The Early Palaeolithic in the South-East

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Introduction

This paper presents a review of the Early Palaeolithic resource in the South-East (Fig 1), alongside an agenda defining current research priorities. The "Early Palaeolithic" covers the periods conventionally labelled as ‘Lower’ and ‘Middle’ Palaeolithic. *Exploring our Past* (1991), identified three main themes for national Palaeolithic research: physical evolution; cultural development; and global colonisation. These national themes have subsequently been kept under review and periodically updated (English Heritage/Prehistoric Society 1999 and 2008). Alongside the broad national framework, it has become increasingly apparent that the diversity of the Palaeolithic resource at the regional level merits the development of regionally-focused frameworks for Palaeolithic research, identifying specific regionally important resource elements and research priorities. Several reviews and assessments of the South-East's archaeological resource have been produced over the last 30 years (Appendix 1). These are, however, widely varied in their scope and content, ranging from county reviews covering the Palaeolithic in varied detail (e.g. Drewett 1978; Leach 1982; Bird and Bird 1987), to more-local research frameworks covering specific parts of the South-East (Williams and Brown 1999). There have also been some Palaeolithic-focussed projects such as the *Southern Rivers Palaeolithic Project* (Wessex Archaeology 1993 and 1994), the *Palaeolithic Archaeology of the Sussex/Hampshire Coastal Corridor* project (Bates et al. 2004) and the *Medway Valley Palaeolithic Project* (Wenban-Smith et al. 2007a). Although all worthy in themselves, the variety of scope and inconsistency of purpose of projects such as these make the need for a south-east regional research framework covering all periods within a consistent framework ever more pressing.

This is particularly so for the Palaeolithic, key resource elements of which (e.g. river terrace formations and spreads of Clay-with-flints) cross sub-regional curatorial boundaries. Improving our understanding of the Palaeolithic depends upon a consistent approach to methods of investigation. This is not happening at present, with the diversity of approaches taken by different county/unitary curatorial authorities leading to the accumulation of inconsistent data concerning, for instance, the presence/prevalence of Palaeolithic remains in different bodies of fluvial gravel within the South-East, or the degree of occupation of the Clay-with-flints chalk plateau. Thus this assessment and review, although of interest in itself, represents a steppingstone towards development of a framework for consistent Palaeolithic investigation and curatorial decision-making across the South-East, founded upon a unified set of regional research priorities.

The Palaeolithic poses other particular problems from the curatorial viewpoint. As discussed in more detail further below, the Palaeolithic resource is a specialised and multidisciplinary field, making it difficult for generalist curators to confidently implement their role in ensuring adequate investigation and appropriate research in the face of development threats. One key challenge is that geological context is of fundamental importance to Palaeolithic study. Natural Pleistocene deposits provide the basic evidence of, and context for, the Palaeolithic world. They contain the artefacts that reflect early human presence, and faunal and palaeo-environmental remains that allow reconstruction of wildlife, vegetation, climate and local landscape. These deposits have formed in a multiplicity of ways, with ensuing interpretive implications for any contained evidence. However, there are fundamental inadequacies in Pleistocene geological mapping for curatorial purposes. Firstly, its resolution is very coarse. Thin spreads of deposit may not be mapped, and boundaries of outcrops are likely to be poorly-defined. Secondly, there is a substantial disconnect between the two-dimensional representation of deposit types, and the genuine distribution, nature and three-dimensional complexity of the actual Pleistocene archive. Most Pleistocene sequences contain a build-up of deposits of different types formed in different ways, so any attempt to delineate an area as of one particular type is doomed from the outset. In short, although it is what is needed, and although it is the best indicator we have, geological mapping cannot be relied upon to address fully the key curatorial questions of:

- Are there Pleistocene deposits at a specific location?
- If so: what sort, how old and how were they formed?
- And ultimately: how important are they, and any contained evidence, for their potential contribution to Palaeolithic research?

The latter question is very carefully phrased. It is only rarely that one can be confident in advance of field investigation that a locality is of high importance, usually due to previous discoveries, either accidental or from earlier research. Palaeolithic remains are generally rare, even in deposits of known high potential, so one must expect numerous negative results from field evaluations as a counterpoint to occasional discoveries of important nuggets of data. Furthermore, important discoveries have been made both in areas where no Pleistocene deposits are mapped, and in deposits thought to be of low potential. So another key problem for a curator is to develop a perspective on how to deal with the ‘low probability/high importance’ aspect of the Palaeolithic archive.

Another problem concerns the philosophical approach taken to the notion of ‘importance’ when assessing Pleistocene deposits and Palaeolithic remains. A conventional approach ranks sites on a notional scale between ‘unimportant’ and ‘internationally important’, on the basis of the quality of evidence demonstrated as present. Perhaps, for example, a site with undisturbed flint-knapping scatters surrounding an elephant carcass would be ranked as ‘important’ for its direct insight into Palaeolithic behaviour. Such sites are indeed important, and we are not suggesting they should not be properly investigated. However, we do think it is necessary to reconsider the apparent counterpoint of ‘unimportant’ sites not worthy of investigation. A broader concept of importance recognises the value of the incremental accumulation of minor snippets of data in developing Palaeolithic understanding. For instance, the long-term accumulation of geological logs of widespread deposit bodies, coupled with results of numerous small-scale investigations for artefactual remains, can contribute to development of a broad picture of the pattern of settlement across a region through the vast period of Palaeolithic time, leading to an important contribution to Palaeolithic understanding without having investigated any one important Palaeolithic site. It is also necessary, as reiterated further below, to recognize the important contribution to Palaeolithic understanding made by geological and palaeoecological studies at sites lacking artefactual remains. These contribute to development of the overall chrono-stratigraphic, geomorphological and climatic framework of the Pleistocene, creating the stage on which rare instances of hominin activity can be meaningfully placed.

Deep-rooted and long-term strategic curatorial initiatives are required to facilitate pre-development Palaeolithic investigations in these directions.

This resource assessment seeks to provide a curatorial introduction to the early Palaeolithic resource in the South-East. It is not merely a review of known sites, which should be covered by county Historic Environment Records, complemented by the *Southern Rivers Project* volumes (Wessex Archaeology 1993 and 1994). Rather, it attempts to explain the Palaeolithic resource at a more fundamental level, highlighting the interpretive indivisibility of its different constituent parts, particularly geological deposits, artefactual evidence and faunal/palaeo-environmental remains. Nor does it purport to provide a desk-based assessment of the Pleistocene resource across the South-East, although in part that has occurred, as many areas of prime potential have leapt out from a review of the geological mapping. Rather, it presents a general review of the range and distribution of Pleistocene deposits in the South-East, with explanations of how the processes associated with the formation of deposits of different types are likely to have affected any contained Palaeolithic remains, and consequent implications for their interpretive potential.

This is not an easy task. The vast span of time involved, the grand climatic changes, the great variety of geological processes and the impossibility of characterising areas of deposit-type in simple two-dimensional mapping all combine to make understanding of the Palaeolithic, and management of the Pleistocene resource, a much harder task for a generalist curator than for any other period. In this report, we hope to provide a wider understanding of the nature, complexity and potential of the Palaeolithic record, and we also identify key problem areas that need to be addressed as priorities for further research, and by strategic initiatives under a subsequent research framework.

Background and approach

The Early Palaeolithic

The Palaeolithic in Britain covers the time span from initial colonisation early in the Middle Pleistocene, possibly as long as 800,000 years ago (Parfitt et al. 2010), to the end of the Late Pleistocene, corresponding with the end of the last ice age c*.*11,700 years ago (Table 1). Thus the Palaeolithic period includes at least ten major glacial–interglacial cycles, accompanied by dramatic changes in climate, landscape and environmental resources. 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 London, and the country must have been uninhabitable. 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. For the majority of the time, however, the climate would have been somewhere between these extremes.

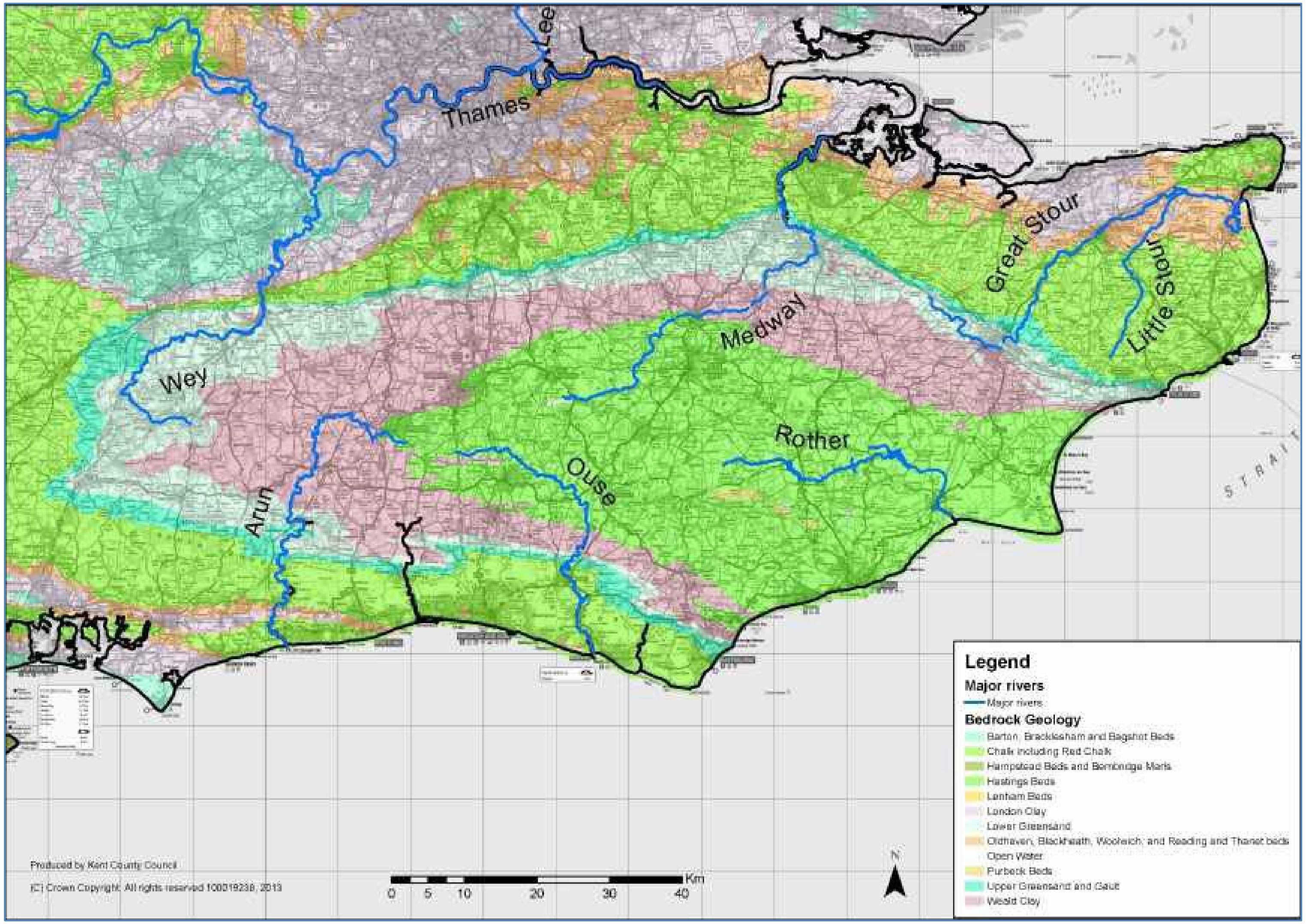

***Figure 2**. Solid geology and major rivers of the SERF region.*

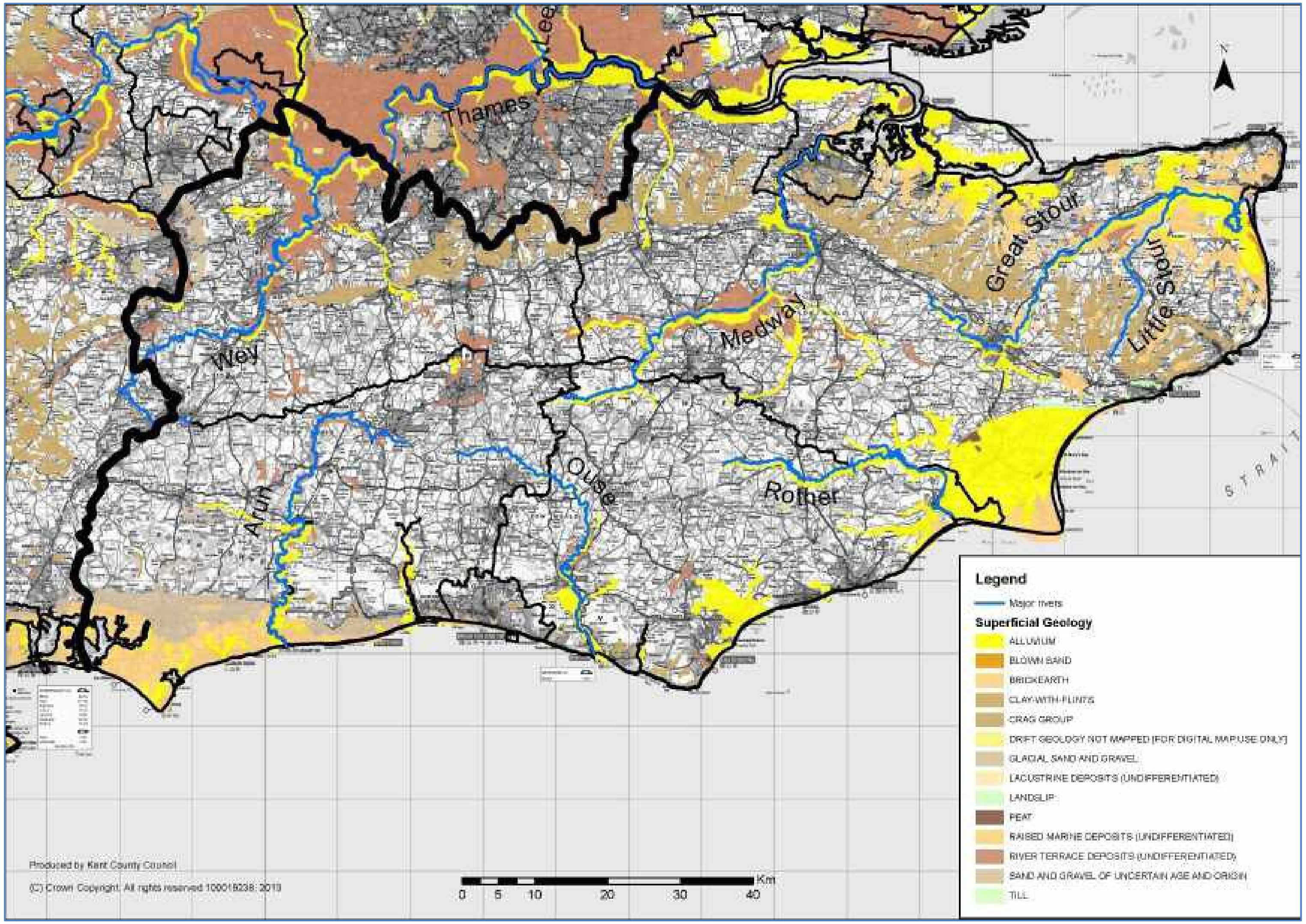

***Figure 3**. Pleistocene deposits in the SERF region*

Table 1. *Quaternary epochs and the Marine Isotope Stage (MIS) framework*

Epoch	*Age (BP)*	*MI Stage*	*British stage-name*	*Climate*
Holocene	Present 11,700	1	Holocene [previously Flandrian]	Warm — full interglacial
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		
	110,000	5a–d		
	125,000	5e	Ipswichian	Warm — full interglacial
Middle Pleistocene	190,000	6	Saalian [previously 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.
	240,000	7		
	300,000	8		
	340,000	9		
	380,000	10		
	425,000	11	Hoxnian	Warm — full interglacial
	480,000	12	Anglian	Cold — maximum extent southward of glacial ice in Britain; may incorporate interstadials that have been confused with Cromerian complex interglacials
	620,000	13–16	Cromerian complex	Cycles of cold and warmth; still poorly understood due to obliteration of sediments by subsequent events
	780,000	17–19		
Early Pleistocene	1,800,000	20–64		Cycles of cool and warmth, but generally not sufficiently cold for glaciation in Britain

The British Palaeolithic has traditionally been divided into three broad, chronologically successive periods — Lower, Middle and Upper — based primarily on changing types of stone tool (Table 2). This framework was developed in the 19th century, before any knowledge of the types of human ancestor associated with the lithic evidence of each period, and without much knowledge of the timescale. This tripartite division has nonetheless broadly stood the test of time, proving both to reflect a general chronological succession across Britain and northwest Europe, and to correspond to a certain extent with the evolution of different ancestral human species. Typical Lower and Middle Palaeolithic remains have been shown to mostly date before c.50,000 years before present (BP), and to be associated with the extinct Neanderthal lineage and their ancestors ('Archaic' Homo). Upper Palaeolithic remains date from c.40,000 BP and are associated with the first appearance of anatomically modern humans.

Table 2. *Palaeolithic period in Britain (traditional)*

Stage of Palaeolithic	*Human species*	*Lithic artefacts and other material culture*	*MI Stage*	*Date (BP)*	*Geological period*
Upper Palaeolithic	Anatomically modern *Homo sapiens sapiens*	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 *Homo neanderthalensis* after OI stage 5e	Continuation of handaxes (towards the end, the development of *bout coupé* 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	
			5e–8	125,000 – 250,000	Middle Pleistocene (later part of)
Lower Palaeolithic	Archaic Homo - *Homo* cf *heidelbergensis* initially, evolving towards *Homo neanderthalensis*	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	
	?? *Homo erectus/ergaster or antecessor*	Very simple core and flake industries — sites on Norfolk coast, particularly Pakefield	14–19	500,000 – 780,000	Middle Pleistocene (early part of)

More recently, however, it has become clear that distinguishing ‘Lower’ from ‘Middle’ Palaeolithic, conventionally marked by the appearance of prepared core technology such as Levallois and/or the manufacture of *bout coupé* handaxes, is not clear-cut in Britain (Roe 1982), and indeed Europe (Ronen 1982; Scott & Ashton 2011). These terms, although based upon (lithic) material culture, have drifted towards representation of successive chronological periods. However, it is becoming apparent that there are several examples, over a prolonged stretch of the later Middle Pleistocene, of (typically ‘Middle Palaeolithic’) proto-Levalloisian technology occurring alongside (typically ‘Lower Palaeolithic’) 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, in prep.). It also seems that fully developed Levalloisian technology in Britain is broadly contemporary with later handaxe industries in the middle of the Saalian complex in Marine Isotope Stage (MIS) 10-6. For instance the handaxe-manufacturing sites at Harnham, Wilts (Bates et al. 2014) and Cuxton, Kent (Wenban-Smith et al. 2007: 30) both date to c. 250,000 BP, contemporary with (or later than) Levalloisian activity at Baker's Hole, Kent (Wenban-Smith 1995; Scott 2011) and Purfleet, Essex (Schreve et al. 2002; Bridgland et al. 2013). It is evidently inappropriate, therefore, in the usual absence of independent dating control, to attempt a distinction between 'Lower' and 'Middle' Palaeolithic in any chronological sense based on the presence (usually in low quantities) of either handaxe manufacture or Levalloisian technology. In contrast, it seems that *bout coupé* handaxes are specifically associated with occupation from the middle of the subsequent (Devensian) glaciation (White and Jacobi 2002; Boismier et al. 2012), so, whether or not labelled 'Middle' they genuinely represent a distinct phase of Palaeolithic occupation.

Separation of 'Lower' from 'Middle' Palaeolithic has mostly not, therefore, been attempted in this resource assessment. The term 'Lower Palaeolithic' is reserved for reliably-dated pre-Anglian industries or occurrences, which can take a variety of forms, including: simple flake/core, as at Pakefield (Parfitt et al. 2005) and Happisburgh (Parfitt et al. 2010), handaxe-dominated, as at Boxgrove (Roberts and Parfitt 1999), or unifacial flake-tool dominated, as at High Lodge (Ashton et al. 1992). The combined term 'Lower/Middle Palaeolithic' is used for post-Anglian and pre-Ipswichian industries, including: handaxe-dominated industries such as those from Swanscombe (Wymer 1968), Red Barns (Wenban-Smith et al. 2000) and Cuxton (Tester 1965; Shaw & White 2002; Wenban-Smith 2006); Clactonian flake/core industries, again well-known from sites in the Swanscombe area (Wymer 1968 and 1974; Wenban-Smith 2013); and Levalloisian-dominated industries, such as at Baker's Hole (Wenban-Smith 1995; Scott 2011) and Crayford (Wymer 1968; Cook 1986; Scott 2011). *Bout coupé* material has been attributed to a later period, which could be regarded as 'true' Middle Palaeolithic but has been named here as 'British Mousterian' to avoid confusion (Table 3). The term 'Early' Palaeolithic is used as an umbrella term for all this pre-Upper Palaeolithic material, including material or sites of too uncertain age or cultural affiliation to be linked with a more specific term.

Thus the Early Palaeolithic is the dominant phase of British prehistory, representing c.95% of prehistoric time, during which extinct lineages of ancestral Archaic hominins came and went as the climate fluctuated and the landscape underwent accompanying dramatic change. The main evidence of the period is stone tools, and the interpretation of these depends heavily on understanding and dating the deposits in which they are found and reconstructing the contemporary climate and environment from any associated biological remains.

Researching the Palaeolithic: 'sites' and evidence

In the conventional archaeological sense, 'sites' do not exist in the British Palaeolithic. A conventional site involves human disturbance of the ground, creating an easily-defined area containing archaeological features such as ditches, pits, foundation trenches and ramparts. In the Palaeolithic, there was none of this disturbance; rather, we have artefacts of day-to-day existence, discarded in the

***Table 3**. Revised chronological/cultural terminology for the Early Palaeolithic*

Traditional Palaeolithic stage	*Updated stage*	*Human species*	*Lithic artefacts and other material culture*	*MI Stage*	*Date (BP)*	*UK geo stage*
Upper Palaeolithic	**Upper Palaeolithic**	Anatomically modern humans (*Homo sapiens sapiens*)	Dominance of blade technology and standardised tools made on blade blanks; personal adornment, cave art, bone/antler points and needles	2–3	10,000–35,000	Late Devensian
Middle Palaeolithic	**British Mousterian**	Neanderthals *(Homo neanderthalensis)*	The appearance of *bout coupé* handaxes; discoidal flake/core reduction strategies	3–5d	35,000–115,000	Early/Middle Devensian
	-	-	Britain uninhabited	5e	115,000–125,000	Ipswichian
	Lower/Middle Palaeolithic	Early pre-Neanderthals, evolving into *Homo neanderthalensis*	Still some handaxe-dominated sites, but growth of more standardised (Levalloisian) flake and blade production techniques (Eg. Crayford)	6–9	125,000–425,000	Hoxnian /Saalian complex
Lower Palaeolithic			Handaxe-dominated (Eg. Swanscombe; Cuxton), but appearance of more standardised flake and blade production techniques (Levalloisian); occasional industries without handaxes (Clactonian)	8–11		
	-	-	Britain uninhabited	12	425,000–480,000	Anglian
	Lower Palaeolithic	*Homo* cf *heidelbergensis*	Handaxe-dominated (Eg. Boxgrove), with occasional unstandardised flake core production techniques and simple unstandardised flake-tools; occasional unifacial flake-tool industries without handaxes (High Lodge)	13	480,000–500,000	Cromerian complex IV
		Homo ergaster	Simple flake/core industries with no standardised flake-tools (Pakefield; Happisburgh)	13–19	500,000–780,000	Cromerian complex **I-III**

ancient landscape, incorporated in natural geological deposits, and miraculously preserved in certain locations until the present day. Lithic artefacts from stone tool manufacture and discard are the most commonly found remains, due to their robustness and their resistance to chemical decay. In certain preservational conditions organic remains are also found, such as worked bone or antler tools, or bones with cut-marks reflecting butchery of the animal for its meat (Table 4). Thus

Palaeolithic ‘sites’ are not so much defined areas of human intervention, with excavatable humanly-formed deposits, but locations where Palaeolithic evidence has been recovered from natural geological deposits. And it is in this, present-day sense, that the term ‘site’ is used in this paper, as a location where one, or more, Palaeolithic artefacts have been recovered, without any necessary implication that it was a significant site of prehistoric activity, or that the location is therefore of importance for further investigation. These then become subsequent questions, the answers to which depend primarily upon the nature of the deposit in which any artefacts (or other evidence) were found.

Table 4. *Palaeolithic remains and relevant information*

Category	*Range*	*E.g. Comments*
Human activities/artefacts	Lithic artefacts	Flaked stone tools and debitage, percussors
	Wooden artefacts	Spears, tool-hafts
	Bone/antler artefacts	Percussors, handaxes (known from Italy on elephant bone)
	Cut-marked faunal remains, faunal accumulations whose attributes indicate human influence	
	Decorated/carved objects	Generally Upper Palaeolithic, but not out of the question for Lower/Middle Palaeolithic
	Cave art	Upper Palaeolithic only
	Manuports	Unused raw material
	Features, structures	Hearths, stone pavements, pits
	Fire	Charcoal concentrations in association with hearths

Category	*Range*	*E.g. Comments*
Biological/palaeo-environmental	Large vertebrates	Mammals (rhino, elephant, lion, deer horse, carnivores, etc.) birds
	Small vertebrates	Mammals (bats, mice, voles, lemmings etc.), fish, reptiles, birds, amphibians
	Plant macro-fossils	
	Pollen and diatoms	
	Molluscs	
	Insects	
	Ostracods and foraminifera	

Some sites may represent single artefacts from a geological deposit that gathered material from a wide area whilst forming, perhaps including derived material from pre-existing older deposits. Others may contain dense accumulations of Palaeolithic material gently buried by steady accumulation of fine sediments, which have remained undisturbed since their burial. One of the main problems in researching the Palaeolithic is to unravel the depositional history of any surviving evidence, to ascertain its spatial and chronological integrity, and consequently: (a) to establish whether the find location also represents the site of Palaeolithic activity; and (b) to consider its potential contribution to researching the period.

The main evidence for researching the Palaeolithic is the lithic and faunal remains contained in Middle and Late Pleistocene contexts. The burial and subsequent preservation of Palaeolithic remains is dependent upon where they have been deposited in the landscape, and which depositional processes have acted upon that part of the landscape. A wide range of processes are possible, ranging from total dispersal by glacial action, solifluction or high energy fluvial torrents, to gentle burial by fine-grained aeolian, colluvial or alluvial processes, leaving evidence essentially undisturbed. Palaeolithic remains, and lithic artefacts in particular which are relatively indestructible, have the potential to be preserved and recognisable, although usually showing signs of wear-and-tear, after substantial transport and disturbance. Consequently, understanding and interpretation of Palaeolithic remains is heavily dependent upon interpretation of the depositional and post-depositional processes that have affected them between their original deposition and their present context. Evidence from both disturbed and undisturbed sites has a role to play in addressing Palaeolithic research priorities. What is most important is, therefore, not necessarily to identify a lack of disturbance, but to be confident about the degree of disturbance. This knowledge then underpins the spatial/chronological scale at which the evidence can be interpreted.

Undisturbed horizons have been rightly highlighted (Roe 1980; English Heritage 1991) 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 predominates in fluvial contexts, has in contrast been widely 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. However, besides avoiding the risk of writing off large quantities of the finite Palaeolithic resource just because we don't yet know what to do with it (cf. Chippindale 1989), it is becoming clear that the study of such material in fact *complements* the evidence from undisturbed sites by bringing a different chronological and spatial perspective to bear. Collections of transported artefacts can 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 may in fact be of more value in documenting and explaining general patterns of material cultural change, since it is less vulnerable to local heterogeneity caused by, for instance, specific tasks or raw material availability.

Besides the direct evidence of human activity, such as artefacts and cut-marked faunal remains, biological/palaeo-environmental evidence plays a central role. This is often large mammalian, small vertebrate or molluscan, but there is a wide range of other evidence that may be present (cf. Table 4). This may be present at the same sites as artefactual remains, either in the same horizon or in stratigraphically related horizons. Or it may be present at sites where direct artefactual evidence is absent. In all these cases, the evidence has the same value and potential for Palaeolithic research, and should be recognised as significant. It can help in dating the deposit and providing information on the local climate and environment at any particular time. Environmental/dating evidence from non-artefactual sites can play a key role in constructing a dated, regional, environmental framework within which artefact-bearing sites can be placed. Such information is essential if we are to carry out core research objectives such as dating sites, constructing a framework of cultural change and development, and understanding human activity and behaviour in its environmental and landscape context.

From a curatorial point of view, Palaeolithic remains generally cannot (due to their non-structural nature) be protected by "scheduling" (ie. adding them to the list of designated remains of national importance). Therefore they are protected mostly through the National Planning Policy Framework (July 2018). This allows for proportionate pre-development investigation commensurate with the scale of a project and the importance of a site. It also states that undesignated sites of national importance should be treated equivalently to designated ones. The discussion above attempts to show the range of Palaeolithic evidence that can be regarded as important, and how it relates to current research priorities. Historic England's Scheduling Selection Guide (2018) for Sites of Early Human Activity also provides a useful overview of the nature and range of Palaeolithic sites, and specifies ten key criteria for national importance (ibid. p19), including: presence of human remains, a perior or area where evidence is rare, well-preserved palaeo-environmental indicators, clear stratigraphic relationships of artefact-bearing deposits, and abundant artefacts.

In summary, the following key points can be made concerning Palaeolithic research:

- The main evidence is lithic artefacts and dietary faunal remains
- It is essential to know the stratigraphic context of such material
- Evidence from *both* undisturbed primary context *and* disturbed secondary context sites is significant
- The interpretive potential of any archaeological material depends upon understanding of depositional and post-depositional processes that have affected it
- Dating is essential to document the degree and spatial scale of contemporary variability, and trajectories of cultural stasis and change through the changing climatic framework of the Pleistocene
- Biological/palaeo-environmental evidence plays a fundamental role, even on sites without artefacts, by contributing to the construction of chrono-, climato- and litho-stratigraphic frameworks

A deposit-centred approach

The approach taken here to assessing the Early Palaeolithic resource in the South-East is deposit-centred rather than find-centred. Clearly artefact finds are the most direct evidence of early hominin presence but, as outlined above, research into, and *understanding of*, the period depend almost more upon the context of discovery, and other evidence, faunal and floral, than upon the finds themselves. Most importantly, the potential for the existence of any Palaeolithic remains at a location is initially contingent upon the presence of Pleistocene sediments; and then the questions are:

- What do they contain in the way of artefactual or other evidence?
- How important are these remains for current research?

Therefore this assessment focuses primarily upon the distribution and prevalence of Pleistocene deposits of various types within the South-East, and secondarily addresses the presence/prevalence/nature of Palaeolithic remains within them. This then provides the basis for a review of our current understanding of the region, both in its own right and within the wider national context, addressing the history of occupation and cultural change represented, and interpretations of lifestyle and behaviour. Gaps in our understanding, and consequent priorities and key areas for future research are then reviewed in the subsequent Research Agenda, supplemented by suggestions for some immediately desirable projects.

Pleistocene Background: landscape, processes and dating

Landscape and topography

The South-East here comprises primarily the counties of: Surrey; Kent; West Sussex; and East Sussex. The region is bounded to the north by London, to the west by Hampshire and Berkshire, and otherwise surrounded by coastline. The defining feature of the region is the Wealden basin. Geomorphologically, this forms the western half of an elongated ring of chalk hills, passing anticlockwise from the north-east corner of Kent: the North Downs, the east Hampshire Downs and the South Downs). The Channel coastline cuts diagonally north-east/south-west across the eastern side of this ring, and the eastern half of the Wealden formation continues under the Channel, emerging in France and Belgium. Geologically, the basin forms an eroded anticlinal dome, with earlier Cretaceous deposits (Hastings Beds, Weald Clay, Lower/Upper Greensand and Gault) outcropping at ground surface in the lower-lying areas within the Wealden ring of (late Cretaceous) chalk hills.

To the north, younger Palaeocene and Eocene deposits (Thanet Sand, London Clay and, at the north-west corner of the region, Barton/Bracklesham/Bagshot Beds) conformably overlie the shallowly north-striking dip slope of the North Downs, forming the southern edge of the synclinal London Basin. A mirror-image Palaeocene/Eocene sequence occurs in the south-west corner of the region, overlying the south-striking dip slope of the western South Downs, and forming the northeastern edge of the Hampshire Basin. Otherwise post-Cretaceous deposits are absent along the southern coastline of the region, which is characterised by, often substantial, chalk cliffs, getting progressively higher eastwards towards Beachy Head. The south-east stretch of coastline, between Eastbourne and Folkestone, where the Channel transgresses upon the central Wealden deposits, is mostly characterised by low-lying marshy ground and Holocene marine sand and shingle, as the eroded early Cretaceous bedrock surface dips shallowly under the sea.

This fundamental geological structure has effectively determined the evolution of drainage patterns within, and around, the South-East, both sets of factors in turn having a major impact upon the nature and distribution of Pleistocene deposits. Residual Clay-with-flints deposits cap the high ground of the Chalk all around the Wealden Basin; and in some places, particularly north-east Kent, loessic deposits (generally mapped as ‘brickearth’) are also present. Northern and southern chalk dip-slopes are dissected by numerous dry valleys, filled with varying thicknesses of slopewash gravel and colluvial brickearth. Likewise, steeper chalk scarp slopes facing into the Wealden Basin are deeply etched with erosional channelling, with slopewash deposits fanning out from their base. Within the Weald, broadly concentric topographic relief is created by relatively hard beds of limestone and sandstone within the predominantly soft early/middle Cretaceous series; and likewise, the high points of these harder beds are capped with residual and loessic deposits, the shallower dip slopes traversed by sediment-filled dry valleys and the steeper scarp slopes having slopewash fans banked against their bases.

The Thames runs west-east across the north of the region, progressively widening to form the Thames estuary. Numerous south-bank tributaries enter the Thames, draining the northern part of the region. The smaller of these (e.g. the tiny Ebbsfleet in Kent, the Palaeolithic importance of its associated surviving Pleistocene deposits being utterly disproportionate to its size cf. Wenban-Smith 1995 and 2007), merely drain the northern dip slope of the Wealden anticline. A few larger tributaries (the rivers Wey, Mole, Darent/Cray, Medway and Stour) drain northward from within the Wealden basin into the Thames, cutting through the chalk hills of the North Downs. This situation is broadly mirrored in the southern part of the region, where the rivers Arun, Adur, Ouse and Cuckmere drain southward through the hills of the South Downs into the Channel. Smaller tributaries draining down the southern Wealden Chalk dip slope are rarer, although there are a few, for instance the Lavant in West Sussex; there are, however, numerous dry valleys attesting to a previous history of more intense southern dip slope drainage. Finally, there are the (eastern) Rother (as distinct from the western Rother which forms a Wealden tributary of the Arun) and the Tillingham/Brede pair, which drain eastwards into the Channel along the central axis of the Wealden basin.

The present-day drainage has not been static through the Pleistocene, but merely represents the latest snapshot of a dynamic history of basin enlargement and tributary capture. Intra-Wealden drainage patterns in particular appear to have undergone substantial alteration. This is apparent, for instance, in the Medway basin, Kent, where it is likely that the major stretches of the Len and Beult valleys, and even the upper parts of the Teise sub-basin, probably previously drained into the Great Stour; and that the breaching of the North Downs by the upper Darent has captured what was once a much more substantial tributary of the Medway, flowing east along the foot of the scarp slope, through the Shode Gorge, into what is now the relatively minor Bourne valley. Another clear example is in Surrey, in the Farnham area, where what were evidently previously upper stretches of the Blackwater have been captured by the Wey; extensive spreads of Pleistocene terrace gravel south of Aldershot attest to the previous link through the narrowest point of the Wealden chalk scarp.

The whole south-east region is scattered with hundreds, if not thousands, of deposit outcrops formed by fluvial activity throughout the Pleistocene. In some cases substantial series of terrace deposits line the valley flanks of major rivers such as the Thames, Medway, Great Stour and Arun, representing deposition in the same valley throughout substantial phases of the Pleistocene. Numerous relatively minor valleys also contain their own mapped terrace systems. These often likewise broadly reflect current drainage patterns, but also in many cases represent a fossil of a now-defunct

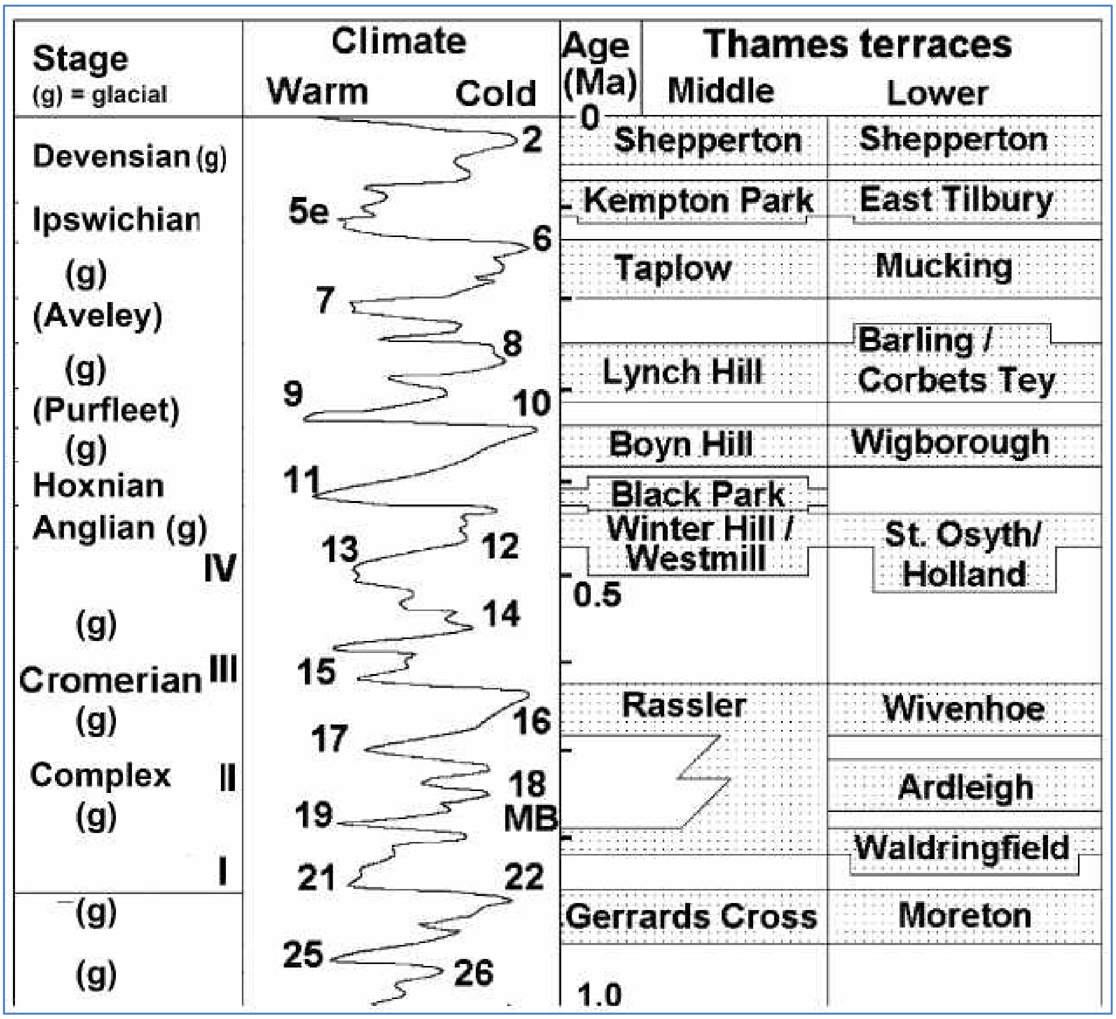

Figure 4. *Correlation scheme for river terraces in the Middle and Lower Thames formed in the past 1.0 million years, also showing the marine oxygen isotope curve (with numbered stages) and named British terrestrial stages. The oxygen isotope data are from benthic microfossils, from Ocean Drilling Program site 677 (Shackleton et al. 1990). Modified from Westaway et al. (2002).*

drainage pattern; lines of isolated terrace patches cross the landscape, representing abandoned courses of (sometimes major) river channels that bear very little relation to the present day drainage. Key points to bear in mind when it comes to considering the potential for Pleistocene fluvial deposits to be present at any particular location are: (a) that fluvial drainage and aggradation must regularly have been substantially greater in the Pleistocene than in the present day, and numerous smaller streams and dry valleys in the present landscape would in the past have been associated with foaming torrents and substantial sediment deposition; and (b) that Pleistocene corridors of fluvial deposition do not necessarily correspond with present-day drainage patterns.

The sedimentary archive from the Middle Pleistocene provides important evidence for landscape evolution. One conclusion that can be drawn, and one that is perhaps not widely acknowledged, is that the landscape in most parts of the world, including south-east England, has changed markedly since the beginning of the Middle

Pleistocene. The best evidence for this comes from river terrace sequences (discussed in more detail below). The earliest terraces, too old to be of value (at least in northwest Europe) as contexts for Palaeolithic archaeology, record a subdued, open landscape lacking the deeply incised valleys that characterize our region at present (e.g. Kukla, 1978; Maddy et al., 2000). The fluvial incision that has led to the present situation began soon after the onset of major climatic fluctuations on a 100,000 year cycle at the beginning of the Middle Pleistocene c.780,000 BP (the so-called 'Mid-Pleistocene Revolution', which replaced shorter c.40,000 year cycles of milder climatic change) and is interpreted by some as a direct consequence of enhanced erosion brought about by greater climatic severity (Bridgland and Westaway 2007a, b).

Another important aspect of landscape history in the context of Early Palaeolithic archaeology is the enormous amount of change through the period. Undisturbed remains are not found in the lowest terraces of our river valleys but are concentrated in terraces typically at least 12m above valley bottoms, and often nearer 30m above, a clear indication of the degree of erosion and incision that has subsequently taken place. Thus any conclusions from, for instance, the apparent absence of living structures and burials should be tempered by the realisation that very little of the landscape in which these people lived now survives. The land surfaces they occupied have almost entirely been destroyed during intervening episodes of climatic change, with the only prospect for preservation being where gently buried by fine sediment or cemented by tufa precipitation; indeed it is no accident that tufa/travertine localities account for a very high proportion of the sub-aerial dwelling or activity sites known from the earlier Palaeolithic. People would not usually have lived and worked in many areas where sediment was typically accumulating, such as damp valley floors, river channels, and lake bottoms. The known record provides a few examples of exceptions, such as river gravel bars at Swanscombe, the foreshore at Boxgrove and colluvially-infilled depressions on the southern dip slope of the Portsdown anticline at Red Barns where minimally disturbed material has been preserved in its original landscape situation; although, of course, the contemporary surrounding landscape has totally disappeared.

Chrono-stratigraphic framework and fluvial system development

The template for the classification and interpretation of the terrestrial Pleistocene sediments that form the Palaeolithic resource is the more continuous sedimentary record of the deep oceans. Oceanic sediment cores provide us with a record of the climatic fluctuation between glacial and interglacial conditions that is an important characteristic of this period, elucidated from the oxygen isotopes in the calcium carbonate exoskeletons of marine micro-organisms (foraminifera). This isotopic record is actually one of global ice volume, which directly influences the relative amounts of ^{18}O and ^{16}O isotopes in seawater (cf. Shackleton and Opdyke, 1973). The palaeoclimatic archive thus revealed is one of relatively short-lived warm 'interglacial' episodes (comparable with that in which we live today) and similarly brief 'glacial' intervals of intense cold, with markedly increased ice volume, with the rest of the time represented by an intermediate situation varying between cool and temperate; the latter accounts for at least 60% of Middle and Late Pleistocene time, with the warm and glacial extremes accounting for c.20% each at most, each occurring approximately once every 100,000 years (cf. Table 1).

These three different situations are not reflected in the classification of Pleistocene time, however, which is still based upon earlier schemes based entirely on terrestrial

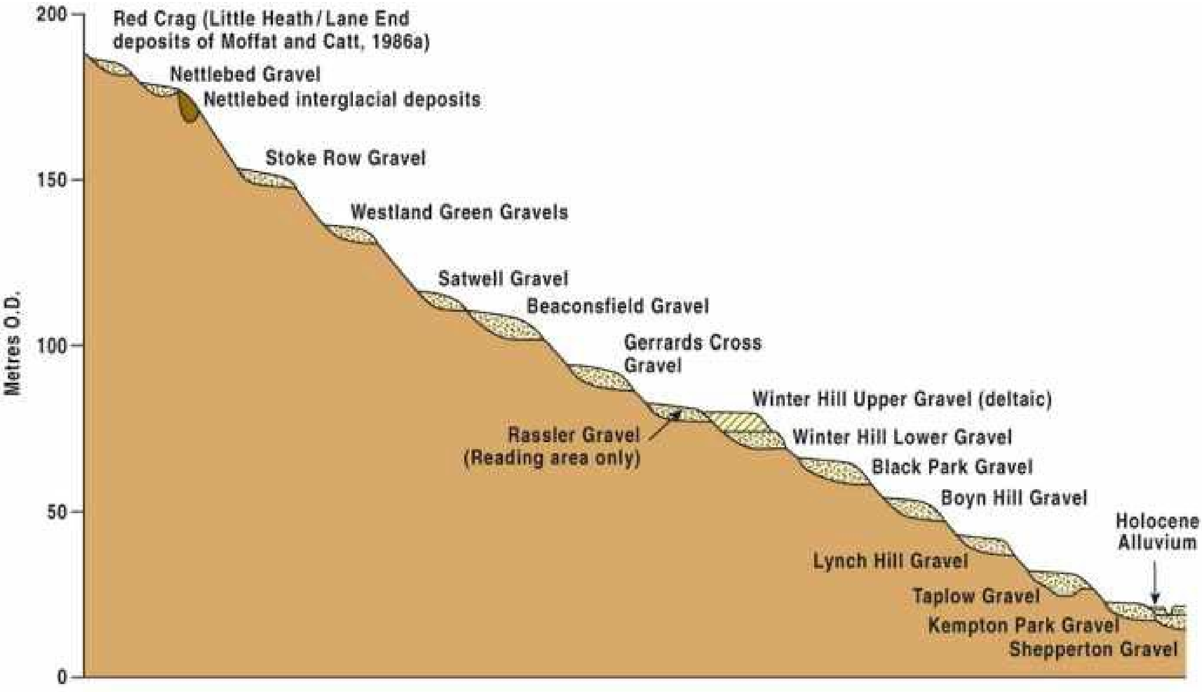

***Figure 5**. Idealized transverse section through the Middle Thames terrace staircase (modified from Bridgland 1994).*

evidence. The warmest episodes are classified as 'interglacials' and all remaining cool and intensely cold periods are lumped together as 'glacials', accounting for c.80% of Pleistocene time. Within these glacials, warmer episodes of insufficient length or intensity for deciduous forest to have developed in north-west Europe are nonetheless recognized and are termed 'interstadials'. A sequence of named British interglacials, glacials and interstadials has been built up over several decades (cf. Table 1), there being separate schemes on the European continent. These interglacials and interstadials are assumed to correspond with the major and minor warm peaks respectively in the marine oxygen isotope record, although correlation of particular episodes remains equivocal and sometimes controversial (see, for example, Preece et al., 2007 for a review).

The best framework we have for correlating the terrestrial climato-stratigraphic episodes (cf. Table 1) with the marine isotope stages is that provided by the 'terraced' sedimentary records of the major rivers, although the sequence of raised marine beaches along the south coast of England fulfils a similar role (Bridgland, 2000; Bridgland, Maddy and Bates, 2004a). These sedimentary terraces represent former floodplains of the rivers, which have been left above modern valley-floor level by the rivers cutting further and further downwards into the landscape, a process that is thought to have been fundamentally driven by climate change, by means of the complex interaction of factors such as changing sea-level, fluvial activity, vegetational cover and slope stability, although perhaps also subject to the influence of local crustal uplift (see Maddy, 1997; Maddy, Bridgland and Green, 2000; Maddy and Bridgland, 2000; Westaway, Maddy and Bridgland, 2002).

The most important of the British fluvial records is that of the Thames (Fig 5), which has formed terraces at a rate of approximately one per 100,000 year climate cycle throughout the Middle Pleistocene (see Gibbard, 1985; Bridgland, 1994, 2000, 2006).

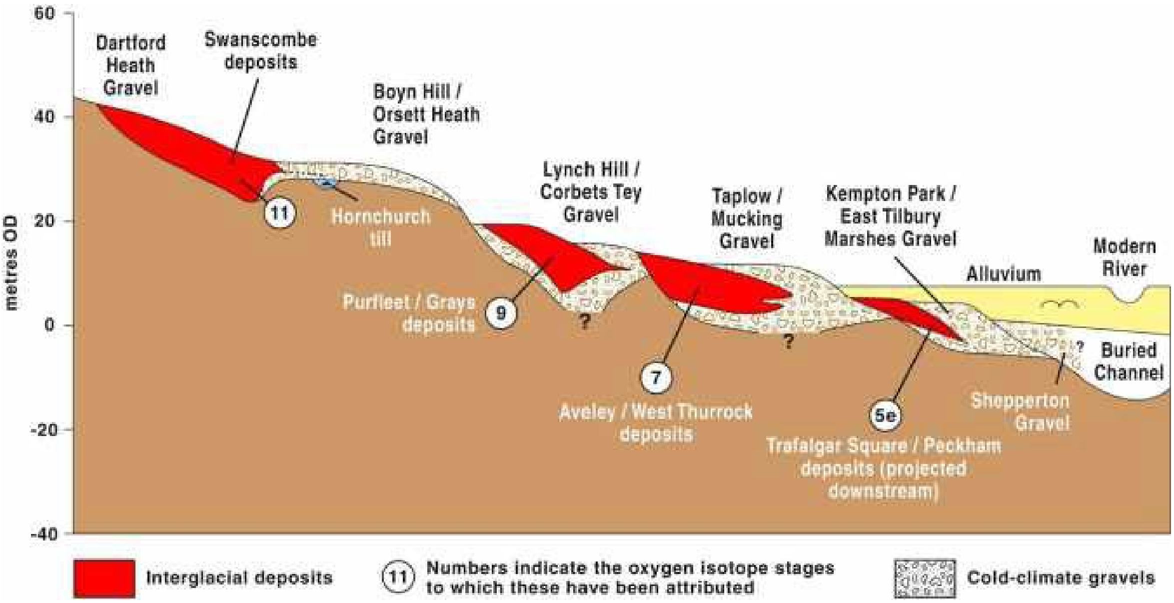

Figure 6*. Idealized transverse section through the Lower Thames terrace staircase (modified from Bridgland (1994, 2006)). Note that the starting point for this sequence is the Anglian glaciation, which caused the Thames to be diverted into its modern valley through London and is represented beneath the highest and oldest terrace at Hornchurch (Hornchurch till). The occurrences of Lower and Middle Palaeolithic assemblages is indicated.*

East of London, in the lower Thames valley (along the northern edge of the south-east region), there is a particularly important archive of fluvial deposits representing the last 500,000 years and incorporating sedimentary evidence for four interglacial periods (Fig 6), which are thought to equate with the last four warm peaks within marine isotope stages (MIS) 11, 9, 7 and 5; MIS 3 being an interstadial within the last glacial. The Lower Thames terraces also incorporate the greatest concentration of important Lower/Middle Palaeolithic sites in Britain, which have provided a key framework for this period (Wymer 1968; Bridgland 1998 and 2006; White and Schreve, 2000; Wenban-Smith and Bridgland, 2001).

The Lower Thames sequence commences with evidence of the largest glaciation to have affected the British Isles, named the Anglian, which diverted the Thames into the valley through London for the first time. Correlation of the Anglian with MIS 12 of the marine record (c.500,000 years ago) has been received wisdom for the past two decades and, although not without dissenters, remains the most plausible interpretation and the basis for classification schemes currently in use (see Preece et al., 2007). The Anglian thus represents a marker level within the Thames sequence that can thereby be traced into tributary systems such as the Wey, Medway and Kentish Stour, all with important Palaeolithic archives.

Correlating the terraces of other rivers in south-east England, which lack physical connections with the Thames and are beyond the maximum extent of the glacial till sheet of the Anglian glaciation (which extends as far south as Hornchurch, in north-east London), and so lack the stratigraphic marker-level it provides in the Thames system, remains a challenge. Where fossils are present they can assist, using biostratigraphy, with mammals (Schreve, 2001) and molluscs (Preece, 1995; Keen, 2001) the most useful fossil groups, although pollen has the lengthiest pedigree in the study of interglacials (cf. Thomas, 2001). In recent years various radiometric and geochemical dating methods have been brought to bear on the subject (see Smart and Francis, 1991; Walker, 2005), the most generally useful for fluvial sequences in south-east England being optically stimulated luminescence (OSL) dating of sand grains (Briant et al., 2006) and amino acid racemization dating of mollusc shells (Penkman et al., 2007), although uranium-series dating (applied to fossil bone, tooth enamel and calcitic crystalline sediments) is perhaps the most reliable method for longer timescales (up to 500,000 years), where suitable materials are available (see Smart, 1991; Preece et al., 2007). More recently it has been suggested that the phases of fluvial incision represented by successively lower terraces can be dated with reference to regional models of crustal uplift, providing a framework for dating, particularly if one or two levels (in addition to the Holocene valley floor) already have independent dates (see Maddy, 1997, Maddy, Bridgland and Green, 2000; Westaway, Maddy and Bridgland, 2002; Westaway, Bridgland and White, 2006).

Sequence problems: discontinuities, abnormalities and complexities

Pleistocene fluvial deposits across the South-East are usually compared with well established sequence models based on the extensively studied deposits in the lower Thames Valley. Here Bridgland (2006; Bridgland et al., 2004a) has established a model for sequence evolution based on changing patterns of deposition and erosion through the glacial/interglacial cycles, although fundamentally driven by tectonic uplift. This model (‘the Bridgland Model’) has been primarily derived from sequences preserved within a major river valley (Thames) in its present day, estuarine lower reaches. However, for much of the time over which the sequences on which the model is based were developing, this part of the river valley was beyond the reach of estuarine influence. Consequently consideration should be given as to whether this is an appropriate model for lower fluvial stretches where estuarine and fluvial sedimentation are co-occurring. Furthermore, it is also questionable whether a major river valley such as the Thames provides a valid model for far smaller tributary valleys, in particular those with small hinterlands. Two examples in the South-East serve to underline these problems.

At the mouth of the river Medway extensive sequences of fluvial sediments have been mapped across the Hoo peninsula (Bridgland, 2003) (Fig 7). These deposits have been integrated with those from the Thames to produce a regional stratigraphic framework (Table 5). Until recently no fossiliferous sediments had been found in this area but discoveries at Allhallows (Bates et al., 2002) and Kingsnorth (Bates 1999) have provided new information. The deposits appear to occupy a large channel cut into bedrock (at least to -5m OD) along the margins of the Hoo peninsula (Fig 8). This channel is freshwater in its early stages of infilling becoming brackish at Allhallows later in the infilling sequence. Recent age estimates for this channel suggest accumulation during MIS 9 (Kirsty Penkman pers. comm. 2008). Such a feature is difficult to accommodate in Bridgland's terrace model without modifying the basic model parameters.

A second example to be considered is the Ebbsfleet Valley in Kent. Here extensive sequences of late Middle Pleistocene age are preserved in a small valley on the south bank of the Thames. The valley (and contained sequences) are incised through a local landscape dominated by Thames sequences of the Boyn Hill (or Orsett Heath) gravel, associated with the major Hoxnian interglacial (MIS 11, c.400,000 BP). However, rather than reflecting contemporary processes and activity of the main Thames, a complex sequence spanning at least the last two interglacials of MIS 7 and MIS 5 is preserved below 14m OD. These sequences are preserved in a detail not currently recorded in the main Thames area due to the Ebbsfleet acting as a sump in the landscape whereas accumulating sequences were removed by later activity in the main Thames.
These two examples highlight the need for construction of detailed local lithostratigraphic sequences and chronological frameworks prior to integration into the more extensive and widespread models for Quaternary chronology.

The Early Palaeolithic resource in the South-East: distribution and potential

Introduction

As explained above, this resource assessment focuses upon the range and distribution of different categories of Pleistocene deposits, complemented by consideration of the prevalence and interpretation of Palaeolithic remains within each category (cf. Wymer 1995). These are perhaps most readily grouped in terms of different sedimentary depositional environments, although within some depositional environments there can be a wide range of different types of contexts with different Palaeolithic potential. Based on current geological mapping (Appendix 2), five main groups of Pleistocene deposit occur in the South-East (Table 6), and these are reviewed below in turn, alongside consideration of some deposit types and situations either not known in the region or known but unmapped.

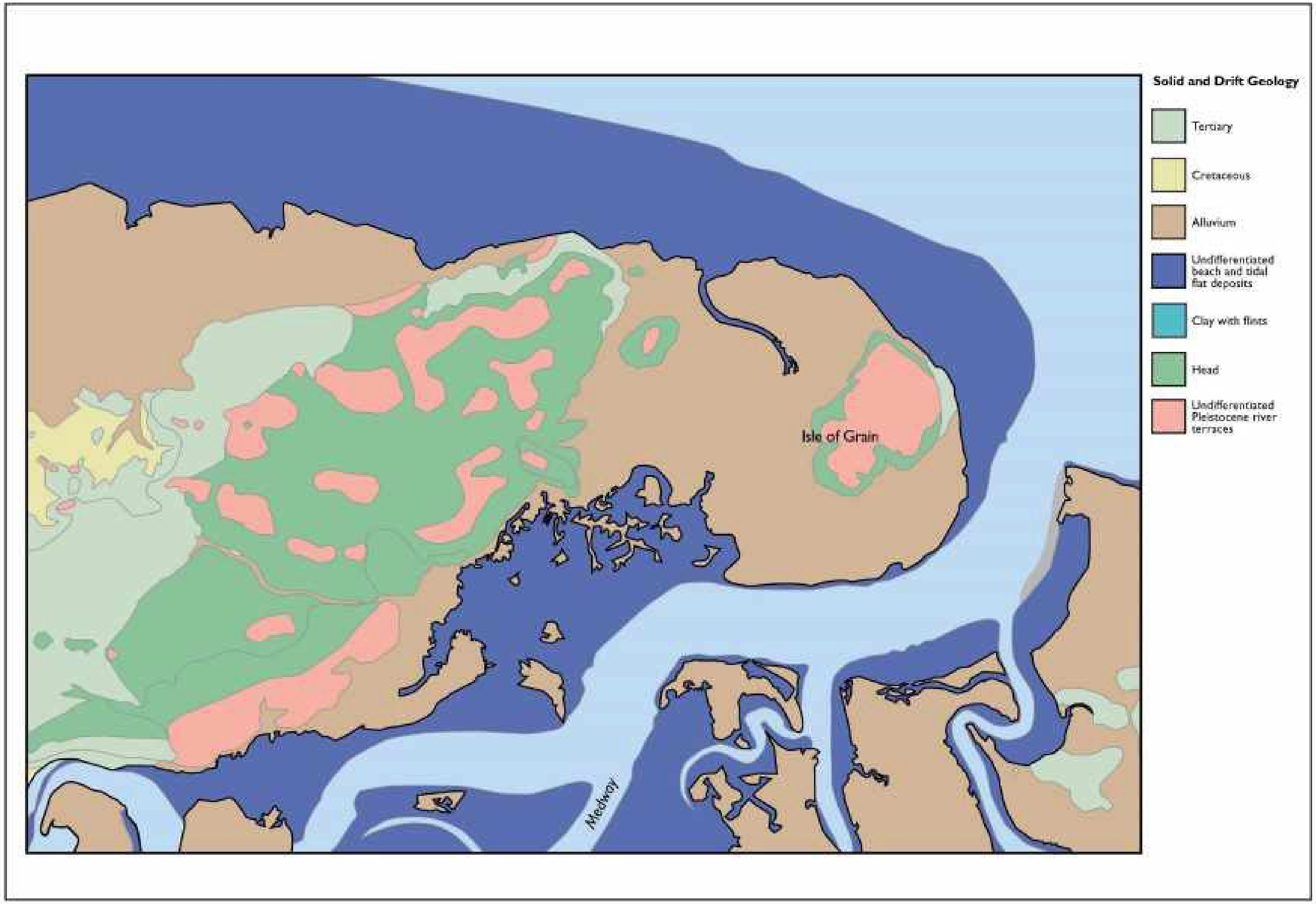

Figure 7. *Drift geology map of the Hoo Peninsula*

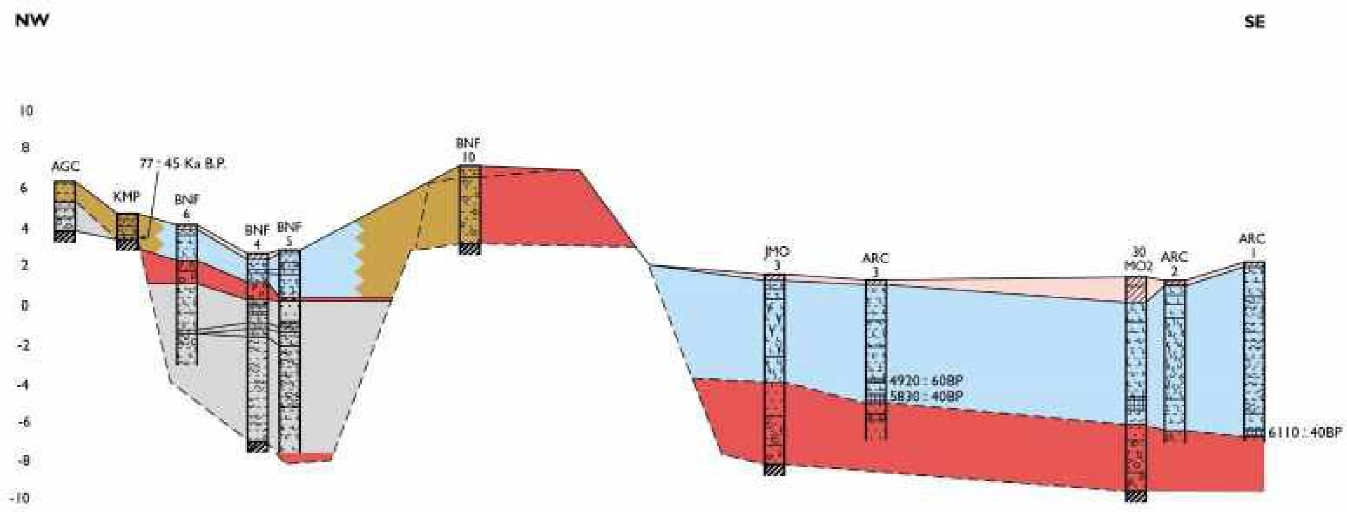

***Figure 8.** Schematic section through the Medway floodplain Quaternary sequence between Allhallows and the Isle of Grain**Table 5**. The Quaternary sequence in the lower reaches of the Medway showing lithostratigraphic sequence and suggested correlations with Thames formations and with chronostratigraphic, climatic and marine isotope (MI) stages (modified from Bridgland, 2003).*

Terrace formation: Medway	*Interglacial deposits (channels)*	*Terrace formation: Thames*	*Members: Lower Thames*	*Age*	*Climate*	*MI Stage*
Tilbury		Tilbury	Tilbury	Holocene	warm	1
Halling		Shepperton	Shepperton	late Devensian	cold	late 2
Aylesford Upper			East Tilbury Marshes Upper	Devensian	cold	5d-2
	?Kingsnorth deposits	East Tilbury Marshes	Trafalgar Square deposits	Ipswichian	warm	5e
Aylesford Lower			East Tilbury Marshes Lower	intra-Saalian	cold	late 6
Binney Upper			Mucking Upper	intra-Saalian	cold	6
	?Allhallows deposits	Mucking	Aveley Silts and sands	intra-Saalian	warm	7
Binney Lower			Mucking Lower	intra-Saalian	cold	late 8
			Botany	intra-Saalian	cold	8
Stoke (Grain Gravel*)	?Allhallows deposits	Corbets Tey (Grain Gravel)	Purfleet deposits	intra-Saalian	warm	9
			Little Thurrock	intra-Saalian	cold	late 10
			Orsett Heath Upper	intra-Saalian	cold	10
Shakespeare		Orsett Heath	Swanscombe interglacial deposits	Hoxnian	warm	11
			Orsett Hearth Lower	late Anglian	cold	late 12
Newhall?		Black Park		Anglian	cold	12
Dagenham Farm/Chalkwell/Caidge		Winter Hill	St.Osyth	Anglian	cold	12
Clinch Street/Canewdon/St. Lawrence			Wivenhoe	pre-Anglian	c/w/c	14-12?
High Halstow/Belfairs/Mayland			Ardleigh	Cromerian complex	c/w/c	?

* The Grain Gravel (present on the Isle of Grain) is a Thames not Medway deposit and is equivalent to the Corbets Tey Terrace of the Lower Thames

Table 6. *Presence and abundance of principal Pleistocene deposit groups in the SE region, with key areas named [✓✓✓Abundant; ✓✓ moderately common; ✓ scarce; - none known; ? Uncertain]*

Deposit group	*Surrey*		*Kent*		*W Sussex*		*E Sussex*	
1a. High-level (Anglian/pre-Anglian) terrace deposits and "plateau gravels"	✓✓	Surrey Hill Gravel; Blackwater and Thames terraces >T6; Mole terraces, Black Park and Plateau	✓✓	Lower Thames; the Blean (Stour); Medway valley and Hoo	-	-	-	-
1b. Lower-level post-Anglian fluvial terrace deposits	✓✓✓	Wey terraces at Farnham; Blackwater-Wey (Aldershot - Farnham); Virginia Water	✓✓✓	Lower Thames, Swanscombe; Darent, esp. Crayford; Stour terraces, Canterbury; Wealden rivers (Marden)	✓✓	Buried Lavant channels at coast (Selsey-Bracklesham); Arun (Peppering elephant)	✓	Ouse (Iford); Cuckmere (Alfriston)
2. Residual surface deposits (Clay-with-flints)	✓✓	North Downs between Dorking and Biggin Hill (esp. Walton Heath);	✓✓✓	North Downs (from Knockholt to Medway, and west of Medway to the coast);	✓	South Downs (north of Littlehampton; north-west of Shoreham)	✓	South Downs (Seaford-Eastbourne)
2. Residual surface deposits (other)	✓✓	Netley Heath Beds; Limpsfield Chart, Limpsfield Common	✓✓✓	Spreads within Weald over Lower Greensand chert/sandstone outcrops: Hythe Beds and Folkestone Beds; Ightham Common	-	-	-	-
3a. Coombe/Head deposits (colluvial)	✓✓	North Downs dip slope, dry valleys; Weald: Wey, Arun and Eden upper basins (esp. Limpsfield)	✓✓✓	North Downs dip slope, dry valleys and minor fleets (esp. Ebbsfleet Valley; Sittingbourne, Luton Valley, Spekes Bottom); Darent basin; Medway Gap and Stour Basin; Weald: Oldbury area, upper Medway basin (esp. Bourne, Dunks Green	✓✓	Weald: Hythe Beds surface and north-facing scarp slope, and central Wealden river basins and watershed areas; South Downs dip	✓✓	Wealden north-facing scarp slopes; Cuckmere and Ouse basins; South Downs Chalk dip slope

				area)		slope		
Deposit group	*Surrey*		*Kent*		*W Sussex*		*E Sussex*	
3b. Head/solifluction gravel	✓	Farnham area	✓✓	Foot of North Downs dip slope (Sittingbourne); Darent basin (South Darenth-Grubb Street); Higham, north-west of Rochester	✓✓	Foot of South Downs dip slope (esp. Boxgrove)	-	
3c. Head/Valley Brickearth, named silt bodies (alluvial/colluvial?)	✓✓	Langley Silt complex (Ashford, Esher); Farnham terraces (brickearth capping); Mole basin within Weald	✓✓✓	Dartford Silt; Crayford Silt; Tonbridge basin; Stour valley, east and north-east Kent, Medway basin and intra-Wealden high ground	✓	Chichester /Selsey plain, south of South Downs, Worthing	✓	To south of South Downs, Shoreham and Hove
4. Aeolian/loessic silt, plateau brickearth	-	-	✓✓	North-east Kent; Isle of Thanet; high ground within Weald (Maidstone area)	?	Patches on high ground within Weald?	?	Patches on high ground within Weald?
5. Marine littoral (raised beach, intertidal/estuarin e)	-	-	?	Deal	✓✓	Coastal plain, south of South Downs, between Havant and Brighton	?	Newhaven, Seaford?

Two problems that have to be confronted here have previously been alluded to. Firstly, some (if not many) Pleistocene sequences will contain, at the same spot, a build-up of sediments from different depositional environments - for instance the Clactonian elephant butchery site at Southfleet Road, Ebbsfleet has a sequence including: solifluction deposits; fluvial sands; lake-margin clays; a tufaceous channel; fluvial gravel; and colluvial/aeolian brickearth (Wenban-Smith et al. 2006) and all these deposits contain Palaeolithic remains. Thus it is often meaningless to characterise an area of deposit as being of one particular type. And secondly, much geological mapping wrongly characterises significant areas of deposit - for instance: (a) many mapped Coombe/Head deposits are likely to be, or to seal, substantial areas of fluvial sediment, and (b) there is general confusion between spreads of residual deposit, aeolian/loessic sediments and Coombe/Head deposits in areas of undulating high ground.

In this review, discussion of the distribution of each category is based as far as possible on the genuine situation, as revealed by field investigations and, when appropriate, re-appraisal of current mapping. However, it will remain a curatorial (and indeed an expert) challenge to interpret the likely presence and nature of Pleistocene deposits, and consequent Palaeolithic potential, in uninvestigated areas earmarked for potential development that either lack mapped deposits or show deposits of notoriously protean nature such as Coombe/Head or fluvial terrace deposits. Despite problems with current mapping, it is usually the best information available on the likely presence of deposits at a location, and the potential presence of unmapped deposits and other sediment types must be deduced from informed speculation in the absence of recorded observations.

Resolving these problems, or developing a curatorial approach to managing them, emerges from this assessment as a priority for future management of the Palaeolithic resource; this theme will be returned to in the subsequent discussions on both research agendas and strategic initiatives for the South-East.

Fluvial terrace deposits and plateau gravel

The most widespread sedimentary contexts for the record in question are undoubtedly the fluvial ones, with the ubiquitous sand/gravel terrace deposits accounting for a large majority of artefacts in the various extant collections. These contexts represent (in the main) the gravel beds of rivers flowing during the colder parts of the Pleistocene, when they would have formed multiple-channelled ‘braided’ systems with gravel accumulating on bars between the channels, and periodic phases of lower energy deposition and overbank flooding represented by sand and silt beds within the predominantly gravel sequence. These braided river gravels rarely yield artefacts in primary or near-primary context, although artefacts may be less disturbed than generally presumed. Contained artefacts have typically been regarded as rolled from downstream transport and possibly reworked from unknown earlier sediments or land-surfaces (see Hosfield, 1999; Hosfield and Chambers, 2002). However, an alternative model (Wenban-Smith in prep.) would see artefacts as relatively immobile within the sediment load, being substantially more angular (and in the case of most handaxes, significantly larger) than most of the accompanying sand/gravel. Under this alternative model, artefacts would be subject to ‘churning’ as channel-braids shifted, becoming abraded in the process, but would not be significantly transported downstream. And, depending upon the energy of the river stream, and the vagaries of channel shifting, many artefacts may be rapidly incorporated into the forming gravel body, and not subsequently disturbed. In this case, we would need to reappraise our perspective on the interpretive potential of artefact collections from gravel bodies, as they would represent more constrained concentrations of Palaeolithic activity than is currently widely believed.

Furthermore, braid bars might well have represented valuable sources of raw material, as well as being associated with river channels that provided water and attracted game animals, so where there was rapid burial and minimal disturbance it is possible that valuable concentrations of knapping debris might survive, particularly near former floodplain edges. Abundant remains of fresh-condition handaxes and debitage from the interface zone between the Lower Middle Gravel and the Upper Middle Gravel at Swanscombe (Wymer 1968) probably represent this type of depositional situation.

Finer-grained fluvial sediments are preserved much more rarely, reflecting infills of abandoned channels and floodplain overbank sediments. They can occur as substantial beds within a gravel-dominant formation, such as the Lower Loam at Swanscombe, where a series of undisturbed Palaeolithic occupation horizons are preserved (Conway et al., 1996) or as relatively restricted channels within a major gravel body, such as at Lynford, Norfolk (Boismier 2003). These sediments will often represent the warmer parts of the Pleistocene, when rivers would have had considerably less energy and would have flowed in narrower single-thread channels. When present, they can provide a plethora of valuable evidence, including fossils and datable materials as well as better-preserved artefacts. Artefacts can be preserved in a condition good enough to preserve signs of use-wear, and bones can be sufficiently well-preserved to reveal cut-marks; an example being the Grays brickearth, which was quarried, unfortunately, in the 19th century, before artefacts were widely recognized, although cut-marks have been recognized on bones from this source (S. Parfitt, pers. comm.).

Rare gravels from interglacial environments, such as the Lower Middle Gravel and Upper Middle Gravel at the famous Swanscombe hominin locality (Conway et al., 1996), should perhaps be grouped with these finer-grained sediments, as they would have been transported over short distances from localized gravel sources. Thus they can preserve artefacts and fossils in reasonably good condition, exactly as is seen at Swanscombe, as well as at other Lower Thames sites such as Purfleet (Schreve et al., 2002) and at Trafalgar Square, London (Preece, 1999).

Two main categories of fluvial deposits are recognized as forming part of the early Palaeolithic resource (cf. Table 6). Deposit group 1a comprises high-level terrace deposits and ‘plateau gravels’, thought to date to Anglian or pre-Anglian times; and deposit group 1b comprises lower level terrace deposits, thought to date to post-Anglian times. Fluvial deposits are also liable to be present either under mapped bodies of Head deposit or misidentified as Head deposits. And finally, certain named silt bodies in Surrey and northern Kent (Langley Silt, Crayford Silt and Dartford Silt), although probably predominantly colluvial, may incorporate/bury varying proportions of fluvial/alluvial sediments.

High-level fluvial terrace deposits and plateau gravel (Anglian/pre-Anglian)
Deposits of this group occur only in Surrey and Kent, associated with Pliocene and Lower/early Middle Pleistocene precursors of the larger rivers: Thames, Blackwater, Wey, Mole, Medway and Stour (Table 7). There is one substantial outcrop associated with Surrey Heath, variously mapped as the Surrey Hill Gravel (BGS Sheet 269) or as Blackwater terraces 8-9 (BGS Sheet 285). Otherwise, there are numerous smaller outcrops on high ground between and beside the aforementioned rivers, with particular concentrations in a few areas such as the Hoo peninsula (Bridgland 2003) and the Blean (Coleman 1952, 1954; Bridgland et al. 1998a). Some deposits are mapped as named bodies such as Black Park Gravel (cf. Gibbard 1985), Chelsfield Gravel (BGS sheet 271) or Cobham Park Gravel (Bridgland 2003), and other deposits are merely mapped as generic 'plateau gravel' - the difference only being as to whether they have attracted research attention, rather than any intrinsic differentiation of their nature and interpretation.

***Table 7**. Resource summary, deposit group 1a: High-level terrace deposits and "plateau gravels".*

	Key areas	*Key sites **	*Palaeolithic remains*	*Notes, comments*
Surrey	Surrey Hill Gravel (Camberley)	-	-	No finds known, but no targeted investigations
	Surrey Heath (south part of Surrey Hill Gravel); Blackwater terraces T8–T9	9 Grange Rd (W&M2-3); Barossa Common (W&M2-4)	Both sites have >1 handaxes found	Uncertain whether handaxes from upon or within high terrace gravel
	Surrey Hill Gravel, Thames terraces T6–T8 (Chobham-Virginia Water interfluve)	-	-	No finds known, but no targeted investigations
	Overlying London Clay, NE of Leatherhead	-	-	No finds known, but no targeted investigations
	Mole terraces, Black Park Gravel and "plateau gravel" (Leatherhead-Cobham-Esher)	-	-	No finds known, but no targeted investigations
	Overlying Weald Clay, S of Dorking	-	-	No finds known, but no targeted investigations
	Wey-Mole interfluve	St. George's Hill (W&M7-2)	Six handaxes	Handaxes are well-provenanced to within gravel
	Key areas	*Key sites **	*Palaeolithic remains*	*Notes, comments*
Kent	Chelsfield Gravel, Kent plateau	Ash-cum-Ridley (NWK2-48)	Very abundant material (>60 handaxes; also	Nothing from within stratified deposits or accurately located;

			flakes, flake-tools and a Levallois core)	much might be residual surface finds
	Extensive spreads at Dartford Heath and Dartford	Bexley Hospital (old); Wansunt Pit	No finds known from extensive higher-level gravel body	Uncertainty whether the main higher-level gravel body is Anglian or post-Anglian
	Small patches E of Dartford, S of Eastern Quarry	Darenth Wood (NWK4-10), Stone (NWK4-11)	Single handaxe finds from both sites	Uncertain whether handaxes from upon or within high terrace gravel
	Outcrops on the Hoo peninsula	-	-	Various high terrace outcrops, but no finds known
	Great Stour terraces, north bank >T3 (the Blean)	Various sites in T4 (S4-4, 9 and 11)	Single handaxe finds at S4-4 and S4-9; three handaxes in trenches at Rough Common (S4-11)	Various high terrace outcrops, but no finds known above T4
	Great-Lesser Stour interfluve, T3-T4	Fordwich (S4-36); Howletts Pit (S6-6)	Numerous handaxe finds at both sites	T3 thought to be Anglian; crude-looking handaxes at Fordwich once thought to suggest early date, but: (a) Boxgrove; (b) poss. related raw material
	Medway Valley	-	-	Various high terrace outcrops, but no finds known
W Sussex	No major outcrops known	-	-	Perhaps a few unmapped outcrops in Weald
E Sussex	No major outcrops known	-	-	Perhaps a few unmapped outcrops in Weald

* Site identification numbering relates to Southern Rivers Project mapping, volume 2 (Wessex Archaeology 1993)

These deposits are associated with a relative abundance of early Palaeolithic finds (Wessex Archaeology 1993, 1994), although it is mostly uncertain whether these are residual surface finds representing activity on the surface subsequent to deposit formation, or whether finds are truly from within the high-level gravel bodies. The geomorphological situation of the high-level gravel outcrops would probably have made them advantageous locations for early hominin activity, providing firm and level underfoot conditions, good vantage points and perhaps also raw material for tool manufacture, all factors that might encourage accumulation of residual material. However, there are a number of sites, e.g. St. George's Hill, northern Surrey (Wessex Archaeology 1993, map W and M 7, find-spot 4), where there is reliable provenance of handaxe finds to within a gravel deposit. These sites are worthy of particular attention to recover further material and to clarify their date and relationship to other fluvial terrace deposits, since they may represent particularly early hominin occupation.

It has been established since the 1980s, through work at sites such as Boxgrove (Roberts 1986; Roberts and Parfitt 1999), High Lodge (Ashton et al 1992) and Westbury Quarry (Bishop 1975, 1982), that England was occupied before the Anglian glaciation. It is evident, therefore, that Anglian and immediately pre-Anglian terrace deposits, corresponding to the younger deposits of this resource group, are liable to contain Palaeolithic remains, and should therefore be subject to evaluation to investigate this possibility when impacted by development, rather than there being a blanket presumption that deposits of this age have no Palaeolithic potential.

Little work has been carried out investigating for Palaeolithic remains in high-level gravels, but a struck flake was found during controlled sieving of the Canewdon Gravel at Southend, Essex (Wenban-Smith et al. 2007b), opposite the Hoo peninsula on the other side of the Thames estuary. This gravel body has been identified by Bridgland (2003) as a pre-Anglian Medway deposit, equivalent to the Clinch Street Gravel of the Hoo peninsula. This result highlights the potential of further controlled investigations of these, and similar, deposits. Furthermore, the recent discovery (Parfitt et al. 2005) of much earlier occupation in the period MIS 18-16, c.700,000 BP, highlights the fact that evidence of even earlier occupation may be present in even earlier gravels than hitherto thought possible, and likewise these require investigation when appropriate.

It would be beneficial if biological remains could be found, and dating and clast lithological studies carried out, building on the previous work of Gibbard (1985) and Bridgland (2003), to place known deposits within a more coherent framework. It is also worth bearing in mind that the problems of derivation and transport are of less significance when studying these early deposits, for which the principal question is the big picture of whether or not there is evidence of hominin presence in a particular gravel body. Obviously, there are extra benefits in discovery of less disturbed material, but identification of any material in deposits of this category establishes a clear threshold date of hominin presence, and any suggestion of derivation merely pushes this date back even further.

4.2.2. Lower-level fluvial terrace deposits (post-Anglian)

Post-Anglian fluvial terrace deposits are the commonest, and the most widespread, Pleistocene deposit within the region. All of the major rivers of the region have Pleistocene fluvial deposits associated, as do most of their tributaries, and many of the tributaries of the tributaries. The region can be divided into three broad provinces:

1. North of Weald
2. Wealden basin
3. South of Weald

Province 1 — North of Weald

In this province, the chalk dip slope that defines the northern edge of the Weald strikes shallowly northwards. It is overlapped at its northern edge by softer Tertiary sands and clays: (a) at its western end in north-west Surrey; and (b) in northern Kent between the Hoo peninsula and the Isle of Thanet. Generally, Pleistocene fluvial terrace deposits are more extensive, better developed and more clearly differentiated in areas of soft Tertiary bedrock. However, these deposits are generally less conducive to preservation of biological remains. Furthermore, they do not contain suitable lithic raw material for stone tool manufacture, making their channel beds and banks a less desirable resource in the Palaeolithic. In contrast, the calcareous nature of chalk bedrock favours preservation of animal bone, molluscs and ostracods in any overlying Pleistocene sediments. Chalk is also a prolific source of flint raw material, favoured for tool manufacture in the early Palaeolithic. However, chalk's relative toughness means that, although still often present, terrace deposits are generally less extensive and less well-differentiated than on softer Tertiary silts and clays.

However, these are not hard and fast rules! Rich Lower/Middle Palaeolithic sites are known from terrace deposits crossing Tertiary sand/clay, for instance the Sturry terraces and the site of Chislet (Bridgland et al. 1998b, c, d), in the vicinity of Canterbury (cf. Table 8a). And many terrace deposits on chalk bedrock lack Palaeolithic remains - which highlights that, rather than being ubiquitous and uninterpretable low-level background archaeological noise, concentrations of Palaeolithic remains from terrace gravels merit proper attention as ‘sites’ from both academic and curatorial perspectives.

Key areas of deposits in fluvial province 1 are given (Table 8a), along with some key sites; however this table is not exhaustive, and many important outcrops and sites are not included. The main river in this province is the Thames, which flows from west to east along the northern edge of the South-East, passing through London. Bedrock is London Clay for most of this route, although there is a short stretch to the east of London where the river crosses Chalk. In north-west Surrey, a complex and dense array of terrace outcrops represents the confluence area of the main Thames channel with its south-bank tributaries: Blackwater, Wey and Mole. All three tributaries have associated terrace systems, and a substantial terrace body is present in the vicinity of Virginia Water. There are also major spreads just south of Aldershot, representing the previous southward continuation of the Blackwater to link with what is now the upper Wey. These deposits have not, so far as is known, produced numerous Palaeolithic remains, although a few are known (Wessex Archaeology 1993). They have not, however, been subject to systematic investigation, so it is too early to be confident either that terrace deposits in this area generally lack Palaeolithic remains, or that there are not a few rich sites awaiting discovery. There is, however, one exception to this pattern of apparent Palaeolithic absence. In the lower Mole, in the triangle of ground between Cobham, Byfleet and Weybridge, dominated by St George's Hill, there is a relative concentration of handaxe finds, many impeccably provenanced to Pleistocene gravels (Wessex Archaeology 1993).

Table 8a. *Resource summary, deposit group 1b: Lower-level post-Anglian fluvial terrace deposits (Province 1 - N of Weald)*

	Key areas	*Key sites **	*Palaeolithic remains*	*Notes, comments*
Surrey	Thames Valley, Virginia Water and Chobham inlet	-	-	Major outcrops of Boyn Hill and Taplow terraces; needs more systematic investigation
	Blackwater T2-T4 (Aldershot-Camberley)	W&M2-2 - Frimley	One handaxe	-
	Blackwater-Wey interfluve, T2-T3 (Aldershot-Farnham)	W&M5-33, 34 & 35	Handaxes, plus mammoth reported	Rare occurrence of mammalian fauna
	Wey Valley, downstream of Guildford, and south-bank dry tributary valleys towards West Horsley and Ockham	-	-	Numerous terrace outcrops, poorly investigated
	Mole Valley (Dorking-Esher)	W&M7-3	Handaxes found *in situ*	Unmapped terrace deposits with some potential across Chalk between Dorking and Leatherhead?
Kent	Thames Valley south bank, Dartford and Dartford Heath	Pearson's Pit (NWK3-13)	Numerous handaxes	Useful BGS photo archive, also annotated with notes relating types of handaxes to sequence
	Thames Valley south bank, Swanscombe	Barnfield Pit (NWK4-19, 20)	Abundant flint artefacts, including undisturbed horizons; faunal and other palaeo-environmental remains, hominin skull	Seminal British site; whole of Swanscombe and environs potentially underlain by deposits of high importance
	Thames Valley south bank, Greenhithe	Dierden's Pit	Abundant handaxes; rich faunal and palaeo-environmental remains	Different handaxe types than from Barnfield Pit; contradictory data from previous work
	Thames Valley south bank minor tributaries	Ebbsfleet deposits (NWK5-4 and vicinity)	Numerous rich Levalloisian and fossiliferous localities	Big Q: is Ebbsfleet Valley special in its richness, or are there other similar undiscovered localities?

	Key areas	*Key sites **	*Palaeolithic remains*	*Notes, comments*
	Darent Valley, and tributary valleys	Smith's Pit (NWK4-3)	Numerous handaxes	Various patches of Crayford Silt up and down Darent; general record of palaeo-environmental remains and ice age mammals from lower terrace and floodplain deposits
	Longfield east-bank tributary of Darent,	Green Street Green?	Various handaxe finds from "Green Street Green" and quarrying in area, but confusion with another Green Street Green a few miles to the west	Preserved high terrace system north-east of South Darenth particularly worthy of targeted investigation
	Lower Medway and tributaries, downstream of Medway Gap	Cuxton (M4-13)	Very abundant handaxes, undisturbed horizons, scarce faunal remains from restricted outcrop close beneath ground-surface	OSL dating provides surprisingly young (MIS 7) date for handaxe site; confirmed co-occurrence of cleavers and ficrons
	Lower Medway, upper "Higham River"	Whitehouse Farm, TP 9	Levallois core from high-level terrace gravel	Found during Medway Valley Palaeolithic Project
	Lower Medway, lower "Higham River" and Wainscott	Four Elms roundabout (Kent SMR: TQ77SE 162)	Mammoth remains recovered during roadworks	Extensive terrace system from defunct "Higham River"
	Hoo peninsula, central and SE side	Shakespeare Farm Pit (M5-17)	Handaxe finds	Extensive terrace system, but scarce artefactual evidence; offshore buried channels have high potential
	Lower Medway, Gillingham	St Georges Road (M5-11); Twydall (M5-14)	Numerous handaxes and flakes	Possibly a series of terrace outcrops above coastline
	Dry valley systems between Medway and Stour: Spekes Bottom	Stonecross, Luton (M4-30)	Numerous handaxes	Prob. several terrace outcrops buried by, or confused with, colluvial deposits
	Dry valley systems between Medway and Stour: Queen Down Warren, Sittingbourne, Swalecliffe	Swalecliffe (M7-3)	At least two distinct terraces; lower one with rich environmental remains	Fluvial systems prob buried by, or confused with, colluvial deposits; or outcropping offshore and at coastline

	Key areas	*Key sites **	*Palaeolithic remains*	*Notes, comments*
	Great Stour Valley, north bank	Sturry sites (S4-29, 30, 31 and 32)	Numerous handaxes	Extensive terrace staircase, extending north into the Blean
	Great Stour Valley, Wantsum Channel	Wear Farm Pit, Chislet (TR 224650)	Rich molluscan and small vertebrate material, plus a flint flake	May be buried deposits with important remains in Wantsum Channel
	Great Stour-Little Stour interfluve Valley	Fordwich (S4-36)	Numerous crude handaxes	Anglian or pre-Anglian; candidate for earliest occupation of Kent
	Little Stour	Howletts sites (S6-5, 6)	Abundant handaxes from small terrace outcrops	-

* Site identification numbering relates to Southern Rivers Project mapping, volume 2 (Wessex Archaeology 1993)

Thames deposits are also present in north-west Kent - the intervening section of the Thames passing through London, not considered here - where deposits from one particular terrace, the 100-ft, or ‘Boyn Hill’ terrace, alternatively called the ‘Orsett Heath’ Gravel Formation (Bridgland 1994), are preserved on the south side of the Lower Thames between Dartford and Gravesend. The deposits consist of a sequence of predominantly fluviatile loam, sand and gravel units laid down in the post-Anglian interglacial period (the Hoxnian) between c.450,000 and 350,000 BP (Bridgland 1994). They are rich in Lower/Middle Palaeolithic archaeological remains, with numerous locations having produced flint artefacts, faunal remains and biological evidence relating to climate and environment (Wymer 1968; Wessex Archaeology 1993). The best-investigated site is Barnfield Pit, Swanscombe (Smith and Dewey 1913; Swanscombe Committee 1938; Ovey *ed.* 1964; Conway et al. 1996), which produced abundant remains and an early human fossil skull (the Swanscombe skull), making it one of only two sites in England with Early Palaeolithic hominin skeletal evidence - the other being Boxgrove, West Sussex, dating to c. 500,000 BP, and discussed further below. The Swanscombe skull shows some Neanderthal-type features, suggesting physical evolution from Boxgrove Man (*Homo* cf *heidelbergensis*) towards Neanderthals had already begun at the time of deposition of the Swanscombe sequence.

Younger fluvial deposits probably attributable to the Thames are also well-preserved at Crayford, c.10km to the west of Swanscombe, at the confluence of the Thames with its south bank tributaries the Cray and the Darent. The thick sequence here includes alluvial and colluvial brickearth deposits over fluvial gravel, with the main fluvial phase of deposition thought to be associated with the period MIS 8-7, c. 250,000 BP. The deposits here contain rich and undisturbed Levalloisian knapping floors, with associated large mammal bone and other environmental evidence such as molluscs and ostracods (Wessex Archaeology 1999).

Otherwise, fluvial deposits of Province 1 are associated with: (a) existing rivers and their tributary systems in Kent; (b) dry, or almost dry, valleys that previously contained much larger Pleistocene watercourses; and (c) defunct larger-scale Pleistocene channels criss-crossing the modern topography that represent fossils of previous drainage patterns. In the first group are: the Darent valley; the lower Medway; the Great Stour; and the Nailbourne/Little Stour. In the second, are various well-developed valley networks that feed into current drainage, but do not contain significant present-day rivers, for example: the Ebbsfleet; Spekes Bottom; Queen Down Warren; and the 'Higham River', Wainscott (cf. Wenban-Smith et al. 2007a: 34-36). And in the last group are major areas such as: the Hoo peninsula, the Blean; and the stretch between Gillingham and Sittingbourne.

The Cray and the Darent cross chalk all the way to the Thames. Both rivers are associated with intermittent terrace and alluvial deposits along their full course, but few sites are known - apart from at their confluence with the Thames (cf. above). Chalk bedrock continues between the Darent and the Medway, capped in places by Thanet Sand. Before the Medway, there are no substantial rivers but innumerable tiny streams and dry valleys, reflecting a Pleistocene history of general drainage northwards towards the Thames.

One of these small streams, the Ebbsfleet, provides a useful case study of problems with identifying, and assessing the Palaeolithic importance, of Pleistocene fluvial deposits. Firstly, no fluvial deposits are mapped. It is only following initial chance discoveries, following quarrying in the 19th and early 20th centuries, that more detailed investigations have been carried out, leading to identification of extensive fluvial deposits at the site. Secondly, even within the small area covered by the Ebbsfleet Valley, these deposits are patchily preserved and very variable over short distances, with key parts of the deposits covering areas of less than 10m by 10m. Thirdly, even within a single horizon, important remains are patchily distributed, with, for instance, faunal preservation locally affected by the thickness and nature of any overlying deposits. Following more than 100 years of fieldwork (Wenban-Smith 1995), particularly ibetween 1997 and 2004 when major investigations have taken place in advance of High Speed 1 (Wenban-Smith et al. in press for 2019), we now have good understanding of the site as both Britain's most prolific Levalloisian location, and as containing key sequences from different phases of MIS 7 that can provide a template for understanding this climatically complex stage. However, without this history of research, the locale would not stand out from desk-based research as being of such high Palaeolithic potential. It is impractical in a document such as this to review the great number of superficially-equivalent sites across the South-East, but there are many sites of similar aspect and geological character, and a curatorial challenge is to ensure that other 'invisible' sites of potentially equal importance are investigated in advance of development.

The Medway crosses chalk bedrock between Maidstone and Upnor, where it then widens into estuarine marshland overlying London Clay. There are a few isolated Pleistocene gravel outcrops mapped either side of this stretch of the river. One of these, at Cuxton Rectory, has produced one of Britain's richest handaxe sites, dating from very late in the Lower/Middle Palaeolithic c.230,000 BP (Wenban-Smith et al. 2007a). There is also a concentration of terrace deposits in the Wainscott area, north and northeast of Rochester, associated with a now-defunct west bank tributary of the Medway christened the 'Higham River' (ibid. 34–36). These terraces have produced faunal remains and Levalloisian artefacts, and substantial areas mapped as Head in the vicinity probably conceal more extensive fluvial deposits, so this is an area worthy of close curatorial attention from the Palaeolithic point of view. Likewise, the extensive Head deposits either side of the Medway between

Maidstone and Cuxton may conceal substantial stretches of fluvial sediment, as well as the mapped terrace outcrops.

North of Upnor, the Hoo peninsula is covered by a substantial staircase of Pleistocene terrace deposits. Palaeolithic remains are known from some of these terraces, for instance at Shakespeare Farm pit and at Hoo St Werburgh, and deposits rich in a range of zoological remains have been studied at Allhallows (Bates et al*.* 2002). Offshore, the estuarine alluvium between Gillingham and the Isle of Grain appears to be underlain by an extensive complex of Pleistocene channels infilled with deep fluvial sequences rich in a range of zoological remains and dating to the late Middle and Late Pleistocene.

East of the Medway, there is a substantial stretch of land between it and the Great Stour basin, sloping down northward towards the Swale and the Isle of Sheppey. It contains no rivers, but it contains numerous north-trending dry valley systems that may have potential for unmapped fluvial deposits on their flanks, including:

- The Wormshill–Rodmersham valley
- The Wormdale (Stockley) valley
- Spekes Bottom
- Queen Down Warren
- The Mere Court valley
- The Wichling-Newnham-Faversham valley

Pleistocene mapping is confused in this area, with numerous outcrops and spreads of Head brickearth and gravel deposits forming little coherent pattern. Few Palaeolithic sites are recorded, and none from indisputable fluvial deposits. However, this has to be regarded as an area of prime Palaeolithic potential. The Chalk/Thanet Sand junction would have been rich in high-quality flint nodules from the Bullhead Bed for knapping, river channels would have migrated relatively easily and formed well-defined terraces in the softer Thanet Sand, and the generally high level of colluvial sedimentation may have buried sites and terrace outcrops rapidly, preserving them up to the present day.

An extra complication is that there may have been a major east-west river channel running transversely across the northward drainage axis of these minor valleys between Gillingham and Faversham, through Newington and Sittingbourne, and then above the south bank of the Swale. A number of fluvial outcrops are mapped in Gillingham (associated with abundant handaxe finds), and further east at Rainham, where Bloors Place was one of Henry Stopes' richest Palaeolithic sites (cf. Wenban-Smith 2004); further eastward several outcrops of Head brickearth and gravel are mapped along the same axis all the way to Faversham, perhaps reflecting this previous drainage course.

North of the Swale the Isle of Sheppey is geologically structurally analogous to the Hoo peninsula, and thus might be expected to have developed a similar Pleistocene sequence. Likewise, the extensive alluvial marshes associated with the Swale might be expected to overlie deep and complex Pleistocene channel-fill sequences. Further east, the other side of the mouth of the Swale, a number of dry valleys drain north across London Clay intersecting the coast between Whitstable and Herne Bay, filled with Head deposits, but likely also to be associated with unmapped fluvial deposits. One notable locality is Swalecliffe (cf. Green et al. 1998), where Worsfold (1926) found flint artefacts in association with woolly rhino remains in a mollusc-bearing clay, at the (current) mouth of the longest of these dry valleys; additional deposits at a higher level nearby suggest the survival of a terrace system including deposits from the last interglacial and the subsequent Devensian glaciation.

Finally, the Stour basin, incorporating the Great Stour and Little Stour (also known as the Nailbourne) and associated tributary valleys, lies at the eastern end of this fluvial deposit province. The Great Stour crosses chalk bedrock between Godmersham and Canterbury, and a substantial number of associated terrace outcrops are mapped along this stretch. In addition, a number of deposits mapped as Head appear to correspond with defunct drainage systems, particularly northward from Chilham towards Faversham, and eastward from Chilham towards Patrixbourne via Lower Hardres. A few handaxe finds are known from this area, and it seems worthy of more careful investigation for fluvial deposits and associated Palaeolithic remains.

In Canterbury, the Great Stour merges with the Little Stour, and their drainage channels cross the junction from Chalk to Thanet sand. Numerous terrace deposits are mapped here, and very abundant Palaeolithic remains have been recovered from several sites, especially in the vicinity of Sturry (Bridgland et al. 1998b, c; White 1998). Particularly notable is the site of Fordwich, associated with Terrace 3, which suggests an Anglian or pre-Anglian age. The abundant finds from lower terrace deposits (mapped as Terrace 2, but probably incorporating two separate terrace levels) at Sturry reflect intense occupation in the Hoxnian and subsequent periods (MIS 11-8). North of Canterbury, there are various terrace outcrops mapped on the London Clay plateau of the Blean. These have been carefully mapped and studied (Coleman 1952 and 1954) and are thought to represent eastward migration of the Great Stour through the Pleistocene. Little Palaeolithic investigation has taken place, but terrace deposits exposed in the cliff at Reculver have produced substantial quantities of handaxes (collected from the beach below), and the site of Wear Farm Pit at Chislet (Bridgland et al. 1998d) has produced rich molluscan and small vertebrate faunas, as well as a Palaeolithic flake.

Province 2 — Wealden basin

This province covers the area within the Wealden basin. It contains a fluvial network of the upper parts of those rivers that breach the Wealden scarp — to the north: the Wey, the Mole, the Darent, the Medway and the Great Stour; to the south: the Arun, the Adur, the Ouse and the Cuckmere); and their tributaries. A single river (the eastern Rother) and a few minor streams (Tillingham and Brede being the largest) also drain eastward directly into the Channel along the central axis of the Weald. As discussed above, these rivers have undergone a dynamic history of conflict and capture, with the current drainage pattern being merely the culmination of a sequence of changing drainage patterns through the Pleistocene. Pleistocene deposits are quite abundant, but, apart from at Farnham, Palaeolithic remains are generally scarce, particularly in the central Weald, giving added importance to any recovered material (Table 8b).

The Wey crosses into the Weald at East Tisted, Hants, and then progresses north-eastward, entering the South-East at Farnham. Here, there is an extensive and well-mapped sequence of at least five terraces, first properly studied by Bury

(1913), which are associated with abundant Palaeolithic artefactual remains. Downstream from here, terrace outcrops occur all the way through to Guildford, via Elstead and Godalming. Quite abundant terrace outcrops are also associated with the Bramley Wey branch of the river, which heads to Haslemere via Dunsfold (near the watershed with the Arun headwaters), crossing Lower Greensand and Weald Clay; a notable feature here is a well-defined buried ancient channel under the

***Table 8b**. Resource summary, deposit group 1b: Lower-level post-Anglian fluvial terrace deposits (Province 2 - Wealden Basin)*

	Key areas	*Key sites **	*Palaeolithic remains*	*Notes, comments*
Surrey	Wey Valley T2-T4	Farnham (Map W&M5)	Numerous prolific sites, Terraces A-D; plus vertebrate fauna and other palaeo-environmental remains	Rare occurrence of mammalian fauna and other palaeoenvironmental remains (molluscs, plant macro-fossils)
	Wey (Bordon-Guildford)	W&M4-4, 5, 6, 7)	Several findspots of handaxes	Background noise of handaxe find-spots and terrace outcrops
	Bramley Wey (Bramley-Cranleigh)	W&M6-3 (Peasmarsh)	Two handaxes and mammoth remains	Extensive spread of deposits downstream of Godalming
	Tillingbourne	-	-	Well-mapped outcrops of T2
	Arun headwaters	Dunsfold airfield	None known, but no investigations	Various outcrops mapped
	Mole (Gatwick-Reigate-Horley-Dorking)	W&M9-4 (Betchworth)	Two handaxes	Possibly alluvial terrace deposits, or terrace under colluvium
	Eden Brook and Eden	Edenbridge (M1-2)	One handaxe	Extensive terrace spreads
Kent	Darent (Otford-Riverhead; Westerham-Seal)	M1-18 (Brasted gravel pits)	Handaxe	Several terrace outcrops along stretch at foot of scarp
	Medway (Maidstone-Snodland)	Ham Hill (M4-11)	High quality handaxes from T2-T3	Many terrace outcrops in/around Maidstone with high potential
	Medway (Maidstone-Snodland)	New Hythe Lane (M4-10)	Handaxes and Levalloisian from T2	-
	Medway (Maidstone-Snodland)	Aylesford (Silas Wagon's Pit)	Numerous handaxes and faunal remains	Poor provenance of material; probably from different terraces; probably much slumped in from plateau to north-east
	Medway (Maidstone-Snodland)	Clubb's Ballast Pit (M4-32)	*Bout coupé* from T1/floodplain, also ice age fauna such as rhino and mammoth	Probably from towards base of buried channel under modern alluvium

	Key areas	*Key sites* *	*Palaeolithic remains*	*Notes, comments*
	Bourne	Dunks Green, Shipbourne (M2-2, 3, 4, 5)	Several findspots of handaxes	Probably terrace outcrops, although mapped as Head
	Teise/Beult	Marden (M3-4, 5, 6)	Several findspots of handaxes	Well-defined series of outcrops heading north-east from Marden
	Len/Great Stour/East Stour	-	-	Series of outcrops, probably represent previous west-flowing drainage
W Sussex	Mole headwaters	Crawley (SRPP 3: 56)	Four handaxes, well-abraded	Extensive terrace deposits
	Arun, NW headwaters (Chiddingfold, E of Haslemere)	-	-	Extensive outcrops mapped
	Arun, NE headwaters	-	-	Extensive outcrops mapped
	Arun, main valley	Wisborough Green (SXR7-1)	One handaxe, *bout coupé* according Tyldesley (1987: 74)	-
	Western Rother	Selham (SXRB4-2)	Flakes	-
	Arun, Pulborough	SRPP 3, map SXR7	Several handaxe find-spots	Bedrock geology sharply folded, bringing chalk ridge near surface at Pulborough
	Adur headwaters	Henfield (SXR5-1, 2, 3, 4, 5)	Several handaxe finds, plus a large Levallois flake dredged from alluvium in bed of Adur	-
	Ouse headwaters, western	Slaugham (SRPP 3: 56)	Two handaxes, surface finds	-
E Sussex	Upper Medway, headwaters	Hartfield (SRPP 3:55)	Handaxe find	May be from Upper Medway terrace deposits
	Ouse	Isfield (SXR4-1)	Handaxe find	-
	Cuckmere	Alfriston-Arlington	Various finds	None reliably provenanced, but indicative background noise
	Eastern Rother	Iden (SRPP 3: 55)	Handaxe find-spot	Uncertain provenance; possibly eastern Rother terrace deposits

* Site identification numbering relates to Southern Rivers Project mapping, volume 2 (Wessex Archaeology 1993) and volume 3 (Wessex Archaeology 1994)

airfield at Dunsfold, capped by loam, which seems to be a location with high potential for preservation of minimally disturbed remains. Surprisingly, there are no Palaeolithic find spots associated with these latter deposits. There is, however, one handaxe findspot at Headley, Hants (Wessex Archaeology 1994) associated with the patchwork of Pleistocene terrace outcrops in the Wealden headwaters of the Godalming Wey, upstream of Farnham, just inside the Hampshire border, and so just beyond the boundary of the south-east region under consideration here.

Further east, the Mole rises in the vicinity of Crawley, then heads north to Dorking, mostly across Weald Clay bedrock. There are numerous Pleistocene terrace outcrops along this part of the river, especially at Horley. Tributary valleys between Horley and Dorking contain substantial fillings of Head brickearth, which may mask fluvial/alluvial sediments in places. There is just one confirmed record of Palaeolithic remains: four handaxes in the museum at Lewes are recorded as from 'Crawley' (Woodcock 1981: 322; Wessex Archaeology 1994: 56), which is surrounded by gravel spreads of the upper Mole. Grinsell (1929) also records finds from the Crawley area, though these are possibly the same handaxes.

At present, the headwaters of the Darent only just breach the Wealden scarp. However, geological and topographical mapping indicate that the Darent previously drained a much more extensive basin within the Weald. A number of gravel outcrops (mapped as terraces T2 - T4) occur between Otford and Riverhead, and a series of terrace outcrops are also mapped westwards from Riverhead towards Limpsfield along the softer strip of Folkestone Beds. Various outcrops mapped as Head along this stretch may also be of fluvial origin or include fluvial elements. Many handaxes have been found at Limpsfield (in Surrey), where it is uncertain whether they originate from fluvial deposits or from residual/Head deposits. Other material from Westerham and Brasted can, however, probably be more reliably associated with Upper Darent fluvial deposits. A defunct southern arm of the Darent heads south through the Shode Gorge towards Hadlow, from where the Bourne now drains into the Medway basin. Various mapped Head deposits occur along this stretch that may also be fluvial terrace deposits, particularly at Dunks Green, where numerous handaxes have been recovered.

The Medway probably drains a greater part of the Wealden basin than any other river in the present day. Its headwaters occur in the vicinity of East Grinstead, with watersheds with the Mole to the west, and the Ouse to the south. From here it meanders eastward to Ashurst, and from there north-east to Penshurst, where it is joined from the west by the Eden. A number of terrace deposits are mapped between Ashurst and Penshurst. However, these are overshadowed by the numerous, and sometimes substantial, terrace outcrops flanking the Eden westwards to Lingfield. No Palaeolithic finds are known, however, from this superficially enticing array of deposits. Downstream of Tonbridge, and continuing as far as Yalding, there is a striking and widespread accumulation of fluvial brickearth and terrace gravel outcrops, where the Medway is joined by its southern and southeastern tributaries the Teise and the Beult. This part of the landscape has obviously been a low point in the Medway basin through the Pleistocene and has consequently been subject to repeated aggradation events. A few Palaeolithic handaxe sites are known from the northern edge of the brickearth spread, but for the most part this area is barren of finds, despite the 'hot spot' of Dunks Green a short distance to the north; as for all of the apparently barren fluvial deposits within the Wealden basin, it remains to be seen whether the apparent paucity of Palaeolithic remains is genuine, or merely reflects a lack of investigation and the deep burial of archaeologically rich deposits.

Bucking the trend, there are some gravel patches (at Marden) associated with a previous course of the Teise, linking it to the Beult via Marden and Wanshurst Green, which are linked with several handaxe finds. Returning to the trend, the abundant terrace gravel patches associated with the valley of the Beult are almost entirely lacking in Palaeolithic remains, although there is one find spot at Hurst Green, at the confluence with the aforementioned now-defunct link with the Teise, and another further east at Smarden. A less well-developed trail of terrace outcrops is present along the Len Valley, heading up towards the head of the Great Stour, and these probably represent previous drainage eastwards, rather than westwards as in the present; no Palaeolithic remains are known.

As the main channel of the Medway approaches the Medway Gap through Maidstone, there are numerous terrace deposits. The recent *Medway Valley Palaeolithic Project* (Wenban-Smith et al. 2007a) identified terrace gravels at no less than ten separate levels, including the late Devensian gravels underlying the current floodplain, with the highest terrace labelled as Terrace I and the lowest as Terrace A. These terrace deposits have produced numerous Palaeolithic remains, including artefacts and mammalian fossils. Lower/Middle Palaeolithic handaxes seemed to be most abundant in the lower-middle part of the terrace sequence (Terraces D, D/E and E), with fine specimens from sites such as Ham Hill and Aylesford. Sites in Terrace B (the second lowest terrace) have produced fine *bout coupé* handaxes and faunal remains such as woolly rhino and mammoth, highlighting the potential for last glacial remains associated with the British Mousterian.

The most easterly of the northern group of rivers draining the Weald is the Great Stour, with its tributary the East Stour, which drains westward from remarkably near the eastern coastline. The main river rises at Len, runs slightly south of east parallel with the foot of the Wealden scarp slope to Ashford, and then turns north towards Canterbury through the gap in the scarp slope at Godmersham. There are quite numerous terrace outcrops along the Great Stour valley between Harrietsham (the source of the west-draining Len) and Ashford; downstream of Ashford there are then more extensive terrace spreads, often covered by thick brickearth. There are also occasional terrace outcrops up the East Stour valley, and more numerous and substantial outcrops following a parallel course a short distance to the north, between Willesborough and Stanford, especially in the vicinity of Brabourne Lees. This extensive network is, as in so many other places, almost devoid of Palaeolithic remains, with the only recorded finds being some handaxes from Terrace 3 at Ashford.

Moving onto the southern group of rivers, the first of these, starting from the west, is the Arun, whose basin extends into a surprisingly large area of the central and eastern Weald, mostly on Wealden Clay bedrock. Its northeastern headwaters abut the southern edge of the Mole basin, and another arm stretches towards Horsham. There is also a northwestern tributary towards Dunsfold and Haslemere, which has captured a substantial area that previously drained into the Bramley Wey via the buried ancient channel east of Dunsfold airfield. The main river channel then heads south to Pulborough, with western offshoots at: (a) Wisborough, heading towards Kirdford and (b) towards Midhurst, parallel with, and a little to the north of, the foot of the southern scarp slope (the western Rother). Pleistocene terrace outcrops are numerous along the majority of the length of the Arun, and its tributaries described above, mapped at four distinct levels (T1 - T4). Amazingly, there are only two Palaeolithic find spots associated with whole of the extensive network of Arun terrace deposits above Pulborough: one at Selham, along the western Rother (Wessex Archaeology 1994: 75); and another on the main Arun near Wisborough Green (Tyldesley 1987: 74), this latter approaching *bout coupé* form, although not of classic Coygan Cave shape. In contrast, there are a number of findspots in the vicinity of Pulborough, where there are substantial terrace outcrops as the Arun crosses a marked fold in the underlying Solid geology as it approaches the southern edge of the Weald.

Further west, the Adur, like the Arun, has extensive terrace networks within the Weald, mostly crossing Weald Clay, from Steyning/Upper Beeding to Coolham through Henfield, and east towards Burgess Hill. There are several Palaeolithic finds in the Henfield area, but otherwise nothing from the extensive spreads further into the Weald.

The Ouse extends north into the Weald from Lewes, with an inlet south of Lewes at Iford with mapped outcrops of four distinct terraces (T1-T4). It has wide terrace outcrops as it crosses the Weald Clay, and then only occasional terrace patches as it heads up across Tunbridge Wells Sand towards Haywards Heath and Crawley. One handaxe is known from Terrace 2 gravels at Isfield (SXR4-1); and there are also a number of finds from T1-T2 gravels in vicinity of Iford.

The Cuckmere extends upstream into the Weald from Alfriston to Hellingly, with terrace outcrops mapped at two levels (T1-T2) along the main river course, and occasional terrace patches scattered throughout its headwater tributary system. There is a reasonable background noise of Palaeolithic finds in the main stretch of valley between Alfriston and Arlington, which may broadly reflect the potential of the fluvial terrace deposits, although none is specifically provenanced as such.

Finally, there is the group of small rivers and streams (primarily the eastern Rother, Tillingham and Brede) which drain eastward across Wadhurst Clay and Ashdown Beds from the central Weald directly into the Channel, without crossing the southern chalk escarpment. These do not have substantial associated terrace systems, although occasional patches are mapped along the Rother. Two stray handaxe finds are recorded, one at Hawkhurst (in southern Kent) and the other at Iden, on the edge of Romney Marsh (Wessex Archaeology 1994: 55).

A recurring theme in this fluvial deposit province is that there are often extensive terrace gravel spreads along the river valleys and dry tributary systems within the Wealden basin, but Palaeolithic artefacts have only been found in a few places. However, the fact that any have been found at all, for instance at Crawley, Dunks Green and Marden, means that there is no *a priori* reason why other sites should not be present, associated with other fluvial deposits within the Wealden basin. Possibly, it is just a lack of systematic investigation, and a credibility threshold that has yet to be breached, that is obstructing new discoveries in these areas. Considering the lack of flint raw material within the Weald, the ‘story’ of Province 2 is not that finds are scarce, but that any have been found at all. As discussed separately (in the Research Agenda below) the diversity of lithic raw material sources in and around the Weald, particularly the well-defined surrounding ring of chalk/flint, make it an important laboratory for investigating the range of territory exploited at different stages of the Early Palaeolithic. Investigating the Palaeolithic content of Wealden river gravels, especially the raw materials used, has a central role to play in addressing this agenda.

Province 3 — South of Weald

This province covers the lower stretches of a number of rivers that originate within the Weald (Arun, Adur, Ouse and Cuckmere) and one (the Lavant) that rises on the chalk dip slope south of the Weald, draining by a circuitous route towards Selsey through a gap in the chalk ridge of the Portsdown anticline (Table 8c). Starting from the west, the Lavant has no mapped terraces in its upper parts; its lower parts pass through the flat landscape of the coastal plain, where thick brickearth deposits, thought to date mostly from the last glaciation, bury any earlier fluvial deposits, if present. The most notable feature of the Lavant is the large number of buried palaeo-channels that emerge from under this brickearth sheet at the coastline in the vicinity of Selsey, at Bracklesham Bay and around Selsey Bill, outcropping in the intertidal zone under a veneer of modern beach sand. First noted by Reid (1892), and subsequently sketched by Stinton (1985) and studied by a number of workers (West and Sparks 1960; West et al*.* 1984; Parfitt 1998; Bates et al*.* 2009), these channels are rich in biological remains and clearly represent a substantial archive on the Middle Pleistocene landscape and environment in the region. Furthermore, although mostly unpublished (Parfitt 1998; Parfitt et al*.* in prep), the almost complete skeleton of an extinct straight-tusked elephant (*Palaeoloxodon antiquus*) was recovered from one of these channels in the 1960s, in direct association with a small number of mint condition flint artefacts. These channels clearly have high potential for both Palaeolithic archaeological and Quaternary environmental studies; it is also likely that they persist inland, underneath the superficial brickearth of the coastal plain.

The Arun has a number of terrace outcrops over the chalk bedrock between Amberley and Arundel, then it passes through the brickearth landscape of the coastal plain, draining into the Channel at Littlehampton. There are a number of Palaeolithic handaxe finds from Arun gravels along this stretch, as well as the reported skeleton of an elephant or mammoth from T4 at Peppering Farm, found in the 19th century, and reburied ‘under the smaller of the two bushes’ (record in Lewes Museum, in Woodcock 1981: 299), also reported as a pink-flowering hawthorn (Godwin-Austen 1857). A small investigation in December 1993 failed to relocate the skeleton but confirmed the presence of clean fluvial gravels (M.B. Roberts pers. comm).

Table 8c. *Resource summary, deposit group 1b: Lower-level post-Anglian fluvial terrace deposits (Province 3 - S of Weald)*

	Key areas	*Key sites **	*Palaeolithic remains*	*Notes, comments*
W Sussex	Lavant, middle stretches	None known	None known	Probably buried channels in various places, heading south
	"Lavant" channels (Bracklesham-Selsey)	West Street	Rich palaeo-environmental remains	Buried by beach sand in intertidal zone
	"Lavant" channels (Bracklesham-Selsey)	Lifeboat Station	Skeleton of straight-tusked elephant, associated with mint condition artefacts	Artefacts have some Levalloisian affinities; poss. MIS 7 (Parfitt pers. comm.)
	Arun valley	Peppering Farm (SXR 6: 13)	Elephant or mammoth skeleton	Various other handaxe finds along Arun, but none reliably provenanced to terrace deposits
	Adur, lower reaches	-	-	Terrace outcrops mapped; no finds reliably associated
E Sussex	Ouse, lower reaches	Piddinghoe (SXR 4-10); Rodmell (SXR 4-5)	Stray handaxe finds	Terrace outcrops on west bank of Ouse; one Rodmell handaxe marked "gravel pit"
	Cuckmere, lower reaches	Lullington Court	None known	Well-defined terrace outcrop, worthy of investigation

* Site identification numbering relates to Southern Rivers Project mapping, volume 3 (Wessex Archaeology 1994)

There is a short stretch of the Adur south of the Weald, between Bramber and the coast, where the Adur enters the Channel at Shoreham-by-Sea. There are a few patches of terrace gravel (T1) flanking the Adur along this stretch, and a handaxe has been recovered from near one of these patches, at Annington House (map SXR5, find-spot 10), although records of its provenance suggest it may come from an adjacent slopewash deposit rather than the terrace itself. There are no rivers presently flowing between the Adur and the Ouse, although there are numerous dry valleys incised into the Chalk, trending down towards the Channel coast, with two major dry valleys meeting in Brighton. Despite the lack of both current drainage and mapped Pleistocene terrace deposits, these latter two valleys in particular may have supported drainage at some point in the Pleistocene, and there may be small associated outcrops of Pleistocene terrace deposit with Palaeolithic potential.

In East Sussex, the Ouse crosses a chalk ridge at Lewes, before exiting the Weald basin at Southease, from where it runs for only c.6km across chalk bedrock before entering the Channel at Newhaven. There is one gravel patch (mapped as T2) on its west flank at Piddinghoe, and another patch, this time mapped as Head, again on its west flank, at Newhaven. No finds are known from the Piddinghoe patch, but a handaxe has been found at the Newhaven patch (map SXR4, find-spot 10). Finally, the Cuckmere crosses a very short stretch of chalk bedrock between Alfriston and the coast, entering the Channel at Cuckmere Haven. There are a number of mapped terrace gravel outcrops along this stretch, particularly just downstream of Alfriston, from where a number of handaxes are recorded, although lacking specific provenance details of location and context.

Overall, the fluvial Pleistocene resource in the south-of-Weald province comprises: (a) intermittent terrace outcrops mapped at various levels above current river channels where they cross Chalk bedrock on their southward coastal journey, with the greatest vertical range (T1-T4) recorded in the Arun Valley; and (b) sunken channels outcropping at the coastline just below the present-day beach sands in the vicinity of Selsey. These latter sunken channel deposits are likely to extend both further offshore, and also back inland under the brickearth deposits of the coastal plain. There is not an extensive Palaeolithic record associated with these deposits, but a number of find spots are known, including handaxe findspots, the recovery of an elephant (or mammoth) skeleton at Peppering and recovery of rich biological remains from the Selsey channel complex, including an elephant skeleton with associated (and probably undisturbed *in situ*) artefactual remains from the channel just to the south of the Lifeboat Station at the east side of Selsey Bill.

Residual surface deposits (including Clay-with-flints)

Residual deposits can be found capping high ground where there has been little Pleistocene deposition, but the surface has been subject to exposure throughout the Pleistocene, leading to the development of sediments. The best-known residual deposits are the Clay-with-flints material that mantles the chalk uplands in various parts of southern England, both north and south of the Thames. Certain spreads of material mapped as Head, capping the dissected plateaux of the Hythe Beds and Folkestone Beds in central Kent are probably also of residual origin. Clay-with-flints is defined by the British Geological Survey as a residual deposit formed from the weathering (dissolution, decalcification and cryoturbation) of chalk bedrock, incorporating sand/gravel from remnants of Palaeogene superficial deposits. It typically manifests on plateuax within chalk downland as a densely-packed layer of fresh flint nodules in a heavy reddish-brown clayey matrix up to 3m thick, sometimes overlain by sandy or gravelly patches. Hollows and depressions (often caused by solution of the underlying chalk bedrock) are also likely to occur in the surface of areas mapped as Clay-with-flints, infilled with aeolian and.or colluvial brickearth.

The Clay-with-flints has long been known to contain Early Palaeolithic artefacts. The Scottish geologist James Geikie wrote to Worthington Smith in 1881, urging him to search for implements, not just on lower river terraces, but ‘in such deposits and at such elevations as will cause the hairs of cautious archaeologists to rise on end’ (Harrison 1928: 91). Smith passed the letter on to the Kent collector Benjamin Harrison and both men started to search the tops of the Chilterns and North Downs respectively. Harrison’s first flint find was made in November 1885 (Harrison 1928:

113), and the deposits have continued to produce artefacts in subsequent research (Dewey 1924; Willis 1947), abundantly in some locations (Halliwell and Parfitt 1993; Scott-Jackson 2000). Brickearth-filled depressions in the Clay-with-flints surface may, in principle, be an important source of high-integrity Palaeolithic remains, including the possibility in larger dolines of stratified series of remains such as at the Caddington brickpits in the Chilterns (Smith 1894). However, no good sites of this nature have yet been found, the only known sites such as at Wood Hill, Kingsdown (Scott-Jackson 2000) being relatively shallow depressions without clear internal stratigraphy.

Appreciation of the Palaeolithic potential of Clay-with-flints has perhaps been coloured by the fact that they provided the main source of so-called ‘Eoliths’, naturally-abraded flint pieces interpreted by Harrison (and others) as artefacts in the late 19th century, although roundly rejected as of human origin by subsequent academic authorities (O'Connor 2003). The stigma attached to the deposits as a source of eoliths has perhaps subsequently obscured the presence of numerous genuine artefacts from Clay-with-flints. Nonetheless, interpretation of the real artefacts that have been found is problematic due to the difficulty of understanding and interpreting their provenance and stratigraphic context (see Wenban-Smith 2001). Any artefacts within residual deposits may have been reworked within the sediment by repeated freezing and thawing but would not have been subject to down-slope movement or fluvial transport. Accordingly any archaeological evidence found in (or on) residual deposits such as Clay-with-flints, which often caps chalk high ground in Kent and Sussex, has probably been deposited close to where it was found. There is rarely, however, any well-stratified material, and Neolithic, Mesolithic and Palaeolithic finds can all be contained within the same horizon. Thus, although the possibility of finding a larger infilled depression with stratified and high-integrity Lower/Middle Palaeolithic remains should not be ignored, the archaeological material from residual deposits and Clay-with-flints typically comes from a palimpsest representing perhaps 700,000 years of intermittent occupation. This is not to disregard or belittle the value of such a palimpsest, whose spatial integrity over such a long period could open interesting avenues of research, but its nature needs to be recognised and understood as a prerequisite for such research.

Particularly well-developed spreads occur along the northern side of the Weald, from Guildford to Biggin Hill (including the Netley Beds on the North Downs east of Guildford), and then all the way from Knockholt in west Kent to Dover on the east Kent coast, although further east the Clay-with-flints becomes less definable as a distinct deposit, and more intermingled with undifferentiated Head and brickearth deposits. Residual deposits have also developed within the Weald on the higher level outcrops of hard chert and sandstone beds within the Lower Greensand in Kent, particularly the Folkestone Beds south-west of Ightham, and extensive spreads on Hythe Beds south and west of Maidstone.

To the south of the Weald, there are small patches of Clay-with-flints along the relatively narrow chalk strip of the South Downs between Littlehampton and Shoreham (in West Sussex), and then between Shoreham and Eastbourne, including Beachy Head (in East Sussex). There are, however, no spreads of residual deposits mapped within the southern Weald; this may reflect a vagary of differential geological mapping, or it may reflect a real difference in the distribution of residual deposits within the Weald.

Sites are patchily distributed, with apparent concentrations of individual find-spots in some areas, and some locations with abundant remains. However, the distribution of sites probably reflects those areas where fieldwork, usually amateur collecting, has been focused. The only Palaeolithic remains found are flint artefacts. reflecting that (a) any remains found would typically be exposed for substantial periods of time rather than rapidly buried, and (b) these acid deposits do not facilitate survival of any associated fauna or other biological remains. Artefacts have mainly been collected as a result of fieldwalking (often after deep-ploughing to break up the sub-soil), or following operations that have impacted sub-soil deposits, such as horticulture, or digging of trenches for services. Recovery by archaeological excavation has been less common, although several research excavations have been carried out at some of the more prolific find-spots in recent years, examples being Rookery Farm (Harp 2005) and Wood Hill (Halliwell and Parfitt 1993; Scott-Jackson 2000).

The main areas with concentrations of sites associated with Clay-with-flints (Table 9a) are:

- On the North Downs in Surrey, in the vicinity of Walton Heath, where the site of Rookery Farm, Lower Kingswood is particularly rich, having produced around 600 lithic artefacts, including over 70 handaxes (Carpenter 1960; Walls and Cotton 1980; Pemberton 1971; Cotton 1985; Harp 2002, 2005) - a further dozen sites within a 5km radius of Rookery Farm have produced less material including Canons Farm and Banstead (Carpenter 1956, 1957, 1963; Walls and Cotton 1980; Harp 1999a, 1999b, 1999c, 2000 and 2002).

- On the North Downs in west Kent, on the Clay-with-flints plateau east of the Darent; the concentration of findspots here probably unduly reflect the collecting activities of Benjamin Harrison, which were heavily focused upon this area, and consequently include a number of non-artefactual ‘Eolith’ findspots. Many findspots do, however, represent genuine artefacts such as handaxes.

- On the North Downs in east Kent, where a group of over 20 sites within a 10km radius in the Dover hinterland has been investigated by Geoff Halliwell and Keith Parfitt, the main sites being Whitfield, Wood Hill, Westcliffe and Eythorne (Halliwell and Parfitt 1993; Wessex Archaeology 1993; Scott-Jackson 2000, 67–171; Parfitt and Halliwell 2002).

- On the South Downs in East Sussex, between Seaford and Eastbourne, in the vicinity of Beachy Head, the main sites being Snap Hill and Folkington Hill (Todd 1934, 1935; Wessex Archaeology 1994; Scott-Jackson 2000: 50–53).

Table 9a. *Resource summary, deposit group 2: Residual surface deposits (Clay-with-flints)*

	Key areas	*Key sites **	*Palaeolithic remains*	*Notes, comments*
Surrey	Walton Heath	Pintmere Pond (W&M9-19)	Handaxes, cleaver, flakes and hammerstone	Need to clarify distribution, concentration, context and integrity

	Lower Kingswood	Rookery Farm (W&M9-11);	More than 70 handaxes, numerous flakes, cores and hammerstones	Need to clarify distribution, concentration, context and integrity
Kent	North Downs, plateau W of the Darent	West Kingsdown (NWK 2-8); Ash Church (NWK 2-51), Wrotham Hill (NWK 2-4, 5); West Yoke (NWK 2-53)	Surface finds of handaxes	Recent monitoring of the Farningham-Hadlow gas pipeline did not reveal any concentrations in the Clay-with-flints
	East Kent, Elham	Standardhill Farm, Dreals Farm (S 3-4);	Several handaxes, including two of *bout coupé* form	Precise locations of material uncertain, needs fieldwalking survey
	East Kent, vicinity of Dover	Whitfield (S 5-8, 9)	Several handaxes and flake concentration	-
W Sussex	South Downs (N of Littlehampton; NW of Shoreham)	-	-	Residual outcrops small and scarce; and no major sites known
E Sussex	Seaford-Eastbourne	Snap Hill (SXR 3-18);	Numerous handaxes and one Levallois core from general vicinity	Exact finds-pots uncertain
	Seaford-Eastbourne	Folkington Hill (SXR 3-16)	Four handaxes, core and a few flakes	Possibly recovered from within sediments, rather than surface finds

* Site identification numbering relates to Southern Rivers Project mapping, volume 2 (Wessex Archaeology 1993) and volume 3 (Wessex Archaeology 1994)

The main areas with concentrations of sites associated with residual deposits other than Clay-with-flints (Table 9b) are:

- On Limpsfield Chart in Surrey; it is hard to distinguish here between residual and Head deposits, and both are probably present. Particularly rich sites are Limpsfield Common Pit (SRPP 2, M 1-5), Tenchleys (SRPP 2, M 1-8) and Lombarden (SRPP 2, M 1-9).

- A short distance south into the Weald on the Folkestone Beds plateau west of Ightham; as for Limpsfield, it is hard to distinguish here between residual and Head deposits, and both are probably present. The abundance of finds is also heavily influenced by the prolific activity of Benjamin Harrison; several findspots may be of non-artefactual ‘eoliths’, although many are known to be *bona fide* handaxes. Nonetheless, the location should be recognised as of potential importance.

***Table 9b**. Resource summary, deposit group 2: Residual surface deposits (other than Clay-with-flints)*

	Key areas	*Key sites **	*Palaeolithic remains*	*Notes, comments*
Surrey	Limpsfield	Limpsfield Chart sites (M1-8, 9, 10, 11)	Very numerous handaxes	Need to clarify whether Head or Residual context; plus distribution, integrity
Kent	Ightham Common	Seal Chart (NWK 6-4, 5, 6);	Several handaxes	Need to clarify whether Head or Residual context; plus distribution, integrity

* Site identification numbering relates to Southern Rivers Project mapping, volume 2 (Wessex Archaeology 1993) and volume 3 (Wessex Archaeology 1994)

It is, however, questionable whether these apparent areas of higher artefact concentration reflect anything more than more intensive collector activity. There seems very little geological or topographical difference between areas where numerous finds have been made, and other areas where none is known. This is perhaps an important question to address through more systematic field survey work. Particular problems which need to be remembered, however, when considering the Clay-with-flints, and the wider residual resource are: (a) that, although any Palaeolithic artefacts are unlikely to have moved far since their original discard, they are not typically found in a sealed context, and so generally lack chronological control, beyond what can be deduced from typology or knapping technology; and (b) that, for artefacts such as waste debitage that are not distinctly attributable to a particular period, there is a problem in distinguishing those of Palaeolithic age from those of later prehistoric periods. Some workers have argued that the degree of staining and patination on Palaeolithic artefacts allows them to be distinguished from later artefacts. This remains to be substantiated, however, and the heavy staining and patination on large numbers of recognizable later prehistoric artefacts in collections such as the Stopes collection, in the National Museum of Wales, much of which was recovered from the Clay-with-flints of north Kent, suggest this is not the case, and that staining/patination cannot be relied upon as a guide to age.

Finally, as pointed out at the start of this sub-section (para 2), it remains a theoretical possibility - as initially argued by Scott-Jackson (2000) and since also by Pope et al, (2016) - that Clay-with-flints plateaux may contain large pockets infilled with colluvial/aeolian sediments containing high-integrity Lower/Middle Palaeolithic remains. However, no sites of this nature have yet been found in the region. This is not due to lack of investigation, since numerous investigations and watching briefs have been carried out in Clay-with-flints areas, such as the extensive monitoring for the Farningham-Hadlow gas pipeline (Wenban-Smith 2010). If present, sites of this nature do not, therefore, seem to be common.

Coombe/Head deposits (colluvial/solifluction)

Mass slope-movement Coombe/Head deposits have formed by a range of processes, for example rapid, high-energy landslip-events that incorporate rocks and pebbles of all sizes alongside finer-grained sands and silts, or gradual, low-energy events where fine grained sediments creep slowly down a slope. Consequently the Palaeolithic remains they contain have varied depositional histories and interpretative potential. In general, colluvial and solifluction deposits occur at the base of slopes, on valley-sides, in dry valleys and in hollows in the landscape; anywhere, in fact, where sediment destabilised by severe climatic conditions and/or de-vegetation has slipped downslope and accumulated. Despite their sometimes coarse nature, many colluvial/solifluction deposits have slipped only a short distance, leading to the relatively gentle burial of archaeological material. The site of Red Barns, eastern Hampshire, just outside the South-East but with a similar sequence of deposits to many situations within the region, provides an instructive example of where a deep sequence of fine-grained colluvial deposits on the south-facing chalk dipslope of the South Downs has buried a rich horizon of Lower/Middle Palaeolithic knapping debris with minimal disturbance (Wenban-Smith et al. 2000). Other colluvial deposits may have moved a longer distance and may also include derived material from significantly older deposits, for instance when a landslip cascades down a dry valley tributary across a series of terrace deposits of different ages.

Colluvial deposits abound across the South-East and are particularly associated with the chalk downland surrounding the Weald. Many outcrops are too minor to be represented in geological mapping, but these unmapped deposits also have great potential for important remains in the same way as mapped outcrops, for instance as at the Dartford M25 Junction 2 Neanderthal site (Wenban-Smith et al. 2010), where a build-up of colluvial sediment over a natural depression (or incipent doline) on the south side of a dry valley buried an undisturbed land-surface with mint condition artefacts dating to the period MIS 5d-5b (c. 110,000-85,000 BP).

The colluvium overlying river terraces often contains artefacts and the rich Palaeolithic remains from doline infills on the Chalk of southern Bedfordshire, made famous by Worthington G. Smith (1894 & 1916), are also preserved in sediment thought to represent colluvial reworking of loess). Similarly well-developed and deeply-infilled doline features may occur across the widespread chalk downland of the South-East, infilled with aeolian and.or colluvial deposits, and, if present, these may be an important source of high-integrity Palaeolithic remains, However no major dolines have been found with any associated Palaeolithic remains, although Palaeolithic material has been found related to minor features in the chalk downs between Dover and Deal (Halliwell & Parfitt, 1993 & 1996; Bailiff et al. 2013), and in a colluvially-buried depression in the chalk bedrock at Frindsbury near Rochester (Cook & Killick 1924). Likewise, dolines or depressions infilled with aeolian and/or colluvial sediment may be present in the Clay-with-flints landscape capping the chalk uplands surrounding the Wealden basin (cf. Scott-Jackson 2000). These latter are considered above as part of the residual Clay-with-flints deposit group.

Reflecting the diversity of British Geological Survey mapping, this broad group of deposits is divided into three different sub-groups (cf. Table 6, deposit groups 3a, 3b and 3c). Group 3b corresponds with deposits mapped merely as ‘Coombe/Head’. This ubiquitous deposit category is widespread across the south-east region, and embraces a broad range of sediment types, usually mixed within a single deposit body, and occurs in a variety of situations: filling dry valleys and landscape depressions; flanking tributary valleys; and capping high ground. As discussed further below, many of the mapped outcrops of these deposits may in fact reflect, or mask, fluvial terrace remnants; this needs to be taken account when making curatorial decisions on Palaeolithic potential and the possible need for evaluation in advance of any development.

Deposit group 3b corresponds with deposits mapped as 'Head Gravel' (cf. Table 6). These deposits are relatively scarce across the region, and usually represent coarse high energy solifluction, and so any Palaeolithic remains within are likely to be highly disturbed. However, as for group 3a Head deposits, certain mapped bodies (particularly in the Sittingbourne/Swale area of northern Kent), almost certainly represent fluvial terrace remnants, and this needs to be taken account of in curatorial decision-making.

Finally, certain fine-grained deposit bodies are either mapped as 'Head Brickearth' or 'Brickearth', or in some instances have been allocated a specific name, such as: Langley Silt, Crayford Silt and Dartford Silt. These deposits are grouped together as deposit group 3c (see Table 6). They are probably mostly of colluvial and/or aeolian origin but are also liable to include (or overlie) fine-grained alluvial beds, with consequent implications for curatorial assessment of their Palaeolithic potential.

General Coombe/Head deposits

In principle, mapped 'Head' or 'Coombe deposits' are formed by colluvial slopewash and mass movement, generally occurring as sheets on shallow slopes, filling depressions in the landscape and along the central axis of dry valleys. In practice, mapped outcrops may represent deposits of other types such as fluvial/alluvial or loessic, either misidentified, or overlain by a thin colluvial veneer. Many mapped outcrops of Coombe deposits have already been discussed above for their potential as being associated with underlying fluvial sediments. Often, the same sequence will contain coarser, more greatly disturbed horizons, interspersed with (or overlain by) finer-grained horizons representing gentle deposition. Thus this deposit type may contain the full range from almost undisturbed Palaeolithic remains to heavily disturbed and transported material.

This sub-section focuses on deposits specifically mapped as 'Coombe Head deposits', which are often interspersed with, and hard to distinguish from, areas of residual deposits and other types of Head deposits. Coarse Head deposits, mapped as 'Head Gravel' are considered separately below; likewise particularly fine deposits mapped as 'Head Brickearth' or named as specific silt bodies, and 'Plateau Brickearth' thought to be of primarily loessic origin. Apart from Head Gravel, which is more likely to contain more disturbed remains, all these other categories are liable to contain Palaeolithic remains with similar, and varied, depositional possibilities. All are also of fundamentally similar nature and distinguishing one type from another is problematic. We rely here on current BGS mapping, and all that can be done from a curatorial perspective is to judge the Palaeolithic potential of specific sites on a case-by-case basis, considering the specific local topography, condition of any known artefactual material, and the presumed mode of deposition.

Coombe/Head deposits are widespread across the South-East (Table 6), and in some places contain, or conceal other deposits containing, significant Palaeolithic remains (Table 10). In Surrey, they fill numerous dry valleys and depressions across the North Downs, at the foot of the Wealden scarp, and within the Wealden basin. Extensive patches and spreads are associated with valleys and dry tributary valleys of the Mole, Wey, the Eden and the upper Darent and uppermost Arun, particularly in the headwater areas where these rivers are currently minor but would in the past have been much more substantial, leaving dry valley systems that are now infilled with Coombe/Head deposits. A particular concentration of findspots occurs around Limpsfield, where Coombe/Head deposits are interspersed with residual deposits. Otherwise this set of deposits has produced very little material in Surrey, although it has not been sufficiently investigated to either define its age (or ages) or its archaeological content. It may be that much is of Holocene origin, masking older deposits and Palaeolithic remains.

***Table 10**. Resource summary, deposit group 3a: Coombe/Head deposits (colluvial)*

	Key areas	*Key sites **	*Palaeolithic remains*	*Notes, comments*
Surrey	North Downs, dry valleys	-	-	Probably contain headwater remnants of rivers such as Beverly Brook, Wandle and Cray
	Weald (Lower Greensand)	-	-	Uncertain age, unknown quantity
	Weald (Weald Clay)	-	-	Uncertain age, unknown quantity
	Wey (Godalming Wey, Bramley Wey and Tillingbourne)	Farley Heath (W&M 8-1)	Single handaxe	Surface find
	Arun headwaters (Haslemere-Chiddingsfold-Dunsfold)	-	-	Uncertain age, unknown quantity
	Eden headwaters (Edenbridge-Limpsfield, Hollybush Corner-Oxted))	Limpsfield sites (M 1-6, 12)	Numerous handaxes found	Hard to distinguish between Residual and Head deposits
Kent	North Downs dip slope	Ebbsfleet Valley	Baker's Hole Levallois site; buried fluvial sediments	Levallois material from chalk solifluction (Coombe Rock), but includes refitting material; extensive and fossiliferous fluvial sediments under thick sheets of Head
		Frindsbury	Refitting scatters	Proto-Levalloisian, according to some, but very proto
	Darent Valley	-	-	No major sites known, but many spreads of mapped "Head", some with potential to conceal fluvial deposits, especially near Longfield

	Sittingbourne	Bapchild, west pit (S 1-2)	Levalloisian material	Although geological mapping shows Head Brickearth, the material comes from underlying Coombe Rock
	Spekes Bottom	Stonecross, Luton (M4-30)	Flake industry from overlying brickearth, and numerous handaxes from underlying gravel	Prob. several terrace outcrops buried by colluvial deposits; also reports of Pleistocene fauna (Turner 1928).
	Dry valley systems between Medway and Stour: Queen Down Warren, Sittingbourne, Swalecliffe	Swalecliffe (M7-3)	At least two distinct terraces; lower one with rich environmental remains	Fluvial systems probably buried by, or confused with, colluvial deposits; or outcropping offshore and at coastline
	Medway Gap	None known	-	Extensive spreads both sides of Medway, probably conceal fluvial deposits
	Stour Valley	None known	-	Spreads both flanks and in dry valley tributaries where crosses from Weald to North Downs, probably conceal fluvial deposits
	Bourne	Dunks Green, Shipbourne (M2-2, 3, 4, 5)	Several findspots of handaxes	Probably terrace outcrops, although mapped as Head
	Sevenoaks-Ightham	Oldbury deposits; various sites map NWK 6, including vicinity of Seal and Seal Chart	Scatter excavated by Harrison on slopes at Oldbury; stray surface finds gen. vicinity	Coombe deposits deriving from residual spreads
W Sussex	Weald: Upper Arun basin and western Rother;	-	-	No finds known
	Central Weald, Hastings Beds (watershed plateau between upper Mole, Medway, Ouse, Adur and Arun)	One find from Slaugham, near patch of Head, although possibly Residual (SRPP 3: 56)	Handaxe	-
	Southern Weald: on Weald Clay, Adur basin, and foot of Wealden scarp slope	Hassocks, Keymer (SXR 5-14, 15, 16)	Concentration of handaxe finds	Quite numerous findspots listed in SRPP vol 3, maps SXR 5, 6 and 7.

	Key areas	*Key sites **	*Palaeolithic remains*	*Notes, comments*
	Billingshurst-Chiltington-Pulborough triangle	Woods Hill House (SXR 7-11); Beedings (SXR 7-12)	Two handaxe finds, the Woods Hill one a fine *bout coupé* (SXR 7-11)	Both sites north edge of Hythe Beds
	South Downs dip slope, spreads between Littlehampton and Brighton	Dukes Croft (SXR 5-13); Broadwater, Worthing (SXR 6- 6, 7)	Handaxe finds	Coombe deposits grade south into spreads of brickearth
E Sussex	Wealden scarp slope	Alciston (SXR 3-5); Ditchling (SXR 4-12); Warningore Farm (SXR 4-13)	Stray handaxe finds	-
	Cuckmere valley	Parkwood Farm, Arlington (SXR 3-1);	Single handaxe, found in ploughed field	Near Cuckmere, possibly relates to fluvial terrace
	Ouse Valley	Northease Farm (SXR 4-4); Southease (SXR 4-6)	Stray handaxe finds	Near mapped terrace outcrops, possibly derived from fluvial deposits
	South Downs chalk dip slope	Ratton (SXR 3-26); Eastbourne (SXR 3-29); Peacehaven (SXR 4-7, 8, 9); Loose Bottom (SXR 4-14); Goldstone waterworks (SXR 5-20);	Stray handaxe find spots	Concentrations at: (a) Peacehaven, where no Pleistocene deposits are mapped, but probably from unmapped Coombe deposits; and (b) Eastbourne vicinity, although none accurately located

* Site identification numbering relates to Southern Rivers Project mapping, volume 2 (Wessex Archaeology 1993) and volume 3 (Wessex Archaeology 1994)

In Kent, there are extensive spreads overlying the northern chalk dip slope, filling northward-trending dry valleys, along the whole coast from Dartford to Isle of Thanet. As discussed above, many of these Coombe deposits may be, or may mask, buried fluvial systems, particularly in the Darent basin, and between Gillingham and Canterbury. The Ebbsfleet Valley is notable for the extensive (and archaeologically rich) fluvial sediments buried beneath the mapped Coombe deposits, and also contains the classic Levalloisian site of Baker's Hole, where a dense concentration of lithic material has been caught up with chalk-rich Coombe deposits (Wenban-Smith 1995; Scott 2011, Chapter 4). Despite the contorted and coarse nature of these deposits, much of the lithic material is in fresh condition and includes some refitting material (Wenban-Smith 1996, Chapter 9), so it cannot have been severely disturbed. Other significant sites from Coombe/Head deposits include

Bapchild, near Sittingbourne (Dines 1929), and Frindsbury, near Rochester (Cook and Killick 1924). The latter site exemplifies the recurring problem in characterisation/assessment of the Palaeolithic resource, in that it occurs within an area mapped as a fluvial terrace deposit, rather than Coombe/Head deposits, although it is within this latter overlying deposit that the main Palaeolithic remains were found. Numerous Coombe deposits also occur over Hythe Beds in the vicinity of Ightham and Sevenoaks; these probably include a major element of residual deposits but interspersed with networks of Coombe deposits; Benjamin Harrison recovered much material from this area, including important last glacial British Mousterian evidence from slopewash sediments beneath the Oldbury 'Rockshelter' (Cook and Jacobi 1998). Extensive spreads of Coombe deposits flank the Medway below Maidstone, confirmed on the west bank as burying fluvial terraces in places (Wenban-Smith et al. 2007a), and the sides of the Stour as it passes north from the Weald. Outcrops of mapped Head near Dunks Green above the Bourne tributary of the upper Medway system have produced numerous handaxes, although it is uncertain whether these are genuinely Head deposits, or perhaps fluvial or residual in origin. There are also numerous minor spreads within the Weald associated with the landscape of the Hastings Beds and Weald Clay. No Palaeolithic remains are yet recorded from these latter areas.

In West Sussex, there are likewise numerous spreads of Coombe deposits associated with the soft rock of the Wealden basin, interspersed with terrace deposits of the Arun and Adur systems, and at the foot of the Wealden scarp slope. Some finds are known (Wessex Archaeology 1994), including a handaxe from Slaugham (ibid. p.p.56), some handaxe finds from Hassocks, Keymer (ibid. p.p.51) and some *bout coupé* handaxes from the Billingshurst-Chiltington-Pulborough triangle (ibid. p.p.54-55). There are also large spreads at the foot of the South Downs, especially between Littlehampton and Brighton, grading into the brickearth and aeolian silt of the Chichester Plain, and filling dry valleys down the southern chalk dip slope. These deposits have few associated finds, and those that are known may well have been derived from deposits such as the Goodwood-Slindon raised beach.

In East Sussex, there are occasional Head patches and dry valley fills in the central Weald, especially associated with the upper basins of the main Wealden rivers, and the Brede and Tillingham, but no Palaeolithic finds are known. In the southern Weald, there are numerous small patches and some substantial spreads: (a) associated with the tributary systems of the Ouse and Cuckmere; and (b) at the foot of the north-facing scarp slope. These deposits have produced some handaxes, mostly from the scarp slope deposits, but no major sites. The southern dip slope of the South Downs contains extensive networks of dry valleys filled with Coombe deposits, and these have produced moderately common stray handaxe finds, but no concentrations, and no locations are known where there are any indications that less disturbed material is present.

Head Gravel

Some Head deposits are sufficiently gravel-rich to be separately mapped as Head Gravel. This is not a common deposit type, but outcrops are present in all four counties of the South-East (Table 11). In Surrey, there is a notable area of linear stretches of Head Gravel south of Farnham, parallel with mapped terrace deposits (British Geological Survey 2001). These are certainly mostly, if not all, fluvial terrace deposits, and one stretch, which has produced numerous prolific handaxe find spots from quarried exposures, has even been designated as 'Terrace A' since the early 20th century (Bury 1913); it is puzzling why current geological mapping, revised in the 21st century, has designated these stretches as Head Gravel, despite having been recognised as fluvial terrace deposits in previous editions. Further north, numerous north-trending Head Gravel channels dissect the London Clay east and west of Guildford, filling dry valleys extending from the chalk dip slope of the North Downs towards the Wey. These deposits are probably mostly correctly interpreted as of colluvial/solifluction origin, although fluvial deposits may also be present in places. No Palaeolithic finds are known, however.

***Table 11**. Resource summary, deposit group 3b: Head/solifluction gravel*

	Key areas	*Key sites*	*Palaeolithic remains*	*Notes, comments*
Surrey	Farnham	Numerous quarry pits in Terrace A, esp. Ward's Pit (W&M 5-10); Stoneyfields Pit in Terrace B (W&M 5-13); Boundstone Pit and Goldhill Grove (W&M 5-14, 15) to south of Bourne	Abundant handaxes in Terrace A sites; also in stretch of deposit south of Bourne. Broken handaxes reported as refitting from Boundstone Pit	Various parallel stretches and outcrops; worth investigating for Pal remains in mapped outcrops not known to be prolific; possibly little-disturbed remains at Boundstone Pit
	North of North Downs dip slope, crossing London Clay to Wey valley	-	-	No sites known; deposits may be fluvial in places
Kent	Darent, east bank between South Darenth and Grubb Street	-	-	No sites known; deposits may be fluvial in places
	Higham, NW of Rochester	-	H. Stopes recovered several fine ovate handaxes from an unknown site at Higham (Wenban-Smith 2004)	Various gravel patches, prob. terraces of "Higham River" (cf. Wenban-Smith *et al.* 2007).
	Rainham-Sittingbourne	Rhode House (M 6-7)	Single handaxe	Just one site from near Head Gravel patch, although various findspots in gen area; deposits may be fluvial in places

W Sussex	Base of South Downs dip slope, between Emsworth and Arundel	Boxgrove (SXRB 1-7); Lavant (SXRB 2-1, 2, 3, 4, 7).	Abundant handaxes and debitage, mostly derived and transported; some mint and refitting material from Boxgrove	Concentrations of material at Boxgrove and Lavant; possibility of undisturbed remains *within* gravel
E Sussex	-	-	-	No Head Gravel mapped

* Site identification numbering relates to Southern Rivers Project mapping, volume 2 (Wessex Archaeology 1993) and volume 3 (Wessex Archaeology 1994)

In Kent, there are various outcrops on the North Downs dip slope and across the abutting Tertiary deposits as they dip into the Thames Estuary. One particularly suggestive stretch occurs on the east bank of the Darent between South Darenth and Grubb Street. Another area particularly rich in Head Gravel outcrops is between Rainham and Sittingbourne, where it is likely that many of the mapped outcrops relate to Pleistocene fluvial drainage north into the Swale (e.g. in the Ham Green, Upchurch and Bobbing areas). There is just one handaxe find-spot from near a mapped Head Gravel patch, at Rhode House (SRPP 2, M 6-7) although there are various findspots in the general area, which contains a complex mix of Head Gravel and Head Brickearth deposits.

In West Sussex, the only significant outcrop of Head Gravel is a major sheet at the foot of the South Downs dip slope extending between Emsworth and Arundel. This deposit, which is over 5m thick in places, not only buries raised beach and other marine littoral deposits containing important remains, but also contains concentrations of early Palaeolithic material in its own right. At Amey's Eartham Pit, Boxgrove (SRPP 3, SXRB 1-7), as well as numerous well-abraded and transported handaxe specimens from the main Head Gravel body, mint condition handaxes have been recovered from fine sand/silt seams within the gravel; and a refitting scatter from manufacture of a single handaxe has been recovered from one sub-horizontal horizon within the gravel. The majority of the material is probably reworked from lost landsurfaces on the South Downs contemporary with the main (but stratigraphically lower) Boxgrove unit 4c occupation. Interpretation of the mint material and refitting scatter is more problematic: the former may represent later occupation contemporary with formation of the Head Gravel; the latter probably represents remains of older occupation, rafted as a frozen mass downslope. Another concentration of material in this Head Gravel sheet occurs in the vicinity of Lavant, although here it is likely that most material is derived from the Goodwood-Slindon raised beach itself. There are also a few gravel-filled channels filling dry valleys down the South Downs dip slope; these are not associated with any Palaeolithic remains, and have little potential for remains of any significance.

In East Sussex, no Head Gravel deposits are mapped, although there may, as for the similar geomorphological situation in West Sussex, likewise be some gravel-filled dry valleys on the chalk of the South Downs dip slope. As in West Sussex, any such deposits would have little potential for remains of any significance.

Head/Valley Brickearth, named silt bodies

This deposit group is widespread across the South-East, particularly Kent (Table 12); it also includes a number of named silt bodies: Langley Silt (north Surrey); Crayford Silt (north-west Kent); and Dartford Silt (north-west Kent). Mapped bodies are mostly of substantial thickness, and are predominantly of colluvial origin, although may conceal alluvial/fluvial deposits. Deposits of this nature are known to have formed throughout the Pleistocene, generally in phases of cold climate, so extant bodies may date any time from the Middle Pleistocene through to the late Devensian (Parks and Rendell 1992), and individual mapped bodies may include depositional phases of differing dates. Palaeolithic remains are generally scarce (Table 12) but, where present, are likely to be minimally disturbed and so of high importance. Significant remains are most likely to be encountered at the base of deposit bodies, which may be another reason why known remains are scarce, as they are only rarely uncovered and found.

Table 12. *Resource summary, deposit group 3c: Head/Valley Brickearth, named silt bodies*

	Key areas	*Key sites*	*Palaeolithic remains*	*Notes, comments*
Surrey	Thames Valley, Esher and Ashford (Langley Silt)	-	-	No known sites in Surrey, but important Levalloisian remains from similar deposits nearby at Yiewsley
	Farnham (T2-3 of Wey, Bury's Terrace D)	No specific sites known, but..	.. fresh Levallois material reported from brickearth (SRPP 2: pp 69)	Base of brickearth most likely horizon for remains
	Mole basin within Weald	-	-	No known sites, unexplored date of formation and potential
Kent	Crayford (Crayford Silt)	Stoneham's Pit, Rutters Pit	Levallois floors	
	Crayford (Dartford Silt)	Wansunt Pit	Mint condition ovate handaxes and refitting debitage	Disputed depositional interpretation, whether colluvial or alluvial — former favoured here
		Bowman's Lodge	Prolific handaxe/core industry from base of thick brickearth	

	Key areas	*Key sites*	*Palaeolithic remains*	*Notes, comments*
	Stour valley, Canterbury	Sites on SRPP map S 4: 16, 17, 18, 20, 27, 23	Handaxe and Levallois material	Fresh condition material found at base of brickearth, overlying buried terrace deposits
	Tonbridge area, especially to east	Goose Green (M 2-10)	Single handaxe	Little material known, but maybe important sites deeply buried
	East Kent, capping Clay-with-flints and South Down south of Canterbury and between Folkestone and Dover	Sites on SRPP map S6: 11, 15, 18	Single handaxes	Some material (eg. site S 6-15) provenanced to within brickearth
	Maidstone, patches over Hythe Beds to south and west	East Malling Heath (M 4-15)	Single handaxe	Deposits may be *in situ* loess
W Sussex	Coastal plain between Portsmouth and Worthing, Selsey peninsula	Worthing	Mint condition flake	Found at base of brickearth, dated to c. 50k BP (Pope and Bates, pers. comm.)
E Sussex	Hove and Shoreham	Portslade (SXR 5-23)	Single handaxe	From an unknown brick pit near station

* Site identification numbering relates to Southern Rivers Project mapping, volume 2 (Wessex Archaeology 1993) and volume 3 (Wessex Archaeology 1994)

In Surrey, the most important area of brickearth is the Langley silt complex and other brickearth bodies capping Thames terraces in the north of the county, particularly in the vicinity of Ashford and Esher. Although no Palaeolithic finds have been made from these deposits within the county boundary, prolific and undisturbed Levallois material has been recovered a short distance to the north at Yiewsley (Wymer 1968: 257), and there is no reason why similar material should not be present in the same deposits in Surrey. In the Farnham area, the lowest terrace of the Wey (Bury's Terrace D, previously mapped as T1 by the BGS, but most recently mapped as T2-3) is covered by a patch of brickearth, and this has also reportedly produced fresh condition Levallois material (Wessex Archaeology 1993: 69). There are also a number of extensive brickearth patches associated with the Mole basin within the Weald (in the vicinity of Horley, Reigate and Dorking), and at the foot of the Wealden scarp at Redhill, and the tributary valley to the east. No Palaeolithic remains unknown from these patches, but they are wholly uninvestigated and of uncertain age; if any are of early Palaeolithic date, any remains found would likely be of high importance.

Brickearth deposits are particularly abundant in Kent. The Crayford Silt forms an extensive deposit body at the northwest county boundary with Greater London, between Crayford and Erith, and intermittently along the Cray and Darent rivers. This deposit is known to contain undisturbed Levallois material in association with diverse faunal and palaeoenvironmental remains at its base and to seal late Middle Pleistocene fluvial deposits also rich in Palaeolithic remains (Wessex Archaeology 1999). Another silt body, the Dartford Silt, is also mapped in the same general area, occurring at higher levels overlying earlier Middle Pleistocene Boyn Hill terrace deposits. The mapped bodies of Dartford Silt have not produced any Palaeolithic remains, but the deposit is probably equivalent to: (a) the so-called Wansunt Loam, a fine-grained deposit probably of colluvial origin which has produced abundant and undisturbed material at Wansunt Pit (Wymer 1968: 326; Wenban-Smith et al. 2003); and (b) the thick brickearth deposit at Bowman's Lodge Pit under which a prolific industry including both handaxes and flake cores was recovered in fresh condition (Tester 1951; Wymer 1968: 328).

There are numerous spreads and patches of Head Brickearth at the foot of the North Downs across the whole of northern Kent, from Rochester to Dover, probably reflecting colluvial reworking of loessic sediments originally deposited on the high ground of the North Downs. Particular concentrations occur in the south of the Hoo Peninsula, the Sittingbourne area, along the Stour valley and at its confluence with the Wantsum Channel, and in the north-east corner of Kent around the Isle of Thanet and Folkestone. Known sites of proven importance or high potential include Hoo St. Werburgh (Dines et al. 1954: 142), and a cluster of sites flanking the Stour in Canterbury where both handaxe and Levallois material had been recovered in fresh condition from within the brickearth, which often here is also capping fluvial terrace deposits (Wessex Archaeology 1993: map S4). Other important localities are Swalecliffe (Green et al. 1998) and Chislet (Bridgland et al. 1998d), where Head Brickearth deposits are mapped, but where the significant artefactual and faunal remains come from underlying fluvial deposits.

Patches and spreads of brickearth deposits also occur commonly within the Weald basin, both associated with the Wealden drainage pattern and overlying high interfluve areas. A particularly widespread concentration occurs in the vicinity of Tonbridge, presumably reflecting a long history of aggradation at a low-lying drainage confluence point. Brickearth outcrops are also more common than usual along the Beult valley.

Few Palaeolithic remains are known from most of these deposits, especially within the Weald, but, as shown by Parks and Rendell (1992), they probably mostly date to different stages of the last glaciation, between c.110,000 and 10,000 BP, although some may be older. On this basis, they may have some potential for containing evidence of Late Pleistocene Neanderthal occupation; loessic sediments of comparable age in (relatively nearby and geomorphologically comparable) northern France contain abundant important evidence of this period, and it is somewhat puzzling why this evidence should be lacking in England. Insufficient investigation has taken place to be sure that this apparent absence is real, and the recovery of several fine *bout coupé* handaxes from superficial sediments in Kent (Tyldesley 1987) suggests that evidence of British Mousterian Neanderthal occupation may be present in places, in deposits of this period. If any remains are found to be present, they are likely to be of high importance. The substantial spread of brickearth in the Tonbridge area is particularly worthy of investigation, as its prolonged aggradational history may have sealed in much material in a minimally disturbed condition.

In West Sussex, there is an extensive spread of brickearth all along the south coast extending from the foot of the South Downs, between Portsmouth and Worthing, forming the Chichester Plain and covering the Selsey peninsula. Much of this deposit is mapped as 'Aeolian silt' (BGS 1:50,000 sheet 317/332, Chichester and Bognor), although it is taken here as being of colluvial origin, probably incorporating a reworked loessic component. This deposit is thought mostly to date to the last glaciation (cf. Parks and Rendell 1992, sites 17 and 26), sealing last interglacial deposits in places (Bates et al. 1998), and it has not produced much Palaeolithic material, bar a few stray handaxe finds of uncertain provenance (Wessex Archaeology 1994, map SXR 6). However, recent work by Pope and Bates in Worthing (pers. comm.) has demonstrated the presence of mint condition artefacts in brickearth deposits dated to c.50,000 BP, indicative of mid-Devensian Neanderthal occupation. It is also suggested by Bates that early Devensian landsurfaces may be present at the base of this brickearth body, and palaeo-environmental indicators such as ostracods have also been shown to be present.

In East Sussex, few brickearth deposits are present, merely small patches along the coast between Worthing and Hove, in amongst the spread of general Coombe deposits at the foot of the South Downs, being an eastward continuation of the much more substantial spread of similar deposits further west in West Sussex. Just one Palaeolithic find is known, a handaxe from an unknown brick pit near the station at Portslade (Wessex Archaeology 1994: 52, map SXR 5, findspot 23), although its provenance is uncertain. As for the similar deposits in West Sussex, however, these brickearth patches merit investigation to clarify their date and for scarce evidence of Neanderthal occupation.

Aeolian/loessic silt, plateau brickearth

Aeolian sediments are poorly represented within the British Pleistocene record, with the exception of last glacial (Devensian) coversands and loess accumulations. These are sand and silt-sized material blown out from glacial outwash plains during periods of severe climate, and then deposited at particular parts of the landscape where wind-speed dies (Catt 1977). Major loessic accumulations from earlier in the Pleistocene are of great importance as archives of palaeoclimatic data (from alternations of cold-climate loess and interglacial soils) elsewhere in the world, especially central Europe and China (e.g. Kukla, 1975) but also including the nearby river Somme valley (Antoine et al., 2007). Much loessic material, even the majority, rapidly becomes colluvially or even fluvially reworked, rather than remaining as primary aeolian loess. Kent is unique within Britain for the quantity of primary loessic sediments preserved on the chalk downland around, and high ground within, the Weald (Catt 1979; Parks and Rendell 1992). From the Palaeolithic archaeological point of view, loessic deposits are potentially significant because they form progressively, burying any archaeological evidence very gently and preserving it undisturbed. Although not so well-developed as the thick loessic sediments of north-east France, various areas of sediment in the South-East (especially north-east Kent) mapped as Head Brickearth are probably of loessic origin, and of Devensian age, based on the small amount of work done (Parks and Rendell 1992). The loess in northern France has produced frequent rich and spectacular Palaeolithic archaeological sites, such as the undisturbed early

Devensian Levalloisian knapping floors at Hermies (Vallin and Masson 2004), and the series of horizons spanning the Lower/Middle Palaeolithic at Etricourt-Manancourt (Hérisson et al. 2016). The potentially equivalent resource in Kent has been less subject to archaeological investigation due to its lack of recognition, although a background noise of stray finds, including classic British Mousterian *bout coupé* handaxes (cf. Tyldesley 1987) gives a hint that more careful investigation could reveal important sites.

A small number of deposits mapped as ‘Aeolian/loessic silt’ or as ‘Plateau Brickearth’ are grouped here as deposit category 4 (Table 13). No deposits are known in Surrey, although it is likely that some survive in places in areas mapped as brickearth. Kent is the heartland of British loess although the majority of outcrops, found in the north-east of the county, date to the late Devensian, beyond the scope of this Early Palaeolithic assessment. Parks and Rendell identified a Middle Devensian loessic deposit at Spotlane Quarry, to the east of Maidstone, and other brickearth deposits are mapped in this area, at West Malling and on East Malling Heath, the latter of which has produced Palaeolithic evidence (Wessex Archaeology 1993: 129, map M 4, findspot 15). The only mapped aeolian sediments in West or East Sussex are those of the major brickearth spread along the south coast between Portsmouth and Hove, regarded here as of colluvial origin. This may, however, contain patches of primary loess. There may also be patches of loess capping high points of the South Downs, and also high ground within the Weald.

Table 13. *Resource summary, deposit group 4: Aeolian/loessic silt, plateau brickearth*

	Key areas	*Key sites*	*Palaeolithic remains*	*Notes, comments*
Surrey	Brickearth deposits capping high ground on North Downs and within Weald	-	-	No primary loess outcrops known, yet
Kent	Maidstone area	Spotlane Quarry	-	Investigated by Parks & Rendell (1992, site 15)
		East Malling Heath (M4-15)	Findspot by Harrison, and handaxe in Maidstone museum (possibly the same event)	Uncertain provenance of find/s

	Key areas	Key sites	Palaeolithic remains	Notes, comments
W Sussex	Brickearth spread along south coast may include patches of primary loess	-	-	May also be primary loess on high points of S Downs and within Weald
E Sussex	May be patches of primary loess along south coast	-	-	May also be primary loess on high points of South Downs and within Weald

* Site identification numbering relates to Southern Rivers Project mapping, volume 2 (Wessex Archaeology 1993) and volume 3 (Wessex Archaeology 1994)

Marine littoral deposits (MB Roberts)

Introduction

Marine littoral deposits include coarse shingle at the back of a transgressive wave-cut platform, defining the boundary between land and sea, and fine-grained sand/silt sediments in the intertidal/estuarine zone extending seawards. Shingle beaches are often backed by high cliffs, although the extent of cliff formation depends upon bedrock type. For ancient relict raised beaches (such as at Boxgrove), cliffs have usually been truncated by subsequent erosion. The distribution of Pleistocene beach deposits is considerably more restricted than fluvial deposits, with the main concentrations in the UK found along the south coast and in the West Country, although they also occur on the east coast in Lincolnshire and further north. Flint-rich beaches, especially when backed by chalk cliffs, would have represented a potential source of raw material; although rounded and wave-battered pebbles and cobbles are not ideal for knapping, they were used for handaxe manufacture, and freshly exposed flint nodules would also have been available from the chalk cliffs. Shingle raised beach deposits are known to be sources of artefacts, although they are often severely abraded under relentless wave action. Associated silty/sandy foreshore sediments, however, can represent better contexts for artefact preservation, as exemplified by the Slindon Sands at Boxgrove, West Sussex (Roberts and Parfitt, 1999), where short-lived palaeo-landsurfaces perhaps exposed for single tides are preserved, along with a capping palimpsest soil horizon perhaps exposed for several hundred years before burial by cliff-collapse sediments associated with the onset of the Anglian glaciation.

Pleistocene marine littoral deposits in the south-east region are for the most part buried under colluvial/solifluction deposits of various types, and so are not fully shown on geological mapping, although some outcrops of the ancient Aldingbourne storm beach deposits in West Sussex are shown by current mapping (BGS 1:50,000 sheet 317/332, Chichester and Bognor). However, a substantial amount of research has recently been done clarifying the sub-surface locations of various remnant littoral formations on the Sussex coastal plain (e.g. Bates et al. 1997; Roberts and Pope in press), where the majority (if not all) of deposits of this type occur in the southeast region, and this research forms the basis of this assessment review, categorised here as deposit group 5 of the Early Palaeolithic resource (Table 14).

***Table 14**. Resource summary, deposit group 5: Marine littoral (raised beach, intertidal/estuarine)*

	Key areas	*Key sites*	*Palaeolithic remains*	*Notes, comments*
Surrey	-	-	-	No coastline
Kent	Sandwich and Isle of Thanet	Cutting to Betteshanger Colliery	-	Details in Shephard-Thorn (1988)
W Sussex	Goodwood-Slindon raised beach	Boxgrove, Slindon Park, Valdoe (SRPP 3, map SXRB 1, sites 7, 8, 13, 15)	Undisturbed landsurfaces and rich zoological remains	Intensively investigated since 1980s (Roberts & Parfitt 1999; Roberts & Pope in press); pollen and plant macro-fossils at Slindon Park
	Aldingbourne raised beach	Pear Tree Knap, Easthampnett Pit, Boxgrove Priory roundabout, Aldingbourne Park Pit, Walberton Lane (SRPP 3, map SXRB 1, sites 3, 4, 5, 6, 10)	Occasional artefacts, mostly abraded but some fresh condition	Need to investigate more thoroughly and clarify context/provenance of artefactual remains
E Sussex	Brighton	Black Rock beach section, Brighton	None from beach sediments	Relevant deposits within jurisdiction of the Brighton & Hove unitary authority

* Site identification numbering relates to Southern Rivers Project mapping, volume 2 (Wessex Archaeology 1993) and volume 3 (Wessex Archaeology 1994)

Deposits of this group are located on the southern margin of the South Downs dipslope in east Hampshire and West Sussex, at the junction with the coastal plain. The sediment bodies comprise a descending staircase of east-west trending flint-dominant raised shingle beaches each associated with foreshore deposits of fine-grained sands and silts. The raised beaches are cut into platforms in chalk bedrock, and the sequences of each beach formation are typically capped by chalk-rich solifluction deposits associated with climatic deterioration and marine regression. Other Pleistocene marine deposits are also found infilling palaeo-drainage channels on the southern margin of the coastal plain, these channels continuing southwards into the English Channel where they can be seen to form tributaries of drowned Pleistocene fluvial networks (Gupta et al. 2007).

The sedimentary record and dating

The highest (c.40m OD) and oldest of these marine littoral sequences is the Westbourne to Arundel Raised Beach (WARB), formally known as the Goodwood-Slindon Raised Beach (Roberts et al. 1994; Stringer et al. 1998), which has an east-west extent of 26km and a north-south extent of c.0.5km (Roberts and Parfitt 1999). These sediments have been proven by various means (principally by containing certain species of voles and rhinos) to have been laid down before the Anglian glaciation, towards the end of phase IV of the Cromerian interglacial period, c.490,000–480,000 BP, equating to the final part of MIS 13 of the deep ocean record (cf. Table 1). Along a shoreline of around 20km the beach would have been backed by 75m –100m high cliffs cut into the Upper Chalk but as the eastern and western limbs swung southwards forming a bay, away from the Chalk and into the Palaeogene outcrops, the height of the cliff fell away until the beach surface was at ground level. The shingle beach of the WARB extends south of the cliff for around 40m and is covered at the seaward end by an interdigitating and overlapping sequence of sands and silts. These fine-grained sediments extend up to 800m southwards in places but exhibit progressively more truncation away from the protection of the cliff; the complete conformable sequence generally disappearing at a distance of c.250m.

The Aldingbourne Raised Beach (ARB), the next youngest in the staircase succession, is cut into the weathered wave-cut platform of the WARB at c.25m OD. Estimates of the time of deposition of the ARB vary from MIS 11 to MIS 7, a span of 200kyr (J.E. Whittaker and M.R. Bates pers. comm.). The beach exhibits some surface expression which has allowed for considerable erosion and reworking. Southwards of the littoral zone, fine-grained marine deposits are preserved and, where the beach overlies the chalk, contain an important invertebrate fauna (Roberts and Pope 2000). The distribution of the ARB sequence is constrained in a similar fashion to that at Boxgrove: namely between the river Arun to the east and Westbourne/Leigh Park in the west, between the extant chalk uplands of the Portsdown and Littlehampton Anticlines. The north-south distribution of the complete sediment package has only been elucidated at a couple of locations in the Tangmere–Norton area, and is thought to be in the region of c.300m.

The sediments of the Aldingbourne Formation are directly truncated by those of the Norton Formation, which include the well-known Black Rock raised beach deposit at Brighton (Bates et al. 1998 and 2000). The wave-cut platform of this latter feature occurs at c.8m OD at the intersection with the cliff, falling to around 5m OD under the near-shore Norton Sand some 200m from the cliff. The Norton Formation sediments are dated to the end of MIS 7 (c.190,000 BP). Unlike the two earlier, higher level events, the Norton-Brighton Raised Beach has a distribution unconstrained by the Portsdown and Littlehampton Anticlines (which must have been finally eroded away during the MIS 7 marine transgression) and extends from west of the Portsdown Hill in Hampshire to Brighton in East Sussex. The north to south distribution of the Norton sediment package is the most extensive of all the coastal plain marine Pleistocene deposits extending for a minimum of 1.6km and a possible maximum of around 3km. The uncertainty on the southern margin arises from a lack of recorded exposures between the Norton type-site and the next sea-level still-stand as represented by the Pagham/Merston Raised Beach, associated with MIS 5e, the Ipswichian interglacial, dating to c.125,000 BP.

Whereas the marine deposits of the Slindon and Aldingbourne Formations are largely cut into the Upper Chalk, the Norton Formation, in the main part of the coastal plain, is cut into Palaeogene deposits of the Reading and London Clay Formations, with the Chalk comprising the solid at the eastern and western margins.

This has implications for the type of palaeoenvironmental data preserved within overlying Pleistocene sediments, with rich molluscan and ostracod microfaunas preserved in marine regressional sequences from the zones of chalk bedrock.

Palaeolithic remains: artefactual and palaeoenvironmental

The sediments of the Slindon Formation and the overlying cliff collapse and mass movement gravels, preserve both dense spreads of archaeological material and intact early Middle Pleistocene landsurfaces with undisturbed evidence of hominin behaviour reflected in both knapping scatters and faunal remains (Roberts and Parfitt 1999). They also contain a rich variety of palaeoenvironmental indicators, allowing detailed climatic and palaeoenvironmental reconstruction. The evidence from these deposits establishes beyond doubt the presence of hominins in England before the Anglian glaciation, making finely-made ovate handaxes and performing behaviour such as deliberate hunting of large herbivores. These internationally important sediments have now been mapped over their full extent and, with the decline in commercial quarrying and development across their distribution, are largely protected (Roberts and Pope 2018), especially at the two key sites of Boxgrove and Slindon. Lithic artefacts have been recovered by casual collection from the littoral sediments of the Aldingbourne Formation, but none has been found in modern investigations (Woodcock 1981). Potential remains, however, for the discovery of better-preserved material in newly identified sands and silts located to the south of the beach at Tangmere and Pear Tree Knapp. Despite quite intensive test pit excavations and analysis of larger exposures, no demonstrably genuine artefacts have been recovered from any of the later MIS 7 and 5e marine deposits, associated with the Norton Formation and the Pagham/Merston raised beach. This phenomenon might reflect climatic and environmental conditions during the period of deposition of these sediments, together with the postulated lower hominin population densities for this time period (Ashton and Lewis 2002).

The Slindon Formation preserves the largest range of palaeoenvironmental data in its marine and terrestrial sediments, from pollen and plant macrofossils at Slindon, to a full range of vertebrate and invertebrate fossils at Boxgrove and the Valdoe. Preservation of palaeoenvironmental data in the sediments of the Aldingbourne Formation is limited but recently, very important foramiferal and ostracod faunas have been identified by J.E. Whittaker from exposures of these deposits in the Tangmere area (Roberts and Pope 2000; J. Whittaker and M. Bates pers comm.). The sediments of the Norton Formation *sensu stricto*, younger regressional MIS 7 sediments, and the as-yet-undated marine sediments of the lower coastal plain, including those in the coastal channel sequences (Bates et al. 2007), also contain a wealth of palaeoenvironmental data, including: organics and pollen at Westhampnett; vertebrate remains at Norton Farm; and invertebrate fossils including molluscs throughout.

Marine littoral overview

The coastal plain of Sussex and Hampshire contains a staircase of marine and terrestrial Pleistocene sediments of international importance. Although it is now clear that there is not a simple correlation between this staircase and the MIS framework, these sediments and their associated archaeological and palaeoenvironmental data, taken either individually or as a group, have the potential to contribute fully to broad national research questions on hominin behaviour, chronology and palaeoecological reconstruction, as well as more detailed site and period specific questions. West Sussex and Kent County Councils, through their archaeological and environment teams, have been at the forefront of promoting the palaeo-environmental investigation and geological recording of Pleistocene sediments to mitigate the impact of development, even where actual archaeological remains are not present. This approach has allowed development of a broader appreciation and resolution of the Palaeolithic archaeological environments and landscape, along with the development and testing of more refined chronostratigraphic models, and has been one of the most productive developments of the discipline in the last ten to fifteen years and needs to be sustained and developed.

Finally, it is worth drawing attention to the possibility that there may be unmapped marine littoral sediments in other parts of the South-East. Besides the offshore channel-fills mentioned above, buried marine sediments may be present around parts of the Kent coastline, and there is a tantalising reference to a possible exposure of raised beach sediments and a wave-cut platform in a cutting leading to Betteshanger Colliery, near Sandwich, TR 349536 (Shephard-Thorn 1988: 37).

Lacustrine contexts

Lake edges would seem to be ideal locations for hunter-gatherer occupation, but the incidence of these in the Early Palaeolithic archive is minimal, especially given that the artefacts from the well-known lacustrine site and interglacial type locality at Hoxne, Suffolk, are now considered to have been recovered from later fluvial sediments (Ashton et al. 2008). Nonetheless, some high-quality sites are known, amongst them Southfleet Road in the Ebbsfleet Valley, northern Kent, where undisturbed remains of an extinct straight-tusked elephant (*Palaeoloxodon antiquus*) have been found in fine-grained lake-margin clays, surrounded by flint artefacts, interpreted as a butchery site (Wenban-Smith et al. 2006) - in a location where no Pleistocene deposits are mapped, and current geological mapping merely shows ‘Thanet Sand’.

The Palaeolithic record from lacustrine localities is very likely to be under-represented, however, in that the quarries that exploited lake beds (e.g. for brick-making) will have been located in the central parts of basin infills, where there are thick and economically viable sediments, whereas the evidence for human activity will be at lake edges, where the sediments are very thin and unlikely to be worked or, therefore, exposed. This is unfortunate, since lacustrine sediments are fine-grained (silts and clays) and therefore provide excellent contexts for undisturbed preservation of lithic artefacts and, indeed, more perishable organic materials, such as at Southfleet Road. The slow rate of deposition in lake environments also leads to the accumulation of sediments from which high-resolution palaeo-environmental evidence can be obtained, from pollen, molluscs and ostracods. It would be a good idea, therefore, where lacustrine sediments are identified, for their feather-edges to be targeted for archaeological investigation; this has already been undertaken at the Hoxnian para-type locality at Marks Tey, in Essex (see Turner, 1970), with some degree of success (D.C. Schreve, D.R. Bridgland and M.J. White, unpublished data).

Larger-scale lacustrine basins are, unfortunately, rare except in volcanic or tectonically active regions, or in areas recently-glaciated, none of which applies to the region under consideration here. The potential for lake environments here is therefore likely to be restricted to small cut-off meanders on river floodplains (ox-bows) and other minor ponds, which will not have the accommodation space for lengthy sedimentary sequences. Such contexts typically provide records for only short 'snapshots' within interglacials, rather than a whole interglacial half-cycle, as is preserved in glacially-formed lakes further north. Nevertheless, these smaller basins can provide valuable archives of well-preserved palaeontological and archaeological evidence, such as in the Wissey valley, Norfolk, at Lynford (Schreve, 2006).

Calcareous precipitates: tufas and travertines

Calcareous tufa and travertine precipitates can provide wonderful contexts for the preservation of archaeology, although these are considerably less common in Britain than in other European countries. The sub-aerially precipitated travertines overlying Muschelkalk bedrock in Germany, for example, contain hominin fossils, superbly preserved fauna and flora of various kinds, well-preserved artefacts and human occupation sites with hearths; the best known sites include Weimar-Ehringsdorf and Bilzingsleben, both integral parts of river terrace records, in the Ilm and Wipper valleys, respectively (Bridgland et al., 2004b; Meyrick and Schreve, 2002). Tufas with archaeology and fossils are also to be found interbedded with the fluvial terrace sequence of the river Somme, in northern France, only a few tens of kilometres to the south of the south-east region of the UK. These include a recently discovered tufa at the Acheulian type locality, at St Acheul (Antoine and Limondoin-Lozouet, 2004; Antoine et al., 2007). The only comparable site in Britain is Beeches Pit, West Stow (Suffolk), which has primary-context archaeology and, possibly, hearths within a tufa-forming spring sequence overlying a glacial lake basin (Preece et al. 2006 and 2007). A small tufaceous channel-fill within the lake-margin sequence at the Southfleet Road elephant site, north-west Kent, provided a rich source of small vertebrate and other faunal remains (Wenban-Smith et al. 2006). The only other British interglacial tufa known at present is also north of the Thames, at Hitchin, Hertfordshire (Kerney, 1959), which has yielded some archaeology but has never been extensively excavated (R.C. Preece, pers. comm.). Any future discovery of an interglacial tufa in the chalk-lands of southern England would be of considerable potential importance, therefore.

Fissure infills

Some potential may be sought within new contexts, previously paid scant attention within Palaeolithic archaeology. Fissures at Beedings in Sussex, for example, produced in the late 19th century an interesting collection of material of likely British Mousterian date (Jacobi 1986; 2007). These features were recently re-investigated, and found to contain a fine silty deposit, with clasts/sills comprised of frost-fractured material (Pope 2007; Pope et al. 2013). The upper deposits within these geological features were found to contain flint artefacts with a white/bluish-grey patina, and at least one concentration of fine chips was apparent, perhaps representing an original flint knapping event. There is great potential in fissures such as these for finding material in context, on small areas of intact ancient land surfaces that have slumped into widening fissures. A *bout coupé* handaxe from Wood's Hill (White and Jacobi 2002) comes from an identical landscape position near to Beedings and may therefore derive from similar preservational circumstances.

Recognition of the possible importance of such sites is not new. At the outset of Palaeolithic investigation in the late 19th century, caves and rockshelters on the continent were a key source of evidence. While northern and western Britain were well provided with caves which formed a natural focus of investigation by pioneers such as Buckland, Pengelly and Widger, the emerging record from south- eastern Britain was very much limited to the recovery of artefacts from river terrace gravels, the raised beaches of Sussex and stray finds from the plough soil. The recognition of the presence of fissure contexts within Wealden geologies caused great excitement, therefore. In 1827 the first hints of the potential of these sites was commented on by Buckland himself, in an anonymously published paper, after the discovery of Pleistocene fauna including hyena, horse, rhinoceros and mammoth within fissures at the site of Boughton, to the south of Maidstone in Kent (Anon [W. Buckland] 1827). In what Buckland described as caverns but were elsewhere recorded as 'pipes' of varying size, fine-grained deposits sometimes preserving bone were encountered regularly within the area of Maidstone associated with Kentish 'rag' beds of the Lower Greensand (Topley 1875).

In the late 19th century the wider prevalence of fissure sites was demonstrated at a quarry located in the parish of Ightham, near Sevenoaks, in Kent. Here the presence of fissures was first recognised by Benjamin Harrison who began to make regular visits to the quarry and to collect faunal material and artefacts from the so-called 'Ightham fissures'. Work at the site was continued by William Abbot and Edwin Newton who monitored the fissures (Fig 9) during their removal by quarrying and made extensive collections of faunal material. The eventual list of recovered fauna from the site was extensive and included Pleistocene mammals (mammoth, rhinoceros, horse, reindeer, hyena, bear), Holocene mammals (roe deer, red deer, sheep and pig) as well a large range of avian, amphibian and small mammal fauna. The assemblage was recovered in excellent preservational condition and suggested that the fissures acted as preservational contexts throughout the late Pleistocene and Holocene periods (Abbott 1899; Newton 1894). An undetermined quantity of stone tools was found associated with this assemblage; these unfortunately are now lost (R. Jacobi pers. comm.)

Less than 2km away, on the western flank of the Shode valley, lies the site of Oldbury, close to the village of Ightham. Here Benjamin Harrison recognised the presence of small caves and fissures again cut into the Lower Greensand 'Rag' beds (B. Harrison 1892; E.R. Harrison 1928). A significant assemblage of tools with British Mousterian affinities were recovered from the weathered slopes flanking the rock outcrop both during Harrison's excavations and through more recent investigations by Desmond and Anne Collins (Collins and Collins 1970; Cook and Jacobi 1998). Recent inspection of the site has revealed that the 'caves' and 'rock shelter' overhangs are formed within fine-grained beds within the Lower Greensand Hythe Beds at the site. It seems probable, as with the Ightham Fissure site on the other side of the valley, that here Pleistocene sediments have also been captured within fissures in the Cretaceous bedrock. It may then be the case that fissures collapsing into the valley at the edge of the outcrop are the sources of archaeological material found flanking the slopes of the site. The site, while poorly understood and investigated only on a small basis, is of immense significance as the only locality in the South-East which has produced a clear British Mousterian assemblage. Comparable material has only ever been found as stray surface finds of *bout coupé* bifaces, although better sites are known in East Anglia (Lynford) and from cave sites in the South-West (Wookey Hole; Kents Cavern).

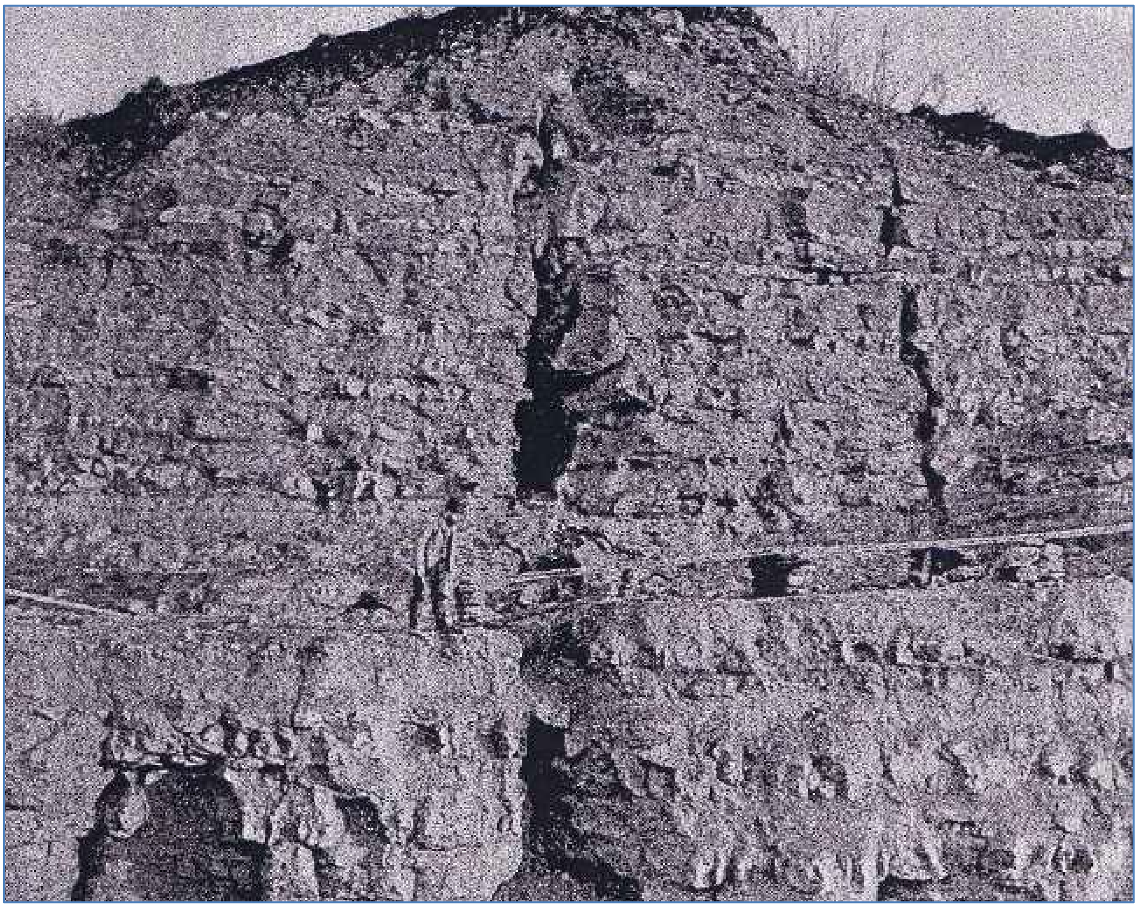

***Figure 9**. The fissure in the Lower Greensand at Ightham (Abbot 1894).*

More recently a significant fissure site was recognised and excavated at Glaston in Rutland (Cooper 2004). Here a small collection of stone tools, including a leaf point with technological affinities to the Beedings assemblage, were found alongside butchered horse remains within an infilled fissure sunk into soft sands forming a ridge. Investigations at Glaston, combined with a consideration of possible processes at the comparable site of Beedings, led Simon Collcutt to consider models of landscape development and suggest the possible widespread occurrence within lowland Britain of fissures, 'gulls' and related features, located on hill tops generally mapped as devoid of Pleistocene geology (Fig 10).

Understanding the processes behind the formation of such fissure contexts is crucial in developing a strategy to manage this as yet unquantified resource. The model of site formation, known as the '*sackung*' hypothesis, was developed by the geologist Zischinsky (1969) to describe the process whereby upland plateau surfaces can 'sag' into trenches or fissures formed parallel to steep slopes formed through glacial, fluvial or tectonic processes. The term was employed by Collcutt to model the effect of over-steepening of slopes during the Pleistocene to isolated upland plateaus or hill tops and the implications for the preservation of Pleistocene landsurfaces within the resultant fissures, fissures which are themselves further widened by peri-glacial process throughout the Pleistocene. The model works on

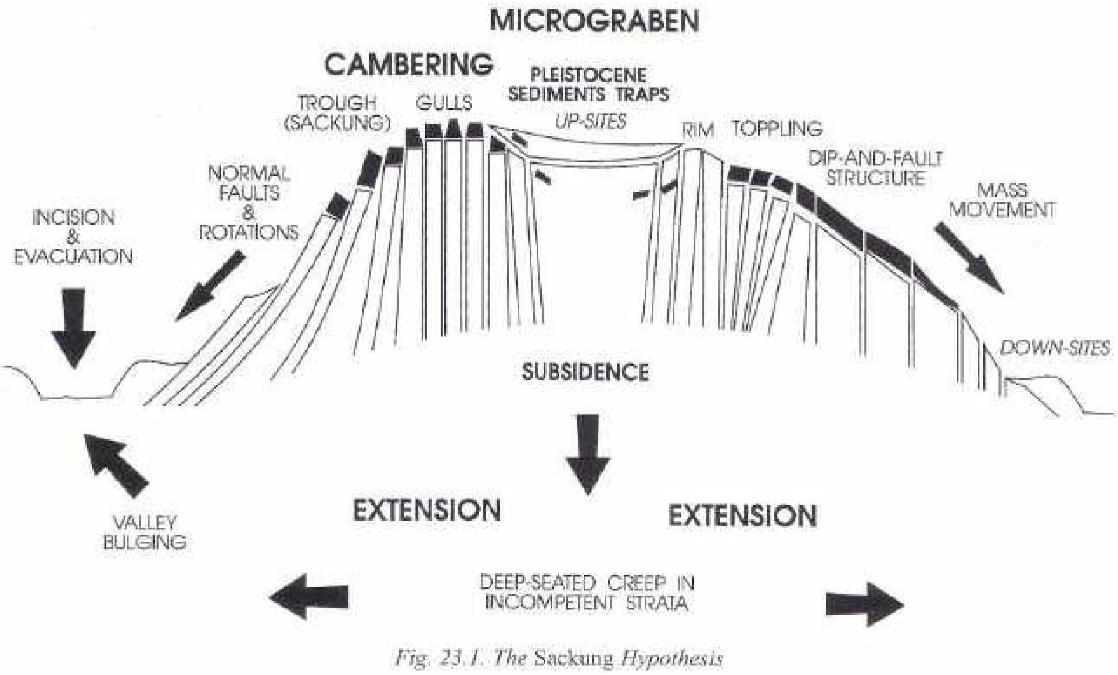

Figure 10. *Schematic of the 'Sackung' hypothesis (Collcutt 2001).*

the principle that, where isolated plateaux of vertically-bedded rock become subject to the effects of gravity through continued erosion or over-steepening of the marginal slopes, vertical fissures will begin to form broadly parallel to the slope. This process will be accelerated where the fissured rock overlies softer beds leading to increased mobility. As these fissures widen with time, landsurfaces on the hilltop will inevitably sag into the surface of the plateau taking with them associated artefacts and faunal material. Collcutt suggests that the sites of both Beedings and Ightham may have formed in just such a manner. Our observations suggest this is indeed the case with clear evidence of over-steepening of the flanking slopes of Beedings Hill associated with spring line erosion along the line of outcropping softer Atherfield clays underlying the Lower Greensand at the site.

Under this model, 'up-sites' preserved at the tops of plateaux, ridges or isolated hills, offer huge potential for primary context material to be preserved. Archaeological material, if recovered from such a context, has not been subject to mass movement or incorporated into fluvial sequences and will generally be accessible through direct excavation. However, such sites are exceedingly rare in the archaeological record of the British Pleistocene. Given the emerging potential from sites such as Glaston and Beedings, it is now critical that we determine whether such sites are genuinely rare, or if our ignorance of their possible presence has been guiding research and planning decisions in a manner to bias against their discovery.

One major factor which has led to the neglect of up-site potential is the limited resolution of Pleistocene geological mapping currently available to researchers and local government curators. This has major implications for development control and the planning process as most site evaluations are triggered on the basis of identified mapped Pleistocene deposits within the footprint or immediate environs of a proposed development. While it is impractical to consider large areas of southern Britain as archaeologically sensitive on the basis of altitude/topography alone, it would be possible, through consideration of the combination of geological and landform features which give rise to fissures, to determine more restricted designated areas which might contain such contexts.

The implications of ignoring this potential could be high. An inspection of OS maps and extraction records for Kent and Surrey has determined no less than 11 recently active sand quarries sited within areas geologically and topographical identical to those known to contain deposit-filled fissures at Ightham and Maidstone. As these sites are geologically mapped as outcrops of Cretaceous sandstone at the surface, they have not been considered as of any possible potential for Pleistocene deposits and Palaeolithic remains, and no consideration has been given to evaluating for important remains. There may be a real need therefore to re-assess the geological mapping of the South-East, and to identify areas of high potential for preservation of Palaeolithic remains in bedrock fissures.

The Early Palaeolithic in the South-East: current understanding

Regional overview

The South-East contains a rich Palaeolithic resource. The most common and widespread part of this constitutes fluvial deposits, which occur across the region, with particularly significant deposits rich in Palaeolithic remains associated with the Middle Thames (north Surrey), the Lower Thames (north-west Kent) and the Stour (north-east Kent). Important remains are also known from numerous deposits associated with smaller rivers and tributary valleys, notably the site of Cuxton from terrace deposits of the Medway. The Stour terrace sequence contains Palaeolithic remains at Fordwich that may pre-date the Anglian glaciation, and rich remains from lower terraces through the later Middle Pleistocene. The Middle Thames sequence contains extensive gravel spreads from before the Anglian glaciation through to the late Devensian. Palaeolithic remains are most abundant from the sequence of terraces post-dating the Anglian glaciation (Boyn Hill, Lynch Hill and Taplow), but there are also some indications of evidence in pre-Anglian deposits. It is only in the last 10–15 years that pre-Anglian occupation of Britain has become widely accepted, so more attention should now be paid to actively seeking hominin evidence in pre-Anglian deposits previously thought too old to be of archaeological relevance. The Lower Thames terrace sequence lacks pre-Anglian deposits, this part of the river only having been diverted into its present valley by the growth of the Anglian ice-sheet. The post-Anglian terrace deposits here are, however, notably rich in Palaeolithic remains, with the key site being Barnfield Pit, Swanscombe, which, besides copious artefactual and faunal evidence, has produced the famous Swanscombe skull, one of very few hominin fossils of this period, and one of the best provenanced.

The South-East is also notable for having Britain's most important area of raised beach deposits, with a staircase of deposits of different age on the West Sussex Coastal Plain between Havant and Brighton. Work at Boxgrove, in particular, since the 1980s has confirmed the international importance of deposits of the Slindon Formation, the highest and oldest flight of the staircase. These contain extensive undisturbed evidence of occupation across a substantial landscape, through a period associated with the end of a pre-Anglian interglacial and the subsequent climatic deterioration. The Boxgrove evidence highlights one aspect of the Palaeolithic record. Namely, that it is only in rare and specific situations that evidence of any particular period is preserved in its original landscape context. The Slindon Formation probably contains 90% of the terrestrial global record of this particular slice of prehistoric time, and at least 99% of the British record. With Boxgrove, we are now confident about a late Cromerian phase of occupation with advanced handaxe manufacture and behavioural practices such as hunting. Without Boxgrove, controversy would likely have remained over whether some of Britain's earliest inhabitants could have exhibited such apparently sophisticated skills, and over whether there was occupation at all at this particular period. Most slices of the Pleistocene do not have their Boxgrove, so that makes it even more important to extract as much research value from the relatively low-resolution? evidence that forms the bulk of the Palaeolithic archive. It also emphasises the national and international responsibility to preserve rare deposits representing ancient landscapes, when found.

The other raised beach deposits lower down the staircase of the Sussex Coastal Plain do not seem to have produced much Palaeolithic evidence, if any. This was particularly puzzling when it was presumed that these lower deposits were the same period as the Boyn Hill and Lynch Hill deposits of the Thames, deposits of this period being particularly rich in Palaeolithic remains in other parts of the country, not least the Lower Thames, and the nearby Solent Basin to the west. However, the recent suggestion that there is a hiatus in the raised beach sequence between MIS 13 (the Slindon Formation) and MIS 7 (the Aldingbourne Formation) provides one solution to this conundrum, since Britain becomes generally deserted after MIS 7. However this dating is not certain, and one might still expect both Levalloisian and handaxe manufacturing evidence from within MIS 7, so this possible revision only emphasises the importance of more accurate dating of the raised beach staircase, and more systematic investigation for any Palaeolithic remains.

Important sites have also been found across the region in Coombe deposits of various types. Paradoxically from the point of view that these slopewash deposits would always have a detrimental effect on any Palaeolithic remains, Coombe deposits have produced many of the region's least disturbed sites, such as Frindsbury and Baker's Hole, and on the hill-slope beneath Oldbury Rockshelter. Another important site is Red Barns, on the north-facing slope of Portsdown Hill, southeast Hampshire, just a few kilometres to the west of the south-east region, where parts of a landscape rich in undisturbed artefactual remains, and including a palaeosol with molluscan evidence, are sealed by 2–3m of colluvial slopewash, all in an area mapped as Chalk bedrock; there is no reason why parts of this preserved landscape should not persist further east, into similar geomorphological situations in West Sussex. The problem with sites from Coombe deposits, however, is that they are not contextualised within a litho-stratigraphic dating framework such as a terrace or raised beach staircase, so, in the usual absence of bio-stratigraphic indicators or material from direct chronometric dating, they are particularly hard to date.

Other forms of deposits have been less productive of Palaeolithic remains. No remains are known from *bona fide* primary loess, although some might exist, most likely in Kent or East Sussex. Infilled fissures on the intra-Wealden scarp slopes of the Hythe Beds have produced some material, notably British Mousterian artefacts at Beedings, and this is a part of the resource to which further attention should be paid. Finally, a certain amount of material has been recovered from residual deposits capping high ground. The difficulty with this context is that it represents a palimpsest from throughout the Quaternary, where material from all phases of the Palaeolithic is intermingled with remains from Holocene activity; there is a possibility, however, of high-integrity Palaeolithic remains occurring in brickearth-filled depressions in the surface of residual deposits. When distinctive Lower/Middle Palaeolithic artefacts such as handaxes are found, they do at least demonstrate the range of the landscape visited and used, providing a counterpoint to the relatively restricted areas — mostly river valleys — where the majority of evidence survives in the present day, which merely reflects the survival of suitable sediments containing evidence, rather than being a reliable demonstration of the distribution of early Palaeolithic activity.

Overall, there is indisputable proof of a major phase of pre-Anglian occupation at Boxgrove, and a background noise of much less conclusive evidence that probably indicates pre-Anglian occupation over much of the region. It is unlikely that any occupation persisted in England during the Anglian glaciation, and the south-east region was probably one of the first areas to be re-colonised as climate ameliorated following this glaciation c.400,000 BP, via the chalk downland that probably still linked Kent with the continent. There followed a prolonged phase of prolific, and perhaps almost continuous, occupation through to the end of MIS 7, c.200,000 BP. For the majority of this time, lithic material culture was based on handaxe manufacture, with the exception of an initial flake/core based Clactonian phase, evidence of which is preserved from a number of sites in both the South-East and East Anglia. Towards the end of this time, there was a marked increase in the occurrence of Levalloisian lithic technology, with two of Britain's best Levallois sites — Baker's Hole and Stoneham's Pit, Crayford — occurring in north Kent; although it should be emphasised: (a) that Levallois technology did not suddenly appear from nowhere, but was a minor element of previous handaxe industries; and (b) that there are a number of very late handaxe-dominated industries, contemporary or later than the Levalloisian florescence, such as the Medway site of Cuxton preliminarily dated to the middle of MIS 7.

After MIS 7, Britain as a whole seems to have become deserted, only becoming reoccupied in middle of the Devensian glaciation, c.75,000 BP, by Neanderthals who went on to develop a distinctive British Mousterian material culture including, in some instances, distinctive *bout coupé* handaxes. Britain must have been very marginal for survivability through the Devensian, and there are only rare instances of this phase of occupation. The scattered recovery of *bout coupé* handaxes from throughout the region, with perhaps more than the average coming from northern Kent and the Sussex Weald, attests to occupation during this period, although all these finds are in derived contexts. The only probable *in situ* site is probably from the fissures at Beedings, West Sussex, which it has been suggested represents very late Neanderthal occupation, when their lithic toolkit began to incorporate a blade-based leaf-point element.

Major questions remain over the history of colonisation and settlement, the distribution of occupation across the landscape, and the behavioural practices and physiognomy of these early hominins. The only Early Palaeolithic post-cranial skeletal evidence known from the UK is a left tibia recovered from the late Cromerian (or very early Anglian) deposits at Boxgrove. This suggests a tall and robust individual, but it is entirely unknown what variations in body size and proportion might have accompanied the long history of occupation by this Archaic lineage as it colonised, settled and re-colonised across northwest Europe through the climatic cycles of the Pleistocene, prior to extinction and replacement by anatomically modern humans in the later part of the Devensian. A more detailed review of research questions and priorities arising out of this resource assessment follows in the Research Agenda below.

The South-East in national context

The South-East both presents unique factors lacking in the wider national record, and conversely lacks other aspects known from other regions. On the former front, the raised beach staircase of the West Sussex coastal plain is nationally unique and internationally important for its evidence of Palaeolithic occupation, and climatic and sea-level change through the Middle and Late Pleistocene. The high, immediately post-Anglian terrace of the Lower Thames in the Swanscombe area of north-west Kent is also unique for its preservation of a significant thickness of Hoxnian interglacial fluvial deposits over a wide area, rich in artefactual and faunal remains, and including undisturbed horizons. On the latter front, the thick Lower and Middle Pleistocene deposits of the Norfolk coastline preserve the only evidence so far discovered in Britain of phases of occupation significantly earlier than Boxgrove, evidence for which is lacking in the South-East. Deposits from early–middle phases of British Mousterian occupation are also lacking in the South-East, although known from Lynford Quarry in Norfolk and cave and rockshelter deposits in Wales, the South-West and the North. It is possible, however, that deposits of this age survive on the slopes beneath Oldbury Rockshelter; and the fissure-fill deposits at Beedings contain rare evidence of the latest phase of British Mousterian occupation.

It should also be emphasised that the Early Palaeolithic record is predominantly a southern British phenomenon. Periodic glaciation through the Pleistocene had led to the majority of Britain north of the M4 corridor being regularly covered by ice sheets, leading to repeated, widespread destruction of interglacial landscapes, and associated Palaeolithic evidence. It is only south of this impact that elements of earlier landscapes, such as drainage patterns, have survived. relatively undisturbed, so that relatively substantial areas of deposits from the Middle and Late Pleistocene have been preserved and can be placed into a chrono-stratigraphic framework; this combined with the artefactual and environmental remains recovered from the deposits forms the basis of our understanding of the Palaeolithic.

The extent of Early Palaeolithic occupation north of the M4 corridor remains uncertain. One might surmise that, if hominins are content and abundant in southern England, such as in the Hoxnian interglacial, they might well have penetrated northwards, as it is unlikely that there would have been sufficient differences of climate and local environment between northern and southern Britain to restrict hominin expansion. On the other hand, a significant factor in the viability of southern Britain for hominin occupation might have been the abundant availability of flint and chert for tool manufacture from southern Chalk and Greensand. Lack of these resources in northern landscapes may have restricted hominin expansion; alternatively they may have appropriated other lithic raw materials for tool manufacture or developed subsistence strategies less reliant on lithic tools. One way or another, lithic evidence of northern occupation is very scarce in the present day (Wymer 1999). There are a number of sites in the southern Midlands, especially Warwickshire (Wessex Archaeology 1996a), associated with rare instances of Middle Pleistocene fluvial deposits sealed beneath later glacial deposits. And there are very rare instances of Early Palaeolithic handaxes further north, either as stray finds of uncertain provenance, or from deposits caught up and reworked by glacial activity (Wessex Archaeology 1996b).

At present we have very little idea of regional variations in occupation intensity, subsistence adaptations and material culture, even within the relatively abundant record of southern Britain. It has, however, become apparent that the British Early Palaeolithic record cannot be considered as a homogenous whole, steadily developing through the period, with developments in one region mirrored in others. Rather, it appears likely that occupation was often highly localised, and that, at any particular period, material cultural changes in one region may have developed in totally different directions from others, particularly over long periods of time. Details of the texture and scale of this variation remain uncertain, however. It remains to be established, for instance, how/whether occupation intensity and material culture varied within the South-East through the Early Palaeolithic; and how important areas of known occupation within the region, such as the Lower Thames basin, compare/contrast with other important areas such as the Middle Thames, East Anglia and the Solent river basin. It also remains to be investigated whether subsistence adaptations were similar in all regions, and within the south-east region, or whether particular landscapes and resources led to the development of groups with different adaptations, and whether any such variations might have fostered the development of group identities, perhaps expressed either deliberately or unconsciously through material culture. These are all questions that remain to be addressed in subsequent decades of Early Palaeolithic research.

Economy

The concept of ‘Economy’ in the contemporary sense is not really applicable in the Early Palaeolithic, rooted as it is in the systematised production, exchange and consumption of goods and services, mediated through tokens of value or a record of credit. The economy of the Palaeolithic is generally characterised as a ‘Hunter-gatherer economy’, but this is a meaningless phrase referring more to their mobility and subsistence adaptation rather than anything economic. This simplistic characterisation also fails to address the key fact that we are dealing with different hominin species in the Early Palaeolithic, and it is questionable whether concepts that underpin modern human economic activity, even in the apparently simple hunter-gatherer context, such as worth and personal ownership, had any relevance in the Early Palaeolithic. Fundamental questions that could form the focus of a consideration of this period's ‘Economy’ are: (a) whether there was a concept of personal ownership; (b) how might this have been mediated, if/when present; and (c) what might have been the currency of ‘worth’, in the sense of what attributes of an object or place might affected its desirability or ‘value’?

On this basis, Early Palaeolithic economy could tentatively be characterised as an 'immediate ecology' economy, whereby you owned what you held, while you held it, whether object or territory, and life was a continual negotiation of your holdings with agents around, including fellow hominins and contemporary animals. The acquisition of valued resources such as meat, whether by hunting or scavenging, and choices and conflicts over their subsequent distribution within a group, perhaps provide an initial condition for development of concepts of ownership and value, that later expand into more recognisable patterns of economic behaviour within and between larger hominin networks. These initial foundations of economic activity are also present in basic primate ethologies, expressed for instance in chimpanzee society, such as sexual access in exchange for meat, or as a response to (apparent) signs of parenting skills. Analogous *quid pro quo* arrangements within early hominin groups may have geared to a new level of complexity once hunting groups were bringing back meat for sharing, particularly in the event of surplus supply.

It is worth remembering that by the time of the earliest occupation of Britain, despite a very simple lithic flake/core material culture, hominin societies had been evolving for several million years, and were successfully surviving the seasonality of these northern latitudes. By 500,000 BP, early in the period under discussion here, Archaic hominins were, in manufacture of their bifacial tools, implementing procedural templates that required both skilful execution and deliberate, anticipated design. Some artefacts such as antler soft-hammers would have been scarce and perhaps highly sought after, as well as requiring effortful trimming to maximise their utility. Other artefacts, such as wooden spears (for which we have indirect evidence at Boxgrove and direct evidence from Clacton-on-Sea and in Germany) would have been time-consuming to make and, once made, would not one imagines have been lightly abandoned. Bearing these facts in mind, it is possible that a rudimentary concept of personal ownership was in place, or developed through the Palaeolithic, and this may have formed the foundations of later more organised systems of ownership and economic exchange. Another key factor in development of an 'Economy' would have been development of societal organisation and complexity, which would have brought extra dimensions to negotiating and defending 'ownership'. In essence, for the Early Palaeolithic, there isn't a formal 'economy', but there is a discussion to be had about the origins of ownership and its negotiation, as precursors to development of economic-like activities such as exchange of equipment and ownership of resources.

Subsistence, diet and society

Archaic humans would have functioned within a group, and life would probably have been dominated by satisfying daily subsistence requirements, and by negotiation of status and sexual relationships. Items of personal equipment such as handaxes and spears, rather than watches and cars as in the present day, could well have been significant weapons in this social battleground, and the incredible attention paid to the size and symmetry of certain handaxes or Levallois cores probably reflects their function in the social arena rather than any practical concerns in relation to butchering efficiency. Cut-marks on animal bones from certain sites, and in particular Boxgrove (Roberts and Parfitt 1999), confirm the long-standing assumption that meat-eating was central to diet, an argument supported by our omnivorous dentition and the necessity for a high protein diet to support our brain development (Aiello and Wheeler 1995; Stanford and Bunn 2001). There is no unambiguous evidence of controlled use of fire until the later Neanderthals, although there are claims for its earlier use, for instance at the East Anglian site of Beeches Pit (Preece et al. 2006). Meat must therefore have been eaten raw through most of the Early Palaeolithic, emphasising the continual need to acquire it fresh. Gathered plant resources would probably also have been exploited, but these would only have been seasonally available. It is entirely unknown what, if any, food preservation or storage technology was in use through the Early Palaeolithic, so it is uncertain what combination of plant and animal resources contributed to the Early Palaeolithic diet, and how this varied through the year.

A number of studies over the last decades have suggested for the earlier stages of the Early Palaeolithic group sizes reaching 20–40 individuals with a home territory of c.30 x 30km, with group sizes increasing to 60–80 and territorial range to c.50 x 50km in the later stages (Gamble and Steele 1999). In respect of group organization and gender roles, little agreement has been reached, and discussion has often been reduced to recognition that there are dangers in uncritically extrapolating present arrangements and prejudices back into the prehistoric past, with the further problem that present arrangements are highly varied in societies around the world.

Concentration on prehistoric life as a world of male lithic production and hunting parties has been justifiably criticised, often on the basis not that the role of females has been unfairly misrepresented, but rather not considered at all. Certain inescapable facts must, however, have influenced division of activity on a gender basis. New-born young would have been dependent upon parental support for their survival, and, although one can envisage exceptions, this must usually, and especially initially, have involved close attention by the mother, the only parent equipped for breast-feeding. Subsequently, toddlers would have required education about their world, and protection from its dangers, while unequipped to fend for themselves and contribute to hunting activity. While still probably reasonably mobile and able to provision themselves with gathered resources, nursing and heavily pregnant mothers would have been constrained in wider-ranging and more physically arduous activities, such as locating and hunting the larger herbivores that were the preferred meat sources.

While there is no reason *a priori* why other females could not have participated fully in hunting and wide-ranging gathering activities, the incapacity of heavily pregnant females and the child-care responsibilities of new mothers would probably have led to increased male involvement, and this is certainly the case in chimpanzee societies, where males habitually range over wider distances and are more involved with hunting (McGrew et al. 1996). The greater muscle bulk and explosive performance capabilities of muscle fibres in the male physique would also have enhanced the likelihood of success in both hunting and the subsequent scramble for meat from a carcass. This would probably have had consequent societal benefits of high group status and sexual access, not to mention personal nutrition. Thus, if hunting is a key part of Early Palaeolithic adaptation, and many sites and nutritional studies suggest that was the case (Stanford and Bunn 2001), then there are grounds for arguing for development of a gender-based structuring of group activity, and perhaps for alpha-male leadership in Early Palaeolithic society. Paradoxically for some unduly androcentric perspectives, a division of labour between more mobile male hunting parties and more residential female-dominated groups might mean that the majority of lithic production at residential base sites, if such sites can be identified, would reflect female rather than male activity.

Finally, what was the size of these early humans and what did they look like? The fragments of skeletal material that we have are sufficient to confirm a fully bipedal hominin with a brain size approaching our own, or even exceeding it in the Neanderthal era. The tibia from Boxgrove indicates the extreme robustness of at least one very early Briton, perhaps similar to an international rugby player, and the fairly large number of continental Neanderthal remains gives a clear image of the general robustness, heavy brow ridges, long head and forward-jutting face of the final Archaics. Skeletal material from the intervening period, however, is restricted to very few specimens, none of which allows facial or post-cranial reconstruction. It is possible that post-cranial proportions would have varied with climatic change, with cooler conditions encouraging squatter body shapes, as is the case with Neanderthals. The large size of many handaxes, hammerstones and waste knapping debitage suggests that Archaic hominins would have been more robust and stronger than the majority of the present-day population. There are no archaeological indications of any form of clothing and, bearing in mind the cold climate, usually colder than the present day, one has to consider how survival was possible without fire or protective clothing in the latitudes of north-west Europe. A number of animals that colonised more northerly latitudes from a tropical origin developed increased fat and body hair to aid survival. These included the woolly rhinoceros and woolly mammoth, the remains of which have been found in the arctic permafrost. It seems highly likely, therefore, that Archaic hominins would have been adapted in a similar way and possessed increased subcutaneous fat and a thick furry pelt over the whole body.

Belief, ritual and funerary practices

Bearing in mind the lack of skeletal remains, it is hard to speculate on funerary practices through the Early Palaeolithic in Britain. In Spain, a concentration of hominin remains dating to c.350,000 BP from Sima de los Huesos at Atapuerca may indicate a deliberate disposal of the dead down a particular hole in the cave system; this possibility is supported by the association of a distinctive red quartzite handaxe that may reflect an offering some sort. This would suggest that hominins of this period had the capacity to consider dead individuals as something other than a source of extra food. Later in the Early Palaeolithic there is ever-increasing evidence of the Neanderthal capacity for symbolic and ritual behaviour, especially in relation to the dead. Long-standing reports of burials incorporating flowers, finely made artefacts and choice meat joints are problematic due to inadequate excavation methodology when these finds were originally recovered but may be genuine. More convincingly, the fact that a higher proportion of Neanderthal remains are recovered as relatively complete skeletons suggests deliberate burial. The recent discovery of perforated and artificially pigmented shells at a Neanderthal site in Spain provides definitive proof of personal adornment (Zilhao et al*.* 2010) and can even be interpreted as having contained pigment for bodily or facial decoration. Finally, Neanderthals had both a physiological capacity for vocalising and hearing speech, and the FOXP2 gene that has been linked with the modern capacity for articulating and interpreting streams of speech.

Overall, there is accumulated evidence that suggests a Neanderthal capacity for belief and ritual behaviour, and it is possible that the origins of this may persist further back in their Archaic ancestry. In the UK and the South-East, however, we to date lack any direct evidence of these capacities at any point in the Early Palaeolithic; although it has been argued (Wenban-Smith 2006) that the increasing variety and standardisation of handaxe types through the British Early Palaeolithic equally demonstrate these capacities, reflected for instance by the recent spectacular finds of both a cleaver and ficron handaxes close beside each other in the same horizon at Cuxton (Fig 11).

Figure 11. *Cleaver and ficron handaxes from Cuxton, found 2005 (Wenban-Smith 2006).*

Research Agenda

Introduction

It was recognised in the 1980s that curatorial management of the archaeological resource benefits from a framework of academic and research priorities, against which to consider the significance of sites and to guide their investigation. The seminal English Heritage publication *Exploring our Past* (1991) identified three main themes for national Early Palaeolithic research: physical evolution, cultural development and global colonisation. This was followed in 1999 with the introduction of three new strategic themes: colonisation, settlement and social organisation, by a committee of the Prehistoric Society (English Heritage/Prehistoric Society 1999). This revision was subsequently updated by a working group under the guidance of English Heritage, who have produced an expanded number of four ‘Primary Research Themes’, supplemented by eight further cross-cutting ‘Strategic Research and Conservation Themes’ (English Heritage/Prehistoric Society 2008). Many of these latest themes relate to issues such as training, curation and dissemination, which are without doubt of high importance at a wider framework and strategic level but are not considered here as part of the core research agenda.

This paper focuses on research priorities from an up-to-date academic viewpoint, to help guide curatorial decision-making and prioritise research efforts in the South-East, in order to contribute most effectively to increasing our understanding of the Early Palaeolithic. A general framework of primary research themes and framework priorities is presented, which are then related to the specific resource of the South-East through regionally specific objectives and projects that have potential to make an important contribution, not only to our understanding of the Early Palaeolithic in the region, but also to wider national and international research on the period. It should be remembered that south-east England is an important laboratory for international study of the period, being: (a) at a critical geographical position where Pleistocene climatic change has had significant effects, but where numerous deposits still survive (cf. Resource Assessment 5.2); and (b) at a critical demographic position, on the fringe of the Archaic hominin range, with a history of occupation known to include repeated periods of colonisation and absence. The region thus provides an important theatre to investigate the interplay of geographic/climatic and social/behavioural factors underlying the fundamental issue of hominin colonisation across the globe through the Early Palaeolithic.

Following the lead of the 2008 national framework, this paper develops three broad Primary Research Themes for the Early Palaeolithic complemented by three slightly more specific Framework Priorities that are still general in nature, and which cross-cut the primary themes. Following from this framework, a number of specific research objectives are put forward, focusing upon particular parts of the resource in the South-East, which have the most immediate benefits for addressing the wider themes and framework priorities. Finally, a number of specific projects are suggested, that seem of immediate relevance to this cascade of primary themes, framework priorities and regional objectives.

Primary research themes

Three broad primary research themes have been identified for Early Palaeolithic research in the South-East (Table 15), building on the recently published national research framework themes. A number of more-specific research issues are listed alongside these themes, illustrating the type of topics covered under each, but these are by no means exclusive or complete; many other research issues have relevance, and many issues have cross-over relevance between themes, and also with framework priorities. Theme 1, The Ice Age, directly asserts the importance of the Pleistocene, not just as an adjunct to hominin-focused questions, but as a theme of interest and relevance in its own right. This theme embraces the environmental and chrono-stratigraphic framework issues that it has long been argued (Wenban-Smith 1995) are directly relevant and provide a context to Palaeolithic archaeological research that may have increased resonance in the coming decades as man-made climate change permeates the public consciousness. It also engages with the development of the physical landscape in the present day, and the past presence in the UK of exotic mammals such as cave bears, rhinoceroses and woolly mammoths.

Primary theme 2, Colonisation and Demography, covers the same ground as the similarly titled theme two of the national framework. It covers both the facts of hominin presence, including both intra-regional distribution of settlement and presence/absence of occupation at the national/regional scale, and debate over the processes and ecology of colonisation (and its converse, when populations ceased to exist — whether by migration, or local extinction).

The third primary theme, Becoming Human, likewise follows the national framework, covering behavioural and material cultural aspects of Archaic adaptation more directly. It is this theme that covers the basic field of documenting and explaining technological and typological details of lithic material culture through the Early Palaeolithic, as well as consideration of less tangible social and behavioural aspects such as speech, ritual, social organisation and logistic planning.

Framework priorities

Complementing these primary research themes, three framework priorities have been identified that facilitate the progress of primary research (Table 16). The first of these, "Understanding the Record", is fundamental to interpretation of any archaeological remains that are found, addressing site formation processes, post-depositional disturbance, preservation bias and taphonomy. These are particularly important issues for the Early Palaeolithic record, with the wide range of depositional environments represented in surviving Pleistocene deposits, and debate over the potential importance of lithic remains from fluvial gravel contexts.

Framework priority 2, "Dating Frameworks", is likewise a self-evidently critical theme for Early Palaeolithic studies, providing the basic chronological order for events, allowing us to examine changes both within and between regions, and at wider scales, between countries and climatic/geographic zones. Great progress has been made in chronometric dating over the last decade with increased use of optically stimulated luminescence (OSL) and significant technical advances in amino acid racemisation (AAR). Further attention is needed, however, to refine both the precision of these techniques, and to expand their range. It is also possible that we might find new ways of dating - a team in Canada is currently working on ‘skinflint dating’, for instance, whereby the time elapsed since a piece of flint is knapped is calculated by differences in radiation absorption between the freshly knapped surface and the interior (Schwarcz and Rink 2001). This would obviously revolutionise Early Palaeolithic studies if it can be shown to work over the appropriate time range, although this has not yet been achieved. There are also continual advances in other methods such as cosmogenic dating, thermoluminescence (TL) dating of burnt material and Electron Spin Resonance (ESR). There is also further work to be done refining the bio-stratigraphic framework for the British Pleistocene which, although very useful as presently understood, is also often somewhat circular, and insufficiently founded on independent chronometric and lithostratigraphic foundations

Table 15. *Primary Research Themes for the Early Palaeolithic in the South-East*

Primary Research Theme	*Typical related research issues*
1. "The Ice Age"	Developing understanding and dating of regional Pleistocene environmental, climatic and litho-stratigraphic frameworks
	How did Pleistocene climate and sedimentary processes contribute to development of present-day landscapes?
	Conversely, what stories of Pleistocene climate and depositional process are reflected in today's landscapes?
	What faunal communities, including extinct tropical and cold-adapted species, previously were present? And what are the climatic and palaeo-environmental implications of recovered fossil communities?
	What effect did Pleistocene climate change have on British environments and faunal communities?
2. Colonisation and demography	Patterns of colonisation, settlement and abandonment through the Pleistocene - were there significant periods when the South-East was deserted? How densely were landscapes settled? And how were activities and occupation organised within landscapes?
	What was the climatic and environmental context of Archaic settlement, and the relationship between climate/environment and colonisation?
	Dating of artefact-bearing deposits within regional, national and international Quaternary frameworks
	What were the biological relationships between British and continental populations?
	When occupation ceased, did the hominins migrate, or did they die out *in situ*?
	What factors constrained/influenced the expansion and viability of hominin populations?
3. Becoming human	Documentation and explanation of diachronic and synchronic patterns of material cultural variability
	Behaviour of Archaic hominins: (a) at specific sites; and (b) across the wider landscape
	Extent of contrasts in Archaic and anatomically modern human behaviour and adaptations, and in fundamental cognitive capacities such as speech and forward planning
	Improved documentation and understanding of hominin physiological evolution
	Investigation of the relationship between evolutionary, behavioural and material cultural change
	Social organisation, behaviour and belief systems
	Models for cultural transmission and learning

The third framework priority, "Curating the Resource", recognizes the importance of carrying out specific projects and programmes that help curators to manage the Palaeolithic/Pleistocene resource effectively. Under the National Planning Policy Framework, the consideration of archaeological potential as part of the planning process provides the key to unlocking the significant Palaeolithic potential of the Pleistocene resource. Many developments impact upon this resource, with major impacts made by mega-infrastructural projects such as road schemes and the HS1 Rail Link, which involved a huge programme of archaeological works of all periods, including the Early Palaeolithic.

It is vital, therefore, to ensure that curatorial decision-making is supported by appropriate models and metadata, developed by specialists in conjunction with curators, and packaged/signposted in as curator-friendly a way as possible. As discussed in the accompanying Resource Assessment), the Pleistocene resource is generally highly variable, poorly characterised and of unpredictable Palaeolithic importance. A number of projects could usefully be carried out to try and improve characterisation of the resource, and to model its distribution and potential so as to highlight, even very crudely, areas of the landscape where it may be more worthwhile to seek field evaluation.

It is also necessary to recognize the threat of inaction in certain circumstances, even when no development is proposed. The Palaeolithic/Pleistocene resource can be highly vulnerable to passive degradation in coastal locations, or in areas where deposits survive, but where the surrounding landscape has been affected by development, exposing sediments to natural processes such as rain and/or plant growth, or perhaps altering the water table leading to *in situ* deterioration of important remains.

Table 16. *Framework Priorities for the Early Palaeolithic in the South-East*

Framework Priorities	*Typical related research issues and focus areas*
1. Understanding the record	Improving models of Palaeolithic site formation and post-depositional modification
	Lithic provenancing studies
	Modeling of raw material distribution
	Experimental investigations of raw material suitability for tool manufacture
2. Dating frameworks	Developing understanding and dating of regional Pleistocene environmental, climatic and litho-stratigraphic frameworks
	Developing improved techniques for AAR and OSL dating, to improve accuracy and expand range
	Refining biostratigraphic frameworks through more detailed anatomical studies; improved chronometric dating; and better litho-stratigraphic controls
3. Curating the resource	Improved mapping/modeling of Pleistocene deposits
	Developing approaches to modeling the likely presence/prevalence/importance of any Pleistocene deposits and/or Palaeolithic remains
	Managing/mitigating passive effects of ongoing natural erosion/degradation, as opposed to just threats posed by

	active development
	Expanding Quaternary/Palaeolithic awareness in the curatorial community
	Refining/expanding HER databases of Palaeolithic and Quaternary records
	Expanding professional training for distinct Quaternary/Palaeolithic field investigation techniques
	Developing and promoting appreciation and understanding of the Palaeolithic and the Pleistocene in the wider community

Research objectives and priority projects

Specific research objectives for key resource areas/elements

Objectives for Early Palaeolithic research in the South-East for all parts of the resource revolve around the primary themes and framework priorities outlined above. A number of current priority research objectives for the region are summarised below, following consultation with the research community engaged with the South-East. These are mostly grouped by deposit types, with the addition of some objectives that are not restricted to a specific deposit type. It should be emphasised that these are a selection of current objectives, and not a prescriptive list. Many have strong overlaps with each other, and many unlisted objectives and questions could make a major contribution to current research. They have, nonetheless, been allocated unique identifying numbers, to facilitate cross-referencing with suggested specific projects.

Clay-with-flints

- 1 - Can individual artefacts from Clay-with-flints deposits be dated on the basis of condition and/or patination: (a) to the Palaeolithic; (b) to any particular stage of the Palaeolithic?

- 2 - Can any infilled dolines with stratigraphically/chronologically constrained beds containing Lower/Middle Palaeolithic material be identified in areas of Clay-with-flints deposits? And if so, how frequently do they occur, and how can they be remotely detected in advance of development?

- 3 - How did Lower/Middle Palaeolithic activity at outcrops of Clay-with-flints fit in with behaviour across the wider landscape?

- 4 - Was there activity of similar nature/intensity at outcrops of Clay-with-flints throughout the Lower/Middle Palaeolithic, or is there differential patterning at different stages?

Fluvial deposits

- 5 - How disturbed/transported are Palaeolithic remains in fluvial contexts?

- 6 - Are there levels or geographic/topographic zones within deposits that are more likely to be richer in Palaeolithic artefactual remains?

- 7 - Improved mapping, longitudinal correlation and dating of terrace systems within major river valley and tributary systems (Lower Thames, Stour, Medway, Arun, Rother, eastern Solent Basin, Wealden rivers)

- 8 – Are there correlations of terrace units between basins/systems?

- 9 – What is the relationship of terrace formation with tectonic uplift, climate change and marine isotope stage (MIS) framework?

- 10 – Can characterisation of occupation (technological/typological change, presence/density of occupation) in specific terrace units be combined into a regional/basin picture?

- 11 – What is the relationship of fluvial terrace systems with the Sussex raised beach sequence?

- 12 - Modelling of fluvial deposit zones/types more likely to contain undisturbed or minimally disturbed remains and biological remains

Raised beaches

- 13 - Improved mapping, sub-surface deposit modelling and dating of raised beach deposits from the Aldingbourne cliff-line to the present coast; in particular further work on the date of the Aldingbourne raised beach, which is currently variously attributed to MIS 7 or MIS 11

- 14 - Modelling of raised beach deposit zones/types more likely to contain undisturbed or minimally disturbed remains and biological remains

- 15 - Relationship of Sussex raised beach sequence with fluvial terrace systems, particularly local systems of the Arun, Lavant and Rother?

- 16 - Survival of sediments of the Slindon Formation under dry valleys should be elucidated

Colluvial/solifluction/aeolian deposits

- 17 - Identification of areas of colluvial/solifluction deposits that may contain undisturbed or minimally disturbed concentrations of Palaeolithic remains (cf. Red Barns)

- 18 - More attention to ‘Brickearth’, and characterisation as colluvial or aeolian (or fluvial)

- 19 - Mapping and dating of loessic sediments, and modelling of likelihood of any contained Palaeolithic remains

General objectives

- 20 - Identification, and more precise dating, of late Lower/Middle Palaeolithic and British Mousterian occupation

- 21 - Identification and dating of Early Palaeolithic occupation in the Weald

- 22 - Investigations into the relationship between raw material nature/quality/availability, mobility and the organisation of activity in the landscape

- 23 - Correlation and integration into a chrono-stratigraphic framework of Sussex raised beach deposits and major fluvial terrace systems within the region (such as the lower Solent Basin, the Lower Thames, the Medway, the Stour)

- 24 - Patterns of technological/typological change through the Early Palaeolithic, and contrast/similarities with adjacent regions such as the Solent Basin, the Thames Valley/London Basin and East Anglia

- 25 - On-shore Pleistocene stratigraphy should be correlated with the channel and near-shore sediments at the current coastline, and off-shore continuations of terrestrial sediments characterised and assessed for their Palaeolithic potential

- 26 - Prospecting for new contexts: for example, periglacial features, structural faults preserving buried surfaces, Sackung fissure fills

- 27 - Investigations on how the date and taphonomic history of artefacts is reflected in aspects of their condition, such as: staining, patination, edge abrasion and surface scratches.

Specific and immediately desirable projects

Ten specific projects (P1–P10) have been identified that would make an immediate contribution to understanding and/or curation of the Early Palaeolithic resource in the South-East. These are summarised below, together with their relevance to the newly defined regional Primary Research Themes and Framework Priorities (Table 17).

- **P1 - HER Review.** Review and update of county and unitary authority HER structures and practices in relation to Early Palaeolithic and Pleistocene evidence — different counties in the South-East may have different arrangements, and relevant information for Palaeolithic remains may not always be adequately included, which may impact upon curatorial effectiveness. For instance, many Palaeolithic sites recorded in the Southern Rivers Project (Wessex Archaeology 1993 & 1994) were not present in the Kent HER prior to the work of the Stour Basin Palaeolithic project. This HER review doubled the number of Palaeolithic sites in the study area and corrected numerous errors on their nature and location. An expanded review across the South-East, perhaps integrated into a GIS predictive model (cf. P2, below) would greatly facilitate more effective management of the Palaeolithic resource.

- **P2 - Early Palaeolithic Predictive Modelling.** Expert review of the region, counties, or specific areas, to model/predict areas of, for instance: more likely, less likely and unknown Palaeolithic/Pleistocene potential — this will always be a fuzzy task, and previous experience suggests a problematic one, particularly when applied to large areas. However, we now should be in a position to compare and critically review previous approaches, for instance as applied to the Thames Gateway (Wessex Archaeology 2006) and in the Medway Valley Palaeolithic Project (Wenban-Smith et al*.* 2007a, b), and at least clarify the optimal approaches to this task and its suitability in particular circumstances.

- **P3 - Fluvial taphonomy.** Intensive surveys of the spatial and vertical distribution of Palaeolithic remains in a variety of artefact-bearing fluvial deposits of differing depositional energies, bedrock geologies and topographic situations. The terrace deposits around Farnham might be a suitable area for a study of this sort.

- **P4 - Preliminary terrace surveys.** Systematic fieldwalking of fluvial gravel outcrops in selected areas to provide baseline information on the possible presence of Palaeolithic remains in as-yet-uninvestigated areas - higher terrace deposits around Farnham might be suitable area for a study of this sort.

- **P5 - Wealden Palaeolithic Survey.** The presence of Early Palaeolithic remains within the Wealden basin is of particular interest, as they may reflect mobility away from the surrounding flint-rich chalk hills. A useful study would be to review the locations of known findspots within the Weald and the raw materials used, and to relate this to a model of raw material availability within the Weald. This study could be complemented by targeted field investigations on intra-Wealden terrace deposits known to have produced material, such as at Marden, south-east of Maidstone (Kent).

- **P6 - Harrison archive review.** It should be possible, using the archive held at Maidstone Museum, which is based on Harrison's catalogue system, to tie in his copious artefact illustrations with specific landscape locations, and, from his illustrations, to distinguish handaxes from eoliths and to carry out a basic technological/typological assessment. There is also a wealth of ancillary information about the Eolith debate and the late 19th century antiquarian world that could form the basis of museum displays and/or academic papers.

- **P7 - St. George's Hill, Surrey.** Test pitting to investigate geological sequence and Palaeolithic remains in order to date the deposits, and to clarify whether the finds from the vicinity represent pre-Anglian occupation.

- **P8 - Farnham Terrace Survey.** Not much work has been carried out on the Early Palaeolithic remains and potential of this rich archaeological area for many decades. This area could benefit from a re-appraisal of geological mapping, identification of surviving deposits, and targeted investigations (perhaps linked in with a preliminary field survey, cf. P4 above) to investigate artefact distribution and taphonomy, and to date and characterise deposits.

- **P9 - Hidden landscapes.** Certain areas have been identified in the Resource Assessment as possibly wrongly-mapped geologically, and/or of high Palaeolithic potential. These areas include: the buried channel at Dunsfold Aerodrome (Cranleigh, Surrey); the brickearth/Head Gravel landscape of the Gillingham-Sittingbourne-Faversham area; residual/Head deposits of the Oldbury (Kent) and Limpsfield (Surrey) areas; and various elongated patches of Coombe/Head deposits that may conceal buried fluvial terraces, such as near South Darenth (Kent). Further field investigations in areas such as these would clarify their formation processes and Palaeolithic potential, and maybe reveal some 'hidden landscapes'.

- **P10 - First presence?** Until the 1980s, the Anglian glaciation was regarded as a watershed moment in Early Palaeolithic occupation, with older deposits regarded as of no possible archaeological potential. However, it is now clear that hominins were intermittently present in the UK well before the Anglian. A useful project would be to review/model the distribution of likely pre-Anglian early Middle Pleistocene deposits, and then to sample systematically a selection for evidence of these early occupations. High-level deposits of the Thames, Medway and Stour have particular potential, as well as various patches mapped as 'Plateau Gravel'.

Table 17. *Specific Projects for the Early Palaeolithic in the South-East*

	Related research themes		
Specific Project	*Regional Objectives*	*Primary Themes*	*Framework Priorities*
P1 - HER Review	-	-	3
P2 - Early Palaeolithic Predictive Modeling	-	-	3
P3 - Fluvial taphonomy	5, 6, 10, 12, 24, 27	2, 3	1
P4 - Preliminary terrace surveys	7, 8, 10, 20, 21	1, 2, 3	1, 2, 3
P5 - Wealden Palaeolithic Survey	21, 22	2, 3	1
P6 - Harrison archive review	2, 3, 4, 17, 20	2, 3	3
P7 - St. George's Hill, Surrey	10	1, 2, 3	3

P8 - Farnham Terrace Survey	5, 6, 10, 12, 21, 22, 24	1, 2, 3	2, 3
P9 - Hidden landscapes	7, 12, 17, 18, 20	1, 2	2, 3
P10 - First contact	10, 21, 24	1, 2, 3	2, 3

Summary, conclusions and transition to the Upper Palaeolithic

The Early Palaeolithic in the South-East

The South-East is a key region for study of the Early Palaeolithic in the UK. It contains a wide range of deposits, extensively distributed, and unaffected by the glacial activity that has ravaged much of the UK through the Pleistocene. As such, the region provides an archive of information from throughout the Early Palaeolithic, from which it is important to derive the maximum benefit. The evidence from the South-East complements that from other regions - particularly the South-West, Solent-Thames and Eastern England - providing points of comparison and contrast that contribute to a full understanding of the Early Palaeolithic in Britain.

There are numerous difficulties to be overcome in developing curatorial approaches that will effectively mitigate the impact of development upon this Early Palaeolithic resource. It is patchily and unpredictably distributed, and it cannot be easily characterised. Even once deposits of potential interest have been identified, the presence of particularly important evidence cannot be reliably anticipated at specific locations. Most importantly perhaps, there are fundamental philosophical hurdles to be overcome in recognizing the crucial importance for Palaeolithic research of: (a) geological recording and palaeo-environmental investigations; and (b) the incremental accumulation of minor pieces of data, concerning for instance geological sequences at numerous points across a landscape, complemented by data on the presence/absence/prevalence of artefactual remains tested by controlled sieving. These interventions, even at sites lacking artefactual evidence, make an important contribution to the study of the Palaeolithic, providing the wider framework within which artefactual remains of the period can be understood. However, what would be particularly desirable, and this perspective is supported in the most recent national Research Framework (English Heritage/Prehistoric Society 2008), would be for research and understanding of the Pleistocene period itself to be recognized as of cultural value and a planning consideration, not merely the hominin Palaeolithic presence. Pleistocene deposits, supported where possible by palaeo-environmental evidence, provide a story of climate change and landscape development of intrinsic interest and value, providing a deep-rooted connection with the local landscape notwithstanding any relevance to the hominin-oriented Palaeolithic past.

The Research Agenda set out above, identifies research priorities and specific projects that reflect the particular potential of the Pleistocene/Palaeolithic resource in the South-East, within the context of the wider national framework.

Transition to Upper Palaeolithic

The scarcity of evidence suggests that even the hardy Neanderthals struggled to survive in the cold climate of the last glaciation, and they never reached large populations in the northern latitudes of the UK, which was probably at the northern limit of their range. After the well-attested presence of (presumed) early Neanderthals in southern England in the period MIS 10-8 at sites such as Purfleet (Bridgland et al. 2013), Harnham (Bates et al. 2014) and Baker's Hole (Wenban-Smith et al. 2020), Britain seems to have been uninhabited during the warm interglacial of MIS 5e. After this, there seem to have been occasional Neanderthal incursions from the continent, or a very low population that has only left sporadic traces, represented by sites such as the M25 Junction 2 near Dartford dating to MIS 5d-5b (Wenban-Smith et al. 2010) and Lynford dating to late MIS 4 or early MIS 3 (Boismier et al. 2012). In the middle of the last glaciation, during the climatic amelioration of MIS 3 between c.60,000 and 40,000 BP, the Neanderthal world was challenged by the arrival in western Europe of anatomically modern humans. Their first influx seems to have occurred from the south-east, perhaps along the Danube, and then they steadily expanded west into France, then north into the UK and Benelux regions, and southwest into Spain. There must have been direct overlap and inter-species confrontations as modern humans expanded their range into territories occupied by Neanderthal groups. The nature of these interactions and the possible role of modern humans in the extinction of the Neanderthals remain open to speculation. Although not totally clearcut, the widely claimed persistence of Neanderthal genes in present-day European populations suggests that some inter-breeding must have taken place. Neanderthal genocide is unlikely. There is no evidence of Neanderthal–modern human conflict, either from skeletal pathology or archaeological remains. Populations would have been so low that the types of tribal conflict characterised as genocide in the present day would have been inconceivable.

However, it does seem from the archaeological record that they did not happily co-exist, as there is a clear trend for displacement of Neanderthals by moderns, leading to the last known relict populations of Neanderthals surviving c.40-35,000 BP in the highlands of the Pyrenées, on the France/Spain border, and on Gibraltar, at the southern tip of Spain (Higham et al. 2015. Zilhao et al. 2017). It is most likely that the influx of modern humans upset the ecological balance of Neanderthal adaptation in some way, making co-existence impossible, and leading to their extinction with minimal direct interaction. Perhaps moderns were more effective at exploiting the same animal resource or over-exploited a plant or game resource that had a catastrophic knock-on effect, or maybe modern humans were more successful in adapting to the deteriorating climate between 40,000 and 20,000 BP (van Andel and Davies 2003).

In the South-East, it is possible that late northern relict Neanderthal populations might have been present in MIS 3 (perhaps reflected by the evidence at Beedings), but the deteriorating climate would have posed problems. It is possible that, when anatomically modern humans first appeared in the region in MIS 3 - perhaps as early as c.40,000 BP (calibrated radiocarbon years) based on their presence in the South West, since direct evidence of this initial phase of occupation is lacking in the South-East (unless one takes an alternative interpretation of the Beedings evidence as of unexpectedly early modern human presence) - Neanderthals were also present. However, it is more likely that the South-East was virgin territory from the hominin perspective when first occupied by modern humans in the later part of MIS 3, and that the early Upper Palaeolithic presence before the Last Glacial Maximum was itself very tenuous.

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Sheet 286, Reigate (1978); Dines, HG (1933).
Sheet 287, Sevenoaks (1971); Dines, HG (1969).
Sheet 301, Haslemere (1981); Thurrell, RG (1968).
Sheet 302, Horsham (1972) [1"]; Gallois, RW (1993).
Sheet 303, Tunbridge Wells (1971) [1"]; Bristow, CR (1972).

Kent

Maps (1: 50,000, Solid and Drift) & Memoirs
Sheet 271, Dartford (1998); Ellison, RA (2004).
Sheet 272, Chatham (1977); Dines, HG (1954).
Sheet 273, Faversham (1974); Holmes SCA (1981).
Sheet 274, Ramsgate (1980); Shephard-Thorn ER (1988).
Sheet 287, Sevenoaks (1971) [1"]; Dines, HG (1969).
Sheet 288, Maidstone (1976); Worssam, BC (1963).
Sheet 289, Canterbury (1982); Smart, JGO (1966).
Sheet 290, Dover (1977); Shephard-Thorn ER (1988).
Sheet 303, Tunbridge Wells (1971) [1"]; Bristow, CR (1972).
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