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Ertebølle Revisited

by SØREN H. ANDERSEN and ERIK JOHANSEN

INTRODUCTION

A series of excavations were undertaken during 1979–84 to re-evaluate the classic kitchenmidden at Ertebølle, a late Mesolithic coastal site, which defines a whole "culture" in Denmark and Southern Scandinavia (Clark 1975, 181–199) (1).

The following is a survey of the preliminary results of these new investigations.

HISTORY OF RESEARCH

Denmark is one of the classic areas for prehistoric studies of shell middens and has a long archaeological tradition for investigations of kitchenmiddens or "Køkkenmøddinger".

In 1837, we find the first reports in the National Museum concerning digs on Danish shell middens (2). Later in 1850–51, the excavations at the large shell midden of Meilgård (done by Worsaae), clearly demonstrated that these accumulations truly were a unique type of stone age site and not – as had been proposed – natural shell banks with artefacts intermixed (3). Also in 1851, the term "Køkkenmødding" was introduced. In the following years these sites played a dominant role in the discussion among Danish archaeologists about the existence of an older phase of the stone age. Chronologically, technologically, and economically these sites differed from the stone age which was characterized by the big megalithic tombs with their polished flint axes and bones of domesticated animals.

To solve this problem, a series of new excavations were started in one of the largest shell middens in Denmark – at Ertebølle near the Limfjord in Northern Jutland (figs 1–2). The site, which later became the type site for this culture, was excavated in 1893–1897 (Madsen et al. 1900).

Under the direction of the archaeologist S. Müller, a group of archaeologists and scientists (2nd kitchenmidden committé) was established in order to cast new light on the shell middens from one well documented and thoroughly investigated site. It was the intention to obtain a large sample of artefacts to describe, define, and date this prehistoric phase in relation to the megalithic monuments, and by that, once and for all divide the stone age into an older and a younger phase.

After achieving these goals through the excavation of a large part of the Ertebølle midden proper (fig. 4), the results were published. The remaining (southern) part of the Ertebølle køkkenmødding was put under government protection (Madsen et al. 1900, 1–90) (fig. 4).

During the excavation, a 2×1 m column of the central part of the midden was brought to the National Museum for exhibition (fig. 8).

Large scale excavations of Danish kitchenmiddens were not resumed until the 1970's. Despite this, however, our knowledge of the Ertebølle culture has been vastly expanded, mainly through research on other types of Ertebølle sites. The information obtained by the excavations of sites such as Dyrholmen (Mathiassen et al. 1942), Ringkloster (S.H. Andersen 1975), Brabrand (Troels-Smith 1937, 1966), and Sølager (Skaarup 1973) formed the basis for a new evaluation of the Ertebølle type site.

This, however, is not the case with the Ertebølle type site itself. Since the end of the excavations in 1897, only on two occasions were new information on this site published. The first was a small article describing the remains of what was supposed to be a hut structure (Simonsen 1951, 222–223, Clark 1975, 194) (see also below). Later in 1970, a series of eight C-14 dates taken from the midden sample in the National Museum were published (Petersen 1970, 7 and 36). Unfortunately, these dates were without any correlation to stratigraphy and/or type inventory (4).

Despite the fact that Ertebølle is the classic type site, Danish archaeologists have not been able to answer a series of questions which today are closely connected with the description, understanding, and interpretation of this Northern European Mesolithic site (e.g. the

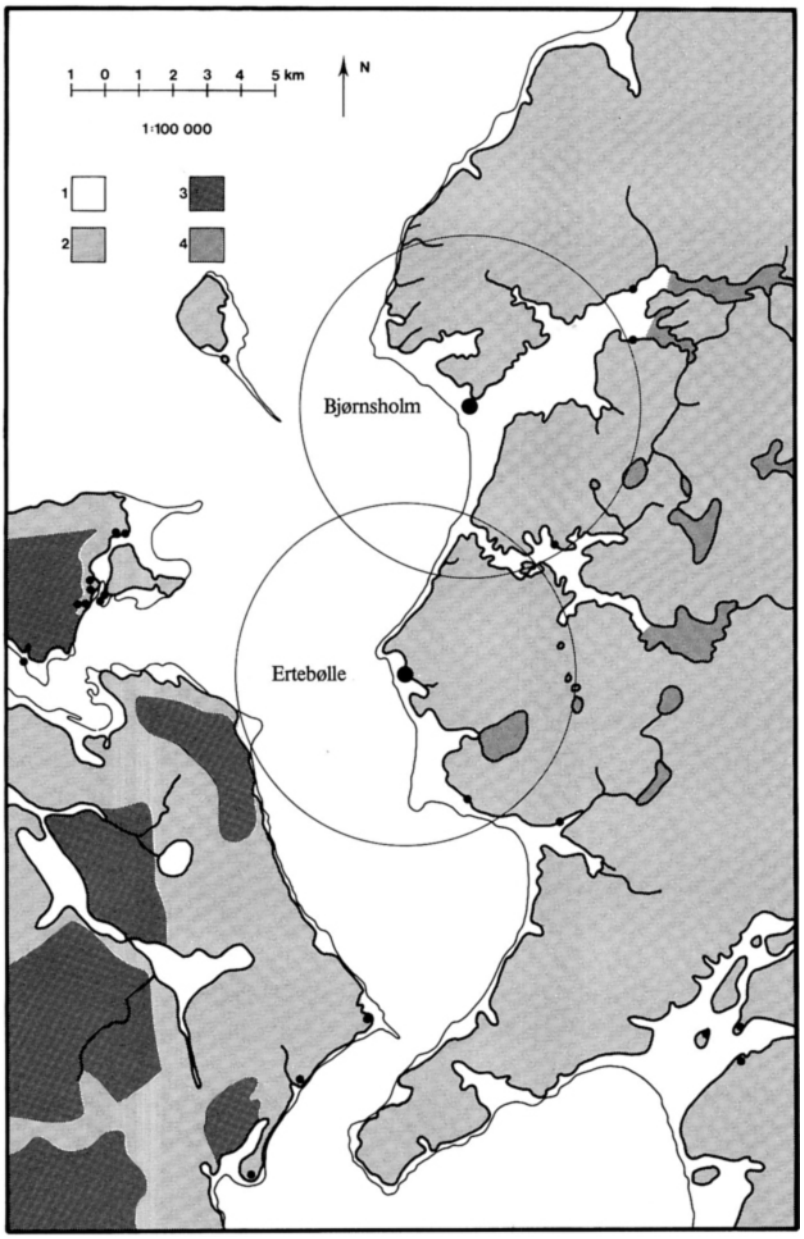


Fig. 1. The position of the Ertebølle and Bjørnsholm shell middens at the Limfjord in Northern Jutland. The distribution of various resource types are indicated. A distance of 5 km from the two "big sites" is indicated by circles. Also the modern and Mesolithic coastline are marked by a thin and wide line respectively
1. Sea
2. Sandy and gravelly soils.
3. Morainic clay
4. Freshwater lakes and marshy areas.
Small black dots mark other Ertebølle-culture sites.
Hanne Stenz and Orla Svendsen del.

character, artefact content, function, accumulation, and chronology of such a settlement).

Since the 1970's, this type of prehistoric research has resumed again and a series of new kitchenmidden excavations at Meilgård (Bailey 1978, 45 fig. 3), Norsminde (S.H. Andersen 1987), Ertebølle (S.H. Andersen 1983), Bjørnsholm (5), and several other locations have been undertaken by the first of the authours (SHA).

Because of lack of up-to-date information, in 1979 it was decided to start a new series of excavations at Ertebølle – a project which continued until 1984 (S.H. Andersen 1983) (6).

As was the case with the 'old' excavations, the new investigations were performed by a group of archaeologists and scientists (i.e. Quarternary geologists, a botanist, palynologists, zoologists, ichthyologists, and a specialist in marine molluscs and foraminiferas) (7).

Before the project started, a series of questions were formulated as a guide. Several problems were closely connected with the site itself, such as:

1. What was the exact size of the midden?
2. Was the midden a chronological unit or not? If not,
3. what was the rate of accumulation?
4. How long a time span did the site cover?
5. Was the Ertebølle midden identical to the other Danish middens?
6. What type of site was the midden?
7. Was it a settlement proper or just an area of waste?
8. Was there a drop zone or waste dump in front of the site as is well known from many other Danish Late Paleolithic and Mesolithic sites (i.e. Tybrind Vig (S.H. Andersen 1975, 15–23))?
9. What was the relationship between the Ertebølle midden and the Littorina sea?

Last, but not least, we wanted to obtain an up-to-date sample of the artefact assemblage in association with a well defined stratigraphy, as well as the possibility for obtaining new samples for C-14 and scientific analysis (see above).

Many of these problems could be solved if we excavated large sqares to the rear and in front of the midden, delineated the site area, and opened a new section or trench through the preserved part of the Køkkenmødding.

ERTEBØLLE REVISITED

The Ertebølle site is located in the northwestern part of Jutland in the central Limfjord area (fig. 1). The Køkkenmødding today lies on the western side of a hilly projection facing the sea of Livø Bredning (fig. 1–2).

Ertebølle sites in the Westhimmerland (fig. 1)

Seen in a larger perspective, the Ertebølle type site is not the only one in this area. A few kilometres to the north in the present day Trend river valley, which during the Mesolithic was a large fjord, several smaller Late Mesolithic coastal sites were found. Finally, approximately 8 km to the north we have another large Køkkenmødding at Bjørnsholm, which is probably the largest Danish shell midden of all (fig. 1) (5).

In this area we have the two largest Danish kitchenmiddens. They are contemporary in an archaeological sense, but differ in artefact style and also to some degree in their economies. Such a situation poses some very interesting questions of settlement patterns, population density, and environmental productivity within this part of the Limfjord.

Unfortunately, this area has never been subjected to any intense or large scale reconnaissance of Ertebølle sites. For this reason, our knowledge of the Late Mesolithic settlement patterns are very limited (e.g. we do not know of any inland sites at all in this part of Jutland).

Site territory

For a geological description of this area, see K. Strand Petersen in this volume.

It is very difficult to tell what the region looked like in the Mesolithic. However, new geological investigations seem to indicate a habitat completely different from today (fig. 2).

The area must have been a large sheltered bay well protected by the "Ertebølle head" to the north and by a small island to the south. This small island – which was later completely eroded away – has been the basis for a large system of beach ridges going in a SW-NE direction, and by that sheltering the area adjacent to the kitchenmidden (fig. 3).

Further to the north, there was an access through the Hanherred out into the Skagerak and North Sea. Just 10 km to the west is the large island Fur and 11 km to the northwest, the small island Livø (fig. 2). The vicinity of the site is dominated by a low hilly terrain which does not exceed more than 30 m in height. The subsoil is glacial meltwater sand and gravel. Along the coastline there are some small river outlets, and just at the site there is a little spring. To the southeast – only 2–3 km from the midden – there was a large freshwater lake connected to the sea through a narrow river channel (fig. 2).

Two to three hundred meters to the west of the site, on what today is raised seabottom, traces of a natural shell bank was discovered. The C-14 dates of this shell bank indicate that it was contemporaneous with a part of the midden itself 4050 ± 100, 3890 ± 95, 3840 ± 95 (K-4340, 4341, and 4342). This bank may very well be where (or one of them) the inhabitants collected their shellfood (see Kaj Strand Petersen this volume).

The coastal climate in the Atlantic period is generally described as moist and temperate with a mean summer temperature of 20°C and a mean winter temperature of 1°C, higher than today (Iversen 1979, 407).

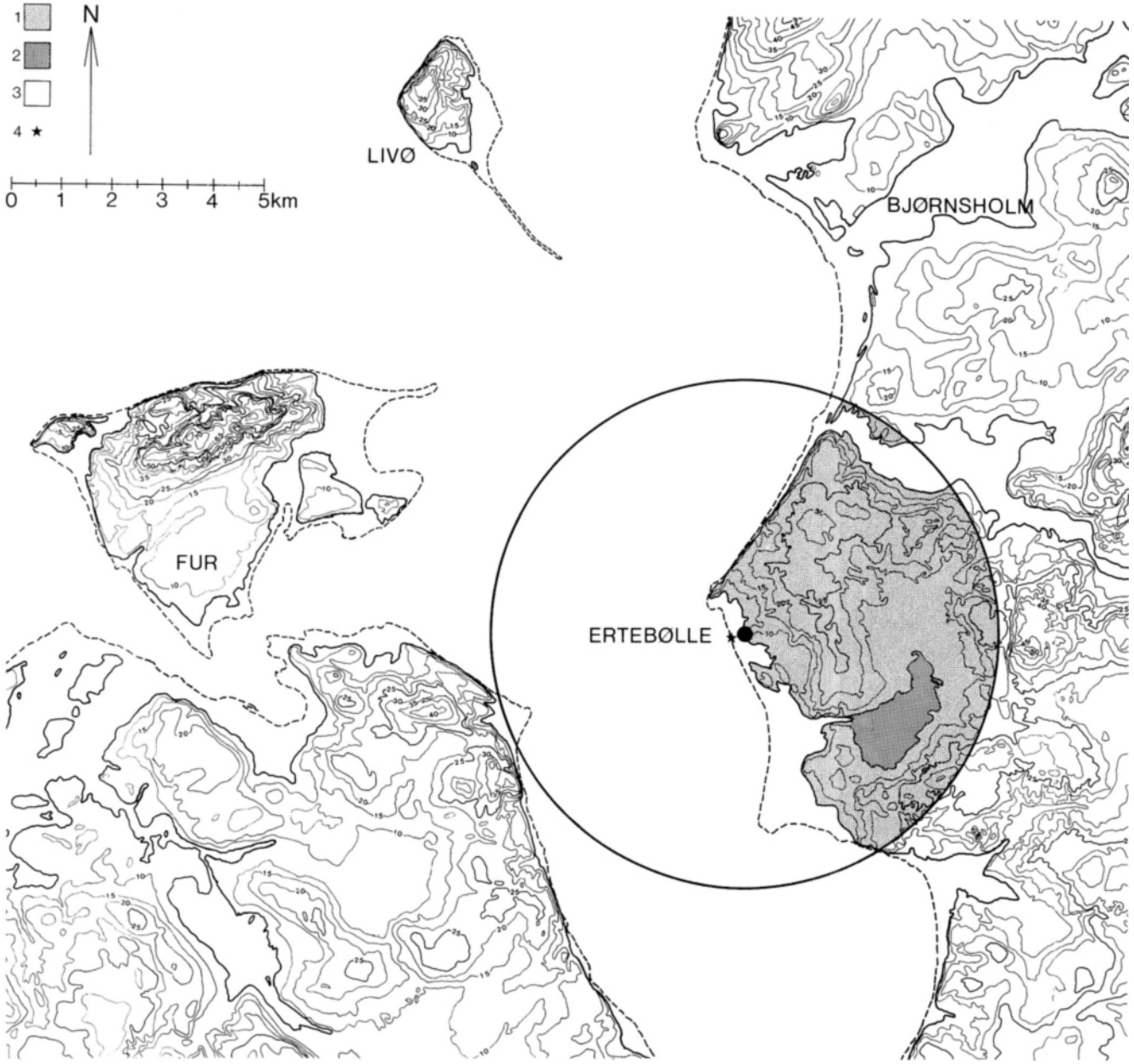


Fig. 2. Topography and geology of the "catchment area" around the Ertebølle site in the Mesolithic.
1. Sandy and gravelly soils.
2. Freshwater lake.
3. Sea.
4. Natural shellbank.
Modern coastline is marked by a dotted line. Contour map. Reproduced with permission of the *Geodætisk Institut* no. A.404/85.

The higher temperature and salinity of the seawater due to stronger tides created very favourable living conditions for the marine food chain.

The local wind conditions may also have played a role. The area around Ertebølle is exposed to the Limfjord and the North Sea. Despite an outer chain of islands, this area must have been more exposed to storm conditions and wind than the east Jutland coast.

As for the vegetation, our pollen analysis has not been completed. However, the earlier analyses of charcoal from the midden suggest a landscape covered by oak (Quercus), elm (Ulmus), birch (Betula), aspen (Po-

pulus), alder (Alnus), hazel (Corylus), and willow (Salix) (Madsen et al. 1900, 89–90). This combination reflects an environment and climate which may have been similar to the modern assemblage seen today around the Limfjord.

Animal life is also well represented, as documented by the list of species from the old excavations (Madsen et al. 1900, 81–89), and by the new one given in this article (see p. 59) (8).

Site area

The new investigations have shown that this famous shell midden is not the only Mesolithic site along the prehistoric coastline in this area. Just 40–50 m south of the type site, a small shell midden (measuring 10×10 m) was recorded, 90 m further to the south, another one (measuring 10×15 m) was found (fig. 3).

On the plateau bordering the old coastline to the east-southeast, a large elongated area (measuring 200–250×30–40 m) containing several partially overlapping concentrations of Ertebølle flint tools and debris were found.

The position of these flint concentrations along the prehistoric beach indicates that they all originally must have been coastal sites. Based on the finds, these areas all seem to belong to the Late Mesolithic Ertebølle culture. It is also worth noting, that these flints are found c. 150 m further to the south along the old coastline than the kitchenmidden itself (fig. 3). These observations tell us that an Ertebølle coastal site is not always a kitchenmidden. Even within small areas, one may find contemporary coastal settlements with an associated Køkkenmødding and/or without.

It should be noticed that the various sites within this defined area manifest themselves *both* as kitchenmiddens as well as coastal settlement sites without shell accumulations. The detailed relationship between these various types of sites are still to be determined (fig. 3).

The kitchenmidden itself is narrow and oblong in shape. It stretches approximately in a N-S direction along the foot of and partially upon the side of a low bank (2–3 m high) which borders a flat plateau gradually rising to the east (figs 3 and 4). The largest dimensions were at the northern end where the 1890 excavations took place. Gradually, the midden becomes thinner and more narrow to the south (the preserved area).

The minimum length was c. 140 m, the width c. 20 m, and the thickness c. 1.9 m (Madsen et al. 1900, 12–20). Today the site is positioned between 5.4–3.7 m above sea level.

The narrow elongated shape is characteristic for most Danish kitchenmiddens. The immediate surrounding areas to the west, north, and south of the location are today low, marshy grasslands – raised seabottom. In this part of Denmark, the postglacial uplift is about 6 m (K. Strand Petersen 1975, 1981 and this volume. S.H. Andersen 1979a, 10).

The bank on which the site is located, is a coastal cliff older than the midden (9). In front of the site is an extensive system of marine deposits in the form of beach ridges (fig. 3) which stretch from the southwest to the northeast up to the kitchenmidden. These ridges are contemporary with the midden. In the field, east of the site, a small spring rises, and from there, runs across the bank and out into the sea. Our investigations indicate that this spring existed during the Mesolithic and must have passed through the midden area, therefore, dividing it into a northern and southern area. It is reasonable to suppose that this small spring was one of the determining factors for the location of the site during the Mesolithic.

INVESTIGATIONS BEHIND THE KITCHENMIDDEN

Due to the large numbers of artefacts recovered, earlier Danish kitchenmidden excavations concentrated exclusively on the shell deposits themselves, while the surrounding areas were not investigated. It has not, therefore, been possible to determine whether the middens were actual settlement sites or simply part of a settlement (i.e. the waste area or "midden").

In order to cast new light on this question, it was decided that the area behind the Ertebøllle midden should be investigated. This area was chosen for several reasons: the flat plateau just behind the midden (see fig. 3) would seem to 1) be the most well suited area for habitation, 2) our surface reconnaissance showed a clear scatter of Mesolithic flints in this area – demonstrating that activities *had* taken place, and, 3) the Ertebølle graves at the Bøgebakken and Skateholm sites in Southeast Scandinvia are all positioned on higher ground *behind* the settlement and their associated waste areas (Albrethsen and Petersen 1977, Larsson 1984).

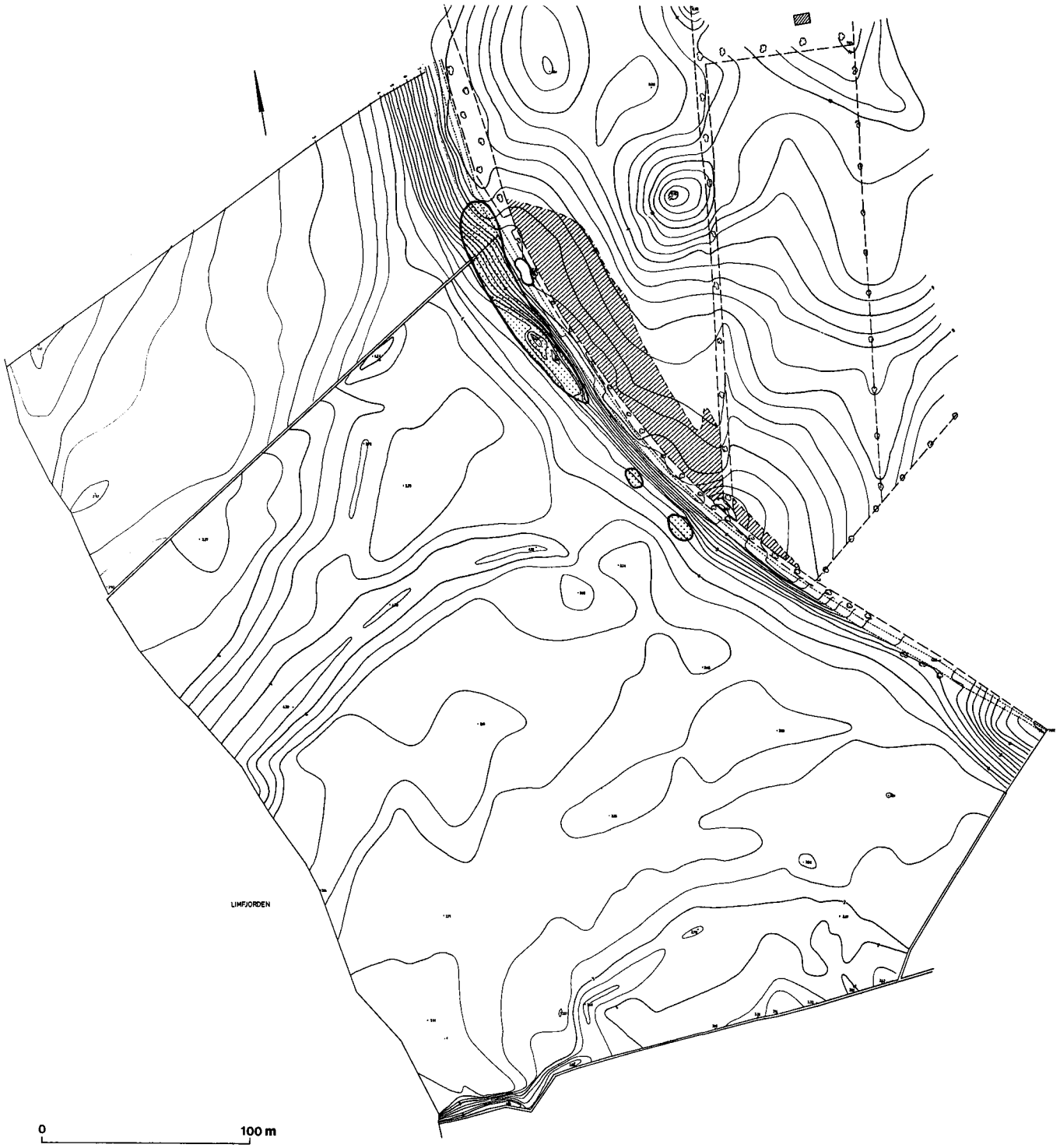


Fig. 3. The position of the kitchenmiddens (dotted) along the prehistoric coastline and the extension of the areas on dry land where flints are found – "activity areas" (shaded). Observe the system of beach ridges running from SW to NE. Distance between the contours is 25 cm. Jan Sloth Carlsen and Orla Svendsen del.

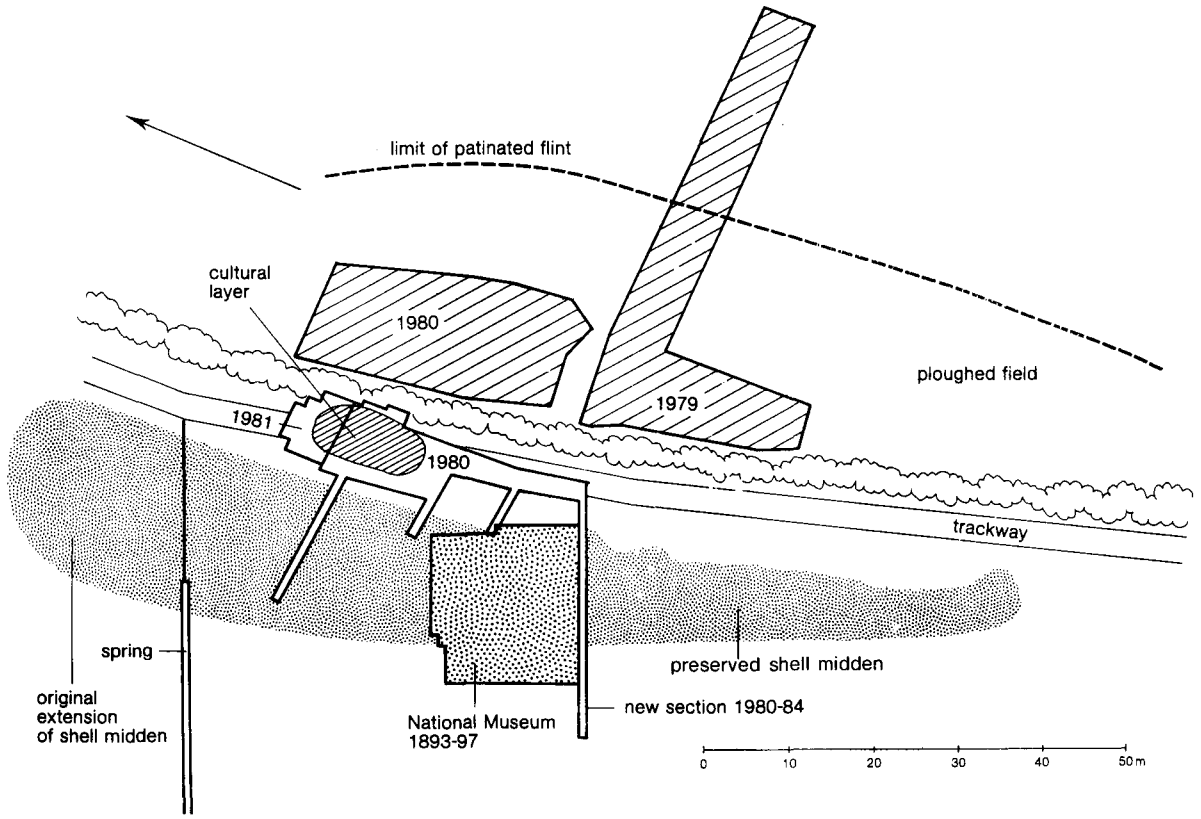


Fig. 4. Plan of the midden (shaded) and its immediate surroundings. Excavated areas are indicated. Jan Sloth Carlsen del.

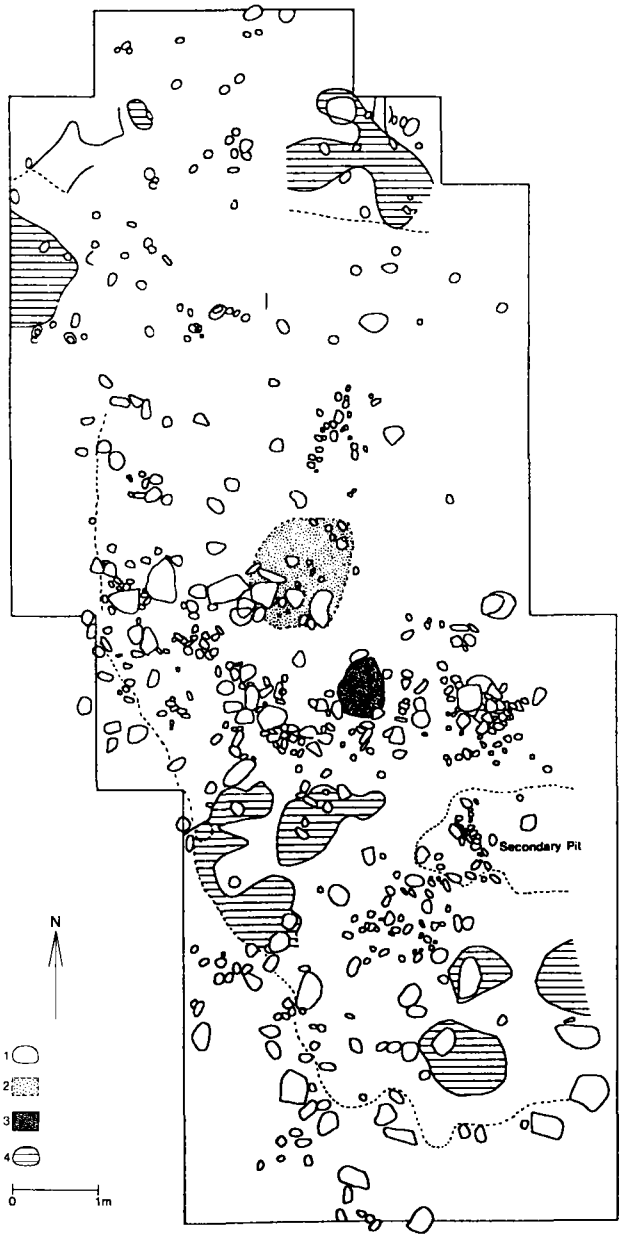
The distribution of Mesolithic flints behind the kitchenmidden follows the old coastline. The intensity of artefacts is especially dense behind the central and southern part of the kitchenmidden. East of the northern part of the midden, there are very few traces of occupation. The frequency of flints is not very high in this area. No more than 10–100 pieces have been excavated pr. m^2, substantially lower than in the midden itself.

After scraping away the plough horizon from two large areas (a total of 910 m^2 (fig. 4 top)), it was clear that no primary cultural layer was present. With increasing distance from the midden, the finds in this top horizon gradually became fewer and disappeared at around 30–40 m – as observed after the surface reconnaissance. Furthermore, the area under investigation was extended to 90 m from the kitchenmidden – but no finds or structures were observed at all (fig. 4).

Scattered flints and artefacts were found throughout the plough horizon, but apart from a small oval pit (c. 100×60×30 cm) containing Ertebølle artefacts, the whole area was found to be completely void of all different types of structures normally associated with settlements.

On top of the bank, just 4–5 m east of the National Museums excavations, the subsoil forms a shallow depression filled with a fine grey sand. In this depression was a thin primary cultural layer, oval in shape (measuring 15×6 m), which contained flint waste and other typical Ertebølle artefacts (figs 5–6). This layer (just 15 cm thick) must reflect a very short occupation episode. Stratigraphic observations here clearly indicate that the top level of the sand horizon has been subjected to marine erosion, an indication that the midden has been flooded by the sea.

Although no ceramics or organic materials were preserved in this area, very high concentrations of flint were found. The artefact density was especially high in an area several meters wide around a large stone (70×60×40 cm) with a particular concentration to the east (figs. 5–6). Close to this stone, the flint debris was



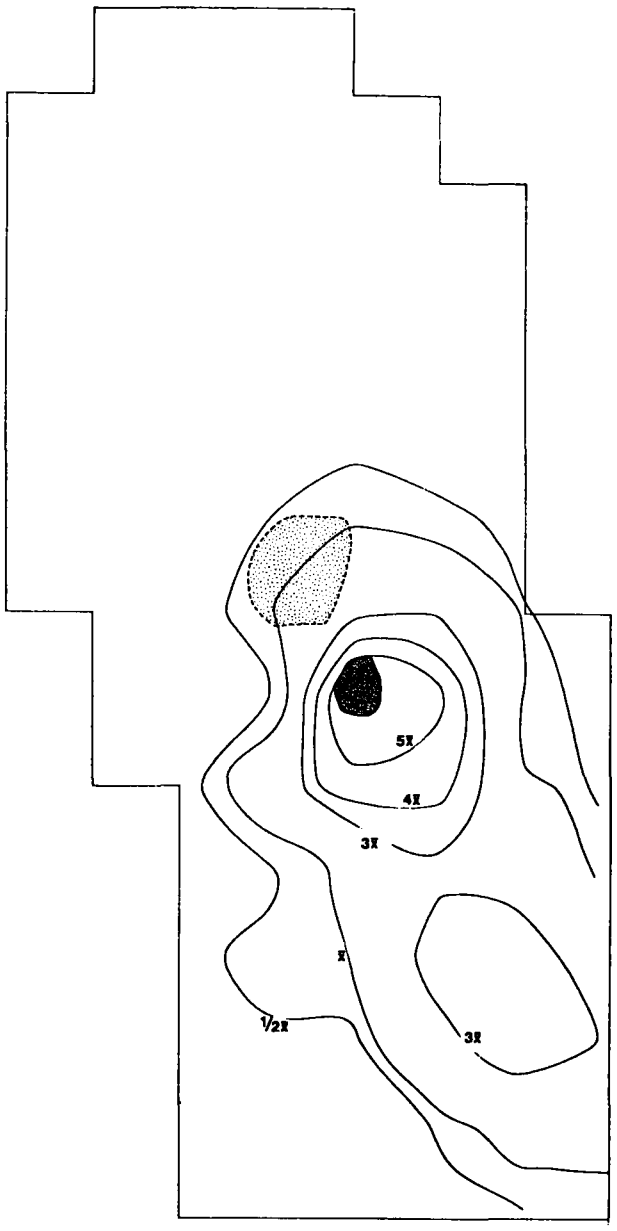


Fig. 5. (Left) Plan of the small flint-knapping area on top of the slope – just behind the central part of the midden, cf. fig. 4.
1. Stones.
2. Fireplace.
3. Big stone.
4. Pits.
Dotted line = Limit of grey sand layer.
(Right) Distribution of flint debris in the deepest horizon (layer 4) in relation to fireplace and the big stone. – The contours are based on the mean weight pr. m^2; ½x = 123 g, x = 246 g, 2x = 492 g, 3x = 738 g, 4x = 984 g, and 5x = 1230 g. Orla Svendsen del.

comprised of very small splinters and chips, while the bigger flakes – often with cortex – were found further away. As well as the debris, several broken tools and many unfinished transverse arrowheads were recorded.

Analysis on this material demonstrated that many of the flints, even when found several meters apart, could be refitted giving further support to the idea that this layer represents an undisturbed activity area.

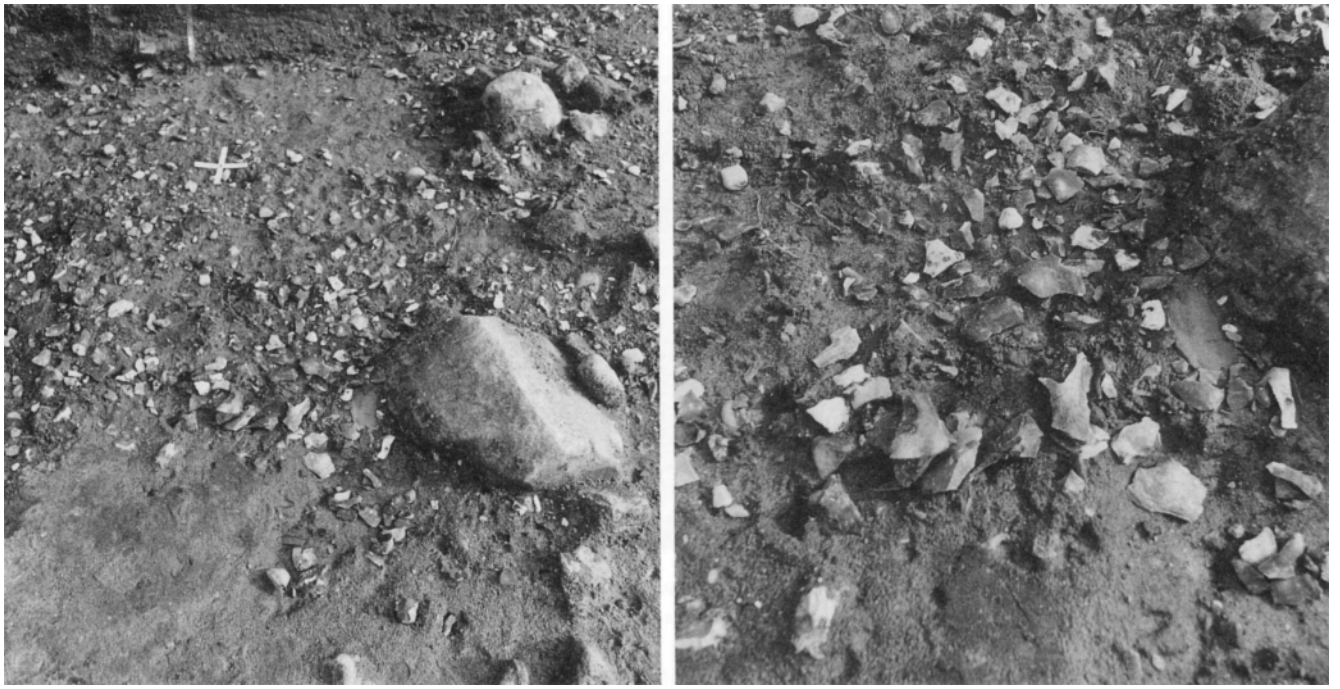


Fig. 6. View of the flint-knapping area on dry land with the big stone. Cortical flakes from the initial preparation stage of the flint working are seen lying on the old surface around the stone. Erik Johansen photo.

One meter to the north of this flint knapping area a pit shaped fireplace (1.2 m in diameter) was found. It was filled with sand and contained firecracked stone and burned flint debris (fig. 5).

Such a distribution of flint debris has been frequently recorded not only at modern excavations of small single occupation sites, but also, from experimental archaeological tests and ethnoarchaeological investigations (Fischer et al. 1977, 93. Fischer et al. 1979, 12. Binford 1983, 152).

These lines of evidence indicate that this area was possibly a working area inwhich the large stone was used either for sitting or as an anvil during flint knapping. The presence of a fireplace in the immediate vicinity of the "working area" is also well known from ethnoarchaeological studies (Binford 1983, 149–150).

In accordance with the modern experiments and the ethnoarchaeological information, the "flint knapper" must have sat on the large stone or have been supported by it with his left side to the fireplace (Hansen et al. 1983).

All the flint types found in this area belong to the Ertebølle culture. Closer chronological analysis indicates that this "working area" is contemporary with the middle phase of the midden. However, contemporanity cannot be proved – just rendered a possibility.

Due to factors such as the topography, marine erosion, ploughing, and excavations, it is impossible to establish any stratigraphic relationship between this area and the midden only 3–4 meters away. It is, however, highly probable that they were both part of the same large settlement.

During the excavation, it was observed that all flints found up to c. 7 m above present sea level were water-rolled and patinated, indicating that this must have been the highest level of the stone age (Littorina) sea in the region. This observation corresponds well with the earlier and more recent geological investigations along the shores of the Limfjord (K. Strand Petersen 1975). This demonstrates that the kitchenmidden (which lies between 3.7–5.4 m above D.N.N.) and an extensive part of the flat plateau behind it, must have been flooded at least once – and possibly twice.

Marine erosion, therefore, could be an explanation for the lack of settlement structures to the rear of the midden. If this is the case, the erosion must have been extremely extensive, washing away even the deepest pits, postholes, and graves. However, it is interesting to

Fig. 7. (Left) Photograph of the "old excavation" in 1893–97. The work was performed within a square meter grid and in 20 cm thick layers. For the digging, local farmers were employed and equipped with small garden rakes. The older man supervising the work is Captain A.P. Madsen. The younger man is Georg F.L. Sarauw.
(Right) Excavation of the new trench in 1983. The south profile is exposed and being measured and photographed. See how the midden is positioned upon the surface of the marine sand. Photo Jan Sloth Carlsen.

note at this point, that the graves at Bøgebakken and Skateholm lie between 10 and 70 cm below the surface (Albrethsen and Petersen 1977, Larsson 1984). These measurements give an idea of the extent of sea erosion which could have taken place at Ertebølle if graves of a similar depth were present at this site.

Such heavy erosion is possible, but this does not fit the observations of the Ertebølle midden, which has an undulating surface and is not covered by any marine sediments, despite the fact that it was c. 2–3 m lower than the plateau behind it.

The explanation for the lack of structural remains, however, is more likely to be found in the types of habitations themselves. Either there was no settlement in this area, or it was of a type that left no traces remaining today (i.e. graves, deeper depressions or pits cut into the subsoil).

Conclusion

Our excavations on the plateau behind the kitchenmidden have only revealed few sporadic traces of habitation; one of which was a flint knapping area. The lack of structural remains in this area may be caused by marine erosion, but may just as well reflect either: that no large scale activity took place there or that they simply have been of a type which has not been preserved in the archaeological record.

Given the long time span during which the kitchenmidden was in use, the small number of flint artefacts and structural remains are striking.

Information from other Danish shell middens, where no marine erosion has taken place, support the Ertebølle results.

At these sites (e.g. Norsminde), traces of habitation to the rear of the midden (S.H. Andersen 1987) were also lacking.

INVESTIGATIONS IN THE KITCHENMIDDEN

In connection with the new investigations at Ertebølle, a 1 m wide by 29 m long trench was excavated through the kitchenmidden (fig. 8). This new trench was positioned immediately to the south of the square excavated by the National Museum (in the 1890's) and runs from the "old" coastal bank in the east, through the midden, and out into the marine deposits to the west. Our trench, therefore, is to be considered as a sample of the southern part of the kitchenmidden.

During our work (1980–84), the edges and corners of the old excavation were found, so that the exact position of the two excavations could be established in relation to each other (fig. 8).

This trench was excavated very meticulously, recording everything both on plans and with three dimensional coordinates. A large series of bulk samples were taken for scientific analysis, the sections were drawn and photographed, and finally, two column samples J and N (on fig. 8) were removed for future analysis.

After excavation and cleaning of the south section of the trench, the Ertebølle kitchenmidden again manifested itself in an impressive way, similar to the photographs in A.P. Madsen's book (Madsen et al. 1900) (fig. 9).

Stratigraphy of the kitchenmidden

In the trench, the maximum thickness of this in situ midden is c. 1.2 m by c. 15 m. The base of the midden is relatively flat, the surface is domed, so the cross section of the midden is semicircular (figs. 10–11).

A sharp delineation of the western end of the midden could not be established, because it fades out into the marine deposits.

The subsoil (consists of morainic clayey sand with stones) slopes gradually from the bank westwards. The bank has been eroded by the sea at a level of 4.5 m above modern sea level (Early Atlantic Transgression).

Above this moraine, there is a marine sand horizon (up to 4.3 m above modern sealevel) where both layers of fine and more coarse grained sand were deposited. This layer begins c. 5 m from the foot of the bank gradually sloping and becoming thicker to the west. Intermixed in this layer are 2–5 cm horizons with flint tools, debitage, animal bone, wood, pices of bark, many shells and shell fragments of predominantly oysters (Ostrea sp.), cockles (Cerastoderma sp.), and mussels (Mytilus sp.). This material shows that these layers are either part of a redeposited kitchenmidden or "waste" from a site. Geological investigations of this sand layer indicate that it was thicker. The erosion of this layer must have been caused by the sea – probably during the High Atlantic Transgression.

Our observations of the square excavated by the National Museum in the 1890's demonstrated with certainty that they had only dug as far as the sand layer,

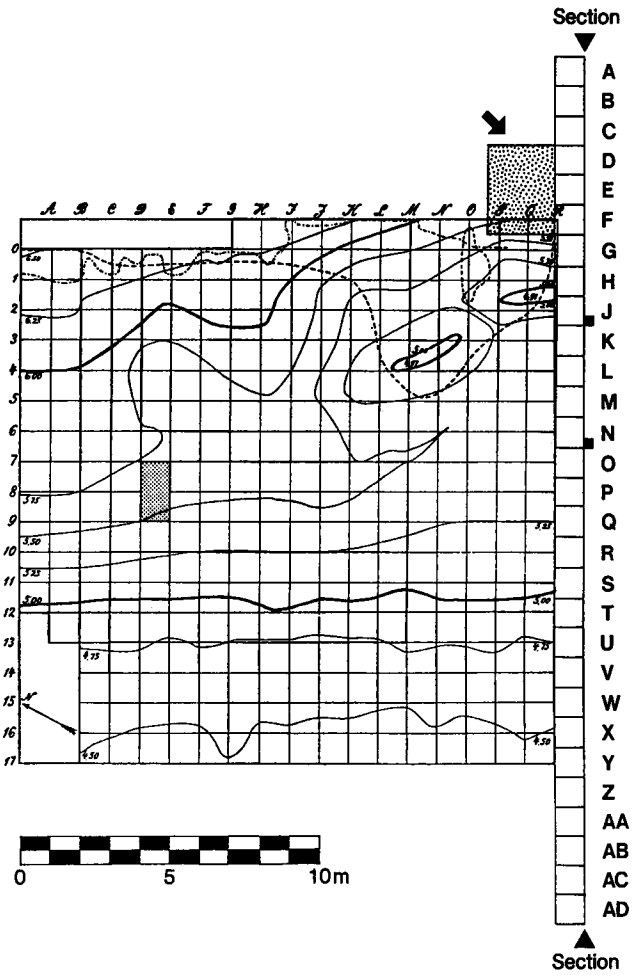


Fig. 8. Map of the position of the "old" and "new" excavation; position of the two column samples, J and N and the small excavated area of the black culture layer at the foot of the slope (arrow). Shading indicates the position of the 2×1 m column taken out of the central part of the Køkkenmødding during the excavation of the National Museum in 1895. Hanne Stenz del.

but not into it. Therefore, the artefacts we excavated within this sand horizon are most probably not represented in the material from the 1890 investigation.

Between the foot of the cliff and the beginning of the sand layer, there is a c. 5 m wide area which slopes gently down to the west (fig. 10). Here a c. 10 cm thick black cultural layer was found, containing large quantities of charcoal, flint tools, flint debitage, bones, and "cooking stones". At the bottom of the slope, this layer has been deposited directly upon the subsoil. To the west, it gradually divides into 2–4 thinner blackish layers which can be followed out into the top part of the

sand horizon where they then disappear. In order to increase the number of artefacts from this black cultural layer, a square (3×2 m) just north of our original trench was excavated (fig. 8). In this area a scatter of hearth stones were found, together with another in situ fireplace. It represents a habitation on the beach down to a level of 4.3 m. The contemporaneous sea level must have been c. 4.3–3.8 m above the present.

The stratigraphic context demonstrates that the black layer is contemporary with the youngest part of the sand layer and older than the midden. This layer provides new information concerning the formation of the site. Repeated occupation took place here several hundred years before the accumulation of the midden.

The black horizon was covered by a series of 30–40 cm thick layers of narrow gravel beach ridges running along the foot of the cliff (figs. 10 and 12) thereby demonstrating that this area was still at that time very close to the sea. Within these beach ridges, cultural material was found showing that the site was still inhabited. There was a further regression of the sea and a larger part of the sand horizon was exposed thereby, making it accessible for habitation. From then on, the deposition of the midden took place. Even then, however, the sea could not have been far away, as the lowest layers of the midden show many unmistakable signs of redeposition with thin horizons of marine sand and gravel.

The upper part of the shell midden is characterized by several secondary pits filled with crushed shells. Since they contain no datable material it is impossible to tell exactly how old they are.

At the foot of the cliff, the kitchenmidden is situated directly upon the system of beach ridges as mentioned above, while further to the west, it lies on top of the sand layer (fig. 10).

In this direction, the midden becomes thinner and the sand content increases. Also, traces of marine activity become more pronounced. Here, there is no primary in situ shell midden. Instead, a layer of crushed shells mixed with many waterrolled artefacts are found. It is clear that the content of this horizon is redeposited material from other parts of the midden. Looking at the topography, this material was probably eroded from the north-northwestern part of the midden and then washed along the coast and later deposited at the southern end. This 'outwash' layer continues at least 25 m further to the west.

The lowest part of the midden is covered by a layer of freshwater peat, indicating that this area – after the retreat of the sea – became a brackish or freshwater lake/marshy area.

Our investigations proved that a 'dump' or 'waste layer' outside (to the west) the kitchenmidden – a pnenomenon known from Danish Mesolithic sites i.e. Tybrind Vig (S.H. Andersen 1985, 55–56) was not present in front of the Ertebølle midden.

The area between the midden and the sloping bank is characterized by alternating layers of sand and shellfish. The position of these layers and their stratigraphic relationship with the midden clearly demonstrate that they derive from the plateau behind the midden – probably eroded by the sea. The presence of shell horizons here shows that in the stone age there also must have been smaller shell deposits (Køkkenmøddinger) on the plateau to the rear of the midden.

Since we have no dates of these layers at the moment, it is only possible to say that they must be older than the transgression(s) which flooded the plateau and eroded the deposits down the bank.

Interpretation of stratigraphy

After the erosion of the bank during the Early Atlantic Transgression, the sea withdrew.

Contemporary with or later than the retreat of the sea, the marine sand horizon was deposited. At the same time we find the oldest traces of habitation at Ertebølle, a small settlement on top of the bank. This settlement c. 4020–4060 b.c. must have consisted of a small kitchenmidden such as the ones seen in Brovst layer 11 (S.H. Andersen 1970) and the Norslund layer 4 (S.H. Andersen and C. Malmros 1966). During the High Atlantic Transgression the sea eroded the top of the sand layer. The sea then receded and the slope at the foot of the bank was exposed and became a dry beach well suited for habitation (the black layer 3,850 b.c.). Shortly after, the beach and the sand layer were exposed enough for the accumulation of the large Køkkenmødding where the oldest part c. 3,800 b.c. is found close to the slope. Several small beach ridges intermixed with cultural material and shells document that the sea still was not far away. Our investigations indicate that the midden was deposited in the regression between the High and Late Atlantic Transgression. About 3,500 b.c., the midden at this spot started to inc-

rease rapidly in a horizontal and vertical way. Contemporary to this accumulation we find indications of a gradual rise in sea level (see K. Strand Petersen, this volume). After 3500 b.c. there is a lapse in the accumulation of shell for some period. Finally, we see the last traces of shell deposits belonging to the youngest Ertebølle c. 3,200 b.c.

Later the sea flooded (once, possibly twice) the Ertebølle midden thereby causing erosion to occur both on the plateau behind the midden and along the coastline. One of these transgressions must have taken place after c. 3,000 b.c. and before 2,800 b.c. (11).

Finally, the sea withdrew and the sea bottom in front of the site gradually became transformed into a brackish marshy or bog area.

The Ertebølle midden displays many traces of marine activity in the form of small beach ridges – layers of gravel and fragmented shell. This means that the midden, in contrast with most Danish kitchenmiddens, was always in the intertidal zone exposed to wave action, high tides, and storms.

A large part of the southern end of the Ertebølle midden is an accumulation of secondary material. This conclusion has, of course, consequences for the material from the old excavation – of which a substantial part must stem from this 'secondary' accumulation. This new information tells us also, that calculations should not be based on midden size alone.

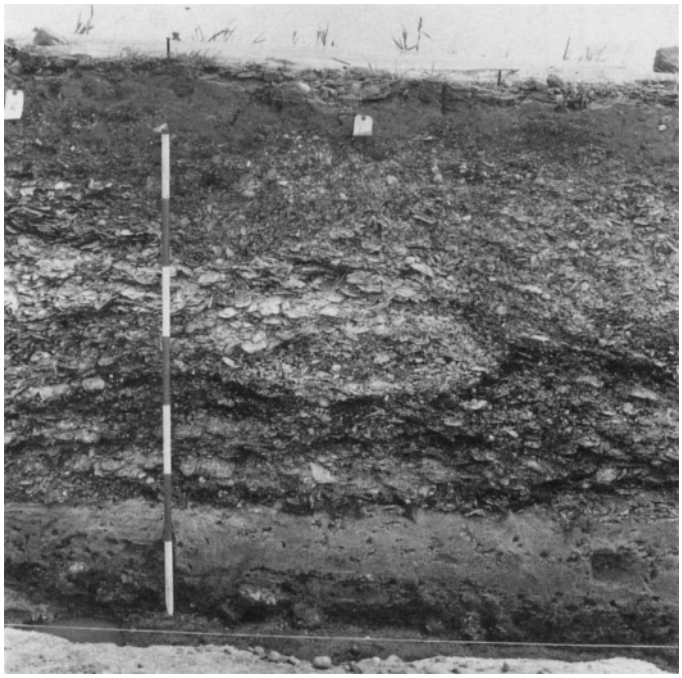


Fig. 9. (Top) Square "D-H" in the eastern part of the Køkkenmødding. In this area the midden is characterized by rather steep-sided shell heaps reflecting a fast accumulation. In the centre of the shell heaps is a large hearth or firepit with three superimposed layers of clay and charcoal. Jan Sloth Carlsen photo.
(Bottom) Square "L" in the central part of the midden. This area is characterized by more horizontal layers reflecting a slow accumulation rate. The lens in the centre is a local heap of cockles.

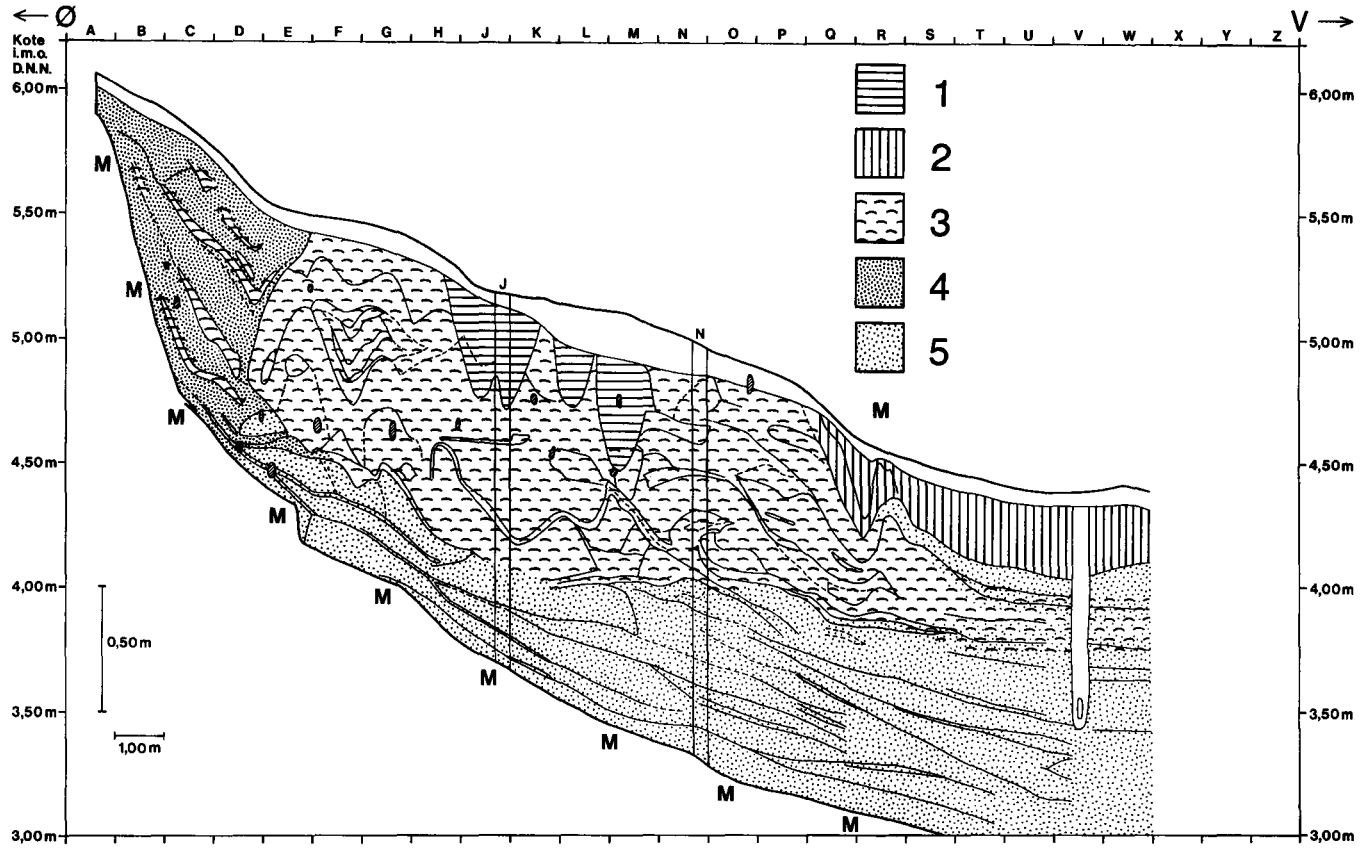


Fig. 10. South section (E-W) through the Ertebølle Køkkenmødding, cf. fig. 9.
1. Secondary pits.
2. Peat.
3. In situ shell midden.
4. Sand and shell layers.
5. Marine sand.
M. Morainic clay.
The two column samples "J" and "N" are indicated. The profile is exaggerated 5x.

Midden composition

The shell midden consists of a mixture of marine molluscs, charcoal, flint debitage, animal bone, ceramics, and stones of varying size. Fireplaces of different types, layers of ash, fishbones, and a few larger stones were also found. The shell composition of the deposits vary, oysters (Ostrea sp.) always dominate (up to 80%), followed by cockles (Cerastodorma sp.), mussels (Mytilus sp.), and periwinkle (Littorina littorea).

In smaller areas, any of these species may dominate completely – most probably representing waste from individual meals of a single species (fig. 9 bottom).

A more detailed survey of the mollusc content and composition is given by K. Strand Petersen in his article (this volume).

The distribution of cultural remains also vary. Some horizons are characterized by a particular dominance of artefacts. The areas around the fireplaces are sometimes extremely rich in finds.

The content of artefact material in these shell heaps is very uniform throughout the midden, suggesting that their types of activities remained constant through the long occupation period.

Around the fireplaces are horizons of ash and charcoal (fig. 14). In some areas it has been possible to follow such layers up to 7 meters from the fireplace. These layers enable us to establish contemporary surfaces within the midden. Furthermore, the extension of such ash horizons clearly prove that these fireplaces were open-air. If they had been in huts, the ash would have been more confined.

The stratigraphy of the midden (figs. 10–11) shows that the excavated part could be divided into two areas,

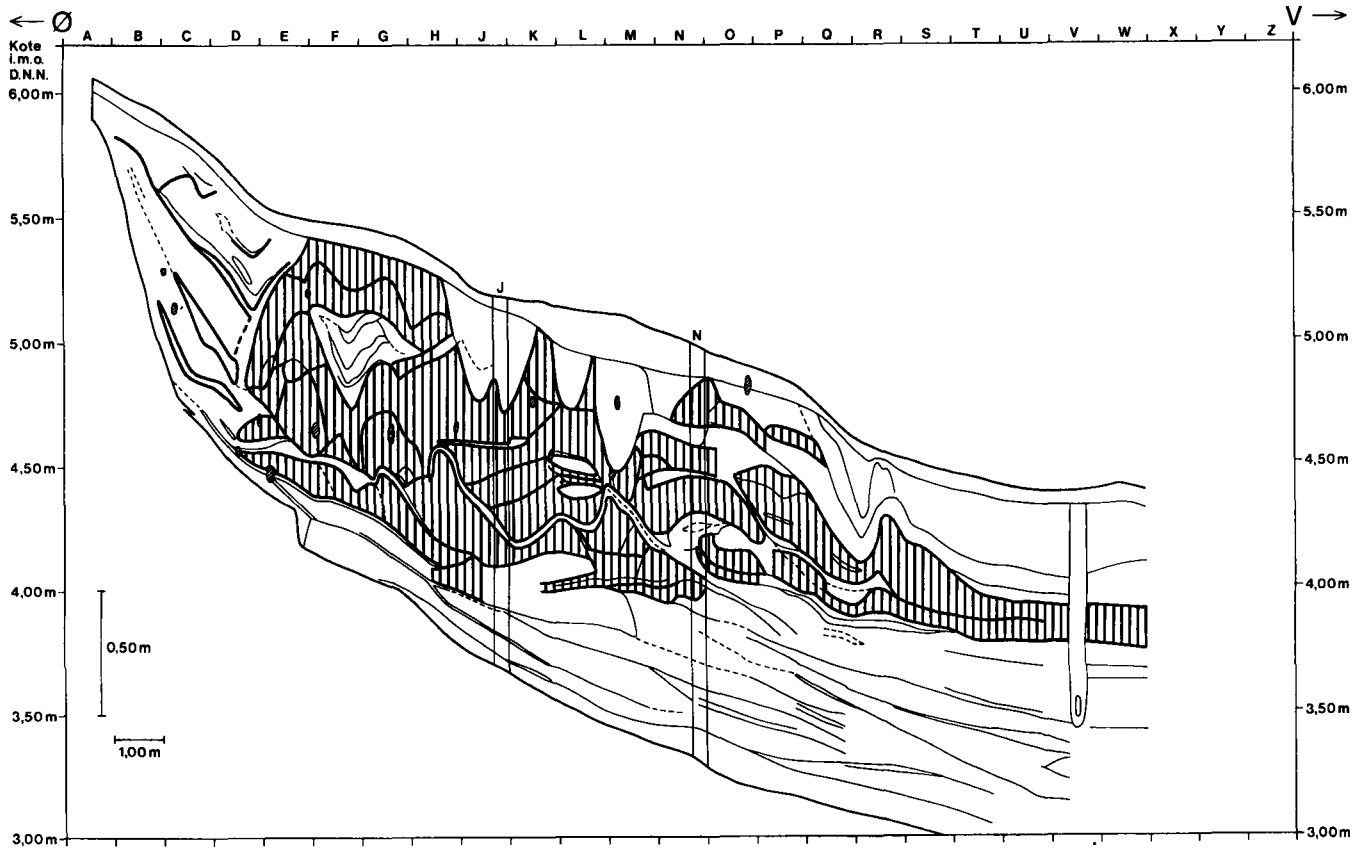


Fig. 11. Section of the Ertebølle Køkkenmødding. All well defined and localized stratigraphic units are indicated by the hatching. Orla Svendsen del.

each characterized by its layers of shellfish. Firstly, the midden area close to the sloping bank is characterized by loose, steepsided shell heaps, few artefacts, and a very homogeneous composition of shellfish species. Secondly, the western part of the midden is comprised of more horizontal horizons (compressed shell) of mixed shellfish containing many artefacts.

This observation probably reflects different activity areas within the midden: 1) an area frequently used for dumping of shell and 2) one with a much slower rate of accumulation.

The positioning of the fireplaces each in the center of these two areas (fig. 12) lends support to this observation.

As can be seen in the section (figs. 9–10), it is obvious that the midden does not represent one regular and continuous accumulation. Quite the contrary, a great number of finer and thicker layers or "heaps" can be defined – either widespread through a large part of the midden or more locally distributed (fig. 11).

The sections (figs. 9–11) exemplify a typical Danish kitchenmidden. By differences in composition, colour, density, and degree of decomposition, it is possible to separate the individual layers. Although the number of layers vary at different points along the section, the general number is relatively constant around 6–10 horizons through the midden (fig. 11).

These individual heaps measure 2–7 m in an E-W direction and 30–50 cm in thickness.

Such heaps of shell debris must represent occupational episodes, stressing that there is not necessarily a relationship between depositional episodes and occupational episodes (Binford 1982, 16). An occupation may cause several shell heaps or none at all. Therefore, it is also impossible to tell how large the individual habitation units were.

A solution to this problem, may be in an analysis of refitting flint debitage and bone, but this has not been tested so far.

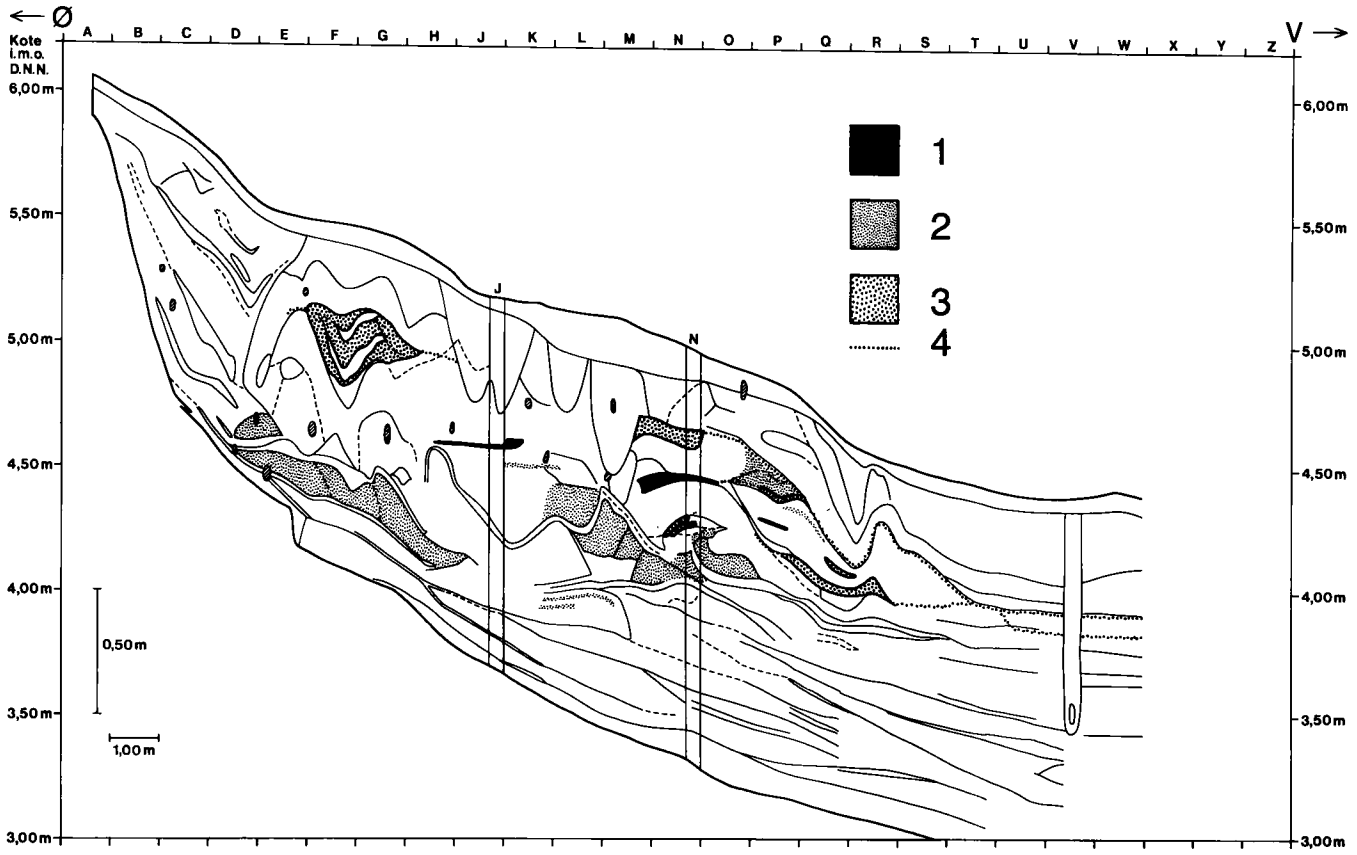


Fig. 12. Section of the Køkkenmødding. The positioning of the fireplaces, ash layers, fishbone horizons and layers reflecting marine activity are marked. Orla Svendsen del.

1. Fishbone layer
2. Marine sediments within the midden
3. Fireplace
4. Ash layer

Activity areas

Around the fireplaces there are concentrations of flint debitage, flint tools, bone, and pottery – clear indications that these areas have been centers of activity such as, production of tool types and consumption of food.

An analysis of the occurence and size of the flint debitage indicate high frequencies near the fireplaces (fig. 14).

The intensity of flint debitage increases towards the fireplace, but drops at a distance of c. ¾–1 m from the periphery (see fig. 14).

A substantial part of this flint waste is microdebitage (less than 1 cm in length) which proves that flint knapping took place on the midden (Binford 1983, 156, Fischer et al. 1979, 17).

In squares N-O (just 1 meter from the fireplace), a large stone (measuring 25×10×10 cm) was found surrounded by flint debitage – most probably a flint knapping area (fig. 14 top). A similar situation was observed in square S. A stone (c. 40×30 cm and 20 cm high) was found surrounded by many flakes. These stones may have functioned as anvils (fig. 14 bottom).

The usewear analysis on the blades found around the fireplace in square N (see fig. 14 top) demonstrates that a high percentage of these were used for shaving and whittling plant stems, probably for the production of baskets and/or fishtraps (see later).

Even though animal bones were found throughout the midden, they display similar distribution patterns as the other types of artefacts. Like the flint tools, there is a clear concentration of bone near the fireplaces (fig. 14 top). It is interesting to note that the number of bones becomes more frequent 3–4 m from the hearth and then increases towards the fireplaces, but suddenly

Fig. 13. Types of fireplaces. 1) horizontal layer of burned shell powder and charcoal (left), and 2) pit-shaped layers of clay, burned shells and charcoal (right). Jan Sloth Carlsen photo.

drops at a distance of c. 1 m from the periphery. These observations are best interpreted as a result of food preparation and consumption around the fireplaces – probably "drop zones" as described by L. Binford (Binford 1983, 151–153).

There are three distinct horizons (5–10 cm thick) of concentrated fishbones (fig. 12). Two of these layers are found in the western part of the midden, while the third is in the central part. These horizons are localized, their diameters are 80 cm, 120, and 170 cm respectively (in an E-W direction), and are found in the middle layers of the midden. The two fishbone layers in the western part of the midden seem to be connected with the nearby fireplaces (fig. 12). Such concentrations may reflect periods of intense fishing or a systematic use of specific areas of the midden for fish processing.

All these observations show that the Køkkenmøddinger – in contrast to general opinion – were divided into different activity areas (flintknapping, cooking, production of tools, and disposal of shellfish) and that especially the fireplaces have been essential as locations for activities over long periods of time.

Fireplaces

In this section of the midden we have documented at least 5 fireplaces of two types. The most common type is round with layers of light grey burned shell material and charcoal. The diameter of this type of hearth ranged from 60–120 cm (fig. 13). The other type of fireplace was comprised of a steepsided pit with three successive layers of charcoal, lightbrown clay, and burned shell (fig. 9). The size (2,5–3 m in diameter) and its pit-like shape clearly make this fireplace unique. Although it may be interpreted as a fireplace, the form and size of this feature may suggest other interpretations, such as "cooking pits" or "firepits" as described by M. Klinge (Klinge 1931). The fact that this feature is found amongst the shell heaps, may also be taken as an indication that its function has some connection with them.

Stone fireplaces were not found during the new excavation, however, traces of such a fireplace were found in the black cultural layer under the midden. In connection with the old excavation, two similar stonelined fireplaces were also recorded underneath the midden (Madsen et al. 1900, 25–28).

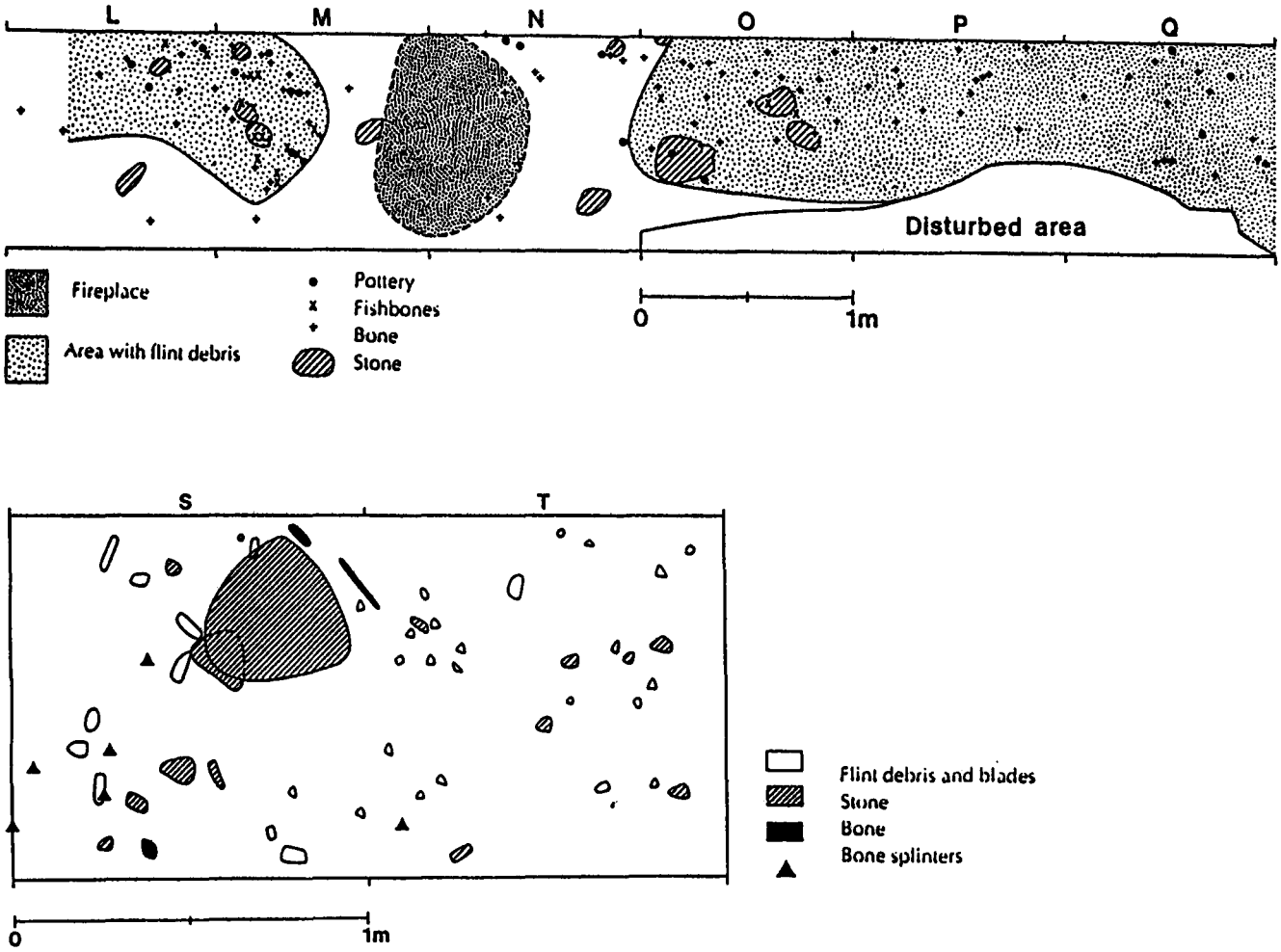


Fig. 14. (Top) Horizontal distribution of flint debris, stones, bones, fishbone concentrations, and pottery around the fireplace in square "N" (see fig. 13 left) Younger Ertebølle culture.

(Bottom) Distribution of flint debris, blades, flake axe, stones, and bones around the stone in square "S" in the marine sand under the Køkkenmødding. Older Ertebølle culture. Orla Svendsen del.

The fireplaces are – with one exception – all found in groups within the same area of the midden and very often superimposed. This observation must indicate that the position of the fireplaces have been fixed through time (in some cases through 2–300 years).

The fact that we only have the stone fireplaces in the bottom layer of the Ertebølle midden is also a fact observed at other middens. This is interpreted as remains of old living floors outside the shell heaps which have been covered by younger shell debris.

The difference in type may also indicate differences in function or state of permanency, but this problem has not yet been analysed.

Other features

No pits, house floors, or graves were recorded within the midden during our excavation, but from the old investigations, at least two (probably Mesolithic) graves were found (Madsen et al. 1900, 77–80).

It was not possible to observe features in the sand under the midden because the trench was too narrow.

The new excavation also proved that what previously was supposed to be a part of a house floor – and published as such (Simonsen 1951, 222–223) was not a house, but the S-E corner of the old excavation.

Fig. 15. Section of square "S" with the stone in the marine sand, cf. (fig. 16 bottom).

Chronology

Twenty-six C-14 dates have been analysed in connection with the new investigations at Ertebølle. Of these, 25 are based on oyster shells (Ostrea sp.) and one on charcoal (see the list p. 60 and fig. 16). The position of each C-14 sample was taken in stratigraphic context in order to date the different sections and layers in this part of the midden.

The C-14 analysis supports the stratigraphic observations. The oldest dates come from the marine sand under the midden, 4,020 ± 95 b.c. and 4,060 ± 95 b.c. (K-4317 and 4318) The black cultural layer at the foot of the bank dates to 3,850 ± 95 b.c. (K-4366). After this time, the accumulation of the midden began. The oldest part of the midden, the area closest to the bank, dates to 3,800 ± 95, 3,750 ± 95 and 3,760 ± 95 b.c. (K-4309, 4312, and 4313). From the start, the growth of the midden seems to have been slow and gradual. However, after 200–300 years (around 3,500 b.c.) the rate of accumulation became faster and the dates demonstrate that the main part of the shell midden (both in a horizontal and vertical way) was deposited within a hundred years. Again, the rate of deposition became slow and the shell heaps close to the bank were accumulated within the years 3,300–3,100 b.c. (K-4307, 4308, and 4305).

The youngest C-14 date is 3,120 ± 90 (K-4307), which is in nice accordance with its stratigraphic position as this sample comes from the uppermost undisturbed layer.

In our trench these dates clearly demonstrate that the Ertebølle Køkkenmødding at this spot is not a chronological unit but rather, an accumulation over 700 years. Neither is it a gradual and continuous one, but rather, a series of more or less intense depositions (figs. 17a–b).

It is essential to stress that all the dates are of a Mesolithic age. No Neolithic levels were observed in this section of the midden.

Finally, it is interesting to compare the new dates with the results from the National Museum's column, which was just 14 m to the north of the new profile (fig. 8). If we compare the two groups of dates (all made on oyster shells) it is evident that a substantial part of the midden deposit of the National Museum's excavation belongs to a period which is barely represented in our section. The majority of the National Museum's C-14 dates fall in a period c. 3,600 b.c. from which we have just a few dates in our series (fig. 16). Again, an emphasis of the fact that such a Køkkenmødding is a result of both a horizontal and vertical accumulation.

It is also worth mentioning, that the topmost and lowest levels in these two areas have given identical C-14 dates respectively c. 3,800 b.c. and 3,100 b.c. This, indicates that these habitations must have been of a rather large horizontal extension.

These observations combined with analyses of the artefact material all suggest that the northern part of the Ertebølle midden is the oldest and that it has been growing along the coastline from the north to the south.

This is probably the explanation for the oblong outline of this midden as well as for other Danish kitchenmiddens.

The above measurements (length, width, and thickness) of the Ertebølle midden are, therefore, not a reflection of one single unit, but a cumulative deposit during a 700–800 year period (see below).

The new investigations show that the kitchenmid-

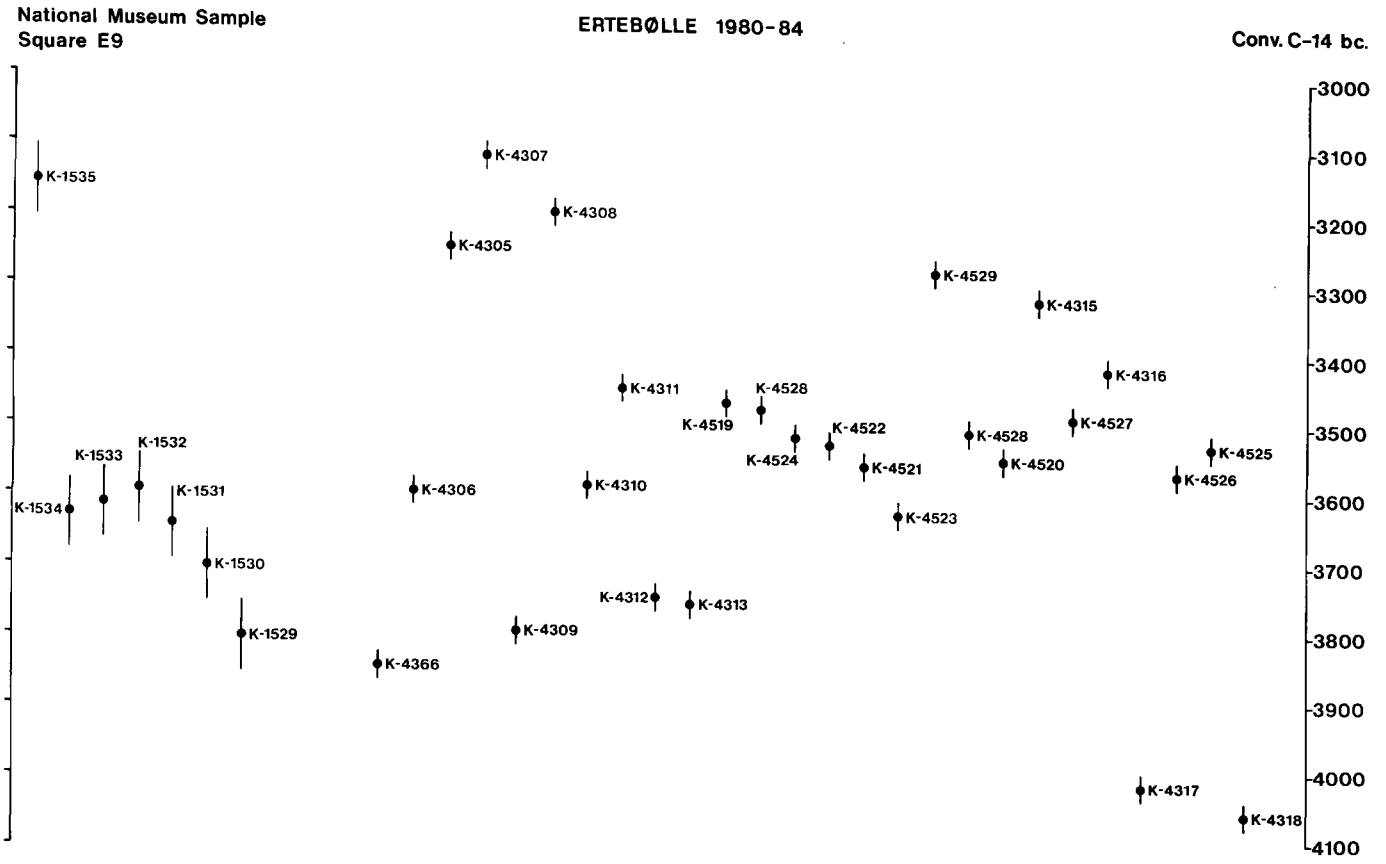


Fig. 16. Diagram of all C-14 datings from Ertebølle. The datings from the National Museum sample are arranged in their stratigraphic sequence; the datings from the 1980–84 excavation are depicted as they occur in the section of the midden.

dens must not be considered as chronological and functional units. They represent a process during which the focus of activities gradually moved along the prehistoric coastline. How large the individual units were seems to vary considerably.

The repetition in the use of such sites like Ertebølle, Meilgård and Norsminde, as demonstrated by the stratigraphy and the C-14 dates, is a clear indication of a rather (if not completely) sedentary settlement system in the later Ertebølle culture.

The finds

Several implements of flint, bone, antler, and pottery of Ertebølle tradition were found.

The abundant artefact material and bone shows that a large number of different activities have taken place. Artefacts occur throughout the midden. Both the horizontal and vertical distribution of artefacts reflect areas of concentrations. In terms of the horizontal distribution, the material around the fireplaces is highly concentrated – not only tools, but also, debris and animal bone. At Ertebølle, the densest concentrations are found within the midden itself.

The vertical distribution of finds are depicted in fig. 18. If we compare figs. 12 and 18, it is evident that the majority of artefacts correspond with the ash layer(s) from the fireplaces. This indicates that these layers reflect long occupations in open air conditions.

Due to the long occupation, the well documented stratigraphy, and the C-14 sequence (see p. 60), we can observe changes in the artefact inventory. Some changes are gradual and minor while others, like the occurrence of ceramics, are more abrupt.

The tools are made on two different types of flint: 1) small flint nodules with a grey hard cortex probably coming from the morainic deposits and 2) flint nodules

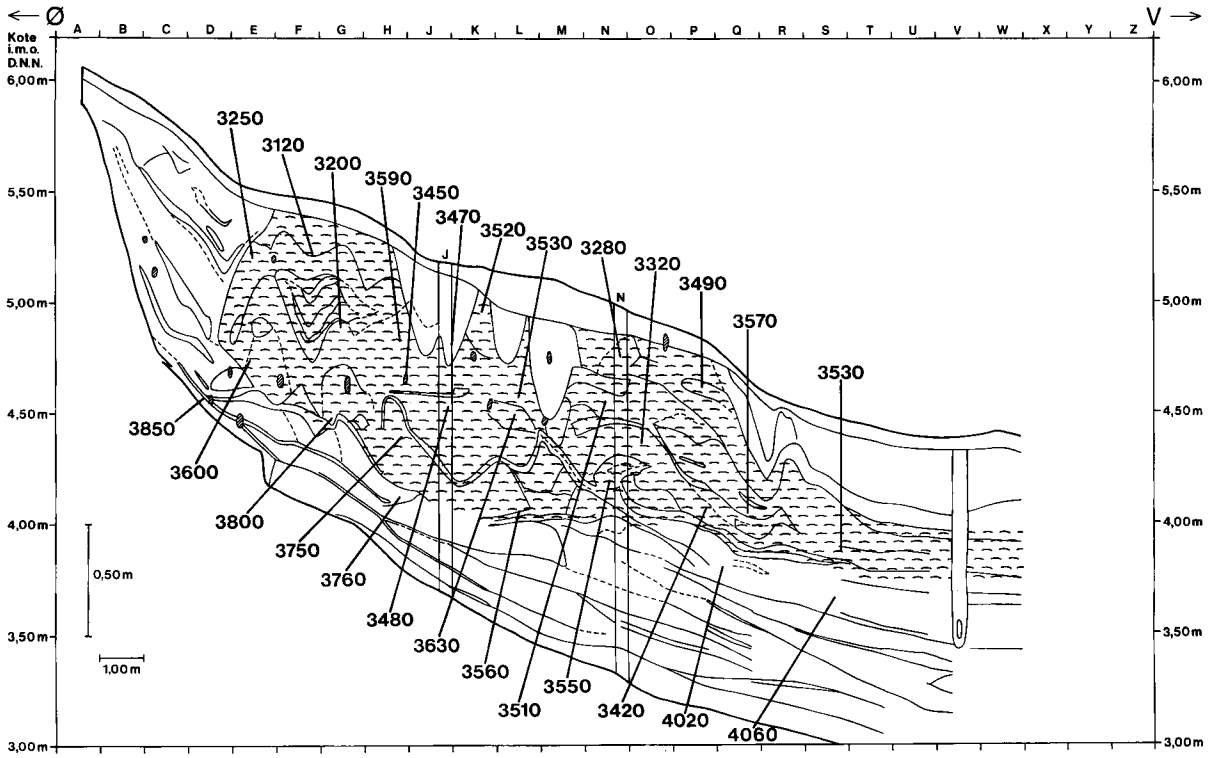


Fig. 17a. The positioning of the individual C-14 samples in the section. Orla Svendsen del.

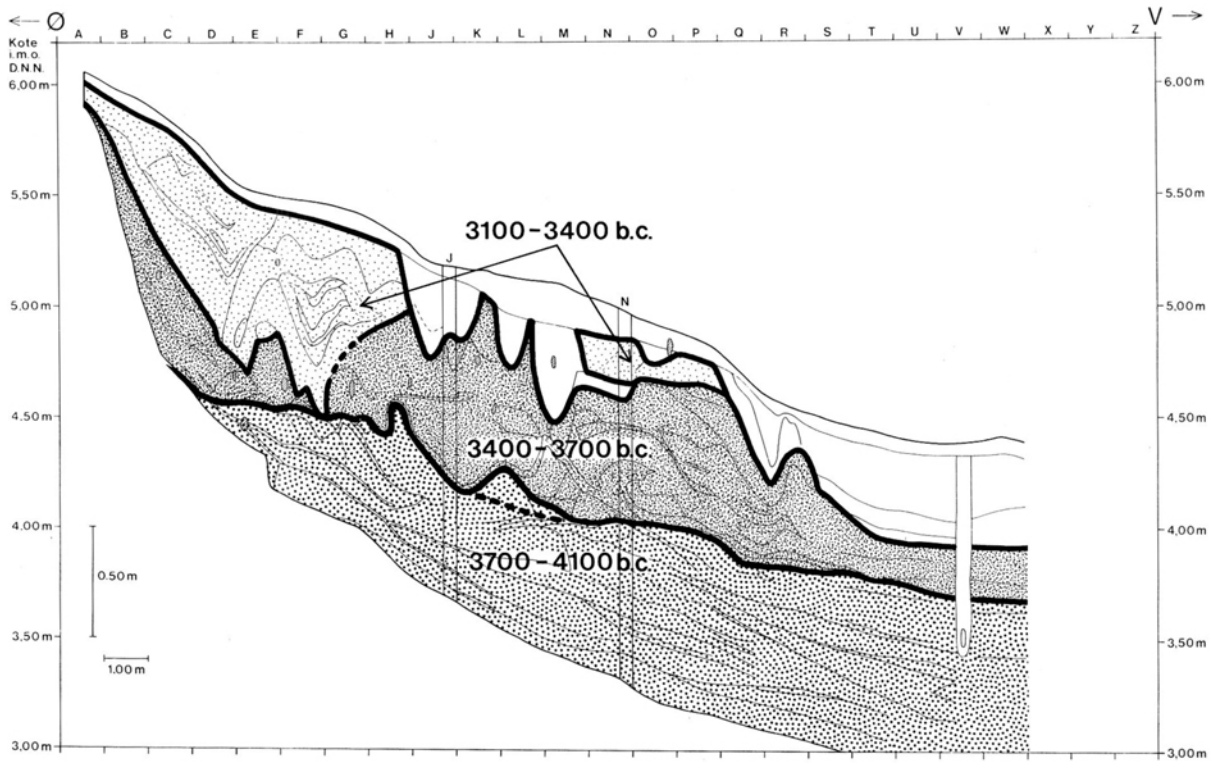


Fig. 17b. Section of the midden showing generalized sequence based on C-14 datings. Orla Svendsen del.

with a chalky soft primary cortex. This type of raw material must have come from areas where there is direct access to limestone or chalk bedrock. Such stone outcrops are not found in the area of Ertebølle, but c. 15 km to the north-northwest in the area around Aggersund.

The flint tools are relatively small, irregular, and simple compared to other contemporary Ertebølle sites. These characteristics seem to be constant throughout the habitation period at this site.

The contemporary nearby sites like Bjørnsholm (fig. 1), had access to the same types of raw material, but their tools differed stylistically. These observations may very well indicate two groups of people with different flint tool traditions.

Besides the flint tools already known from the old excavations at Ertebølle, we have also found types which were not known at the end of the previous century. This applies especially to the burin group, edge rejuvenating flakes from axes, burin spalls, and so on. The number of transverse arrowheads has been greatly increased due to the modern techniques of excavation.

The flint inventory is characterized by many tools on blades, such as scrapers, borers, burins, and truncated pieces (fig. 19).

The occurrence of composite tool types (fig. 19,11) is also a very characteristic regional aspect of the Ertebølle culture in North Jutland.

Also, with these types of tools are transverse arrowheads and both flake and core axes (figs. 20–21). In the Danish Late Mesolithic, the core axe dominates in the older phases, while the flake axe dominates in the younger. In Ertebølle, the flake axe dominates in the top layers, while the two forms are evenly represented within the rest of the midden. In the vertical distribution of the subtypes of the flake axe, we also find chronological differences. In the top layers, there is a dominance of flat flaked flake axes, while the edge trimmed variant is common in the deeper layers of the midden. No axes on greenstone (diabase) were found.

From the sand horizon under the midden, we find the same flint tool types, but we can observe slight differences in technique and relative proportions. For instance, there is an increase in the number of burins and a decrease in scrapers and borers. A greater number of blade knives are also found in this horizon (fig. 19,13) This a characteristic of the older Ertebølle in Jutland (S.H. Andersen & C. Malmros 1966, 76–77, 88, and 92).

Among the tools on flakes, it is worth mentioning a few scale worked flakes (S.H. Andersen 1979). These flakes are found in the secondary marine outwash to the west of the midden. This type is significant to the oldest Ertebølle phase in Jutland. They are also indications that other (probably more northern) parts of the midden must be older than that of the area where the new trench was placed.

A sample of 98 blades have been analysed for traces of usewear (Juel Jensen 1986, 22). Of these, 57 displayed traces of plant polish (figs. 20,4–8). The direction of wear is perpendicular to the edge, and the polish is restricted to a few centimeters along the edgeline. These types were probably used for the splitting and shaving of plant stems, and have been interpreted as waste from the production of baskets or fish traps (Juel Jensen 1986, 25).

Tools of antler and bone of the Ertebølle tradition are also found: 1) one red deer antler axe with the shafthole near the burr of the antler (fig. 22,3), 2) several sawed tines for pressure flaking (fig. 22,4–6), 3) many simple roundt sectioned bone points (fig. 23,1–7), and 4) a small fishhook (fig. 23,8).

The abrupt appearance of pottery occurs in the layers of the midden later than c. 3,700 b.c. (fig. 21). Apart from one rimsherd found in the top layer of the sand under the midden, no pottery was discovered here or in the black cultural layer at the foot of the slope. Also, pottery is found in small concentrations around the fireplaces (fig. 21). The pottery is from a very thick ware – clearly thicker than what was found at contemporary sites further to the south in Jutland (S.H. Andersen 1975, 56–64).

Cultural context

All finds from the new excavation belong to the Ertebølle culture. The artefact inventory from the marine sand under the midden, the black cultural layer at the foot of the bank, and the deepest part of the midden itself is similiar to what is known and described from the sites Dyrholmen I (Mathiassen et al. 1942), Norslund layer 3–4 (S.H. Andersen & C. Malmros 1966), and Brovst layer 8 (S.H. Andersen 1970). These horizons all define the older Ertebølle culture (the aceramic Ertebølle) of western Denmark. The Norslund layer 3–4 are dated to c. 4,400 b.c. (S.H. Andersen & C. Malmros 1981, 60–61) and Brovst layer 8 has a chronological po-

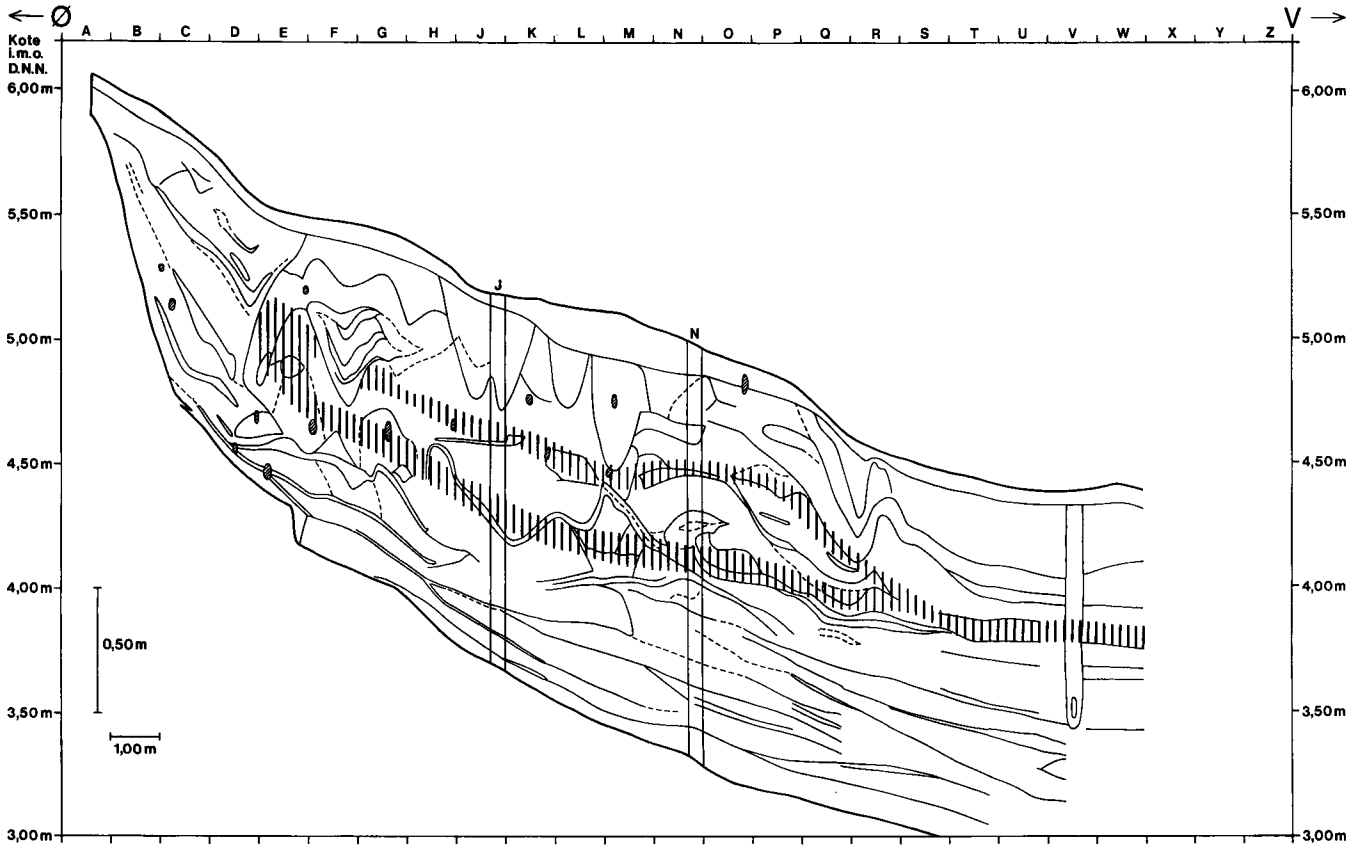


Fig. 18. Section of the midden. The highest vertical concentration of finds is indicated by shading. Orla Svendsen del.

sition around 3,800 b.c. (S.H. Andersen 1970), 85–87). There is a nice correlation between the C-14 dates and the typological dates from Ertebølle and the other sites.

The archaeological material from the middle part of the midden dates to the "middle Ertebølle culture" as described by Mathiassen (Mathiassen et al. 1942, 52–53 and 62). A similiar artefact assemblage is recorded from Norslund layer 2 (S.H. Andersen & C. Malmros 1966).

An identical artefact composition is also described and dated from the nearby small shell midden at Aggersund (S.H. Andersen 1980). This site is C-14 dated to 3,480 b.c. (S.H. Andersen 1979, 42 and 53) – which is contemporary with the major part of the Ertebølle midden.

The undisturbed shell midden associated with the youngest habitation phase at Ertebølle is very restricted in the new excavation; because of this, the number of finds is also very small. Therefore, the typological date of these horizons are not well founded, but all available data point to the "younger Ertebølle culture" or "ceramic Ertebølle". This phase is C-14 dated in Jutland from the Flynderhage site at 3,280 ± 110 b.c. (K-1450) (Petersen 1971, 7 and 36). This date is in accordance with the Ertebølle results.

It is essential to stress that the artefact assemblages found at the Ertebølle type site in a chronological sense cover most of this cultural phase (early, middle and late Ertebølle culture) as described in the literature (Clark 1975, 181–199, Petersen 1973, 77–128).

The relevance and use of Ertebølle as a type site is, therefore, still correct.

Economy

Subsistence was based on hunting, fishing, and gathering. This is well documented by the types of artefacts found associated with large numbers of animal bones, shellfish and a single charred hazelnut.

The list of species (see p. 59) displays a wide range of

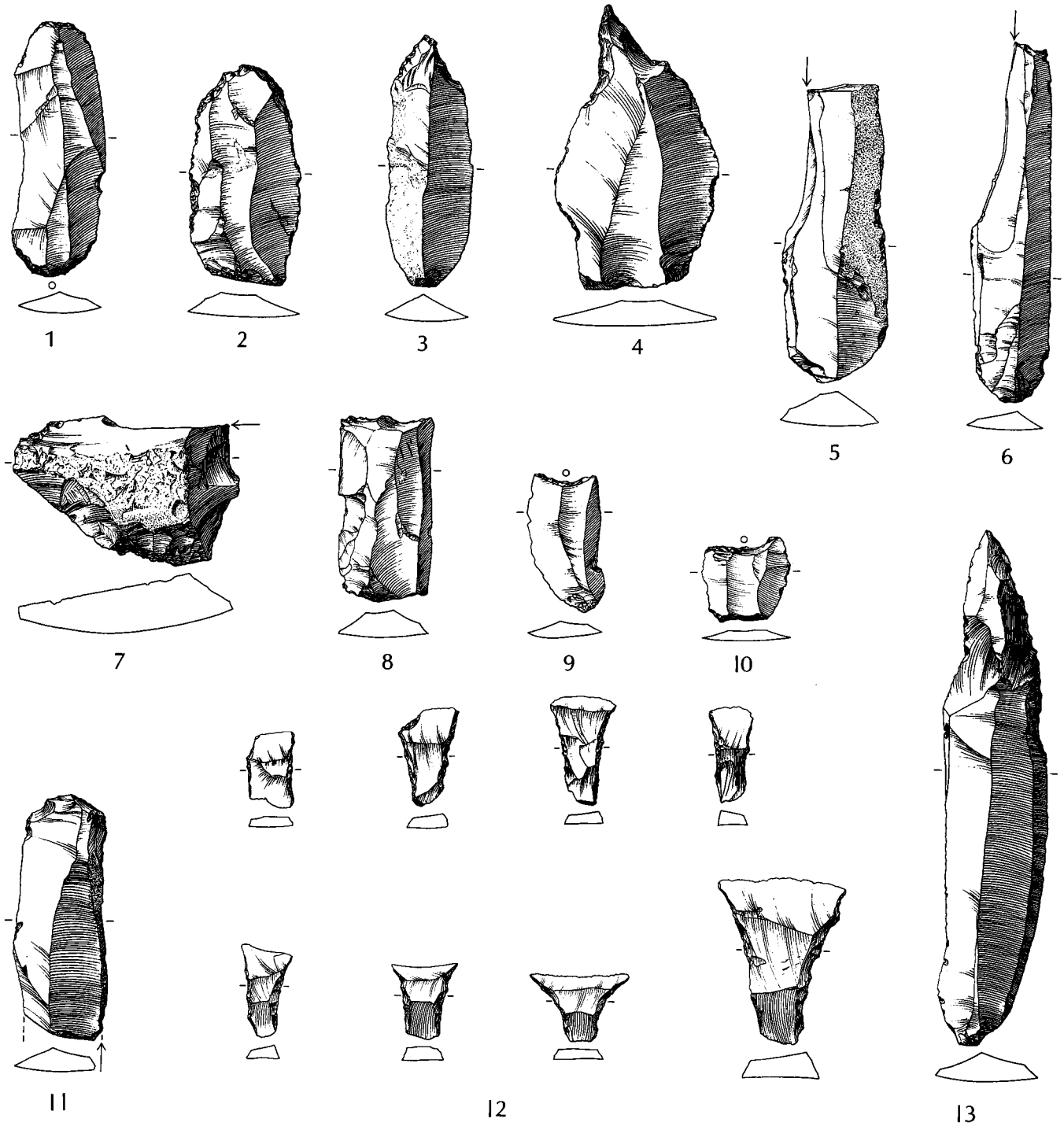


Fig. 19. Flint types from Ertebølle: 1) Double blade scraper. 2) Simple scraper. 3) Blade borer. 4) Flake borer. 5)–6) Angle burins on a break and on oblique truncation. 7) Transversal burin on lateral retouche. 8)–10) Truncated pieces. 11) Composite tool (scraper-burin). 12) Transverse arrowheads. 13) Blade knife. 2:3. Orla Svendsen del.

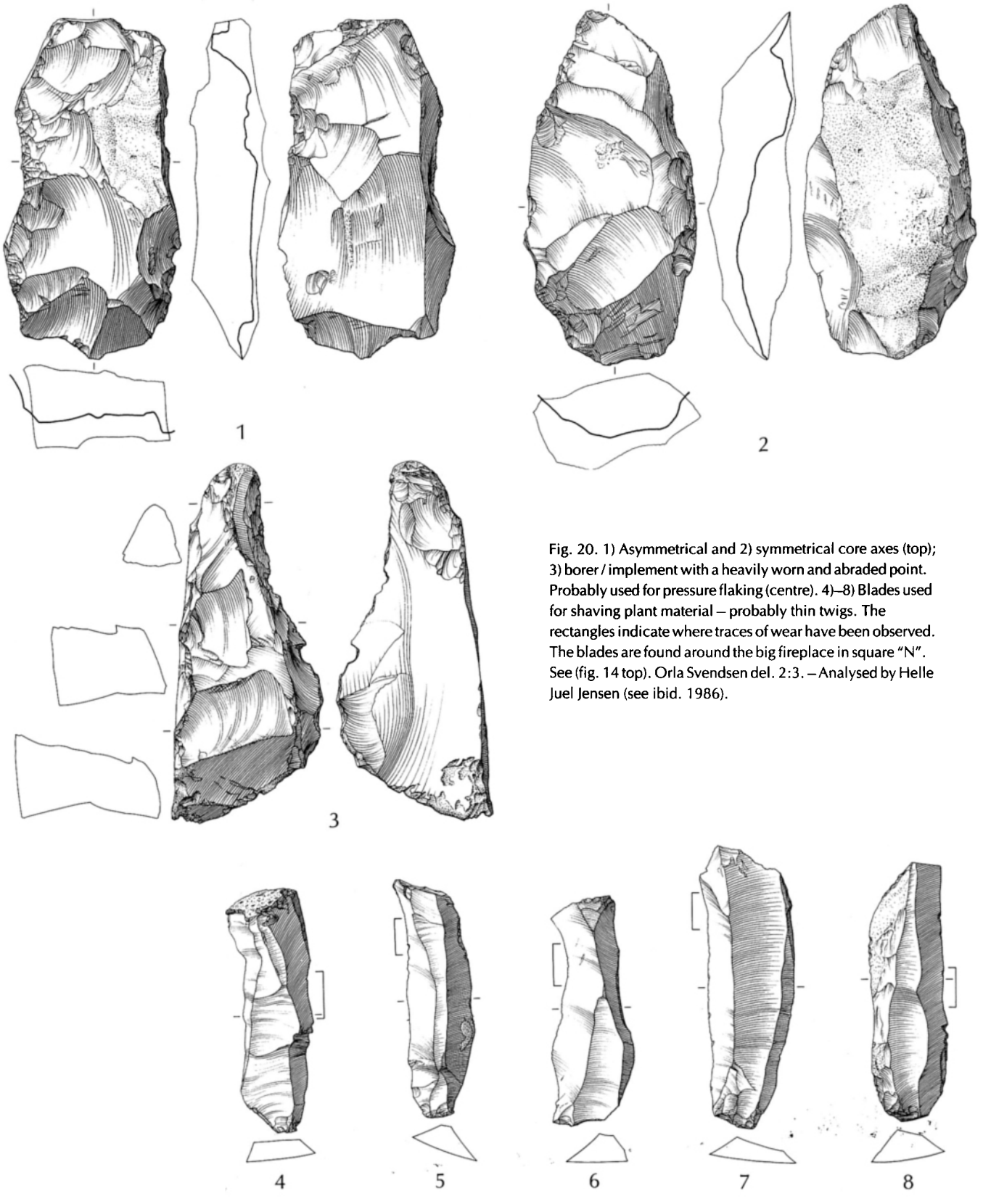
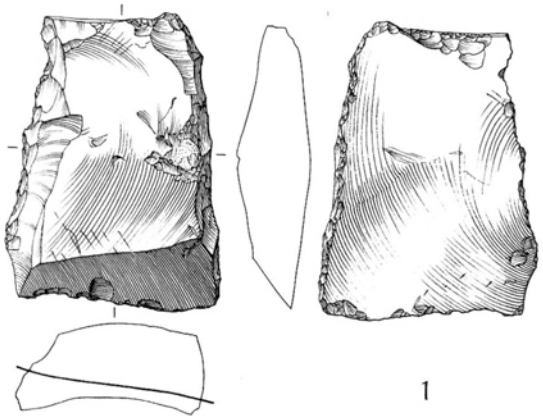
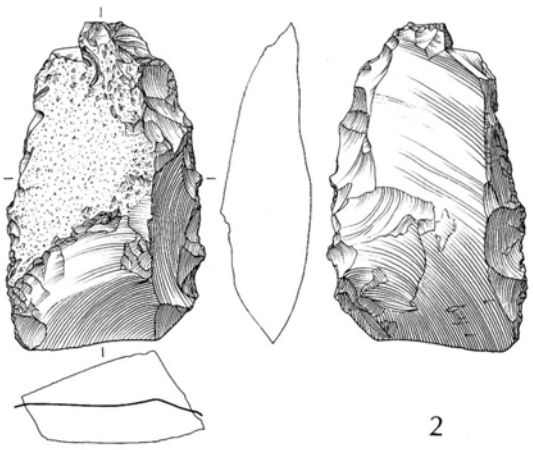
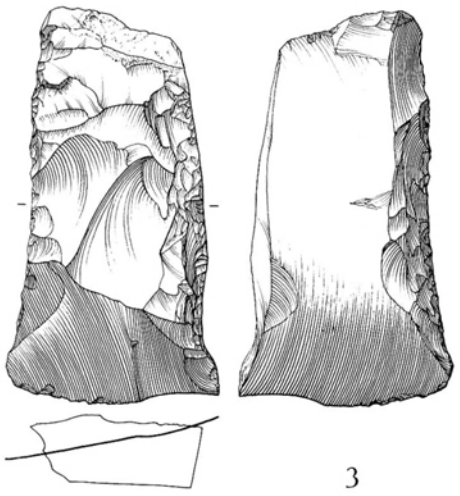
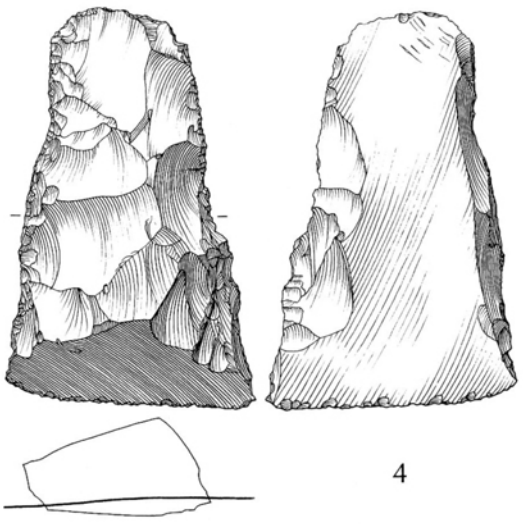


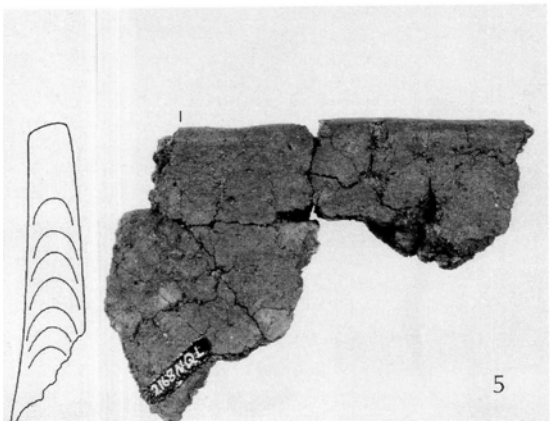
Fig. 20. 1) Asymmetrical and 2) symmetrical core axes (top); 3) borer / implement with a heavily worn and abraded point. Probably used for pressure flaking (centre). 4)–8) Blades used for shaving plant material – probably thin twigs. The rectangles indicate where traces of wear have been observed. The blades are found around the big fireplace in square "N". See (fig. 14 top). Orla Svendsen del. 2:3. – Analysed by Helle Juel Jensen (see ibid. 1986).











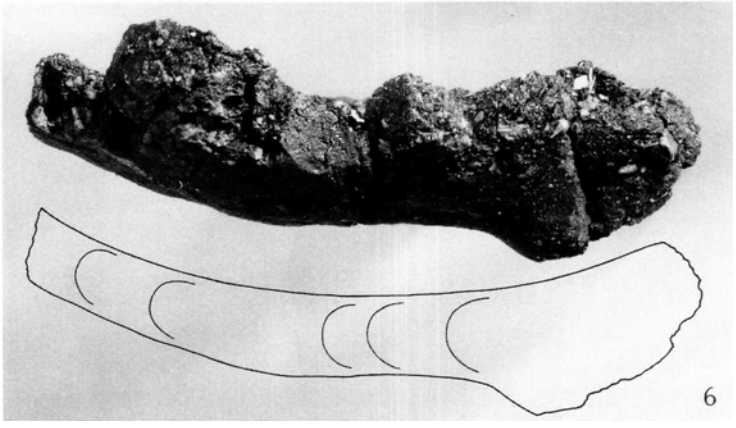


Fig. 21. 1) Symmetrical edge trimmed flake axe; 2) atypical flake axe; 3) asymmetrical flat-flaked flake axe; 4) symmetrical flat-flaked flake axe. Orla Svendsen del. 2:3.
(Bottom) Rimsherd of a thick-walled, pointed-based pot (left) and pointed base of a thick walled pot. P. Dehlholm photo. 2:3.

mammals, birds, fish, and a single reptile. The only domesticated animal is the dog.

A few bones of man were also recorded. These were found scattered throughout the midden matrix, but probably came from graves destroyed by later activities.

It is interesting to note that the bones in the midden in general are much smaller (less than c. 10 cm in length) than the ones found in the waste dumps at Ringkloster and Tybrind Vig (lake and sea deposits) (S.H. Andersen 1975, 1985). This difference may be explained by the fact that the bones from the kitchen-midden have been exposed to many different taphonomic factors such as dogs, weather, and walking to name a few. In contrast, the bone and antler material found at sites like Ringkloster and Tybrind Vig have been deposited in muddy wet layers outside the habitation area.

The vertical distribution of animal bone follow the same patterns as described for the flint debris (see fig. 18). To the west, there is a close correlation between the ash horizons around the fire places and the higher concentrations of bone.

The bones from mammals and birds are in most cases found individually, while fish bones either occur in layers (as described earlier) or as small concentrations (10–15 cm in diameter). These fish bone concentrations, of which we do not have any interpretation at present, display a similiar distribution pattern as the other animal bones, and concentrate around the fireplaces.

In a few cases, mammal bones are also found in small clusters (i.e. bones of juvenile red deer and wild pig). Bones from animals killed for their fur (i.e. pine marten, wild cat) are also found in clusters – a well known phenomenon at other Ertebølle sites such as Ringkloster (S.H. Andersen 1975) and Tybrind Vig (S.H. Andersen 1985, 57).

Among the larger animals, the roe deer (Capreolus capreolus), red deer (Cervus elaphus), and wild pig (Sus scrofa) were the most common species. Elk (Alces alces) and auroch (Bos primigenius) were represented by only a few bones.

Animals such as wild cat (Felis catus), lynx (Lynx lynx), fox (Vulpes vulpes), otter (Lutra lutra), wolf (Canis lupus), and pine marten (Martes martes) were killed for their fur.

Grey seal (Halichoerus grypus) were hunted at sea and along the coast. Also, a substantial number of swans (Cygnus sp.) and ducks (Anatidae sp.) were captured.

Fishing has been of great importance here as con-

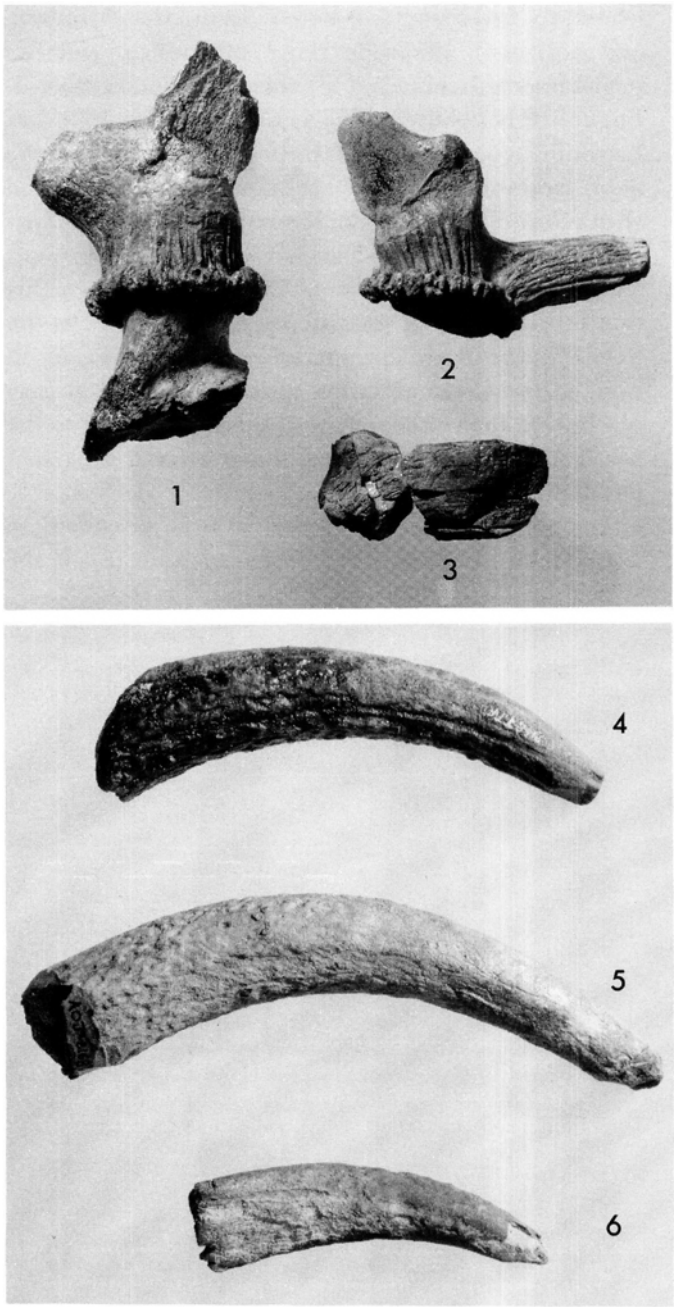


Fig. 22. 1)–2) Bases of red deer antlers (top) – waste from the production of antler axes and tines for pressure flaking; 3) Antler axe with the shafthole near the burr of the tine (older type in the Ertebølle culture); 4)–6) Sawed-off tines of red-deer antler. The point has been sawn off and rounded. Probably used for pressure flaking. P. Dehlholm photo. 2:3.

firmed by the many fish bones (both concentrations and horizons), the wide range of species, and the technological items used for this activity (see Inge B. Enghoff this volume). The types of species found at Ertebølle (coastal site) is surprising, because of the many freshwater fish like eel (Anguilla anguilla), roach (Rutilus rutilus), and pike (Esox lucius). Marine species are also represented, such as cod (Gadus morhua) and garfish (Belone belone). The explanation for this interesting aspect of subsistence is to be found in the habitat at the time of occupation. A bay like area was in front of the site, numerous springs were within easy reach from the settlement, and there was a lake to the south-southeast which must have offered excellent possibilities for eel fishing.

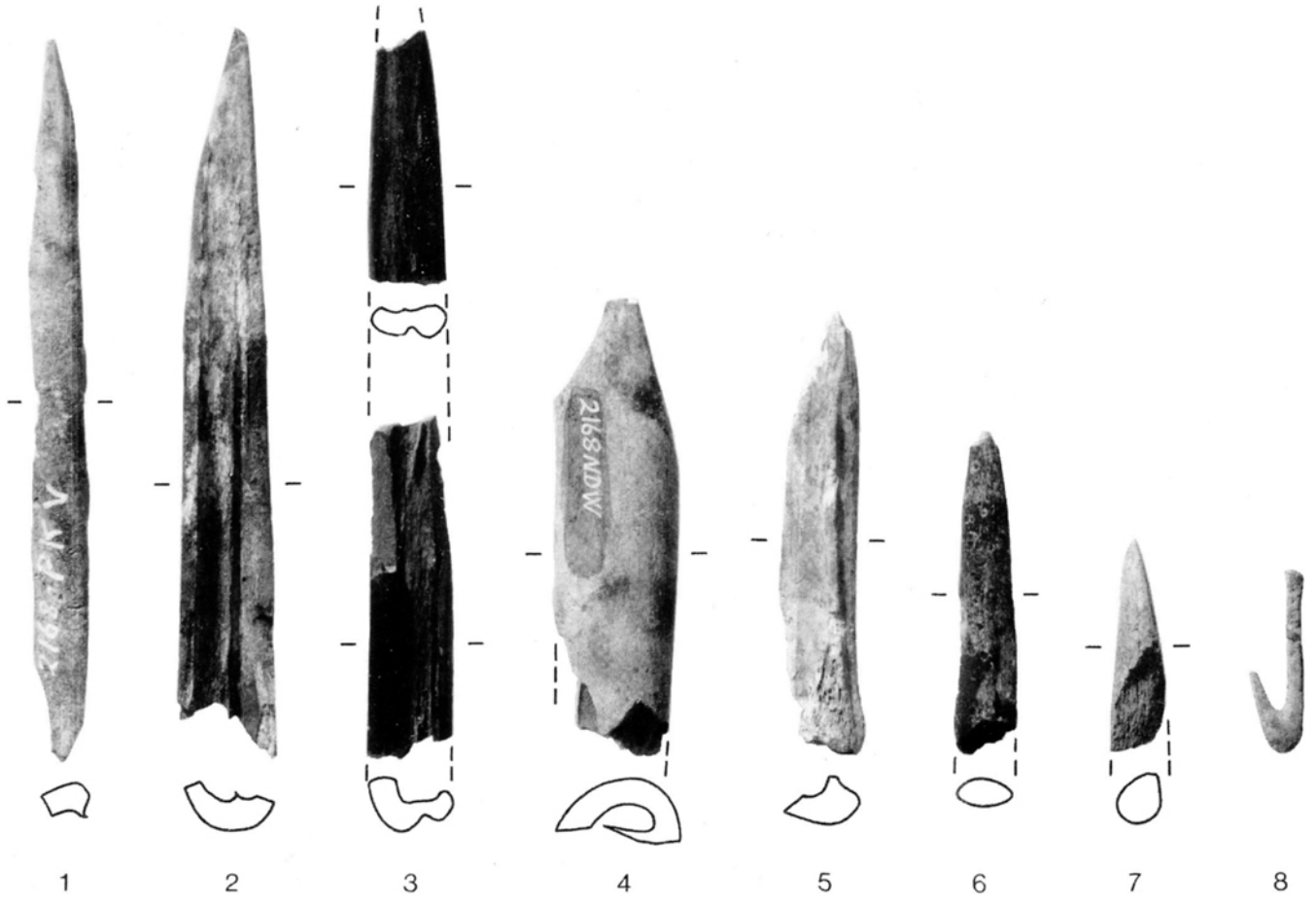
The percentage of bone from eel is far greater than normally at Ertebølle sites. One reason for this is the high content of fat in eel which makes this fish much more attractive than most of the other fish species. Everything points to the fact that eel fishing has been of great importance in the diet of the inhabitants, and that this type of fishing has been one of (or the) the decisive factor(s) for the positioning of the settlement.

Eel bones were found throughout the midden, thereby demonstrating that this type of fishing has been a constant factor with a long tradition.

Such great numbers of eel bones have never been documented before at any Danish Ertebølle coastal site. This aspect of subsistence probably explains why Ertebølle (type site) is one of the largest Late Mesolithic sites.

Gathering is documented by the many shells of oysters (Ostrea sp.), mussels (Mytilus sp.), cockles (Cerastoderma sp.), and periwinkle (Littorina litto-

Fig. 23. Simple bone points and fishhook. P. Dehlholm photo. 4:5.



rea). Also, a charred fragment of a hazelnut shell (Corylus sp.) was found.

Some information on seasonality is available (8). The occurrence of the juvenile red deer and wild pig indicate spring/summer, the cockles have been gathered between May and October (12), the presence of garfish indicates summer fishing, the eels have been caught in August, and finally the hazelnut points to early autumn. The presence of stag antlers still attached to the skull indicate winter. The animals that were used for fur were most probably hunted in the winter months. This is also the case with the swans and some species of ducks.

At present, it is possible to state that summer, autumn, and winter indicators were found, but it would be premature to argue for a permanent year round occupation.

One of our future tasks is to analyze the content of the bones and the seasonal indicators of the different stratigraphic units of the midden, to see whether these indicators are localised or found in all the units. Such information will help correlate individual seasons with the different shell deposits.

CONCLUSION

The investigations at the Ertebølle type site has offered a wealth of new information. We have seen that this kitchenmidden is not only a midden (accumulation of shell fish), but a mixture of food waste and activity areas. It has been demonstrated that this midden has been organized into specific activity areas. These areas have been in use for long periods of time. This indicates a rather stable settlement system.

If we add to this the possibility of some graves, we have all the ingredients which scholars normally use to define settlement sites in a Mesolithic sense. The only feature which is lacking is houses.

It rises the obvious question: Is the shell midden the living area? The observations on the distribution of flint debitage and ash horizons clearly demonstrate that huts have not been positioned on top of the shell midden. Several other facts which support this observation are the lack of living space and the uneven surface. The information attained thus far, suggests that the people have been living *outside* the midden, but have performed the main part of their daily routines *on* the midden.

Today, there seem to be two possible answers to this question. Firstly, there is still a possibility that people have been living behind the midden. In this case, we do not have any definable traces of houses. Secondly, the hut(s) may have been standing *beside* the shell dumps (Meehan 1982, 116) and then later on were covered by deposits as the general layout of the site shifted its position along the coastline. This hypothesis is supported by the presence of well built stone fireplaces positioned on the subsoil under the midden layers and the frequency of cultural remains at the very bottom of the kitchenmidden.

A final solution to this question is one of the future tasks connected with studies of Danish Køkkenmøddinger.

Søren H. Andersen, Institute of prehistoric Archaeology, University of Aarhus, Moesgaard, DK-8270 Højbjerg.
Erik Johansen, Aalborg historiske Museum, Algade 48, DK-9000 Aalborg.

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ERTEBØLLE. List of animal species identified 1980–84 (det. B. Bratlund and I. Bødker Enghoff).

Mammals: (*Mammalia*) (det. B. Bratlund)

Red Deer	(*Cervus elaphus*)
Roe Deer	(*Capreolus capreolus*)
Wild Pig	(*Sus scrofa*)
Lynx	(*Lynx lynx*)
Man	(*Homo sapiens*)
Wolf	(*Canis lupus*)
Dog	(*Canis familiaris*)
Fox	(*Vulpes vulpes*)
Wild Cat	(*Felis catus*)
Pine Marten	(*Martes martes*)
Otter	(*Lutra lutra*)
Aurochs	(*Bos primigenius*)
Grey Seal	(*Halichoerus grypus*)
Elk	(*Alces alces*)
Water vole	(*Arvicola terrestris*)

Birds: (*Aves*) (det. B. Bratlund)

Swan	(*Cygnus sp.*)
Duck	(*Anas sp.*)
Gull	(*Larus sp.*)
Capercaillie	(*Tetrao urogallus*)
Red-necked Grebe	(*Podiceps griseigena*)
Red-throated Diver	(*Gavia stellata*)
Velvet Scoter	(*Melanitta fusca*)
Godwit	(*Limosa sp.*)
Thrush	(*Turdus sp.*)

Fishes: (*Pisces*) (det. I. Bødker Enghoff)

Roach	(*Rutilus rutilus*)
Rudd	(*Scardinius erythrophthalmus*)
Eel	(*Anguilla anguilla*)
Cod	(*Gadus morhua*)
Saithe	(*Pollachius virens*)
Perch	(*Perca fluviatilis*)
Garpike	(*Belone belone*)
Flounder	(*Platichthys flesus*)
Herring	(*Clupea harengus*)
Three-spined Stickleback	(*Gasterosteus aculeatus*)
Pike	(*Esox lucius*)
Eelpout	(*Zoarces viviparus*)
Salmon/Trout	(*Salmo sp.*)
Whitefish	(*Coregonus sp.*)
Gobiids	(*Gobiidae*)
Bullhead	(*Acanthocottus scorpius*)
Sea Stickleback	(*Spinachia spinachia*)
Grey Gurnard	(*Eutrigla gurnardus*)
Turbot	(*Psetta maxima*)
Ray	(*Rajidae*)
Spurdog	(*Squalus acanthias*)

Reptiles: (*Reptilia*) (det. I. Bødker Enghoff)

Slowworm	(*Anguis fragilis*)

ERTEBØLLE. List of C-14 datings 1980–84.

K-4305	Oyster shells (Ostrea ed.)	3250 ± 90 b.c.
K-4306	Oyster shells (Ostrea ed.)	3600 ± 95 b.c.
K-4307	Oyster shells (Ostrea ed.)	3120 ± 90 b.c.
K-4308	Oyster shells (Ostrea ed.)	3200 ± 90 b.c.
K-4309	Oyster shells (Ostrea ed.)	3800 ± 95 b.c.
K-4310	Oyster shells (Ostrea ed.)	3590 ± 95 b.c.
K-4311	Oyster shells (Ostrea ed.)	3450 ± 95 b.c.
K-4312	Oyster shells (Ostrea ed.)	3750 ± 95 b.c.
K-4313	Oyster shells (Ostrea ed.)	3760 ± 95 b.c.
K-4314	Oyster shells (Ostrea ed.)	3480 ± 95 b.c.
K-4315	Oyster shells (Ostrea ed.)	3320 ± 85 b.c.
K-4316	Oyster shells (Ostrea ed.)	3420 ± 90 b.c.
K-4317	Oyster shells (Ostrea ed.)	4020 ± 95 b.c.
K-4318	Oyster shells (Ostrea ed.)	4060 ± 95 b.c.
K-4366	Charcoal (Alnus sp., Quercus sp., Ulmus sp., Tilia sp.)	3850 ± 95 b.c.
K-4519	Oyster shells (Ostrea ed.)	3470 ± 90 b.c.
K-4520	Oyster shells (Ostrea ed.)	3550 ± 90 b.c.
K-4521	Oyster shells (Ostrea ed.)	3560 ± 90 b.c.
K-4522	Oyster shells (Ostrea ed.)	3530 ± 95 b.c.
K-4523	Oyster shells (Ostrea ed.)	3630 ± 95 b.c.
K-4524	Oyster shells (Ostrea ed.)	3520 ± 90 b.c.
K-4525	Oyster shells (Ostrea ed.)	3530 ± 90 b.c.
K-4526	Oyster shells (Ostrea ed.)	3570 ± 95 b.c.
K-4527	Oyster shells (Ostrea ed.)	3490 ± 95 b.c.
K-4528	Oyster shells (Ostrea ed.)	3510 ± 95 b.c.
K-4529	Oyster shells (Ostrea ed.)	3280 ± 95 b.c.

NOTES

1. Despite the fact that the Ertebølle excavation took place in the years 1893–97, the term "Ertebølle culture" was not regularly used before 1919, when the Danish archaeologist Th. Mathiassen proposed this term.
2. Reports in the archives of the National Museum concerning finds from a shell midden at Krabbesholm near Skive in northern Jutland. See: "Oversigt over Videnskabernes Selskabs Forhandlinger" 1848–51, p. 12–13 and 46–50.
3. This interpretation of the Danish Køkkenmøddinger was first proposed by the Danish archaeologist J.J.A. Worsaae.
   From a visit at Meilgård in 1850 we have a remark in his dairy on the true nature of these sites.
4. These samples were taken from the south side of square E 9 and submitted for C-14 analyses by E. Thorvildsen and H. Tauber of the National Museum.
5. The Bjørnsholm Køkkenmødding was partly excavated by the National museum in 1931 (H.C. Broholm). Report in the National Museum, j.nr. 361/31. The report is unpublished, but briefly mentioned by Th. Mathiassen 1940 and 1942.
   In 1985 new investigations at this large site were resumed by the authors.
6. The project has been sponsored by the Danish Research Council for the Humanities, Aalborg historiske Museum, Aarhus Universitets Forskningsfond, Dronning Margrethe II's Arkæologiske Fond and Fredningsstyrelsen.
7. Archaeologists: Søren H. Andersen, M.A., University of Aarhus.
   Erik Johansen, M.A., Ålborg Historiske museum.
   Quaternary geologist and marine molluscs: Kaj Strand Petersen, Danish Geological Survey, Copenhagen.
   Zoologist: Bodil Bratlund, B.A. University of Aarhus.
   Fish specialist: Inge B. Enghoff, Zoological Museum, University of Copenhagen.
   Marine mollucs: Vibeke Brock, Department of Ecology and Genetics, University of Aarhus.
   Forameniferas: Ellen Lopez, Department of Marine Sciences, SUNY, New York. Stonybrook.
8. The bones of mammals and birds have been determined to species by Bodil Bratlund, B.A. University of Aarhus, Dept. of Prehistoric Archaeology.
9. See Kaj Strand Petersen this volume.
10. All C-14 dates are given in conventional C-14 years.

11. A waterroled and heavily patinated fragment of a polished axe of early neolithic type (pointed butted type) was found on the plateau behind the kitchenmidden. This type of axe (dated to the period 3,000–2,800 b.c.) demonstrates that at least one transgression (The Subboreal Transgression) flooded this area after the depositioning of the axe.
12. Information by Vibeke Brock (see note 7).

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