3. Theme 2: The Nature of the Pre-submergence Archaeological Deposits

3.1 Introduction

3.1.1 Rationale

Having examined issues of the palaeo-geographic contexts that past hominids may have occupied, attention must now be turned to the nature of the evidence they left behind. As relatively few sites (when compared to the terrestrial record) are known from the Northwest European continental shelf (see Section 3.6), it will be necessary to extend the known terrestrial record offshore to provide some idea of the nature of the submerged archaeology. The use of terrestrial evidence as an analogue for the underwater deposits is not a new idea; note for instance Coles's (1998; 2000) speculative reconstructions of 'Doggerland' (the exposed North Sea basin), which were based on terrestrial material from Britain and continental Europe. This method is justified on the basis of similarities in material culture, and moreover broadly contemporaneous shifts in material culture, on both sides of the North Sea and English Channel regions (Coles, 1998; 2000, Housley et al, 1997; White & Schreve, 2000). These similarities are observable from the earliest periods of prehistory, for instance the presence of the Lower Palaeolithic 'Clactonian' and 'Acheulean' toolkits in Britain and Germany, and Britain and France, respectively, through to the latest periods; note for example the presence of early Mesolithic Maglemosian tool forms in both Britain and Scandinavia (Coles, 1998; Mithen, 1999; White & Schreve, 2000).

This therefore implies a network of contacts, either in the form of the movement of people, or the transmission of ideas across the presently submerged regions. The existence of these contacts at times in which relative sea levels were low in turn argues for the occupation and exploitation of these regions by the groups creating the archaeological record in continental Europe and the British Isles.

This section will therefore review both the known terrestrial and submerged records of Northwest Europe. Particular topics to be focused on consist of the following:

- The location of the archaeological deposits
- The composition of the archaeological deposits
- The state of the archaeological deposits
- The information regarding past societies that can be obtained from the archaeological material

An overview of these issues will provide an indication of the archaeological potential of the existing terrestrial record, and hence go some way towards highlighting the potential of the submerged evidence. Each of these topics will now be discussed briefly in turn.

3.1.2 The location of the archaeological deposits

A secure understanding of the relationship between topography, ecology, geography and the archaeological material is essential if predictive models of site location are to be constructed. This is necessitated by the fact that predictive modelling is based on the principle that sites tend to recur in environmental settings favourable to human occupation and use (Brandt et al, 1992; Wescott & Brandon, 2000). Knowledge of terrestrial patterns of site location could be applied to the seabed, assuming of course

that the submerged palaeo-land surface can be reconstructed, and that the hominids, which occupied the presently submerged area, followed similar settlement patterns to their terrestrial counterparts.

In addition it must be remembered that the environmental setting of a site may also have an influence on the sorts of post-deposition taphonomic processes that will operate on the archaeological material. For instance, it might be expected that many sites will be found in river valleys, as the presence of fresh water would have made them attractive for human settlement. However, concentrations of artefacts in river valleys may also be the result of their incorporation into river gravel terraces by natural processes of fluvial erosion and deposition (Wymer, 1992).

Finally, distributions of archaeological sites may also be the result of patterns of archaeological research (Rigaud & Simek, 1987), industrial work, such as gravel extraction (Hosfield, 1999) and or the activities of avid collectors of artefacts (Ashton & Lewis 2002). Hosfield (1999), for instance, has correlated the existence of dense findspots of Lower Palaeolithic material with areas of extensive aggregates extraction in the Hampshire basin.

This review will therefore highlight any patterns that are immediately apparent from a broad scale overview of the available literature. The potential of these patterns for use in predictive modelling will be examined as part of Section 5.

3.1.3 The composition of the archaeological deposits

Certain classes of archaeological material have the ability to shed light on different aspects of the societies under study. Tools for instance may provide information as to technical abilities, or subsistence practices, while art or ornamental objects can serve to illuminate aspects of social life. For example, the discovery of spears from a number of Lower and Middle Palaeolithic contexts, such as Clacton and Lehringen help substantiate the view that these hominids were hunters rather than scavengers (Mellars, 1996).

This review will therefore look at the available terrestrial material to identify the kind of evidence that is likely to be encountered on or under the seabed. However, it must be remembered that underwater preservational conditions are different to those on land, and consequently the composition of underwater deposits may not be analogous to those found on dry land.

3.1.4 The state of the archaeological deposits

In this instance the state of a deposit can be taken to mean the degree of post depositional reworking it has suffered. The importance of this lies in the fact that the state of an archaeological deposit has a bearing on its interpretative value and hence, archaeological potential.

Studies of taphonomic processes (e.g. Schiffer, 1983; 1987) have highlighted the fact that deposits of material culture rarely survive intact or maintain their spatial integrity over the millennia between deposition and discovery. With respect to the study of submerged landscapes it is worth considering the various categories of evidence that may be encountered on the continental shelves. This arises from the fact that any submerged material may have been disturbed or altered by marine as well as terrestrial site formation processes.

For the purposes of classification, the following definitions will be used in this paper:

• Primary context sites are assemblages in which the artefacts are still located on the past land surface (be it currently buried or exposed) on which they were deposited. This does not mean to say that the artefacts are exactly at their point of deposition, merely that the overall artefact movement caused by intervening taphonomic processes is small on a regional (i.e. beyond the confines of an individual site) scale (Schiffer, 1987). Since the spatial relationships between artefacts will not have been altered to a significant degree, the best examples of these contexts have the potential to provide 'snapshots', or very finely detailed images, of past behaviour (Gamble, 1999). This allows detailed interpretations of tool manufacturing techniques, subsistence behaviour, settlement strategies and social lives to be made. These sites will be discussed in section 3.3.

• Secondary context sites are those in which artefacts have been derived or moved from their original point of deposition by environmental processes (Hosfield, 1999; Schiffer, 1987). To quote Gamble (1999:114):

"at best they are findspots with differing numbers of items which were gathered from a number of old land-surfaces, at different times and from a range of distances."

With respect to the archaeological deposits under study, the most widespread form of secondary context consists of artefact bearing fluvial sediments typically associated with terrace landforms. These form as a result of the lateral movement and downcutting of rivers over the course of a glacial/interglacial cycle (Bridgland et al, 1995). Secondary contexts may also form as a result of other geological processes, such as permafrost action, glacial movement and solifluction. For example, as glaciers move across a land surface, they pick up and incorporate large bodies of sediment. As they retreat this material is redeposited in the form of moraines. Any archaeological material within these sediment bodies will therefore be removed from its point of origin and can potentially be deposited hundreds of kilometres away (Schiffer, 1987). Marine syn- and post-transgressive processes also have the potential to turn primary context sites into secondary context assemblages.

This review will focus primarily on fluvial sediments, as these are the most prevalent form of secondary context in early prehistory, but will touch briefly on other secondary contexts formed by marine processes.

"more Palaeoliths are found on the deposits underlying river terraces than any other context. For the most part, they are not in primary context, but derived from river beaches, old land surfaces and even earlier reworked terrace deposits" (Wymer, 1999:21)

Evidence from secondary context terrace sediments is both spatially and temporally coarse in that the artefacts within a given river system may represent a sample derived from an area of several tens or hundreds of square kilometres, over a period of up to tens of thousands of years. While these were once regarded simply as providing a source of artefacts for typological comparison and also providing broad indications of hominid presence or absence, recent work (e.g. Hosfield, 1999; 2001, 2004; Ashton & Lewis, 2002) has demonstrated that they have the potential to provide information as to long term patterns of hominid demography and land use. Ashton and Lewis (2002) in particular have used

evidence from the terraces of the Middle Thames Valley to demonstrate that British hominid populations appeared to decline from OIS (Oxygen Isotope Stage) 10 onwards with a possible absence from OIS 6 till OIS 4 (see Figure 64 for chronological subdivisions). These sites will be discussed in section 3.4.

- With respect to the investigation of submerged landscapes, it is worth considering a third category – 'tertiary contexts' (Figure 63). These represent terrestrially formed secondary contexts assemblages that have been modified as a result of either syn- or post-transgressive processes. Essentially, the processes that accompany, and follow, marine transgressions, may further rework assemblages that are already in secondary context, such as fluvial terraces. This is a new classification formulated on the basis that much of the early prehistoric record is composed of terrestrially formed secondary context sites (Wymer, 1999), and consequently, the submerged archaeological record may contain a large number of these deposits, a significant proportion of which may have undergone reworking during, and after transgression. The fact that multiple marine transgressions and regression have taken place over the Pleistocene (Chappell & Shackleton, 1986; Rohling, 1998) serves to highlight the fact that presently submerged archaeological deposits may have undergone significant reworking. These contexts have yet to be studied in any detail and their archaeological potential remains to be determined. These will be discussed in section 3.5.

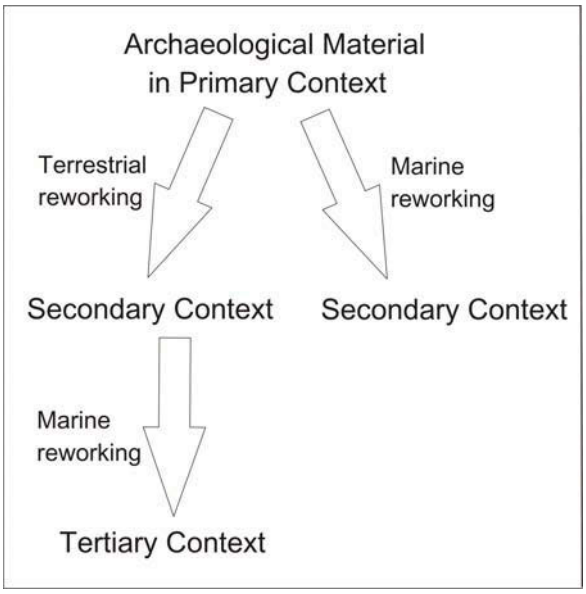

Figure 63. Diagram illustrating the progression from primary to secondary to tertiary context that will be adopted in this document. The term 'marine reworking' encompasses both syn- and post-transgressive processes.

3.1.5 Interpretation of the archaeological material

Assessing the archaeological potential of continental shelves will involve an understanding of what the relevant material can reveal about past societies. To this end, this review will highlight the existing interpretations that have arisen out of decades of studying the terrestrial (see section 3.2 to 3.4), and to some extent the submerged records (see section 3.6) of North West Europe. Where possible, it will also draw attention to questions and areas that could be investigated by evidence from

submerged contexts. This is particularly relevant given that submerged contexts could potentially provide both additional, and totally new, evidence, compared to what is currently found in terrestrial contexts. This arises from the fact that submerged landscapes are likely to contain two broad categories of evidence:

- Sites that are direct analogues to those of the same period that are currently found in terrestrial contexts. These represent inland use of the landscape before it was submerged.
- Sites located on, or near, a coastline for the purposes of occupation or interaction with, or exploitation of the maritime environment. The submergence of Palaeolithic coastlines means that barring occasional exceptions, these sites have no direct contemporary analogues in the terrestrial contexts investigated today.

Particular research questions relevant to submerged landscapes therefore include the timing and nature of inland and coastal migration routes, the antiquity and nature of marine exploitation and the role of these presently submerged regions within the wider geographical context of the past landscape (Coles, 1998; Flemming, 1998; Erlandson, 2001).

3.1.6 Chronological focus

In this review, for the purposes of analysis, the archaeological record will be broken down chronologically as follows (see Figure 64):

- Lower Palaeolithic – 500 to 300 ka BP
- Middle Palaeolithic – 300 to 40 ka BP
- Upper Palaeolithic – 40 to 10 ka BP
- Mesolithic – 11 to 5 ka BP

All dates will be expressed in calendar years unless explicitly stated.

The divisions have been made on the basis of the following:

- Archaeological evidence strongly suggests that the large-scale occupation of North West Europe did not occur until OIS 13 (528 - 478 ka BP) though brief ephemeral 'pioneer' incursions may have been made before this point in time (Roebroeks & Van Kolfschoten, 1994; 1995).
- The archaeological record of lithic tool types retains remarkable unity and stability across Europe until the emergence of the prepared core, or Levallois, technique of tool manufacture in OIS 8 (301 - 242 ka BP). In addition, the period from c.300 ka on sees the appearance of 'proto-Neanderthal' traits in the hominid population of Europe. The conventional beginning of the Middle Palaeolithic is therefore usually given as sometime between 250 (Mellars, 1996) and 300 ka BP(Gamble & Roebroeks, 1999). In this review the earlier date will be adopted.
- Around 40 ka BP, anatomically modern humans and their associated material culture appear in the European archaeological record. This marks a significant change in terms of both material culture and hominid behaviour (Klein, 1999).
- The start of the Mesolithic is traditionally associated with the Pleistocene-Holocene transition (c. 11 ka BP in calendar years, but 10 ka BP in radiocarbon years) and its end with the 'Neolithic revolution' and the replacement of the

hunter-gatherer way of life by settled agriculture (c.6 to 5 ka BP in North West Europe) (Champion et al, 1984; Mithen, 1999).

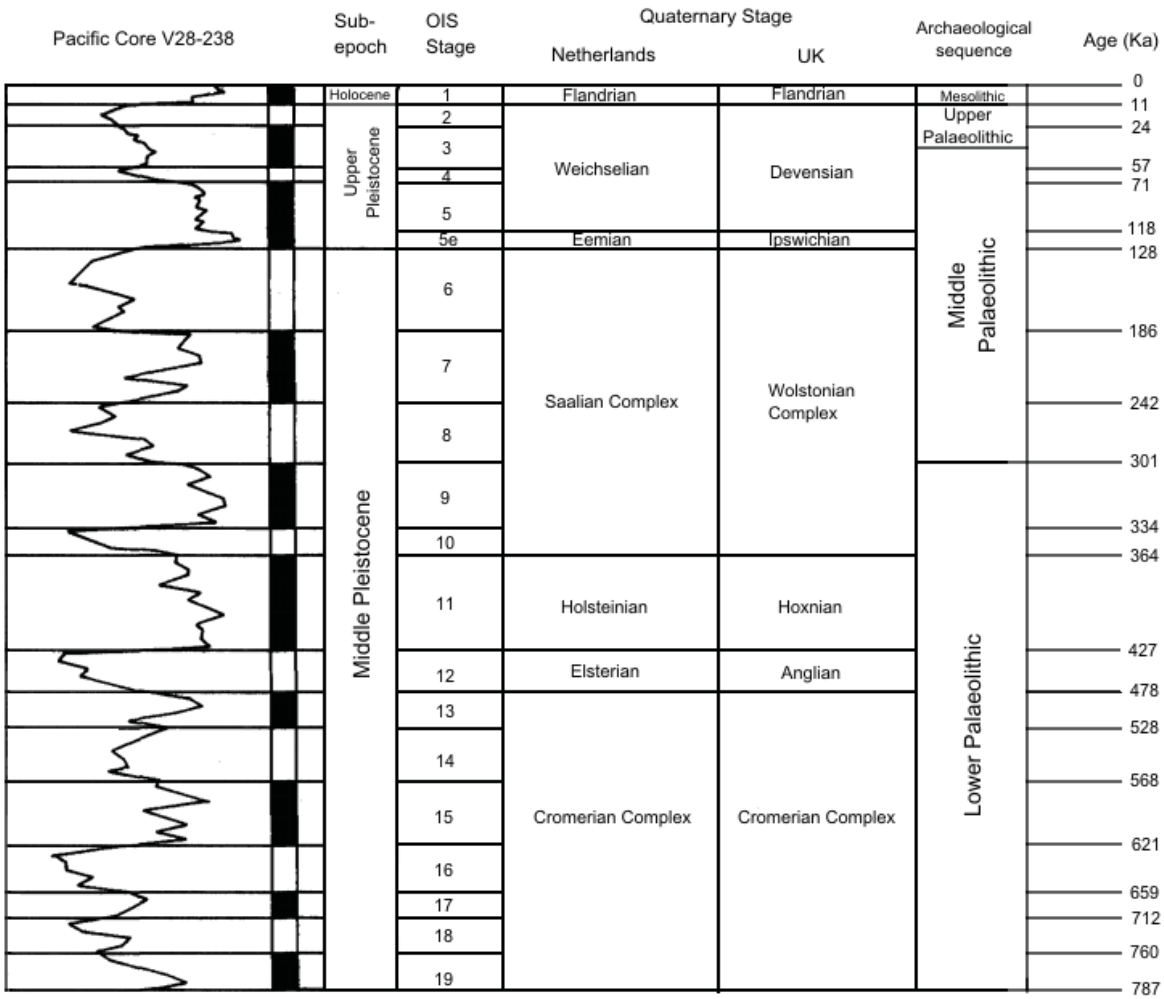

Figure 64. Chronological overview. Dark band represent warm stages, white bands represent cold stages (after Gamble, 1999; Roberts & Parfitt, 1999; Wymer, 1999)

3.1.7 Spatial focus

The archaeological records of the following countries will be examined: Great Britain, France, Holland, Belgium, Germany, Denmark, Norway, and Sweden. The choice has been made on the basis that they surround the submerged landscapes in question (the English Channel and North Sea) and thus there is a high probability that the underwater archaeological evidence will be similar to that from the aforementioned terrestrial regions.

3.2 Environmental Background

3.2.1 Overview

The long-term and large-scale environmental backdrop to these periods is provided by the alternation of global climate between glacial and interglacial phases initiated by variations in the Earth's orbit, rate of rotation and axial tilt (the Milankovitch cycle: Zachos et al, 2001).

Glacial stages are characterised by decreased temperatures, the growth of ice sheets, and decreases in global ocean volume resulting in changes in palaeo-coastline configuration (see Section 2 for full discussion of sea level change). Three major glacial phases affecting North West Europe have been identified which fall within the relevant chronological period; the Anglian/Elsterian, the Wolstonian/Saalian and the Devensian/Weichsalian (Figure 64: Woodcock, 2000). Of these, the most extensive ice cover occurred in the Anglian, extending in the south as far as the Celtic Sea, the Thames and the Severn estuary, and linking up with the Scandinavian ice sheet across the southern and central North Sea (Gibbard, 1988; Huuse & Lykke-Andersen, 2000; Woodcock, 2000). The Wolstonian ice sheet is somewhat more difficult to trace, though it likely did not extend further south than the Anglian one. The presence of pre-Devensian glacial till overlying Hoxnian deposits in the central North Sea does indicate an offshore extension of this sheet, and it too probably connected to the Scandinavian ice sheet (Gibbard, 1988). Furthermore, extensive erosional surfaces in the North Sea have been attributed to action of these ice sheets (Woodcock, 2000). The Devensian sheet is somewhat smaller than its earlier counterparts, extending only as far south as southern Ireland and Wales, with a tongue of ice extending down from North East England into the North Sea off East Anglia (Figure 65). Some debate exists over whether it connected with its Scandinavian counterparts across the North Sea, with a number of researchers inferring a connection across the northern North Sea on the basis of subglacial valleys believed to date to this time (e.g. Ehlers & Wingfield, 1991; Sejrup et al, 1998), while others see the lack of glacial sediments in this area as proof that a connection did not exist at the LGM (e.g. Long et al, 1986; Huuse & Lykke-Andersen, 2000). Recent geochronologic dating however, suggests that there was no connection across the North Sea during the LGM, but a connection may existed prior to earlier in the Weichsalian, possibly around 40 ka (Bowen et al, 2002).

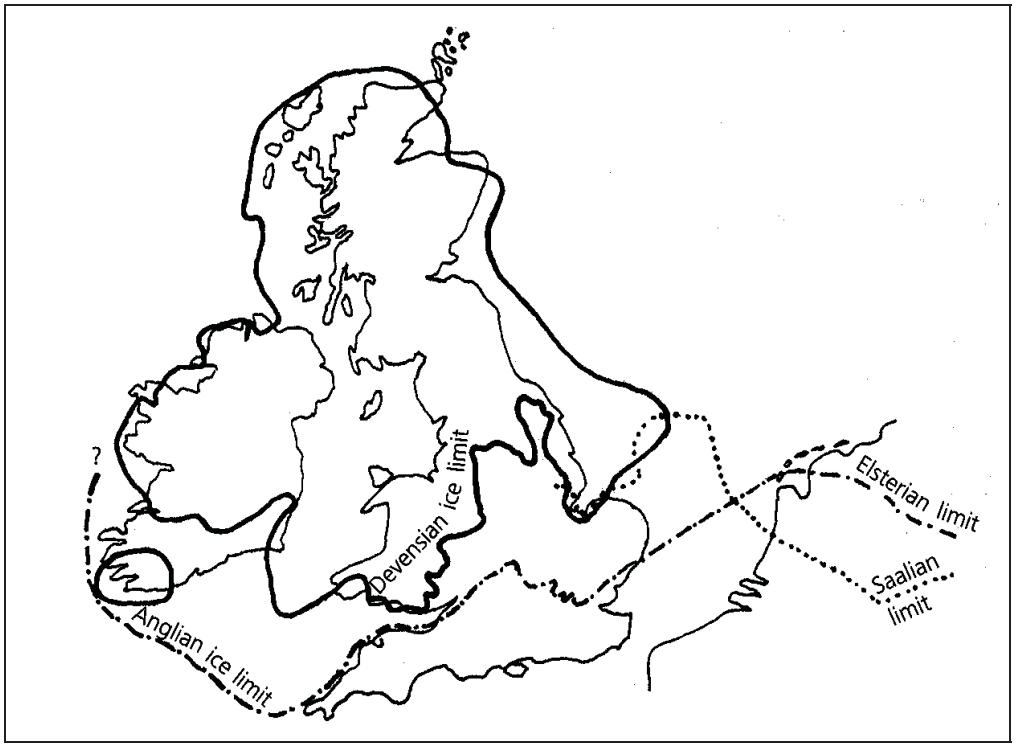

Figure 65. Approximate maximum ice limits of the Anglian and Wolstonian ice limits, and the LGM Devensian ice limits in relation to present day British shorelines. A connection between the British and Scandinavian ice sheets across the northern North Sea probably existed earlier in the Devensian (modified from Woodcock, 2000).

In terms of ecology, in North West Europe, this led to a reduction in tree cover and the replacement of woodland by open environments such as steppe tundra. The reverse is true of interglacial cycles – temperatures increased; ice sheets melted, eustatic sea levels rose and trees replaced the open steppic environments (Bell & Walker, 1992). On a smaller scale (i.e. tens to hundreds of kilometres) there will have been regional variations with respect to the composition and distribution of the flora and fauna, seasonality, temperature ranges and precipitation. Note for instance the argument that south-west France provided a 'glacial refugia' for both animals and humans during the Last Glacial Maximum (LGM) due to its greater productivity, reduced seasonality and higher temperatures compared to the more northerly areas of the continent (Housley et al, 1997; Jochim, 1987).

In addition, climatic amelioration along a west-east axis has also been suggested (Vandenberghe et al, 1998; Gamble, 1999). This amelioration takes the form of reduced seasonality and sometimes, increased precipitation in areas in the vicinity of the oceans. This 'maritime' climate results from the greater specific heat capacity of the oceans compared to the land. Water takes on, and gives up, heat slower than the land. For instance, in the continental interior heat taken on in the summer is quickly lost during the winter. Consequently, due to this moderating influence, areas in proximity to the coast have warmer winters and cooler summers than those located in the continental interior (Goudie, 2001). For example, at 13 to 12.5 (C^{14}) ka BPa difference of 7°C in the mean temperature of the warmest month between southern England and southern Sweden has been interpreted as the moderating of the cooling effect of the Scandinavian ice sheet by warm North Atlantic surface water

(Vandenberghe et al, 1998). It should be noted though that this ameliorating effect can be 'turned off' in exceptional circumstances. During the Younger Dryas (11 – 10 (C^{14}) ka BP), extended winter sea ice cover in the North Atlantic in conjunction with onshore westerly winds resulted in influxes of cold dry air to coastal areas resulting in a modification of the ameliorating trend to the point where even coastal areas such as Ireland exhibited annual temperature ranges of 30 to 34°C, a value that is normally associated with a continental climatic signature, and one that was comparable to contemporary values for areas in the continental interior, such as Poland. As a point of comparison, the present day annual temperature range for Ireland is between 9 and 11°C (Isarin et al, 1998).

The Younger Dryas cold phase also provides an example of the short term climatic fluctuations that exist within the long term glacial/interglacial cycles. Ice cores from Greenland suggest the majority of its transition to the Holocene warm phase took place at around 11.7 ka BP, when annual surface temperatures increased by as much as 5 to 10°C within the space of 20 years (Taylor et al, 1997; Taylor, 1999). In fact these short-term high amplitude fluctuations occurred regularly over the past hundred thousand years, resulting in temperature changes of up to 7°C above the intervening cold spells (Figure 66). These third order Dansgaard/Oeschger (D/O) oscillations were in turn superimposed on top of a second order cycle of interstadials (warm phases) and stadials (cold phases), each of which could potentially last several thousand years (Van Andel, 2003). These events were in turn nested within the first order sequence of glacial/interglacial cycles.

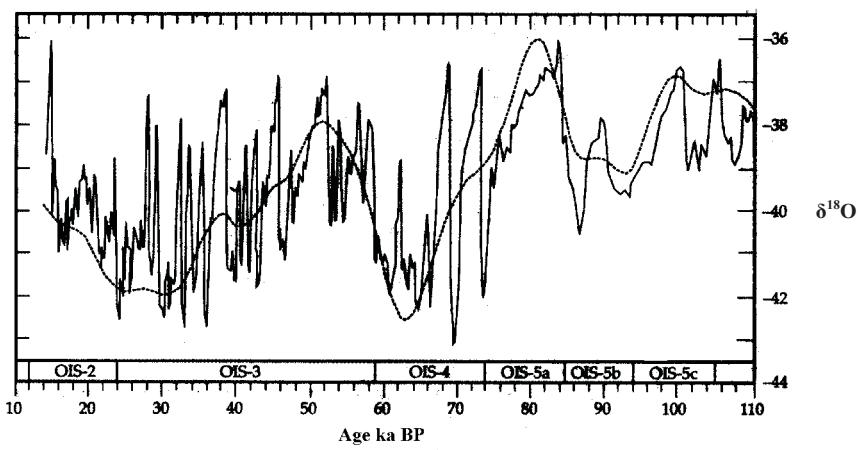

Figure 66. High-frequency high amplitude climate changes occurring over the past 100,000 years as inferred from Greenland ice cores. The smooth curve depicts the general climatic trend, while the jagged profile depicts the changes in $\delta^{18}O$ recorded in the ice. Greater values of $\delta^{18}O$ indicate cold stages (after Van Andel, 2003).

3.2.2 Implications for submerged landscape research

Glaciation provides a limiting or boundary variable to consider when assessing areas that might contain archaeological material. In effect, areas covered by glaciers will be uninhabitable and thus contain little or no archaeological material. Furthermore, any artefacts deposited prior to glaciation are likely to have been destroyed or intensively damaged by the ice advance, while sites will be converted from primary to secondary contexts (Flemming, 2002). Indeed the extent of reworking it such that Gibbard (1988) has described it as 'total landscape remodelling'. Therefore, looking at the

available data on glacial limits and shoreline positions, submerged landscapes of varying archaeological potential in the study area can be defined. These are as follows:

- The coast of Scotland. Due to isostatic uplift, any areas occupied by humans since the retreat of the ice sheets will have been elevated beyond mean sea level rather than being submerged. In addition, there is no evidence for a pre-Holocene occupation of Scotland.
- The North Sea. Any material dating from prior to the LGM may well have been disturbed or destroyed by the impact of the Anglian, Wolstonian and Devensian ice sheets, except in the most southerly parts of the area (the Southern Bight). These sheets will also have rendered this area uninhabitable for long periods of time. Hence the majority of material found here is likely to date to the Late Pleistocene and Holocene after the ice sheets had retreated.
- The English Channel. This area is free of glacial action and hence may have been occupied during glacial periods. In addition its archaeological deposits will not have been directly affected by destructive glacial processes.

A further aspect to consider is the impact of shorter term events such as interstadials, stadials and D/O events on sea level change, and palaeo-coastline position. While they are known to have an impact on the magnitude and extent of ice sheets (Van Andel, 2003), their effect on shoreline position has not been addressed to a significant extent. The latest glacio-eustatic curves (Siddall et al, 2003) do provide a high resolution picture of rapid global fluctuations in sea level, but these have yet to be correlated with specific climatic events. However, the isostatic effects of these short term fluctuations have not been considered in great detail. The implications of this are that snapshot reconstructions of shoreline position similar to those presented in Section 2 represented only a partial representation of the total situation, in that between each snapshot, rapid sea level fluctuations of several meters could have changed the coastline configuration by as much as several tens of kilometres.

3.3 Archaeological Material in Primary Context

3.3.1 Background

As stated in section 3.1.4 assemblages in primary context are those in which the archaeological material has not been modified or disturbed to any significant extent by post-depositional taphonomic processes. With respect to the periods in question a useful test of this is whether the lithic material can be refitted, assuming that knapping took place on site (Figure 67: Gamble, 1986; Schick, 1986).

A B

Figure 67. A) Refitted Upper Palaeolithic blade core. B) Exploded view of the same core showing the original core and detached flakes and blades. Refitting represents a useful way of ascertaining if a site is in primary context (after Barton, 1997)

Archaeological evidence from primary contexts from the Lower Palaeolithic to the Mesolithic consists primarily of some, or all, of the following (Wymer, 1976, 1982; Gamble, 1986, 1999; Champion et al, 1994; Klein, 1999):

- Stone tools and débitage.
- Bone tools and other worked items.
- Unmodified or cut-marked bone, both hominid and animal.
- In exceptional circumstances (e.g. waterlogging), other organic material, such as wood, may be preserved.
- Art. This consists of parietal (wall) art and also mobile decorated or ornamental objects. It is restricted to the Upper Palaeolithic and Mesolithic.
- Structures. Evidence consists either of postholes or the foundations of the structure in question.
- Hearths.

The importance of primary context evidence is that it provides a fine-grained picture of past lifeways, hence the frequent use of the terms 'snapshot' or '15 minute episode' (e.g. Gamble, 1999) when describing exceptionally preserved examples of these contexts. In reality, the time span of the depositional processes may range from a matter of minutes to a period of months or years. Therefore, while a primary context site may be spatially coherent, it must be remembered that it could represent something of a temporal palimpsest. For instance, where detailed dating, or stratigraphic separation is not available, a large dense accumulation of archaeological material could represent a single long term occupation, or the abandonment and reuse of the site over a longer period of time.

Primary context sites are also important in that in some cases biological evidence such as pollen, molluscs, insects and small vertebrates may be preserved. These provide material that can often be dated and provides information on the palaeo-environment (Wymer, 1976).

Individual primary context sites can potentially provide great detail on technology, subsistence patterns and social organisation within the context of a particular group at particular place and time. For example, an examination of the relative frequencies of certain artefact forms (assuming their functions are known) could allow interpretations to be made as to whether a particular locale had functional or social significance within the wider landscape. However the elucidation of broader temporal and spatial patterns requires these sites to be looked at in conjunction with evidence from other primary contexts and also the available secondary context evidence. Specific examples of primary context sites and their interpretation will be discussed in the following sections.

3.3.2 The Lower Palaeolithic

3.3.2.1 Hominid species

Fossils from the Lower Palaeolithic tend to be attributed to *Homo heidelbergensis*; the generic term given to the early European populations (Klein, 1999; Lewin, 1999; Gamble, 1999). There is some debate over the use of the term *H. heidelbergensis* in that the specimens so far discovered exhibit varying degrees of similarity with preceding *Homo ergaster* and later *Homo neanderthalis* populations. Klein (1999) for instance makes use of the term 'early *H. neanderthalis*' in preference to *H. heidelbergensis*. In general though, *H. heidelbergensis* is primarily used as a chronological definition, in that it encompasses the various European specimens that date from the first large-scale occupation of Europe (c.500 ka BP) till the appearance of 'proto - Neanderthals' from about 300 ka onwards (Mellars, 1996).

Remains have been found at a number of sites including Boxgrove (Britain), Mauer and Bilzingsleben (both Germany) (Bosinski, 1995; Mania, 1995; Roberts et al, 1994).

3.3.2.2 Archaeological evidence

The most common form of evidence consists of scatters or concentrations of stone artefacts, débitage and faunal remains. Assemblages have often been classified on the basis of whether they contain the classic type fossil of the Lower Palaeolithic – the Acheulean hand axe (Figure 68). Assemblages without these tools have often been assigned to separate technological traditions, such as the Clactonian or proto-Mousterian (Klein, 1999). Evidence suggests that there is a continental divide running north-west to south-east roughly corresponding to the course of the Rhine, with handaxe bearing assemblages restricted to the southern and western regions, and non-handaxe assemblages restricted to northern and eastern areas (White, 2000; White & Schreve, 2000). Questions have arisen as to whether this is evidence of separate groups of hominids with different levels of social learning (e.g. Mithen, 1994), hominid planning behaviour (e.g. Wenban-Smith, 1998), a reflection of different activities (e.g. Ashton & McNabb, 1994) or a factor of local raw material availability (e.g. Ashton, 1998) (see White (2000) for an overview of this debate).

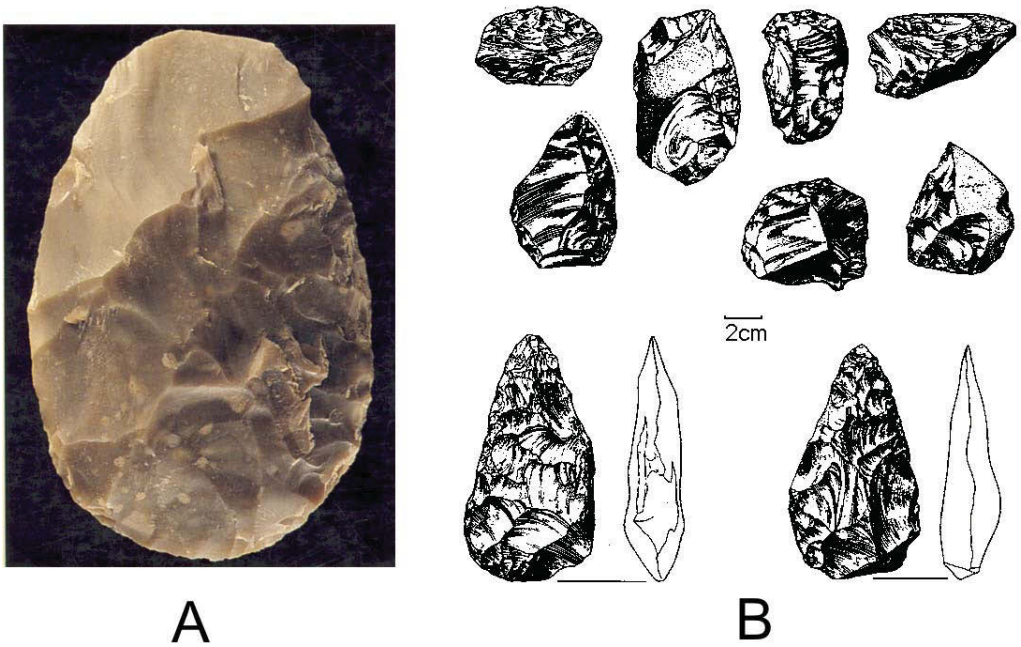

Figure 68. A) Ovate handaxes from the site of Boxgrove, southern England. B) Selection of Acheulean tools: scapers (top) and handaxes (bottom) (after Barton, 1997)

The dominance of stone artefacts in the archaeological record is as much a reflection of their durability as hominid raw material preferences. Artefacts made on other raw materials have been preserved in a number of instances. A number of rhino and elephant bones that have flaked in much the same way one would knapp a flint nodule were recovered from Bilzingsleben, while among the best known examples of preserved organic artefacts are the wooden spears from Clacton (Britain) and Schöningen (Germany: Figure 69 - Klein, 1999; Gamble, 1999). In terms of recovery, organic artefacts tend to be less common than in later periods.

Figure 69. 2.3m long spear from Schöningen, Germany. The preservation of wooden objects from this period is rare, except in exceptional circumstances, such as this (from Barton, 1997).

Organic evidence though is often preserved in the form of the remains of animals. If the environmental tolerances of the species in question are known, they can be used as proxy indicators of palaeoclimate and to some extent, chronology. For example, in Britain each of the four post-Anglian (OIS 12) interglacial stages, is characterised by its own distinctive mammalian faunal grouping. Stage 11, the first of these interglacials, for instance, is characterised by the presence of cave bear (*Ursus spelaeus*) and a large subspecies of fallow deer (*Dama dama clactoniana*). The presence of these species at the primary context sites of Hoxne and Swanscombe (both Britain) places them both within this interglacial (Schreve, 2001). These and other members of the faunal assemblage such as the rabbit, horse and pine vole, also indicate that conditions were as warm as today's during this period. In addition, at Swanscombe, changes in the faunal assemblage over time can be observed, with numbers of woodland species such as *D. d. clactoniana* decreasing, and grassland taxa such as horse increasing. This implies an ecological shift within the interglacial from closed to more open environments (Schreve, 2001). Should these mammal remains bear cut marks or evidence of human modification, they can provide indications as to the subsistence patterns of these hominids.

Evidence for built structures in this period is somewhat equivocal. Several sites have concentrations of artefacts and other debris that could mark the position of huts or shelters. At Bilzingsleben for instance, three semi circular concentrations of travertine blocks and animal bones have interpreted as weights to hold down structures, possibly windbreaks or shelters of some sort (Mania, 1995). An alternative interpretation however, has suggested that these concentrations may in fact be the result of deposition of material around trees, rather than shelters (Gamble, 1999). This particular site will be discussed further in the next section.

3.3.2.3 Sites

A number of well-preserved sites in primary context do exist for this period. These can occur when low energy fluvial or lacustrine sediment are deposited over archaeological material. Examples of this include Miesenheim I (Germany) and Hoxne (Britain). The low energy nature of the process means that the artefacts maintain their spatial relationships, while the deposited sediment serves to protect the material from destructive taphonomic processes. Similarly, evidence can also be preserved in situ through burial by wind blown loess. Examples include the Karlich site in Germany and Cagny-la-Garenne in France (Wymer, 1976; Bosinski, 1995; Gamble, 1999). Three examples of primary context sites are listed below. They have been chosen on the basis that they illustrate the various settings in which exceptional preservation can occur.

- *Boxgrove (Britain) – Primary Context Coastal Site – OIS 13 – c. 500ka BP*

The site of Boxgrove in southern England represents an example of a coastal site in primary context. At present it is situated on a raised beach some 10km from the current shoreline. At the time of deposition of the main in situ assemblage, the surrounding environment would have consisted of lagoonal mudflats created by marine regression (Figure 70).

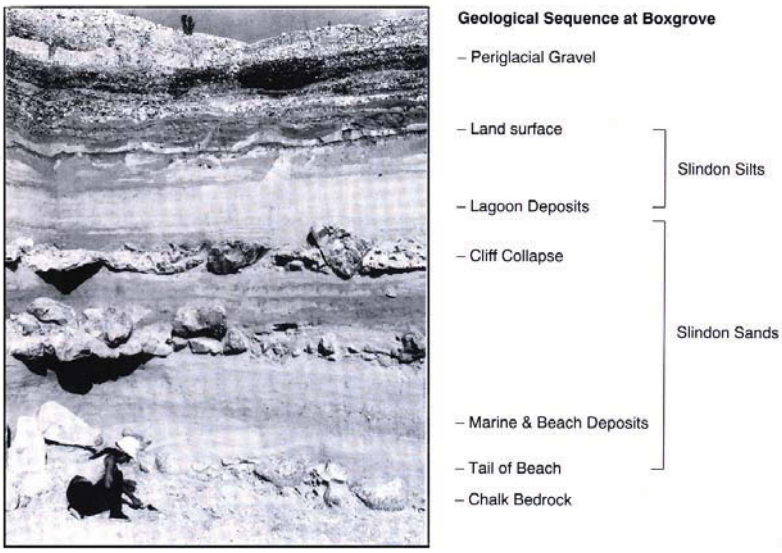

Figure 70. Stratigraphic section and geological sequence at Boxgrove. This highlights the coastal nature of the site (from Barton, 1997).

Earlier levels at the site do contain several flakes, handaxes and butchered bones that appear to have been discarded in what was then the intertidal zone. The site is located at the base of a chalk sea cliff, and consists of several discrete lithic and bone scatters, which imply on site flint knapping and animal butchery. The source of the flint appears to have been the aforementioned sea cliff. Refitting and use wear analysis point to the fact that handaxes were manufactured on site, used to butcher animal carcasses and then discarded. In addition to the animal remains, a *H. heidelbergensis* tibia and two teeth have been recovered. Although fish bones have been recovered from the site, it is not known if these were part of the hominid diet or introduced to the site by natural processes (Roberts et al, 1994; Stringer et al, 1998; Roberts & Parfitt, 1999).

- *Bilzingsleben (Germany) – Primary Context Terrestrial Site – OIS 11*

The site of Bilzingsleben (North Germany) was situated on the shore of a shallow lake. The remains of freshwater fish are present as are the remains of larger mammals. These have been attributed to the subsistence practices of the hominids occupying the site. Several concentrations of material have been interpreted as semi circular dwelling structures, each of which is associated with a hearth. Other concentrations of material have been interpreted as workshop areas with anvils of stone or bone. The lithic industry includes flake tools, choppers but no Acheulean handaxes. In addition to stone, wood and bone artefacts, the remains of three hominids are also present. This site has been interpreted as the home base for a group of these hominids for some time (Mania, 1995). An alternative interpretation however sees the site as the product of the reuse of this particular locale over many years and visits, possibly as a result of its affordances. According to this perspective, the anvils were the focus of social and technical activity, while the apparent 'structures' were the product of concentrations of material around trees. The site is thus seen more as series of gatherings rather than built campsite (Gamble, 1999). At present, the archaeological evidence does not support one argument over the other.

- *Hoxne (Britain) – Primary Context Terrestrial Site - OIS 9 or OIS 11*

At the time of occupation the site was located on a lakeshore. This location resulted in the archaeological deposit being sealed in fine-grained lacustrine sediment which ensured its preservation in primary context. Dating of the site is somewhat uncertain, with thermoluminescence (TL) dating of burnt flint (298+/-16 ka BP and 330+/-27 ka BP), uranium series (U-Th) and electron spin resonance (ESR) (average of 319+/-38 ka BP) placing the archaeology in OIS 9, but biostratigraphical considerations suggesting a date of OIS 11. In terms of the archaeological material, handaxes and flakes have been found, as have the remains of various mammalian bones and teeth, some of which bear cut marks. Stone clusters and a stone 'emplacement' have been regarded by some as early evidence of built structures (Singer et al, 1993; Wymer, 1999).

The majority of the primary context archaeological evidence for the Lower Palaeolithic occupation of Europe is found near water sources, such as streams or lakeshores; examples include the aforementioned sites of Bilzingsleben, Hoxne, and others such as Swanscombe (Britain) and Miesenheim I (Germany) (Bosinski, 1995; Mania, 1995; Gamble, 1999).

"Open fluviolacustrine habitats with diverse and abundant resources were extensively targeted by Middle Pleistocene hominids." (White, 2000:49)

To some extent, this can be attributed to hominid choice. These areas would have been preferred due to the presence of fresh water, raw material (e.g. flint eroding out of river banks), and other animals. In addition, rivers may have facilitated movement around the landscape (Wymer, 1982, 1992, 1999). This preference is substantiated by its recurrence in similar patterns across the world. The Rift Valley of East Africa, for instance is home to a number of well known lakeside sites occupied by early hominids, such as Olduvai Gorge, Koobi Fora and the Turkana Basin sites (Wymer, 1976, 1982; Rogers et al, 1994; Klein, 1999). However, site formation processes are also likely to have played a part in creating this pattern, in that low energy fluvial or lacustrine sedimentation represents an ideal context for fine-grained preservation. Areas on the edges of abandoned channels or oxbow lakes are regarded as particularly amenable to preservation of primary context as they are still located on the floodplain, but far enough away from the main stream that they escape erosion at a later date (Wymer, 1992).

The vast majority of sites also appear to be located in the open air. Whether this is entirely the result of hominid preference is uncertain since it has been pointed out that most caves from this period have collapsed and their deposits eroded or scoured away (Wymer, 1982; Klein, 1999).

With the exception of Boxgrove, coastal sites in primary context are not known for North West Europe. Worldwide, a number of sites do exist which have been interpreted as possible examples of early coastal exploitation. The closest one to the study region is Terra Amata (c.300 to 250 ka BP), which is located on the French Mediterranean coast and which contains shellfish and fish remains in association with various lithic implements (Erlandson, 2001).

Although primary context sites do exist for the Lower Palaeolithic, they tend to be rather rare, especially when compared to the sheer quantity of archaeological material obtained from river gravel deposits. In Britain, there are only 11 primary context sites for this period compared to the several hundred derived assemblages. These 11 sites

are Boxgrove, Clacton, Swanscombe, Hoxne, High Lodge, Stoke Newington, Barnham, Red Barns, South Woodford, Dartford Heath, West Stow (Wymer, 1992, 1999).

Indeed in Scandinavia, no primary context assemblages have been discovered though some evidence in secondary context has been attributed to this period. In this area the original sites are likely to have been disturbed by a combination of glacial movement, periglacial activity and fluvial processes (Hølm & Larsson, 1995).

3.3.2.4 Interpretation

Claims have been made for a hominid presence in North West Europe as early as 1 million years ago (Roebroeks & Van Kolfschoten, 1995; Klein, 1999). However, the bulk of sites dated to this period suffer from either a lack of hominid remains, the exception being Atapuerca TD6 (Spain), which is in any case outside the study area, or the possibility that the artefactural evidence may be the product of natural forces rather than hominid manufacture (Roebroeks & Van Kolfschoten, 1994; 1995).

The earliest undisputed evidence for a hominid occupation appears in OIS stage 13 (538-478 ka BP). Sites from this period are found in both primary and secondary contexts, while human remains and undisputable artefacts such as Acheulean handaxes are common. Earlier sites do occur sporadically in southern Europe, notably Atapuerca, Orce (both Spain) and Ceprano (Italy) which date to between 1 Myr and 700 ka BP. Overall the pattern seems to be one of restriction to warmer southern European climes with possible sporadic excursions north, until 500 ka when the large scale colonization of more northerly European latitudes (Gamble, 1999).

In terms of the occupation of the most northwesterly part of the continent (i.e. Britain) a pattern emerges after 500 ka. Clactonian, or assemblages without handaxes, appear in the initial stages of OIS 11(Hoxnian) and OIS 9 (Purfleet) interglacials before being replaced by Acheulean (handaxe bearing) assemblages, followed by a subsequent lack of archaeological material during the glacial maxima of OIS 10 and 8 (White & Schreve, 2000). White and Schreve (2000) have interpreted this patterning as the result of separate pulses of colonization following the abandonment of Britain during glacial maxima, with Clactonian populations arriving in Britain from northern and central Europe in the early parts of interglacials before being replaced by Acheulean populations from the south. Various explanations for this patterning have been proposed, notably the presence of physical, ecological or social barriers that allowed one population access to Britain before the other (White & Schreve, 2000). This scenario is plausible but not entirely certain, as various other arguments have also been proposed to explain the difference between the Clactonian and the Acheulean, notably Ashton's (1998) suggestion that the presence or absence of handaxes reflects the suitability of local raw material and the particular focus of hominid activity.

It is likely that these hominids were hunters. Evidence for this comes in the form of the Clacton and Schoeningen spears and the presence of cut marks appearing on animal bones before the gnaw marks of non-human carnivores, thus implying the prey animal was initially killed and butchered by hominids (Roberts & Parfitt, 1999). In terms of function, use wear analysis has indicated that stone tools were used on a variety of raw material including bone, antler, meat, plant material and wood. One to one correlations between tool types and functions are still somewhat speculative

though experiments have illustrated the usefulness of the handaxe as a butchery implement (Schick & Toth, 1993).

With respect to the occupation and exploitation of coastal and aquatic environments very little is known. A number of sites do contain the remains of fish and shellfish, though whether hominids or other animals brought these in has yet to be determined. The Boxgrove site is situated on a beach; however whether this was for a coastal or maritime reason, or simply that flint was easily obtainable from the cliff is uncertain. In general, primary context sites from this period have been able to shed light on hominid subsistence practices (e.g. via the cut marked bones from Boxgrove and Hoxne), their technical abilities (e.g. via the in situ flint scatters at Boxgrove) and also to some extent their planning aptitude and use of resources. For instance, the presence of discarded handaxes in mint condition at Boxgrove implies that their construction and use was something of an immediate term response to a need, in this case animal butchery, rather than them being curated tools that were transported about the landscape (White, 2000).

3.3.2.5 Implications for submerged landscape research

The undisputed presence of hominids in Britain as early as OIS 13 argues strongly for an occupation of the submerged landscapes in question, when they were exposed during the Middle Pleistocene, and implies they played a role in the colonization of Britain given the lack of evidence for watercraft in this period. For instance, an investigation of these areas could serve to confirm or deny White and Schreve's (2000) suggestion that the Clactonian and Acheulean toolkits in Britain represent the archaeological signature of separate pulses of colonization and migration by hominids from central and eastern Europe (Clactonian) and southern and southwest Europe (Acheulean).

Based on the distribution of known terrestrial sites, prime areas to undertake site prospection would be situated close to water sources, such as rivers, lakes or springs. This is most likely a factor of hominid preference for these areas and the high preservation potential of low energy fluvial sediments. The anaerobic environment of the seabed sediment could potentially enable the preservation of organic remains. These would enhance existing palaeoenvironmental records, while any organic artefacts would fill in some of the vast gaps in the current evidence. The survival of stone artefacts from the Lower Palaeolithic in submerged contexts is more certain though, with the recent discovery of three Acheulean handaxes in 8m of water in Table Bay, South Africa (Flemming, 1998; Werz & Flemming, 2001). The existence of coastal sites (e.g. Boxgrove) certainly indicates that hominids were not avoiding the littoral zone. More evidence from the coastal zone would go some way to determining the reason they were there. Possibilities include the coast as a route for migration (e.g. Stringer, 2000) or a source of resources (Erlandson, 2001).

3.3.3 Middle Palaeolithic

3.3.3.1 Hominid species

The Middle Palaeolithic is characterised by the appearance of Neanderthals (*Homo neanderthalis*), the descendants of the *H. heidelbergensis* populations of Europe (Lewin, 1999). Specimens exhibiting the 'classic' Neanderthal physiology do not appear until OIS 5 (127 to 71 ka BP), however the specimens dated to before this time can be thought of as 'proto-Neanderthals' or transitional specimens in the

evolutionary progression from *H. heidelbergensis* to *H. neanderthalis* (Mellars, 1996; Klein, 1999).

3.3.3.2 Archaeological Evidence

As in the preceding period, lithic implements, debitage and faunal material dominate the archaeological record. The classic knapping technique of the Middle Palaeolithic is known as 'Levallois'. This involves the shaping and modification of a lithic core so as to control the size and shape of the subsequently struck flakes (Bordes, 1980; Schick & Toth, 1993). Tool industries of the Middle Palaeolithic, such as the Mousterian, tend to be characterized by a reduction in the numbers of large bifacial tools such as Acheulean handaxes, an increased emphasis on flake tools often made using the Levallois technique, such as the bout coupe handaxe (Figure 71). Retouching of flakes and other tools was also a common practice designed to resharpen blunted edges (Dibble & Rolland, 1990).

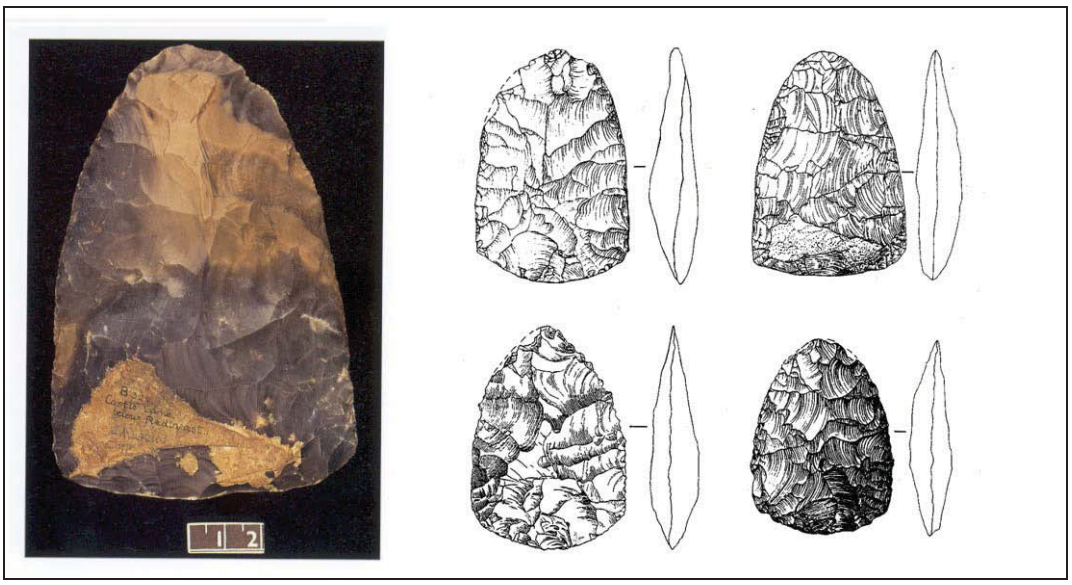

Figure 71. Mousterian or bout coupé handaxes commonly found in the Middle Palaeolithic of southern England (after Barton, 1997; Mellars, 1996).

Microwear analysis has suggested functions for certain classes of tool form. Notches and denticulates appear to have been used mainly on wood, while sidescrapers and points were used on both wood and flesh. There is no equivocal evidence for hafted tools, however marks and striations on some points could indicate friction caused by hafting while impact fractures on some pieces, such as those from the site of La Cotte de St Brelade (Jersey), strongly hint that they were used as weapon tips or projectile points (Callow, 1986).

Exceptional instances of preservation have resulted in the survival of artefacts made of organic raw materials. The German site of Lehringen for example has produced a 2.4m long wooden spear, while some 30 tools made on mammoth bone have been recovered from the site of Salzgitter Lebenstedt (Klein, 1999; Roebroeks & Tuffreau, 1999; Gaudzinski & Roebroeks, 2000).

As before, faunal remains have the potential to inform us about palaeo-ecology; and should they have been accumulated and utilised by past hominids, provide information as to their subsistence organisation. Mauran (France) for instance is almost entirely composed of prime age bison, thus implying that some sort of selective hunting strategy was in operation, while La Cotte de St. Brelade has strong indications of specialization in rhino and mammoth (Scott, 1980; Mellars, 1996).

Deliberate burials are one facet of evidence that serve to distinguish this period from the preceding one. Examples include the sites of Le Moustier, La Chapelle-aux-Saints and La Ferrassie (all France - Gamble & Roebroeks, 1999). Whether these involved ritual or ceremony is uncertain as the grave goods are no different to the artefacts that constitute conventional assemblages.

3.3.3.3 Sites

On a continental scale, sites in primary contexts are more common than in the Lower Palaeolithic. Southwest France for instance has over fifty cave and rockshelter sites and several hundred open air sites (Mellars, 1996). However, this pattern does not apply to all regions. As before, Scandinavia lacks any such sites, while Britain has less than ten. The lack of such sites in Britain is partially the result of the fact that there appears to be a break in occupation between 180 and 60 ka (AHOB, 2003; Ashton & Lewis, 2002) as well as the reworking of the primary context evidence by fluvial and other taphonomic processes.

In terms of site location patterns, many Middle Palaeolithic sites are found in rockshelters or caves. This may be a reflection of archaeological research as much as than hominid preference in that cave sites are preferentially investigated as they are more obvious sources of archaeological material than open air locations. This results from the fact that discovery of open air sites tends to be fortuitous, while caves and rockshelters are rather more obvious places to look for archaeological material (Rigaud & Simek, 1987; Bocquet-Appel & Demars, 2000). In addition, the sheltered environment of a cave is more likely to protect archaeological material from disturbance than exposed open ground.

However, even within this research driven pattern, concentrations of cave sites do exhibit distinct patterns of land use. They tend to be concentrated in limestone, though this is almost certainly a function of geology as much as hominid choice. In southwest France in particular, occupied caves are found in main river valleys, and especially in tributary valleys. This has been interpreted as a preference for narrow, sheltered micro-habitats with access to wider resources on the major floodplains. Further factors determining site location in this area include the proximity to good quality flint and exposure to sunlight. To this end, the majority of caves are located on south facing slopes to maximise the amount of light they receive and also because the local prevailing cold winds blow from the north (Mellars, 1996).

Cave sites also exist closer to submerged landscapes under study such as Spy (Belgium) and Feldhofer (Germany - Roebroeks & Tuffreau, 1999). In Northern France though, cave occupation is much rarer, though as Roebroeks and Tuffreau (1999) have pointed out, this may be more to do with the obscuring of caves by thick loess cover. Two examples of cave sites are described below:

- *La Cotte de St. Brelade (Jersey) – OIS 7 – c. 238 ka BP.*

At present the cave is located on the coast at the foot of a cliff (Figure 72). At the time of occupation, low sea levels would have ensured that the surrounding region was an exposed steppe.

Figure 72. Present day setting of La Cotte de St Brelade, Jersey, showing the cliff and cave (from Gamble, 1999).

TL dating of flint artefacts has provided an initial timing of occupation of c. 238 ka BP (Callow & Cornford, 1986; Roebroeks & Tuffreau, 1999). Evidence, in the form of a long sequence of artefacts and faunal remains from OIS 7 till the last glacial stage, indicates the reuse of this locale periodically over the long term. Of particular importance is the material from Layers 3 and 6. In these layers, faunal remains are composed solely of mammoth or rhino remains, which appear to have been stacked into organized piles against the cave wall. Layer 6 for instance has stacked mammoth scapulae with a rhino skull placed on top, while Layer 3 contains a concentration of skulls without their accompanying parts (Figure 73).

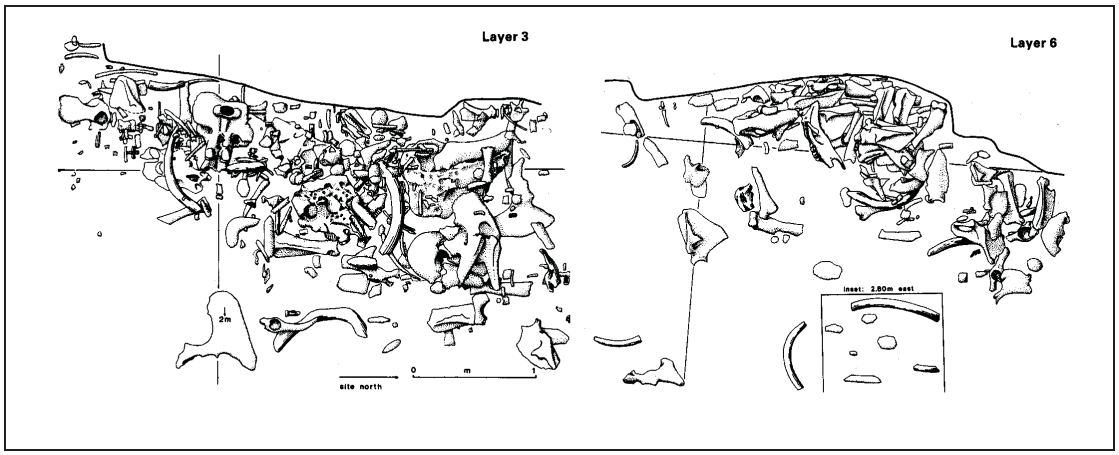

Figure 73. Faunal remains from Layers 3 and 6 at La Cotte de St Brelade (after Scott, 1986)

This, in conjunction with cut marks on the bones, implies hominid accumulation of the remains. There are indications that these concentrations represent rapid rather than long term accumulations, notably the lack of weathering on many bones (implying rapid post depositional sedimentation), and that most of the remains are in direct contact and not separated by sediment and other debris. Exceptional preservation in this instance is the result of rapid covering of the remains by loess. These deposits have been interpreted as the product of a mass drive of animals over the cliff behind and their subsequent butchery (Scott, 1980; 1986). The importance of this site lies in the evidence it provides to support the view that hunting was practised in this period and the utilisation of particular landscape features to aid in this practise. The assemblage also contains lithic points, some of which appear to have impact fractures (Scott, 1980; Callow, 1986).

- *Pontnewydd (Wales) – OIS 7*

The site is located in a limestone valley approximately 10km from the present coast of north Wales. It represents the most northerly extent of the Neanderthal world uncovered so far. The lithic assemblage consists of recognisable tools, such as handaxes, and debitage. In total around 330 artefacts have been recovered. Analysis of these remains has indicated the use of the Levallois technique. TL dating of a burnt flint has provided a date of 200 +/- 25 ka BP. Organic remains have been preserved; the faunal assemblage includes roe deer and reindeer, however, whether were brought in by the hominid occupants of the cave is not certain. In addition, the cave has also produced 7 hominid teeth and mandible fragments, which are said to exhibit Neanderthal features. The significance of Pontnewydd also lies in the fact that provides the earliest evidence of a hominid presence in the upland regions of Britain. The site has been interpreted as a short term, possibly seasonal, hunting occupation. Analysis of this site is rather limited as debris flows into the cave have disturbed the spatial integrity of the remains and possibly introduced some of them (Green, 1984). Pontnewydd therefore provides an example of a primary context site in which the elucidation of a snapshot of past lifeways is not possible, but still provides valuable information on past hominids.

Open air sites are again located both near water sources, be they springs, lakes or rivers. They are however also found in areas further away from water, such as interfluves and also in upland regions. To again use southwest France as an example, the densest concentrations of, and generally, richest open air sites coincide with the high portions of the interfluve locales between areas of dense cave occupation in river valleys (Mellars, 1996). Smaller (both in terms of their size and quantity of archaeological material) sites meanwhile are distributed across high and low areas, both on slopes and also within the floodplains of the river catchments. These distributions should not be taken at face value though, as it has been pointed out their discovery is due in large part to exposure by modern agriculture, and their concealment to local geology and vegetation (Mellars, 1996). It does seem to point to the occupation and use of large areas of the landscape rather than small localized territories.

A number of open air sites are also known from closer to the study region:

- *Maastricht-Belvedere (Netherlands) – OIS 7.*

Burnt flints have provided a TL date of 250 +/-22 ka BP. The site was located by a river and was partially preserved in fine grained fluvial sediments. Site J at this locale was preserved by wind blown loess. The assemblage includes the remains of both small and large animals and a large quantity of lithics and debitage. Refitting experiments have clearly demonstrated the in situ nature of the assemblage (Gamble, 1999; Roebroeks & Tuffreau, 1999).

- *Biache-St.Vaast (France) – OIS 6.*

TL dates on burnt flint point to a date of 175 +/- 13 ka BP. The site lies on a fluvial deposit and is covered by loess sediment. The assemblage contains many lithic artefacts, a large number of faunal remains, dominated primarily by large mammals such as bovids, bears and rhinoceros, and two fragmentary hominid skulls. (Roebroeks & Tuffreau, 1999).

- *Lynford Quarry (England) – OIS 4*

This open air site was located and excavated very recently, hence a published account is not yet available. A preliminary interpretation suggests it was a Neanderthal butchery site situated by a pond. Some 30 Mousterian handaxes and over 500 other worked flint artefacts have been recovered along with the remains of 9 mammoths, a reindeer, a woolly rhino and a brown bear. Preservation at this site is exceptional; with the remains of various species of insects and flora providing a detailed palaeoenvironmental record for this findspot. OSL dates on organic sediments have pointed to a date of between 64,000 to 67,000 ka (English Heritage, 2003; Norfolk Archaeology Unit, 2002).

Sites situated on the coast for the purpose of exploiting the maritime environment are not known for this region. However, while quite rare, these sorts of sites do exist for other areas. Notable examples are Vanguard Cave (Gibraltar) and Abdur (Eritrea) (Barton et al, 1999; Walter et al, 2000). Erlandson (2001) provides a comprehensive overview of these sites.

3.3.3.4 Interpretation

The Middle Palaeolithic is characterised by the emergence of the Neanderthals, an indigenous development of the *H. heidelbergensis* populations of Europe and by the development of a new and complex set of knapping techniques that involved extensive core preparation (Mellars, 1996; Klein, 1999).

A number of well preserved primary context sites in both open air and sheltered (cave and rockshelters) locales are known for this period. Note for example the dense concentration of sites in the limestone plateau of southwest France (Turq, 1999). The widespread occupation of the latter does seem to mark a break from the preceding Lower Palaeolithic, though this may be as much a function of preservation (section 3.2.3) as hominid preference.

Well preserved primary context sites include Combe Grenal, the Grotte Vaufrey and La Micoque (all France). Further north examples include La Cotte de St Brelade (Jersey), and Pontnewydd Cave (Wales - Green, 1984; Callow & Cornford, 1986; Mellars, 1996).

In much the same way as in the preceding period, primary context sites are often located in riverine environments such as Maastricht-Belvedere (Netherlands) and Salzgitter-Lebenstedt (Germany) (Gaudzinski & Roebroeks, 2000). Sites also tend to be located near other water sources, such as ponds and lakes; examples being Lehringen (Germany) and Lynford Quarry (England - Roebroeks & Tuffreau, 1999; Norfolk Archaeology Unit, 2002). As before, it is likely that the occupation of these locales was conditioned by hominid preference, in that they afforded abundant food and water, but also by the high preservational potential of these environments. In terms of contexts affording high preservation, loess areas should also be considered.

Cave sites have tended to be interpreted as living areas or base camps. The number of archaeological layers at many sites reflects the fact that these locations were favoured locations and reused by hominid groups over the timespans of thousands of years (Mellars, 1996). Open air sites may have been camps, kill sites, butchery sites, workshop sites or may have incorporated all functions. Analysis of the patterning of the various site types in southwest France has pointed out that workshop sites tend to be located on or near flint sources while mixed activity open air sites are systemically situated in the higher parts of the interfluves where observation of the surrounding valleys and micro regions could be performed (Turq, 1999).

Analysis of lithic raw material found at these sites provides an indication as to the movement patterns of these people. Studies from southwestern France indicate that the bulk (70-98%) of the material came from less than 5km away, while less than 5% was from distances of 30km or more (Mellars, 1996). This implies relatively restricted geographical ranges compared to the societies of later periods (see section 3.3.4.4).

3.3.3.5 Implications for submerged landscape research

The continuing presence of hominids in Britain and continental Europe from OIS 13 till the end of OIS 7, combined with contemporaneous shifts in lithic technology in both areas, notably the development of the Levallois technique, strongly argues for the movement of hominids across the North Sea and English Channel regions. Given the lack of evidence of watercraft in this period, it must be assumed that this movement took place at times of low relative sea level when these areas were exposed as dry land. Furthermore given the size of the areas concerned and the likelihood that the societies in question would not have conceived of Britain and Europe as two separate geographical areas, this process of movement would have probably been part of a longer-term occupation of the presently submerged areas (White & Schreve, 2000).

In particular, the occupation of these currently submerged areas between 180 and 60 ka BP, would raise further questions of why Britain appears to have been abandoned at this point in time.

In terms of site distribution, a similar pattern to that described for the Lower Palaeolithic (see section 3.3.3.5) is recognizable, with potentially well preserved open air sites occurring near water sources, such as rivers, lakes and ponds due to the twin processes of hominid preference and enhanced preservation in low energy fluvial or lacustrine sediment. However, for this period, additional areas to consider would be those in which the solid geology affords high potentials of cave or rockshelter formation. Smaller, more ephemeral deposits may exist in upland and interfluve locations. Whether these locations can be predicted underwater with any degree of certainty is not known, since even on land they tend to be chance finds.

Finally, as with all other periods of submerged archaeology, the possibility that enhanced preservation of organics remains and artefacts must be considered.

3.3.4 Upper Palaeolithic

3.3.4.1 Hominid species

Around 40 ka BP, anatomically modern humans (*Homo sapiens sapiens*) appear in Europe. The balance of evidence suggests they were part of a population dispersal out of Africa rather than an indigenous evolutionary development of the Neanderthals. The 2 species co-existed for a period of time until around 27 ka BP– the date of the latest Neanderthal deposits (d'Errico et al, 1998). How and why the Neanderthals became extinct is not entirely certain though genetic differences between the two populations suggest that interbreeding was not possible (Klein, 1999; Lewin, 1999).

3.3.4.2 Archaeological Evidence

The Middle to Upper Palaeolithic transition has often been seen as marking something of a 'revolution' in the archaeological record. The period sees the proliferation of certain techniques of flint knapping, notably the use of blades, increased standardization of tool forms and also greater industrial variability in both time and space. This is evident in the proliferation of regional and chronological techno-complexes, examples being the Aurignacian, Gravettian, Magdalenian and Creswellian, to name but a few (Champion et al, 1984; Gamble, 1986; Barton, 1997; Mussi et al, 2000).

The use of non-lithic raw materials also becomes more common. While examples of worked bone do exist from the earlier periods, the Upper Palaeolithic witnesses a veritable explosion of tools, implements and ornamental objects made on bone, antler and ivory (Figure 74 - Gamble, 1986). In exceptional circumstances, wooden artefacts have also been preserved. The wet conditions at the site of Stellmoor (Germany) for example have preserved 105 arrow shafts and fragments dating to the final phase of the Upper Palaeolithic (Bokelmann, 1991).

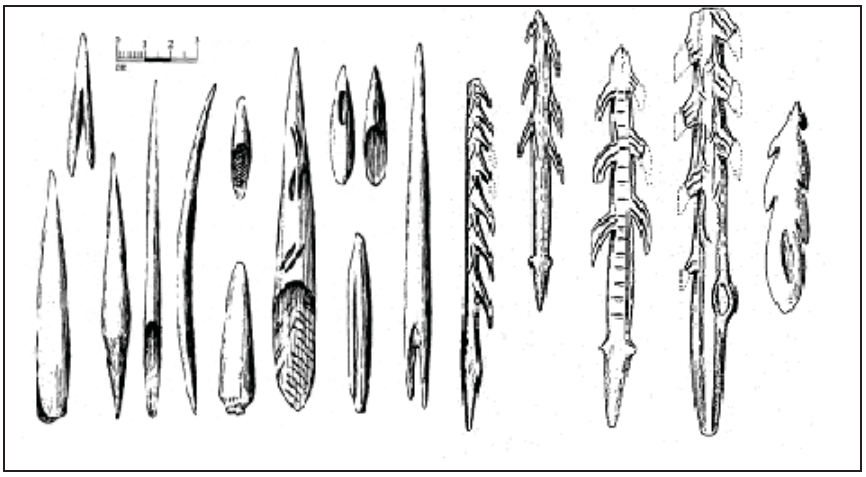

Figure 74. Selection of Upper Palaeolithic implements made on bone and antler. They range from simple points, on the left to more complex harpoons, on the right (from Peterkin, 1993)

A major difference between the Upper Palaeolithic record and that of the Lower and Middle Palaeolithic is the existence of art. This comes in the form of either parietal, or wall, art – such as the cave paintings at Lascaux, Chauvet and Cosquer - and portable carved or engraved objects. Animal teeth and shell that have been pierced for suspension also occur in many sites and have been interpreted as decorative or ornamental objects (Champion et al, 1984; Klein, 1999).

Structures are also apparent at a number of open air sites across Europe. Gonnersdorf and Andernach (Germany) for example have post holes, boiling pits and internal fireplaces which imply substantial dwelling structures, while evidence of tent like structures with outside hearths have been inferred for the sites of Pincevent and Verberie (France - Audouze, 1987; Barton, 1999).

3.3.4.3 Sites

In contrast to the earlier periods, quite literally hundreds of primary context Upper Palaeolithic sites are known from across North West Europe.

Where local geology permits, caves and rockshelters continue to be intensively occupied. Examples include Kent's Cavern (Britain), Peterfels Cave (Germany) and Trou Magrite (Belgium - Albrecht, 1983; Dewez, 1986; Barton, 1999).

Open air sites however, are more common than in the preceding period and in some instances have evidence of substantial and repeated occupations. This could be an accident of preservation (i.e. there has been less time for destructive taphonomic processes to operate compared to the earlier periods), though the unequivocal presence of structures at a number of them (see below) does highlight the ability of anatomically modern humans to create their own shelter and thus be less dependent on the distribution of natural cavities.

Once again a number of well preserved open air sites are known from around natural water sources. Riverside locations include sites such as Pincevent and Etiolles (Audouze, 1987), while there are also a number of sites situated on lakeshores. This is especially true of the Late Upper Palaeolithic sites in Scandinavia, which are often situated near the inlets and outlets of lakes (e.g. Trollesgave (Denmark)). The location of these latter sites has been interpreted as an indication that these groups were fishing (Fischer, 1991; Larsson, 1991). As before though the presence of sites near water probably relates to hominid preference and preservational factors.

Hunting strategies are also inferred to have conditioned site location to some extent. The south German sites of Peterfels, Kesserloch and Schaffhausen are situated adjacent to narrow tunnel valleys into which herds of reindeer were driven and slaughtered (Albrecht, 1983). Closer to the study area, similar patterns are evident in the Ahrensburg tunnel valley (Schleswig-Holstein, North Germany). The site of Miendorf is situated between 2 small lakes, while the site of Stellmoor is located between a lakeshore and the steep sides of the valley. Both locations form ideal bottlenecks for driving and then ambushing reindeer herds (Bokelmann, 1991; Bratlund, 1991). Similarly, settlement patterns at Cheddar Gorge (Britain) could have been influenced by these factors, as there is a concentration of sites in association with narrow canyon-like topography suitable for corralling or driving animals (Barton, 1999). Alternatively, sites near river fords can either be seen to have been located there to take advantage of migrating salmon or reindeer herds, which would have been vulnerable when crossing these rivers (White, 1989).

In general, it seems that areas of significant relief are prime areas for site prospection, for the reasons described above (shelter and hunting), but also in that these areas represent points from which a range of diverse biotopes (e.g. upland plateaus and lowland floodplains) could be readily accessed (Rozoy, 1998).

This is not to say that upland areas were totally avoided. For instance, the site of Ville St. Jacques (France) is located on the edge of a plateau in the Paris Basin, unlike the majority of sites in this area (e.g. Etiolles, Pincevent, Marsangy) which are positioned in the river valleys. The relative rarity of these sorts of sites compared to the cave and valley sites above is probably a function of the overwhelming focus of archaeological research on cave and valley sites to the detriment of other loci of settlement, and the higher incidence of plough damage to upland sites, which are not protected by layers of fluvial sediment (Rigaud & Simek, 1987; Audouze & Enloe, 1991).

The distribution of high quality flint outcrops can also be seen as influencing regional settlement patterns. For instance, the current archaeological record suggests that Brittany was far less densely occupied in the post Last Glacial Maximum (LGM – c. 22 ka BP) re-colonization of northern Europe than other areas. This has been interpreted as a reluctance to visit it because it lacks high quality flint (Rozoy, 1998).

These factors though are not universally applicable, given the element of human choice involved in weighing up the pros and cons of a particular location.

The site of Pincevent for example is located some 30km from a high quality flint source. Its rich reindeer dominated faunal assemblage though implies that the priority at this location was the hunting of reindeer. In contrast, the site of Etiolles (around 35km from Pincevent) exhibits a reverse priority with the assemblage including numerous large high quality flint nodules but a relatively small faunal assemblage (Audouze & Enloe, 1991).

Coastal sites are not apparent for this period and region. However, the existence of evidence inland of journeys to the coast, such as perforated sea shells and artistic images of sea fauna strongly implies that the lack of sites is more a function of the submergence of the coastline by the postglacial sea level rise (Figure 75) (see Cleyet-Merle & Madeleine, 1995; Erlandson, 2001 for a comprehensive review).

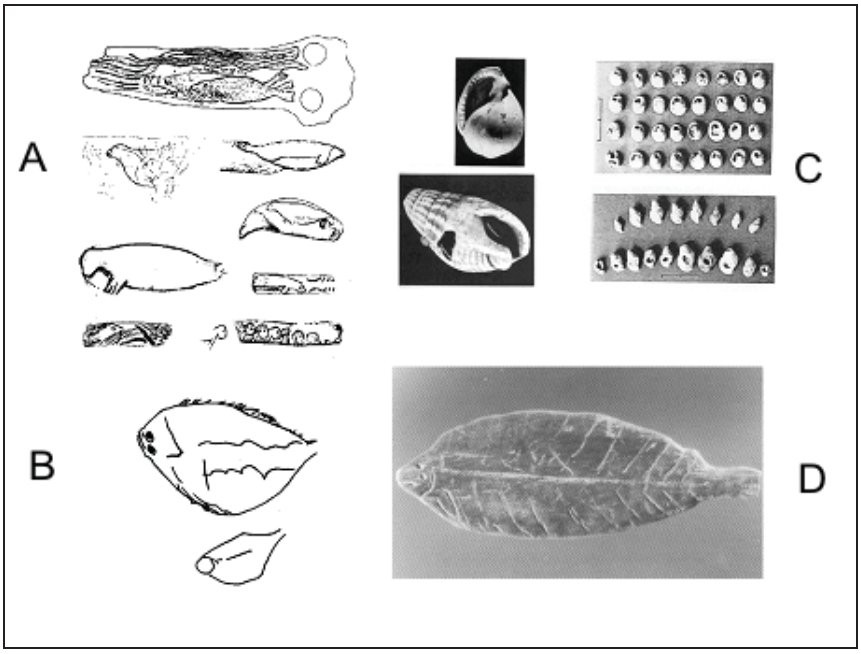

Figure 75. Artistic evidence of coastal knowledge in the Upper Palaeolithic. A) Depictions of seals on various art objects. B) Engraved flat fish from the walls of Le Mas d'Azil cave, France. C) Perforated ornamental shells. D) Mobile engraving of a flat fish from Lespuge, France.(from Cleyet-Merle & Madeline, 1995; Stiner, 1999).

Some examples of primary context sites now follow:

- *Gough's Cave (Britain) - Inland cave site - OIS2*

The site is located in the Cheddar Gorge (Somerset), where several other sites of the same period are also situated. Various dates have been obtained for the site, ranging from 12.8 to 11.8 ka (C^{14}) BP. If the earliest date is accepted, then it provides the earliest date for the post-glacial re-colonization of Britain. The lithic assemblage has been assigned to the Creswellian, a British variant of the wider European Magdalenian tradition and is characterized by the presence of distinctive trapezoidal backed blades (Figure 76: Cheddar points - Barton, 1999).

Figure 76. Cheddar points from Gough's Cave, England. The longest measures 6cm (from Barton, 1997).

Sourcing the flint to Wiltshire (some 60km away) has provided some clues as to the mobility patterns of the cave's occupants. The long distance patterns are

substantiated by the presence of non-local seashells and Baltic amber, the nearest source of which is the North Sea coast, which would have been some 300 to 400km away at the time. The remainder of the material culture includes ivory rods, antler batons, bone needles and awls similar to those found in contemporary sites across North West Europe. The faunal assemblage contains the remains of both small (e.g. hare) and large mammals (e.g. red deer and wild horse). It seems the topography of the gorge may have been a factor in site location in that it forms a narrow winding canyon well suited to driving animals, just beyond the cave.

The presence of whooper swan in the assemblage, a migratory species, implies that the cave was a winter site. Whether it was a specialised 'task site' or 'residential site' remains to be determined at some point. Finally, Gough's Cave has also produced the remains of at least three adults and two children. Cut marks on the bones indicate that post-mortem dismemberment and defleshing of the remains took place. This has been interpreted as evidence for cannibalism or the existence or a two stage burial practice (Currant, 1991; Barton, 1999).

- *Oldeholtwolde (Netherlands) – Inland open air site - OIS 2*

The site is located in the Tjonger Valley of the north west Netherlands and is attributed on the basis of typology to the Hamburgian culture. At the time of occupation the site would have been located on a stream bank. C^{14} dating has provided an Allerød date of c. 11.5 ka (C^{14}) BP. The site consists of a central hearth surrounded by a scatter of some 10,400 flint artefacts. These include cores, debitage and recognized tool forms. Refitting of many of the pieces has demonstrated the in situ nature of the assemblage. No organic remains have been preserved. The site has been interpreted as a short term - possibly as little as two to three weeks - occupation by a small group, most likely a nuclear family. The proportions of artefacts do not however provide any information as to whether this site had a specialized function (Stapert et al, 1986). The evidence from this site is rather less spectacular than that from Gough's Cave described above. Nevertheless it highlights the variation that exists between assemblages as a result of both cultural and natural site formation and evolution processes.

- *Pincevent (France) – Inland open air site – OIS 2*

The site of Pincevent is situated in the Paris Basin region of northern France. It consists of several hearths, lithic scatters and a reindeer dominated faunal assemblage. Organic artefacts are sparse, and consist of a few batons, awls, needles and points made on bone. It is located, as are the majority of contemporary sites in the Paris Basin, on a low river terrace, a few kilometres from the confluence of two rivers and close to a ford. The site contains some 12 occupation units, many of which are stratigraphically independent but spatially repetitive, thus implying the reuse of this site over time. A number of C^{14} dates have been obtained from the various layers, ranging from c. 12.3 to 10.9 ka (C^{14}) BP. Frequent flooding has ensured the rapid burial and thus exceptional preservation of the living floors. Patches of low numbers of artefacts situated to one side of the hearths have been interpreted as position of light tent-like structures. Pincevent has been interpreted as a site geared primarily towards the processing of reindeer that were probably killed nearby, as mentioned in section 3.3.4.3, this function took precedence over local deficiencies in other resources (Audouze, 1987; Audouze & Enloe, 1991).

3.3.4.4 Interpretation

Settlement patterns between the Middle and Upper Palaeolithic exhibit a degree of continuity in that similar locales continue to be occupied, notably caves, rockshelters, river valleys and lakeshores. However, there is also a certain amount of variation between the two periods in that more substantial and complex open air sites are known for the later period. This could be interpreted as an accident of preservation or the greater ability of Upper Palaeolithic people to mitigate the surrounding environment by building their own shelters.

On a continental scale sites as far north as Wales are known before the advent of the LGM, Paviland Cave (Wales) for instance is dated to c. 26 ka BP(Barton, 1999). On the whole, settlement in the north west of the region (i.e. Britain and Scandinavia) though is rather more sporadic than in the more southerly regions (e.g France) and Central Europe (Mussi et al, 2000). This pattern was disrupted by the climatic and environmental downturn of the last glacial stage which is often believed to have led to the near total depopulation of the Western Europe above latitude 50°N (Tolan-Smith, 1998; Housley *et al*, 1997). Evidence suggests that the inhabitants of these areas made their way to two refugia located in Franco-Cantabria (southwest France and northern Spain - Jochim, 1987) and the Central Russian Plain (Soffer, 1985). Both these areas have evidence of continuous occupation throughout the Upper Palaeolithic, which furthermore appears to increase through the period concerned (Jochim, 1987). The reasoning behind proposing these areas as refugia hinges on their greater productivity, resource diversity and milder climate relative to northern Europe.

This occupational hiatus is evidenced by the lack of sites in Britain and Belgium between 25 and 14 ka (C^{14}) BP and only 5 sites dating to this period in Germany (Jochim, 1987; Housley *et al*, 1997; Street & Terberger, 1999). It was from these refugia therefore, that human groups emerged to reoccupy the northerly latitudes of the continent in the postglacial, with radiocarbon dates suggesting that the process of recolonization began around 14 ka (C^{14}) BP with the appearance of Magdalenian groups in the Upper Rhine valley and Britain and Scandinavia - occupied from 12.8 and 12.5 ka (C^{14}) BP respectively (Housley *et al*, 1997).

In terms of the subsistence organisation the societies of the European Upper Palaeolithic appear to have been that of mobile hunter-gatherers. Faunal assemblages from across western Europe have indicated that a diverse range of species ranging from salmon (Jochim, 1987) to reindeer (Boyle, 1993) were hunted. While differences in prey choice do exist between different regions resulting from the varying spatial distribution of the animals, there seemed to have been a common continental focus in that the primary prey category was big game, specifically large herbivores such as reindeer, red deer, horse, bison, aurochs, ibex and saiga.

Climatic shifts in the post glacial, notably the replacement of the steppe tundra environment by closed forests are believed to have altered this system such that it was modified to a more diverse strategy that sought to incorporate a wider range of resources into the diet such as small game and aquatic resources.

The distances travelled by these people through the landscape as part of their mobile lifestyle are thought to have been quite large, up to several hundred kilometres in some instances, as evidenced from sourceable objects such as flint and sea shells (Rozoy, 1998; Barton, 1999).

3.3.4.5 Implications for submerged landscape research

The investigation of submerged archaeological sites is particularly pertinent to the Upper Palaeolithic given that there is evidence inland of contact with the coast but yet these very coastlines are missing from the present archaeological record (Cleyet-Merle & Madeleine, 1995; Erlandson, 2001). Questions to be focused on for this period would therefore concern the antiquity and development of the coastal adaptation. The possibility of either separate coastal and inland populations, or the seasonal movement of people between the two regions would add an extra dimension to what is presently known of the social system of the time. The possibility of a coastal Upper Palaeolithic presence also has implications for the routes taken in the recolonisation of Northern Europe after the LGM, for instance via the western coast of the continent rather than through Northern France and Germany as is frequently assumed (e.g. Housley, et al, 1997). Alternatively, given the ameliorating effect of the coastal climate, it might be worth investigating the possibility that the coastline of the northern sector of the continent was occupied during the LGM, rather than the near total abandonment scenario that is generally envisaged.

A small quantity of archaeological evidence from the seabed can be assigned to submerged regions in question, notably the Viking Bergen core and the Leman and Ower point (see section 3.6.2). In addition, similarities in material culture between Britain and the continent imply contact across the presently submerged regions, an thus a human presence in these areas.

With respect to site prospection, as before, likely areas to look for sites would be river valleys, lakeshores, cave bearing geological strata and areas with high quality flint sources. In particular, narrow valleys similar to the Cheddar Gorge and Ahrensburgian tunnel valleys may have held a particular attraction for the reindeer hunters of the Late Palaeolithic. Coles (1998) in fact has pointed out the existence of a number of submerged sub-glacial incisions or tunnel valleys, to the north of the present day Dogger Bank, and also off the East Coast of Scotland, that may have been amenable to settlement when this land was exposed.

3.3.5 Mesolithic

3.3.5.1 Hominid species

By this stage, anatomically modern humans (*Homo sapiens sapiens*) are the sole hominid species present in Europe, and indeed the world (Klein, 1999; Lewin, 1999).

3.3.5.2 Archaeological evidence

In terms of technology, the distinctive hallmark of the Mesolithic is the microlith; a small shaped blade designed to be fitted into a haft to form a composite tool. Microliths are known in the Upper Palaeolithic and their use increases over time, to the point where they represent the dominant tool form of the Mesolithic (Figure 77). Beyond this, evidence tends to be very similar to the Upper Palaeolithic; primarily scatters of stone, bone and other tools (Price, 1991). There is a significant degree of regional variability both in time and space. In Britain for instance, early Mesolithic sites are dominated by so called ‘broad blade’ assemblages containing relatively large isosceles triangle shaped microliths. After 8.5 ka BP, there is a shift from these larger microliths to smaller ones, taking a variety of forms ranging from scalene triangles to needle points (Mithen, 1999). In France, regional variants include the Sauveterrian, the Tardenosian, the Beaugencien and the Ardennien, to name but a few (Rozoy, 1998).

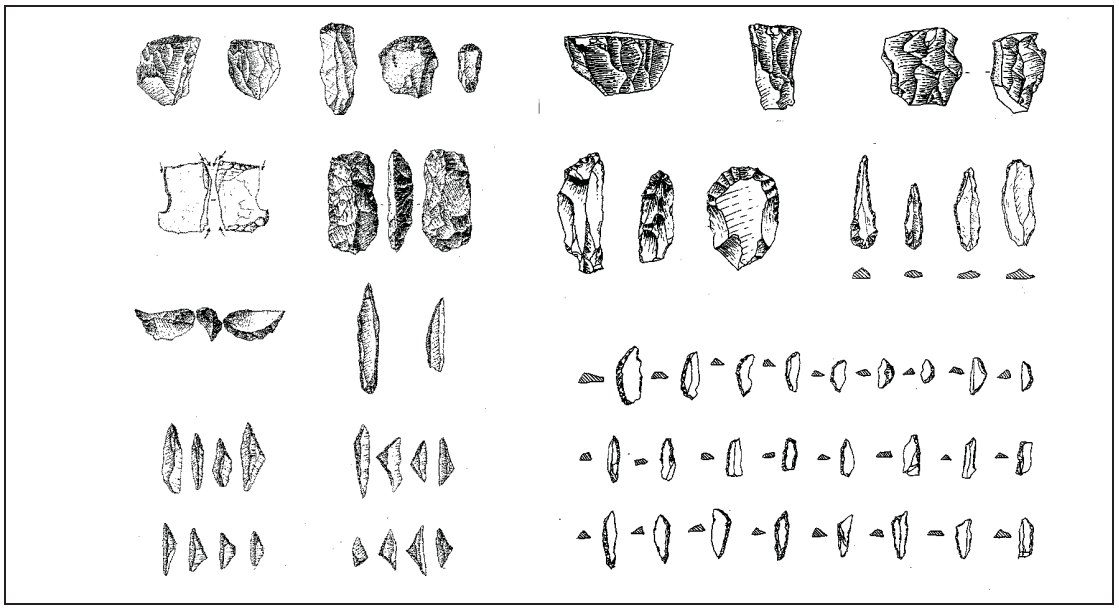

Figure 77. Selection of Mesolithic tools including cores, scrapers, borers, burins, bladelets and microliths (from Mithen, 1999).

There is greater evidence for structures in this period, usually in the form of post holes. Examples include Mt. Sandel (Ireland), East Barns (Scotland) and Howick (England - Mithen, 1999; Gooder, 2003; Waddington, 2003).

A difference with the earlier periods is that middens become more prevalent. These consist of waste heaps of shells, faunal remains and artefacts, and are known predominantly from coastal locations. Towards the end of the sequence, Neolithic traits start to appear. Pottery for example is used by the late Mesolithic (6.6-5.2 ka BP) Ertebølle culture of Scandinavia and the Swifterbant group of the Low Countries (Price, 1991, Louwe Kooijmans, 1999).

Organic artefacts also appear in a number of sites, such as pierced shells, antler mattock and bone points and harpoons (Figure 78). In exceptional circumstances, such as waterlogging, wooden artefacts may also be preserved (Andersen, 1985).

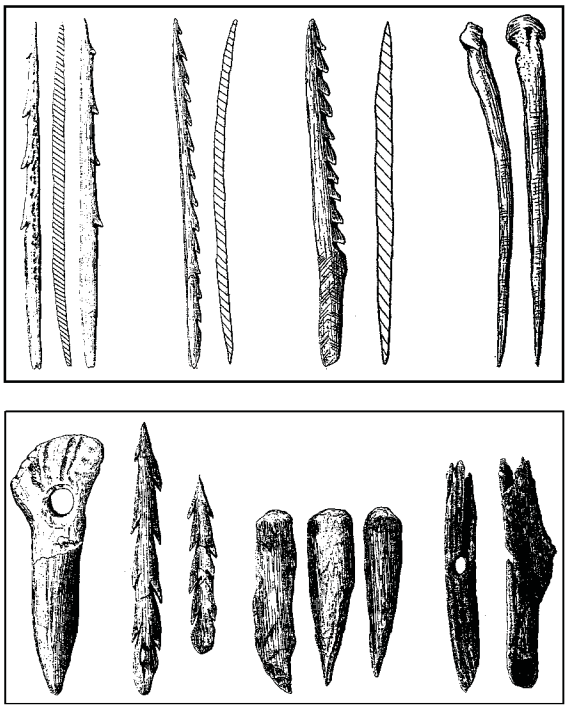

Figure 78. Organic artefacts from Mesolithic contexts. Top row: barbed antler points and a bone pin. Bottom row: Mattock heads, bone harpoons and 'limpet scoops' (from Mithen, 1999)

3.3.5.3 Sites

As in the Upper Palaeolithic and in contrast to the Lower and Middle Palaeolithic, hundreds of primary context sites are known for this period.

The majority of Mesolithic sites excavated so far appear to be open air. A major difference when compared to the Upper Palaeolithic is that coastal settlement is now apparent. Shell middens proliferate, and sites with material culture associated with maritime activities such as fish traps, boats and fishhooks become far more common. This however could be related to the submergence of earlier coastal settlements by rising relative sea levels (Bailey, 1983). Some of the best preserved examples of the Mesolithic coastal lifestyle come from southern Scandinavia. For example:

- *Tybrind Vig (Denmark) – 6.6 to 5.2 ka BP(uncal)*

  Postglacial relative sea level rise has resulted in the inundation of this site. Submergence though has resulted in remarkable preservation conditions.

  The site is located at a water depth of 2-3m and is about 250m from the modern shoreline. At the time of occupation it would have been a multi-seasonal site situated on the coast. The exceptional preservation conditions have resulted in a very rich collection of organic artefacts including the remains of 3 canoes, 14 paddles (four of which are decorated), fishhooks, leisters and a fragment of fishing line (Figure 79).

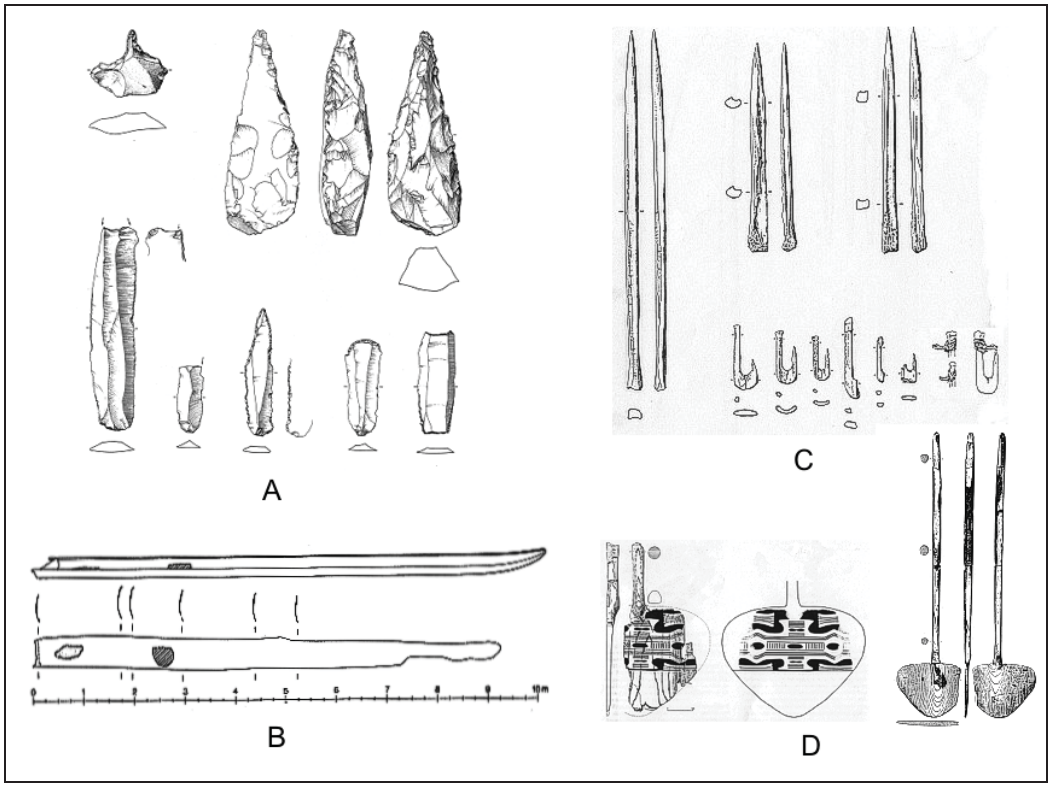

Figure 79. Selection of finds from the underwater excavation at Tybrind Vig. A) Lithic implements. B) 9.5m long canoe. C) Organic artefacts including bone points and bone fishhooks. D) Paddles, both decorated and plain examples. Artefacts are not to scale (after Andersen, 1985)

Faunal remains consist of a combination of marine and terrestrial species including both large and small mammals, molluscs and fish. In addition, the remains of a woman and a small child were found in a burial pit. The significance of the site lies in both its spectacularly preserved organic inventory and the fact it was the first submerged prehistoric settlement to be systematically excavated in North West Europe (Figure 80 - Andersen, 1985; Malm, 1995).

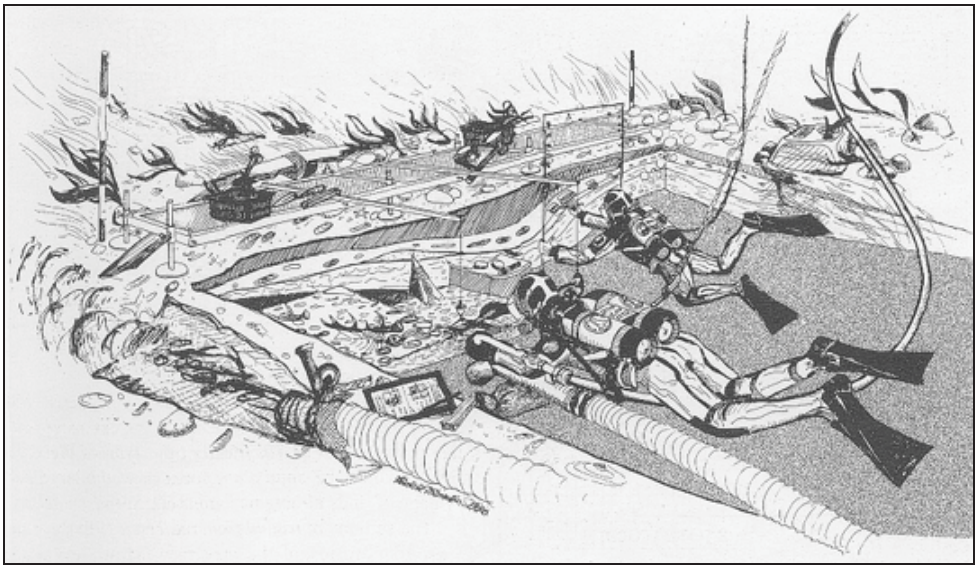

Figure 80. Artist's impression of underwater excavations at Tybrind Vig (from Malm, 1995)

The use of inland areas still continues, with sites located by rivers, lakes (e.g. Star Carr, England) and so on, while many sites are located in areas of high relief, presumably to provide views of the surrounding landscape and for the particular resources that the uplands afford. This appears to be the case for the Mesolithic of northern England, with many sites located on ridges, hills and valley heads (Kvamme & Jochim, 1985). Examples of inland sites include:

- *Téviec and Hoëdic (France) – 7.7 to 5.3ka BP*

Both these sites are presently located on small islands in the Bay of Quiberon (Brittany). They both contain shell middens, abundant microlithic industries and rich cemeteries. Téviec has ten graves containing 23 individuals, while Hoëdic has 9 graves containing 14 individuals. These remains in fact constitute two thirds of the burials from the French Mesolithic. Grave goods, including perforated shells, red deer antler, bone pins and flint implements are common (Figure 81). A number of AMS dates have recently been obtained from the human remains. Dates from Téviec cluster around 7.2 ka BP while those from Hoëdic are spread between 7.3 and 6.5 ka BP with outliers at c. 7.8 and 5.3 ka BP.

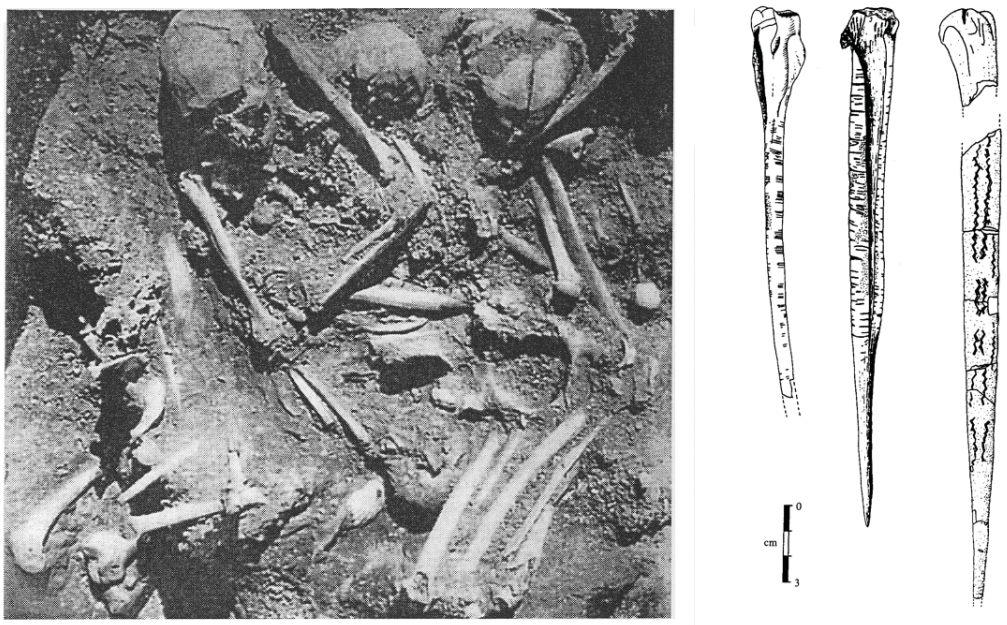

Figure 81. Burial from Téviec (left) and bone pins from Téviec and Hoëdic (right) (from Schulting, 1996).

At the time of occupation, when the local relative sea level was lower, the islands would have been high points on a coastal plain. Téviec would have been 1km from the shoreline, while Hoëdic would have been 2km from the shoreline at the time of the first burial. However, by the time of its latest burial, sea level changes would have ensured that its position in relation to the coastline would have been relatively similar to the present (Schulting, 1996; Schulting & Richards, 2001).

Data from the midden deposits has indicated the sites may have been occupied for most of the year and that the inhabitants subsisted on a diverse set of resources which included both marine and terrestrial fauna. This has recently been substantiated by isotope analysis of human remains from both of the sites which have indicated that the inhabitants of Hoëdic derived some 70 to 80% of their protein from the sea while those from Téviec had a diet based on roughly equal proportions of both protein sources (Schulting, 1996; Schulting & Richards, 2001).

- *Jardinga (Netherlands) – 7.4 –7 ka BP*

The site is located in the valley of the Tjonger River, an area known for its concentration of Late Palaeolithic sites. Fewer Mesolithic sites are known from the area, though there are a great deal of surface finds that have yet to be dated and which may enhance existing knowledge of the Mesolithic activity in this area. Jardinga consists of a concentration of some 66 cut marked and broken aurochs bones, a red deer rib fragment, 6 flint artefacts and 8 pieces of wood. Two sets of radiocarbon dates have been obtained from the bones, implying 2 separate occupations – one at c. 7400 yr BP, and another between 7250 and 7050 yr BP. The lack of weathering on the bones indicates they were rapidly buried in the sediment after deposition and highlights the in situ nature of the assemblage. This is further substantiated by the completeness of certain small skeletal elements, such as the foot bones of the aurochs, which might be expected to have been dispersed if the remains had undergone a degree of post depositional reworking. The site has been interpreted as a kill and primary butchery site on 2 separate occasions in the Late Mesolithic. Its location is probably chosen so as to hunt animals when they came to the river to drink. In addition the open areas around the river would have been more attractive to large herbivores than the surrounding closed forest, which in turn would have made it attractive to hunters (Prummel et al, 2002). While the deposit is far less spectacular than those of the sites mentioned above, it does provide detailed insights into a particular facet of a local subsistence strategy.

3.3.5.4 Interpretation

Settlement patterns in the Mesolithic are diverse and sites are found in a variety of locales. Caves and rockshelters, while still occupied (e.g. Ulva Cave, Scotland) form a smaller proportion of the total site types due to the proliferation of open air sites. Settlement continues on lakeshores (e.g Star Carr, England) and in river valleys (e.g. Noyen-sur-Seine, France), while many sites are also found in upland areas, presumably for the views and resources they afforded (Kvamme & Jochim, 1985; Whittle, 1996; Mellars & Dark, 1998). On a continental scale, an absence of evidence from large areas of central and south east Europe may indicate a reluctance to inhabit large heavily wooded lowland areas that lacked natural openings created by rivers, lakes and marshes (Whittle, 1996). The main break from all the earlier periods of prehistory is the appearance and spread of large numbers of coastal sites. It has yet to be ascertained whether this marks the development of a new subsistence-settlement pattern, or simply the first archaeologically visible manifestation of this phenomena, the earlier examples having been submerged by sea level rise (Bailey, 1983).

The Mesolithic is characterised by broad-spectrum economies. Sites from a variety of diverse areas ranging from Tybrind Vig (Denmark), Freisack (Germany) and Ulva Cave (Scotland), contain evidence of a wide range of foods including shellfish, fish,

marine mammals, terrestrial big and small game and edible plants (Price, 1985; Gramsch & Kloss, 1985; Andersen, 1985; Russell *et al*, 1995). In particular, shell middens proliferate in coastal regions, with numerous examples turning up on the Atlantic coasts of France, Scotland and Scandinavia (Bailey, 1983; Andersen 1995; Russell et al, 1995). These have been taken as evidence of the intensified use of the maritime environment described above. If one takes the position that the intensification of coastal occupation is primarily a Holocene event, then the impetus behind this behavioural shift is usually attributed to the continental scale climate changes initiated in the Late Glacial, namely increased temperatures and the replacement of open steppe tundra with closed forest environments, leading to the disappearance of the large herds of grazing herbivores, such as reindeer.

The hunter-gatherer lifestyle does continue, though in some instances mobility can be seen to be decreasing. The rich coastal resources of the Danish archipelago for instance have been seen as providing a stable resource base, which in turn promoted a more sedentary lifestyle (Woodman, 1985).

The adoption of agriculture and the so-called 'Neolithic revolution' appeared around 6 to 5 ka BP. Whether or not it was brought in by migrating people, indigenously developed or came about through a combination of the aforementioned factors is not certain. It was not however, universally adopted at the same time. For example, people in Scandinavia maintained a hunter-gatherer lifestyle for a thousand years after the adoption of farming in neighbouring Germany (Whittle, 1996).

3.3.5.5 Implications for submerged landscape research

Again similarities in material culture in both Britain and continental Europe suggest the existence of contacts across the presently submerged landscapes. Archaeological evidence from the submerged areas would therefore help ascertain the nature of these contacts. Were they constituted largely by the movement of people and ideas (i.e. migration and cultural transmission), or was there a continuity in population across the North Sea and English Channel; in other words, long-term habitation in the manner suggested by Coles (1998). Determination of this would go some way to addressing the 'landbridge question' (see section 1.3) which currently dominates archaeology.

The Mesolithic also differs from earlier periods in that submerged sites have been located and excavated. Examples include Bouldnor Cliff (England: see section 3.6.2) and Tybrind Vig (Denmark) (see section 3.3.5.3). Sites on land meanwhile are distributed widely across the landscape, possibly as a result of human choice and the fact that there has been less time for post-depositional processes to remove or rework them compared to earlier periods. The sorts of questions that could be looked at in relation to submerged Mesolithic archaeology are similar to those for the Upper Palaeolithic mentioned in section 3.3.4.5, namely the antiquity of large scale maritime exploitation and the nature and extent of coastal occupation. In fact, the rich and complex coastal occupation of south Scandinavia was in fact one of the main lines of evidence that served to demonstrate that the Mesolithic was more than an impoverished relation sandwiched between the art rich Upper Palaeolithic and the farmers of the Neolithic (Price, 1991). This again places a premium in locating the submerged shorelines. Finally, the known existence of a substantial coastal occupation, in conjunction with the Holocene transgression would also make this

period ideal for looking at hunter-gatherer responses to sea level change, and assessing whether there was rapid abandonment in the face of inundation, or whether adaptation to new environments took place as well. This may in turn have implications for the adoption of a new way of life (settled agriculture) in around the mid-Holocene.

3.4 Secondary Contexts

3.4.1 Overview

As stated in section 3.1.4 the most prevalent form of secondary context for the periods concerned are river terrace sediments. These take the form of 'staircases' arranged with the oldest deposits at the top of the sequence (see Figure 82). Essentially, terrace formation is brought about by incision into the bedrock over which the river runs. Over the timescales in question (10,000 to 1,000,000 years) the causes of this process are external to the river system, notably climate change and tectonic or isostatic uplift. Climate affects the river discharge and sediment supply, which in turn leads to variable degrees of sedimentation or erosion, while the actual formation of the staircase requires progressive uplift of the land surface (Bridgland, 1995; Maddy et al, 2001). This is highlighted by the fact that terrace staircase sequences do not form in areas experiencing crustal subsidence. The lower Rhine for instance, situated in the subsiding southern portion of the North Sea Basin, has formed an aggradationally stacked sequence of deposits rather than terraces, while its upper reaches, located in the uplifting continental interior, are characterised by extensive terrace sequences (Bridgland, 2000).

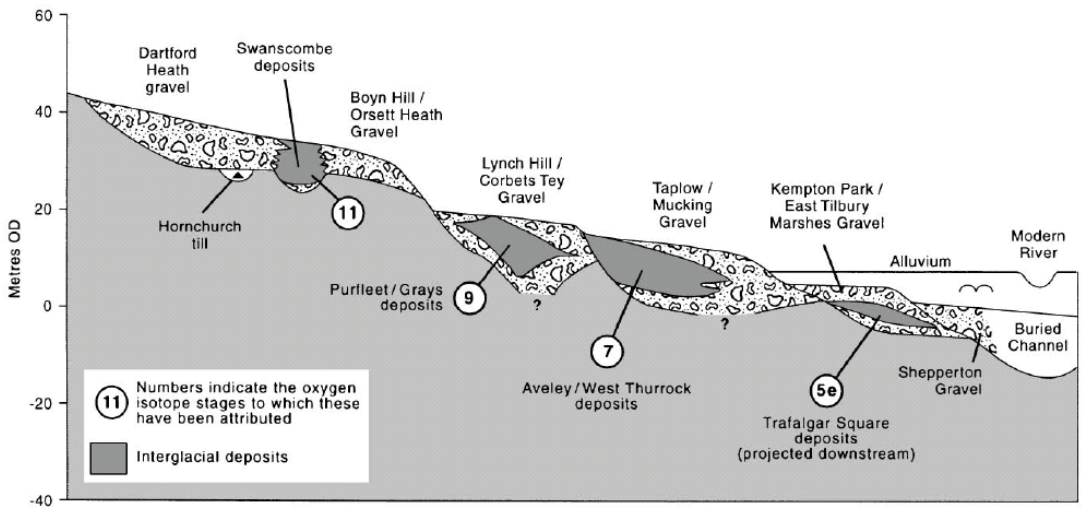

Figure 82. Idealized terrace staircase for the Thames valley (from Bridgland, 2000).

Recent models (e.g. Bridgland, 2000; Maddy et al, 2001) have illustrated the climatically driven aspect of this process in terms of a six-stage sequence (see Figure 83).

- Stage 1) – *Fluvial incision.* [Glacial to interglacial transition, warming trend]

  Sediment supply is reduced as increasing vegetation cover stabilizes valley slopes. Stream power is increased by the release of water from

glaciers and frozen ground. Climatic instability also results in a higher incidence of high frequency/high magnitude rainfall events which in turn increase stream power. The combination of reduced sediment supply and increased stream power promotes erosion.

- Stage 2) – *Aggradation.* [Glacial to interglacial transition, warming trend]

  Fluvial incision in stage 1 creates accommodation space which is filled by the deposition of pre-existing terrace sediment. This occurs primarily in the lower reaches of rivers

- Stage 3) – *Stable.* [Interglacial stage, stable and warm]

  Fine grained, low energy interglacial flood deposits are overlain on the gravels deposited in stage 2.

- Stage 4) – *Erosion.* [Interglacial to glacial transition, cooling trend]

  Climatic instability in the early stages of the transition may promote high energy flooding events, thus resulting in an initial phase of erosion.

- Stage 5) – *Aggradation*. [Interglacial to glacial transition, cooling trend]

  Decreases in vegetation and increased freeze thaw weathering promote the movement of sediment from valley slopes to the valley floor. Climatic instabilities once again promote high frequency/high magnitude rainfall events thus increasing stream power. This, combined with the high sediment supply leads to substantial aggradation.

- Stage 6) – *Stable*. [Glacial stage, stable and cold]

  A large quantity of potential discharge is locked up as permafrost and ice. The rainfall events of stage 5 are reduced, further decreasing the flood frequency. Activity tends to be small scale and high frequency – e.g. the redistribution of stored sediment by an annual flood.

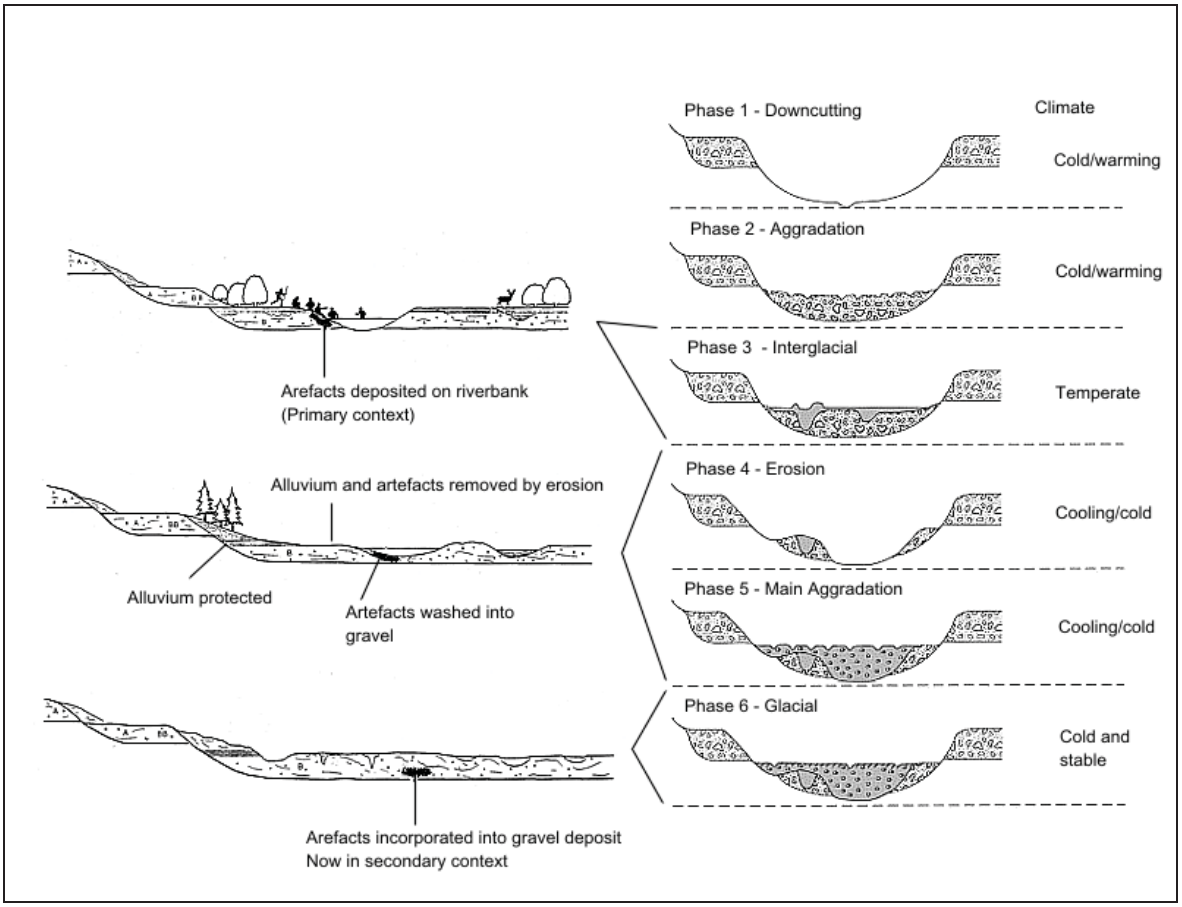

Figure 83. Formation of secondary context archaeological deposits (left) as part of a six-stage model of climatically induced terrace formation (right) (modified from Bridgland, 2000 and Wymer, 1999).

Any archaeological material situated on valley slopes and floodplains can be considered as a form of sediment and thus subject to the above processes of erosion and aggradation. The upshot is that artefacts may be redistributed up to tens of kilometres from their point of origin, and the spatial and temporal relationships between artefacts from each individual site will be lost. Conversely, this does mean that the artefacts within a single terrace unit are a reflection of a wide variety of activities over a long (tens of thousands of years) period of time, and they can be compared with the material from older or younger units (Ashton & Lewis, 2002). This makes them particularly amenable to looking at the long term spatial structure of lithic distributions about a landscape with the ultimate aim of elucidating demographic trends and landscape exploitation strategies on a macroscale (i.e. hundreds of kilometres and tens of thousands of years) level (e.g. Ashton & Lewis, 2002; Hosfield, 1999; 2001). Note for instance Ashton and Lewis's (2002) use of Thames gravel terraces to infer regional population dynamics over OIS stages 13 to 5.

The issue of sites in secondary context fluvial gravels has only really been applied to the Lower and Middle Palaeolithic periods. As described above, terrace gravels form as a result of the movement and downcutting of rivers over the course of a glacial/interglacial cycle (Bridgland, 1995). The preponderance of secondary contexts in earlier periods is a consequence of the actions of multiple examples of these events. Since the start of the Upper Palaeolithic there has only been a single glacial to

interglacial transition, thus there has been far less time for multiple terraces to form. In fact the time span of each gravel terrace is estimated to be between 70 and 100,000 years (Hosfield, 1999). In comparison the Upper Palaeolithic spans only 30,000 years and the Mesolithic 4,000 years. The sheer number of primary context sites from these two periods has meant that disturbed and derived assemblages have never been examined to the same degree as in earlier periods. Indeed, an examination of the relevant literature would reveal that the question of the potential of secondary context deposits is simply not an issue discussed by Upper Palaeolithic and Mesolithic specialists.

The point in time at which deposits were forming in the postglacial (Stages 1 and 2 above) also coincides with the large scale de-population of northern Europe between the LGM and the Bölling interstadial described in section 3.3.4.4. Consequently there would simply have been far less archaeological material available for reworking by fluvial process (Wenban-Smith, 2002).

Individual gravel terraces may also contain lenses of finer sediment which could reflect periods of lower energy activity, and it is possible that primary context archaeology and biological material may be preserved in them (Wenban-Smith, 2002). The lower loam layers at Swanscombe (England) for example contain a core and flake industry in primary context, while the gravel layers overlaying them contain derived artefacts (Wymer, 1999). Figure 84 illustrates this phenomenon in relation to the archaeological deposits in the Cagny area (France).

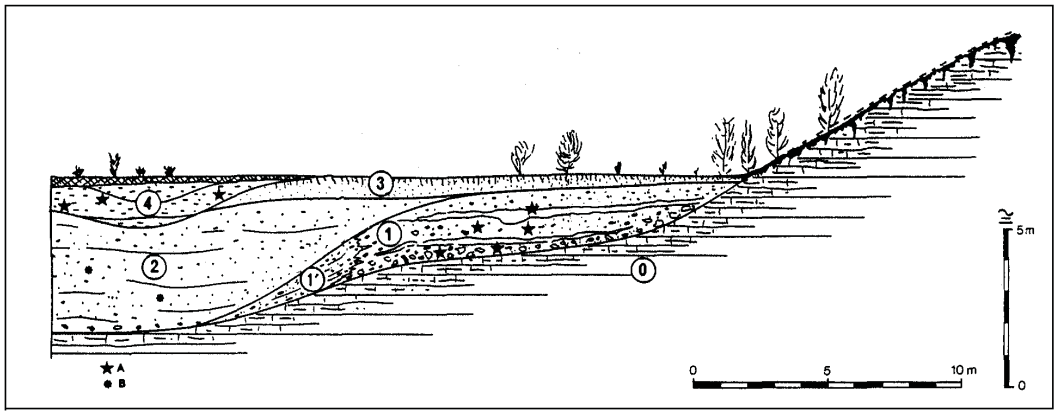

Figure 84. Idealized section through terrace complex in the Cagny area. (A) Undisturbed Palaeolithic sites. (B) Reworked Palaeolithic artefacts. (0) Bedrock. (1) Chalky slope deposits with interstratified bed of calcareous fluvial silts. (1') Calcareous fluvial gravels. (1 & 1': Early glacial sedimentation). (2) Coarse sedimentation in periglacial environment (Full glacial sedimentation). (3 & 4) Calcareous fine fluvial silts (Interglacial sedimentation). (5) Brown leached soil (Interglacial). Note the presence of both reworked and undisturbed sites within the same terrace complex (modified from Tuffreau & Antoine, 1995).

3.4.2 Secondary context terrace sites

A large proportion of the archaeological evidence for the Lower and Middle Palaeolithic comes from derived or secondary contexts. For instance, the record for Britain is made up of around 16 primary context assemblages and several hundred secondary context collections, which take the form of fluvial gravel terraces (Hosfield, 1999; Wymer, 1999). Lower Palaeolithic findspots in Britain therefore tend

to be concentrated along the Thames Valley, the Hampshire rivers and the Ouse valleys (Wymer, 1999). Similar patterns are present in continental Europe with concentrations in the Rhine and Somme valleys (Wymer, 1982; Bosinski, 1995; Tuffreau & Antoine, 1995). Examples of secondary context sites from North West Europe include:

- *Mauer (Germany) – OIS 13.*

The site was located on an aggrading river bank, onto which animal bones and a hominid mandible were washed. Some struck lithics were found in the deposit, however it is more likely they were created by natural forces than human action (Bosinski, 1995).

- *Abbeville: Stade and Champ de Mars sites (France) – OIS 13.*

These gravel terraces are located 33m above the bedrock of the present day river valley. Numerous Acheulean handaxes and bifaces have been recovered from them (Tuffreau & Antoine, 1995).

- *St Acheul: Rue de Cagny site (France) – OIS 11 to 12*

The stratigraphic sequence at this site contains both gravel and fine-grained fluvial deposits. The gravels have produced large numbers of lithic artefacts including handaxes, flake tools, notches and denticulates. The lower parts of the finer grained deposits have also produced around 220 handaxes (Tuffreau & Antoine, 1995).

- *Thurrock – OIS 10*

No handaxes are known from this site. However, large numbers of cores and flakes have been recovered. Few are in mint condition, indicating a degree of post depositional reworking. The site is situated in a terrace some 14m OD which has been assigned to OIS 10. Artefacts occur at all levels within 1.5 to 2m of gravel (Wymer, 1999).

- *Great Pan Farm (Isle of Wight) – OIS 7*

This site has produced over 50 handaxes, at least one of which is of bout coupé form, two Levallois flakes and some cores from a gravel pit situated on a terrace some 8 metres above the present surface of the river Medina (Wymer, 1999).

3.4.3 Relevance to submerged landscape research

Today's rivers represent only the upper reaches of palaeo-rivers that would have drained North West Europe during the Pleistocene. At times of low sea level, these rivers would have extended across the exposed continental shelf (Figure 85) (Bridgland, 2002; Gibbard & Latridou, 2003).

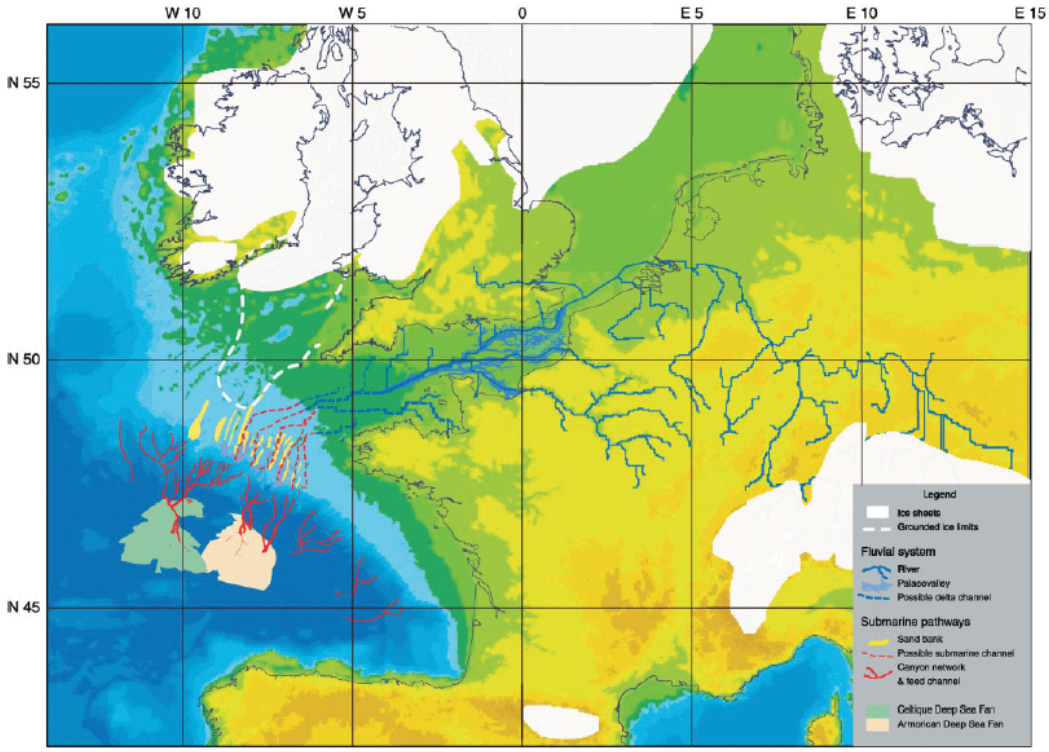

Figure 85. Reconstruction of the exposed shelf and palaeo- rivers at the LGM lowstand and their course through the present day English Channel region. Shorelines have been modified to account for isostatic influences (modified from Bourillet et al, 2003).

Surveys of the seabed and sub-seabed stratigraphy have identified a number of palaeo-channels (see Figure 86, 87) (e.g. Bridgland et al, 1993; Velegrakis et al, 1999). Comprehensive reviews of these palaeo-channels and palaeorivers can be found in Gibbard (1988), Bridgland (2002) and Antoine et al (2003).

Palaeo-channels can also be produced by forces other than fluvial erosion. Deeply incised submerged palaeo-valleys on the North West European shelf, are currently the subject of significant debate with current theories of formation including steady meltwater erosion, glacial erosion, tidal scour, catastrophic meltwater outbursts, lowstand fluvial erosion or aggradation of delta channels (Huuse & Lykke-Andersen, 2000; Kluiving et al, 2003). Recent work suggests a combination of glacial erosion and steady subglacial meltwater erosion is the likely cause (Huuse & Lykke-Andersen, 2000). In any case, many of the palaeo-valleys in the North Sea will not have been produced by fluvial processes and hence will not have formed the terrace sequences seen elsewhere in the region. Although disputed by Flemming (2002) on the basis of the extent of re-working, it is still probable that these glacio-fluvial systems will have re-worked and re-deposited archaeological material both within channels and in ice proximal locations. Although much deeper in the section (100-200 m below seabed) and inevitably heavily spatially and temporally mixed they may still represent locations of secondary context material.

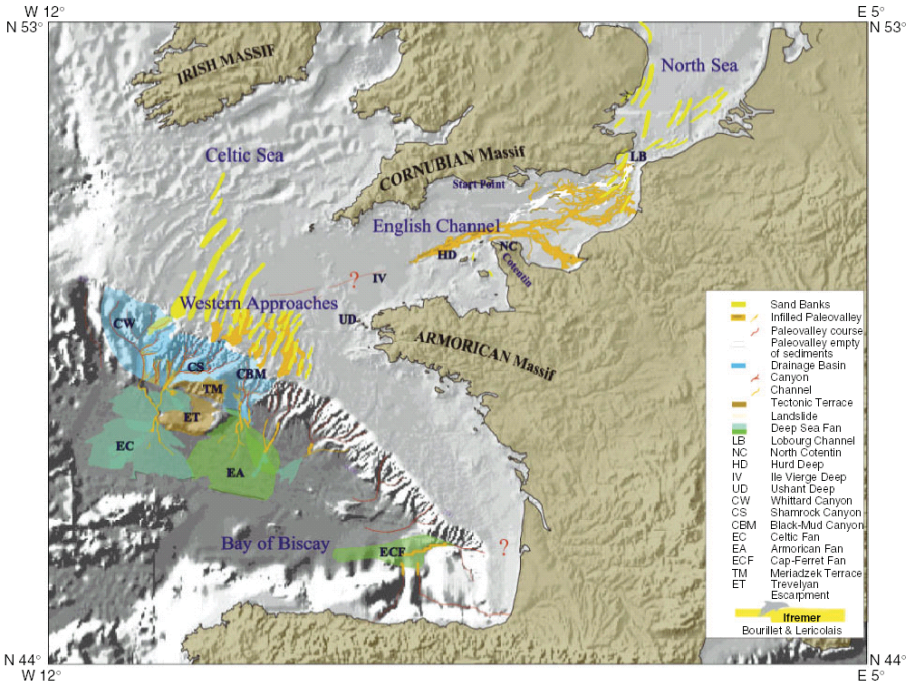

Figure 86. Quaternary palaeochannels in the English Channel and Western Approaches (from Lericolais et al, 2003).

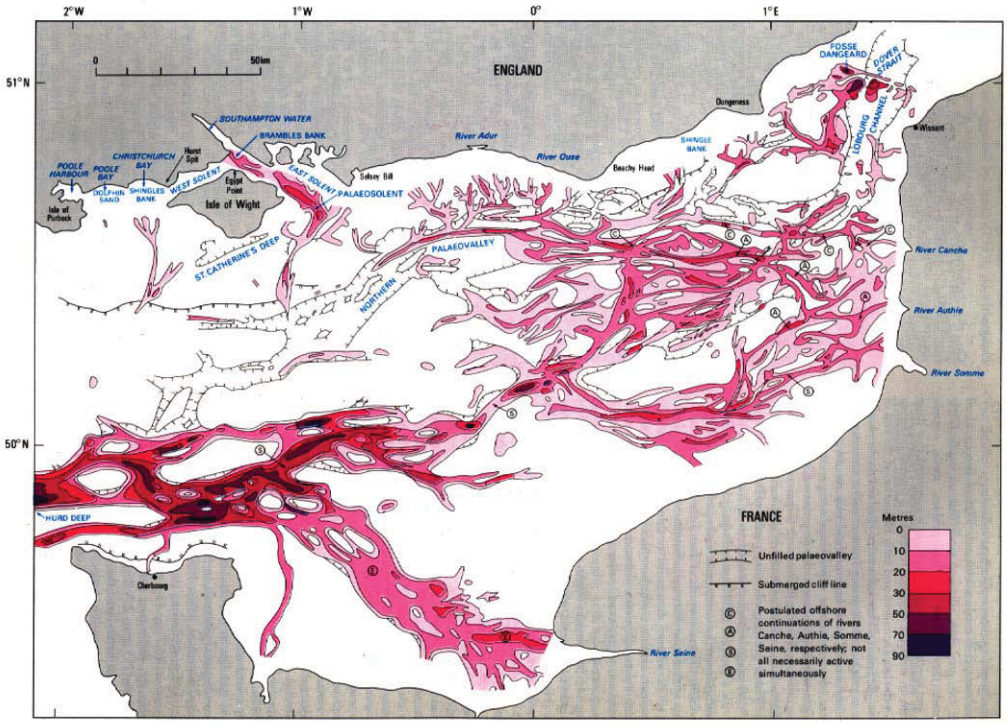

Figure 87. Close up of Quaternary palaeo-channels in the Eastern English Channel (from Hamblin et al, 1992).

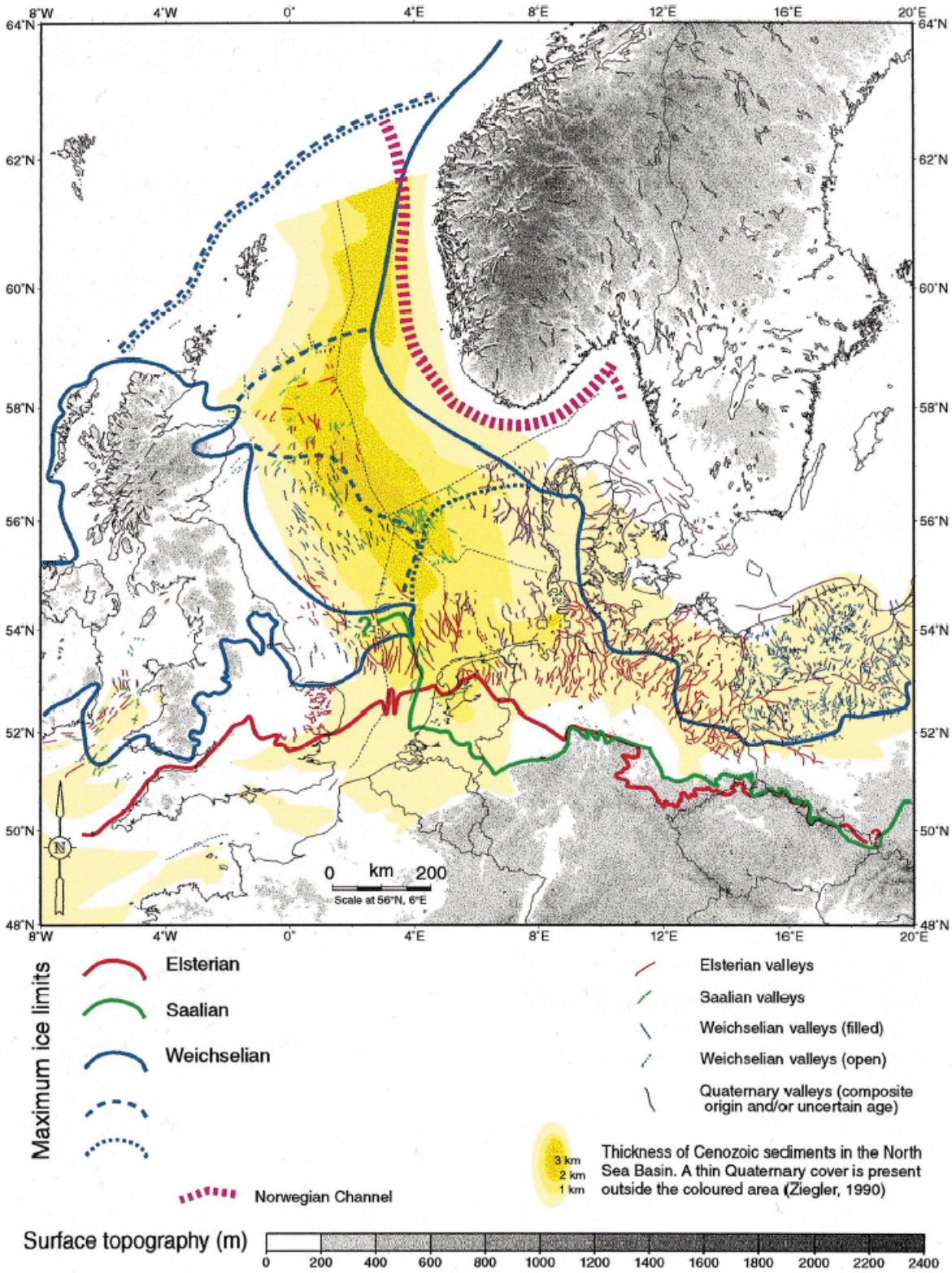

Figure 88. Quaternary palaeovalleys in the North Sea. The blue dotted ice limits indicate alternative perspectives on the Weichsalian ice limits which infer a connection between the British and Scandinavian ice sheets (after Huuse & Lykke-Andersen, 2000).

The implications are that if hominids did occupy these submerged landscapes at various points in time since OIS 13, there is potentially a wealth of archaeological information in secondary contexts locked up in the terrace and channel deposits associated with these fluvial and glacio-fluvial palaeo-channels. This information could be of great use in understanding long term land-use strategies and hominid demography across the English Channel and North Sea plain. In addition, the fluvial records may be of great assistance in reconstructing palaeo-environmental conditions and palaeo-climatic fluctuations (Bridgland, 2002). However, before these goals can be realized, two main issues have to be considered.

The first is that, while submerged palaeo-channels and river terraces are known to exist in the study area, it should not be automatically assumed that the presence of the former necessarily precludes the existence of the latter. As stated in section 3.4.1 they require long term tectonic uplift to form and thus do not exist in subsiding areas, such as the Lower Rhine (Bridgland, 2000). They are however known to be present in the outer Thames estuary (Figure 89) (Bridgland et al, 1993), which is located just outside of the subsiding portion of the North Sea.

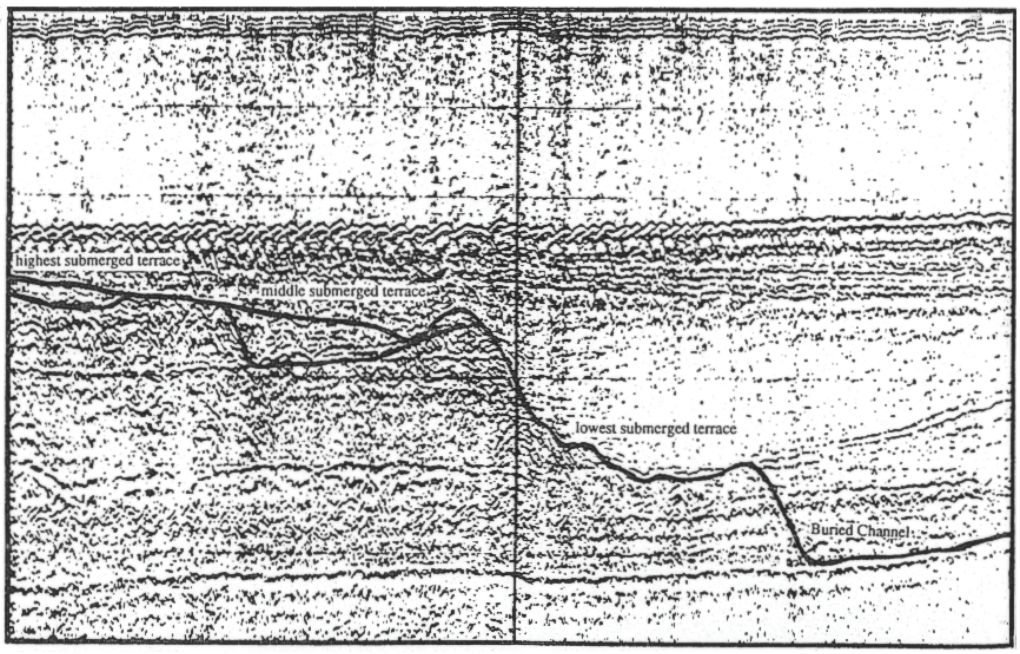

Figure 89. Seismic profile of the submerged Thames-Medway Valley. Image has been annotated to highlight the three river terraces and the buried channel (from Bridgland et al, 1993). Note no scale in original paper.

Other areas of uplift include the south coast of England, as indicated by the presence of raised beaches (Bridgland, 2000), hence raising the possibility that terraces exist in the English Channel. However, geological investigation suggests that terraces appear to be absent through much of the area. This contrasts somewhat with the terrestrial evidence for this region which is characterised by a number of terraces (e.g. the Solent terrace sequence). This absence is most pronounced in the larger palaeovalleys, such as the Lobourg Channel and Northern Palaeovalley, though sediments may be preserved in some of the smaller channels due the protection their banks afforded. The absence of terraces has been attributed to their destruction and reworking by marine

transgression during each phase of sea level rise (Hamblin et al, 1992). There are some exceptions to this though, in that several well developed gravel terraces are known to exist in the offshore buried channels of the Arun Rivur, and the East Solent (Velgrakis et al, 1999). Sediment from terraces reworked by marine processes would currently be distributed about the Channel floor and therefore may represent an example of a tertiary context (see section 3.5).

Clearly, rather than simply assuming that palaeo-channels and terrace deposits go hand in hand, we have to ascertain first whether deposits would have actually formed, and then whether they have been preserved. In areas where terraces do exist, these relict fluvial gravels are the kinds of deposit targeted by the marine aggregates industry (Selby, 1992). Thus a secure understanding of their location, evolution and also archaeological potential will be crucial in developing a sensible and practical research and legislative strategy to enable their utilization by both the archaeological community and aggregates industry.

In addition to terrestrially formed secondary contexts, we also have to consider that the impact of transgression may be such that the primary contexts described in section 3.3 may have been reworked by marine processes into secondary contexts. Little is known about the nature of these deposits, and they will be examined further in Section 4. However, their interpretative potential is likely to be similar to that of the fluvial secondary contexts described above. If a sufficiently large sample can be obtained they may provide evidence geared to answering long term and landscape scale questions.

3.5 Archaeological Material in Tertiary Context

The category of tertiary contexts is proposed on the basis that much of the submerged record may consist of terrestrially formed secondary contexts that have been reworked by marine processes.

A number of regions of potential tertiary contexts can be identified on the North Western European shelf. These consist of areas of known sediment movement and can be identified from the presence of particular bedforms. Various types of these are known from the study regions, notably sand ribbons, sand waves, sand banks and gravel waves (see Figures 90 and 91: Cameron et al, 1992; Hamblin et al, 1992).

Many of these would have formed when rising sea levels reworked fluvially or glacially deposited sediments, but other examples may have formed more recently due to tidal action and wave currents. Areas of particular potential may be located in the vicinity of palaeo-valleys, as their fluvial terrace deposits may well have provided the sediment supply for both syn- and post-transgressive processes. The extent of reworking is likely to range from the formation of a sea bed lag to the total modification of the deposit, depending on factors such as the composition of the sediment, the amount of times it has suffered transgression and regression and the local hydrodynamic regime (Selby, 1992). It has been suggested that with the exception of the gravel waves between the South Falls and the Sandettie Banks (see Figure 91), most relict Pleistocene fluvial and glacial gravel deposits in the southern North Sea have not been reworked to a significant degree despite the presence of strong tidal currents (Cameron et al, 1992). If this were true it would enhance the archaeological potential of these deposits. As the exact nature of what a archaeological tertiary context looks like is unknown at present, their ability to aid in research questions is uncertain. Nevertheless, they should be able to at last provide

indications of hominid presence or absence within a given area, at a particular time, if the artefacts can be dated. Therefore, in some ways they occupy the niche previously occupied by secondary contexts (see section 3.1.4) before they were found to be of use with respect to addressing long term patterns of hominid demography (e.g. Ashton & Lewis, 2002). Given this precedent, it would be prudent to not to designate these deposits as being of little use to current archaeological work as they may be valuable to future research.

Figures 90 and 91 illustrate the distribution of known areas of sediment movement. The archaeological potential of these deposits will be discussed further once marine taphonomic processes have been investigated further in Section 4.1 and 4.2.

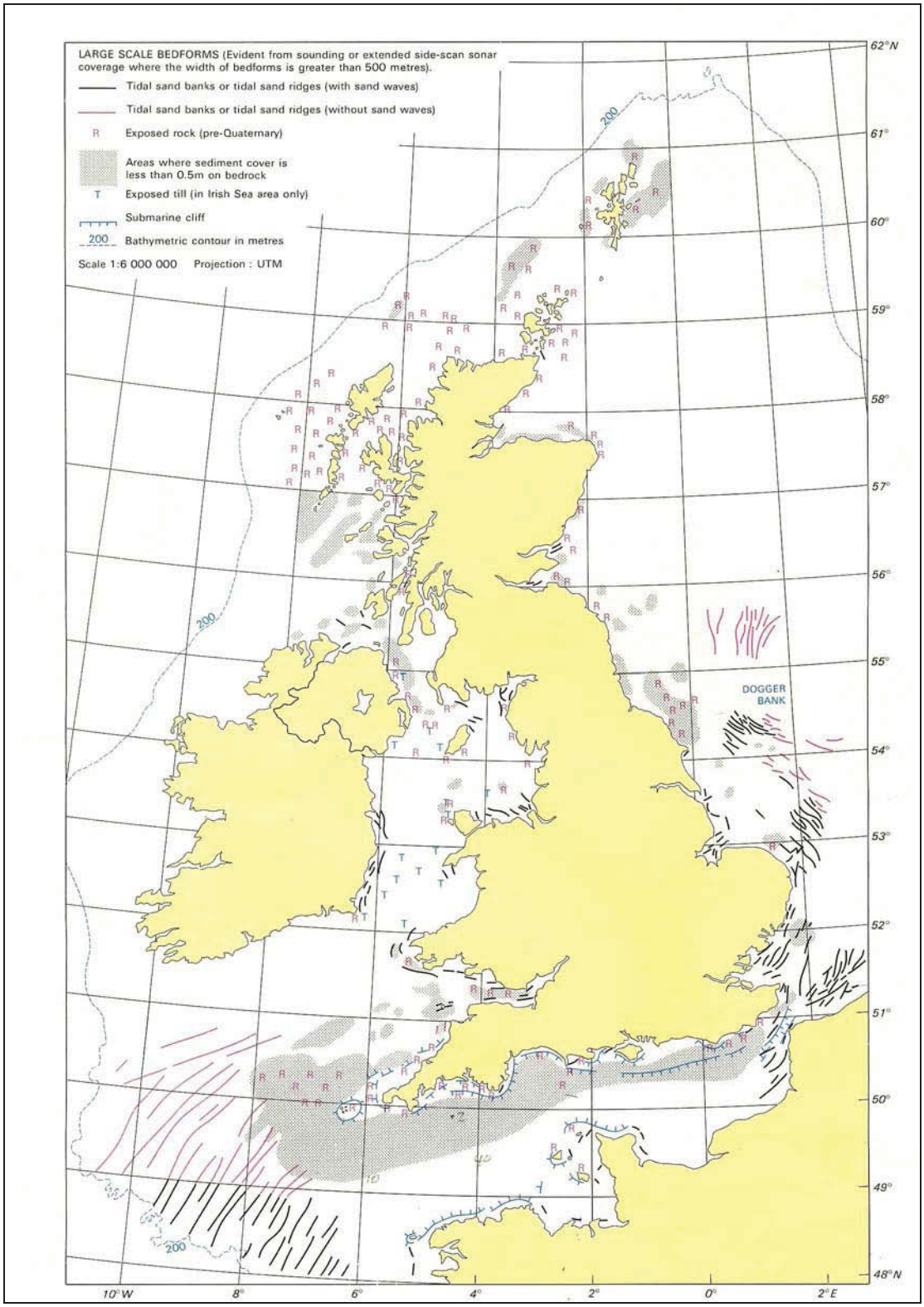

Figure 90. Areas of known sediment movement and hence potential tertiary contexts. Map shows large scale (width > than 500m) bedforms. Particular features to note are areas of thin, or no sediment cover, over bedrock, thus implying significant marine erosion. Archaeological sites in this area are most likely to take the form of marine formed secondary contexts or tertiary contexts (from Rippon, 1987).

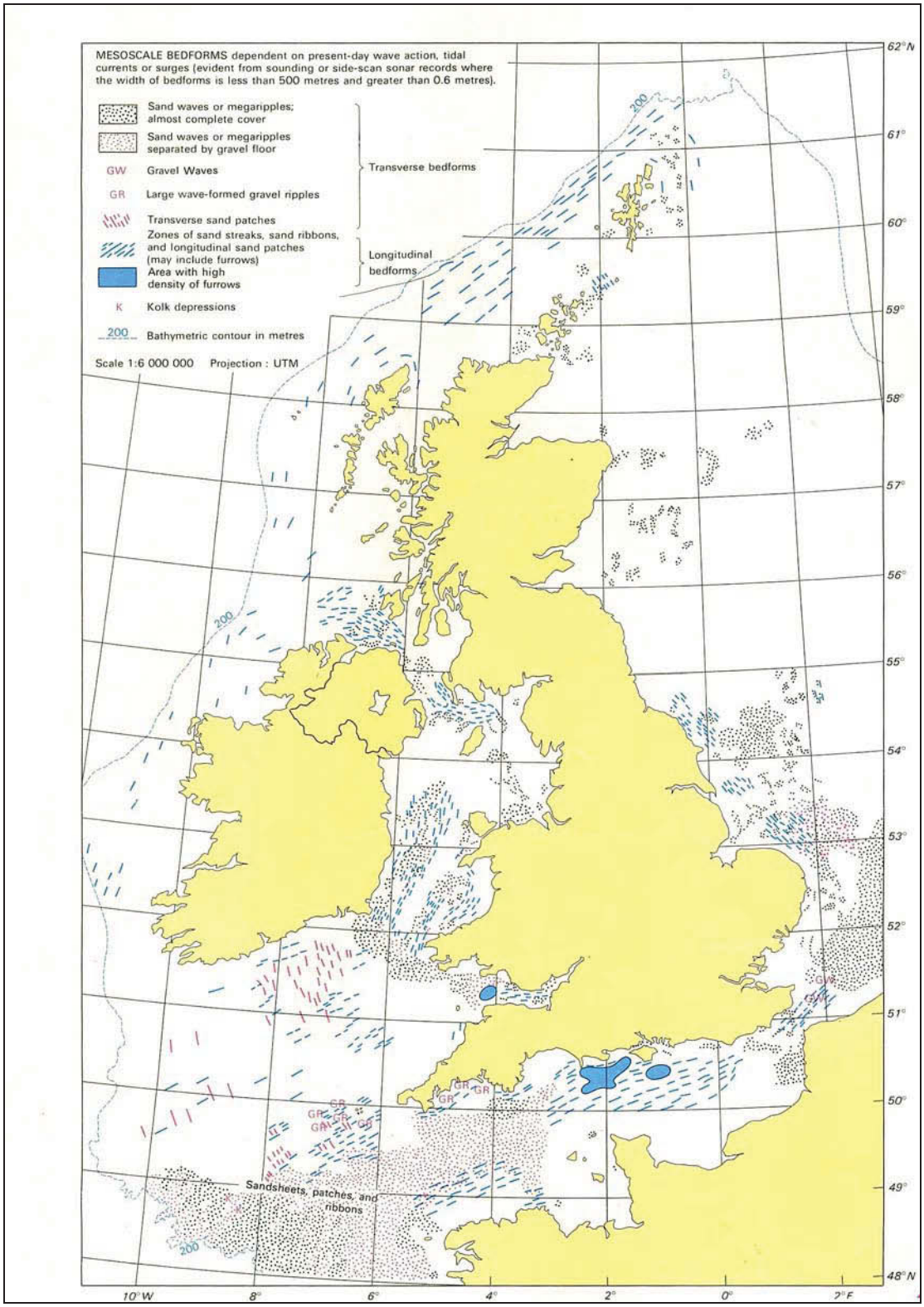

Figure 91. Areas of known sediment movement, and hence potential tertiary contexts. Map shows mesoscale (than 0.6m <width < than 500m) bedforms. Particular features to note are areas of gravel waves and gravel ripples. These imply that current movements are strong may be strong enough to rework and displace archaeological material (from Rippon, 1987).

3.6 Submerged Contexts

3.6.1 Background

Some submerged evidence for these periods has actually been located in the North Sea and English Channel regions (see Flemming, 2002 for a comprehensive review). Some of it comes from relatively secure stratigraphic and spatial contexts, and can be dated. For the purposes of this section these will be classified as sites. In addition, there are also substantial collections of material, often obtained inadvertently by dredging or trawling. These have not been classified as 'sites' on the basis that the exact provenance and dating of the material culture are not securely known. Figure 92 illustrates the distribution of these sites and collections.

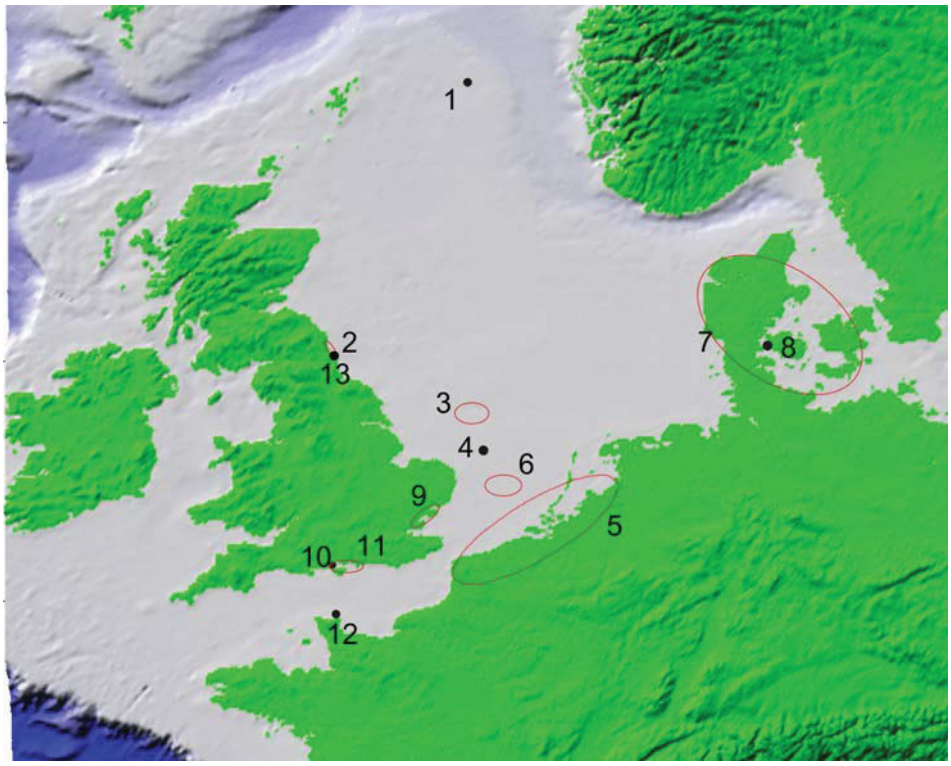

Figure 92. Location of submerged sites and collections mentioned in the text. Black dots = individual sites. Open ellipses = collections or large concentrations of individual sites. (1). Viking Bank Core. (2) Northeast of England. (3) Dogger Bank. (4) Leman and Ower point. (5) Various collections of finds from Dutch and Belgian waters. (6) Brown Ridge. (7) Various Scandinavian sites. (8) Tybrind Vig. (9) Essex Coast. (10) Bouldnor Cliff. (11) The Solent. (12) Fermanville (13) Gateshead.

3.6.2 Sites

- *Viking Bank*

A worked flint has been recovered from a vibrocore taken from the Viking Bank area of the North Sea at a depth of 143m. It has been attributed typologically to the Upper Palaeolithic but its exact function is unknown, as it is broken and incomplete. The flint itself is believed to have derived from a terrestrial archaeological site prior to marine transgression and then became incorporated

into a layer of Holocene sediment. Geological investigations of the seabed sediment indicate that this area was transgressed by 9 ka BP, thus providing a minimum age for any terrestrial archaeological sites in the area (Long et al, 1986).

- *Bouldnor Cliff*

An early Mesolithic site has been located and excavated at Bouldnor Cliff in the Solent. The site is located at the base of an underwater cliff in 11m of water and has produced over 300 worked flints. Dendrochronological dating of timber from the remains of a submerged forest associated has provided dates of c.8 to 8.5 ka BP (Momber, 2000, 2001).

Work is currently being undertaken by the Hampshire and Wight Trust for Maritime Archaeology (http://www.soc.soton.ac.uk/HWTMA/).

- *Fermanville, Cherbourg*

Levallois-Mousterian tools dating to c. 45 ka BP have been found eroding out of peat deposits in a water depth of 25m. The peat beds appear to form the sides of a gully which has been interpreted as a submerged stream bed (Flemming, 1998, 2002).

- *Scandinavia*

Quite literally hundreds of late Palaeolithic, Mesolithic and Neolithic sites have been located in the waters off southern Scandinavia. These range from scatters of worked flints (Figure 93) situated on the seabed surface to full scale settlements, such as Tybrind Vig (see section 3.3.5.3), embedded in the sediment. To go into the details of these sites would require an entire separate review. For more information, see Pedersen et al (1997) and Fischer (1995a). Both volumes contain comprehensive overviews of the areas in question.

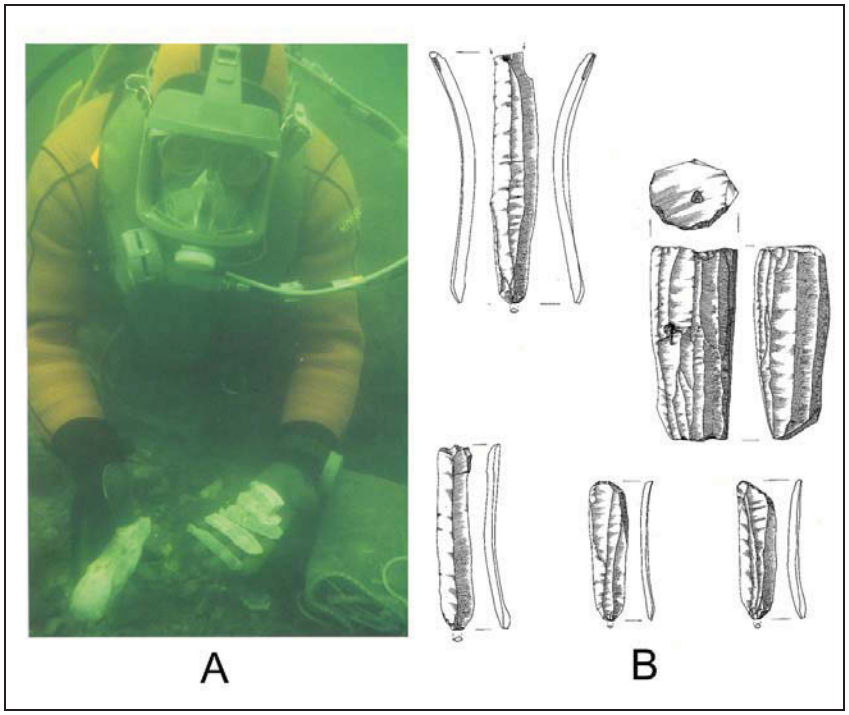

Figure 93. A) Collection of lithic artefacts from the underwater site of Stavreshoved (Denmark). B) Examples of the blades and cores recovered from the Stavreshoved site (after Pedersen et al, 1997)

- *Leman and Ower Bank*

In 1931 the trawler *Colinda* dredged up a barbed bone weapon tip that was embedded in a lump of peat from about 36m water depth (Figure 94). The point is similar to many examples from the late Upper Palaeolithic terrestrial record and is AMS dated to c.11,740 +/-150 BP(Smith & Bonsall, 1991; Coles, 1998; Barton, 1999).

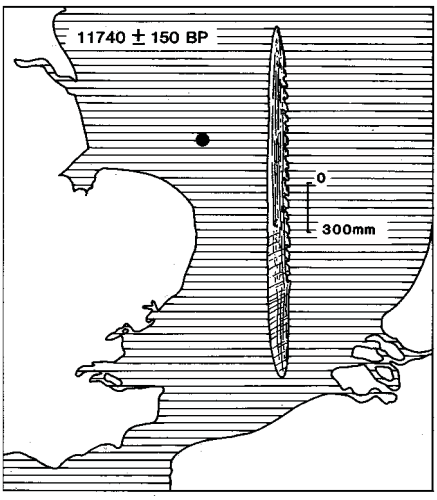

Figure 94. The Leman and Ower point and the location from where it was recovered (from Smith, 1992)

- *Gateshead*

In 2003 a number of lithic artefacts were recovered by scuba divers from the waters off Tynemouth. These range from Early Mesolithic (10 to 8.5 ka BP) pieces recovered from 6-8m of water to Late Mesolithic (8.5 to 5 ka BP) material from the intertidal zone to 4m depth. The artefacts include flakes, blades, scrapers and cores and appear to be water rolled. They are believed to have been originally deposited on the presently submerged Mesolithic shoreline (SALT, 2003).

3.6.3 Collections of material from insecure contexts

- *Brown Ridge and Dogger Bank*

Quite literally hundreds of worked flint, bone artefacts and tonnes of Pleistocene faunal remains have been dredged up by fishermen from these areas of the North Sea (Flemming, 2002). Beyond the general location of these areas, little is known about their stratigraphic context, and the spatial patterning of the assemblages.

- *The Solent*

Peat beds in the Solent are a rich source of lithics. With the exception of Bouldnor Cliff though, little is known about the context of these lithics as they tend to be obtained by dredging (Momber, 2000).

- *Dutch and Belgian waters*

A similar situation to the above is known in Holland and Belgium where dredging operations and harbour constructions have uncovered large numbers of flint artefacts (Flemming, 2002).

- *Essex Coast*

Surveys in the intertidal zone along the coast have resulted in the collection of several hundred lithics, many of them Mesolithic. Denser scatters of Mesolithic implements are known from two sites – Crouch Site 4 and Blackwater Site 3. Both these have been interpreted as inland sites located adjacent to freshwater stream well inland of the tidal limit. The artefacts were then covered by sediment as the sites were inundated. Their exposure and discovery is attributed to the recent erosion of the sediment at these locations (Wilkinson & Murphy, 1995; Fulford et al, 1997).

- *North East Coast of England*

A submerged forest is known to exist in the waters off Hartlepool. While the bulk of it is underwater, parts of it can be observed at very low tide. Investigation of these areas has resulted in the collection of a number of worked flints, including cores, debitage, microliths and microburins from peat bed associated with the forest. The artefacts were typologically assigned to the Maglemose, an early Mesolithic technocomplex (Trechmann, 1936; Fulford et al, 1997).

Much of this material finds its way into private collections or local or regional museums, both in Britain and the Low Countries (Flemming, 2002), and as a result the information on them is rather diverse and spread out. In this country at least, this situation is currently being remedied by Wessex Archaeology's ALSF project *"Artefacts from the Sea"* which is designed to enhance information in the existing Sites and Monuments Records (Wessex Archaeology, 2003).

3.7 Summary and Discussion

Any review or assessment of archaeological potential should entail an understanding of the type of archaeological material that might be encountered, its state of preservation and its interpretative potential. To this end this chapter has highlighted the following:

- Broad-scale patterns can be detected in the archaeological record of the areas adjacent to the North Sea and English Channel regions. The implication is that the patterns apply to these submerged landscapes as well to a certain extent, and thus should provide some indication as to the sorts of prehistoric archaeology that are likely to be encountered on, or below, the seabed.

- Glaciation has provided certain limits on the distribution of archaeological material. Large areas of the central and northern North Sea have suffered extensively destructive glacial erosive processes and therefore are unlikely to contain a great deal of useful archaeological material from prior to the Last Glacial Maximum. They may however be a rich source of post-LGM material. The southern North Sea and English Channel though may have been less intensively affected and hence are more likely to contain a variety of deposits possibly dating back as far as 500 ka BP.

- Sites are found in a variety of location at different points in time. With respect to hominid preference, worthwhile areas of potential appear to be located in river valleys. Lakeshores also appear to be attractive areas,

especially in the earlier periods while areas with geology susceptible to cave formation should also be considered. On a finer scale, settlement patterns are also likely to be determined by the distribution of both raw material, such as flint, and subsistence activities or resources, such as topographically based hunting strategies.

- In terms of preservation, there is likely to be a continuum ranging from significantly reworked deposits to sites in which the archaeology has maintained nearly the same spatial integrity since the time of deposition. Work on these primary and secondary contexts on land has revealed that both sorts of deposits can provide very useful insights into past societies. A large part of the secondary context evidence will be contained in preserved fluvial river terraces, examples of which are known underwater. However, marine and transgressive reworking may have lead to the creation of secondary contexts as well. Developing an understanding of the potential of these contexts is important, especially with respect to Upper Palaeolithic and Mesolithic research, which at this point in time, have not really had to contend with this issue.

- The dynamic nature of the marine environment necessitates the consideration of a third category – tertiary contexts. These represent reworked terrestrially formed secondary contexts. Their archaeological potential is uncertain but it should not be discounted until further research has been undertaken. At present, potential areas of tertiary context are areas of significant sediment movement (inferred on the basis of bedforms) in the vicinity of possible terrestrial secondary contexts (e.g. fluvial terraces) which may have provided a sediment supply during and after phases of transgression.

- The impact of short-term climatic fluctuations such as Dansgaard/Oeschger oscillations on sea level and transgressive events has to be examined further as they are likely to have an influence on shoreline position. Rapids oscillations of sea level within glacial/interglacial cycles may also enhance the marine reworking of archaeological material and reduce the possibility of finding in situ primary contexts exist.

- In terms of the actual material culture, the most common forms of evidence are scatters of worked stone and bone. However, given the anaerobic environments underwater, preservation may be considerably enhanced, and this could lead to the possibility that organic artefacts, such as those made on wood, may also be found. Better organic preservation could provide evidence which would enhance our knowledge of past societies both in terms of the material culture they possessed, which in turn could allow insights into their social lives, and the palaeo-environments they inhabited.

- Submerged prehistoric archaeological evidence can potentially assist in a number of current research questions. Among these are the 'traditional' questions concerning patterns of colonization and migration, notably the timing and entry of hominids into Britain and the routes they took. However, integrated with this should be a more secure understanding of how this process took place, and the role that the long-term occupation of areas such as the North Sea played in it. Further important questions

concern the development and extent of coastal occupation throughout prehistory, a subject which the terrestrial record in isolation cannot address to a significant degree, and the impact of sea level change on past societies.

It should be stressed that this is not a predictive model. Sites have been looked at only in very general terms and the relationships between resources, topography, site location and so on have not been quantified or examined on local scales. Whether or not this information can be integrated into a predictive modelled will be discussed in Section 5. Furthermore, the syn- and post-transgressive processes acting on the archaeological material have not yet been brought into the equation. In the light of the dynamism of the marine environment, and the probability that it will have resulted in the creation of many secondary and tertiary context assemblages, an enhanced understanding of the way in which it does this is necessary. Consequently, the next Section (4), will attempt to address this issue.