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Ringkloster
Ertebølle trappers and wild boar hunters in eastern Jutland
A survey

by Søren H. Andersen

ABSTRACT

The Late Mesolithic Ertebølle culture of Southern Scandinavia is known for its coastal settlements, the *"køkkenmøddinger"*. However it did not occupy the coastal zone alone, but was also present in the interior areas along freshwater lakes and rivers. When one hopes to give as detailed a picture as possible of the range of the settlement structure and economy of this culture, the lack of excavations of inland settlements in Jutland is strongly felt. The Ringkloster settlement in eastern Jutland is an Danish inland Ertebølle site, the first to be excavated and published in Denmark in the last ca. 50 years. The settlement is located on the prehistoric shore of Skanderborg lake, and thanks to excellent preservation conditions for organic materials has given us a fascinating insight into the material culture and economy of a west Danish inland Ertebølle settlement.

The excavation was extensive and comprised a settlement area on dry land with a large number of structural remains such as pits and hearths of different types, trenches, post holes etc., and an adjacent "dump zone" in the prehistoric lake in front of the settlement site with thousands of animal bones and artefacts of organic materials.

The settlement covered the whole Ertebølle culture of the later part of the Atlantic and the beginning of the Early Neolithic Funnel Beaker culture of the Subboreal, i. e. 5400 - 3550 BC. The sequence therefore also covers the Mesolithic-Neolithic transition, which at Ringkloster is dated to 3940 - 3820 BC.

Ringkloster is by far the largest inland settlement in this region due to a combination of several factors: The site was optimally located in the centre of the lake region, and it most probably functioned as a sort of inland "central site" surrounded by a series of smaller sites and contemporary with an extensive occupation along the coastline only ca 20 km away. In contrast to the "established" Danish opinion this site demonstrates that extensive inland Ertebølle occupation *also* took place in the older Ertebølle period, i. e. 5400-4700 BC; however the occupation at Ringkloster was of special intensity as regards debris and site area in the middle and younger Ertebølle 4700-3990 BC - as can also be observed at the coastal settlements. The pollen analytical study shows a primeval Atlantic forest of lime, elm, oak, alder and hazel. During the Ertebølle occupation a distinct elm and lime decline is observed - which was probably caused by the activities of the Ertebølle population. At the beginning of the Subboreal, ca 3900 BC, the first activities of (Neolithic) farmers are indicated by pollen of ribwort and a contemporary decrease of the forest, combined with a higher frequency of open ground herbs, all together demonstrating the opening up of the forest for farming activities.

The faunal remains tell that Ringkloster is a seasonal (winter) site occupied from autumn to early spring. The settlement is interpreted as a location for the procurement of meat, furs/hides and antler. The economic activities were centred on the hunting of wild boar, red deer and aurochs, combined with the trapping of animals with fur - especially pine marten and otter. The skeletons of the fur-bearing animals were discarded intact in the dump zone,

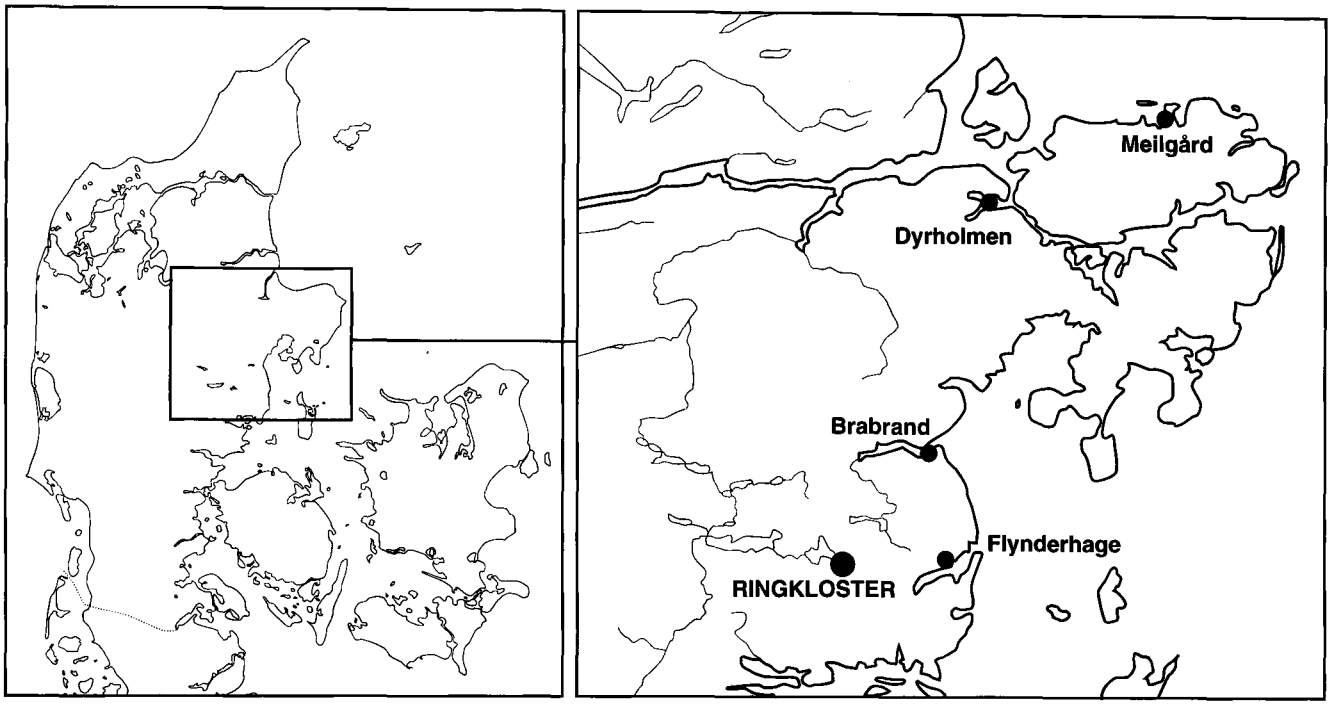


Fig. 1 Denmark and the area of study in East Jutland with the position of Ringkloster and some contemporary, coastal Ertebølle settlements. The High-atlantic coastline (ca. 4000 BC) is marked on the detailed map; S. Kaae del.

and the bones have distinctive fractures from the traps in which the animals were caught, and also cutting marks from the skinning process. Both its strong seasonality and the many bones of wild boar and pine marten make Ringkloster unique within the Ertebølle record of Scandinavia. The analysis of the bones of the larger mammals seems to demonstrate that the meat of these species was removed from Ringkloster to another location - probably on the coast. Quite extraordinary is the presence of bones of dolphins and marine fishes such as cod, saithe and flounder, species which prove contacts between Ringkloster and the coastal region.

The seasonal and economic interpretation of Ringkloster is supported also by the artefact inventory, which is distinctly different from what is known from the many excavations at coastal sites. At Ringkloster the dominant types are scrapers (used for hide), burins, denticulate and micro-denticulate blades, and transverse arrowheads, but in strong contrast to the coastal sites axes were uncommon. Artefacts of antler were abundant, as was antler waste, while bone tools are few - especially bone points, which normally are one of the common types in the *køkkenmøddinger*. New Ertebølle types from Ringkloster are curved bone "skinning knives" of rib bones, and oyster shells used as knives and/or scrapers.

Sherds of the usual Ertebølle pointed-base pottery and oval vessels ("lamps") were found in great numbers, and a small part of it is quite extraordinarily decorated with bands of stabs, lines of double stabs and rhombic patterns. Decorated Ertebølle pottery is extremely rare in Denmark and is only known from a small group of settlements in central eastern Jutland - within 20-25 km of Ringkloster.

As already mentioned the Ringkloster material includes a series of marine indicators - bones of dolphins, marine fish, oyster shells and amber. Such materials clearly show contacts between Ringkloster in the interior of Jutland and the coast, but of what character and at what social level is difficult to tell - i. e. do these materials reflect seasonal movements of people or groups of people from the coast into the interior of Jutland, or are they the vestiges of exchange networks connecting two independent set-

tlement/social systems, an inland and a coastal? In other words are we dealing with one large coastal settlement system which used the interior (Ringkloster) for seasonal (winter) procurement of meat and skins, or do we have had two independent systems, "forest hunters" and "coastal fishermen"?

At present most arguments point towards interpreting Ringkloster as a seasonal part of one large East Jutland Ertebølle settlement and procurement system, which included both the coast and the interior. Such a situation must inevitably also have brought into existence social relations independent of whether these were originally intended or not. Ringkloster, therefore, must also have played an essential social role in the east Jutland Ertebølle system - a role as essential as the economic one.

INTRODUCTION

The Ertebølle culture of Southern Scandinavia is famous for its coastal sites, especially the "køkkenmøddinger" (kitchen middens), like the *locus classicus*, Ertebølle itself (Madsen *et al.* 1900; Andersen & Johansen 1987). The sites which have received most attention in the study of the Ertebølle culture are coastal settlements in Jutland, i.e. Meilgaard, Ertebølle and Dyrholmen (fig. 1). This has given a false impression of the Ertebølle culture as a purely coastal culture characterised by large kitchen middens, an opinion which is widespread in the international literature. However, this opinion needs strong modification.

As early as 1892 the first Danish inland Ertebølle site, Vester Ulslev on Lolland, was mentioned in the literature (Bahnson 1892, p. 163) and later similar sites were recorded from Zealand - especially in the large Åmosen basin (Mathiassen *et. al.* 1943; Andersen 1983) and in the Neverkær bog on Funen (Albrectsen 1973; Andersen 1977). Inland settlements are described also from other areas of the Ertebølle culture, e. g. Southern Sweden (Ageröd V, Bökeberg III) (Althin 1954; Larsson 1983; Regnell *et al.* 1995) and Northern Germany (Ellerbek and Satrup Moor) (Mestorf 1904; Schwabedissen 1960; 1994). The main part of this comes from the eastern and southern part of the Ertebølle area, while excavations of inland Ertebølle settlements in Jutland were not carried out or published. In contrast to the excellent preservation of organic materials at the coastal settlements, the inland sites in this part of Denmark showed no trace of Mesolithic bone, antler or wood This was due to the sandy subsoil and acid bogs, which provided geological conditions similar to those found in most other Northwest European countries.

Nevertheless, numerous stray finds and surface collections from a large number of settlements along the rivers and lakes of Jutland have clearly demonstrated that the Ertebølle culture also exploited the inland biotopes of this region (Mathiassen 1937). Unfortunately very few of the inland sites have been systematically excavated and properly published.

To obtain as complete a picture as possible of the total range of the subsistence activities of this culture, it has for many years been desirable to find and excavate an inland site in Jutland, preferably one where organic materials were preserved, and to use it for the comparative analysis of coastal and inland settlement systems. Such a site was played into our hands with the discovery of the Ringkloster settlement.

THE RINGKLOSTER SITE

History of investigation

Ringkloster was the first inland Ertebølle site in this part of Denmark where bone, antler and wood were preserved; even today, almost 30 years after its discovery, it is still the only Late Mesolithic inland settlement in this area with good conditions for the preservation of organic materials.

As the only publications are preliminary descriptions of the first 3 years of excavation (Andersen 1975; 1979b), and because different aspects of the material have been used and referred to on several occasions in the international literature, the following survey is given as an attempt to provide an up-to-date, general picture of the status of research of this unique north European Mesolithic settlement (Rowley-Conwy 1981; 1993; Andersen 1975; 1994; Enghoff 1994).

Mesolithic flint artefacts have been known for many decades from surface collections on inland sites in Jutland (they were earlier labelled "Gude-

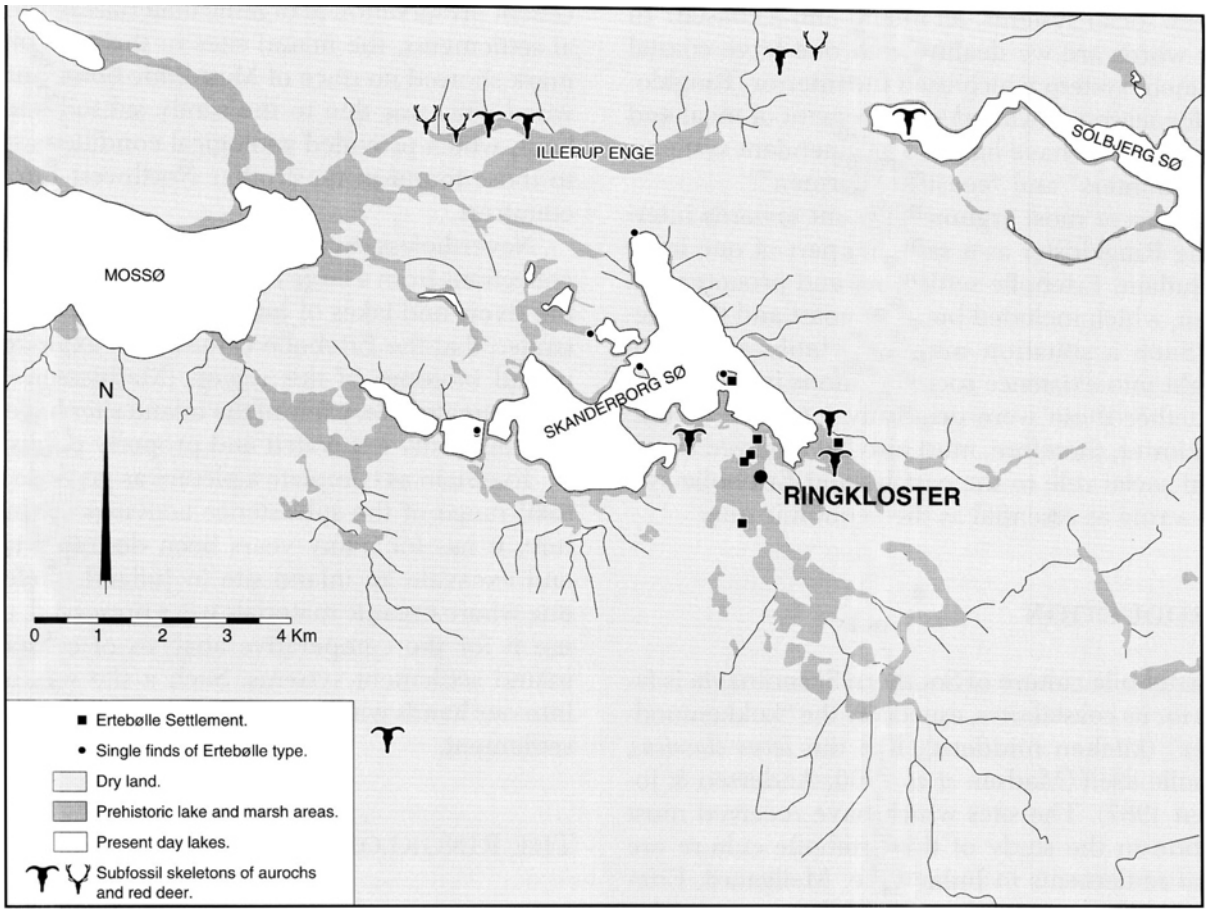


Fig. 2 The extension of the lakes in the Skanderborg Sø region in the Late Atlantic (dark shaded). Subfossil finds of aurochs and red deer are indicated; single finds and settlements of Ertebølle type are marked; S. Kaae del.

naa Culture" (Mathiassen 1937), a term which today has been totally abandoned because it is based on mixed sites containing artefacts from all Danish Mesolithic cultures (Andersen & Sterum 1971).

In actual fact the Ringkloster settlement was *not* a new Mesolithic site. It had been known for years, and amateur archaeologists had collected artefacts from the surface of the ploughed field. It was labelled as site no. 86 by Mathiassen, when he published his paper on the "Gudenaa Culture" (Mathiassen 1937, p. 53). Apart from a single test-pit in the settlement area proper, no excavation took place on this site in connection with his work in the late 1930s.

In 1969 drainage work in the bog adjacent to the settlement exposed large quantities of Ertebølle artefacts, and as a great surprise also well preserved animal bones, antler and wood. The artefacts and the presence of the organic materials showed that for the first time a west Danish inland Ertebølle settlement had been found with good preservation conditions for organic materials. A test excavation followed, and revealed a 20-80 cm thick "waste layer" or "dump zone" of discarded material in the prehistoric lake sediments (today a bog) in front of the dry land settlement. The situation at Ringkloster is therefore similar to that at many other Late Palaeolithic and Mesolithic sites of Northern Europe, i. e. it incorporates a habitation area proper on dry land and an adjacent "dump" in the lake sediments in front of the settlement, e.g. Stellmoor, Star Carr etc. (Rust 1943; Clark 1952).

Geology

Ringkloster is located in eastern Jutland very close to Skanderborg Sø, one of the most beautiful areas of Denmark, consisting of a mixture of steep forest-covered hills interspersed with wider valleys, small boggy areas and larger lakes (fig. 2). The area is called "the central Jutland lake upland" (Jacobsen 1976, p. 2), and ca. 10 km to the Southwest is the highest part of Denmark with elevations of up to 173 m. 3 - 5 km to the East-Northeast we find the lake, Solbjerg Sø, and 8 km to the west is the large lake, Mossø. In the past there used to be another large lake to the North, now the bog Illerup Enge (fig. 2).

Skanderborg Sø is one of the largest lakes in Denmark (ca. 9 km^2), today measuring 4-5 km North-South and 6 km East-West; by Danish standards it is deep (18.8 m), and in the Mesolithic (with less sediment) it must have been even deeper. The bottom-relief is like the surrounding landscape very undulating. The shores (especially towards North and East) are steep and depth increases rapidly, and therefore the reed belt along the lake is narrow. Many small rivers and springs have their outflow in the lake - especially towards the east and south (fig. 2).

The distance from Ringkloster to the east coast of Jutland (Norsminde Fjord) is as the crow flies ca. 14-18 km; to the Northeast (Brabrand Fjord) it is ca. 18-20 km; and to Horsens Fjord in the South it is ca. 14-15 km. In the Late Mesolithic the fjords cut much further into eastern Jutland and the distances were some kilometres shorter (fig. 3)[1].

Skanderborg Sø is located just 6 km west of the main watershed in eastern Jutland, and as a part of the Gudenå catchment area it is drained to the west via Mossø into the Gudenå, which then runs in a North to Northeast direction to the sea ca. 55 km away at Randers Fjord. Topographically the Skanderborg Sø catchment area is separated from Horsens Fjord (to the South) and Norsminde Fjord (to the East) by ridges of hills, running parallel to the coast. There is therefore no direct connection by water from Ringkloster to the east coast (fig. 3).

The subsoil of this region is a mixture of morainic clay and meltwater sand and gravel. The areas to the North, East and Southeast of the lake are dominated by morainic clay, while sand and gravel dominates towards the west and Southwest. At the settlement proper the subsoil is clay, while the opposite side of the lake is characterised by sand and gravel. The bottom of the prehistoric lake in front of the settlement is blue-grey calcareous clay.

Along the southern edge of Skanderborg Sø is a large system of morainic hills running E-W; this ridge was formed during a late stage of the Weichselian glaciation, when the ice front was just south of the lake (Harder 1908). To the south this hill ridge is connected with a 3-4 km long (NW-SE) and 1-2 km wide "valley" which was either eroded by a small local glacier or by melt water running towards the north from the ice front to the south.

A large local meltwater lake formed in this valley, and thin layers of calcareous clay and fine sand were deposited on the lake bottom ("varves") - a geological situation quite different from that in the rest of the Skanderborg Sø system, which follows the "normal" geology of this region, i. e. with sediments of melt water sand and gravel (Harder 1908).

The presence of this type of clay combined with a high water level in the modern bog is the background for the extraordinary preservation conditions at this location. In the rest of the Skanderborg Sø area several other Mesolithic settlements are known, but they are all without organic material, and follow the normal west Danish pattern with only flint, stone and charcoal preserved.

The Late Glacial and Early Postglacial history of Skanderborg Sø is well illustrated by systems of lake terraces along the shores, which show a gradual lowering of the water level from ca. 29.50 m above present sea level in the Late Glacial to ca. 24-25 m in the Mesolithic; the modern lake level is 23-24 m above sea level.

As the connection between the valley and Skanderborg Sø was very narrow and the above mentioned morainic ridge formed a sort of threshold on the lake bottom, it was impossible for the sediments to be washed out into the much larger and deeper parts of Skanderborg Sø, resulting in a very fast sedimentation in this part of the lake.

As early as the Atlantic period a swamp with a dense vegetation of alder (*Alnus sp.*) was established

[1] We have tried experimentally to measure how long it takes in a modern environment and without any close knowledge of the terrain to walk from the coast to Ringkloster. The result was 5-6 hours.

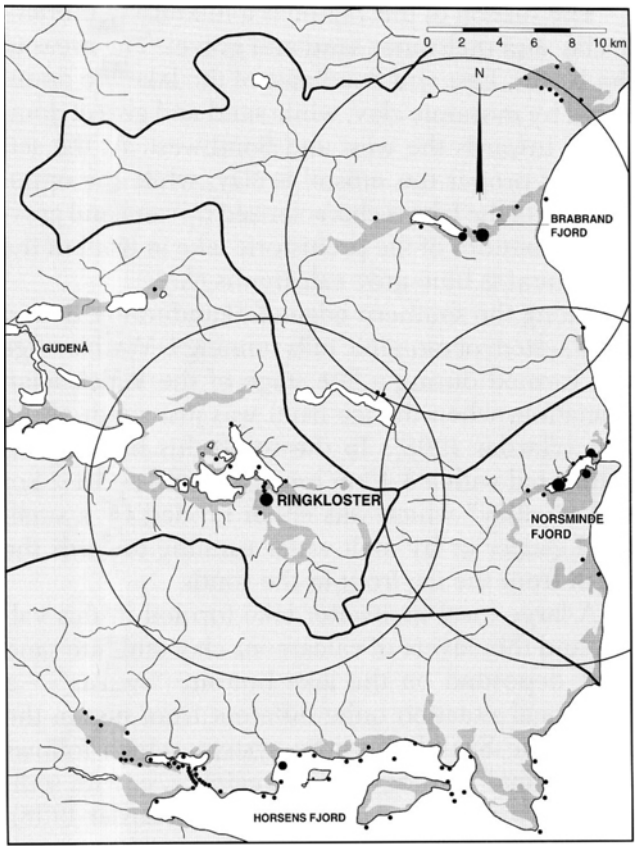


Fig. 3 Central eastern Jutland with the maximum extension of High-atlantic fiords and lakes (dark shaded): Ertebølle settlements are also indicated. The biggest settlement, "central" site in each resource area is marked by a large dot. Each "central" site is surrounded by a 10 km circle; Thick black lines indicate main water sheds S. Kaae del.

along the lake shore, and the accumulation of sediments continued during the following millennia.

Another geological aspect of this area is the occurrence of large deposits of red ochre only 1.6 km to the east of Ringkloster. The concentration and extension of ochre is so large, that even today the fields and hillsides are coloured bright red; the ochre was exploited and used as the basis for paint production as recently as in the 16th century[2].

The environment

In the Mesolithic Skanderborg Sø was much larger than today especially towards the West, Southeast and South, where it had several large extensions which today are bogs (fig. 2). These areas, especially those to the South, must at this time have been lakes, extensive swamps and boggy areas and a very characteristic topographic element in the biotope of the Mesolithic. The southern part of the lake had also a lot of small inlets, and the steep-sided hills were cut by gullies going down to the lake shore. Altogether this gave a very varied biotope.

The lake in front of the Ringkloster settlement was 3-4 km long and 6-700 m wide, and was connected with the main lake through a very narrow opening where "Ringkloster" (today a farm) is located[3].

The sediments and levels of the cultural layers responded to variations in the level of the prehistoric lake. During the Late Mesolithic occupation (pollen zone VII) we observe a gradual rise in the water level, followed by a lowering indicating a change to a drier climate at the transition from pollen zone VII-VIII (Atlantic-Subboreal) at ca. 3900 B.C.

Humified peat could be followed to an altitude of ca. 25 m, and this combined with the archaeological finds shows the maximum extent of the lake and the position of its shore during the Ertebølle occupation.

The pollen analysis gives a detailed picture of the vegetation around the settlement before and during the habitation period from the Atlantic to the early Subboreal (pollen zone VII-VIII) (Rasmussen this volume).

Prior to the occupation (in the Atlantic period, pollen zone VII) the landscape was characterised by a dense and stable primeval forest dominated by lime (*Tilia sp.*), elm (*Ulmus sp.*), oak (*Quercus sp.*), hazel (*Corylus avellana*) and alder (*Alnus sp.*) with a restricted field layer vegetation. In the forest there was also a dense vegetation of ivy (*Hedera helix*), which may have been a climber on tree trunks and branches. The most dominant vegetation type near the settlement however was an extensive alder carr covering

[2] One cannot exclude the possibility that this resource also was exploited in the Mesolithic, cf. the use of red ochre for tanning skins etc.

[3] "Ring" is a Danish place name and "kloster" is Danish for "monastery". In the medieval period "Ringkloster" was a convent.

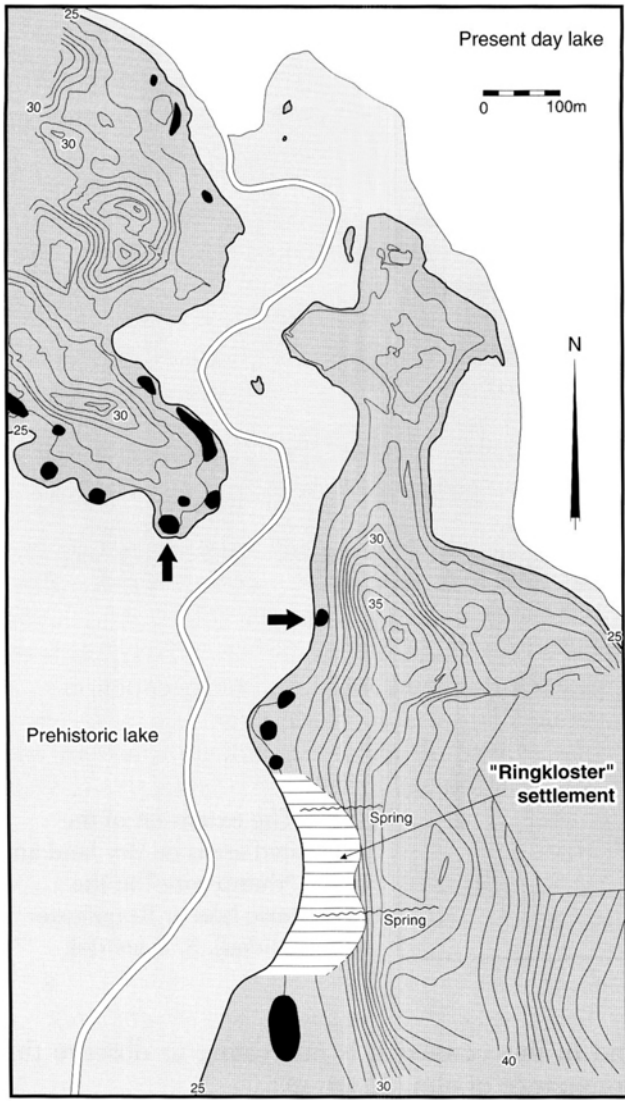


Fig. 4 The Skanderborg Sø and the Ringkloster area in the High Atlantic period, 4000 B. C. "Smaller", Late Mesolithic Ertebølle sites in the vicinity of the Ringkloster settlement are marked by black. Arrows indicate where test excavations have taken place. S. Kaae del.

a belt along the lake margin, with open water only found further from the shore. Also today dense alder carr vegetation is a characteristic feature along the shores of Skanderborg Sø - especially where the lake is shallow.

From the beginning of the Ertebølle occupation the settlement refuse was deposited in organic mud (gyttja) - indicating there was open water in front of the settlement, but gradually (mainly from the transition Atlantic/Subboreal) the lake filled in and the lake shore changed into a dense alder carr. The preservation conditions were very good, but some of the organic remains have been gnawed by mice and beetles, probably because they lay on the surface for some time before they ended up in the wet, calcareous sediments[4].

An important question is whether it has been possible to find traces of man's impact on the surrounding vegetation. According to the palynological investigations (Rasmussen 1998 - this volume) two main phenomena are observable during the Ertebølle occupation in the Atlantic: A contemporary and distinct elm and lime decline several hundred years before the end of the Ertebølle phase. Thus the elm decline at Ringkloster is older than the "classical" Danish elm decline at the transition from Ertebølle to Funnel beaker culture, ca. 3900 B.C. According to Rasmussen the early elm and lime decline at Ringkloster is likely to reflect the local activities of the Ertebølle population, either as a clearing of the surrounding forest, or as a systematic selection of lime and elm trees to make canoes, dwellings and wooden tools. This opinion is supported by the dominance of elm in the charcoal samples. Also the relatively high frequency of hazel (*Corylus avellana*) could be a result of human impact, in this case of systematic coppicing of hazel to produce long and slender stakes for fish fences, etc., such as have been found at Ringkloster and are a very characteristic aspect of many Ertebølle (coastal) settlements, e. g. Tybrind Vig (Andersen 1985, pp. 60-61). Also hazelnuts were an important food resource and an essential component of the diet.

Later (at the beginning of the Subboreal period, ca. 3900 B.C.) the pollen diagram indicates a fall in the lake level and a simultaneous decrease of the forest followed by a higher frequency of open ground herbs; the first pollen finds of ribwort (*Plantago lanceolata)* are recorded at this stage. These vegetation changes demonstrate an opening of the primeval forest, and the activity of Neolithic farmers in the vicinity (also indicated by archaeological finds at the

[4] Unpublished report from cand. scient. Bodil Noe-Nygaard of 18/3 - 1985.

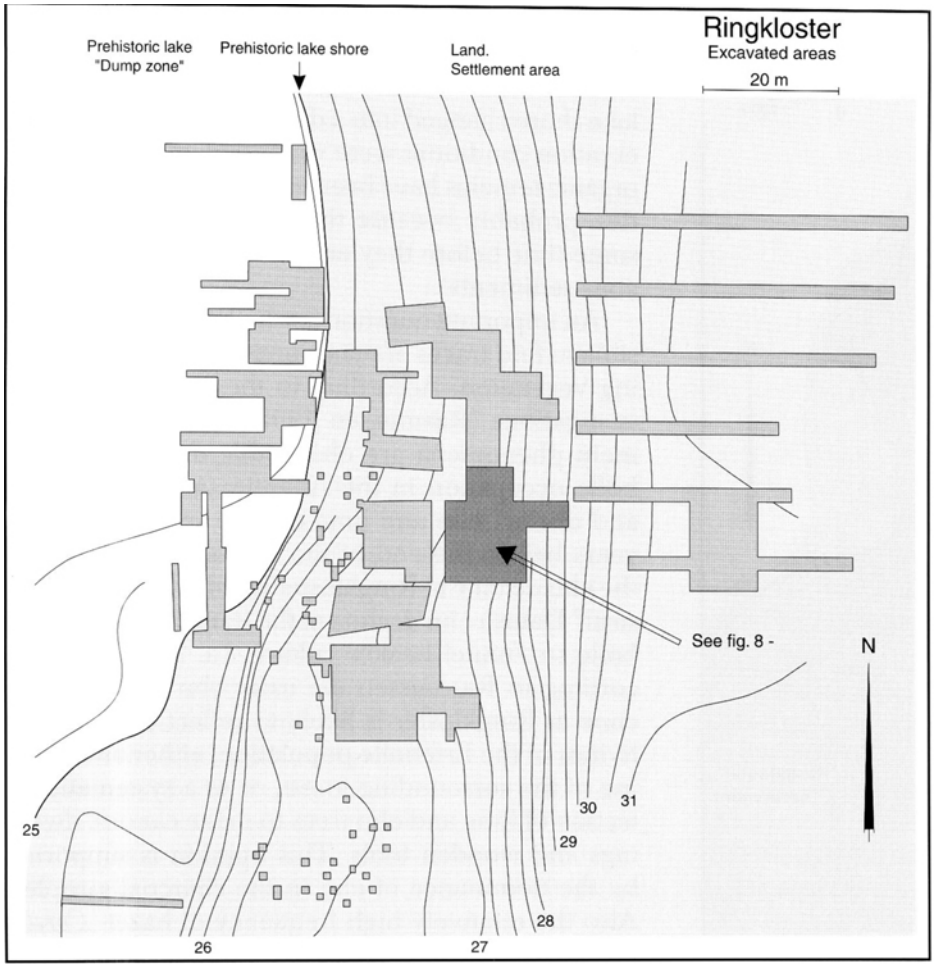


Fig. 5 The extension of the excavated areas on dry land and in the "dump zone" in the prehistoric lake at Ringkloster (dark shaded). S. Kaae del.

site - see later). The decrease in the forest is a sign of anthropogenic influences aimed at making clearances for cattle grazing; traces of arable farming are not directly recorded in the two Ringkloster diagrams.

A sample of 205 pieces of wood from the Ertebølle occupation layer (of which 115 were charred) has been determined as to species (Malmros 1986)[5]. The commonest charcoals identified were elm (*Ulmus sp.*) (24%), hazel (*Corylus avellana*) (17%), oak (*Quercus sp.*) (17%) and alder (*Alnus sp.*) (16%), which reflects the types of wood used at the site as firewood and left over from the production of wooden tools. This sample gives an impression of which specie(s) of wood were chosen by the inhabitants, and in this context it is interesting to observe the dominance of elm (*Ulmus sp.*).

The determinations of the unworked and uncarbonized wood show that alder was completely dominant (70%), followed by elm (10%) and hazel (9%). This shows the type of vegetation growing close to the settlement. Analysis of seeds and fruits from the cultural horizons in the lake sediments has also been carried out (see later)[6].

The fauna of the late Atlantic/Early Subboreal in the region around Skanderborg lake is shown by the thousands of animal bones from the "dump zone" in front of the settlement, and by subfossil

[5] Unpublished report by C. Malmros in the National Museum, NM VIII A 5502 of 11/11-1986.

[6] Unpublished reports by G. Jørgensen in the National Museum, NM VIII A 5502 of 18/9-1974 and 28/1-1976.

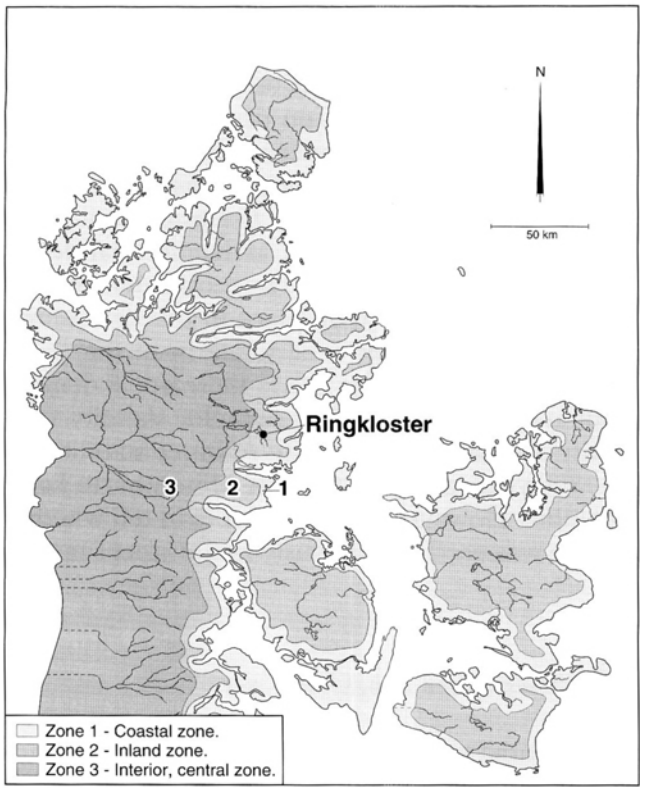


Fig. 6 The position of Ringkloster in relation to the 3 Ertebølle occupational zones in Jutland. S. Kaae del.

skeletons of aurochs (*Bos primigenius*) and red deer (*Cervus elaphus*) found during peat-digging in bogs of the region (fig. 2)[7]. For a description of the faunal remains: see the papers by Rowley-Conwy (1998) and Enghoff (1998) in this volume.

The many small rivers and the lake offered excellent opportunities for fishing, and the extensive swamps and marshy areas, especially south of the settlement, must have offered very good conditions for wild boar, waterfowl etc.

Altogether the area around the site constituted a very mixed biotope which included primeval forest, extensive alder swamps, lake shores, open lake, many small streams and rivers, and the possibility of good fishing at the narrow passage between the two parts of Skanderborg Sø.

[7] The data for the map, fig. 2, have been kindly submitted by Knud Rosenlund, Zoological Museum, Copenhagen.

The settlement

The settlement lay at the northern end of the prehistoric lake, ca. 800 m south of the narrow passage between the two parts of Skanderborg Sø. The concentration of other Mesolithic sites where the two lakes join is a reflection of the fact that such a position is favourable for fishing, but as Ringkloster is further to the South it is doubtful if access to good fishing played any role for its location (fig. 4).

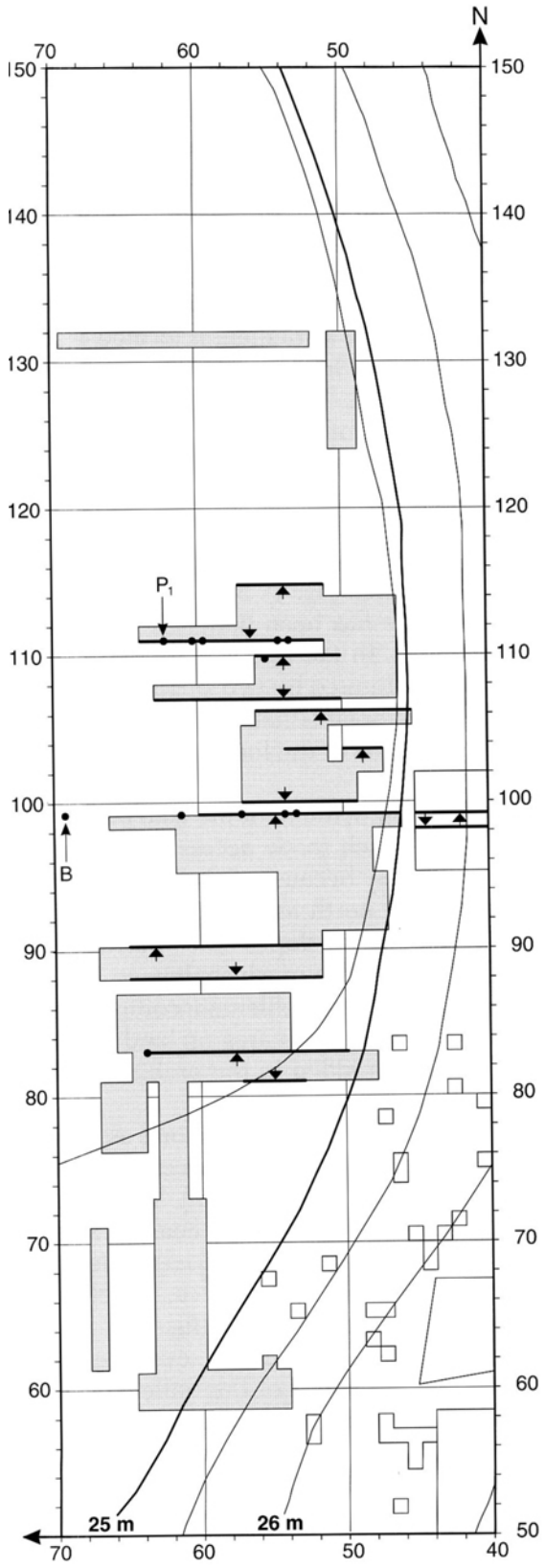
The Ringkloster settlement is located at the sloping foot of a 3-4 m high, rather steep hillside facing West to Southwest. This hill belongs to a large glacial terrace which follows the eastern side of the bog/lake area. In the Late Glacial or early Post Glacial the lake eroded the terrace at a level of ca. 26.5 - 27 m above sea level, thereby forming a 20-30 m wide flat area running east-west along the lake, which was the settlement area (fig. 4). Subsequent to the Stone Age the hillside has been flattened out by erosion and ploughing. To the North and South the settlement area is delimited by two small headlands, and at the site two streams had their outflow from the hill - probably one of the location factors of the settlement (fig. 4).

In front of the settlement the lake bottom slopes very steeply, which made access to the settlement from the lake easy because of the great depth of water. Towards the north and south (where the headlands are) the bottom slopes much more gently and the lake was therefore much shallower.

The full Ringkloster settlement comprises two different units - a settlement area on land and an associated dump or midden in the prehistoric lake deposits in front of this.

The settlement area on the shore, as defined by the distribution of flints, measures ca. 100x30 m orientated north-south (ca. 3000 m^2). This is the same size as the largest contemporary coastal *"køkkenmøddinger"* (Andersen 1995). The adjacent "dump zone" in the lake sediments measures ca. 90x20 m orientated north-south (ca. 1800 m^2)(fig. 5).

To both the North and South several smaller and well defined flint scatters of Ertebølle type are to be found well separated from the main site. To the North at least 3 such flint concentrations have been recorded, measuring 20x20 m, 10x10 m and 10-15x15 m respectively. To the South 2 concentrations measuring ca. 20x20 m and 10x10 m are also known, and



Mesolithic flint debris has in addition been found on the terrace to the rear of the settlement (fig. 4). The horizontal distribution of cultural remains in the main settlement area on dry land furthermore reflects smaller discrete concentrations. All these observations prove that Ringkloster was not one large settlement unit from the very beginning, but is the result of an accumulation of archaeological debris from many visits to the site. The most extensive and intensive occupation took place in the Late Mesolithic Ertebølle period - particularly in the Late/ Younger Ertebølle. The site is therefore a demonstration of a high level of topographic stability/continuity and thereby indirectly resource stability for ca. 1800 years covering the Late Mesolithic to Early Neolithic. However, it is impossible to tell whether the site was used continuously in the strict sense or not.

The setting of the Ringkloster site

It is essential to see settlements not only as individual sites, but also as a part of the territory in which they were located, and of the larger settlement system in which they functioned.

In view of this the Skanderborg Sø region has been the object of intense reconnaissance for many years, but despite this no more than 5 other Ertebølle sites have been recorded (apart from scattered stray finds of blade cores, axes, etc.)

A cluster of small flint concentrations is found on a SE facing headland ca. 375 m NNW of Ringkloster - closer to the narrow passage between the two prehistoric lakes (fig. 4).

All the other Ertebølle sites in the lake area are distinctly smaller than Ringkloster and measure only ca. 10-20x10-20 m; flint debris and flint artefacts have been surface-collected from ploughed fields, and in two cases small test excavations have been carried out (fig. 4).

If we look at the area in terms of site catchment (Vita-Finzi & Higgs 1970), ca. 30% of the total area

Fig. 7 Excavated areas in the "dump zone" at Ringkloster. Measured sections are indicated by thick, black lines and arrows. The position of the pollen series "P1" and the boring "B" is also marked. Other pollen series are indicated by black dots. S. Kaae del.

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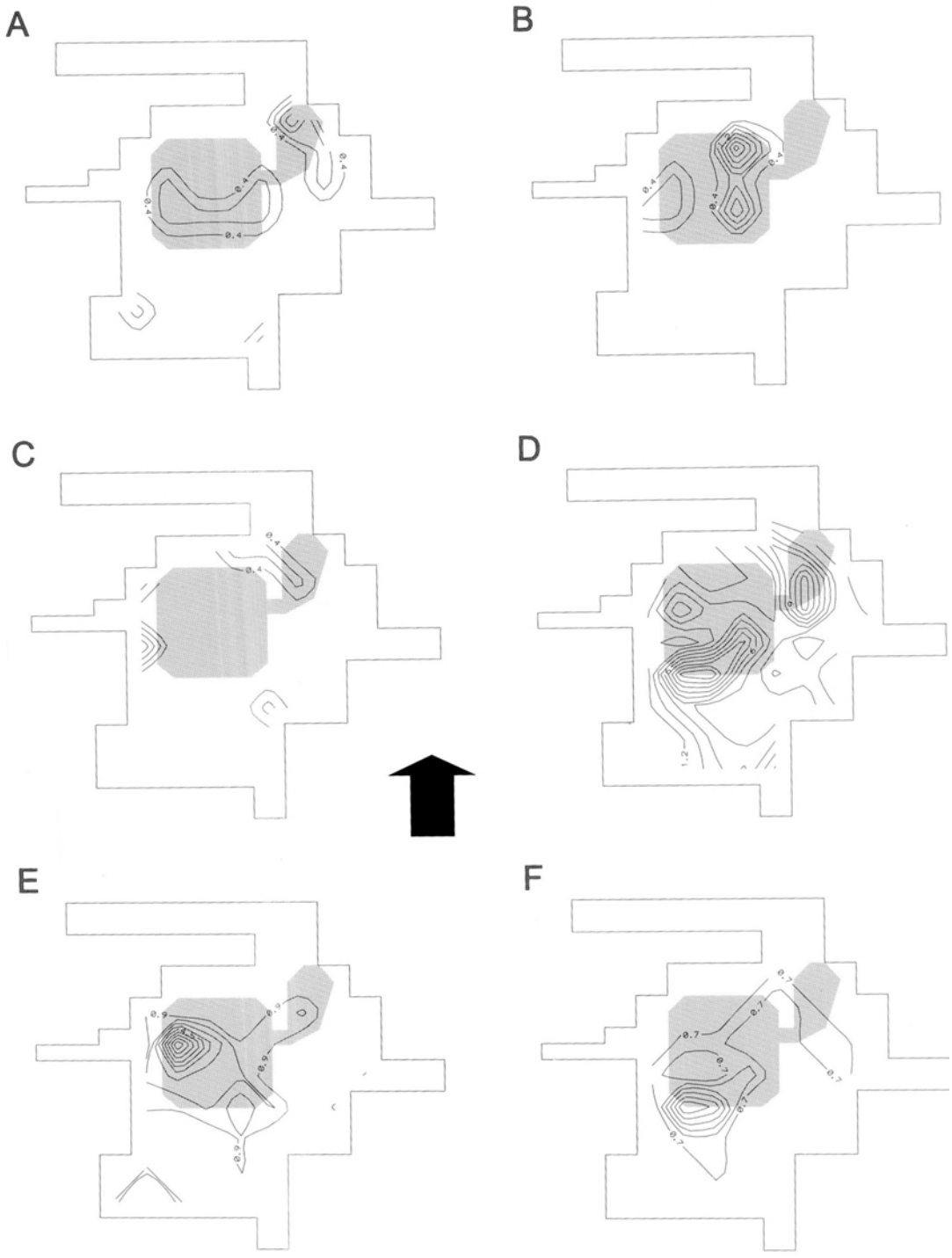


Fig. 7. Distribution of: A, broad trapezes, equidistance 0.4, max=2; B, burins and burin spalls together, equidistance 0.4, max=3; C, knives with retouched backs, equidistance 0.4, max=2; D, blades and blade fragments with micro-polishes on their edges, equidistance 1.2, max=120; E, intact blades with no observable micro-polishes on their edges, equidistance 0.9, max 9; F, intact blades with micro-polishes on their edges, equidistance 0.7, max=7.

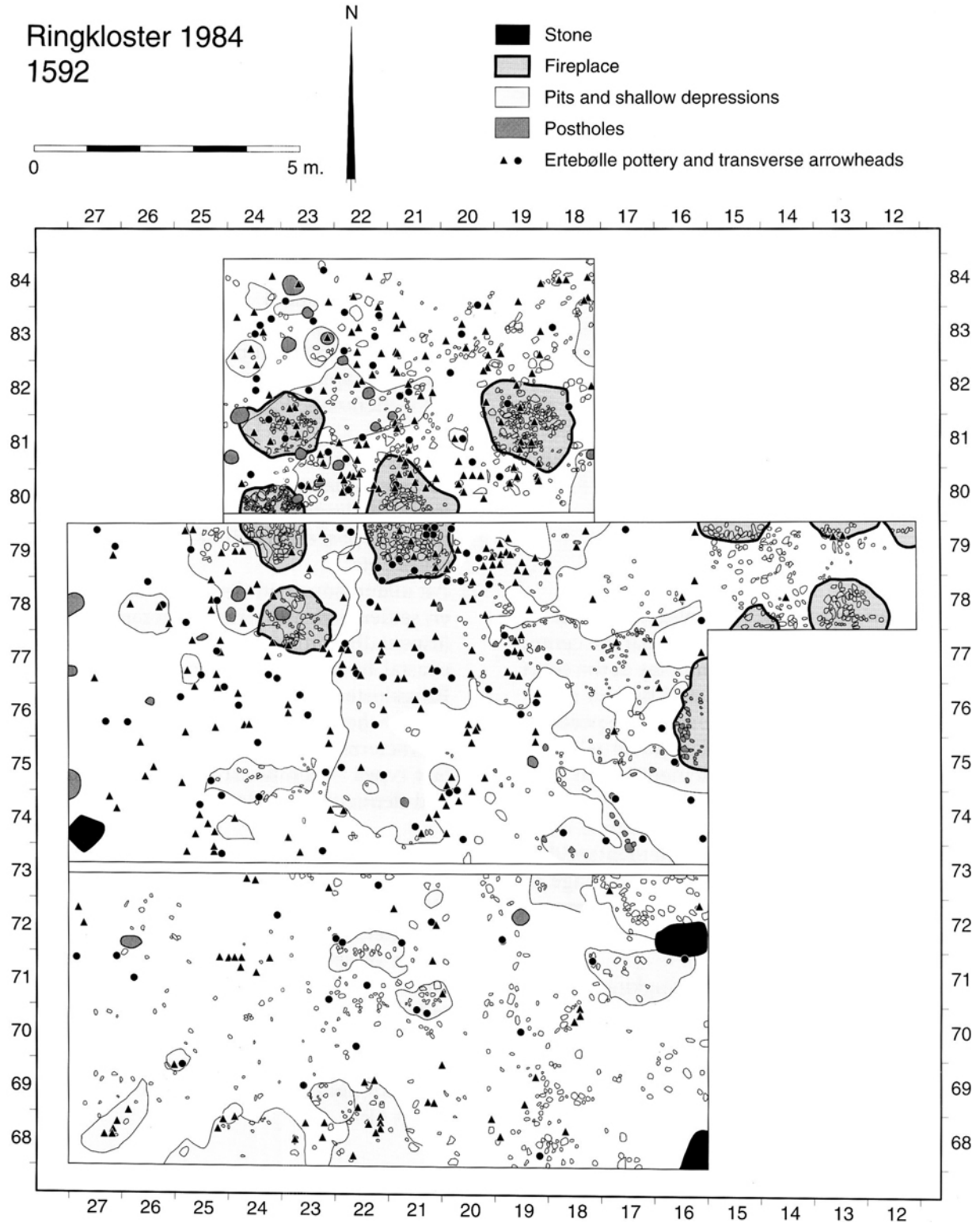


Fig. 8 Excavation plan of a part of the Ringkloster settlement on dry land. Black dots indicate transverse arrowheads of late Ertebølle-type. Black triangles indicate thick-walled Ertebølle pottery. S. Kaae del.

within a 5 km radius (78.57 km^2), in the Late Mesolithic was lake, ca. 22% swamp and ca. 48% high-lying, dry ground. Within a 10 km radius from the settlement (ca. 314 km^2) lake made up ca. 11%, swamp ca. 7%, and dry land ca. 82% (fig. 3).

Altogether the inland Ertebølle settlements of the Skanderborg Sø territory cover ca. 7000 m^2 (fig. 3).

Reconnaissance along the shores of the other lakes in the region has not revealed any other large Ertebølle sites, but only stray finds and small flint scatters, and it is therefore an open question whether any other large settlements existed.

The conclusion is that Ringkloster gradually became the largest settlement in the Skanderborg Sø territory, primarily because it remained located at the optimal position in the resource area (the centre of Skanderborg Sø) for 1800 years. It can therefore be regarded as a sort of "central site" in the Late Mesolithic in this East Jutland territory (fig. 3).

Ringkloster in a regional context

The distribution map of the Ertebølle settlements in Eastern Jutland clearly demonstrates that the centre of gravity of the Ertebølle habitation lay at the coast (fig. 3). Here we find the largest and biggest settlements. Even if we take all source critical aspects into consideration, this fact is indisputable whether expressed in the number of settlements, their size, the thickness of the deposits or the number of tool types. A crude expression of this is a simple comparison of the total area of all the settlements within a 10 km radius of the central site, Flynderhage in Norsminde Fjord (ca. 11700 m^2) with the contemporary inland sites on Skanderborg Sø (ca. 7000 m^2) (Andersen 1995, pp. 48 and fig. 7).

Seen in a regional perspective Ringkloster is located where the distance to the nearest coastal area is ca. 14-18 km., whether one goes towards the North-east, east or south. In these fjords we find many contemporary Ertebølle settlements, and they are structured with one or two large, centrally situated sites surrounded by smaller "satellite" sites (fig. 3).

The topographical facts raise the obvious questions whether Ringkloster represents an inland forest system ("forest-hunters") independent of the coastal system ("coastal fishermen") - and if so how the system functioned in relation to the coast - or whether it was part of one "large system" with its centre of gravity on the coast incorporating both coastal and inland resource areas. These questions are dealt with later in this article.

Ringkloster in the settlement pattern of western Denmark

Traces of Ertebølle inland activities are known from most central and south Jutland rivers and lakes. Based on the number and range of tool types it is possible to divide the Ertebølle habitation in this region into 3 occupation zones, each characterized by its topographical location and the artefact types of the settlements (fig. 6).

1) A coastal zone (extending 0-10 km inland) with the great majority of the settlements, which are generally large in extent and have a wide range of tool types, especially of axes (Ertebølle, Norsminde etc.).
2) An inland zone with fewer (and generally smaller) settlements with a restricted range of tool types (especially with few axes) stretching from the coastal hinterland up to ca. 30 km inland, e.g. Ringkloster, Satrup Moor.
3) Finally there is An interior, central Jutland zone characterized by very small sites with few artefact types - mainly arrowheads, blade scrapers and denticulate blades.

A large number of the so-called "Gudenaa Culture" sites belong to the last mentioned group (Mathiassen 1937). As none of these sites have preserved organic material, we have no possibility of any determination of seasonality and subsistence activities. However, the preferred topographical location on river banks and along lake shores combined with the small area of the sites and the many arrowheads strongly argues in favour of interpreting these localities as Ertebølle "hunting camps" (Binford 1983, pp. 118 - 119).

EXCAVATION

The excavations began in 1969 and continued until 1985[8]. From the very beginning the work was estab-

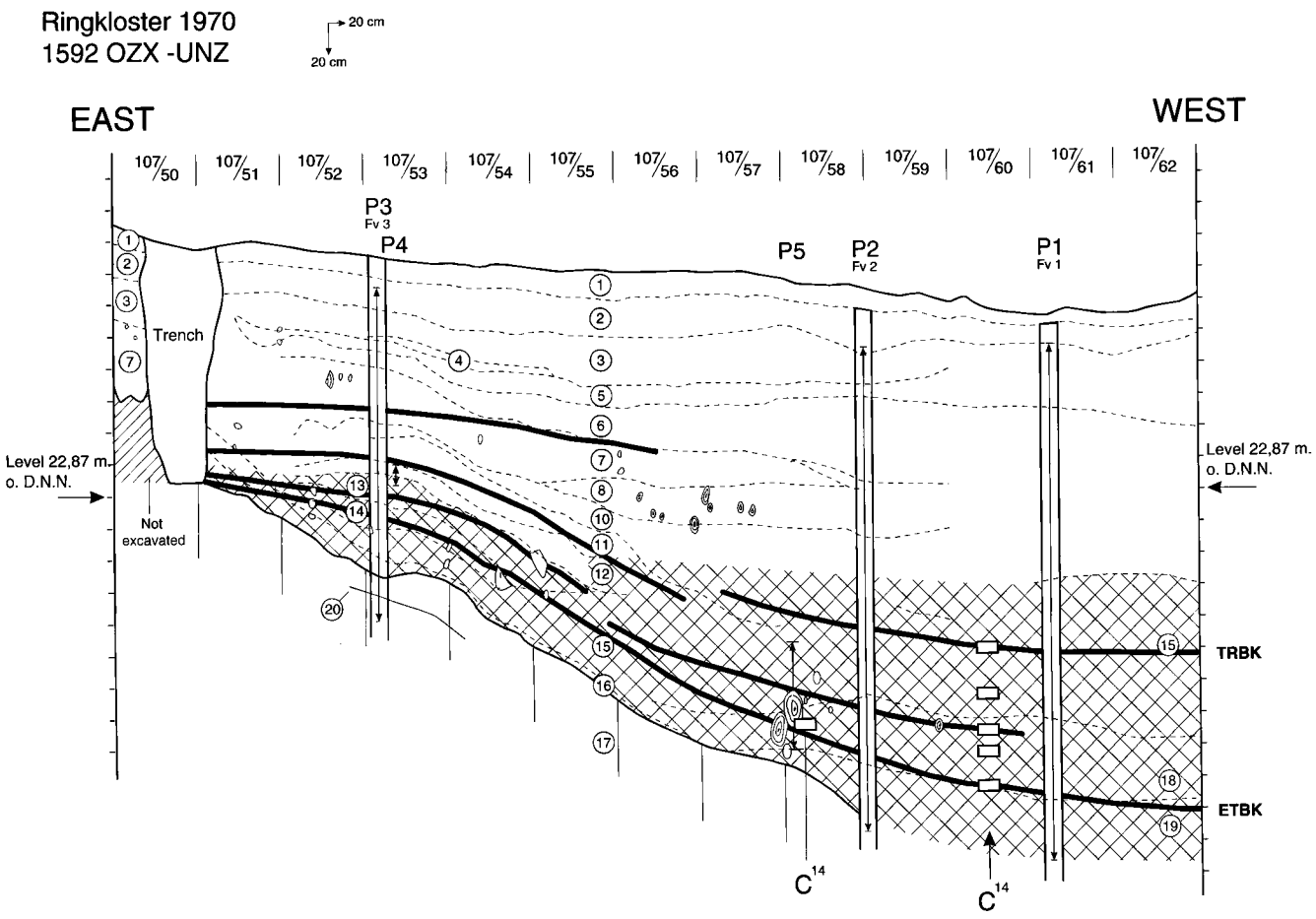


Fig. 9 East - West section running from the lake shore (left) through the "dump zone" into the lake deposits adjacent to the settlement. The gyttja horizons are cross hatched. The thick black lines indicate the main concentrations of artefact depositions. S. Kaae del.

lished as an interdisciplinary project with co-operation between archaeology and the natural sciences, and during the campaigns specialists from several disciplines participated in the fieldwork.

During the first years (1969-1980) the investigations were concentrated on the cultural deposits in the prehistoric lake (today a bog) with its exceptional organic finds, while the excavations from 1980-1985 were conducted on the settlement area proper on dry land and along the shore of the prehistoric lake. In an attempt to find a Mesolithic cemetery a natural terrace to the rear of the site was investigated by a series of test trenches and a large square (fig. 5). Altogether ca. 500 m^2 were excavated in the bog, and ca. 1600 m^2 on land. The Ringkloster investigation therefore belongs among the largest excavations of a Mesolithic settlement in northern Europe and includes in contrast to most other Mesolithic excavations not *only* the "midden" or "dump zone" (or a part of it), but *also* the main part of the habitation on dry land (fig. 5).

The habitation area proper was investigated in horizontal layers of 5 or 10 cm's thickness; features and discoloration were planned and described, and also documented with black-and-white and colour photographs. All artefacts were plotted with 3 co-

[8] The Ringkloster excavation has been sponsored by the Danish Research Council for the Humanities, Aarhus Universitets Forskningsfond and Arbejdsmarkedsnævnet for Århus Amt.

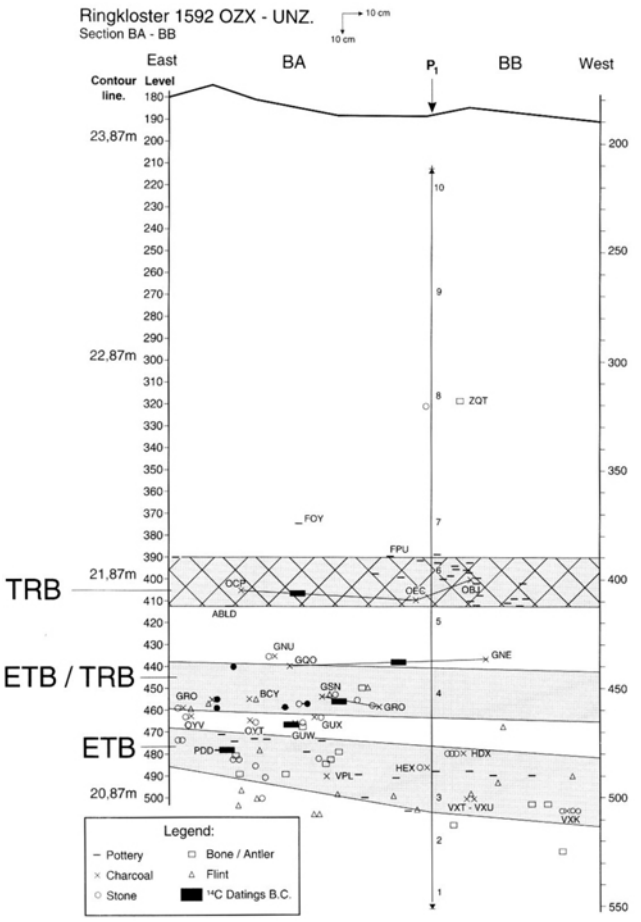


Fig. 10 The position of the pollen series "P 1" and the "cultural horizons" as they are defined by characteristic pottery. The Ertebølle horizons are shaded and the Funnel Beaker horizon is cross hatched. Black dots indicate Early Neolithic(?) sherds or sherds of a Mesolithic-Neolithic (transitional) type, cf. fig. 26. S. Kaae del.

ordinates, while flint debris was recorded by square meter.

The excavation in the prehistoric lake was carried out very carefully with 3-dimensional measurement of all objects, and pollen samples and material for ^{14}C dating were taken. Samples of the depositswere water screened. Owing to the very steep bottom of the prehistoric lake and the high (natural) water level, the excavation was technically very difficult, and depended on constant pumping and shoring up of the sections in the bog.

During the excavation a large number of sections at 1 or 2-3 m intervals were measured and described (fig. 7). Also 9 borings were made in the bog with the object of investigating the sediment stratigraphy and of obtaining samples for plant macrofossil and pollen analysis. One of these borings, "B", has been analysed, and from one of the open sections the pollen series "P1" has been investigated (fig. 7) (Rasmussen 1998 - this volume).

Of special importance is the pollen series P 1, because it comes from a clear stratigraphic and ^{14}C dated sequence with well defined archaeological types of Ertebølle and Early Neolithic Funnel Beaker culture material. Therefore this pollen series gives one of the very few direct correlations in Denmark between faunal/environmental analysis and well defined archaeological stages (cf. fig 10).

Stratigraphy of the dry land habitation area

Due to soil erosion the habitation area on dry land was covered with sand and sandy humus from the terrace behind. Therefore only a small part of the area had been disturbed by ploughing - mainly the part closest to the modern bog, where the covering sediments were thinnest. Below the eroded sediments was a ca. 20 cm thick *in situ* occupation horizon with cultural debris.

The top layer was a black (charcoal-rich) sandy horizon characterized by many cooking stones, flint debris and artefacts of Ertebølle type. The layer dates to the youngest Ertebølle occupation phase at Ringkloster. The high content of cooking stones is very interesting because layers with similar contents are found also as the youngest horizons at several of the large coastal settlements, e. g. Flynderhage and Norslund (Andersen & Malmros 1966, pp. 37), Bloksbjerg (Westerby 1927, pp. 22-24) and Vålse Vig (Bahnson 1892, pp. 166-168). Below this was a ca. 10-15 cm thick, sandy, cultural layer with Ertebølle material and fire-cracked stones. In this horizon and below (in the top layer of the subsoil), were many settlement features such as stone hearths lying either directly on the surface of the subsoil or in shallow pits, fireplaces without stones, series of stake, and post holes, and also charcoal patches, pits of varying shape, size and depth, and systems of parallel stone filled ditches (fig. 8). Although no well defined building structures were recorded during the excavation, the features and distributions of finds

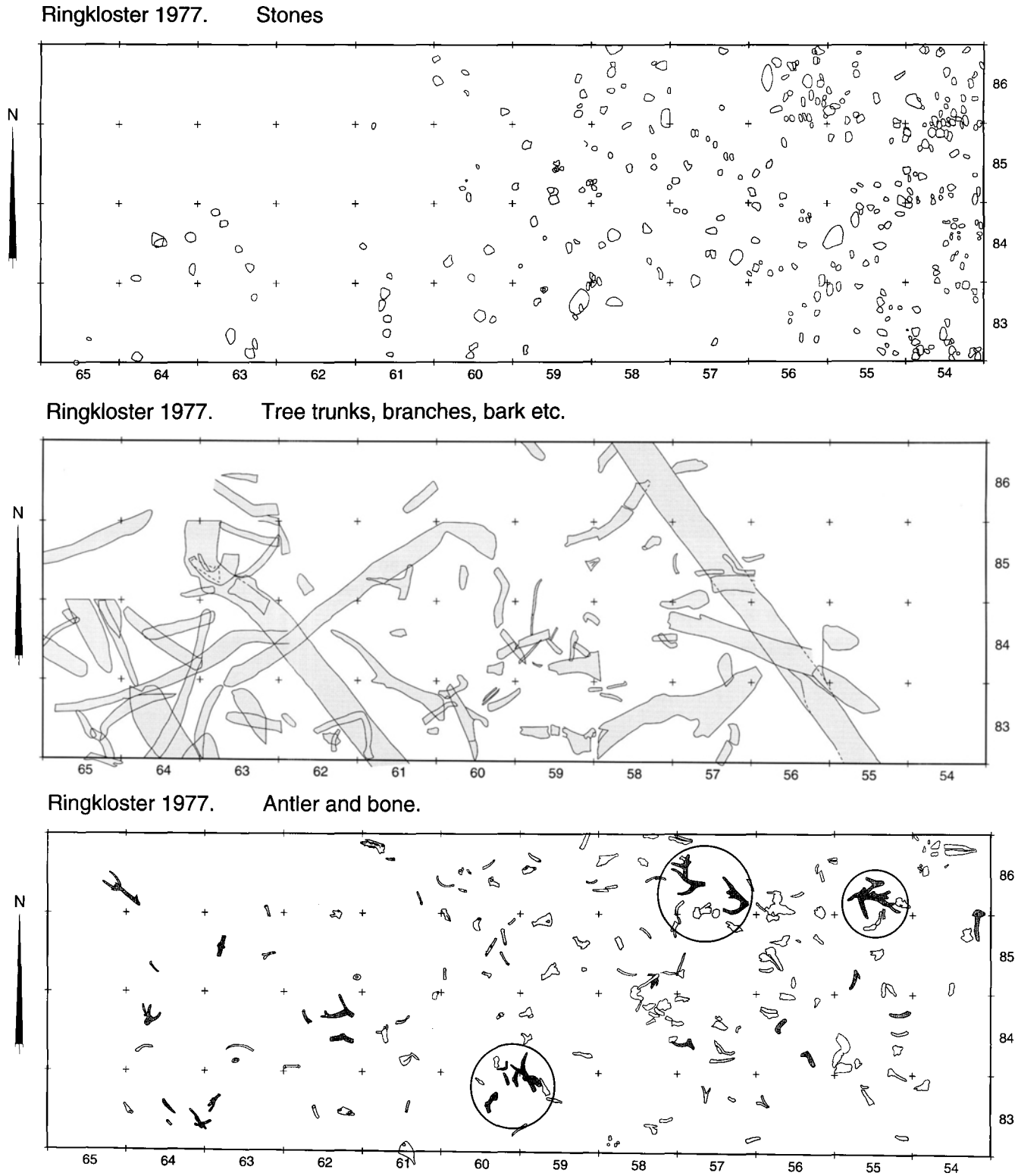


Fig. 11 Plans of the horisontal distribution of stones (top), tree trunks and large branches (middle) and bones and antler (bottom) in the "dump zone" of the excavated square 1977. The prehistoric lake shore is to the right. Antler is dark shaded. Heaps of "antler waste" are marked by a circle. S. Kaae del.

Fig. 12 Heaps of seven pelvis bones of red deer (*Cervus elaphus*) (left) and three pieces of "antler waste" of red deer (*Cervus elaphus*)(right) in the "dump zone". The last-mentioned show clear cut marks at the base and are the remnants of the production of T-shaped antler axes. P. Dehlholm photo.

Fig. 13 Section of the "dump zone" in front of the Ringkloster settlement. Animal bones, antlers, tree trunks and some stones are visible on the surface of the prehistoric lake bottom. P. Dehlholm photo.

Fig. 14 T-shaped antler axe with a part of the preserved handle lying *in situ*. P. Dehlholm photo.

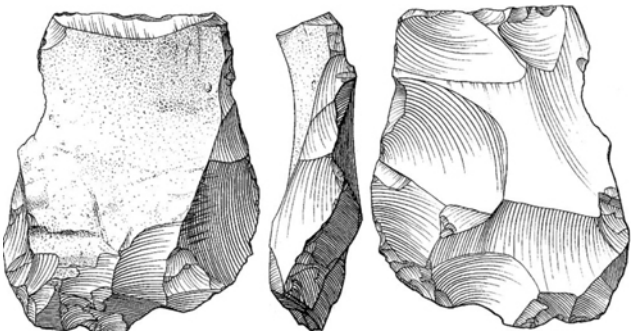


Fig. 15 "Scale worked flake" from the habitation area on dry land. These flakes are a (regional) West Danish type, and are waste from the production of transverse arrowheads in the Older Ertebølle culture of Jutland. (2:3) F. Bau del.

are highly suggestive of dwellings belonging to the Ertebølle phase.

The number and variety of the features at Ringkloster is remarkable, and distinguishes this settlement from the contemporary coastal settlements, where such features are surprisingly few considering the long occupation, e. g. Norsminde and Ertebølle (Andersen 1991; Andersen & Johansen 1987). This is another respect in which Ringkloster clearly represents a different type of Ertebølle settlement.

Due to the thinness of its cultural horizon and the long period of occupation, however, the area on land lacks stratigraphy, and it is therefore only possible to assign rather crude dates or habitation episodes to the individual features. Only the oldest and youngest levels are well preserved. Much work has to be done in the coming years with regards to analysis of the features and associated debris and artefacts from this part of the settlement.

Lake/bog stratigraphy

The sections show a rather uniform stratigraphy (fig. 9). The bedrock is boulder clay. In the prehistoric lake and along the shore this is covered by a series of thin, laminated layers 1-2 cm thick of white-grey calcareous clay and fine grey sand (fig. 9; layers 17+20). Along the shore the upper 5-10 cm of this layer contains scattered cultural debris, which was probably trampled down by the inhabitants.

Out in the prehistoric lake the next layer is a 5-20 cm thick horizon of grey sand with small stones (< 5 cm)(fig. 9; layer 16); at shore the sand is mixed with drift gyttja indicating the erosion and sedimentation of organic materials. Further out this horizon contains freshwater gastropods and bivalves.

This deposit is followed by a horizon of homogeneous, unhumified, fine grained, brownish-green gyttja (*Limus detrituosus*) with many gastropods and cultural remains (fig. 9; layer 19). This is followed by a coarser brown detritus gyttja (or drift gyttja) with gastropods (*Lymnaea sp., Planorbarius corneus* and *Planorbis sp.*), bivalves (*Anodonta sp.* and *Unio sp.*), tree trunks, branches, bark, stones and cultural debris in the form of charcoal, flint waste, animal bones and antlers, worked wood, pottery, and artefacts of Ertebølle types (fig. 9; layer 18). This horizon is followed by a ca. 30 cm thick layer of coarse drift gyttja without molluscs (fig. 9; layer 15). Towards the lake shore the drift gyttja content increases, and gradually the gyttja horizons change into layers of humified alder carr peat (fig. 9; layers 11-14).

Along the prehistoric lake shore the number of tree trunks and branches was very high, being a combination of driftwood from the lake and windfalls from the shore - a phenomenon found at all Danish inland and coastal settlements and a nice illustration of how much natural wood was concentrated at such a Stone Age lake shore. There is no argument

for interpreting this as an artificial construction or "platform" as has been done at Star Carr (Clark 1954, p. 2 and fig. 2; Pitts 1979, p. 33, 36).

The top horizon is 1-2 m thick brown-black, very humified alder carr peat (fig. 9; layers 2-10).

Along the lakeshore the gyttja horizons gradually becomes thinner and more humified, and the content of sand increases. The transitional layer from the sequence in the prehistoric lake to the occupation area on land (the ploughed field) is a black, humified and sandy deposit (fig. 9; layer 7).

Stratigraphy at the pollen series P1 (fig. 10). From bottom to top: the deepest layer is dark grey sand with fragments of freshwater molluscs (layer 1). Above this follows a layer of fine yellow brown gyttja with detritus, shells and shell fragments; in the upper ca. 30 cm of this horizon the first cultural remains appear (flints, animal bones, stones and charcoal) (fig. 10; layer 2). Layer 2 is followed by a ca. 5 cm transitional layer very similar to layer 2, but with more detritus (fig. 10; layer 3). Above this comes a thick layer of coarse, yellow-brown greyish detritus gyttja with tree trunks, branches, twigs, shells, shell fragments, fish bones and fish scales; this is the main cultural horizon and contains many finds of flint, pottery, stones, animal bones, antler and charcoal (fig. 10; layer 4). This layer is covered by a similar type of coarse detritus with branches, bark, twigs, a few shells, and cultural remains such as stones, pottery, flints and charcoal (fig. 10; layer 5). The next layer is a rather coarse, red-brown drift gyttja with scattered cultural debris such as pottery, flints, charcoal and stones (fig. 10; layer 6). Again follows a layer of red-brown gyttja with many secondary alder roots (fig. 10; layer 7). The upper two meters of the sequence consist of yellow-brown (fig. 10; layer 8) or black alder carr peat (fig. 10; layer 9) with alder roots and different degrees of humification (fig. 10; layers 8-9); a few bones and stones have been recorded at different levels in this horizon, reflecting short visits to the lake shore in later prehistoric periods. The top horizon is a black-brown strongly humified alder carr peat covered by grass turf (fig. 10; layer 10).

Our geological investigations and the typological development of artefacts through the sequence of layers demonstrate that in general the stratigraphy in the lake is undisturbed; however, along the lake shore erosion and water level change(-s) could have caused some mixing of sediments and materials.

Cultural horizons in the prehistoric lake

The excavation revealed several cultural horizons in the prehistoric lake sediments. Close to the shore the cultural horizons are embedded in strongly humified alder carr peat (fig. 9; layer 7), while further out they are found in fine gyttja with gastropods (at the bottom)(fig. 9; layers 18-19). Further up it is in coarse detritus gyttja and alder carr peat (fig. 9; layer 15).

The deepest cultural horizon is the Ertebølle layer, which is ca. 50 cm thick. The preservation conditions for organic material are excellent in the deep horizons of organic mud, but preservation of bone, antler and wood was less favourable in the higher levels dominated by the alder carr peat (although good compared with conditions in Jutland as a whole).

Close to the shore the frequency of objects of cultural debris is very high, while further out the content gradually decreases and finally disappears ca. 30 m from the shore. Vertically the "Ertebølle layer" is well defined, being delimited clearly both above and below by peat (close to the shore) and gyttja horizons (further out in the lake). To the north and south the cultural horizon could be followed along a ca. 100 m stretch of prehistoric lake shore, with the highest intensity of archaeological material being between the two small headlands.

Rapid sedimentation has made it possible to subdivide the occupation layer in the lake sediments stratigraphically. Plots of the depths of typical Ertebølle artefacts show two to four separate Ertebølle horizons, each 10-15 cm thick. These became increasingly separated from one another with increasing distance from the shore by layers of gyttja containing very few or no cultural remains (fig. 9-10).

Ca. 20 cm above the youngest Ertebølle horizon and separated from it by ca. 20 cm of coarse drift gyttja with few cultural remains is another horizon (Early Neolithic) ca. 20-30 cm thick, containing charcoal, some flint artefacts and debris, fire cracked stones and pottery (fig. 10). The youngest horizon in the bog contains scattered finds from the younger roman iron age (fig. 9).

The main part of the Ertebølle horizons are found in geological/sedimentary conditions similar to "taphozone" I and II (Noe-Nygaard 1995, pp. 70-73, fig. 33).

The cultural debris occurred along the edge of the prehistoric lake, generally with the highest intensity close to the lake shore, but it is characteristic that the distribution of debris is not uniform, and we can observe differences in the frequency of flints, ceramics and bone/antler between the land area and the lake deposits. While the amount of flint debris is 5-200 pieces/m^2 on the settlement proper, the frequency in the lake is only between 1 and 13 pieces/m^2. In contrast the number of sherds is low on land, while the frequency in the lake is high, very often rising to 50-70 sherds/m^2. The number of bones in the individual squares goes up to 29 pieces/m^2. Often the highest frequency of animal bones was found several metres from the prehistoric lake shore (fig. 11).

In particular some of the larger bones and antler waste occurred in discrete concentrations, presumably representing rubbish from individual households or butchering debris from individual hunting trips (fig. 12). Many of these small "dumps" are within a range of 5 m of the lake shore; further out such bone clusters are absent, and here all bones and antlers are lying individually (fig. 11 bottom).

The composition of these "bone heaps" varied considerably, but generally they consisted of pine marten skeletons, bones of wild boar, or of red deer antlers - often 3-4 pieces lying in a way showing that they must have been deposited contemporaneous - either tied together before being thrown out into the lake or deposited on the surface during periods when it was possible to walk on the ground surface (in dryer or colder seasons). During post-excavation analysis it has been possible to refit several bone and antler fragments, thereby linking together some of these bone-clusters. As regards fish bones the number is generally low, but they occur in delimited concentrations along the prehistoric lake shore; further out in the lake the number of fish bones is very low and here only larger bones such as vertebrae are found.

The Ertebølle horizon is also characterised by the presence of many branches, tree trunks and stones, generally the size of a fist, but sometimes larger - up to the size of a head. They are especially numerous in the top layer, where their frequency is high (up to 25 - 30 stones/m^2). Frequently these stones have been heated before being deposited in the lake ("cooking stones"), but many show no distinct trace of utilisation or heating. At present we can give no reasonable explanation for the presence of these stones, but it is evident that they were disposed of in the lake from the settlement proper during the occupation period.

THE FINDS

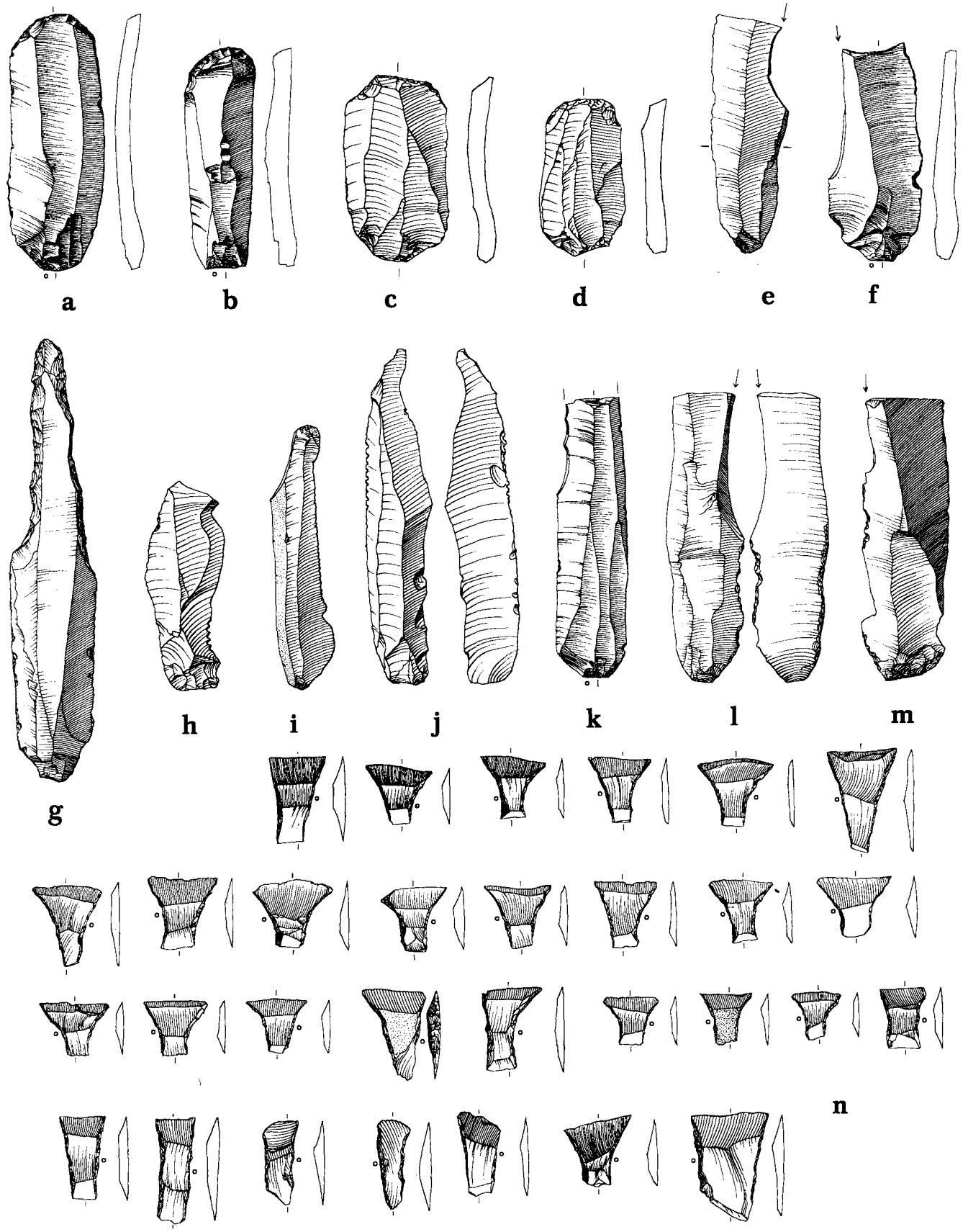
With few exceptions all the excavated material is artefacts and waste from the Late Mesolithic Ertebølle- and Early Neolithic Funnel Beaker Cultures. Some microliths from the Maglemose- and Kongemose cultures are the only finds which do not belong to the main (Ertebølle) occupation phase.

The thickness of the waste deposits and the typological changes in the artefact inventory also support the impression of a long duration of occupation.

If we look at the thickness and extent of the waste deposits associated with the different occupation phases it is evident that two thirds of the Ertebølle horizon belongs to the younger Ertebølle. This indicates a clear expansion of settlement area and intensity during the Late Mesolithic period. This has not been observed before at an inland Ertebølle settlement, and interestingly enough it fits excellently with observations from contemporary settlements on the coast (Andersen 1995, pp. 48).

The horizontal distribution of artefacts demonstrates that the occupation expanded in a horizontal direction and that the southern part of the "dump zone" is the youngest.

It is important to note that no significant difference between the land area and the lake area can be demonstrated with respect to the occurrence of individual implement types, but the frequency of debris is higher on the actual settlement area. In addition there is a clear tendency towards the occurrence of larger (and heavier) objects in the lake than on dry land.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Finds from the Ertebølle habitation area proper

In the settlement proper on dry land the archaeological remains consist of flint artefacts and flint debris, fire cracked stones ("cooking stones"), charcoal, potsherds and a few fragments of animal teeth. The frequency of flint debris and worked flints is low compared to what is found at contemporary Ertebølle coastal sites. Apart from some microliths and rhombic points from visits at the site in earlier Mesolithic periods (Maglemose and Kongemose cultures), all the artefacts of flint belong to the Ertebølle period - especially the late Ertebølle, but a number of scale-worked flakes also demonstrate settlement in the older Ertebølle period (fig. 15)(Andersen 1979a).

Finds from the Ertebølle horizons in the lake

A number of implements of flint, bone, antler, pottery and wood of the types common in the Ertebølle Culture were found in the "dump" in front of the settlement. However, some "new" types are also present.

The artefact types are the same as those known from other sites covering the same time span, but it is interesting that the relative proportions of the types differ markedly from what is found at the well known coastal sites.

Due to the long duration of settlement and the well documented stratigraphy and ^{14}C sequence we can observe several changes in the total artefact inventory. Some of these are only gradual and minor proportional changes, while others, i. e. the introduction of ceramics, are more abrupt and interesting from a cultural historical viewpoint.

The flint inventory is characterised and dominated by tools on blades made by a "soft" technique; especially by many blade scrapers, angle burins on a break, denticulate and micro-denticulate blades - types which are typical for the west Danish Ertebølle culture (Jensen 1994, pp. 51 and fig. 13, 3-5) and transverse arrowheads, while borers, truncated blades and axes (especially flake axes) are very few (fig. 16-17).

Together with these flint artefacts were found a large number of transverse arrowheads of the late Ertebølle type with expanding edge; also the type made on biconvex flakes dating to the older Ertebølle is present.

The number of axes is exceptionally low, flake axes in particular being rare in relation to the area excavated compared with other (coastal) Ertebølle settlements; besides the flake axes are small and irregular in size (fig. 17). We have a few axes of greenstone (diabase), one of which was extraordinary in having a shaft-hole (fig. 17 bottom).

A group of 21 complete blade scrapers, 18 broken scrapers as well as two burins and a blade borer have been investigated for traces of wear (fig. 16). Of the 21 complete scrapers, 17 were used for working hide. With the exception of two, the polish was interpreted as coming from dry hide. Only 4 showed wood-working polish. With these results in mind one would expect to find the same frequencies of worked materials within the group of broken scrapers, but surprisingly the hide/wood ratio turned out to be the opposite as 13 had been used for working wood, while only 5 showed polish from working hide. The wood-working pieces were very short (between 22 and 29 mm long), while the hide-working tools were all between 32-44 mm long.

The analysis of the Ringkloster scrapers suggests that short broken scrapers may not only be the result of heavy use, but could represent a separate functional and morphological group produced for working wood, while the complete scrapers in contrast seem to be hide working tools (Jensen 1982, pp. 224-225).

Approximately 60% of the lateral edges of the complete scrapers showed work polish, in most cases produced by wood, more occasionally by plant materials. This means that the blades were primarily produced and used as unretouched tools, and only served secondarily as blanks for retouched pieces.

A sample of 47 blades from the "dump" area in the lake has been analysed for traces of wear on the edges; of these 30% had been used for working wood, 17% for plant materials, 13% for fresh hide, 9% for dry hide, 9% for meat, 6% for meat and bone and finally 17% for bone and/or antler. In comparison with other Ertebølle sites the Ringkloster blades

Fig. 16 A selection of the characteristic flint types from Ringkloster. scrapers (a-d), burins (e-f, l-m) borer (g) microdenticulated and denticulated blades (h-k) and transverse arrowheads (n). (2:3). Louise Hilmar and F. Bau del.

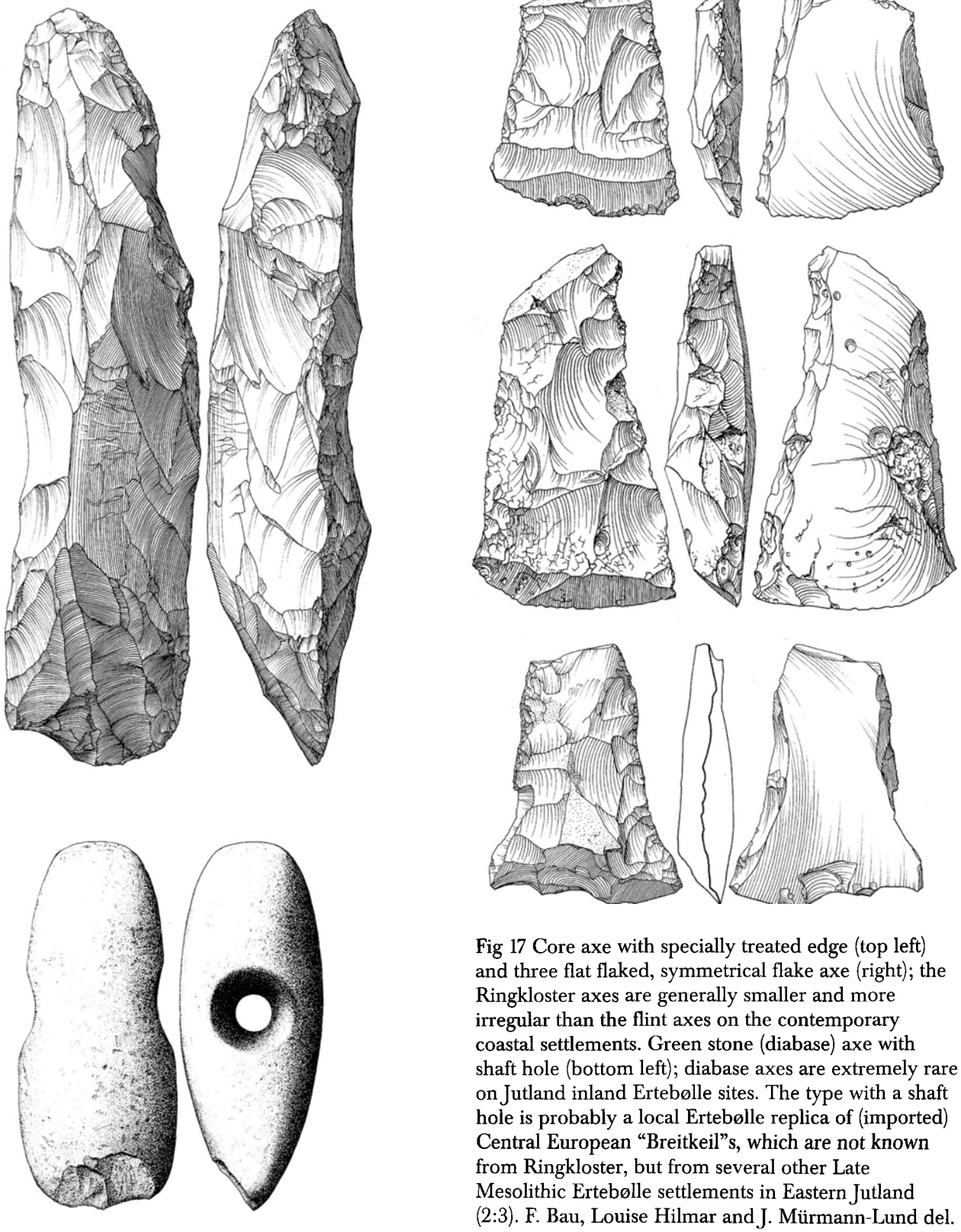

Fig 17 Core axe with specially treated edge (top left) and three flat flaked, symmetrical flake axe (right); the Ringkloster axes are generally smaller and more irregular than the flint axes on the contemporary coastal settlements. Green stone (diabase) axe with shaft hole (bottom left); diabase axes are extremely rare on Jutland inland Ertebølle sites. The type with a shaft hole is probably a local Ertebølle replica of (imported) Central European "Breitkeil"s, which are not known from Ringkloster, but from several other Late Mesolithic Ertebølle settlements in Eastern Jutland (2:3). F. Bau, Louise Hilmar and J. Mürmann-Lund del.

Fig. 18 Antler axes with the shaft hole near the burr (from the lower part of the "dump zone") (Older Ertebølle culture) (bottom) and with the shaft hole through the base of a sawn off tine (so called „T-shaped" antler axe) (Younger Ertebølle culture) (top). Photo P. Dehlholm.

show a higher frequency of use for fresh hide, wood and bone/antler, while plant and dry hide is less dominant (Jensen 1986, p. 24, Table 2).

The micro-denticulate blades, which seem to be a (regional) west Danish phenomenon, have also been analysed for traces of wear by Helle Juel Jensen, who came to the conclusion that contrary to the generally held opinion these tools were *not* used for cutting or sawing, but with a transverse motion perpendicular to the edge; her results seem to support the opinion that these artefacts were used in contact with siliceous plant stems - probably some kind of ripping and/or hacking of fibres. These implements reflect probably a "Neolithic" non-subsistence-related type comparable to the early ceramic production, and were an integrated part of Danish Mesolithic technology several centuries before the actual introduction of animal and plant husbandry ca. 3900 BC (Jensen 1989, p. 135; 1994, p. 5-68 and fig. 13, 4-5).

Summarised, the Ringkloster flint industry is characterised by many scrapers used for hide-working, burins, denticulate and micro denticulate blades and transverse arrowheads.

Tools of the usual Ertebølle types of bone and particularly red deer antler are also common, yet typologically uniform. In comparison with Ertebølle coastal sites, Ringkloster is characterised by a large quantity of red deer antler axes and antler waste, whereas bone implements are rare. A total of 677 pieces of antler have been recovered, of which ca. 55-60 % were worked. In this respect Ringkloster is similar to Stellmoor and Star Carr, which also both are characterised by large numbers of worked antler disposed of or cached in the lake in front of the site, It has been argued that both sites were specialized hunting stations (Grønnow 1987; Legge & Rowley-Conwy 1988).

Among the antler and bone artefacts we also find marked differences in the relative frequency of the different types. Red deer antler axes are numerous, and occur in two distinct types: deeper in the Ertebølle layer were those with the shaft-hole near the burr (19 pieces) (fig. 18), while higher up, were the T-shaped variety with the shaft-hole through the base of the tine (79 pieces). The T-shaped antler axe has a clear regional distribution in western Denmark, and is one among several west Danish Ertebølle

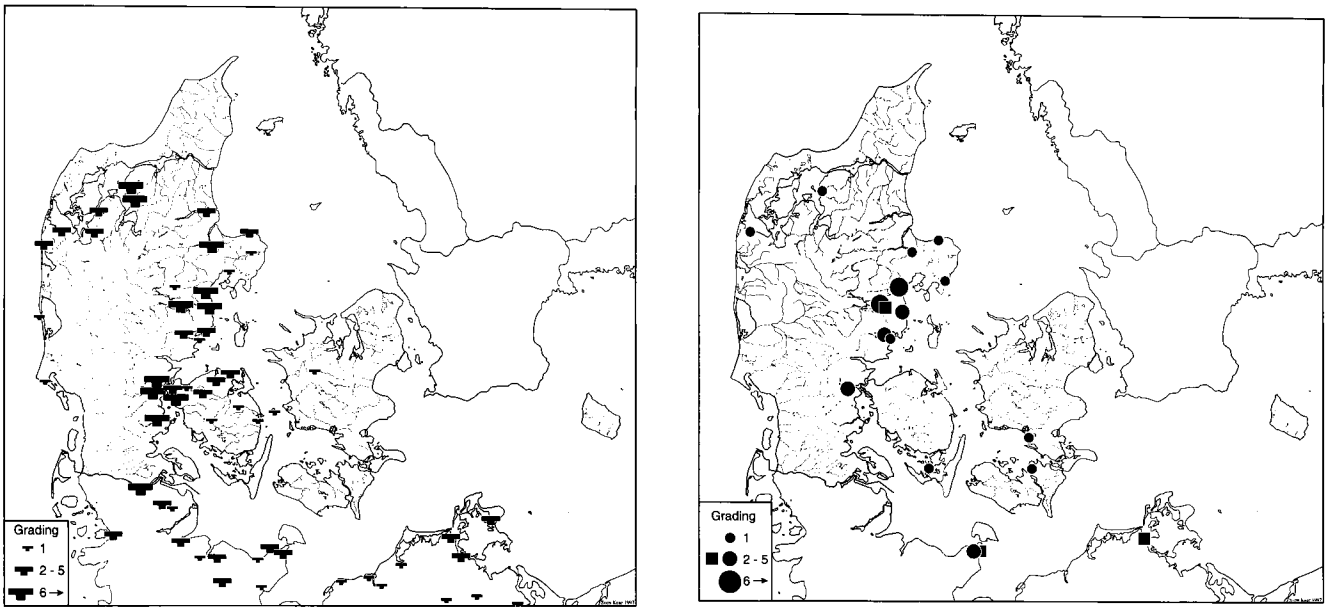

Fig 19. The distribution of T-shaped red deer antler axes (left) and "bone rings" made of scapulae (right). Some of the North German finds have square cuttings in the scapulae - a variant also known from Ringkloster. If we look at the number of the various types at the individual settlements, it is evident that the sites of central Eastern Jutland must have formed a dynamic centre for the production of these types. S. Kaae del.

types which reflect contacts between this region and north continental Europe, where the T-axe has a wide distribution (fig. 19 left).

The Ringkloster material also includes several semi-products, fragments of antler axes, and much characteristic waste from the production of antler axes of both types. Wooden shafts of hazel (*Corylus avellana*), rowan (*Sorbus sp.*) and dogwood (*Cornus sanguinea*) have also been found (fig. 14). A plot of the vertical distribution of the antler axes demonstrates three well defined horizons separated by layers without any axes; the early type of antler axe belongs to the non-ceramic occupation phase, while the T-axes form two distinct horizons within the ceramic Ertebølle period; it is also interesting to observe that there are no antler axes in the youngest horizon.

A new type in Danish Ertebølle finds are chisels or burnishers made of sawn-off tines with a bevel at the tip, of which a long, narrow, tongue-shaped edge has been fashioned on the concave inner surface; two chisels have a perforation at the base. Strikers are very common; among these is a group of 5 whose surface has been scraped smooth - a type unknown from other Jutland Ertebølle settlements (fig. 20 g).

Only one antler with traces of groove-and-splinter technique is present. This is remarkable, as such pieces are common at coastal Ertebølle sites. The explanation for this is that antler with groove-and-splinter technique is waste from the production of harpoons (Andersen 1972). Apparently such production did not take place at Ringkloster.

Fragments of finely polished shafts ("bâtons") of red deer antler are also a part of the Ringkloster inventory (Andersen 1981, pp. 24-38), as well as nicely polished sawn-off tines of red deer antler.

Thirteen shoulder blades of aurochs, wild boar and red deer, from which at least 17-19 discs of varying size have been cut, were also found (fig. 20a). It was possible only to cut one disc from the smaller shoulder blades, while series of up to 3 discs have been cut from the much larger shoulder blades of aurochs. The bone discs served as raw material for the production of bone rings, of which 3 fragments were found (fig. 20b). Here again we have one of the regional west Danish Ertebølle types, which oc-

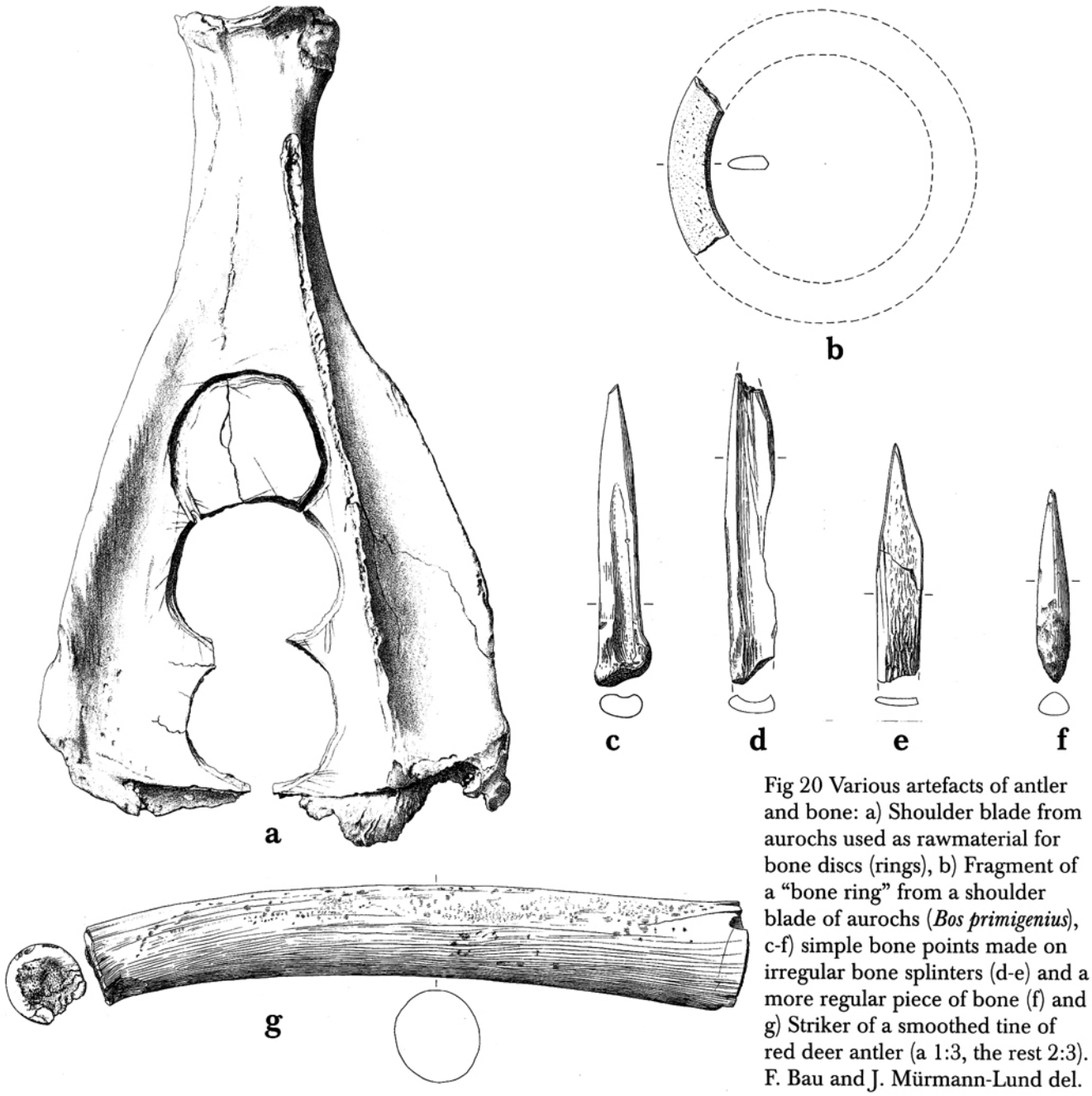

Fig 20 Various artefacts of antler and bone: a) Shoulder blade from aurochs used as rawmaterial for bone discs (rings), b) Fragment of a "bone ring" from a shoulder blade of aurochs (*Bos primigenius*), c-f) simple bone points made on irregular bone splinters (d-e) and a more regular piece of bone (f) and g) Striker of a smoothed tine of red deer antler (a 1:3, the rest 2:3). F. Bau and J. Mürmann-Lund del.

cur at several of the larger settlements especially in central eastern Jutland (fig. 19 right). They are also known from sites further south, e.g. from Hüde I in the Dümmer in Niedersachsen, Spoolde in central Netherlands (Clason 1986 fig. 12, p. 86), Grube-Rosenhof in Holstein (Schwabedissen 1994) and an unpublished site near Prohn in Mecklenburg, and they underline the close contacts between the West Danish Ertebølle culture and contemporary groups further south (Deichmüller 1969, p. 33, Abb. 2, 1). However the number of cut shoulder blades (and the number of bone discs) at Ringkloster is far greater than at any other settlement in this part of Denmark. It is evident that production of bone rings was an essential activity at the site. The use of these bone rings is still unknown; maybe they served as orna-

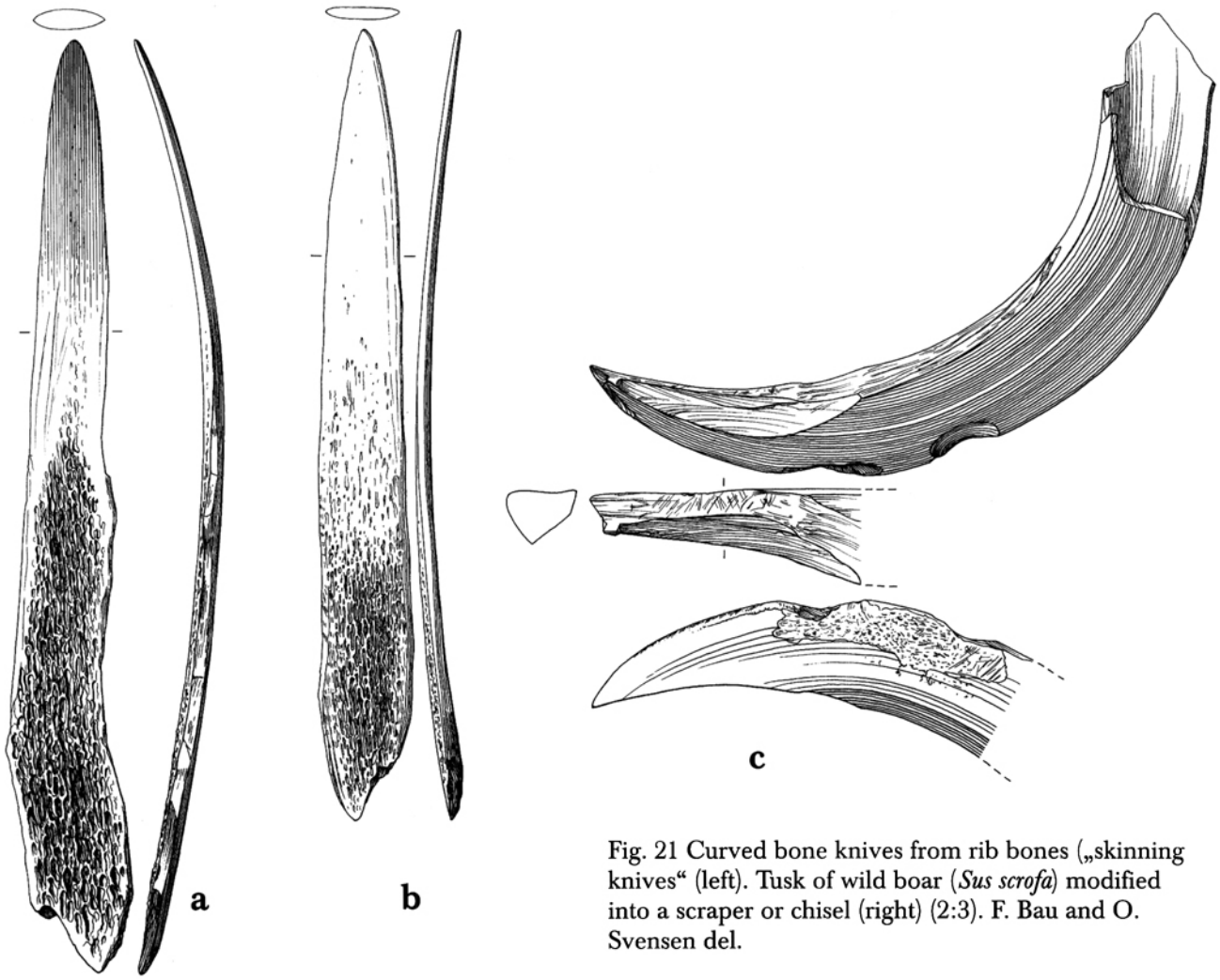

Fig. 21 Curved bone knives from rib bones („skinning knives" (left). Tusk of wild boar (*Sus scrofa*) modified into a scraper or chisel (right) (2:3). F. Bau and O. Svensen del.

ments or as part of the clothing. Their similarity to the well known Rössen marble rings is striking, and maybe the west Danish bone rings are imitations of these and therefore are another element stressing the contacts/influences between the Danish Ertebølle Culture and central European (Neolithic) groups.

The number of bone points is very low (13 pieces). The majority (10) are made on irregular bone splinters with a short point. Only 3 are regular round-sectioned points (fig. 20 c and f). Waste products from the manufacture of such points are correspondingly rare. Not only the number, but also the form of these points, which otherwise are one of the most characteristic and numerous Ertebølle bone artefacts, is in sharp contrast to what is found at coastal Ertebølle sites (Andersen 1985; 1991; 1993).

A special Ringkloster type is a curved bone knife made of elk or aurochs rib, of which 15 (and one semi-product) are recorded (fig. 21 a-b). They are oblong with a pointed, slightly rounded tip and edges which are not really sharp, but are smooth and rounded near the point and rounded or not worked at all further up the handle. Seen in profile they are curved. Semi-products show that they were produced at the site. Knifes of this type are only known from Ringkloster, and an interpretation is therefore difficult, but they could easily have served as skinning knives, a function which fits well with the rounded tip and edges. However, they resemble similar artefacts known from Swiss (Neolithic) lake dwellings, at which they are often found in bundles of 2 to 5 tied together, and are interpreted as tools for whittling plant fibres (e.g. Bleur et al. 1993, Taf. 81,

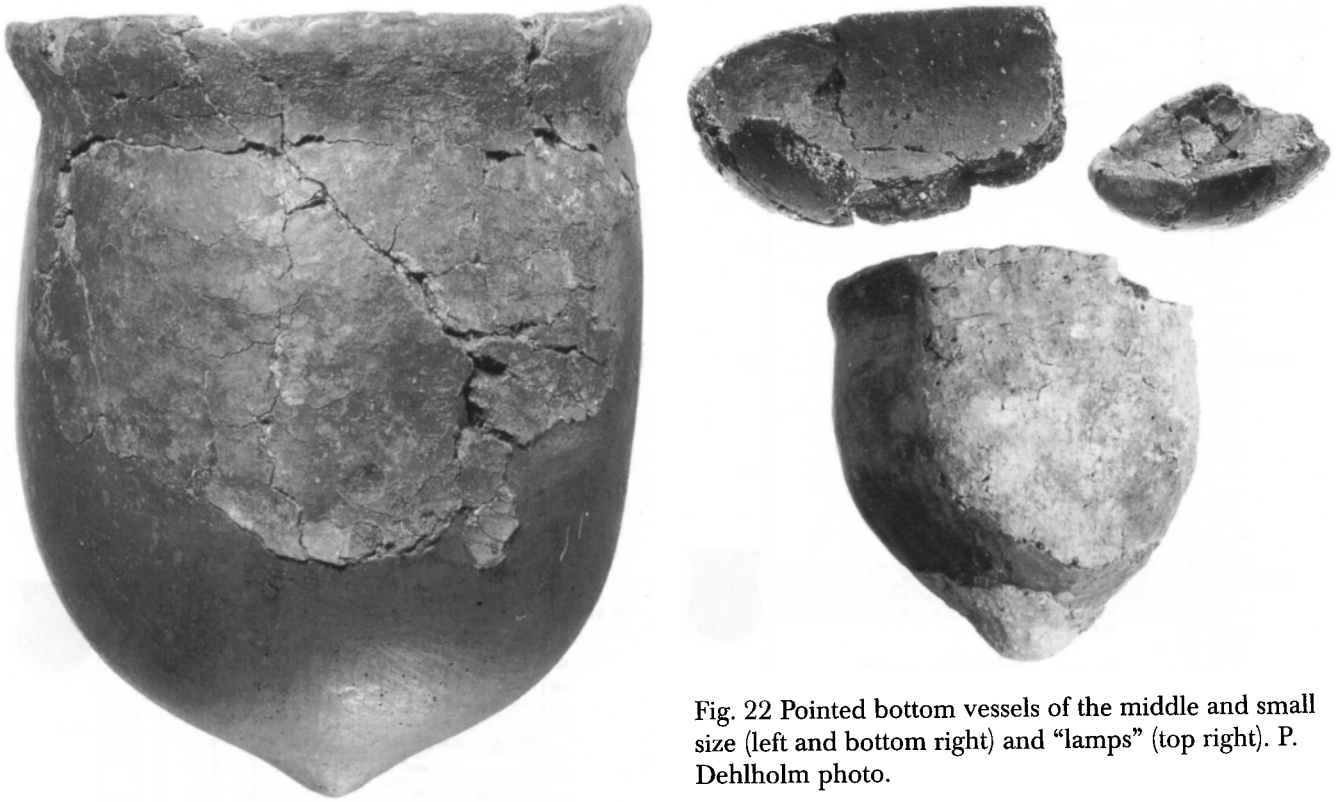

Fig. 22 Pointed bottom vessels of the middle and small size (left and bottom right) and "lamps" (top right). P. Dehlholm photo.

8-14 and Taf. 84, 13-15). A similar interpretation may also be valid for the Ringkloster pieces. No bone fish hook of the Ertebølle type is recorded.

Worked lower canines of wild boar were common; most frequently they were used as boars' tusk knives; one had been worked into a chisel (fig. 21 c); several tusks show traces of lengthways splitting and one piece has a perforation - made clearly with the intention of making ornaments from the outer side of the tusk (the enamel side); such ornaments are well known from Limfjord Ertebølle sites e. g. Bjørnsholm (Andersen 1993, 84, fig. 26) and Ertebølle (Madsen et. al. 1900, Plate VII lower row). One outer side of a tusk has been cut into a rectangular enamel plate, and another shows traces of perforation by drilling. From the Brabrand settlement a piece of wild boar tusk is also known, which had been sawn off at one end (Thomsen 1906, p. 35).

In two cases the whole front part of the lower jaw has been broken off and used as a tool with the tusks still in place. Similar objects are known from other Ertebølle sites such as Tybrind Vig (Andersen 1985) and Ølby Lyng (Møhl 1971), and this is a type, which must also be included in the Ertebølle bone inventory.

A single lower jaw of a beaver has been used as a knife without any modification (Sørensen 1969).

Three daggers of red deer ulna are present; one of them has a long tongue-shaped point very similar to the bone knives, and it is probable that this implement had a function similar to the bone knives.

Only one piece of bone/antler is decorated. The surface of a red deer vertebra is ornamented with a regular criss-cross motif on one side. This bone has been heavily used and the surface is shiny from wear.

Summarised the bone and antler industry of Ringkloster is characterised by a large number of worked and unworked antlers; especially antler axes and strikers, whereas bone artefacts are few; the most prominent of these are shoulder blades used for the production of bone rings, and bone skinning knives. New types are chisels with a bevel, and curved bone knives. The small number of bone points stands in sharp contrast to the situation at contemporary coastal settlements, the lack of perforated animal teeth, and the absence of ornamented antler.

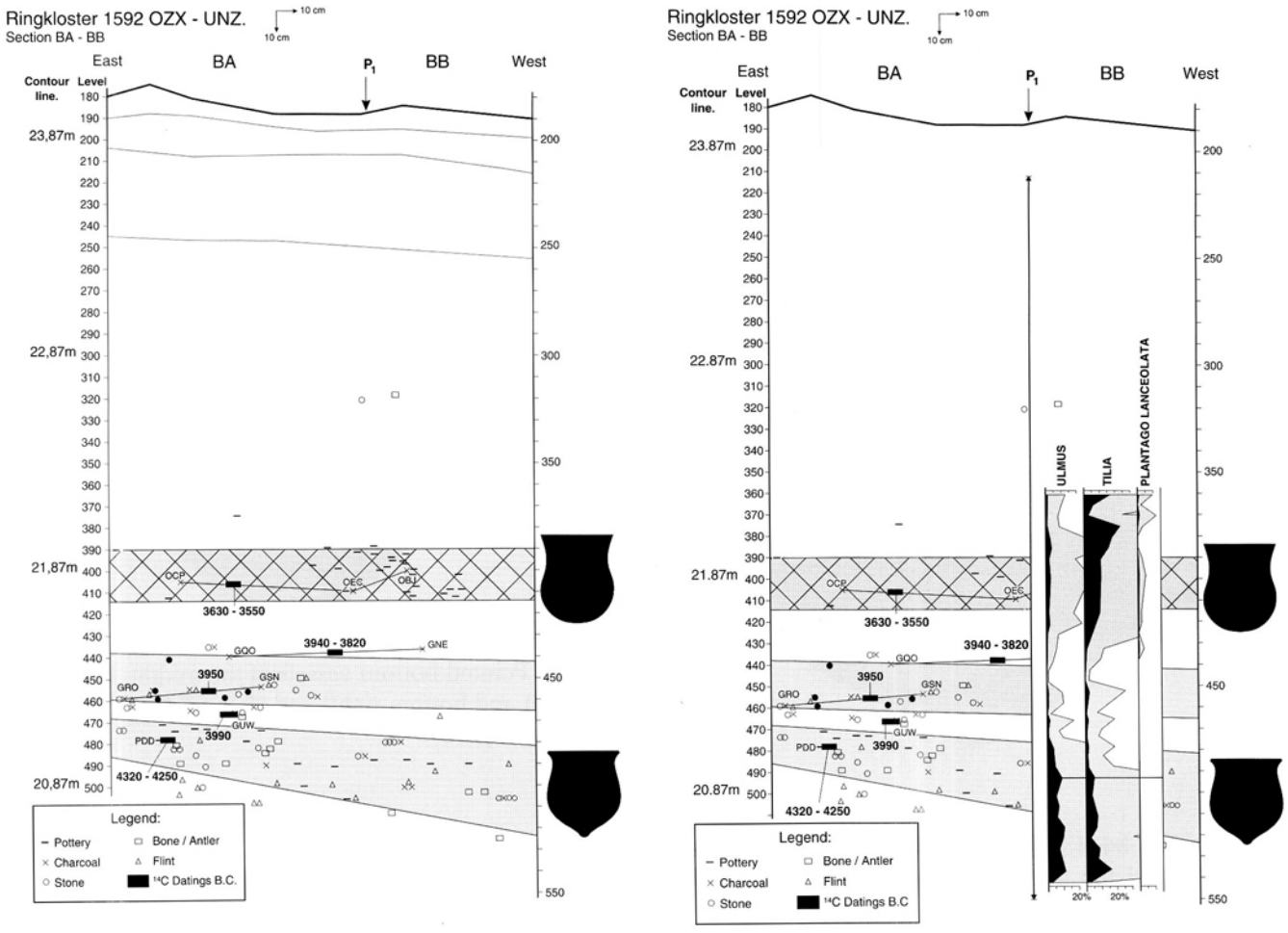

Fig. 23 The section at the pollen series "P1" and the vertical occurrence of typical Ertebølle and Funnel Beaker ceramics (left). The vertical occurrence of Ertebølle and Funnel Beaker pottery in relation to the pollencurves of elm (*Ulmus sp.*), lime (*Tilia sp.*) and rib worth (*Plantago lanceolata*). The thin horisontal line traversing the pollen curves indicates the "*Elm decline*" and the beginning of a contemporary decrease of lime. Above the Ertebølle ceramics the curve of ribworth appears for the first time, and continues without interruption during the Funnel Beaker Culture (right). S. Kaae del.

Ertebølle pottery is abundant and appear in two principal types - pointed bottomed vessels of at least 3 different sizes and oval "lamps" in a smaller and larger variant (fig. 22). Besides the ceramics, lumps of stone-tempered but unfired clay have been recorded from the "dump-zone" in the lake.

The Ertebølle ceramics have been analysed by Hulthén with respect to technique, tempering and raw materials (Hulthén 1977, pp. 42, 48 and 50). Eight samples of clay from within 1 km of the site have been analysed and compared with the ceramics. Two different types of clay has been used: a coarse non-calcareous clay and a more calcareous type. For tempering were used crushed rock (feldspar and quartzite) or chamotte. About 45% of the pottery also has plant material mixed into the clay (Hulthen 1977).

Pointed-base pots were found in large numbers - at least 31 vessels are represented. Thus the high frequency of ceramics is another very characteristic element at the site. The pottery appears some time after the beginning of the cultural sequence, and the

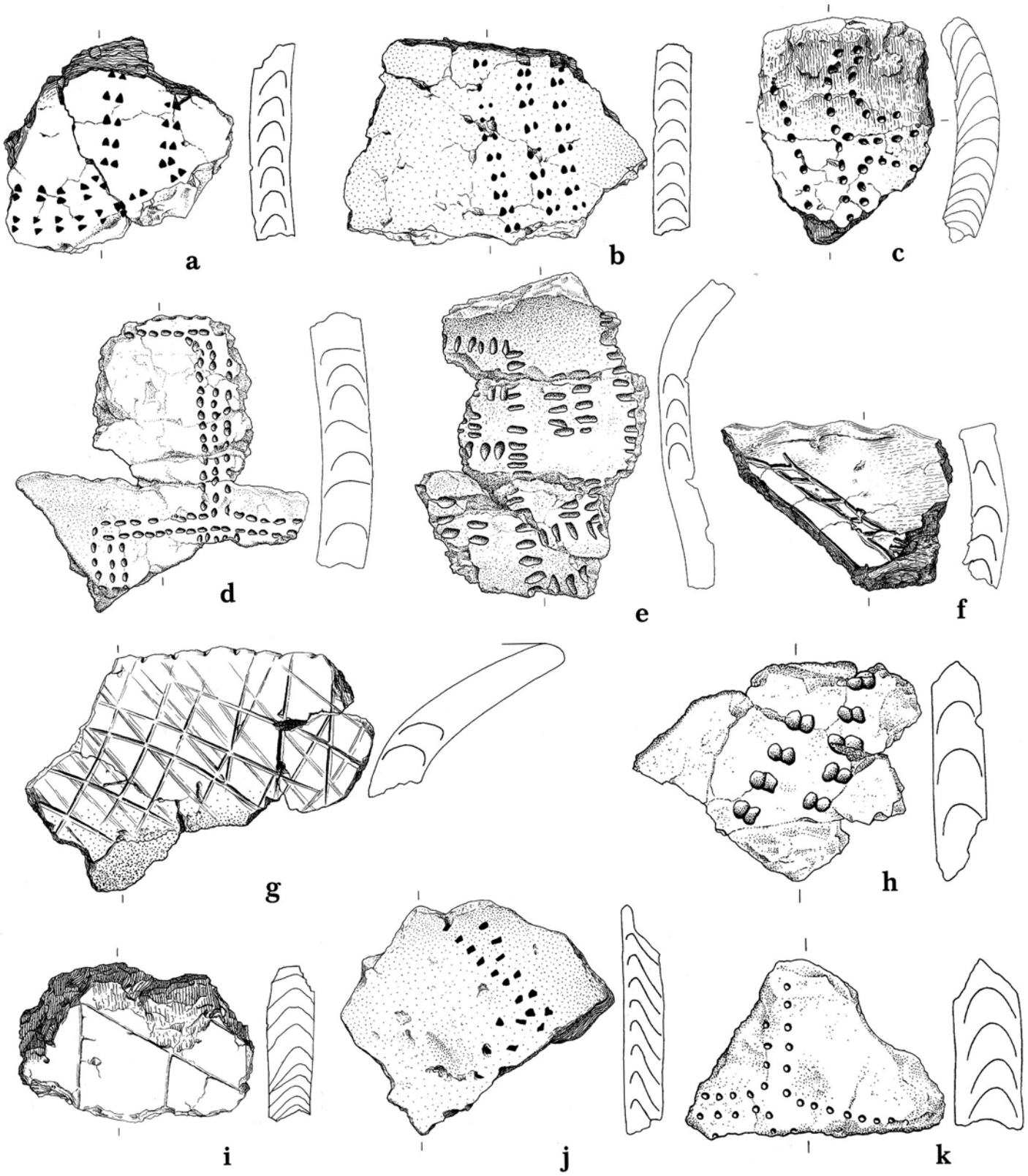

Fig. 24 Decorated Ertebølle pottery from Ringkloster (2:3). F. Bau del.

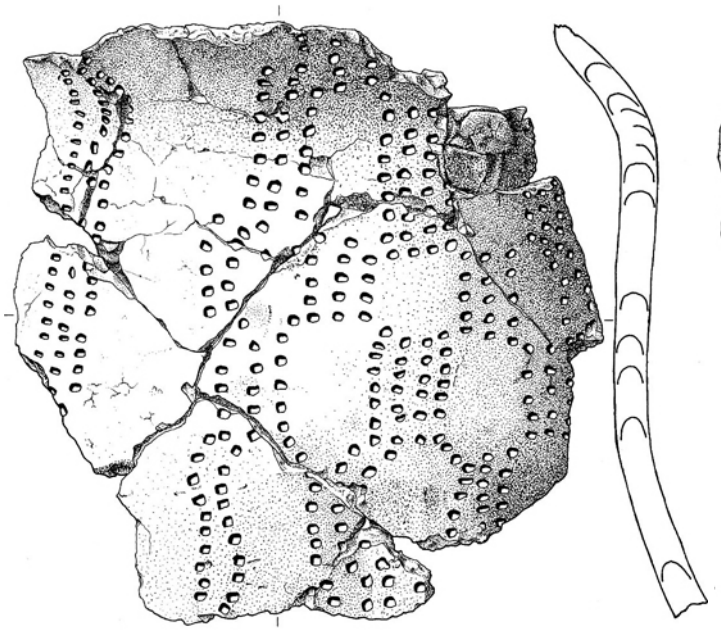

Fig. 25 Large fragment of a pointed bottomed pot decorated with a checkerboard pattern. From the Norsminde *køkkenmødding* in Norsminde Fjord, cf. fig. 3. (2:3) F. Bau del.

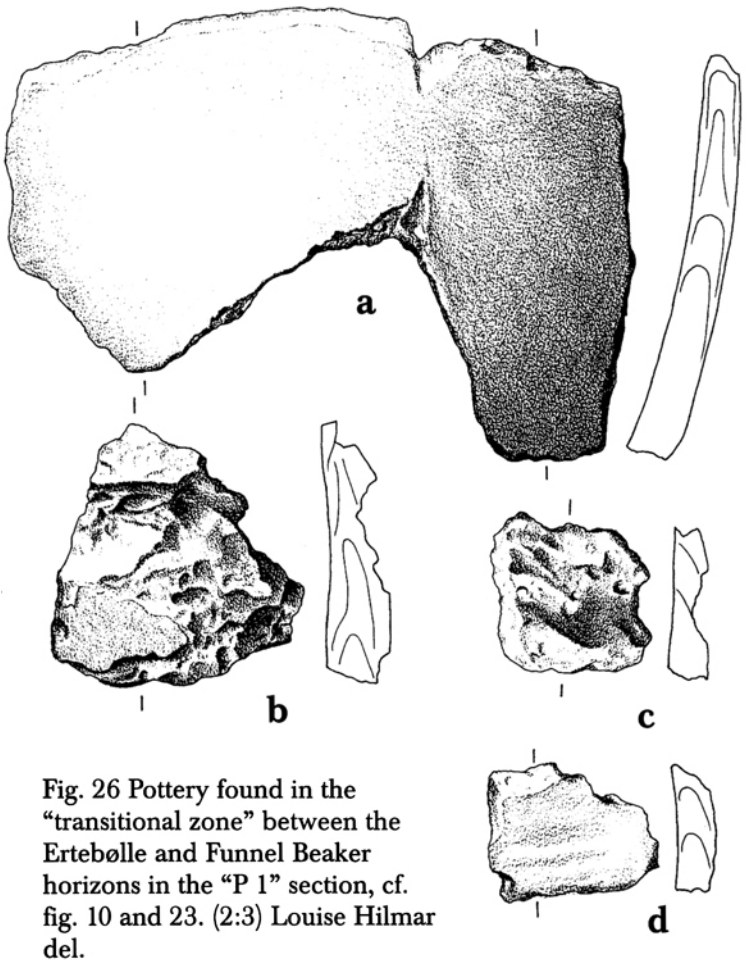

Fig. 26 Pottery found in the "transitional zone" between the Ertebølle and Funnel Beaker horizons in the "P 1" section, cf. fig. 10 and 23. (2:3) Louise Hilmar del.

Ertebølle cultural horizon at Ringkloster therefore covers both the "non-ceramic" and the "ceramic" Ertebølle phases, i. e. the whole duration of the Ertebølle culture. At Ringkloster the Ertebølle ceramics were present between 4700 and 3950 BC (fig. 23). The Ertebølle pottery reflects at least 3 distinct ceramic horizons, of which the topmost contains the most sherds. It is also in this horizon that we find the oval "lamps" and the small vessels or "cups". The frequency and type inventory of the vessels reflect some general tendencies during the Ertebølle period. In regard to the technique and thickness of the vessels there is a gradual change from the predominance of a thick-walled type in "H" and "U" technique in the deepest horizon (with a mean thickness of ca. 1.2 cm), towards the predominance of thinner sherds in "N" technique in the top horizon (with a thickness of ca. 1 cm), e.g. the smallest "cups" are only found in this layer. Also the rims undergo typological change during the occupation period. In the deepest ceramic horizon the rims are "decorated" with nail and finger impressions, while this feature is absent in the upper part of the "dump zone".

The Ringkloster Ertebølle pottery also reflect some local typological features. For example the body of the pots ranges from conical to cylindrical, while the bottom is rounded with an offset point; the rims are upright, inturned with a hollow colar, or everted.

The pottery often contains deposits of charred food remains on the inside, but this has not yet been analysed.

Most of the pots are undecorated, which is normal for Ertebølle vessels, but a few sherds (1-2%) exhibit decoration. This can be of three different types: rhombic patterns, irregular bands of stabs, and there is a distinctly finer type of pot with lines of double stabs (fig. 24).

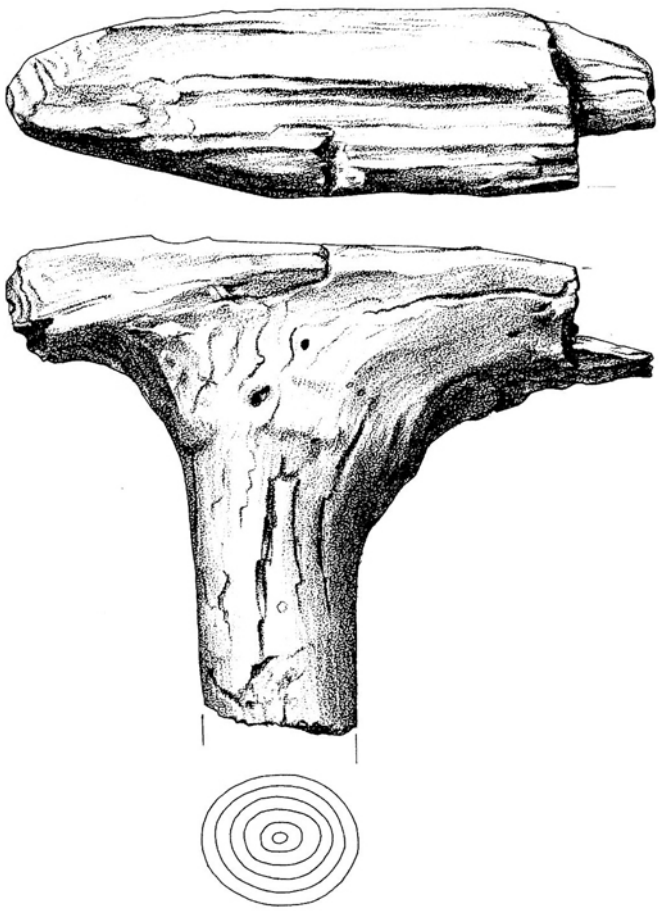

Fig. 27 Fragment of an axe-handle of hawthorn (*Crataegus sp.*). (2:3) J. Mürmann-Lund del.

In Denmark rhombic designs on Ertebølle pottery are only known from Brabrand (Klindt-Jensen 1947, pp. 21, fig. 11) and Flynderhage (Gabrielsen 1953, pp. 12). Decoration with lines of separate stabs is found only on pottery from three Ertebølle settlements in the Brabrand area and two in the Norsminde area; from the Norsminde *køkkenmødding* comes a large fragment of a pointed bottomed pot decorated with a checkerboard pattern (fig. 25).

Two sherds from settlements on Zealand are decorated in a similar way, but their cultural association is problematical (Becker 1939, pp. 263, fig. 21a; Mathiassen 1943, pp. 95, fig. 46, 15). In Sweden ornamented Ertebølle pottery is only known from the Löddesborg site (Jennbert 1984, pp. 58, fig. 48), and where the sherds are strikingly similar to those from Ringkloster, both in the technique employed and in the choice of motifs (cf. fig. 24 and fig. 25). A small number of related sherds are known also from the north German Early Neolithic settlements of Rosenhof, Boberg, Travenbrück (Hartz 1996 pp. 54, 1997 pp. 179, Abb. 5,5). and Dümmer I (Schwabedissen 1981 pp. 137, fig. 8, 1994 p. 398, Taf. 17, 1, p. 400 Taf. 19, 7-8; p. 401, Taf. 20, 1-2; Schindler 1961 pp. 28, fig. 7, 2; Deichmüller 1965 p. 17, Abb. 8 f, h, i & Taf. 1, 4).

The use of motifs such as rhombic and net patterns and lines of points is familiar from decorated artefacts of bone, antler and amber in the west Danish Ertebølle culture (Andersen 1981), but the decorated sherds demonstrate for the first time the use of these motifs on another material (clay).

All the decorated sherds from Ringkloster are securely dated to the Ertebølle occupation and are found both on dry land and in the "dump-zone" in the bog; they reflect a type of decoration which is very unusual in Danish Ertebølle settlement finds. The double-stab motif however is completely unknown from other Danish Ertebølle sites. A related type of ornament is found on a vessel from the Early Neolithic settlement of Mosegården, ca. 20 km south of Ringkloster (Madsen & Petersen 1984 fig. 18a). A similar decoration is known from a round bottomed vessel from Dümmer I (Deichmüller 1965 Taf. 1, 4).

In comparison with the many other Ertebølle sites with pottery the geographical distribution of contemporary settlements with ornamented pottery is most striking, because they form a cluster in a small area of eastern Jutland (fig. 39). The presence of the same type of decorative motifs and technique within this geographically restricted group of East Jutland Ertebølle settlements obviously point towards some type of contact(s) between the sites (see later)

Of special importance is the presence of ceramics at the pollen profile P1 (fig. 23). In the deepest part of the sequence ceramics are absent. Above this follows a ca. 30 cm thick horizon with thick-walled Ertebølle pottery in "U"-technique. This is followed by a ca. 10 - 15 cm "sterile" horizon capped by a ca. 30 cm layer characterised by thin walled sherds in "U" and "N" technique (fig. 26). Unfortunately they are all uncharacteristic, so it is impossible to relate them to any specific cultural stage. However, the stratigraphic position tells that they represent an occupation at Ringkloster belonging to the youngest

Fig. 28 Bow of elm wood (*Ulmus sp.*), ca. 160 cm long. F. Bau del.

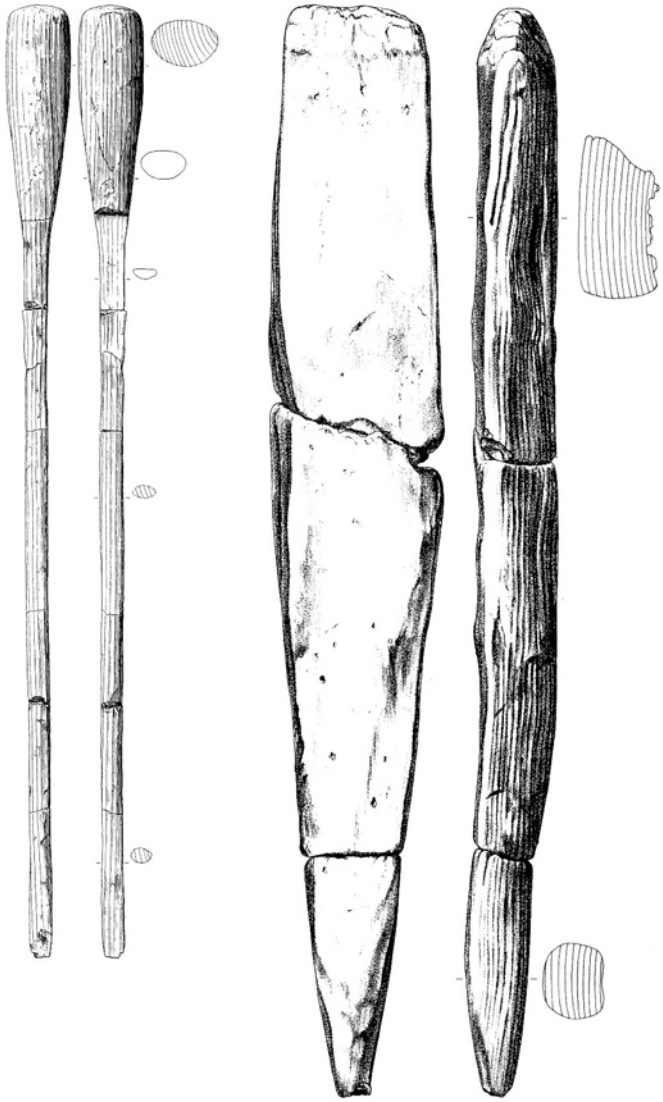

Fig. 29 (left) Fragment of a wooden arrow with a club-shaped head of hazel wood (*Corylus av.*). (1:3) F. Bau del.

Fig. 30 (right) Wooden wedge for splitting tree trunks. (1:3) J. Mürmann-Lund del.

Ertebølle or the transition between the Ertebølle and Funnel Beaker culture. Above this comes ca. 20 cm "sterile" gyttja capped by a ca. 25 cm thick, horizon with thin walled pottery of Funnel Beaker type in "N" technique".

The "dump zone" contained a number of sharpened and pointed hazel stakes (between 15 and 200

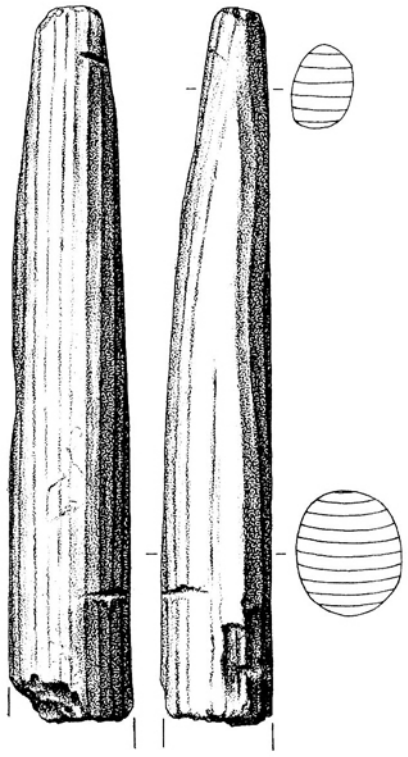

Fig. 31 Fragment of a spear or lance of ash wood (*Fraxinus exc.*). (2:3) J. Mürmann-Lund del.

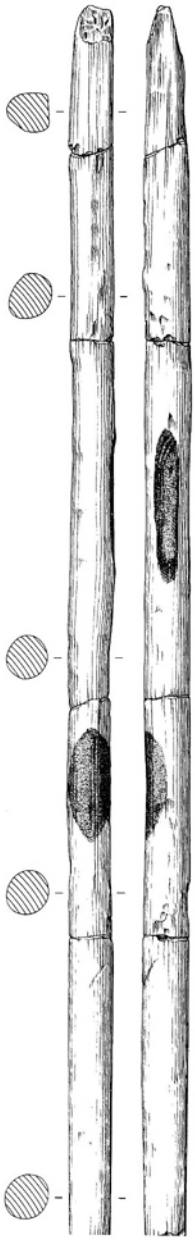

Fig. 32 Straight and cylindrical stick of oak (*Quercus sp.*) - probably a "digging stick". (1:4) F. Bau del.

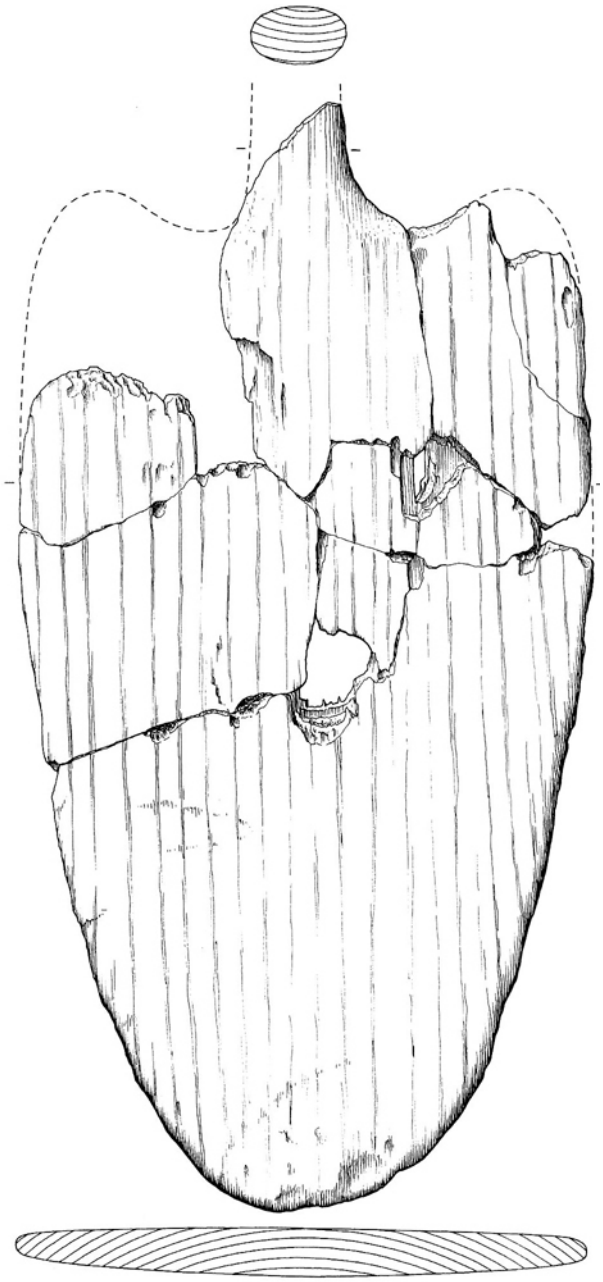

Fig. 33 Lower part of a paddle made of ash (*Fraxinus exc.*). (2:3) F. Bau del.

cm long) which probably derived from destroyed fish weirs in the prehistoric lake. However the number of such stakes is much lower at Ringkloster than at coastal Ertebølle sites. This is probably due to a combination of the season when the site was occupied (see later) and the steep lake bottom, which must have made it difficult to set up fish traps in the lake in front of the site. Chips from preparing and splitting of wood are numerous.

Wooden artefacts were also found, but due to the large amount of natural wood embedded in the layers and the technical difficulties of the excavation (the depth of the cultural horizons and the high water level), they were difficult to recognise and therefore relatively few were recovered. Among them are

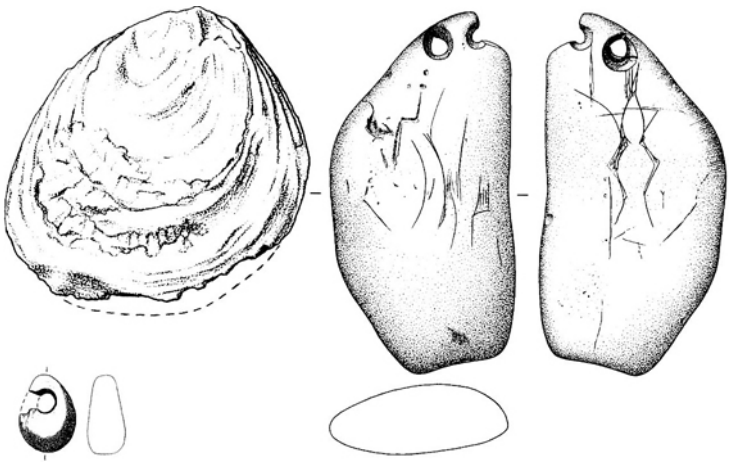

Fig. 34 Oyster shell (top left) and amber pendants. The large amber ornament has a nicely polished surface with an incised net pattern and a figure (person?) on one side. At the top this pendant has two perforations for the string. (2:3) F. Bau and J. Mürmann-Lund del.

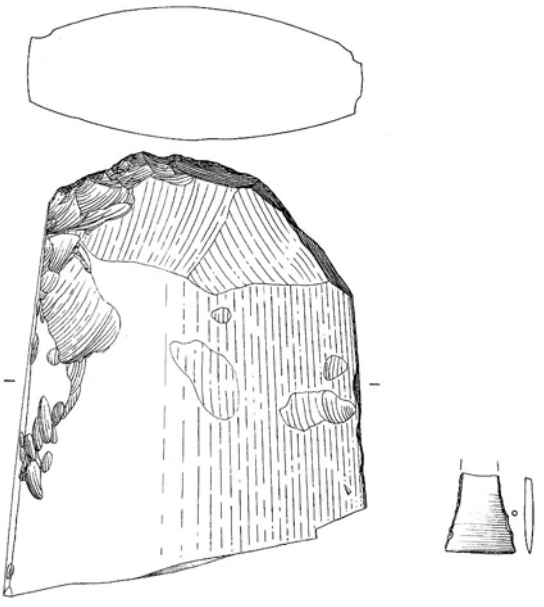

Fig. 35 Finds from the Early Neolithic Funnel Beaker horizon in the "dump zone" in the prehistoric lake. Fragment of a polished thin butted axe (left) and a transverse arrowhead made from a flake taken from a polished, thin butted axe (right). (2:3) F. Bau del.

a semi-product of an axe-handle of hawthorn (*Crataegus sp.*)(fig. 27), an unfinished bow, and two finished bows of very different size and type. Both are made of elm (*Ulmus sp.*) (determined by P. Wagner). The large fragment was of a bow that had originally been ca. 180 cm long with a round cross section. This type is unique in the Danish Mesolithic record being longer, more slender, and having a rounder cross section than other Danish Ertebølle bows. The other bow (fig. 28) is intact (ca. 160 cm long) and identical to bows known from Ertebølle sites like Tybrind Vig (Andersen 1985 p. 64, fig. 16a). A 35 cm long fragment of the front part of a wooden arrow with a club-shaped head of hazel wood (*Corylus avellana*) is also recorded (fig. 29). Three wooden wedges for splitting tree trunks are the first specimens of this type recorded in the Danish Mesolithic (fig. 30). Similar wedges are well known from the Swiss Neolithic (Waterbolk & van Zeist 1991 pp 133-135, fig. 125-129). Slender spears or lances of ash (*Fraxinus excelsior*) - an artefact type well known from other Ertebølle settlements such as Satrup (Schwabedissen 1960 p. 12, Abb. 6 c) and Tybrind Vig (Andersen 1985 pp. 61) are also a part of the Ringkloster inventory in wood (fig. 31). Among this group of implements are also two straight and cylindrical sticks of oak (*Quercus sp.*), respectively 1 and 1.5 m long with diameters of ca. 3 cm (fig. 32). No similar artefacts are known from other Danish Mesolithic settlements; the use of oak is extraordinary and may indicate a function demanding a rather strong wood, e.g. some type of digging stick.

Also a fragment of a dug-out canoe and the lower part of a paddle of ash (*Fraxinus excelsior*) have been recorded (fig. 33).

"Exotica"

One of the more extraordinary objects at Ringkloster were 13 oyster shells (*Ostrea edulis*), which were found scattered in the "dump area" (fig. 34). Only flat shells are represented, and they must be shells deliberately brought to the site from the coastal region. They are best interpreted as being a special type of artefact used for cutting and/or scraping purposes. The strong, sharp and even perimeter of the flat oyster shell could have been used directly as a knife or scraper without further preparation. The use of such "shell scrapers" or knifes was probably very com-

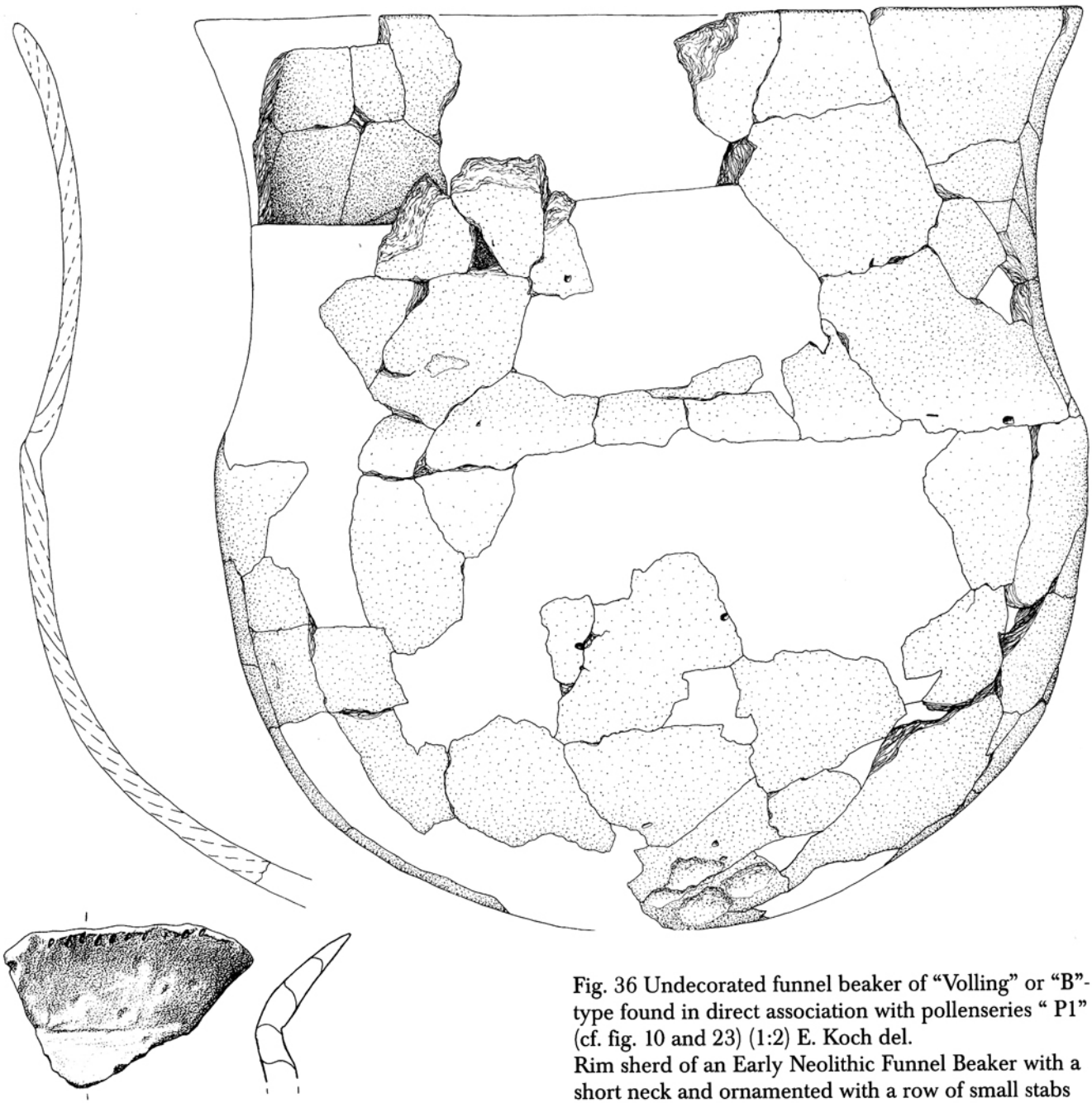

Fig. 36 Undecorated funnel beaker of "Volling" or "B"-type found in direct association with pollenseries " P1" (cf. fig. 10 and 23) (1:2) E. Koch del.
Rim sherd of an Early Neolithic Funnel Beaker with a short neck and ornamented with a row of small stabs below the rim (left) (2:3) Louise Hilmar del.

mon in the Ertebølle culture, but because of the millions of shells in the coastal middens and their lack of secondary working they have understandably been overlooked hitherto. Their presence in the bog is unambiguous evidence of contacts between Ringkloster and the nearby coast.

Amber was used for pendants, of which two were found (fig. 34) - a small, simple bead with a perforation and a large, oval pendant with a carefully polished surface in which there is an incised ornament (a person?) on one side (Andersen 1981, pp. 44, fig. 26).

Fig. 37 Shoulder blade of wild boar (*Sus scrofa*) with a healed lesion from an arrow wound. (1:2) P. Dehlholm photo.

Finds from the Funnel beaker horizon in the bog

The youngest horizon in the "dump-zone" contained thin walled pottery, fire cracked stones, charcoal, some flint debris and a transverse arrowhead made on a flake from a polished flint axe (fig. 35). Among the finds is a ca. 28 cm high, undecorated funnel beaker of Volling type (Early Neolithic I), which gives a clear typological dating of this horizon[9] (fig. 36) (Madsen & Petersen 1984). The finds also include a rim sherd of another Early Neolithic Funnel Beaker with a very short neck - a type which is known from the oldest Neolithic levels in the stratified shell middens, e. g. the nearby Norsminde *køkkenmødding* (Andersen 1991 p. 36, fig. 22)(fig. 36). From the area at the prehistoric lake shore comes the rear part of a broken, thin butted and polished flint axe (fig. 35).

The finds from this horizon are few and must reflect a rather short occupation phase - an observation which is supported by the lack of Early Neolithic material from the excavation on the settlement area on the lake shore.

DATING AND CULTURAL CONTEXT

The archaeological material from Ringkloster shows that the main occupation of the site belongs to the Late Mesolithic Ertebølle culture; there is also a thin horizon from the early Neolithic Funnel beaker cul-

[9] The Early Neolithic funnel beaker fig. 36 has earlier been published by H. Tauber (Tauber 1971, p. 395).

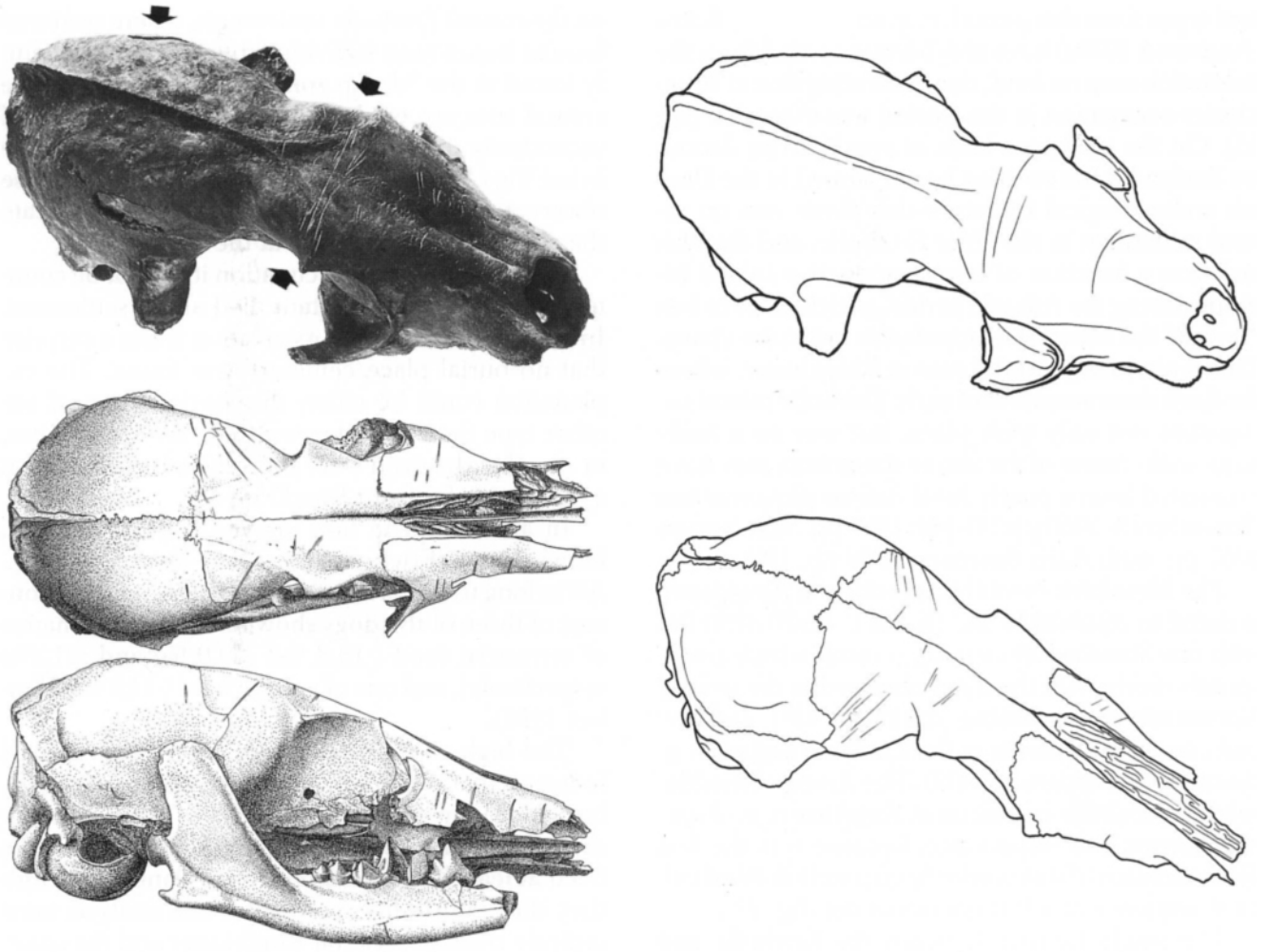

Fig. 38 Cranium of pine marten (*Martes martes*) (top) with clear cut marks across the brow from the use of flint knifes as a result of skinning (arrows) and symmetrical fracturing of the rear of the skull - probably caused by a sort of trap (arrows). A cranium of fox (*Vulpes vulpes*) with similar traces of skinning is seen at the bottom. E. Morville del. P. Dehlholm photo.

ture; furthermore there are a few traces of older (Maglemose and Kongemose culture) activities on the site.

The cultural horizons have been dated both by archaeological typology and by ^{14}C dating, and the results agree well.

The deepest section of the cultural sequence in the lake deposits contains artefacts belonging to the early, "aceramic" Ertebølle phase, which is not ^{14}C dated at Ringkloster, but is well documented by artefact typology. By comparison with the Norslund sequence this phase must be dated to 5400-4700/4800 BC (Norslund layers 3-4)(Andersen and Malmros 1965, 1981), while the finds and several ^{14}C dates from the middle and upper part of the drift gyttja indicate that the Ertebølle occupation period at Ringkloster cover the time span 4710-3990 BC (K-4367 and K-4369)(All ^{14}C dates are given in calibrated years following Stuiver & Reimer 1993)and that the habitation has been especially extensive and intense right through the "ceramic" or middle and younger Ertebølle (4700-4000 BC) (Norslund layer 1-2), lasting until the transition from the late Mesolithic to the early Neolithic.

Of special importance is the clear stratigraphical horizon of the early or "aceramic" Ertebølle culture;

tool types from this period, e. g. scale-worked flakes (Andersen 1979a) have also been recorded from the habitation area on land, demonstrating that at Ringkloster occupation in this period was extensive (fig. 15). On the exclusive basis of results from Åmose on Zealand it has so often been claimed in the Danish archaeological literature that there was no inland settlement in the older Ertebølle, and that this lack was a function of a less productive inland biotope during the Atlantic period, which more or less "forced" the Mesolithic population out to the coasts. This is obviously not the case at Ringkloster, where the finds demonstrate that early Ertebølle inland occupation not only took place, but was on a fairly large scale. Some of the above statements may have originated from a purely local Åmose phenomenon (Troels-Smith 1960 pp. 99-100; 1967 pp. 522; Iversen 1967 pp. 404; Aaris-Sørensen 1988 pp. 197).

The Mesolithic-Neolithic transition at Ringkloster is dated to 3940-3820 BC (K-4371) (3970-3790 BC with one standard deviation), a result which corresponds nicely with the dates obtained at the nearby Norsminde *køkkenmødding* (Andersen 1991) and several coastal settlements in the Limfjord region, e. g. Bjørnsholm (Andersen 1993). The dating of the Mesolithic/Neolithic transition at Ringkloster is of special interest and importance, because it is the first determination of this border from a well-defined cultural sequence at a Danish *inland* site (fig. 23).

The sterile horizon between the Ertebølle and the Funnelbeaker Layers (cf. figs. 10 and 23) and the ^{14}C datings show that there was a short "break" in the occupation at Ringkloster during the Mesolithic-Neolithic transition.

The youngest cultural horizon in the prehistoric lake is typologically dated to the early Neolithic Funnel Beaker culture, which agrees well with the ^{14}C result of 3630-3550 BC (K-4372) (3650-3510 BC with one standard deviation), and ^{14}C dates from other west Danish (coastal) sites such as the stratified *køkkenmøddinger* Norsminde (Andersen 1991) and Bjørnsholm (Andersen 1993) (fig. 23).

^{13}C analysis

Despite the large number of well preserved animal bones (ca. 4. 000), no human skeletal remains were preserved. This was a clear contrast to the situation on the coastal Ertebølle settlements, where scattered human bones (and individual burials) are frequently found in the "dump zone". Human bones at the coastal sites are explained as being the remains of secondarily disturbed Mesolithic graves, e. g. at Tybrind Vig (Andersen 1985). In accordance with these observations, the situation at Ringkloster indicate the absence of such graves at the site.

In view of the long occupation it cannot be countenanced that no inhabitant died at the settlement. In view of the extensive excavation it was a surprise that no burial place/cemetery was found. The explanation could be either that burials were of another type than those known from the coastal sites, or else that the dead were transported and buried at a settlement far from Ringkloster.

In an attempt to find material for ^{13}C analysis, bones from 4 (Ertebølle) dogs have been analysed[10]. All belong to the Ertebølle occupation. The ^{13}C content of three of the dogs showed a clear dominance of terrestrial food (-18,8 ‰, -20,0 ‰ and -21,3‰ respectively), and one of marine food (-11,8 ‰) (Tauber 1981).

The high marine content in one of the animals indicates that this dog (which also was the youngest, but older than 1-2 years) must have lived on a marine diet (at the coast), while the others must have lived at least for some time at the inland site before they died. With due reservation this analysis must indicate contact between Ringkloster and the coast. Similar studies have been made of dog bones from settlements in the Åmose area on Zealand (Noe-Nygaard 1988).

ECONOMY

Hunting is indicated by thousands of bones, mainly of mammals, while bones of birds and fishes are few (Rowley-Conwy 1998 - this volume; Enghoff 1998 - this volume). Of these bones only four demonstrate well defined hunting injuries: a vertebra of a red deer, two left and a right scapula of wild boar (Noe-

[10] K-386: -20, 0 ‰ (adult/ "older dog")
K-387: -11, 8 ‰ (adult/"younger dog")
K-388: -22, 9 ‰ (bone of Cervus elaphus/ Red deer)
K-4132: -21, 3 ‰ (dog)(^{14}C: 4030 - 4000)
K-4133: -18, 8 ‰ (dog)(^{14}C: 4320 - 4260).

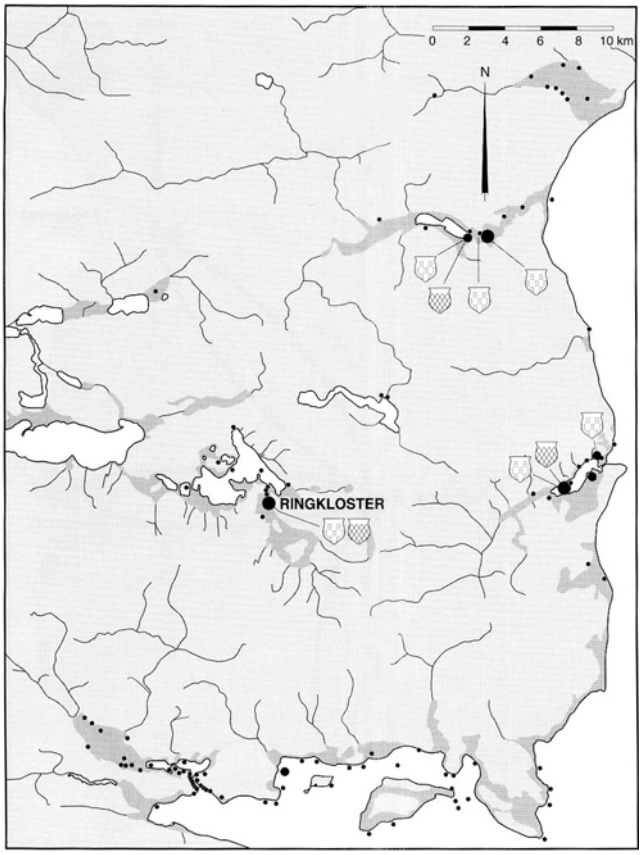

Fig. 39 The occurrence of ornamented pottery on Ertebølle settlements in Eastern Jutland contemporary with Ringkloster. S. Kaae del.

Nygaard 1974 p. 225-226 and fig. 8, pp. 233-234 and fig. 14, Plate VIII a1-2) and (fig. 37).

Stratigraphical analysis of the faunal material demonstrates that in general terms the frequency of wild boar and aurochs remained unchanged through time, while red deer and pine marten appear in more restricted "horizons" - probably reflecting individual occupations or seasonal hunting "episodes". All the evidence therefore points to the economy of the site being constant during the long occupation period. This must mean that the biotope and resource potential remained the same, and that these factors combined with the excellent topographical position may explain why so much settlement material accumulated here and why Ringkloster became so large in contrast with other Jutland Ertebølle inland settlements.

The most common mammal is the wild boar *(Sus scrofa)* followed by the red deer (*Cervus elaphus*), aurochs (*Bos primigenius*) and roe deer (*Capreolus capreolus*); a few bones of elk (*Alces alces*) are also present. The only domesticated animal is the dog (*Canis familiaris*). The faunal remains (and the great number of antler waste and antler tools) demonstrate that hunting of wild boar and red deer was of major importance

Of special interest is a very high frequency of bones of animals with fur, especially pine marten (*Martes martes*). These were normally found articulated and in heaps of several individuals, i. e. they have not been eaten, but have been discarded intact without being cut up. Distinct symmetrical fractures or round holes in the rear of the craniums of these animals, and also transverse cut marks across the front of the snouts, are best interpreted as traces of the traps in which they were caught and of the subsequent skinning with flint knives (fig. 38). These observations tell us that we are not dealing with "normal" use of these animals (for food), but with a more specialised activity; i.e. the reason that the pine martens were hunted was because of the fur. This fits also with the archaeological material. The number of pine martens at Ringkloster surpasses what is known from most other Danish Mesolithic settlement; only the coastal Ertebølle site Tybrind Vig has a similar high number of these animals (Trolle-Lassen 1986). This strongly suggests that trapping for pelts was an essential part of the activities at this site. Other animals in this category are otter (*Lutra lutra*), wild cat (*Felis silvestris*), badger (*Meles meles*) and fox (*Vulpes vulpes*), which were also hunted for their furs. The fact that no less than 28.4% of the red deer and 18.6% of the roe deer are newborn - an aspect of the faunal assemblage in which Ringkloster also differs from other Ertebølle settlements - probably reflects hunting for the fine, white-spotted skins.

The hunting activities fits nicely with the archaeological material, which is dominated by arrowheads, scrapers for skins, bone skinning knives, "oyster-scrapers" and many blades.

The presence of two bones of (wild) horse (*Equus ferus*) is interesting. Their stratigraphical position indicates the Ertebølle period, which means that they must come from wild horses. So far only one horse bone has been found - at the Ertebølle site of Brabrand, not far from Ringkloster (fig. 1 and 3). A ^{14}C

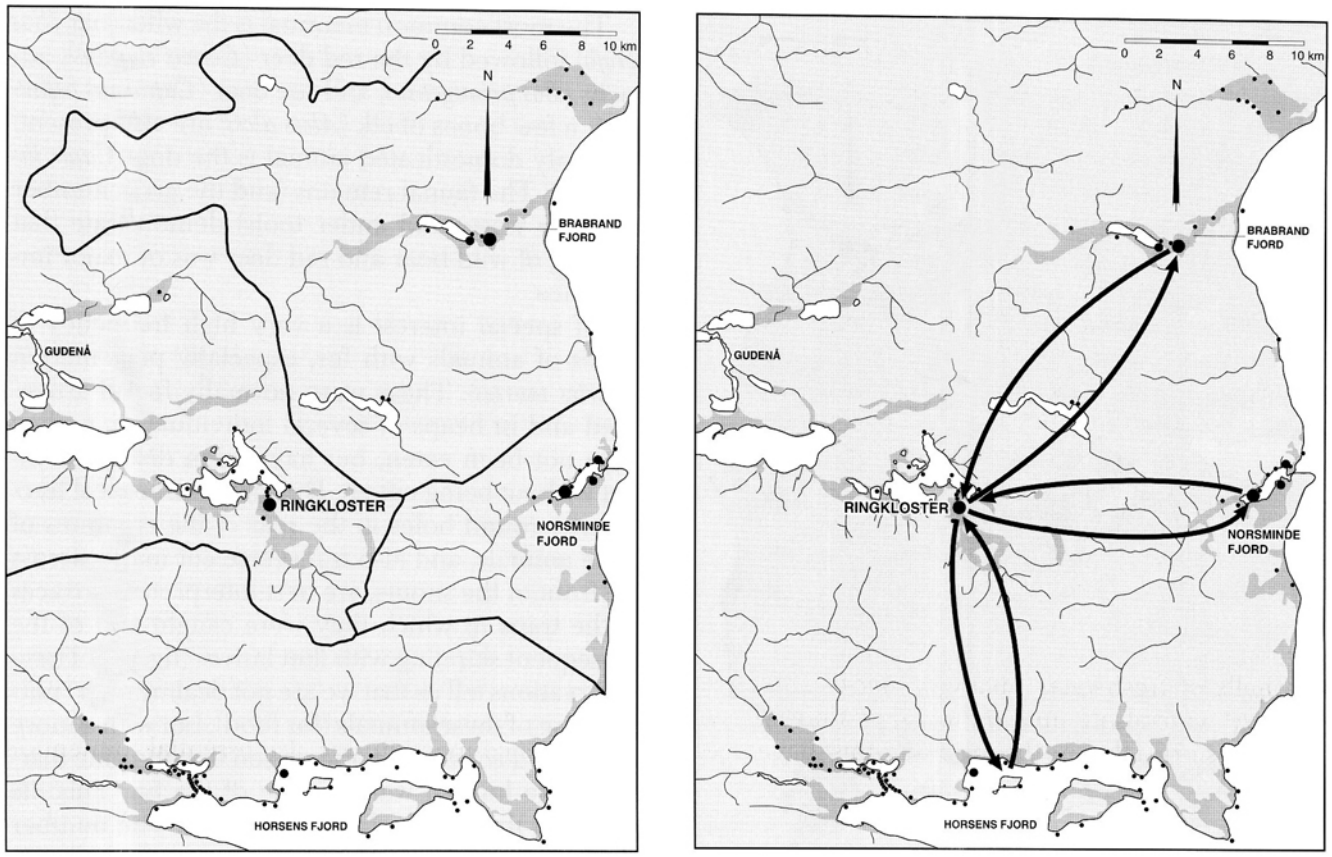

Fig. 40 Models of the Late Mesolithic, Ertebølle settlement system in Eastern Jutland. As two, individual systems, "Forest hunters" and "Coastal Fishermen" (left) and as one, single unit with seasonal movements from the coastal region into the interior (right). cf. fig 3 S. Kaae del.

date places this horse clearly in the Ertebølle culture (4350 BC (K-2651) (4450-4260 BC with one standard deviation). (Davidsen 1978 p. 145), and thereby also supports the assumption that the Ringkloster horse bones are of Ertebølle age, and that there were wild horses in eastern Jutland in the Atlantic period. These findings demonstrate that parts of the biotope of Jutland in the Late Atlantic must have been favourable to this animal, i. e. there were open grass covered areas, rather different from the normal description of the environment of this period as a dark, primeval lime/elm and oak forest (Troels-Smith 1960 p. 98; Iversen 1967 pp. 399-402).

More extraordinary is the presence of 3 bones of bottle-nosed dolphin (*Tursiops truncatus*), which are a further proof of contact(-s) between Ringkloster and the coast.

Birds are surprisingly few - especially if the location of Ringkloster beside a fresh water lake is remembered. They include red throated diver (*Gavia stellata*) (the most common species) as well as sea eagle (*Haliaetus albicilla*) and swan (*Cygnus sp.*).

Fish bones are also found - especially along the prehistoric lake shore where they occur in restricted concentrations - while further out in the lake only scattered and larger fish bones (mainly vertebrae) are recorded (Enghoff 1994 p. 85 ff; 1998 - this volume). Compared with contemporary coastal Ertebølle settlements the number of fish bones and species is small, which also is in accordance with the small number of remains of stationary fish traps and the lack of fish hooks. Other types of fishing equipment are also lacking, which may be compared not only with the coastal sites, but also with contemporary inland settlements in Satrup Moor, such as Rüde 2 and Förstermoor, where both leisters, netfloats and nets are known (Schwabedissen 1960 pp. 14-15, Abb. 8 a-b, Abb. 9 a, c and e).

The archaeological as well as the zoological material seems to indicate that fishing and fowling were of minor importance in the Ringkloster economy.

The fish material is dominated by species living in Danish freshwater lakes, and the majority derive from the Cyprinidae family (roach (*Rutilus rutilus*), whitebream (*Blicca bjoerkna*), rudd (*Scardinius erythrophthalmus*) or bream (*Abramis brama*). The second most frequent species is pike (*Esox lucius*), followed by perch (*Perca fluviatilis*), while the remaining species are only represented by a few bones.

During the analysis of the fish bones it came as a great surprise to find that a distinct part consisted of marine species: Cod (*Gadus morhua*), saithe/pollack (*Pollachius sp.*) and plaice/flounder/dab (*Pleuronectes platessa/Platichthys flesus/Limanda limanda)* (Enghoff 1994). Therefore, the fish species also demonstrate contact(s) between Ringkloster and the coast, but it is impossible to tell in which form these fishes came to the site.

Shells of freshwater bivalves (*Anodonta sp.* and *Unio sp.*) were also found in the deepest horizons in the prehistoric lake. As the molluscs must have lived in the Mesolithic lake adjacent to the settlement it is an open question whether their presence at Ringkloster is as waste from food gathering, or whether they are a natural part of the lake sediments (or a mixture of both). From the Åmose region on Zealand small (inland-) "middens" of these species are well documented, but in these cases they are found at the settlement proper (Noe-Nygaard 1983 pp. 135-137; 1995 pp. 63-64, fig. 30). The most reasonable is to assume that the collecting of freshwater bivalves and snails was yet another part of the economy in the Ertebølle period at Ringkloster.

A few Garden Snails (*Cepaea hortensis*) are also recorded from the lake - a species which is also frequently recorded in the kitchen middens, but always in small numbers (Petersen 1987 pp. 77-84).

Gathering is first and foremost documented by the presence of large numbers of hazelnut shells (*Corylus av.*), which were a substantial part of the debris in the "dump-zone". Collecting of hazel nuts has quite obviously been an essential aspect of the economy at this site.

Samples of gyttja from the "dump" have been analyzed for seeds and fruits. The species of dogwood (*Cornus sanguinea*), hawthorn (*Crataegus sp.*), yellow waterlily (*Nuphar lutea*), white water lily (*Nymphaea alba*), yellow flag (*Iris pseudacorus*) and lime (*Tilia* sp.) have been identified (determinations by Jørgensen). Of special interest is a surprisingly high frequency of fruits of hawthorn (*Crataegus sp.*) and lime (*Tilia sp.*) of which the former is only sparsely represented in the pollen diagrams (cf. Rasmussen 1998 - this volume). Their presence in the waste deposits is most probably a reflection of human activity, i. e. the fruits have been collected and used for food in the autumn and winter. The use of hawthorn fruits is well known from the ethnobotanical record and has been documented up to modern times (Brøndegaard 1979 pp. 53).

A renewed examination of the seeds of hawthorn established that 8 out of 68 seeds were charred or showed the effect of exposure to heat (letter from D. Robinson, The National Museum, Natural science Unit of 15/10-1997). This new investigation demonstrated that these seeds were not a "natural" component of the lake sediment in the "dump zone", but quite contrarily that they were food waste from the settlement area proper.

In this connection it is also essential to mention the large number of hawthorn seeds from the contemporary Ertebølle settlement of Møllebgabet II at Ærø (Grøn & Skaarup 1991; Robinson 1992).

THE RINGKLOSTER SETTLEMENT

Seasonal occupation

It is clear from the archaeological record, that the site was not just used for shorts periods during occasional explorations from a main settlement located elsewhere. The amount of artefacts, debris and the many various features point towards repeated or "semi-permanent" use.

Ringkloster has a number of different and clear seasonal indicators. The analysis by Rowley-Conwy (1998 - this volume) demonstrates that the bones of birds and mammals reflect a distinct seasonality of winter and spring occupation, i. e. the main period of habitation was from November to May. Analysis of wild boar, red and roe deer tooth wear and tooth eruption and bone growth all point towards a winter and spring occupation, while the many hazel nuts point towards the fall. These observations also

fit with the presence of the many furry animals, for the pelts are best during the winter time. The collecting of hawthorn fruits also point in the same direction. The fishes neither support nor contradict this result, but it should be remembered that pike is easiest to catch during their spawning season from March to May (Enghoff 1998 - this volume). Summer indicators are few, but 8 unshed roe deer antlers demonstrate activities on the site during this season; in the same direction point the very young foetal red deers which could not have been killed before May or May-June. Sporadical visits outside the "normal" autumn-winter season seem therefore to have taken place.

All together the faunal and botanical evidence point towards a main occupation period from autumn to early spring, but the whole year occupation could not be completely ruled out.

Type of settlement - "Forest hunters and coastal fishermen"?

What was the purpose of the occupation at Ringkloster? As stated above, Ringkloster differs in many respects from contemporary coastal Ertebølle settlements. As there are only 2 other excavated inland Ertebølle settlement in Jutland, and they are without faunal remains, we lack a wider base for any sort of comparison[11]. This is also the case with the other Danish and North German inland Ertebølle sites, which are not yet satisfactorily published.

The many structural features at Ringkloster reflect functional differences from the coastal sites rather than a cultural one. Although of a negative order, the lack of graves at Ringkloster is also an element which should not be forgotten.

Both the archaeological and the faunal material from Ringkloster argue in favour of interpreting the site as a seasonal site for the procurement of antler, furs/hides and meat. In this respect Ringkloster is unique not only in the Danish, but in the whole North European archaeological record; no other winter inland Ertebølle settlements have so far been published. Only one other Danish Ertebølle site - the coastal site of Hjerk Nor on the Limfjord - demonstrates a similar high frequency of fur-bearing animals, but as this material has been recovered by dredging in the last century it is not usable in a comparison with Ringkloster (Hatting, Holm & Rosenlund 1973).

This interpretation of Ringkloster is also supported by the dominance of arrowheads, flint scrapers for hides, bone knifes, the "oyster shell scrapers", the low axe ratio, and the few artefacts for fishing. Based on his osteological identifications Peter Rowley-Conwy argues that meat of wild boar, red deer, and aurochs must have been removed from Ringkloster to some other location, and that such (base) camps were where the meat and furs ended up (Rowley-Conwy 1993).

This raises other questions. Where were such base camp(s) located? As mentioned before, we have several different signs of contacts between Ringkloster and the sea coast: the whale bones and the marine fishes, the oyster shells, amber (although this raw material theoretically could have been found along the shores of the inland lakes) and the high value of marine food in one of the dogs. These all point in the same direction - the seashore, which only was 14-18 kms away. No other Danish Mesolithic settlement has so many and various traces of contacts between the interior and the coast as Ringkloster (however one should not forget that contacts from Ringkloster and further west into the interior of Jutland also *could* have taken place, but would be nearly impossible to prove). Also the decorated Ertebølle pottery shows a concentration in eastern central Jutland (fig. 39). Both in the Brabrand Fjord (to the north) and in Norsminde fjord (to the east) 2-3 contemporary Ertebølle sites are characterised by this type of ornamented pottery; similar decorated Ertebølle pottery is not found at the Ertebølle sites in Horsens Fjord to the south, but this could also be a function of a lower research intensity in this area

[11] Rosenholm. Forhistorisk Museum, J. nr. 872 and 2011. Unpublished excavation of an inland Ertebølle settlement ca. 25 km Northeast of Århus. Unfortunately it was only partially excavated and only flints and a few charred bones were found. Another excavation of an inland Ertebølle site has taken place at Stallerup Sø (Vejle amt), Forhistorisk Museum, J. nr. 2746 (unpublished). This site was excavated *in toto*, but only flints were found.

compared to the other east jutland regions (fig. 39). The highest frequency of such ceramics is known from the large Flynderhage *køkkenmødding* (central site) in Norsminde Fjord (Gabrielsen 1953).

Together these finds demonstrate a series of contacts between the interior and the coast, but it is not possible to explain the character of these connections and at what social level they took place, i. e. are the marine elements on the inland site Ringkloster vestiges of an exchange network connecting an Ertebølle inland settlement system with a contemporary coastal system, or have the marine elements been brought into the inland district by people moving seasonally from their main settlements at the coast and into the Skanderborg Sø area? In other words did we have two independent groups, *"forest hunters"* and *"coastal fishermen"* connected by exchange networks or are we dealing with one large settlement system covering the whole of Eastern Jutland (fig. 40) ?

The present evidence point in both directions: An argument in favour of two independent Ertebølle settlement systems in this region is given by the 3 dogs with a clear terrestrial food content in their bones - although it is still difficult to evaluate the strength of this type of information. Perhaps the many structural features and the high number of ceramics point in the same direction, as they contrast with the situation at the coastal sites. Pointing in the opposite direction are the conclusions based on the faunal elements, and probably also the absence of graves at Ringkloster.

No conclusive answers to these questions can be proposed now, but at present most information seems to be in favour of interpreting Ringkloster as a seasonal site and as a part of one large East Jutland Ertebølle settlement and procurement system, which included both the coast (Brabrand and Norsminde Fjord) and the interior (Ringkloster).

A situation similar to the east Jutland one has been demonstrated in the Åmose basin on Zealand, but here Nanna Noe-Nygaard argues (mainly based on ^{13}C analysis of dog bones) that we are dealing with two independent groups, an inland population and a coastal population, independent, but with contacts in both directions (Noe-Nygaard 1983 p. 140, 1988 p. 93).

Social organisation

Was Ringkloster a seasonal winter hunting/trapping site of a single coastal settlement, or was it a common procurement site for a whole group of coastal sites of the region? An indication that Ringkloster not only was connected with a single coastal settlement comes from the narrow geographical distribution of contemporary settlement sites with decorated Ertebølle pottery in Eastern Jutland. This extraordinary element indicate connections between these sites, but again it is difficult to define at what level such connections were.

Another question is whether it was all the coastal population that moved seasonally inland in the autumn or whether it was just a small hunting/trapping group. The small number of inland settlements and their relatively small extent in comparison with the coastal sites, tells that it only was small hunting parties which visited Ringkloster in the winter time.

If Ringkloster served as a seasonal camp for several different coastal settlements - if it was a part of an economic structure/network - it must inevitably also have brought into existence social contacts/relations independant of whether this was originally intended or not. Ringkloster also functioned as a meeting place with all the options this gave for establishing social contacts between the peoples - a structural role just as essential as the economic one.

CONCLUSION

Ringkloster is the first excavation of an inland Ertebølle settlement in Denmark for nearly 50 years. Besides it is the first inland settlement with preserved organic materials in the western part of Denmark. The excavations have been extensive and cover both a habitation area on dry land and the ajacent "dump zone" in the prehistoric lake deposits. On dry land a large number of structural features such as different types of pits and fireplaces, trenches, postholes etc. have been recorded, while the "dump" yelded a large faunal material as well as a wide range of Ertebølle types in antler, bone and wood. The occupation at Ringkloster covers ca 1800 years, i.e. the whole Ertebølle and the Early Neolithic Funnel Beaker cultures from ca 5400-3550 BC. - and there-

fore also the Mesolithic - Neolithic transition at ca 3940-3820 BC.

Ringkloster probably functioned as a "central inland site" contemporary with an extensive habitation along the east Jutland coastline. During the long habitation period it gradually became the largest settlement in the lake region of Eastern Jutland as a combination of an optimal location in the exact centre of the lake area and as a function of a high degree of resource stability during ca 1800 years. The most intense occupation with regards to site area and accumulation of debris took place during the younger Ertebølle phase, but it must be stressed that Ringkloster - against normal Danish opinion - also indicates that there was extensive inland habitation during the older Ertebølle period.

The pollen analysis show a distinct contemporary elm and lime decline in the primeval Atlantic forest, which was most probably caused by the Ertebølle population's use of wood for boats, houses etc. Because of the well defined stratigraphy and layers with distinct archaeological types, it has been possible to make direct correlation between archaeological cultures and the botanical evidence. At the beginning of the Subboreal, ca 3900 B.C. the evidence point to an opening of the forest, and at the same time the first pollen of ribwort are recorded - demonstrating the activities of the earliest "Neolithic farmers" in the vicinity of Ringkloster.

The artefact industry at Ringkloster differs markedly in relative frequencies from the contemporary coastal settlements; it is characterised by a dominance of scrapers, burins and transverse arrowheads, while borers, truncated blades and axes are few. Antler implements - especially antler axes - and antler waste are abundant, but bone tools are rare, especially bone points are few at this site. A new type is curved bone knives - interpreted as "skinning knives". Ertebølle pottery is found in large quantities, and a gradual change from a dominance of thick-walled pottery in the deepest horizon to a more thin-walled ware in the upper layer has also been observed. Quite extraordinarily some of the Ertebølle pots were decorated, a feature only known from a small group of contemporary coastal settlements in the central east Jutland region. The new tool types at this site included scrapers of oyster shell.

The analysis of the faunal remains give an explanation for the composition of the artefact industry. Ringkloster is a seasonal (winter) settlement with a specialised economy centred on hunting wild boar, red deer, aurochs and furry animals, especially pine marten and otter. Ringkloster is an inland site for the procurement of meat, skins/pelts and probably also antler. Fowling and fishing seem not to have played a significant economic role. An interesting aspect of the economic activities is that a major part of the meat seems to have been brought to other settlements, probably coastal, for consumption. The presence of bones from dolphins and marine fishes as well as the oyster shells and amber all point to contacts with the coast, and Ringkloster is so far the Danish inland site with the largest number and greatest variety of coastal indicators. However, it is difficult to interpret the nature of these contacts. Are they indicators of seasonal movements of groups between the coast and the interior of Jutland or are they traces of exchange networks between an inland and a coastal population? In other words is Ringkloster an example of an inland Ertebølle settlement system independent of, but connected with a coastal settlement system, or is it a part of a single large east Jutland settlement system with its main settlements based on the coast, but incorporating the interior lake region? At present most evidence point to an interpretation of Ringkloster as the seasonal, winter, inland settlement component of a large settlement system based on the coast. If Ringkloster served as an inland procurement site for more than one of the coastal sites, it must inevitably also have played an important role as a location for social exchange and impulses in East Jutland Ertebølle society.

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REFERENCES

Althin, C. -A. 1954: The Chronology of the Stone Age Settlement of Scania, Sweden. *Acta Arch. Lundensia.* Series in 4°. No. 1. Lund.

Andersen, K. 1983: *Stenalderbebyggelsen i den vestsjællandske Åmose.* Fredningsstyrelsen. København.

Andersen, S. H. 1972: Ertebøllekulturens harpuner. (English summary) *Kuml* 1971: 73-125.

- 1975: Ringkloster, en jysk indlandsboplads med Ertebøllekultur. (English summary) *Kuml* 1973-74: 11-108.
- 1976: Et østjysk fjordsystems bebyggelse i stenalderen; Norsminde Fjord undersøgelsen. In: H. Thrane (ed.) *Bebyggelsesarkæologi.* Skrifter fra Institut for Historie og Samfundsvidenskab no. 17. Odense Universitet.
- 1977: Ertebøllekultur på Vestfyn. En oversigt. *Fynske Minder*: 7-36.
- 1979a: Flade, skælhuggede skiver af Brovst-type. (English summary)*Kuml* 1978: 77-98.
- 1979b: Pelsjægere. *Skalk* 1979, nr. 2: 3-8.
- 1981: Ertebøllekunst. Nye østjyske fund af mønstrede Ertebølleoldsager. (English summary) *Kuml* 1980 (1981), pp. 7-59. Århus.
- 1985: Tybrind Vig. A Preliminary Report on a Submerged Ertebølle Settlement on the West Coast of Fyn. *Journal of Danish Archaeology* vol. 4: 52-69.
- 1991: Norsminde. A "Køkkenmødding" with Late Mesolithic and Early Neolithic Occupation. *Journal of Danish Archaeology* vol. 8, 1989: 13-40.
- 1993: Bjørnsholm. A Stratified Køkkenmødding on the Central Limfjord, North Jutland. *Journal of Danish Archaeology* vol. 10, 1991: 59-96.
- 1994: Kød, pelsværk og skind. *Humaniora.* Nr. 2. 8 årg.: 27-31.
- 1995: Coastal adaption and marine exploitation in Late Mesolithic Denmark - with special emphasis on the Limfjord region. In: A. Fischer (ed.) *Man and Sea in the Mesolithic. Coastal settlement above and below present sea level,* pp. 41-66. Oxbow Monograph 53, Oxford.

Andersen, Søren H. & Malmros 1966: Norslund. En kystboplads fra ældre stenalder. (English summary) *Kuml* 1965: 35-114.

Andersen, Søren H. & N. Sterum 1971: Gudenåkulturen. *Holstebro Museum. Årsskrift* 1970-71: 14-32.

Andersen, Søren H. & Malmros 1981: Appendix. Dateringen af Norslund - bopladsens lag 3 og 4. *Kuml* 1980: 60-62.

Andersen, Søren H. & Johansen 1987: Ertebølle Revisited. *Journal of Danish Archaeology* vol 5, 1986: 31-61.

Bahnson, K. 1892: Meddelelser fra Nationalmuseets danske Samling. Stenalderen. *Aarbøger for nordisk Oldkyndighed og Historie* II Rk. 7 Bd.: 166 (Vålse Vig).

Becker, C. J. 1939: En Stenalderboplads paa Ordrup Næs i Nordvestsjælland. Bidrag til Spørgsmaalet om Ertebøllekulturens Varighed. *Aarbøger for nordisk Oldkyndighed og Historie* : 199-280.

Binford, L. 1983: *In Pursuit of the Past.*

Bleuer, E. et al. 1993: *Jungsteinzeitliche Ufersiedlungen im Zürcher Seefeld. Zürcher Denkmalpflege.* Band 2: Tafeln. Archäologische Monographien 23. Zürich.

Brøndegaard, J. V. 1979: *Folk og flora. Dansk etnobotanik.* 3. København.

Clark, J. G. D. 1954: *Excavations at Star Carr.* Cambridge.

Clason, A. T. 1986: Spoolde, worked and unworked antlers and bone tools. *Palaeohistoria* 25, 1983: 77-130. Rotterdam.

Davidsen, K. 1978: *The Final TRB Culture in Denmark. A Settlement Study.* Arkæologiske Studier V. København.

Deichmüller, J. 1965: Die neolithische Moorsiedlung Hüde I am Dümmer, Kreis Grafschaft Diepholz. Neue *Ausgrabungen und Forschungen in Niedersachsen* 2: 1-18. Hildesheim.

- 1969: Die neolithische Moorsiedlung Hüde I am Dümmer, Kreis Grafschaft Diepholz. *Neue Ausgrabungen und Forschungen in Niedersachsen*: 28-36. Hildesheim.

Enghoff, I. B. 1994: Fishing in Denmark During the Ertebølle Period. *International Journal of Osteology,* Vol. 4: 65-96.

- 1998: Freshwater fishing at Ringkloster, with a supplement of marine fishes. *Journal of Danish Archaeology* vol 12, 1994-95: 99-105.

Fischer, A. 1982: Trade in Danubian Shaft-Hole Axes and the Introduction of Neolithic Economy in Denmark. *Journal of Danish Archaeology* vol. 1: 7-12.

Gabrielsen, S. 1953: Udgravningen på Flynderhage 1945 - 47. *Aarb. udgivne af Historisk Samfund for Aarhus Stift* XLVI, 1953: 5 -16.

Grøn, O. & J. Skaarup 1991: Møllegabet II. A Submerged Mesolithic Site and a "Boat Burial from Ærø. *Journal of Danish Archaeology* vol 10, pp. 38-50.

Grønnow, B. 1987: Meiendorf and Stellmoor revisited. *Acta Archaeologica,* vol. 56: 131-166.

Harder, P. 1908: En østjysk Israndslinie og dens Indflydelse paa Vandløbene. *D. G. U. II rk.* , nr. 19, pp. 108 ff and 121 ff.

Hartz, S. 1996: Älteste Keramik der Erteböllekultur. *Archäologie in Deutschland,* Nr. 2, 1996: 53-54

- 1997: Ertebøllekultur in Travetal. *Stormarner Hefte. Denkmalpflege im Kreis Sormarn* III, 20: 171-186

Hatting, T., E. Holm & K. Rosenlund 1973: En pelsjægerboplads fra stenalderen. *Kaskelot* 1973: 13-20.

Hulthen, B. 1977: *On ceramic technology during the Scanian Neolithic and Bronze Age.* Thesis and Papers in North-European Archaeology 6. Stockholm.

Iversen, Johs. 1967: Naturens udvikling siden sidste istid. In: Nørrevang, A. og T. J. Meyer (eds.) *Danmarks natur.* Bd. 1. Politikens Forlag. København.

Jacobsen, N. Kingo 1976: Natural - Geographical Regions of Denmark. *Geografisk Tidsskrift* 75: 1-7. København juni 1976.

Jennbert, K. 1984: *Den produktiva gåvan. Tradition och innovation i Sydskandinavien för omkring 5300 år sedan.* Acta Arch. Lundensia. Series in 4° No 16.

Jensen, H. Juel 1982a: Analysis of wear on flint tools. Pact 7, pp. 441-445. *Second Nordic Conference on the Application of Scientific Methods in Archaeology.* Helsingør, Denmark, 17-19 August 1981. Strasbourg.

- 1982b: A Preliminary Analysis of Blade Scrapers from Ringkloster, A Danish Late Mesolithic Site. *Studia Praehistorica Belgica* 2 - 1982: 323-327.
- 1986: Unretouched blades in the Late Mesolithic of South Scandinavia. A functional study. *Oxford Journal of Archaeology* 5: 19-33.
- 1989: Plant harvesting and processing with Flint Implements in the Danish Stone Age. A View from the Microscope. *Acta Archaeologica.* Vol. 59, 1988: 131-142.
- 1994: *Flint Tools and Plant Working. Hidden Traces of Stone Age Technology.* Aarhus University Press.

Klindt - Jensen, O. 1947. Udgravningen 1944. In: Haugsted, E. (ed.) *Bopladsen paa Rugholm. Aarhus Museums Undersøgelser ved østenden af Brabrand Sø 1944-45.* Aarhus.

Larsson, L. 1983: Ageröd V. *An Atlantic Bog Site in Central Scania.* Acta Arch. Lundensia. Series in 8°. No 12. Lund.

Legge, A. J. & P. Rowley-Conwy 1988: *Star Carr Revisited. A Re-analysis of the Large Mammals.* London.

Madsen, T. & J. E. Petersen 1984: Tidlig-neolitiske anlæg ved Mosegården. Regionale og kronologiske forskelle i tidligneolitikum. *Kuml* 1982-83: 61-120.

Malmros, C. 1986: *Rapport om bestemmelse af ved, trækul, bark og svampe fra Ringkloster.* Unpublished Report. The National Museum, Natural Science Research Unit. J. Nr. A 5502-92, 19 p. København.

Mathiassen, Th. 1937: Gudenaa-Kulturen. En mesolitisk Indlandsbebyggelse i Jylland. *Aarbøger for nordisk Oldkyndighed og Hist*orie 1937, 1 Halvbind: 1-181.

- 1943: *Stenalderbopladser i Aamosen.* Nordiske Fortidsminder III Bind, 3. Hefte. København.

Mestorf, J. 1904: Wohnstätten der älteren neolithischen Periode in der Kieler Föhrde. Archäologischer Teil. *43 Bericht des Schleswig - Holsteinischen Museums vaterländischer Altertümer bei der Universität Kiel,* 1904: 17- .

Noe - Nygaard, N. 1974: Mesolithic Hunting in Denmark Illustrated by Bone Injuries Caused by Human Weapons. *Journal of Archaeological Science* 1974, 1: 217-248.

- 1983: The Importance of Aquatic Resources to Mesolithic Man at Inland Sites in Denmark. In: C. Grigson & J. Clutton-Brock (eds.) *Animal and Archaeology : 2. Shell Middens, Fishes and Birds,* pp. 125-142. BAR international Series 183.
- 1988: Delta 13 C-Values of Dog Bones Reveal the Nature of Changes in Man's Food Resources at the Mesolithic - Neolithic Transition, Denmark. *Chemical Geology (Isotope Geoscience Section),* 73: 87-96. Amsterdam.
- 1995: Ecological, sedimentary, and geochemical evolution of the late - glacial to postglacial Åmose lacustrine basin, Denmark. *Fossils & Strata.* No 37. 8th June 1995. Scandinavian University Press. Oslo, Copenhagen, Stockholm.

Pedersen, L. 1980: Skolæstøkser. *Skalk,* nr. 4: 27-29.

Petersen, K. S. 1987: The Ertebølle "Køkkenmødding" and the Marine Development of the Limfjord, with Particular Reference to the Molluscan Fauna. *Journal of Danish Archaeolgy* vol. 5, 1986: 77-84.

Petersen, P. V. 1984: Chronological and Regional variation in the Late Mesolithic of Eastern Denmark. *Journal of Danish Archaeology* vol. 3: 7-18.

Pitts, M. 1979: Hides and antlers: a new look at the gatherer-hunter site at Star Carr, North Yorkshire, England. *World Archaeology,* Vol. II, No. I: 32-42.

Rasmussen, Peter 1998: Mid-holocene Vegetation Development at the Inland Ertebølle Settlement of Ringkloster, Eastern Jutland. *Journal of Danish Archaeology* vol 12, 1994-95: 65-85

Regnell, M. , M - J. Gaillard, T. S. Bartholin & P. Karsten, 1995: Reconstruction of Environment and history of plant use during the late Mesolithic (Ertebølle culture) at the inland settlement of Bökeberg III, southern Sweden. *Vegetation History and Archaeobotany,* vol. 4: 67-91.

Robinson, D. 1992: Bestemmelse af planterester fundet i forbindelse med en stammebåd ved Møllegabet II, Ærø *N:N:U: rapport nr. 6*

Rowley - Conwy, P. 1981: Mesolithic Danish Bacon: Permanent and Temporary Sites in the Danish Mesolithic. In: A. Sheridan and G. Bailey (eds.) *Economic Archaeology,* pp. 51-55.BAR International Series 96.

- 1993: Season and Reason: the case for a regional interpretation of mesolithic settlement patterns. In: G. L. Peterkin, H. Bricker and P. Mellars (eds.) *Hunting and Animal Exploitation in the Later Palaeolithic and Mesolithic of Eurasia,* pp. 179-188. Archaeological Papers of the American Anthropological Association no. 4, 1993.
- 1998: Meat, Furs and Skins: Mesolithic Animal Bones from Ringkloster, a Seasonal Hunting Camp in Jutland. *Journal of Danish Archaeology* vol 12, 1994-95: 87-98.

Schindler, R. 1961: Rössener Elemente im Frühneolithikum vom Boberg. *Hammaburg* 7/XIII: 9-29.

Schwabedissen, H., 1960: Die Ausgrabungen im Satruper Moor. *Offa* Bd. 16. 1957-58 (1960): 5-28. Neumünster.

- 1981: Ertebølle/Ellerbek - Mesolithikum oder Neolithikum ? In: B. Gramsch (ed.) *Mesolithikum in Europa.* Veröffentlichungen des Museums für Ur- und Frühgeschichte Potsdam 14/15, 1980: 129-142.
- 1994: Die Ellerbek-Kultur in Schleswig-Holstein und das Vordringen des Neolithikums über die Elbe nach Norden. In: J. Hoika & J. Meurers-Balke (eds.) *Beiträge zur frühneolithischen Trichterbecherkultur im westlichen Ostseegebiet. 1. Internationales Trichterbechersymposium in Schleswig vom 4. bis 7. März 1985*: 361-401. Neumünster.

Stuiver, M. & Reimer, P. J. 1993: Extended ^{14}C data base and revised CALIB 3. 0 ^{14}C age calibration program. *Radiocarbon* 35, 1: 215-230.

Sørensen, I. 1969: Er bæverens tænder benyttet som redskaber i stenalderen i Danmark? *Aarbøger for nordisk Oldkyndighed og Historie* 1969: 116-126.

Tauber, H. 1971: Nye perspektiver i kulstof - 14 dateringsmetoden. *Naturens Verden* 12: 393-401.

- 1981: Kostvaner i forhistorisk tid, In: *"Det skabende menneske 1". Kulturhistoriske skitser tilegnet P. V. Glob 20 februar 1981*, pp. 112 - 126.
- 1971: Nye perspektiver i kulstof-14 dateringsmetoden. *Naturens Verden* 12: 393-401.

Troels-Smith, J. 1960: Ertebølletidens Fangstfolk og Bønder. *Fra Nationalmuseets Arbejdsmark* 1960: 95-119. København.

- 1967: The Ertebølle Culture and its Background. *Palaeohistoria*, vol. 12: 505-528. Groningen.

Trolle-Lassen, T. 1986: Human exploitation of the pine marten (Martes martes (L.)) at the Late Mesolithic settlement of Tybrind Vig in western Funen. In: L. -K. Königsson (ed.) *Nordic Late Quaternary Biology and Ecology.* Striae 24, pp. 119-124.

Vita-Finzi, C. & E. S. Higgs 1970: Prehistoric Economy in the Mount Carmel Area of Palestine. Site Catchment Analysis. *Proceedings of the Prehistoric Society.* Volume XXXVI, Dec. 1970: 1-37.

Waterbolk, H. T. & W. van Zeist 1991: *Niederwil. Eine Siedlung der Pfyner Kultur.* Academica Helvetica. Bd. 1^{IV} : Holzartefakte und Textilien. Bern.

Westerby, E. 1927: *Stenalderbopladser ved Klampenborg. Nogle Bidrag til Studiet af den mesolitiske Periode.* København.

Aaris-Sørensen, K. 1988: *Danmarks forhistoriske dyreverden. Fra istid til vikingetid.* København.