

Economic Prehistory in Southern Scandinavia

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THE WORK OF SCANDINAVIAN ARCHAEOLOGISTS on sites with organic remains was an inspiration to Grahame Clark from the start of his career. *The Mesolithic Settlement of Northern Europe* appeared in 1936, followed nearly 40 years later by *The Earlier Stone Age Settlement of Scandinavia* (Clark 1936; 1975). In between, Clark's perspective had broadened to encompass the world, but Scandinavia remained an area of major interest. It is probably no coincidence that his last three research students all worked in the region: Priscilla Renouf (Memorial University of Newfoundland) in northern Norway; Marek Zvebil (University of Sheffield) in Finland; and the author of this contribution in Denmark.

This paper examines some recent developments in Scandinavian prehistory in two areas: (1) hunter-gatherer settlement and society, and (2) the appearance of agriculture. These topics, always of interest to Clark, will be approached principally via two methodologies championed by him: zooarchaeology, and radiocarbon dating. Clark was one of the first to realize that subsistence and chronology are not just pleasing cultural wallpaper; they often revolutionize the way we view the past.

The periods considered will be the Mesolithic and the earlier Neolithic. The chronology is set out in Figure 1. The Maglemosian forms the long early Mesolithic period. The Kongemose (middle Mesolithic) and Ertebølle (late Mesolithic) are each divided into early, middle, and late phases. The Neolithic is divided into four: early, middle, Single Grave (middle Neolithic B), and late. Contemporary sea level is crucial in any consideration of especially the Mesolithic; the curve in Figure 1 is from Christensen (1995).

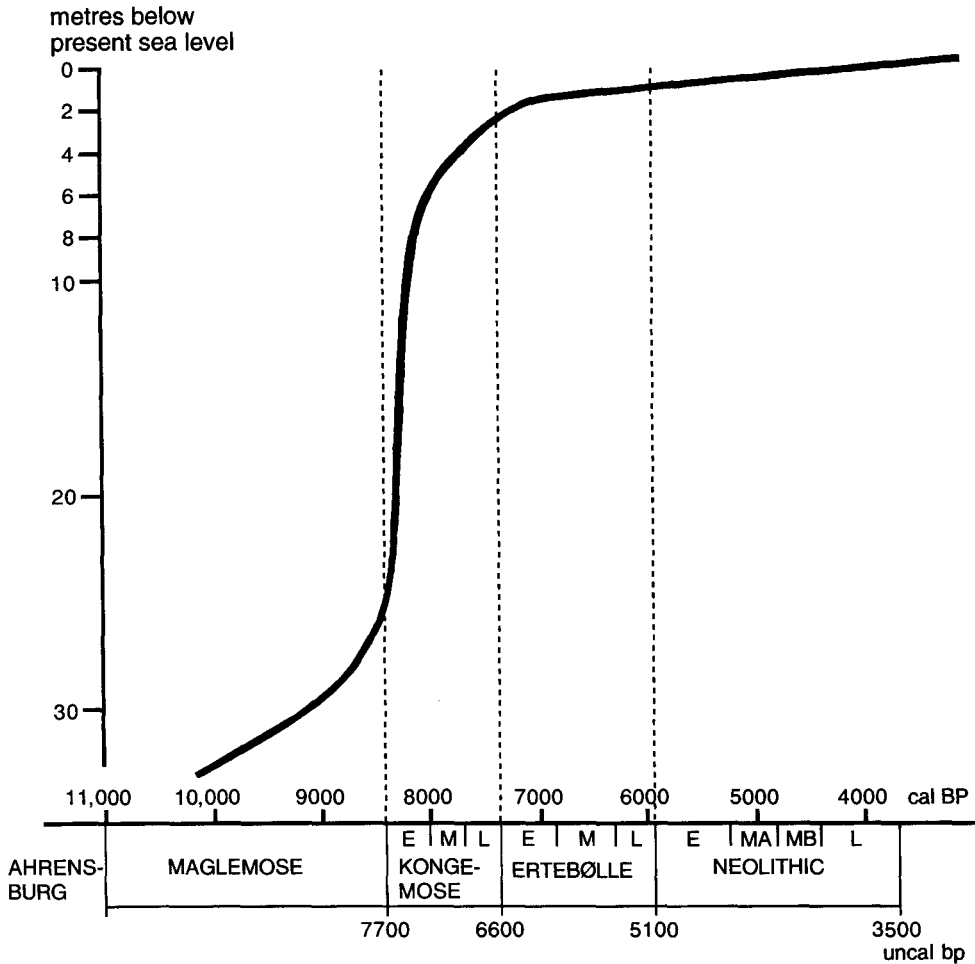


Figure 1. Sea level curve and chronology of the Danish Mesolithic and Neolithic. The sea level curve is for the Storebælt region, from Christensen (1995, Fig. 2). Dates for archaeological periods from Fischer (1997a, Fig. 1).

Hunter-gatherer settlement and society

The Danish early Mesolithic

The Maglemosian period is characterized by small lakeside settlements, often with good organic preservation (for recent reviews see Grøn 1995; Blankholm 1996). Clark's excavation of Star Carr (Clark 1954) was of a similar site in Britain, believed to be occupied in winter; this led to a settlement model involving winter sites such as Star Carr in the lowlands, and summer sites in the highlands (Clark 1972).

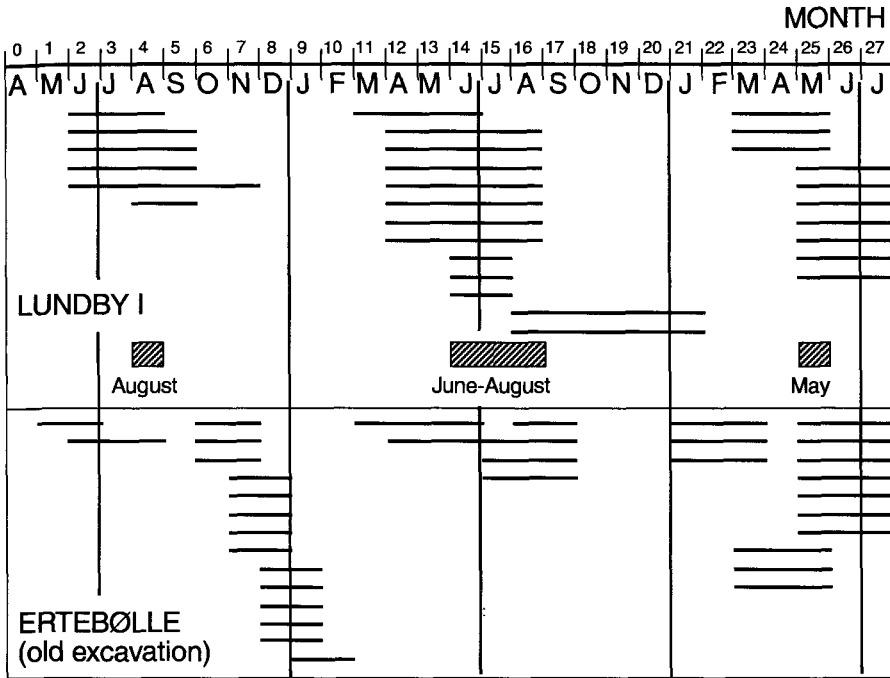


Figure 2. Season of death of wild boar at Mesolithic sites. Lundby I is Maglemosian, Ertebølle is the *locus classicus* of the late Mesolithic. Based on the method put forward by Rowley-Conwy (1993; in press a).

The Danish Maglemosian was, however, different. Zooarchaeology demonstrated from the very first that the sites were mostly occupied in summer (Winge 1903; Rosenlund 1980; Richter 1982). More recently, tooth eruption and bone growth of the large mammals, particularly wild boar, have confirmed that these animals too were killed in the summer (Rowley-Conwy 1993; in press a). Lundby I is an example (Figure 2). The site yielded numerous immature wild boar jaws which can be aged fairly precisely and thus allocated to a season of death assuming a restricted season of birth in late March or early April. Each line on Figure 2 represents one jaw, covering the period in which the animal could have been killed. Lundby I has three killing peaks; all fall in the summer, and there is no need to suggest any winter occupation.

Recently, a re-examination of Star Carr has indicated that this site was in fact also occupied in summer (Legge & Rowley-Conwy 1988). Only a single Danish Maglemosian site was claimed to be occupied in winter, namely Holmegaard V (Becker 1953; Brinch Petersen 1973). The argument was that unlike the other sites it lay on firm ground, not peat, and had no evidence for fishing. Neither of these arguments is particularly conclu-

sive. No mandibular evidence of seasonality is available, but bone growth suggests that this site was also a summer occupation like the others (Rowley-Conwy 1993; in press a).

Thus no Maglemosian site is demonstrably a winter settlement. Some could remain unrecognized among the numerous undiagnosed findspots. Alternatively, the post-glacial marine transgression may have covered many settlements. During the Maglemosian, sea level was well below that of the present day (Figure 1). As a result the map of Denmark looked completely different to that of today (Figure 3): large areas of the modern North Sea bed and the straits between the islands were dry land. The Baltic Sea was a fresh-water lake, draining into the North Sea through two rivers, one via the now-submerged Danish lowlands, the other via central Sweden.

Occasional hints of Maglemosian activity off the current land area are known, for example the grey seal mandible from Sværdborg I (Degerbøl 1933). A human bone found on the bed of the Øresund has been radiocarbon dated to the late Maglemosian; trace elements indicate a marine diet (Tauber 1989) although at this time the sea was probably still some way from the findspot. More recently, several submarine Maglemose findspots have been located by divers in the Øresund and the Storebælt waterways (Figure 3), some in connection with the extensive work preceding the construction of fixed links across them (L. Larsson 1983; Fischer 1997a; 1997b). These sites are at considerable depths and have

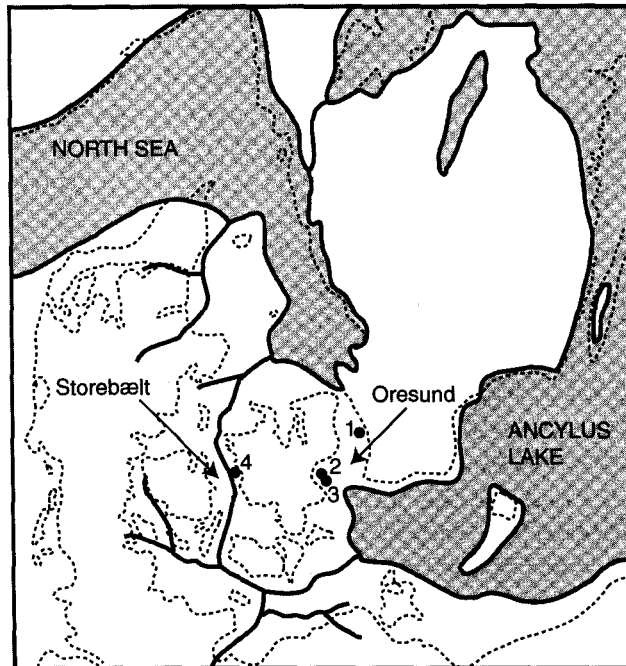


Figure 3. The Danish coastline at c.8400 BC, during the early Mesolithic. Submarine finds of Maglemose sites are marked in the Øresund and the Storebælt. 1. Pilhaken; 2. Juelsgrund; 3. Knaggen; 4. Tudeå.

not been excavated, so season and nature of occupation is unknown; but it is quite possible that much or all of the winter facies of the Maglemosian is below present sea level.

At the moment it is therefore not possible to describe the whole Maglemosian settlement system. It may be that the entire year was spent moving from campsite to campsite, exploiting seasonal resources in sequence; if so, the system would resemble the 'serial specialists' described by Binford (1980), and if little or no storage was practised the economy was of the 'immediate return' type (Woodburn 1982). Alternatively, the winter sites might have had a logistically organized delayed return economy. The logistic aspect could have been more pronounced if the summer sites were occupied by task groups involved in transporting stored resources back to the winter (or all year?) base camps. However, spatial studies suggest that the summer sites were occupied by family groups (Blankholm 1996; Grøn 1995), so unless these families formed the task groups this is less likely. In addition, initial zooarchaeological studies show that these sites did *not* resemble the late Mesolithic logistic hunting camp of Ringkloster (see below).

The South Scandinavian late Mesolithic

By the Ertebølle period, the sea had risen to near present levels (Figure 1). The isostatic rebound of central Scandinavia carried southern Sweden and northern Denmark with it, however, so these regions have risen further than the sea. As a result, late Mesolithic coastlines in these regions are above contemporary sea level. In Denmark south and west of the axis of tilt the coasts are now below sea level (Figure 4).

The middle and late Ertebølle is the era of the big shell middens (kitchen middens, Danish *køkkenmødding*). Much work has established that the settlement system was very different from that of the Maglemosian. The big shell middens are often on the interior parts of sheltered bays or fiords. Due to the low-lying topography, Danish fiords are not deep clefts like the Norwegian ones, but are broad shallow estuaries. Estuaries are among the most productive and reliable ecological systems (for example, Odum 1975; Whittaker 1975). If this ecological productivity is in forms exploitable by humans, it may provide all-year support for hunter-gatherer groups. Sedentary occupation based on the Danish fiords has been suggested for this reason (Paludan-Müller 1978; Rowley-Conwy 1983; Aaris-Sørensen 1988). The stable, long-term nature of the large settlements has been stressed (S.H. Andersen 1995). Zooarchaeological support for all-year settlement appeared early on, based on migratory birds (Winge, in Madsen *et al.* 1900). Tooth eruption in wild boar supports this; Ertebølle itself is an example (Figure 2) in which animals appear to be killed in all seasons of the year, in contrast to the Maglemosian pattern.

The big shell middens are not the only Ertebølle coastal settlements, however. Smaller sites, with or without shell middens, are also numerous. These are often in more exposed locations, and specialize on fewer resources than the large middens. Some contain large numbers of winter migrant waterfowl; these include Aggersund (Møhl 1978) and Sølager (Skaarup 1973). Ølby Lyng contains an unusual number of harp seal and porpoise (Møhl

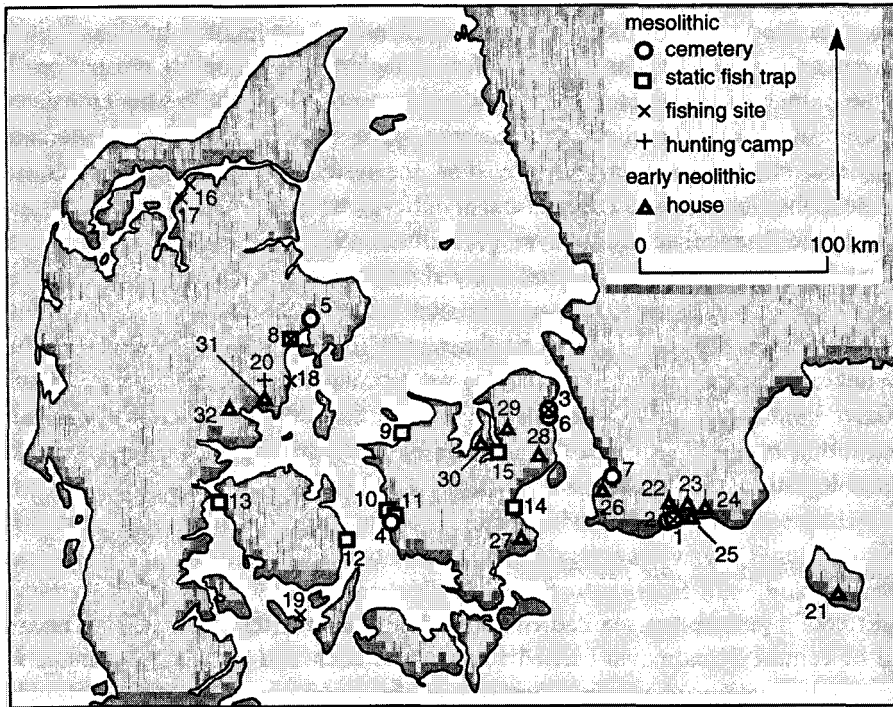


Figure 4. Mesolithic and early Neolithic in Denmark and southern Sweden. *Mesolithic cemeteries:* 1, 2: Skateholm I and II; 3: Vedbæk; 4: Korsør Nor; 5: Nederst; 6: Gøngehusvej; 7: Segebro. *Mesolithic static fish traps:* 8: Lystrup; 9: Nekselø; 10, 11: Halsskov Øst and Syd; 12: Lindholm; 13: Tybrind Vig; 14: Vedskølle Åmunding Nord; 15: Blak II. *Mesolithic fishing settlements:* 16: Bjørnsholm; 17: Ertebølle; 18: Norsminde; 19: Møllegabet II. *Mesolithic hunting camp:* 20: Ringkloster. *Early Neolithic houses:* 21: Limensgård; 22: Karlshem; 23: Karlsfält; 24: Mossby; 25: Rävgrav; 26: Bellevuegård; 27: Ornehus; 28: Albertslund; 29: Topperøgel; 30: Skæppekærgård; 31: Mosegården; 32: Bygholm Nørremark.

1970), while Hjerk Nor saw the specialized hunting of fur-bearing animals such as wild cat (Hatting *et al.* 1973). These smaller settlements are interpreted as seasonal hunting camps exploited by groups from the central large shell midden. The Danish Ertebølle settlement pattern was thus radial and logistic: the small settlements were visited from and supplied resources to the large central sites (Rowley-Conwy 1983; S.H. Andersen 1995).

The best example of a logistically organized hunting camp, however, lies inland. This is Ringkloster (S.H. Andersen 1975), a lakeside settlement with excellently preserved animal bones. Several zooarchaeological aspects mark the site out as a specialist hunting camp. Firstly, it is seasonally occupied; all indicators point to winter and spring. Secondly, there was specialized procurement of furs and skins: nearly 800 bones of pine marten were found, making this the second most common animal, while over 20 per cent of both red deer and roe deer are newborn or even foetal—presumably killed for their soft spotted

skins. Thirdly, despite the superb conditions of preservation the bones of aurochs, red deer, and wild boar show peculiar patterns of skeletal representation. The red deer and aurochs are represented predominantly by neck vertebrae, the wild boar mostly by the head and upper forelimb. This cannot be explained by any process of natural taphonomy, but must represent human action. The most likely explanation is that animals were processed at Ringkloster, and much meat was then transported to some other location—perhaps the large sedentary settlements on the coast 14 km away (Rowley-Conwy 1993, in press b). The radial settlement pattern thus encompassed the interior hinterland as well as the coast; Ringkloster was not a base camp in a separate settlement system operating exclusively in the interior, as argued by Price (1993). Despite the lakeside location, 26 bones of marine fish and five oyster shells were found (Enghoff in press), as were three bones of bottle nosed dolphin (Rowley-Conwy in press b). These are best explained as food supplies brought along by hunters on logistic expeditions from the coast.

The radial system described above is based mostly on the middle and late Ertebølle of Jutland. It cannot automatically be applied to other areas and/or periods of the Ertebølle as though economy and settlement were cultural variables similar to artefact styles. The early Ertebølle in southern Sweden was apparently different. The major site of Skateholm I has yielded a cemetery and a settlement (L. Larsson 1988; 1989). Most of the migratory fish and marine mammals were available in winter, although the general productivity of the area was such that the faunal analyst argued that the site was probably occupied all year (Jonsson 1988). Re-examination of the large mammals leads, however, to the somewhat unexpected conclusion that Skateholm I was occupied seasonally, since the large mammals were also procured only in winter (Rowley-Conwy 1998a). It is not clear where the inhabitants spent the summer, but it does seem that the settlement pattern was not radial like the Jutland Ertebølle.

Skateholm I is further into the Baltic than the Jutland Ertebølle sites. The sea was more brackish and less productive in this region, and this may have contributed to the difference between the two cases. In between the two areas is the major Ertebølle settlement concentration around the Øresund, including the cemetery and settlements at Vedbæk. These have yielded rich faunal remains (Aaris-Sørensen 1980; Enghoff 1983) and it would be interesting to know more about their seasonality.

Ertebølle fishing

The most important recent development in Ertebølle archaeology is the realization of just how important fishing was. Developments have occurred on three fronts. Firstly, trace element analysis of human skeletons has revealed a strongly marine diet (Tauber 1982).

Secondly, several spectacular static fish traps have recently come to light. The remains consist of numerous sharpened stakes, mostly lying on the former sea bed but sometimes still standing *in situ*. The stakes originally formed a barrier projecting out at right angles to the shore; fish encountering the barrier swam along it, and entered a basket trap or

catching chamber at the outer end. Such traps are passive, requiring (once built) no active human involvement beyond periodic emptying. People are thus free to undertake other activities while the trap is working. The traps have come to light because excavations have begun focusing on areas away from the settlements themselves, in areas formerly just offshore. North-east of Denmark's tilt axis the relevant areas may now be above sea level, the trap elements being preserved in waterlogged sediments. South of the line they remain under the sea and are studied by divers.

The largest and most spectacular is Lystrup. Excavation has encompassed over 3500 m² (part is reproduced in Figure 5). No fewer than 588 pointed stakes have been recovered, 67 of them *in situ*. They are up to 3 m long, and 1–4 cm in diameter. Two have

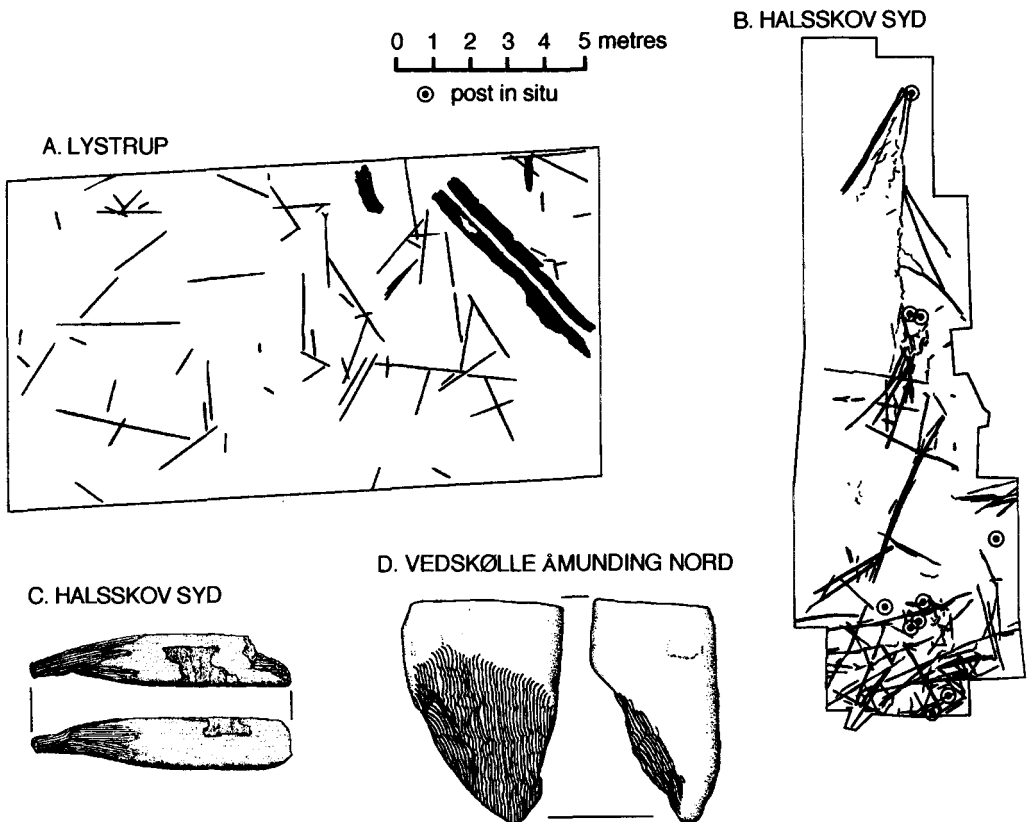


Figure 5. Static fish traps from the Danish middle and late Mesolithic. A: part of the very large exposure at Lystrup (redrawn from S.H. Andersen 1997, Fig. 3)—the large fragments are a 5 m dugout canoe; B: plan of Halsskov Syd (redrawn from Pedersen 1997, Fig. 20); C: pointed stake from Halsskov Syd (redrawn from Pedersen 1997, Fig. 21); D: pointed stake from Vedskølle Åmunding Nord (redrawn from Fischer 1997a, Fig. 17); this is truncated because the upper part was radiocarbon dated to 7880–7675 BP (T-11331) and is thus of Kongemose date.

been radiocarbon dated to 7210–6950 BP (K 4053) and 7200–6910 BP (K 4054); the trap is thus early Ertebølle (S.H. Andersen 1997). The large size of some of these traps is shown by the middle Ertebølle find at Nekselø, below present sea level. *In situ* stakes were found 100 m from the contemporary shoreline, and to function properly the trap would have had to extend this far (Pedersen 1995).

The remarkable work resulting from construction of the fixed link across the Storebælt has yielded three more examples. Halsskov Syd (Figure 5) is early Ertebølle, while Halsskov Øst is middle Ertebølle (Pedersen 1997). On the opposite side of the Storebælt an example was located at Lindholm, excavated by divers (Dencker 1997). The fact that intensive survey in a relatively small area has produced no fewer than three such structures is a good indication of how common they were. Finally, Tybrind Vig was excavated by divers, and has produced many pointed stakes testifying to yet another example (S.H. Andersen 1987a; 1987b).

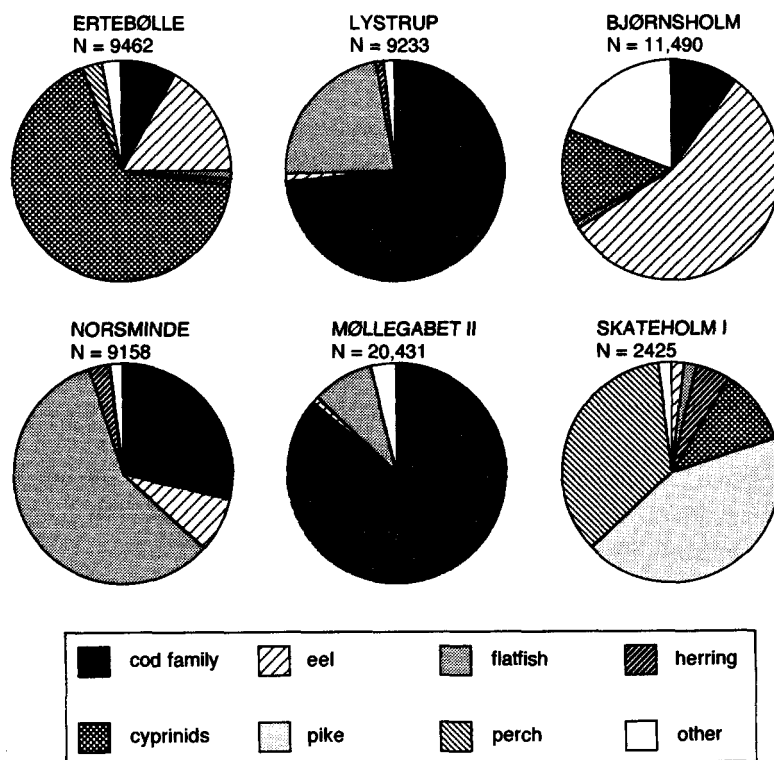


Figure 6. Proportions of fish species at Ertebølle sites. Ertebølle from Enghoff (1987, Table 1); Lystrup from Enghoff (1994, Table 1); Bjørnsholm from Enghoff (1993, Table 1); Norsminde from Enghoff (1993, Table 1); Møllegabet II from Cardell (in press, Table 1); Skateholm I from Jonsson (1988, Table 1).

The true cod (*Gadus morhua*) is overwhelmingly predominant within the 'cod family' group.

Thirdly, fish remains have been recovered in quantity and well studied. Considering the material available at the time, Clark (1975) concluded that cod fishing using hook and line was the major activity. Recent work has altered this conclusion. The majority of fish caught were remarkably small, and fine sieving is vital if their bones are to be recovered during excavation. At Lystrup, most cod were below 50 cm in length (Enghoff 1994). This is significant because of the static fish trap at this site (see above and Figure 5): large numbers of small fish are evidently the typical catch using this technology. Cod were small everywhere in the Ertebølle—at Maglemosegårds Vænge the majority were between 25 and 35 cm, and at Norsminde they were even smaller—and Enghoff (op. cit.) states that these size ranges indicate the widespread use of static traps.

Static traps are indicated by the fish remains in another way as well. While cod was important, other fish predominate at some sites. Several examples of fish proportions are given in Figure 6. Cod predominate at Lystrup, but at Norsminde they are heavily outnumbered by flatfish, mostly plaice, flounder, and dab (Enghoff 1991). At Bjørnsholm, eel was the main catch; small freshwater cyprinids were also common, perhaps taken as a byproduct of the eel fishery (Enghoff 1993; 1995). At Ertebølle, the small cyprinids (mainly roach) were dominant despite the coastal location of the site; few were over 15 cm in length (Enghoff 1987). Further to the south, the early Ertebølle site of Møllegabet II, 4.5 m below present sea level, was excavated by divers using fine screening (Grøn & Skaarup 1991). The sample of over 20,000 identified fishbones is dominated by cod, mostly between 30 and 45 cm in length (Cardell in press); these were probably much more important than the far less numerous mammals and birds (Hodgetts & Rowley-Conwy in press). At Skateholm I, in less saline waters, freshwater pike and perch dominated; herring was the most common marine fish (Jonsson 1988). The small size of the fish, the local variation in predominant species, and the wide range of rarer species including some that are active only at night, are exactly the patterns expected from the use of static traps (Enghoff 1994).

Ertebølle complexity?

The Ertebølle has attracted attention regarding hunter-gatherer 'complexity'. Various definitions of this concept have been offered; that used here is based on a four-fold scheme for non-tropical hunter gatherers (Rowley-Conwy in press c):

- 1 Serial specialists moving from resource to resource in sequence, with little or no logistic movement of resources or food storage.
- 2 Logistic groups that *do not* defend territories.
- 3 Logistic groups that *do* defend territories.
- 4 Sedentary groups, who invariably defend territories and store resources.

These form a continuum from non-complex (type 1) to most complex (type 4). Other attributes are sometimes brought into the definitions, for example complex technology, hierarchical social organization, resource specialization and intensification, high population density, and so on (for example, Price 1985).

Some aspects of the Ertebølle have been linked to complexity. Perhaps the earliest was the sedentism of the large Jutland settlements. Although many of the other attributes could not be demonstrated archaeologically, it was argued that social and demographic factors would covary with sedentism; regional population would probably be relatively dense, and society might not be egalitarian (Rowley-Conwy 1983).

Another unusual archaeological feature is the presence of cemeteries. Those at Skateholm I and II (L. Larsson 1988; 1989) and Vedbæk (Albrethsen & Brinch Petersen 1976) are well known. Another at Korsør Nor, containing seven or eight graves, was destroyed during harbour works in 1945 (Schilling 1997; Bennike 1997). Nederst in Jutland is another likely candidate, and there may be more (L. Larsson 1995). Formal disposal of the dead was linked to territoriality by Saxe (1970), who argued that cemeteries containing ancestors legitimized territorial ownership by the living. This argument was extended and applied to other areas (see, for example, Goldstein 1981; Pardoe 1988; Chattopadhyaya 1996), and has been discussed in connection with Skateholm I (Rowley-Conwy 1998a).

The discussion has been taken further in two main ways. The first is archaeological: the recovery of the numerous static fish traps and the small fish they caught (see above). This adds complex technology to the Ertebølle attributes suggesting complexity. Such technology is one of the key features allowing recognition of food storage in the archaeological record, because it implies that more resources were taken than could be consumed on a day-to-day basis. Food storage has important implications for social stratification, because stores are privately owned and not accessible by all (Rowley-Conwy & Zvelebil 1989).

The second is ethnographic. A major cross-cultural survey of hunter gatherers by Keeley (1988; 1991) has revealed some interesting correlations (Figure 7). Degree of sedentism is closely linked to population density relative to ecological productivity; both charts in the figure show this. This suggests that the intuitive feeling of many archaeologists that the Ertebølle had a relatively high population density is in fact correct. The left-hand chart in Figure 7 plots the dependence of the various societies on stored food, and shows a strong trend for this to increase with sedentism and population—which fits well with the archaeological arguments mentioned above. The right-hand chart plots social variables, and again there is a strong trend for more stratified societies to correlate with sedentism and population—and thus with food storage, confirming Rowley-Conwy and Zvelebil (1989). This opens further connections: descent classes are common among territorial societies (Richardson 1982), and are thus linked to the use of cemeteries (Saxe 1970; Pardoe 1988); territorial exclusivity is thus mirrored by social exclusivity (Rowley-Conwy 1998a).

The upshot is that the early suggestions of Ertebølle complexity in areas not directly visible archaeologically may now be put forward with somewhat greater confidence. More connections between the various attributes have been established, to the point where Keeley (1988) felt able to distinguish between two major types of hunter gatherers—visible in both parts of Figure 7. Accordingly, the Jutland middle and late Ertebølle is interpreted as sedentary, territorial, and food storing (type 4, above), and therefore probably organized

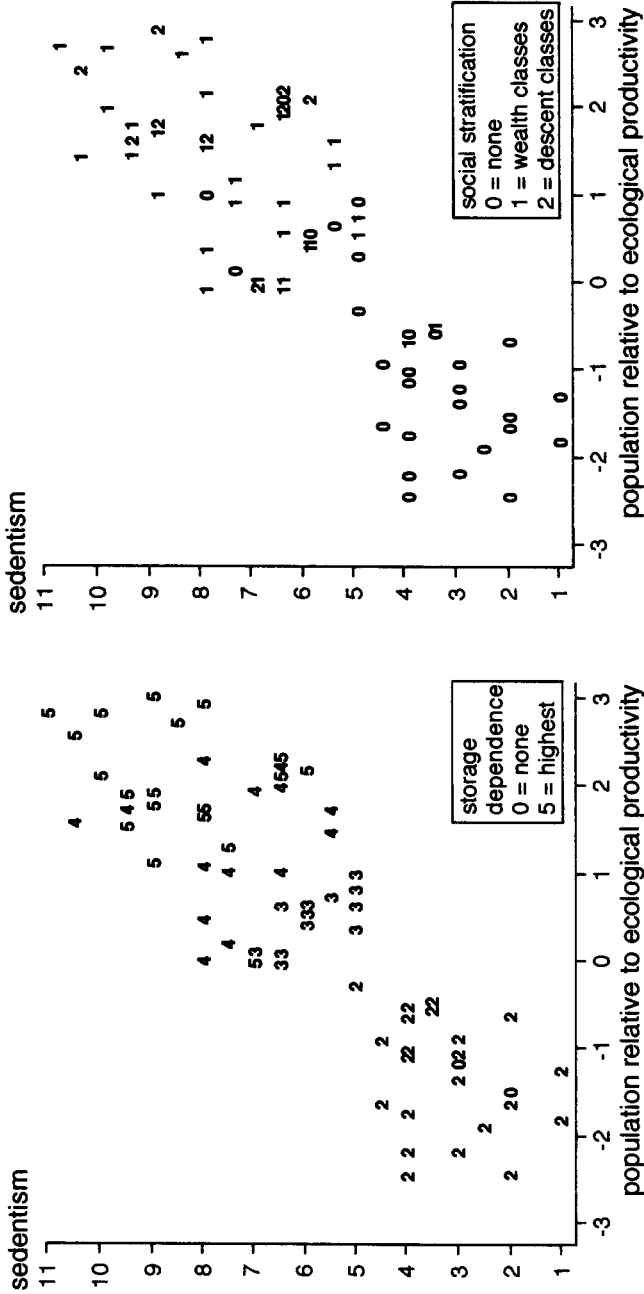


Figure 7. Correlations between various attributes of hunter-gatherer societies (redrawn from Keeley 1991, Figs. 17.1 and 17.6). Sedentism (Keeley's STAY) is the number of months for which the winter settlement is occupied. Population relative to ecological productivity (LNY) is calculated by Keeley (1988, 385). Each data point is one ethnographic hunter-gatherer group. Left: correlation with dependence on storage. Right: correlation with social stratification.

in descent classes. The South Swedish early Ertebølle was not sedentary but did establish cemeteries, and is accordingly interpreted as a type 3 group. It is not clear whether the Øresund groups were type 3 or 4.

Where does complexity come from?

We thus have an early Mesolithic in which complexity cannot be demonstrated, and a late Mesolithic in which (with increasing clarity) it can. Explanations for the appearance of complexity may be divided into developmental and adaptational (Rowley-Conwy in press c; cf. also Gould 1985; Bettinger 1991). Developmental views seek the cause of complexity in either internal sociocultural change or demographic increase; whichever is selected is put forward as an independent variable. Adaptational views, however, seek to embed these factors in a broader social and ecological context.

Developmental views assume slow unidirectional change in the variable selected for emphasis. Intensification of economic activities is sometimes apparently regarded as the normal and ubiquitous state of affairs during the Mesolithic (for example, Price 1996; J. Thomas 1996); sometimes this is seen as having quasi-agricultural results by the late Mesolithic (Clarke 1976; Zvelebil 1994; 1995). The concept of intensification is sometimes rather vague, however, and (if it is used at all) it is better placed in context. In the South Scandinavian case, the use of large static fish traps is an intensification, but it occurred in the ecological context of an approaching sea shore; in the early Mesolithic the sea was elsewhere. The social context was the increase in population resulting from the arrival of the sea and its resources. A subsequent intensification of terrestrial resources would occur in coastal hinterlands due to this greater population. This was probably why logistic hunting camps like Ringkloster were used (see above). There is currently no evidence for quasi-husbandry (Rowley-Conwy 1995a). Intensification is thus best seen as an economic adaptation within the changing ecological and social context, rather than an explanatory *deus ex machina*. The word 'intensification' is therefore redundant and potentially misleading, and best omitted from future discussions.

Demographic increase is the other variable sometimes regarded as independent (Cohen 1977). Cemeteries have been argued to result from the crossing of a 'demographic threshold' at the start of the late Mesolithic (Clark & Neely 1987, 124). Independent population growth has, however, been criticized (Rowley-Conwy in press c). Cemeteries should not be considered outside the context of territoriality (see above), which in turn has an ecological context. Territoriality arises when resources in a limited area are both productive and reliable (Dyson-Hudson & Smith 1978; D.H. Thomas 1981). In South Scandinavia the relevant resources were probably migratory fish such as cod and eel—whose routes could be interdicted by large fishtraps and whose meat could be stored. Keeley (1988; 1991) draws these ecological factors into his cross-cultural correlations: groups based on storage and arranged in descent classes are usually found in areas with less interannual variability. Descent classes are the common organization of territorial groups (Richardson 1982); reliable and

productive resource nodes owned by territorial descent classes are thus directly linked to the establishment of cemeteries (Saxe 1970; Pardoe 1988; Rowley-Conwy 1998a).

'Intensification' and demography are thus elements in a complex contextual web rather than independent causative factors. In South Scandinavia the arrival of the rising sea and its resources was the most important element creating the differences between early and late Mesolithic. Change in response to this was apparently rapid—not long and slow as the developmental view implies. This emerges from a consideration of the middle Mesolithic Kongemose period, not considered so far. The period of most rapid sea level rise falls in the earlier Kongemose (Figure 1), but there are some signs that complexity was present. An outstanding result from the work in connection with the Storebælt fixed link has been the offshore extension of Ertebølle coastal settlement foci. Suitable settlement areas were occupied much earlier than the Ertebølle, when the sea was lower; as it encroached, so the settlements moved further into the bays or estuaries to locations above present sea level (Fischer 1997b). The earlier submarine settlements go back to the early Kongemose; at this time sea level rise was so rapid that it would have been discernible within a human generation (Aaris-Sørensen 1988). Despite this the settlements were substantial; discussing Stavreshoved, Fischer (1997b, 77) writes:

These sites are from a time at which the rise in sea-level was at its most rapid. As a result there would have been significantly fewer years available for the accumulation of cultural traces here than on corresponding coastal sites from the end of the Ertebølle Culture. It is therefore remarkable that Stavreshoved does bear comparison, in terms of its extent and the density of cultural traces, with the richest known find places from the latest Ertebølle period. This site can thus hardly be the product of short, seasonal visits by small groups. It must reflect the more or less permanent settlement of a relatively large group of people.

Musholm Bay is another large site, at 8.5 m below sea level the deepest excavation yet conducted in Denmark. This has been radiocarbon dated to 8300–8100 BP, the very inception of the Kongemose period, and was in a good location for the erection of a static fish trap—although no trap was found (Fischer & Malm 1997). Probable traces of a static trap were however found in the Øresund at Vedskølle Åmunding Nord (Figure 4); a pointed stake (Figure 5) was dated to 7880–7675 BP (T-11331) and is thus of early Kongemose date (Fischer 1997a). Another probable site is Blak II, where several stakes were found driven into the sea bed. The stakes have not been dated, but bone and charcoal range between 7660–7390 BP (K 5836) and 8360–8120 BP (K 5834) and are thus also very early Kongemose (Sørensen 1996).

Kongemose complexity is hinted at in another way. Gøngehusvej 7 (Figure 4) in the town of Vedbæk has so far yielded four Kongemose graves containing several individuals, some interred, some cremated (Brinch Petersen *et al.* 1993). Segebro in Sweden yielded three grave-shaped features containing red ochre, although no bones were preserved; they were interpreted as graves (L. Larsson 1982, 30–1). Both these sites might be Kongemose cemeteries.

The Kongemose thus encompasses large sedentary settlements, large static fish traps, and possible cemeteries. These are all attributes indicating complexity, and we must now accept that the Kongemose was in this respect similar to the Ertebølle. This is a key point, because in the Storebælt the marine environment *was only formed around 9000 BP* as the sea inundated the former river valley; at this time it was still brackish and only attained

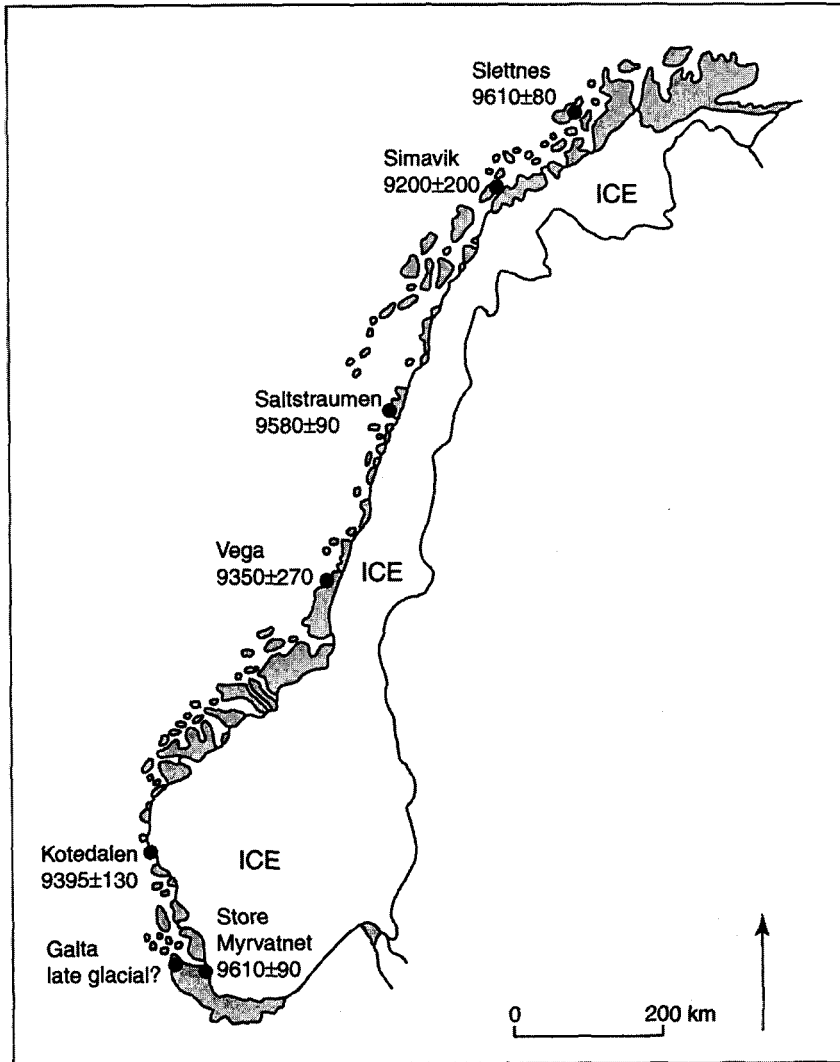


Figure 8. Radiocarbon ages in uncalibrated years BP for the early maritime occupation of Norway. Shaded: ice-free areas at Younger Dryas maximum glacial extension, 11,000–10,000 BP. Combined from Bjerck (1995, Figs. 5 and 7) with additions.

its modern form around 8000 BP (Mathiassen 1997). The Kongemose thus 'went complex' as soon as it was possible to do so. This is the clearest possible evidence that the change was an adaptation to the new environment and not the result of the independent operation of 'intensification' or demography.

The radiocarbon dating evidence thus indicates that complexity was a rapid adaptation, not a slow independently-generated process. Perhaps Maglemosian coastal settlements on the palaeoshore of the North Sea were complex, perhaps not. Either way, the developmental view of slow change from simple to complex can no longer be sustained; it must be seen in an adaptive context.

Speed of response: coast and mountain in Norway

Norway differs from South Scandinavia in a number of ways. The first is its sheer size: from Copenhagen to the North Cape is the same distance as from Copenhagen to Naples, and most of this is Norway, which extends to over 71°N. The deeply indented shoreline has a total length of 26,000 km. Unlike Denmark and South Sweden, the terrain is steep and rocky, not gentle and undulating; organic preservation is usually poor. Despite this, recent work in Norway provides two very good examples of fast hunter-gatherer responses to changed conditions.

The first concerns the initial occupation. The oldest potential site is Galta, which may be of late Glacial date (Prøsch-Danielsen & Høgestol 1995). It is, however, only dated by the beach level in which it is found, and some remain doubtful as to its date (Bjerck 1995). Good radiocarbon evidence is available from the early post-glacial (Bjerck op. cit.). This is plotted in Figure 8; note that the ages are in uncalibrated radiocarbon years, because of the problems of calibration in the 10th radiocarbon millennium BP (Becker & Kromer 1991). Two things stand out: firstly, occupation appears to have been extremely rapid, with no visible trend from south to north—although the 10th millennium BP radiocarbon wiggles may be an obscuring factor; and secondly, most of Norway was still under ice at this time, so the adaptation must have been strongly maritime. Animal bones do not survive, but there can be little doubt that marine resources would have been overwhelmingly important.

The second concerns the occupation of the very mountainous southern interior region. This is shown in Figure 9 (dates again uncalibrated). Again, there was rapid occupation as the ice melted (Bang-Andersen 1996). The nature of the exploitation of the highlands is not clear, but it does represent the rapid appearance of a new adaptation when the opportunity appeared.

The lack of organic remains makes these sites seem less spectacular than the South Scandinavian ones considered above, but the results are arguably at least as significant. The maritime adaptation is earlier than any documented further south, and must have been spread by boats peninsula-hopping along the coast. Its rapidity and antiquity contain important implications for other areas of the globe, and both coast and mountains reveal once again how fast hunter-gatherer communities can respond to new adaptive possibilities.

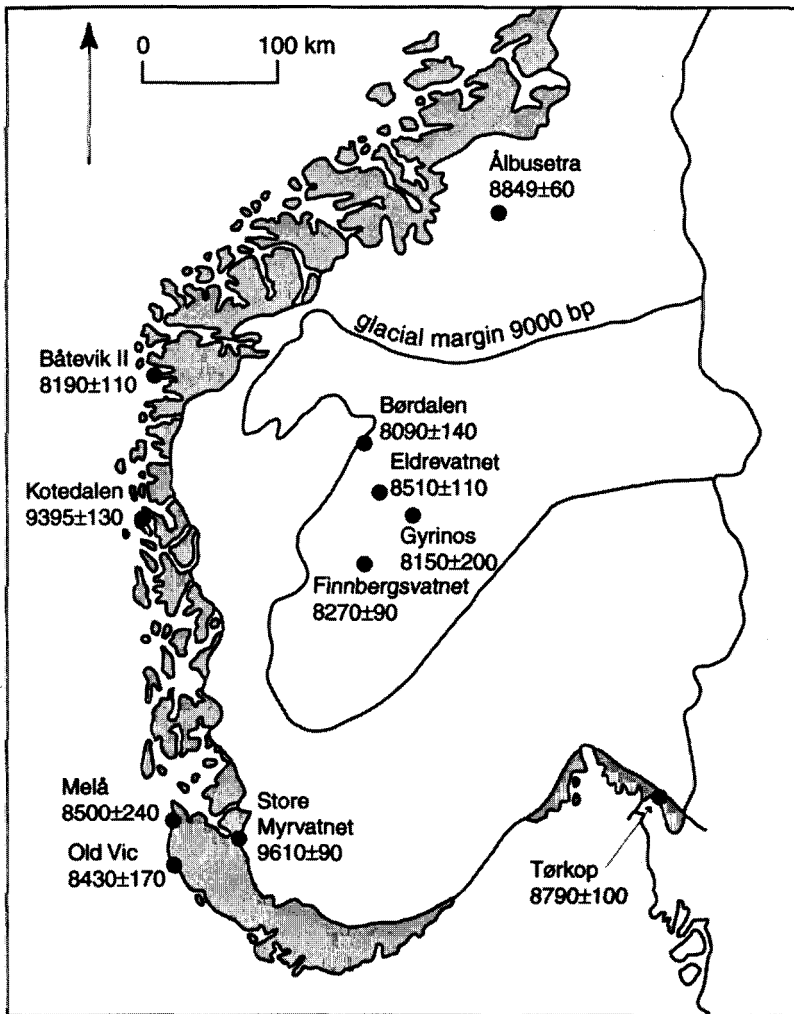


Figure 9. Radiocarbon ages in uncalibrated years BP for the early occupation of the mountains of southern Norway. Shaded: ice-free areas at 10,000 BP; glacial margin at 9000 BP also marked. Simplified from Bang-Andersen (1996, Figs. 3 and 5).

The appearance of agriculture

Denmark: radiocarbon dating and the demise of tribal explanations

Radiocarbon dating has had a fundamental effect on theories concerning the appearance of agriculture in Denmark. It was the major cause of the change from tribal to processual views. Many archaeological explanations changed in this way in the late 1960s and early 1970s, but the impact of radiocarbon dating in Denmark was earlier than this. The

theoretical change in Denmark was thus a direct result of the application of archaeological science.

The tribal view was the result of relative stratigraphic dating. The chronological scheme was put forward by Iversen (1937), who distinguished four marine transgressions which he linked to vegetational changes (Figure 10 left). He used the elm decline as the border between pollen zones VIIIb and VIII (Iversen 1941). Jessen (1937) correlated two marine layers at the Ertebølle midden of Klintesø with two layers in a bog 2 km away; these latter could be dated by their pollen to transgressions III and IV. The Klintesø midden was contemporary with the upper marine layer, and was thus placed in transgression IV, in pollen zone VIII. Troels-Smith (1937) pollen dated the major Ertebølle site of Brabrand to the time of transgression IV, and Dyrholm phase III (also regarded as Ertebølle) to the same transgression (1942). There were thus three major Ertebølle sites in the early part of pollen zone VIII (Figure 10).

This dating was crucial because Jessen (1938) pollen dated Troldebjerg and Bundsø to the same period. These are Neolithic sites with full domestic economies, contemporary with the megalithic passage graves. Therefore coastal hunter gatherers and inland farmers, economically and culturally distinct, were apparently living alongside each other. This tribal separation formed the basis for the next round of debate: Becker (1954) believed that the Neolithic was ethnically intrusive in its entirety, while Troels-Smith (1953) believed that phase A of the early Neolithic was an integral part of the Ertebølle, while phases B and C were the immigrants.

This scheme unravelled as radiocarbon dates accumulated. Figure 10 shows the process (using uncalibrated dates, because this is the form in which they had their impact). Dates are plotted from the datelists quoted by Tauber (1972), although the pattern had become clear well before 1972. Ertebølle dates preceded the elm decline, while Neolithic dates fell at or after it. The large series of dates from the stratified site of Norsminde (S.H. Andersen 1989) confirms this neatly (Figure 10). Troels-Smith (1966) retracted the stratigraphic dates: the correlation between Klintesø and the bog 2 km away may have been spurious, and Brabrand might have been disturbed by ice action; certainly both equate typologically with Dyrholm II, not Dyrholm III. Dyrholm III is typologically Neolithic, and remains in pollen zone VIII where Troels-Smith placed it; it is now regarded as a hunting or fishing camp used by Neolithic farmers (Skaarup 1973; Rowley-Conwy 1983).

Denmark and South Sweden: rate of change

The speed of the appearance of agriculture in Denmark and South Sweden is debated. Some take a gradualist perspective, stating that developments began in the Ertebølle while full agriculture appeared only quite late in the Neolithic (for example, Price 1996; J. Thomas 1996). This paper, however, argues the opposite view, that the change was relatively fast.

The site of Löddeborg in South Sweden (Jennbert 1984) is often quoted as evidence

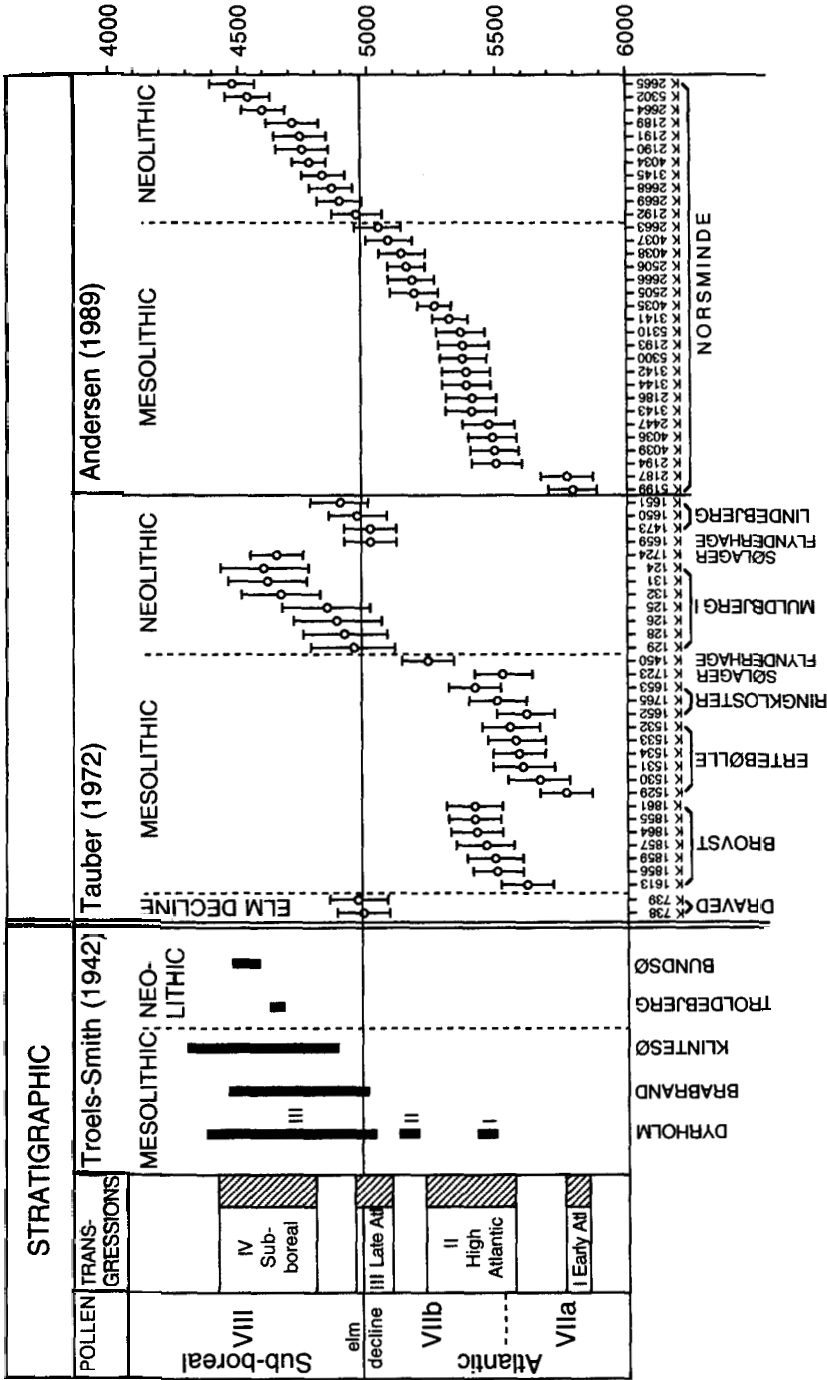


Figure 10. Changing chronological views of the Mesolithic-Neolithic transition in Denmark. Left: relative scheme based on stratigraphic correlations (simplified from Troels-Smith 1942, Fig. 5). Right: absolute scheme based on accumulating radiocarbon ages (in uncalibrated years BP); dates from Tauber (1972) and S.H. Andersen (1989). Note that the radiocarbon scale applies only to the right-hand part of the figure; the only chronological marker common to both parts is the elm decline. The pollen and transgressions columns are now known to cover substantially more time than is covered by the radiocarbon scale on the right.

of Ertebølle cereal cultivation, but the original report makes it clear that the typological attribution of the sherds with cereal impressions to Mesolithic or Neolithic was problematic; the Mesolithic and Neolithic ceramics were not stratigraphically separated, raising questions about the stratigraphic integrity of the site (M. Larsson 1984; Nielsen 1985). There is in fact no convincing evidence for any Ertebølle cereals or domestic animals except dogs (Rowley-Conwy 1995a; 1995b; 1998b).

The claim that the earlier Neolithic was nomadic and mainly based on hunting and gathering ignores the evidence from trace element analysis that there was an abrupt change to a terrestrial diet at the start of the Neolithic (Tauber 1982); this is matched by an abrupt shift of settlement into the interior (Nielsen 1985; M. Larsson 1984). It also ignores no fewer than 43 Danish sets of preserved Neolithic ard marks, 14 of which date to the early or the start of the middle Neolithic (Thrane 1982); these suggest permanent fields. Finally, it ignores a major recent development: the appearance of early Neolithic longhouses. Earlier claimed residential houses at Barkær (Glob 1949) and Stengade (Skaarup 1975) are now regarded as funerary monuments (Madsen 1979; Liversage 1992). A new series of residential longhouses has, however, appeared in Denmark; Ornehus measures 16×6 m, Skæppekærgård 14×4.5 m, and the best preserved of two at Limensgård on Bornholm 18.5×5.5 m (Eriksen 1992). Two indeterminate post-hole structures were found at Mosegården, stratigraphically older than 5940–5730 BP (K 3463), the earliest good Neolithic date in Denmark (Madsen & Pedersen 1984). In South Sweden Mossby measures 12×6 m, Karlshem 7×3 m (Larsson & Larsson 1986). Probable examples are known from Bellevuegård (M. Larsson 1984), Karlsfält (L. Larsson 1985), and Rävgrav (L. Larsson 1992). Three house plans are reproduced in Figure 11; the substantial and consistent nature of the constructions do not mesh well with the notion of nomadism.

Grahame Clark (1965a; 1965b) was probably the first to see that radiocarbon showed that agriculture spread across Europe not slowly and evenly, but in a series of rapid jumps punctuated by pauses. The longest pause occurred at the southern margin of Scandinavia, where for well over a millennium there was a fairly stable boundary between hunter gatherers and farmers—but, as argued, when the change came it was rapid. The rapidity of the change argues against developmental explanations. This writer's suggestion that the oyster was seasonally important, so that its disappearance at the end of the Ertebølle caused problems (Rowley-Conwy 1984a), has not met much favour (for example, Blankholm 1987; Price & Gebauer 1992) and social explanations have been more in vogue (for example, Blankholm 1996; Hodder 1990). However, the end of the late Ertebølle remains contemporary with a marine regression; shell midden accumulation declined drastically and the oyster virtually disappeared (S.H. Andersen 1995, Figs 9a and b). Whether the oyster was an important seasonal resource or not, it acts as an index of high marine salinity; its disappearance thus testifies to a substantial decline in ecological productivity. The appearance of agriculture in Denmark is likely therefore to have an ecological context.

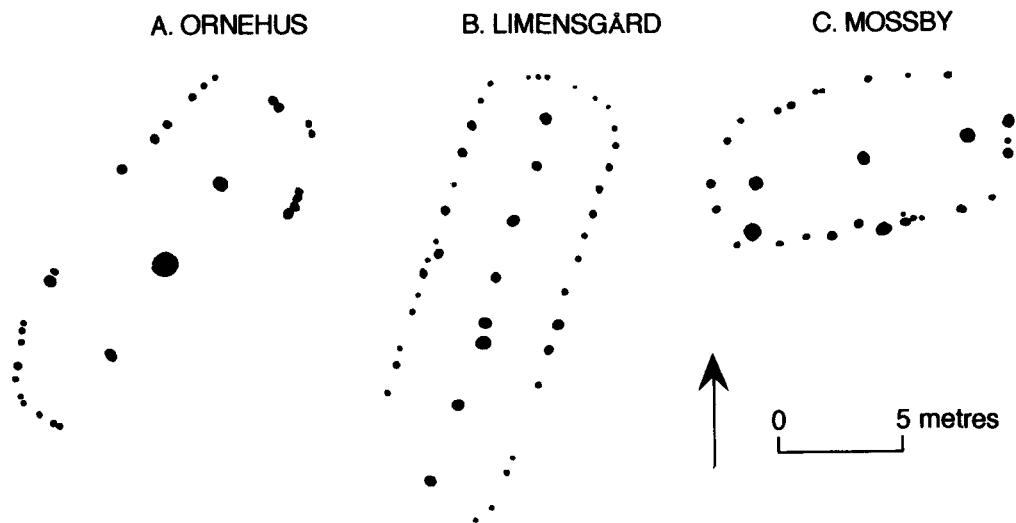


Figure 11. Early Neolithic houses from southern Scandinavia, reproduced to the same scale and orientation. Ornehus and Limensgård redrawn from Eriksen (1992, Figs. 3 and 8); Mossby redrawn from Larsson and Larsson (1986, Fig. 35). See Figure 4 for locations.

Norway: another stable boundary?

The spread of farming far to the north up the Scandinavian coasts is sometimes seen as an early development. This could be so, but the rarity of preserved organic remains makes the picture far from straightforward and an alternative picture is emerging.

In coastal Norway, the later layers at the important site of Kotedalen (Figure 12) are of Neolithic age, with 29 radiocarbon dates falling around 5800–5000 BP (A.B. Olsen 1992). These layers produced a few traces of cereal-type pollen (Hjelle 1992), perhaps evidence for agriculture. However, the macrobotanical assemblages contained no cereals at all (Soltvedt 1992). Exceptionally, bone was preserved. The very large combined Neolithic assemblage is shown in Figure 13 (right). Fragments of fish and birds between them outnumbered those of mammals, something not unexpected in view of the site's location on a narrow strait between the open sea and an interior basin (Figure 13, left); tidal movements through the strait make fishing highly productive. The overwhelming majority of mammal bones were unfortunately pulverized beyond recognition. No domestic animals at all were observed in the identified sample, and the faunal analyst states that non-native species such as sheep, goat, and cattle are quite different to the native large terrestrial species. Had domestic mammals been present in any numbers it is therefore likely they would have been spotted despite the degree of fragmentation (Hufthammer 1992; 1995).

The few cereal-type pollen grains thus remain the only source of agricultural evidence. This is not the only place in Scandinavia with claimed cereal pollen but an absence of

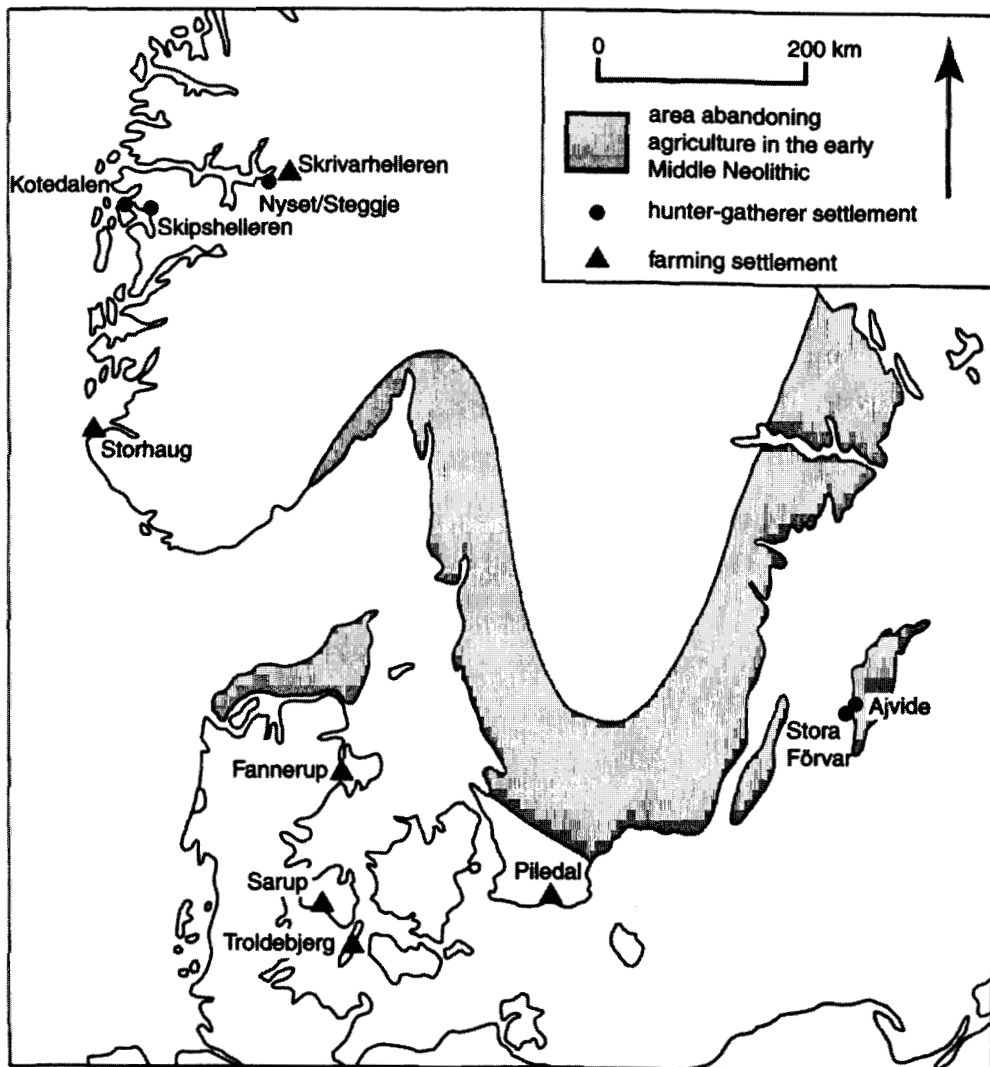


Figure 12. Southern Scandinavia at the start of the middle Neolithic period (except Storhaug and Skrivarhelleren, which are late Neolithic). Area abandoning agriculture after Zvebil (1996, Fig. 18.3).

domestic animals or cereals (Rowley-Conwy 1995b). In view of the problems in identifying such pollen (Edwards 1989), the claims for agriculture are by no means certain unless and until backed up by domestic animals and plants. This is certainly true for Kotedalen in view of the situation at other nearby sites. The earliest domestic animal bones in the stratified cave of Skipshelleren (see Figure 12) were directly dated to 4820–4350 BP (H. Olsen 1976). These remain the oldest domestic animal bones from anywhere in Norway (Hufthammer 1995), and even this date is not without its problems (Prescott 1996, 81). At

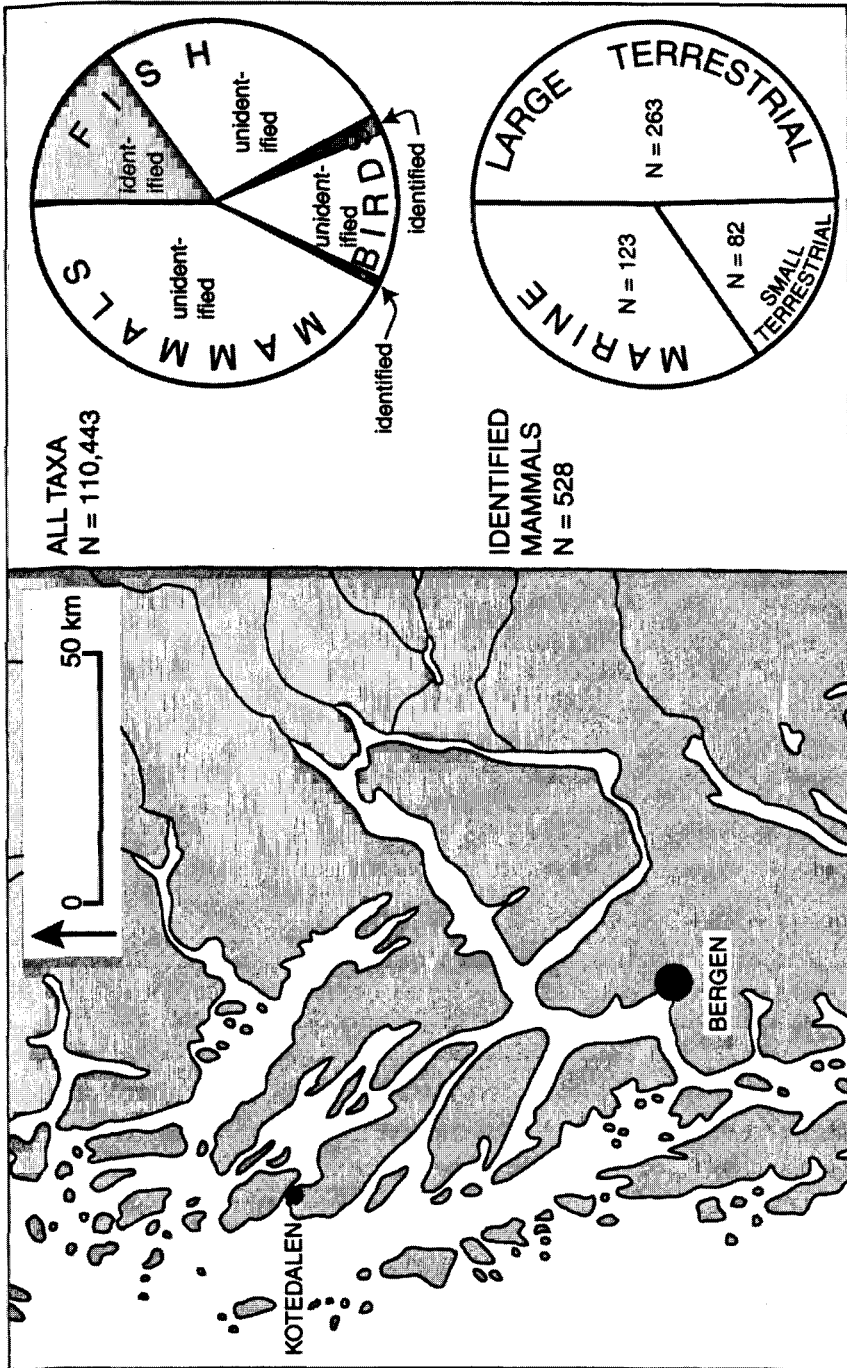


Figure 13. The south-west Norwegian site of Kotedalen, near the city of Bergen. Left: map showing site location on entry to interior marine basin, redrawn from A.B. Olsen (1992, Fig. 1). Right: faunal proportions in Neolithic layers 12-15; top, major groupings including unidentified fragments; bottom, identified mammals only. Information from Hufthammer (1992, Tables 20, 22, 26, and 31).

Skrivarhelleren, the earliest domestic animals and cereals are in late Neolithic layers dated after 4050–3850 BP (T 7686—Prescott 1991; Soltvedt 1991). The earliest directly dated cultivated cereals are from late Neolithic Storhaug, dated to 3850–3690 BP (Soltvedt & Mydland 1995). A major shift in late Neolithic settlement location in the Nyset and Steggje regions is believed to reflect the appearance of agriculture (Bjørøgo *et al.* 1992; Prescott 1995). Bones are not preserved on the island of Flatøy, but early Neolithic sites are in the same locations as Mesolithic ones, optimally placed for fishing and sea mammal hunting; the 50,000 artefacts are linked to the manufacture and repair of hunting and fishing gear (Simpson 1992). The same is true of the island of Kollsnes except that the sites continue through the middle Neolithic; all sites appear small and temporary and are probably fishing camps. The only exception is Budalen 17 which has a larger post-hole structure; one post-hole contained pellets of sheep dung, one of which was dated to 4200–3945 BP (Ua-2456), at the transition from middle to late neolithic (Nærøy 1994).

This suggests that agriculture was not adopted in south-west Norway until the (artificially defined) late Neolithic. At least for the present it can be argued that there was a stable boundary between hunter gatherers and farmers somewhere south of Skipshelleren. Where the boundary lay is not known because organic preservation is very poor. In the highlands of the Hardanger (Figure 12) 13 Neolithic sites yielded a total of only 38 identifiable bones, none of them from domestic animals (Indrelid 1994). Further south in Telemark the many Neolithic sites have produced no bone at all, and pollen remains the only basis for claims of agriculture (Mikkelsen 1989). Even in Østfold, Norway's south-eastern extremity, the only evidence for early Neolithic agriculture is that some sites are on sandy soils suitable for cultivation (Østmo 1988). It is legitimate to ask: was there *really* a Neolithic in Norway? (Prescott 1996).

Gotland: middle Neolithic re-adoption of hunting and gathering

Agriculture spread through South Sweden in the early Neolithic, coming to a halt near the northern edge of the temperate zone (Hulthén & Welinder 1981, 156–61). Denmark and southernmost Sweden remained agricultural in the middle Neolithic; for example, domestic animal bones come from Troldebjerg (Higham & Message 1968) and Fannerup (Rowley-Conwy 1984b); cereals were found at Piledal (Hjelmqvist 1985) and the major causewayed camp at Sarup (N.H. Andersen 1997). In much of coastal Sweden, however, there was a re-adoption of hunting and gathering (Figure 12).

The island of Gotland (see Figure 12) is perhaps the best place to examine this. The key sequence is from Stora Förvar cave, on an islet 6.5 km off Gotland's west coast, excavated in the last century in horizontal 30 cm spits. The basal spits were aceramic but thought to date from the later part of the early Neolithic, while the rest of the sequence was middle Neolithic (Schnittger & Rydh 1940, 78–9). Grahame Clark used the sequence as a case study in bioarchaeology (1976); his chart based on Schnittger and Rydh's chronology is reproduced in Figure 14, annotated with recent results.

		P H O C I N A E				A R T E F A C T S		
Layers		GREY SEALS %	RINGED SEALS %	HARP SEALS %	Numbers	HARPOONS %	FISH-HOOKS	CERAMICS
Iron Age	B 1	100			6			STONE CIST
	H 2		100		1			
	B 2	75	25		4			
	H 3	666	33		3			
	G ^H 3	100			1			
	B 3	100			2			
	Late Neolithic/ Early Bronze Age	I 4		89	11	9	3	
G 4			86	14	14	3		
Middle Neolithic no sheep or cattle	I 5	14	71	14	14	3	SÄTER IV	
	G 5	11	76	13	38	32		
	B 6		86	14	43	53		
cattle, sheep, pigs	H 7	57	42	1	74	53	SÄTER III	
	G 7	37	54	9	59	53		
Early Mesolithic no large terrestrial mammals	G 8	71	29		55	3	SÄTER II	
	G 9	73	27		86			
	F10	88	12		32			
	G11	94	6		34			
	A11	75	25		40	3		
	F12	92	8		38			
	F13	85	15		39	Total 34		

9500 BP

2000 year hiatus

Figure 14. Right: table correlating seals and artefacts at Stora Förvar cave, after Clark (1976, Fig. 1), based on dating from Schnittger and Rydh (1940). Left: revisions resulting from radiocarbon dating and zooarchaeological analysis (Lindqvist 1997; Lindqvist & Passnert 1997).

Recent work has demonstrated that the chronology is much longer than formerly envisaged (Lindqvist 1997; Lindqvist & Possnert 1997). Radiocarbon reveals that the basal ceramic spits are in fact early Mesolithic, separated from later deposits by a 2000-year hiatus. During the Mesolithic, no large terrestrial mammals were present; accelerator dating demonstrates that 'mesolithic' pigs are intrusive, thus resolving a problem that has plagued the archaeology of Gotland for a century. Domestic species were introduced in the early Neolithic; these, along with a change from a marine to a terrestrial diet (and a token megalith), link Gotland with the early farmers in Denmark and South Sweden (Lindqvist & Possnert op. cit.).

Many sites are known from Gotland proper, and their distributions reflect the economic

changes: a coastal Mesolithic is followed by an interior early Neolithic (Österholm 1989). The middle Neolithic is of crucial interest: diet is strongly marine, and sheep and cattle disappear (Lindqvist & Possnert 1997). Sites move back to the coast; many are large, and associated with cemeteries (Österholm *op. cit.*). The major site of Ajvide D is a good example, with a settlement and 50 graves (Burenhult 1997). In the late Neolithic, domestic sheep and cattle reappear at Stora Förvar (Lindqvist & Possnert *op. cit.*).

The evidence thus supports a re-adoption of coastal hunting and gathering during the middle Neolithic. One problem, however, remains. Pigs must have been introduced by human agency. Initially they were part of the early Neolithic agricultural suite, but they continue to be found when the other domestic animals disappear and settlement moves back to the coast in the middle Neolithic. They are often regarded as domestic, both because they are a human import (Jonsson 1986; Lindqvist & Possnert 1997) and because many mandibles are found in some graves; it would be difficult to hunt so many pigs to order when required for a funerary ritual (Österholm 1989). The issue is far from clear, however; killing was seasonal, which suggests they could have been wild (Ekman 1974; Rowley-Conwy & Storå 1997). Wild as well as domestic animals may be carried to islands as an economic resource. The specimens in the graves were killed over several months of the year, *not all at once; they could therefore be trophied jaws from hunted specimens.* More work is needed; but one may ask what niche a domestic pig would fill in an economy that was not producing agricultural waste.

Conclusions

The economic prehistory of Scandinavia is a truly massive subject, something shown not least by the size of the bibliography accompanying this contribution. The number of references published in the last few years testifies that work is increasing, and the last decade has transformed our views of many issues.

Clark's favourite archaeological sciences, zooarchaeology and radiocarbon dating, have played crucial roles in this transformation. Changes in theoretical perspective are vital for the future of archaeology, and the most useful ones emerge simply from an improved knowledge of what happened in prehistory. Archaeology is, fortunately, a discipline that can be (and frequently is) surprised by unexpected findings. The production of new theories to account for such surprises is the basic method of disciplinary advance; much more fruitful than merely basing them on whim.

An aspect stressed throughout this contribution has been the speed of change (with regard to Danish Mesolithic complexity, Norwegian maritime and mountain adaptations, and the appearance of agriculture) and the punctuated and sometimes reversible nature of the spread of agriculture (with regard to stable boundaries between hunter gatherers and farmers in Denmark and Norway, and the re-adoption of hunting and gathering in middle Neolithic Gotland). These are aspects argued on the basis mainly of zooarchaeological and

radiocarbon results, but they conform to theoretical changes in neighbouring disciplines such as ecology. Here we find rapid and contingent change replacing unilinear succession and climax (Blumler 1996); the conflict between adaptational and developmental views is not unique to archaeology.

Given the wealth of its well-preserved archaeological record and its long history of research, Scandinavia is probably unique in its ability to contribute to such theoretical issues. No wonder Grahame Clark liked the place so much.

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on the Late Mesolithic and Neolithic communities, 5500–2500 cal BC, and on the adoption of agriculture in the Dutch part of the North European Plain. We note that prospection and excavation down to 10 m below sea level require a special technology.

PETER ROWLEY-CONWY

Economic Prehistory in Southern Scandinavia

This contribution explores hunter-gatherer settlement and society, and the appearance of agriculture. It argues that zooarchaeology and radiocarbon dating have been the major sources of new information and have led to many theoretical changes.

Hunter-gatherer settlement and society: in the Danish early Mesolithic all the diagnosed sites were occupied in summer; the winter half of the year may have been spent in areas now below present sea level. The late Mesolithic is above or only just below sea level, and in Jutland is characterized by permanent central sites and small satellite camps; in southern Sweden the main base camps may have been seasonal, while in the Øresund it is unknown. The extent to which the Ertebølle was based on fishing has become clear in recent years, due to the finding of large static fish traps and the recovery of many large samples of fish bones. Various aspects of the archaeological record enhance the impression that the Ertebølle was what is commonly described as 'complex'; this is an adaptation to prevailing conditions rather than the result of internal social development, because the middle Mesolithic shows such features as soon as sea level nears the modern level and becomes accessible to study.

Appearance of agriculture: claimed chronological overlap between hunter gatherers and farmers in Denmark was the result of relative dating methods subsequently shown to be faulty by radiocarbon; the result was the development of a processual theory emphasizing a stable frontier between Danish hunter gatherers and German farmers that lasted at least a millennium. When agriculture finally appeared in Denmark, it apparently did so rapidly, in contrast to some current suggestions of gradual change. Less evidence is available from Norway because of poor organic preservation, but agriculture may not have reached south-western regions until the late Neolithic. In eastern Sweden there was a re-adoption of hunting and gathering in the middle Neolithic; recent work on Gotland has shown that after an early Neolithic based on agriculture, the middle Neolithic moved back to the sea shore and concentrated on marine resources.