Chapter 3:
Coastal and submerged landscapes

by Matthew Pope and Martin Bates

THE CHANGING SHAPE OF BRITAIN

Britain is a landmass defined by its modern Holocene coastlines, situated on the edge of the continental shelf in the north-east Atlantic Ocean and separated from mainland Europe by the English Channel and the North Sea (Fig. 3.1). The long perspective offered by Palaeolithic archaeology and scientific study of Pleistocene sedimentation in the region demonstrates that this arrangement is simply the current geographical condition in a long and dynamic process of landscape evolution stretching back through the Pleistocene and into the later parts of the Tertiary (Gibbard and Lewin 2003). In order to reconstruct the long term development of Britain as a landmass, and to understand the human occupation record, it is necessary to understand the complex interplay of a number of long-term processes which include global climate change, changes in the relative and absolute height of solid rock formations, the short term processes of sedimentation/erosion, and fluctuations in sea-level.

Reconstructing the long term evolution of the British landscape and its relation to the sea is therefore critical in developing an accurate understanding of the prehistory of human colonisation of Britain in terms of connectivity or separation from the continent (Box 3.1). Recent research, heavily supported by English Heritage through the ALSF, has deepened

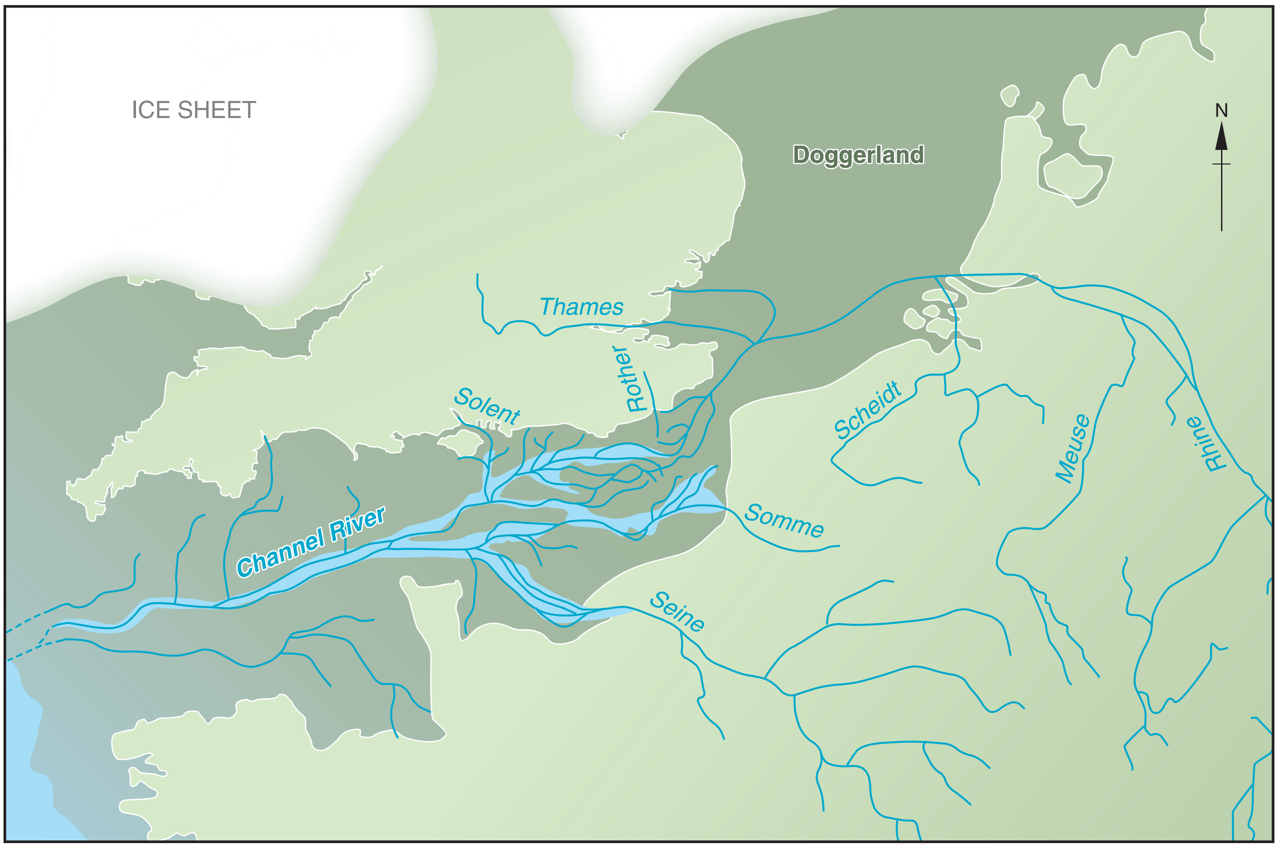
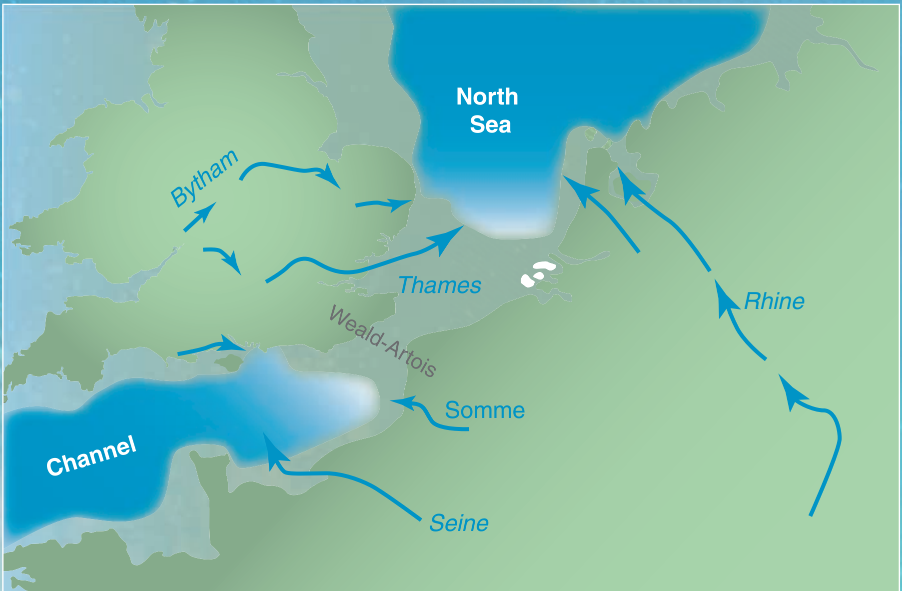


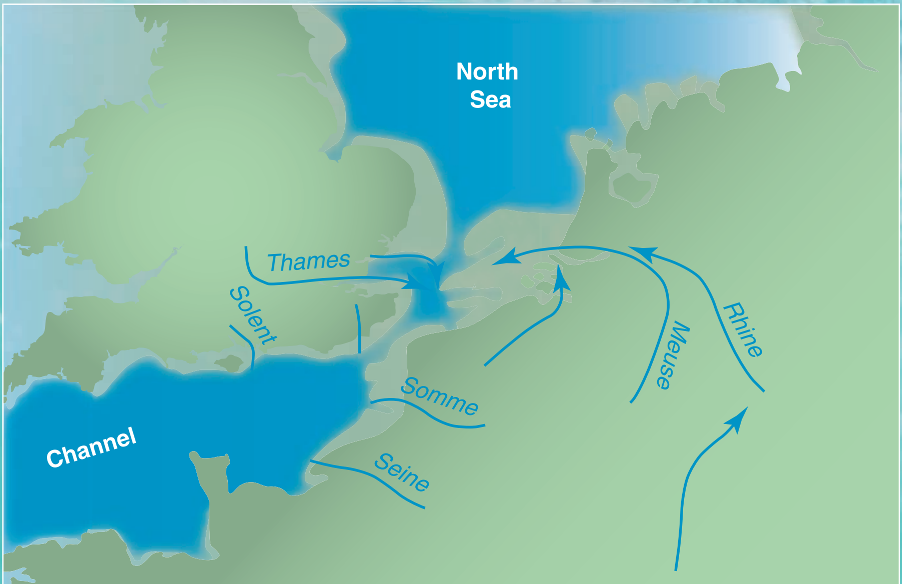
Fig. 3.1 Map showing the position and outline of Britain against landscapes of now submerged Doggerland and the La Manche/English Channel lowlands during the last glacial maximum (from Gibbard 2007)

ISLAND BRITAIN

Through tectonic uplift, much of Britain had emerged as a permanent landmass by the Early Pleistocene, effectively becoming a significant peninsula of north west Europe open to relatively easy colonisation by terrestrial plant, animal and human species. Its form defined areas of the continental margin such as the North Sea that was periodically subject to inundation during sea level high stands. It also saw the beginning of the English Channel (although at this stage this comprised simply a large embayment of the north east Atlantic). From this point on, the combination of long term climatic change and associated sea-level rise and fall began to shape the landscape of north west Europe and give shape to the British Isles as we know them today. The cycles of global warming and cooling intensified after 1 million years ago, ultimately forming 100,000 year cycles. With the on-set of each cold stage, sea-level falls would have occurred with the build-up and advance of the polar icecaps and peripheral ice sheets. During the shorter, more punctuated periods of global warming, meltwater lakes would have formed, which, when breached, would have released raging mega-floods. Interglacial periods would have also led to massive rises in sea-level to about the limit we see on the planet today. This would have led to the flooding of the lower reaches of our river systems and the continental margins and, as today, the resumption of erosion of the high sea-level coastline which over the millennia has defined the existence and shape of our island.



Map 1: *c* 480,000 yrs



Map 3: *c* 235,000 yrs

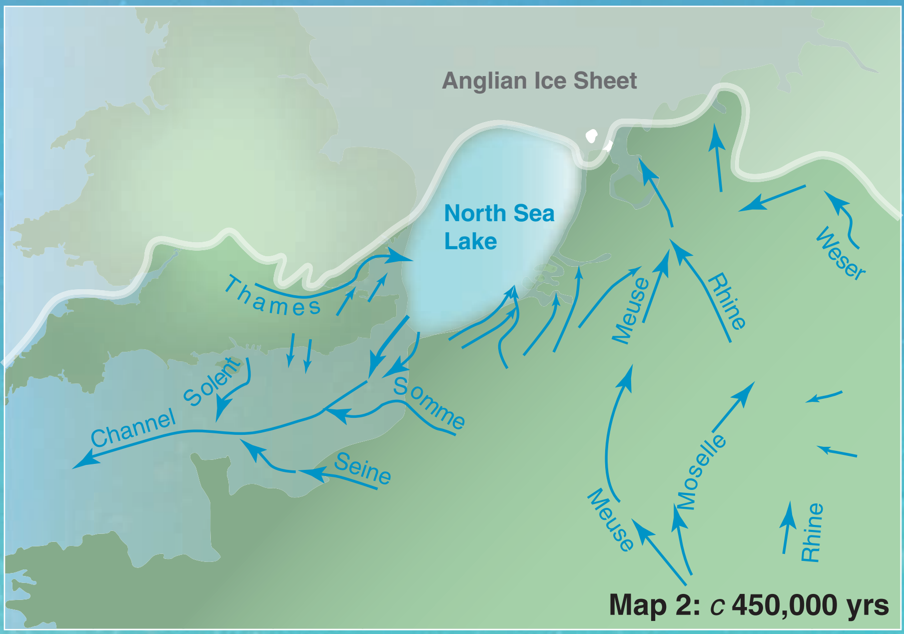
Map 1 An early Middle Pleistocene interglacial: peninsula Britain, MIS 13

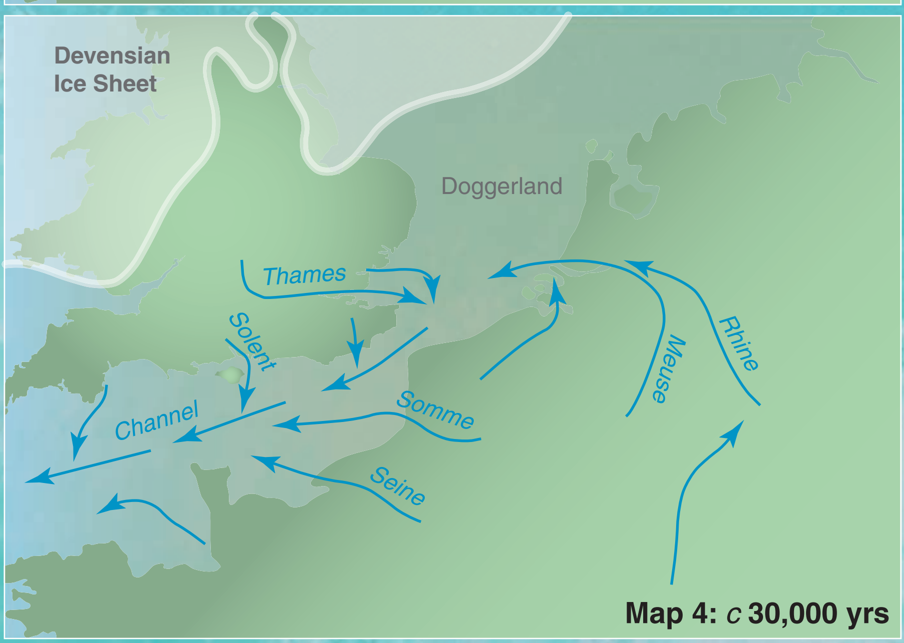
During a high sea-level interglacial period some 480,000 years ago, Britain's coastline broadly conformed to that we see today, although the coastline of south east England continued across to northern France. The River Thames and River Rhine emptied directly into a separate North Sea while the Seine, Solent, Arun and Rother flowed into the English Channel embayment. Access to the British landmass was relatively open, with a 110km corridor through the Weald-Artois anticline providing a permanent landbridge for humans (*Homo heidelbergensis*) and other Pleistocene fauna (White and Schreve 2000).

Map 2 An early Middle Pleistocene late glacial: formation of pro-glacial North Sea Lake, MIS 12

The Anglian glaciation was deep and prolonged and resulted in the furthest extension of the arctic ice sheet across Britain in the Pleistocene, as far south as Finchley in London. The course of the River Thames was effectively shifted into its current position occupying the London Basin, and much of the North Sea was covered by ice. It is thought that during the retreat of the ice sheet at the end of this glacial period meltwater from the ice, channelled also through the Rhine and Thames Valleys, accumulated as water in the southern North Sea. Eventually this meltwater would have spilled across the Weald Artois anticline (ridge) incising deep meltwater channels and beginning the process of breaching through the permanent land bridge connecting Britain to the continent.

BOX 3.1





Sea floor survey undertaken by Gupta *et al.* (2007) have identified landforms in the submerged palaeo-valleys of the English Channel which appear to be a trace of the catastrophic mega-flooding caused by the formation and discharge of these melt-water lakes. At least two of these phases of catastrophic flooding appear to have occurred, one occurring during the end of MIS 12 as shown here, the other occurring during the closing stage of another later cold stage. Possibly MIS 8 or 10 (Gibbard 2012).

Map 3 Late Middle Pleistocene interglacial: the formation of island Britain

While it is not yet fully possible to determine exactly when Britain first became an island, it is highly likely that island Britain existed during parts of MIS 7. The English Channel may have been approaching something like its current configuration and was large enough, as climates cooled at the end of the interglacial period, to allow the movement of icebergs down the English Channel. The virtual absence of any evidence for human activity during the last interglacial period (MIS 5e), suggests that sea-level rise and the cutting off of Britain occurred rapidly during the onset of warm global conditions. During this period, in which global temperatures and sea level were slightly higher than those experienced today, there is good evidence for Neanderthal occupation of the continent, and for large mammals, including Hippopotamus, on the island of Britain. Traces of human activity which can be firmly tied to the period are, however, scant and controversial.

Map 4 Late Pleistocene Cold Stage MIS 2: landscapes of the English Channel River and Doggerland

This map shows the palaeo-topography for much of the last 100,000 years, prior to the sea-level rise of our own warm interglacial (the Holocene). During this time, Britain formed part of a large extension of the European continental landmass exposed by a sea-level fall of up to 125m. Areas exposed included the vast landscape of Doggerland, a series of river valleys and low plains occupying the southern North Sea, and the English Channel River system, the massive fluvial system left behind by the catastrophic events which breached the Weald-Artois anticline (ridge).

While Doggerland today is a relatively shallow area of sea, heavily exploited and impacted on by oil/gas and gravel extraction and fishing, much of the English Channel river system lies more deeply submerged with relatively few direct opportunities to explore its now flooded landscapes. Consequently, while Doggerland has revealed a great wealth of finds, including mammalian fauna, stone tools and even a portion of Neanderthal skull, finds from the English Channel River System are exceedingly rare. The English Channel River would have comprised the combined drainage of the Rhine, Thames, Seine, Solent and other tributaries making it potentially the largest river in Europe, and one of the great rivers of the world. Such a massive watercourse may have presented a significant barrier to human colonisation from the south compared to more easy access into Britain across the flatter and less broken Doggerland plains.

and widened this knowledge base. It has enabled earth scientists and archaeologists to develop a more accurate understanding of the distribution of ancient terrestrial deposits offshore and their potential to preserve traces of ancient human activity within both ancient landscapes now submerged by the sea and in deposits relating to past coastlines preserved high above the modern sea-level. In this chapter the unique record of these lost landscapes of human prehistory are considered in terms of their formation, current preservation and the potential they hold for documenting the colonisation and occupation of the British landmass over the past 800,000 years.

EVOLUTION OF THE BRITISH LANDMASS AND THE PREHISTORY OF HUMAN OCCUPATION

For much of the Pleistocene period Britain, as defined by the current limits of the landmass, was non-existent, it simply constituted the north-west extension of continental Europe projecting into the north Atlantic Ocean. Our understanding of the relationship between long term sea-level change and the Earth's climate has been radically accelerated in the past 40 years. Today, the starting point for understanding the chronology of sea-level fluctuations is the marine isotope curve discussed in Chapter 2 and Box 2.1 (Lislecki *et al.* 2005; Martinson *et al.* 1987; Shackleton 1987; Shackleton and Opdyke 1973; Shackleton *et al.* 1990; Steffersen *et al.* 2008). Simply put, during the cold stages and substages of the marine isotope sequence lowered sea-levels greatly increased the extent of the terrestrial landmass around what we currently know as the British Isles, exposing large areas of the continental shelf as open steppic environments. During periods of intense cold, permafrost tundra would have formed on the southern margins of these landscapes, while parts of northern Britain and the North Sea would have witnessed the encroachment of ice sheets. During the relatively brief warm stages and substages, sea-levels rose to submerge the low-lying continental shelf and the extensive river valley systems that flowed through them, thus drowning the landscapes of the English Channel and North Sea (see Box 3.1).

High sea-levels brought with them rapid transformations of the terrestrial landscapes through transgression of the coast and submergence of former dry landscapes. At the coast, erosion and deposition at the emergent zones formed active shingle beaches and new cliffs and estuarine environments identical to those that fringe the British Isles today. During the earliest phases of human occupation in Britain, even these periods of high sea-level did not always lead to isolation. For much of the Lower and early Middle Pleistocene, Britain remained connected to Europe across a substantial landbridge along the axis of the Wealden Anticline, a 60 mile wide neck of land which includes the South and North Downs and their equivalents on the French mainland (Gibbard 2007; Cohen *et al.* 2014).

This connecting peninsula was breached during one or more of the glacial periods of the last 500,000 years when large lakes, dammed on the northern side by the build up of ice (and at one point possibly moraine), catastrophically overflowed (Gibbard 1995; Gupta 2007; Gibbard 2007; Murton and Murton 2012). This initial erosional event was then augmented by more sustained marine erosion during the high sea-level stands of interglacials. After these processes of breaching, and certainly by 125,000 BP, we can finally begin to talk in terms of a definable island Britain, separated from the continental mainland during the high sea-levels of interglacial periods and defined as an upland zone by former coastlines during periods of sea retreat during the cold glacial stages.

Determining the details in terms of timing and process of this breaching of the Wealden Anticline, and the periods in which Britain was isolated from the continent, has been the focus of much work during the past 25 years and is absolutely critical to a true understanding of the British Palaeolithic record. The developing narrative of the hominin occupation of British throughout the Pleistocene relies entirely on a true appreciation of the dynamic palaeogeography of the landmass and the access points and obstacles at any given time (eg White and Schreve 2000; Conneller 2007).

Equally pivotal has been the unravelling of the story of the human occupation of the richest Palaeolithic landscapes in Britain: the Thames Valley (Bridgland 1994; 1996; Bridgland *et al.* 1999; 2004; 2006; Gibbard 1985; 1994; McNabb 2007; Mitchell *et al.* 1973; Pettitt and White 2012; Roe 1981; Wymer 1968; 1988). Detailed investigation of this occupation record by the Leverhulme-funded *Ancient Human Occupation of Britain Project* (AHOB) has attempted to develop and understand the macro-scale record of human occupation directly in terms of the interplay between hominin populations, sea-levels, climate and palaeogeography (Ashton and Lewis 2002). Current models rely on assumptions of what the archaeological record – in terms of density of artefacts – may tell us about palaeodemography, and how this in turn might relate to the accessibility of the British landmass in terms of environmental challenges during glacial periods and the gradual or sudden isolation of the landmass during the interglacials. However, the validity of this approach and the interpretations drawn from it are disputed by others (eg Pettitt and White 2012).

The importance of coastal exposures (see Pakefield and Happisburgh below and Fig. 3.2) and submerged landscapes for reconstructing the details of past coastline development has thrust the sedimentary archives preserved in both near-shore and offshore contexts into the spotlight during the past fifteen years. The identification of extensive and archaeologically important deposits associated with marine and intertidal deposits at Boxgrove in West Sussex drew attention to these sedimentary environments as offering preservation potential which

LL text.qxp_GtB 26/01/2016 14:34 Page 57

Fig. 3.2 Cromerian sediments exposed on the foreshore at Happisburgh, Norfolk

Fig. 3.3 Excavation of fine-grained deposits and in-situ *archaeology at the horse butchery site GTP17, Boxgrove*

matched, and sometimes exceeded, the level of detail from fluvial deposits that had previously contributed to our understanding of human occupation history (Fig. 3.3). With this recognition came an understanding that the connectivity and relative interplay of coastal and terrestrial resources necessitated an approach to Palaeolithic archaeology that was not confined by modern geographical boundaries. Marine and regressional deposits could be found inland at altitudes of up to 40m above modern sea-level, and terrestrial deposits were preserved at depths in the sea waters around Britain.

Rapid mechanised development of the aggregate extraction industry during the latter half of the 20th century – a recurring theme throughout this volume – impacted heavily on both near and offshore assets. Marine deposits preserved at elevations above sea-level were heavily exploited in both Sussex and Hampshire from the 1970s onwards and offshore dredging of gravel deposits increasingly actively targets submerged fluvial contexts (Wessex Archaeology 2008; Tizzard *et al.* 2015).

FLOTSAM OF THE ICE AGE: THE POTENTIAL OF THE SUBMERGED RESOURCES AS REVEALED BY FINDS

It has long been recognised that the fringes of coastal northern Europe were not as fixed as it might at first appear. The coastal and intertidal exposures of submerged forests (Reid 1913), peats (Hazell 2008) and bone-bearing channels revealed after storms and at low tides not only informed early scientific studies but had long fired the collective imagination of people deep in our medieval past and possibly earlier in prehistory. The occurrence of stone fish traps, tree stumps and other traces of apparent terrestrial activity has given rise to a deep, embedded mythological tradition of submerged lands and lost villages throughout the coastal areas of the continent. These include the Tír na nÓg of Irish mythology, Cité d'Ys of Breton mythology and the Welsh equivalent – Cantre'r Gwaelod – a legendary drowned kingdom in Cardigan Bay (Kavanagh and Bates in press).

In the 20th century, the intensification of seabed trawling, private collection from the foreshore and the development of professional archaeology and Quaternary science, started to lead to an understanding of the reality behind these myths. Fishermen's nets gave rise to abundant finds of ice age and early Holocene fauna, stone and bone artefacts and palaeoenvironmental remains including tree stumps. Despite the unsystematic nature of this collection, it

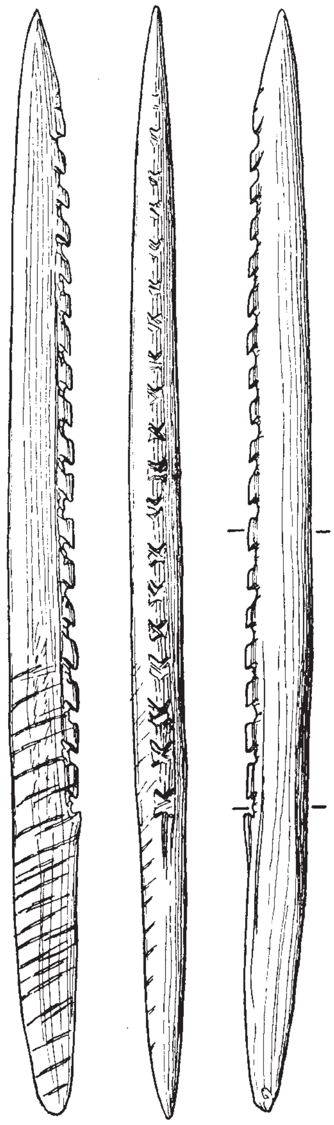


Fig. 3.4 Barbed antler point, discovered by the trawler Colinda from the surface of the bed of the North Sea in 1931(from Clarke and Godwin 1956)

Fig. 3.5 A large commercial trawler. These vessels, along with marine extraction activities, are undoubtedly having a damaging effect to the offshore record. Through proper management under the NSPRMF, this destruction is monitored, controlled and utilised to provide investigations of the deeply submerged archaeological record (Wessex Archaeology)

firmly demonstrated that deposits preserving stone tools and organic material in remarkable condition were widespread across the bed of the North Sea (Gaffney *et al.* 2009). The find, in 1931, by the trawler Colinda was instrumental here. The skipper, Captain Pilgrim E Lockwood, recovered a barbed antler point dating to the Mesolithic period from a block of peat 25 miles off the Norfolk coast (Fig. 3.4). The find demonstrated that there lay, preserved in submerged organic deposits, exceptional archaeology of a type that was to take British archaeology a couple of decades to equal on land, with Clark's Star Carr excavations. Today we know the area of former submerged landscape as Doggerland, after the shallow bank of the same name known to millions through the shipping forecast, a term first used in this context by Bryony Coles (1998).

Today, trawling is still the most effective way of recovering faunal and artefactual material from the sea, given the practical difficulties of using divers or submersibles to search large areas. Specialist trawlers have been in operation for the past 20 years as a result of partnerships between Dutch fishermen and museums to undertake controlled trawls of the seabed and systemic study of the recovered material (Fig. 3.5; Peeters *et al.* 2009). While an improvement on the *ad hoc* nature of previous studies of submerged material, these trawls produce material for which it is still difficult to ascertain information on time-depth, association and context. The trawls are also destructive to underlying deposits, not to mention marine life, and represent a level of fieldwork standards that would not be tolerated in terrestrial contexts. But perhaps this sacrifice is worth making, given our low levels of understanding and logistical issues surrounding other methods of recovery, the widespread threat and damage occurring through uncontrolled commercial activities and unregulated trade in fossils from the same deposits. The loss to what appear to be extensive deposits seems minimal in comparison to the information and awareness being gained by such studies. It will be up to future researchers to judge whether the cost was worth it. That will be dependent upon us now capitalising on these early gains in understanding through coarse investigation methods and evolving a fully mature investigative and management approach to the submerged record.

Fig. 3.6 Portion of frontal bone from the skull of a Neanderthal, dredged from the Zeeland Bank off the Dutch coast

The collections of fauna recovered thus far are overwhelmingly dominated by cold-stage mammals of the last glacial, representing a cool period of low sea-level when Doggerland was last fully exposed as a terrestrial land surface. Finds of woolly rhinoceros (*Coelodonta antiquitatis*), mammoth (*Mammuthus primigenius*), bison (*Bos bison*) and reindeer (*Rangifer tarandus*) attest to cool, open environments of the mammoth steppe that dominated here during the 90,000 years of the last glacial. However the fauna also contains species that hint at different environments, ranging from marine mammals from previous high sea-level interglacials, through to warm terrestrial mammals such as straight-tusked elephant (*Palaeoloxodon antiquus*), aurochs (*Bos primigenius*), red deer (*Cervus elephas*) and hippopotamus (*Hippopotamus sp*.). Early Pleistocene faunas representing diverse environments are also present, including the southern mammoth (*Mammuthus meridionalis*), musk ox (*Ovibos moschatus*) and beaver (*Castor fiber*). Part of the explanation for the presence of deposits of different ages close to the sea floor in the southern North Sea is that the area is part of a structural basin, sinking in the middle and infilling with sediments primarily derived from the river Rhine. At the edges of this basin older sediments lie close to the sea-bed while towards the middle of the basin older sediments lie deeply buried beneath more recent ones.

The finds also include two very significant and rare species. In 2008, the Dutch trawler TX-1 collected the partial leg bone of a large scimitar-toothed cat (*Homotherium latidens*) usually thought to have been absent from northern Europe after 600,000 BP. This and other dated finds (Reumer *et al.* 2003) are significant in suggesting that large cats might have either continued to occupy northern Europe through the Middle and Late Pleistocene, albeit in low numbers, or had a range which occasionally extended into the Doggerland region. Amongst the bones dredged from the Zeeland Bank, an area that has also produced many handaxes, a frontal bone of a Neanderthal has recently been reported (Fig. 3.6; Hublin *et al.* 2009). Although lacking information about the original context of the find, which could have had an origin as diverse as a formal burial or a hyena den bone accumulation, the find indicates the potential of the submerged deposits to preserve scientifically important human fossil material. The bones of Neanderthals and other human species will undoubtedly be rare, as will those of the sabre-toothed cats, since top level predators occur in lower numbers than herd mammals like bison. But research may develop to allow future researchers to home in on suitable areas, especially by targeting the concentrations of human artefacts that might indicate occupation sites.

LL text.qxp_GtB 26/01/2016 14:34 Page 60

It should, however, be noted that the scenario presented for the southern North Sea (Doggerland) is but one facet of our submerged landscapes, and that the English Channel region presents a very different set of features and problems for investigation (Gupta *et al.* 2007). The prime reason for the preservation of stacked sequences of sediments in the southern North Sea rests, as has just been mentioned, on the fact that it is a geological basin that is subsiding over time. During the Pleistocene this basin was periodically filled by sediments (primarily) derived from the Rhine system. These buried older sediments beneath thick sequences of deposits in the centre, but left those same deposits closer to the seabed at the margins. In contrast, conditions in the English Channel are essentially defined by uplift, meaning that erosion rather than deposition dominates and only in incised river valleys, such as those of the Arun or Seine, are sediments preserved. This means that across much of the Channel bedrock dominates close to the seabed. The result of these very different sets of geological and geomorphological conditions means that not only are differences seen in the nature and types of sequences present but that preservational potential will vary between the areas and different methodologies will be needed to investigate the sequences.

Through developments in research frameworks and a truer picture of threats and potentials, archaeologists and Quaternary scientists have developed an impetus towards greater understanding in the North Sea and English Channel (Coles 1998; Flemming 2002; 2004*).* As part of this drive, the first decade of the 21st century saw significant research funding through the ALSF aimed at increasing our understanding of these resources, and developing tools for their effective management and preservation. Today we can recognise that there are a number of different elements to the 'marine' archaeological resource:

- Elements of erstwhile terrestrial landscapes, formed during low sea-level stands (colder climatic episodes), that are now submerged beneath the sea
- Elements of terrestrial landscapes that were submerged due to subsidence of formerly dry ground or when topographic features may have prevented flooding of low-lying areas during sea-level high-stands (warm, interglacial periods)
- Elements of marine sedimentary sequences preserved as ribbons of deposits around our coastlines as raised beach/marine sequences from erstwhile high sea-levels

While challenging, the present day terrestrial components of these marine records (see above) could be dealt with using a range of existing techniques of geological survey and mapping. However, the offshore record presents real challenges to effective understanding: its depth, relative inaccessibility and vast spatial distribution requiring the application of cutting edge science-based investigation, costly technology and a new breed of highly skilled marine Palaeolithic archaeologists. While very much in its infancy as a discipline, significant developments have been made through ALSF-funded research. These have resulted in a new and exciting perspective on ancient landscapes as dynamic, transitional and continuous surfaces that require an approach that can fully integrate terrestrial and marine assets of the ancient human occupation record. The examples presented here give an account of how the submerged resource provides opportunities to examine established and emerging ecological niches of critical importance to ancient hunting and gathering populations.

FIRST EUROPEANS AND DYNAMIC COASTS: PAKEFIELD/HAPPISBURGH MARINE SURVEY

The confirmation in the first decade of the 21st century that genuine artefacts were present beneath Middle Pleistocene tills (perhaps in excess of 750,000 years old) transformed our understanding of the colonisation of the British Isles. Leading this new understanding of human presence in Britain was the Leverhulme-funded AHOB Project, with some landform work also carried out under the auspices of ALSF.

The first important finds were from the site of Pakefield, on the Suffolk coast, where a collection of struck flint artefacts was found in sedimentary deposits relating to an ancient river, draining into what was to later become the North Sea (Parfitt *et al.* 2005; Preece and Parfitt 2012). Environmental evidence suggests that temperatures at Pakefield during the time of human occupation were as warm, if not warmer, than they are today. Beetle fauna indicate July temperatures between 18 and 23°C and mean January/February temperatures between -6 and +4°C. The combined assessment of forest composition, temperature range and the presence of carbonate nodules within the deposits indicated a seasonally dry woodland environment, such as that found in today's Mediterranean zone. The tools were also found alongside the remains of well-preserved fauna that included rhinoceros (*Stephanorhinus hundsheimensis*), hyena (*Crocuta crocuta*), mammoth (*Mammuthus trogontherii*), and sabre-toothed cat (*Homotherium sp.*). The site was dated on the basis of palaeomagnetism and biostratigraphy as early as MIS 19 (*c* 750,000 BP).

In 2005, investigations were undertaken by the AHOB team on the Norfolk coast at Happisburgh some 30 miles north of Pakefield. Here artefacts were recovered from deposits that seemed superficially similar to the context at the former site: freshwater and terrestrial sediments underlying Anglian glacial till. Initially the team investigated a set of deposits exposed on the foreshore at low tide that

LL text.qxp_GtB 26/01/2016 14:34 Page 61

Fig. 3.7 Artist's reconstruction of the boreal woodland environment of Happisburgh. Early Homo *utilised a simple stone tool technology to butcher mammals. It is not known whether these were secured through direct hunting or scavenging of other carnivore kills. Copyright John Sibbick*

LL text.qxp_GtB 26/01/2016 14:34 Page 62

produced a single handaxe and other sparsely distributed flakes. When, however, attention was turned to fluvial gravels a few hundred yards to the north of the handaxe site, a different archaeological signature was encountered. Here, 78 simple flint artefacts were recovered from deposits relating to the estuary of a significant river – on the basis of the geological origin its gravels. This river was draining a large portion of lowland Britain including the Midlands, south-east England and possibly parts of Wales (Parfitt *et al.* 2010).

Palaeoenvironmental analysis on sediments from Happisburgh indicated a different climatic profile to that found at Pakefield. At Happisburgh, pollen evidence pointed to a more open woodland of pine and spruce, with the beetle fauna attesting to cooler mean summer temperatures in the range of 16–18˚C and winter temperatures averaging 0–3˚C. Taken together, the evidence suggests a more continental climate with ecology and temperatures equivalent to those of southern Scandinavia (Fig. 3.7). The dating evidence is based on palaeomagnetism (Bassinot *et al.* 1994) and the presence of Early Pleistocene flora and fauna, including the ancestral mammoth (*Mammuthus meridionalis*), archaic horse (*Equus suessenbornensis*) and *Tsuga* (tree hemlock). These have been used to claim either an MIS 21 age (*c* 860,000–810,000 BP) or an MIS 25 age (*c* 970,000–930,000 BP), although this has been disputed (Westaway 2011).

Unlike the other two key resources for Palaeolithic archaeology to be examined in this chapter (raised beaches and submerged landscapes), the Pakefield and Happisburgh sites point to an exciting and problematic context for evidence of lost landscapes and extinct humans. Both sites presented evidence for hitherto unknown episodes of early human occupation, separated widely in time from each other and later sites in Britain (which show more established human populations after 600,000 BP). Both sites, however, are located on rapidly eroding and retreating coastlines, parts of the coast of Britain that are being reshaped and redefined with almost every passing tide. The rapid erosion on the East Anglian coast is part of a pattern of increased erosion rates that can be seen around the beaches and cliff of many areas in Britain. Partly this appears to be a response to patterns of climate and maritime change that have developed in our own lifetimes, as sea-levels gradually rise and the climatic system gives rise to increasingly common storm events. However, in recent years erosion has been accelerated at sites at some vulnerable coastal locations through a change in costal management policies. For example, the rapid erosion at Happisburgh comes from the abandonment of beach defences maintained for many decades as part of widespread and relatively effective coastal defence measures. The adoption of policies involving managed retreat have seen coasts that were previously 'tamed' and inactive abandoned to the full transformative force of the sea, the relatively soft sediments of the Pleistocene and early Holocene exposed to erosion, and the archaeological evidence preserved within both brought to the surface and at great threat of loss. The archaeology of this intertidal zone faces a clear and present danger. Parts of these precious Pleistocene landscapes are lost every year and without organised responses and assessment it is left to fate alone whether tools or faunal remains are discovered before surf and sediment remove or cover them.

Investigating the offshore record of the North Sea

One response to the discovery of significant sites like Pakefield and Happisburgh on the North Sea coast has been to focus attention on the offshore continuation of the deposits preserved at these sites as part of the near shore seabed and into deeper waters. Between 2004 and 2007 the ALSF funded the *Seabed Prehistory* project (ALSF 3876, 4600, 5401, 5684). Round 2 of the *Seabed Prehistory* project comprised a further 3 years of work again funded by the ALSF through both English Heritage and the Minerals Industry Research Organisation (MIRO) (Tizzard *et al.* 2015).

This ground-breaking project aimed to push existing methodologies to their limits within the marine environment and allow the development of new techniques and protocols for the management and investigations of the off-shore resource. Through the project, methodologies would be developed for characterising deposits and determining the presence or absence of prehistoric archaeology within marine sands and gravels as well as providing guidance to industry.

English Heritage funded four phases of research as part of the *Seabed Prehistory* project:

- Geophysical and geotechnical survey off the coast of Great Yarmouth, Norfolk (Area 240)
- Geophysical and geotechnical survey just offshore from Happisburgh, Norfolk and Pakefield, Suffolk
- Grab sampling survey in the palaeo-Arun, off the coast of Sussex (described later in this chapter)
- A project synthesis, which provided an overall interpretation of the results from each phase, including phases commissioned by MIRO

Area 240 Survey

The background to the project was the long history of seabed gravel extraction as part of the aggregate industry but the specific impetus was the discovery of stone tools and mammal bones within gravels being washed at the SBV Flushing Wharf in Holland. Here, Dutch palaeontologist Jan Meulmeester recovered 75 flint tools, including handaxes, and the remains of mammoth, bison, reindeer and rhinoceros. The gravel producing this rich assemblage of tools and fauna was traced back to a specific area of

LL text.qxp_GtB 26/01/2016 14:34 Page 63

Fig. 3.8 Map of the North Sea showing localities of gravel extraction monitored through ALSF surveys

the seabed: Area 240 situated just 13km off the coast of Great Yarmouth in the southern North Sea (Fig. 3.8). While the original collection of tools was studied by Dutch archaeologists at the University of Leiden, English Heritage commissioned the mapping of the 3 x 1km area of sea floor comprising gravel extraction Area 240 (Wessex Archaeology 2008).

Initially the project sought to collate existing data, bringing together the results of 158 vibracores sunk into the sediments below the sea by the main gravel-extracting contractor Hanson Aggregates Marine Ltd. In addition to this, some 400km of subsurface geophysics were undertaken including side-scan sonar, single beam echo sounders and magnetometer survey. Taken together this allowed the Wessex Archaeology team to build up a picture of the sediments preserved below the sea floor, identifying changes in the sedimentation, and determining the distribution and topography of key deposits. In this way, the team was able to target areas which were likely sources for the dredged artefacts found in the gravels taken to Holland. From the virtual 3D model of the offshore geology target areas were noted and the second phase of the project could allow for focused assessment of sediments during further phases of extraction. This took the form of sieving of up to 17 tonnes of sediment yielding 10 possible flakes but no further handaxes.

Pakefield and Happisburgh Offshore Survey

In response to the exceptional finds made within the intertidal zone at Happisburgh and Pakefield, English Heritage commissioned Wessex Archaeology to assess the possible survival of related deposits in the near-shore zone. Initially, sediment sequences known to contain archaeology exposed in the intertidal zone and cliffs of Pakefield and Yarmouth were mapped and traced offshore using high-resolution geophysical survey followed up with samples taken using a geotechnical vibracore. While the survey was easily able to identify deposits relating to the underlying Wroxham Crag Formation (ancient marine and estuarine deposits), the archaeologically important Cromer Forest Bed Formation (alluvial/terrestrial deposits) appeared entirely absent, having been apparently removed by either glacial or marine erosion. The geophysical survey did not rule out the possibility that these deposits survived close to the shore, but determined that survival was not extensive across the seafloor. The Vibracore survey, comprising 5 cores into the seabed (Fig. 3.9) did, however, confirm that the upper parts of the Wroxam Formation, which contain possible artefacts, were present as part of the submerged offshore record. Dating and palaeo-

Fig. 3.9 Vibracore survey undertaken at Area 240 to map the sea floor off the Yarmouth Coast

LL text.qxp_GtB 26/01/2016 14:34 Page 64

environmental samples were taken from these cores to provide an archive of detailed scientific data for further analysis of the age and context of these early archaeological levels.

The survey at Happisburgh was hindered by the remains of offshore coastal defences – the remains of wooden groynes now submerged by the inundating sea. These obstructions prevented the operation of the survey close to the shore and required positioning in deeper, safer water. Perhaps as a consequence, the survey revealed only deposits that were older than the archaeological levels, the sea-bed being below the depth of the river channel that preserved the flakes and fauna in the intertidal site. However, the likelihood is that deposits do survive immediately offshore here, although there is obviously the danger of erosion, a fact which might be corroborated by the occasional finds of organic deposits and fauna rolled amongst the beach material after storms on the Happisburgh shore.

PRESERVED ANCIENT COASTLINES: MAPPING RAISED BEACHES IN SUSSEX AND HAMPSHIRE

The Raised Beach Mapping Project (RBMP)

Historically, a number of sites in the region surrounding Boxgrove have produced Acheulean archaeology. Some of these were known to be associated with identical suites of marine and terrestrial deposits at a similar altitude to the Boxgrove site, about 40m above sea-level (Roberts 1986; Roberts and Parfitt 1999). In the late 1990s Boxgrove was shortlisted for status as a UNESCO World Heritage Site, but it was considered prudent to first establish the true extent of the Boxgrove deposits so that the whole palaeolandscape could be included with the designated area. To this end, a geological survey was initiated in 2001 with the aim of mapping the limits of preserved land surfaces, characterising differences in local sedimentary sequences, and prospecting for future archaeological potential (Pope 2005). The mapping project incorporated reassessment of historical records with trial pitting and borehole surveys across the northern extent of the coastal plain of Sussex and eastern Hampshire. Through 42 field investigations, a full picture of the Boxgrove palaeolandscape became apparent for the first time (Fig. 3.10). The marine deposits and associated cliff line have now been traced for some 26km, between the towns of Westbourne to the west and Arundel to the east. Within this area, some 13km of intact fossiliferous land surface have been identified (Fig. 3.11). These deposits are very similar to those discovered at Boxgrove and have the potential to preserve similar high-resolution behavioural and social information. One horizon, designated the Unit 4c palaeosol, is a single isochronous land surface which has been shown to have developed over a period of 10-50 years. This important unit represents a developing grassland habitat and preserves *in-situ* human activity over the broad time-span of a single hominin generation (Roberts and Parfitt 1999). The realisation that this horizon is now traceable for over 10km opens the possibility that patterns of variation in human activity across a huge spatial area, within a relatively limited timeframe, can now be explored.

The survey also revealed some local environmental variation and has allowed the reconstruction of the topographic setting of the palaeolandscape in finer detail (Pope 2005). The saltmarsh and grassland environments that developed as the interglacial sea retreated appear to have been partially enclosed by two pronounced chalk ridges. These have now been lost to later marine erosion. The two

Fig. 3.10 Map showing the 26km extent of the Boxgrove palaeolandscape as mapped through the Raised Beach Mapping project. The dashed lines show the position the chalk bedrock beneath the coastal plain

LL text.qxp_GtB 26/01/2016 14:34 Page 65

headlands defined an embayment backed by the imposing 80m chalk cliffs traced along much of the course of the raised beach (Fig. 3.12; Roberts and Pope 2009). A series of spring-fed chalk streams appear to have emptied into this embayment, forming gravel fans at their estuarine mouths, and the project was able to explore the interface of these gravels with the grassland palaeo-land surfaces. In addition, beds of preserved organic remains were identified with potential to help in the reconstruction of local vegetation. At the margins of this embayment, where unfortunately preservation was less good, areas have been located where the cliffs were lower in height and cut into the clay geology

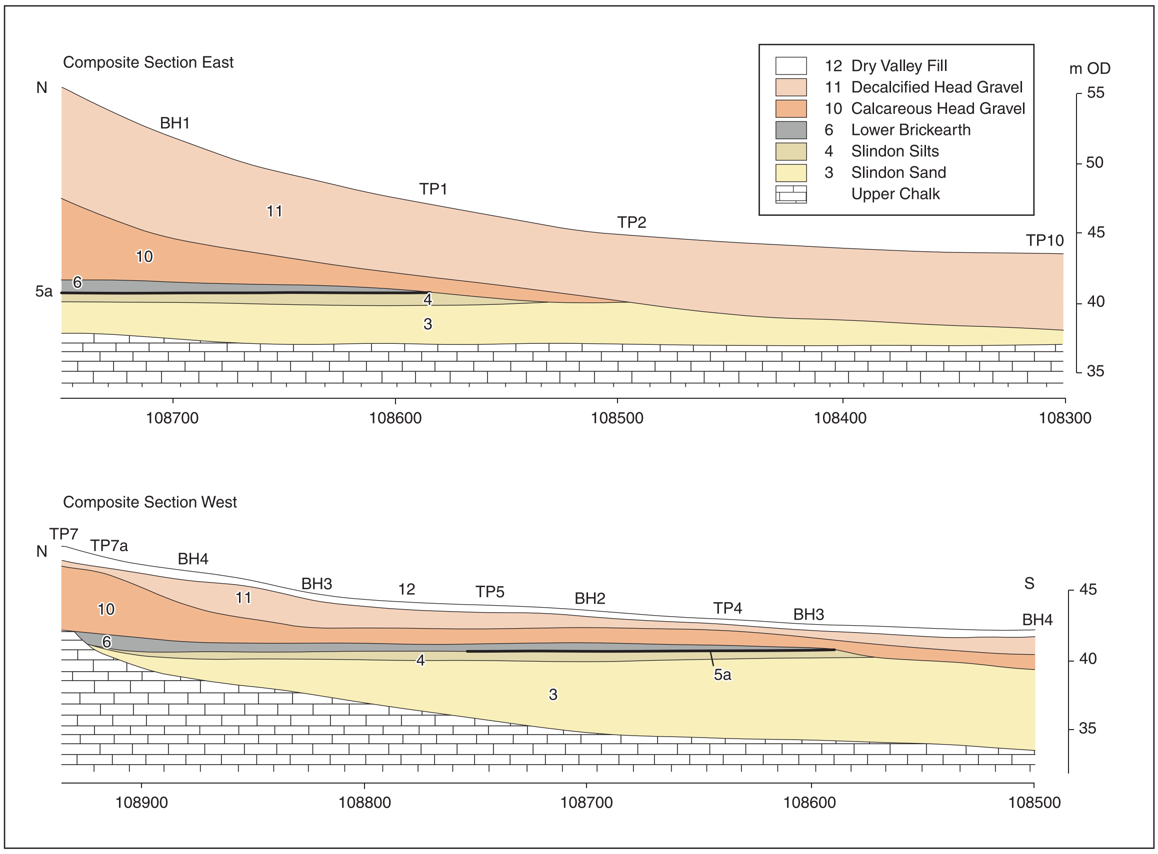


Fig. 3.11 Cross section through the archaeologically important Slindon Silts at the Valdoe, West Sussex. This site presented a direct continuation of the sedimentary sequence observed at the main Boxgrove site but lay some 6km to west (Unit 5a is the ferric manganese layer representing marshy conditions, also found at Boxgrove)

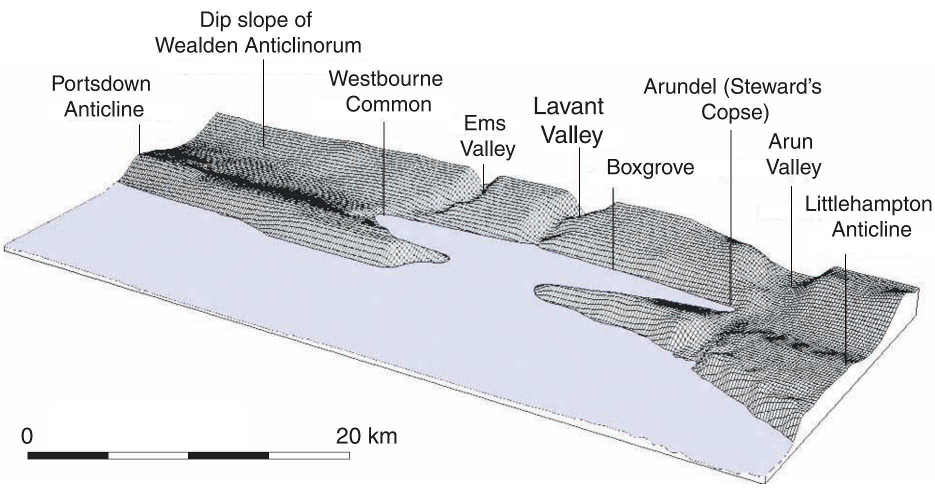


Fig. 3.12 Reconstruction of the partially enclosed marine embayment defining the Boxgrove Raised B each during the MIS 13 interglacial

of Tertiary bedrock rather than chalk. These varying local environments may have produced different local ecologies and provoked different behavioural responses among the human groups occupying them. Further prospective excavation – small test pits as described in Chapter 2, for example – may help to isolate some of these behavioural differences. One testable hypothesis is that human groups would have curated and reused stone tools more extensively in these marginal areas away from local raw material sources (Pope *et al.* 2009).

The results of the RBMP clearly show that it is no longer valid to consider Boxgrove a single, isolated site. Instead, it sits at the heart of a vast, preserved prehistoric landscape buried between 2 and 20m below the modern soil horizon of the Sussex coastal plain. While quarries such as those at Boxgrove still provide the best chance of getting at extensive tracts of this landscape, the discovery of a number of valley-side locations, where the deposits rest close to the surface, holds open the possibility of discovering new locales rich in the traces of human activity.

The Palaeolithic Archaeology of the Sussex/ Hampshire Coastal Corridor (PASHCC)

Directly complementing the RBMP was the ALSF research initiative aimed at understanding Pleistocene sedimentation of the lower coastal plain in West Sussex and Hampshire. Like the RBMP, it aimed to map and characterise marine, intertidal and terrestrial sequences associated with raised beach landforms dating from the more recent parts of the Quaternary record of the area. The *Palaeolithic Archaeology of the Sussex/Hampshire Coastal Corridor* (PASHCC) project ran between 2005 and 2007. It was the culmination of almost 20 years of field and desk-based research in the West Sussex coastal plain by Martin Bates and other workers (Bates 1993; 2001; Bates *et al.* 1997; 2000; 2003; 2004; 2007a; 2007b; 2007c; Bates and Wenban-Smith 2011). As with the RBMP it took a multi-disciplinary approach to landscape investigation, building a team comprising archaeologists and earth scientists from a number of institutions throughout the United Kingdom.

While an understanding of the nature and distribution of Pleistocene deposits relating to the Middle and Late Pleistocene has been developed over a period of nearly 150 years, until recently there had been little formal work aimed at integrating the range of existing datasets into a single coherent model of sediment distribution and archaeological potential. The PASHCC offered the possibility of understanding the relationship between sea-level change, climate cycles, tectonic processes and human activity across 400,000 years of the Pleistocene, and formed a record contiguous with submerged deposits to be investigated by some of the same team in the Transition Zone Mapping Project (see below).

The key objectives were straightforward: to obtain a better understanding of the distribution of sediments likely to contain Palaeolithic archaeology, the nature of the archaeological materials, and the ages of the sediments containing the archaeology. To do this, it focussed on integrating and assessing existing datasets, which could later be tested and ground-truthed through targeted fieldwork. This methodology was different to that used in the RBMP because an extensive body of commercial and research data already existed, resulting from the more urbanised and industrial nature of modern landuse on the lower coastal plain compared to the relatively unspoilt landscape of the Westbourne-Arundel Raised Beach (where prior knowledge was minimal). For the lower coastal plain the project aimed to develop a more detailed understanding of the distribution of key sedimentary sequences, constrain the age through dating of key sedimentary sequences, and determine the potential for the survival of Palaeolithic archaeology across a range of timescales. The area examined was also highly significant, comprising the eastern margins of the Solent river system and the extensive suites of preserved fluvial terrace gravels rich in Palaeolithic archaeology, the main body of the Sussex Raised Beaches of the lower coastal plain (including the key localities of Aldingbourne, Brighton-Norton and Pagham) as well as the rivers Arun and Adur.

For the West Sussex coastal plain, large archives of borehole data were collated from work previously undertaken through mineral assessment surveys by the BGS (Lovell and Nancarrow 1983). These were integrated with other archives of borehole observations and use to create a subsurface sediment model using geological modelling software. Investigations utilising geophysical survey, borehole drilling and test pitting were then undertaken as part of a programme of fieldwork, allowing the development of mapped transects for the geological sequence across the West Sussex coastal plain. Sediment bodies were sampled for indicators of past palaeoenvironmental conditions, including detailed analysis of microfossils (foraminifera and ostracoda), and dating work was undertaken using OSL (Huntley *et al.* 1985; Murray and Wintle 2000; Rhodes 1988; Bates *et al.* 2010) and Amino Acid Geochronology (McCarroll 2002; Penkman *et al.* 2008; 2011).

Alongside the identification and study of marine and intertidal sequences relating to earlier interglacials, the research located an extensive distribution of non-marine sediments associated with cold climate and low sea-level events. The added complexity raised the possibility of more complete sequences of climate and landscape change being preserved as part of the overall sediment body on the coastal plain, offering the potential for better reconstructing the interplay between marine and terrestrial phases of sedimentation than had been previously thought possible. Perhaps among the most surprising results of the study was the fact that the team's preconceptions regarding the range of deposits present in the area were quickly demonstrated to be wrong. It soon became apparent

LL text.qxp_GtB 26/01/2016 14:34 Page 67

during the fieldwork phase that extensive bodies of previously unrecognised sediments were present in the area, radically modifying our understanding of the landscape history and demanding a rethink of the archaeological potential of the area (Fig. 3.13).

In the west of the study area, the nature of sedimentation and the formulated response were different. The Eastern Solent and Test Valley (previously studied by Allen and Gibbard 1993) differed from that of the West Sussex coastal plain in presenting a far more restricted corridor for investigation, associated with narrow ribbons of river terrace sediments. The area was also more substantially developed, being largely covered by the urban areas of Portsmouth, Gosport and Southampton. This restricted the scope for field research, so the project focussed on integrating the detailed records that existed in archives rather than developing new datasets through fieldwork.

This work confirmed the continued validity of existing schemes of terrace mapping and allowed previous understanding to be refined and built upon, through dating work (Briant *et al.* 2006) and reconstruction of river development (Briant *et al.* 2012). Beyond the academic output from the project, the evidence recovered has been integrated into a GIS model in which both river valleys and the coastal plain have been divided into a series of mapped zones that characterise the nature of the sediments within the zone and define the potential for Palaeolithic archaeology. These zones were then utilised as the basis for eventual integration with the offshore record as part of the subsequent Transition Zone Mapping Project (see below), and now form the basis for an enhanced HER within parts of West Sussex and Hampshire.

THE LOST RIVER: SUBMERGED LANDSCAPES OF THE ENGLISH CHANNEL

Out of the wide-ranging work funded through the ALSF, few projects brought the topography of the submerged Pleistocene landscapes to life as clearly as the detailed offshore mapping of the submerged Palaeo-Arun River. This project concentrated on a clearly defined marine landform that had a relatively well-understood onshore continuation and demonstrated archaeological potential. Led by Sanjeev Gupta from Imperial College, it aimed to integrate multiple datasets into a detailed landform model of the submerged Palaeo-Arun Valley system (Fig. 3.14) and assess from sediment samples the palaeoenvironmental and archaeological potential (Gupta *et al*. 2004; 2007; Wessex Archaeology 2008).

Fig. 3.13 Mapping of marine, intertidal and terrestrial deposits undertaken by the PASHCC project

LL text.qxp_GtB 26/01/2016 14:34 Page 68

The results led to the emergence of a highly detailed and focused dataset comprising a level of terrain mapping normally limited to terrestrial contexts. This allowed details of the submerged topography to emerge in high resolution, allowing the identification of specific features of the Palaeo-Arun Valley landform, including terraces and details of the submerged floodplain. Vibracore sampling established not only the presence of well-developed Pleistocene and early Holocene environmental sequences but also the presence of human activity (evidenced by collections of apparently humanly struck stone artefacts). The project provides perhaps the most vivid example of translation from understanding of terrestrial prehistoric assets to the targeting of likely offshore potential, with dedicated mapping of the distribution of significant sedimentary contexts and recovery of apparently archaeological material. The success stemmed from the scale of enquiry aimed at understanding a key landform rather than a wide area of seabed. As such it perhaps provides a research model for how exploration of the submerged landscape around Britain might proceed, and an indication of the resources involved in progressing from desk-based assessment and research design to recovery of archaeology.

There are, however, a number of problems with offshore work that need to be addressed. The nature of the identified and discussed features do not fit into the normal terrestrial models used by scientists to understand geochronology (eg the Thames terrace sequence: Bridgland 1994). Interpreting archaeological evidence such as stone artefacts can also be problematic as we are not able to carry out the usual range of analysis of material in context, which can help us determine the role of natural processes in the formation of these assemblages. However, as increasingly high-resolution datasets are collected from onshore and offshore, attempts can be made to understand this evidence at increasing levels of complexity. Central to future work will be the development of strategies that can help establish the nature of site formation processes in forming archaeological assemblages found offshore, and developing methodological approaches, such as transition zone studies described below, that can link the better understood terrestrial deposits with their offshore counterparts.

CONTIGUOUS PALAEO-LANDSCAPE RECONSTRUCTION: TRANSITION ZONE MAPPING

Another project aimed at taking a fully integrated approach to linking offshore sedimentation with the terrestrial record was undertaken by the ALSF-funded *Transition Zone Mapping Project* (TZMP), led by Dr Richard Bates. The transition zone is that part of the coastline between low water mark and deeper offshore waters in which geophysical surveys are safely undertaken. The nucleus of the TZMP was a comprehensive review of the methodologies available to enhance our understanding of the relationship between onshore and offshore records. These included seismic, sonar and electrical seabed and subsurface mapping techniques and ground truthing using borehole data from commercial and public borehole records of both the onshore and offshore records. Information from all these datasets was evaluated and integrated, leading to the development of a continuous zoned map of Pleistocene sedimentation and topography across the West Sussex Coastal Plain and extending some 12 miles out under the sea floor.

This project focused on the Sussex coast between the mouth of the River Arun at Littlehampton and Chichester Harbour, a modern marine inlet some 12 miles to the west. In between these points sits a low-lying peninsula coastline known as Selsey Bill, a projecting triangle of largely Tertiary solid geology overlain by Pleistocene Head and raised beach

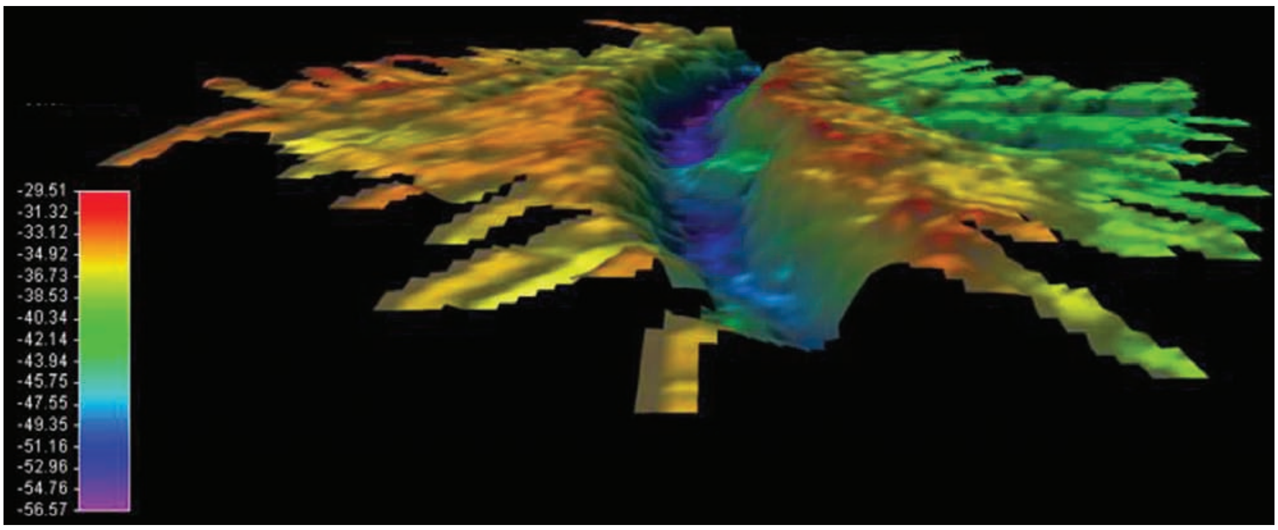


Fig. 3.14 Bathymetric survey of the palaeo-Arun Valley mapped by Gupta et al. *(2004)*

Fig. 3.15 Excavating fluvial deposits from the Middle Pleistocene Earnley Channel on Selsey Bill, West Sussex

deposits and dissected by Pleistocene fluvial channels and mostly infilled Holocene marine inlets. The Pleistocene geology of the coastline and its immediate terrestrial hinterland has been intensively studied since the late 19th century, from early work by Reid (1904) through West and Sparks (1960) to a substantial body of research and commercial geoarchological recording led by Martin Bates and augmented by other researchers including Chris Pine, Mark Roberts and Matt Pope (Bates *et al*. 1997; 2010; Roberts and Pope 2009).

The work characterised the nature and extent of raised beach formation across the Selsey peninsula, which forms a substantial portion of the West Sussex lower coastal plain. The modern topography lies at less than 30m OD, and constitutes two clearly defined raised beaches:

- The Pagham Raised Beach, which has its wave cut bench at 0.5m OD
- The older Brighton Norton Raised Beach at 8m OD

In between these two beaches further raised beach deposits outcrop at intervening altitudes, possibly comprising a continuous, if patchily preserved, record of sea-level and climate change between 250,000 and 120,000 BP.

Preserved both under and over this record of marine level change are north-south orientated alluvial sequences that appear to be the antecedents

LL text.qxp_GtB 26/01/2016 14:34 Page 70

of drainage systems that once flowed across the coastal plain draining the South Downs escarpment to the north. These channels are best seen after storm events on the foreshore around Selsey Bill where scour exposes the alluvial sedimentation at low tide. Discrete channels can be seen displaying a range of depositional regimes from high energy fluvial gravels through to organic channel margin deposits and estuarine/marine sediments. They range in date from perhaps 500,000 BP through to the early Holocene, and contain excellent records of organics, fauna and occasional lithic artefacts (Fig. 3.15, Box 2.4 and Fig. 2.22; Bates *et al.* 2009). These channels provide an excellent record of palaeoenvironments, and are undoubtedly also preserved further inland, where they are covered by depths of Pleistocene Head deposits, and out to sea where they are submerged and buried beneath marine sediment.

The TZMP successfully met its primary objective, which was to create a seamless model characterising Pleistocene sediments from the dry terrestrial zone, through intertidal and nearshore contexts and into the offshore, submerged record (Bates *et al.* 2007a; Bates *et al.* 2007b; Bates *et al.* 2009). Rather than simply attempt to develop isolated models of offshore sedimentation, or correlate sub-bottom samples with the geological sequence of the shore, this approach aimed to create contiguously mapped datasets that fully encompassed the transition zone. The project was important in both methodological terms, where a new paradigm and standard was established for the mapping of offshore and transition zone records, and also in integrating pre-existing datasets and extending understanding directly aimed at the recovery of archaeological material. The first step in these explorations is a multibeam survey, which provides detailed information of the seabed topography and, at a broad scale, can be taken to represent the landscape at the time of occupation (minus any sandwave fields etc). This would be followed by sub-bottom profiling to ascertain where any bodies of sediment exist in pockets in the landscape or as river terrace sequences associated with major drainage. The final stages involve coring, remotely operated vehicles (ROV) and diving work.

In the test area the project was able to identify clearly where gaps in data existed, allowing for future targeted surveys. It also identified areas where the preservation of fluvial terraces was likely to be better, generally in deeper water where sea-level change may have proceeded more quickly at the beginning and end of interglacial periods. The project also flagged up the need for access to datasets from the oil and gas industry and offshore dredging and was able to develop clear statements regarding Palaeolithic and palaeoenvironmental potential, likely levels of significance and key research questions. This represents a significant first step in developing a basis for future targeted fieldwork both as mitigation of offshore industrial impacts on the Pleistocene aggregate resource and as strategic research projects.

To date, the TZMP represents the most comprehensive attempt to integrate onshore and offshore data, and provides a benchmark model for how the offshore record can begin to be integrated with the terrestrial component. This raises our overall understanding of both as a single depositional system, and installs the Pleistocene sedimentary configuration as the significant boundaries rather than modern coastlines. Transition zone mapping at Happisburgh is now underway following the lines outlined in the TZMP.

THE 21ST CENTURY EXPLORATION OF DOGGERLAND AND THE SUBMERGED ENGLISH CHANNEL: NORTH SEA PREHISTORY RESEARCH AND MANAGEMENT FRAMEWORK

The culmination of the strands of research discussed above is not yet, unfortunately, a mature and developed archaeology of the submerged landscapes of northern Europe. We must consider this a discipline and exploration area that, having emerged from infancy, is still only taking tentative steps towards an effective methodological approach. While the resources and sophisticated techniques exist to assess potential, it is still trawling which provides the source of most recovered artefacts and faunal material.

The exploitation of offshore gravel deposits is now being brought under national and international management through resource protection and exploitation strategies (Peeters *et al.* 2009) and the marine licensing system brought into force in April 2011 under the auspices of the Marine Management Organisation. Yet it is arguably still the case that where high potential is determined neither the resources nor the methodologies are in place to adequately assess it, let alone recover high quality archaeological and palaeoenvironmental information. Indeed, actually ascertaining potential (high or low) remains difficult where research questions remain unarticulated. Without an effective moratorium on marine gravel extraction – which is not likely to happen in the current or any other economic climate – it is not possible to say that we have anything more than a degree of oversight and awareness of the potential destruction to the records of these drowned ice age and early Holocene landscapes.

But great leaps have been made in developing a coherent, and necessarily international, consensus that strategies and research methods need to be developed, and that the resource requires urgent protection and continued improvements in assessment and research. Perhaps the most concrete and hopeful outcome of this focus has been the *North Sea Prehistory Research and Management Framework* (NSPMF), a document funded and produced by international bodies and researchers including

English Heritage. First published in 2009 and conceived of as a living document to be updated as new finds are made and understanding develops, the NSPMF is an agreed international statement on the prehistoric potential of the submerged record and a commitment to developing research and protection of the resource. The initiative began with meetings in the Netherlands and led to the formation of a network of heritage managers and researchers from countries fringing the North Sea and English Channel, taking regional understanding and attempting to correlate across records (eg Fischer 2004; Fitch *et al.* 2005; Gibbard and Cohne 2008; Gijessel 2006; Hijma *et al.* 2012; Laban 1995; Laban *et al.* 1984; Roep *et al.* 1975; 2005). It took as its scope the entire chronological period from the earliest occupation of Europe (Cohen *et al.* 2012) through to the final flooding of the North Sea by 7,500 BP. It thus covers the entire Palaeolithic, Mesolithic and (on the continent) early Neolithic (Behre 2007; Bell 2007; Bell and Walker 2005; Bos and Janssen 1996; Bos *et al.* 2005; Cohen 2005; Jelgersma 1979; Kiden *et al.* 2002).

Through further international meetings and consultation, the NSPMF stands as a comprehensive management document, identifying research agendas, the significance of the resource, threats from commercial activities, and providing a methodological framework for improving understanding. This mirrors the level of engaged and joined-up strategic thinking that up till now has only characterised the heritage management approach to the terrestrial resource across western Europe. The parity in approach shows that for the first time the submerged resource has been placed on an equal footing, even if we cannot yet deliver parity in terms of actual field investigation.

EMERGING MISCONCEPTIONS

Although significant works have been undertaken in the marine sector during the last ten years many issues remain to be addressed and the concept of the 'archaeological potential of our shallow seas' remains difficult to address. Much of the focus of current works stems from the 'Doggerland syndrome', where vast tracts of submerged landscapes have been mapped in the subsiding/infilling basin of the southern North Sea. These sequences have been quietly adopted as the norm for comparison and are typically rated 'high potential' areas in much the same way '*in situ*' archaeological remains are rated high potential in terrestrial situations. By contrast those areas such as the English Channel where erosion dominates are often considered as lower potential in much the same way that secondary context artefacts from river gravels are graded at a lower scale in terrestrial situations. However, this somewhat simplistic association fails to take into account the nature of the questions being asked of the sequences and the ability of the sequences to provide answers to archaeological questions.

Another area of emerging consideration concerns the approaches to investigation within such diverse situations. Methods adopted by Gaffney *et al*. (2007; 2009) for the southern North Sea are not applicable in erosional situations. Although a coherent set of methods for the Palaeolithic has not been put forward for bedrock-dominated landscapes, Bates *et al.* (2012) have published methodologies for investigation of later prehistoric landscapes in such situations (based on fieldwork in Orkney).

The emerging issue that appears at the present time is, therefore, one of heterogeneity within the marine sector. Although perhaps treated until now as an area in which terrestrial ideas can be applied, we might today argue that just as a range of methods and techniques are necessary in terrestrial situations to address the key questions, so too tailored approaches need to be applied to the marine sector. We cannot, and should not, simply see our marine resource as an extended British landmass just like the current one. Archaeologies of the (modern) sea-bed are likely to be as diverse and specific as those in terrestrial situations, and we should expect novel archaeologies to exist beneath the sea floor that require tailored approaches to their understanding.

SUMMARY

The submerged landscapes around Britain truly represent Lost Landscapes of deep prehistory. They deserve this title because they offer a distinctive record of extensive and well-preserved terrains that have so far been inaccessible to archaeological research. Despite great improvements in mapping and seabed profile modelling, the actual characterisation of preserved palaeoenvironments is still coarse. The collection of material by trawler and private individuals may have been brought within wider networks, but it still provides the overwhelming majority of finds, both faunal and artefactual, from the seabed. In this sense, we are still very much standing on the shoreline of these lost worlds and are reliant on flotsam and chance finds to inform our understanding of the potential which might lie there. That these finds include Neanderthal human remains, well-preserved tools and fresh, undisturbed archaeological signatures, has made scientists aware that the record is not simply a great jumble of scoured and disturbed debris, but rather contains extensive tracts of sediment in primary context and with immense potential, perhaps equalling that of contemporary sites such as Lynford in Norfolk (Fig. 3.16; Boismier *et al.* 2012; Wymer 2001).

There remain numerous challenges to investigating these environments in terms of methods and in working in such locations, but also in developing frameworks for investigation. The assessment of potential in the marine zone remains a contentious and largely ignored facet of the debate. High potential is typically assigned to those areas of the seabed

Fig. 3.16 Crossing Doggerland. Excavation of Middle Palaeolithic archaeology and mammoth remains at Lynford, Norfolk showed that the southern North Sea was an important seasonal migration route for Neanderthal hunters during MIS 3 © Nigel Larkin

in which deposition outweighs erosion. However, recent work around the British coastline has demonstrated that even in those parts of the seabed thought to be erosional in character, important information may be preserved on the seabed (Bates *et al.* 2012). Additionally, and something that has not generally been articulated through the ALSF projects, is the difficulty in projecting terrestrially based archaeological knowledge into the marine zone. Although fluvial sediments do exist in the submerged zone they do not necessarily represent contexts analogous to those in present-day terrestrial situations, and consequently assigning significance to these offshore bodies of sediment may require additional consideration. Perhaps we need to be looking to develop an offshore framework for Quaternary sediments that reflects the fact that our submerged landscapes are not simply extensions of the modern landscape beneath the sea but areas in which processes reflect the unique nature of landscapes at lower elevations, subject to frequent transgressions and regressions, and in which large river systems operate at scales rarely, if ever, seen in the terrestrial UK today.

What we cannot know, from the perspective of our glimpse of these Lost Landscapes, is how important they were to people in the past. Were they marginal, undifferentiated and difficult landscapes through which hunter-gatherers moved, or were they core areas of prime importance for which out terrestrial landscapes served as only marginal hinterlands? Answering these questions for different periods and climatic conditions will become one of the great research drivers of the next century. The possibility exists that parts of the record of the behaviours of hunter-gatherers not represented in the terrestrial archives might exist in the landscapes of the English Channel river and Doggerland. Given the methodological advances and suitable resources, we may soon be in a position to deliver a fully integrated archaeology of north-west Europe, where the transition between these records is seamless, in terms of research, methodological effectiveness and understanding.