Journal of Danish Archaeology vol. 8, 1989, pp 13–40

Norsminde

A "Køkkenmødding" with Late Mesolithic and Early Neolithic Occupation

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HISTORY OF RESEARCH

From 1945, and especially since 1960, continuous archaeological investigations have taken place along the beaches of Norsminde Fjord, positioned on the East Jutland coast, c. 20 km south of Aarhus (fig. 1). During this project a long series of essential settlement sites and single finds were recorded and excavated, i.e. the big Ertebølle kitchenmidden "Flynderhage" (S. Gabrielsen 1953), the stratified Ertebølle site "Norslund" (S. H. Andersen and C. Malmros 1966 and 1981), and the Neolithic shell-midden "Kalvø" with finds from the Single Grave Culture (S. H. Andersen 1983).

As a result of this extensive archaeological research, this area is one of the most thoroughly and intensively researched regions for Stone Age settlements in Den-

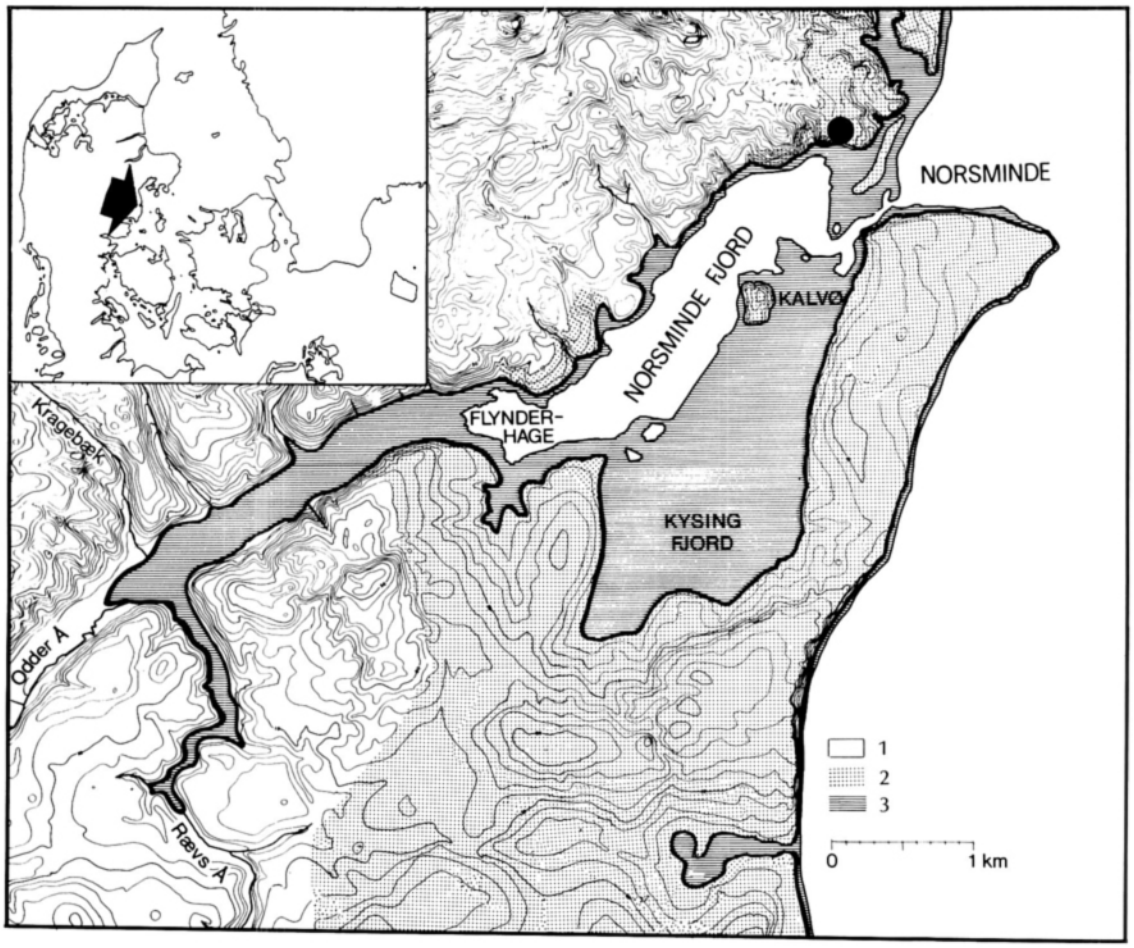


Fig. 1. The position of the Norsminde fjord and the Norsminde settlement. E. Morville *del.* Legend: 1) Morainic clay. 2) Glacial sand. 3) Raised sea-bottom.

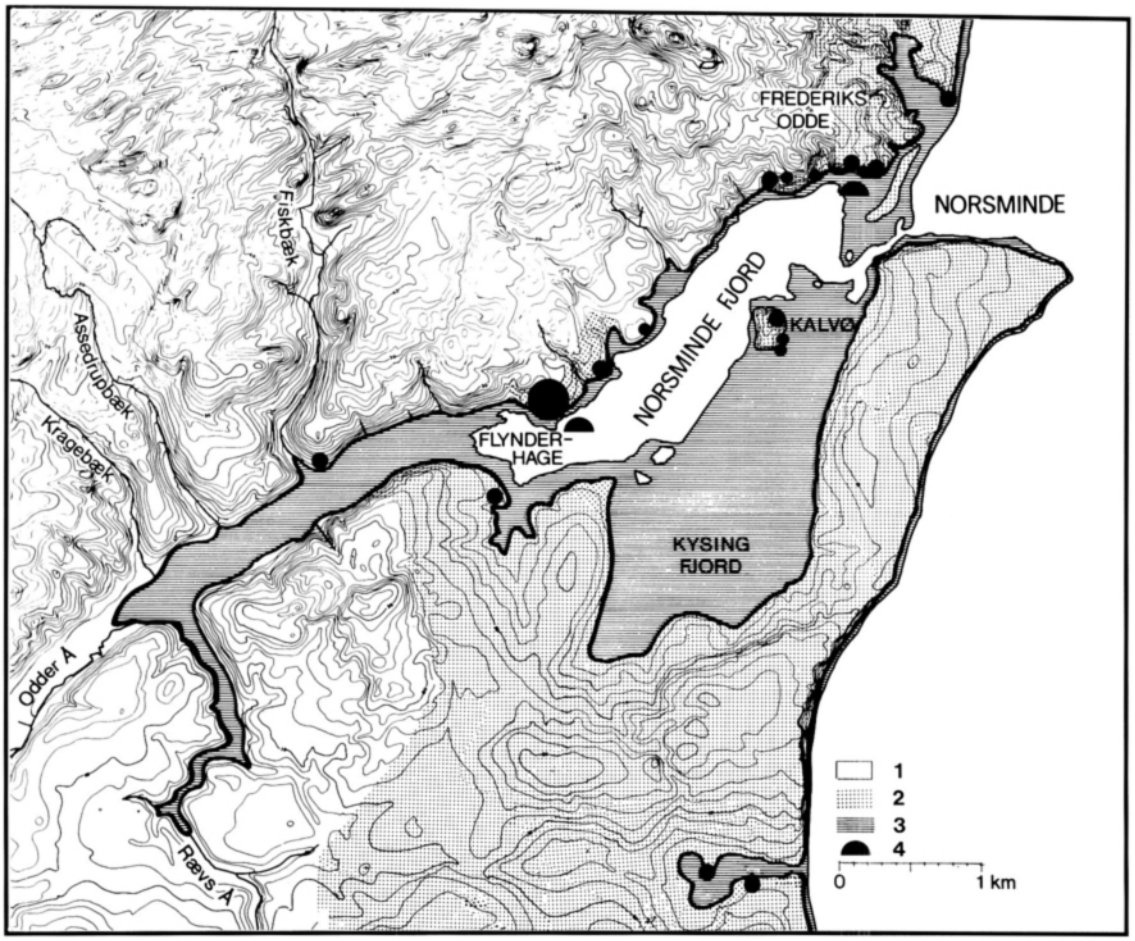


Fig. 2. The Norsminde fjord with all known Ertebølle sites. E. Morville *del.* Legend: 1) Morainic clay. 2) Glacial sand. 3) Raised seabottom. 4) "Natural" shellbanks from the Stone Age.

mark. A survey of all the recorded finds from the different prehistoric periods was published in 1976 (S. H. Andersen 1976).

In order to acquire both an overall and a detailed picture of Late Mesolithic Ertebølle habitation along the coastlines of the Norsminde Fjord, a series of intensive reconnaissances were undertaken in 1972. As a result, a new and completely unknown shellmidden – "køkkenmødding" – was found in the vicinity of the village of Norsminde (fig. 1).[1] A trial excavation revealed that the site had a cultural layer up to 1.5 m thick with a well defined stratigraphy, composed of a Late Mesolithic "Ertebølle horizon" at the bottom, superposed by an Early Neolithic "Funnel Beaker" (TRB) horizon. The midden was covered by a 1–2 m thick deposit of sandy humus.

Norsminde represented a new, undisturbed, completely *in situ* shellmidden, which furthermore was rather small compared to other Danish "køkkenmøddinger". Thus, the midden offered a unique opportunity for a total excavation – with modern techniques – of a "classical" type of Danish Stone Age site. In addition, the site contained a stratigraphic sequence covering the transition Late Mesolithic / Early Neolithic. We had, therefore, a good opportunity of obtaining new data to revaluate the introduction of farming in this region. These were all essential arguments in favour of an excavation, which was undertaken from 1972–1989.[2]

The investigation has partially been carried out in collaboration with the Institute of Archaeology and Ethnography, Cambridge.[3] The following is a survey of the preliminary results of this investigation.

ERTEBØLLE SITES IN THE NORSMINDE FJORD

The Late Mesolithic habitation along the shores of the Norsminde Fjord has been dense. The Norsminde settlement is just one of 15 Ertebølle sites. Four are regular "køkkenmøddinger", while the others are either "ordinary" coastal sites without shellmiddens or eroded, redeposited sites (fig. 2). With a single exception, all the Late Mesolithic sites – including all "køkkenmøddinger" – are positioned along the northern coastline of the fjord (fig. 2). All the sites are excavated – either totally or by sampling.

The Ertebølle sites are concentrated in two areas: in the centre of the fjord at Flynderhage and near the mouth of the fjord, where the Norsminde settlement is positioned (fig. 2).

Just 50–75 m to the west and 200 m to the east there are other Ertebølle sites. With a few exceptions, they are all contemporaneous "in an archaeological sense" and belong to the Younger or "Ceramic" Ertebølle Culture, 3.600–3.100 b.c. (All dates in the article are expressed in conv. C-14 years). The largest "køkkenmødding" is Flynderhage (S. Gabrielsen 1953), while the other sites are relatively smaller. The detailed relationship between these various types of sites is still to be determined.

The Norsminde "køkkenmødding" distinguishes itself from other coastal settlements in this region by the fact that it is the only one that contains thick layers of Late Mesolithic Ertebølle material (hereafter ETBK) as well as of Early Neolithic Funnel Beaker Culture (TBK). At two of the other sites traces of Early Neolithic occupation were also recorded, but then only as very thin horizons with few artefact types (fig. 3).

GEOLOGY AND TOPOGRAPHY

Today the Norsminde fjord is an estuary (Muus 1967) and belongs to the smallest Danish fjords. It is c. 6 km long, 200–300 m wide and runs SW-NE, with a 40–50 m wide entrance into the open sea Kattegat in the NE (fig. 1). The fjord was formed as a valley by the melt-water during the last advance of the Weichselian glaciation (Harder 1908, Milthers 1948). Originally it was a large freshwater basin – a lake or a river (in the Late Glacial and Boreal periods). Initially – in the Early Atlantic period (c. 5.500–5.000 b.c.) – the area was transformed into a saltwater fjord. The fjord forms a sharp border line between two very different geological-topographical areas to the north and the south – and, therefore, between two rather different biotopes.

To the north and the southwest the subsoil is heavy morainic clay. These areas are very hilly and characterised by several narrow valleys and many small rivers running down to the northern coastline of the fjord. From the coast northwards the terrain rises steeply, up to c. 40 m. Therefore, the northern coastline is very irregular with many small and larger bays intermixed with peninsulas (fig. 1). To the northeast – by the mouth – the topography is more even; the subsoil here is glacial melt-water sand and gravel.

The area south of the fjord is completely different: the landscape is flat, gently rising to the south up to 10 m and the subsoil consists of glacial melt-water sand. With a single exception no fresh-water streams are found here. Also, the southern coastline of the fjord is more straight and without bays. To the south is the large, shallow area formed by the previous "Kysing fjord", which today is a reclaimed area (fig. 1).

The biggest rivers emptying out into the fjord are in the southwest: Odder Å, Rævs Å, and Assendrup Å (fig. 1). To the northeast is the only island, Kalvø, but our investigations have demonstrated that originally one more small island was present in the fjord – c. 500 m south of Kalvø. The bottom of the fjord itself is characterised by a narrow and deep channel following the northern coast, while the rest of the area – especially to the south – is very shallow.

As the fjord is positioned north of the so-called "tilting-line" this region has raised 2–3 m since the Stone Age – also an indication of the maximum level of the Littorina Sea (Mertz 1924); however, it is impossible to tell which transgression actually formed the sea level maximum (most probably the subboreal transgression). Because of the higher sea level in the Atlantic period, the fjord had a much larger extension than today – especially to the south and southwest, while the northern coastline remained relatively unchanged. During this period the length amounted to c. 10 km, and the width to c. 2.7–3 km. The mouth was originally c. 500 m wide, but has gradually been closed by sand banks and beach ridges (fig. 1).

Our investigations reveal that in the Atlantic period the channel which runs along the northern coast had a maximum depth of c. 9 m, and the "Kysing fjord" formed a large shallow bay. The presence of the channel with its

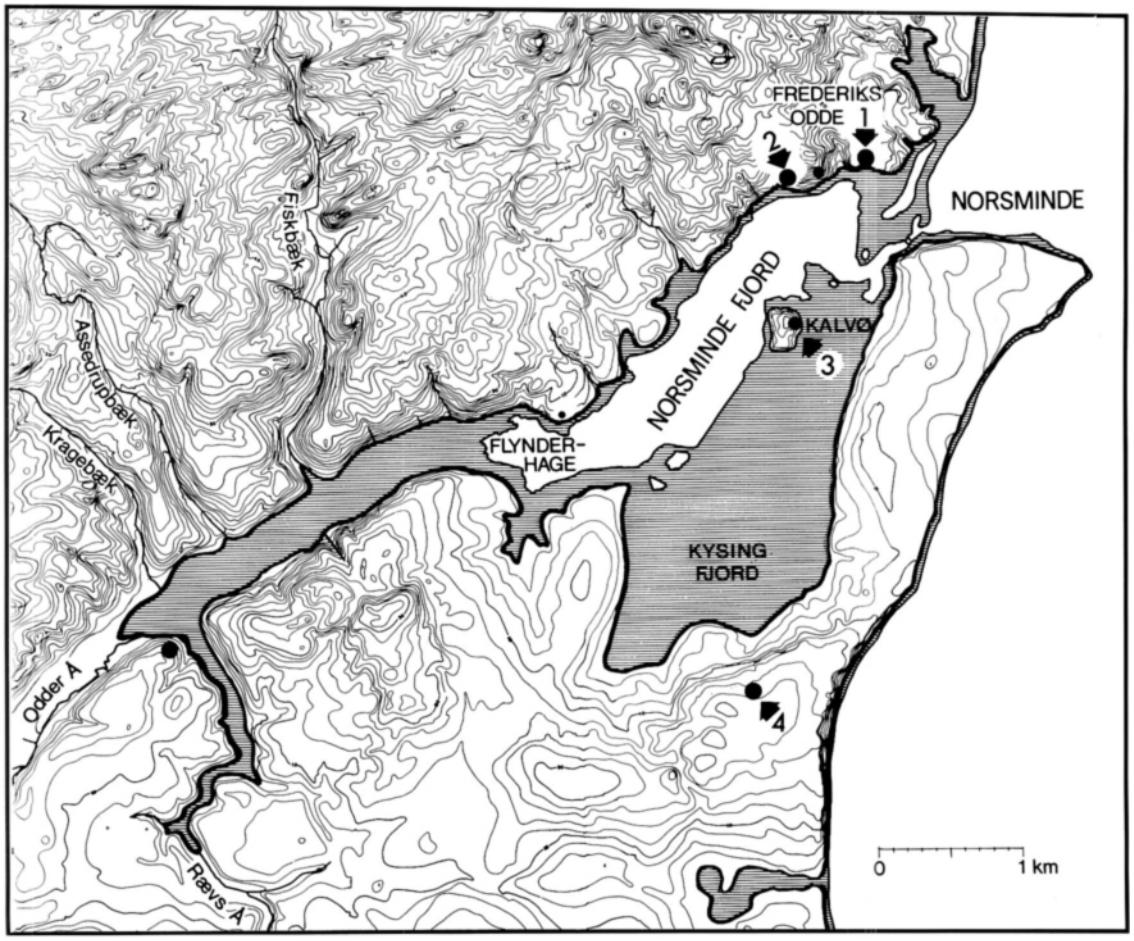


Fig. 3. The Norsminde fjord with all known Early Neolithic Funnel Beaker settlements. E. Morville *del.* Legend: 1) The Norsminde site. 2) Store Nor. 3) Kalvø. 4) Saxild.

fresh, nutritious water provided good conditions for a rich marine food-chain, and this is probably one of the explanations why all the "køkkenmøddinger" and most of the Stone-Age settlements are positioned along the northern coastline of the fjord.

SITE TERRITORY

The Norsminde "køkkenmødding" is located on the north coast, c. 200 m west of the entrance to the fjord, on an old beach cliff, eroded by the Littorina transgression before the earliest habitation (fig. 4). To the rear of the site is a shallow valley bordered by two small hilltops. The valley has been eroded by a small spring which had its outlet on the beach where the site is. Today the area in front of the site is raised sea bottom, containing sand and gravel.

The area within a 5 km radius of the site must be characterised as highly variable, consisting of several different biotopes: land (50%), fjord (10%), fjord entrance, and open sea (40%). Because of the rather steep northern coastline the relationship between land and sea has not changed very much since the Atlantic period. Therefore, the beach zone has always been very narrow, but because of the very irregular outline of the coast it represents a very long and mixed habitat.

The subsoil is made up of light sandy, morainic clay with many boulders. Therefore, access to good flint and clay for pots and houses was always good. The light sandy soil may have been covered by a rather open oak/lime forest which would have provided possibilities for hunting

of red and roe-deer, wild boar, aurochs, and furred animals such as pine marten, fox, etc. In the later habitation periods the rather sandy subsoil must have offered good possibilities for farming.

The location of the site – close to the open sea, but in the protected fjord, and in front of the deep channel gave excellent possibilities for gathering of shellfish, fowling, and for different types of fishing and sea-mammal hunting in the more open water (Kattegat) (figs. 2–4).

Larger freshwater lakes or rivers are not represented within a 5 km radius of the Norsminde-settlement (fig. 3), but the many small streams running down to the coastline must have provided good possibilities for fishing (figs. 3–4). Just in front of the Norsminde køkkenmødding there is evidence of a natural shell-bank – probably one of the localisational factors for the site (figs. 2–4).

As for the vegetation, pollen analysis has not been completed. Animal life is well documented, as illustrated by the preliminary list of species from the Norsminde site and from the Norslund and Kalvø-settlements (S. H. Andersen and C. Malmros 1966, S. H. Andersen 1983).

All in all the biotope seems to have been highly varied, and the long occupation period – c. 1.200 years – further indicates that essential aspects of the environment must have remained constant and economically prosperous for Man during the Late Mesolithic and Early and Middle Neolithic periods.

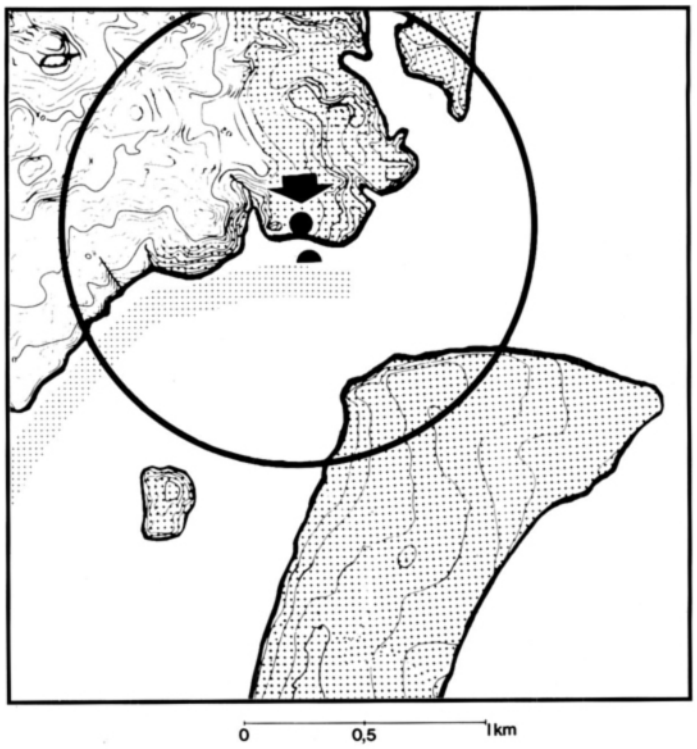


Fig. 4. Site territory within a one kilometer radius. E. Morville *del.* Legend: Similar to figs. 1 and 2. The deep-water channel along the north coast is indicated by shading.

INVESTIGATIONS BEHIND THE "KØKKENMØDDING"

In order to define the limits of the site, excavations were carried out in areas ajacent to the midden, i.e. behind and in front of the midden. Just north of the eastern part of the "køkkenmødding" a stonebuilt hearth associated with a few scattered pieces of flint debris was recorded; no additional datable cultural layer or structures were found in the vicinity of the fireplace.

Despite all our efforts, no traces of Ertebølle-habitation outside the midden area have been documented. This observation is in accordance with the results obtained by the new excavations at the Ertebølle midden (S. H. Andersen and E. Johansen 1987, 39–40) and other Ertebølle coastal sites.

However, on the more flat plateau c. 50 m north of the kitchenmidden, a settlement area with a thin cultural horizon and some pits containing Early Neolithic type flint debris and pottery was found. This area with finds and structural remains measures c. 30x30 m, and it is not stratigraphically connected with the midden on the prehistoric beach. The thickness of the cultural layer, its small size, and the relative paucity of finds are all characteristic traits for the Early Neolithic settlements of the TBK, for instance Mosegården (Madsen and Petersen 1984). All observations indicate the presence of a small Early Neolithic settlement. Although impossible to prove, it is reasonable to assume that it is contemporaneous with, but positioned at a certain distance from the midden. If this assumption is correct the Norsminde site in the Neolithic consisted of a habitation area on high, dry ground and an associated midden area on the beach, the two areas separated by a 50–60 m zone without many finds.

In an attempt to locate a waste area in front of the site – common at many Danish Mesolithic sites, – both inland and coastal – i.e. Ringkloster, Tybrind vig (S. H. Andersen 1975, 1986) etc., several trenches were excavated in the marine sediments. However, nothing of this sort was

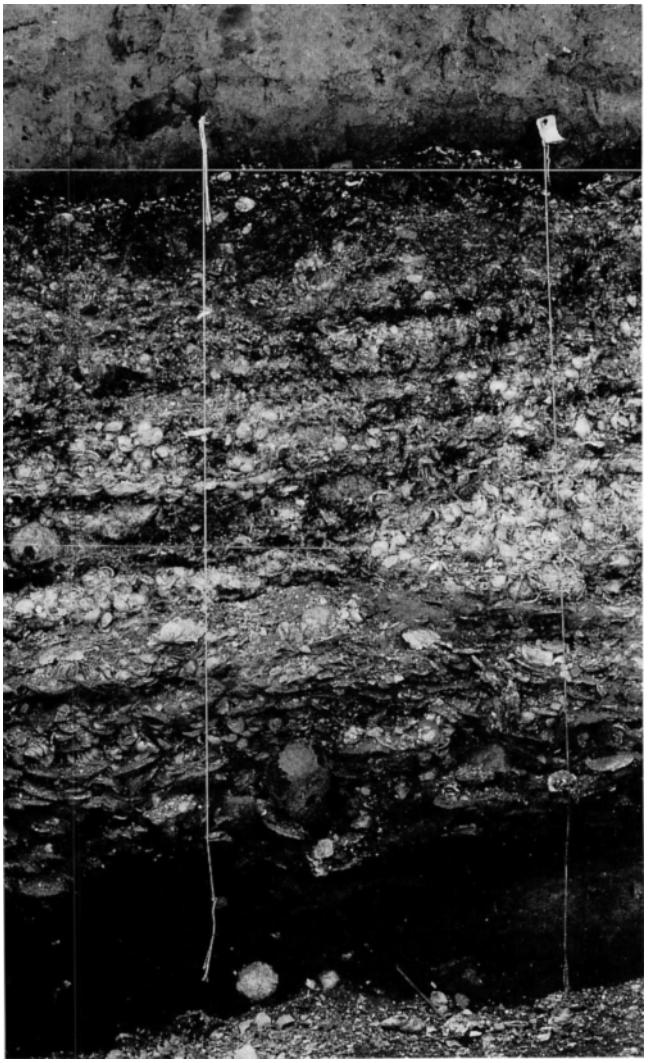


Fig. 5. Photo of section through the "Køkkenmødding" showing the complete sequence og layers (*Cf.* fig. 6).

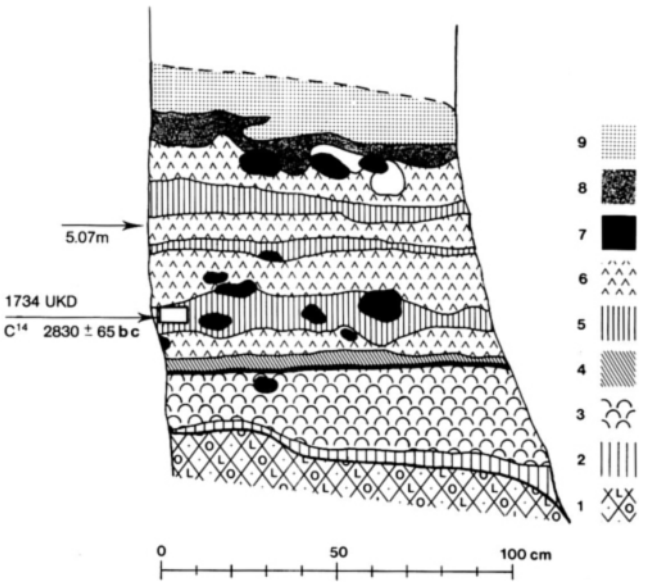


Fig.6. N-S going section (1734 RLH) through a square meter of the central part of the "Køkkenmødding". The position of the funnel beaker UKD (see fig. 20, 2) and the C-14 dating are indicated. O. Svendsen *del.* Legend (from bottom to top): 1) Subsoil. 2) Ash layer. 3) Køkkenmødding characterised by large oysters (*Ostrea sp.*). 4) Light yellow, fine sand. 5) Ash and charcoal horizons. 6) Køkkenmødding characterised by cockles (*Cerastoderma sp.*). 7) Fire-cracked stones. 8) Black, clayey cultural layer. 9) Lightbrown sand with humus.

found; just scattered animal bones and water-rolled/patinated flint artefacts, imbedded in marine sand and gravel. The explanation for the lack of such a dump area is probably to be found in the topographic position of the site, which is towards the longest free stretch in the fjord (towards the southwest); the site has therefore always been heavily exposed to high tide and wave action, sea currents, etc.; all of which would long ago have washed away all types of waste and materials dropped into the sea in front of the site.

INVESTIGATIONS IN THE "KØKKENMØDDING"

The "køkkenmødding" is oval in outline, c. 30 m from East to West and c. 5–12 m wide. The maximum width (c. 12 m) and thickness (c. 1,5 m) is found in the most eastern part of the midden, which gradually becomes more narrow (5–7 m) and thin (c. 0.40–0.60 m) towards the west (fig. 7). The base of the midden is flat – following the sloping subsoil, and the surface is horizontal – slightly falling towards the south. The delineation of the midden is distinct in all directions; especially to the south it is abrupt and bears evidence of secondary erosion by the sea.

The Norsminde site is not a single uniform unit, but the cumulative result of activities on this location during c. 1.200 years. It is made up of several individual heaps of shells and debris of different types.

Because of the necessity of controlling the exact position of all finds in relation to the Mesolithic and Neo-

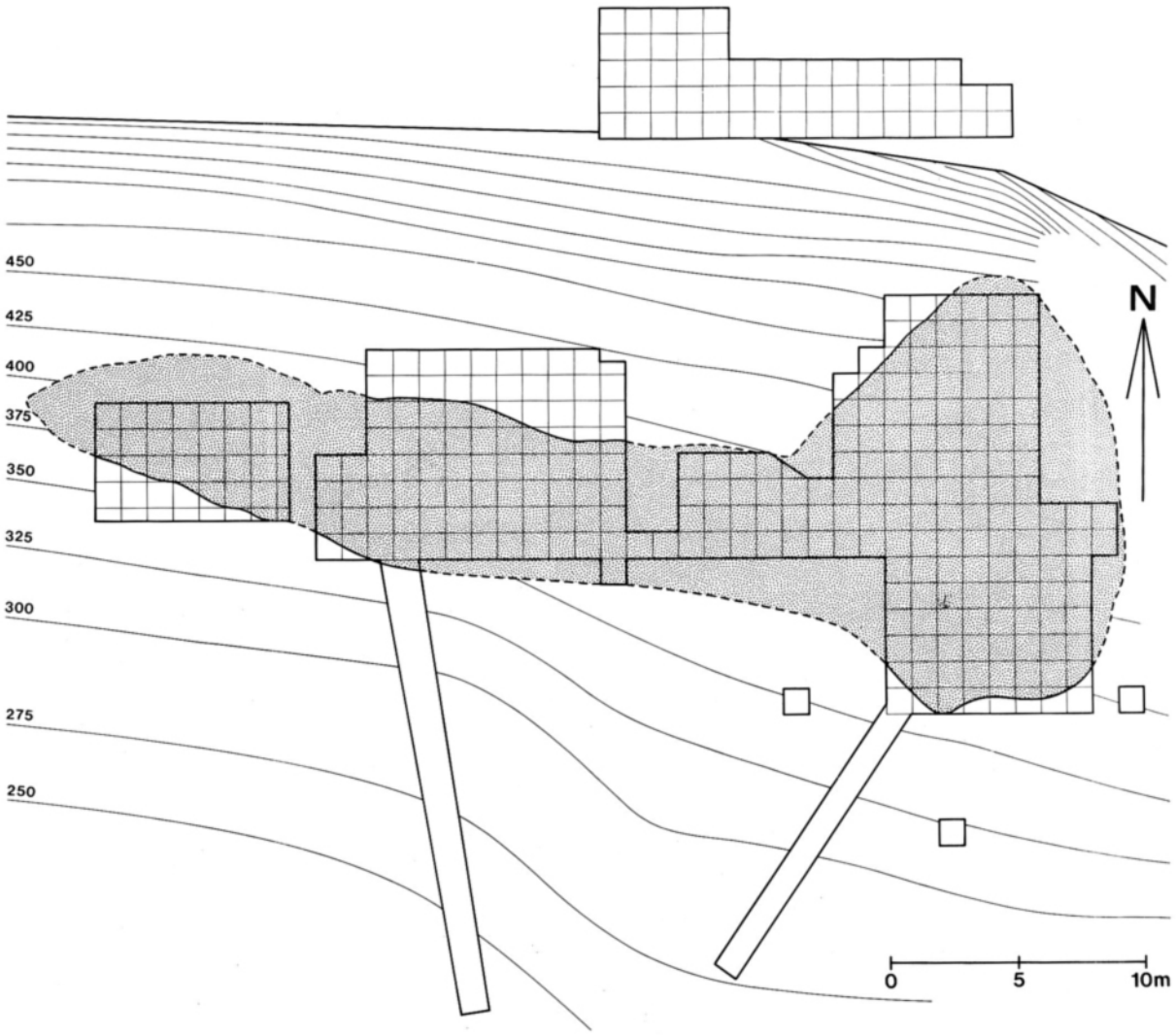


Fig. 7. Maximum extension of the "Køkkenmødding". O. Svendsen *del.*

lithic horizons, it was decided to excavate the site in a continuous series of 1 m wide sections, running N-S and E-W through the central and eastern (the thickest) part of the kitchenmidden. The method of excavation was a combination of following original midden layers and digging in levels of 5–10 cm spits. A distinction was made between special finds, i.e. retouched types, pottery, and bones whose exact position was recorded in three dimensions, and other finds, which were collected by spits. After excavating each of the sections the profiles were recorded and midden-samples – both individual as well as column – were cillected for scientific analysis.[5] Therefore, this part of the settlement was "covered" by a fine-meshed system of profiles, so that no finds are more than 0.50 m from a profile. This excavation method gives a careful control of the stratigraphy and an exact correlation between finds and horizons, but at the same time it is nearly impossible to obtain a larger over-all-survey of structural remains, distributional patterns of finds etc. To cope with this deficit the excavation procedure was changed so that the western part of the site was investigated in larger coherent squares measuring 6x3 m and 6x6 m, respectively, to expose synchronous horizons.

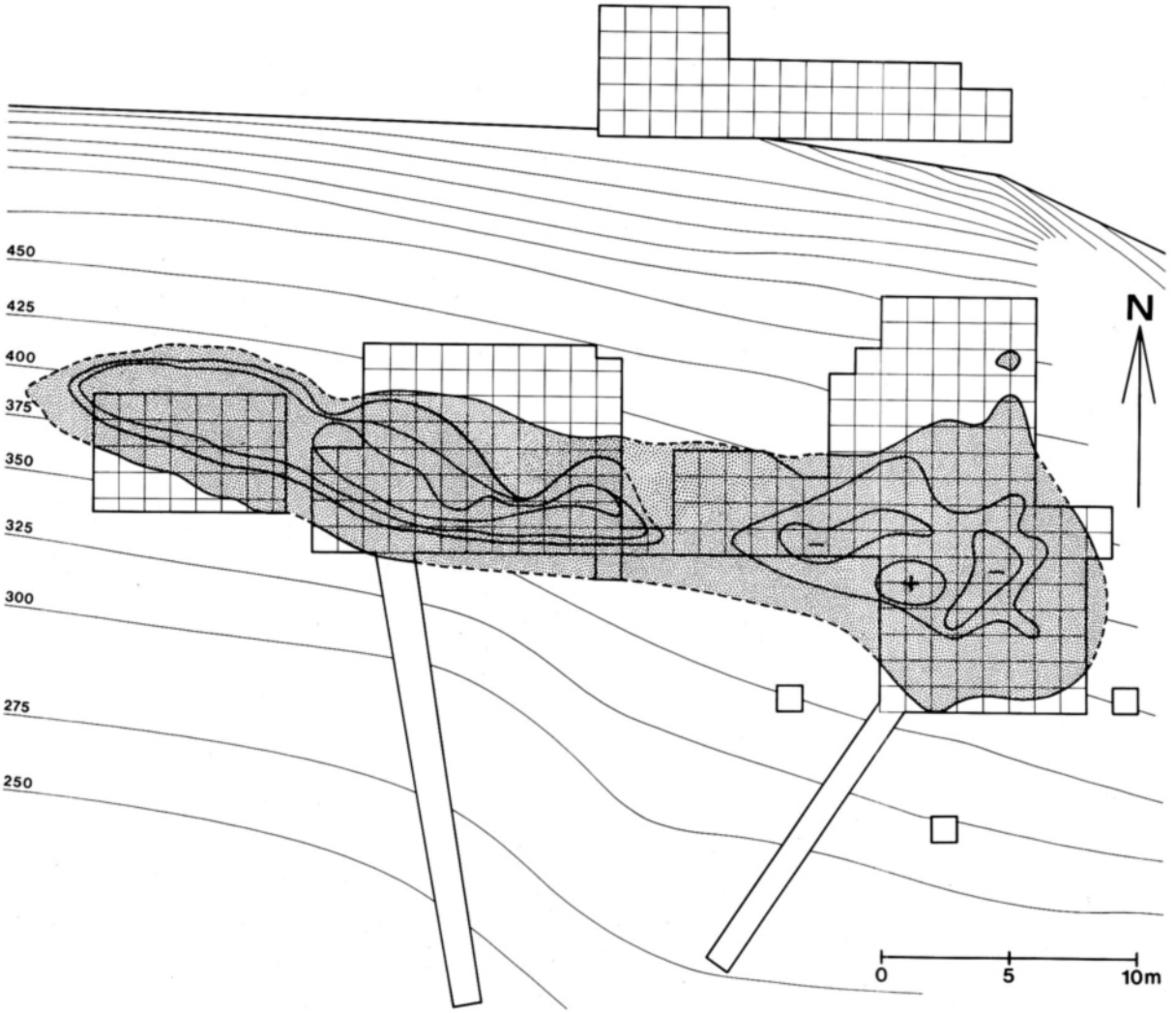


Fig. 8a. Maximum extension of the Ertebølle Køkkenmødding. Equidistance of contours in the midden = 25 cm. O. Svendsen *del.*

Stratigraphy of the Midden

The subsoil (consisting of morainic clay with many stones) slopes gradually from the cliff southwards. The cliff has been eroded by the sea at a level of c. 3.00 m above modern sea level (High Atlantic Transgression) (fig. 11).

Above the moraine, there is a c. 10–15 cm thick sandy blackish-gray humus horizon (old land surface). Upon this follows a 5–10 cm gray, ash horizon with scattered finds of firecracked stones, large numbers of flint debris, bone fragments and charcoal. This ash layer is only found under the shellmidden proper, and its thickness and content of artefacts and bones is highly variable. In four different areas the ash layer was especially thick – and in three of these areas hearths were found (fig. 8b).

The Ertebølle midden which is oblong and irregular in outline is found through the entire excavation area and it measures c. 30 m x c. 12 m east to west, north to south, respectively (360 square metres) (fig. 8a). The eastern part of the Ertebølle midden is c. 0,75–1,00 m thick, while the thickness to the west is only c. 20–50 cm. The volume of shell is c. 170 cubic metres. Topographically, the midden is divided into three areas separated by

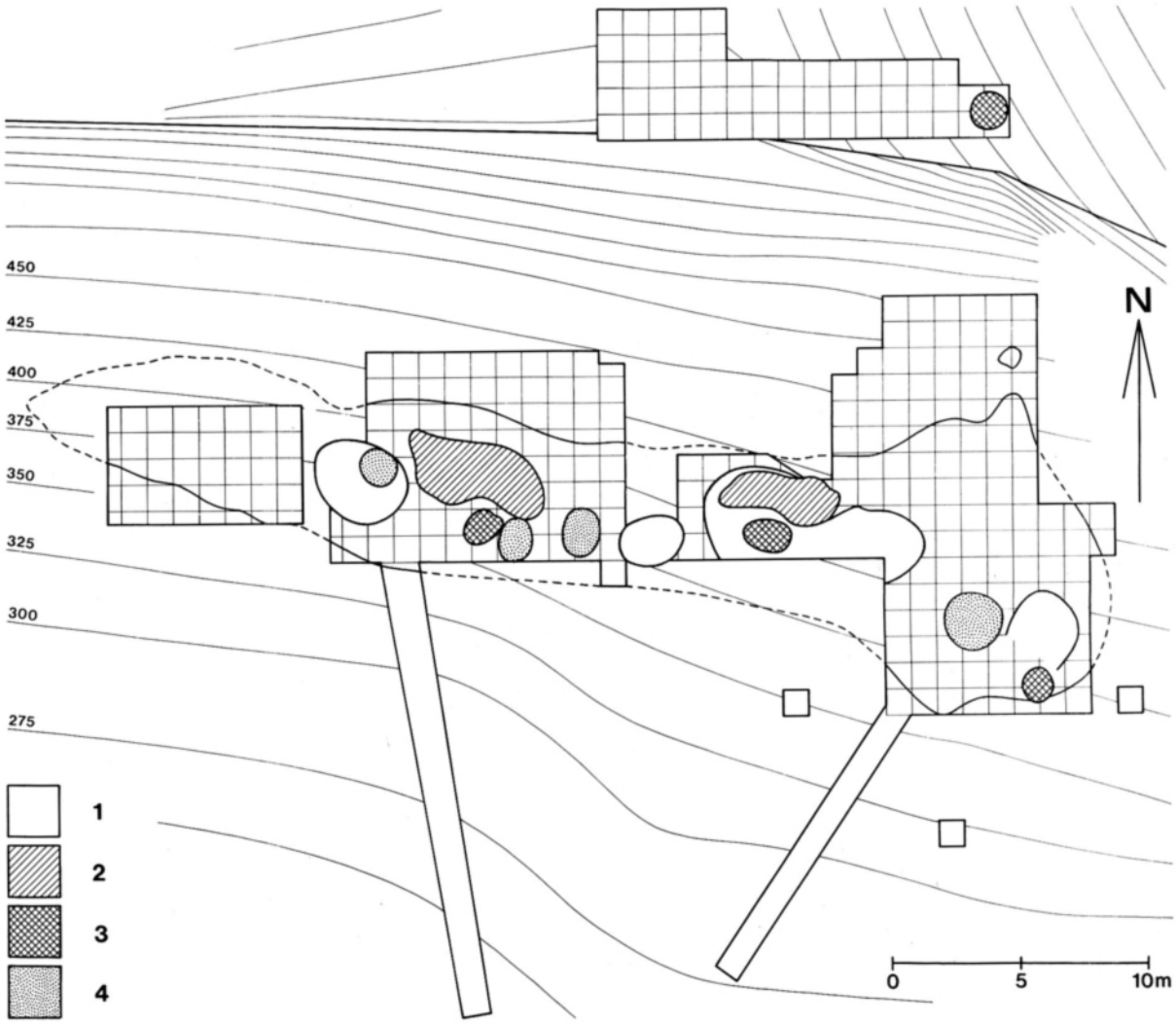


Fig. 8b. Maximum extension of the Ertebølle Køkkenmødding with indication of: 1) Ash layers, 2) Concentrations of flint debris, 3) Stone built hearths, and 4) Concentrations of fish bones. O. Svendsen *del.*

tions of the morainic cliff (fig. 8a). Apart from a few secondary pits and some marine erosion of the southern border this midden is completely preserved. It has been built up by local shell heaps which gradually grew both horizontally (along the coastline) and vertically (especially in the eastern area). Based on stratigraphic and topographic criteria the Ertebølle shellmidden could be divided into at least three fairly well defined areas centred around associated fireplaces (fig. 8b).

The midden consists of a mixture of marine molluscs, mainly large oysters (*Ostrea sp.*) (60–80% of shell), cockles (*Cerastoderma sp.*), mussels (*Mytilus sp.*), periwinkle (*Littorina littorea*), charcoal, flint tools and debitage, animal bones, antler, ceramics, and scattered stones of varying size.

Fireplaces of two types, layers of ash and fishbones and a few larger stones were also found. The shell composition of the layers varies, and in smaller areas one of the above mentioned species may dominate completely – most probably representing waste from the gathering (and subsequent consumption) of a single species.

The horizontal and vertical distribution of cultural remains also varies. Especially, the areas around the fireplaces are generally extremely rich in flint debris, bone

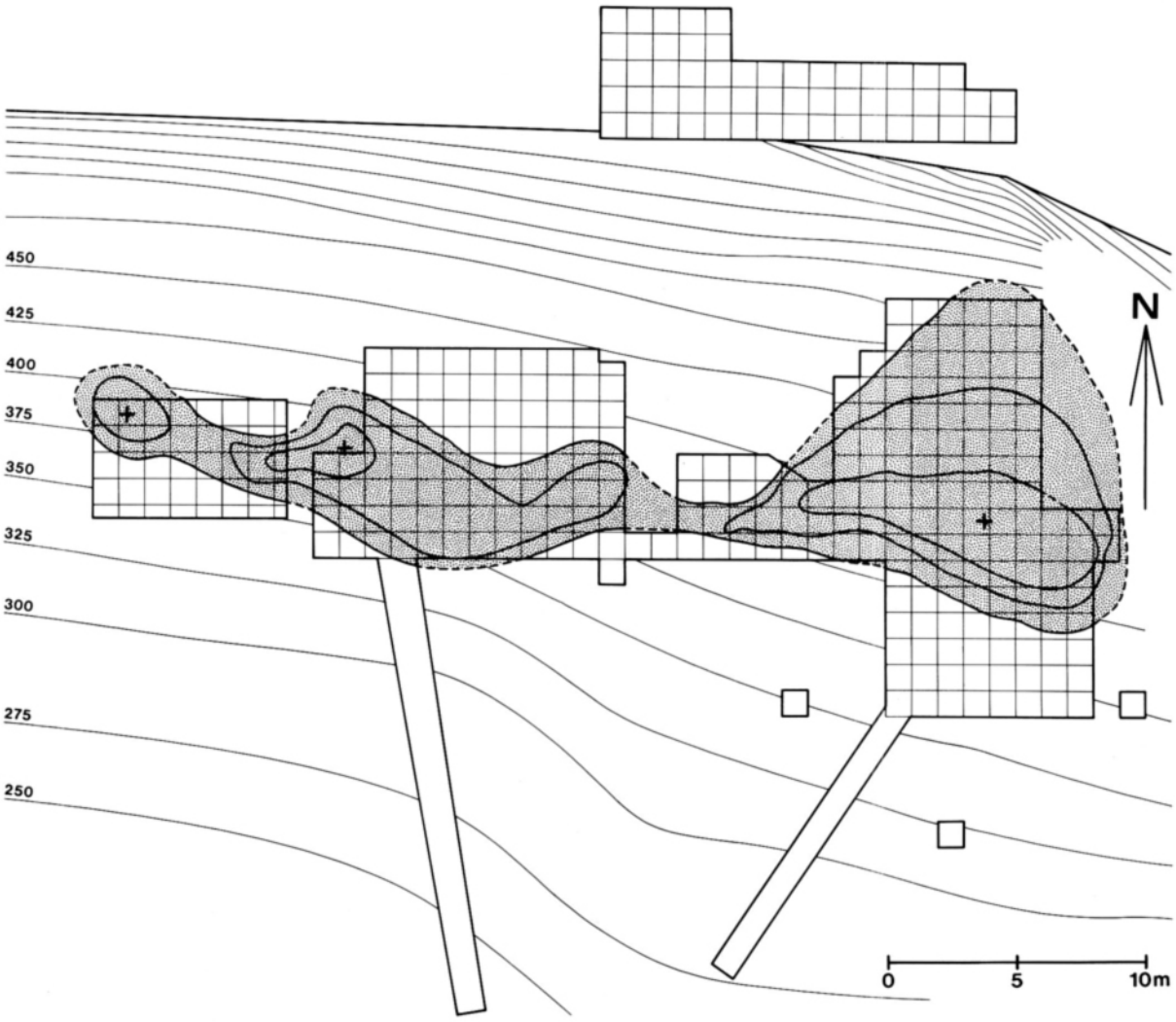


Fig. 9. Maximum extension of the Early Neolithic Køkkenmødding. Equidistance of contours in the midden = 50 cm. O. Svendsen *del.*

fragments, and sometimes fishbones. The range of artefact material is very uniform throughout the midden, suggesting that the types of activities remained constant during the occupation period.

By differences in composition, colour, density, and degree of decomposition, it is possible to divide the midden into 2–3 individual layers, a small number compared to that of other Danish middens, i.e. Ertebølle (S. H. Andersen and E. Johansen 1987). These individual heaps measure 5–10 m in a N-S and 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 direct relationship between the number of deposition episodes and occupational episodes (Binford 1982, 16). An occupation may cause several shell heaps or non at all. Therefore, it is impossible to tell how large or how numerous the individual habitation units were.

The stratigraphic analysis and the number of shell horizons indicate that the Ertebølle occupations at Norsminde probably were very few and in rapid succession – observations which correspond nicely to the C-14 dates from the individual heaps. There are only few indications of a sterile layer or erosional level of the top of the Ertebølle-midden (fig. 6). The TBK-midden is situated directly upon the Ertebølle horizon with no "transitional level". These observations suggest that the Ertebølle and

TBK-layers must have been deposited at a steady, continuous rate, or at least without a long depositional break. However, it is impossible to prove that there was no "hiatus" between the Ertebølle- and TBK-occupations.

The TBK-midden is oblong in outline and a little smaller and thinner than the Mesolithic; the largest extension (width and thickness) is found to the east (fig. 9). This midden measures 40 m (E-W), 12 m (N-S) and its thickness is c. 20–100 cm. The area is c. 220 square metres and the volume is c. 100 cubic metres. It is easily separated from the Ertebølle-layer and consists of alternating strata of "fire affected" stones (cooking stones), charcoal and burned shells and shells. This midden is dominated by shells of cockles (*Cerastoderma ed.*) (80% of shell), some oysters (*Ostrea sp.*) (fewer and distinctly smaller than in the Mesolithic horizon), mussels (*Mytilus sp.*), and periwinkle (*Littorina littorea*). Apart from a few secondary roasting pits from the Early Bronze Age the TBK-midden is also undisturbed and an in situ deposit.

The shell horizon could be divided into three individual areas of which the eastern is by far the largest (fig. 9). The TBK-horizon is characterised by 5–10 cm horizontal layers of charcoal and cooking stones (fig. 6, 11). These layers are found all through the midden and they are especially clear and well defined in the (thick) eastern part of the site (fig. 11). Here we find 5–6 well-defined horizons, which may represent a similar number of occupational episodes.

The cooking stones are always of three kinds: Granite, sandstone and quartzite. The number in a 10 cm spit varies within very narrow limits: From 21–49 and from 4,800 kgs to 6,675 kgs. They differ clearly from the "fire-cracked" stones in the Mesolithic levels by the fact that the Neolithic ones are smaller and much more cracked. The cooking stones are very often found in well delineated heaps, usually measuring 0.50–1.00 m in diameter. Such "heaps" are interpreted as "dumps" from individual cooking-/boiling activities (fig. 10). Modern experiments heating similar types of stones and then dropping them into water show that after 4 successive heatings the stones crack in ways similar to those found in the TBK-layers. The practise of cooking with heated stones was observed i.a. among the Northwest Indians. (Krause 1956).

The Neolithic layers indicate a steady continuous accumulation rate, probably covering only a short time span. In these levels we have many localized lenses of

Fig. 10. "Dump"or "clearing-up" of fire-cracked stones (cooking-stones). Photo P. Dehlholm.

grey-yellow ash and burned shell matrix 5–10 m thick, which may be fireplaces, but may just as well be interpreted as "dumps" or "refuse from clean-ups". The numerous occurrences of fire-cracked stones and ash strongly indicate activity differences in the Early Neolithic and in the Mesolithic levels. The horizontal sedimentation and wide extension of all the Neolithic ash layers must indicate some sort of "levelling" by the inhabitants, or the cooking must have taken place simultaneously on a large area of the midden surface (fig. 11).

There are other significant differences between the two main horizons in the Norsminde køkkenmødding: *No layers or concentrations of fish bone around the hearths are observed in the Neolithic midden.* This may be a question of preservation, but in relation to the other – and small well-preserved bones in these horizons, it is rather a reflection of differences in activities/economy.

The number of pieces of flint debitage is also remarkably smaller in the Neolithic level; this suggests that flint knapping did not normally take place on the midden itself in this period. The only really abundant artefact type in the TBK horizon is ceramics, which occurs in great numbers – often in the shape of large, well-preserved fragments of pots. No structural remains, i.e. pits, house floors, post holes or graves from this period were recorded.

This "køkkenmødding" is best interpreted as a specialised coastal activity *area*, which was mainly used for the cooking, smoking, or drying of shellfish.

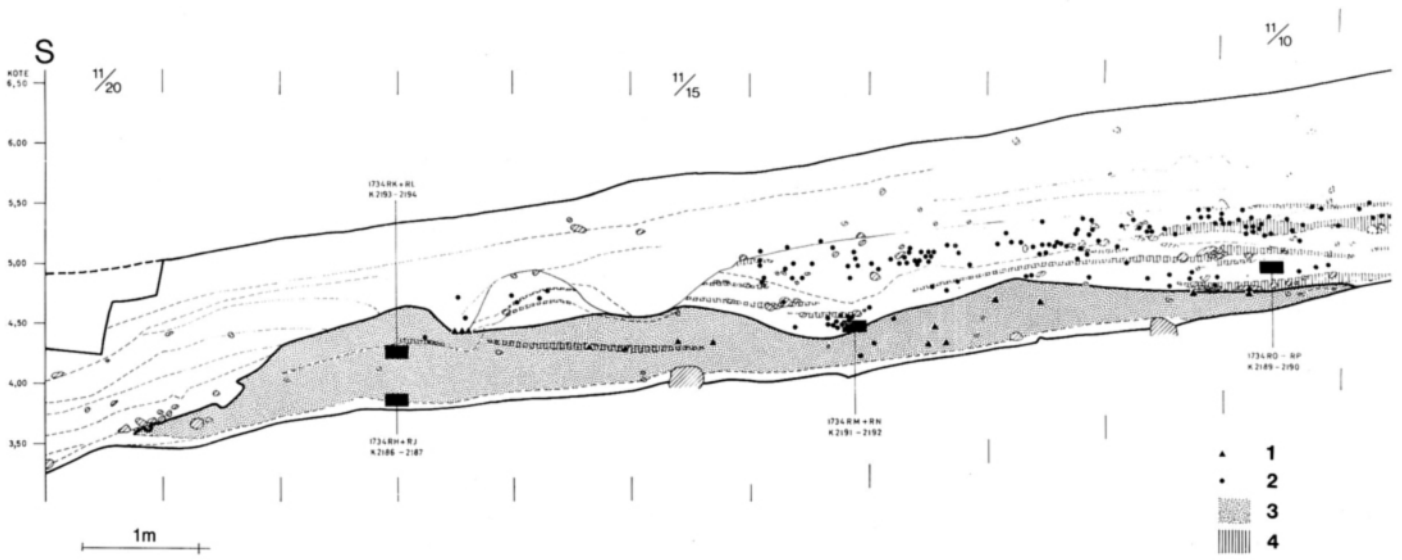


Fig. 11. Plot of all well-defined potsherds within the nearest meter-section of the profile. E. Morville *del.* Legend: 1) ETBK-ceramics. 2) Early Neolithic pottery. 3) Oyster-kitchenmidden. 4) Horizons of ash and fire-cracked cooking-stones. Partially after E. L. H. Olsen.

The "Black Layer"

On top of the shellmidden follows a c. 10–15 cm black clayey horizon with fragments of shells, ceramics, cooking stones, animal bones, and flint artefacts (fig. 6). The molluscs are once more dominated by Oyster (*Ostrea sp.*). This horizon contains artefacts from several Late-Early Neolithic and Middle Neolithic periods, which must reflect several, but short-time activities on the site – in contrast to the Mesolithic and Early Neolithic depositions. The "black" layer is deposited after the Early Neolithic occupation and during the period in which the midden was exposed.

Finally, the sequence ends with an up to 2 m thick level of fine light-brown sand (secondary deposits from the hills to the rear of the midden) (fig. 11).

Summary of Stratigraphy

The Norsminde site demonstrates a stratigraphy as follows (from bottom to top): Subsoil, ancient land surface mixed with ash and a high concentration of flint debris, shellmidden dominated by large oysters, and shellmidden dominated by cockles and charcoal horizons. On top of the midden is a black cultural layer. Finally, the site is buried under a thick deposit of sandy earth.

Correlation between Archaeological and Geological Horizons

A plot of the vertical distribution of pottery throughout the sections demonstrates that the occurrence of Ertebølle ceramics corresponds exactly to the midden layers dominated by the oyster. An identical situation is observed with the Early Neolithic TBK ceramics which corresponds closely to the cockle-dominated midden section (fig. 11). The black top layer is characterised by TBK-ceramics of Middle-Neolithic type.

This merging of ceramics and geological layers is also relevant for all the other well defined archaeological types and is an essential and characteristic trait of the Norsminde settlement, where the horizon with Ertebølle types is defined by a dominance of oysters and the Early Neolithic Funnel Beaker artefact types correspond with layers characterised by cockles, ash and cooking stones.

This phenomenon is not restricted to Norsminde, but has also been recorded at other Danish sites. First, about 100 years ago by the excavation at the "køkkenmødding"

Krabbesholm at Skive[5] (fig. 12), later at Bjørnsholm[6] (Mathiassen 1940). Similar observations have also been made at Askø (Skaarup 1973, 128), Sølager and Fårevejle (Skaarup 1973, 127–128). On all these sites – distributed over the whole of Denmark – the transition from Ertebølle – to Early Funnel Beaker Culture (and thus from the Mesolithic the Neolithic) – corresponds to a abrupt change from midden levels characterised by oysters to levels dominated by cockles (figs. 12 and 23).

It is in this connection essential to underline that in no case Ertebølle horizon(s) have been found on top of Funnel Beaker layers. There are no stratigraphic support for arguments of contemporaneity between the two phases as put forward by K. Jennbert (1984).

Fireplaces

In the Ertebølle layers we have found five fireplaces of two types. The most common are stone built fireplaces c. 1 m in diameter of which three were documented in the grey ash horizon beneath the midden (fig. 8b). These hearths were found along the prehistoric beach at intervals of 5–7 m, but it is impossible to tell whether they are contemporaneous – and thereby reflect a regular division of the settlement into areas centered around such hearths, or if their spacing reflects a gradual movement of the settlement along the old coastline.

In two areas we see another type of fireplace, i.e. areas where the subsoil has been coloured reddish-yellow by the heating from fireplaces; around these places we also find more charcoal, burned bone-splinters, fragments of "heath-cracked" stones, etc.

The difference in type may represent differences in function or degree of permanence, but this problem has not yet been analysed. In one case we see a stratigraphic sequence of three fireplaces – an observation which indicates a fixed position of the hearths through time. An identical observation was made at Ertebølle (S. H. Andersen and E. Johansen 1987, 48).

With few exceptions all the hearths have been found in the ash layer underneath the kitchenmidden – thereby indicating that habitation had taken place in these areas before periods of shell accumulation. However, it is impossible to tell whether this horizon constitutes an older and different settlement type than does the kitchenmidden; it is more reasonable to assume that this lower horizon represents traces of settlement activities connected with the oldest occupation of the site, so that both smaller shell heaps and flint debris have been deposited close by and around the fireplaces. As the habitation gradually moved along the beach and the shell layer(s) grew in height, these activity areas were slowly covered by later shell layers.

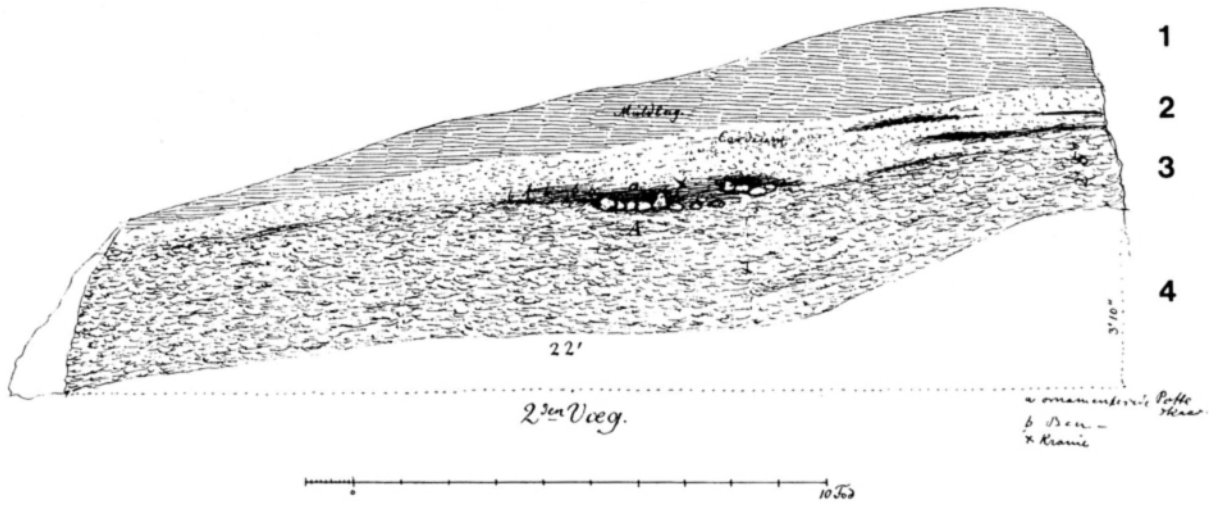


Fig. 12. Section of the køkkenmødding Krabbesholm in Northern Jutland (drawn in 1896, after drawing in the archives of the National Museum, Copenhagen. Legend: 1) Sandy humus. 2) Køkkenmødding with cockles, ashlayers, and horizons of cooking-stones (Early Neolithic). 3) Køkkenmødding with oysters (Mesolithic). 4) Subsoil.

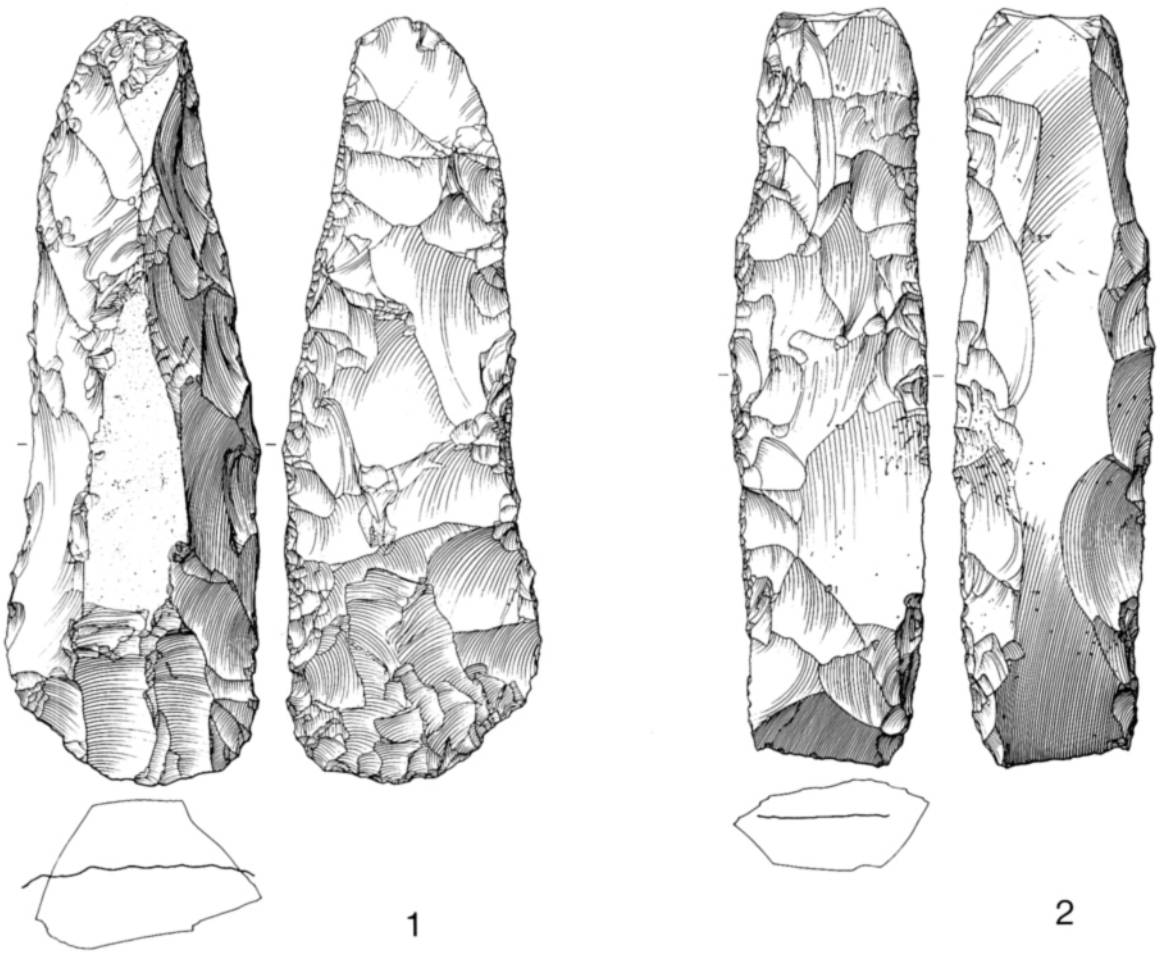


Fig. 13. Flint tools of Younger Ertebølle types. 1) Core adze, 2-3) Flake adzes, 4-7) Transverse arrowheads, 8) Flake borer, 9) Blade borer, 10) Truncated blade, 11) Saw, 12) Blade scraper, and 13) Burin on a break. Scale 3:4. O. Svendsen *del.*

Activity areas

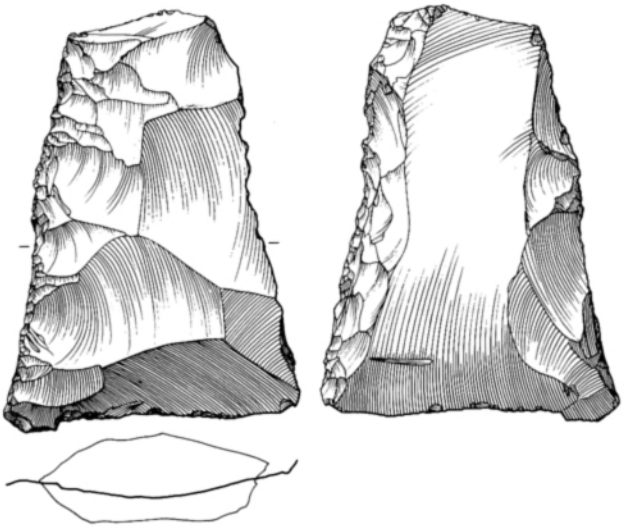
Around the Ertebølle-fireplaces are concentrations of flint debitage, flint tools, fishbones, and pottery – clear indications that these areas have been centres of activity i.e. production and use of tools and consumption of food. An analysis of the size of the flint debitage indicates that a substantial part of the flint waste consists of small splinters (micro debitage less than 1 cm in length) which proves that flint knapping took place on the midden.

There are also distinct areas of concentrated fishbones (fig. 8b). These areas are localised, and found in association with the fireplaces. Fishbones is also found in a c. 3–5 cm thick grey horizon in the middle layer of the midden. These concentrations may reflect periods of intense fishing or a systematic use of specific areas of the midden for fish processing.

Anthropological evidence

In the Ertebølle shell-layer some scattered human cranium fragments (Homo s. sapiens.) were found – probably the vestiges of one or several graves.

This was confirmed by the occurrence of a disturbed grave (unfortunately without grave goods). The grave, a shallow pit dug into the subsoil, contained the remains of a woman c. 25–30 years old, with the head facing SW.[7] The dating was later confirmed by a C-14 analysis giving



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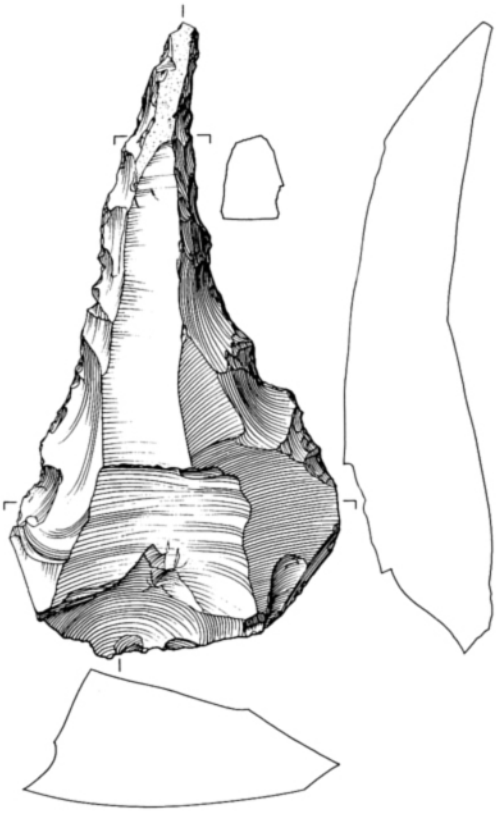

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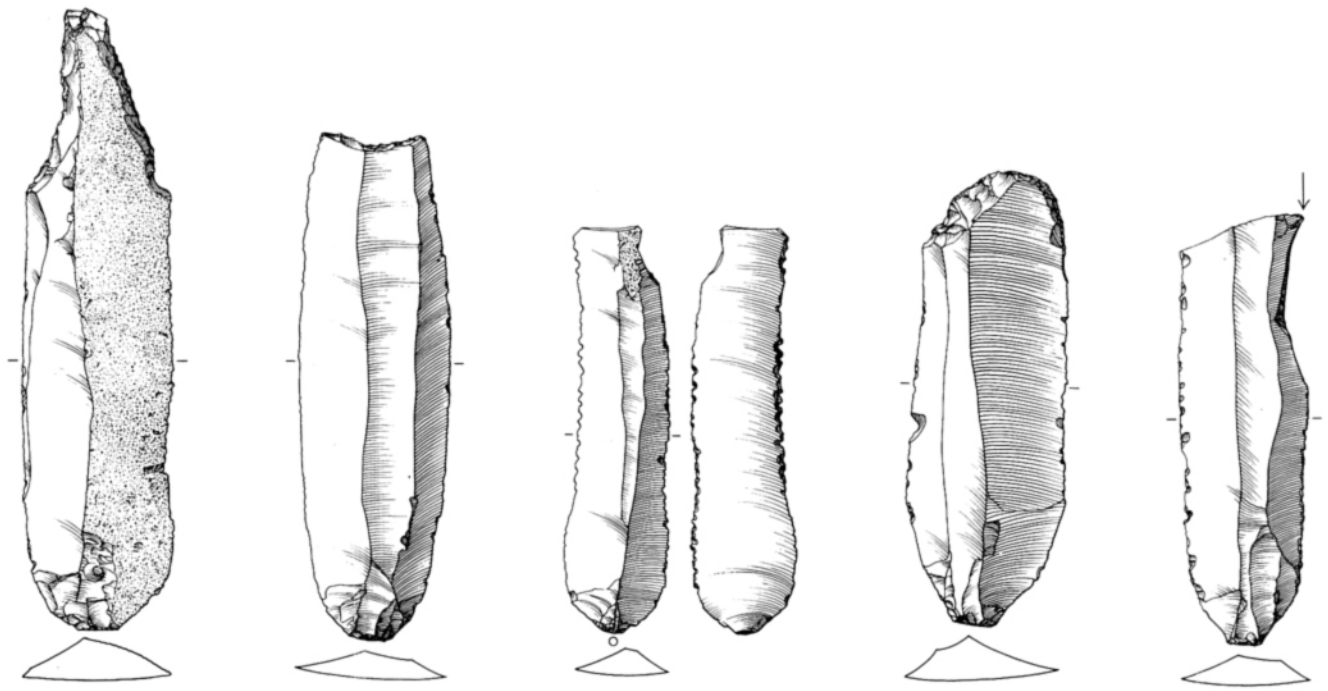


9 10 11 12 13

Fig. 14. Red deer antler-axes. Bottom: Older type with the shafthole near the burr. Top: Younger type – so-called T-axe with the shafthole bored through a sawed off tine (Scale 1:3). Photo: Moesgård.

Fig. 15. Rim sherd and bottom of typical pointed-bottom vessels of the Ertebølle Culture. E. Koch *del.* Scale 1:2.

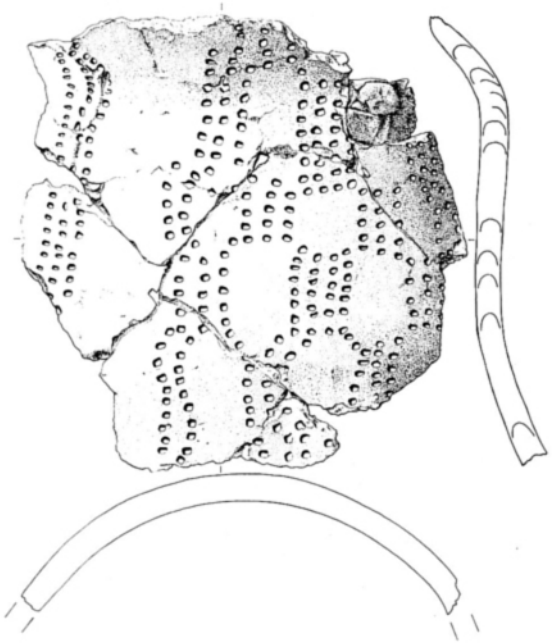


Fig. 16. Thinwalled, pointed bottom vessel ornamented with series of small dots in a net-design. O. Svendsen *del.* Scale 1:2.

Fig. 17. Sawed off tines of red deer used for pressure flaking. Top: Late Mesolithic. Bottom: Early Neolithic. Scale 1:2. Photo: Moesgård.

a date of c. 3.400 b.c. (K-5199). Analysis of the stabile isotope 13.C from two of the cranium fragments indicates that the food mainly was composed of a marine diet, i.e. fish, seals, shell food, etc. (Tauber 1981).

Other features

No pits or house floors were recorded within the Ertebølle or Funnel Beaker midden during the excavation. Also, no traces of structural remains were found in the subsoil

under or to the rear of the midden. However, it was observed that no "natural" boulders were found on the old surface within a distance of c. 3–4 m around the stone-built fireplaces of the Ertebølle period. This may reflect a "clearing" of stones from these areas to make them more suited for the different settlement activities which took place around the hearths.

CHRONOLOGY

Thirty-three C-14 dates have been analysed in connection with the Norsminde excavation. Of these, 26 are based on oyster shells (*Ostrea sp.*), five on cockle shells (*Cerastoderma sp.*) and one on bone (see the list page 39). The position of each sample was taken in stratigraphic context and in direct contact with well defined archaeological types in order to date the different sections and layers. The C-14 analysis support the stratigraphic observations, and demonstrate that the whole midden accumulated over a period of 700–800 C-14 years; not as a gradual and continuous process, but rather a series of more or less intense depositions.

The Ertebølle-midden

Twenty-one C-14 dates have been investigated from this part of the midden; sixteen are from oyster shells (*Ostrea sp.*) and two from cockles (*Cerastoderma sp.*) (see list page 39). The lowermost part of the Ertebølle-midden is dated to 3820 ± 100 b.c. (K-2187), while the top horizon belong to 3090 ± 90 b.c. (K-2663).

Apart from one date (on cockles, K-2187: 3820 ± 100 b.c.) all the samples from the "oyster-midden" are concentrated in the period 3.500–3.100 b.c. It is essential to note that all samples taken from layers with an archaeologically well defined artefact inventory of Late Mesolithic type also have dates within the range known from other Late Mesolithic sites i.e. Ertebølle (S. H. Andersen and E. Johansen 1987, 49–50). The datings are in nice accordance with the artefact inventory and suggest that the central part of the midden is the oldest and that it grew along the coastline. Furthermore, the dates support our stratigraphic observations that this part of the midden has been made up by very few depositions within a short time-span of 200–300 years – mainly in the younger or youngest Ertebølle period.

The TBK midden

We have 10 C-14 dates from this level; six are from oysters (*Ostrea sp.*) and four from cockles (*Cerastoderma sp.*). The results are spaced in the period 3010 ± 100 b.c. (K-2192) – 2530 ± 85 b.c. (K-2665); the mean is 2880–2860 b.c.

The main part of the Neolithic midden is dated to 3.000–2.800 b.c., hereby placing it in a very Early Neolithic context. The youngest dates of this midden are 2650 ± 85 b.c. (K-2664) and 2530 ± 85 b.c. (K-2665). Since these two dates differ from the rest and since they both come from the most eastern part of the midden, it is reasonable to assume that they represent a younger and individual occupational episode on the site.

Finally we have one C-14 date from "The black layer": 2450 ± 100 b.c. (K-2188) (*Ostrea sp.*). This date corresponds nicely with the ceramic inventory in this horizon (MN I a).

ARTEFACTS FROM THE ERTEBØLLE LAYER

The finds from the Ertebølle midden reflect a broad range of types of flint, bone, antler and ceramics. All types are within the range known from other contemporary Ertebølle sites. Based on the range and relative number of artefacts this site should be characterised as a "base-camp".

All artefacts belong to the Younger Ertebølle Culture, and occur throughout the midden. Both the horizontal and vertical distribution of artefacts show areas of concentration. In terms of the horizontal distribution, the material around the fireplaces is highly concentrated – not only tools, but also debris and animal bones. As for the vertical distribution, there is a high concentration on the surface of the subsoil.

We can observe only very few changes in the artefact inventory in relation to the stratigraphy; an indication of a short occupation period. There is a change in the type of the red deer antler axes from axes with the shafthole near the burr of the tine (at the bottom of the layers), to antler axes with the shafthole further up the stem where a tine has been sawed off – the so-called T-axes – in the top layers (fig. 14).

The flint tools are very regular and well made. The blades are long, wide, regular and made by "soft technique"; they form the basic blanks for tools, such as blade scrapers (few), different types of borers (several), burins,

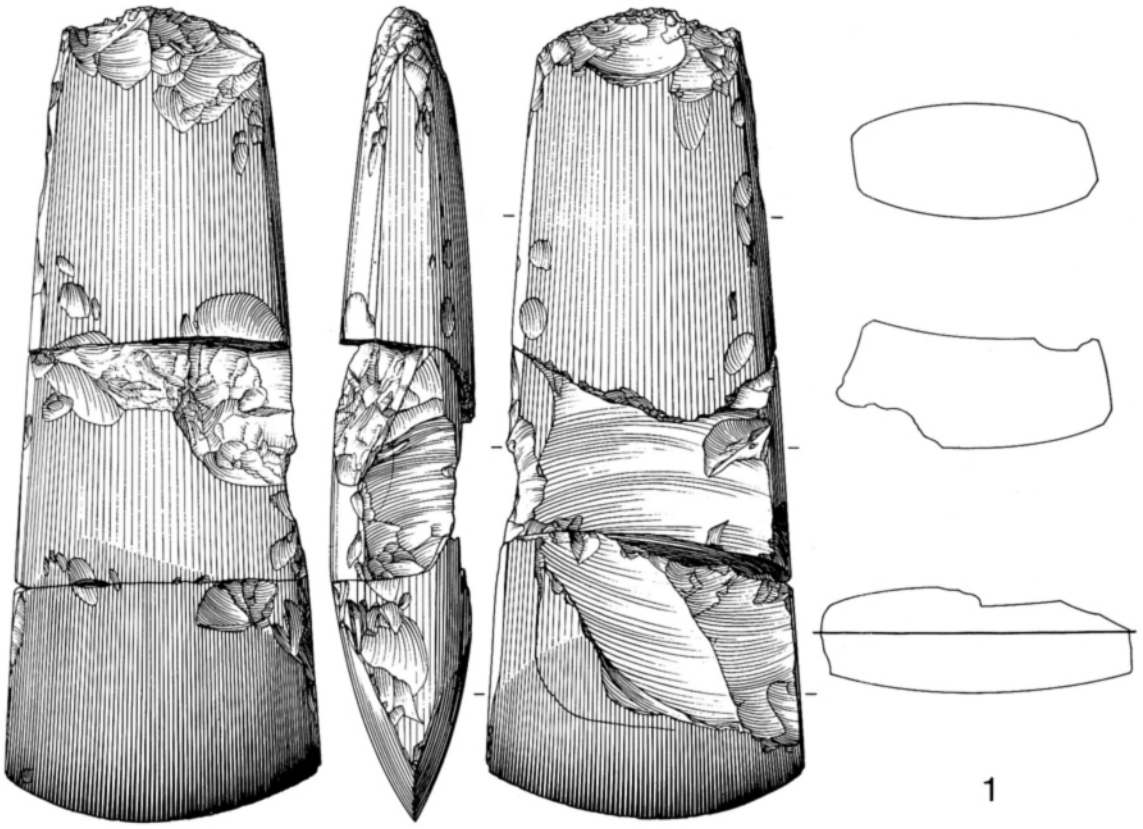


Fig. 18. 1) Polished thinbutted axe, 2-3, 6) Scrapers, 4) Truncated blade, 5) Flake adze, 7-8) Needle - shaped drills, 9-12) Transverse arrowheads. Scale 3:4. O. Svendsen *del.*

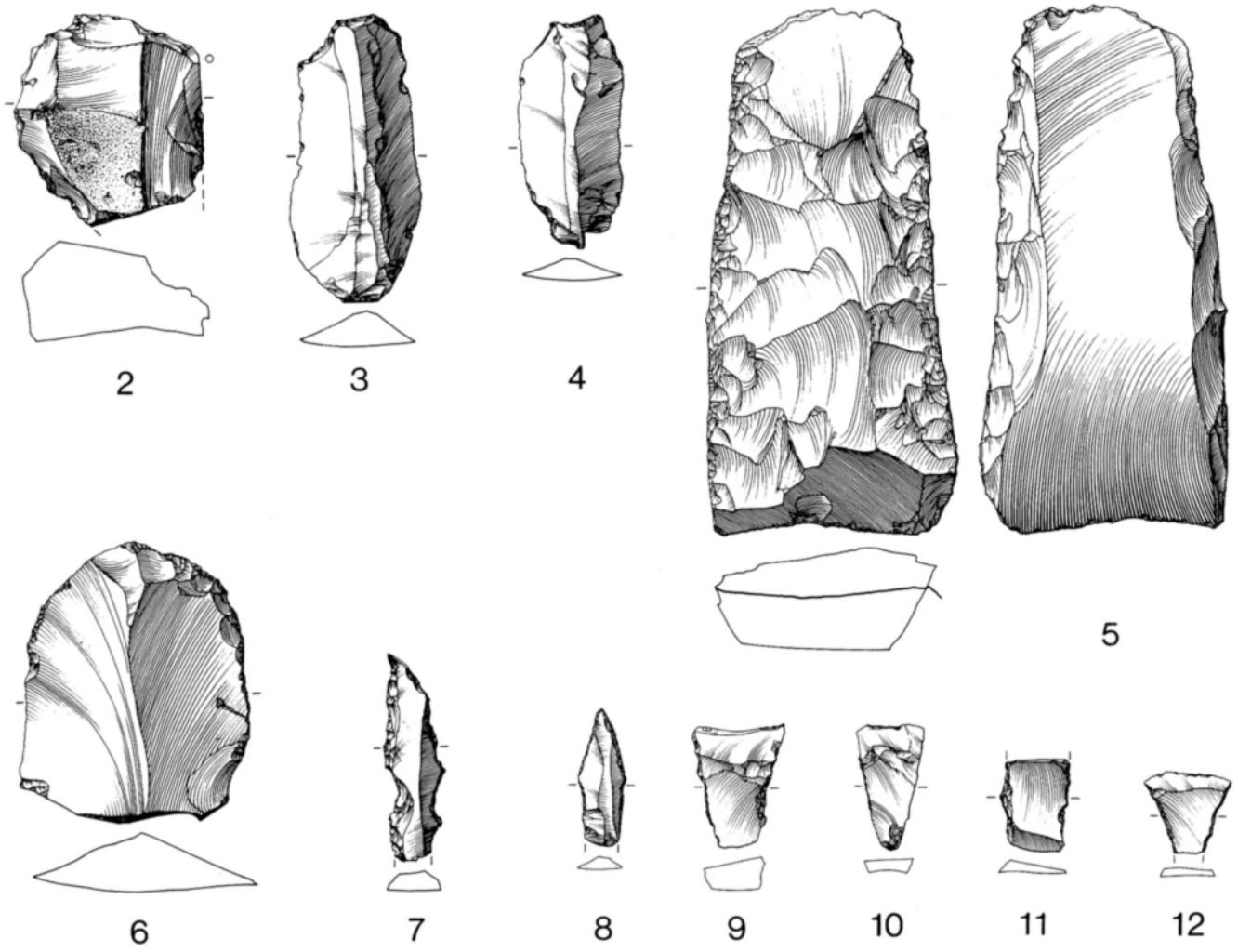
concave truncations, and other truncated pieces (numerous). These types occur together with transverse arrowheads and flake-, core-, and green stone (diabase) axes. In all layers, there is a heavy dominance of beautifully shaped flat flaked flake axes – very often with expanding edge corners. The core axe is rare, but occurs normally as very symmetrical with specially trimmed edges (fig. 13:1).

A concentration of blades and blade scrapers found around the stone built fireplace in the squares 32–34/31 have been analysed for traces of use wear.[8]. The investigation showed that a majority of the scrapers were used for scraping dry hide, but scrapers for fresh hide were also recorded. All in all, these data clearly demonstrate the presence of a well defined "work area" for skin preparation just beside the fireplace. The use-wear analysis proves that the shell midden is the settlement proper – not only an area for sporadic activities, but rather more basic and time consuming activities.

Tools of bone and antler of the Ertebølle tradition were also found: Most numerous are simple bone points, red deer antler axes of the two above mentioned types, and sawed off tines for pressure flaking (fig. 17).

Ertebølle pottery occurs in all layers of the midden. The material comes from the both thick- and thin-walled pointed-bottom vessels – both larger and small pots are present, but on this site the thin-walled ware is the dominant. No sherds of the so-called "lamps" were recorded. The rim sherds display finger impressions on the edge (fig. 15).

A fragment of a small Ertebølle vessel is ornamented. The design is an elaborate net pattern made by a series of rows of small dots (fig. 16) – a technique and motif well-known from the contemporary inland Ertebølle site Ringkloster (S. H. Andersen 1975, 62–63).



FINDS FROM THE TBK MIDDEN

The flint artefacts from the TBK-level are distinctly different from those in the Mesolithic horizons. Technologically this level is characterised by flake technique, while blades are vere few; nearly all tools are made on flakes. As we are dealing with the same site there is no reason to suppose that this difference has anything to do with access to raw material, it must, indeed, be a change in "style". Typologically, we generally find the same types as before, but in other relative frequencies.

Only a few axe types are documented from this level. Core- and greenstone-axes are completely absent and only a few flake axes are found. The dominant axe type is now the polished, thinbutted axe of type IV (eventually also type I) (fig. 18) (P. O. Nielsen 1977, 72–74 and 77–78, 106). Transverse arrowheads are numerous, but occur in other shapes than in the Ertebølle culture; the Neolithic arrows have slightly convex sides and a pointed back (fig. 18:9-12). In addition, we have several round flake scrapers, many borers and knives, while burins and truncated pieces are few (fig. 18:2-4, 6-8).

To summarise: The flint artefacts demonstrate type-continuity between the youngest Mesolithic and the oldest Neolithic period, while the technique is markedly different; finally we can observe a change in the relative frequencies among the types.

Tools of bone and antler are very few in number; only some simple bone points and sawed off tines for pressure flaking are present (fig. 17).

The most numerous artefact group is ceramics; c. 150

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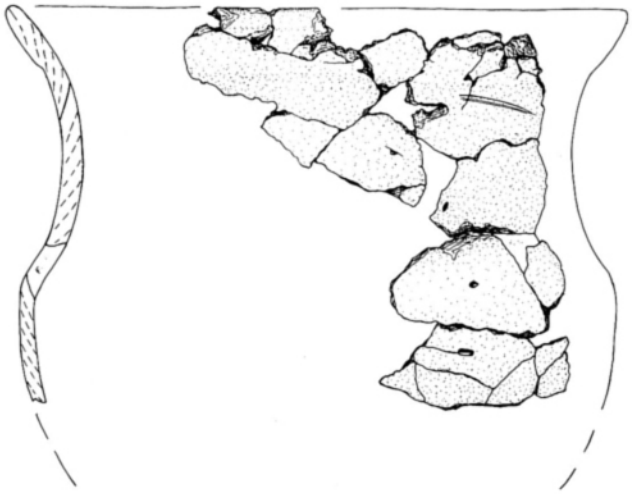

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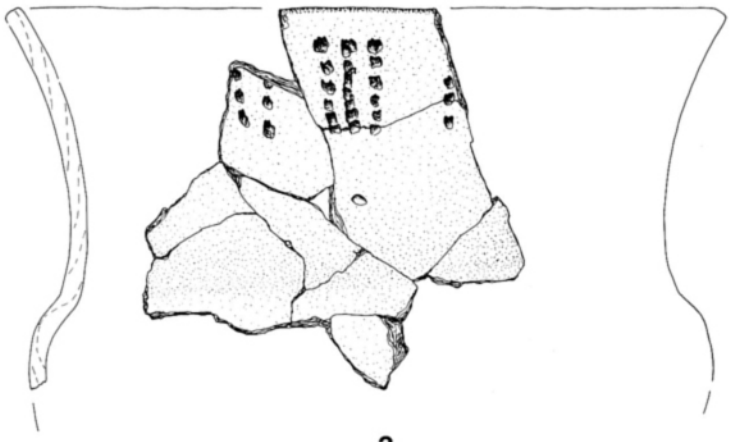

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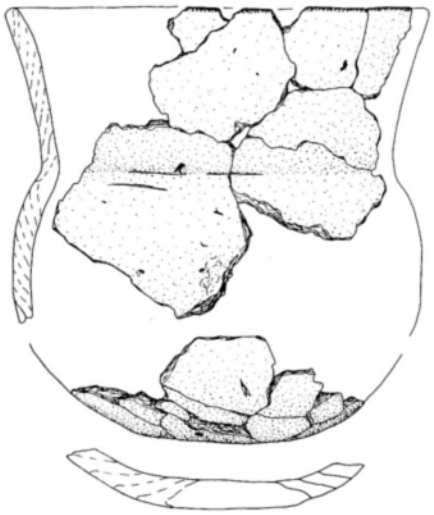

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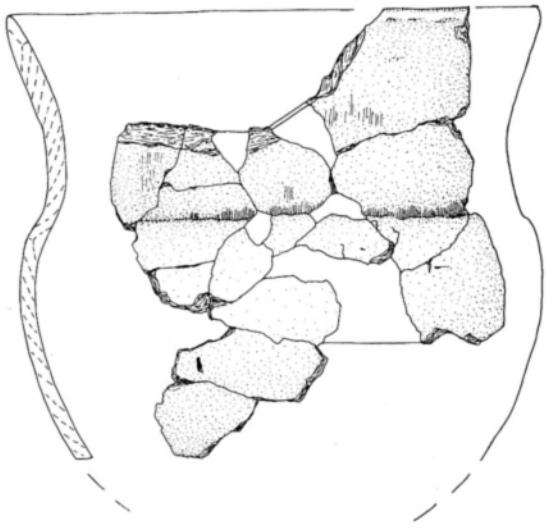

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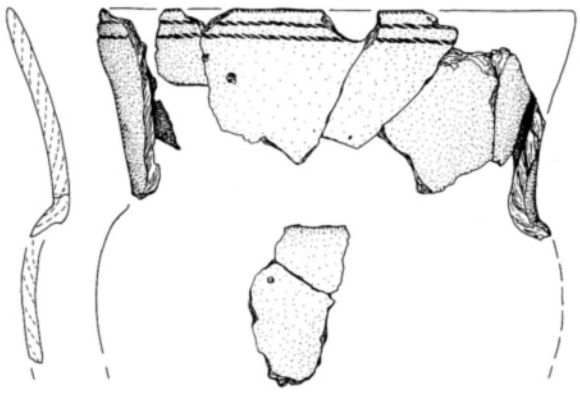

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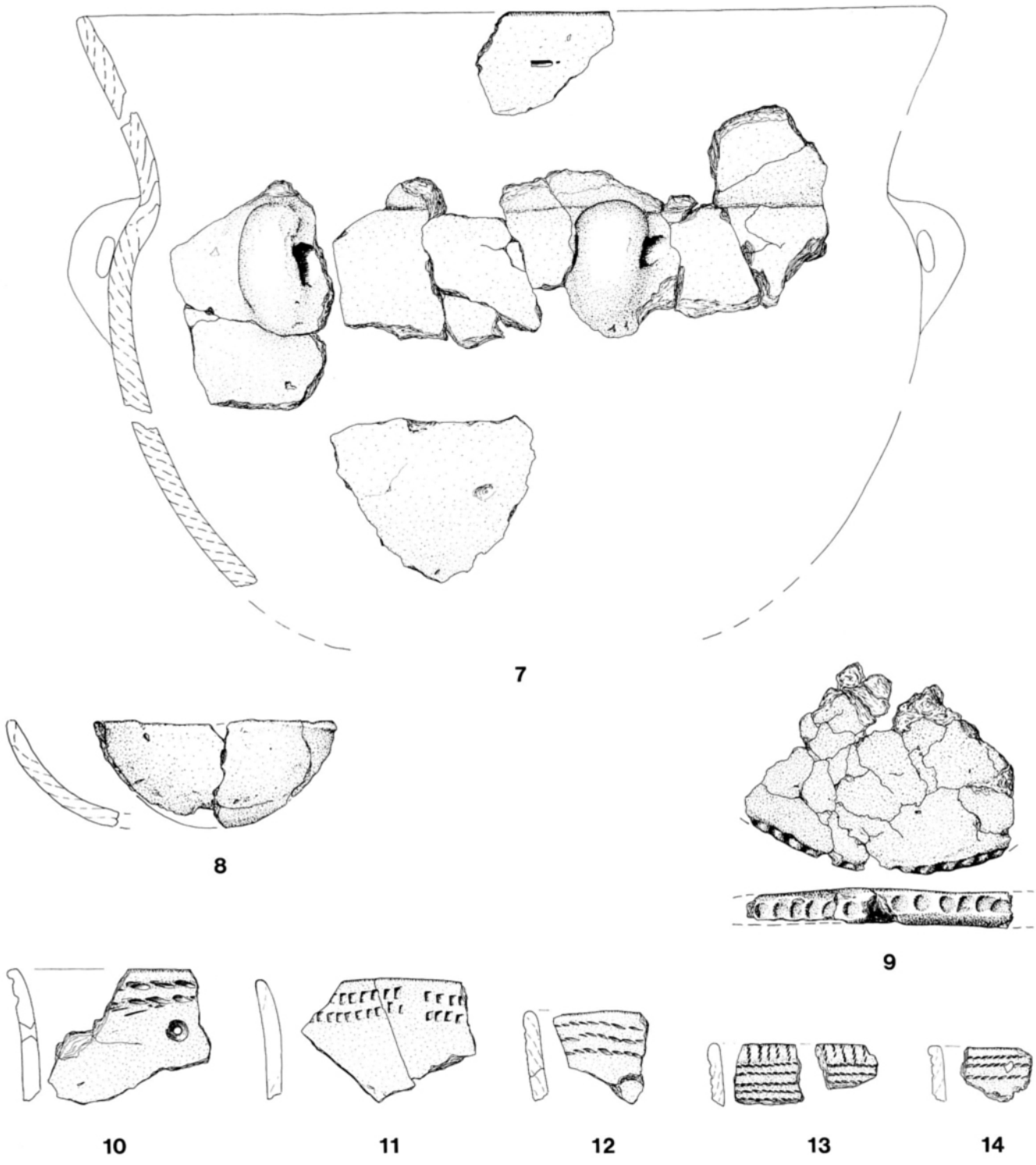

Fig. 19. 1-6) Funnel beakers of the Volling type. 7) Lugged beaker, 8) small bowl and 9) clay disc. 10-14) Types of ornaments. Scale 3:4. E. Koch *del.*

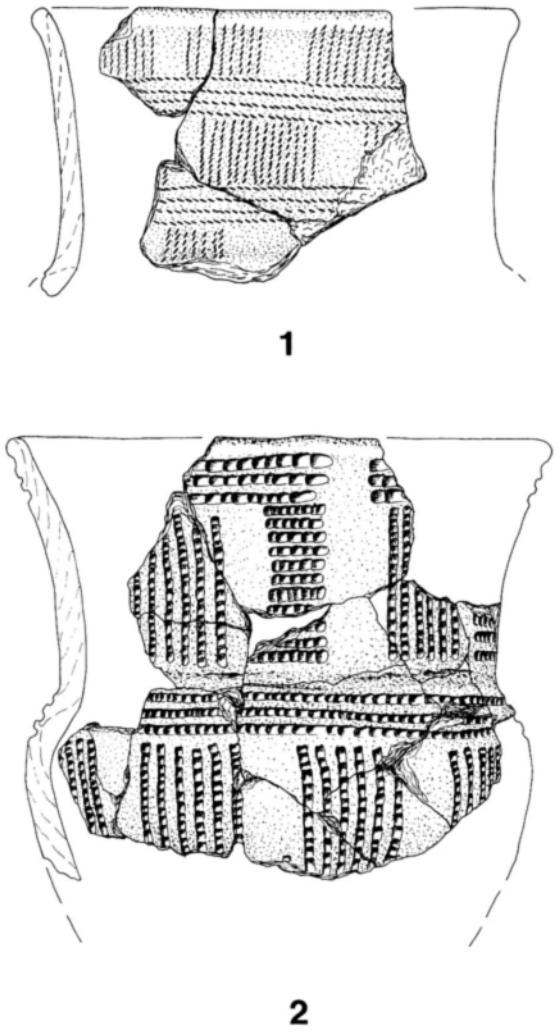

Fig. 20. Funnel beakers of Volling type with fully decorated neck and belly. Scale 3:4. E. Koch *del.*

different vessels are recorded, of which c. 1/3 is decorated. Normally the ceramics are found in large fragments – very often in the ash- and stone layers. In comparison to the Ertebølle level it is obvious that ceramics – as a type – play a more important role in the inventory than earlier. Not only the shapes, techniques and ornaments, but also the number and type-inventory are fundamentally different. It is essential that "hybrid"-forms between the ETBK- or TBK-ceramics have not been found.

The ceramic inventory is simple funnel-necked beakers, lugged beakers, lugged jars, small bowls, and clay disks. The dominant form is simple funnel-necked beakers, which are present in two size-groups: The largest group is made up by rather small vessels with a height of c. 15–20 cm and a smaller group of larger pots of c. 30–40 cm in height (fig. 19). The majority of the vessels display a very characteristic profile with a relative high, concave neck, separated from the convex belly by a distinct angle from neck to body (figs. 19:1-6). The base is always round or rounded. The pottery is generally without ornamentation. If decoration is found, it is usually confined to just below the rim. Out of c. 129 pots of this type, c. 40 are decorated on the rim – normally with 1–6 horizontal impressions of twisted cord . The most frequent ornament is two horizontal cord impressions on the rim (fig. 19:6). Some vessels also display single or double rows of horizontal stabs or short strokes (figs. 19:3).

Within this ceramic group a small number are different from the rest by the fact that they are of a "finer ware", i.e. thinner and that the entire surface is covered with decoration in a chequer composition (fig. 20). The clay disks are decorated with finger impressions on the edge (fig. 19:9). Finally, we have three undecorated beakers of slightly different type with a short, straight neck (fig. 21).

The large group of funnel beakers corresponds the so-called B-beakers, while the "finer" vessels belong to the "non-megalithic C-group" (Becker 1947). Both groups have recently been incorporated in the so-called "Volling group" (Madsen and Petersen 1984). The stratigraphical observations clearly testify that the two types of funnel beakers are contemporary in eastern Jutland, and this type of inventory should be dated to c. 3,000–2,800 b.c.

From an archaeological-typological point of view the upper shellmidden at Norsminde must be dated to the beginning of the Early Neolithic Funnel Beaker Culture – a dating which is also supported by the stratigraphy and C-14 dates.

The Norsminde settlement has, probably, provided one of the largest samples of Early Neolithic pottery and it, therefore, gives a good impression of the ceramical type inventory and range of variation of the Oldest Funnel Beaker culture in this region.

As mentioned before we have three vessels of a slightly different form (fig. 21) which from a typological point of view show clear affinities to the "A-group" (Becker 1947). A preliminary investigation of the stratigraphical position of these pots shows, that they all belong to the oldest "Neolithic" horizon – just above the Ertebølle layer. They could either define an occupation older than the "Volling-group", or be a part of the oldest "Volling".

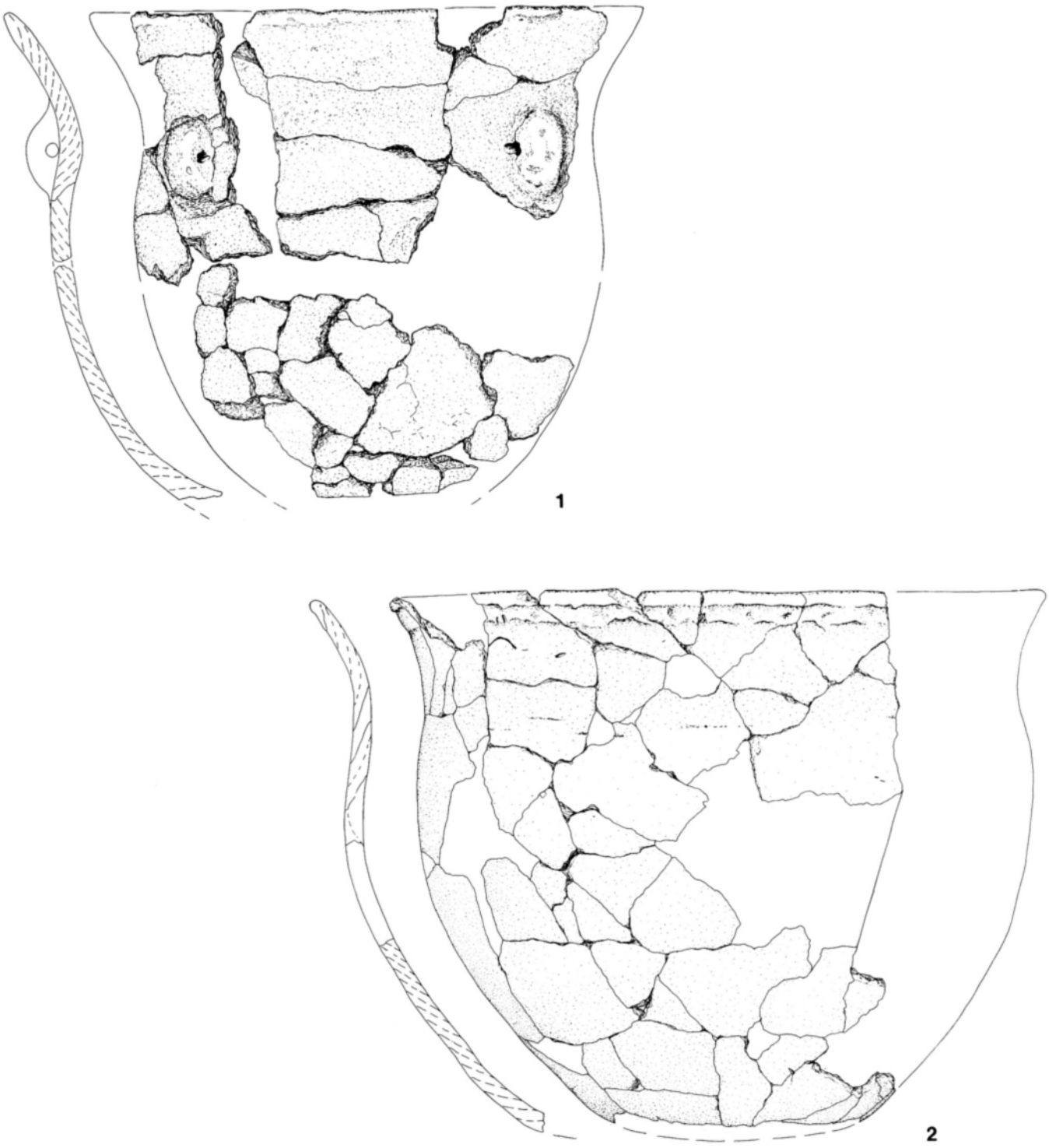

Fig. 21. Funnel beaker, lugged beaker and bowl with a short, straight neck. Scale 3:4. E. Koch *del.*

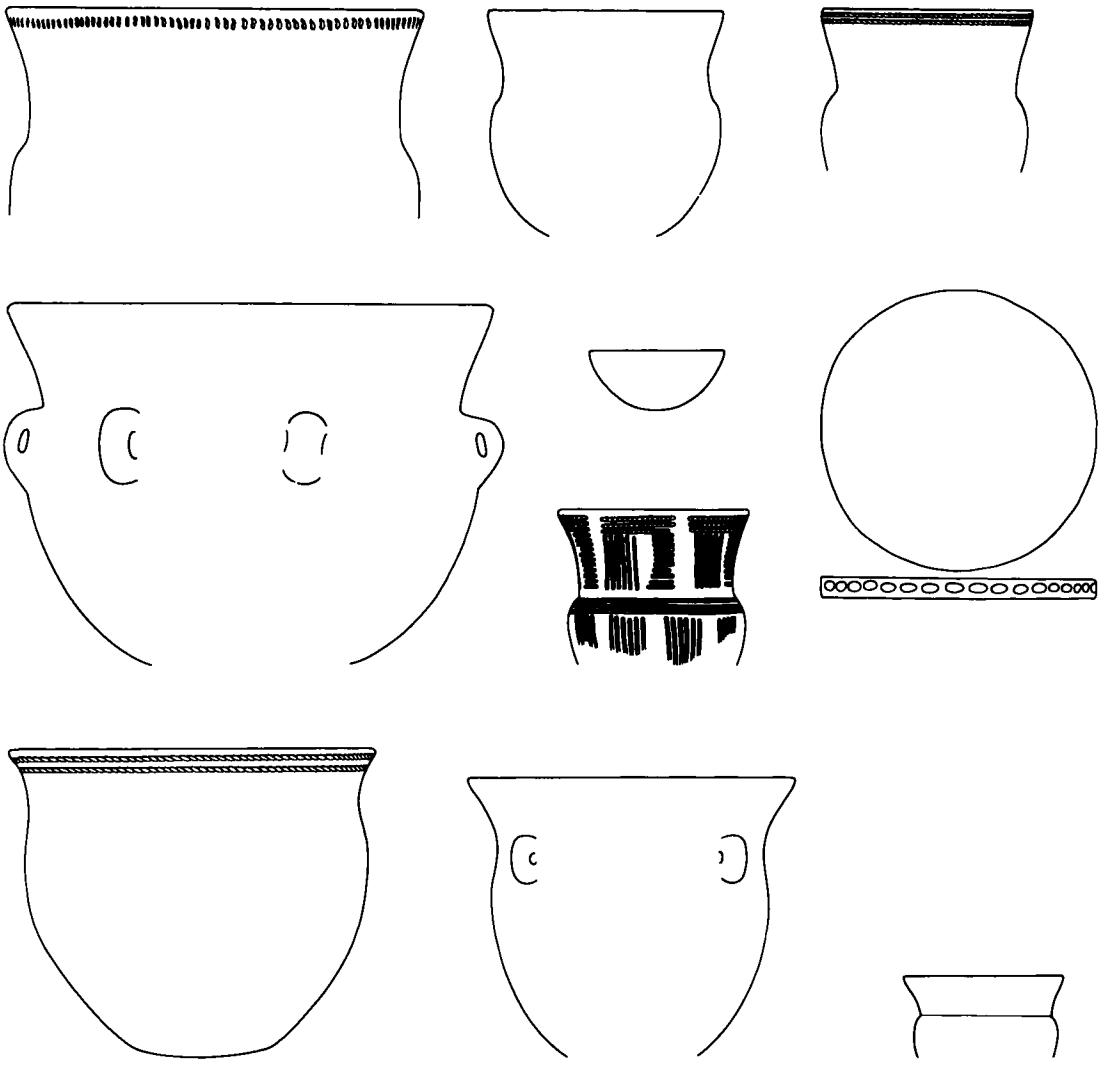

Fig. 22. Type table of Early Neolithic pottery forms from the Norsminde settlement. The three beakers in the bottom row are found in a stratigraphic position *below* the others. Scale 1:4. O. Svendsen *del.*

SUBSISTENCE

The economy of the Ertebølle levels has been based on hunting, fishing and gathering. This is well documented by the types of artefacts found associated with the large numbers of animal bones and shellfish. The list of species display a wide range of mammals, fish, and some birds. The only domesticated animal is the dog. A few bones of Man were also recorded – probably coming from (a) grave(s) destroyed by later activities. As it is usually the case in "køkkenmøddinger" the bones are very small and fragmented – either a result of many different taphonomic factors or because they have been crushed for cooking purposes, i.e. for soup (Binford 1985, 157). The distribution of animal bones follow the same patterns as described for the flint debitage, i.e. there is a strong correlation between the ash horizons around the fireplaces and the higher concentrations of bones.

The bones from mammals and birds are in most cases

found scattered in the shell matrix, while fishbones either occur in layers or as concentrations close to the fireplaces. Among the larger animals, the red deer (*Cervus elaphus*), wild pig (*Sus scrofa*), and roe deer (*Capreolus capreolus*) were the most common species; aurochs (*Bos primigenius*) is represented by only a few bones.

Animals such as wild cat (*Felis silvestris*), beaver (*Castor fiber*), and wolf (*Canis lupus*) were huntet for their furs.

Grey seal (*Halichoerus grypus*) as well as large whale (*Cetacea*) were hunted at sea and along the coast. Also swans (*Cygnus sp.*) and ducks were captured.

The fact that fishing has been of great importance in the subsistence is confirmed by the many fishbones (both concentrations and horizons), the wide range of species, the technological items used for this activity and the 13.C-analysis of human bones (see page 28 and Inge B. Enghoff, this volume). The dominant species are flatfish (*Platichthys, Psetta/Scophthalmus*), cod (*Gadus*), and eel (*Anguilla*).

All species present are marine; not a single bone of freshwater fish has been found. The fish species, combined with their relatively small size, indicate fishing close to the beach – probably conducted by means of fish traps, i.e. Tybrind Vig (S. H. Andersen 1986, 61). Gathering is documented by the many shells of oysters (*Ostrea sp.*), mussels (*Mytilus sp.*), cockles (*Cerastoderma sp.*), and periwinkle (*Littorina littorea*).

Some information on seasonality is available. Fishing has taken place in the summertime and the cockles have been gathered between May and October. The fur-bearing animals were most probably hunted during the winter. 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.

The subsistence of the TBK-levels has been based on a mixture of hunting, farming and gathering. Wild game is represented by seal (Phoca sp.), wild boar (*Sus scrofa*), fox (*Vulpes vulpes*) and red deer (*Cervus elaphus*). Domesticated animals are pig (*Sus dom.*), cattle (*Bos t. domesticus*) and sheep/goat (*Ovies aries, Capra hircus*). Also, the presence of dog (*Canis fam.*) and Man (*Homo sp. sp.*) must be mentioned.

It is essential that no traces of fishing has been recorded from this horizon (for further discussion of this: see I. Bødker Enghoff 1991, this volume).

The Neolithic subsistence is further documented by grain-impressions in the vessels, by charred grains of Emmerwheat (*Triticum dicoccum*) and of Naked barley (*Hordeum vulgare*), but grains are very few in number.

Gathering is documented by the many shells of cockle (Cerastoderma ed.), and mussels (Mytilus sp.), periwinkle (*Littorina lit.*), and oysters (*Ostrea ed.*). Also shells of hazel nuts (*Corylus av.*) are found. Analysis of the "yearrings" of the cockles indicate that they were collected in the spring- and summertime.[9]

Although the economy of this habitation reflects exploitation of several different biotopes, it is remarkable that fishing is not documented. Also, the change from oysters to cockles as the focus of gathering is interesting. This may be explained in several ways i.e. as a result of "overcollecting", but it is more reasonable to suppose that it reflects a general change in the (marine) biotope as the cockles are more resistant to environmental alterations in temperature, salinity in the sea, than is the oyster. This does not necessarily need to have had any economic importance in itself, but may just indicate alteration(s) in the (marine) environment, which may have resulted in a change in the available (marine) resources. The stratigraphic information and the C-14 dates demonstrate that this environmental change took place c. 3.000 b.c., and it is, therefore, contemporary with the transition from pollenzone VII to zone VIII (Atlantic-Subboreal) – and form the Late Mesolithic Ertebølle culture to the Early Neolithic Funnel Beaker culture (fig. 23). This observation is also recorded at other coastal sites with stratigraphic sequences covering this period, i.e. Krabbesholm, Bjørnsholm etc. (see page 24-25).

CONCLUSION

The Norsminde site is a "køkkenmødding" with two different occupation layers from the Late Mesolithic and Early Neolithic periods. The oldest habitation belongs to the Ertebølle culture, while the Neolithic one represents the Funnel Beaker culture. The occupation may very well have been continuous – and thereby also covered the Meso-/Neo-transition, but such an assumption is impossible to prove.

No traces of occupation outside the midden area have been documented from the Ertebølle period. All finds reflect basic home base activities of production and consumption without any trace of specialisation. In the

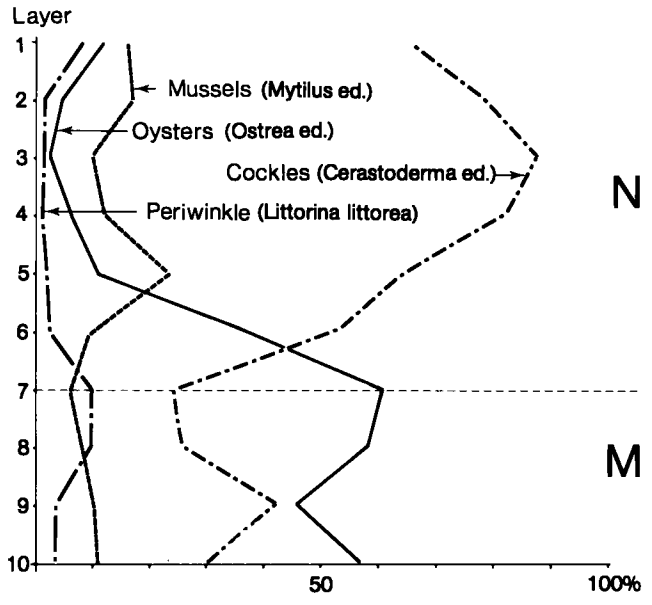

Fig. 23. Percentages of the different species of molluscs in the layers of the Norsminde "Køkkenmødding"

subsistence the fishing of flounder, cod and eel seem to have been of special importance (see I. Bødker Enghoff, this volume).

The Mesolithic horizon is characterised by oysters, while the Neolithic one is dominated by cockles. This change from oyster to cockle may reflect a change in the (marine) environment, an observation which seems to be of a general order and is contemporary with the transition from pollenzone VII to VIII (Atlantic-Subboreal). This change in the biotope is also contemporary with the transition from the Mesolithic to the Neolithic in Denmark (fig. 23).

The number of artefacts is much more restricted in the Neolithic than in the Mesolithic horizon. However, it is generally the same type groups which are present in the two periods. This reflects more or less the same activities in those two periods. Indeed, the TBK-midden bears all indications of being a real midden or dump – most probably belonging to the habitation-area on the hillside to the rear of the midden area.

The transition from the Late Mesolithic to the Early Neolithic is most sharply reflected in the ceramics: New types, techniques, and ornamental motifs appear, but it is also reflected in the flint tool inventory – not only in the presence/absence of types and relative numbers of type groups, but also – and very distinctly – in the style; from a dominance of regular blades in the Mesolithic to a similar dominance of flakes in the Neolithic. Apart from this we can also observe a series of 'constants' in the type inventory between the two main horizons in the midden. Of special importance is the disappearance of the core axe and greenstone axe, which apparently are replaced by the polished thin butted axe.

The ceramical material from Norsminde is one of our largest Early Neolithic materials from eastern Jutland and is thereby essential in defining the range and variation within such an assemblage. Of special importance is the observation that two ceramic groups, which previously were thought to define and belong to two different geographical and chronological groups (simple, roundbottomed vessels only decorated by cordimpression on the rim and a 'finer' type of ceramics which is fully ornamented on the surface), are found together in the same levels.

The subsistence in the Neolithic levels is documented by the presence of domesticated animals and a few finds of wheat and barley. It is also important that fishing seems to have stopped or at least lost importance.

While the shift in technology and material culture seems to have been very rapid and abrupt – within c. 100 C-14 years, this does not seem to be the fact with the site location and subsistence; people continued to live on the same spot, hunting and gathering continued, and the new subsistence activities (farming and agriculture) were rather supplements than substitutes to the "old" Mesolithic ones, i.e. hunting, (fishing) and gathering. The economic transition seems to have been much more gradual, which is also supported by the fact that there was habitation on the same location – a clear indication of stability in the resource potential and stability in the subsistence basis of the population.

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NOTES

1. The site has been recorded in the Forhistorisk Museum, j.nr. 1734. Norsminde, Malling s., Ning h., Århus amt.
2. The project has been sponsored by the Danish Research Council for the Humanities, Aarhus Universitets Forskningsfond and Ny Kredits Fond. Prof. C. J. Becker is thanked for support during the initial stage of the project.

3. During the excavation, one complete column sample measuring 1x1 m was taken in the central part of the midden and brought to the Institute of Archaeology and Ethnography at Cambridge for further analysis.
4. Fragment of cranium of Homo sp. sp. (a young individual) from the deepest part of the shelllayer. Sample no. 1734 NHG. K-385. 13.C = -14.9% O. The sample itself was too small for C-14 dating.
5. Report in the archives of the National Museum.
6. The Bjørnsholm Køkkenmødding was partly excavated by the National Museum in 1931 (H. C. Broholm). Report in the National Museum, j.nr. 361/31. This report is unpublished, but the main results have been mentioned by Th. Mathiassen in 1940 and 1942.
   In 1985 a new large scale investigation at the site was resumed by the author in collaboration with E. Johansen, Aalborg Historiske Museum.
7. Preliminary analysis of the skeleton has been performed by H. C. Petersen, Dept. of Genetics and Ecology, University of Aarhus.
8. The blades have been analysed by Peter Rasmussen, the National Museum, Copenhagen.
9. Analysis have been carried out by Miss G. Fromm in Cambridge at the Dept. of Archaeology and Ethnography – under the supervision of Geoff. Bailey.

List of C-14 dates

1734 DHK	K - 2505 Ostrea ed. ETBK	3230 ± 95 b.c.
1734 DHM	K - 2506 Ostrea ed. ETBK	3200 ± 70 b.c.
1734 NEO	K - 2447 Ostrea ed. ETBK	3520 ± 100 b.c.
1734 RH	K - 2186 Ostrea ed. ETBK	3450 ± 100 b.c.
1734 RJ	K - 2187 Cardium ed. ETBK	3820 ± 100 b.c.
1734 RK	K - 2193 Ostrea ed. ETBK	3420 ± 100 b.c.
1734 RL	K - 2194 Cardium ed. ETBK	3550 ± 100 b.c.
1734 PAC	K - 2663 Ostrea ed. ETBK	3090 ± 90 b.c.
1734 PAH	K - 2666 Ostrea ed. ETBK	3220 ± 90 b.c.
1734 TNN	K - 3141 Ostrea ed. ETBK	3370 ± 65 b.c.
1734 TNO	K - 3142 Ostrea ed. ETBK	3430 ± 95 b.c.
1734 TNP	K - 3143 Ostrea ed. ETBK	3450 ± 95 b.c.
1734 TNR	K - 3144 Ostrea ed. ETBK	3430 ± 95 b.c.
1734 AESM	K - 4035 Ostrea ed. ETBK	3310 ± 65 b.c.
1734 AESK	K - 4036 Ostrea ed. ETBK	3530 ± 95 b.c.
1734 AESN	K - 4037 Ostrea ed. ETBK	3130 ± 90 b.c.
1734 AESJ	K - 4038 Ostrea ed. ETBK	3180 ± 90 b.c.
1734 AESH	K - 4039 Ostrea ed. ETBK	3540 ± 95 b.c.
1734 RM	K - 2191 Ostrea ed. EN TBK	2790 ± 100 b.c.
1734 RN	K - 2192 Cardium ed. EN TBK	3010 ± 100 b.c.
1734 RO	K - 2190 Ostrea ed. EN TBK	2800 ± 100 b.c.
1734 RP	K - 2189 Cardium ed. EN TBK	2760 ± 100 b.c.
1734 PAD	K - 2664 Ostrea ed. EN TBK	2650 ± 85 b.c.
1734 PAE	K - 2665 Ostrea ed. EN TBK	2530 ± 85 b.c.
1734 PBO	K - 2668 Ostrea ed. EN TBK	2910 ± 85 b.c.
1734 DHJ	K - 2669 Ostrea ed. EN TBK	2940 ± 85 b.c.
1734 TNX	K - 3145 Cardium ed. EN TBK	2880 ± 85 b.c.
1734 UKD	K - 4034 Cardium ed. EN TBK	2830 ± 65 b.c.
1734 RQ	K - 2188 Ostrea MN 1a-b	2450 ± 100 b.c.
1734 BMNB	K - 5199 Bone (Homo sp.) ETBK	3840 ± 95 b.c.
1734 BSFO	K - 5300 Ostrea ed. ETBK	3420 ± 90 b.c.
1734 BSFP	K - 5301 Ostrea ed. ETBK	3410 ± 95 b.c.
1734 BSFQ	K - 5302 Ostrea ed. EN TBK	2590 ± 85 b.c.

Preliminary List of Species

Mammals (Mammalia) (Det U. Møhl & P. Rowley-Conwy):

Mesolithic.
- Reed deer. (*Cervus elaphus*)
- Roe deer. (*Capeolus capreolus*)
- Wild pig. (*Sus scrofa*)
- Grey seal. (*Halichoerus grypus*)
- Large Whale. (*Cetacea*)
- Dog. (*Canis familiaris*)
- Wolf. (*Canis lupus*)
- Aurochs. (*Bos primigenius*)
- Oxen. (*Bos sp.*)
- Beaver. (*Castor fiber*)
- Wild cat. (*Felis silvestris*)
- Water vole. (*Arvicola terrestris*)
- Man. (*Homo sapiens sp.*)

Neolithic
- Red deer. (*Cervus elaphus*)
- Wild pig. (*Sus scorfa*)
- Sheep. (*Ovis aries*)
- Seal sp. (*Phoca sp.*)
- Pig sp. (*Sus sp.*)
- Dog. (*Canis familiaris*)
- Cattle. (*Bos taurus*)
- Oxen. (*Bos sp.*)
- Aurochs. (*Bos primigenius*)
- Wild cat. (*Felis silvestris*)
- Otter. (*Lutra lutra*)
- Fox. (*Vulpes vulpes*)
- Man. (*Homo sapiens sp.*)

Birds (Aves sp.):

Mesolithic
- Razorbill/Guillemot. (*Alca torda/Uria aalge*)
- Duck. (*Anas sp.*)
- Swan. (*Cygnus sp.*)

Neolithic.
- Duck. (*Anas sp.*)

Fishes (Pisces) (Det. I. Bødker Enghoff):

Mesolithic.
- Flounder. (*Platichthys flesus*)
- Turbot/Brill. (*Psetta maxima/Scopthalmus rhombus*)
- Plaice/Flounder/Dab. (*Pleuronectes platessa/Platichthys flesus/Limanda limanda*)
- Flatfish. (*Heterosomata*)
- Cod. (*Gadus morhua*)
- Saithe. (*Pollachius virens*)

Gadids. (*Gadidae*)
Eel. (*Anguilla anguilla*)
Herring. (*Clupea harengus*)
Macherel. (*Scomber scrombus*)
Grey Gurnard. (*Eutrigla gurnardus*)
Greater Weaver. (*Trachinus draco*)
Bullhead. (*Acanthocottus scorpius*)
Salmon/Trout. (*Salmo sp.*)
Eelpout. (*Zoarces viviparus*)
Dragonet. (*Callionynus lyra*)
Three-spined stickleback. (*Gasterosteus aculeatus*)
Sand-eel. (*Hyperoplus/Ammodytes sp.*)
Gobiid. (*Gobiidae*)
Pipefish. (*Syngnathidae sp.*)
Spurdog. (*Squalus acanthias*)

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