

## **The Origins of the Neolithic Along the Atlantic Coast of Continental Europe: A Survey**

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*The main aim of this work is to compare the processes of transition to the Neolithic along the Atlantic coasts of continental Europe. Archaeological data on the late Mesolithic and the early Neolithic in the best known regions (central and southern Portugal, Cantabrian Spain, Atlantic France, the shores of the North Sea, and southern Scandinavia) are discussed. The transition to the Neolithic in Atlantic Europe can be viewed as a relatively late phenomenon, with several interesting particularities. Among those, we point out the fundamentally indigenous character of the processes; the existence of a long availability phase, in which hunter-gatherer groups maintained contact with neighboring agriculturalists and probably were familiar with farming and animal husbandry without applying them in a systematic way; and the later development of megalithic monumental funerary architecture. Finally, the main hypotheses so far proposed to explain the change are contrasted with the available evidence: those that argue that the change derives from economic disequilibrium, and those that opt for the development of social inequality as the fundamental cause.*

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**KEY WORDS:** Mesolithic; Neolithic; Europe; economy; social change.

### **INTRODUCTION**

The study of the transition to the Neolithic is one of the classic issues in prehistory and has inspired some of the most animated debates in the

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last few years. This should not be surprising since, together with the biological origins of the human species and the rise of hierarchical societies and of the state, it is one of the great problems in which prehistory rises above mere erudite details about the past and confronts questions fundamental to the understanding of humanity. The transition to the Neolithic may be regarded as one of the most significant events in history as a whole (including, of course, so-called pre-history). It involves a major economic shift—the replacement of hunting, fishing, and gathering with the cultivation of the fields and animal husbandry—but its relevance is much deeper. The adoption of agriculture implies deep transformations in the social relations of production. In some cases, it may have facilitated settlement in permanent villages, which usually results in the development of complex social and political relationships for the organization of communal life. Further, from the Neolithic onward, the economy was centered on one activity, agriculture, capable of producing, almost anywhere, a storable surplus, which would favor the social division of labor and the beginning of social inequalities. In addition, the new subsistence methods made it possible to overcome the limitations on population growth that exist for hunter-gatherers. In fact, the beginning of the Neolithic was followed by a population explosion which is comparable only to that of the last two centuries.

The significance of the arrival of the Neolithic is not a change in methods of making a living, but rather a profound transformation in all aspects of life, including particularly the rate of change. In the 10,000 years that have passed since the invention of agriculture, the transformation of human societies has been incomparably greater than in the preceding two million years that the genus *Homo* lived on earth. Thus, we may agree with Childe when he regarded the “Neolithic Revolution” as one of the fundamental milestones in history, comparable only to the establishment of the first urban societies and the Industrial Revolution of the 18th and 19th centuries (Childe, 1936).

Our understanding of Neolithization has changed greatly since 1865, when the Neolithic was defined for the first time (Lubbock, 1865). The evolution of theoretical approaches in archaeology and the social sciences as a whole has caused the dominant perspective among archaeologists to vary. Thus, from the fundamentally technological focus that predominated among the evolutionists of the 19th century, the emphasis shifted in the first third of the 20th century, in particular after the work of Childe, to changes in subsistence methods and, in general, to the social relations of production. This perspective has predominated for the greater part of this century and was still implicit in the hypotheses of researchers of the New Archaeology who took up this problem, such as Flannery (1968, 1969) and Binford (1968). With the development of postprocessual archaeology in

the last 20 years, changes in subsistence have ceased to be the obligatory center of the debate over the transition to the Neolithic, a process that many authors now link to changes in social organization, conceptual systems, or values (Hodder, 1990; Thomas, 1991, Whittle, 1996), or, from an more explicitly idealist perspective, in religion (Cauvin, 1994). The present work is situated in an intermediate position between the classic materialist perspective and the recent focus on social archaeology. We are convinced that the replacement of economic systems based exclusively on hunting, fishing, and gathering by others that include cultivation and, to a lesser degree, animal husbandry was a change of paramount historical relevance. However, that economic change should not be analyzed as an isolated occurrence, but should be integrated in a series of deep transformations in social organization, in the way that human communities settle in their territory, and in their ideology. All of these aspects should be kept in mind when describing a group as truly "Neolithic," not simply the mere appearance of domesticated species.

Extremely varied historical processes are included under the term Neolithization. There are substantial differences between the autonomous invention of this new type of society in the Levant or Mesoamerica and processes of acculturation that are documented in many parts of Europe. Therefore, research into the processes involved in the transition to the Neolithic faces very different scenarios, depending on area, time period, the degree of evolution of local societies before the transition to the Neolithic, and the route by which the innovations arrive.

In the specific case that occupies us here, considerable archaeological research has been carried out on the topic in the last 30 years. In part this is due to the change in our image of hunter-gatherer societies that resulted from the colloquium *Man the Hunter* (Lee and DeVore, 1968). Archaeologists realized that archaic agriculture did not necessarily bring a more comfortable and agreeable way of life. Therefore, the supposed motivation for the change to the Neolithic disappeared, and it became necessary to search for explanations for this transformation of human societies. This has contributed notably to the development of research into the European Mesolithic and, to a lesser degree, of the transition to the Neolithic. Although some aspects of the 'Man the Hunter' model have been superseded by later research that called into question the representativeness of the sample studied (see, for instance, Headland and Reid, 1989; Solway and Lee, 1990; Wilmsen and Denbow, 1990; Kent 1992) and, above all, the use (even the abuse) of the "Bushman" scheme of the nomadic hunter with a simple and egalitarian social organization as the model for all preagricultural societies, recent perspectives have deepened that shift toward the archaeological study of local hunter-gatherers. The development of the

concept of complex hunter-gatherers, who had a sedentary lifestyle, food storage and a delayed return economy, high population densities, elaborate ritual and ceremonial behavior, and a hierarchical organization (Leacock and Lee, 1982; Testart, 1982; Schrire, 1984; Price and Brown, 1985; Ingold *et al.*, 1988), had a deep impact on the study of the transition to the Neolithic in Europe, since many argued that some European Mesolithic groups might have been complex.

As a result of this, the transition to the Neolithic in Europe has become a problem of great historical and paleoanthropological relevance. Its analysis permits the observation of diverse forms of change and adaptation, as well as processes of internal transformation, and contact between groups with different levels of economic and social complexity. The transition to the Neolithic is one of the problems to which a great deal of energy, both in empirical research and in theoretical study, has been dedicated in European prehistory in the last few years.

The transition to the Neolithic in Atlantic Europe was relatively late compared with the rest of the continent. The first Neolithic societies in Europe are documented in Greece at the beginning of the seventh millennium BC (Theocharis, 1973), and spread throughout the remainder of the Balkan Peninsula around 6250 BC (Whittle, 1996; Guilaine *et al.*, 1999). After the consolidation of the rural farming populations in the Balkans, the expansion to the rest of the continent had varied rhythms and modes. Thus, during the first half of the sixth millennium BC, agricultural communities were established in three large areas that, because of their climates and soils, were particularly well suited for agriculture: the great central European plain, where farming groups coming out of the Danube valley rapidly colonized a sparsely populated area (Lüning, 1988, p. 73; Milisauskas and Kruk, 1989; Stäuble, 1995; Lenneis *et al.*, 1996); the Pontic plains, where, in contrast, local hunter-gatherers slowly adopted the new way of life (Zvelebil and Dolukhanov, 1991); and the central and western part of the Mediterranean Basin, in which small population movements (some of them probably by sea) combined with fundamentally indigenous processes among hunter-gatherers, who were probably preadapted to agriculture by centuries of tight control over natural resources (Guilaine *et al.*, 1987; Guilaine, 1994).

The advance of the Neolithic away from these favorable zones was much more difficult, and its expansion into areas like the Atlantic coast of continental Europe was much slower. We will examine the transition in five regions for which adequate archaeological information is available: central and southern Portugal, Cantabrian Spain, the French Atlantic coast, the shores of the North Sea, and southern Scandinavia (Fig. 1). Great Britain and Ireland are not included, since, apart from difficulties presented



**Fig. 1.** Principal archaeological groups and sites mentioned in the text, dated to the end of the sixth millennium BC.

by the available archaeological data (Whittle, 1990), specific issues arising from their insular character would excessively complicate this study.

The European Atlantic coast combines undeniable geographical variety and diverse cultural influences with several common traits. Among them we would highlight its geographical marginality with respect to the region of origin of the Neolithic (the Atlantic coast is at the opposite extreme from the point of entry into Europe), an environment conditioned by a temperate oceanic climate that is clearly distinct from the subarid Mediterranean climate where the Neolithic originated, a coastal environment rich in easily accessible resources, and a dense Mesolithic occupation that was largely tied to that marine environment. The analysis of the five regions focuses on the significance of the differences and similarities of the diverse processes studied.

One important factor for a study of this type is the rich tradition of research, in some cases more than a century long, in all of these countries, which has produced abundant high-quality archaeological and paleoenvironmental information. Nevertheless, we must also keep in mind that the differences between national traditions make it difficult to homogenize the information. For instance, only in Scandinavia has there been a serious debate over the causes of the transition to the Neolithic. Here, abundant archaeological documentation has been paired with a concerted effort to go beyond mere data and search for explanations. In large part, this is a result of the considerable influence of processualism on Danish and Swedish archaeology. On the other hand, the scarce attention to these questions elsewhere can be explained by the empirical and atheoretical traditions of archaeological research in most of those countries.

In the following sections, we present a synthesis of the transition to the Neolithic for each of the five regions, organizing the data similarly so as to permit comparison of the process among them. The degree to which this review depends upon original data varies by region. In Cantabrian Spain, it is based on the author's own research and direct familiarity with the materials and sites. In other regions, particularly those in the north of Europe, the information comes mainly from the literature. Nevertheless, we believe that a comparison of these regions should provide an interesting perspective, or at least a relatively new one, which has previously been attempted only in a longer version of this article published in Spanish (Arias, 1997a).

The chronological framework of this paper is based on "solar" chronology, mainly through calibrated radiocarbon dates, and occasionally through thermoluminescence or dendrochronology. All the calibrations are based on the INTCAL98 curve (Stuiver *et al.*, 1998), through the program CALIB (rev. 4.1.2, 1999) (see Stuiver and Reimer, 1993, for a general description

of the program). Following this journal's editorial policy for radiocarbon dates, dates are given as years BC rather than as years cal BC.

### THE CENTRAL AND SOUTHERN COAST OF PORTUGAL

The Portuguese shell middens (*concheiros*) are among the classic issues in the study of the European Mesolithic. Sites such as Moita do Sebastião, Cabeço da Arruda, or Cabeço da Amoreira were explored by the mid 19th century (Costa, 1865; Ribeiro, 1880; Oliveira, 1892), and have been an important focus of attention ever since.

The main Portuguese Mesolithic communities occupied areas that were very rich in marine resources, such as Muge, in the old Tagus estuary, the Sado and Mira valleys, and the Alentejo shore. They practiced fishing and shellfish gathering in a diversified economic system that seems to have permitted sedentism and high population density. Nevertheless, their subsistence was not dominated by marine resources, as were those of other contemporaneous Mesolithic societies (see below). Studies of stable isotopes ( $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$ ) in Portuguese samples indicate a mixed diet, in which marine and terrestrial components are combined in variable proportions depending on the individual (Lubell *et al.*, 1994). This is consistent with other information provided by the Portuguese shell middens. They contain a great variety of marine invertebrates, most of them from estuaries (with a predominance of cockles [*Cerastoderma edule*] in Muge and the Sado valley, and of limpets [*Patella*] and mussels [*Mytilus edulis*] on the Alentejo shore). Fish remains have also been documented, particularly in Arapouco, in the Sado, where the sample was dominated by meagre (*Argyrosomus regius*) and gilthead (*Sparus auratus*), and included large species, such as sharks, rays, and tuna. However, there are also important quantities of terrestrial mammals (wild boar, red deer, rabbit, hare, aurochs) and indications of plant-gathering (nuts, grains). It is possible that plants (Lubell *et al.*, 1994) and fish (Tavares da Silva, 1989) were being preserved, although no conclusive evidence has been found.

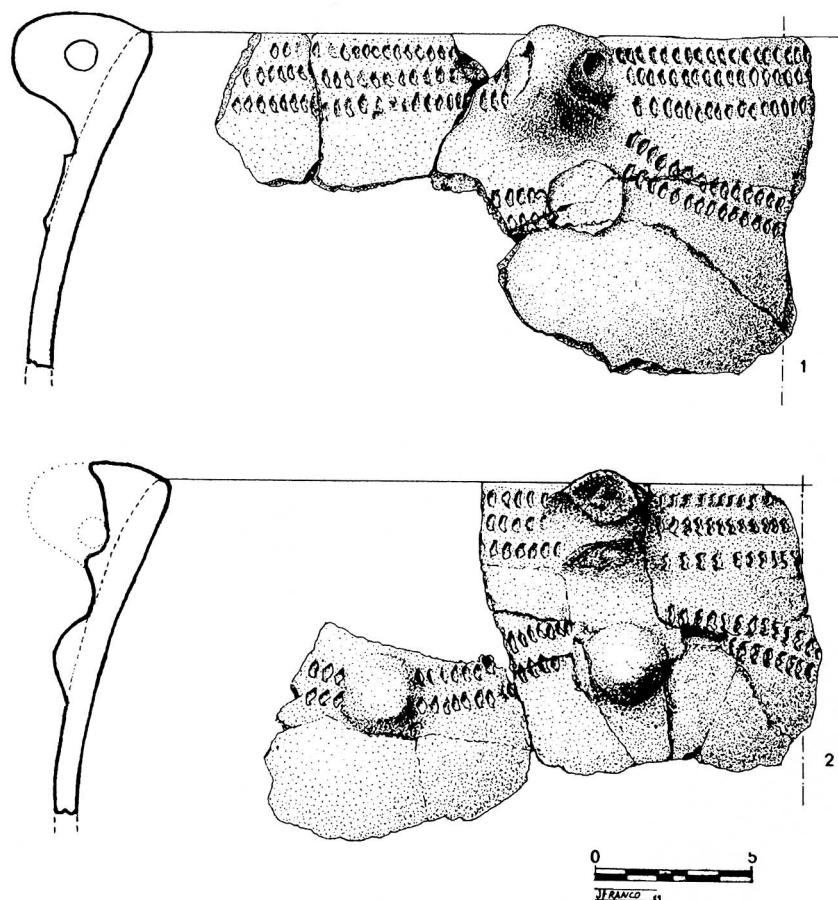
A consequence of this abundance was an apparently good general state of health and an estimated life expectancy of about 30 years. Although some indicators of stress have been detected, they seem to diminish in later contexts, such as Cabeço da Arruda (Lubell *et al.*, 1994).

One of the main issues in the study of the Portuguese Mesolithic is the presence of cemeteries with dozens of graves (at least 34 in Moita do Sebastião and 27 in Cabeço do Pez). The anthropological sample recovered includes the remains of hundreds of individuals (some 300 in the area of Muge and around 100 in the Sado valley). The Portuguese cemeteries were

located in settlement areas, as elsewhere in the European Mesolithic. Some elaborate spatial distributions of graves have been observed. Thus, in Romeiras they were placed radially, forming a semicircle facing the river (Arnaud, 1989), whereas in Moita do Sebastião the graves of children were grouped in one part of the settlement, also placed in a semicircle (Roche, 1989). The graves were individual inhumations, possibly in pits, in which the cadaver, in a supine (Muge) or a laterally flexed (Sado) position, appeared with personal adornments and ochre. The grave goods were generally modest and included utilitarian items (endscrapers, geometric microliths, pointed bones) and probable food offerings (Roche, 1972a, b; Arnaud, 1989).

There is no documentation of either significant differences in the richness of grave goods or objects which can be interpreted as luxury or prestige goods. Some of the features noted above, such as the possibility of sedentism, the existence of cemeteries, the intensification of production, possible storage, and the presence on some skeletons of evidence of violence (Lubell *et al.*, 1989), fit within the usual definitions of complex hunter-gatherers. However, the absence of differentiation in funerary treatment and the lack in the material culture of clear indicators of social standing make the relevance of the concept to the Portuguese Mesolithic dubious.

The first evidence of the Neolithic in Portugal probably dates to the middle of the sixth millennium BC in western Algarve and the north of Estremadura, as is suggested by sites with Cardial ceramics in the areas of Figueira da Foz, Torres Novas, and Tomar. In fact, the oldest dates for the Cardial horizon in Portugal are in the second half of the sixth millennium BC: Cabranosa (Sac-1321:  $6930 \pm 60$  BP; on shellfish, corresponding to 5620–5370 BC after the local estimation of reservoir effect proposed by Soares, 1993) and Padrão (ICEN-873:  $6920 \pm 60$  BP; ICEN-645:  $6800 \pm 50$  BP; the average of these dates, also from shellfish, corresponds to 5510–5320 BC), in Algarve (Zilhão, 1997); Pena d'Água (ICEN-1146:  $6390 \pm 150$  BP; 5620–4960 BC) (Zilhão and Faustino de Carvalho, 1996), and Caldeirão (OxA-1035:  $6330 \pm 80$  BP; OxA-1034:  $6230 \pm 80$  BP; OxA-1035:  $6130 \pm 90$  BP; average: 5320–5050 BC) (Zilhão, 1992) in Estremadura. These dates probably do not correspond to the earliest Neolithic in the region, for the decorations on the ceramics from the Estremadura sites (Fig. 2) have been attributed to an evolved stage of the Cardial horizon, probably later than that represented by some vessels from Almonda and Figueira da Foz. Although evidence regarding subsistence is scarce, the recent excavation of the cave of Caldeirão (Zilhão, 1992) has demonstrated that from at least the last third of the sixth millennium BC, domestic sheep were present in the area (the average of the samples OxA-1035 and 1034, both from sheep bones, corresponds to 5370–5060 BC). There is no evidence, for the mo-



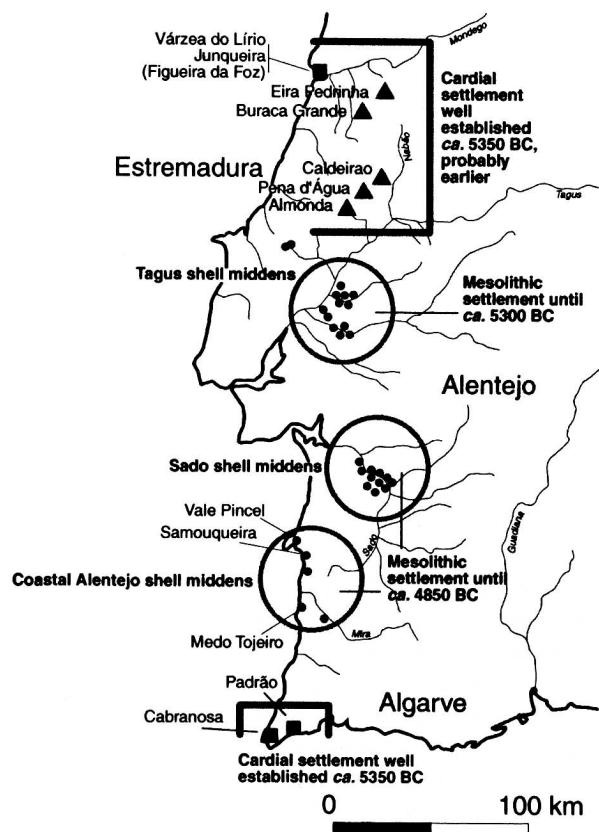
**Fig. 2.** Cardial shards from the cave of Caldeirão (from Zilhão, 1992).

ment, for domesticated plants. However, although it has been argued that cultivation was not practiced in the Portuguese early Neolithic (Kalb, 1989), the absence of evidence is probably related to sampling problems.

Elsewhere in central and southern Portugal, the chronology is less precise. On the basis of typology, high ages have been attributed to some sites, such as the open air settlement of Vale Pincel I, near Sines (Tavares da Silva and Soares, 1981), and might be partially confirmed by recently published radiocarbon dates (ICEN-724:  $6700 \pm 60$  BP [5720–5480 BC]; ICEN-723:  $6540 \pm 60$  BP [5620–5370 BC] (Soares, 1997; but see Zilhão, 1997). Nevertheless, there is generally no evidence of the Neolithic in southern Portugal until the early fifth millennium BC. In any case, it seems

clear that the introduction of Neolithic innovations into some areas of Portugal did not necessarily mean their immediate diffusion throughout the entire area. Rather, a mosaic dispersal might be proposed, with some areas occupied by Neolithic groups while other zones were inhabited by hunter-gatherers (Straus, 1991). The paleodietary data, which show a strong contrast between the Muge shell middens and the Neolithic sites (see below), indicate that this cannot be explained as functional differentiation between sites occupied by the same group.

The spatial segregation of Mesolithic and Neolithic settlements is especially clear between the Tagus and the Mondego valley (Fig. 3), where a true border appears to separate the large shell middens of the Muge area



**Fig. 3.** Geographical distribution of sixth millennium BC settlements in central and southern Portugal (after Zilhão, 1997).

from the contemporary Neolithic sites of the Estremadura limestone massif (Zilhão, 1992). This, plus the notable differences between those groups of sites in settlement patterns, subsistence systems, material culture, and funerary rites, has led some (Arnaud, 1990; Zilhão, 1993) to explain the appearance of ceramics and domesticated species by the arrival of foreign groups. The discontinuity in distribution of Cardial ceramics from their nearest source in Andalusia (Fig. 1) suggests such groups probably came by sea. Others, however, are inclined to see a slow process of change in the indigenous populations. This hypothesis finds some support in anthropometric studies, which show no biological discontinuity between the Mesolithic and Neolithic (Jackes *et al.*, 1997; but see criticism in Zilhão, 1998) and in the fact that farther south, in the Alentejo area, there is also no rupture and the Neolithic appears to show continuity with the local Mesolithic in settlement patterns, economic strategies, and material culture (Tavares da Silva, 1989; Straus, 1991; see also Bicho *et al.*, 1999, for details of this process in the Algarve).

On all accounts, the beginning of the Neolithic in the north of Estremadura did not mean an immediate disappearance of the hunter-gatherer communities in the Tagus estuary; in fact, they were not necessarily affected at all. Apparently, the Mesolithic groups in central and southern Portugal were not influenced by the agriculturalists for several centuries (perhaps some 500 years), until the beginning of the fifth millennium BC, as the dates from Mesolithic sites such as Vidigal and Cabeço do Pez suggest (see Jackes *et al.*, 1997, for a complete list of radiocarbon dates). It is noteworthy that although the distance between some contemporaneous Mesolithic and Neolithic settlements is limited (around 30 km), there seem to have been no relations between them. Mesolithic objects are not found in Neolithic sites, and vice versa. The only exception might be the ceramics found in several shell middens, but, according to Arnaud (1990), most of them should be considered intrusive.

The lack of contact has been explained as a result of the exploitation of distinct ecological niches: the Mesolithic groups using the estuaries and the lower parts of the large rivers, the agriculturalists occupying the hills of inland Estremadura (Zilhão, 1993). This is supported by paleodietary studies, which show a major role of marine resources for the Mesolithic communities and a nearly exclusive dependence on terrestrial resources for the Neolithic groups (Lubell *et al.*, 1994).

The situation had changed by 5000 BC. Throughout the first half of the fifth millennium, the Neolithic expanded to the south, inland, and north, as indicated by the radiocarbon dates from Buraco da Pala, in Tras-os-Montes (GrN-19104:  $5860 \pm 30$  BP; ICEN-935:  $5840 \pm 140$  BP; average: 4830–4620 BC) (Sanches, 1997).

The relationship between that process and the important megalithic center, which probably appeared in interior Alentejo around 4500 BC, is not yet clear. Nevertheless, the vicinity of the oldest megaliths to the principal zones of Mesolithic settlement, their proximity in time, and the presence in many megalithic graves of “archaic” traits such as microliths [first noted by Cartailhac (1886), and followed by Bosch Gimpera (1945, 1966) and Leisner and Leisner (1951)] suggests that this funerary and ceremonial complex could be related to the initial development of a complex farming society descended from local Mesolithic groups.

## THE CANTABRIAN REGION

The Cantabrian region is a narrow strip of land between the Gulf of Biscay and the Cantabrian Mountains, including the Spanish provinces of Asturias, Cantabria, Vizcaya, and Guipúzcoa. This is one of the classic areas for study of the Iberian Mesolithic, especially the western half, where the Asturian “culture” developed (Vega del Sella, 1923; Clark, 1976, 1983). Cantabrian Mesolithic groups, like those described above, had a very diversified economic system. Exploitation of the marine environment had considerable importance, as indicated by the number of shell middens along the coast. These are large accumulations of limpets (*Patella vulgata*, *Patella intermedia*), topshells (*Monodonta lineata*), mussels (*Mytilus edulis*), oysters (*Ostrea edulis*), crustaceans, sea urchins (*Paracentrotus lividus*), and fish remains. Nevertheless, the sea was not the only resource exploited, and was probably not even the principal one. Although less visible than the marine remains, terrestrial animal bones are also very abundant, and the settlement patterns are not consistent with an economy oriented toward the sea. Major sites tend to be a couple of kilometers from the coast, in the center of the littoral plain, and in places from which a great variety of resources were accessible. The central focus of this very diversified system (Arias, 1992) seems to be the woods of the littoral plain (hunting red deer, roe deer, and wild boar, collecting plants and small mammals, fowling), with additional use of the marine environment and the mountains, which are very close to the coast in this region.

Mountain ungulates, such as ibex (*Capra pyrenaica*) and chamois (*Rupicapra rupicapra*), are quite common in the Mesolithic record. In fact, some sites could be specialized hunting camps, such as Las Pajucas, in Vizcaya, where the chamois accounts for 46.4% of the mammalian remains. There is even evidence of Mesolithic groups in the steepest areas of Cantabrian Spain (Arias, 1999): the abrupt coastal mountains (caves of Torreviejo, Los Canes, and Arangas) and the areas immediately beyond the high Picos

de Europa massif, with sites such as La Mina, La Calvera, Peña Oviedo, and El Espertín, at more than 1000 m above sea level.

Mesolithic groups seem to have combined intensive exploitation of the coastal region with less intensive use of other biotopes. This gave them sufficient resources to reach quite high population densities, as suggested by the large number of sites known for this period (about 130 along the 50 km of coast of eastern Asturias alone) (Fano, 1998). Nevertheless, they do not appear to have been as prosperous as their northern contemporaries (see below). The few human remains studied show signs of nutritional deficiencies (Arias and Garralda, 1996). The narrowness of the region, constricted by high mountains, and the low natural productivity of the littoral region, much poorer than the Portuguese, French, or Scandinavian shores (Bailey, 1978), would have contributed to this.

It is possible that the limited economic possibilities of the region restricted the development of social organization in the Cantabrian Mesolithic. Information is scarce, but suggests that these groups attained a lower level of social complexity than their contemporaries in other parts of Atlantic Europe. There are no indications of large permanent settlements, no evidence of storage, no indications of significant ceremonial behavior. The few graves excavated so far do not point clearly to the existence of a complex society. There are no cemeteries, but, rather, concentrations of a few burials in the cave of Los Canes (Asturias), where three Late Mesolithic graves and traces of other structures were found (Arias and Garralda, 1996). These graves (and the other known Mesolithic burial—Molino de Gasparín) are rather simple: individual inhumations in pits, in which the body is accompanied by personal adornments and a series of grave goods that includes stone tools (Asturian picks, geometric microliths) and remains of mammals, probably meat offerings. The only possible exception is Burial II from the cave of Los Canes (Fig. 4), dated to the first half of the sixth millennium BC (AA-11744: 7025 ± 80 BP; AA-5296: 6770 ± 65 BP). This had a much richer set of grave goods, including many beads, two ibex frontals, a *baton percé* of red deer antler, a long bone point, and a pair of elongated pebbles. The grave was much more complex than the other two burials at the same site, and the body was on its side, while the other two were supine.

It should be noted that in the late Mesolithic there are rather clear indications of territoriality, such as the coexistence of several industrial complexes with well-defined geographic distributions: the Asturian (Clark, 1976, 1983; González Morales, 1982) to the west, and the so-called post-Azilian Epipaleolithic of the Basque Country (Barandiarán, 1983; Arias, 1991) to the east. There is also some indirect evidence of this, in the localness of the lithic raw materials (Arias, 1991), which suggests the existence of

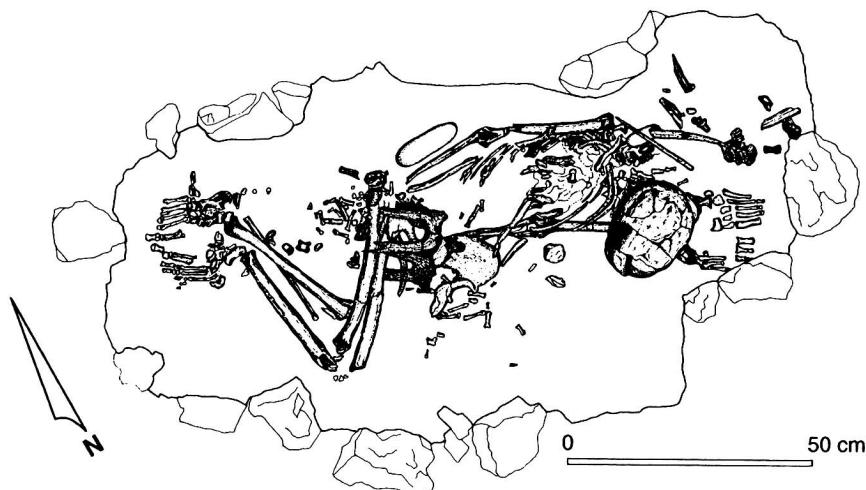


Fig. 4. Burial II of the cave of Los Canes.

small catchment areas, and the stable-isotope ( $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$ ) analyses of the human remains from the cave of Los Canes (unpublished analysis by H. Schwarcz), which show an essentially terrestrial diet in a site close to major Asturian shell middens. It is possible that different groups were exploiting the coastal and mountain areas.

The Neolithic of the north of the Iberian Peninsula came from the Mediterranean Basin. In the middle centuries of the sixth millennium BC, agricultural groups who decorated their ceramics with impressions of cockle-shells (*Cerastoderma edule*, formerly *Cardium edule*—the so-called “Cardial” pottery) are widely documented in Mediterranean Spain, from Catalonia to Andalusia (Bernabeu, 1989). The influence of this new culture quickly penetrated to the interior along the Ebro valley, where Cardial ceramics date to the second third of the sixth millennium (Chaves and Forcas in Huesca, La Balma de la Margineda in Andorra, and El Pontet in Saragossa) (Utrilla *et al.*, 1998). They appear at the fringe of the Cantabrian region by at least to 5000 BC, on the basis of the radiocarbon date from the bottom of level IV of Peña Larga, in Alava (I-15150:  $6150 \pm 230$  BP; 5520–4540 BC) (Fernández Eraso, 1997). This date is imprecise, but seems to be somewhat older than the first signs of the Cantabrian Neolithic.

Cereal grains, domestic animals, and ceramics appear in the Cantabrian region at the beginning of the fifth millennium BC (Fig. 5). However, there is no sudden change, but rather a transitional situation, at least during the first half of the fifth millennium. Sites dated to that

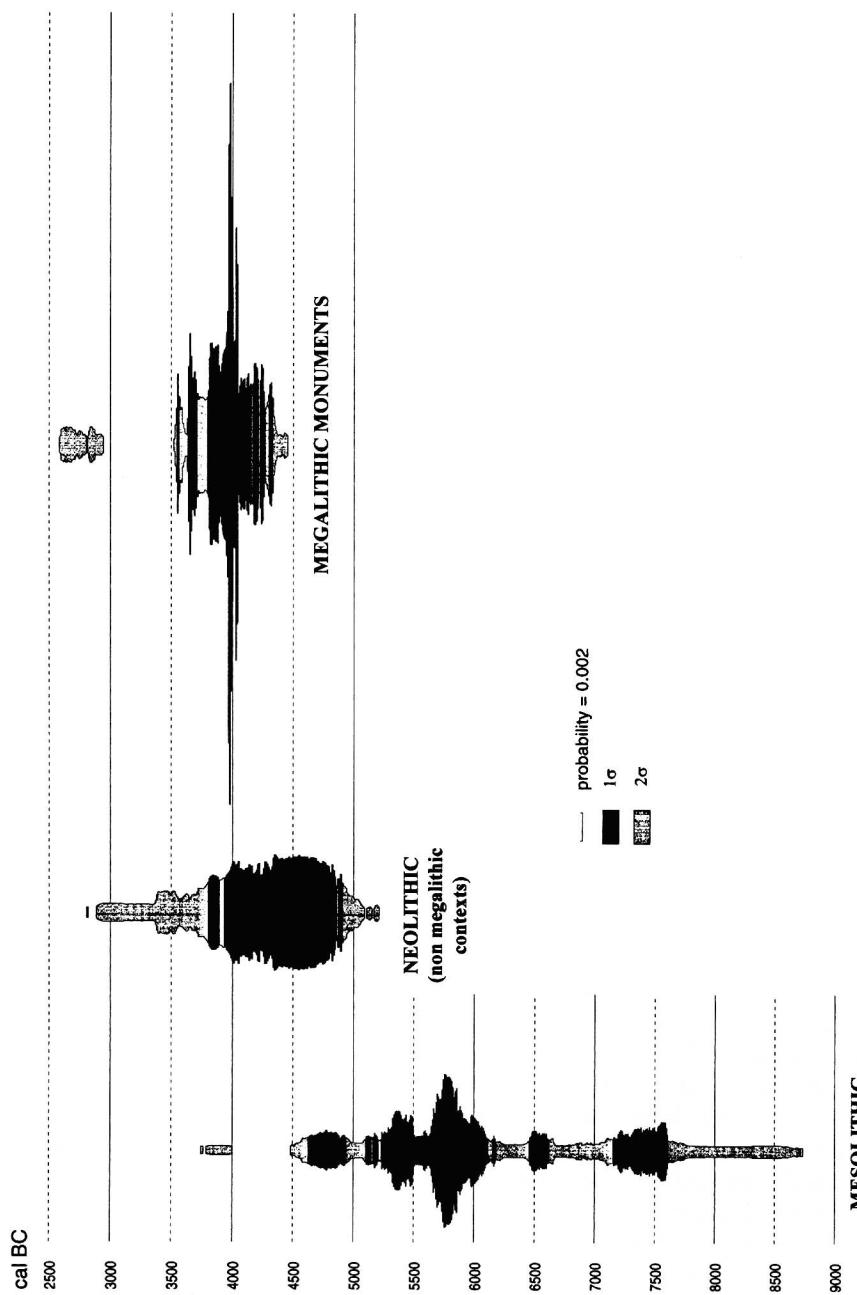
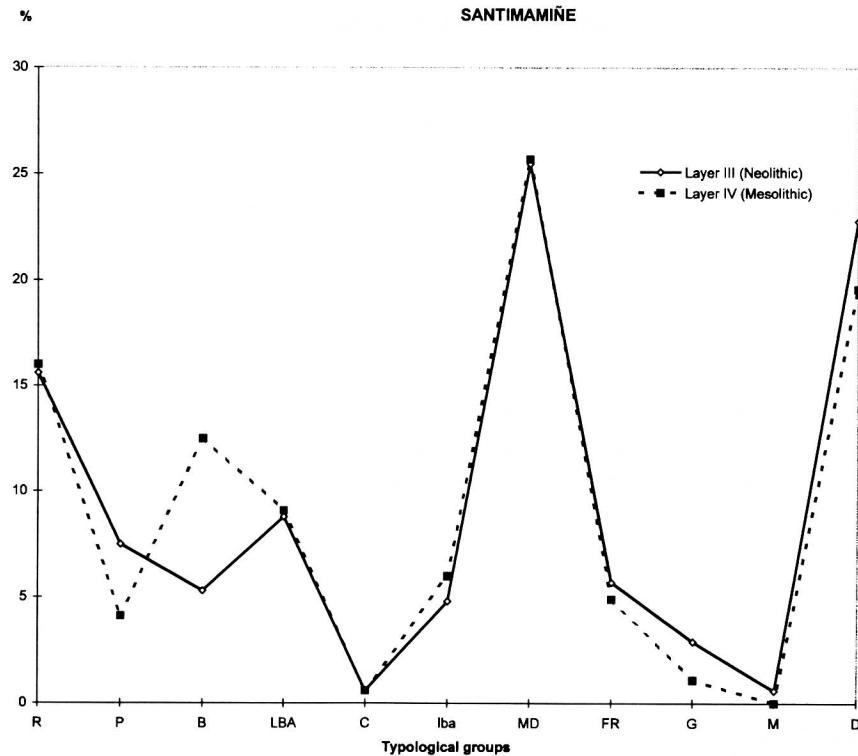


Fig. 5. Sum of the probabilities of the radiocarbon dates for the Mesolithic and the Neolithic of the Cantabrian region.

period are very diverse. Some of them are truly Neolithic contexts, such as layer IC2 of the cave of Arenaza (Vizcaya) where “Epicardial” ceramics (noncardial, coarsely impressed wares) are associated with a fauna dominated by domestic animals (Altuna, 1980) (AMS dates for domestic cattle: OxA-7157:  $6040 \pm 75$  BP; 5210–4730 BC; OxA-7156:  $5755 \pm 65$  BP; 4770–4460 BC) (Arias and Altuna, 1999), or the cave of Kobaederra (Vizcaya), where cultivated cereals (at least *Hordeum vulgare*) and domestic animals date to the second third of the fifth millennium (UBAR-470:  $5630 \pm 100$  BP; 4720–4260 BC). Other roughly contemporaneous sites have only wild animals, such as the open site of Herriko Barra, the caves of La Trecha and El Tarrerón, and layer 7 of the cave of Los Canes, a deposit with ceramics that overlies the Mesolithic burials (Arias *et al.*, 1999). The reasons for this coexistence are not clear. There are two types of explanations, which are not necessarily incompatible: either the introduction of the Neolithic happened at different rates in different areas, resulting in the coexistence of hunter-gatherers and agriculturalists, or the sites lacking evidence of domestication by the middle of the fifth millennium (in general, barely habitable caves, in areas that were not appropriate for cultivation, with very poor archaeological assemblages) were the specialized hunting and gathering camps of groups who practiced cultivation and herding in other locations. There are not sufficient data to choose between these options.

In any case, the data suggest that throughout the entire fifth millennium, cultivation and herding were integrated in a social system which, culturally and economically, remained very close to Mesolithic. Indisputable evidence of the consolidation of the regional Neolithic does not appear until the period of the expansion of megalithic tombs, around 4250–4000 BC (Arias, 1997b).

Current data allow us to define the regional transition to the Neolithic as a slow and gradual process of change within indigenous societies, in which little or no role was played by the arrival of foreign populations. In fact, the oldest Neolithic sites occupy the same areas, and even the same caves, as those of the Mesolithic, and the two periods can hardly be differentiated by lithic industry (Fig. 6), burials, or even artistic manifestations (Arias, 1991). Similarly, there was no radical change in subsistence with the appearance of domestic species, but rather a broadening of an already diversified economy. The addition of cultivation did not mean the abandonment of hunting and gathering, but, instead, coincides with their intensification. This is observed in shellfish gathering, which was extended to include areas of heavy surf, where species not systematically exploited in the Mesolithic were collected, such as the barnacle (*Pollicipes cornucopia*) and some types of limpets (*Patella aspera*, *Patella ulyssiponensis*) (Arias, 1992, 1996).



**Fig. 6.** Comparison of the industrial assemblages of layers IV (Mesolithic) and III (Neolithic) of the cave of Santimamiñe (Vizcaya), classified according to the typological groups of Fortea (1973).

How did, then, Cantabrian communities know about the new subsistence strategies and technologies that they began to adopt in the fifth millennium BC? Goats, sheep, wheat, and barley were not domesticated in Cantabrian Spain, nor did the local inhabitants invent ceramics. The key seems to lie in the existence of exchange systems with groups on the other side of the Cantabrian mountains, of which there are indications from the beginnings of the Mesolithic. These include very striking parallels in some technical and typological features that link them clearly with contemporary groups in the Ebro valley (Arias, 1991): the Helwan technique in the geometric microliths, and the presence of strangulated blades and flakes and blades with deep inverse retouch. After the Neolithic began in the Ebro valley in the sixth millennium BC, the Cantabrian groups could have learned about new developments from these contacts, and later, little by

little, they applied them. It is interesting to note that some of the Mediterranean traits just mentioned (for instance, the Helwan technique) appeared in the Ebro valley at the beginning of the local Neolithic (Barandiarán and Cava, 1989), which was contemporaneous with the Cantabrian late Mesolithic contexts where that feature is found, as the burials of Los Canes. Thus, it seems that some technical traits spread quite quickly among contemporary groups regardless of their levels of social and economic development.

### THE FRENCH ATLANTIC COAST

Archaeological information about the Mesolithic of Atlantic France is unevenly distributed. Several well-preserved sites have been excavated on the southern coast of Brittany, but, for the rest of the region, there are few data and those few are usually of mediocre quality. They consist largely of surface collections of lithics, which are difficult to date and almost impossible to relate to subsistence, beliefs, etc. Thus, our picture of the last hunter-gatherers along the French Atlantic coast is based on two extraordinary sites, the cemeteries at Téviec and Hoëdic, in Brittany, with a few additions, concerning little more than settlement patterns and lithic industries, from the rest of the region.

On the basis of lithics, French archaeologists distinguish three industrial complexes: from north to south, the Mesolithic of Brittany (Kayser, 1991, 1992), the Retzien, between the Loire valley and the marsh of Poitou (Rozoy, 1978, pp. 748–752; Joussaume and Tessier, 1991; Marchand, 1999b), and the less well-defined Mesolithic of Aquitaine. Smaller scale differences led Kayser (1992) to subdivide the Brittany Mesolithic into three regional facies: the Monts d'Arrée group, the Beg an Dorchenn/Ty Nancien group (south of Finistère), and the Morbihan group (also named Téviécien). This diversity (which is based on stylistic traits, such as the form of the arrowheads, rather than functional differences), suggests that, during the late Mesolithic, the territorialization process characteristic of Holocene hunter-gatherer groups could also have been occurring along the Atlantic French coast.

The Mesolithic of Brittany seems to consist of communities with a tendency to sedentism and with high demographic densities that were possible probably because of the exploitation of a wide range of resources, notably marine resources. Thus, sites yield remains of gilthead bream, labroids, scienids, rays, sharks, and cetaceans, also seals, and, of course, appreciable quantities of marine mollusks (limpets, mussels, periwinkles, oysters, clams). Intensive exploitation of marine resources has recently been confirmed by stable-isotope analysis, which shows that a significant

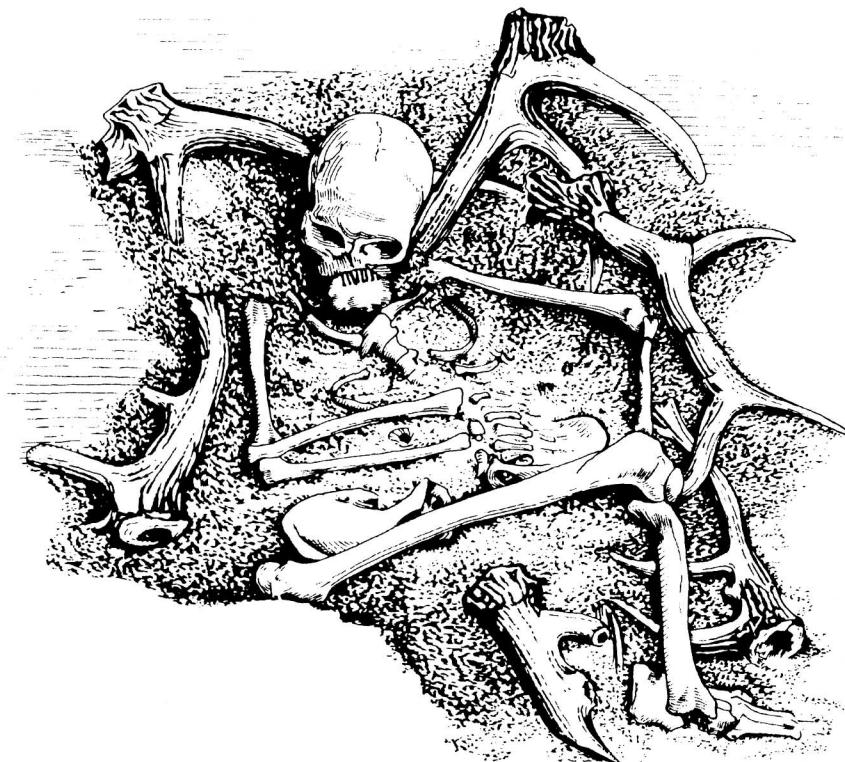
portion of the protein component of the diet was derived from the sea, particularly at Hoëdic (Schulting, 1998). The presence of large quantities of fish also suggests that they might have known navigation techniques. There are also indications of subsistence activities on land, such as the hunting of red deer, wild pig, and roe deer, as well as of fur-bearing species (fox, beaver, marten, wild cat). There is also a varied sample of large or medium-sized birds, such as ducks (the most abundant), birds of prey (eagle, falcon), doves, storks, and various marine birds such as guillemot (*Uria* sp.), razorbill (*Alca torda*), and great auk (*Pinguinus impennis*). In contrast, there are few signs of gathering on land, only rare traces of hazelnuts, forest pears, and land snails.

These populations may have developed food-conservation systems: some of the so-called 'garbage pits' (*fosses dépotoirs*) in Beg er Vil might be an example of that (Kayser, 1991). It has also been suggested that the relationship between the distribution of settlements and salmon migration routes might reflect the use of storage techniques (Cassen, 1993), which are very common in the ethnographic record of complex hunter-gatherer societies (Testart, 1982). However, there is no conclusive evidence as yet.

Most information about social, spiritual, or ideological realms comes from the excellent excavations of the cemeteries of Téviec and Hoëdic (Péquart *et al.*, 1937; Péquart and Péquart, 1954), dated between 6000 and 4500/4000 BC (data from Schulting, 1998, Fig. 8). Apart from these, there is only an isolated grave at Beg an Dorchenn (Brittany) and the recently discovered necropolis at La Vergne, in Charente (Duday and Courtaud, 1998; Courtaud *et al.*, 1999), an older site that has been dated to *ca.* 8000 BC.

The burials in the Brittany shell middens are shallow pits or small depressions (Hoëdic), with one or, more often, several bodies. The individuals, in supine position with the back slightly elevated or else sitting with the legs bent, are provided with numerous ornaments (shell necklaces and bracelets), tools, and ochre. In some outstanding graves (Fig. 7), red deer antlers were placed next to the body, or covering it (in structure 10 of La Vergne were two frontals of *Bos primigenius* with huge horns). In some cases, particularly at Téviec, more complex structures have been documented, with the burial covered by a ritual hearth in which offerings were deposited (red deer or wild boar mandibles), and over which small barrows were erected.

The considerable variety in the graves of these two cemeteries can be attributed to several factors. First, some differences are related to the age and sex of the dead. Infant graves are usually the simplest (at Téviec, for example, they do not have ritual hearths or offerings of mandibles or red deer antlers), and personal adornments differ according to sex. Thus, Taborin (1974) has observed an association of *Trivia europaea* shells with



**Fig. 7.** Burial K of Hoëdic (from Péquart and Péquart, 1954).

males and of *Littorina obtusata* shells with females. More interesting are the contrasts in the quality and abundance of grave goods and in the complexity of the funerary treatment, which might indicate nonegalitarian societies. Thus, within the same age class, rather poor graves (J in Téviec and D in Hoëdic, for example) occur next to very complex and rich burials (Téviec A, D, and K; Hoëdic H, J, and K), including those of a couple of children (graves C of Téviec and of Hoëdic), which, as Péquart noted long ago (Péquart *et al.*, 1937, p. 36), appears to indicate social inequality (see Schulting, 1996, for a detailed analysis of that issue).

It is probable that these social changes can be related to the indications of violence documented for individual 6 of grave K of Téviec. This was a young male killed with arrows and with a healed mandibular fracture, to whom a very particular funerary treatment was given.

Finally, the graves of Téviec and Hoëdic and the shell midden of Beg

er Vil have also provided an interesting collection of portable art, consisting of pointed bones (including a human rib) decorated with series of short, parallel marks, and a fish mandible with a quadrangular motif.

The Neolithic innovations came to the French Atlantic coast by two routes. In the north, groups of the Danubian tradition colonized the Paris basin about 5200 BC. Their influence over a wide area, from Normandy to Poitou, can be traced through the remains of the Villeneuve-Saint-Germain culture, dated to the first half of the fifth millennium BC, and later through more extended archaeological complexes, generally ascribable to the Cerny culture (Constantin, 1990), which can be dated from 4500 BC.

Farther south, along the coast of Vendée, Charente, and Gironde, is a series of sites (La Pointe du Grouin du Cou, Les Gouillauds, Longeville-Plage, Plage du Batard, La Lède du Gurp, and La Balise) characterized by impressed pottery, for which the term Early Centro-Atlantic Neolithic has been proposed (Joussaume, 1986). Their discovery has recently led to a reconsideration of the beginning of the Neolithic in western France, previously thought to be entirely due to influences of the Central European tradition. The presence of ceramics decorated with shell impressions suggests a possible link to the Mediterranean Cardial horizon, or perhaps to the somewhat later Epicardial.

In any case, several loose ends remain. As some French archaeologists have noted implicitly or explicitly, the identification of the Atlantic decorated pottery with the Cardial is still insecure (Cassen, 1993). There are certainly impressions of shells, but they are not identical to those in the Cardial, and the forms of the vessels are poorly known. Although the Mediterranean connection is an interesting possibility, and even a probable one (Laporte, 1997), mere convergence cannot be excluded. The use of the edge of a mollusk shell to decorate clay is a simple option for a coastal potter, and ceramics from very diverse periods and unrelated cultural contexts share this trait, as examples such as the Bell Beakers of Galicia (northwestern Spain) (Criado and Vázquez, 1982) show.

On the other hand, the suggestion that two waves, LBK and Mediterranean, characterized the transition to the Neolithic in western France is still somewhat simplistic, unless we choose to regard migration or copying a foreign model as the only possible explanations for the geographic expansion of archaeological traits. We should keep in mind more complex possibilities that involve the contributions of local communities, the influences of exchange, and so forth. In fact, many French archaeologists consider it likely that the LBK and Mediterranean “waves” were not completely isolated (Roussot-Larroque and Thévenin, 1984; Roussot-Larroque, 1990; Jeunesse, 1995; Guilaine, 1997). There may have been some interaction between the communities from the two cultural spheres, as has been claimed

for the ceramic style of La Hoguette, which might also be a product of LBK and Mediterranean influences (Lüning *et al.*, 1989).

In spite of the uncertainty inherent in information derived mostly from surface collections, it seems clear that the impressed ceramics from western France correspond to a true Neolithic. The ceramics are associated (with some contextual problems), with abundant domestic fauna, including cattle, sheep and pig (from most to least common) (Joussaume, 1986). There is also some evidence of possibly contemporaneous agriculture in the region. Cereal pollen has been identified in deposits dating to at least the very beginning of the fifth millennium BC and perhaps the sixth (Kerpenhir and l'Organais, in Brittany), and wheat seeds (*Triticum aestivo-compactum*) (Marinval, 1990) and legumes recovered in the paleosol from Dissignac (Gif-3823:  $6250 \pm 150$  BP; Gif-3822:  $5940 \pm 150$  BP; Gif-3820:  $5780 \pm 150$  BP; average: 5200–4690 BC).

It must be stressed that in the zone of Danubian influence as well as in most of the Early Central-Atlantic Neolithic area, the Neolithic appears to show a rupture from the local Mesolithic tradition. This is particularly clear in the central-western zone, where the Neolithic lithic industries have little in common with those of the Retzien (Marchand, 1999a). The situation in Aquitaine is somewhat more confused. The evolution of the lithic industries from sites such as Lède du Gurb might suggest some continuity between the local Mesolithic and the Neolithic (Roussot-Larroque and Villes, 1988; but see Prestreau, 1983, and Marchand, 1999b, for a critical view on that stratigraphic sequence), but the question has not yet been studied in detail.

The case of Brittany is more complex, for the beginning of the Neolithic has traditionally been subsumed into one of the classic questions of local (and European) prehistory: the origin of the megaliths. Ever since the early dates for the megaliths were known (some from the first half of the fifth millennium BC, which practically overlap with the dates from the shell middens at Morbihan), many scholars have linked the two phenomena. Nevertheless, much remains unknown.

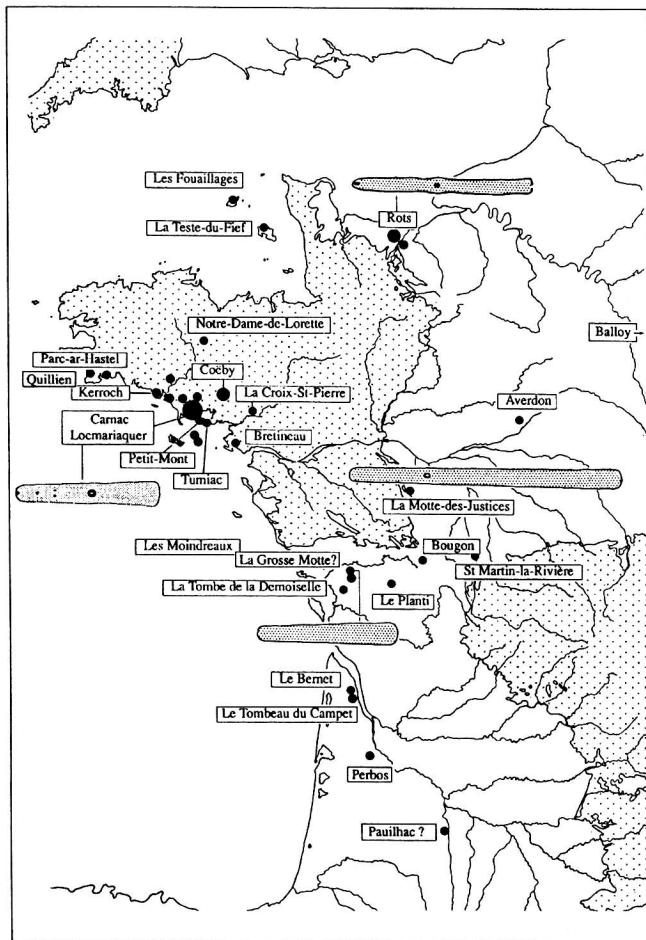
One basic and unresolved question is whether or not there was a Breton Neolithic before the first megaliths. Most prehistorians implicitly assume that there was an intermediate phase between the Mesolithic and the megaliths, although there is no clear evidence for this. There are some indications of farming in times which seem too early for megaliths (around 5000 BC or perhaps even earlier), such as the paleosol of Dissignac, or those of the peat bogs of Kerpenhir and l'Organais (see above), but they are problematic. In the case of Dissignac, some doubt that the C-14 dates are contemporary with the domestic plants found in this site (S. Cassen, personal communication). Besides, the methodological problems involved

in the identification of agricultural activity from palynological studies are well known (see Rowley-Conwy, 1995a, for a lucid criticism of that issue along the entire European Atlantic coast).

The subject is complicated by the existence in the region of archaeological units with controversial chronological and cultural affiliations, such as the group from Castellic. This is a ceramic style that seems to be very frequent around 4000 BC or even later (it has been found, for instance, in the paleosol beneath the dolmen of La Table des Marchand, dated to the beginning of the fourth millennium: Gif-7554:  $5170 \pm 70$  BP; Gif-7555:  $5040 \pm 70$  BP; average 3980–3780 BC), and has been said to be stylistically related to late Cerny ceramics (L'Helgouac'h, 1990; Letterlé, 1992). However, others see these ceramics as evidence of a quite old Neolithic (the beginning of the fifth millennium BC) because of their supposed relation to the Pinacle/Fouailles group. The megalithic structure of Les Fouailles, on the island of Guernesey (Kinnes, 1982), where this kind of ceramic has been found, has early radiocarbon dates (BM-1892R:  $5850 \pm 100$  BP; BM-1893R:  $5900 \pm 110$  BP; BM-1894R:  $5670 \pm 170$  BP; average: 4850–4520 BC) (Patton, 1992), but some scholars associate them to the Villeneuve-Saint-Germain materials found at the site, and propose an age of around 4500 BC for the oldest phase of Castellic (Cassen *et al.*, 1998).

Another problem (into which we cannot go deeply) is whether LBK influence predominated in the origin of the megaliths (Boujot and Cassen, 1992; Patton, 1994) or whether they were primarily developed by the indigenous societies (Scarre, 1992). The defenders of the latter position find support in the great antiquity of the dates associated with some monuments in Brittany (Barnenez, Kercado) and in the central-western area (Bougou) (such as Gif-1309:  $5740 \pm 150$  BP and Sa-95:  $5840 \pm 300$  BP for the former, and Q-3234:  $5860 \pm 65$  BP and Ly-1700:  $5830 \pm 160$  BP for the latter, all corresponding to the second quarter of the fifth millennium BC) and also in the supposed relation between certain aspects of the Mesolithic graves of Téviec (collective burials and some architectural characteristics, which would make them a kind of 'megalithic embryos', in the words of Briard, 1995, p. 14; but see also L'Helgouac'h, 1990) and those of the megaliths. Both arguments are problematic, since the reliability of the dates before 5500 BP/4300 BC for megaliths has been questioned (Boujot and Cassen, 1992) and the similarity between those two groups of funerary structures is very debatable.

The contrary perspective emphasizes the probable linkage of the *terres tumulaires* of Brittany and some zones of the French Atlantic coast, which would be the oldest monumental tombs of the region (Boujot and Cassen, 1992; Briard 1992, 1995) (Fig. 8), to the tradition of elongated earthen and wooden tombs. The latter are found in the early Neolithic throughout the



**Fig. 8.** Geographic distribution of the principal long barrows of western France (from Boujot and Cassen, 1992).

north of Europe, ranging from the Polish necropolis of Sarnowo to the English Earthen Long Barrows, and passing through, and including, the Scandinavian constructions described below (Ashbee, 1970; Midgley, 1985). It has been proposed that there might be a relationship—morphological, but also symbolic and functional—between those funerary structures and the long houses characteristic of the LBK. This idea was advanced by classical scholars such as Childe (1949), and has recently been restated by several archaeologists (Hodder, 1990; Sherratt, 1990; Duhamel and Midgley,

1999; but see Tilley, 1996, pp. 109–110, who suggests a similar relation with the Mesolithic middens). Elongated burial structures with material culture of LBK tradition found in northeastern France (for instance, the necropolis of Passy-sur-Yonne, in Burgundy) (Duhamel *et al.*, 1997) might provide a link between the central European tombs and those of western France. In that area, the recently excavated necropolis at Balloy supports such a hypothesis. Elongated tombs, similar to those from Passy, were superimposed on trapezoidal houses of the local Late LBK (*Rubané Récent du Basin Parisien*) (Chambon and Mordant, 1996; Mordant, 1998), suggesting both a consecration of the domestic space in honor of the ancestors, and an origin of the form of such tombs in domestic architecture.

It tends to be assumed in the literature that the most important catalyst in the transition to the Neolithic in the French Atlantic coast was the arrival of new populations. Nevertheless, some observations suggest a more important role for hunter-gatherer groups. Thus, Joussaume (Joussaume *et al.*, 1987) observed parallels between the distributions of impressed ceramics and of a series of geometric microliths, including the Châtelet point, characteristic of the Retzien, and some types from the Mediterranean basin (Montclus point, Jean-Cros point). This suggests the existence, at least from the Mesolithic, of exchange routes and contacts with the Mediterranean world, which should be kept in mind when explaining the arrival of innovations. Some also see the transition as a largely indigenous phenomenon (Cassen, 1993), and this is supported by the discovery, below the *tertre* of Lannec er Gadouer, in Morbihan, of a Mesolithic layer, with links to industries in the Loire valley and the Paris basin (Boujot and Cassen, 1997, 1998).

In any case, it seems indisputable that foreign groups did come to the French Atlantic coast and its surrounding areas, particularly in the northern sector, as indicated by the discovery at the site of Le Haut Mée, in northeastern Brittany, of a settlement characteristic of the Villeneuve-Saint-Germain culture, dated to the beginning of the fifth millennium BC (Cassen *et al.*, 1998). One important implication of this is that the first local Neolithic communities coexisted with hunter-gatherers. The C-14 dates show that some Breton Mesolithic sites were still occupied in the second third of the fifth millennium BC (Beg an Dorchenn, GrN-2001:  $5970 \pm 80$  BP; 5060–4620 BC; Hoëdic, OxA-6710:  $5755 \pm 55$  BP; 4770–4460 BC; Téviec, OxA-6662:  $5680 \pm 50$  BP; 4680–4370 BC, and even a later—probably too young—date for Hoëdic, OxA-6705:  $5080 \pm 55$  BP; 3980–3720 BC). There are already dates from Neolithic contexts on the western coast around 5400 BC (Grouin du Cou: Gif-5043:  $6480 \pm 150$  BP; Gif-5042:  $6450 \pm 150$  BP; Gif-4372:  $6300 \pm 160$  BP; average: 5530–5150 BC) and various dates from the end of the sixth millennium or the beginning of the fifth (La Balise, Lède du Gup, Les Gouillauds, Les Ouchettes, Kerpenhir, Dissignac, L'Organais).

Even with the reservations arising from the scarcity of dates and the uncertainty of radiocarbon dating, this appears to indicate that the last hunter-gatherers coexisted with populations who had ceramic technology and domestic species during a period that which could have lasted some 900 years, if the dates from Grouin du Cou are confirmed, and about 400 years if not.

This might shed light on some facts known for the past 60 years which have been difficult to explain: the presence of a domestic ovicaprine molar in Téviec, of some cattle bones that seem to be too small to be aurochs in Hoëdic (and also in Beg an Dorchenn) (see Rowley-Conwy, 1995b, for a criticism on such identifications), as well as knots of oak in Téviec, which have been interpreted as the result of nibbling by herd animals or pruning (Péquart *et al.*, 1937, p. 103). The evidence that the hunter-gatherers who occupied these sites were contemporaneous with nearby Neolithic groups might explain these anomalies (and others, such as the occasional presence of ceramics in Mesolithic sites like Ty Nancien and Beg er Vil) through exchange with agriculturalists, the theft of animals, or the hunting of strays. There are ethnographic descriptions of similar contacts between farmers and hunters such as the Bushmen (Parkington, 1984) and the Australian aborigines (Davidson, 1989). Nevertheless, new and more reliable data are needed.

## THE COUNTRIES OF THE NORTH SEA

Along the length of the current coastline of the North Sea and the English Channel, from Lower Saxony to the north of France, there extended a chain of Mesolithic communities that share some characteristics with those of southern Scandinavia and northern Germany (see below).

Unfortunately, the available archaeological evidence is confused and fragmentary. In many areas, particularly in the Low Countries, the complex geological processes of the Holocene have destroyed Mesolithic deposits or made access to them difficult (Louwe Kooijmans, 1998). These processes include the Flandrian rising of the sea that submerged an enormous area of the early Holocene landscape, and, of course, all the coastal and many inland settlements, as the finding of bone and antler implements on the current seafloor shows (Louwe Kooijmans, 1971). In addition, many of the sites already investigated lack clear stratigraphy and often have been altered by complex postdepositional processes (Vermeersch, 1999). Thus, caution is necessary when interpreting distributions of objects and, in some cases, associations among the artifacts, or between the artifacts and the dated samples (Crombé, 1999). In addition, many of the important sites were located in humid, boggy, or inundated areas (dunes, elevations at the

edges of creeks affected by the tides, *Terpen*, and floating islands of peat), where the ecological particularities must have affected the subsistence strategies of human groups. For all of these reasons, the study of the transition to the Neolithic in this area is especially complex. Nevertheless, and in spite of the wide variety of situations documented, there are some common characteristics, which will be the subject of this section.

Mesolithic subsistence practices followed a pattern similar to that in western France. The economy was again based on the exploitation of a very wide range of resources, through fishing, the collection of seafood and plant foods, and the hunting of a variety of animals, from the ubiquitous red deer and roe deer to birds, and numerous species of small and medium-sized mammals. The principal difference from France is a higher occurrence of freshwater resources (fishing in rivers and lakes, the hunting of mammals such as moose or beaver in swampy or marshy areas, the capture of ducks and other aquatic birds) than of marine. This seems to be fundamentally due to the differences between the environments of the two regions, and the distance of the preserved sites from the sea. The economic system is still that of the so-called "broad-spectrum revolution" (Flannery, 1969).

Unlike Brittany, there is no evidence for a sedentary way of life. Most of the studied sites are small settlements, with short-term or seasonal occupation. This has led to a characterization of those populations as rather mobile groups. In this, they appear more like the traditional model of hunter-gatherers (Lee and DeVore, 1968) than those of the Téviécien or the Ertebølle cultures, perhaps because there was not so marked a concentration of natural resources as on the Danish or Swedish seashore. However, the lack of the original coastal sites in the North Sea region may give us a distorted image of the prehistoric reality.

Despite the differences noted above, there are some indications of territorial behavior, such as the appearance of stylistic discontinuities in the lithic industries of the late Mesolithic (Gendel, 1984) and possible indications of violent death.

Funerary ritual is known from late contexts, considered to be probably Neolithic but linked to Mesolithic traditions. One such is Swifterbant, where 23 graves were excavated at several localities, dated at the S-2 site to around 4300 BC (GrN-5443: 5300 ± 40 BP; GrN-5606: 5540 ± 65 BP). They included individual burials (occasionally double), supine, in elongated, rectangular pits. Since there is a great uniformity of ritual and simplicity of the grave goods (arrowheads and some amber beads), nothing seems to indicate the existence of nonegalitarian societies. There is also some evidence of other types of funerary ritual, such as collective graves in caves in Belgium (Grotte Margaux, Abri des Autours) (Cauwe 1994, 1996, 1998), dating to an early phase of the Mesolithic—the ninth millennium BC.

Also in the realm of the symbolic and spiritual behavior, the wooden statuette from Volkerak (southern Netherlands) must be mentioned (van Es and Casparie, 1968). This is an anthropomorphic representation, 13 cm high, which has been dated to the second half of the sixth millennium BC (GrN-4922:  $6400 \pm 85$  BP; 5510–5150 BC).

The arrival of Neolithic influence in this part of Europe is also related to the Danubian wave. From ca. 5300 BC onward, groups of LBK colonists established themselves in the loess zones on the periphery of the region. For a long time, the consequences of this were only modest, the most general being the diffusion of ceramic technology. Indigenous communities possessed ceramic containers from quite early times. They appear in most of the coastal regions of the North Sea in the last third of the sixth millennium BC, as documented at sites such as Hüde I (Lower Saxony) or Swifterbant (northern Netherlands) (de Roever, 1979; Price, 1983). However, some authors question the reliability of the dates at the latter site and prefer later determinations for the IJssel-Vecht valley, such as that from Nagele 2 (GrN-14124:  $5635 \pm 40$  BP; 4540–4360 BC) (Hogestijn, 1990). In Belgium, the dates of sites such as Weelde-Paardsrank and Melsele are somewhat contradictory, although an age of around 5250 BC has been estimated (Keeley, 1990). In other areas, the oldest dates are rather late, and probably are nothing more than a *terminus ante quem* for the beginning of ceramic production, as in the Rhine/Meuse delta and in the southwest of the Netherlands, which date to the last third of the fifth millennium (phase 1 of Hazendonk, GrN-6215:  $5320 \pm 40$  BP; 4320–4000 BC; Bergschenhoek, GrN-7764:  $5415 \pm 60$  BP; 4360–4050 BC).

There are important differences between these ceramics and those of the LBK in the form of the vessels (containers with conical bases, similar to those from the Ertebølle culture, see below) and in the techniques of production ("reduced" firing and particularities such as the use of organic temper). They may thus have been basically of local production. Something similar has been proposed for the ceramic styles of La Hoguette and Limburg, distributed across the western edge of the LBK Neolithic (the former through the Rhine, Main, Neckar, and Mosel valleys, and part of Normandy; the latter through most of Belgium and the north of France). The combination of decorations that reinterpret LBK motifs (perhaps also, in the case of La Hoguette, from the Mediterranean Cardial, according to Lüning *et al.*, 1989) and of particularities in the forms (some with pointed bases) and the manufacturing techniques (reduced firing, organic temper) that relate them to the ceramics of the groups of Mesolithic tradition has caused many authors to consider them indigenous products (Jeunesse, 1986; Lüning *et al.*, 1989; Bogucki and Grygiel, 1993).

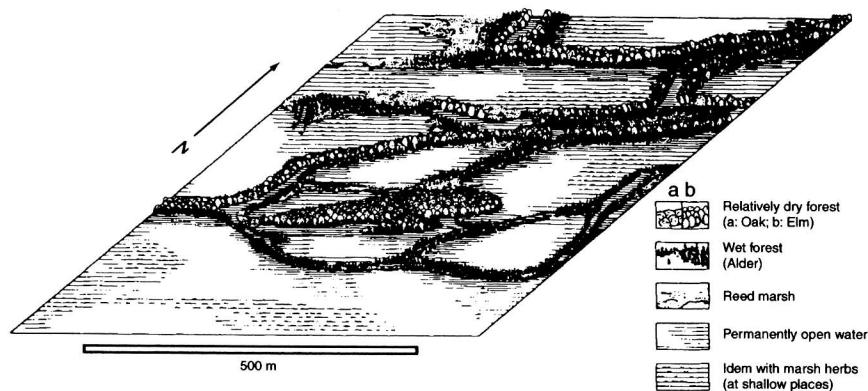
More direct evidence of contacts between local communities and agri-

culturalists is found in the presence of artifacts derived from the Danubian cultural sphere in contexts associated with indigenous groups, such as perforated ax-heads characteristic of the Rössen culture (*durchlochte Breitkeile*) (van der Waals, 1972), which appear in Swifterbant 3-5 and in some sites from the Meuse valley in the southeast of the Netherlands. These items probably circulated among Mesolithic groups as luxury or prestige goods (Verhart, 1995).

Another indication of the relationship (in this case, inverse) is the presence in LBK sites of raw material coming from beyond the western limit of this culture. This is the case with the quartzite from Wommersom, and the flint from the Meuse valley, which makes up more than 80% of the lithic raw material in LBK sites some 200 km east of the sources. This happens, for instance, at the site of Friedberg-Buchenbrücken, which is interpreted by Gronenborn (1990) as evidence of exchange between indigenous groups and the LBK colonists.

It has also been suggested that some features of LBK graves of the western fringe might reflect indigenous influence. This could be the case for the burial in structure 50 of Geleen, in Limbourg (Netherlands), with mixed offerings including Limbourg ceramics and a typical LBK adze, or of one of the graves of Schwetzingen, near Heidelberg, where the position of the corpse seems to follow Mesolithic patterns, or of the inverse orientation of a good number of graves in cemeteries such as Elsloo (Netherlands), Niedermerz (North Rhine-Westphalia), and Souffelweyersheim (Alsace) (Jeunesse, 1997, 1998).

In spite of these relationships, the ways of life of the indigenous groups do not appear to have been modified in any significant way until the last third of the fifth millennium BC (about a millennium after first contact). Throughout much of this time, the subsistence basis continued to be hunting and gathering, notwithstanding the occasional presence of small percentages of domestic fauna and cereal grains in contexts of Mesolithic tradition. Most such cases are difficult to evaluate, for the chronology of the domestic specimens is not always clear, sometimes because of the lack of absolute dates, sometimes because of the debatable association with the dated samples. Nor is it easy to evaluate their role in the overall economy. The issue of whether or not the presence of cereal grains implies the practice of agriculture has been discussed in the literature (Louwe Kooijmans, 1987; Van Zeist and Palfrenier-Vegter, 1981; Bakels, 1981; Kampffmeyer, 1983). The evidence in favor of agriculture are the presence of plant stalks and, at one site, Hazendonk, the abundance of cereal remains. The main argument against agriculture derives from the locations of the sites in swampy or marshy areas, sometimes without cultivable land (Fig. 9), that would have made cultivation improbable, or at least difficult. It has been proposed that



**Fig. 9.** Reconstruction of the landscape around Hazendonk *ca.* 5200 BC (after Louwe Kooijmans, 1987).

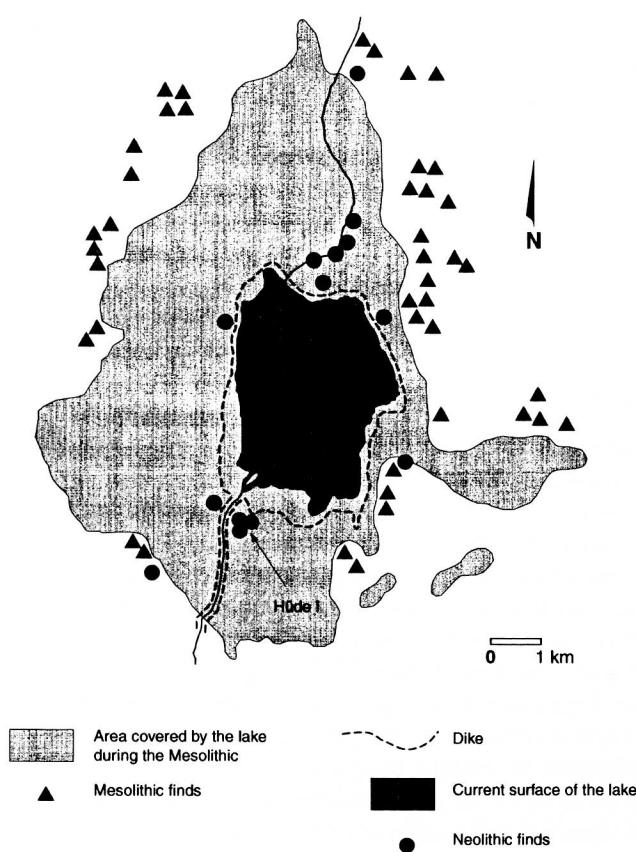
the cereals could be evidence of exchange, or could indicate that the sites were temporary occupations by groups who cultivated in other areas, as Kampffmeyer (1983) has suggested for Hüde I.

In any case, apart from somewhat meaningless discussions of terminology over whether these assemblages should be classified as Neolithic or Mesolithic, it should be noted that the samples of domestic species are usually very small and occur in contexts where subsistence continued to depend on hunting, gathering, and fishing, where material culture is clearly of the local Mesolithic tradition, and without a way of life or social relations that deserve to be termed Neolithic (Thomas, 1991).

The establishment of true Neolithic societies at the end of the fifth millennium BC has traditionally been considered to be the result of a migration of late Danubian groups from the east. In the last few years, this view has been challenged in most of the areas by the discovery of links between the first fully Neolithic groups and the local Mesolithic, and by observing a tendency of the Neolithic cultures to occur within smaller regions (much less homogeneous than the LBK), which could be interpreted as the result of indigenous influence. These Neolithic cultures might then be the result of an interpretation of damubian cultural traits by the descendants of local hunter-gatherers (Louwe Kooijmans, 1998). Thus, links have been proposed between the western TRB group and the Swifterbant culture (Hogestijn, 1990), of the variants of the Michelsberg culture of the south of Holland with Hazendonk (Louwe Kooijmans, 1993), as well as an origin in the local Mesolithic of the Villeneuve-Saint-Germain and Blicquy groups of Hainaut (Cahen *et al.*, 1986), and the north coast of France and Picardie (Fagnart, 1991).

If, indeed, there was contact between LBK and indigenous groups, what was the nature of the contact? There is little relevant information available, but we seem to be dealing with a complex, truly varied reality. It appears to have covered the gamut from rather fluid contacts which would have occurred in a relatively rapid acculturation, to manifest hostility, and almost everything in between.

The clearest example of the first situation is the introduction of the Neolithic into the area of Dümmer Lake, in Lower Saxony (Fig. 10). The site of Hüde I (Deichmüller, 1965; Kampffmeyer, 1983; Fansa and Kampffmeyer, 1985) shows the gradual appearance of Neolithic traits in contexts of undeniable indigenous character after the establishment of the first



**Fig. 10.** Distribution of Mesolithic and Neolithic sites around Dümmer Lake (after Fansa and Kampffmeyer, 1985).

agricultural settlements in the region by 5300 BC. During the first half of the fifth millennium, ceramics are present (similar to those of the Ertebølle/Ellerbek culture; see below), but no domestic species. In a second phase (approximately 4500–4400 BC), some domesticated plants and fauna appear, although in the context of a broad-spectrum, mainly hunting and gathering, economy, and the ceramics show a curious combination of indigenous traits of form and technique with decoration reminiscent of that of the Rössen culture. Finally, in the fourth millennium BC, the fully Neolithic TRB culture develops. Two types of interpretations have been proposed for the second phase of Hüde I: that it represents specialized groups of the Rössen culture, or acculturation of local Mesolithic groups by nearby Rössen populations. In either case, the relationship between LBK colonies and groups of hunter-gatherers must have been rather fluid.

In Flanders, there are fewer indications of interaction between the hunter-gatherers and the Neolithic colonists. It is likely that some type of contact existed, as suggested by some common traits in their lithic industries, such as the use of the same raw materials (like Wommersom quartzite or Céroux-Mousta phthanite), the microburin technique, and some similarities between the asymmetrical Danubian points and some Mesolithic microliths (Vermeersch, 1990). However, the relationships do not seem to have been intense. In fact, according to Vermeersch (1991), Neolithic and Mesolithic groups occupied separate areas and probably exploited separate ecological niches (see also Louwe Kooijmans, 1998). Vermeersch suggests that the low, sandy zones of Belgium would have held little attraction for the colonists, who would have settled in the silty areas, leaving most of the Mesolithic hunting territories unoccupied. Thus, there would have been little competition between the two economic systems. This situation would have remained stable until the beginning of the Michelsberg culture, around the end of the fifth millennium BC, when agricultural activities would have so altered the environment as to make hunting and gathering no longer viable. As Vermeersch himself acknowledges, the problems of chronology in the Belgian Mesolithic make this scheme only provisional (see Gob, 1990, for an alternative view). Nevertheless, the possibility of a long coexistence of Mesolithic and Neolithic groups in this region is an interesting issue, for which other explanations are possible, in addition to the agriculturalists' lack of interest in colonizing part of the territory.

The situation in eastern Belgium seems to be very different. Keeley (1990) has proposed that relationships between the Mesolithic groups of the Rhine-Meuse-Scheldt culture (RMS) and the Neolithic groups would have been manifestly hostile. He stresses the scarcity of evidence for interaction between them, despite their being very near to one another, and the existence of presumed fortifications in Neolithic settlements that are close

to the "border," such as Darion, Oleye, or Longchamps (Keeley and Cahen, 1989). Other authors challenge the military interpretation of these structures (Bradley, 1993; Whittle, 1996; and especially Lüning, 1998, pp. 177–184, where a complete reinterpretation of the site is proposed). Whether or not the relations between the RMS and LBK groups were violent, what seems certain is that they were not very intense, and perhaps almost nonexistent. In this respect, it has been argued that the few ceramics associated with the RMS culture appear much more similar to those of the distant Swifterbant culture than to those of the LBK (van Berg *et al.*, 1992), despite the proximity of contemporary LBK settlements (42 km in the case of Melsele; 34 km in that of Weelde). Also, it is possible that the few scarce remains of cattle from Mesolithic sites are of a different race from those of the Neolithic sites, but the available sample is too small for any certainty.

This suggests the interesting possibility that the diffusion of innovations was not necessarily always directly from agriculturalists to hunters. It might also have taken place along the existing lines of exchange among the hunters themselves, in the same way as the spread of the "culture of the horse" among the Native American Plains tribes in the 18th and 19th centuries was not primarily due to direct contact with the Europeans, but rather to exchange with other Native American groups.

To sum up, the transition to the Neolithic on the coastal region of the North Sea was a very complex phenomenon with varied tempos, depending on the degree of social development of the Mesolithic groups and the environmental conditions. We could define it as a mosaic process, in which the predominant role belonged to the indigenous groups, and in which there was a pause of about a millennium in the diffusion of agriculture. This probably contributed to the development of some interdependence between the hunter-gatherers and the colonists.

## SOUTHERN SCANDINAVIA

The western shores of the Baltic Sea harbor one of the best-known archaeological complexes of the European Mesolithic: the Ertebølle/Ellerbek culture, extending over Denmark, the Swedish region of Scania, and the German *Länder* of Schleswig-Holstein and Mecklenburg-Vorpommern.

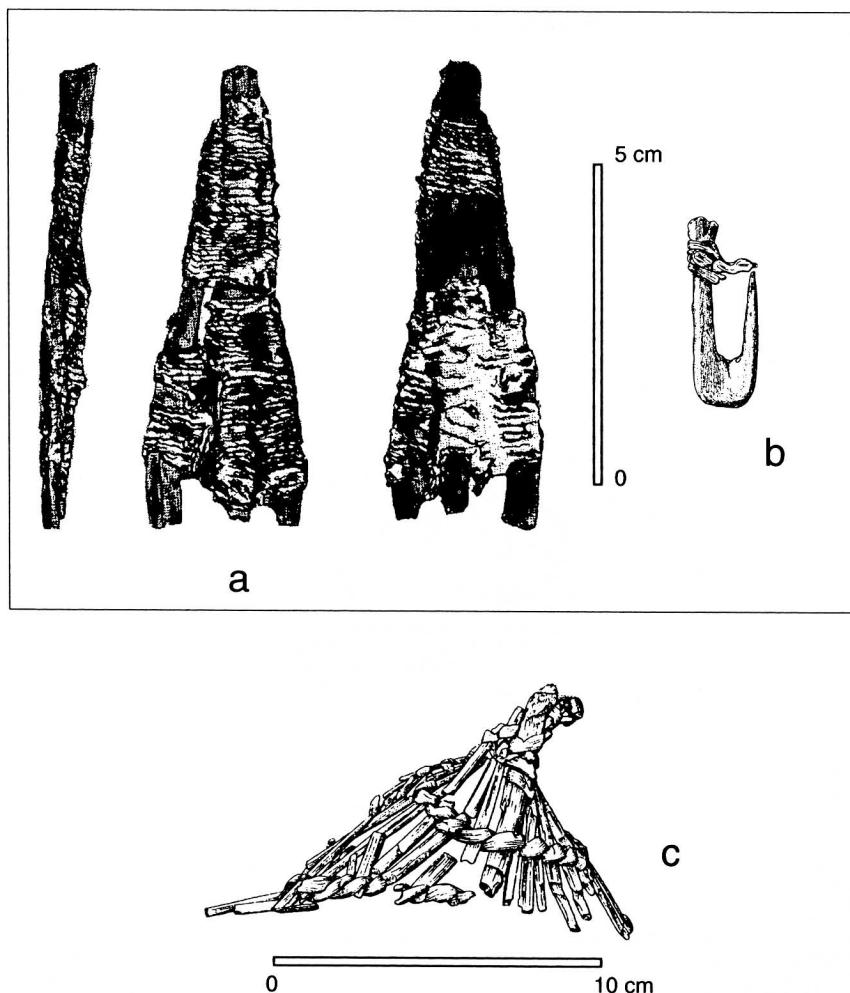
The confluence of excellently preserved archaeological evidence (including wooden objects and other organic materials) with a long and valuable tradition of research has placed the Ertebølle/Ellerbek in a paramount position in the European late Mesolithic. The Scandinavian countries have been pioneers in prehistoric research, and also in the development of natural science studies applied to the reconstruction of the past. Palynology, for

example, was born in Sweden at the beginning of the 20th century. The Mesolithic has been one of the themes to which this scientific tradition has paid most attention. The spectacular nature of the sites (enormous accumulations of oysters and other mollusks, known in Denmark as *køkkenmøddinger*) favored the development, from the mid-19th century, of intense archaeological research (Klindt-Jensen, 1975), led by great scholars such as Jens Jacob Worsaae, one of the fathers of European prehistory, and including even King Frederick VII of Denmark, who personally carried out excavations in the shell middens.

The Mesolithic communities of this region constitute the classic European example of "complex hunter-gatherers." The basis of their subsistence was the abundant coastal resources. The *køkkenmøddinger* have yielded, in addition to oysters and other invertebrates, numerous fish and marine mammals (seals above all, but also dolphins, porpoises, and whales). The impression given by such food remains is supported by paleodietary studies (mainly  $\delta^{13}\text{C}$ ), which have demonstrated that most of the protein consumed by Ertebølle groups was of marine origin (Tauber, 1981; Price, 1989). In addition, evidence of intense seasonal activities inland, centered on the hunting of wild boar, red deer, aurochs, and fur-bearing species, has recently been recovered at the Ringkloster site, in Jutland (Andersen, 1994–1995).

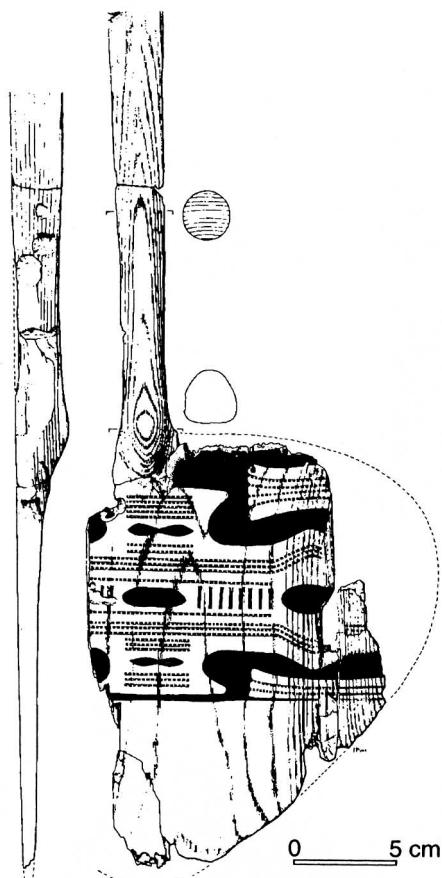
However, the prosperity of these communities was not based solely on the richness of the region, but was also a result of their ability to exploit it very efficiently, applying a wide range of specialized techniques and, probably, a complex labor organization. Fishing was particularly well developed. A great variety of tackle (hooks, harpoons, leisters, nets, baskets) (Fig. 11) and installations for mass catches were used, as well as canoes (Christensen, 1990), some with richly decorated paddles, such as those from the submerged deposit of Tybrind Vig (Fig. 12) (Andersen, 1987). The presence of species that live far from shore, such as cod, suggests fishing on the high seas. In addition, there were less hazardous coastal activities, such as the collection of oysters and mussels, the capture of seals and other marine mammals, and the hunting of migratory birds such as swans, ducks, and geese. Terrestrial resources played a secondary, but not negligible, role. There is evidence of hunting (principally *Cervus elaphus*, *Capreolus capreolus*, and *Sus scrofa*) and plant gathering. The possibility has also been raised that they developed food storage and preservation techniques (Rowley-Conwy and Zvelebil, 1989), but the evidence is inconclusive. The economic strategy of these groups lay in the diversification of resources and techniques, in order to limit the risk of scarcity. This tendency seems to increase with time: from the Maglemosian to the Ertebølle culture, the number of exploited species rose by 50% (Price and Gebauer, 1990).

This system seems to have functioned well. Mesolithic populations



**Fig. 11.** Fishing implements from Tybrind Vig (after Andersen, 1987). (a) Leister prong of hazel; (b) bone hook, with rests of twine made of plant fibers; (c) fish trap.

reached high densities, probably close to the limits generally assumed for hunter-gatherers (Lee and DeVore, 1968), and, certainly, much greater than most contemporary nonfarming societies. There are also possible indications of sedentism, or at least the use of very limited catchment areas. For example,  $\delta^{13}\text{C}$  analysis of dog bones (Noe-Nygård, 1988) shows great contrast between coastal and inland sites.



**Fig. 12.** Engraved and painted paddle of ash wood from Tybrind Vig (from Andersen, 1987).

One of the most outstanding characteristics of the Scandinavian Mesolithic is the existence of cemeteries with dozens of graves. In recent years, three important sites dated to the beginning of the fifth millennium BC (the actual radiocarbon dates range between  $6290 \pm 95$  BP [Lu-1835] and  $5930 \pm 125$  BP [Lu-1886]) have been excavated in southern Scandinavia: Henriksholm-Bøgebakken, at Vedbæk (Albrethsen and Brinch Petersen, 1976), Nederst (Brinch Petersen, 1989, 1990) in Denmark, and Skateholm, in Sweden (Larsson, 1988). The most frequent burial form was individual interment in an elongated pit. Skateholm also provides evidence for an extraordinary variety of funerary practices in corpse processing (which

occasionally includes cremation), in burial positioning, and also in the actual grave configuration, over which wooden structures were sometimes raised. Numbers of other types of structures are also known from Skateholm, including cenotaphs and dog burials (Larsson, 1990) (also present at Nederst). Many of the bodies were dusted with ochre, and there are numerous personal adornments (generally pendants), some tools, mammal bones, and offerings of fish. Several graves at Vedbæk and Skateholm contained deer antlers, sometimes forming a base on which the body was placed, or interwoven over the body.

The overall significance of the variations in posture and grave goods is not yet fully understood. It seems beyond doubt that the age and sex of the dead were important factors, but it is not clear whether the funerary ritual reflects differences in wealth or social status. Most scholars believe that there are no certain indications of social differences within the Ertebølle culture (Knutsson, 1995). Nonetheless, there are important contrasts in the complexity and abundance of the grave goods: from burials in which there is only a corpse, to very rich graves, such as one at Vedbæk, which contained a young woman with more than 200 beads and a child dusted with ochre (the only individual in the entire necropolis to receive this treatment) and laid on a swan's wing.

Indications of violent death are known from a number of individuals, such as a male in burial 13 of Skateholm I, who had an arrow stuck in his pelvis. Another example is an individual in grave 19 of Vedbæk (probably male), who had a bone point lodged in his throat.

It is often supposed that the appearance of cemeteries is related to demographic growth and sedentism. However, the latter is dubious, as Rowley-Conwy (1998a) showed for the case of Skateholm I, which was not occupied in summer. It is much more likely that the cemeteries are related to territorial behavior, of which there is other evidence in the Scandinavian Mesolithic. This includes stylistic variations in stone tools in the final phases of Ertebølle (Vang Petersen, 1984), the dietary differences between the coastal and inland sites (Price and Gebauer, 1990, p. 109), and perhaps also the evidence of violent deaths. In this respect, we note that a cemetery is more than a place to bury the dead. In many societies, it is also a statement, symbolic and material, of the possession of territory by a group (Saxe, 1970; Goldstein, 1981).

The funerary data, the evidence of intensification and specialization in production, territoriality, and trade permit a characterization of the Scandinavian Mesolithic as one of the clearest examples of complex hunter-gatherers in European prehistory.

Furthermore, these societies lasted well after the arrival of the Neolithic in the region. Around 4800 BC, groups of colonists with a culture derived

from the LBK tradition established farms along the southern limits of the area. There is clear evidence that the Mesolithic way of life remained essentially unchanged for centuries. Not until *ca.* 3900 BC do we find the first, timid indications of cultivation in Denmark and Sweden (Andersen and Rasmussen, 1993), and its real consolidation took another 600 years (Price, 1996). A similar process is documented some centuries before in the Ellerbek culture of Schleswig-Holstein (Schwabedissen, 1979, 1981; Hoika, 1990). Thus, about 1000 years elapsed between the moment when agriculture reaches the proximity of these communities and the time when they themselves put it into practice.

However, it seems that Scandinavian Mesolithic communities were aware of this new subsistence strategy. The archaeological record shows that they maintained fluid contacts with the agriculturalists, who were only some 100 km to the south. It seems that the foragers adopted some technology from their neighbors, such as pottery, which is made in Ertebølle contexts around the middle of the fifth millennium BC (but see Koch, 1998, p. 176, for an alternative view on this topic), and there was circulation among them of objects originating in the German or Polish Neolithic, such as T-shaped, antler axes (*Tüllengeweihäxte*), bone combs and rings, or the famous *Schuhleistenkeile*, or shoe-last celts (Fischer, 1982). Indeed, there is some direct evidence of familiarity with domesticates, such as the appearance of cereal pollen or grain impressions in ceramics in indigenous Scandinavian (Löddesborg, Vik) (Jennbert, 1984, p. 94; Koch, 1998, Fig. 19; but see criticism in Rowley-Conwy, 1998b) and German (Rosenhof and Ellerbek) sites, and of possible remains of domestic fauna in Ellerbek sites (Rosenhof, Satrup-Förstermoor) (Schwabedissen, 1981). The latter seemed recently to be confirmed by the dating of a bone of domestic cattle from Rosenhof to around 4850 BC (Thorpe, 1996, p. 47), but Rowley-Conwy (1995b) is critical of the domestic status of the samples. In contrast, there are few Mesolithic objects in the area occupied by the agriculturalists. Exceptions include a bow and an arrowshaft similar to those from Tybrind Vig located in the LBK wooden well of Erkelenz-Kückhoven, dated by dendrochronology between 5089 and 5067 BC (Weiner, 1994). It is possible that trade relations were asymmetrical, as often happens between groups with unequal levels of technology—for example, the exchange of prestige objects for raw materials. The frequent appearance of certain animals—sable, beaver, otter, wild cat, lynx, fox, wolf, badger, and so forth—in Mesolithic sites could be related to the exploitation of their pelts. Another exportable raw material was Baltic amber.

The earliest Neolithic in Scandinavia corresponds to the so-called *Trichterrandbecher* (TRB) culture (or, as it is locally named, *tragtbæger*). This archaeological complex, which begins shortly after 4500 BC (Midgley,

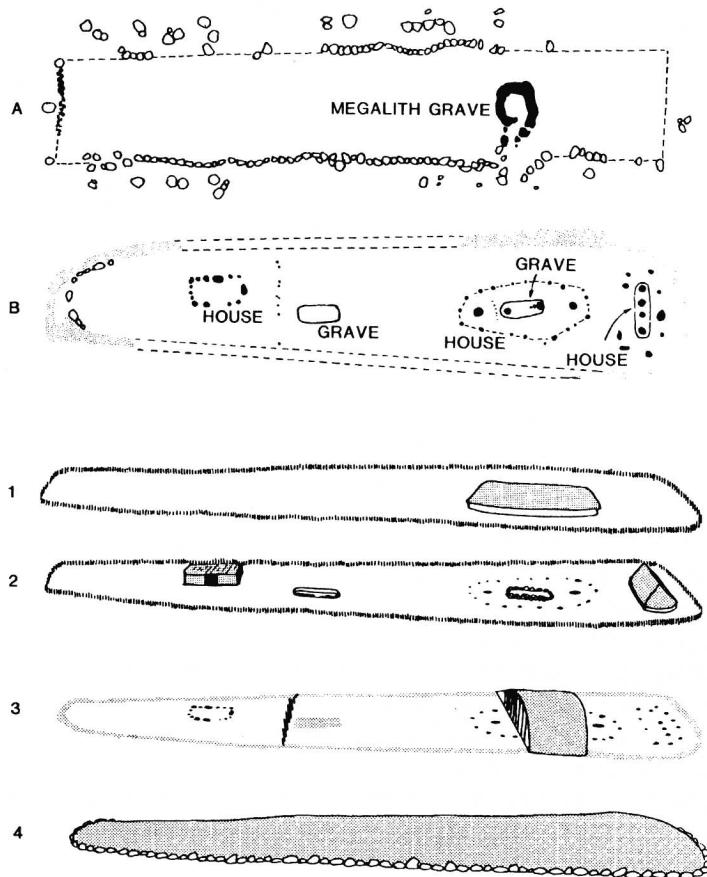
1992), rapidly spread across north central Europe, from Poland to the Netherlands, moving the agricultural border beyond the limits of the loess soils, where the first Neolithic had halted.

In southern Scandinavia, the first indications of this culture appear at the beginning of the fourth millennium BC throughout the formerly Ertebølle region. Curiously, these early sites seem to be related to very elaborate ceremonial behavior (long barrows, bog offerings), or to relatively complex economic activities, such as flint mines, rather than to habitation or subsistence tasks (Price, 1996).

In Denmark, complex and varied early Neolithic funerary constructions named *jordgrav* ("earthen grave") have recently been documented (Madsen, 1979; Liversage, 1992). They include structures of various types, normally built of wood and usually covered by very long (occasionally up to 100 m) earthen mounds. Sometimes they include other wooden structures (timber facades, palisade enclosures, mortuary houses) (Fig. 13) and indications of complex rituals, including ceramic deposits and the deliberate burning of the structures. These long barrows contain a very few burials (normally one to three), so only a minimal part of the population was buried there (see, as a reference for the TRB culture of Pomerania, Weber and Piontek, 1985). Given the important labor investment and coordination required for the construction of such buildings, along with their undoubtedly ceremonial and symbolic significance, these monuments might reflect the existence of considerable social inequalities between individuals or lineages. However, the grave goods in the long barrows are not necessarily richer than those in simpler graves (Tilley, 1996, p. 80), such as Dragsholm (see below), which suggests that the differences might be between groups rather than individuals.

A particularly interesting feature of the Scandinavian Early Neolithic is the practice of depositing offerings in bodies of water (swamps, lakes, etc.), which was greatly developed in later periods of Nordic prehistory (Bradley, 1990). The TRB ritual deposits are quite varied (Koch, 1990, 1998). The most frequent are ceramics, flint axes, and animal bones, but other objects are occasionally encountered, such as amber jewelry. There is even some evidence of human sacrifice (Sigersdal, Bolkilde) (Bennike and Ebbesen, 1986). In some sites (Salpetermosen, Søen, Tingbjerggård, Veggerslev, Siggeneben Süd, Östergötland), wooden platforms were built so that offerings could be deposited far from the shore (Koch, 1998).

Finally, the flint mines of Hov (Becker, 1959), Alborg and Bjerre in Jutland, and of Kvarnby in Scania (Rudebeck, 1987), exploited from the early phases of the TRB culture onward, are too large to have been solely for domestic or local needs. On the contrary, they served as the basis of an extensive trading system of excellent flint axes over all southern



**Fig. 13.** Long barrow at Bygholm Nørremark (from Jensen, 1982). (A) Plan of the megalithic structure. (B) Plan of grave complex below the megalithic structure. (1-4) Four main stages in the construction of the long barrow.

Scandinavia and throughout a wide zone of central Europe (Netherlands, Germany).

The evidence of complex social and religious behaviors coexists with very poorly developed settlements, smaller than those of Ertebølle and with less evidence for intensity of occupation. This has prompted investigators such as Madsen (1982, 1990) to think of small and mobile communities. In terms of subsistence, the early Neolithic is characterized by a very eclectic system in which the onset of cultivation and herding is associated with the continued importance of hunting, fishing, and gathering. The principal

changes from the Mesolithic pattern are a higher incidence of food (or at least protein) of terrestrial origin (based on stable isotopes analyses; see Schulting, 1998) and a settlement pattern less focused on coastal areas. That broad-spectrum strategy is reflected in the preferential location of settlements in places with easy access to a great variety of resources (Madsen, 1982). A true sedentary and food-producing society did not develop for some 600 years, during the middle Neolithic, when, in Madsen's words, there was a change from an "adaptive" to a "manipulative" strategy (Madsen, 1990).

How did the Neolithic come to Scandinavia? The problem is that it is difficult to compare the Ertebølle culture with the early Neolithic because of the different types of available data (settlements and subsistence-related sites for Ertebølle and ceremonial centers for the early Neolithic). At first impression, such dramatic contrasts support the traditional hypothesis of colonization from the south (for instance, Lichardus *et al.*, 1985). However, a more thorough examination of the archaeological evidence permits quite a different view.

Comparison of the general location of sites in the region shows no break in settlement pattern between the Ertebølle culture and the early Neolithic (Price, 1996). This is equally true within restricted areas that have been systematically surveyed, such as Saltbæg Vig (Price and Gebauer, 1990). There is also continuity in industries. Naturally, there are important differences between the lithic tools of Ertebølle and those of the TRB, but there are also similarities, especially in flaking technology (Madsen, 1986). This is clearer in the ceramics. As Nielsen (1986) proposed some years ago relative to techniques, and Koch has recently stated from a more general point of view, there is a continuity between the Mesolithic pottery and the local early Neolithic ceramics. Koch's meticulous work has shown that the earliest TRB pottery in Denmark, dated to 4000–3800 BC, corresponds to a transitional class (her "Type 0"). These wares are classified as funnel beakers because of their manufacture technique, even though their shape is more like Ertebølle vessels than typical TRB ceramics. These beakers come from sites such as the settlement of Åkonge (Fischer, 1993) and the shell middens of Bjørnsholm (Andersen, 1991) and Norsminde (Andersen, 1989), in which the stratigraphic sequences show no sharp changes in the evolution of the industries from Mesolithic to TRB.

In ritual aspects, there are similarities between the form of the burial chambers in the long barrows of the early Neolithic and the Mesolithic tradition. The continuity is quite evident in the case of Dragsholm (Brinch Petersen, 1974), where a grave dated precisely to the transition (K-2224: 5160 ± 100 BP; 4230–3710 BC) has features unequivocally similar to Mesolithic funerary practices (two women, covered with ochre, with personal

ornaments of perforated teeth of various animals, including domestic cattle, a flint transverse arrowhead, a bone dagger, and a bone awl). This grave was only 2 m from an individual male burial from the beginning of the Neolithic (dated to 3910–3370 BC; K-2291: 4840 ± 100 BP), with a TRB funnel beaker, amber pendants, transverse arrowheads, and a battle axe. Also of significance is the continuity in bog offerings from the Ertebølle culture to the Neolithic recently documented at the Swedish site of Hindby, where Mesolithic and Neolithic axes were deposited in the same area (Tilley, 1996, p. 110).

Thus, it seems probable that the Scandinavian TRB culture was the result of a cultural transformation of Ertebølle groups under the influence of nearby agriculturalists. With the exception of rare contrary voices (Solberg, 1989), this is the generally held opinion of most specialists who have studied this issue (Schwabedissen, 1981; Fischer, 1982; Jennbert, 1985; Larsson, 1986; Price and Gebauer, 1990). This is not surprising given the current tendency to interpret the whole TRB culture as the result of a basically indigenous transition to the Neolithic (Häusler, 1975; Jankowska and Wisslanski, 1991; Midgley, 1992). From this point of view, the expansion of the TRB to the north would not result from migration, but rather from the extension in space of the same process of change to societies that probably were already in contact in the Mesolithic. According to ideas recently developed by Thomas (1996) (in part suggested years ago by scholars such as Bailloud, 1974, p. 410), entities such as TRB and Cerny might be understood as the result of a “reformulation” of the Neolithic by indigenous groups who would have selectively adopted cultural traits of the Neolithic “package.” The result would be a much more flexible culture than the classic LBK Neolithic, which would give them a great adaptability and facilitate the adoption of the new developments by many peripheral Mesolithic groups. In turn, this would give rise to the complexes such as the Scandinavian TRB, the northern varieties of the Chasséen, and the British early Neolithic.

### GENERAL TRENDS IN THE TRANSITION TO THE NEOLITHIC IN ATLANTIC EUROPE

We arrive here at the end of our journey, from south to north along the Atlantic coast of the European continent, from the banks of the Tagus to the shores of the Baltic. The processes of transition to the Neolithic that we have examined are certainly quite varied. No doubt, the ecological and environmental conditions in which the last hunter-gatherers lived were very diverse, and the chronology of the beginning of the processes is also varied,

ranging from the middle of the sixth millennium BC (Portugal) to the beginning of the fifth millennium BC (Scandinavia). The influences and pathways by which innovations arrived in each region or its surrounding areas were also distinct. In the north, it was the LBK wave from central Europe, whereas in the south, it was mainly the Cardial horizon from the Mediterranean basin. Finally, the actual processes of change varied from region to region: immigrant groups seem to have moved into some areas, while in other zones, acculturation processes developed as a result of the presence of small foreign populations nearby, and in yet other regions, change was mainly an indigenous process, perhaps fostered by the circulation of objects and information between foragers and farmers.

Nevertheless, there are numerous and nontrivial common traits. The most outstanding and universal characteristic is the postponement of change. In every region, a long period of time elapsed (400–1000 years) between contact with Neolithic communities, providing knowledge of cultivation and animal husbandry, and the time when the hunter-gatherers decided to try these new ways themselves.

The process of accepting those innovations also ran along rather constant lines. It generally began with a long stage in which individual novelties were incorporated very slowly. First, ceramic technology was appropriated, followed by domesticated species. However, pottery never occupied a central place in the material culture as a whole, nor were the domesticates a major part of the diet. After this phase, there was usually a more dynamic and shorter stage, in which cultivation and animal husbandry take the place of the hunting and gathering as the basis of the economic system. We could call these stages the “availability phase” and “substitution phase,” following the terminology of Zvelebil and Rowley-Conwy (1986), whose model of transition from forager to agricultural society fits well the archaeological reality we have described here.

Another particularly interesting regularity is the emergence, generally in what Zvelebil and Rowley-Conwy have termed the “consolidation phase,” of the megalithic complex. This phenomenon, at once funerary, ritual, and social, extended along the entire Atlantic coast, from Denmark to the Alentejo, in the second half of the fifth and beginning of the fourth millennium BC. Although some common traits in the funerary conception and the architectural styles may be observed across this vast region, the actual monuments are so different from one another that we must consider them interpretations of the same idea by very diverse societies.

Finally, the transition to the Neolithic along the Atlantic coast is a process in which, ultimately, the indigenous component predominated, even in regions such as the coast of Portugal, where there are possible indications of immigration. Thus, a model of population replacement, as proposed by

Ammerman and Cavalli-Sforza (1984) for the origin of European Neolithic, does not seem applicable to the Atlantic coast of the Continent.

The foundations behind some of the regularities cited above are quite obvious. The Mesolithic communities of the Atlantic coast lived, in general, in quite rich areas, and developed a very efficient economic system, seemingly well adapted to the available resources. One sign of their success is the high population densities probably reached at least by some of them. Another is the development of a sedentary way of life. Therefore, we find ourselves faced with perfectly viable societies based on hunting and gathering, for whom cultivation appears to have offered no short-term advantage. It did not provide them with better food, a more leisurely existence, or a sedentism, which many already had.

We should also note the tendency of all societies to maintain the fundamental aspects of their organization. The adoption of agriculture could have meant more than simply a change in economy. It might also have been a serious challenge to the entire system of social organization and power relations (Hodder, 1990; Thorpe, 1996). From this perspective, the delay of several centuries in the adoption of agriculture should be understood as a resistance phenomenon, not as an indicator of "backwardness."

Furthermore, the adoption of some of the new techniques would not have been particularly easy. Except for Portugal (but cf. Kalb, 1989) and parts of Denmark, the areas occupied by the Mesolithic groups were not as suitable for cultivation as were the regions through which farming had expanded before the middle of the sixth millennium: the Mediterranean basin, with an environment that was similar to that where cereals and legumes were first domesticated, and the central European loess plains, which were fertile and easily worked. In Atlantic Europe, the potential farmer would have had to deal with too humid conditions and soils that were not very suitable for agriculture, from the periglacial sediments in northern Germany to the granite massifs of the Hercynian mountain range of the western regions of Iberia and France, passing through the boggy parts of the Low Countries.

In any case, the environmental conditions seem not to have been the determining factor since the human groups were able to adopt agriculture rapidly when they decided to do so. In fact, sociodemographic factors appear to be more important. While it is likely that the Neolithic groups colonizing central Europe found a sparsely populated region, along the Atlantic coast there probably were societies with population densities comparable to their own who could offer strong resistance to their advance, as seems to be documented in Belgium.

Therefore, following Binford's question of why agricultural and food-

storage techniques were developed at all (Binford, 1968), we ask ourselves why, in spite of their resistance, did the Atlantic Mesolithic groups finally become cultivators? The answer—without a doubt, not a simple one—has been sought mainly in two types of causes.

The “classic” hypothesis proposes that hunter-gatherers would have exceeded the carrying capacity of their territory and been unable to maintain their populations with existing technology. Mesolithic groups along the Atlantic coast do seem to have had fairly elevated population densities, perhaps close to the maximum for hunter-gatherers. Thus, because of demographic increases or resource decreases, maximum population limits could have been reached or surpassed. A logical response would then be to accept the new strategies of production that were already known for some time, but had not been needed until then.

This type of cause, with variants according to specific circumstances, has been proposed for various regions of the Atlantic coast. The demographic factor has been considered to be primary by Paludan-Müller (1978) for Scandinavia and by Arias (1991) for Cantabrian Spain, who note that a relaxation in control of birthrates could have led to a population growth higher than could be sustained with a hunter-gatherer economy. Other proposals are closer to the “theory of the marginal areas,” in the style of Binford’s (1968) explanation for the process of Neolithization as a whole. Some investigators have proposed, for Ertebølle, that the decline in some important resource produced by ecological changes during the Atlantic and Subboreal climatic phases, such as lesser availability of oysters (Rowley-Conwy, 1981, 1984; Larsson, 1986), or the relative scarcity of resources in interior areas (Madsen, 1986), could have obliged the hunter-gatherer groups finally to adopt food production. Such an argument has recently been restated by Schulting (1998), who suggests that a general decline in marine productivity, produced by falling sea levels, could have had disastrous effects on the dense populations of the Baltic area during the Late Atlantic period. This would have produced a rapid shift toward food production.

The alternative kind of hypothesis suggests that the fundamental causal factor might have been competition within the hunter-gatherer societies themselves. This follows the line of research initiated some years ago by Bender (1978) and recently developed by authors such as Hayden (1990, 1992). Some communities described above show indications of being non-egalitarian, with the presence of elites with increasing economic and political power. It is known from ethnography that social prestige is usually more important than coercion in this kind of process. If a society tolerates the existence of an elite, it is because its members accept that those enjoying the privileges have a right to them (Godelier, 1984). A vital part of “prov-

ing" that differences are justified and convenient is the ostentatious display of wealth and its distribution in large competitive festive occasions, such as those carried out by the "Big Men" documented ethnographically in Melanesia. From this point of view, the main purpose of food production would have not been, at the beginning, subsistence, but rather to get storable surpluses or to obtain new and exotic foods for the redistribution of wealth, which would contribute to cementing the still fragile prestige of the new elites.

These types of explanation have recently been common in the Scandinavian area, where researchers have been more concerned with looking for causes. Scholars such as Fischer (1982) and Jennbert (1984, 1985, 1994) have related the arrival of domesticated species to the evidence for the circulation among the Mesolithic groups of valuable and exotic objects deriving from the Danubian cultural sphere. Specifically, Jennbert has emphasized that possession and control of these goods probably conferred great social prestige. She suggests that such prominent people may have encouraged the initial exploitation of domesticated species in order to accumulate wealth in the context of competition with other leaders. According to Price (1996), the archaeological evidence from the early Neolithic occupation of the region is more closely related to status differentiation and exchange of valuable objects than to modifications in subsistence and settlement patterns, which, as we have seen, hardly changed before the middle Neolithic. Tilley (1996) recently stressed that the development of extensive exchange systems would have acted as a catalyst, by bringing disparate sets of ideas into a new logic, radically different from Ertebølle way of life and symbolic apprehension of the world. From this point of view, domestic species would have served as exotic and distinctive symbols in ceremonies and rites. They would have been primarily produced for social and ideological reasons rather than economic goals. They would also have radically altered the relation between human groups and the wild, which would have been reconceptualized as a threat to society and its symbolic bases.

In much of the region, the archaeological data are inadequate to test these two hypotheses. However, we will go as far as possible with the available evidence. The first type of hypothesis, the disequilibrium model, is countered by the fact that there is little evidence for a Mesolithic subsistence crisis. The only support is in indications of dietary deficiency in Cantabrian Spain, some less clear signs in Portugal, and some diseases in the Scandinavian Mesolithic that could be due to seasonal variation in the dietary quality, but could also be linked to factors such as sedentism or lack of hygiene (Meiklejohn and Zvelebil, 1991). Nor is there indisputable evidence of an abrupt population increase in the Mesolithic, which suggests that change

to the Neolithic may be more a cause of population increase rather than a consequence of it. However, this is difficult to assess, given the difficulty of estimating population density from archaeological data (Hassan, 1981; Jackes, 1992). Lastly, except for very local effects, such as those documented in the Baltic, it does not appear that there were environmental changes that would have led to the adoption of agriculture.

The hypothesis that places central emphasis on social competition has in its favor the evidence of social complexity found in Brittany, Scandinavia, and, perhaps, Portugal. More ambiguous support is the indication of violence. On the other hand, the diffusion of technology and of objects of Neolithic origin is common among the Mesolithic communities along the Atlantic coast. In addition, the exchanges were very selective. Rather than being centered on subsistence goods, they focused on luxury or exotic items that could raise or reinforce the social positions of their owners, by their possession or by the possibility of ostentatiously donating them (see Marshall and Maas, 1997, for a good ethnohistorical account of the social and ceremonial role of the first ceramics among North American hunter-gatherers). All of this suggests that the contact between the hunter-gatherer groups and the farmers might have generated, or accelerated, the social competition within the Mesolithic groups.

Against this type of explanation is the fact that social complexity was not a universal phenomenon along the Atlantic coast. There are almost no indications in Cantabrian Spain or the area of the North Sea, and those in Portugal are debatable. Another problem is logical weakness: the relationship between cause and effect is less secure than in the case of a subsistence crisis. While it is clear that the scarcity of resources almost inevitably leads to the adoption of agriculture by groups for whom the option exists, it is also clear that social tensions do not need to be resolved in all places in the same way.

In either case, we should keep in mind that the changes along the Atlantic coast were not totally independent of the general development of western Europe during the sixth and fifth millennia BC. Although archaeologists tend to conceive of the societies we study as isolated entities, in most cases they were integrated in wide exchange networks of goods and ideas, reciprocally influencing one another up to some point. This probably existed long before the transition to the Neolithic, as the extension throughout Europe of phenomena such as Paleolithic parietal art or the Mesolithic manufacture of geometric microliths suggests, but is particularly evident in the period studied here. With the possible exceptions of eastern Belgium and Portuguese Estremadura during the sixth millennium, the border between agricultural and hunter-gatherer groups along the European Atlantic coast seems to have been of the type that Dennell (1985) has named

"porous." It would have permitted a cross-flow of objects, ideas, and people. This circumstance, which is frequently documented in historical contacts between hunter-gatherers and agricultural groups, is almost inevitable for the initial settlements of farming communities. Such pioneers still depend largely on wild resources (Coles, 1976), and they often maintain relations with the indigenous communities, which may even be vital as a source of information about the new territory (Moore, 1985) and as a possible emergency resource in times of scarcity. This has been suggested, for instance, for the expansion of the LBK (Bogucki, 1988).

In the specific case of the Atlantic coast, the extremely long phase of availability—almost a millennium in some areas—must have favored the development of a complex network of relationships between foragers and farmers. This would undoubtedly have fostered changes in the indigenous way of life, facilitating the adoption of agriculture and all the transformations in the organization of labor and in the social structure that it usually unleashes. For example, changes in diet could have been encouraged by exchanges with farming communities, the occasional participation of hunter-gatherers in cultivation or husbandry (frequently documented in the ethnographic record in societies such as the Mbuti) (Wæhle, 1986; Woodburn, 1988), or the effects of possible marriages. The last could have occurred in the context of alliances between populations, in spite of cultural differences (as illustrious examples such as the marriages of the Carthaginians Hasdrubal and Hannibal to Iberian princesses show). Over the course of centuries, such occurrences would have helped smooth over the resistance of the indigenous society to change, whatever the causes that finally brought about the change.

One particularly interesting aspect of the long transition process is its relationship to the origin of megaliths. The causes of this phenomenon are not clear, although they seem to be related to the social context of the transition to Neolithic, if we understand it not only as an economic change, but also as a process of transformation of both society and of the symbolic representation that the society makes of the world. Megaliths might be, in some sense, a response to the tensions that the new ways of life would have produced in the indigenous communities. The megalithic tombs required considerable labor by many people and, by storing the bodies of ancestors, would help to maintain group cohesion. Sherratt (1990, 1995) suggested that they could have contributed to the necessary readjustment of the social systems in the process of adapting to agricultural activity, as much in the economic sphere (collective work) as in the realm of ideas and shared values and sentiments (the attachment of the members of the community to a specific territory, for example).

To sum up, the causes of the transition to the Neolithic along the

Atlantic coast are not well understood, and their clarification will require new research. At present, it appears that the hypothesis of social competition is somewhat better supported as the fundamental factor in the changes, particularly in Scandinavia. Nevertheless, aspects linked to subsistence cannot be completely discarded, especially in regions such as Cantabrian Spain, where the natural resources were scarcer than in other areas of Atlantic Europe. In any case, looking for a single cause is not realistic, since the complexity of the process and the regional diversity point to variability among the different parts of Atlantic Europe. However, the two kinds of general explanation discussed above are not completely incompatible. It is probable that when more accurate information becomes available, more complex and multicausal hypotheses may be proposed.

### FINAL CONSIDERATIONS

One of the aims of this paper has been to present systematically the most relevant archaeological information on the late Mesolithic and the early Neolithic in continental Atlantic Europe. This has permitted us to gaze from a broader perspective at a question that is usually approached from a regional point of view. It has also allowed us to make comparisons between the different processes, and has facilitated the search for regularities and differences.

Clearly, much remains to be learned about the transition to the Neolithic in this region. In particular, we need an archaeological record of broader scope and with fewer gaps, which would remove analytical dependence on a few privileged regions. Many poorly known or even unknown areas need to be incorporated into the overall picture. It would be especially useful if systematic programs of field research were developed in regions such as Galicia (northwestern Spain), northern Portugal, southwestern France, or northwestern Germany.

Nevertheless, the gaps in the archaeological record are not the main problem. Indeed, some of the regions studied here, particularly southern Scandinavia, are among the best known regions in the world with respect to this issue, with an abundant and complete corpus of data and with very high quality fieldwork. Thus, we make an observation that is no less valid for having been noted numerous times in the past 40 years: archaeological data (as in any other science) do not speak for themselves. It is necessary to analyze imaginatively and to develop new methods to deepen our understanding of prehistoric human societies, and to enable a rigorous contrast between reality and our hypotheses. In the specific cases here, what appears to be of fundamental importance is a deepening of our understanding of

the role played by domestic species and exotic objects in the social life of the people involved in the transition to the Neolithic. Likewise, it is of critical importance to explore the intensity of the relationship between hunter-gatherers and agriculturalists, and to evaluate realistically the impact that this would have had on both groups. The research that is currently being developed in much of Atlantic Europe is encouraging, but substantial effort is vital to further real progress in our understanding of one of the most interesting problems in European prehistory.

In the preceding sections, we have attempted to understand the earliest origins of farming societies in Atlantic Europe, a part of the world in which human groups apparently resisted the adoption of cultivation and animal husbandry for a long time and, in the end, contributed to the configuration of a very particular version of Neolithic society, in which notable cultural traits, such as the first great monumental architecture in Europe, were developed. The Mesolithic societies along the European Atlantic coast were not passive recipients of innovations developed in other regions, but, in accordance with their needs, they actively interpreted and, in some ways, recreated the Neolithic.

#### ACKNOWLEDGMENTS

The research in Cantabrian Spain that has led to this paper has been possible thanks to the financial support of the project “Los orígenes de las sociedades campesinas en la región Cantábrica” (Programa Sectorial de Promoción General del Conocimiento de la DGICYT; ref. PB94-1062). I am very glad to acknowledge the most valuable help of many colleagues and friends who provided me with bibliographic orientation or were so kind as to comment on previous drafts of this paper and discuss many aspects of the transition to the Neolithic in Atlantic Europe. My warmest gratitude, then, to Profs. Jean Guilaine, Serge Cassen, T. Douglas Price, Gerhard Bosinski, Jens Lüning, João Zilhão and José Luis Izquierdo. A very especial mention is deserved by Dr. Heather Stettler for her help with the translation of the original Spanish text, and by my good friend, David Lubell, for his encouragement to produce an English version of it, without whose advice this paper would probably have never been written.

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