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The Mesolithic of Southern Scandinavia

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The Mesolithic of Southern Scandinavia, with comprises Denmark and Southern Sweden, has been an attractive area for research for several reasons, including the good preservation conditions at many sites. Most of the work has been concentrated on the southwestern part of Southern Scandinavia, but results from more recent investigations mean that other areas can also be analyzed. New finds in the last few years have given us a greater understanding of the Late Paleolithic settlement and of its relation of the Mesolithic. For the Early Mesolithic (10,000–8000 B.P.), interest has focused primarily on the small inland bog sites in the southern part of the area, where the coast has since been submerged. Farther north, where the land has been uplifted, evidence of coastal settlement has been documented. The Late Mesolithic (8000–6000 B.P.) is known chiefly on the basis of its large coastal settlements. In this period, there is also a larger and more varied collection of finds, which makes it possible to discern clear regional differences. There has also been considerable research on the transition from Mesolithic to Neolithic.

KEY WORDS: Mesolithic; Late Paleolithic; Southern Scandinavia; adaptation; bog sites; coastal settlement.

INTRODUCTION

In research into the European Mesolithic, Southern Scandinavia has an importance disproportionate to its limited geographical extent. The geological setting, with a landscape rich in lakes and with good preservation of organic material, and the extensive research into this period that has been carried out since the midnineteenth century are significant factors in this. Together, they have given us a profound and detailed knowledge of Mesolithic society.

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SOUTHERN SCANDINAVIA AND ITS MODERN DIVISION

In this article, Southern Scandinavia comprises Southern Sweden, including Öland and Gotland (the two large Baltic islands) and the whole of Denmark (Fig. 1). The Baltic island of Bornholm, which lies southeast of the Southern Swedish land mass, is part of Denmark. I have drawn the boundary of Southern Sweden so as to include Götaland, thus incorporating parts of Northern Sweden according to Nygaard (1989). This area comprises regions which vary greatly in geology and climate—both factors of considerable influence in shaping prehistory.

Except for southwestern Denmark, Southern Scandinavia was covered by ice during the Weichselian glaciation, which produced a topographically broken landscape with numerous ponds and lakes and with few traces of sediment older than that glaciation (Berglund and Lagerlund, 1981).

Since the edge of the land ice during the peak of the Weichselian glaciation ran through Jutland, this area abounds in glaciofluvial formations and massive terminal moraines (Strand Petersen, 1985). As a result, northern Jutland has great variation of clay and sand, whereas eastern Jutland, like Funen, Zealand, and the other south Danish islands, is largely covered by calcareous clays (Naturgeografisk, 1984). This is also true of southwestern Scania, the southernmost province of Sweden. A very clear geological boundary

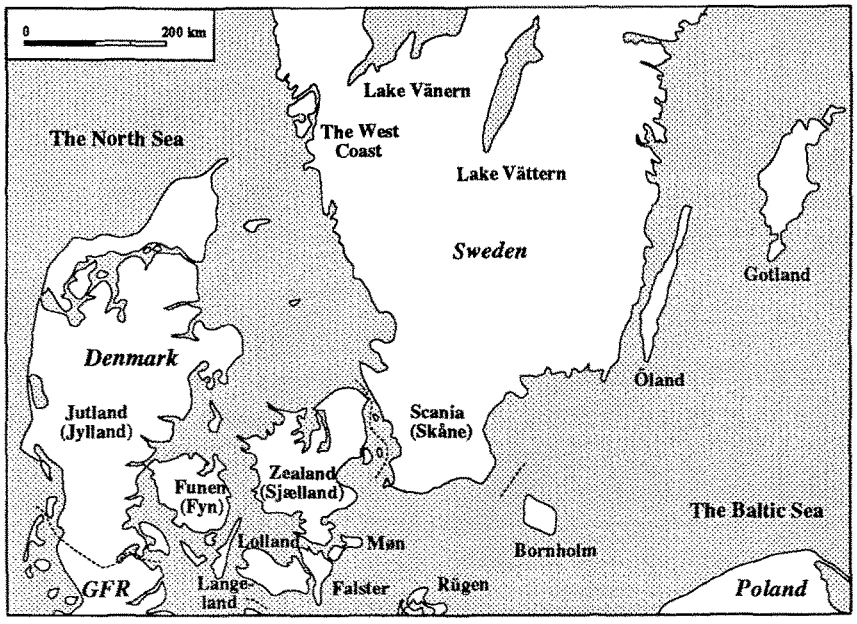

Fig. 1. Map of the area of study.

can be followed NW–SE through Scania, with the landscape north of the boundary having a radically different character, dominated by gravelly–sandy till with a low calcium content; there are also exposed outcrops of rock. This boundary is of great geological importance, since it marks the transition from the Precambrian Fenno-Scandian rock to the younger, particularly Mesozoic, rocks that make up the whole of Denmark. The center of Götaland is an extensive horst formation with a relatively flat surface. In these areas, the land reaches a height of some 350 m asl, so that the area, which is known as the Southern Swedish highland, has a climate that is comparable to that of much more northerly parts of Scandinavia. Huge joint valleys and long eskers are also typical of the landscape. Only along the western coast of Götaland and in Gotland do we find any significant areas of clay. Because of the bedrock, there is considerable limestone in the soils of Gotland.

The location of Southern Scandinavia—along the North Atlantic coast and connected to the Eurasian landmass—gives the western part a maritime climate. The eastern part, owing to the large basin of the Baltic Sea, has features of both maritime and continental climates. The prevailing winds are west to southwest, so precipitation is heaviest in the west of southern Scandinavia. Annual precipitation varies from 500 to 800 mm (Naturgeografisk, 1984). The mean January temperature for the whole of Southern Sweden is between 0 and -4°C; Denmark, except for central Jutland, has a mean between 0 and $+1$°C (Mead, 1958). The mean July temperature in Southern Sweden and Denmark is 16–17°C.

Factors such as temperature, precipitation, soils, and bedrock divide Southern Scandinavia into a number of physiographical regions (Naturgeografisk, 1984). Denmark, southernmost Sweden, the western coast of Sweden, and the southern parts of Öland and Gotland belong to the nemoral zone, while the rest belong to the oceanic, southern boreal, boreo-nemoral zone.

Climatic conditions have changed since Mesolithic times, so the modern division does not correspond precisely to that of the past. It can, nevertheless, be used as a basis for the division of southern Scandinavia (Fig. 2).

THE MESOLITHIC SITUATION

In the early Postglacial (Preboreal, Boreal, and Atlantic), there were considerable transformations of the landscape. Four major processes must be mentioned: uplift (isostasy), rising sea level (eustasy), subsidence, and the filling of lakes with organic sediments. Since the Weichselian land ice was thinner and thus exerted less downward pressure at the edges, the isostatic

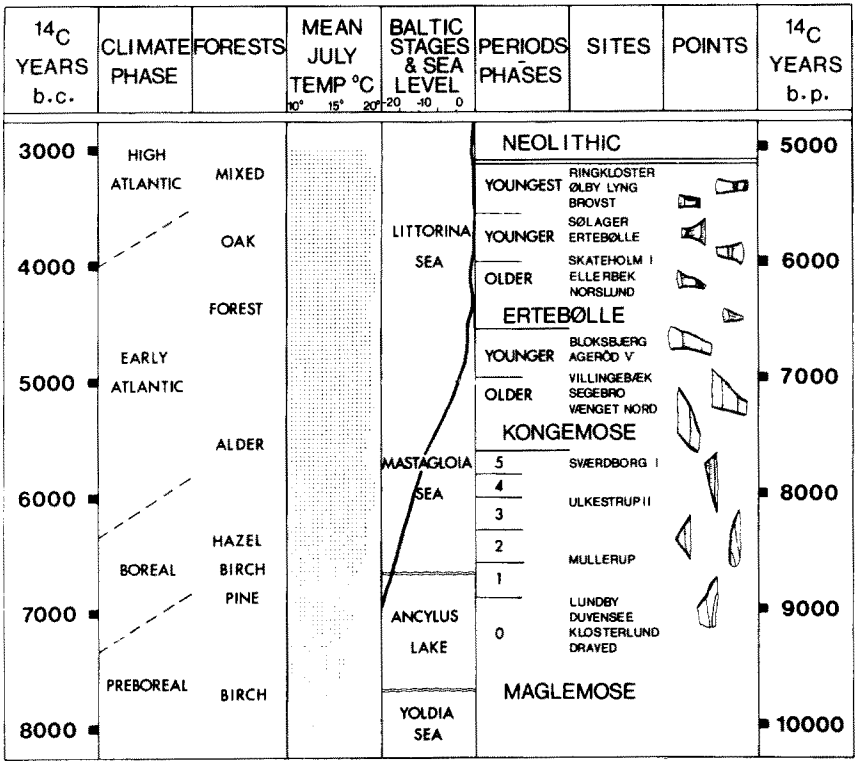

Fig. 2. The Mesolithic of southwestern Scandinavia (from Price, 1985).

effect during and after the melting of the ice was greatest in the northern part of Southern Scandinavia. Here the total isostatic recovery is estimated at about 40 m (Mead, 1958), and the process is still not complete. In the south, on the other hand, isostasy probably ceased in Late Glacial times.

As a result of the surviving land ice and the downward pressure on Northern Sweden, large areas in the south of Southern Scandinavia which are now under water were dry in Late Paleolithic and Early Mesolithic times (Figs. 3, 4, and 6). The southern part of the modern North Sea was a land bridge to the British Isles.

The depression that is now the Baltic Sea has undergone many changes (Agrell, 1976, 1979; Fredén, 1979; Krogh, 1979a, b; Königsson, 1979; Ludwig, 1979). In the Late Glacial, the land ice was a barrier between the North Sea and the Baltic (Berglund, 1979; Björck and Digerfeldt, 1982), and the meltwater Baltic Ice Lake filled part of the depression (Fig. 3). When the ice receded from the central Swedish depression (on the northern boundary of the study area) during the Younger Dryas (Björck *et al.*, 1982), the Baltic Ice

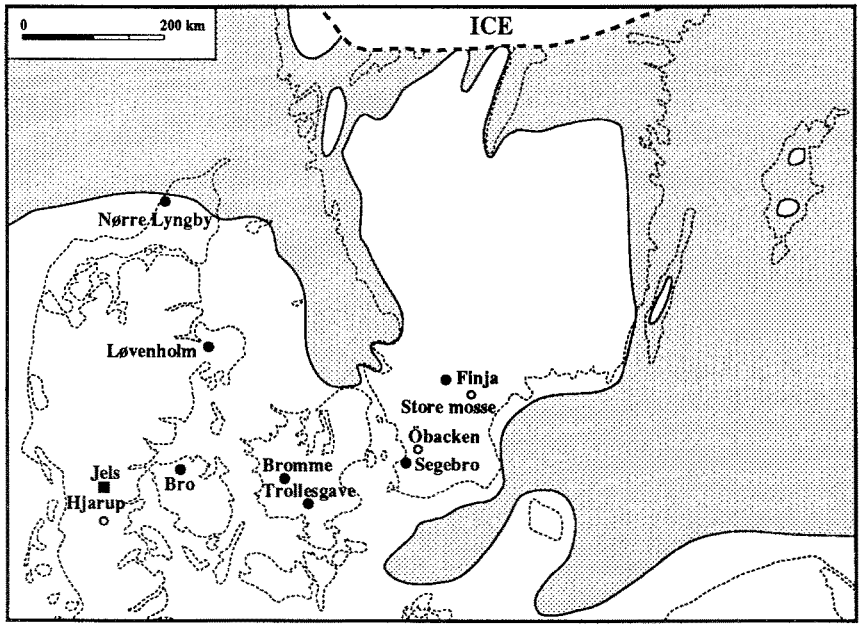

Fig. 3. Southern Scandinavia during the Late Paleolithic with some important sites and finds, showing land, water, and ice during the Younger Dryas (ca. 10,500 B.P.). Filled square, Hamburgian site; filled circle, Bromme site; open circle, Ahrensburgian site.

Lake, which was about 25 m higher than the North Sea, was quickly drained to the latter level at about 10,400 B.P. (Björck, 1989). Salt water found its way in and the Baltic Ice Lake was transformed into the Yoldia Sea (named after the mollusk, *Yoldia arctica*) (Fig. 4).

Increasing isostasy, which may have been as much as 8–10 m per century in the northern part of Southern Scandinavia, combined with the final melting of the land ice (completed ca. 8700 B.P.), led to a marked rise in water level in the south of the Baltic depression. At the same time, the rising sea level meant that land in the southern North Sea was flooded (Krogh, 1979a, b). The rising of the central Swedish depression cut contacts with the North Sea, so that, in the Preboreal, the Baltic depression was transformed into the freshwater Ancylus Lake (named after the mollusk, *Ancylus fluviatili*). Eustatic sea-level changes affected large areas in western Southern Scandinavia, creating parts of Öresund (the sound between Zealand and Scania) and the Danish sound of Store Bælt between Funen and Jutland (Fig. 6). Large areas of forest and bog, as well as the southern Baltic, were submerged. The dating of surviving tree stumps and peat layers allows us to follow the eustatic process (Berglund *et al.*, 1986). A significant rise in sea level can be observed in the Late Boreal (Krogh, 1979a; Persson, 1962).

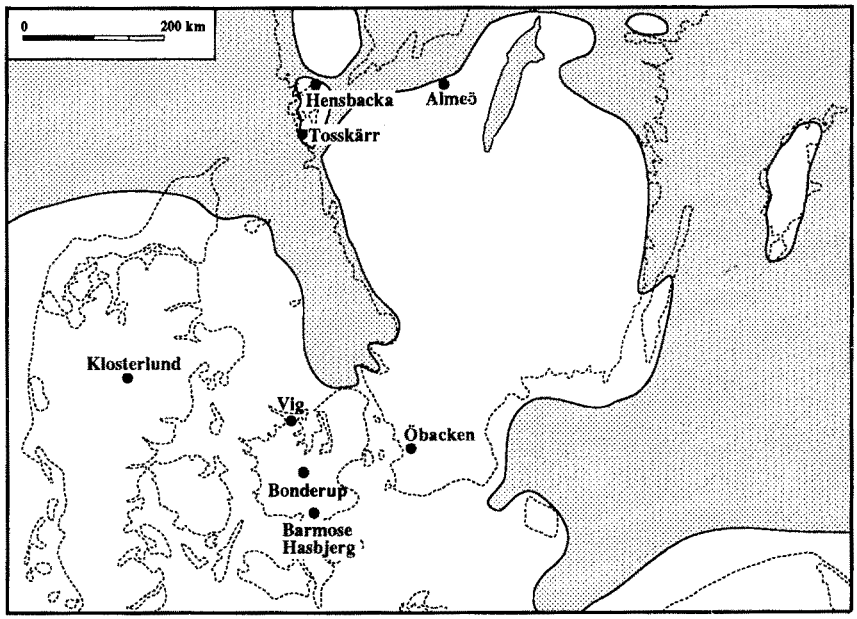

Fig. 4. Southern Scandinavia during the Preboreal (ca. 9500 B.P.) with some important sites and finds.

Toward the end of the Boreal, there was a widening of the channel through the modern Öresund or Store Bælt; the latter had probably existed since the time of the Baltic Ice Lake. This brought an influx of salt water and raised the salt content in the Baltic depression; this transitional stage is called the Mastogloia Sea.

Quaternary biological studies of several sites in Southern Scandinavia have provided a complex, detailed picture of the Littorina Sea transgressions (Berglund, 1971; Christensen, 1982; Digerfeldt, 1975b; Liljegren, 1982; Strand Petersen, 1985). The complexity is due chiefly to the isostatic process going on in the north of Southern Scandinavia while the south was subsiding; the tilt line runs diagonally NW–SE through Denmark (Andersen, 1987b; Price, 1985). In the southwest of Southern Scandinavia, this has caused the land to subside as much as 9 m since the Late Mesolithic. In southern Öresund, which was probably not affected by isostasy, there is evidence of four transgressions from a level of -1 m during the Early Atlantic up to a maximum of about 4 m near the end of the Late Atlantic (Fig. 9). On the western and eastern coasts of Sweden, where there was both isostasy and eustasy, there have been complex shifts in the shoreline.

In a hilly landscape like that of Southern Scandinavia, there were many lakes in the Mesolithic. In particular, those in the calcareous clays of eastern

Denmark and southernmost Sweden were eligotrophic with a rich flora and fauna. Most of the shallower lakes were thus completely filled with organic sediment during the Mesolithic, a process which began immediately after the melting of the ice, so that the lakes in the southwest of the area were filled earlier than those in the northeast (Welinder, 1978). Since the lakes appear to have been particularly attractive for settlement during the infilling, the attraction of these inland sites was most evident in the Early Mesolithic in the west of the area and in the Late Mesolithic in the east.

Aspects of Source Criticism

The changing relationships of land and water are also significant for another aspect of Mesolithic studies: the possibility of finding any evidence of settlement at all. Much of the Early Mesolithic coastal zone in the south of Southern Scandinavia is now drowned, as is also the Late Atlantic coastal belt in the southwest. In parts of the Swedish western coast, the Early Mesolithic shore has been transgressed (in several stages at some levels), so that later transgression layers have covered large areas; this is also true of some levels of the Late Mesolithic shoreline in the south. In addition, there is good reason to suspect that a great many coastal settlements were wiped out by transgressions or regressions: the settlements marked only by highly waterworn artifacts in beach gravel provide clear examples of the destructive effect of rises in sea level on coastal settlement.

Another important factor is the use of bog land. Peat has been extensively cut in recent centuries for fuel in eastern Denmark and southern Scania—areas with a high population but few trees (Kristiansen, 1976). This has uncovered evidence of prehistoric remains including traces of Mesolithic settlement. In contrast, in the center of Southern Scandinavia, there are considerable areas of bog suitable for Mesolithic settlement, but the plentiful supply of wood and the sparser population have meant that peat use was less intensive and the peat cutting has affected only post-Mesolithic layers.

Soil composition also affects the preservation of organic matter. In the southwest of Southern Scandinavia, there is a high proportion of lime in the soils, whereas this is uncommon in the northeast, except on the islands of Gotland and Öland. In some areas, where the pH value of the soil used to be slightly basic, organic matter is destroyed by the acidification resulting from artificial fertilizers and air pollution.

SURVEY OF PREVIOUS RESEARCH

The 1840s saw the start of a vehement debate among Danish archaeologists about whether the assemblages of molluscs along the coasts of northern

and eastern Jutland and northern Zealand were natural formations or remains of human settlement. An interdisciplinary committee was established to solve this problem (Andersen, 1989), which soon determined that human activity was responsible for the assemblages, for which the term kitchen midden (*køkkenmødding*) was first used in the committee's report. Worsaae (1859) believed the finds to be older than those from the megalithic graves, and on this basis, he divided the Stone Age into an early and a late period. This division provoked discussion. In the 1890s, extensive studies were conducted of a kitchen midden at Ertebølle in northern Jutland. The comprehensive reports of the excavation showed that the finds were indeed older than the megalithic graves (Madsen *et al.*, 1900), and the site gave its name to the Ertebølle culture. Its characteristic artifacts were transverse arrowheads, flake axes, and thick-walled pots.

In 1900, the first excavations of a bog site began at Mullerup in the Maglemose bog, Zealand. The finds were judged to be older than those from the kitchen middens, younger than those from the continental reindeer-hunting period, and contemporary with the Ancylus Lake (Sarauw, 1903). This material culture was named Maglemose, and microliths, core axes, and leister points were the typical indicators of the culture. Increased peat cutting during the First World War led to the discovery of several new bog settlements (Broholm, 1924; Friis Johansen, 1919). Swedish archaeologists also found similar sites in Scania (Rosén, 1912; Sernander, 1908).

The investigation of coastal sites with finds different from those in the kitchen middens led to the identification of yet another cultural phase, the Early Coastal Culture (Mathiassen, 1943, p. 143; Westerby, 1927, 1933). Excavations in central Jutland uncovered a fourth culture, the Gudenaa culture, which was seen as a specifically inland and long-lived culture (Mathiassen, 1937).

Sarauw, who excavated the Mullerup site, obtained an appointment in Gothenburg on the west coast of Sweden. This was a major reason that research into the Early Stone Age became much more attractive in the west than in the east of Sweden, a situation which was unchanged until recently (Alin, 1935; Alin *et al.*, 1934; Sarauw and Alin, 1923).

In the interwar years, there was discussion of the relations between these cultures, with consideration of factors such as artifact forms, find composition, and adaptation to inland or coastal environments (Brinch Petersen, 1973, Fig. 4. 1, 2; Larsson, 1978a, pp. 18–19). The relation to the Late Stone Age also entered the debate, with some scholars claiming that Mesolithic elements survived well into the Neolithic (Forssander, 1930; Rydbeck, 1940). Quaternary biologists provided greater knowledge of vegetational composition and changes in sea level (Iversen, 1937; Jessen, 1937; Nilsson, 1935).

The new intensity of peat cutting in the Second World War led to the discovery and excavation of more bog sites (Becker, 1945; Mathiassen, 1943), but some of these were not analyzed in detail until many years later (Bille Henriksen, 1976, 1980; Brinch Petersen, 1972). The first Late Glacial settlement site was also identified (Mathiassen, 1946b; Westerby, 1987).

The increase in the quantity of finds and of studies of Quaternary geology led to a research trend toward detailed description of material culture from a chronological perspective, although the chronologies were often based on sites that had been only preliminarily analyzed. Scholars proposed subdivisions of both the Ertebølle culture (Becker, 1939) and the Maglemose culture (Althin, 1954a; Becker, 1953; Brinch Petersen, 1966). The latter was based on changes in microliths and core axes. Stages in the Ertebølle culture were distinguished on the basis of changes in transverse arrowheads and axes. Inland sites showed that the Early Coastal Culture was not represented only in the coastal areas (Mathiassen, 1943), so it was renamed the Kongemose Culture, named from an inland bog site in central Zealand (Jørgensen, 1956)! New analyses of the Gudenaa Culture showed that it was not a separate culture but a mixture of other cultural phases (Andersen, 1971). At the end of the 1940s, there was a large-scale project intended to shed light on Mesolithic development in southernmost Sweden (Althin, 1954a).

The new "biological" orientation represented by the Cambridge archaeologist J. G. D. Clark (Clark, 1954; Clarke, 1972) gained a following in Southern Scandinavia (Althin, 1954b), where there was already a tradition of collaboration between archaeologists and natural scientists, and where archaeology and Quaternary biology were sometimes studied by the same person. This also explains the rapid adoption and development in studies of the Southern Scandinavian Mesolithic (Gräslund, 1974) of a paleoecological orientation, following Anglo-American models in the New Archaeology (Binford, 1972; Binford and Binford, 1968; Clark, 1972; Clarke, 1972, 1976; Higgs, 1972, 1975; Jochim, 1976; Lee and DeVore, 1968; Service, 1972).

Although important excavations of Mesolithic settlement sites were conducted in the 1950s and early 1960s (Andersen, 1960, 1961; Andersen and Malmros, 1966), it was only in the late 1960s and early 1970s that there was renewed interest in Mesolithic research, both fieldwork and analysis. Excavated material was reexamined or used to elucidate new questions (Andersen, 1970a; Bille Henriksen, 1976, 1980; Brinch Petersen, 1966, 1972; Cullberg, 1972; Larsson, 1973; Welinder, 1971b), and new sites were excavated (Andersen, 1970a, 1975b; Brinch Petersen, 1971).

S. H. Andersen led an ambitious program of fieldwork and publication concentrating on the Late Mesolithic in Jutland (Andersen, 1970b, 1971, 1972, 1975a, b, 1976, 1977b, 1979b, c, 1985, 1987b, 1989; Andersen and Johansen, 1986; Blankholm *et al.*, 1968). In Scania, there were new

investigations of Early Mesolithic inland settlement (Welinder, 1971a, b). Other studies included both inland and coastal settlement in the Late Boreal and Early Atlantic periods (Larsson, 1976, 1978a, b, 1980, 1981a, 1982c, 1983a, b). There was also work on the Swedish West Coast (Andersson *et al.*, 1988; Cullberg, 1972, 1974, 1975; Welinder, 1973a; Wigforss, 1983) and in central Sweden (Welinder, 1973a, b, 1974a).

In eastern Zealand, the Vedbæk project, under the direction of E. Brinch Petersen, studied Late Mesolithic settlement near a lagoon (Albrethsen and Brinch Petersen, 1977; Brinch Petersen, 1989; Brinch Petersen *et al.*, 1976, 1977, 1979, 1982; Juel Jensen and Brinch Petersen, 1985; Price and Brinch Petersen 1987; Vang Petersen, 1982, 1984). In the early 1980s, the Skateholm project investigated Late Mesolithic settlement around a lagoon in southernmost Sweden (Larsson, 1982, 1984a–c, 1985a, b, 1988b, c, 1989d).

A BRIEF OUTLINE OF MESOLITHIC MATERIAL CULTURE

In describing the development of material culture, Southern Scandinavia can be treated as a unit only in very general terms. The southernwestern part of the area is used here to illustrate development, but it should be borne in mind that even here there were distinctive variations.

In the Preboreal, there were large lanceolate microliths, usually with only one side partially retouched (Fig. 5), as well as isosceles and broad triangular microliths (Brinch Petersen, 1966). Flake axes occur early, whereas the later parts of the Boreal are characterized by core axes. Flaking techniques were not very well developed, so it is not always possible to distinguish clearly between blade and flake tools. Bone and antler tools are varied. Fine-toothed bone points and transverse-shafted hoes of elk antler are typical of this time.

In the Boreal, the microliths—lanceolate, triangular, and segment shaped—become longer and narrower. Tools of bone and antler appear in greater variety, with chisels, sockets for flint axes, and coarse-toothed leisters.

In the course of a few centuries at the end of the Boreal, we can discern several stages (Becker, 1953). Flaking techniques become more sophisticated, and special cores appear for manufacturing microblades (Fig. 7); the first examples are conical, but handle cores appear immediately before the transition from Boreal to Atlantic. The microliths, mostly asymmetrical triangles with a few trapezoids, become extremely long and narrow. The slotted bone point appears (a point with two opposed grooves in which microblades were fixed with resin). Stone axes also occur, some with shaft holes.

During the very last part of the Maglemose culture, we also find trapezes made on blades and an improvement of the flaking technique (Knutsson, 1970; Larsson, 1978a).

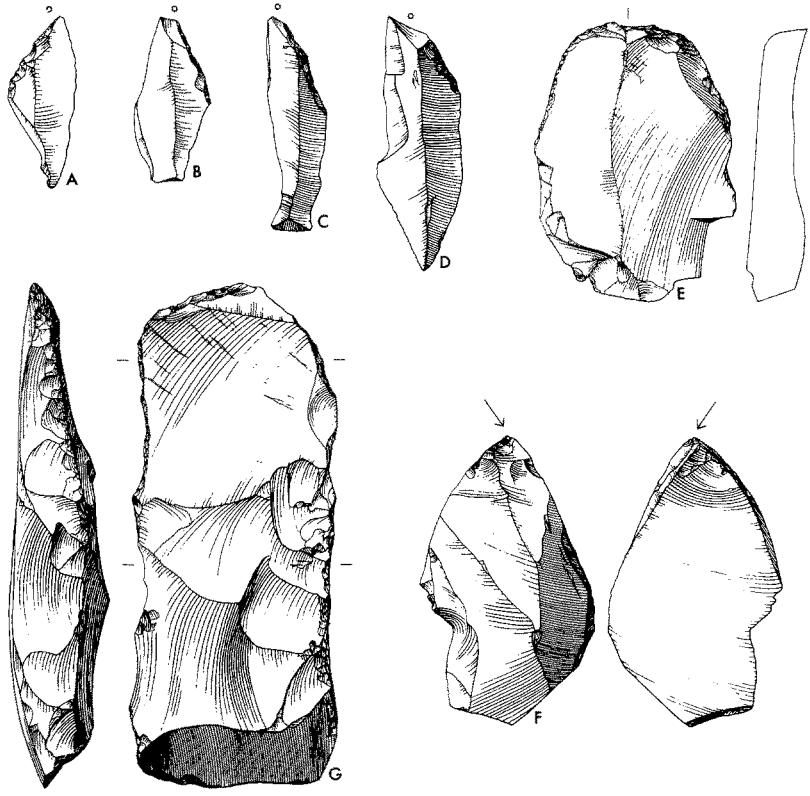

Fig. 5. Artifacts from the Preboreal site of Barmose on Zealand, A–D, lanceolate microliths; E, flake scraper; F, burin; G, flake ax.

Broad trapezes are the first stage in the sequence of microlith shapes leading to the characteristic oblique arrowhead of the Kongemose culture. This culture is distinguished by a well-developed blade and microblade technology; most tools are on blades. Pecked stone axes become widespread. Bone and antler tools are less important than in the Maglemose culture. Several Maglemosian tool forms, such as antler axes and slotted bone points, continue to be made.

The oblique arrowheads become even longer and narrower, allowing division of the Kongemose culture into two phases (Fig. 8) (Vang Petersen, 1984). A transverse arrowhead with an oblique edge marks the transition from the Late Kongemose to the Early Ertebølle culture; at this time, the microburin technique also disappears. In the middle Ertebølle culture, the transverse arrowhead has concave sides, but in the later phase, we find a long, narrow form with parallel sides. The change in transverse arrowheads is so

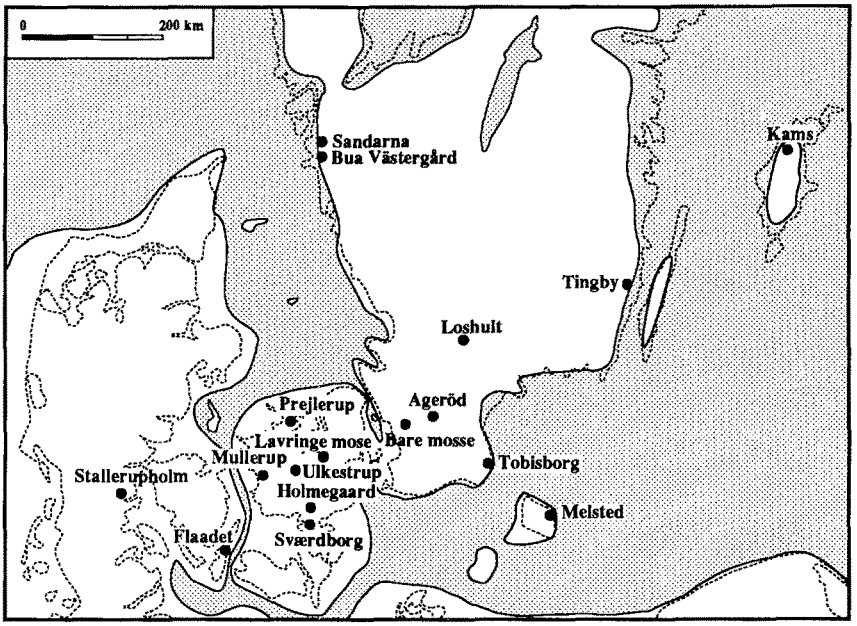

Fig. 6. Southern Scandinavia during the Boreal (ca. 8500 B.P.) with some important sites and finds.

slight that it can hardly be functionally conditioned. Nevertheless, it is the most important criterion for distinguishing the three different stages of the Ertebølle (Vang Petersen, 1982, 1984). A similar change in trapezoid forms is documented in some parts of continental Western Europe (Vang Petersen, 1982).

In the earliest stage of the Ertebølle culture, there are relatively few tools of flint. In the middle phase, flake axes become important, and they are dominant in the Late Ertebølle. Ceramics appear in western Denmark around 5600 B.P., in the forms of wide-mouthed vessels with a pointed base but no clearly marked neck and of low, oval bowls. The Late Ertebølle culture is characterized by great variation in tools of flint, bone, and antler.

THE PALEOLITHIC BACKGROUND

Although there are occasional finds in Denmark from the Early and Middle Paleolithic (Becker, 1985; Grote and Maagaard Jacobsen, 1982; Nielsen, 1985), the landscape has been so altered by the land ice that we do not find traces of continuous settlement until after the Weichselian glaciation.

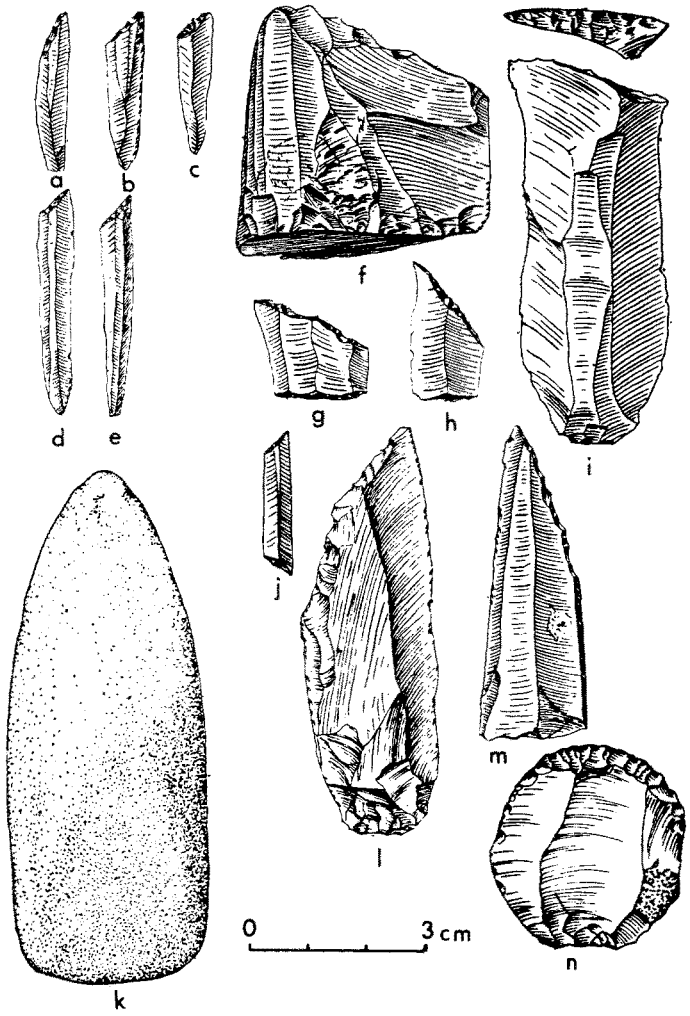

Fig. 7. Artifacts from sites at Ageröd, central Scania, dated to the Late Maglemose culture. a–e, triangular microliths; f, handle core; g and h, broad trapezes; i, blade scraper; j, narrow trapeze; k, ground stone axe; l and m, blade knives; n, flake scraper (from Larsson, 1973).

The oldest remains of Late Glacial sites, dated to the Hamburg culture, are at Jels in southern Jutland, where two sites have been excavated, a few tens of meters apart at the edge of a tunnel valley (Holm and Rieck, 1983; Holm and Rieck, 1987). One site, Jels I, yielded few finds, but the other was rich. The spatial and temporal relationships of the two sites are unclear (Andersen, 1988; Fischer, 1990; Holm *et al.*, 1987). The tanged arrowheads found here are very similar to those of the Havelte group in Holland, which

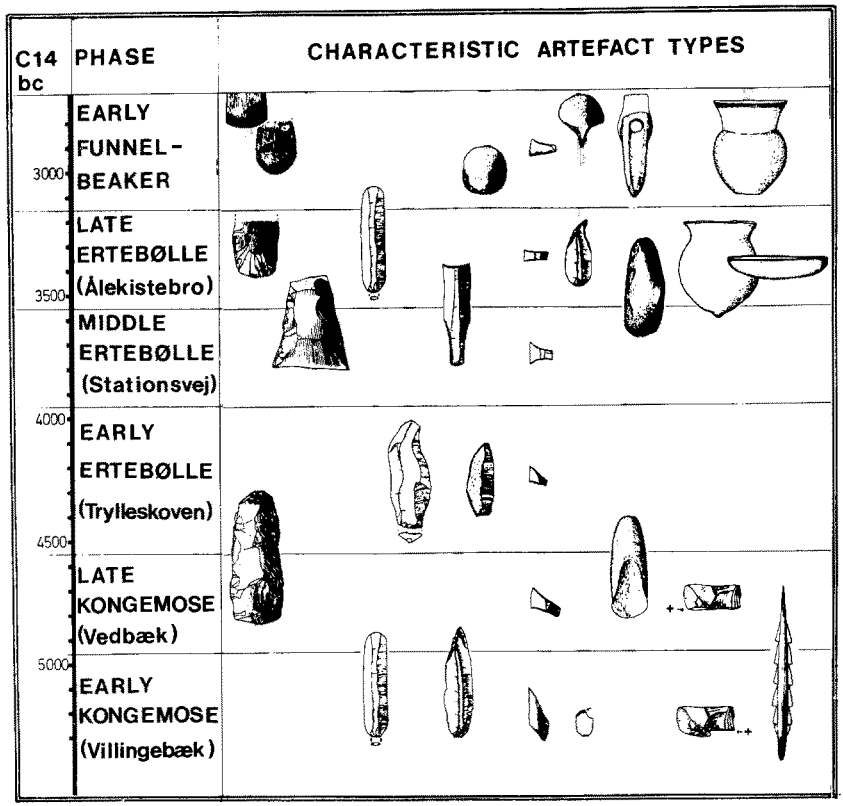

Fig. 8. The late Mesolithic and early Neolithic of southwestern Scandinavia (from Vang Petersen, 1984).

is dated to a late phase of the Hamburgian (Tromnau, 1974). New C-14 dates from the classic site of Meiendorf in northern Germany (Rust, 1937) fall between 12,360 B.P. ± 110 years and 10,110 B.P. ± 85 years (Fischer and Tauber, 1986) and are confirmed by occasional dates from other northern European sites (Burdukiewicz, 1986; Fischer *et al.*, 1986). There are also occasional Hamburgian sites in southern Jutland (Becker, 1971; Holm *et al.*, 1987): finds are thus confined to the southwest of the area under study. A reindeer antler artifact, from the north of the Öresund and previously dated to the Oldest Dryas (Holm *et al.*, 1987; Mathiassen, 1938), has now been shown by C-14 dating to be historical (A. Fischer, personal communication).

The relationship between the Hamburg culture and the typically Southern Scandinavian Bromme culture is somewhat unclear. A find from Løvenholm in eastern Jutland may be evidence of a transitional phase, with a combination of Havelte-type tanged arrowheads and Bromme points (Madsen,

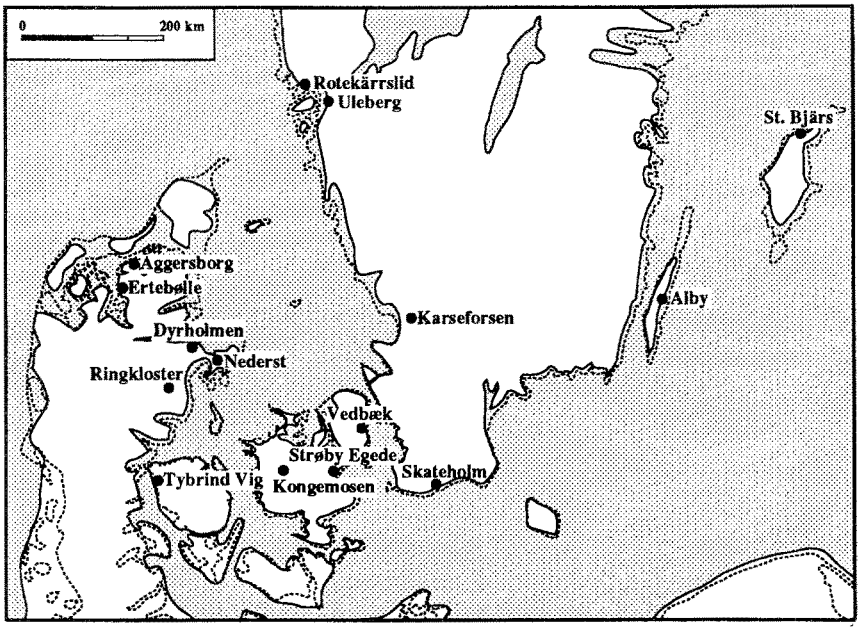

Fig. 9. Southern Scandinavia during the Atlantic (ca. 7000 B.P.) with some important sites and finds.

1983). Reanalysis of the material from the eponymous site of Bromme in central Zealand (Mathiassen, 1946b) shows that this contains not one but four concentrations, corresponding to a camp site with an area of some 50 m^2 (Fischer and Sonne Nielsen, 1987). It is possible to discern a chronological seriation of Bromme points and scrapers. For the points, the early phase is dominated by tanged arrowheads retaining the bulb of percussion, while in the later phase the tang is sharpened by retouching, thus removing the bulb (Fischer *et al.*, 1987, Fig. 20). The scrapers show a decline in the number with retouched sides (typical of the Hamburgian) in favor of a type with unretouched edges (Fischer *et al.*, 1987, Fig. 22).

A few of the Late Glacial sites have backed blades (*Federmesser*) with clear parallels to northern German finds (Andersen, 1977a; Fugl Petersen, 1974; Schwabedissen, 1954). The Federmesser group has been dated to the earliest part of the Allerød oscillation (Hartz, 1987). It may have been a precursor of the Bromme culture (Fischer, 1990).

Before the mid-1970s, only a few Bromme culture sites were known (Andersen, 1973a; Salomonsson, 1961, 1964), but intensive field surveys in Denmark have identified many new sites, mostly in southern Zealand, Funen and eastern Jutland (Fischer, 1977, 1985; Fischer and Mortensen, 1978;

Madsen, 1983). New surveys in southernmost Sweden have also led to new finds (Larsson, 1990c), the distribution of which marks the northern boundary of the culture, running through the southern half of the Southern Swedish highland.

The dating of the Bromme culture is uncertain. An arrowhead was found at Nørre Lyngby in northern Jutland in layers dated to the Younger Dryas (Iversen, 1942). We have a single C-14 date of about 11,100 B.P. from Trollesgave, a Bromme settlement in southern Zealand (Fischer *et al.*, 1978). This may suggest that the Bromme culture flourished at the end of Allerød and the beginning of the Younger Dryas (Andersen, 1973a).

Most of the known Bromme settlements are in well-drained sandy soil and lack organic remains. Faunal remains from the eponymous Bromme site include reindeer, elk, wolverine, beaver, swan, and pike (Mathiassen, 1946b); elk seems to have been more important than reindeer. There is evidence of red deer from Trollesgave (Fischer, 1977). Giant red deer and brown bear are known from several bog finds (Aaris-Sørensen, 1988). Scattered finds of ringed seal and several species of whale, such as blue whale and rorqual, shed some light on the marine fauna. Polar bear has also been found along what was then the North Sea coast (Aaris-Sørensen and Strand Petersen, 1984).

Most sites lie at the inlets or outlets of large lake basins. Settlements were also located on chains of hills and on the edges of tunnel valleys. The tool-kits vary with location, indicating marked functional differences between kinds of camps (Fischer, 1976). Despite wide variation in the number of artifacts, each site appears to represent a single camp. It is also common to find several camp sites in close proximity, but in such cases, the composition of the assemblages, as, for example, at Bromme, suggests that they are of different ages (Fischer *et al.*, 1987) and therefore did not function as units in a larger social group.

Coastal settlement by the Bromme culture is indicated by flint objects and bones dredged up from the Öresund strait (Aaris-Sørensen, 1988).

There was a sharp drop in temperature in Younger Dryas (Lemdahl, 1988), and there are relatively few traces of human activity from this period. Occasional sites have yielded tanged arrowheads similar to those from the north German Ahrensburg culture (Andersen, 1977a; Becker, 1971; Larsson, 1976; Rust, 1958; Welinder, 1971b). It is not clear whether this paucity of finds reflects a sparse population or the difficulty in identifying Ahrensburgian sites. Some artifact types, such as blades (Hartz, 1987) and rhomboid points, are very similar to those of the Mesolithic Kongemose culture (Larsson, 1980), and this led earlier scholars to see a parallel between the Ahrensburgian and the "Early Coastal Culture" (Mathiassen, 1943).

There are many reindeer antlers from small areas of bog, chiefly in Zealand and southwestern Scania. Some of these have been dated by pollen analysis to the Younger Dryas (Althin *et al.*, 1950; Degerbøl and Krog, 1959;

Welinder, 1979b). Shed antlers show that reindeer lived in southern Sweden even during the winter, so human settlement must have been possible the whole year round. Isolated finds of reindeer antler hoes occur in gyttja layers from the Younger Dryas (Welinder, 1971b), as do harpoons with opposed rows of barbs (Bokelmann, 1988). Comparable finds from northern Germany suggest that these should be dated to the Ahrensburgian and thus to the Younger Dryas.

THE TRANSITION FROM LATE PALEOLITHIC TO MESOLITHIC

The study of insects shows that there was a sharp and sudden rise in temperature of about 8°C (Lemdahl, 1988) at the transition from Late Glacial to Postglacial (Younger Dryas/Preboreal). There have been several hypotheses about the rate of change from Late Paleolithic to Mesolithic. Unfortunately, there are very few settlements dated to the Preboreal, so it is hard to study the change. The scarcity of Preboreal finds may mean that the population was relatively small or may reflect human geographical and climatological factors. Studies of lakes and bogs have revealed a significantly low water level in the Preboreal and early parts of the Boreal (Digerfeldt, 1975a; Gaillard, 1984); since people preferred locations by open water, they would settle in areas which were submerged when the water level rose and become covered by organic sediment. In addition, the shoreline zone in the Preboreal and Early Boreal was close to the present edge of the bog, which has thin layers of peat that are not so attractive for fuel; farther from the edge are thicker peat layers, which are more often dug, revealing considerable numbers of later (Boreal and Early Atlantic) bog sites.

Although the insect fauna indicates a rapid rise in temperature, this need not mean that the other fauna changed equally suddenly. Radiocarbon dates from Stellmoor, where the Ahrensburgian was first identified, are between 10,140 B.P. ± 105 years and 9810 B.P. ± 100 years (Fischer *et al.*, 1986); these values are very close to that of the Late Glacial–Postglacial transition —10,000 B.P. From C-14 dates, we know that reindeer survived in the early Preboreal in Bornholm and Scania (Aaris-Sørensen, 1988; Larsson, 1990c). It is conceivable that there was a coexistence of the Late Glacial fauna and the newcomers. The transition to the Postglacial times probably saw an immigration of bison, wild horse, and aurochs (Aaris-Sørensen, 1988). Somewhat later in the Preboreal, red deer and wild boar, both typical of the Mesolithic landscape, appeared.

We may postulate two alternative processes of change: either the Late Glacial material culture changed over a rather long period or the process was quicker, with a clear break in continuity, and was based instead on influence

or direct influx from continental societies which had already adapted to the new conditions (Fischer, 1978).

Bonderup, in central Zealand, might support the thesis of a slow transition from Late Paleolithic to Mesolithic (Fischer, 1982a). The artifacts, found in a gyttja layer dated by pollen analysis to the Preboreal (Fredskild, 1982), included a point of Ahrensburg type, bipolar cores typical of the Ahrensburgian, and a triangular microlith, as well as a large flint tool interpreted as a prototype of an axe blade. At Öbacken, in southern Scania, a Preboreal gyttja layer yielded a point of Ahrensburg type and crude lanceolate microliths (Welinder, 1971b).

Farther south, northernmost continental Europe appears to suggest a more rapid and dramatic change. Radiocarbon dates from the bottom layers of Friesack, west of Berlin (Gramsch, 1987a), are close to the Younger Dryas/Prebroeal transition and to the dates of ca. 10,000 B.P. for the Ahrensburgian in the Stellmoor district. However, the finds from Friesack are wholly Mesolithic in character, with no Late Paleolithic features. This probably indicates that marked influence from the south totally changed the material culture within a century. Moreover, the faunal remains from this site contain no subarctic forms, possibly suggesting that, early in the Preboreal, the area immediately south of Scandinavia underwent a rapid change in both material culture and fauna, whereas in Southern Scandinavia both of these changed more slowly.

In this respect, the study of immigration into the northern parts of Southern Scandinavia is of interest, particularly the west coast of Sweden, where there are occasional finds of tanged arrowheads very similar to the Bromme type (Fredsjö, 1953). Scattered finds of this type of arrowhead are also documented in southwestern Norway (Bang-Andersen, 1988).

The oldest cultural phase on the Swedish west coast is known as the Hensbacka culture (Niklasson, 1965). Finds from the Hensbacka site of Tosskärr A (Cullberg, 1975) include occasional large tanged arrowheads and a number of smaller points, many of which are very similar to the Ahrensburg type; these occur with irregular but classifiable flake axes. Comparable material, believed to belong to a very early phase of the Fosna culture, has also been found at southern Norwegian sites, such as Rørmyr II (Johansen, 1964; Mikkelsen, 1975; Skar and Coulson, 1987), where the small points are known as single-edged points.

There has been vigorous debate over the significance of the flake axes. Some have claimed a high age for the Hensbacka culture—the start of the Mesolithic—on the basis of the location of the sites and the point types (Cullberg, 1974, 1975), while others have claimed, on the basis of the flake axes, that the sites are Late Mesolithic, like those with flake axes in Southern Sweden and Denmark (Welinder, 1973, 1974b).

Finds at Barmose in southern Zealand, which have only recently been accepted as Preboreal in age, suggest an explanation for this seemingly remarkable combination of artifact forms (Fischer, 1978; Johansson, 1971, 1990). Barmose I and Hasbjerg I yielded crude lanceolate microliths which are distinctive because of the removal of the bulb of percussion and the retouch which affects only the area nearest the break face; these are called the Vig type after a Preboreal bog find of a whole aurochs skeleton with three such pieces (Hatz and Winge, 1906). Occurring with Vig-type microliths were flake axes, mostly a flat trimmed variant, sometimes of considerable size. This form should date to the Late Mesolithic (Late Ertebølle culture), but the context indicates that it was Preboreal. There are also details in the method of manufacture which distinguish these Early Mesolithic axes from their Late Mesolithic counterparts (Fischer, 1978).

The Barmose finds thus shed a new light on the western Swedish and southern Norwegian finds and support their probable Preboreal age. It is possible that we see in western Sweden and southern Norway a stage in the development from Late Paleolithic to Mesolithic that has not yet been detected in southernmost Scandinavia. It may be that the western Swedish sites are coastal sites that have been preserved by the marked isostasy, whereas the ancient coastal zone in southern Scandinavia is now under water. This, however, cannot be the entire explanation, since sites from the Hensbacka culture are also found inland, beside infilled lakes. Almeö, by Hornborgarsjön Lake in the north of Southern Scandinavia, is a small settlement beside the lakeshore, with dates close to 9000 B.P. (Kindgren, 1985).

EARLY MESOLITHIC SETTLEMENT IN SOUTHWESTERN SCANDINAVIA

Vegetation in the Early Mesolithic reflects the rise in temperature, although the forest succession was slower than the changes in insect fauna (Lemdahl, 1988). Birch and pine formed thin forests in the Preboreal (Berglund, 1966, 1968; Iversen, 1973); during one phase, juniper may have been the predominant species, especially on nutrient-poor land. In the Boreal, there is an increasingly accentuated forest succession, with the broad-leaved trees (lime, elm, and oak) becoming common.

Since Southern Scandinavia was surrounded by larger land masses than today, the climate in the Early Mesolithic must have been much more continental than in later prehistoric times. There were great differences between winter and summer temperature, and the transitions between the seasons were short and with low precipitation (Frydendahl, 1988). The moderating effect now exercised by the Baltic Sea was almost nonexistent,

since the Ancylus Lake froze more easily. The mean winter temperature in Denmark is estimated to have been about 1.5°C lower than today. The prevailing winds were probably easterly or southerly, and the modern south-westerly winds were not common. Precipitation was about 600 mm, roughly half the modern figure. Lakes were frozen from December to April, and snow covered the land for most of the winter. Mean summer temperature was about 0.5°C higher than today, and precipitation was slightly lower. In some years, northwesterly winds may have brought unusually cold, wet summers. There was less cloud formation and less temperature variation throughout the year.

The Bog Sites

From the early Preboreal onward, we find a form of settlement that is typical of the Early Mesolithic: a small camp, consisting of a hut structure, on layers of gyttja and peat (former marshland) on the edge of an infilling lake (such as sites in the Danish bogs of Sværdborgs Mose and Holmegaards Mose and the southern Swedish bogs of Ageröds Mosse and Bare Mosse). The area is often reinforced with small tree trunks, branches, and bark to permit occupation on an unstable surface. In some cases, such as Ulkestrup, structural details such as wall posts or the reinforced bark floor are preserved, showing that the huts were not very sturdy. Most of them are rectangular, but some are trapezoidal (Andersen *et al.*, 1982; Blankholm, 1981, 1987; Grøn, 1983, 1988; Sørensen, 1987). Their size varies between 2.5 × 2.5 and 4 × 6 m (Sørensen, 1987, Fig. 5). The roof and walls were probably made of bark or reeds. Since they are found with layers of organic material above and beneath, preservation of bone and antler, and occasionally other organic material such as wood, is good.

The distributions of artifacts and hearths (mostly concentrations of charcoal or fire-damaged flint debitage) allow a detailed study of the functions of the huts and the activities that went on in them. In several huts, it is possible to discern two concentrations of microliths, perhaps indicating that they were used by two households (Grøn, 1983). Others estimate the number of inhabitants as corresponding to only one household, from a nuclear family to an extended family (Blankholm, 1987). Huts of the same plan were generally used throughout Southern Scandinavia.

Alternatively, the bog sites have been interpreted as summer base camps, with three or four huts, about 40 m apart, functioning in collaboration; the winter sites, on firm ground, were camps for no more than a couple of families (Grøn, 1988). Most of the bog sites, however, are viewed as temporary, seasonal camps. This interpretation is supported by the traces of extensive

collecting, in the form of hazelnut shells, in the refuse layers beyond the hut floors (Bokelmann, 1980; Larsson, 1983a).

The sites are interpeted as being used during the summer, and only a few sites—Flaadet, Holmegaard IV, and the well-known site of Star Carr in northwestern England—have been seen as winter sites (Becker, 1945; Clark, 1954, 1972; Grøn, 1988). However, new analyses of faunal remains have shown that both Holmegaard IV and Star Carr were used in summer (Legge and Rowley-Conwy 1988; P. Rowley-Conwy, personal communication).

Since there is great variation in the quantity of material, there has been debate about how long these sites were used and whether a hut site was visited repeatedly (Bokelmann, 1981). For example, Duvensee 13 consisted of a bark floor, < 1.5 m in diameter, with a few flint chips and hazelnut shells (Bokelmann, 1986). At Lavringe Mose, in central Zealand, there were only about 200 artifacts altogether (Sørensen, 1987), including microliths of different ages which show that the site was used on at least two occasions separated in time by at least half a millennium. The smallest sites, such as Duvensee 13, are probably the remains of a stay of 1 or 2 days, while others may have been used for a month or two.

In many cases, we lack clear structural details of the hut, so the distribution of finds is used to estimate the number and size of the huts (Bille Henriksen, 1976, 1980; Brinch Petersen, 1972; Welinder, 1971b). It is often not possible to determine whether several adjacent huts were used at the same time as part of a large social organization or they are simply the result of repeated occupation.

Since most lakes were infilled in the Early Mesolithic, there are fewer bog sites from the Late Mesolithic. The later sites are like the earlier ones in the form of the huts and the distribution of finds, but they appear to have been slightly larger (Andersen, 1983) with lengths of 5–7 m.

The bog sites noted above are all in what were then inland areas. Small hut sites also occur on sandy soil, where the hut floor is marked by a slight depression with a sooty cultural layer, such as at Tobisborg in southeastern Scania (Strömberg, 1986). This site is a few hundred meters from the modern coast. Since the seabed slopes steeply, the settlement cannot have been more than a kilometer from the Mesolithic coast. A similar site, Melsted, has been documented on the island of Bornholm (Becker, 1953).

Obviously, the now submerged Early Mesolithic coastal zone is virtually unknown to archaeologists. In the eastern part of the narrow inlet which Öresund formed at that time, a section of the seabed has been surveyed by divers and by sampling from a boat (Larsson, 1983c). This yielded evidence of at least three sites at depths between -6 and -20 m, close to a prehistoric river estuary. This was a typical site location in the Late Atlantic, showing that the coastal settlement followed similar principles in both the Early and

the Late Mesolithic. With further study of the seabed between the Danish islands (Fischer, 1989), it should soon be possible to conduct proper excavations of Early Mesolithic coastal sites with well-preserved occupation layers.

We must remember that as much as two-thirds of the former land area was submerged in the Early Mesolithic—a process which must have influenced the structure of coastal settlement. During the Late Mesolithic, changes in the sea level were much smaller.

LATE MESOLITHIC SETTLEMENT

Southwestern Scandinavia: The Kitchen Middens

The Atlantic forest is often described as dense and not susceptible to forest fires. There were areas with thinner forest, however, such as in the northern parts of Southern Scandinavia and in Jutland. Beavers may also have been an important factor in shaping the landscape, as their dams caused the forest to be inundated.

Because of the transgressions, the earliest coastal sites excavated are dated to about 7500 B.P. They belong to the Kongemose culture and contain most elements typical of the Late Mesolithic sites, such as structures of different kinds.

The Late Mesolithic kitchen middens of Southern Scandinavia are famous. They occur in eastern Jutland, northern Funen and Zealand, and, occasionally, on the western coast of Sweden, primarily because the sea surrounding these areas has such a high salt content that mollusks are able to grow to a size attractive to humans. In contrast, the low salt content of the Baltic Sea hampered mollusk growth and no kitchen middens are known along its shores.

The eponymous site of Ertebølle in Limfjorden, northern Jutland, is particularly significant for our view of the Late Mesolithic. A recent reinvestigation and detailed analyses have given us a wider and somewhat different picture of the site (Andersen *et al.*, 1986). The excavation of the area above the midden revealed only limited occupation, suggesting that activities in this part of the site were restricted. A minor accumulation of shells began around 6000 B.P., while the accumulation of the shell midden proper began around 5800 B.P. and continued until 5200 B.P. Several layers can be distinguished, representing accumulations with a thickness of up to 0.5 m and an area of 2–7 m, with layers of ash and hearths; the latter are the only documented structures. Despite the chronological difference, it appears that the same activity area fulfilled a similar function for much of the time the site was used. This is interpreted as indicating a stable settlement system (Andersen *et al.*,

1986, p. 59). The lack of structures suggests that the inhabitants lived elsewhere but engaged in most of their activities on the shell midden. The house may have been beside the midden and later covered as it grew. Despite the marine orientation of the site indicated by the mollusks, some 71% of all the fish bones come from small species of fish from nearby freshwater basins (Bødker Enghoff, 1986)! This shows once again that the Late Mesolithic economy may have been much more complex than site location would suggest.

We also have new evidence from other western Danish sites. Ringkloster is a good example of an inland settlement, located by a large lake in eastern Jutland about 15 km from the coast (Andersen, 1975b); it was used during most of Ertebølle culture. The limited variety of tools and the composition of the fauna show that activities at the site were carried on mostly during the winter. Marten and wild boar were important prey. Finds of whale bone and oyster shell—the latter used as scrapers—show that there was some relation to the coast.

Eastern Denmark and Southern Sweden

In eastern Denmark and southernmost Sweden shell middens are small or absent. However, we know of large sites, interpreted as base camps, situated close to estuaries or former lagoons, such as Vedbæk on the Danish side of Öresund and Skateholm on the southern coast of Scania (Brinch Petersen *et al.*, 1979; Larsson, 1982c, 1984b, 1988c). Here, it is possible to trace the occupation of different sites on capes or islands, as the transgressions forced the inhabitants to move to new camps at higher levels. Tens of Mesolithic sites have been found within a single lagoon.

In the later Mesolithic, there is still occasional evidence for hut sites in the infilling belt around the lakes (Andersen, 1983; Larsson, 1983a; Welinder, 1978); their rarity may be because the infilling process in most lakes had ceased by this time. In southern Sweden, on the other hand, there are many sites on headlands and by still-open lakes throughout the Mesolithic (Larsson, 1990b). These correspond to the "Gudenaa culture" sites in Jutland, which are the remains of long-term riverside and lakeside settlements—areas which did not change much and which therefore continued to be attractive. At Karseforsen, on the western coast of Sweden, there is evidence for use throughout the Stone Age of a waterfall that was known recently to be an excellent place for catching salmon (Arbman, 1954).

The good conditions for preservation at many sites have given us a relatively full picture of the organization of a Late Mesolithic coastal settlement. Waste material was deposited along the shore, and it was here, too,

that the large dugout canoes (up to 10 m long) were kept (Andersen, 1987a; Rieck and Crumlin-Petersen, 1988). Stationary fishing equipment—fish traps with arms several tens of meters long—were built near the settlement. Pits, houses, and hearths are found on the beach, and the graves were located above these.

The evidence for cemeteries at Late Mesolithic sites (see below) has also stimulated an intensive study of the internal organization of the sites (Andersen, 1988a; Brinch Petersen, 1989; Juel Jensen *et al.*, 1985; Larsson, 1982c, 1984b). As we have seen, studies of this kind previously concentrated on the Mesolithic bog sites. Archaeologists have identified several different forms of structure, such as hearths, house types, structures for ritual purposes, and assemblages of material for special activities (Andersen, 1989; Juel Jensen *et al.*, 1985; Larsson, 1985a, 1988b).

Although many structures have been documented at settlement sites, there are surprisingly few houses. Only two structures from sites in Scania have been interpreted as Late Mesolithic house foundations (Larsson, 1975a, 1985a); they are oval depressions in sloping beaches, measuring 4 × 5 and 6 × 11 m, and are similar to new finds of Mesolithic pit-houses in northern Sweden (Loeffler and Westfal, 1985). Other less distinct structures may be remains of houses (Andersen, 1975a; Larsson, 1985a). Apart from the hearths and hearth pits, the function of most structures at Late Mesolithic sites is uncertain.

Western Sweden

Unlike southwestern Scandinavia, most of the settlements that have been discovered in western Sweden appear to be on the coast. In this area, there has been constant uplift, but the rising sea levels of some periods submerged what was previously land. In the Gothenburg region, where the Preboreal sea-level was over 20 m above the present level, the Boreal sea level was at about 16 m, but in the Late Boreal and Early Atlantic, it rose again to a maximum of about 22 m (Påsse, 1983, 1988), which means that the Early Mesolithic settlements are covered by transgressional material. Despite this, rescue excavations have uncovered a significant number of sites under deposits of gravel and sand.

The material culture during the Preboreal and Boreal has been named after one of the first sites to be excavated, Sandarna (Alin *et al.*, 1934; Cullberg, 1972; Fredsjö, 1953; Welinder, 1973a). The Sandarna culture is represented by microliths and core axes (Fig. 10). The former are predominantly lanceolate types, including a characteristic type in which the retouch forms a barb. This type also occurs sporadically in southwestern Scandinavia (Aaris-Sørensen and Brinch Petersen, 1986; Boas, 1986).

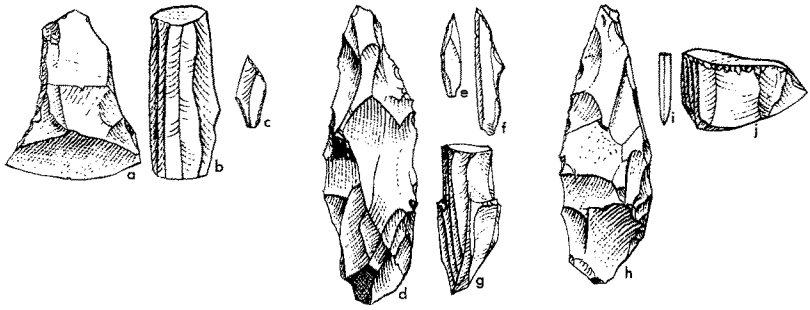

Fig. 10. Mesolithic artifacts from the western coast of Sweden of the Hensbacka (a–c), Sandarna (d–g) and Lihult (h–j) cultures. a, flake axe; b, blade core; c, single-edged point; d, core axe; e and f, microliths; g, blade core; h, core axe; i, microblade; j, handle core (from Andersen *et al.*, 1988).

We still lack the basis for a chronological division of Sandarna culture sites, comparable to what we have for the Maglemose culture. Generally speaking, the larger microlith forms occur in an early phase and the narrower ones in a later phase. Conical microblade cores are also found in a late phase.

Some of the buried sites have quite well-preserved faunal remains. These clearly show the marine economy of the settlements, with seals and saltwater fish combined with terrestrial species (Lepiksaar, 1983).

The Late Mesolithic stage is represented on the western coast by the Lihult culture. Its artifacts include both flint and ground stone axes (Welinder, 1973a); the Lihult axe is cut to shape and ground, with one arched and one rounded broadside. Handle cores are also characteristic, but there are no microliths. Considerable numbers of Lihult culture sites are documented, since they are located on the highest transgressional ridges and are therefore easy to identify by field survey.

The transition from the Late Sandarna culture to the Lihult culture has been the subject of vigorous discussion based on the first appearance of handle cores (Cullberg, 1972, 1974; Welinder, 1974b). There are no convincing finds of such cores from any of the buried sites, so they can scarcely have appeared before 7200 B.P. (Larsson, 1978; Wigforss, 1983). On the other hand, it is uncertain how long the microblade technique was maintained. An important site in this respect is Rotekärrslid, the only excavated shell midden in southern Sweden (Alin, 1935). A relatively thin layer of shells, covering a few tens of square meters, contained not only stone artifacts but also large numbers of bone artifacts such as slotted bone points and hooks. Core axes, a few flake axes, and round pecked axes were also present, but there were no definite arrowhead forms. The C-14 dates fall between 5800 and 5700 B.P. (Welinder, 1973a). In contrast, we have very limited knowledge of the very latest phase of the Late Mesolithic and the transition from the Mesolithic to the Neolithic.

Eastern Sweden

Much less is known about the Mesolithic in central and eastern southern Sweden than in southwestern Scandinavia. The settlement of eastern central Sweden was studied in the 1970s (Welinder, 1973a, 1974a, 1977). The few occupation sites excavated had few artifacts and lacked internal stratigraphy, although there were many hearth pits and fire-cracked stones. The stone artifacts were on flint imported from the south, but much quartz, quartzite, and diabase were also used; the most common tool was the pecked stone axe.

Two main groups were distinguishable. The flint group is dated between 7000 and 6000 B.P. but could be older. The presence of Lihult axes suggests contact with Late Mesolithic communities in western Sweden. Most of the flint artifacts are microblades. The quartz group utilizes local raw material and, thus, shows greater similarities to the northern Swedish Mesolithic (Broadbent, 1979; Welinder, 1974a). The quartz group is dated between 7000 and 4500 B.P., which indicates that imported flint was of less importance toward the end of the Late Mesolithic, with a probable regional development of material culture. Both coastal and inland sites have been documented. However, we still lack remains of Early Mesolithic settlement. There are indications of Early Mesolithic sites in the central region, just north of the Southern Swedish highland (Browall, 1981).

The Mesolithic of the eastern coast of southern Sweden is also characterized by pecked stone axes. The site of Tingby provides interesting data to our view of coastal settlement in eastern Sweden (Rajala and Westergren, 1990). Two house-like structures were discovered by a prehistoric lagoon. One of them measured 4 × 9 m, with distinct staining caused by walls and a row of roof-bearing posts; the artifacts included lanceolate and triangular microliths made on imported flint; local porphyry was also used. The site is dated to a late phase of the Boreal or the Early Atlantic. The lack of pecked stone axes at Tingby indicates that most of the sites in this region which have many pecked axes belong to the Late Mesolithic.

There are several Mesolithic sites on the island of Gotland (Österholm, 1989). Radiocarbon dating has shown that some settlements with a noticeable lack of classifiable tools belong to a Mesolithic dating from the seventh century B.C. and later. Unfortunately, there has been little research here and some of the Mesolithic remains are accidental finds from excavations of later remains. Organic matter, which is well preserved in the lime-rich soil, shows a clear marine orientation. Some of the bone tools have their closest parallels in the Baltic region. It thus appears that Gotland, at this time as later in prehistory, had established contacts not only with the Swedish mainland but also with the Baltic area. Gotland also has Mesolithic graves. Three Early Mesolithic graves have been found at Kams (Arwidsson, 1949),

and a male grave from Stora Bjärs contained flakes, fragments of a slotted point, and severed antler tines (Arwidsson, 1979).

Remains of a Mesolithic site have also been found on the island of Öland. Alby, on the eastern coast of the island, has both Mesolithic and Neolithic settlement (Königsson *et al.*, 1971). The undoubted Mesolithic features include several examples of slotted bone points and the occurrence of microblades. The rich fauna from the site clearly indicates a marine economy, with gray seal predominating. We suspect, however, that Mesolithic settlement in Öland may have been connected with that on the mainland, since the island was smaller then than it is today—1340 km^2—and may have been too small to support permanent settlement.

Several Mesolithic sites are known from the central part of southern Sweden—the Southern Swedish highland (Cullberg, 1981; Kjellmark, 1944; Taffinder, 1983). Most of them are close to lakes or rivers. So far, there has been limited study of the Mesolithic in this region.

MESOLITHIC CEMETERIES

Recent studies of mortuary practices are of great importance to our view of the Mesolithic. Occasional graves near Late Mesolithic settlements have been known for some time (Brinch Petersen and Vang Petersen, 1978; Hansen, 1941; Lund Hansen *et al.*, 1972; Mathiassen, 1946a; Norling-Christensen and Bröste, 1945; Westerby, 1927), but the existence of cemeteries in this period was not confirmed until 1975, when the excavation of Bøgebakken on the eastern coast of Zealand revealed 22 individuals in 17 graves (Albrethsen and Brinch Petersen, 1977). That this was not unique was shown by the excavation of Skateholm (Fig. 11) in southeastern Scania, initiated in 1980, where three adjacent cemeteries were documented (Larsson, 1981b, 1984a, b, 1988c, 1989a). Other cemeteries have been found since (Brinch Petersen, 1988b, 1989a).

The reason that cemeteries were not identified earlier shows the importance of contextual factors. Most Late Mesolithic settlements are on small hills sloping down toward a prehistoric water basin. Since organic matter was best preserved on and near the prehistoric shoreline, excavations were undertaken here, rather than on the upper part of the slopes, where most settlements were, but where erosion has destroyed the cultural layers and organic materials. It was only with the start of rescue excavations by topsoil removal from a large area at Bøgebakken that the importance of investigating the higher slopes became apparent.

It now appears that the combination of cemeteries and large settlements is, in fact, a common phenomenon in the Ertebølle culture. The earlier finds

of one or a few graves (Mathiassen, 1946a; Norling-Christensen *et al.*, 1945; Westerby, 1927) may therefore be remains of larger cemeteries. Sites with graves are also known below modern sea level (Andersen, 1987b; Fischer, 1987). As well as cemeteries, single graves are known to exist within settlements (Brinch Petersen, 1988b; Brinch Petersen *et al.*, 1979; Juel Jensen *et al.*, 1985).

Although isolated graves have been known for some time at settlements in Jutland (Andersen, 1975a; Hougaard Rasmussen, 1990), it is only recently that a cemetery with several graves has been identified at Nederst in eastern Jutland (Brinch Petersen, 1988b, 1989a).

In the Kongemose culture, we find single graves and also indications that small numbers of graves could be placed together (Larsson, 1983c; Norling-Christensen *et al.*, 1945). This can be traced back to the Late Maglemose culture or its equivalents. At Kams, on the Baltic island of Gotland, three graves were found during gravel-quarrying (Arwidsson, 1949; Larsson, 1982b); a C-14 date for a buried woman gave a value of 8050 B.P. $\pm$ 75 years (Lu-1983). Near Holmegaard bog in southern Zealand, at least two skeletons without grave goods were found close to the Late Maglemosian settlement of Holmegaard V; C-14 dates show that they are the same age as the settlement (Tauber, 1986; K. Ebbesen, personal communication).

Human skeletons of Boreal age come from bogs, not graves (Bröste and Fischer Møller, 1943; Nilsson *et al.*, 1979). The only Mesolithic grave on the Swedish western coast is at Uleberg, dated to 6890 B.P. $\pm$ 100 years (St-2440) (Niklasson, 1933; Wigforss, 1968).

There is considerable variation in mortuary practices, not least the placing of the dead. In Denmark, they were almost all extended and supine. In cemeteries at Skateholm in Scania, this is combined with crouched and sitting positions (Fig. 11); the latter is attested in both the west and the east of southern Sweden (Larsson, 1989b). A smaller number of finds show that cremation was also practiced in the Mesolithic (Larsson, 1984b; Mathiassen, 1946a).

Most graves contain only one individual, but there are some graves for two or three persons. A grave was recently found at Strøby Egede in eastern Zealand with eight bodies, both children and adults, four males and four females (Brinch Petersen, 1988a). The men were laid in one part of the grave; the women in another part, with their feet toward the men.

The composition of the grave goods follows a more distinct pattern than do the body positions. Tools, such as knives and axes, are typically found with men, while women have ornaments like belt decorations made of animal teeth. Tooth beads are also occasionally found in male graves. In addition, various combinations of animal bones were sewn onto the clothes, and red ocher is common. At Skateholm, it was shown in several cases that objects

Fig. 11. Grave from the cemetery of Skateholm II, southernmost Sweden, with two men, one sitting and one supine.

were deposited in the grave when it was being filled in. Buried dogs occur, sometimes with grave goods (Larsson, 1989a, b), and human burials have been found with sacrificed dogs.

Other Finds of a Religious Character

Parts of human skeletons are often found at Mesolithic settlements (Larsson *et al.*, 1981; Meiklejohn and Denston, 1987; Newell *et al.*, 1979). At some sites, it is clear that areas that were originally used for burials were later used for settlement and the skeletal remains presumably come from disturbed graves (Larsson, 1984b). Elsewhere, this was not the case; instead, parts of human bodies were kept deliberately. The removal of parts of the body both before and after burial has also been confirmed by finds of graves where extremities are missing (Larsson, 1984b). At the Late Mesolithic site of Dyrholmen, Jylland, there are traces of cut marks and fractures of bones to reach the marrow, suggesting cannibalism (Degerbøl, 1942). Cut marks on crania from the same site suggest scalping, although the marks could result from postmorten use of crania as containers, as occured at a Late Mesolithic site in Scania (Rydbeck, 1931). Deliberate dismemberment of skeletons has been demonstrated in graves at Skateholm (Larsson, 1984b).

Other evidence of religious concepts is given by the deliberate deposition of objects. Since there are many settlements in bogs, it can be difficult to determine whether a collection of objects relates to activities connected with the settlement, or was lost during hunting or gathering, or represents a cache

or votive deposit. Examples are the finds of arrows from Preboreal and Boreal times (Andersen, 1979a; Malmer, 1968; Nilsson, 1968; Petersen, 1951; Troels-Smith, 1962). In a bog at Loshult in northern Scania, two arrow shafts were found together (Petersen, 1951); one of them is the only known example of microliths fixed to an arrow shaft. Assemblages of finished or unfinished objects found near settlements look like caches (Larsson, 1978a, 1983a; Welinder, 1977). On the other hand, there are some cases where the objects were deliberately destroyed before deposition (Gramsch, 1987b; Larsson, 1978a), and these can scarcely be anything but votive deposits. Later, during the Neolithic, finds interpreted as votive deposits are very common (Rech, 1979), showing continuity from the Mesolithic tradition.

Another probable expression of religious practice, from the Late Maglemosian, is an oblong, almost phalluslike, flint nodule, which was incised on its cortex and then reduced to flakes and chips, which were left at the site (Fischer, 1974). Other finds also indicate that flint nodules which were incised were deliberately split with no intention of making tools (Althin, 1950; Larsson, 1975b, 1978a).

Under this heading, we may also include structures found directly beside graves, containing grave goods but no burial; some have been interpreted as cenotaphs (Albrethsen and Brinch Petersen, 1977; Larrson, 1984b). At the Scanian site of Skateholm II, there was a remarkable structure in the form of a rectangular area demarcated by a belt of red ocher and containing deposits of different parts of animals; on the basis of the find and its location within a cemetery, it has been interpreted as having a ceremonial function (Larsson, 1988b).

MESOLITHIC ART

There are many decorated objects from the Late Mesolithic in Southern Scandinavia, and comprehensive studies have revealed several patterns among them (Andersen, 1981; Clark, 1936, 1975). Many of the decorated bone and antler objects are stray bog finds, but decorated tools are also frequently found in settlements and graves.

The division into deep and shallow incised patterns was formerly seen as chronologically determined (Vebæk, 1938), but this has now been proved incorrect (Andersen, 1981; Liversage, 1966). However, the choice of types of object to be decorated does appear to be connected to period (Brinch Petersen, 1973, p. 101). In the Maglemose culture, it was chiefly bone objects and pointed antler tools that were decorated, while decorated antler axes and long antler shafts, for example, appear in the Kongemose and Ertebølle cultures. A few artifact types, such as slotted bone daggers, are almost always decorated.

Regional variation can also be seen in decoration. Some patterns have limited geographical distributions (Andersen, 1981, Fig. 8), as does the positioning of decoration on objects like harpoons (Larsson, 1987b).

The surface of the object was often ground smooth before the decoration was incised. Some objects have compositions of patterns designed to cover the entire decorated surface, while other have different phases of decoration, most clearly seen in the overlapping of patterns. Traces of resin show that this material was rubbed into the scratches to give a contrast between the dark resin and the light surface of the bone or antler.

Although most decorated objects are bone or antler, we also find other materials, such as sandstone or limestone (Althin, 1950; Andersen, 1981). Amber was used for the creation of the only plastic art, in the form of animal figurines (Mathiassen, 1960), but amber pendants with carved patterns are much more common (Andersen, 1981; Mathiassen, 1960).

An underwater site of Tybrind Vig in Funen has yielded decorated wooden artifacts (Andersen, 1987a, b). These are paddles with carved ornamentation filled with brown coloring (Fig. 12). The visual impression of this decoration is very different from that of other objects and shows clearly how the execution of the decoration varied according to material. The paddles may have required decoration that was easy to see from a distance (Andersen, 1987b), perhaps to make it possible to identify the group to which the owner belonged when he passed the coast or to identify other groups' boats when they were brought ashore.

Another form of decoration can be seen in graves where red ocher was rubbed into the body or clothing before burial (Larsson, 1984b); this was done to only certain parts of the body. In the Late Maglemose and Kongemose culture, there are also scratchings in the limestone cortex of flint nodules, apparently to extract white color (Althin, 1950; Fischer, 1974; Larsson, 1975b, 1978a, 1982c).

Art also includes carvings or paintings on rocks. Some of the animal motifs in southern Norway are considered to be Late Mesolithic (Mikkelsen, 1977), and some rock paintings from western Sweden may be the same age (Cullberg *et al.*, 1975).

REGIONALITY AND ETHNICITY

In recent years, regionality and ethnicity have attracted increasing attention, but our knowledge of these aspects of the Early Mesolithic is practically nonexistent. The sparse settlement would not have encouraged the formation of groups with clear distinguishing features. However, certain differences in artifact composition can be observed. One example is the

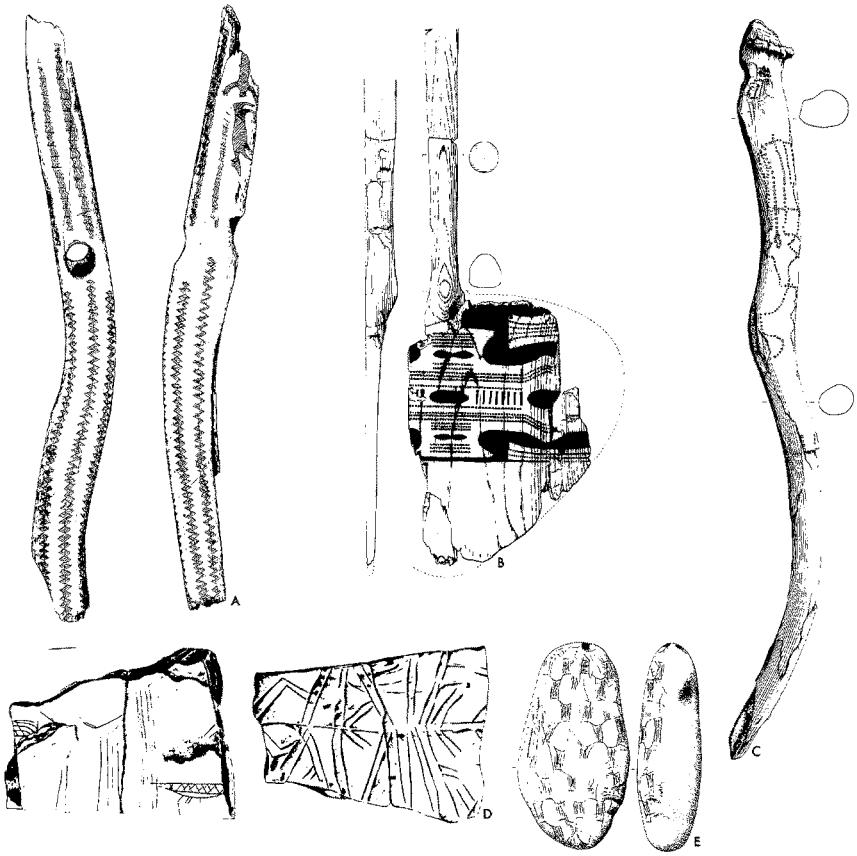

Fig. 12. Art from the Mesolithic of Southern Scandinavia. A, antler artifact with shaft hole (after Brinch Petersen, 1982); B, wooden paddle (after Andersen, 1987); C, antler haft (after Andersen, 1981); D, sandstone slab (Larsson, 1978); E, amber pendent (after Andersen, 1981). Scale: A–D, 1 : 10; E, 1 : 5.

fine-toothed bone points which disappear from use in Denmark in the Boreal but which continued to be used in Sweden as late as the Atlantic (Larsson, 1987b, 1982c). Mullerup points—coarse-toothed leisters made of ribs—are a common tool in eastern Denmark (Bille Henriksen, 1976; Sarauw, 1903) but are completely absent from Sweden. The handle core, from which microblades were struck, is characteristic of the Late Maglemose culture in southern Sweden (Knutsson, 1970; Larsson, 1978a) and eastern Denmark (Andersen, 1985), but it is very rare in Jutland. Slotted bone points and daggers with an edge consisting of microblades, which are found in the Late Boreal and Early Atlantic periods, are common in the very south of Sweden and in Denmark (Larsson, 1978b; Larsson and

Larsson, 1976; Lidén, 1942; Voss, 1961) but are rare in Jutland (Andersen, 1970b).

Different traditions and channels of contact thus began to crystallize as far back as the Maglemose culture. We cannot discern any clear differences in Kongemose material culture, perhaps because of the lower intensity of research. Nevertheless, it appears that some artifacts of this culture, such as oblique arrowheads, are less common in western than eastern Denmark (Andersen, 1970a). It is also hard to find evidence of this culture south of Jutland (Hartz, 1985), and typical Kongemose artifacts are rare north of Scania. The characteristic Kongemose artifact assemblage thus appears to cover a more restricted area than does the Maglemose culture.

In the Ertebølle culture, there are very clear differential distributions for different elements, suggesting that Southern Scandinavia was divided into distinct territories. The weak Late Boreal differentiation between western and eastern Denmark becomes much clearer: certain tools, such as some harpoon types, bone combs, and T-shaped antler axes (Fig. 13), and some pattern motifs (Andersen, 1981, Fig. 8) do not occur east of Funen; in contrast, other elements, such as a certain stone axe type and some harpoon types, are not found in Jutland. Southernmost Sweden differs from Denmark in mortuary practices; in Sweden, the dead were buried in a sitting position (Larsson, 1989b), a tradition going back to the Late Boreal (Larsson, 1982b). Scanian harpoon barbs have decoration not known on any of the far more numerous Danish finds (Andersen, 1972, 1976). Decoration in the form of small impressions is very common in Scanian Ertebølle pottery, but unusual in Denmark (Jennbert, 1984).

Three areas, Jutland, the eastern Danish islands, and Scania, appear to have been major areas with partly differing traditions and channels of influence. The development detectable in southern Sweden shows that there

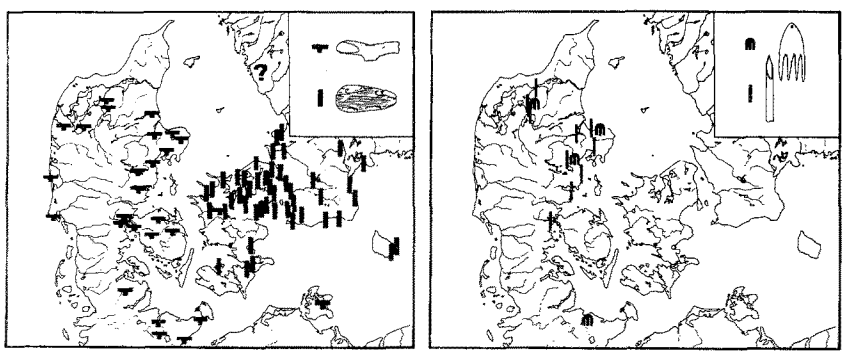

Fig. 13. Distribution of T-shaped red deer antler axes and Limhamn stone axes (left) and bone combs and bird-bone points (right) in southwestern Scandinavia (after Vang Petersen, 1984).

were at least three other comparable main areas: the western coast, the eastern coast, and the central parts of southern Sweden. However, these seem too large to have been tribal territories. In Scania, the population is estimated to have been 2000–3000 people (Welinder, 1982) and it was probably even greater in the two other main areas in southwestern Scandinavia.

The existence of ethnically determined aspects of material culture, even in areas which must have been smaller than tribal territories, has been shown by studies of flake axes, among which distinctive local forms have been identified which do not appear to depend on chronological change (Vang Petersen, 1984). This division is also confirmed by the occurrence in southern Scania of other forms of flake axes without counterparts in eastern Denmark (Juel Jensen, 1988; Larsson, 1984b). The main areas discernible in Southern Scandinavia in the Late Mesolithic can also be seen during much of the Neolithic.

HUNTING, FISHING, AND GATHERING

The study of Mesolithic fauna and its exploitation by humans is greatly facilitated not only by the food refuse preserved at many sites (Brinch Petersen, 1973, Appendix I) but also by the osteological material. Bones found in occupation layers shed light upon the great variety of species that were caught, although some of them, such as rodents and amphibians, are secondary deposits. The wealth of species documented may give a false picture of resource utilization. Throughout almost the entire Mesolithic, animals such as red deer, roe deer, and wild boar were the predominant mammals, in terms of both number and weight.

Some finds of individual animals in bogs provide valuable information for the study of cultural history (Aaris-Sørensen, 1988; Degerbøl, 1933; Liljegren, 1975). Several show traces of confrontation with humans in the form of projectile wounds (Noe-Nygaard, 1974, 1975). In some cases, we find wounds showing that the hunters failed to kill the animal, while in other cases the wounds were obviously fatal. The skeleton of a Preboreal aurochs bull found at Vig, northern Zealand, has examples of both these kinds of wound (Hatz *et al.*, 1906; Noe-Nygaard, 1973). The direction of the mark made by the entry of a point with three microliths, which inflicted the fatal wound on the bull, shows that the arrow or spear was probably part of a trap rigged by the hunters; this could be why the animal ended up in a lake and not at a settlement. Another important find is a Boreal aurochs from Prejlerup, also in northern Zealand (Aaris-Sørensen and Brinch Petersen, 1986). Careful excavation revealed 15 microliths, which probably made up seven arrows, near the skeleton; none of these had touched the bones, having stuck in the fleshy parts of the animal.

Although arrowheads, for example, underwent continuous change throughout the Mesolithic, it is hard to relate this process to changes in hunting methods. Most hunting was probably done with fixed devices, such as pits; the large number of such structures found in northern Sweden would indicate this. The oldest of them are Late Mesolithic (Forsberg, 1989).

At some settlements, we find a wealth of bird species, but there are only a few examples of each species, suggesting that fowling was of secondary importance.

The large base settlements with rich faunal collections reflect the composition of hunting in an annual cycle (Aaris-Sørensen, 1980a, 1988; Jonsson, 1988; Lepiksaar, 1982, 1983). Within this cycle, there was great variation in resource utilization, as is clear from the study of seasonal camps. One settlement, Aggersborg in Jutland, demonstrates intensive seasonal exploitation of swans (Møhl, 1979). Another inland Jutish settlement, Ringkloster, shows that winter hunting was geared toward wild piglets and martens (Andersen, 1975b).

There is evidence that some species declined in numbers or vanished completely in the Late Boreal and Early Atlantic, especially in the islands of eastern Denmark (Aaris-Sørensen, 1980b, 1988); examples include aurochs, elk, and bear. This appears to be due to a combination of hunting and changes in the environment, which made it unsuitable for some species. Artifacts made from the bones of these species found in Zealand and southernmost Sweden have been interpreted as evidence of exchange (Larsson, 1988b; Vang Petersen 1984, 1990).

Sites with good preservation that are carefully excavated yield large quantities of fish bones. The role of fish in the human diet may have been larger and more stable than that of mammals. We know more about fishing methods than we do about hunting. Nets were used throughout the period from the Preboreal to the Late Mesolithic (Gramsch, 1987a). They may also have been used to catch seals and birds. In contrast, the other form of trapping device—a structure with arms and a wicker cage in the middle—does not appear until the Atlantic, when it seems to have been frequently used; there are several examples from refuse layers and isolated finds (Andersen, 1988; Brinch Petersen *et al.*, 1979; Kapel, 1969; Larsson, 1983a; Peterssen and Olausson, 1952). Bones from small species of fish or small examples of large species show that they were caught in fine-meshed nets or traps. There is also evidence of fishing with hooks throughout the Mesolithic (Andersen, 1987b; Larsson, 1978a). The hooks vary greatly in size depending on the size of the intended prey. Species such as ling, found on the western coast of Sweden, show that deep-sea fishing was also practiced (Lepiksaar, 1983).

Danish bogs have yielded assemblages of leister points from the Boreal period, indicating special fishing grounds where leister fishing was practiced.

In one case, the point and base of the same leister have been found, the former at a fishing ground and the latter at a nearby bog site (Andersen, 1983). There are no such finds of bone points from the Atlantic; however, because of good preservation, we know that leisters continued to be used, but with prongs of wood instead of bone (Andersen, 1987b; Larsson, 1983a; Skaarup, 1983). Clearly distinguishable long and short groups of leister prongs have been interpreted as being intended for a soft and hard ground, respectively.

High C-13 values are common for human skeletal remains from the Late Mesolithic coastal sites in eastern Denmark (Tauber, 1982, 1986), and they can be correlated with the consumption of marine fish species. In contrast, there are lower C-13 values in human bones from sites with a predominance of species from brackish and fresh water (Price, 1989b, Fig. 3). The few human remains from Early Mesolithic inland sites have low C-13 values, showing a diet with a predominance of terrestrial products, and thus indicating year-round residence inland (Tauber, 1986).

Information on diet can also be obtained from analyses of trace elements. The strontium content varies among several analyzed individuals from the two cemeteries at Skateholm in Scania, where differences have also been documented between men and women (Price, 1989a, b).

Human skeletal remains also add to our knowledge of the physiognomy, pathology (Bennike, 1985), and diet of Mesolithic groups. Detailed studies of teeth can provide information about general health, dental hygiene, and the use of the teeth as tools, with a clear difference between the sexes in the last respect (Alexandersen, 1978, 1988).

Obviously, it is hard to assess the importance of plant-foods. In the Preboreal, we have the first evidence of hazel, which then spread rapidly. The rapidity of this spread has been attributed by some scholars to human influence (Iversen, 1973). For the remainder of the Mesolithic, hazelnuts were an important and sought-after addition to the diet; bog sites have thick layers of hazelnut shells. To make it easier to crack the shells and to roast the nuts so they would keep longer, they were heated on a layer of sand strewn on hot coals (Bokelmann, 1980; Larsson, 1983a). This also made it possible to collect the nuts before they were fully ripe, thus avoiding competition from animals like squirrels and bank voles.

Collections of water chestnut (*Trapa natans*) have been found throughout Southern Scandinavia, even in lake systems in central southern Sweden, where it would have been difficult for the plant to spread naturally. It has been suggested that this utility plant was also subject to human influence (Sundelin, 1920). Other nuts, berries, and seeds for which we have evidence include water-lily seeds and wild raspberry (Price, 1989b). Acorns, which were an important element of the diet in many other parts of the world

(Clarke, 1976), appear to have only marginal significance in Southern Scandinavia, judging by their scarcity at settlement sites. Unlike hazelnuts, which can be eaten directly, acorns must be leached of their tannic acid before they are edible. In addition, the wild boar, which was rather dangerous as well as good eating, was a competitor for acorns.

Charred food remains have been analyzed from both the interior and the exterior of earthenware vessels from the Late Ertebølle culture. The remains from Loddesborg in western Scania have been interpreted as fermented porridge with ingredients including hazelnuts and probably blood (Arrhenius and Lidén, 1989). Remains of earthenware vessels from sites in Jutland contain fish and terrestrial plants (Andersen and Malmros, 1984).

Despite the investigation of numbers of Mesolithic sites with good preservation, certain categories of artifacts which we might expect on the basis of ethnographically known hunting/fishing societies are lacking. The most important example is the almost total lack of containers. Wicker baskets should have been as well preserved as, for example, fish traps. Either their absence as evidence reflects actual practice or some finds have been misinterpreted.

Only in recent years, thanks to more sophisticated excavation techniques, have fragments of objects made from plant fibers been commonly found. An example is the large find of nets and ropes at the Early Mesolithic site of Friesack in northern Germany (Gramsch, 1987a; Gramsch and Kloss, 1989). Another is the textiles made by needle-looping technique from the now submerged site of Tybrind Vig in Funen (Andersen, 1987b); the textiles are too fragmentary to permit an interpretation of their function, but they could have come from clothing or containers.

THE TRANSITION FROM MESOLITHIC TO NEOLITHIC

Debate about the transition from Mesolithic to Neolithic began in the midnineteenth century, as soon as the two periods had been distinguished. The discussion became more problem-oriented after Iversen's biological interpretation of the change, which included the elm decline and a *landnam* phase (Iversen, 1941). The problem is made more complex because scholars have different definitions of the term Mesolithic: some associate it with a particular material culture—the Ertebølle culture (Becker, 1955)—while others emphasize economic aspects, and still others see it as a purely chronological phase (Troels-Smith, 1953). In recent years, discussion has been vigorous and full of new ideas (Andersen, 1973b; Berglund, 1969, 1985a, b; Bostwich Bjerck, 1988; Clark, 1980; Fischer, 1982b; Göransson, 1987; Jennbert, 1984, 1986, 1987; Larsson, 1987a, 1988a; M. Larsson, 1985, 1987;

Madsen, 1985, 1987; Mahler, 1981; Meurer-Balke, 1983; Nielsen, 1987; Nygaard, 1987; Paludan-Müller, 1978; Pedersen, 1982; Persson, 1979; Schwabedissen, 1981; Thomas, 1988; Welinder, 1985; Zvelebil, 1986a, b; Zvelebil and Rowley-Conwy, 1984, 1986).

Most of those involved are convinced that the transition process was influenced by several different factors, although interpretations of these differ. The relatively permanent settlement structure led earlier archaeologists to attach great importance to the pressure exerted by a rise in population.

Others have emphasized the role of external influence. These are reflected in the introduction of pottery around 5700 B.P., with Ertebølle pottery showing advanced techniques with different tempers, depending on the use for which the vessel was intended (Hulthén, 1977). Some decoration, in the form of groups of impressions, is similar to pottery decoration in the Rössen group (Andersen, 1975b; Jennbert, 1984). In Southern Scandinavia, there are several finds of Danubian shaft-hole axes (Fischer, 1982b). These have not yet been found in certain stratigraphical contexts, but they probably come from the late Ertebølle culture. A few stone axes from the early part of the Ertebølle culture are very similar to continental forms of early Danubian axes (Larsson, 1988a).

Tillage and animal husbandry were introduced as a result of continental influence. In current research, however, the earlier model of extensive immigration of farming groups has been abandoned. The wild precursors of cultivated cereals are absent from Scandinavia, as are ovicaprids. The marked morphological differences between wild and domestic cattle and pigs suggest that these were also introduced already domesticated (Degerbøl and Fredskild, 1970; Lepiksaar, 1987). However, the question remains of whether or not tillage and animal husbandry were introduced during the Ertebølle culture and were of minor economic importance for an initial period. Impressions of seeds in Ertebølle pottery from western Scania show the existence of cereals (Jennbert, 1984). Pollen diagrams also reveal pollen of *Cerealea* type from the Late Atlantic (Göransson, 1986; Kolstrup 1988). In an explanatory model of the introduction of agriculture, this has been seen as a phenomenon that was combined with an extensive network for the exchange of prestige goods (Fischer, 1982b; Jennbert, 1986; Persson, 1979).

In Southern Scandinavia, we must assume that the process of change took different courses depending on the distance from the continent and on paleoecological conditions. Where it has been possible to conduct detailed studies of the transition, through excavations of settlements and shell middens in Jutland and bog sites in central Zealand (Andersen, 1989; Fischer, 1982b), it has been shown that the change was drastic and was completed in less than 100 years between 5100 and 5000 B.P. In southernmost Scandinavia, there are some results which support the earlier model of the parallel existence

of the Ertebølle culture and a Neolithic economy (Schwabedissen 1981). In the northern part of the area, there are data from excavations of settlements, which could be interpreted as traces of coexistence between Ertebølle and the Funnel Beaker culture (Bagge and Kjellmark, 1939).

In much of Southern Scandinavia, the study of this problem is made more difficult by the fact that the Atlantic transgressions attained their maximum at roughly the same time as the change. Many Late Mesolithic settlement sites were damaged or destroyed by inundation. This change in sea level is also in itself an accepted factor in the change. In Jutland's shell middens, there is a distinct change in the composition of mollusks between the Mesolithic and the Neolithic (Bailey, 1978). The rise in sea level also meant that the formerly productive lagoons and deltas were flooded or closed off by beach ridges, which contributed to a completely new situation for what had been a dense settlement. The social structure broke down and there was fundamental change in the pattern of society. In Scania, we can detect a sharp increase in the use of a zone inland from the coast (Larsson, 1987a).

FINAL REMARKS

This essay should be seen as an updating of earlier surveys (Brinch Petersen, 1973; Price, 1986) of the state of research into the Mesolithic in Southern Scandinavia. My own more critical attitudes to the underlying theoretical assumptions have been deliberately restrained; they will be presented in a future work (Larsson, 1991).

We have some hopes for the course of future research into the Mesolithic. One hope is that the Southern Scandinavian Mesolithic will not be taken as virtually synonymous with conditions in the southwestern part of the area, as is now often the case. I have presented the results of research from other areas, but these efforts need to be considerably expanded, not least those investigations of the large areas of bogs that cover much of the interior of southern Sweden. It is essential to have a wider range of finds for a more detailed examination of the relation between, for example, southern and northern Scandinavian influences (Nygaard, 1987).

The ancient monuments commission in Denmark has established a department to register and investigate underwater remains. This department has already produced important results concerning Mesolithic coastal settlement (Fischer, 1987, 1988, 1989). Since much Early Mesolithic land is now under water, we may expect further important results from this research field, such as a broader knowledge of Boreal coastal settlement.

Most of the research in the last two decades has been directed to the Late Mesolithic. Although this work has been very fruitful, it is to be hoped there

will be a greater interest in the Early Mesolithic. In particular, the processing of excavated material could shed new light on this phase.

It is clear that the theoretical foundation associated with the New Archaeology, with its ecological basis, encouraged research into the Mesolithic. It was possible to combine new theoretical angles very productively with well-developed field methods and a traditionally based knowledge of the material. In recent years, however, other theoretical approaches have become current in the research world. It is therefore time for a more thoroughgoing critical evaluation of such concepts as man's view of his physical environment, with terms such as site catchment and carrying capacity, settlement patterns with the division into base sites and seasonal sites, and social structure, with a study of both the basic family structure and larger groupings and the place of the individual in these structures. We hope that human beings and the ideology that guides their actions will have a more central role in future research.

Finally, my hope is that international collaboration can be continued and extended. This work has followed several important trends. One of these is the writing of general surveys with a healthy disregard for modern national boundaries (Kozłowski, 1980; Price, 1987; Rozoy, 1978). Another is the regular conferences on the theme of "The Mesolithic in Europe" (Kozłowski, 1973; Gramsch, 1981; Bonsall, 1989). These give us a chance to put Southern Scandinavia in a wider international perspective. Contacts with the south have previously been favored, but in future we may see relations with the north and the east becoming significant aspects of discussion.

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