

Palaeolithic Geo-Archaeology: Palaeolandscape Modelling and Scales of Investigation

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Abstract

The present day landscape context of Palaeolithic artefacts is very different to that of their original use and deposition. Reconstructing the contemporary landscapes that were associated with even the best known sites is often unusually fraught with problems. This paper argues that a landscape-based approach is essential to contextualise our limited but growing knowledge of early human activity in Britain. Further, it argues through a series of case studies at macro, mesa and micro level that the use of landscape concepts at a variety of spatial and temporal scales can increase our understanding of the Palaeolithic beyond individual sites. Most importantly, a landscape frame starts to give added meaning to the disturbed and transported material which predominates in fluvial contexts, but which has often been regarded as of insufficient significance to merit research protection or research. Indeed, researching such data in a landscape context – treating it as a time- and space-averaged sample – might give a more representative view of the Palaeolithic world, for example explaining general patterns of material cultural change, and of Palaeolithic peoples' landscape perceptions, than even highly preserved evidence from a few square metres representing one afternoon in the distant past.

Introduction

Palaeolithic remains reflect human lives enjoyed in very different landscapes to those of their present day find spots. Recognition of this is deeply rooted in the very origins of Palaeolithic research (Figure 1). Initial identification in the mid 19th century, in northern France as well as in southern Britain, of early human presence in deposits of great antiquity relied upon the collaborative application of the earth sciences, zoology and archaeology (Trigger 1989, O'Connor 2007). Humanly-worked flint artefacts were found deeply buried within sand, gravel and clay deposits left by major rivers and lakes in what



FIGURE 1. Marcellin Boule's vision of a Neanderthal in 1909; note the landscape setting for this scene.

are now dry terrestrial situations. Faunal remains within these deposits included extinct species such as mammoth or straight-tusked forest elephant and also reflected very different climates and environments ranging from sub-arctic to significantly warmer-than-present conditions. Many British fluvial sediments, for example, were found to contain the mollusc species *Corbicula fluminalis*, now found no further north than the Nile (Prestwich 1859, Evans 1860).

Palaeolithic archaeology remains highly multidisciplinary, embracing contributions from the full range of Quaternary, physical and biological sciences to address a range of issues from dating to climate, palaeo-environment, site formation processes, and, most recently, human genetics (Cann 1988). Understanding the palaeolandscape context of Palaeolithic archaeological remains is of particular importance (Figure 2). It expands our interpretive horizons for excavated material, but it also develops a better predictive understanding of the likely locations of evidence for our earliest ancestors, and offers approaches to investigation and interpretation that accord with the varying spatial and temporal scales of our evidence in its sedimentary context. The latter is of growing importance due to increasing development pressure upon key parts of the sedimentary archive such as gravel aggregate resources in major river valleys, coastal plains and offshore zones increasingly subject to large scale wind turbine construction.

This paper therefore proposes using a landscape framework for Palaeolithic archaeological work in southern Britain. The nature of the evidence for past landscapes is considered alongside current knowledge of the surviving associated Palaeolithic archaeological remnants. Case studies illustrate the range of spatial and temporal scales at which both Pleistocene palaeolandscapes and Palaeolithic remains can be investigated and understood. They help to demonstrate appropriate methodologies for investigating the Pleistocene/Palaeolithic resource in the present landscape, the potential of which is currently poorly understood and consequently rarely fully addressed to its maximum potential.

Pleistocene chronology

The initial Palaeolithic occupation and subsequent settlement of Britain occurred during the Pleistocene, a period of time characterised by the onset and recurrence of a series of alternating cold/warm and glacial/interglacial climatic cycles (Lowe and Walker 1997). More than 60 cycles have been identified during the last 1.8 million years, corresponding with fluctuations in proportions of the Oxygen isotopes O16 and O18 in selected foraminifera from deep-sea sediment sequences. These Marine Isotope Stages (MIS) have been numbered by counting back from the present-day interglacial or Holocene period (MIS1). MIS2–4 all relate to the last cold stage, but in all other cases interglacial peaks are given odd numbers and glacial peaks even numbers (Table 1). The individual



FIGURE 2. Excavation of a Middle Pleistocene site at Southfleet Road, Northfleet, Kent. The dark grey sediments in the foreground were deposited in a small lake in which was found the bones of a straight-tusked elephant and a series of Clactonian flakes. Today these sediments lie beneath the valley side of the Ebbsfleet, a small tributary of the Thames; when deposited these sediments were close to the confluence of the Thames with the Ebbsfleet.

stages identified have been dated by a combination of radiometric dating and tuning to the astronomical timescale of orbital variations (Martinson *et al.* 1987), which have been a fundamental causative agent of the Quaternary climatic fluctuations. This is now the yard-stick by which Quaternary scientists (including Palaeolithic archaeologists) consider the evidence and contemplate correlations between sites. Today we divide the Pleistocene into Early, Middle and Late parts. The Middle and Late Pleistocene are of most relevance to the British Palaeolithic, with the first occupation of Britain occurring between 800,000 and 1 million years BP near the start of the Middle Pleistocene (Parfitt *et al.* 2005, 2010), and continuing thereafter, albeit with regular gaps.

Climatic oscillations were sufficiently marked during the Middle and Late Pleistocene to have a major impact on sea level and the patterns of terrestrial sedimentation. In colder periods, ice sheets grew across much of the country, and arboreal forests were succeeded by steppe or tundra. Sea levels dropped across the globe due to the amount of water locked up as ice, exposing extensive areas offshore as dry land, and enhancing river channel downcutting. In the warmer periods sea levels rose as ice melted, river channels tended to be stable and prone to silting up within alluvial floodplains (Gibbard and Lewin 2002), and forests regenerated. The range of faunal species inhabiting Britain changed in association with these climatic and environmental changes (Schreve 2001a, b), with both in situ evolution of species to adapt to these changes and reconfiguration of faunal guilds due to local extinction and recolonisation.

Britain has been particularly sensitive to these changes. It was situated at latitude that allowed the growth of ice sheets in cold periods and the development of temperate forests in warm periods. Whilst periodically isolated as an island by rising sea levels but rejoined to the adjacent European land-mass when sea level fell (Preece 1995). This led to different climatic stages having reasonably

<i>Epoch</i>	<i>Age, kBP</i>	<i>MI Stage</i>	<i>Traditional stage (Britain)</i>	<i>Climate</i>	<i>Feature of the Palaeolithic archaeological record</i>	<i>Palaeogeographic features</i>
Holocene	Present–10,000	1	Flandrian	Warm – full interglacial		
	25,000	2	Devensian	Mainly cold; coldest in MI Stage 2 when Britain depopulated and maximum advance of Devensian ice sheets; occasional short-lived periods of relative warmth ('interstadials'), and more prolonged warmth in MI Stage 3.	Possible overlap of occasional Late Neanderthal populations with early modern humans	
Late Pleistocene	50,000	3			Occasional presence of Neanderthal populations in Britain	
	70,000	4			Absence of humans from Britain	Island Britain during much of interglacial
	110,000	5a–d			Absence of humans from Britain?	
Middle Pleistocene	125,000	5e	Ipswichian	Warm – full interglacial		
	190,000	6	Wolstonian complex	Alternating periods of cold and warmth; recently recognised that this period includes more than one glacial–interglacial cycle; changes in faunal evolution and assemblage associations through the period help distinguish its different stages.	Occasional proliferations of Levallois expression?	
	240,000	7			Occasional proliferations of Levallois expression	
	300,000	8			Incipient Levalloisian techniques alongside handaxe manufacture	
	340,000	9			Continuation of quite common handaxe-based occupation	
	380,000	10			Re-settlement of Britain, quite abundant evidence, mostly handaxe-based	
late Early Pleistocene	425,000	11	Hoxnian	Warm – full interglacial	Absence of hominins in Britain	Major glaciation, 'old' river patterns disrupted, ?Weald/Artois ridge broken
	480,000	12	Anglian	Cold – maximum extent southward of glacial ice in Britain; may incorporate interstadials that have been confused with Cromerian complex interglacials	Various, archaeologically diverse occupations of Britain: Boxgrove (handaxes); High Lodge (worked flakes)	
	620,000	13–16	Cromerian complex III and IV	Cycles of cold and warmth; still poorly understood due to obliteration of sediments by subsequent events	Sporadic flake/core-based settlement (Pakefield)	
	780,000	17–19	Cromerian complex I and II		Sporadic flake/core-based settlement (Happisburgh 3)	
	1,000,000	19–25	Bavelian complex	Cycles of cool and warm, but generally not sufficiently cold for glaciation in Britain		

TABLE 1. British Quaternary timescales and nomenclature.

distinctive sets of associated fauna and flora which generally reflect climate and environment but more specifically identify particular Marine Isotope Stages (*e.g.* Schreve 2001a, b). The study of evidence for large mammals, small vertebrates, molluscs, ostracods, insects and pollen is an integral part of Pleistocene and Palaeolithic research for its role in dating early hominid occupation and recreating the associated palaeo-environment. In contrast to the deep-sea bed, however, where there has been continuous sedimentation, terrestrial deposition only occurs in specific, limited parts of the landscape. It also takes place as a series of short-lived depositional events such as land-slips or river-floods interrupted by long periods of stability and erosion. The terrestrial evidence is thus relatively piecemeal, and the challenge for both Pleistocene and Palaeolithic investigation is to integrate it with the global MIS framework, based on relatively few direct stratigraphic relationships, and making maximum use of biological evidence and inferences about the sequence of deposition in major systems such as river valleys (Bridgland *et al.* 2004a, b; Bridgland 2006).

Present understanding is summarised in Table 1. The current interglacial began *c.* 10,000 BP (years Before Present) and it is generally agreed that MIS2 to MIS5d, dating from *c.* 10,000–115,000 BP cover the last glaciation (Devensian), and that MIS5e, dating from *c.* 115,000–125,000 BP, correlates with the short-lived peak warmth of the last interglacial (Ipswichian). Beyond that, disagreement increases although many British workers feel confident in accepting that MIS12, which ended abruptly *c.* 425,000 BP, correlates with the major Anglian glaciation when ice-sheets reached as far south as the northern outskirts of London (Shackleton 1987; Bridgland 1994).

It is also important to remember that the MIS framework only reflects major climatic trends. Within each MIS there were also numerous climatic oscillations that have not been recognised as distinct numbered stages; these can be represented by only a few centimetres within sediment cores as much as 10–20 metres long yet potentially correspond to thousands of years of climatic change with potential for associated changes in environment and sedimentary deposition (Lowe and Walker 1997). These may. Colder diversions within predominantly warm stages are known as stadials, and warmer diversions within cold stages as interstadials. Some of the larger diversions have been recognised as distinct sub-stages with the MIS framework (such as MIS5e), but many have not, and their presence has the potential to confound overly simplistic correlations of isolated terrestrial sequences with peaks or troughs on the continuous marine record.

Lower and Middle Palaeolithic archaeology

This paper is primarily concerned with the interpretation of Lower/Middle Palaeolithic remains from the Middle and Late Pleistocene, prior to the advent of modern humans, although its ideas about using landscape to frame archaeological research will be much more widely applicable. Research concerns for this period revolve around three core themes (*cf.* English Heritage 1991, 1999, 2008): (1) the “Ice Age” (its chronology, climate, environments and depositional

processes); (2) settlement and colonisation (when and where hominins were present and what factors controlled their movement and survival); and (3) the hominins themselves: what were they doing, what were their cognitive abilities, how did they organise and relate socially, how did they perceive landscapes, and, fundamentally, how human were they? The archaeological remains of this period, in accordance with their depositional context and post-depositional history, particularly requires a landscape perspective because they are associated with a wide range of palaeolandscapes not analogous to present day topography; and need to be interpretable at many different spatial and temporal scales.

The Palaeolithic stretches from an initial colonisation of Britain in the Middle Pleistocene at least 800,000 years ago (Parfitt *et al.* 2005, 2010) to the end of the Late Pleistocene, corresponding with the end of the last ice age *c.* 10,000 years ago. This very long period includes at least ten major glacial–interglacial cycles (Table 1), each accompanied by dramatic changes in climate, landscape and environmental resources. At the warm peak of interglacials, mollusc species that now inhabit the Nile were abundant in British rivers, and “tropical” fauna such as hippopotamus and forest elephant were common in the landscape. But at the cold peak of glacial periods, ice-sheets hundreds of metres thick would have covered most of Britain, reaching on occasion as far south as what is now London, and the region must have been uninhabitable.

Archaeological evidence of the Palaeolithic mostly comprises flint tools, and waste flakes from their manufacture. These are very robust and resistant to decay and persist in the landscape, eventually becoming buried or transported by sedimentary processes related to climatic change and landscape evolution. Other forms of evidence include remains of large animals, sometimes cut-marked reflecting the stripping of flesh for food, or broken open for marrow extraction while wooden artefacts have also been found on very rare occasions, notably a spear-point from the foreshore at Clacton-on-Sea (Oakley *et al.* 1977). These forms of evidence are, however, more vulnerable to decay, and it is only very rarely that burial conditions were suitable for their preservation. Hominid skeletal remains are exceptionally rare, reflecting the low density of the hominin populace and the rarity with which they became preserved, although they have been found on occasion, for instance at Boxgrove in West Sussex (Roberts *et al.* 1994).

A number of early occupation sites have recently been discovered in Britain along the Norfolk coast at Pakefield (Parfitt *et al.* 2005) and Happisburgh (Parfitt *et al.* 2010) (Figure 3), with Happisburgh 3 dating to between 800,000 and 1 million years BP. The evidence consists of a very simple core and flake industry, and was presumably made by a form of *Homo erectus/ergaster*, known to be present in Central/Eastern Europe from over 1.5 million BP (Gabunia *et al.* 2000). Following this early occurrence, there are a number of UK sites dating from the pre-Anglian interglacial MIS13, *c.* 500,000 BP, associated with the later western European *Homo heidelbergensis*, particularly at Boxgrove in Sussex, where an extensive area of undisturbed evidence from handaxe manufacture and faunal exploitation is associated with a rich range of other palaeo-environmental indicators (Roberts and Parfitt 1999).

From the Anglian onwards, Palaeolithic occupation in Britain becomes more frequent although probably not continuous. Numerous sites, some with exceptional quantities of lithic remains, attest to relatively dense occupation in the period from after MIS12 to MIS8 (Wymer 1988, 1999). There seems thereafter to have been a decline of activity through MIS7, and it appears that Britain was deserted during MIS6 and the Ipswichian interglacial, MIS5e (Ashton 2002; Ashton and Lewis 2002; Stringer 2006). Re-colonisation of Britain was until recently thought to have occurred in MIS3, between *c.* 60,000 and 40,000 BP based on a number of sites in Wales and southern England with distinctive *bout coupé* handaxes considered to represent a late Neanderthal population, but a newly discovered site at Dartford, Kent raises the possibility of earlier Neanderthal incursions during MIS5d–5a (Wenban-Smith *et al.* 2010).

The British Palaeolithic (*e.g.* Wymer 1968, 1982; Roe 1981) has for long been divided into three broad stages – Lower, Middle and Upper – based primarily on the changing types of stone tool (Table 2). This framework was originally developed in the 19th century (de Mortillet 1872), before any knowledge of the types of human ancestor associated with the evidence of each period, and without much knowledge of the timescale. The tripartite division has nonetheless broadly stood the test of time, proving, at least across Britain and northwest Europe, to



FIGURE 3. Site location plan for sites discussed in text.

TABLE 2. Palaeolithic period and hominin evolutionary history in Britain (traditional)

Stage of Palaeolithic	Human species	Lithic artefacts and other material culture	Marine Isotope Stage (MIS)	Date (BP)	Geological period
Upper Palaeolithic	Anatomically modern <i>Homo sapiens sapiens</i>	Dominance of blade technology and standardised tools made on blade blanks. Development of personal adornment, cave art, bone/antler points and needles	2–3	10,000–35,000	Late Pleistocene
Middle Palaeolithic	Early pre-Neanderthals initially, evolving into <i>Homo neanderthalensis</i> after MIS5e	Continuation of handaxes (towards the end, the development of <i>bout coupé</i> handaxes), but growth of more standardised flake and blade production techniques (Levalloisian and Mousterian) and development of a wider range of more standardised flake-tools	3–5e	35,000–125,000	Middle Pleistocene (later part of)
			5e–8	125,000–250,000	
Lower Palaeolithic	Archaic <i>Homo</i> – <i>Homo cf. heidelbergensis</i> initially, evolving towards <i>Homo neanderthalensis</i>	Handaxe dominated, unstandardised flake core production techniques and simple unstandardised flake-tools. Occasional industries without handaxes, based on large flake blanks made by unstandardised core-reduction techniques	8–13	250,000–500,000	Middle Pleistocene (early part of)
	?? <i>Homo erectus/ergaster</i>	Very simple core and flake industries – sites on Norfolk coast, particularly Pakefield	14–21	500,000–850,000	

FIGURE 4. Handaxe picture



FIGURE 5. Levallois artefact (from Gowlett 1984).



reflect a general chronological succession of lithic technology, and to correspond to a certain extent with the evolution of different ancestral hominin species. Typical Lower and Middle Palaeolithic remains have been shown to date before *c.* 50,000 BP, and to be associated with the extinct Neanderthal lineage and their ancestors ('Archaic' Homo, in Britain, Homo cf. heidelbergensis, as represented by a tibia and two teeth at Boxgrove and part of a skull at Swanscombe, and Homo neanderthalensis, as represented by a few teeth at Pontnewydd, Wales, but many flints from across southern Britain). Upper Palaeolithic remains date from after *c.* 40,000 BP, after which no Neanderthal remains are known from northern Europe, and are associated with the appearance of anatomically modern humans.

Very broadly speaking, the Lower Palaeolithic in Britain has been associated with early Archaics and handaxe manufacture (Acheulian) (Figure 4), and the Middle Palaeolithic with the development of Neanderthals and increasingly sophisticated flake-tool based lithic technology (Levalloisian and Mousterian) (Figure 5), alongside one distinctive form of handaxe, the bout coupé. It has,

however, become clear with improved dating and lithic analysis of several key sites, as well as the recent discovery of the Pakefield site, that the definition and distinction of Lower and Middle Palaeolithic are less clear-cut in Britain than has hitherto been thought.

The earliest phase of occupation, the Lower Palaeolithic, has been shown to embrace a variety of lithic technologies besides handaxe manufacture. At Happisburgh and Pakefield, there is not a hint of handaxe manufacture, and the lithic industry consists entirely of flint cores and flakes, some of them showing minor modification. Following this, most sites from the period MIS13 to MIS8 are dominated by the manufacture of handaxes, although usually alongside a small component of core/flake production. There are however also a number of early sites without handaxe manufacture that can be included as Lower Palaeolithic, particularly the curious MIS13 assemblage of large unifacially worked flake tools from High Lodge in Suffolk (Ashton *et al.* 1992), and cores, flakes and notched flake-tools that occur in MIS11 at several Kentish and East Anglian sites labelled Clactonian (White 2000).

Following the dense, usually handaxe-based, occupations of MIS10–11, the appearance of Levalloisian lithic technology has often been taken as a conveniently visible point to divide Lower Palaeolithic from Middle Palaeolithic. However, there are increasingly common examples of proto-Levalloisian technology occurring alongside handaxe manufacture, for example at Red Barns, in Hampshire (Wenban-Smith *et al.* 2000), and even at the classic “Lower” Palaeolithic locality of Swanscombe, in Kent (Wenban-Smith unpublished). It also seems that later handaxe industries persist to be contemporary with fully developed Levalloisian technology in Britain in MIS8–7 (for example at Harnham, Wilts (Whittaker *et al.* 2004), Cuxton, Kent (Wenban-Smith *et al.* 2007), Baker’s Hole, Kent (Wenban-Smith 1995) and Purfleet, Essex (Schreve *et al.* 2002). For this period in Britain, we may therefore need to talk about a combined Lower/Middle Palaeolithic between MIS11 and MIS6, or even a more general concept such as the “Early Palaeolithic”.

In contrast, it seems that *bout coupé* handaxes are specifically associated with occupation from MIS3 in the middle of the last (Devensian) glaciation (White and Jacobi 2002), thus representing a distinct phase of Palaeolithic occupation. Although other post-Ipswichian (MIS5e) UK occupation, for instance as recently discovered at Dartford for the period MIS5d–5b (Wenban-Smith *et al.* 2010), does not always contain this distinctive artefact form, the term “Middle Palaeolithic” could usefully be retained for the post-Ipswichian UK record prior to the Upper Palaeolithic and the appearance of anatomically modern humans.

The Upper Palaeolithic is also characterised by cultural changes such as the development of bone and antler tools and the representation of images of animals painted on cave walls or as small antler or bone carvings. The suddenness of this change, and the physiological differences between Neanderthals and modern humans, suggest that modern humans did not evolve from Neanderthals, but evolved elsewhere, probably in Africa or western Asia *c.* 125,000 BP, before colonising other parts of the world.

Reconstructing Pleistocene landscapes: questions of time and space

Attempts to reconstruct past Pleistocene landscapes are hampered by fragmentary evidence, incomplete sequences, poor dating control and an absence of evidence for the faunal and floral aspects of the environment. But equally problematic is that Pleistocene landscapes do not have modern analogues and therefore a modified 'principle of uniformitarianism' needs to be applied in attempting to reconstruct such landscapes. Despite these problems, many text books dealing with the Pleistocene or Palaeolithic record offer reconstructed palaeogeographies. Gibbard (1985, 1994) and Bridgland (1994, 2006) for example have reconstructed the pattern of drainage in southern Britain associated with the Thames and Medway systems by mapping the distribution of sands and gravels attributed to these rivers (Figure 6) and (in the case of Bridgland) by placing them within a chronological framework based on the marine isotope record. Such macro-scale reconstructions (Table 3) tend to work well at the scale of the marine isotopes (100k year cycles in the Middle and Late Pleistocene), where even the relatively coarse temporal framework achieved using dating methods beyond the limit of radiocarbon dating (Walker 2005) can usefully date and correlate sediments. Such frameworks are helpful in considering human distribution/dispersal within macro regions and across macro MIS timescales, but are less useful for examining intra-site landscapes and human activity at shorter time intervals. These are probably broadly comparable with Gamble's (1996) notion of the concept of Colonising Territories.

Occasionally evidence may be obtained from the lithological archive for geographies at smaller scales and shorter time intervals. For example the sediments associated with the raised beaches of West Sussex (Figure 7) represent preserved palaeolandscapes at a scale typically of less than 100 km and with temporal resolutions probably down to 10,000 years or less (Roberts and Parfitt 1999; Pope 2010). This is comparable to Gamble's 'landscape scale' (1996). Within parts of these deposits events may be preserved that represent even finer temporal intervals such as buried land-surfaces (Figure 8) on which high resolution archaeological remains of small scale events of short duration (knapping activity *etc.*) may be present. These situations may provide important information on human behaviour at a scale ranging from hours to days, camp sites *sensu* Gamble (1996). These are usually spatially restricted and, because of the short time duration represented, difficult to correlate with other sites, even those nearby sites that are broadly contemporary. Recently excavated sites such as Boxgrove (Roberts and Parfitt 1999), Barnham East Farm (Ashton *et al.* 1998) and the elephant butchery site at Southfleet Road, Swanscombe (Wenban-Smith *et al.* 2006) fall into this category.

Palaeolithic remains can be studied at a wide range of temporal and spatial scales. In the next section, case studies are presented at the macro-level (national palaeogeography at major glacial/interglacial timescales), at a meso-level (regional landscapes over shorter durations), and at micro-levels (the finer temporal/spatial scales such as sealed occupation surfaces containing remains

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FIGURE 6. Gravel stratigraphy section.

	Micro (<0.5km ²)	Meso (0.5–100km ²)	Macro (>100km ²)
Short (0–100 years)	Boxgrove waterhole (Q1/B) Unit 4b activity Unit 4c	Boxgrove Slindon Silts Boxgrove 5a landsurface	
Medium (100–10000 years)	Swanscombe I (Lower Loam/Lower Gravel)	Sussex Raised Beaches Swanscombe II (Middle Gravels) Thames terrace sequences	Swanscombe II (Middel Gravels – faunal connections) Channel geography Bytham River
Long (>10000 years)			

from specific short-lived events or from palimpsests of weekly, monthly or yearly durations which are conventionally idealised as the preferred focus of current Palaeolithic investigations).

Scales of investigation: Case studies

Macro-scale: palimpsest palaeogeography, ancestral rivers, the Channel link and the impact of glaciations

The earliest human occupation of the British landmass occurred during a period in the Pleistocene associated with a physical geography very different to that of the present (MIS21–13) (Figure 9A). Efforts to reconstruct the palaeogeography associated with this earliest phase of human occupation (Rose 2009) have focused on modelling the distribution of the contemporary river channels and the nature of the land bridge connecting southern Britain to the rest of

TABLE 3. Archaeological examples of sites and sequences representing a range of temporal and spatial scales.

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FIGURE 7. Sussex raised beach section.

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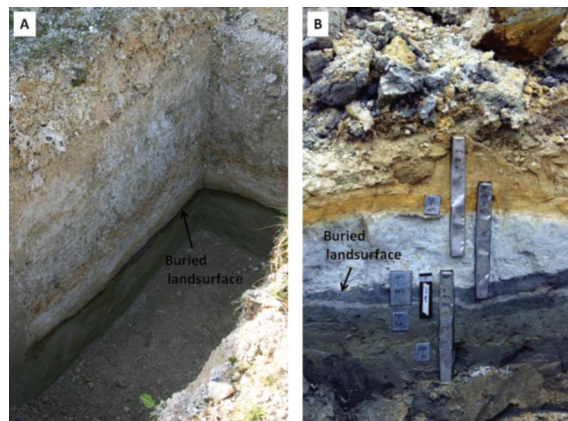
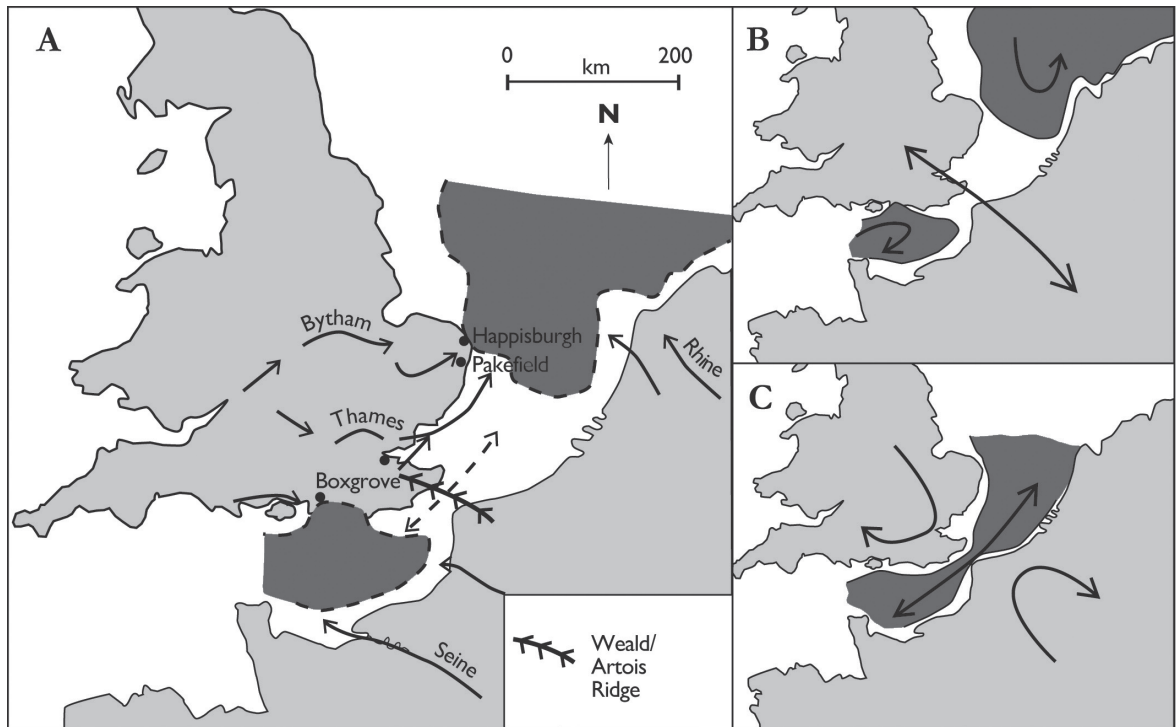


FIGURE 8. Sussex buried land surface.

Europe. This model (Figure 9) represents a combined period of time of nearly 300,000 years throughout which considerable variation at the meso and micro scales will have occurred; this may be termed a palimpsest-palaeogeography. Whilst coarse, such representations are nonetheless useful for interpreting the local landscape setting of particular finds and in helping to evaluate migration routes and associated sequences within which additional evidence for human activity may be preserved.

Recent work (Lewis 1998; Rose 1994, 2009; Rose *et al.* 1999, 2002) has revealed the presence of a major eastward-draining water system originating in



the Midlands and flowing across the area now occupied by the Fenland basin towards eastern Norfolk (Figure 9). Known as the Bytham river, this was a contemporary of an ancestral Thames flowing north of its present position and through the Vale of St Albans (Gibbard 1985). Both river systems drained into a southern North Sea embayment formed by the presence of a major land barrier joining Kent with the Pas de Calais region, the Weald/Artois Ridge (Gibbard 1995; Bates *et al.* 1997), with the eastern end of the English Channel forming a large embayment south of this land-bridge (Bates *et al.* 2003).

Human occupation in this landscape is now well attested by the *in situ* finds at Pakefield as well as younger finds from the interglacial sediments at Boxgrove in West Sussex. Extensive evidence of prolonged human activity within the region is also attested by the abundant lithic remains from gravels at Warren Hill, Mildenhall in Suffolk where terrace gravels of the Bytham are present in the Lark Valley (Wymer *et al.* 1991). Access to southern Britain during both warm and cold phases within the time frame when the land-bridge was extant has implications for contemporary faunal provinciality. Humans and other terrestrial fauna would have found accessing the British landmass easy, but faunal provinciality in marine species, unable to colonise the southern North Sea from the English Channel, would have occurred (Figure 9B).

Disruption of this ancestral landscape is generally accepted to have occurred as a result of the advance of ice to the north London area around 500,000 years ago (an event known as the Anglian glacial advance, commonly thought to have

FIGURE 9. A: Reconstructed palaeogeography for the 'Cromerian' period in Britain showing the presence of the Bytham River and the Weald/Artois land-bridge. B and C: impact of the presence or absence of a land-bridge on patterns of terrestrial and marine movements.

occurred during MIS12). This event had considerable impact on the geographical structure of the landscape, resulting in major re-modelling of the major drainage basins such as the Thames (Gibbard 1985), the loss of some systems such as the Bytham River, and the creation of new rivers and basins such as the Severn and the Fens (Rose 1994). This event (or series of events) resulted in the destruction of much of the landscape associated with the earliest phases of human activity (Wymer 2001). Evidence from the seabed (Smith 1985; Gupta *et al.* 2007) also suggests that the Anglian glaciation was most likely also responsible for the initial breaching of the Weald/Artois Ridge. Elsewhere, for example in central East Anglia, the ice buried the evidence for older river systems deep beneath till deposits associated with the Anglian ice advance (*e.g.* Lewis 1998).

After the formation of the Channel (Gibbard 1995), human (and animal) access to Britain remained complicated by occasional flooding during the high sea-levels of subsequent interglacial periods (Gibbard 1995; White and Schreve 2000). Flooding of the channel during the warm interglacial events would increasingly have isolated Britain as erosion widened the Channel (Figure 9C), resulting in impoverished faunas in Britain and barriers to colonisation by humans. Consequently early hominids were only periodically present in Britain (White and Schreve 2000), placing it at the northern margin of the inhabited world. The different scenarios for open/closed channels are complex, however, varying according to a range of factors including sea level and crustal uplift/subsidence. This is well illustrated by evidence from MIS11 (the temperate stage immediately following the Anglian glaciation), including the so-called Rhenish mollusc fauna at sites such as Swanscombe, for at least partial contact with the continent.

Archaeologically these large scale (both temporally and spatially) landscape models are useful when attempting to understand the broad patterns of human movement across the landscape as well as temporal patterns at scales of 100,000 years where perhaps crude changes in frequencies of occupation and technology may be mapped (see for example Ashton and Lewis 2002, Ashton and Hosfield 2010).

Meso-scale: the Sussex/Solent system

The Meso-scale can best be considered as a scale at which a local landscape can be constructed where spatial patterns of tens of kilometres and hundreds to thousands of years are considered. Within Britain, the best developed meso-scale model is perhaps that for the Goodwood-Slindon Raised Beach in the Sussex/Hampshire coastal corridor. Here, the Palaeolithic archaeology is best known for the important site micro-scale site at Boxgrove (Roberts and Parfitt 1999) (Figure 12), but the Boxgrove site is just one locale within much more extensive marine deposits preserved at the northern edge of a major coastal plain.

The significant elements of the deposits of the region, including preserved sediments ranging in date from nearly 500,000 years old to recent Holocene deposits are:



FIGURE 10. West Street, Selsey. Interglacial channel exposed on foreshore beneath beach sand. The channel lies in the foreground (dark grey sediment) and is cut into Tertiary bedrock (light brown clay). This channel was in-filled under estuarine conditions at least 200,000 years ago and is one of a number exposed at low tide around Selsey Bill in West Sussex.



FIGURE 11. Excavation of trenches on the foreshore at Stone Point, Lepe (Hampshire). Interglacial deposits of a former estuary can be seen at the base of the trench; this estuary was only open to the east and the fossils from Lepe and other sites in the area demonstrate that a barrier to the sea existed to the west towards Hurst Point. Today these deposits lie beneath the beach on the northern side of the Solent (the Isle of Wight is in the background).

- A series of raised beaches (Figure 7) of different ages preserved between Portsdown and Brighton (Bates *et al.* 1997, 2003, 2010) at different elevations in the landscape as a result of regional uplift (Figures 13, 14). These beaches can be traced for considerable distances across the landscape and are the basic units for reconstructing meso-scale regional landscape geographies;

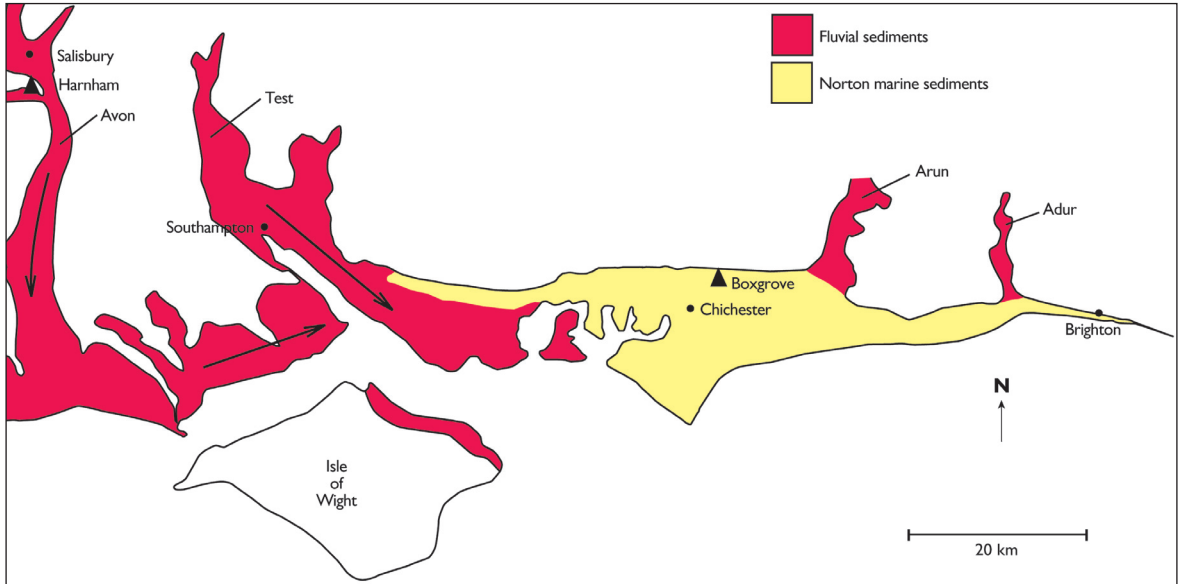
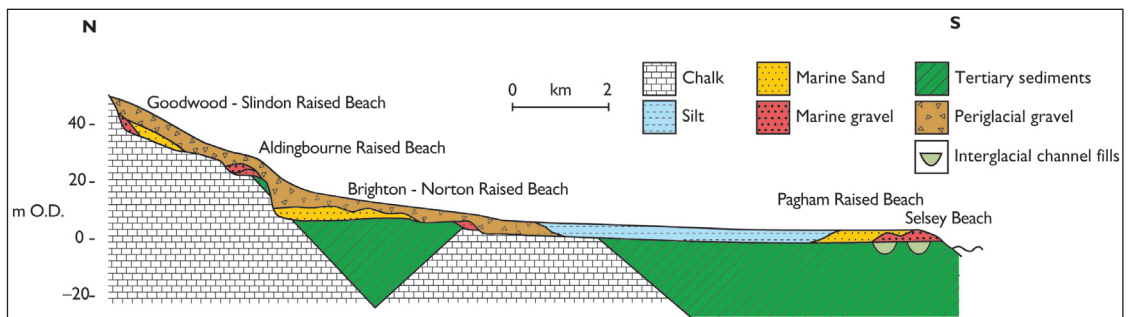


FIGURE 12. Regional geography of the West Sussex Coastal Plain/Hampshire corridor showing main distributions of marine and fluvial sediments.

- Palaeolithic archaeological remains associated with the higher beaches, the Goodwood/Slindon and Aldingbourne Raised Beaches (Figure 8);
- Extensive, preserved buried landsurfaces associated with two of these beaches (Figure 8);
- Fluvial sediments replacing marine deposits at the western end of the region (Figure 12), and entering the coastal plain in the Arun and Adur valleys (Figure 14).

These largely marine sediments are important as they contain a range of palaeoenvironmental indicators including molluscs, foraminifera and ostracods that document the nature of the associated palaeoenvironments. When coupled to the evidence from the sediments themselves, their evidence demonstrates evolution of the coastline from an embayed coastline associated with the Boxgrove beach via an open coastline through to the harboured coast line of today (Table 4, Figure 15; Bates *et al.* 2010). These changes are associated not only with local changes, but also with larger scale palaeogeographic changes such as the breaching of the English Channel, the severing of the Isle of Wight from the mainland and changes in the (presently) off-shore geography associated

FIGURE 13. Staircase of marine sediments of the West Sussex Coastal Plain.



<i>Epoch</i>	<i>Age kBP</i>	<i>MI Stage</i>	<i>Traditional stage (Britain)</i>	<i>Climate</i>	<i>Marine sediments (Raised Beaches)</i>	<i>Region Palaeogeographic condition</i>	<i>Local Palaeogeographic conditions</i>
Holocene	Present–10,000	1	Flandrian	Warm – full interglacial			Harboured coastline
Late Pleistocene	25,000	2	Devensian	Mainly cold; coldest in MI Stage 2 when Britain depopulated and maximum advance of Devensian ice sheets; occasional short-lived periods of relative warmth ('interstadials'), and more prolonged warmth in MI Stage 3.			
	50,000	3					
	70,000	4			Woodend Silts Warblington Silts		
	110,000	5a–d					
	125,000	5e	Ipswichian	Warm – full interglacial	Selsey Ridge Pagham Formation (Pagham Raised Beach)	Fully open channel. Isle of Wight/mainland ridge breached by sea, truncated Solent system and modern tidal patterns established	Harboured coastline
Middle Pleistocene	190,000	6	Wolstonian/Saalian complex	Alternating periods of cold and warmth; recently recognised that this period includes more than one glacial–interglacial cycle; changes in faunal evolution and assemblage associations through the period help distinguish its different stages.			
	240,000	7			Norton Formation (Brighton/Norton Raised Beach)	Fully open channel. Major Solent estuary	Open coastline
					Aldingbourne Formation (Aldingbourne Raised Beach)		
	300,000	8					
	340,000	9			?		
	380,000	10					
	425,000	11	Hoxnian	Warm – full interglacial	?	Open channel for part of interglacial. Major Solent estuary	Embayed coastline
	480,000	12	Anglian	Cold – maximum extent southward of glacial ice in Britain; may incorporate interstadials that have been confused with Cromerian complex interglacials		Channel ridge breached	
Early Pleistocene		13–16	Cromerian complex and Beestonian glaciation	Cycles of cold and warmth; still poorly understood due to obliteration of sediments by subsequent events	Slindon Formation (Goodwood/Slindon Raised Beach)	Channel closed. Major Solent Estuary	Embayed coastline
	620,000	17–19					
	780,000						
Early Pleistocene	1,800,000	20–64		Cycles of cool and warm, but generally not sufficiently cold for glaciation in Britain			

with fluctuating sea level. Understanding these palaeogeographic changes helps explain the distribution of the archaeological resource, and allows us to make predictions regarding the location of sequences likely to contain Palaeolithic archaeological remains.

TABLE 4. Regional stratigraphic framework and associated landscape evolution for the West Sussex Coastal Plain.

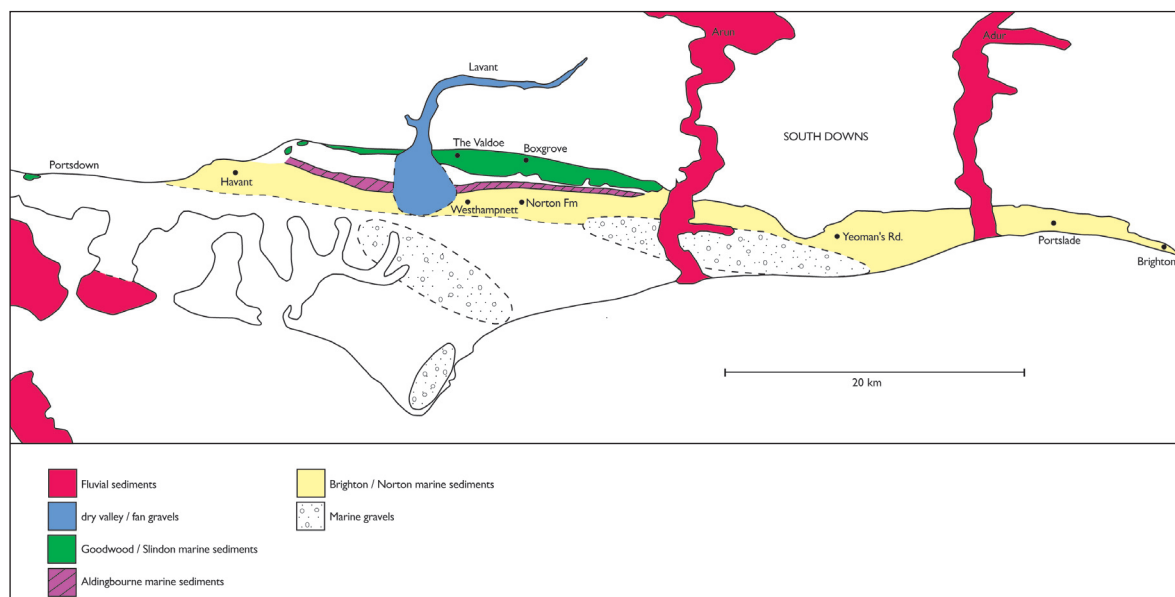


FIGURE 14. Major mapped sediment bodies on the West Sussex Coastal Plain.

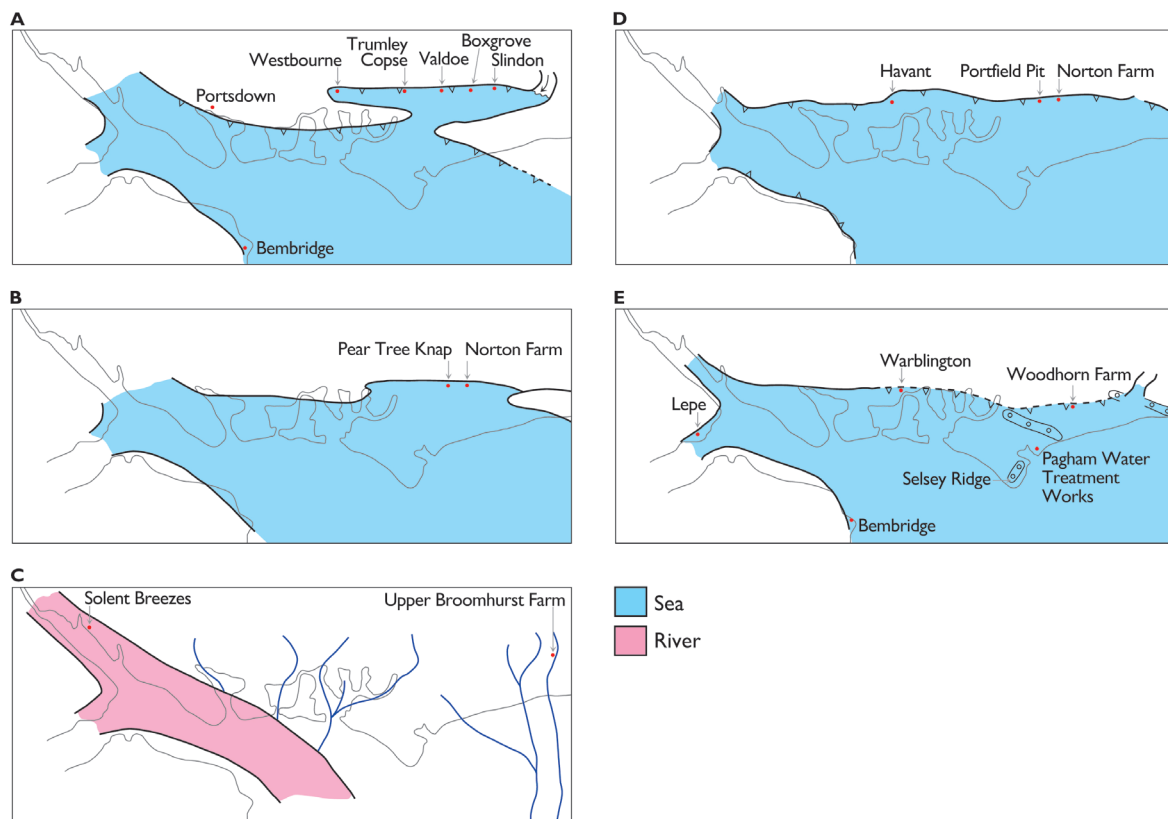


FIGURE 15. West Sussex Coastal Plain palaeogeography.

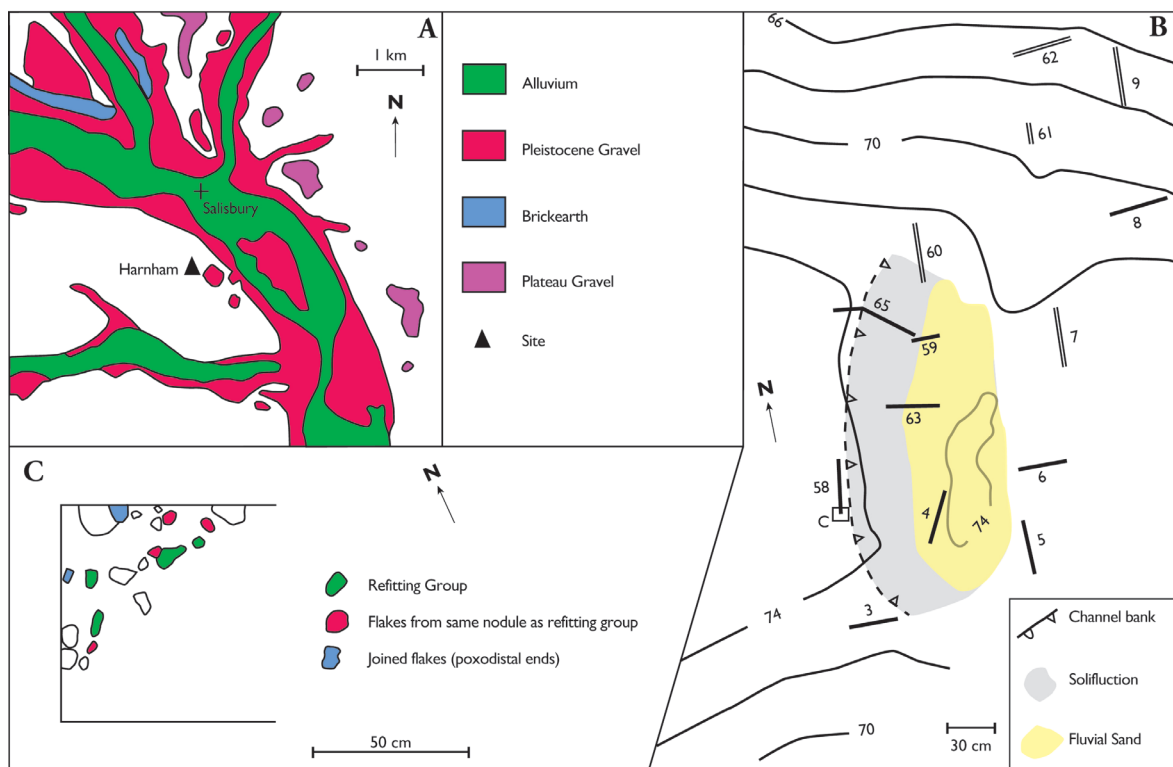


FIGURE 16. Harnham. A: Site location plan showing local mapped geology for the Salisbury area. B: Site plan showing trench locations, topography and distribution of main sediment units. C: Excavated flints and refit patterns from material resting in fluvial sands (3).

The Goodwood/Slindon Raised Beach is important not only because of the internationally important site at Boxgrove but because this and other sites can be articulated within a wider landscape for which attempts at reconstruction are justifiable. Recent mapping (Roberts and Pope 2009) have shown that the sediments of this high sea level stand can now be mapped over a distance of 26 km (Figure 14). The distribution of the sediments is thought to reflect the local palaeogeography during the existence of an embayed coastline (Bates *et al.* 2010). Regional variability in this landscape is illustrated by the findings from the Valdøe site west of Boxgrove where Pope (2010) describes the occurrence of *Aubignyna perlucida* a foraminifera, a 'southern', warm indicator that might also indicate local conditions within the Boxgrove embayment where a slight freshening of the brackish conditions reflects the inflow of streams from the Downs.

Micro-scale: Boxgrove and Harnham

Both Boxgrove and Harnham are sites where relatively large areas (up to 50 ha or more) of palaeolandscape are exceptionally preserved along with undisturbed archaeological and palaeo-environmental remains. As mentioned above, these palaeolandscapes occur now in very different geomorphological situations to those of their original formation. At Boxgrove (Figure 8), sediments once associated with exposed sand flats in the intertidal zone at the base of a chalk cliff now lie *c.* 40 m above OD beneath five metres of solifluction gravel just

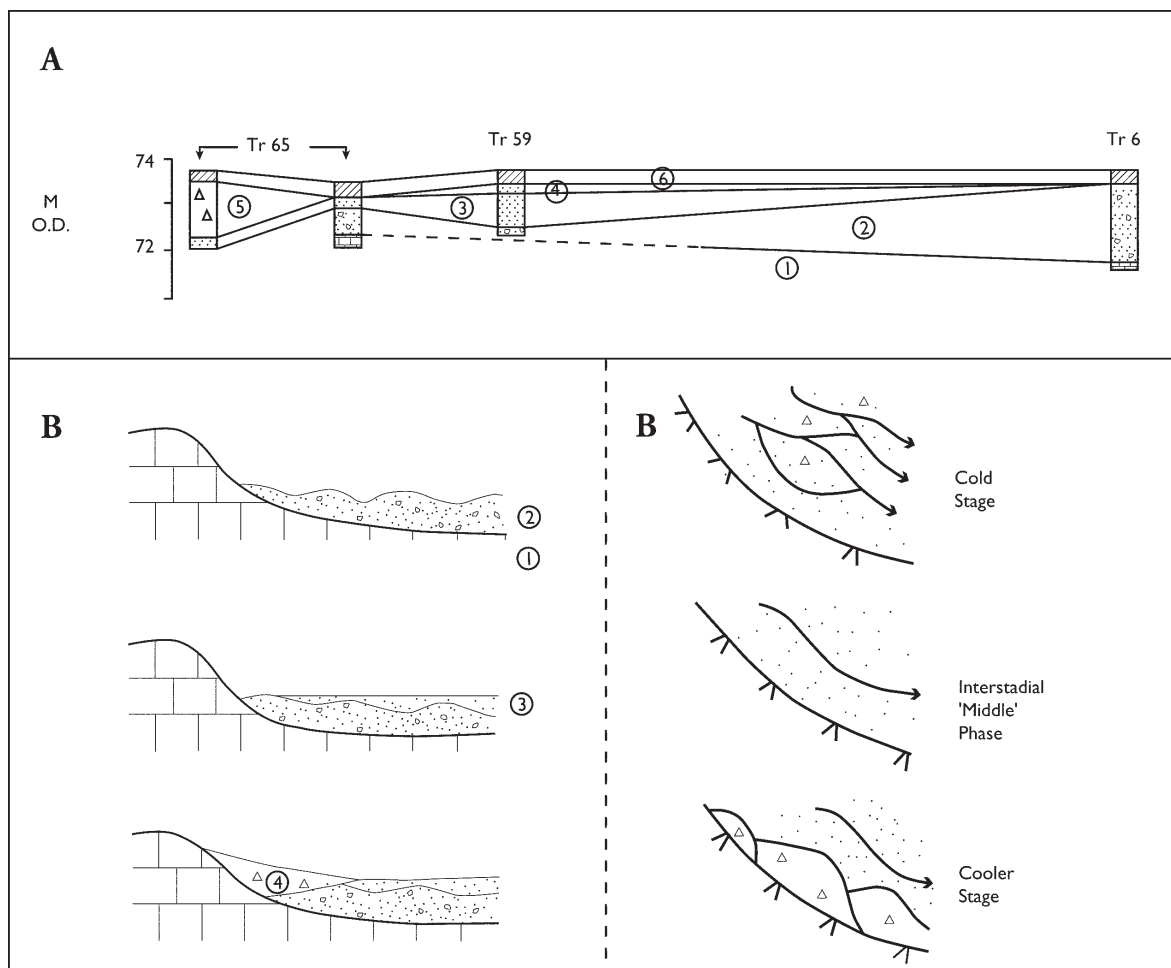


FIGURE 17. Excavation of a trench at Harnham, Wiltshire. The sequence seen in the trench consists of a basal gravel with overlying sands (grey) and capped by yellowish-grey cold stage slope deposits. The archaeological material from the site derives from the grey sands and the cold stage deposits. Today the site lies on a spur of ground between the main Avon valley flowing south from Salisbury and a small tributary valley

south of the chalk escarpment now called the South Downs. At Harnham (Whittaker *et al.* 2004) (Figure 16), sediments associated with a loop in the early course of the Wiltshire Avon are now preserved at the top of a hill 40 m above its current course and more than 1 km to the west.

Furthermore, these sedimentary archives preserve not just a momentary snapshot of the palaeolandscape, but a history of development through a relatively brief period of geological time, even at certain levels preserving evidence from periods sufficiently brief to have registered with contemporary hominin actors. At Boxgrove (Roberts and Parfitt 1999), the sedimentary archive preserves the record of successive landscape evolutions: from marine and intertidal conditions at the end of an interglacial, through a marine regression and the exposure of the intertidal zone as a grassy plain dissected by minor stream channels, to the burial of this landscape by chalky solifluction gravels as climate deteriorated to a full glacial. At Harnham, the sequence documents the evolution of the site from a high energy river flowing during cold climate conditions, through slower moving water when climate ameliorated, culminating with a return to colder conditions and the collapse of the adjacent chalk river bank (Figure 18).

At both sites evidence is preserved of undisturbed landscapes with histories of preservation and activity recorded at the micro scale. In both cases diverse topographic features have been mapped within these landscapes. This local diversity in topography is probably also mirrored in a mosaic of resources in the contemporary landscape including elements such as raw material sources at the



cliff or river margin, the locations of streams and springs, water and game, and suitable shelters or look-out points. At Harnham preliminary artefact refitting (Figure 16C) illustrates the potential for the site to reconstruct local behaviour, and cut-marked faunal remains demonstrate direct human engagement.

Preservation at these heterogeneous, micro-scale landscapes of undisturbed archaeological remains allows access to interpretation of behaviour at the intra-site level. It becomes possible to ask questions regarding areas of activity, relationship of activity to topography and resources, and investigation of change.

Multiple-scaled sites: Swanscombe

As is probably already apparent from the discussion above (particularly with reference to sites such as Boxgrove), individual sites may preserve evidence at a range of scales both across space and through time. This is particularly the case with the complex of sites in the Swanscombe region of NW Kent.

FIGURE 18. Harnham. A: Cross section illustrating the distribution of main sediment bodies at site. B: Schematic reconstruction showing sequence evolution of site from cold stage (1 and 2) through milder climate (3) and a return to cold conditions (5). C: Schematic reconstruction showing mapped distribution of main sediments units at site from cold stage (1 and 2) through milder climate (3) and a return to cold conditions (5).

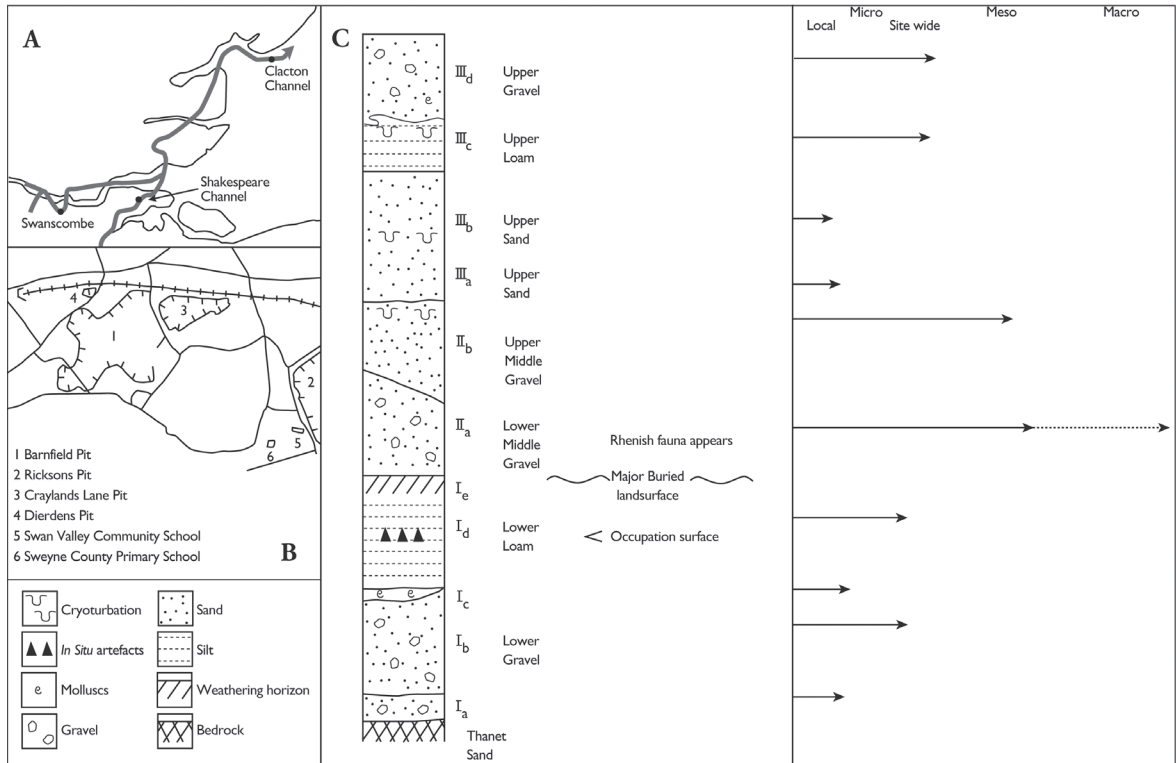


FIGURE 19. Swanscombe. A: Regional palaeogeography for the Thames/Medway system associated with the formation of the Swanscombe sequences. B: site location plans. C: Stratigraphic sequence in the Barnfield Pit.

The sequences in the Swanscombe area are particularly well represented by the deposits at Barnfield Pit (Figure 19) and a number of other sites in the vicinity (Conway *et al.* 1996; Wenban-Smith and Bridgland 2001; McNabb 2007). The sequence of deposits preserved consists of the Lower Gravel and Lower Loam (Phase I), containing a non-handaxe industry labelled as Clactonian, beneath a thick sequence (Phase II) consisting of the Lower and Upper Middle Gravels. The Phase II deposits typically contain a predominance of pointed and subcordate handaxes. The final phase (III) consists of the Upper Loam and Upper Gravel; suggestions (*e.g.* Wymer 1968) that these contain distinct ovate-dominated industries have yet to be substantiated by well-provenanced material.

The Lower Gravel and Lower Loam fluvial sediments fill a specific restricted channel, known best from the Barnfield Pit area (micro/meso scale). They appear to have been deposited under temperate conditions (Schreve 2004); the artefacts in it are mostly in secondary contexts, perhaps spanning a wide chronological range and being derived from the local banks of the active channel. The exception is an occupation surface within the Lower Loam (Waechter *et al.* 1970, Ashton and McNabb 1996) on which refitting artefacts as well as bones were recovered from a short duration phase of activity.

By contrast, the sediments of the Middle Gravels (Phase II) are considerably more extensive in nature and extend across the full Swanscombe region, even well beyond current geological mapping (Wenban-Smith and Bridgland 2001).

These deposits can be viewed as true terrace deposits and have been equated with the regional Orsett Heath Gravel that has been successfully traced across much of the lower Thames area, and in turn equated with the Boyn Hill gravel of the classic Middle Thames area (*e.g.* Bridgland, 1994 and 2006). Indeed, even larger palaeogeographical links have been suggested by the presence of a particular association of molluscs, known as the Rhenish fauna, that hint at links with the river Rhine during MIS11 (White and Schreve 2000; Bridgland *et al.* 2004b).

Taken as a whole the deposits preserved at the surviving parts of Barnfield Pit, and in (or perhaps “under”) the wider Swanscombe area, are considered by many researchers to represent nearly the whole of an interglacial stage, MIS11. This would indicate that the site spans both short to medium temporal frameworks as well as micro to macro spatial archaeological scales. This range and variety enables the deposits of the Swanscombe area to contribute to Palaeolithic understanding by revealing both short-term technological choices and longer term industrial traditions. Although the micro-scale short-term choices are demonstrated in the much-sought ‘flagship’ *in situ* occupation horizons, the complementary longer term evidence is equally, or perhaps more, important in developing a deeper understanding of more settled traditions and the range of technological choices incorporated in a particular industrial tradition. This underlines the significance and importance of Swanscombe in the framework of the British Palaeolithic archive, but more broadly it highlights factors that need to be taken into consideration when assessing the importance of other sites and landscapes.

Discussion

Consideration of the spatial and temporal scale of variability in the nature and condition of the Palaeolithic archaeological record is particularly important in both interpreting different aspects of the past and also in developing approaches to its field investigation. An understanding of the landscape context of Palaeolithic finds is needed to guide site evaluation and impact mitigation decisions and to inform spatial strategy in relation to the anticipated nature of a palaeo-landscape and the anticipated chronological/spatial scale of its preservation. Undisturbed horizons preserving micro-scale evidence (such as at Boxgrove and Harnham) have been rightly highlighted (Roe 1980; English Heritage 1991, 1998) as of particular significance for their stratigraphic and chronological integrity, and their fascinating glimpses into short-lived episodes of activity. Disturbed and transported material, such as that which predominates in macro-scale fluvial gravel contexts, has in contrast generally been downgraded in its potential significance, to the extent that some in the current curatorial environment would regard such material as being of insufficient significance to merit any protection or research in advance of destruction.

This reflects a significant misunderstanding, however, of the nature of the

questions to be asked of the material recovered. Besides avoiding the risk of writing-off large quantities of the limited Palaeolithic resource just because we do not yet know what to do with it (cf. Chippindale 1989), the study of such material can complement the evidence from undisturbed sites by bringing to bear a different chronological and spatial perspective – a landscape-scaled and landscape-framed view. Collections of transported artefacts represent a time- and space-averaged sample, giving a more representative view of lithic production and diversity than the evidence from a few square metres representing one afternoon in the distant past. Such evidence, especially when formed of substantial collections tied in with specific terrace formations, may in fact be of more value in documenting and explaining general patterns of material cultural change. It is less vulnerable to local heterogeneity caused by, for instance, specific tasks or raw material availability. Ultimately these issues relate back to understanding the landscape context and setting of the archaeological resource, and its position within this framework.

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