasing productivity in a situation when a number of formerly used plant resources – water chestnut, hazelnut, to mention but two – were disappearing from the area« (p. 163).

Thus Zvelebil uses sophisticated techniques of ecological analysis to provide an explanation for the appearance of farming in southwest Finland. The differences between this approach and that of *Introduksjon* have been one of the most interesting aspects of reviewing the two works. In *Introduksjon* we repeatedly find claims that there was agriculture in the neolithic based on pollen analysis alone, with no supporting archaeological evidence. *Farmer to Forager*, however, specifically questions these claims on the basis of the Corded Ware site locations.

Either the neolithic farming and herding sites will be found; or Zvelebil will be proved right and the earliest agriculture will belong to the Late Bronze Age. Zvelebil's thorough treatment, the absence of conventional evidence of neolithic agriculture, and the problems of pollen interpretation, are all factors leading the reviewer to suspect that the latter will be the case. At all events, pollen analysis has now made considerable claims for northern Scandinavia. The evaluation of these claims will be one of the most important aspects of archaeological work in the next twenty years.

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ESTER BOSERUP: *Population and Technological Change. A Study of Long-Term Trends.* The University of Chicago Press, Chicago 1981. xi+225pp., tables, bibliography, and index.

In 1965 Ester Boserup published *Conditions of Agricultural Growth*, a book which rapidly became a standard reference among many students occupied with such topics as primitive agriculture and population pressure especially. The book was translated into Spanish, French, Swedish and Japanese, and it looks as if we are here already dealing with a »classic« less than twenty years after the publication of the book.

In the preface to the new book, *Population and Technological Change. A Study of Long-Term Trends*, Ester Boserup tries to clarify the different scope of this new book in relation to the old one. Though both books are focussed on those types of technology which are supposed to be related to population changes, the new one not only discusses problems having relations to agriculture, but also to other »population-linked« technologies, where the word »technology« should be understood in the broad sense. This makes the new book different and much more comprehensive when compared with *Conditions of Agricultural Growth.* Yet, behind all this is still the perception of a development reverse to the Malthusian one, and the importance of population size when discussing technological innovations is constantly in the foreground. When the point is looking for »models« the archaeologist of today is still much of a hunter, and in this respect there is much to gain or think over in Ester Boserups new book, especially because she looks at things as an economist, often focusing on phenomena, which would seldom enter the mind of an archaeologist.

The book is divided into five parts; in the introductory first part can be found considerations on the relationship between population density and food supply systems in general. Here there are also tables giving population estimates for different areas in the world covering a time span from A.D. 1 to the present day, thus giving a first picture of the demographic evolution, which is to be more closely looked upon in later parts of the book.

In the second part of the book the main topic is population and technology in the Ancient World. Starting with hunter-gatherers' economy of today, it is shown how relatively small an input of time is needed to get sufficient food. The same must have been the case in prehistoric times, not least because food-gathering populations then lived in more favorable areas, while populations of today practising this type of economy mostly live in marginal areas with poor soil or an unfavorable climate. Thus it is unlikely that prehistoric hunter-gatherers lived in a state of permanent semi-starvation, keeping their numbers from increasing. Instead the low population increase may have been due to different diseases, including high child mortality in general. Some other reasons are also discussed, however.

In a subsequent chapter Ester Boserup is dealing with ancient agriculture, and such different areas as Mesopotamia, Pre-Columbian Mesoamerica and Europe are considered. The very slow diffusion of the techniques of food production seem to show that in sparsely populated areas this type of economy is not always preferred to hunting and gathering. Here as elsewhere, Ester Boserup neglects such archaeological notions as »periods« and »cultures«, and the reader thus gets the impression that the theories put forward are of general value when dealing with pre-industrial societies. This way of thinking would still be unfamiliar to many archaeologists, having in the main their experience from material remains, which are often »local« types belonging to a certain area and period. Many of Ester Boserup's observations, however, concern such topics as flow irrigation, slash and burn technique, use of animal draft power etc., phenomena which are of a universal nature.

Especially interesting is the view put forward on the relationship between population density and agricultural strategy, already shown in a table in part one. Certainly, it is a well known fact that population density has to be low within communities practising forest-fallow, compared with e.g. flow irrigation, to take the extreme contrast, but here the evolution from a primitive to a highly developed agricultural technique is shown in a table step by step, indicating population density figures pr. km^2 for each type of agriculture. Forest fallow for instance, which needs extensive use of land, would have a population density which is no higher than 4 persons per km^2, whereas annual cropping combined with intensive animal husbandry would take place only in communities with a population density of 64–256 persons per km^2. Though the data in this table are from modern times, they are also worth studying for an archaeologist.

Another table shows the number of operations needed within different food supply systems. The more primitive ones need only a few operations, whereas multicropping and investment in water control would need much more work and would not be possible until there is a very high population density. This is illuminated by referring to the evolution in Mesopotamia especially, but also the development of ancient European agriculture is considered. Nicely according to Ester Boserup's theories, it can be shown that Greece and Italy with the higher population density in the first millennium B.C. had short fallow systems, whereas the areas north of the Alps had more primitive systems.

In the following there are two chapters on ancient urbanisation, which look most interesting from an archaeological point of view. Again, it is the economist at work, and – not surprisingly in this case – Ester Boserup draws attention to the apparent relationship between population size and urbanization. There are reflections on the size of the surplus needed to feed the inhabitants in the towns; mainly arguing out from ancient sources on taxation, she proposes a surplus of about 10%, which would be at the disposal of the inhabitants in the towns. This involves that a town with say 1.000 inhabitants – supposed to be occupied with non food producing activities – should be surrounded by a food producing population, which is ten times as large, i.e. 10.000 persons. Furthermore these have to live at a distance, which is no more than 7–8 kilometers from the center of the city. This is the distance which could be overcome with a primitive land transport technology. Certainly, such figures should not be taken quite literally, and Ester Boserup herself mentions several exceptions; but it is under-

lined that long distance food transport did not take place in pre-industrial societies due to the poor land transport technology and infrastructure.

Further calculations show that only areas with a population density of more than 64 persons per km^2 could be urbanized: a circle with a radius of the above mentioned 7 km from the center of a town would cover an area of 154 km^2, and with the said density of 64 persons per km^2, there would here live about 17.000 persons. The surplus these persons could produce (10%) may feed an urban population of 1700 persons. With a population density of f.i. 6 persons per km^2, there would live 1.000 persons in the same area, and in this case these could only feed 100 persons. This is so small a population that the settlement would hardly deserve the term urban center or town. Thus it is possible for Ester Boserup to conclude that urbanization in areas with low population densities and long transport distances was not possible in ancient societies.

The hypothesis put forward here that low population density is an obstacle to urbanization, is a most interesting one, and it remains to be seen how archaeologists, who have suggested many explanations for the emergence of towns but not this one, will react.

The subsequent chapter deals with characteristic features of ancient urbanization, especially trade and the scientific and technological progress caused by a high grade of specialization. When looking at Europe after the fall of the Roman Empire, Ester Boserup argues that the breakdown may very well have been due to epidemics, where the subsequent depopulation was highly destructive to the urbanized economy and the infrastructure, a theme which has often been debated among historians.

In part III the rôle of demographic factors in the European development is further discussed. The period from 850 A.D. to the emergence of the Black Death saw five centuries of population increase with economic progress, e.g. the introduction of the three-course rotation and further urbanization. Periods, however, followed with population decline and labor shortage, and then the agricultural system had to shift back to a more extensive strategy. The relationship between dense population, intensive agricultural systems, and technological progress in the broad sense of this word, can also be seen when looking at Tuscany and the Netherlands during the Renaissance and later, or the Industrial Revolution in Great Britain, since these areas are among the most densely populated in the periods mentioned.

As it can be seen, we are now dealing with periods which are rather more within the fields of the historian and economist. This is also the case with part IV and V on diffusion of industrial technologies, technological change in the Third World and several other topics, which should not be dealt with here.

Ester Boserup's new book is an important and inspiring one; especially the chapters on Ancient agriculture and urbanization ought to make archaeologists reflect in a more untraditional way; it also reminds one of the large rôle that demographic studies now play in this field of research. Though the book is most complex, with a wealth of details, some archaeologists maybe would complain that several new investigations from the last decades are not considered. This objection, however, is hardly essential since Ester Boserup is working along a general line that would scarcely be affected by a couple of new archaeological investigations. The essential thing is that the archaeologist in this book can find many valuable views that may help interpreting the archaeological material, or construct new »models«, where other factors than diffusion, i.e. demographic ones, are responsible for innovations.

Svend Nielsen

Recent Excavations and Discoveries

Please observe the following abbreviations:
s. *sogn*, Danish parish
h. *herred*, Danish district
a. *amt*, Danish county
All places mentioned in this list can be located on the map p. 223 and identified by their no.

PALAEOLITHIC

1. SEBBELUNG, Fyn
Øster Hæsinge s., Sallinge h., Svendborg a.

Reinder antler implement
The artifact (fig. 1) was found in 1981 during drainage digging in a layer of clay at a depth of c. 2 m. below layers of peat and sand. It measures 54.3 cm. and consists of the proximal part of the antler beam. The bez-tine at the distal end is smoothed and has an oblique facet at the end which forms a tongue-shaped edge.

A limited number of such reindeer antler implements have been found in Denmark and none of them comes from a securely dated context (see survey in Skaarup, reference sited below). There is a close parallel from Løgeskov, likewise on Fyn (Skaarup, no. 6, fig. 6). The type with a tongue-shaped, parallel edge is known from the upper layers of the Late Palaeolithic site at Stellmoor in Holstein (Ahrensburg Culture, Younger Dryas).

Nationalmuseet, Prehist. Dept. A 51070 (deposited at *Fyns Stiftsmuseum*, Odense). – Lit. on reindeer antler implements from Denmark: Th. Mathiassen: Some Recently found Reindeer Antler Implements in Denmark. *Acta Archaeologica* IX, 1938. – V. Nielsen: Another Blade Handle of Reindeer Antler. *Acta Archaeologica* XVII, 1946. – J. Skaarup· Et rentakslagvåben fra Storebælt. *Fynske Minder* 1974 (Odense).

P.O. Nielsen

MESOLITHIC

2. ENGEBÆKGÅRD, North Sjælland
Græse s., Lynge-Frederiksborg h., Frederiksborg a.

Settlement site
In the area around Frederikssund a number of Late Mesolithic settlements have recently been discovered. At one of the sites, Engebækgård, a trial excavation in 1982 revealed a culture layer from the Early Ertebølle Culture. The finds are almost exclusively of flint as no organic material has survived. Among the c. 4000 pieces of flint are 13 core axes, including preforms and fragments, 12 transverse arrowheads with oblique edge, 13 transverse arrowheads with straight edge, and a few scrapers, borers, and burins. Among the cores only one is a micro-blade core. Two rhombic arrowheads suggest a minor occupation at the time of the Late Kongemose Culture. The site is situated on the northern bank of a former inlet which in Atlantic Time was a small fiord.

Nationalmuseet, Prehist. Dept. 4455/82.

P.O. Nielsen

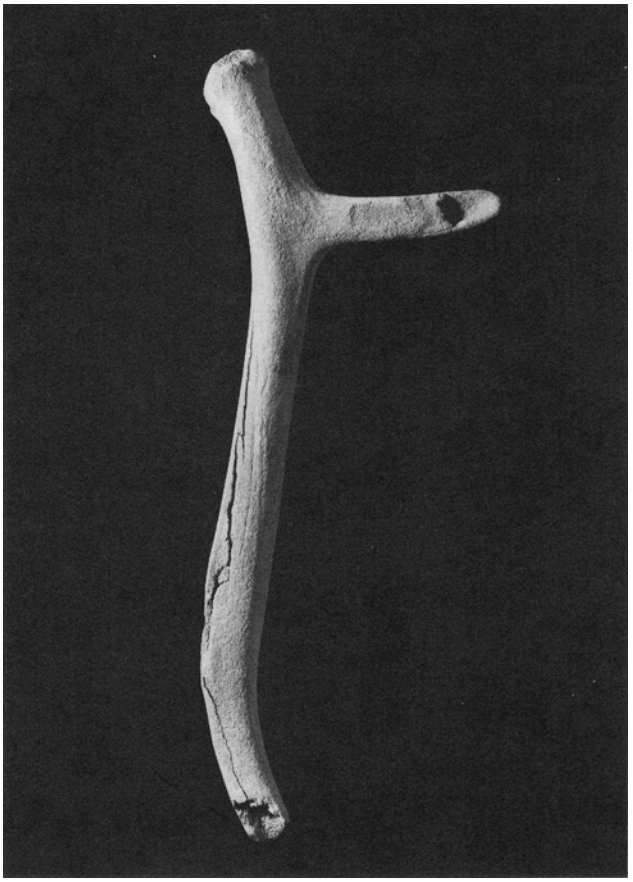


Fig. 1. Reindeer antler implement from Sebbelung, Fyn (no. 1). Length: 54.3 cm. (L. Larsen photo).

3. GRISBY, Bornholm
Ibsker s., Bornholms Øster-Herred, Bornh.

Settlement site
In 1982 a trial excavation revealed settlement material from the Late Ertebølle Culture imbedded in a beach ridge. There were a number of separate settlement phases. The finds comprise typical Ertebølle pottery, a greenstone axe, and faunal remains (fish and mammals, mainly seal). Excavation by Finn Ole Nielsen.

Bornholms Museum, Rønne, 981.

Margrethe Watt

4. GULLESTRUP, West Jutland
Herning s., Hammerum h., Ringkøbing a.

Settlement site
In 1980 trial excavation was carried out of 23 m^2 of a large settlement on a terrace facing the river Storå. The finds included 53 microliths, 33 rhombic arrowheads, and 15 transverse arrowheads.

Herning Museum 2097. – Lit.: H. Rostholm: *Oldtiden på Herningegnen*. Herning Museum, 1982, p. 12 and figs. 3–4.

Hans Rostholm

NEOLITHIC

5. Vestergård, East Sjælland
Solrød s., Tune h., København a.

Middle Neolithic settlement site
In 1982 an area with pits and a few postholes was investigated. One of the pits contained finds from Period III of the MN TRB Culture: finely ornamented pottery together with coarse vessels, blanks for flint axes, a flint axe of the Bundsø type, transverse arrowheads, awls, scrapers, and a well-preserved faunal material.

Køge Museum 1010.

Svend Åge Tornbjerg

6. SIGERSTED, Central Sjælland
Sigersted s., Ringsted h., Sorø a.

Settlement site
The settlement is situated on a sandy terrace overlooking the river Suså. In 1979 a large pit with finds from Period II of the Middle Neolithic TRB Culture was excavated and in 1982 a pit from the Early Neolithic Period A was found and excavated. The finds from the latter (Pit A) were rich in pottery and flint. There are fragments of a variety of pottery vessels including aboth large and small funnel-beakers, lugged vessels, clay discs, and fragments of two clay spoons. C. 29 kg. of flint was recovered half of which was fire-shattered. Among the flint artifacts were flake axes, flake scrapers, backed knives, borers, transverse arrowheads, and fragments of polished axes of the pointed-butted type.

The finds from Pit A are comparable to the settlement finds from Muldbjerg (J. Troels-Smith, *Aarbøger* 1953), St. Valby (C.J. Becker, *Aarbøger* 1954), and Värby in Scania (B. Salomonsson, *Acta Archaeologica*, Vol. 41, 1970).

Nationalmuseet, Prehist. Dept. 2103/77.

P.O. Nielsen

7. BØGEBJERG, Langeland
Magleby s., Langeland Sdr. h., Svendborg a.

Megalithic grave
The remains of a passage grave were excavated on a promontory east of Nordenbrogård, southern Langeland. The chamber had measured 9 × 2.2 m with a cobbled floor and entrance from the east. In the floor layer were found numerous human bones as well as flint axes, blade implements, transverse arrowheads, amber beads, and pottery. Of particular note was a battle-axe of Fredsgårde type. The tomb was in use from period I to V of the Middle Neolithic. The surrounding barrow was rectangular and measured 23 × 10 m.

Langelands Museum 11164.

Jørgen Skaarup

8. FREDENSBRO, Strynø
Strynø s., Sunds h., Svendborg a.

Grave and Mortuary House
Near the remains of a destroyed domen was found an E-W orientated inhumation grave with faint indications of a double burial – unfortunately with no grave goods. A few meters away were found the remains of a small U-shaped structure of wood, in which was found an unpolished thin-butted flint axe. For the present the feature may be regarded as a small mortuary house.

Langelands Museum 9887.

Jørgen Skaarup

9. DONS, East Jutland
Vester Nebel s., Brusk h., Vejle a.

Single-Grave mound
Five barrows were excavated in connection with the laying of the natural gas pipeline between Egtved and Snoghøj. One at Dons contained a male burial from the Bottom-Grave Period. There were found traces of a wooden coffin, a stone battle-axe, a flint axe, 7 flint arrowheads, an amber ring, and a blade knife.

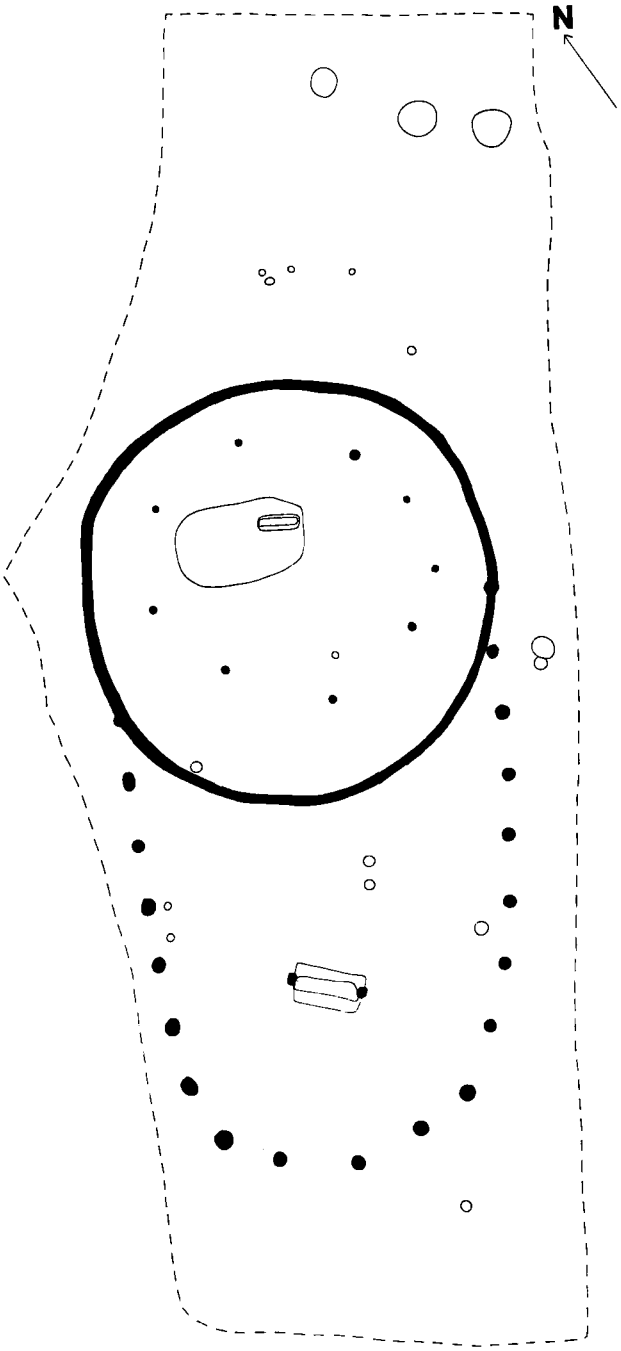


Fig. 2. Plan of the excavation at Løsning, East Jutland (no. 12). Scale 1:300.

Under the barrow was found a ring-ditch in which there had stood posts reaching a depth of 1.5 m. Excavated by Lone Hvass.

Vejle Kulturhistoriske Museum M514.

Steen Hvass

10. HARRESKOV, West Jutland
Assing s., Hammerum h., Ringkøbing a.

Grave mound
Excavated in a tree belt in winter 1982–83. Dimensions 15 × 5 m, height 1.5 m. Highest was a grave with a clay vessel and a bronze ring from the Early Bronze Age. Lower down were three graves from the Single-Grave Culture. In the earliest, which lay on the original ground surface, was found a battle-axe of Ground Grave type. Grave 2 contained 41 amber beads and was surrounded by a 3 m long rectangular setting of large stones. In grave 3 was found a straight-walled beaker and a battle-axe from the Upper-Grave Period. Environmental studies of the turf-line and fill are being made by the Danish Geological Survey.

Herning Museum 2478.

Hans Rostholm

11. SKARRILD MOSE, West Jutland
Skarrild s., Hammerum h., Ringkøbing a.

Settlement site
In 1978–80 part of a large settlement site of the Late TRB Culture was excavated on the eastern bank of Skarrild Bog. Within an area of 2500 sq. m. many postholes, pits, and a few fireplaces were found as well as culture layers dating from the Middle Neolithic TRB Culture, mainly Period V. In 1980 11 amber beads shaped like double-edged battleaxes were found in a small pit. The finds include i.a. 542 scrapers and 484 fragments of polished flint axes and chisels. Forty sherds had imprints of cereals, mostly emmer and einkorn. Also in 1980 a grave complex of the Single-Grave Culture was investigated (see H. Rostholm, *JDA*, Vol. 1, pp. 35–38).

Herning Museum 1519. – Lit.: H. Rostholm: *Oldtiden på Herningegnen*. Herning Museum, 1982, pp. 32–34, figs. 18–20.

Hans Rostholm

LATE NEOLITHIC AND BRONZE AGE

12. LØSNING, East Jutland
Løsning s., Hatting h., Vejle a.

Grave mound
In connection with the laying of a gas pipeline a ploughed-over barrow was excavated, measuring 20 × 30 m., being c. 1 m. high. Within living memory the now ruined monument appeared as a twin barrow. The excavation showed that there was an older, circular barrow from the Late Neolithic with an extension added in the Early Bronze Age (fig. 2).

The earliest grave was a timber-built chamber measuring 5.35 × 3.24 m., constructed c. 1 m. below the original surface. Just above the bottom of the grave was a compact layer of charred wooden planks parallel to and at right angles to the axis of

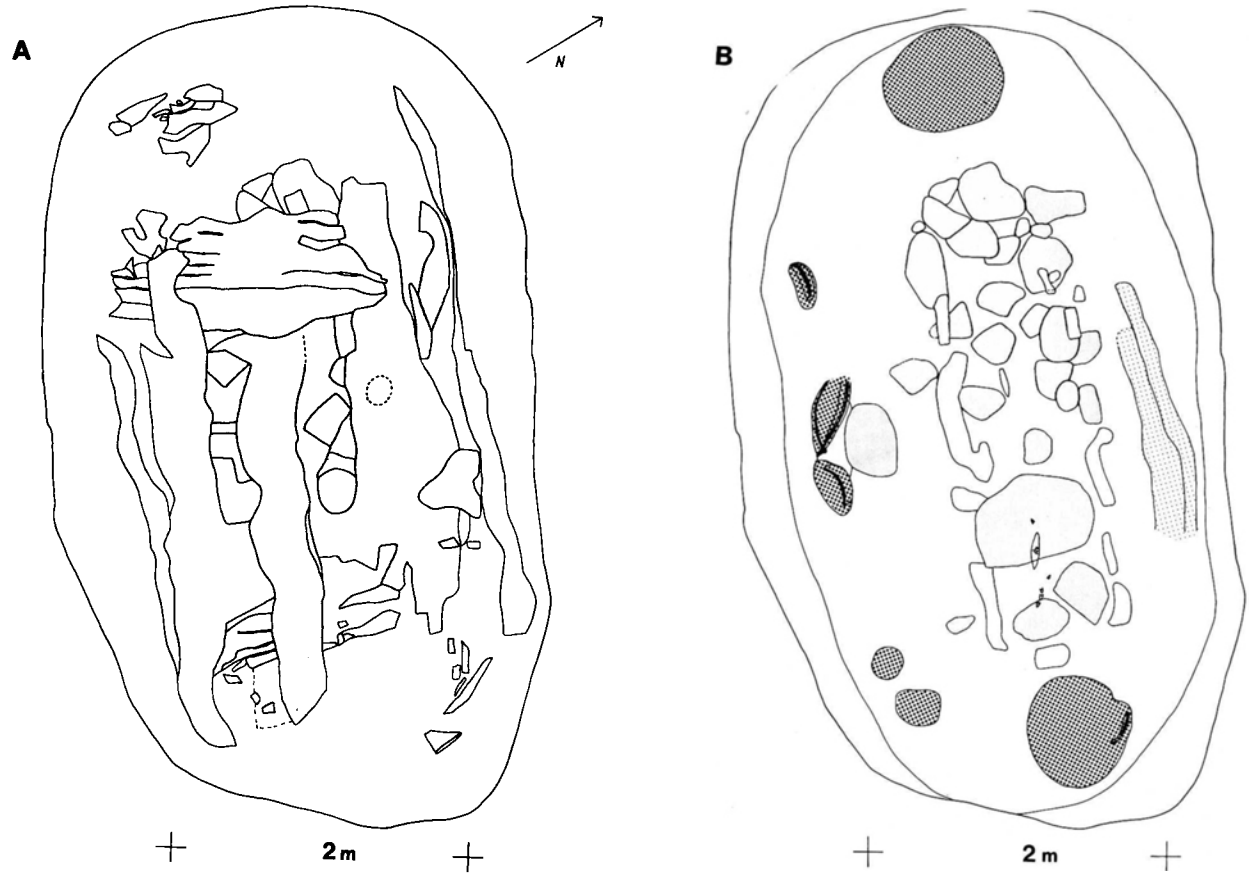


Fig. 3. – a, plan of the grave chamber at Løsning (no. 12) showing the remains of a wooden superstructure. – b, the stone paving with artifacts.

the grave (fig. 3a). From the remains of timber a reconstruction was attempted. Below the layer of charred wood was a paving of flat stones (fig. 3b). On top of the paving there were two borders of clay which were interpreted as the remains of the foundation of a coffin. On the stone paving two flint daggers (type I and II) were found together with 7 barbed flint arrowheads. At each end of the grave was a large posthole, obviously supports for a ridged superstructure. Along the southern edge of the grave were a number of smaller postholes, and in the opposite side a shallow ditch was found. Charred wood occurred in some of the postholes.

Above this grave a small cremation burial was found measuring 1.66 × 0.29 m. The grave was not containing any stones, but there were traces of a log coffin. This grave is undated as no grave goods were found. Both the above-mentionned graves were surrounded by a ring of small postholes, again surrounded by a ring-ditch, 16–17 cm. in diam., in which the imprints of upright wooden posts were detected.

Seven-eight m south of the circular ditch was another grave appearing as a layer of stones with a depression in the middle, being the foundation of a now disintegrated log coffin. There were large postholes at both ends of this grave, too, suggesting that it had also had a ridged superstructure. The grave contained a bronze dagger in a wooden sheath, a palstave, and two goldwire bracelets, dating to the E.B.A. Period II. This grave had been encircled by an oval setting of upright posts, forming an extension to the first barrow. C. 5 m. North of the ring-ditch four cinerary urns from the L.B.A. were found. – Excavation by Per Ethelberg.

Vejle kulturhistoriske Museum M525. – Lit.: *Skalk* no. 6, 1982.

Steen Hvass

BRONZE AGE

13. VIBY, Central Sjælland
Syv s., Ramsø h., København a.

Votive axes

In 1977 the National Museum received a massive bronze axe from Viby, one of the heaviest Bronze Age implements ever found. In the spring of 1983 a similar axe was found in Viby c. 1 km. from the first one. None of the axes were found *in situ* and both were discovered in redeposited soil, the original find location of the axes thus being unknown but possibly within the Viby municipal area. The axe first found (fig. 4, above) is 46 cm. long and weighs 5230 g. The second axe (fig. 4, below) is

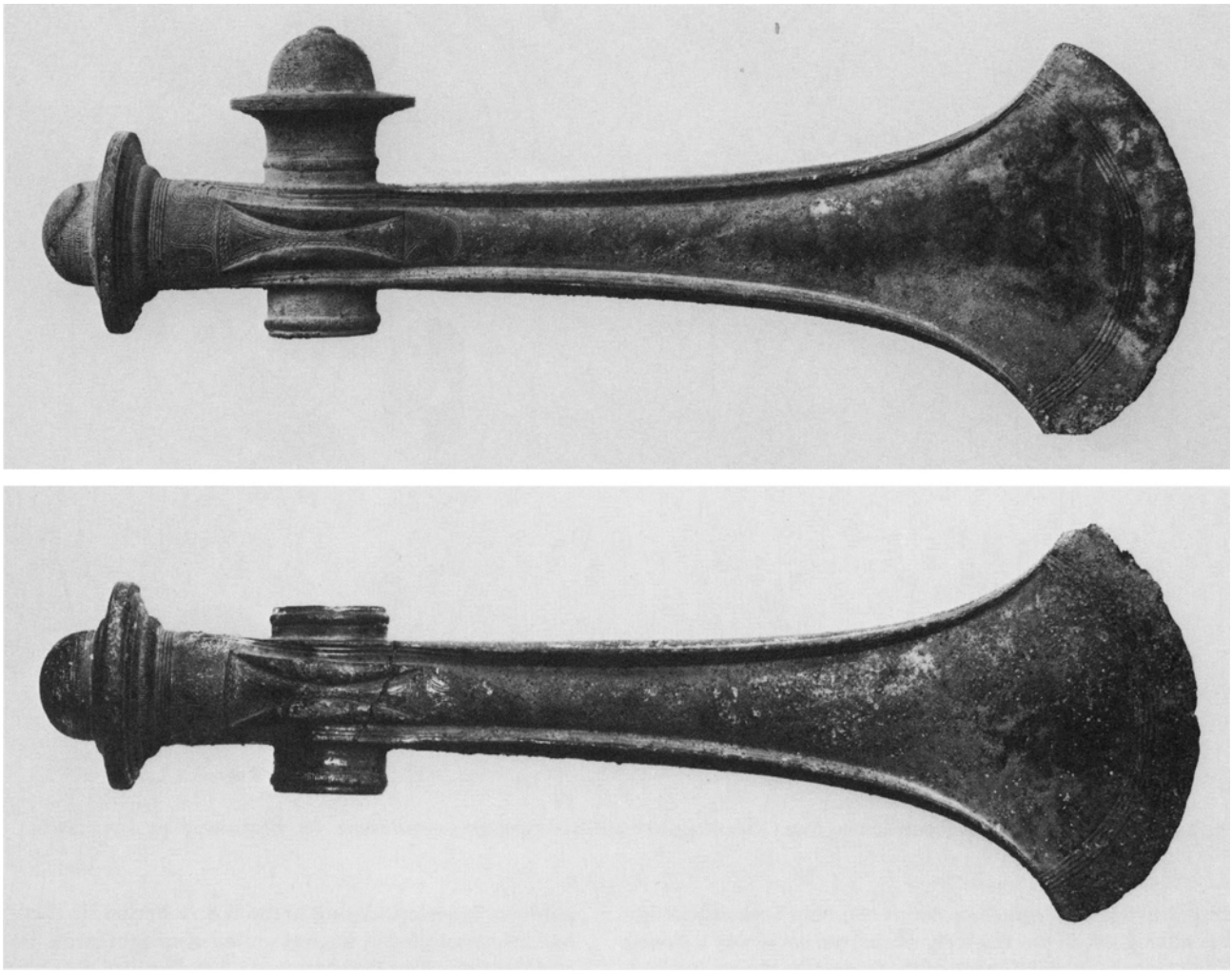


Fig. 4. Massive bronze axes from Viby, Sjælland (no. 13). Above the axe from 1977 (length 46 cm.), below the one recently found (length 45.5 cm.) (L. Larsen photo).

45.5 cm. long and weighs 5130 g. They are decorated in an almost identical way with fine lines and spirals of the E.B.A. Period II. A small fragment of the wooden shaft was found deep in the socket of axe no. 1, the wood being determined as ash (*Fraxinus* sp.). The top cap at the end of the socket on axe no. 2 is missing.

Assuming that the two almost identical axes were deposited together in the B.A., this find is comparable with the two massive bronze axes from Egebak in North Jutland.

Nationalmuseet, Prehist. Dept. 2104/77. – Lit.: J. Jensen: Kultøkser fra bronzealderen. *Nationalmuseets Arbejdsmark*, 1978 (Copenhagen).

14. NORS HAVRELAND, North-West Jutland
Nors s., Hillerslev h., Thisted a.

Grave mound
Two cremation cists were excavated in a ploughed-over barrow. One also contained fragments of a twisted bronze bracelet, the other a bone pin with perforated head. Excavated 1981.

Museet for Thy og Vester Hanherred, Thisted, 1673.

Anne-Louise Olsen

15. NØRHÅ, North-West Jutland
Nørhå s., Hundborg h., Thisted a.

Grave mound
On the site of a completely ploughed-away barrow were found

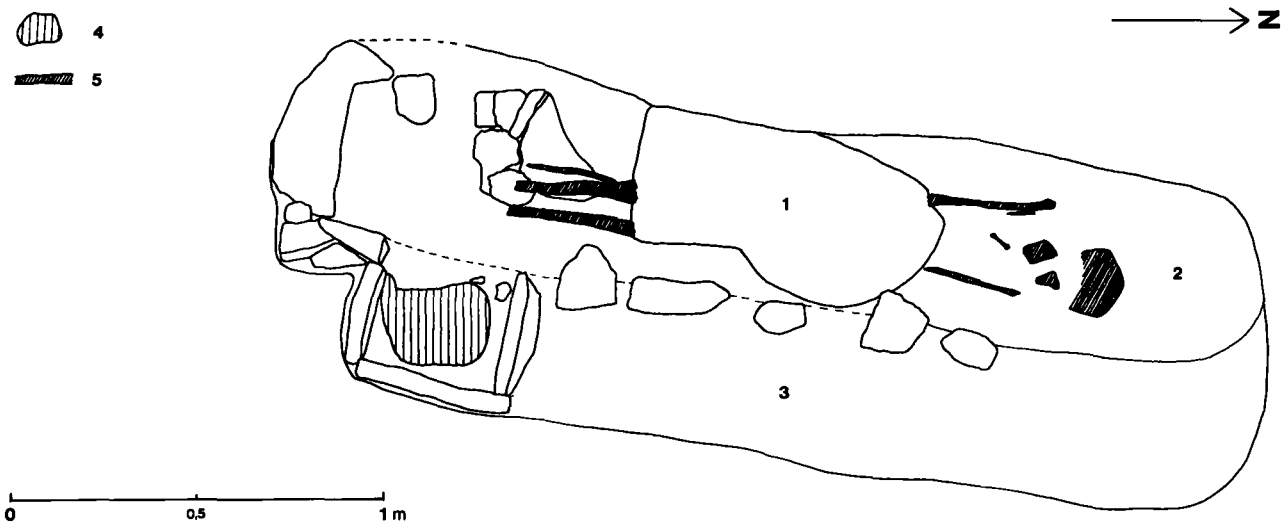


Fig. 5. Plan of double burial from Nørhå, North-West Jutland (no. 15). – 1, recent disturbance; 2, traces of log coffin; 3, heterogeneous fill; 4, cremated bones; 5, uncremated bones.

three graves. The one that is thought to be primary was a double grave with the skull and longbones of an unburned skeleton, probably originally in a log coffin (fig. 5). No grave-goods were found, but the grave was already disturbed. At the foot of the grave was a rectangular setting of flat pieces of lime-stone, containing the cremated remains of a second individual. There were also two cremation cists without grave goods. At the end of one of them was an oval pit 1.7 m long and 0.3 m deep containing charcoal and red-burned sand, probably from the pyre.

Museet for Thy og Vester Hanherred, Thisted, 1550.

Anne-Louise Olsen

16. VILLERUP, North-West Jutland
Vestervig s., Refs h., Thisted a.

Grave mound

Destroyed mound, excavated 1981–82. The barrow was built in 5 stages and contained 6 stone cists with cremated bone. The primary grave measured 0.8 × 0.4 m. and contained the burnt remains of a 5–6 year old child, a belt ornament (*tutulus*) of bronze, and a piece of woven cloth. The mound covering the infant grave was only 4.1 m. in diam. and 0.5 m. high. Belonging to phase 3 of the mound was a large stone cist measuring 2.0 × 0.8 m. containing cremated bones, a bronze sword with wooden sheath, and a bronze pin. There was a cup-mark on the inside of one of the capstones of the cist. In the 3rd phase the mound had been surrounded by a stone kerb, whereas in the 4th and 5th phases there were ring-ditches with imprints of posts. In the final phase the barrow was 21 m. in diam. and 2.60 m. heigh. – Excavation by Jakob Vedsted and Per Orla Thomsen.

Museet for Thy og Vester Hanherred, Thisted, 1696.

Anne-Louise Olsen

17. SPJALD, West Jutland
Brejning s., Hind h., Ringkøbing a.

Settlement site

In connection with road construction works on Highway A 11 some 2300 sq.m. were investigated, supplementing earlier, extensive excavations (1). In the recently excavated area which lies E of the highway parts of four buildings, refuse pits, and cooking pits from the L.B.A. Period 6 were found, together with a cremation burial from Period 1 of the Pre-Roman I.A. On the same spot a Pre-Roman Period la cremation burial had previously been found. Among the settlement material there is a great quantity of pottery, hammerstones, a quernstone, flint tools and debris, and, finally, many fragments of a clay mould for a twisted torque (*Wendelring*) of the type Broholm, 1953, no. 271 (2). It should be noted, that this find has occurred in a part of the country from which torques of this type have not been previously recorded (3). This may either be due to cultural differences or different conditions of preservation.

Nationalmuseet, Prehist. Dept. 436/71.

(1) C.J. Becker: Hal og hus i yngre bronzealder. *Nationalmuseets Arbejdsmark*, 1972. Copenhagen.
(2) H.C. Broholm: *Danske Oldsager*, IV, *Yngre Bronzealder*. Copenhagen 1953.

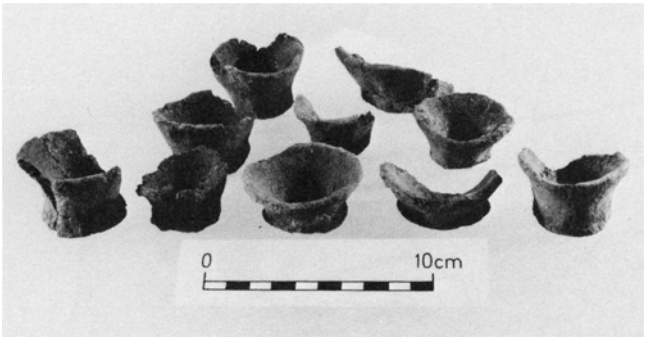


Fig. 6. Miniature vessels from Building A.II at the late Pre-Roman Iron Age settlement at Højris, West Jutland (no. 21).

(3) E. BAUDOU: *Die regionale und chronologische Einteilung der jüngeren Bronzezeit im Nordischen Kreis*. Studies in North European Archaeology, 1. Stockholm 1960.

Leif Chr. Nielsen

PRE-ROMAN AND ROMAN IRON AGE

18. HELTBORG, North-West Jutland
Heltborg s., Refs h., Thisted a.

Village mound
A large rescue excavation was carried out in 1981–82 of a thick occupation layer from the Early Iron Age. The 1,600 m^2 excavated is thought to represent about one third of the settlement. The thickness of the deposit ranged from 45 cm to 1 m. Twenty-four houses were found from period III of the Pre-Roman and the Early Roman Iron Age, and also one house from the Later Roman Period. The settlement began in period IIIa, but its end is hard to establish with the same confidence as the upper layers have been largely destroyed by cultivation. Some of the sherds found must date from the Early Germanic Period.

In general it may be said that settlement was centred at three places within the area excavated, where there stood houses all the time from Pre-Roman period III to the end of Early Roman times. Up to six houses lay directly above one another.

Unconnected with these was a single house from the Late Bronze Age. It was 17.5 m long with door posts set back out of line.

Museet for Thy og Vester Hanherred, Thisted 1690.

Jens Henrik Bech

19. RUGSTEDLUND, East Jutland
Ødsted s., Jerlev h., Vejle a.

Settlement site
Excavation work along the gas pipeline revealed a settlement with 15 buildings from the Pre-Roman and Roman Iron Age. A large ceramic material from the Early Roman Period was recovered. – Excavation by Chr. Adamsen.

Vejle kulturhistoriske Museum M856.

Steen Hvass

20. GAMMEL SOLE, East Jutland
Øster Snede s., Nørvang h., Vejle a.

Settlement site
Natural gas excavation. The pipeline passed straight through a late Pre-Roman and Early Roman village, of which a 200 m long and 20 m wide strip could be excavated. Fourteen houses were found, falling into two groups with a 60 m stretch without houses between. In the SW area were found a house 19 m long with eight bays, a 12 m long house with four bays, and four 9 m long houses with three bays. In the NE area were found four houses that succeeded one another. They had had 5–6 bays and lengths of about 18 m. North of them were found three 9 m long houses with three bays, and still further north, at the edge of a low area liable to flooding, traces of two 13–14 m long houses with 4–5 bays. The plan of this settlement appears to resemble that of the village excavated at Hodde, south-central Jutland (S. Hvass in *Acta Archaeologica* vol. 46, 1975). – Excavation by Per Ethelberg.

Vejle kulturhistoriske Museum M879.

Steen Hvass

21. HØJRIS, West Jutland
Nørre Omme s., Hind h., Ringkøbing a.

Settlement site
In the autumn of 1982 a Pre-Roman (Period IIIa)–Early Roman Iron Age settlement was partly excavated. Three farm complexes were found, each with a number of buildings surrounded by a fence. From one of the farm complexes a large amount of iron slag and white porous cinders from smithing hearths was obtained. In each of the postholes of the roof-supports in the main building of one of the house-groups a miniature clay vessel was found (fig. 6). Ard-furrows from later cultivation were detected over parts of the settlement area. – Excavation by Leif Chr. Nielsen.

Nationalmuseet, Prehist. Dept. 3882/81.

ROMAN IRON AGE

22. HAVBOGÅRD, East Sjælland
Solrød s., Tune h., København a.

Settlement site
A rescue excavation occasioned by the natural gas pipeline revealed the remains of four buildings belonging to a settlement from the Early Roman I.A. Only the holes of the roof-support-

ing posts were preserved. Around the buildings was a wide area with many pits containing pottery, animal bones, and hammerstones.

Køge Museum 1012.

Sv. Åge Tornbjerg

23. OLLERUP SØ, Fyn
Svendborg a.

Bronze saucepan
Roman saucepan of Gödåker type (fig. 7), found years ago on the bank of Ollerup Lake, handed over to the Svendborg og Omegns Museum in 1982. The end of the handle is missing, and no manufacturer's stamp is preserved. Height: 10.1 cm., rim diam.: 19.4 cm. The inside has a babbitt-metal lining. The outside wears a simple decoration consisting of horizontal lines below the out-turned rim and above the base. The latter is profiled in an elaborate way with 5 concentric ribs around a central knob. This is the third saucepan of Gödåker type found in Fyn. Date: Early Roman Iron Age.

Nationalmuseet, Prehist. Dept. C30239. – Deposited in *Svendborg og Omegns Museum*. – Lit.: Ulla Hansen: En romersk kasserolle fra Ollerup, Fyn. *Årbog for Svendborg & Omegns Museum*, 1982, pp. 25–30.

Ulla Lund Hansen

24. TVED, Fyn
Tved s., Sunds h., Svendborg a.

Settlement site
In 1982 a settlement from the Early Roman I.A. was excavated at Tved, c. 3 km. North of Svendborg. The remains of 7 buildings measuring 11–20 m. in length were excavated, together with one smaller building, 4 huts or barns, and sporadic traces of fences. The large buildings were of the common type with two rows of roof-supporting posts and, as it seems, walls consisting of vertical posts with wattle-and-daub. No culture-layer, however, was preserved at the house-sites. The buildings were grouped along an E-W orientated line. To the east a well was found. Due to the find circumstances it could not be determined whether the excavated features were contemporary so as to form a village, or whether they represented different stages of the development of 2–3 farm complexes.

The finds mostly come from pits and from a dump area in an adjacent originally flooded area. They consist of pottery, iron slag, a few iron implements, quernstones, and bones of cattle, sheep, pigs, and horses. The site is dated by the pottery to the 1st century A.D. Among the potsherds a small number with painted decoration deserve attention.

Svendborg og Omegns Museum TM82. – Lit.: *Årbog for Svendborg og Omegns Museum*, 1982, pp. 6–24.

Per O. Thomsen

Fig. 7. Bronze saucepan from Ollerup, Fyn (no. 23) (L. Larsen photo).

25. PRIORSLØKKE, East Jutland
Horsens s., Nim h., Skanderborg a.

Fortified settlement site
The settlement is surrounded on three sides by swampy areas close to the bank of Hansted River. To the south, it is protected by a fortification consisting of a dry moat and a palisade of oak stakes. On the low hill on which the settlement is situated 17 larger and 11 smaller buildings have been excavated until the spring of 1983. The large buildings are of the ordinary E–W orientated Early Iron Age type with from 3 to 7 sets of roof-supporting posts, being c. 5 m. wide and up to 20 m long. No floor-layers are preserved and only the holes of the larger posts have survived. There is a considerable differentiation in size among the buildings. The settlement is dated by pottery to the Early Roman I.A. A few refuse-pits with pottery and quernstones from the early Pre-Roman Period were also found.

Nationalmuseet, Prehist. Dept. 1180/75.

P.O. Nielsen

Fig. 8. Sheet-gold figure from Fyn (no. 26). Height: 6.7 cm. (L. Larsen photo).

GERMANIC IRON AGE

26. FYN

Sheet-gold figure
Male figure of sheet gold, 6.7 cm. high (fig. 8). The body is naked but wears a smooth neck-ring. There are narrow, tripartite bands around the top of the head, dividing it from front to back in two halves, possibly an indication of the coiffure. The eyes are small round buttons encircled by beaded strings. The ears are flat and pretzel-shaped. The head, body, and upper parts of the legs seem to be made of two thin sheets of gold which are soldered together. The arms and lower parts of the legs with the feet are made separately. The feet are pierced which suggests that the figure was once fastened on a support. From this it must have been torn with force, as the metal is broken at the perforations. A date to the Early Germanic Iron Age is suggested by the type of the neck-ring.

The figure was picked up on the surface at the same place as large number of metal objects including a Roman *aureus* (Valerian), a golden pendant, and a smaller object of bronze with a human face. The find location is concealed as investigations are still in progress.

Nationalmuseet, Prehist. Dept. 4013/81.

27. GUDME, Fyn
Gudme s., G.h., Svendborg a.

Bronze statuette
During a continuous registration of surface finds a large number of metal objects mainly from the Late Roman – Early Germanic Periods have been recovered. Among the finds is a small bronze figure of a human being riding on a beast of indeterminate nature (fig. 9). The statuette is 5 cm. high, has faint traces of gilding, and appears to have been attached to a larger object. The crown of the head is set off, suggesting the coiffure, and the hair hangs down at the back in a pony-tail manner. Otherwise the body is rendered in a simple way with no details of clothing or ornaments. The find context suggests an Early Germanic I.A. date. There are, however, no exact parallels among the sculptured art of that time.

Fyns Stiftsmuseum and *Nationalmuseet*, Prehist. Dept. 4620/82.
P.O. Nielsen

VIKING AGE AND MEDIEVAL

28. FRIBRØDREÅ, Falster
Maglebrænde s., Falsters Nr. h., Maribo a.

Shipyard(?)
During works along a small stream in northern Falster some ship's timbers were found. In 1982 a number of trial trenches were dug parallel with and at right angles to the stream. The deposits were found to be peaty, resting on till 3 m below the present surface. At a depth of 2 m was found a layer containing ship's timbers and waste material in the form of chips and to a greater or lesser degree worked wood and branches. There were also tools and pottery.

Most of the ship's timbers were worn and damaged pieces from different ships, though apparently all were from vessels built in the Nordic tradition of the Viking and early Medieval periods. It should be noted, however, that the planks were not held together with iron clench rivets, as in other Nordic finds, but with small, closely-spaced wooden plugs, a feature often connected with Slavonic ship-building.

The site is provisionally interpreted as a place where ships were repaired and possibly built in the 11th or 12th century.

The Viking Ship Museum, Roskilde, 57/82.
Jan Skamby Madsen

29. OMGÅRD, West Jutland
Nørre Omme s., Hind h., Ringkøbing a.

Road and waterfront constructions
Excavations were undertaken in the autumn of 1982 as a continuation of the previous investigations of a large Viking Age settlement (see *Acta Archaeologica*, vol. 50, 1979, pp. 173–208). The most recent campaign has been concerned with dam and

Fig. 9. Bronze statuette from Gudme, Fyn (no. 27). Height: 5 cm. (L. Larsen photo).

road works from the late Viking Age along the river Pøl Bæk. Part of the artificial embankment is interpreted as a quay. Examination of the deposits makes it possible to demonstrate a successive rising of the water level. Among the finds are parts of waggons (including a hub), various pieces of timber, and a fragment of a green glass bead. – Excavation by Leif Chr. Nielsen.

Nationalmuseet, Prehist. Dept. 114075 & 2947/80.

30. ÅRHUS

Excavation of the Medieval town hall and square

In connection with a planned re-shaping of Store Torv (the main square) (fig. 10), in the summer of 1982 a large urban-archaeological investigation in the centre of the Viking Age town within the ramparts was launched. The aim of the excavation was to investigate the Medieval town hall and to examine the date of the square and to demonstrate previous traces of settlement, if any.

The town hall functioned up to 1859 when it was pulled down. It was situated immediately in front of the west-façade of the brickbuilt Medieval cathedral, the construction of which was begun around 1203. The main façade of the town hall faced the most important Medieval market square of Århus. Investigations in the 1940's have shown that large parts of the Medieval masonry of the remains of the town hall basement were preserved.

The 1982 excavation uncovered almost the entire groundplan of the building and showed that large parts of the basement walls were intact. The town hall had been an impressive brickbuilt house approx. 26.5 × 10.4 m, laid on a firm foundation and with the brickwork in regular Flemish bond.

No traces of the Medieval walls were found inside the basement, as they were all changed in 1750; consequently the light partition seen to the south on the photo also dates from that time. Finds in the foundation trenches date the building to the end of the 15th century and probably the town hall is built close to the time when it is first mentioned in the written sources, 1484. This means that Århus, too, got its town hall in the 15th century, as it is the case with most Danish towns, where town halls are first mentioned from this period. Somewhere in the 16th century the town hall was equipped with a square stair turret facing the market square.

The investigation of the square itself proved surprisingly that the level of the Medieval square was no lower than today and may even have been somewhat higher. Under the square traces of an intense settlement were found. The date of the latest phase of settlement shows that the square must have been laid out around 1300 and that there have been building activities in the area before that time. The excavation showed that throughout the 12th and 13th centuries there had been an ordinary settlement with houses and an intensive pit-activity. The small-finds also indicated this.

Surprisingly enough not much Viking settlement with houses was found. There were a few pits, and in the SE corner appeared a small 10th century pit-house like those excavated further south at Søndervold and at the Cathedral school. That there were so few remains from the 10th and 11th centuries in the 350 m^2 area excavated may indicate lack of permanent occupation in this part of Århus at that time.

Århus was founded in the 10th century and, as we can see it

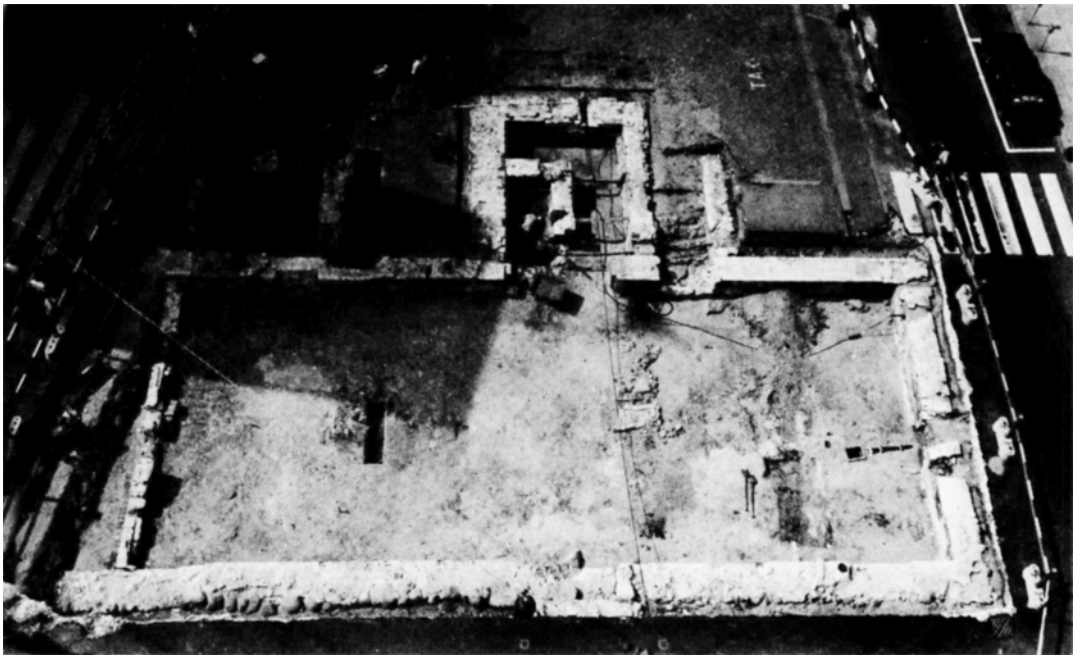


Fig. 10. Århus (no. 30). The excavated area at the town square. The Medieval town hall.

now, as a planned fortification with ramparts and moat. The general settlement was placed along the beach and along the river. This settlement contained, as earlier excavation has shown, many traces of trade and crafts. The remaining part of the town was probably an open space. It is obvious to assume that the town was founded as a royal fortification and stronghold, the function of which was military and which was of strategic importance in the 10th and 11th centuries. Here the king could rally his army in the open space, which also could function as a market place and as a refuge for the inhabitants of the region in times of war. It was natural that tradesmen and craftsmen sought this fortification and that the church in the 10th century (bishop mentioned 948) was placed here under the protection of the king. The bishopric was abolished shortly after 988 and we know of no ecclesiastical buildings from the following period.

When the town in the middle of the 11th century once again became a bishopric and the travertine cathedral was built outside the town a small settlement arose around the church, while inside the ramparts the space still seems to be vacant.

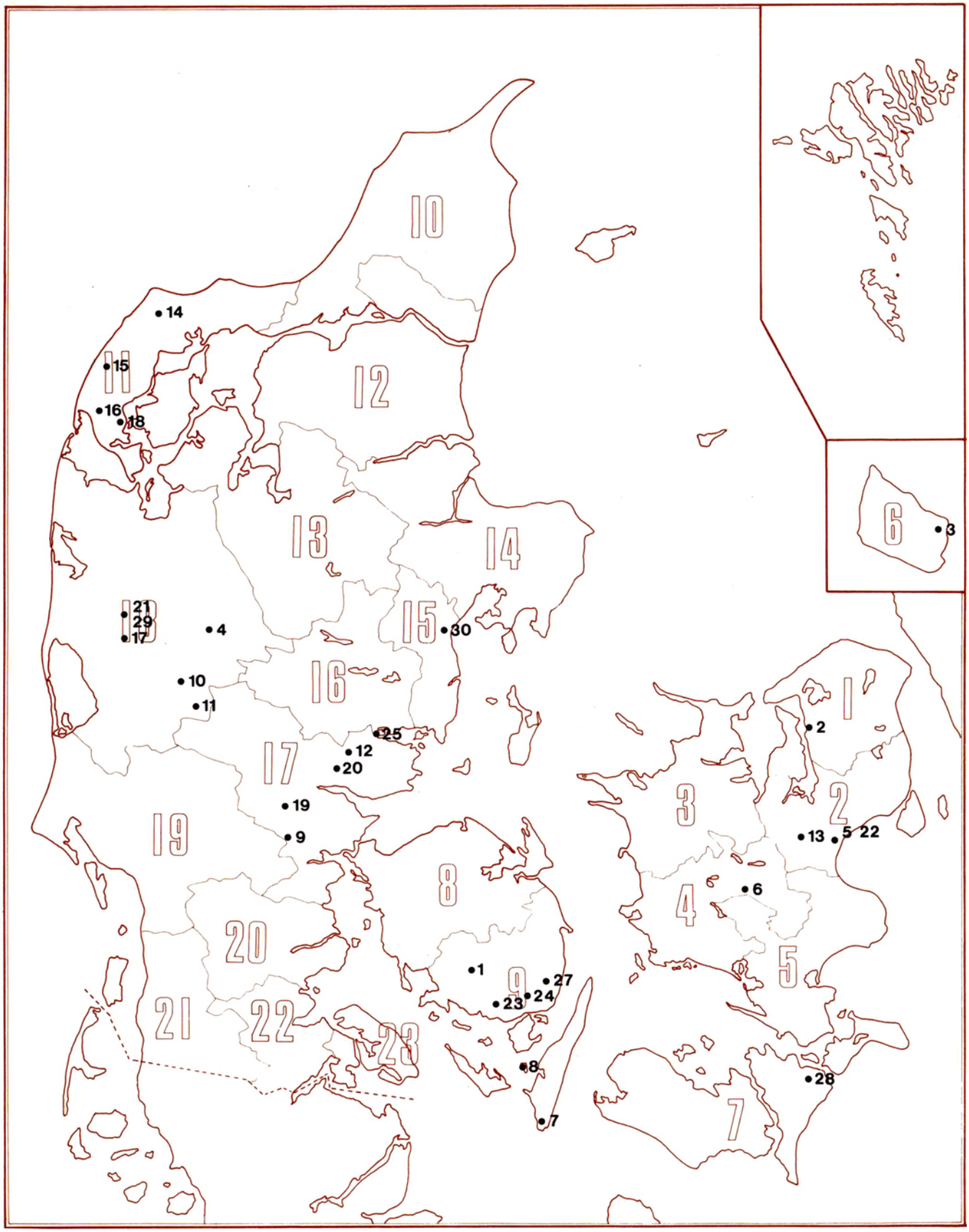
The pattern of this settlement did not change radically until around 1200, when bishop Peder Vognsen initiated a transformation of the townscape. The cathedral was moved to within the ramparts and with the Bishop's Palace to the north and canons' house to the south most of the old town was taken up by eccleciastical functions. The bishop seems to have taken over some of the king's interests in the town.

This plan was completed by the construction of the square, Store Torv, c. 1300, together with a partial reregistration so that a large number of the old inhabitants now have to move into the suburbs and especially along Vestergade, where new institutions and the king's water mill were also situated.

Ole Schiørring

Map showing 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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