

# *Meat, Furs and Skins:* Mesolithic Animal Bones from Ringkloster, a Seasonal Hunting Camp in Jutland

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## INTRODUCTION

The site of Ringkloster belongs to the late mesolithic Ertebølle period, and dates from the 4th millennium BC in uncalibrated radiocarbon years. The Ertebølle is best known for its numerous large shell middens, but inland sites are also known. The excavations at Ringkloster represent the first modern excavation of an inland Ertebølle site in Denmark, and the first excavation ever of such a site in Jutland. Ringkloster lies some 15 km inland from the present coastline of eastern Jutland, although at the time of occupation sea level was a little higher than at present and the sea shore consequently somewhat closer (for more information see Andersen 1975; 1998 - this volume).

The site lies on the shore of a former lake, now infilled with fen peat. Little or no animal bone material survives on the actual area of occupation itself. However, the inhabitants disposed of large quantities of animal bones and other items by throwing them into the adjacent lake, where they were subsequently covered by the growing fen peat. In this respect the site is similar to other well-known mesolithic lake edge sites such as the Maglemose settlements of Zealand, and Star Carr in Britain.

Preservation of animal bone in such contexts is superb, and Ringkloster is exceptional even when compared to other bog sites. Dog bones are present in the assemblage, and some other bones show visible traces of gnawing. These are relatively rare, however, so it is felt that dogs have probably not modified the assemblage as much as is usually the case. Once bones had been discarded into the lake, dogs

would no longer have had access to them (cf the similar arguments advanced for Star Carr by Legge & Rowley-Conwy 1988: 70).

The peat deposits from which the bones were recovered were not amenable to systematic large scale sieving. Bone fragments were therefore recovered by hand during the excavation. It is believed, however, that recovery was as good as could be achieved under the circumstances. The excavators (among them for several seasons the author of this paper) worked slowly and carefully and made every effort to recover all items. Some samples of material from the bog were sieved as a check on the degree of recovery, and very little material was found to have been overlooked by the excavators. For the most part one may therefore be reasonably confident that the assemblage is representative of what was in the deposits. However, the near absence of items such as astragali and phalanges of small carnivores (other bones of which are very common) must be due to their not being recovered.

A substantial part of the animal bone assemblage was previously examined by Dr. Ulrik Møhl, and a preliminary report presented (in Andersen 1975: 84-89, 94). The present author has examined the entire assemblage, and aspects of it have been referred to in other contexts (Rowley-Conwy 1993; in press). It must be stressed here that this report is preliminary, and that some analysis remains to be carried out. Although the main conclusions will not change, details of quantification etc. may differ in the final report.

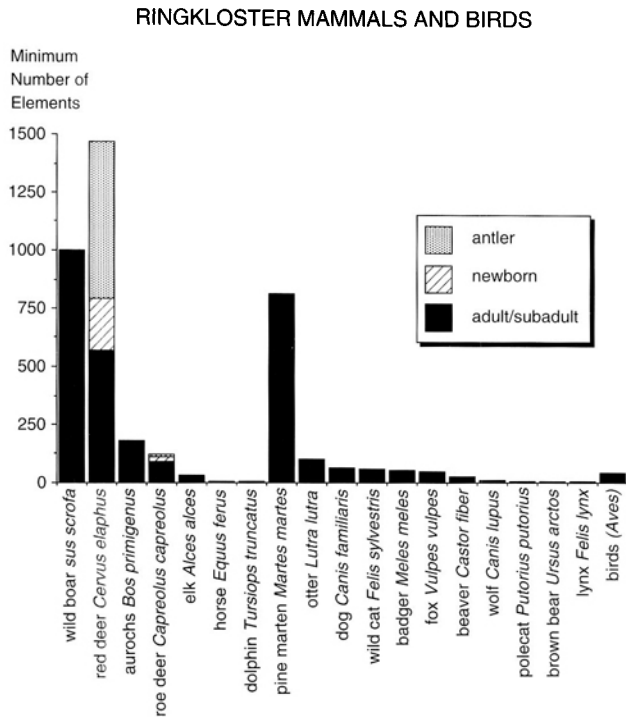


Fig. 1 Results of a preliminary quantification of the Ringkloster mammal and bird bones. For method of quantification see text.

## SPECIES REPRESENTED

Fig. 1 shows in graphic form the frequencies of mammals and birds at Ringkloster. The method of quantification that this is based upon is a variant of the Minimum Number of Elements (MNE) method presented by Binford (1978: 69-72; 1984: 50-51). This is preferable to both a simple count of fragments (NISP or Number of Identified Specimens) and any calculation of minimum numbers of individuals (MNI). MNI counts are usually based on only a small part of the assemblage such as the most common element, so that interspecific comparisons of even quite large assemblages may be based on small numbers. NISP counts suffer from problems of anatomical differences between species and differential fragmentation.

There are two stages in calculating MNE totals: firstly, the minimum number of each element (for example, distal humerus) must be estimated from the fragments found; secondly, these numbers must be adjusted because not all bones are equally repre-

## RINGKLOSTER WILD PIG DENTAL EVIDENCE

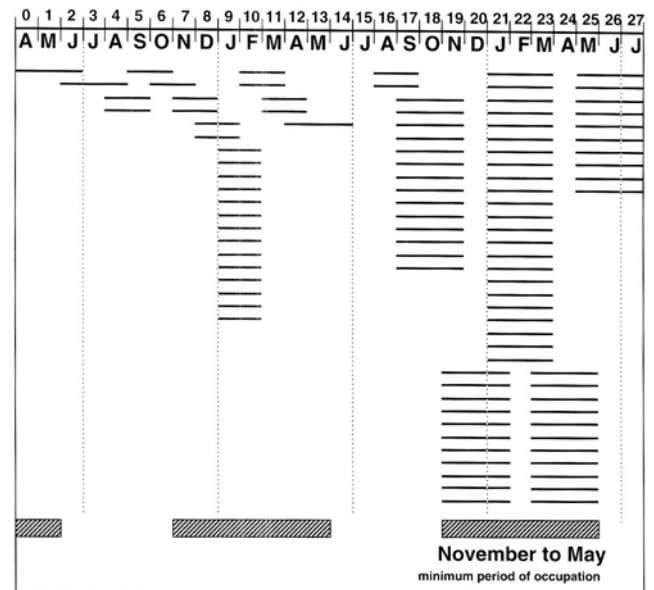


Fig. 2 Seasonal evidence from dentition of wild boar (*Sus scrofa*) from Ringkloster (preliminary version).

sented in a skeleton. For example, a ruminant has one atlas vertebra, two distal humeri, and eight proximal phalanges; the count for atlas vertebrae is therefore doubled, and that for proximal phalanges divided by four, to bring them into line with the long-bone articulations.

This is preferable to NISP and MNI calculations in a number of ways. Firstly, all jaw and teeth fragments are not counted separately, but have been used to calculate the minimum number of mandibles and maxillae they could have come from. Although imprecise, this is preferable to counting each fragment separately, because at Ringkloster the large mammal jaws were often broken. One smashed jaw liberates many identifiable teeth into the archaeological deposits, and if each tooth was counted separately biases would be introduced both within and between species. Secondly, among the animals considered here, pigs have more metapodials than do the ruminants. For the purposes of comparability, the totals for metapodials III and IV are therefore halved, and the lateral metapodials and phalanges

are ignored. Metapodial totals of carnivores are similarly adjusted to make them comparable to the ruminants. Thirdly, differential fragmentation is to some extent circumvented by counting each long-bone articulation separately. Many newborn deer limb bones and the overwhelming majority of carnivore limb bones were unbroken, while almost all the subadult and adult large mammal limb bones were broken. In a NISP count a complete pine marten humerus would count as one fragment, while a smashed pig humerus could be represented by two or more fragments. This bias is removed by counting the complete pine marten humerus as two elements in the MNE count, one for each articulation.

No method of quantification gives a magic solution to interspecific comparisons. However, the method outlined here probably gives a truer general picture of animal frequencies than most (subject of course to cultural biases such as differential transport of species or skeletal parts - see below). In light of this, various comments may be made with regard to fig. 1.

Wild boar is clearly the most common large mammal. Red deer is the second species in this category, only exceeding wild boar if the large number of antler fragments are taken into consideration. It is remarkable that bones of pine marten should be so common; these exceed those of red deer (excluding the antlers) and are second in frequency only to wild boar. The only domestic animal present is the dog; no sign has yet emerged from the analysis that the wild boar or aurochs are in any sense "proto-domestic". Three scapulae of wild boar have healed shot wounds, indicating that these animals at least were hunted. The presence of two horse bones is unexpected but not entirely implausible, since a horse first phalanx from the Ertebølle site of Brabrand has been directly dated to  $3550 \pm 75$  BC uncalibrated (K-2651), thus placing it squarely within the Ertebølle period (Davidsen 1978, 145). Direct radiocarbon dates will be taken from the Ringkloster specimens to ascertain their contemporaneity with the rest of the cultural material. Finally, the presence of a rib of bottle-nosed dolphin at Ringkloster was noted by Dr. U. Møhl (in Andersen 1975: 88). In this author's analysis two further bones of small whales were found. Both are vertebrae, and were identified (with Dr. Møhl's help) as coming from the same species.

## SEASONALITY

A major question with regard to any hunter-gatherer site is whether the site was seasonally occupied, and if so in which season. Ringkloster has a number of clear indications of seasonal occupation; it will be argued here that all the evidence indicates a winter/spring occupation, from about November to about May.

### *Wild Boar Tooth Eruption*

Tooth eruption provides one of the clearest methods of determining the season of hunting and therefore of occupation. The large number of wild boar jaws in the Ringkloster assemblage provide more information than perhaps any other European mesolithic assemblage can do.

The method uses only dentally immature animals; once the third cusp of the third molar is in wear, the animal is no longer so precisely ageable. Two pieces of information are required: (1) the age at which the various teeth erupt in modern animals; and (2) the time of year in which the modern animals are born. Two assumptions are then made: (1) that prehistoric animals erupted their teeth at the same ages as their modern counterparts; and (2) that prehistoric animals were born at the same time of year as their modern counterparts. Modern wild boar have been relatively well studied. Three sets of eruption ages for different modern wild populations are known to the author (Bull & Payne 1982; Briedermann 1967; Matschke 1967). These all agree closely with each other and with the modern domestic ages put forward by Silver (1969). Can these figures be safely extrapolated back to the mesolithic? Silver (1969) also quotes figures for domestic animals in the last century; these differ from the modern figures and Silver suggests that plane of nutrition determines tooth eruption speed. However, recent work on cattle and sheep has indicated that 19th century data are suspect or spurious, and that tooth eruption is unlikely to be much affected by nutrition (Payne 1984; Legge, Williams & Williams 1992). In view of this, and of the similarity between the various sets of pig data mentioned above, it is likely that modern figures for tooth eruption can be extrapolated back with some confidence. In Denmark

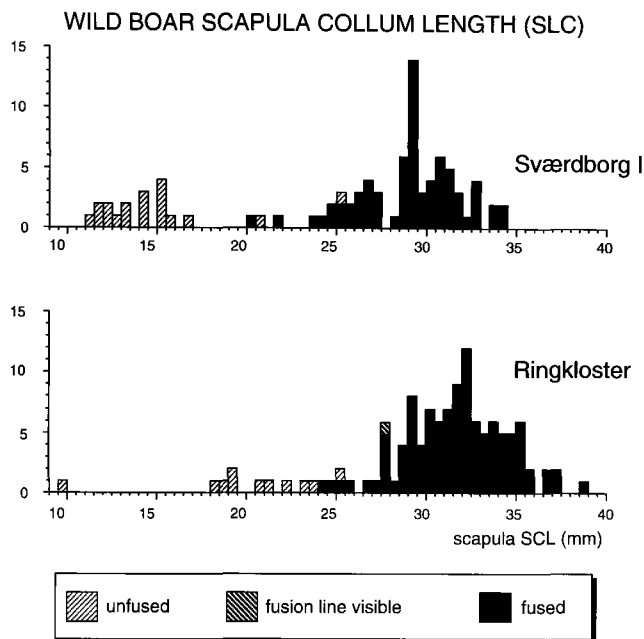


Fig. 3 Scapula measurement SLC of wild boar (*Sus scrofa*) from Ringkloster, compared to the same measurement from Sværdborg I. Measurement definition from von den Driesch (1976).

wild boar give birth in March and April (Møhl 1978), and this too has probably changed little within the Holocene.

Fig. 2 shows the preliminary results. The ages used are those put forward by Higham (1968) using an earlier edition of Silver's (1969) ages. Each jaw ageable within Higham's scheme is given a line covering its determined age in months. Months in the year are calculated taking April 1 as mean date of birth. A line on fig. 2 means that an animal was killed somewhere within the timespan; it does not of course indicate human activity throughout the months covered. It is clear that there are two separate peaks of killing, one in each winter. The fact that these peaks coincide, both falling in the winter, is a further point in favour of extrapolating back the tooth eruption ages of modern pigs: if eruption ages were substantially different in the mesolithic, the two peaks should indicate different times of year.

The minimum period of occupation necessary to include almost all the second winter animals is November to May; this includes the "inner" ends of both the 17-19 month and the 25-27 month groups. This theoretical minimum is indicated in fig. 2, op-

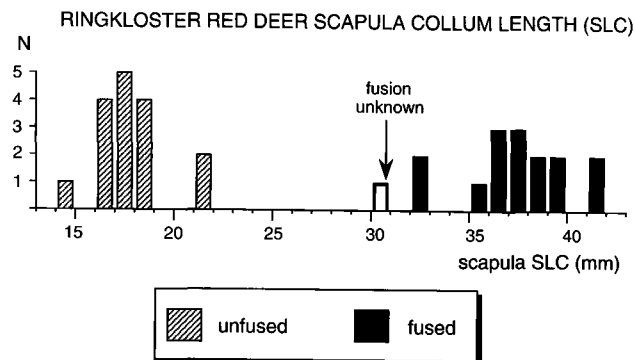


Fig. 4 Scapula measurement SLC of red deer (*Cervus elaphus*) from Ringkloster. Measurement definition from von den Driesch (1976).

posite both the first and second winters and the first spring. Of exactly 100 ageable jaws in fig. 2, all but 5 could have been killed within the November to May minimum.

Does the minimum necessary occupation coincide with the actual period of occupation? At Ringkloster there are two grounds for suggesting so. Firstly, other indicators all agree (see below). Secondly, the gaps in fig. 2 support this. If, for example, occupation had regularly begun as early as September, many more animals of 4-5 months and 16-17 months would have been expected; but they are virtually absent. The minimum necessary occupation period is thus a useful tool which may help to indicate concentrations in data of this sort. For example, Trolle-Lassen (1990: fig. 5) plots red deer data from Tybrind Vig, and states that the animals were killed "at all times of the year" (1990: 10). The minimum necessary period to account for 25 of the 26 Tybrind Vig specimens (excluding antler) is however a limited period from June to October. At Tybrind Vig, red deer hunting therefore appears to have been a seasonal activity. In view of the fact that the numerous pine martens at Tybrind Vig were also killed in the autumn (Trolle-Lassen 1986), it would be interesting to know what evidence there is for occupation at other times of the year.

### Red Deer Tooth Eruption

The majority of red deer bones from Ringkloster comes from mature animals, a fact already noted by

Møhl (in Andersen 1975: 86). However, one class of juvenile also noted by Møhl appears in quantity: very young fawns. Seventeen mandibles from such animals were recovered. In two cases, deciduous m3 is nearly fully erupted but is unworn; in the other fifteen jaws, deciduous m3 is only half erupted. None of these teeth is thus worn, but very faint hairline wear was observed on four of the m2 teeth in these jaws. The animals from which these came can be no older than one or two weeks, and they could indeed be foetal.

Red deer in Europe today give birth mainly in May and June. Births in any one area are usually fairly concentrated, and variations between areas are probably due to local vegetational development (Ahlen 1965). During the Atlantic period, Denmark was over 2°C warmer than today (Degerbøl & Krog 1951). Vegetation is thus likely to have developed relatively early in the year, which may suggest that Ertebølle period red deer births would concentrate in May rather than June. Adding a month before this for the possibility that the little deer were foetal, the season that the Ringkloster fawns indicates is tentatively placed as April and May. The fact that no jaws have wear beginning on m3 indicates an abrupt ending of hunting, best explained as the start of a seasonal absence by the hunters.

### Wild Boar Bone Growth

Bone growth is a method which has recently been used to diagnose seasonality (Legge & Rowley-Conwy 1987; Rowley-Conwy 1993; in press). Gaps in distributions are good evidence of a cessation of killing and thus of seasonal killing, but do not by themselves indicate which season is involved.

Where sites can be diagnosed by tooth eruption, the bone growth patterns lend support. An example is given in fig. 3. The Maglemosian site of Sværdborg I is classified as a summer site on the basis of among other things pig tooth eruption, because of the presence of many piglets of about 2-5 months age (Rowley-Conwy 1993). The group of unfused scapulae from this site (fig. 3) must correspond to these. There is then a gap (containing only three specimens), separating the very young and the more mature specimens. This gap reinforces the conclusion that people were mostly absent from Svær-

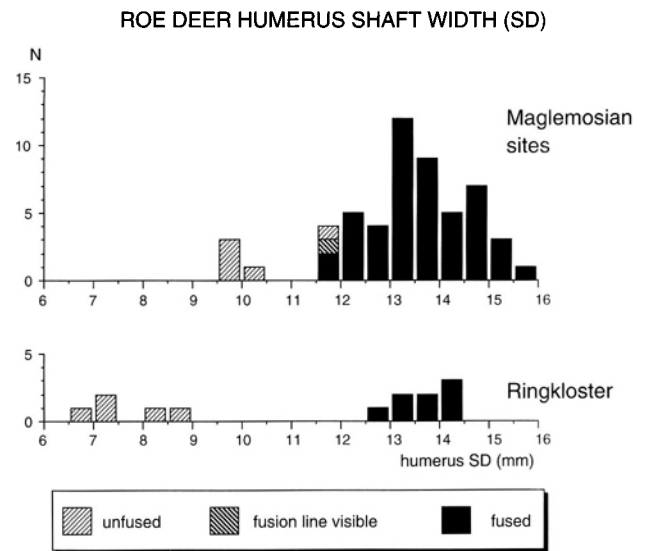


Fig. 5 Humerus measurement SD of roe deer (*Capreolus capreolus*) from Ringkloster, compared to the same measurement from Sværdborg I, Holmegaard I and IV and Mullerup. Measurement definition from von den Driesch (1976).

borg I during the winter. Ringkloster is exactly complementary: a single tiny scapula is even smaller than the Sværdborg juveniles, indicating a newborn specimen probably killed in about April. There is then a gap opposite the summer juvenile size range at Sværdborg; killing at Ringkloster resumed opposite the winter gap at Sværdborg. Wild boar bone growth thus supports the conclusions derived from the jaws.

### Red Deer Bone Growth

The Ringkloster red deer scapulae show a similar pattern to those of wild boar (fig. 4), though no Maglemosian comparative specimens are available. However, the major gap between the fused and the unfused specimens must indicate seasonal cessation of killing. The little scapulae must correspond to the newborn or foetal jaws described above, while the fused ones derive from subadult or adult animals.

### Roe Deer Bone Growth

Bones of very young roe deer were also present at Ringkloster, although only one newborn or foetal

jaw was found. These bones cannot therefore be so clearly seasonally diagnosed by means of evidence from Ringkloster. However, sufficient Maglemosian comparative material is available to provide a pattern.

The sites of Sværdborg I, Holmegaard I and IV and Mullerup produced many roe deer bones, a few of which were from very young animals. The sites in question are all diagnosed as summer sites, occupation probably starting around June (Rowley-Conwy 1993). If the above discussion about the birth season of red deer applies also to roe deer, the roe would have been up to a month old in June. Bones of very young roe deer are rare at Maglemosian sites, but four humeri were measured from the four sites mentioned above. They are plotted in fig. 5, and form a clearly separate group.

The Ringkloster unfused specimens are even smaller than the Maglemosian ones (fig. 5). This indicates that they were killed at a still earlier stage of growth. Once again the possibility that they were foetal animals cannot be ruled out, so once again the period April-May is put forward as the most likely time of death.

### *Seasonality: Discussion*

The wild boar, red deer and roe deer provide about the best seasonal evidence from any mesolithic site in Europe, and all converge on winter and spring as the main period of occupation. It is worth stressing that summer occupations at other sites are clearly visible using the techniques applied here (Legge & Rowley-Conwy 1988; Rowley-Conwy 1993); the winter/spring concentration at Ringkloster is not the result of some methodological bias.

Absence is much harder to prove than presence, and consideration must be given to the possibility of "invisible" occupation in the summer months. It is argued here that such a possibility is unlikely. If most of the main food animals were killed in winter and spring, what resources could have been used at other times? The other animals on the list could have provided meat in the summer, although there is no evidence that they did so. The pine martens are numerous but small; their bones were frequently found still articulated, indicating that they had been disposed of into the lake intact and unbutchered. This

would suggest they were not eaten, and the pelts were probably the reason the animals were hunted (see below). The pelts are at their best in the colder months of the year, so the presence of so many animals at Ringkloster might thus be further evidence of occupation in this season. Detailed seasonal analysis of the kind carried out by Trolle-Lassen (1986) at Tybrind Vig has not, however, yet been undertaken.

Birds are present but in small numbers. Such evidence as they provide also indicates winter. Of the 45 identified bones, 13 (or 29%) come from red throated diver (*Gavia stellata*), sea eagle (*Haliaeetus albicilla*) and swan (*Cygnus* sp). The first two are cold-season visitors to Denmark (Bruun and Singer 1970). The swans are likely to be either Bewick's Swan (*Cygnus bewickii* - to which species two of the five swan bones were tentatively referred) or whooper swan (*Cygnus cygnus*) both of which are winter visitors. No finds of the permanently resident mute swan (*Cygnus olor*) are known from this period of prehistory (Løppenthin 1967).

Other resources that might have played a part are fish and plants. Pike and cyprinids predominate among the fish (Enghoff 1998 - this volume). However, the fish provide no direct evidence for season of kill; both taxa are difficult to catch in midwinter but could certainly have been caught in spring (Enghoff 1998 (this volume) and pers. comm.; Rowley-Conwy 1993: 183). Plants would certainly be more available in summer and autumn. However, apart from hazel nuts and acorns such resources provide relatively low energetic returns, and their importance in the mesolithic may have been exaggerated (Rowley-Conwy 1986). It is unlikely that "invisible" food-stuffs could have been so important in summer that exploitation of the winter/spring resources stopped as abruptly as it appears to have done. It is concluded therefore that the gap in the hunting of large mammals most probably reflects a seasonal absence from the site.

If this is correct, it must be asked where the inhabitants spent the rest of the year. In view of the short distance to the sea, I have earlier suggested that the sea shore was the most likely place (Rowley-Conwy 1983; 1993). Recently, however, a totally different scenario has been put forward by Price (1993), using the work of Noe-Nygaard (1988):

“In the later mesolithic, both inland and coastal sites are recorded; the question of residential sedentism vs. mobility and relationships between the coastal and inland sites is important for understanding the transition to the neolithic in this area. New information from bone chemistry has helped to resolve this question. Noe-Nygaard (1988) used the  $\delta^{13}\text{C}$  levels in dog bones at inland and coastal mesolithic sites as a proxy for humans. Dogs at coastal sites consumed a diet dominated by marine foods, while dogs at inland sites ate an almost exclusively terrestrial diet. Such evidence indicates that the dogs, and most likely their human owners, spent most of the year inland. This study provides strong evidence for a sedentary pattern in both areas, as well as a distinction between coastal and inland settlements.” (Price 1993: 242-243)

This is a considerable oversimplification. Taking the eleven definite middle and late mesolithic dogs only (Kongemose and Ertebølle periods) from Noe-Nygaard (1988: table 1), the following pattern emerges:

- at coastal sites there are six dogs with a marine diet (Carstensminde, Bloksbjerg, Maglemosegårds Vænge, Vedbæk, Sølager and Ertebølle);
- at coastal sites there are two dogs with a terrestrial diet (Kassemose and Ølby Lyng)
- at inland sites there is one dog with a terrestrial diet (Præstelyng);
- at inland sites there are two dogs with marine diets (the two specimens from Kongemose).

The situation is thus not as straightforward as Price states. A variety of interpretations of these data are possible, not all supporting the dichotomy between inland and coastal settlement. Furthermore, there is absolutely no reason why the dog data should imply sedentism. Finally, a variety of circumstances can be envisaged whereby the diets of individual dogs might differ from each other and from humans, so too much weight should not be placed on dog  $\delta^{13}\text{C}$  data. There may well have been separate human populations in the deep interior of Jutland. However, a regional perspective is essential if mesolithic settlement is to be understood (Rowley-Conwy 1993). From this perspective the presence of a highly productive sea coast less than 15 km away from Ringkloster cannot be ignored. Such a coast would have a relatively high population density, and these populations would inevitably make extensive

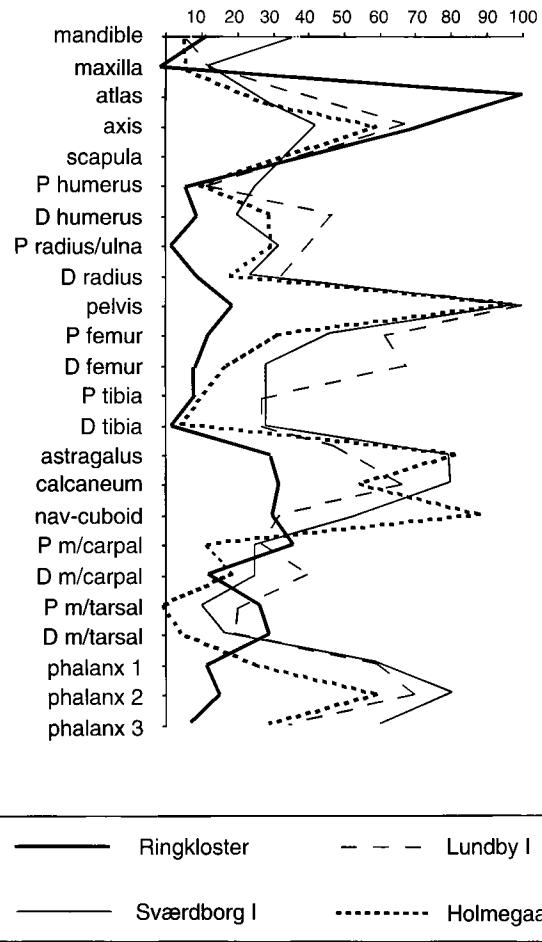


Fig. 6 Skeletal element frequency of aurochs (*Bos primigenius*) from Ringkloster, compared with that from Sværdborg I, Lundby I and Holmegaard V.

use of the adjacent hinterland as well. This is in fact what Noe-Nygaard suggested for the Kongemose dogs: the site is not coastal but the dogs had marine diets (see above). The site was only 12 km from the contemporary sea coast, so “the dogs might thus stem from a coastal group of hunters on inland hunting expeditions” (Noe-Nygaard 1988: 91). This is exactly what is here argued for Ringkloster.

## PURPOSE OF OCCUPATION

It will be argued in this section that the Ringkloster assemblage differs in a number of respects from what would be expected at a base camp. The site was

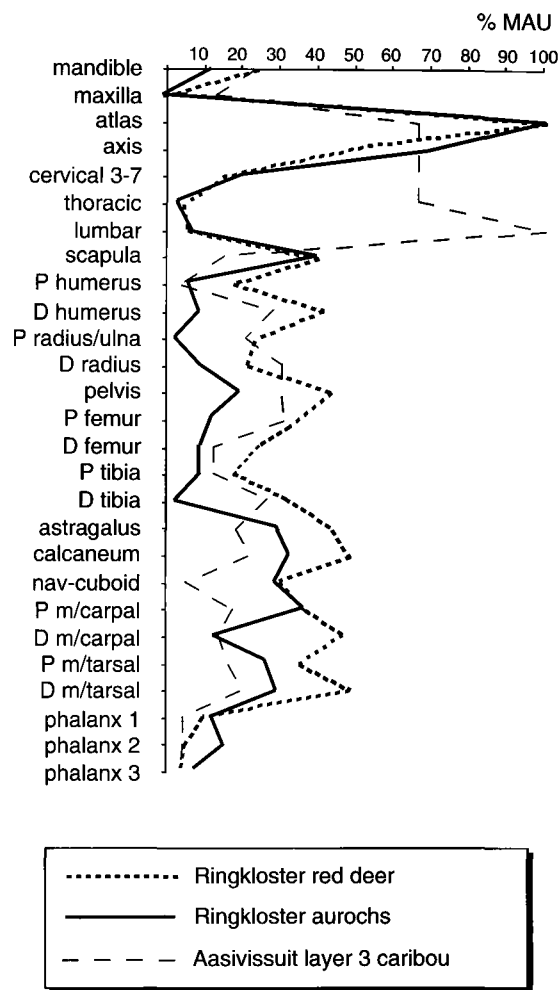


Fig. 7 Skeletal element frequency of aurochs (*Bos primigenius*) and red deer (*Cervus elaphus*) from Ringkloster, compared with that of caribou (*Rangifer tarandus*) from layer 3 at Aasivissuit. Aasivissuit figures from Grønnow *et al.* (1983: fig. 83).

probably a hunting camp specialising on the procurement of meat, furs and skins.

#### Meat: Aurochs and Red Deer

The relative frequencies of skeletal parts of wild boar, red deer and aurochs at Ringkloster are markedly unusual, and have led to the suggestion that not all parts of these animals were always consumed at the site but rather that significant quantities of meat were exported. The argument is presented in full else-

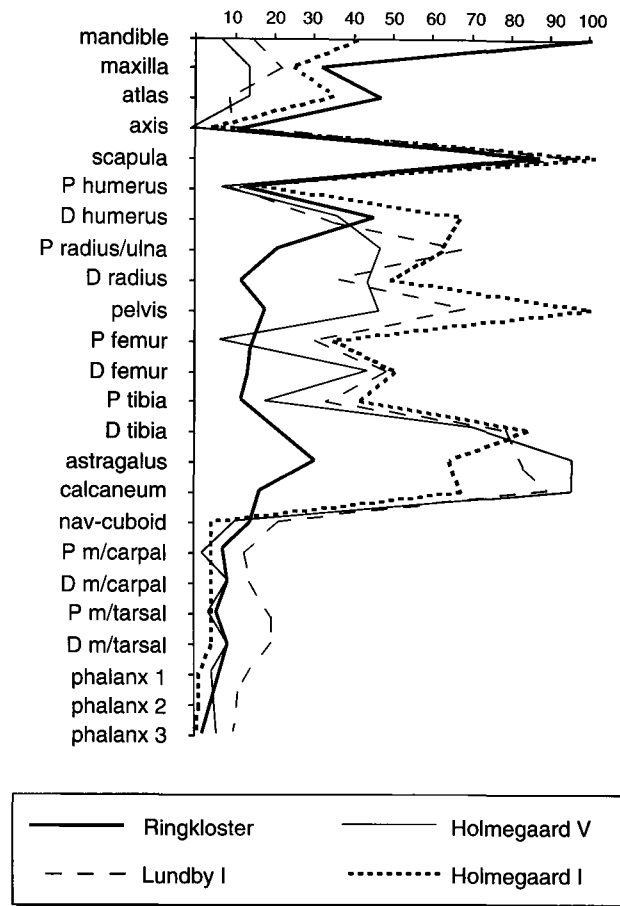


Fig. 8 Skeletal element frequency of wild boar (*Sus scrofa*) from Ringkloster, compared with that from Lundby I and Holmegaard I and V.

where (Rowley-Conwy 1993) and will therefore be summarised here.

Quantification of skeletal elements was discussed above. The method used to compare skeletal element frequencies uses the Minimum Number of Elements totals as follows: the most common MNE is expressed as 100%, and all other frequencies are expressed as percentages of the most common MNE. This is the "Percent Minimum Animal Unit" (%MAU) method described by Binford (1984: 50-51). Newborn animals are not included in the following discussion; only bones of subadult and adult animals are included in figs. 6, 7 and 8.



Fig. 6 plots the %MAU of the Ringkloster aurochs compared to those of three Maglemosian settlements: Lundby I, Sværdborg I and Holmegaard V (Rowley-Conwy unpublished). Two things are immediately apparent: (1) the Ringkloster assemblage is heavily dominated by atlas and axis vertebrae, all other elements having low values; (2) Ringkloster is very different from the other sites in this regard. Fig. 7 plots the Ringkloster aurochs and red deer; the lines are closely similar.

Under what circumstances will an assemblage be dominated by atlas and axis vertebrae? Measurements of aurochs bone hardness are not available, but bison atlas and axis vertebrae are remarkably hard bones (Kreutzer 1992), so if the same is true of aurochs these bones might be expected to survive quite well even if other bones did not. However, it is difficult to see how a non-cultural taphonomic effect could be responsible for the Ringkloster patterns. Firstly, the Ringkloster red deer have an identical pattern (fig. 7), but atlas and axis are among the softest bones in the deer skeleton (Kreutzer 1992). Secondly, as mentioned conditions of preservation in the lake peats at Ringkloster were excellent, so it is unlikely that all the other elements have been destroyed. Thirdly, similar conditions of preservation at the Maglemosian sites plotted in fig. 6 have not produced similar assemblages, and nor have any other sites known to the author. Fourthly, the pig pattern is quite different (see below).

Cultural factors may thus be responsible for the Ringkloster pattern. One possible factor emerges from a consideration of fig. 7, where the red deer and aurochs are compared to the caribou bone representation from layer 3 of the Inuit site of Aasivissuit in western Greenland (Grønnow *et al.* 1983). Aasivissuit is dominated by lumbar vertebrae, not the first two cervical vertebrae, but is otherwise remarkably similar to the Ringkloster patterns. At Aasivissuit it is ethnographically recorded that caribou were killed nearby, and much of the meat removed to the coastal settlement from which the people came (Grønnow *et al.* 1983). The Aasivissuit assemblage is thus what remains after animals have been processed at a hunting camp and much meat transported further to a base camp.

The similarity between Ringkloster and Aasivissuit does not of course prove that a similar cause is involved at both. However, it is difficult to see why

people should introduce just the first two neck vertebrae to a site. These bones have no marrow, and carry less meat and fat than most other bones (Binford 1978). It is much more likely that some practice similar to that recorded at Aasivissuit is responsible, and that meat was removed from Ringkloster to some other location.

#### *Meat: Wild Boar*

The wild boar skeletal element pattern differs from that of the red deer and aurochs (fig. 8). The assemblage is dominated by mandible and scapula, with maxilla, atlas and distal humerus also common. All other elements are represented by low values.

Once again it is difficult to see how this might come about for non-cultural reasons. The Maglemosian sites in fig. 8 have similarly good preservation, but none resemble Ringkloster in element frequency; frequencies are variable but most elements are much more common than at Ringkloster. Cultural practices are more likely to be involved. It is probable that wild boar hindquarters were removed from Ringkloster; however, the forequarters of these animals must have been consumed at the site to account for the presence of so many scapulae and mandibles.

#### *Fur: Pine Martens*

The unusually large proportion of pine martens at the site (fig. 1) is more compatible with Ringkloster being a special-purpose procurement camp than a base camp. Apart from the spectacular assemblage from Tybrind Vig (Trolle-Lassen 1986) no other site in Denmark is known with so many of these animals, and this strongly suggests specialised procurement rather than normal usage.

It was mentioned above that skeletons were sometimes found articulated rather than butchered. Many skulls do however show transverse cut marks across the front of the skull, characteristic of skinning. A Ringkloster specimen was illustrated by Andersen (1975: fig. 72), and others are known from Tybrind Vig (Trolle-Lassen 1986: fig. 3). A total of eighteen such cases have been observed at Ringkloster. A single fox skull had similar transverse cuts. One badg-

er skull, four dog skulls and one beaver skull had longitudinal cuts in the same region, probably indicating a variant on the same skinning method. Finally, a bear skull had transverse cuts across the nasal bone and longitudinal cuts running up the front of the skull. This consistency argues for highly routinised processing of the carcasses.

### *Skins: Red Deer and Roe Deer Fawns*

The large numbers of red and roe deer fawns is yet another way in which Ringkloster differs from more "normal" mesolithic assemblages. Using the quantification method described above, 28.4% of red deer and 18.6% of roe deer were newborn or foetal. This indicates specialised procurement of these animals, and is thus another argument in favour of Ringkloster being a hunting camp. It is unlikely that deer populations under continuous predation could sustain a cull of these proportions.

Bones of red deer fawns have been noted elsewhere in the Danish mesolithic, though not in the high proportions found at Ringkloster, and it has been suggested that the spotted skins of these animals were desirable raw material for clothing (U. Møhl personal communication). At Ringkloster few of the bones showed evidence of butchery, but some of the metapodials had cut marks across the rear of the distal end. This is consistent with skinning.

## CONCLUSIONS

It has been argued that Ringkloster was a seasonal hunting camp, occupied mainly in winter and spring, and specialising in the procurement of meat, furs and skins for removal to a base camp elsewhere. The combined evidence in favour of a winter/spring occupation is superior in quantity and clarity to seasonal evidence from most sites known to the author, while the evidence for resource specialisation is second to none.

It is unclear from the animal bones whether Ringkloster was visited by the inhabitants of just one base camp, or from several; if the latter, the site could have played a social role as a gathering place that went beyond its strictly economic role. One may speculate that not all the inhabitants of the base

camp(s) need have visited Ringkloster: quite small hunting and trapping parties on visits of as short as a few days would be sufficient to generate the archaeological remains if the visits took place frequently enough and over a long enough period.

Specialised hunting may help to account for one other unusual aspect of the site: the large quantities of red deer antler. A total of 677 fragments were recovered (see fig. 1), of which no fewer than 386 (57%) were worked in some way. The site is similar in this respect to Star Carr and Stellmoor (Legge & Rowley-Conwy 1988; Grønnow 1987), both argued to be specialised hunting sites and both having large quantities of worked antler disposed of or cached in lakes adjacent to the site.

This again raises the question of where the base camp(s) were located. It was argued above that the coast was the most likely region, and that view is reiterated here. Judging by the rarity of most of the red deer and aurochs skeletons, removal of meat of these species was maximised. Pork contains more fat than beef or venison, so hunters leading an active life would be more likely to choose to eat wild boar at a winter hunting camp (cf Speth & Spielmann 1983). Nevertheless the hindquarters, the most transportable and probably the fattest parts, were also transported away from Ringkloster. This suggests fairly intensive exploitation of the resources in question. This is also the impression gained from the large numbers of pine martens and the high proportions of newborn or foetal red and roe deer.

Such intensive and specialised procurement may suggest that the regional population exploiting the resources was quite dense. This points once again to the sea coast, where population densities would be relatively large. It is likely (though it cannot be proved) that Ringkloster was visited by groups from one or more coastal base camps, and that such coastal base camps were where the meat, furs and skins ended up. Such coastal base camps would be the hub of a radial system of exploitation which would include both coastal and hinterland regions. Further elucidation of the system is a major goal for future research.

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*In memory of Dr. Ulrik Møhl*

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