Project stream 4G1: Palaeolithic and Mesolithic archaeology

Project 6637
Stour Basin Palaeolithic Project:

Final Report

Version 2.1

Kent County Council, Heritage Conservation

Project contact details

Stour Basin Palaeolithic Project

Paul Cuming (Project Manager)

Historic Environment Record Manager

Kent County Council

Invicta House

County Hall

Maidstone

ME14 1XX

Tel: 03000-413 358

Email: paul.cuming@kent.gov.uk

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Project summary

This is a final report on the *Stour Basin Palaeolithic Project*. The project, funded by English Heritage, took place between February 2013 and March 2015. Its main concern was to improve curation of the Palaeolithic historic environment in the potentially important Stour Basin area, which is also an area of high development pressure. The project carried out a major enhancement of the HER in the project area and produced a broad predictive model that identified and characterised areas of Palaeolithic potential. It also developed advice for practitioners on how Palaeolithic archaeology is curated in Kent and a specification for desk-based assessments of the Palaeolithic resource. It has also developed a Toolkit for use of Kent’s curators. It also carried out some fieldwork that improved understanding of the Palaeolithic resource in the project area. A staircase of buried terrace deposits was shown to be present in the Chislet area northeast of Canterbury, and robust dating evidence was obtained from one level which can be extrapolated back to tie in with the terrace staircase at Canterbury, some levels of which have produced abundant Palaeolithic remains. It was also confirmed that some plateau brickearth outcrops are considerable earlier than late Devensian, and thus have higher potential than hitherto widely presumed. This latter result has wider ramifications for mapped brickearth deposits beyond the project area.

This report includes suggestions for further future work that could build on the results presented here to further improve management and curation of the Palaeolithic resource. In particular, it would (a) seem important to carry out further work to ensure that Palaeolithic representation in HERs is improved, and (b) it would be valuable to explore (with a view to optimising) varying approaches to predictive modelling of the Palaeolithic resource. An outline proposal is also submitted for further analysis and reporting on the archive resulting from the fieldwork element of the project (**Appendix 8**). This was beyond the scope of the current project, the focus of which was identifying the importance of Pleistocene deposits through assessment of their palaeo-environmental potential, rather than carrying out full analyses and reporting on any palaeo-environmental remains encountered.

1. Introduction

The *Stour Basin Palaeolithic Project* — henceforth, "the project, or the Stour project" — was a Kent County Council Heritage Conservation project, carried out in collaboration with Department of Archaeology, University of Southampton, Canterbury City Council and Canterbury Archaeological Trust. The project was funded by English Heritage as part of a wider programme concerned with enhancing curation of the Palaeolithic and Mesolithic historic environment. The project, which was carried out between February 2013 and March 2015, was focused on the Stour catchment basin in the north-east quarter of Kent, covering the planning districts of Swale, Ashford, Canterbury, Thanet and Dover (**Figure 1**).

This report represents the Final Report of the project. It provides an overview of the project background, objectives and methods. It then reviews the project results, and provides some discussion of how successful these were in achieving the project objectives. Suggestions are made on the best directions for further work to build on the results of project, with the ultimate goal of continuing to acquire information and improve curatorial practices so as to ensure safeguarding and promotion of the Palaeolithic historic environment.

This Final Report has been prepared by the project's Palaeolithic specialist (Francis Wenban-Smith, Department of Archaeology, University of Southampton) in collaboration with members of the KCC Heritage Conservation Team (Lis Dyson, KCC Heritage Conservation Manager; and Paul Cuming, KCC Historic Environment Record Manager).

2. Background

2.1. Circumstances of the project

Kent County Council's Heritage Conservation team has for a while been aware that understanding of the Palaeolithic heritage in the county has significant gaps, leading to concern over unmitigated threats to this resource in the face of high development pressures in the county. The Stour Basin is relatively un-investigated compared to other parts of Kent, such as the Lower Thames and Medway valleys, which have been the focus of previous Aggregates Levy projects and large-scale commercial investigations such as in advance of High Speed 1. The project is in an area of high development pressure, which also contains a rich and extensive Palaeolithic resource. Some immediately threatened parts of the resource are known to be of high potential, and other threatened parts of which are of uncertain or unappreciated potential. More details of the Palaeolithic resource and threats to it are given below (**Sections 2.3**, **2.4**).

The project had its origins in a proposal called the '*Stour Valley Palaeolithic Project*' that was submitted to English Heritage under a previous call for projects (2D4.301) in December 2011. That proposal was not accepted but the KCC team were later invited to re-submit an amended and developed proposal in a subsequent call for projects (3A3.202 and 4G1.401) in September 2012, leading to acceptance of the Project Design in February 2013 (KCC Heritage Conservation Team 2013).

2.2. Study area: the Stour basin

The project is focused on the Stour catchment basin in north-eastern Kent, covering the planning districts of Swale, Ashford, Canterbury, Thanet and Dover (**Figure 1**). This area includes the north-eastern part of the Wealden basin and the Wealden scarp, the eastern part of the chalk hills of the North Downs, which dip shallowly down to the northern and eastern Kentish coastline, and the chalk plateau of the Isle of Thanet. The Stour valley forms the main drainage axis of the project area, rising inside the Wealden basin, passing through the Wealden scarp north-east of Ashford, and then draining north-east towards the Isle of Thanet, where it drains around the Isle both northwards (via the River Wantsum) and eastwards, entering the sea at Pegwell Bay. Various tributary valleys extend sideways from the main Stour valley, notably the East Stour and the Little Stour, but many of them are dry valleys in the present era.

2.3. The Palaeolithic resource in the Stour Basin

At the start of the Stour project, the most up-to-date information on the Palaeolithic resource in the study region was provided by "SERF". This new historic environment Research Framework for the South-East region (see **Section 2.5** below; and Wenban-Smith *et al.* 2010a) included a review of the Palaeolithic resource that was as up-to-date as possible in 2010, including findspots recorded in the *Southern Rivers Palaeolithic Project* (Wessex Archaeology 1993) and subsequently-reported discoveries in the Kent Historic Environment Record. This review demonstrated that the Stour basin contains a rich Palaeolithic resource, described in more detail below. Some parts of this resource already recognised as of high potential are threatened by imminent development proposals. Other parts of uncertain potential, or potentially unappreciated significance, are also threatened.

The study area contains three main groups of Pleistocene deposits known to have produced Palaeolithic remains (**Figure 1**):

- Terrace deposits: fluvial silts, sands and gravels
- "Head/Brickearth" deposits: varied colluvial and/or aeolian depositional processes

- Clay-with-flints: palimpsests of residual material on long-term landsurfaces

2.3.1. Terrace deposits

There are relatively abundant outcrops of high-level pre-Anglian terrace deposits that are thought (at Fordwich, Canterbury) or suspected (at other areas, such as in the Blean plateau, to the north of the main Stour) to contain rare evidence of early pre-Anglian occupation, dating to 700,000 - 500,000 BP [years Before Present]. Britain was then unoccupied during the Anglian glaciation, but middle-level terraces in the vicinity of Canterbury contain exceptional concentrations of artefacts (eg. at Sturry and at Howlett's), representing evidence of re-settlement in the period after the Anglian Glaciation from 425,000 - 250,000 BP. Other lower/middle level terrace deposits a little to the north-east of Canterbury (at Chislet, on the west side of the Wantsum Channel) contain rare environmental remains, as well as having produced occasional artefactual remains.

The main Stour valley is associated with extensive outcrops of Middle-Late Pleistocene fluvial terrace deposits, occurring up the valley sides up to *c.* 40 m above the current river surface level. These occur all along its length, but particular concentrations are present: (a) in its upper stretch to the northwest of Ashford, where it flows along the foot of the Wealden scarp; (b) at Ashford and Kennington, where there is a drainage "pinch-point" where the intra-Wealden drainage network converges and breaches the Wealden scarp; (c) on the northern bank of the Great Stour in the vicinity of Canterbury; and (d) in the contained area of ground between the Great Stour at Canterbury and the Little Stour. There are also deeply buried and little-investigated Pleistocene fluvial deposits in the lower ground surrounding the Isle of Thanet, in the vicinity of the River Wantsum, and the lowest stretches of the Stour as it approaches Pegwell Bay to the south of the Isle of Thanet.

These fluvial terrace deposits have been well-known since the late 19th century as a Palaeolithic resource (Evans 1897), with dense concentrations of lithic finds known in some areas, often minimally disturbed; although other areas remain of unknown potential due to their lack of investigation. The *Southern Rivers Project* (Wessex Archaeology 1993) identified *c.* 25 findspots directly associated with fluvial terrace deposits in the eight maps S1-S8 covering the River Stour and its tributaries. Most of these are in the Canterbury area, where there has been the most intensive history of quarrying and research, but some are also from fluvial deposits in the Dover and Ashford areas.

Pleistocene fluvial deposits are well-recognised as a prime Palaeolithic resource, with the potential to contain minimally disturbed horizons of occupation and palaeo-environmental remains, as well as more disturbed/transported material that is nonetheless of value in developing the broad picture of settlement and cultural change through the Palaeolithic. It is additionally beneficial if outcrops along a river valley can be placed into a robust chrono-stratigraphic framework to (a) maximise the interpretive potential of finds already made from known sites, and (b) help model the potential of uninvestigated terrace outcrops. This remains to be achieved for the Stour Valley, which has not yet been subject to investigations for these purposes.

2.3.2. Head/Brickearth deposits

However, the most notable aspect of northeast Kent is the abundance of Head/Brickearth deposits, and the known or potential importance of the associated Palaeolithic remains. Deposits of this group are distributed extensively throughout the project area, but the most significant outcrops are: (a) in its northwest quadrant, between Sittingbourne and Faversham; (b) in the vicinity of Canterbury; (c) between Canterbury and Deal; (d) on the Isle of Thanet; (e) overlying the higher parts of the Clay-with-flint spread capping the North Downs inland from Folkestone and Dover; and (f) in the gap where the Stour valley cuts through the Wealden scarp, in the vicinity of Kennington.

These "Head/Brickearth" deposits have produced substantial numbers of Palaeolithic finds in the project area, with *c.* 80 findspots recorded in the *Southern Rivers Palaeolithic Project* (Wessex Archaeology 1993), with recovery of more than 400 handaxes, and 6 (all from different sites) of the distinctive (and nationally rare) Middle Palaeolithic *bout coupé* form thought to be associated with Neanderthal occupation in the last glaciation, *c.* 80,000 - 50,000 BP (years Before Present). Palaeolithic finds seem (on present knowledge) to be concentrated in four of the above-listed areas, namely in the vicinities of:

- Sittingbourne and Faversham, where there are important known sites at Bapchild and Ospringe;
- Canterbury (where there have of course been the most intensive investigations), and where important known sites include Wincheap, Vauxhall Pit and Martyr's Field;
- inland from Folkestone/Dover, where important sites include Elham;
- and Deal, where there is no individual important site, but a marked concentration of stray finds, including some from well-provenanced brickearth contexts, such as a Levallois core from more than one metre deep in brickearth excavated for a private swimming pool at Great Mongeham.

As well as some Levalloisian material of uncertain date, brickearth deposits in Swale, Thanet, Dover and Canterbury seem to contain an unusually high representation of nationally rare British Mousterian remains (*bout coupé* handaxes) associated with Neanderthal occupation in the last ice age, between c.

80,000 and 50,000 BP. Most brickearths are thought to have been laid down during the peak of the Last Glacial Maximum *c.* 20,000 BP (when Britain was unoccupied) and therefore to be of low Palaeolithic potential. One particular goal of the project is therefore to investigate the date of brickearth deposits, and find out if any of them date pre-35,000 BP and therefore have potential for rare Neanderthal or pre-Neanderthal remains.

Particularly important brickearth sites are at Bapchild, near Sittingbourne, Ospringe near Faversham, and various sites in the vicinity of Canterbury. At Bapchild the lithic material from the upper part of the brickearth appears to be of late Upper Palaeolithic character, another rarity in the UK. Another important known site where *bout coupé* handaxes have been found is at Elham, inland from Folkestone. Here, although geological mapping indicates a wider sub-surface context of Clay-with-flint, it is more likely that these have been recovered from a little-understood sandy brickearth deposit that caps the Clay-with-flint here. Similar outcrops cap the Clay-with-flint across much of northeast Kent, and merit further investigation to understand them better.

2.3.3. Clay-with-flints

Clay-with-flints is the third main Pleistocene deposit in the project area. This is a residual deposit that caps the Chalk high ground of the North Downs, forming an extensive sheet, dissected by dry valleys heading north and northeast down the dip-slope of the Chalk bedrock. It is clear from a long history of surface finds recovery — *c.* 20 findspots are recorded in the *Southern Rivers Palaeolithic Project* for the project area — that Palaeolithic flint artefacts can be incorporated in the upper parts of Clay-with-flint deposits. However, despite some sites where material seems to occur in relatively dense concentrations — eg. at Kingsdown and Whitfield (Halliwell & Parfitt 1993) — this is not regarded here as a deposit of high potential, despite contrary claims (Scott-Jackson 2000). The artefactual material from Clay-wth-flints is never found in a sealed high integrity context, but rather, is always part of a palimpsest that conflates material from throughout the prehistoric past into perhaps the top 1m of the deposit (see Wenban-Smith 2001 and Ashton 2001 for a more detailed critique). At certain locations such as Elham, the potentially important Palaeolithic material that has been found is thought to have come from brickearth deposits capping Clay-with-flints, rather than the Clay-with-flints itself - which is why Elham was one of the sites targeted for fieldwork in this project (see *Section 4.2.1*)

2.4. Development context: site applications and minerals/waste allocations

There is high development pressure in the project area, with more than 50 allocated Minerals/Waste sites, and many hundreds of other allocated development sites in district plans (**Fig 1**). Ashford in particular, in the heart of the project area, has been highlighted by HM Government as one of four major priority growth areas in the southeast. And Swale, in the northeast part of the project area, forms part of the Thames Gateway, another priority growth area for the same sustainable development plan. The Stour valley is currently subject to extensive development, both for minerals and waste activities and for other development, including large-scale housing. The Isle of Thanet is also subject to a remarkable concentration of development allocations. Specific areas where numerous development allocations immediately threaten the Palaeolithic resource are:

- Swale, between Sittingbourne and Faversham, where extensive "Head/Brickearth" deposits are impacted by both a high number of minerals/waste allocations and also other developments. As discussed above (**Section 2.3**), the "Head/Brickearth" deposits here have produced a relatively high number of Palaeolithic finds, including several *bout coupé* handaxes and Levallois material.
- Ashford, where there are extensive river terrace and "Head/Brickearth" deposits directly under the existing town, extending northeastward through Kennington down the Stour valley. These have produced some known Palaeolithic findspots, including recovery of a *bout coupé* handaxe from brickearth at Kennington in a private residence. Despite the relative paucity of known finds, the nature of the Pleistocene deposits here suggests they may be of high potential, and any finds would be of high importance due to the current lack of information about Palaeolithic occupation in this area. This makes it a high curatorial priority to understand these deposits better and establish a model of Palaeolithic potential in the Ashford area.
- Canterbury, where there are extensive river terrace and Head/Brickearth deposits directly under the existing town and its environs, extending northeastward through Sturry down the Stour valley and southeastward to the Nail Bourne valley. These have produced very numerous Palaeolithic finds, particularly from terrace gravels at Sturry and Fordwich, the latter being poorly dated but widely regarded as potentially of pre-Anglian date, making it one of Britain's oldest sites. There is also a concentration of *bout coupé* handaxe finds from "Head/Brickearth" under the western side of the city. The Pleistocene deposits here are of proven high potential, but there is currently a lack of (a) a robust chrono-stratigraphic framework and (b) a predictive model of their sub-surface distribution and potential. The next few years will see extensive development that will impact on these deposits, particularly at the Chaucer Fields/Western Slopes development where early fieldwork has identified a much more complex sequence of gravels than was indicated in current BGS mapping, and where improved mapping of the deposits is urgently needed.
- Thanet, where there are extensive and poorly understood "Head/Brickearth" deposits. These have as yet only produced one find, a handaxe at Stone House School (*Southern Rivers Palaeolithic Project*, map S8, findspot 1), but they are little investigated. They may provide the best UK counterpart to the extensive loess deposits of northern France, which contain deeply buried undisturbed occupation horizons. If similar remains are present in Thanet, they would be of international importance, and it is

desirable to investigate this before the imminent intensive development proceeds much further.

- Sandwich, where there are extensive Head/Brickearth deposits extending eastward inland past Ash towards Canterbury, with a dense cluster of site allocations in the vicinity of Ash. This particular spread of "Head/Brickearth" has not as-yet produced any Palaeolithic finds. However, the similar spread a short distance to the southeast, towards Deal (see below) has produced numerous finds. It thus seems likely that this spread may be of similar, and as-yet unappreciated, potential. It is desirable to clarify this prior to development.
- Deal, where there are extensive "Head/Brickearth" deposits extending eastward inland past Finglesham to Eastry, with a dense cluster of site allocations. These deposits have produced surprisingly numerous Palaeolithic finds (*Southern Rivers Palaeolithic Project* map S6, findspots 11-18), mostly from the ground surface, but one found *in situ* deep within the brickearth during construction of a swimming pool. The quantity of finds suggests an area of high potential, but the deposits are poorly understood, with the context of Palaeolithic material mostly unknown, and of uncertain date and formation process.

These sequences are at present poorly mapped and understood, making it difficult to implement effective and cost-efficient evaluation and mitigation programmes in response to development proposals. This has consequences for the heritage assets themselves, as it is difficult to predict the impact of development proposals on a poorly understood resource, and thus mitigation and fieldwork may be less successful than desired.

2.5. Curatorial context: national and regional framework, and synergies with other projects

Kent County Council is the historic environment curator for the County of Kent, providing heritage advice and/or a Historic Environment Record service to 12 local planning authorities (LPAs) and Medway Unitary Authority. This advice is both strategic, through Local Plan documents and other key plans and initiatives, and on a case-by-case basis for individual development proposals (the team appraises some 1,200 planning applications each year based on maps of Areas of Archaeological Potential sent to the LPAs). The Heritage Conservation team also works closely with Kent County Council colleagues in the preparation of the Minerals and Waste Development Framework and to support road and school developments.

Canterbury City Council also maintains its own historic environment curatorial service which provides heritage advice on development control in the district. The advisor has access to a snapshot of the Kent Historic Environment Record and works closely with Kent County Council’s team where appropriate.

The Local Plans for the different LPAs in the study area are at different stages of preparation. Some, such as in Ashford and Canterbury, are relatively advanced in identifying site allocations and the supporting policy development, whilst others such as Thanet are still at a relatively early stage. There was thus significant potential for the project to inform these plans and thereby help ensure that important archaeological deposits are preserved or appropriately mitigated.

The Kent Minerals and Waste Development Framework reached the pre-submission stage in late 2013. Although this was before the project was completed, the resource assessment and HER cleaning stages (see below, **Section 3.3**) had been carried out, and so the results from these were able to directly impact on the pre-submission document. There was also opportunity to influence the policies in the Core Strategy during this period, and the Minerals and Waste team asked the Heritage Conservation team to assist in their drafting. The project was therefore very timely and directly influenced policies and site allocations both within the County Council and also at the local planning authorities. The outputs have also fed into Heritage Strategies as prepared for various districts, particularly Dover, Thanet and Shepway.

The project has been developed within the context of the "Understanding" stage of English Heritage's National Heritage Protection Plan (NHPP), contributing to project streams 6235 (Measure 3 "Recognition and Identification of the Resource", Development Area Pleistocene Projects, 3A3.202) and 6396 (Measure 4 "Assessment of Character and Potential", Palaeolithic and Mesolithic HER Enhancement, 4G1.401), over the period up to 31st March 2015.

Within the context of Measure 3, project stream 6235, the Project has developed improved approaches to mapping and modelling of Pleistocene deposits in the study region, supported by investigation of their formation date and processes, geophysical work (resistivity surveys complemented by EH ground penetrating radar investigation) and their known (or potential) Palaeolithic artefact/ecofact content, leading to a predictive spatial model of areas of high Palaeolithic potential for use as part of the Kent HER. This is particularly important for areas of (currently) undifferentiated brickearth deposits, where there may be nationally important assets that are not yet recognised as such, and therefore at risk.

Within the context of Measure 4, project stream 6396, the Project has developed the framework for assessing the importance of the resource by:

- improved mapping of the distribution and depth of Pleistocene deposits of potential Palaeolithic importance

- improving/establishing the dating framework for mapped deposit bodies
- improving/establishing understanding of the formation processes of mapped deposit bodies, particularly deposits loosely grouped as "Head", "Brickearth" and "Coombe" deposits
- collating information on the faunal/floral palaeo-environmental content of deposits
- checking and enhancing Palaeolithic information in the HER, incorporating data from Natural England, the Portable Antiquities Scheme, the Southern Rivers Project, grey literature, geo-technical reports and anecdotal sources

As well as addressing projects 6235 and 6396 under the "Understanding" stage of the NHPP, and feeding into LPA strategic planning as outlined above, the project also directly addressed many of the key priorities specified in the national *Research and Conservation Framework for the British Palaeolithic* co-ordinated by English Heritage (2008a), the *Greater Thames Estuary Historic Environment Research Framework* (Williams & Brown 1999, revised 2010) and the draft regional *Historic Environment Research Framework for the South-East* (SERF), the Palaeolithic part of which was prepared in 2010 (Wenban-Smith *et al.* 2010a, b).

In relation to the national framework, the project directly addressed the "strategic research and conservation themes" of:

- Understanding the record
- Dating frameworks
- Curation and conservation

In relation to the Greater Thames Estuary framework, relevant to the north side of the project area, the project directly addressed the framework objective of increasing understanding of the physical evolution of the Thames Estuary, with direct contribution to the specific objectives of:

- Developing the framework of environmental and climatic change
- Identifying key areas where primary context sites might be preserved

In relation to the SERF framework, the project area forms the northeast part of the wider SERF regional study area - the counties of Kent, Surrey, East Sussex, West Sussex and the unitary authorities of Brighton and Hove, and Medway. The draft Palaeolithic part of SERF was prepared in 2010 (Wenban-Smith *et al.* 2010a, b), comprising: (a) characterisation of the resource; (b) identification of a priority research agenda; and (c) establishment of a research strategy. The new SERF Palaeolithic research framework not only characterised the Palaeolithic resource and identified 27 key research questions for the southeast region, building on the updated national framework (English Heritage 2008a), but also suggested ten priority projects P1-P10.

Key questions identified in SERF that were addressed by the project are questions 6-10 and 12 concerning fluvial terrace deposits, and 17-19 concerning mapping, differentiating and modelling the Palaeolithic potential of Coombe, Head and Brickearth deposits. The Project also directly addressed the first two priority projects identified in SERF, namely: *HER Review* (P1) and *Palaeolithic Predictive Modelling* (P2).

The outputs of the project, described below (**Sections 3.5**, **4.4**), will also help to achieve the goals identified in '*Mineral Extraction and Archaeology: a Practice Guide*' (English Heritage 2008b). They will help ensure that future development-led fieldwork follows a question-led approach (para 23), that the needs of Palaeolithic archaeology are better integrated into Local Plans (para 25), particularly Minerals/Waste allocations, and will help all stakeholders base their decision-making on high quality information (para 28).

Finally, this project builds on, and incorporates lessons and methods from, previous curatorial projects in adjacent regions, particularly the *Survey of Mineral Extraction Sites in the Thames Estuary* (ECC and KCC 2004), the *Medway Valley Palaeolithic Project* (carried out by University of Southampton in collaboration with Kent and Essex County Councils — Wenban-Smith *et al.* 2007a, b) and the *Palaeolithic Archaeology of the Sussex/Hampshire Coastal Corridor* (carried out by University of Lampeter in collaboration with Kent County Council — Bates *et al.* 2004 & 2007) . After these projects, we now have a clear idea of achievable goals for improving Palaeolithic representation in the HER and modelling areas of high Palaeolithic potential, and of the optimum methods by which to achieve these goals.

In carrying out this Project, we have collaborated as appropriate with other projects who addressing similar issues. In particular, there was close liaison with Essex County Council concerning the project "*Managing the Essex Pleistocene*", which had some similar aims to the Stour Basin project, in particular to produce advice and curatorial tools for planners and developers in Essex. Once both projects were accepted for funding we discussed how work and perspectives may be shared. Besides the natural synergy and crossover of ideas resulting from participation of F Wenban-Smith as a Palaeolithic specialist for both projects, it was agreed that it would be beneficial to have a joint Kent/Essex seminar at the conclusion of the project process. The objective of this seminar would be to compare and contrast the differing approaches adopted, and to learn any lessons for the future as to the optimum approaches to (a) developing predictive modelling for the Palaeolithic heritage and (b) implementing appropriate curatorial responses in relation to development threat. To this end, the timescale of the Essex project was extended to match with the Stour project. This seminar is currently [as of 20th March 2015] planned to take place on Friday 15th May 2015, although the agenda for the seminar is currently under review with the possibility of expanding its scope and participants.

3. Project overview

3.1. Project scope

The project covered an area of *c.* 1200 km^2, forming the northeast part of Kent. It focused entirely on the Palaeolithic, for which there is both a particularly pressing need to improve understanding in the Stour Basin area, and also a clear pathway of how this can be achieved.

The project sought to provide some fieldwork training opportunities for archaeological contractors or students when possible. These were however necessarily very limited, due to the small and focused nature of the fieldwork programme, the tight budget (which did not cover training of additional workers) and, most importantly, the need to ensure good Health and Safety practices. This was incompatible with the presence of unskilled and inexperienced helpers while digging deep test pits with mechanical excavators. Training needs are recognised as important, but these would be better met with a specific project for which training is the primary objective, rather than attempting to piggy-back it onto a project with specific research goals and a tight timetable for fieldwork. Nonetheless, the opportunity to participate in the fieldwork at one of the investigated sites (Chislet Court Farm, see **Section 4.2**) was offered to staff of Canterbury Archaeological Trust, although CAT were not able to take the offer up at the time.

Although the project sought (and will continue to seek) to disseminate its products as widely as possible, it was not primarily a community or outreach project, but a specialist project primarily aimed at addressing curatorial goals. It was not possible within the scope of the available timetable and budget to involve the public in the fieldwork. We did however raise awareness of the project and the Palaeolithic resource in the Stour Basin through public talks (see **Section 4.5**). And one of the final outputs of the project will be universally accessible web pages and a picture gallery summarising its results and outlining the improved understanding of the Palaeolithic in the project area.

3.2. Aims and objectives

The overall goals of the project were:

- *to enhance significantly the Palaeolithic HER in the study area, producing a clean and comprehensive Palaeolithic dataset with newly structured Event and Source information, and improved GIS representation.*
- *to develop a predictive model for areas of high Palaeolithic potential within the study area, that will then be incorporated into the Areas of Archaeological Potential GIS layer that is sent to LPAs as consultation flags*
- *to aid curatorial decision-making, and improve understanding of the resource, in areas of high development threat with known concentrations of Palaeolithic finds*
- *to resolve current uncertainties over the Palaeolithic potential of the widespread deposits mapped as "Head/Brickearth" that occur in the study region*
- *to develop and provide an exemplary template for other projects aimed at achieving these desirable goals in other parts of the country*
- *to work with the English Heritage geophysics team to develop/test the use of Ground Penetrating Radar to investigate the depth/nature of sub-surface Pleistocene deposits in areas of varying bedrock geology*

More specific aims within the context of these goals were:

- *to improve understanding and characterisation of the resource, both for curatorial purposes, and by developing HER information that can be accessed and understood by non-specialists. This will be achieved by creating new HER records, and enhancing old ones, such that they contain accessible summary fields suitable for non-specialists and are uploaded to the online HER database. Similarly accessible web pages will be created for the KCC, University of Southampton and Canterbury Archaeological Trust websites that describe the project and the discoveries. The project will also be supported by outreach events designed to present it to non-specialist audiences.*
- *to improve the structure and representation of Palaeolithic data within the HER, including information from the Southern Rivers Palaeolithic Project, the on-line Wymer database; relevant discoveries from grey literature; and palaeo-environmental and faunal data*
- *to collate, and add into the HER, records of palaeo-environmental recovery, ranging from fossils such as hippo and mammoth, to the presence of deposits with evidence such as pollen, molluscs and small vertebrates*
- *to provide an improved dating framework and sub-surface deposit model for river terrace and "Head/Brickearth" deposits in the study area,*

particularly in areas of high development threat and with known concentrations of Palaeolithic finds

- *to investigate "Head/Brickearth" deposits, and develop an improved framework of their dates and models of formation*
- *to sub-divide the ubiquitous "Head/Brickearth" deposits across the project area into curatorially appropriate facies, relating to mode of formation and Palaeolithic potential*
- *to compare results from electrical resistivity and ground-penetrating radar surveys, and to validate them by test pitting*
- *to aid curatorial understanding of suitable approaches to evaluation and mitigation, particularly here in relation to the less well understood parts of the Palaeolithic heritage in key areas of high development pressure. This will be by means of new guidance for planners and developers and a toolkit consisting of improved HER data, new GIS layers and supporting user guidance.*

3.3. Project team

The project was led by Kent County Council Heritage Conservation in association with the Department of Archaeology at University of Southampton. Representatives of Canterbury Archaeological Trust and Canterbury City Council were also involved. Key individual staff and roles are summarised in the table below (**Table 1**). This team combined internal curatorial responsibility and expertise, with external collaborators with curatorial awareness, knowledge of the numerous projects in the Canterbury area and extensive experience of Palaeolithic and Pleistocene investigations in Kent, as well as the necessary surveying and GIS skills to carry out and report all aspects of fieldwork. It also includes a representative of Kent County Council's Minerals and Waste team who will provide the perspective of planners and developers in the minerals industry and a representative from Ashford Borough Council's Planning Team who can represent non-minerals planners and developers.

The project was led and managed by Kent County Council, with the Project Executive being Lis Dyson, County Archaeologist and Heritage Conservation team manager. The Project Manager was Paul Cuming, the Historic Environment Record Manager.

3.4. Project stages and methods

There were six main project stages, including initiation and dissemination/closure. These are reviewed below, with details of the methods and tasks contributing to each stage.

3.4.1. Stage 1 - Project initiation

Preparation of the Project Design, underpinned by a detailed review of current geological mapping and up-to-date locations of all Minerals/Waste and other development allocations in the project area.

3.4.2. Stage 2 - Review of Palaeolithic and geological data, selection of priority areas

Stage 2.1. Palaeolithic sites review

All records of Palaeolithic finds in the study area were reviewed, and cross-checked with the existing HER. Then the HER was revised, including improved period assignation and artefact descriptions, to ensure that the HER contains the best possible record of Palaeolithic and palaeo-environmental information for the project area. The main sources for this work were Evans' original national review (Evans 1897), Roe's Gazetteer of the Palaeolithic material in museum collections (Roe 1968), the Southern Rivers Project (Wessex Archaeology 1993), and the Kent HER. Grey records held by Kent County Council and Canterbury Archaeological Trust were also checked for Palaeolithic information. Original references were checked for most Palaeolithic records, as well as Natural England records, BGS sheet memoirs and the online Wymer archive. A separate project database was created to hold and collate Palaeolithic site information for the duration of the project. This database was formed of a series of relationally-structured tables whose content was deliberately structured for easy subsequent import into the HER. All data produced by the project was then transferred to the Kent HER and curated as part of the normal HER service, whereby site information is publically available on-line. Along with the project archive this will also be made available via the ADS website on completion of the project.

Stage 2.2. Geological deposit review

Geological records in the study area were investigated, to inform understanding of the thickness and nature of Pleistocene deposits. British Geological Survey on-line borehole data, sheet memoirs and grey geotechnical records were the primary sources of data, as well as deep test pit archaeological investigations carried out by Canterbury Archaeological Trust [CAT]. A synthesis of the geo-archaeological information in the Canterbury area was produced by CAT.

Combined with the geological mapping, the improved information on Palaeolithic site distribution and information on development allocations, these led to identification of priority areas of uncertainty and development threat. These were targeted for fieldwork and geophysical surveying, to clarify Palaeolithic importance and establish deposit formation processes and the chrono-stratigraphic framework. A draft Updated Project Design (UPD) was prepared (project product P13a), with proposals for fieldwork and dating analyses, environmental sampling and geophysical surveying. This was then discussed with English Heritage stakeholders (Jane Corcoran, Peter Marshall, Paul Linford and Jonathan Last), leading to preparation of an agreed UPD (project product P13b) that formed the basis of the fieldwork programme [Stage 3, below], with suitable resourcing for OSL dating, environmental sampling and geophysical surveying.

3.4.3. Stage 3 - Targeted fieldwork

Stage 3.1. Fieldwork planning and site selection

Following the work of Stage 2 discussed above, a fieldwork programme was agreed that had two main goals:

1 - to investigate a detailed transect at the east side of the Blean plateau in the Chislet area, to try and provide a more secure dating framework for the terrace and brickearth deposits of the Great Stour in the Canterbury area that have produced rich Palaeolithic remains over the last century;

2 - to investigate a representative range of brickearth deposits in different topographic and geomorphological situations, to try and establish how and when they were formed, and thus what might be their potential to contain important Palaeolithic remains.

The first stage of the fieldwork programme was identifying potentially suitable sites based on BGS geological mapping, and seeking permission from the landowners. For the first objective, permission was obtained from Chislet Court Farm — situated on the east side of the Blean plateau about 8km northeast of Canterbury (**Figure 2**) — to excavate a substantial number of test pits in fields that were temporarily available due to crop rotation. The opportunity was also taken to do more detailed section recording and sampling in the old Wear Farm Pit, which is located within the field "Ware/Bells" north of Chislet Court Farm. Wear Farm was present in the northwest corner of this field from the 1st Series of OS mapping in the mid-19th century through to the 1930s, when incidentally its spelling was modified to "Ware Farm"; after the 1930s Wear/Ware Farm ceased to exist, and no buildings are now present at its site. Besides being a ready-made exposure through deposits thought to represent a Pleistocene terrace, the old Wear Farm Pit, which was actively quarried in the mid-19th century, but not since, is also one of the rare sites in the project area known to produce rich faunal remains, first reported by Prestwich (1855), and then recently re-examined by Bridgland *et al.* (1998). Further sampling at the site could therefore provide important dating and palaeoenvironmental information. When suitable sand-rich sediments were encountered, samples were also taken for dating by optically stimulated luminescence (OSL).

For the second objective, permissions were obtained from five other landowners where geological mapping showed outcrops of brickearth to be present (**Table 2**; **Figure 2**). Two of these sites (Somali Farm and The Loop) were located in Thanet, where geological mapping showed older "Head 1 - plateau brickearth" capping higher ground. Furthermore, previous field evaluation at The Loop (Canterbury Archaeological Trust 2003) had suggested the presence of a buried landsurface with *in situ* late Last Glacial occupational evidence, and it was desired to investigate this further.

One site (Hundred Acres Field, Dreal's Farm) was located on the North Downs plateau 10km north of Folkestone where a patch of Head Brickearth is mapped capping the Clay-with-Flints. This is also an area where fieldwalking has produced abundant Palaeolithic remains including two *bout coupé* handaxes (Roe 1981: 259; Tyldesley 1987: 70; Halliwell & Parfitt 1993: 82-83; Wessex Archaeology 1993: 143), so it was desired to investigate whether the brickearth deposit here could be a source of early-mid Last Glacial archaeological material.

The last two sites were located on brickearth patches within the Weald. One of these (Heath Farm School) was located at the foot of the Wealden scarp 10km north-west of Ashford, just above the eastern arm of the Great Stour headwaters. Terrace deposits are mapped in this vicinity, and it was desired to investigate not only whether the large brickearth patch here was of colluvial or loessic origin, but also whether it was alluvial in its lower parts, and whether it might be masking more-deeply-buried fluvial terrace deposits.

The other Wealden site investigated was Otterpool Manor Farm, 10km west of Folkestone, where there is a patch of brickearth capping the minor intra-Wealden plateau of the Hythe Beds. This is located a little further into the Wealden basin, to the southeast of the head of the East Stour, and to the south of the low ground at the foot of the Wealden scarp where there might previously have been an eastward draining river course into the Channel. Thus this brickearth patch could be of older loessic origin in its highest parts; it could also consist of, or overlie, fluvial terrace deposits in its lower more northerly parts.

Written Schemes of Investigation (WSIs) and Risk Assessments were then prepared for the fieldwork programme at each site (project product P15).

Stage 3.2a. Fieldwork phase 1, test pitting

A limited programme of fieldwork was carried out at the locations identified in Stage 2.2. Due to the costs of fieldwork implementation, fieldwork was restricted to three weeks. Samples for environmental assessment and OSL dating were collected in the field as thought appropriate, and then subsequent discussions took place with English Heritage as to levels of post-excavation assessment and analysis for these archive elements.

The fieldwork methods applied at the six sites chosen for investigation were:

- excavation of test pits by mechanical excavator, with sieving for lithic artefacts and larger mammalian fossils, and environmental sampling for micro-palaeontological remains and particle-size analysis [standard approach for all sites]
- section-cleaning using hand tools [where necessary/appropriate]
- optically stimulated luminescence dating (OSL) [where suitable sediments encountered]

Precise details of the methods for these aspects of fieldwork are given in the Written Schemes of Investigation for each site (project output P15) as well as in the various separately-produced reports arising from the fieldwork (itemised below, **Table 6**), so are not reiterated here.

Each fieldwork site was given a unique site-code within the project as a whole (**Table 2**). Within each site, each test pit location was given a unique incremental number, and its outline and height in metres above Ordnance Datum (mOD) surveyed using a portable GPS system, tied in with the OS National Grid. Investigations were made for each site before excavation commenced as to whether there were any statutorily protected remains listed as Scheduled Monuments or Sites of Special Scientific Interest. It was established that no designated protected areas were affected by the proposed works. After that, the precise test pit locations were arranged at each site in consultation with the landowner, in accordance with the general intent to dig a transect of test pits in a line across the mapped geological outcrop.

The test pit locations at each of the six fieldwork sites are shown in an appendix, in relation to 1:25,000 landline mapping and Pleistocene geological mapping (**Appendix 1**).

Stage 3.2b. Fieldwork phase 2, geophysical survey at Chislet Court Farm

An important aspect of the original Project Design (KCC Heritage Conservation

2013) was the intention to work with the English Heritage geophysics team and apply a range of geophysical survey methods in one of the areas where test pits were dug. Besides having the potential to provide important additional information on the sub-surface litho-stratigraphy in the area of the test pits, the already-excavated test pits provide ground-truthing to test/validate the geophysics results. This validation then provides a baseline of the degree of confidence that can be given to future geo-physics results in areas of similar geological/sedimentological nature. Furthermore, the application of a range of geophysical techniques, including 2D Lund electrical resistivity tomography (ERT) transects and ground-penetrating radar (GPR), allows the efficacy of these different techniques to be compared, and thus helps develop and test the use of GPR as a low-impact and cost-effective geophysical technique for getting rapid results from a wide area.

It was agreed with the English Heritage geophysics team (Paul Linford and Neil Linford) that a decision on where to carry out the geophysical survey programme would be held over until after the completion of phase 1 of the fieldwork. Then it would be considered which of the sites investigated would be most suitable for carrying out a range of geophysical techniques, and which area also had the most pressing litho-stratigraphic questions where geo-physical surveying would have the greatest benefit in improving understanding of the sub-surface deposits.

Having reviewed the options, it was decided to carry out the geophysical survey programme at Chislet Court Farm, in the field "Ware/Bells" where TPs 1-3 and 5-8 were dug around the old Wear Farm Pit (**Appendix 1**, **Figure A1-2**). Apart from being the most feasible place in terms of consent and availability, it was also the place where there were the most pressing stratigraphic problems to investigate, and where there was the best test pit record of varying ground-truthed sediments. This made it the best place to look at how GPR results tie in with the ERT results and the excavated sequences.

A 2D Lund ERT transect survey was carried out by the project team (under supervision of Martin Bates). The electrical imaging collected in this project was acquired using an ABEM Terrameter SAS4000 resistivity meter with 80 electrodes. Two ERT survey transect lines - GT1 and GT2 - were positioned to correspond with lines of test pits already dug (**Figure 3**). This would firstly allow the geo-physical results to be validated by the ground truth known from the test pits. And secondly it would allow interpretation of sub-surface deposits and stratigraphic changes between the sequences directly observed in the test pits. The two survey transects GT1 and GT2 were aligned in a broadly east-west direction down the slope towards the Wantsum Channel, with the intention of identifying any buried terraces of the Stour, which would here be passing northward into what is now the mouth of the Thames estuary. The electrode spacing was set to 1m spacing on the two transects surveyed. The paths of these two geophysical survey transects were initially aligned by eye in relation to the test pit footprints and the field layout. Separate runs along the transects (corresponding with tape lengths and separate ERT survey episodes) were then surveyed in using a portable GPS system tied in with OS datum and the national grid.

This survey was then supplemented by the English Heritage team, who later carried out a GPR survey along the same transects (**Figure 3**, R1 and R2), as well as along an orthogonal grid of other transects (**Figure 3**, R3-R7) to try and increase understanding of the complex sub-surface deposits. The EH team were not able to carry out their survey work concurrently with the Stour project team due to condition of the field, so the survey data for the transect locations was passed to the EH team to ensure duplication of the same transects for the GPR survey.

The Lund ERT transect survey was carried out on 18th-19th March 2014, with kind permission of the farmer (Mike Wilkinson). The field at that time had been deeply ploughed, and the ploughsoil was damp from heavy rainfall of the last few months, making it impossible for the radar survey to be carried out concurrently. Therefore the GPR survey was held over until 22nd-25th September 2014, when there was a window of roughly one week when the field surface was in a flat condition suitable for the radar survey, before being re-planted with the next crop.

The results of the geophysics work are incorporated below in the summary report of results from the work at Chislet Court Farm (**Section 4.2**).

Stage 3.2c. Fieldwork phase 2, additional palaeo-environmental sampling at Wear Farm Pit, CCF 14

Additional palaeo-environmental sampling was carried out at Wear Farm Pit, Chislet Court Farm, in conjunction with the geophysics work in March 2014. There was a question-mark over whether the sampled sequence in the lower part of TP 21 (at the north end of the exposed face of Wear Farm Pit) had properly reflected the stratigraphy. Recognition of brackish ostracods in the lower part of the sequence during the assessment programme (Wenban-Smith 2014b, Table 6) made it particularly important to carry out more detailed sampling of the sequence to establish whether or not any trends of increasing or decreasing brackishness were present through the deposit sequence. There was also one deposit at the base of the sequence (context 2108) for which it was thought that insufficient sampling had been carried out for molluscs and small vertebrates, and for which the ostracod assessment had suggested that it might be possible to recover *Bithynia* opercula for dating.

It was also desired at TP 22 to carry out additional sampling of context 2204 and the immediately overlying lower part of context 2203b. The former context was both vulnerable to decay, being directly exposed, and also rich in remains. It was hoped that recovery of a larger sample would provide small vertebrate remains that could be used for biostratigraphic dating, as well as mitigating future erosion of the sediment. It was also hoped to recover small vertebrate and/or molluscan remains from the lower part of context 2203b. This horizon had proved barren in the samples taken in September 2013 (Wenban-Smith 2014b, Tables 4 and 5), although previous work (Bridgland *et al.* 1998) had apparently recovered material from this horizon. Therefore two vertically contiguous samples were taken from the lowermost part of context 2203b, as near as possible to the location investigated by Bridgland *et al* (1998: 47, sample <1.3>). This additional fieldwork was carried out 18th-19th March 2014, under the site code CCF 14.

Stage 3.3. Post-fieldwork assessment and reporting

Following fieldwork, the archives from the various investigations were collated and reviewed into a Fieldwork Summary Report (Wenban-Smith 2014a, project product P16). Priorities for environmental assessment were identified, and the relevant material sent to appropriate specialists with clear instructions as to what work was required and the timetable by which results needed to be received back. Assessment was aimed at identifying the potential of deposits, rather than achieving it. The results were then incorporated in a draft assessment report and updated task list and post-excavation programme (Wenban-Smith 2014b, project output P17a). This summarised the quantity and range of environmental and dating sampling carried out, and outlined a proposed programme of analysis to feed into the remainder of the project. It identified needs for dating analysis (OSL, amino acid and any other approaches such as biostratigraphy) and further environmental analyses. This was then discussed and reviewed with English Heritage, and appropriate resourcing agreed. It was agreed that a programme of OSL dating was essential for the project, so a variation to the initial Project Design was instigated to support this. Otherwise, as envisaged in the original Project Design, no additional specialist analyses were supported. A revised and updated Project Design was produced (KCC Heritage Conservation 2014a) with an amended timetable and programme, in line with the ongoing project progress review process.

Specialist palaeo-environmental assessments, the results of which fed through into the project results, encompassed the following areas: ostracods, molluscs and small vertebrates. Specialist work was carried out to produce 21 OSL dating results from the 31 OSL samples taken. Specialist amino acid dating was also carried out on mollusc remains (*Bithynia* opercula) from certain key horizons at Chislet Court Farm. Processing of the ERT geophysical survey data was carried out, and hard copy images of the results were created. These were discussed with the EH geophysics team and compared with those from the GPR survey.

The results from the specialist work and other post-fieldwork analysis were collated into a single Final Fieldwork Report (Wenban-Smith 2015, project output P18). New HER records were developed to add into the Kent HER for the fieldwork locations, reflecting any new discoveries made, whether artefactual or palaeoenvironmental.

The results of the fieldwork are summarised and reviewed below (**Section 4.2**), and then incorporated where appropriate in the final Discussion and Conclusions section of this report (**Section 5**).

3.4.4. Stage 4 - Characterisation and predictive modelling

Stage 4.1. Designation of Palaeolithic Character Areas (PCAs)

Following the field programme a revised model of the Palaeolithic deposits in the Stour project area was produced. Sub-surface deposit models were developed as fence diagrams for areas where fieldwork was carried out, integrating dating evidence and data from BGS borehole records when available. Palaeolithic Character Areas — PCAs — were defined primarily on the basis of geological mapping, supplemented by: fieldwork results, revised HER records and sub-surface deposit modelling. In total 44 different PCAs were identified, designated as "SP_1" through to "SP_44", with "SP" representing "Stour Project". Each PCA could be represented by one or more polygons, for instance the area SP_1 is represented by several different outcrops of Head Brickearth on the Isle of Thanet.

PCAs were initially developed for the project area as hard copy on maps, with area boundaries drawn by hand. These were then digitised as 2D GIS shapefiles, linked to tabular summaries of Palaeolithic finds and environmental potential. Specific complementary tables were linked to the digitised PCA areas: (a) tables of site attribute data for artefacts and palaeoenvironmental remains; and (b) tables of geological sequences at key locations.

The attribute data collated for each PCA is tabulated below (**Table 3**). These include categories of "Likelihood" of their being Palaeolithic remains (including palaeo-environmental remains), and the likely "Importance" of any remains. The criteria for different grades of Likelihood and Importance are also tabulated below (**Table 4**). These grades were then combined in a matrix to derive an assessment of "Palaeolithic potential" for each PCA (**Table 5**).

Stage 4.2. Addition of PCAs to Kent HER

The 2D GIS shapefile of PCAs has been made available to curators within the Kent HER as part of its suite of Palaeolithic models (these comprise the shapefiles from the *Archaeological Survey of Mineral Extraction Sites around* *the Thames Estuary: Aggregates Levy Sustainability Fund and those from the Medway Valley Palaeolithic Project)*.

Originally, it had been intended that there would also be an assessment for each PCA of the significance of surviving deposits in relation to past losses. Thus, small areas of surviving deposits in areas that have been heavily extracted or developed would have been highlighted as of extra importance. In the event, however, it was not possible to complete this action. In part this was because the relevant information was not found to be as easily available as hoped (we had believed that it might be held within KCC) but more because as we considered the task more deeply we realised that we had allowed a wholly inadequate amount of resource for it (being only 2 days). As we were already finding that we were under-resourced in other areas of the project (eg 2-107 and 2-108) we decided that this task could not be pursued. In fact it is likely that a project will be submitted by the Canterbury Archaeological Trust that will help address this goal by mapping past minerals extraction sites in east Kent and assessing the impact of the extraction industry on the historic environment of the region.

3.4.5. Stage 5 - Development of curatorial tools

Stage 5.1. Stakeholder consultation

The goal '*to aid curatorial decision-making, and improve understanding of the resource* ' (section 3.2) is likely to be more effectively addressed if the different perspectives and views of key stakeholders are more fully understood. This will help curators develop and explain appropriate planning responses and reduce friction or uncertainty among archaeologists, consultants, specialists and developers. The project decided to try to obtain such an understanding and the method chosen was to conduct a series of interviews with professionals. These included those working in the different stakeholder groups associated with Palaeolithic archaeology and development control – curators, contractors, consultants and specialists and planning officers. Numerically, it was biased towards curators and contractors and ideally the selection would have included more consultants. It should be noted, however, that the interviewees were not selected to be fully representative of the sector in the south-east and this survey is not intended to be comprehensive. They were selected simply to gain the general views of a number of local stakeholders operating in Kent and nearby.

24 individuals were interviewed as part of the project. A report was produced that detailed their responses (KCC Heritage Conservation, 2014b product P28).

Stage 5.2. Curatorial toolkit

Following the interviews a set of management tools were developed, comprising advice for planners and developers on Kent County Council's approach to the management of the Palaeolithic resource and a specification for a Palaeolithic desk-based assessment.

In the project design these documents were called 'guidance', however for technical reasons due to the difference between 'guidance' and 'advice' within Kent County Council ('guidance' has to go through a consultation process and formal adoption) they are now termed 'advisory documents'.

A Toolkit was developed to aid curators in managing Palaeolithic archaeology within development control. The Toolkit consists of:

- The GIS layer (polygon) showing sensitive Palaeolithic sediments in the Stour Basin (Palaeolithic Character Areas). This included the assessment of significance (See above, **Stage 4.1** and **Stage 4.2**)
- The complementary tables that support the PCAs
- GIS layers of HER information (point or polygon as appropriate)
- A summary of the interviews carried out in Stage 5.1. This is to present the perspectives of developers and planners to curators
- A user guide explaining how to use the GIS layers
- The advisory documents explaining Kent County Council's curatorial decision-making process as it relates to Palaeolithic sites

3.4.6. Stage 6 - Dissemination and closure

Stage 6.1. Public dissemination

The Stour valley is little known and perhaps under-appreciated by local people as well as the professional archaeological community as a key Palaeolithic resource. To raise awareness of the area and its Palaeolithic importance, two public talks were given, open to the general public, and advertised to local history groups, relevant Higher Education establishments and the professional archaeological community in north-east Kent.

Stage 6.2. On-line dissemination and professional engagement

The key outputs from the Project have been made available online. The enhanced HER records are available via the KCC and Heritage Gateway websites. Project summaries and photo galleries will be made available via the three main collaborating institutions: Kent County Council, University of

Southampton and Canterbury Archaeology. The advisory documents for developers and planners and the textual components of the Toolkit will be made available via the KCC website. The full project archive including all GIS datasets, tables and reports will be available via the ADS website.

In addition to the public talks, outcomes and lessons from the project were provided to the curatorial and professional archaeological community through participation in two seminars and an on-line conference, details provided further below (**Section 4.5**).

There will also be one specialist seminar following completion of the project to review its conclusions, raise awareness of the new advisory documents and Toolkit produced, and discuss approaches to categorising and predicting area of Palaeolithic potential. This will be organised by English Heritage and held jointly with Essex County Council, and is currently planned to take place on Friday 15th May in London.

Stage 6.3. Final Report

A formal archive Final Report (this document) has been produced for the project, specifying the work done, summarising the outcomes of different aspects of the project, and specifying the various project reports that provide more detailed project results. This will then be made widely available through ADS and other on-line platforms (see above, **Stage 6.2**), as well as directly circulated to stakeholders in the project and other relevant parties.

Stage 6.4. Project closure

The Final Report and other project outputs will be checked by English Heritage, and once any final amendments have been made, and any financial transactions completed, the project can be signed off as closed and completed.

3.5. Project outputs

A full listing of 43 products - P1 to P43 - that would be produced through the project was incorporated in the Project Design (KCC Heritage Conservation 2013, Table 3). Many of these were necessary staging posts marking progression of the project, rather than completed outputs. A reduced version of this product listing is provided here (**Table 6**), specifying the products that are available as project outputs, and incorporating additional project outputs that were not foreseen in the original Project Design.

4. Results

4.1. HER review

An initial list of 171 site records was exported from the Kent HER for the districts that were part of the project. To ensure the maximum possible number of records was produced a search was made for all records classified as ‘Paleolithic’, or ‘early prehistoric’ or indeed that contained the word ‘Paleolithic’ in their description fields. This was to minimize the possibility that any Paleolithic records would be missed. A rapid check of these established that inevitably many of them were clearly nothing to do with the Palaeolithic, such as Bronze Age metalwork from surface field collection, so this initial list of sites was quickly reduced to 137 records. These surviving records were then looked at more carefully. It became apparent that they included several duplicate records, or records such as "prehistoric flake" that could not be sufficiently confidently accepted as Palaeolithic. Therefore this initial weeding process resulted in a reduced list of 120 Palaeolithic HER records for the project area (**Figure 7a**).

After this, all the site details in the HER were checked, and cross-referenced with key primary published sources, principally Evans' initial British Palaeolithic survey (Evans 1897, 2nd edition), Roe's Gazetteer (Roe 1968) and the Southern Rivers Project (Wessex Archaeology 1993). References and information quoted in HERs were checked, and site locations were checked through use of historic OS mapping, available on-line through EDINA digimap.

Several key results arose from this process, which have wider ramifications than the Stour project alone.

- it was found that the HER included numerous inaccuracies in terms of site location
- many sites were mis-described or muddled with other sites, or Palaeolithic records were inappropriately included as part of a later period record
- 20 new Palaeolithic records were added resulting from separation of Palaeolithic sites from later period sites into different HER records
- period definitions were often wrongly applied or inappropriate
- terminology for lithic artefact description was often wrongly applied or inappropriate
- very numerous sites listed in widely available primary sources, in particular the collation of the Southern Rivers Project, were absent from the HER
- twelve new Palaeolithic records were added that were palaeo-environmental findspots, usually finds of Pleistocene megafauna such as mammoth, elephant or woolly rhino; sometimes locations with deposits rich in diverse remains such as small vertebrates, molluscs, ostracods and insects

- 6 new Palaeolithic records were added from recent grey literature
- overall, it was possible to enhance the HER with addition of 114 new Palaeolithic records for the project area, raising the total number to 234 Palaeolithic records (**Figure 4b**); 76 of these were entirely new sites, 65 of which were listed in the Southern Rivers Project

These problems with Palaeolithic representation in the HER have probably arisen for a number of reasons. These are worth considering in a no-blame context, purely to try and improve the situation in future, both in the HER for the rest of Kent, and for other HERs in central and southern England where Palaeolithic sites are known to be most frequent.

- There may have been a history of HER maintenance by workers who are not particularly familiar with the Palaeolithic. This may have resulted in a lack of consideration of period ranges appropriate to discoveries of artefacts such as handaxes or Levallois cores, and lack of understanding of archaic 19th and early 20th century usage of terms such as "implement".
- The standardised thesauri (maintained by Historic England, but owned by FISH - the Forum on Information Standards in Heritage - within the parameters of MIDAS Heritage: http://thesaurus.historicengland.org.uk/frequentuser.htm) that constrain site description options, lithic artefact terminology, and period names and date ranges, are full of basic errors and are fundamentally not-fit-for-purpose for describing Palaeolithic sites and artefacts. It would be beneficial if these thesauri could undergo a major overhaul by Palaeolithic and lithic specialists. To give just two examples, the lithic artefact thesaurus omits the term "lithic artefact", and includes "core" as a subset of "debitage".
- There was a fundamental misconception that sites listed in the Southern Rivers Project [the SRPP] would *de facto* already be in the HER. This is in fact the opposite of the actual situation. The SRPP included sites that were listed in the HER at the time it was prepared, which was about 1991 for most of Kent. However the SRPP includes numerous additional sites that were not in the HER. The SRPP can be awkward to use, since there is very little rhyme or reason to which region is in which volume, or to the map order within volumes, so it can be inconvenient to identify which map needs to be checked to establish finds in a particular area. It is also now nearly 25 years old, so becoming quite out of date. It is therefore imperative that all HERs are checked to ensure that they include the sites listed in the SRPP.
- There is no reason to believe this situation is unique to Kent or the Stour basin. Although the concurrent Essex County Council project *Managing the Essex Pleistocene* did not involve a similar HER enhancement exercise, it was clear from the consultation of the HER

that was involved, that it included similar levels of inaccuracies, duplications and omissions.

4.2. Targeted fieldwork

A detailed Final Report on the fieldwork and its results has been separately prepared (Wenban-Smith 2015). Therefore the section below provides a brief overview of the fieldwork and its most important results; for more details the Final Report should be consulted.

4.2.1. Fieldwork programme: rationale and overview

The first stage of the project involved a review of Palaeolithic sites and sub-surface deposit data in the project area. In conjunction with geological mapping and the distribution of planning applications and site allocations for purposes such as mineral extraction and waste disposal, this led to the identification of several priority areas and curatorial themes that could be addressed through fieldwork.

As identified in background investigations at the outset of the project, the project area is rich in deposits categorised as "brickearth". However this term includes deposits that can be of widely varying ages, and formed by a wide variety of processes. In conjunction with the history of Palaeolithic find-spots associated with brickearth deposits, and the concentration of planning applications in some areas of brickearth, it was decided that further investigation of brickearth deposits should be one of the objectives of the project's fieldwork programme.

It is recognised that some brickearth deposits filling dry valleys represent colluvial deposition in the Holocene, and thus have potential to bury (or contain) evidence of final Upper Palaeolithic, Mesolithic or other Late Prehistoric remains. However most brickearth deposits (particularly the major spreads of northeast Kent) are regarded as slopewash deposits comprising a mixture of reworked Solid bedrock (Cretaceous or Tertiary sands, silts and clays) and aeolian sands and silts, and formed in the Last Glacial Maximum of the last Devensian glacial period between *c.* 24,000 and 18,000 BP (years Before Present). This is a period when Britain was unoccupied so if correct this would make them a deposit of low potential for Palaeolithic remains. However, it was thought possible that north-east Kent could contain unrecognised deposits mapped as brickearth that were un-reworked aeolian loess from earlier in the Devensian. If so, these deposits would be of much higher Palaeolithic potential, dating to a period when Neanderthals were present, and with the potential to contain undisturbed remains of their activity. Some brickearth spreads might also seal, or represent, fluvial deposits. These too would be of significantly higher Palaeolithic potential than presumed.

Therefore one target of the fieldwork programme was to identify and investigate a selection of brickearth deposits that (a) it was thought possible could represent un-reworked loessic sediments from earlier than the Last Glacial Maximum, or (b) could seal or represent fluvial deposits.

The second target of the fieldwork programme was to try and improve understanding and dating of Pleistocene terrace deposits associated with the Middle Pleistocene development of the Stour in the Canterbury area. A "staircase" of terrace deposits has been recognised here, progressing from higher and older deposits thought to date from prior to the Anglian glaciation (*c.* 500,000 BP or earlier) down to the present sub-alluvial valley infilled with deposits from the end of the last glaciation dating to c. 12,000BP. Terrace deposits preserved at intervening levels on the valley sides above the present Stour date to uncertain stages of the intervening later Middle and Late Pleistocene periods. However these deposits are known to be rich in Palaeolithic remains, as well as subject to substantial development pressure. Therefore the second target of the fieldwork programme was investigate a transect through the terrace staircase of the Stour valley in the Canterbury area, with a view to (a) improving understanding of the terrace sequence and the presence within particular terraces of Palaeolithic remains, (b) recovering palaeo-environmental material that could be used for palaeo-climatic/palaeo-environmental interpretation and bio-stratigraphic dating, and (c) carrying out direct chronometric dating by optically stimulated luminescence (OSL) if suitable deposits were encountered.

The project's fieldwork programme (summarised in **Table 2**) took place in two stages. The first (and greater) phase of fieldwork took place between 2nd and 18th September 2013. This involved five relatively small test pit investigations at mapped brickearth deposits in and around the project area, and one larger test pit investigation in the Chislet area, where a major spread of brickearth was thought likely to overlie a buried terrace staircase sequence of the Stour. This was followed by a second (relatively minor) phase of fieldwork on 18th-19th March 2014. This involved geo-physical resistivity surveying at the site of the Chislet test pit investigation and recovery of additional palaeo-environmental samples from standing faces exposed in the old Wear Farm Pit, also in the Chislet investigation area.

The locations of the fieldwork sites within (and near to) the project area are shown (**Figure 1**) in relation to the mapped Pleistocene geology. The distribution of test pits at each fieldwork location is then given in an appendix (**Appendix 1**). Photographic highlights of the fieldwork at each location are then given in another appendix (**Appendix 2**). Full details of the results of fieldwork at each location are given in the Final Fieldwork Report (Wenban-Smith 2015), and an overview of the key results is provided below.

One additional piece of fieldwork in conjunction with the project was carried out by the English Heritage geophysics team, between 22nd and 25th September 2014. This involved a ground-penetrating radar (GPR) survey of the same Chislet area as had been investigated for resistivity in March 2014. The main purpose of this was to validate the method against the more-detailed results of the resistivity survey and the ground-truth data provided by the test pits also dug in the area. It was also hoped that the survey would produce additional results that could contribute to interpretation of the sub-surface deposits in the area.

4.2.2. Archive overview and potential for analysis

The fieldwork archive is summarised and quantified below (**Table 7**). The archive had three main categories: paper records, material remains comprising samples and finds, and digital data. Sediment samples were recovered from three sites: Chislet Court Farm (CCF 13), Dreal's Farm Hundred, Acres Field (HAF 13) and Somali Farm (SOF 13). A full list of the sediment samples recovered is provided (**Appendix 3**), together with information on sub-sampling for assessment and analysis. A tabular summary of artefact (and other find) recovery is also given (**Table 8**). Key archive elements with potential to contribute to post-excavation analysis were assessed, leading to consideration of their potential for further analysis within the context of the project's aims, followed by a limited programme of post-fieldwork analysis.

The fieldwork archive had good potential for further analyses that would (a) contribute directly to furthering the immediate aims of the Stour Basin Palaeolithic Project and (b) contribute more widely to current Palaeolithic and Quaternary research. The archive contains elements that will improve understanding and dating of brickearth deposits, improve dating and interpretation of Stour terrace deposits and expand the record of Palaeolithic/Pleistocene sites in the project area.

Priority analyses and avenues of further work were suggested in the post-fieldwork *Assessment Report* (Wenban-Smith 2014b) as:

1 - to use the test pit logs and survey data to develop sub-surface deposit models in the areas investigated, integrated with previous borehole and test pit records (where these latter exist)

2 - to carry out further analysis of the faunal remains found in various deposits at Chislet Court Farm - namely: small vertebrates, molluscs and ostracods - with a view to improving understanding of (a) mode of deposit formation, (b) prevailing climate and local environments, and (c) dating based on any biostratigraphic indications

3 - to carry out a programme of OSL dating, focused on brickearth deposits but including terrace deposits where suitable samples were taken

4 - to carry out a programme of amino acid dating, focusing on the three horizons in different test pits at Chislet Court Farm (TPs 5, 6 and 22) from which *Bithynia* opercula were found in reasonable abundance

5 - to carry out particle-size analyses through the brickearth deposits, to investigate the degree to which they incorporate loessic material

6 - to use the sub-surface deposit models in conjunction with sediment descriptions, faunal evidence, particle-size analyses and dating results to interpret the mode and date of formation of major deposit beds

7 - to incorporate the results of the fieldwork into the Kent HER

8 - to carry out a geophysical survey at Chislet Court Farm, in the field "Ware/Bells" that surrounds the old Wear Farm Pit, which contains deep brickearth deposits and buried Pleistocene terrace deposits with a wide range of faunal remains, as well as lithic artefacts

It was also found desirable following the results of the small vertebrate and ostracod assessments to carry out further palaeo-environmental sampling of the exposed face of Wear Farm Pit, Chislet Court Farm, in test pits 21 and 22. This was carried out in March 2014 (under site-code CCF 14) at the same time as the geophysical survey work.

4.2.3. Overview of post-fieldwork analysis programme

Following from the assessment and the additional palaeo-environmental sampling at Wear Farm Pit, Chislet Court Farm, a post-fieldwork programme of analysis took place that incorporated items 1, 3, 4, 6, 7 and 8 in the above list of recommended work. An ostracod analysis was carried out that examined further samples, identified the species present, and presented them in a broad quantitative manner, rather than as detailed counts. However due to budgetary limitations it was not possible to follow up with more-detailed analysis of the small vertebrate and mollusc remains, or with particle-size analyses. Summaries of the post-fieldwork analyses and further fieldwork that were carried out for the project are provided below, followed by a synthesis of the main results for each site

(*Sections 4.2.4 - 4.2.9*) and a final review of the key fieldwork outcomes (*Section 4.2.10*). Then a justification of the benefits of completing the post-fieldwork analysis is presented in the final section of this report (**Section 5.6**), with an outline programme and costs (**Appendix 8**).

Sub-surface deposit modelling

The existing paper archive of test pit logs was firstly annotated with altitudinal and locational survey data, and then the sequence and survey information was typed up as a digital record of the sedimentary sequence in each test pit. Maps were prepared showing the location of each log in relation to any existing sequence records from the British Geological Survey archive or from other sources such as grey literature. Then scaled hand-drawn fence diagrams were produced for each of the investigated site areas, showing the different lithologies and any horizons with OSL dating and palaeo-environmental remains. These were then used (integrated with any dating and, for Chislet Court Farm, with palaeoenvironmental analyses and geophysical survey results) to develop models of sub-surface lithostratigraphy and deposit formation that fed into the wider project objectives. The sub-surface deposit models at each fieldwork site are given here as an appendix (**Appendix 4**), and these models are integrated into the site-by-site overviews below (*Sections 4.2.4 - 4.2.9*)

OSL dating

Thirty-one OSL dating samples were taken during fieldwork (**Table 9**). Of these, twenty-one of them (**Table 9**, right-hand column) were selected for dating following discussion with Kent County Council and English Heritage based on the principles of: (a) to obtain an OSL age determination from each site, (b) to analyse vertical series of samples through deposit bodies where possible, (c) to focus on brickearth deposits thought most likely to be of earlier date, and (d) to obtain a representative spatial spread of age determinations for the Chislet brickearth spread.

The light-proofed sediment samples were provided to Jean-Luc Schwenninger (Research Laboratory for Archaeology and History of Art, University of Oxford) in October 2013, together with the spectra from the *in situ* gamma ray dosimetry.

The OSL results of the analysed samples are given (**Table 10**). These dates are discussed further below in the site-by-site syntheses (*Sections 4.2.4 - 4.2.9*) in conjunction with their topographic situation, and within the context of the sub-surface models developed for the site areas using the test pit sequences. The OSL dating results are given throughout this report as a central date, with a ± range representing a diminishing probability distribution away from the central date. For the sake of simplicity, the bounds of this distribution are taken as maxima and minima of date ranges, although there remains a low probability of true dates being beyond this ± range. A separate archive report (Schwenninger *et* *al.* 2015) containing the dating results as well as more details pertaining to the OSL and dose-rate measurements (probability distributions related to dating results, shine down curves, growth curves, palaeodose estimates, dose rates and elemental composition) will be issued in the Historic England Research Report series.

Amino acid racemisation

Bithynia opercula suitable for dating by measurement of amino acid racemisation (AAR) were recovered from four horizons, from different test pits in the vicinity of the old Wear Farm Pit at Chislet Court Farm (**Table 11**). Three sets of opercula came from the first phase of fieldwork, CCF 13, from presumed-fluvial sediments in test pits 5, 6 and 22. The fourth group of opercula resulted from the second phase of fieldwork, CCF 14, from presumed-fluvial sediments towards the base of test pit 21. This chronological technique has been refined over the last ten years, and the new protocols have been proven robust in dating *Bithynia* opercula in the Middle/Late Pleistocene time range (Penkman *et al.* 2011). In particular, it has proved possible to provide reliable discrimination between different Marine Isotope Stages, the primary yardstick of Middle/Late Pleistocene dating that is relevant to Lower/Middle Palaeolithic research.

Full details of the amino acid dating methods and results are provided in the Final Fieldwork Report (Wenban-Smith 2015). A summary is given here, and then the results are considered below in the synthetic section on Chislet Court Farm (*Section 4.2.4*), in conjunction with OSL dating results and interpretation of the deposits based on the sub-surface deposit model derived from the test pit sequence data.

The extent of racemization (D/L) was established for five amino acids and their decay products (Asparagine/aspartic acid - Asx; Glutamine/Glutamic acid - Glx; Serine - Ser; Alanine - Ala; and Valine - Val), along with the ratio of the concentration of Serine to Alanine ([Ser]/[Ala]), for both the Free and Hydrolised fractions. These indicators of protein decomposition have been selected as their peaks are cleanly eluted with baseline separation and they cover a wide range of rates of reaction. It has been demonstrated that with increasing age, the extent of racemization (ie. the values of the D/L ratios) will increase, whilst the [Ser]/[Ala] value will decrease due to the decomposition of the unstable serine. Therefore the results can be interpreted in light of the robust framework now established for the British Pleistocene (Penkman *et al.* 2011). The results have been presented as charts showing points for the analysed material in relation to cross-hairs representing different MI Stages, based on the framework derived from comparative material thought to be reliably dated on independent litho-stratigraphic and bio-stratigraphic grounds.

In summary, the amino acid data from the opercula from Chislet are very similar (for all four dated horizons) to data from UK sites correlated with MIS 9, as shown by the results for Alanine (**Figure 5**). This amino acid racemises at an intermediate rate, so is one of the most useful amino acids for distinguishing samples at later Middle Pleistocene timescales.

4.2.4. Fieldwork results: Chislet Court Farm, CCF 13 and CCF 14

Introduction to site

Chislet Court Farm (NGR 622000 164300) occupies a tract of land on the east side of the Blean plateau, a few km to the northeast of Canterbury, and on the west side of the Wantsum Channel. This land is mapped as containing gravel outcrops and extensive Head brickearth deposits. It was therefore selected (with kind permission of the farmer, Mike Wilkinson) for an intensive study along a broadly east-west transect from the Blean plateau down to the edge of the Wantsum Channel. This transect would, we hoped, therefore intersect any terrace deposits that are present, and provide a model for the Stour terrace sequence that can be extrapolated a short distance upstream to Canterbury. The test pit transect also provided numerous exposures of the Head Brickearth deposit that is extensive in the area, allowing investigation of its varying nature and thickness, and dating analyses.

Eighteen machine-dug test pits were excavated, TPs 1-3, 5-16 and 18-20 (**Appendix 1**, Figures A1-1 and A1-2). In addition, section-cleaning and sampling took place at three locations in the face of the old Wear Farm Pit, designated as TPs 4, 21 and 22. The latter location corresponded with the same part of the face recorded as "Section 1" by Bridgland *et al.* (1998), which produced abundant small vertebrate and molluscan remains from one horizon.

The test pits encountered a range of deposits, including Pleistocene fluvial terrace deposits (as hoped), and thick brickearth deposits. Recent (ie. post-Pleistocene) features and finds were encountered in five test pits, TPs 1, 2, 6, 7 and 22 (see *Section 4.2.10*). Several sand/gravel deposits were sieved for artefacts, leading to recovery of two flint flakes (**Table 8**). A handaxe was also found in the ploughsoil of TP 11. Seventeen OSL dating samples were taken, twelve of which were selected for analysis (**Table 9**). Numerous sediment samples were taken, which were processed off-site for assessment for molluscan and small vertebrate remains, and sub-sampled for ostracod analysis. As discussed in detail in the post-fieldwork Assessment Report (Wenban-Smith 2014b), some of the deposits encountered are rich in palaeo-environmental remains, containing fish, molluscs, small mammals and ostracods.

Some photographic highlights of the fieldwork are shown (**Appendix 2**, Figure A2-1).

Stratigraphy and distribution of sediments

The test pits were distributed in two main transects. Transect 1 (which included test pits 1-8 and, within Wear Farm Pit, test pits 21 and 22) was shorter, and ran broadly east-west for approximately 0.5km from a patch of gravel mapped as Head Gravel (TP 8, ground surface level *c.* 15m OD) down across a spread of Head Brickearth to just above the edge of the alluvium filling the Wantsum Channel (TP 1, ground surface level *c.* 3m OD). This transect passed through the old Wear Farm Pit, where previous work (Prestwich 1855; Bridgland *et al.* 1998) had identified the presence of Pleistocene fluvial terrace deposits.

Transect 2 (which included test pits 9-20) was longer, and ran broadly east-west for *c.* 2km from a higher spread of gravel at Hoath (TP 20, ground surface level *c.* 32m OD) down through two other progressively lower spreads of gravel (TPs 15 and 11, where the ground surface was respectively *c.* 25m and 20m OD) to Chitty Farm (TP 9, ground surface level *c.* 9m OD). The areas between the gravel spreads were mapped as Head Brickearth, as was the eastern end of the transect between the 3rd gravel spread (TP 11) and TP 9.

A model of the sub-surface deposits along these transects was prepared (**Appendix 4**, Figures A4-1 and A4-2). For the longer Transect 2 (**Figure A4-2**), there were four discrete groups of sand/gravel deposit with different base-levels. These were interpreted as representing separate fluvial terrace aggradations. For the shorter Transect 1 (**Figure A4-1**), there were at least two (and possibly three) discrete groups of sand/gravel deposit with different base-levels, likewise interpreted as representing fluvial terrace aggradations. There was a terrace at 12m in both transects, providing a tie-point between them. There were extensive spreads of fine-grained brickearth deposits (interpreted as slopewash deposits) overlying the sand/gravel-dominant fluvial terrace deposits.

Geophysical survey results

Geo-physical surveying was carried out along the Transect 1 profile, so the records from these test pits can be used to ground-truth the geophysics results, and the geophysics results can provide more details on the deposits between the test pits. The north-eastern part of the transect through test pits 1-3 matches the ERT transect GT 2, and the south-western part of the transect through test pits 6 and 7 matches the central part of GT 1 (**Figure 3**).

The raw results of the ERT survey (**Figure 6a**) show that a number of distinct geo-electrical units are present beneath the ground in both profiles. Profile GT1 (**Figure 6a**, upper) shows a near-surface layer of moderate to high resistance material within 2m to 3m of the ground surface along the profile, possibly becoming thicker downslope beyond 154m along profile. The character of this surface layer appears to differ between the upslope end of the profile and the downslope end, where resistances are lower and more uniform. This layer is underlain by two pods of very low resistance material down to 10m below the ground surface at either end of the slope. Between these two pods (90-154m along profile) an area of high resistance is encountered. A high resistance layer underlies the whole section below a depth of around 10m below ground surface, with a further possible change/boundary at around 20-25m depth (although this remains equivocal given the paucity of data points at this depth). Profile GT2 (**Figure 6a**, lower) shows a similar sequence although the pod of low resistance material noted up-slope at the west end of GT1 is missing. The interpreted boundaries on these profiles are shown as a separate figure (**Figure 6b**).

Palaeo-environmental remains

A variety of palaeo-environmental remains were recovered from deposits at Chislet Court Farm, summarised in the table below (**Table 12**), and with separate summary details given below for the three categories of remains: small vertebrates, molluscs and ostracods. All remains came from the group of test pits in the field "Ware/Bells", in the vicinity of the old Wear Farm Pit (**Appendix 1**, Figure A1-2, test pits 5, 6, 21 and 22). from sub-surface sand-dominated deposits linked with one (or possibly two) presumed terrace aggradations between c. 5m and 9m OD (**Appendix 4**, Figure A4-1).

Small vertebrate remains were recovered from presumed-fluvial sands/gravels at approximately the same altitude in test pits 6 and 22. The remains from TP 6 (contexts 606 and 607) included fish, amphibians and diverse voles (including watervole), supporting the sedimentary interpretation of fluvial deposition. The remains from TP 22 (context 2204) were rich and diverse, with numerous fish (including tench), amphibians, diverse voles, lemming and pika. These likewise support the notion of a fluvially lain deposit, and the close proximity of these horizons provides an indication that they are broadly equivalent. They also provide a very specific environmental and palaeo-climatic signature of a continental climate with very harsh winters and warm summers, indicative of a warm interstadial within a cold stage. Small vertebrate remains were also recovered towards the bottom of test pit 5, between *c.* 5m and 6m OD. These remains included fish, watervole and field vole, likewise supporting the sedimentary interpretation of fluvial deposition.

Mollusc remains were identified in several horizons. However they have not yet been picked or analysed by a specialist, so only very preliminary interpretations can be made from them. In test pit 3, a few hydrobid molluscs were seen in the ostracod sample from the sandy clay-silt at the very base of the deposit sequence (context 306, between c. 3.5m and 4m OD). These provide an indication of aquatic deposition, in conjunction with the ostracod results discussed below.

In test pit 5, scarce molluscs were seen in the lower part of the same sand/gravel deposit that also produced some small vertebrate remains (context 512, between c. 5m and 5.5m OD). These have not been analysed, but they included several *Bithynia* opercula which (if not reworked) provide an indication of both fluvial deposition (supporting the sedimentary data) and temperate climate.

In test pit 6, molluscs became progressively more abundant downwards through the bedded (and presumed fluvial) sand/gravel of context 607 (which occurred between c. 8.5m and 9.5m OD). The presence of abundant *Bithynia* opercula in the bottom part suggests a temperate fluvial environment. Therefore in conjunction with the fish bones from the top of context 607, and from the overlying context 606, the palaeo-environmental evidence suggests fluvial deposition through contexts 607 and 606.

In test pit 21, molluscs were very scarce, the only identifiable remains found being a few *Bithynia* opercula in sample <245> from one of the finely-laminated sand/silt deposits at the base of the sequence (context 2119, between c. 7m and 7.5m OD). If not reworked (which they quite possibly are) these would indicate a temperate fluvial depositional environment.

In test pit 22, molluscs were very abundant in context 2204 (a thin sand/gravel bed between c. 9 and 9.5m OD), and present but much less abundant in the directly (and conformably) overlying sand/silt deposit (context 2203b). No analyses of this material have been carried out, but some observations were made during the small vertebrate assessment (Simon Parfitt, pers. comm.). The presence of some complete bivalves with both shells joined at the hinge provides a strong indication that the mollusc fauna represents an *in situ* assemblage, and has not been reworked. A mixture of freshwater and terrestrial species was noted, including clausiliids, *Belgrandia*, *Pisidium* (pea mussels) and *Bithynia* opercula. As a group these suggest fluvial deposition in a temperate environment.

An extensive assessment for ostracod and other micro-palaeontological remains was carried out (details given in the Assessment Report, Wenban-Smith 2014b), followed by further analysis and sampling of horizons where ostracods were found to be present. In test pit 1, a distinctive cold climate ostracod assemblage was recovered from the sand/silt towards the base of the sequence (context 107, between c. -0.15m and 0.50m OD). These provide a clear indication of deposition under glacial or near-glacial climatic conditions, in small, shallow, cold, oligotrophic pools located in low-centred ice wedge polygons or in small thermokarst depressions that warmed during the summer season. Very similar cold climate tundra-pool faunas are known quite extensively from the Warblington-Bognor area of West Sussex-Hampshire, in the Ebbsfleet Valley, and nearby at Swalecliffe (see Whittaker & Horne, 2009).

In test pit 3, a population of the brackish species *Cyprideis* torosa, an inhabitant of tidal flats and creeks, was found at the very base of the deposit sequence (context 306, between c. 3.5m and 4m OD). It is common here and as both adults and juveniles are present, it would indicate it is *in situ.* Some of the valves were noded and some smooth. Noding occurs when the salinity falls below *c.*6‰, thus the environment was tending to be quite low brackish. The proto-Stour must have been a tidal river at this time. Tidal access, as indicated here, must indicate a sea-level as high, if not higher than the present, and thus indicative of interglacial conditions.

In test pit 21, a consistent ostracod fauna was found throughout the lower part of the sequence, containing a diverse combination of freshwater species in conjunction with the brackish species *Cyprideis torosa*, the latter generally most abundant in the lowest parts of the sequence, and slightly less abundant progressively higher in the sequence. The ecology can be summarised as a tidal river, with salinity low brackish ±5‰. The marine proximity can be taken as an indirect indication of temperate conditions, since there would not be a marine influence in deposits at this altitude unless the sea level was at least as high as the present day, which would only occur under temperate conditions.

In test pit 22, an abundant ostracod fauna was found in context 2204 (the thin sand/gravel bed between c. 9 and 9.5m OD), strongly dominated by the brackish species *Cyprideis torosa*, accompanied by a few specimens of diverse freshwater taxa. A similar, but more restricted and less abundant fauna was present in the directly (and conformably) overlying sand/silt deposit (context 2203b). This almost certainly is again evidence of a tidal river, with the channel subject to migration and drying up (as indicated by the rhizoliths/rhizoconcretions and iron mineral), with the shelly and pebbly sands of context 2204 perhaps reflecting higher energy deposition.

Chronology

Three approaches to dating were carried out: OSL dating, amino acid dating and biostratigraphy. The results from each of these are summarised in turn below, and then integrated with the sub-surface deposit model and stratigraphic framework.

Twelve OSL measurements were obtained from the site, distributed between six test pits (**Table 10**). Dating was carried out in four of the test pits within Transect 1: TPs 1, 2, 5 and 21. The results and dated horizons are shown on the sub-surface model for Transect 1 (**Appendix 4**, Figure A4-1). OSL dating in this transect was mostly focused upon the brickearth in the upper part of the sequence, from which the centroid date from probability distributions of the OSL dating results were consistently between c. 18k and 21k BP, corresponding with the late Devensian Last Glacial Maximum. The similar dates of 26.74k BP for OSL-16 from the base of the brickearth in TP 21, and 20.58k BP for OSL-02 from the lower sandier part of the brickearth in TP 1, suggest that the full thickness of the brickearth was formed during this period.

Two dates - OSL-06 in TP 5, and OSL-17 in TP 21 - were obtained from lower horizons sealed beneath the brickearth and thought likely to be buried terrace deposits. The results confirmed this, with a minimum date of 137.22k ± 34.15 kBP from the laminated sand/silt at the base of TP 21, and a date of *c.* 247k ± 30 kBP from bedded sands in TP5.

OSL samples from two of the test pits within Transect 2 were dated - TPs 13 and 16. The results and dated horizons are shown on the sub-surface model for Transect 2 (**Appendix 4**, Figure A4-2). In TP 13, the upper OSL date (OSL-09) was from the main brickearth spread in this area, and the lower date (OSL-10) was from a more sandy and gravelly deposit at the base of the brickearth. In TP 16, both dated OSL samples were from the main brickearth spread, with the upper of the two (OSL-11) near its top (40cm below the base of the ploughsoil) and the lower (OSL-13) towards the base of the brickearth, 20cm above its sharp junction with the underlying clayey/gravelly sand of context 1607. The two dates from the main body of the brickearth (OSL-09, and OSL-13) with centroid results for the dating probability distribution of *c.* 19k and 23k BP respectively, likewise corresponded with the late Devensian Last Glacial Maximum. The much younger date of 2.04k ± 0.41 kBP from the top of the brickearth in TP 16 is perhaps an indication of intrusive contamination or later Holocene slopewash, since this location is at the foot of a slope. The older (and minimum) date of *c.* 143 ± 45 k BP for OSL-10 from the sandy/gravelly deposit below the brickearth in TP 13 suggests that the brickearth does overlie older deposits in places further upslope along Transect 2. These older and more deeply buried deposits could be the result of earlier phases of solifluction/slopewash, or they could be buried terrace deposits, and this is discussed below.

Amino acid racemisation (AAR) dating was carried out for mollusc remains (*Bithynia* opercula) from four separate horizons (**Table 11**), in test pits 5, 6, 21 and 22, all of them within the central part of Transect 1 (**Appendix 4**, Figure A4-1). The dated horizons at TPs 6 and 22 were closely adjacent and at roughly the same height, between 8m and 9m OD. The dated horizon at TP 21 was a little lower, at c. 7.5m OD. The dated horizon at TP 5 was a little lower still, at *c.* 5m OD. Full details of the AAR work are provided in the Final Fieldwork Report (Wenban-Smith 2015). The AAR results (**Figure 5**) were all broadly similar, suggesting an age of MIS 9 (between c. 350,000 and 300,000 BP) for all the dated material. However the strong continentality indicated by preliminary small vertebrate analysis suggests that the deposits are associated with an interstadial rather than an interglacial episode. This in turn suggests that the deposits most likely date to the warm episode MIS 9a at the end of MIS 9 (which is sometimes regarded as the first interstadial within MIS 8, labelled as MIS 8.5) or the warm episode MIS 9c in the middle of MIS 9.

There are a few biostratigraphic indications in the palaeo-environmental data. From the ostracod data, there is an abundance of cold climate forms from towards the base of TP 1 that represent species that became extinct within, or at the end of the last (Devensian) glacial. The ostracod fauna here is very similar to other Devensian ostracod faunas from southeast England, including one from nearby Swalecliffe, so it seems likely on purely biostratigraphic grounds that this context is of Devensian age, although an earlier cold stage cannot be entirely ruled out.

For the small vertebrate fauna from TP 22, context 2204, its overall composition and environmental implications resemble a warmer interstadial (Bølling, Allerød) during the last cold stage in northern Europe. These assemblages are well-dated and their ‘non-analogue’ aspect reflects biological reality rather than re-working or mixing of distinct faunas. In terms of age, there can however be no doubt that the Chislet fauna is substantially earlier than the last cold stage. This is based on the presence of a pre-Devensian (and probably pre-MIS 6) morphotype of the water vole *Arvicola cantianus* in the assemblage. Pre-Devensian faunas of this type are rare in the British Pleistocene and thus poorly understood.

Site formation and palaeo-environments

The fluvial nature of the sediments associated with TPs 6 and 21-22 is confirmed in the associated fossil material. As well as fish bones, this includes some ostracods that suggest the presence of a tidal river, close to the brackish head of the system. The subsequent events remain difficult to ascertain. The presence of sands and gravelly deposits in TPs 3-5 is suggestive of fluvial deposition at the base of these sequences and tidal river ostracods have been recovered from the fine-grained sediment at the very base of TP 3. However, in all cases these deposits lie below the elevation of similar sediments in TPs 6, 21 and 22, and in TP 3 the deposit with the ostracods is at 4m OD. These deposits must either represent reworked elements of the higher fluvial deposits seen in TPs 6, 21 and 22, and would thus be the first element of downslope colluviation better represented by the overlying sediments in test pits 3-5 (**Figure 7**, C), or they may represent fluvial deposition at lower elevations associated with a younger and lower terrace (**Figure 8**, C).

Fine-grained sandy silts (colluvium) cap the sequences in TPs 1-6, 21 and 22. On the basis of the OSL dates (**Table 10**), all of which lie between 18.5k and 26.74k BP, these appear to reflect substantial movement and deposition of sediments downslope around the Last Glacial Maximum (LGM) at the site (**Figures 7**, C; and **8**, D). OSL dates from the finer-grained sediments present in TPs 13 and 16 suggest extensive LGM colluviation in the upper parts of the deposits in this transect, as for the other transect.

Stratigraphic correlation and dating

Combining the profiles of transects 1 and 2, there seems to be a well-demonstrated terrace staircase down the east side of the Blean in the Chislet area. In the work here, there is an upper terrace staircase at the west end of Transect 2, with its base level at c. 28m OD, then a series of at least four further progressively lower terraces to the east, with base-levels at c. 22m OD, 18m OD, 12m OD and 5m OD. The lowest and eastern-most of these terraces (corresponding with the group of bedded fluvial sands with rich palaeo-environmental remains in test pits 5, 6 and 22) has been dated by AAR to MIS 9 (between c. 350,000 and 300,000 BP), and has an OSL date of c. 250,000 BP (from fluvial sands at c. 6m OD towards the base of TP 5). In addition to these, there is a mapped gravel outcrop at a higher level to the west of Transect 2, which wasn't investigated for this project. Therefore five terrace levels have been identified, above the west side of the Wantsum Channel, sealed beneath slopewash brickearth deposits of the Devensian glacial period.

The Great Stour terrace sequence at Canterbury, which has previously produced such abundant Palaeolithic remains, is best summarised by Bridgland *et al.* (1998). Following from Coleman's work (1952, 1954) they identify a lower series of at least four terraces above the current floodplain, progressing down from a Fordwich terrace at c. 42m OD, to an un-named terrace at 100 ft (c. 30m OD), the Sturry terrace (c. 21m OD) and the Chislet terrace (c. 5-6m OD). Bearing in mind that the Canterbury sequence is about 4km upstream from the Chislet area, and so base river levels could be a little higher, the Sturry terrace is most likely to correspond with the 22m or the 18m aggradation of the proposed new Chislet sequence, and the 100-ft terrace with the 28m aggradation. The Fordwich terrace seems to be at too high a level to be represented in the uninvestigated gravel outcrop to the west of transect 2, the ground surface here reaching a maximum of 37m OD. However, there may be higher unmapped outcrops. If any such outcrops were to correlate with the Fordwich terrace deposits, their base level would probably be c. 40m OD.

Evidence of Palaeolithic activity

Four lithic artefacts were recovered during the fieldwork at Chislet Court Farm (**Table 8**). Two lithic artefacts were found in the on-site sieve-sampling: a flake from TP 6 sample <26> and another from TP 10 sample <53>. An abraded handaxe was recovered from the ploughsoil in TP 11, and a slightly-abraded flake from the bulk small vertebrate sample <21> from TP 5, context 512, which was thought to be a Pleistocene fluvial terrace deposit.

The handaxe was a small pointed form, stained a deep ochre colour, and moderately abraded. It was found in the ploughsoil at TP 11, at about 19m OD, so it must have been reworked from higher terrace deposits to the west, which here could be any of the two terraces identified at 22m and 28m OD in Transect 2, the higher uninvestigated terrace presumed to exist to its west, or even-higher unmapped terrace outcrops of putative Fordwich age. The handaxe was retained by the farmer, Mike Wilkinson.

The flake from TP 6 came from a gravel deposit near the top of the sequence that unconformably truncated the top of the Pleistocene fluvial sands. It is in quite fresh condition, and technologically undiagnostic, although showing some weak indications of being from handaxe production, notably its narrow butt and the concavity of its dorsal surface. However the deposit in which it was found is either a slopewash deposit, or may be fill of a substantial late prehistoric feature, many of which are present in this vicinity, seen both in aerial photos (**Figure 9**) and in the section of Wear Farm Pit, just to the southwest of the recorded sequence at TP 22. Thus the flake is not well-associated with its context, and cannot be taken as indicative of Palaeolithic activity at any particular horizon.

The flake from TP 10 is small, likewise quite fresh, but entirely technologically undiagnostic. It came from towards the base of the sequence, in gravel deposits associated with the putative 12m terrace feature (**Appendix 4**, Figure A4-2). It would thus, despite its unprepossessing nature, seem to represent occupation broadly contemporary with formation of this feature. This flake would thus indicate occupation at a slightly earlier date than the next lower terrace (at 5-6m OD), which is associated with MIS 9, or an interstadial episode in the period between MIS 10 and MIS 8.

The flake from TP 5 is of medium-size and slightly abraded, but is entirely unpatinated and unstained, being a very glossy black colour. It is technologically undiagnostic, and has a small well-defined cone of percussion indicating having been struck by a hard stone percussor. It came from soft sandy gravel at the base of the sequence, from deposits associated with the putative 5-6m terrace feature (**Appendix 4**, Figure A4-2). It would thus seem to represent occupation broadly contemporary with formation of this feature, which is associated with MIS 9, or an interstadial episode in the period between MIS 10 and MIS 8, based on the various dating evidence discussed above.

Concerning the handaxe find from the Herne Bay pipeline reported by K Parfitt (1996), so far as can be established from pipeline route diagrams and site location descriptions in unpublished grey literature (Bates 1994), it was found in the vicinity of TP 7, and was reported as having been recovered from a gravel deposit sealed below Head Brickearth. Therefore it most likely originated from deposits of the putative 12m terrace.

There is also a record (Bowes 1928) of at least two handaxes having been found *in situ* in gravel deposits at Hoath, Millbank [HER-MKE6510]. These deposits would equate with the putative higher terrace to the west of Transect 2, with a terrace aggradation perhaps between *c.* 33 and 35m OD.

Curatorial implications and potential for further work

The work at Chislet Court Farm has been successful in numerous ways, namely:

- identifying a putative terrace staircase on the east side of the Blean at Chislet, with terrace aggradations buried below a wide spread of Devensian slopewash
- situating the fossiliferous deposits at Wear Farm Pit within this staircase
- establishing a dating tie-point of c. MIS 9 for the 5-6m terrace at Wear Farm Pit
- improving understanding of the climate and palaeo-environment associated with deposition of deposits of the 5-6m terrace at Wear Farm Pit
- identifying hominin activity at two terrace horizons within the staircase, the 12m terrace and the 5-6m terrace
- relating the Chislet staircase to the Great Stour terrace staircase on the north side of the Stour valley at Canterbury, in particular to the deposits rich in Palaeolithic finds at Sturry
- establishing that the wide spread of brickearth in the Chislet area is mostly a slopewash deposit of late Devensian date.

From a curatorial viewpoint, these results draw attention to the Palaeolithic potential of unmapped fluvial terrace deposits on the west side of the Wantsum Channel, in Palaeolithic character area (PCA) 17 of the Stour project. And by extrapolation of this result, they likewise draw attention to the potential of unmapped terrace deposits in analogous situations in other fluvial basins. At the same time they clarify the low potential of the brickearth deposits here (and in other analogous valley-side situations) to contain Palaeolithic remains, although one can never rule out a rare and unforeseeable discovery of material sealed beneath their basal junction.

In terms of further work, it would now be desirable to:

- do further ERT geophysical survey and test pitting work (and maybe also borehole investigations) to confirm and clarify the putative sub-surface terrace model established in this project

- examine the geoarchaeological and watching brief records from the Herne Bay pipeline and integrate them into a more-detailed sub-surface deposit model, contextualising the handaxe find from the pipeline project.

- carry out more intensive sieving for lithic artefacts in the terrace staircase

- carry out test pit investigations of the higher mapped outcrop to the west of Transect 2, to confirm its fluvial nature and investigate the presence/prevalence of Palaeolithic artefactual remains

- carry out further specialist analysis of the palaeo-environmental remains (small vertebrates and molluscs) recovered from the fossiliferous deposits of the 5-6m terrace aggradation

4.2.5. Fieldwork results: Hundred Acres Field, Dreal's Farm, HAF 13

Introduction to site

Dreal's Farm, 100 Acres Field (NGR 619500 144750) is underlain by a large patch of brickearth capping Clay-with-flints, and so was selected for study (with kind permission of the farmers, Anthony and Richard Martin). It is also near to the location of several Palaeolithic handaxe surface finds, including one of *bout coupé* form associated with Neanderthal presence *c.* 60,000 years ago.

Four machine-dug test pits were excavated, TPs 1-4, in a broadly northwest-southeast transect across the mapped brickearth patch (**Appendix 1**, Figure A1-3). A thick brickearth sequence of clayey silt/sand was encountered in TP 1 with cobbles of nodular flint in its topmost part. Deposits in the other three test pits were much more flint-rich, with common large nodular flint clasts in clay-silt/sand matrix.

Seven sediment samples were taken through the deep brickearth sequence exposed in TP 1, sub-samples of which would have potential for particle-size analysis. Two OSL dating samples were also taken from the TP 1 brickearth sequence. One mint condition flint flake was found in the top part of the brickearth in TP 2, 15cm below the base of the ploughsoil.

Some photographic highlights of the fieldwork are shown (**Appendix 2**, Figure A2-2).

Stratigraphy and distribution of sediments

As shown in the test pit location plan (**Appendix 1**, Figure A1-3), four test pits were dug along a broadly ESE-WNW transect. This crossed the mapped patch of Head Brickearth capping Clay-with-flints that was the target of fieldwork at this site. As also can be seen from the test pit location plan, there are numerous handaxe findspots in the nearby vicinity, including two *bout coupé* specimens. A sub-surface deposit model has been constructed along the test pit transect (**Appendix 4**, Figure A4-3).

Besides ploughsoil, which capped the sequence in all four test pits, two main deposit groups were identified, Clay-with-flints (phase 1) at the bottom of the sequence and Brickearth (phase II). The brickearth was sub-divided into IIa (a lower level with scarce or very few flints) and IIb (an upper level with common flints).

The base of the brickearth was not reached in TP 1, but was broadly horizontal between TPs 1 and 3 at *c.* 140m OD. It then dipped downslope to c. 136m OD at TP 4. The upper flint-rich part of the brickearth was consistently approximately 1m thick.

Chronology

Two OSL dates were obtained from TP 1, one on the lower flint-free brickearth (OSL-02, phase IIa) and the other a little higher in the sequence in the lower part of the upper relatively flint-rich brickearth (OSL-01, phase IIb). The age estimates and stratigraphic locations of the OSL samples are shown on the sub-surface deposit model (**Appendix 4**, Figure A4-3). Although the result of the lower date is slightly younger, and the upper date was close to saturation and needs therefore to be regarded as a minimum date, there is overlap between the ± error-margins of each date between *c.* 119k and 138k BP. It is therefore reasonable to conclude (a) that both parts of the phase II brickearth are of broadly similar age, and (b) that they (in contrast to slopewash brickearths examined in the project, for instance at Chislet Court Farm, *Section 4.2.4*) are considerably older than the late Devensian. If taken as an accurate indication of age, the overlapping date-range is indicative of the broad period between the late part of MIS 6 and the early part of MIS 5.

Site formation and palaeo-environments

The only evidence that contributes to interpretation of the deposit formation process and associated climatic and palaeo-environmental conditions is (a) the nature and any internal structures of the sediments, (b) the geometry of sediment bodies in the sub-surface deposit model and (c) the overall geomorphological situation of the sediment bodies in the landscape. The fact that the mapped patch of Head Brickearth caps a plateau of Clay-with-flints high ground seems at first to rule out the possibility that it is a slopewash deposit, since there is no higher ground from which it could have originated. However, it then becomes difficult to explain the prevalence of flint clasts, often large and angular, in the upper part of the sediment sequence — phase IIb.

Preliminary particle-size results from the main thickness of the brickearth — phase IIa, as best seen in TP1at the southeast end of the transect — suggest a strong predominance of particles in the coarse silt size-range between 0.02mm and 0.05mm, supporting an aeolian model for its formation.

It therefore seems likely either (a) that the Clay-with-flints/Chalk junction might outcrop higher than the excavated test pits somewhere in the current field, and that this has fed flints downslope into the top part of the sediment sequence, or (b) that slightly higher ground with this junction used to occur in the vicinity of the site, but has subsequently eroded away. A much-more-detailed grid of test pits or boreholes across the mapped brickearth patch in the area of the site would be needed to develop a better model of sub-surface stratigraphy of this mapped patch of brickearth and to try and resolve this conundrum. Such a project might additionally throw light on the abundance of *bout coupé* and other handaxe finds from the vicinity. The deeper OSL date — OSL 2, from phase IIa — seems a reliable result with a clear ± range, which would seem to preclude the possibility that the fine-grained deposits of phase IIa are Early Pleistocene or pre-Pleistocene.

Deposition of wind-blown silt would typically occur during cold periods, so here most likely late MIS 6 or early MIS 5, bearing in mind the OSL result of 119.91 ± 18.61 kBP . And then once deposited the loessic body would become stabilised by subsequent development of vegetation and soil formation. It would however be prone to erosion and downslope movement around its edges.

Evidence of Palaeolithic activity

One small and quite thin flint flake was recovered during the fieldwork, from the upper part of the phase IIb flint-rich in brickearth in TP 2. It was found 15cm below the base of the ploughsoil. It is very lightly patinated towards the proximal end of its ventral surface. It is in absolutely mint condition, lacking in cortex, and retains the scars on its dorsal surface of at least three previous flakes struck from roughly the same direction. However it is entirely technologically undiagnostic. At this height in the sequence it is quite possible for relatively recent post-Palaeolithic lithic remains (ie. within the Holocene) to become moved down the sediment profile by worm action, or to have fallen down a crack in the sediment, now closed up; however it is possible that this flake is evidence of Palaeolithic activity. Whatever its period, it is unlikely to have moved far from its original point of discard, so represents activity at this location. However, there was no sign of a palaeo-landsurface, nor of other flint artefacts suggesting sustained activity at this location.

There are relatively numerous discoveries of handaxes in this general area, as shown on the test pit layout plan (**Appendix 1**, Figure A1-3), including two of *bout coupé* form. The locations of these findspots seem concentrated around the edge of the mapped brickearth patch. This may well genuinely represent a zone of higher potential where Palaeolithic material is most likely to be recovered. There could be Palaeolithic remains preserved at the base of the brickearth, which are becoming exposed as the brickearth erodes away and washes downslope into the dry valleys below. Alternatively, if the extent of the brickearth patch has been consistent through much of the Palaeolithic, the zone just beyond its edge where the Clay-with-flints was becoming exposed would be a prime source of flint raw material, and so might be a focus for Palaeolithic (as well as post-Palaeolithic) activity.

Curatorial implications and potential for further work

The identification of a deep brickearth deposit in conjunction with its early OSL date supports one of the prime rationales of the Stour project, which was to investigate the idea that patches of Head Brickearth capping high ground might not be of late Devensian origin, but might be of earlier date (middle or early Devensian, or earlier) and thus of unrecognised high Palaeolithic potential. It is currently accepted that humans are absent specifically in the interglacial of MIS 5e. However recent work in the Dartford area (Wenban-Smith *et al.* 2010), has found evidence of occupation early in the Devensian in the later parts of MIS 5, in the time range 5d-5b. Episodes of lower sea-level would make Britain accessible from the continent then, and there is proven occupation in N France, so it is not that surprising that there would be occasional incursions into Britain in later MIS5, although the Dartford site is the only current known location.

It would be desirable firstly to carry out some more detailed assessment of landscape topography and geological mapping to identify where other similar brickearth patches are present, or likely to be present, and then to carry out further and more detailed field investigations to clarify their deposit sequences, their dates and the likelihood of there being Palaeolithic remains present, and the nature/period of any such remains. It would also be desirable to extend these investigations into the zone round the edges of these patches, to investigate the suggestion that this might be a zone of high Palaeolithic potential. These curatorial implications are factored in to the PCA model developed for this project, and in the associated attribute tables.

Completion of the analysis and reporting of the particle-size analysis of samples through the brickearth sequence in TP 1 at Hundred Acres Field should be undertaken to determine whether the sediment body is principally loessic.

4.2.6. Fieldwork results: Heath Farm School, HF 13

Introduction to site

Heath Farm School (NGR 592800 148700) is underlain by a large patch of brickearth, which is unusual for a location within the Weald basin. It was desired to investigate whether this patch might be at least partly of loessic origin, and whether it contained fluvial/alluvial elements, so it was selected for study (with kind permission of Sanjay Vadher, the interim Facilities Manager at the time of fieldwork).

Four machine-dug test pits were excavated, TPs 1-4, in a broadly north-south transect across the central part of the mapped brickearth patch (**Appendix 1**, Figure A1-4). TPs 1-3 showed a thin sequence of brickearth overlying Sandgate Beds bedrock, which comprised soft glauconitic variably clayey silt/sand. Recent archaeological features were encountered in TP 3 (discussed below, *Section 4.2.10*). A thicker sequence of brickearth, becoming sandier downward and gravelly at its base, was encountered in TP 4; the lower sandy and gravel-free part of the brickearth was sampled for OSL dating.

No sediment samples were taken, nor were any artefacts or faunal remains found.

Some photographic highlights of the fieldwork are shown (**Appendix 2**, Figure A2-3).

Stratigraphy and distribution of sediments

As shown in the test pit location plan (**Appendix 1**, Figure A1-4), three test pits (TPs 1-3) were dug along a broadly north-south transect, and a fourth test pit (TP 4) was dug offset to the east of TP3. The test pits were located roughly in the middle of the large mapped patch of Head Brickearth here that was the target of fieldwork at this site. There were numerous borehole logs held by the BGS for deposits in this area. Three of these (their locations also shown on the test pit location plan) were used to extend the sub-surface deposit model further to the south, just beyond the southern edge of the M20 motorway. Logs of the sequences in the test pits were used to construct a sub-surface deposit model along the test pit transect (**Appendix 4**, Figure A4-4).

Besides topsoil with turf, which capped the sequence in all the test pits, in TPs 1-3 there seemed to be only a very thin veneer of Head slopewash deposits, coming down onto Cretaceous bedrock (Sandgate Beds). Then the same sequence was present in TP 4, although the Head deposits were thicker, with an identifiable sandier and gravel-rich horizon at their base.

However, once the sequences in the boreholes to the south of the test pit transect were added in, a more complex sub-surface model emerged. This shows an increasing thickness and complexity of Head Brickearth slopewash deposits, with at least two phases of deposition. The most southerly borehole (TQ94NW90) shows sand/gravel deposits between 1m and 2m below the surface, underlain and overlain by different phases of slopewash deposition. These sand/gravel deposits, which had their base at 71m OD, were interpreted as fluvial terrace deposits, associated with the north-east branch of the Upper Stour, which drains from Lenham Heath towards Ashford along the foot of the Weald scarp slope.

The Quaternary deposit sequence can be summarised as, heading downwards through the phases:

Phase III - Head Brickearth [later, late Devensian phase of colluviation/slopewash]

Phase II - Sand/Gravel [fluvial terrace deposits, equivalent to BGS T4 of Upper Stour]

Phase I - Head Brickearth [earlier phase of colluviation/slopewash]

Chronology

One OSL date was obtained from TP 4, in the middle part of the brickearth (OSL-01, phase III). The resulting age estimate was 18.84 ± 1.79 kBP, and the stratigraphic location of the analysed OSL sample is shown on the sub-surface deposit model (**Appendix 4**, Figure A4-4). This indicates that the phase III brickearth is a slopewash deposit of late Devensian age, formed during the Last Glacial Maximum. It is uncertain whether this brickearth continues under or over the fluvial terrace deposits identified in borehole TQ94NW90, but the latter seems unlikely, which would meant that the fluvial terrace is of an earlier date, as is the fine-grained sediment of the earlier phase (I) of Head Brickearth that underlies the fluvial terrace deposit (phase II).

Site formation and palaeo-environments

The Head Brickearth deposit of phase III is clearly a slopewash deposit, dated by OSL to the cold peak of the Last Glacial Maximum. The sand/gravel of phase II has been interpreted as a fluvial terrace deposit. The underlying brickearth of phase I has also been interpreted as a slopewash deposit, since it would be unusual to have a basal fine-grained fluvial terrace deposit overlain by sand/gravel. However it would be possible to construct the sub-surface model differently, with phase II being directly underlain by Cretaceous bedrock, or with phase II being a gravelly phase of Devensian slopewash, rather than a fluvial deposit. In short, further information is required from test pit exposures to clarify the sub-surface deposits to the southeast of TP4.

Curatorial implications and potential for further work

It is clear that the part of the brickearth patch investigated between TPs 1 and 4 is of no or very low Palaeolithic potential. If these results are representative of the rest of the northern part of the brickearth patch, then much of it can be regarded as of similarly low potential, although this needs to be verified by ground truthed investigations. The situation is more complex in the southern part of the brickearth patch, towards the M20. Here there were deeper presumed-Quaternary sediments, including sand/gravel deposits thought to be a fluvial terrace aggradation. These would be of higher Palaeolithic potential.

It would be desirable to carry out test pit investigations in the vicinity of borehole TQ94NW90 to establish (a) whether or not fluvial deposits are present, (b) what is the nature and origin of deposits below the presumed fluvial deposits and (c) whether these deposits contain Palaeolithic or palaeo-environmental remains.

4.2.7. Fieldwork results: Otterpool Manor Farm, HF 13

Introduction to site

Otterpool Manor Farm (NGR 611100 136200) is another of the rare locations within the Weald basin where a large patch of brickearth is mapped. It was desired to investigate whether this patch might be of loessic origin, and whether it contained fluvial/alluvial elements, so it was selected for study (with kind permission of the farmer, John Champney).

Three machine-dug test pits were excavated, TPs 1-3, in an L-shape pattern within the northern part of the mapped patch of brickearth, and downslope from the peak altitude of the mapped patch which was approximately 300m to the southeast (**Appendix 1**, Figure A1-5). All three test pits showed a thick sequence of brickearth, gravelly at its base in TP 3, overlying Sandgate Beds bedrock, which here comprised clayey/silty glauconitic sand.

No sediment samples were taken, nor were any artefacts or faunal remains found. Three OSL dating samples were taken through the thick brickearth sequence of TP 1.

Some photographic highlights of the fieldwork are shown (**Appendix 2**, Figure A2-4).

Stratigraphy and distribution of sediments

As shown in the test pit location plan (**Appendix 1**, Figure A1-5), three test pits (TPs 1-3) were dug in an L-shaped transect. The test pits were located at the north end of the large mapped patch of Head Brickearth here that was the target of fieldwork at this site. Unfortunately it wasn't possible to gain access to the highest point of this brickearth patch, which was c. 10m higher and several hundred metres to the southeast. Therefore on purely topographic grounds one might have expected these test pits to show Devensian slopewash deposits, rather than older plateau brickearth of aeolian origin. Logs of the sequences in the test pits were used to construct a sub-surface deposit model along the test pit transect (**Appendix 4**, Figure A4-5).

Besides topsoil with turf, which capped the sequence in all three test pits, there was only one deposit present, which was a thick body (phase I) of Head Brickearth 2-3m thick and slightly gravelly at its base, coming down onto Cretaceous bedrock (Sandgate Beds).

Chronology

One OSL sample was analysed from TP 2, in the middle part of the brickearth (OSL-02, phase I). The resulting age estimate was 19.36 ± 2.23 kBP, and the stratigraphic location of the analysed sample is shown on the sub-surface deposit model (**Appendix 4**, Figure A4-5). This result confirms that the phase I brickearth is a slopewash deposit of late Devensian age, formed during the Last Glacial Maximum.

Site formation and palaeo-environments

The topographic situation of the part of the brickearth examined, in conjunction with the OSL dating result, confirm that the phase I brickearth is a slopewash deposit of late Devensian age, formed during the Last Glacial Maximum. However, it remains possible that older plateau brickearth of aeolian origin is present upslope to the south-east, and this might date to earlier in the Devensian, or even older.

Curatorial implications and potential for further work

The fieldwork established that the northern fringe of this mapped patch of brickearth is late Devensian slopewash of low Palaeolithic potential, and there was no evidence of buried fluvial terrace deposits.

It would be desirable to carry out further test pit investigations, supported by sedimentological studies and OSL dating, upslope to the southeast to verify whether or not there are aeolian or other sediments (such as buried fluvial aggradations) in the uninvestigated parts of this brickearth patch.

4.2.8. Fieldwork results: Somali Farm, SOF 13

Introduction to site

Somali Farm, Thanet (NGR 631500 168800) is underlain by a large patch of brickearth, mapped as "Head 1", older plateau brickearth. It was therefore selected for study (with kind permission of the farmer, David Linington) to investigate its age and whether it may be of loessic origin.

Six machine-dug test pits were excavated, TPs 1-6, in a broadly north-south transect across the northern part of the mapped brickearth patch, with the most northerly test pit TP 6 being beyond the mapped patch (**Appendix 1, Figure A1-6**). Reddish-brown brickearth deposits up to *c.* 1m thick were exposed, thinning and becoming more stony northwards and underlain by chalk-rich slopewash/solifluction deposits, which in turn overlay Chalk bedrock.

Two sediment samples were taken from the brickearth in TP 1, sub-samples of which were analysed for ostracods and other micro-palaeontological remains, and will also be analysed for particle-size. Two OSL dating samples were taken from the brickearth in TP 2. Two more OSL samples were taken from the TP 5 sequence, the lower of these from a basal sand bed below chalk-rich slopewash deposits, and the upper one from stony sand above the chalk-rich deposits. No lithic artefacts were found, nor any faunal remains.

Some photographic highlights of the fieldwork are shown (**Appendix 2**, Figure A2-5).

Stratigraphy and distribution of sediments

As shown in the test pit location plan (**Appendix 1**, Figure A1-6), six test pits (TPs 1-6) were dug along a broadly north-south transect. The test pits were located at the north side of the large mapped patch of Head Brickearth that was the target of fieldwork at this site. Unfortunately it wasn't possible to gain access to the highest point of this brickearth patch, which was c. 8m higher and several hundred metres further south in Quex Park. Logs of the sequences in the test pits were used to construct a sub-surface deposit model along the test pit transect (**Appendix 4**, Figure A4-6).

Besides ploughsoil, which capped the sequence in all the test pits, three deposit phases (I-III from lowest/oldest to higher/youngest) were recognised, the higher/youngest phase (III) being subdivided into two parts, IIIa and IIIb.

The two older/lower phases I and II were present at the southern end of the transect, in TPs 1 and 2, with the lower chalk-rich deposits of phase I grading into Chalk bedrock with a broadly horizontal base at c. 26.5m OD. These were in turn overlain by a broadly horizontal spread of brickearth attributed to phase II, with its base at c. 27.5m OD. These deposits were truncated to the north, by deposits of phase III dipping and thickening downslope northward. The lower deposits of phase IIIa were chalk-rich, with silt/sand beds well-developed at their base in places, and the upper deposits of phase IIIb were predominantly silt/sand.

Chronology

Four OSL samples were taken, two from the phase II brickearth in TP 2 (OSL-01 and OSL-02), one from a silt/sand bed in the bottom part of the phase IIIa deposits in TP5 (OSL-04) and one from the bottom part of the phase IIIb deposits in TP5 (OSL-03). All these samples were analysed for OSL, and the resulting age estimates and the stratigraphic locations of these samples are shown on the sub-surface deposit model (**Appendix 4**, Figure A4-6) as well as tabulated below (**Table 10**).

It can immediately be seen that the results from the phase II samples in TP2 are very young, most likely only *c.* 600-1200 years before the present day. These results clearly contradict the proposed deposit model and phasing, as well as the results from TP 5 which are much more in line with expectations. In TP 5, the lower date from phase IIIa came out at 20.98 ± 3.33 kBP, and the upper date from phase IIIb came out at 16.77 ± 1.80 kBP. However, rather than revising the deposit model, it was concluded that it was most likely that the dating samples in TP 2 were too close to the base of the ploughsoil, and that the sediment there included recent quartz grains, perhaps through worm action or root hollows.

Site formation and palaeo-environments

The downward dip of the phase III sediments, together with the presence of involutions in the chalk-rich deposits at their base and the OSL dating results provide a clear indication of slopewash deposition in the late Devensian, corresponding with the peak cold conditions of the Last Glacial Maximum. Concerning the phase II sediments at the south end of the test pit transect, these may also be on a sufficient slope to have formed by slopewash process, or (as shown in the deposit model) they may represent un-reworked aeolian sediments of greater age (despite the very young OSL dating results, which are here regarded as due to sedimentary contaminants). The underlying phase 1 sediments are thought to be essentially *in situ* deposits of degraded chalk bedrock, that have undergone heaving and involution in course of the oscillating cold/warm climate through the Quaternary.

Curatorial implications and potential for further work

The work done has established that the northern side of this mapped patch of brickearth, to the north of TP 3, is late Devensian slopewash of low Palaeolithic potential. There remains a question mark over whether deposits in the vicinity of TPs 1 and 2, and in the main body of brickearth in Quex Park to the south of the investigated area, are of similar or younger age, or whether they might be older plateau brickearth of aeolian origin and earlier date.

It would be desirable to carry out further test pit investigations, supported by sedimentological studies and OSL dating, further south in Quex Park to verify whether or not there are aeolian sediments of earlier date in the uninvestigated parts of this brickearth patch. At the moment, this still seems a high possibility, and if so this would be an area of high Palaeolithic potential considering the abundance of flint in the chalk bedrock which would be an important raw material source for flint artefact manufacture.

4.2.9. Fieldwork results: The Loop, Manston, THL 13

Introduction to site

The Loop, Manston, Thanet (NGR 631700 166800) is underlain by a patch of brickearth, mapped as older plateau brickearth, so was selected for study (with kind permission of Matt Hyland, on behalf of East Kent Opportunities, for the landowner Kent County Council) to investigate its age and whether it might be of loessic origin. It is also a location where flints of possible late Upper Palaeolithic origin have previously been recovered from a possible palaeo-landsurface towards the base of the brickearth, during archaeological evaluation of the Evron site by Canterbury Archaeological Trust (2003), Kent HER reference MKE80483.

Two machine-dug test pits were excavated, TPs 1-2 (**Appendix 1**, Figure A1-7). The first of these, TP 1, was located immediately to the south of the Evron evaluation site, where a possible undisturbed palaeo-landsurface with lithic artefacts was reported at the base of a sequence of loessic brickearth *(ibid.* p7). Broadly the same sequence of deposits was seen in TP 1 as at the Evron site, although the test pit was heavily affected by modern disturbance, previous backfilling and a possible services trench. Nonetheless, a sequence of undisturbed deposits was exposed along the south side of TP 1, and four OSL dating samples were taken from the brickearth deposits that were present, two from the upper part of the brickearth sequence and two from the lowest part, just above chalk-rich slopewash/solifluction deposits. TP 2 was located about 200m further south. This showed a thin layer of brickearth, overlying a thick sequence of chalk-rich slopewash (or periglacially distorted) sediments.

No sediment samples were taken from either of the two test pits; however, the OSL dating samples from the brickearth sequence in TP 1 can be sub-sampled for particle-size analysis if desired. One mint condition flint flake was found towards the base of the brickearth in TP 1, at a horizon that is possibly equivalent to the artefact-rich horizon at the Evron evaluation site. No faunal remains were found.

Some photographic highlights of the fieldwork are shown (**Appendix 2**, Figure A2-6).

Stratigraphy and distribution of sediments

As shown in the test pit location plan (**Appendix 1**, Figure A1-7), two test pits (TPs 1-2) were dug along a broadly north-south transect. The test pits were located at the north edge of the large mapped patch of Head Brickearth that was the target of fieldwork at this site. This area was targeted since it was very close to a location where previous archaeological evaluation (Canterbury Archaeological Trust 2003, for Evron Foods) had identified a buried landsurface with undisturbed Middle or Late Upper Palaeolithic flint artefacts on it, sealed beneath the Head Brickearth.

Logs of the sequences in the test pits were used to construct a sub-surface deposit model along the test pit transect (**Appendix 4**, Figure A4-7). The sub-surface deposit model has been extended northwards from TP 1 to include Section 1 recorded at the south end of the Evron evaluation site.

Topsoil or ploughsoil capped the sequence at all the locations, and there was also c. 50cm thick of modern made ground at TP 1 between the base of the topsoil and the top of undisturbed Quaternary sediments. At TP 2, at the south end of the transect, there was a thin body of flinty/sandy clay-silt (phase **II**a), underlain by a thick body of chalk diamict (phase I), which included faint remnants of involution structures filled with sandier/siltier chalk-rich sediment. In TP 1, the same sequence was present as at TP 2, with an additional less clay-silty and more sandy/silty layer (phase IIb) at the top of the pre-Modern sequence. Section 1 of the Evron evaluation was not observable, having either been dug away or obscured by backfill (probably the latter considering the broadly flat topography at the site's location); however the records of the section in the evaluation report (Canterbury Archaeological Trust 2003) showed a similar sequence to that seen in TP 1.

The Quaternary deposit sequence can be summarised as, heading downwards through the phases:

Phase IIb - sand/silt, with flints

Phase IIa - sandy clay-silt, with flints

Phase I - chalk diamict, with involutions in filled with sandier/siltier chalk-rich sediment

Chronology

Four samples for OSL dating were taken in TP 1, one of which (OSL-04) was analysed, from the phase IIa sandy/flinty clay-silt. The resulting age estimate was 12.68 ± 1.09 kBP, and the stratigraphic location of the dated sample is shown on the sub-surface deposit model (**Appendix 4**, Figure A4-7). This suggests that the phase IIa deposit is of very late Devensian age, formed after the Last Glacial Maximum. Although the age estimate comes with a margin of error of ± c. 1000 years, the centre of the dating probability distribution range suggests deposition during the very final (Loch Lomond/Younger Dryas) cold episode of the Devensian.

Site formation and palaeo-environments

It seems likely that phase 1 is a slopewash deposit of Devensian age, and that phase phase II sediments are slopewash deposits from the cold snap at the very end of the Devensian.

Evidence of Palaeolithic activity

One small flint flake was recovered from TP 1, from towards the base of the phase IIb deposits. It was in mint condition and lightly patinated in places; it was however entirely technologically undiagnostic, and unattributable in terms of date or cultural affinity. This was roughly the same horizon as the larger flint assemblage reported in the Evron evaluation. This was reported (Canterbury Archaeological Trust 2003: 7) as an assemblage of 18 artefacts in "crisp" condition including a Long Blade core, two scrapers and a small cordate biface of Mousterian appearance. This combination of artefacts remains curious as a group. The new work failed to identify a palaeo-landsurface, but provided some indication that the deposits below the Evron flint horizons date to the end of the Devensian, if the proposed sub-surface correlations are correct. This would suggest that if there are any undisturbed Palaeolithic remains at the site, they date to the very end of the Upper Palaeolithic, or if they are, are of earlier Upper or Middle Palaeolithic date, then they are probably reworked from slightly higher ground to the south.

Curatorial implications and potential for further work

The work done has suggested that the northern side of this mapped patch of brickearth is late Devensian slopewash, and that it does contain lithic remains, probably of Palaeolithic date. It remains uncertain whether there is an undisturbed occupation surface in the vicinity, and if so of what date. There also remains a question mark over whether deposits to the south of the investigated area are of similar or younger age, or whether they might be older plateau brickearth of aeolian origin and earlier date.

It would be desirable to carry out further test pit investigations, supported by sedimentological studies and OSL dating, in the area of the Evron evaluation site to reinvestigate the horizon where the palaeo-landsurface with lithic remains was identified. It would also be desirable to carry out further test pit investigations in the main brickearth patch further south, to verify whether or not there are aeolian sediments of earlier date in its uninvestigated parts. At the moment, this still seems a high possibility, and if so this would be an area of high Palaeolithic potential considering the abundance of flint in the chalk bedrock which would be an important raw material source for flint artefact manufacture, and also the possible recovery of a reworked Mousterian biface at the Evron site.

4.2.10. Post-Palaeolithic remains

Post-Pleistocene finds and/or features were encountered at two of the six fieldwork sites: Chislet Court Farm and Heath Farm School.

At Chislet Court Farm, varied remains (tile, pottery, bone, burnt flint and flint artefacts) were found out-of-context in the uppermost slopewash deposits and in the ploughsoil in TPs 1 and 2. Archaeological features were seen in TPs 1, 6, 7 and 22, but these were not investigated and the deeper test pit excavation took care to avoid them. As shown in aerial photos of the site (**Figure 9**) and in the HER, there are numerous crop-marks and findspots in the area reflecting Late Prehistoric activity. Perhaps these locations should be earmarked in the HER as having high archaeological potential.

At Heath Farm School, edge cuts from two intersecting features were present in test pit 3, cut into the brickearth and extending down from below the topsoil (**Appendix 2**, **Figure A2-3e**). The fills of both features were rich in pieces of charcoal and slag. The ground surface (which was turfed pasture) was also uneven in the vicinity of the test pit, making it likely that this is an area rich in sub-surface archaeological remains, possibly associated with the Wealden iron industry. This location should also be earmarked in the HER as having archaeological potential.

4.2.11. Key fieldwork outcomes

"Brickearth": formation processes and age

Although it was attempted to target plateau brickearth deposits capping high ground for fieldwork and OSL dating, this was not usually possible due to limitations on the locations accessible for fieldwork. The sub-surface deposit models showed that even in some areas mapped as plateau brickearth, the areas investigated by the project's test pits usually included sloping bodies of brickearth that were most likely of slopewash origin. OSL dating of brickearth deposits for the project mostly gave results reflecting slopewash deposition during the late Devensian (**Table 10**). It proved possible with OSL dating to distinguish between deposits from early in the Last Glacial Maximum (eg. OSL-16 from TP 21 at Chislet Court Farm), late in the LGM (eg. OSL-05 from TP 5 at Chislet Court Farm) and the final Loch Lomond/Younger Dryas cold episode of the Devensian (OSL-04 from TP 1 at The Loop). If it was ever thought important to distinguish deposits of these ages, more robust separation could be obtained by taking a greater number of samples in a vertical series, and applying Bayesian methods of analysis to their OSL age estimates.

There was one notable exception to the Late Devensian brickearth dates, at Hundred Acres Field, Dreal's Farm, where test pits were dug into a substantial spread of brickearth capping Clay-with-flints. The OSL age estimates here gave results of 119.91 ± 18.61 and 143.25 ± 23.65 kBP, this latter result being from a sample close to saturation and thus treatable as a minimum age rather than an accurate result. This provides at least one firm indication that there is the potential for plateau brickearth deposits capping high ground to be substantially earlier than the late Devensian, and thus to have high Palaeolithic potential.

The Stour terrace staircase: distribution, dating and Palaeolithic potential

Combining the profiles of transects 1 and 2, there seems to be a well-demonstrated terrace staircase down the east side of the Blean in the Chislet area. In the work here, there is an upper terrace staircase at the west end of Transect 2, with its base level at c. 28m OD, then a series of at least four further progressively lower terraces to the east, with base-levels at c. 22m OD, 18m OD, 12m OD and 5m OD. The lowest and eastern-most of these terraces (corresponding with the group of bedded fluvial sands with rich palaeo-environmental remains in test pits 5, 6 and 22) has been dated by AAR to MIS 9 (between c. 350,000 and 300,000 BP), and has an OSL date of c. 250,000 BP (from fluvial sands at c. 6m OD towards the base of TP 5). In addition to these, there is a mapped gravel outcrop at a higher level to the west of Transect 2, which wasn't investigated for this project. Therefore five terrace levels have been identified above the west side of the Wantsum Channel, sealed beneath slopewash brickearth deposits of the Devensian glacial period.

It is likely that outcrops of these terraces extend intermittently north and south from the locations where they have been identified, and they have high potential for Palaeolithic remains where present.

The Great Stour terrace sequence at Canterbury, which has previously produced such abundant Palaeolithic remains, is best summarised by Bridgland *et al.* (1998). Following from Coleman's work (1952, 1954) they identify a lower series of at least four terraces above the current floodplain, progressing down from a Fordwich terrace at c. 42m OD, to an un-named terrace at 100 ft (c. 30m OD), the Sturry terrace (c. 21m OD) and the Chislet terrace (c. 5-6m OD). Bearing in mind that the Canterbury sequence is about 4km upstream from the Chislet area, and so base river levels could be a little higher, the Sturry terrace is most likely to correspond with the 22m or the 18m aggradation of the proposed new Chislet sequence, and the 100-ft terrace with the 28m aggradation. The Fordwich terrace seems to be at too high a level to be represented in the uninvestigated gravel outcrop to the west of transect 2, the ground surface here reaching a maximum of 37m OD. However, there may be higher unmapped outcrops. If any such outcrops were to correlate with the Fordwich terrace deposits, their base level would probably be c. 40m OD.

Survival of palaeo-environmental remains, and sampling for evaluation

Environmental samples were not collected at all sites, in fact they were hardly collected apart from at Chislet Court Farm. This was because previous experience of numerous negative results from palaeo-environmental assessments provided a good basis for recognising which deposits are most likely to have palaeoenvironmental potential. Slopewash deposits are generally not good sources of palaeo-environmental remains, and the reddish-brown colour of many fine-grained sediments is a sign of oxidation that usually precludes survival of delicate remains such as ostracods, molluscs and small vertebrates. Curiously however, context 2204 in TP 22 at Chislet Court Farm was notably reddish-brown in colour, and yet was exceptionally rich in all these categories of palaeo-environmental remains, including abundant visible molluscan remains. This highlights that colour alone is not a 100% reliable guide, and that appearance should be supplemented by close visual inspection.

Another useful lesson was perhaps that some un-promising-looking fluvial sands may in fact contain useful small-vertebrate remains, particularly when there is some evidence for likely-calcareousness, such as chalk pebbles or derived Tertiary shell remnants - although one must take care not to confuse the latter with Pleistocene fossils when in the field. The basal part of the soft fine-coarse fluvial sands at Chislet Court Farm TP 5 was bulk-sampled for small vertebrate remains, where some chalk pebbles were present, and these remains proved to be moderately common. In retrospect, larger samples would have been beneficial, and the upper part of the deposits should also have been sampled. However, it is always important to try and strike the balance between extensive, time-consuming and expensive blind-sampling of unproductive deposits, and failing to sample possibly-productive deposits. In this instance, the focus was on establishing the potential of certain deposits, rather than achieving full research benefits. The level of sampling was therefore appropriate to achieve its objectives, since the potential of the deposits was successfully established. And any future investigations can recover larger samples from the deposits that have now been identified as containing palaeo-environmental remains.

However, blind-sampling for evaluation will remain an inexact science. Numerous sites (for instance the Ebbsfleet elephant site, in Kent - Wenban-Smith 2013) contain pale yellow fluvial sands in a Chalk bedrock landscape, extensive sampling of which failed in most places to produce any palaeo-environmental remains. Based on experience, positive indications for the survival of palaeo-environmental remains in fluvial deposits include:

- predominantly a sand deposit, not too gravelly
- buried by a fine-grained deposit that will have reduced groundwater penetration
- no sign of reddish-brown staining bands indicating previous water-tables and *in situ* oxidation
- a calcareous context reducing the likelihood of decalcification, such as Chalk bedrock
- the presence within the deposit of chalk pebbles or abundant derived Tertiary shell fragments; in some instances trails of chalk pebbles or Tertiary shell fragments can be associated with limited zones of better palaeo-environmental preservation

Key locations for HER inclusion

From a Palaeolithic viewpoint, important finds of palaeo-environmental remains have been made at many of the test pits in the field Ware/Bells around the old Wear Farm Pit at Chislet Court Farm. Important remains were found at TPs 3, 5 and 6.

Flint artefacts thought to be of Palaeolithic date were recovered from TPs 5, 10 and 11 at Chislet Court Farm.

Flint artefacts of probable Palaeolithic date were also recovered from TP 1 at The Loop, Thanet, and TP 2 at Hundred Acres Field, Dreal's Farm.

4.3. Characterisation and predictive modelling

4.3.1. Sub-surface models in key areas

The use of geotechnical borehole data (primarily from the BGS archive) often enables archaeologists and geomorphologists investigating areas of stratified Pleistocene and Holocene sediments to model sub-surface sedimentary architecture. In archaeology this has been discussed in the British context by a number of authors Bates and Bates (2000), Bates *et al*. (2000) and most recently by Bates and Stafford (2013). Such sources of information are particularly useful for providing both direct and remote views of the stratigraphy buried at depth in such areas. Information obtained from such investigations may be utilised to build sub-surface ground models and ultimately be used within a predictive modelling framework to locate areas of high archaeological potential (Deeben *et al*., 1997). Used in this way the techniques have an important role to play within regional management strategies both for archaeological as well as non-archaeological fields.

Extensive use has been made of the BGS archive in this project including consultation at the planning stage of the project and within the phases of data integration and interpretation following fieldwork. Its use in this project is however limited by a number of factors:

- The spatial distribution of the borehole locations.
- Inadequate supporting information.
- Problems in description of the sequences.

Despite a large number of borehole records being available for consultation typically their locations are skewed to linear distributions (associated with route corridors) or are randomly distributed across the landscape. Very few areas of the landscape are associated with either the density of boreholes required for deposit modelling or are distributed in a suitable pattern to allow 3-D deposit modelling. Furthermore many of the boreholes shown in the BGS archive are confidential records and even those available for consultation often are missing from the electronic archive.

A further additional problem is the absence of supporting information in many cases where ground level elevations for the logs are missing. This is of considerable difficulty as it renders attempts to integrate such records, with better quality records, impossible or, when ground surface elevations are estimated from nearby locations, of limited value.

Finally problems are encountered in the lithological descriptions. For example the level of detail recorded in the logs (which can range from basic (i.e. clay silt) to complex (where a full sediment description is provided)) is highly variable. Because of the numbers of individuals involved in the process of geotechnical ground investigation (drillers' logs, geotechnical field technician logs, final geotechnical published logs) individual descriptions can often be significantly modified through the recording process. Additionally the interpretation of the logs is also often difficult where origin (estuarine alluvium, periglacial head etc.) is appended to the lithological description.

As a consequence we were not able to use these resources to produce a sub-surface deposit model for any substantial areas within our Stour Basin study region. However, we have been able to produce transect profiles in some areas based on extant data held by the BGS, along with our own field investigation data, although even these are compromised by difficulties in the interpretation of the lithological evidence in many of the commercial borehole logs. Nonetheless all this having been said, the BGS borehole data enabled much better interpretation of the fieldwork results at Heath Farm School in Area 14 in particular (*Section 4.2.6*, HF 13; **Appendix A4-4**).

The results are presented below, and supporting figures are provided as a separate appendix (**Appendix 7**).

Area 2 transect.

Transect running approximately SSW to NNE from higher ground to the south towards the Swale. Bedrock can be seen to young to the north (right hand side of transect) from Chalk in the south, through Thanet Sand (in the middle of the transect) to Woolwich Beds and then Thanet Sand to the north. Ground surface elevations trend from higher in the south to lower in the north (albeit that dips in this trend associated with minor valley systems are noted).

Superficial deposits vary along the length of the transect and tend to reflect the nature of the underlying bedrock geology (hence chalky solifluction deposits only appear to occur when 'head' deposits overlie chalk bedrock, e.g. TQ86SE120, TQ86SE167). On Thanet Sand grain sizes within the 'head' tend to be finer (TQ86SE56). Gravels occur in valley like features (TQ86SE175) while remnants of possible fluvial gravels overlie possible steps in the underlying bedrock (TQ86NW36, TQ86NW85).

The Pleistocene sediments derive from processes operating on the North Downs dip slope where small valleys dissecting the dip slope transport slope deposits

(Head) downslope to the valley base where fluvial (perhaps intermittent) processes transport the gravels down valley towards the Swale. Locally important traps for Palaeolithic archaeology may occur in such situations (for comparison see work undertaken in similar contexts at Dartford – Wenban-Smith et al., 2010c; Wenban-Smith and Bates, 2011).

Area 4a transect.

Transect running approximately WNW to ESE along the route of the M2 near junction 6. Ground surface elevations rise slightly to the east.

Probable Head deposits are mapped in the westernmost two boreholes (TR95NW5/TR05NW7) varying from a chalky head to a more sandy head reflecting the underlying geology. This head is replaced by possible colluvium in TR05NW9. A chalky head lies above Chalk bedrock to the east. Thanet Sand is present in the middle of the transect.

Area 14 transect.

Transect runs approximately NNW to SSE along the route of the M2 SW of Charing Heath. Ground surface elevations rise slightly at the start of the transect and then fall to the SSE.

Bedrock geology consists of Sandgate Beds to the west giving way to Hythe Beds in the middle of the transect before the Sandgate Beds return to the east. Head deposits dominate most of the boreholes and reflect the nature of the underlying bedrock. Possible Holocene alluvium is noted in TQ 94NW 317 as well as TQ 94NW 279

Area 19 transect.

This transect runs approximately WNW to ESE along the route of the M20 near junction 11. Ground surface elevation varies and rises from west to east by c20m. Rockhead variation in this area is not as great as that in Areas 2 and 4a where Chalk was present. Here both the Sandgate and Hythe Beds are present.

Superficial deposits are dominated by clay, silt and sand fractions that might in part be derived from the bedrock. Considerable difficulties in differentiating weathered bedrock from superficial sediments, in part derived from bedrock. Head deposits are present in TR 13 NW274, TR 13NW 225 and TR 13 NW 151 while possible Holocene alluvium appears in TR 13 NW 254.

4.3.2. Palaeolithic Character Areas (PCAs) and assessment of their potential

Palaeolithic Character Areas (PCAs) were defined and their potential assessed in accordance with the methods outlined above (Figure 10). The areas are now incorporated in the HER as a 2D shapefile layer (project output P25) and their supporting attribute tables are given here as an appendix (**Appendix 5**).

4.4. Development and curatorial tools

4.4.1. Development control and Palaeolithic archaeology

The general curatorial context for the management of Palaeolithic archaeology within the development control process has been reviewed above (**Section 2.5**). Discussion among the project team suggested that in Kent there was, prior to the project, a degree of uncertainty among curators, consultants and contractors about how development proposals should be assessed for their Palaeolithic potential and how to evaluate and excavate sites appropriately. It was further believed that this uncertainty is not limited to Kent but extends across the south-east of England and probably nationally.

Such uncertainty places the Palaeolithic resource at risk and limits the ability of the sector to take advantage of the greater understanding of the Palaeolithic being achieved by the Stour Project and similar research projects. If any gaps in understanding can be closed developers can be better prepared for the likely archaeological requirements of their proposals, consultants and contractors can be better placed to advise them, and curators can appraise proposals more effectively and design more appropriate investigation strategies.

4.4.2. The stakeholder consultation programme

Objectives

The consultation programme had a number of objectives:

- To explore the awareness and understanding of Palaeolithic archaeology among professionals working in the sector
- To discuss interviewees' experiences of working with Palaeolithic archaeology
- To review how development management processes are employed to manage Palaeolithic archaeology and whether there are lessons to be learned

- To see if any tools can be developed that would help Palaeolithic archaeology be managed more effectively in the development control process
- To review whether communication is effective during the management of Palaeolithic projects
- To gauge opinion of the value of Palaeolithic archaeology and how this might be enhanced
- To provide an opportunity for stakeholders to raise any other issues on the subject of Palaeolithic archaeology and development management.

Methods

A programme of interviews was designed to identify and close any understanding gaps. Those chosen to participate in the consultation process were selected to provide a representative sample of professionals working in the sector in the south-east of England and particularly Kent. Appropriate organisations were identified and asked to nominate an individual for interview who would, as far as possible, gather the views of a range of colleagues before responding.

Interviewees were divided into 5 groups:

- Heritage curators
- Archaeological contractors
- Archaeological consultants
- Palaeolithic archaeology specialists
- Planning officers
- English Heritage

A number of developers were also approached but these declined to participate suggesting that it would be more appropriate to talk to consultants or contractors.

In total 25 different people were interviewed during the programme. In total the interviewees comprised:

- 6 heritage curators
- 6 archaeological contractors
- 2 archaeological consultants
- 4 Palaeolithic archaeology specialists
- 4 planning officers
- 3 English Heritage officers

Each interviewee was sent a list of questions for discussion. They were not asked to answer the questions in writing, merely to think about them before the phone interview. The questions were phrased slightly differently to reflect the different responsibilities of the stakeholder groups but each was focused on the same broad themes:

- Awareness and Understanding
- Experience
- Process
- Tools
- Communication
- Value
- Recommendations

At least a week after receipt of the questionnaire the participant was interviewed by telephone, each interview taking typically 1 hour. The participants' responses were noted in writing. On the conclusion of the interview the notes were written up and sent to the interviewee for approval or editing and to allow them to add any subsequent thoughts.

The interviewees were promised individual confidentiality to encourage them to speak freely.

Results

The results have been presented in a report "*Stour Basin Palaeolithic Project Consultation Programme Report*" (KCC Heritage Conservation 2014b). A number of general conclusions can be presented here:

- The approach to the Palaeolithic taken by curators is highly variable. This seems to be based on very different levels of understanding of Palaeolithic potential and confidence in designing fieldwork strategies. All the stakeholder groups working with curators urged a greater degree of standardisation.
- There is a significant degree of uncertainty about what is the best strategy to use to evaluate sites with Palaeolithic potential.
- There are insufficient Palaeolithic specialists available. This causes a slow response rate, variable fieldwork strategies and some concerns about conflicts of interest.

- There is some concern that specialists' reports are not providing the information curators need in the form they need it in. This may be due to the especially technical nature of the reports or to the way they are used by main contractors in the final report.
- The ways in which planning conditions are signed off are highly variable and often confusing to contractors and consultants.
- For most stakeholder groups the Palaeolithic is encountered only rarely making it difficult to build up experience and establish standardised approaches.
- Many desk-based assessments do not at present assess the Palaeolithic potential successfully. Curators would like contractors to be more pro-active about assessing the Palaeolithic potential properly. Contractors would like curators to provide more guidance on how curators want them to assess the Palaeolithic.
- There is uncertainty about whether and how to evaluate sites below the depth of proposed foundations.
- Specialists need to be brought in to projects as early as possible and earlier than they generally are at present, in particular to advise on WSIs and budget decisions.
- Fieldwork may be made more effective and efficient if the developers geotechnical work and the geoarchaeological work could be brought together better.
- Improved guidance was generally to be welcomed but there were different views expressed for where it should focus. One common wish was for a document that would outline good practice for investigating the Palaeolithic so that contractors could use it for developing WSIs and could use it to demonstrate that their suggestions are reasonable.
- Almost all the interviewees would welcome effective and meaningful GIS data that accurately described Palaeolithic potential.
- Communication between the stakeholder groups generally works well though a number of interviewees were concerned that consultants often prevented contractors and specialists from discussing matters direct with the curator. This was felt to be harmful by most interviewees.

- Almost all the interviewees seek to promote the results of Palaeolithic fieldwork to the public. Whether it is possible to do so is dependent on resources and the attitude of the developers.
- There is considerable doubt about what constitutes meaningful Palaeolithic discoveries – whether in-situ sites, relocated flints, environmental evidence, deposits of potential or even an absence of all of these. This may explain why there is a general feeling that a very low proportion of Palaeolithic evaluations are successful.
- There is a feeling that the Palaeolithic archaeology is not well understood by the sector or the public and thus is less valued than it might be.
- Many interviewees felt that there should be more information sharing between specialists and contractors so that contractors can develop a better understanding of what the specialists are trying to achieve.

- The information produced by Palaeolithic investigations can be made more useful if it can be integrated into dynamic research frameworks easily.
- Planning officers do not think they need much understanding about Palaeolithic archaeology, relying rather on the curators. Some officers do acquire a significant degree of understanding based on their case-work experience.
- Many interviewees thought that training seminars involving specialists, contractors, consultants and curators would be a useful way to disseminate local approaches to the Palaeolithic.

4.4.3. Advisory documents

The consultation programme carried out as part of the project suggested that contractors, consultants and curators would welcome guidance on how Palaeolithic archaeology is investigated in Kent during the development control process. This will help them prepare high quality and consistent documentation, anticipate likely evaluation and excavation strategies and take specialist advice when needed. A particular issue identified was a need for guidance on how to write useful desk-based assessments for sites of Palaeolithic potential. This issue has been addressed by a separate document (KCC Spec Manual Part B - Palaeolithic Desk Based Assessment).

KCC Advice Note A Investigating Palaeolithic archaeology in Kent v2

Advice note A is intended to help archaeologists, developers and their consultants anticipate the approach to the Palaeolithic taken by KCC and thereby help them to be better prepared. This will help Palaeolithic projects develop more efficiently and also more effectively with benefits anticipated for both the heritage itself and for developers.

When the advice is finalised (following any comments from EH) it will be sent to all curators, contractors, consultants and specialists working in Kent and will be additionally supplied in advance of any projects likely to involve Palaeolithic assessment whether desk- or field-based.

The advice contains a number of sections:

1 Background

Explains why the advice has been developed and the audience for which it is intended. It outlines the general importance and potential of Kent for the Palaeolithic and explains how the South Eastern Research Framework has contributed to our understanding of the period. The origin of the advice within the Stour Basin Palaeolithic Project is described.

2 Planning policy background

This section puts the study of Palaeolithic archaeology within national planning policy context and national strategies for heritage and Palaeolithic archaeology in particular. This includes the National Planning Policy Framework and English Heritage guidance and advice.

3 Research objectives for the Palaeolithic period

The research objectives for the Palaeolithic period are reviewed in this section so that readers can understand how the projects fit into the wider national picture. The national research framework for the Palaeolithic is reviewed and the conclusions of the South East Research Framework primary research themes and framework priorities are presented.

4 Palaeolithic archaeology and 'significance'

The consultation programme identified a particular confusion in the minds of many archaeologists about what is meant by Palaeolithic 'significance'. In this section, therefore, the notion of significance as it applies to Palaeolithic archaeology is reviewed, to help practitioners understand that the study of the Palaeolithic is about more than finds of Palaeolithic archaeological material. The importance of deposit modelling in the study of Palaeolithic archaeology is outlined and the 11 English Heritage criteria for assessing Palaeolithic importance are reviewed. Readers are also reminded that it is extremely difficult to ensure that Palaeolithic sites receive statutory protection, which makes it all the more important that significance is addressed by development control projects effectively.

5 Do I need a Palaeolithic specialist?

The consultation suggested that archaeologists are often unsure whether to bring in a Palaeolithic specialist or not. In this section, therefore, the necessity for specialist advice is reviewed and the appropriate timing of such advice is discussed. In particular the advice is clear that "whenever Pleistocene deposits are affected by a proposed development there is likely to be a need for a desk based assessment to be prepared by a Palaeolithic specialist".

6 Assessing Palaeolithic potential

In this section the means for assessing Palaeolithic potential is reviewed. The main element is this is explanation of the deposit-led approach developed by Francis Wenban-Smith and followed in Kent is explained. The advice explains the three main questions to be asked in assessing potential:

"*1. Are Pleistocene sediments present?*

2. If so, i) what sort and how old are they, and how were they formed?
ii) what do they contain in terms of artefactual or other evidence?

3. What is their potential contribution to Palaeolithic research and how important are they?"

The weaknesses of BGS data are also discussed as well as means of addressing these as part of development control projects. The need for adequate and informed desk-based assessments is underlined (and the other KCC advice produced as part of this project highlighted). Finally, the 'low probability / high return' nature of Palaeolithic investigation is identified as being an inevitable consequence of searching for ephemeral but highly important evidence of Palaeolithic activity.

7 Fieldwork methods and strategies

This advice note is not intended to provide a thorough review of fieldwork methods rather an overview of what Palaeolithic projects are trying to achieve and the thinking process involved. Nevertheless, in this section the need for specialist methodologies to be conducted in a multidisciplinary approach is highlighted.

8 Reporting

In this final section the need for appropriate reporting is highloighted. Further advice will be offered on this is due course (not as part of this project) but archaeologists are reminded of the need to comply with the KCC specifications which contain detailed reporting clauses.

9 Appendix I: Key documents

A useful list of the main reference documents is provided that underpin the advice given in this advice note.

KCC Standard Specification B for a Palaeolithic desk-based assessment generic requirements

Standard specification B is intended to guide archaeologists, developers and their consultants as to how to gather, assess and present all available archaeological and environmental information in order to help curatorial decision-making. The specification is based on standard KCC specifications but is tailored to take account of Palaeolithic archaeology's particular requirements and the special complexities of the environmental data.

It contains a number of sections:

1 Introduction

In this section the writer should describe the site and the purposes of the study, including the nature of the proposed development. They should also summarise the Palaeolithic potential of the site that will be explained in more detail in the rest of the document.

2 Project Background

The author should explain the background to the project and in particular the planning history of the site.

3 Legislative and policy background

All development control projects take place within the UK's legal and planning policy framework. In this section all relevant aspects should be reviewed. It should not be a full regurgitation of all UK planning policy.

4 Location

The location of the project should be identified and set in context within the wider study area.

5 Palaeolithic background

Describe briefly what is currently known about the Palaeolithic archaeology and Pleistocene geology at the site

6 Objectives

This section of the specification describes the overall objectives that desk-based assessment must meet.

7 Method: desk-based study

The full range of available information that must be consulted is reviewed. In particular the specification requires that RIGs, BGS data, geotechnical reports and both archaeological and geological reports are examined.

8 Method: walkover survey / site inspection

The study area is to be systematically walked and inspected, by a team of at least two appropriately qualified archaeologists. The team will include an experienced Palaeolithic archaeologist and Pleistocene geologist. All archaeological features, items of historic interest, and Pleistocene geological exposures within the study area will be accurately plotted using standard conventions although detailed recording will not be undertaken at this stage.

9 Recording and archive

This section specifies how any features that have been identified should be mapped but also reminds the authors to prepare for deposition of any site archive, even at this early stage.

10 Reporting

This section provides a detailed description of the report that will be written. The sections to be included are reviewed and the requirements of each are detailed. Authors are particularly directed to a full consideration of the geology, topography, soil and ground conditions. A primary deposit model is required and evidenced. Crucial stages in this section are the impact assessments, both of the past and present land-use and of the proposed development. Detailed questions to be answered are provided and the writers are specifically guided towards consideration of whether or not field investigation may be needed. The specification also provides guidance as to how illustration should be prepared as well as appendices, references and a bibliography of sources considered.

11 Staff qualifications

This section underlines the need for appropriately qualified staff to be employed to carry out the assessment. It specifically advises that recognised specialists in Palaeolithic archaeology will be required as part of the project team.

12 General

This final section outlines some general requirement eg health and safety, the requirement to make records available to the curator, the need for monitoring and the need to update the HER.

4.4.4. Curatorial toolkit

The Project has allowed a much improved understanding of the Palaeolithic potential of north-east Kent, as well as an improved geological model, characterisation map and HER. These will all be of use to curators, consultants and archaeologists working in the region and beyond. The advisory documents will help to explain to practitioners how the Palaeolithic resource is managed in Kent, help them prepare more effective desk-based assessments and will help them use the project's products.

To aid this process, a Toolkit has been designed that links the various outputs of the project and summarises clearly how they can be accessed and used.

The Toolkit consists of a range of GIS layers, borehole logs and advisory documents. To be most effective they should be used in combination. All the Tools have been installed on KCC servers for ease of access to KCC curators via hyperlinks in the Toolkit document but copies can be supplied on demand to curators from other regions, archaeological contractors, consultants and specialists wishing to use the Toolkit as a model.

The structure of the Toolkit is as follows:

1 - Background

2 - How to use this toolkit

3 - Data Components

3.1 - Borehole Data

3.2 - Sub-surface models

3.3 - Revised Geology data

3.4 - Enhanced HER Dataset

3.5 - Fieldwork reports

3.6 - Palaeolithic Character Areas

4 - Advisory documents

5 - Summary of resources

4.5. Dissemination and closure

4.5.1. Public dissemination

To raise awareness of the Palaeolithic of east Kent and its potential for discovery and investigation during development control work, two public talks were arranged.

On Tuesday 18th November 2014 Francis Wenban-Smith gave a talk to an audience in Maidstone consisting of the Kent Geologists Group with additional visitors from the Medway Fossil and Mineral Society and the Open University Geological Society SE Group.

On Tuesday February 10th 2015 Francis Wenban-Smith and Jake Weekes gave a talk in Canterbury to the Westgate Parks Project and other members of the public.

The cleaned HER dataset has been made available via the Kent County Council online HER (www.kent.gov.uk/HER). It is also available on the Heritage Gateway (http://www.heritagegateway.org.uk/gateway/).

Web pages have also been prepared for the Kent County Council, Canterbury Archaeological Trust and University of Southampton websites. The pages present information about the project to the different audiences in appropriate language.

4.5.2. Professional engagement

Through the course of the project, members of the project team participated in three distinct curatorial events.

On 20th January 2014 Francis Wenban-Smith and Paul Cuming made a presentation "*The Stour Basin Palaeolithic Project*" at the English Heritage Seminar, Palaeolithic and Mesolithic Enhancement, held Waterhouse Square, London.

On 9th July 2014 Francis Wenban-Smith made a presentation "*Looking after the Palaeolithic and Mesolithic: some urgent recommendations on HER structure and terminology*" at the HER forum, held at the Directory of Social Change, Stephenson Way, London. This was accompanied by a hand-out, reproduced here (**Appendix 6**).

On 23rd and 24th October 2014 Francis Wenban-Smith and Paul Cuming played an active role in the FISH (Forum on Information Standards in Heritage) Terminology Working Group e-conference "*Labels, Lithics, and Landforms*". Francis Wenban-Smith was Lead Discussant for Session 1 "Chronology" and Session 3 "Artefacts", and Paul Cuming was lead discussant for Session 2 "Landforms, sites and palaeo-environmental information"..

4.5.3. Dissemination of products

Copies of all the key products have been disseminated among the project team. These products consist of:

The Toolkit, consisting of:

- The linking ‘Stour Basin Palaeolithic Project Toolkit’ document
- A shapefile describing the cleaned Palaeolithic HER dataset
- A shapefile presenting the locations of the borehole transects examined in the projects

- A shapefile presenting the locations of the fieldwork carried out in the project.
- A shapefile presenting the Palaeolithic Character Areas and accompanying attribute tables
- The report on the consultation programme
- The advisory documents

In addition, the project team have been supplied with:

- The fieldwork assessment report
- The final fieldwork report
- The project closure report

The Toolkit and project reports, when agreed by English Heritage, will also be made available via the KCC website, the ALGAO Forum and the HER Forum.

4.5.4. Project archive

When the products have been approved by English Heritage the full project archive will be deposited with the Archaeology Data Service at the University of York.

5. Discussion and conclusions

5.1. Key project successes

In summary, the following could be pulled out as key successes of the project:

- Engagement with curatorial community: HER forum, FISH and FISH-TWG, Canterbury Archaeological Trust. In course of these events, and in course of working with Canterbury Archaeological Trust on the project, there was a significant widening of awareness of the problems of curating the Palaeolithic heritage, and of practical issues such as limitations in the thesauri. Contacts were made with numerous individuals who recognised these problems, leading to initiation of steps to address them such as extensive consultation with Peter Watkins of Norfolk CC over lithic thesaurus terminology.

- Community and landowner engagement. In course of giving public presentations, carrying out the fieldwork, and seeking locations to dig, extensive contact was made with a diversity of the public and with landowners of land with Palaeolithic potential. These contacts were universally positive, and can only help the cause of curating the Palaeolithic heritage in the future.
- HER enhancement, and predictive framework. A significant increase was made in representation of Palaeolithic sites in the HER for the project area, and the records were substantially overhauled to locate them accurately, and to bring them up to date in period and cultural attributions, and in lithic artefact terminology, so far as possible within the constraints of the thesauri in use
- Toolkit, Advisory documents notes and DBA specification. Development and availability of these tools will, we hope, improve early recognition of Palaeolithic potential, and suitable evaluation and safeguarding measures.
- Chislet fieldwork (Stour terraces). The fieldwork in the Chislet area was hugely successful in developing a framework of a buried Stour terrace staircase, and achieving dating of one terrace, as well as establishing human presence at and palaeo-environmental conditions at certain levels. It was also informative in improving understanding of the date and formation process of the wide brickearth spread on the eastern slope of the Blean plateau down towards the Wantsum Channel.
- Brickearth dating and understanding. Although many brickearth deposits investigated were found to be late Devensian slopewash deposits, an earlier brickearth from early in the Devensian, or earlier, was found at one of the six sites investigated (Hundred Acres Field, Dreal's Farm). This would suggest that there may be several other outcrops of plateau brickearth of older date and higher Palaeolithic potential than currently recognised. Further work would be desirable to clarify this.
- Clear directions for future work and new initiatives. As well as a number of successful outcomes, the project has identified some clear directions for further work and new initiatives to improve future curation of the Palaeolithic heritage. And some of these initiatives, for instance trying to establish optimal approaches to predictive modelling may be applicable more widely than just to the Palaeolithic.

5.2. "Brickearth": formation, dating and Palaeolithic potential

Although it was attempted to target plateau brickearth deposits capping high ground for fieldwork and OSL dating, this was not usually possible due to limitations on the locations accessible for fieldwork. The sub-surface deposit models showed that even in areas mapped as plateau brickearth, the areas investigated by the project's test pits usually included sloping bodies of brickearth that were most likely of slopewash origin. OSL dating of brickearth deposits for the project mostly gave results reflecting slopewash deposition during the late Devensian.

However, there was one notable exception to this, at Hundred Acres Field, Dreal's Farm, where it proved possible to dig test pits into a substantial spread of brickearth capping clay-with-flints. The OSL dating results here gave results of 119.91 ± 18.61 and 143.25 ± 23.65 kBP. This provides at least one firm indication that there is the potential for plateau brickearth deposits capping high ground to be substantially earlier than the late Devensian, and thus to have high Palaeolithic potential.

It is therefore necessary to carry out further work on plateau brickearth deposits, to develop a picture of when they were formed, which is a key aspect of considering their Palaeolithic potential. As regards slopewash deposits, many of those investigated

5.3. Predictive modelling of Palaeolithic potential

Predictive modelling of Palaeolithic potential was based on a matrix of "Likelihood" of Palaeolithic remains and their potential "Importance", as outlined above (*Section 3.4.4*) and tabulated below (**Tables 4** and **5**). The large size of the PCAs meant that a broad triage was being attempted, to distinguish in a broad way areas that might be more likely to have Palaeolithic remains from areas that might be less likely. The unfortunate facts are that Palaeolithic remains are essentially (a) very rare, and (b) also hard to predict with confidence.

The deposit-centred approach first put forward in SERF (Wenban-Smith 2010a, b) is probably the best model so far, in that it recognises the essential fact that useful Palaeolithic remains are contained in Pleistocene deposits, and from then one can start considering the likely importance of Palaeolithic remains in different Pleistocene deposits, for which mapping exists, put together by the British Geological Survey over the last 150 years or so. However, unfortunately BGS mapping itself is quite broad-brush with respect to Pleistocene deposits, so it is vital to remember that the lines on BGS maps can only be regarded as fuzzy indications of deposit outcrop boundaries, and many potentially important deposits may not be mapped at all.

Furthermore, deposits may vary significantly and unpredictably over short distances, with commensurate variation in Palaeolithic potential. Another fundamental difficulty in effective predictive modelling is the massive contrast between the scale of development applications, perhaps usually less than a hectare, and certainly even less than that for trying to plan specific impact areas even within much larger application areas, and the scale of practical modelling areas. This is why it was thought feasible in this project to only attempt the broad brush triage. However, this is a problem that would benefit from further consideration, and a review of the various predictive modelling projects that have been attempted over the last decade or so, as outlined below (*Section 5.5.1*, P3). It might be possible to combine geological mapping and HER information, with the input of both specialist Palaeolithic knowledge and GIS modelling expertise, into an algorithm that may act as a reasonable predictor of Palaeolithic potential.

5.4. Curatorial practices and relationships

5.4.1. Divergences of perspective

It was not a formal objective of this project to study or amend the curatorial processes in Kent. However, the project did provide an opportunity, through the consultation interviews, to reach a better understanding of how different curators see their role, and their perceptions of the strengths and weaknesses of current approaches. The role of curators within the development control process is central to the management of the Palaeolithic resource. If they lack understanding of the period or skill in managing it then the tools that the project has produced will inevitably fail to deliver their potential.

The interviews revealed a number of issues that curators are concerned about as well as some useful perspectives from other stakeholders about curators and their work.

The consultation programme has been described elsewhere in this report (**Section 4.4**) but a summary of the results as they affect curators is:

- It is apparent that curators have different notions about what Palaeolithic fieldwork and desk-based study is trying to achieve – whether the goal is the identification of *in situ* finds, re-deposited artefacts or geologies of potential.
- There is also some uncertainty about how different field techniques contribute to these and whether best use is being made of the information gained.
- There seems to be some doubt about what constitutes the most effective strategies and what can be justified as a reasonable curatorial response to a development proposal.
- There seems to be a lack of understanding of some specialist scientific techniques, when to apply them and what they mean.
- Curators would very much like developers, consultants and contractors to consider the Palaeolithic properly early in the application process, and particularly when drafting desk-based assessments. Specialist input may well be needed even at this early stage.
- Curators would like specialists' reports to be more focused on the impact of proposed developments on the Palaeolithic resource and appropriate mitigation, and written in more accessible language.

- Curators think it is important that they can talk to archaeological contractors and specialists quickly and directly without having to go through a consultant as an intermediary. Specialists also said it would be beneficial to talk to curators directly without having to go through consultants.
- Most curators would welcome an accurate characterisation of the Palaeolithic resource in their areas, delivered as a GIS map and supported with guidance on appropriate planning responses.
- Curators value Palaeolithic archaeology but may lack the appropriate language to explain it. In part this is because some do not have a clear idea about how the different elements in the Palaeolithic picture fit together – artefacts, deposits, environmental evidence etc – and thus do not know how to explain or defend the need for mitigation.

Inevitably, other stakeholders in the development control process had different views to the curators, which provide food for thought.

In contrast to the frequently-stated criticisms of desk-based assessments that were made by curators, several contractors suggested that during pre-application discussions the curators did not always flag up the Palaeolithic need properly and did not ask for much information on impact or mitigation. It is possible, therefore, that curators and others have somewhat different expectations about the level of information and synthesis to be expected in a desk-based assessment and the different roles of curators and consultants/contractors.

Both contractors and consultants complained that the approaches and requirements of different curators are highly variable – much more so for the Palaeolithic than for other periods. They thought that greater consistency was essential if they were to advise their clients appropriately and prepare effective WSIs. Almost all urged greater consistency in the curatorial community.

A number of contractors and consultants said that they found the fieldwork programmes, and particularly archaeological evaluations, required by curators especially variable. Some contractors and consultants complained that they had evaluated numerous sites for their Palaeolithic potential but these had almost never found archaeological material. In the eyes of some contractors and consultants, this represented a failed evaluation whereas to curators and specialists following a deposit-led approach such exercises represented success in establishing the absence of a development impact upon the Palaeolithic resource that had potential to be present.

Conflicting perspectives such as this highlight the need for greater understanding within the sector about (a) what is the fundamental nature of the Palaeolithic resource, (b) how its importance is judged, and (c) what are the goals and subsidiary objectives of field evaluation. They reflect a lack of understanding of (a) the general rarity of Palaeolithic sites, making recognition of any artefact concentration a matter of importance in a deposit that has potential to contain Palaeolithic remains, and (b) the Palaeolithic as a dispersed resource within natural sediments, about which knowledge is gained incrementally through an accumulating series of investigations. In that sense a negative evaluation result for recognition of a concentration of material at the same time serves a wider mitigating purpose in gaining knowledge about the impacted deposit. But it does not mean that the distinction between evaluation and mitigation is blurred. Every investigation in an area regarded as of Palaeolithic potential serves to improve understanding of the resource, leading to a continuing improvement of curatorial understanding and decision-making.

A second area of concern for consultants and contractors concerned the fieldwork methods used to evaluate Palaeolithic sites and mitigate the impact of development proposals. Some said that there seemed to be a blurred boundary between evaluation and mitigation for the Palaeolithic and asked for great clarity and consistency here. Others commented that curators sometimes ask developers to excavate test-pits that are far deeper than the foundations will go. EU directives oblige the developer to reinstate the site before the development can progress and it is difficult to justify this to the developer when the deposits would not have been impacted by the development anyway. Several contractors and consultants commented that it would be good to have a single document that they could work from that described the approach taken to the Palaeolithic by curators and that was generally regarded as representing good practice. This was in fact the basis of the advisory documents written as part of this project (see section 4.4.3). It should be noted however that the advisory documents represent the approach taken by Kent County Council – it does not claim to represent approaches taken in other areas.

5.4.2. Conclusions and future actions

The views recorded in the stakeholder consultation inevitably include many areas of disagreement and difference as well as areas of agreement. Whether the level of disagreement among curators, consultants, contractors and specialists is greater than for other periods is difficult to say but there are a number of areas where further discussion and guidance would be beneficial.

It would seem essential that the sector agree on the significance and importance of different types of Palaeolithic evidence. Most of the stakeholders questioned accepted the importance of different types of Palaeolithic evidence – in-situ or re-deposited finds, palaeoenvironmental evidence, significant deposits etc however, there seems to be less agreement about the relative importance of different types of evidence. This question is central to the development control process. When curators have to decide on their response to development proposals and what fieldwork approaches are 'reasonable' they take a value judgement about how important the different types of evidence are. For developers and their consultants to be able to estimate accurately the likely impact of their proposals on archaeology, they need these value judgements to be consistent.

To take consistent and reliable decisions, curators need applicants to provide accurate and well-thought-out assessments of the impact of development proposals on the archaeological resource. This requires effective desk-based assessments that (a) provide the information curators need in the form that they need it, and (b) pay pro-active specific attention to the possibility of there being Palaeolithic remains. Too often at present DBAs are generic representations of the HER data with little detailed analysis of the deposits and their potential for research. And it came out of the consultation that curators were often looking to consultants and developers to recognise a Palaeolithic potential, whereas these latter stakeholders were conversely often looking to the curators for this. Everyone agreed that it was beneficial to know as early as possible whether or not a specific site had the potential for Palaeolithic remains, and whether specialist input would be likely to be required. This key problem seems to be one of the hardest to address, since it seems presently to be the case that Palaeolithic expertise is often required to make a good judgement on whether or not there is Palaeolithic potential. This is a conundrum that must be given high priority to solve. One suggestion we have is that every DBA must include a statement of Palaeolithic potential. Even if this statement is negative, at least this will ensure that it has been considered, and someone has to have taken responsibility for making that judgement, and in order to abide by IfA codes of practice, that person either has to have suitable expertise, or to have taken advice from someone who has. The advisory document on DBAs that this project has produced is intended to help address this situation and enable the production of DBAs of greater quality and consistency but it is likely that ALGAO, English Heritage and the IFA will need to work together to raise the standard across the sector.

Greater agreement across the sector on the nature of 'significance' for Palaeolithic archaeology, combined with higher quality DBAs that can assess the likely impact of development proposals on this significance, will help curators design or approve effective and consistent WSIs. It may be, however, that further work is needed before the sector can agree on what constitutes effective and appropriate evaluation strategies and also how impacts on Palaeolithic deposits can be mitigated. This work would require collaboration between ALGAO and IFA with appropriate input from specialists and English Heritage.

The project also suggested that there are lessons for Historic Environment Records. HERs need to understand that Palaeolithic archaeology is different from other periods. HER officers also tend to be generalists and there has been much misuse and misunderstanding of specialist terms. The thesauri are somewhat confused in their nomenclature and in need of revision. Much of what is significant may be non-archaeological (or at least unrelated to human activity) in nature, for example palaeoenvironmental evidence or sensitive geological deposits, and these do not fit easily in to the MIDAS Heritage model or common HER software types. As with questions of Palaeolithic significance, there are a number a different ways that sensitive deposits etc have been recorded in HERs to date, as was revealed by the recent e-conference. Much of the available information is also antiquarian in nature and often dates from well before individual HERs were founded. HER officers may have made assumptions about whether antiquarian collections have been included in HERs or not and many of these assumptions are disproved on examination. In addition, specialists familiar with antiquarian fieldworkers work can extract more information from these records than can most HER officers. HERs therefore need to carry out programmes of data cleaning that involve appropriate specialists if their datasets are to be as accurate and up to date as possible. If these improved datasets can be combined with Palaeolithic characterisation models and practical Toolkits as with this project then the power of the enhanced HERs can be greatly increased.

5.5. Priorities for future work

5.5.1. Curatorial projects and initiatives

P1 - HER enhancement in other areas

The curatorial enhancement carried out for the Stour project nearly doubled the Palaeolithic representation in the HER for the project area, raising the number of records from 120 (once a substantial number of erroneous or misleading records had been weeded out) to 234. There is no reason to think that the project area is any different to other parts of Kent, or to other parts of the country. This suggests that one big priority should be to carry out a similar housekeeping task for firstly the rest of Kent, and then for other counties with a significant Palaeolithic record - principally counties in the southern half of England.

P2 - Thesauri updates

As an adjunct to this, it would be useful to review and update thesauri for lithic artefact terminology, Palaeolithic period terminology and date ranges, and descriptive terms for Palaeolithic sites, Pleistocene deposits and palaeo-environmental remains. As outlined above, current thesauri have numerous problems, it if effort is going to expended in enhancing the HER it would be nice to have the tools to do the job properly.

P3 - Predictive Palaeolithic modelling: review and comparative approach

It would be useful to carry out a wider review of various projects over the last decade that have attempted to develop predictive models of Palaeolithic potential, and which have taken an algorithmic approach to greater or lesser degrees. At least six projects spring to mind that have attempted this: *Palaeolithic Archaeology of the Sussex/Hampshire Coastal Corridor* (Bates *et al.* 2004, 2007), the *Archaeological Survey of Mineral Extraction Sites around the Thames Estuary* (ECC & KCC 2004), the *Thames Gateway Historic Environment Characterisation Project: Final Report* (Chris Blandford Associates 2005), the *Medway Valley Palaeolithic Project* (Wenban-Smith *et al.* 2007a,b), this project, the concurrent *Managing the Essex Pleistocene* project (Essex County Council/T O'Connor in prep.). There may also be others. It would be interesting to compare the slightly different approaches taken, and to get a curatorial viewpoint on how useful the models have proved, and where they could be improved. It would also be useful to conduct a new study in an as-yet un-modelled area that applied both an expert person and an expertly-informed algorithm, and saw how the results compared, and whether any lessons could be learned for expanding Palaeolithic modelling. Ultimately, it would be very valuable to move towards an agreed best practice for predictive Palaeolithic modelling, which would allow greater curatorial confidence in dealing with Palaeolithic aspects of development control work.

P4 - Palaeolithic upskilling

One of the outcomes of the stakeholder consultation carried out for this project has been recognition of a lack of Palaeolithic expertise in every area of the development control process: curators, consultants, specialists and contractors. It would be desirable to take some steps to address this lack of skills. This could be achieved in various ways. One way would be to support (at least on a start-up basis) a position at a university or other teaching institution that provided tailored short courses for professionals in these areas, and/or that taught more sustained modules as part of existing degree programmes that would lead ultimately to a greater number of curators, consultants and contractors with sufficient Palaeolithic expertise, and a greater number of Palaeolithic specialists able to work effectively with curators/consultants/contractors in a development control context.

P5 – Public outreach / consultation

The project revealed the great interest in the Palaeolithic period among the public but also that both specialists and the public often struggle to communicate information about the period effectively. One goal of future projects, and certainly an action to be included in future projects, will be to continue the process of awareness raising among the public generally and key stakeholder groups more specifically (developers, planners etc) of the potential for encountering Palaeolithic deposits and discoveries and what these can tell us about Kent’s past.

P6 – Updating of PCA maps

In order to ensure that the PCA maps remain up to date they will be reviewed every 5 years to see if amendment is needed in light of new discoveries or new interpretations. This will be carried out by KCC in partnership with an appropriate specialist and will be funded by KCC.

5.5.2. Enhancing understanding in the Chislet area

At Chislet, there is various additional work that could be done that would enhance our understanding of this key area. The work done so far has established that there is an extensive staircase of buried terrace deposits. It has also provided some indication of the heights at which different terraces occur, and shown that at least one of the terraces — at between c. 5 and 10 m OD — contains abundant palaeo-environmental remains in one location. It has also produced some evidence of scarce lithic remains from different terrace deposits, but this aspect is still poorly understood. The work to date has provided a preliminary indication of the age of the 5-10m terrace, which allows tentative correlation of the Chislet terrace staircase with terrace staircase 5km upstream at Canterbury, which has produced abundant Palaeolithic artefact remains. Further work (described below) could provide increased understanding of the distribution and division of terrace deposits in the Chislet area, and thus allow more robust correlation with the Canterbury terrace staircase. It could also allow more confident dating of the Chislet terrace sequence, a better understanding of depositional processes, palaeo-environments and palaeo-climate during deposition of the sediment sequences. Further useful work includes a range of new fieldwork, analysis of existing "grey" archives and further more detailed analysis of palaeo-environmental remains recovered from the Stour project fieldwork.

New fieldwork:

- further ERT geophysical survey and test pitting work (and maybe also borehole investigations) to confirm and clarify the putative sub-surface terrace model established in this project
- carrying out more intensive sieving for lithic artefacts in the terrace staircase
- carrying out test pit investigations of the higher mapped outcrop to the west of Transect 2, to confirm its fluvial nature and investigate the presence/prevalence of Palaeolithic artefactual remains
- carrying out work to stabilise the existing fragile section of Wear Farm Pit, that secures long-term preservation of the sequence by backfilling sediment against the free-standing face, but at the same time mitigates the consequent loss of access by carrying out further cleaning and sampling before the face is obscured
- carrying out cleaning, recording and sampling at other uninvestigated parts of the surviving quarry face

Analysis of "grey" archives:

- examining the geoarchaeological and watching brief records from the Herne Bay pipeline and integrating them into a more-detailed sub-surface deposit model, contextualising the handaxe find from the pipeline project and improving understanding of sub-surface Pleistocene deposits in the area. More details and justification for this are provided below (**Section 5.6**), supported by an outline cost and programme as an appendix (**Appendix 8**).

Further more-detailed analysis of palaeo-environmental remains from the Stour project:

- carrying out further specialist analysis of the palaeo-environmental remains (small vertebrates and molluscs) recovered from the fossiliferous deposits of the 5-6m terrace aggradation. More details and justification for this more-detailed analysis are provided below (**Section 5.6**), supported by an outline cost and programme as an appendix (**Appendix 8**).

5.5.3. Enhancing understanding of brickearth

The spreads of Head Brickearth at plateau locations such as Quex Park and The Loop (both on Thanet), and at Hundred Acres Field (Dreal's Farm) have been confirmed as of possibly-high Palaeolithic potential. It would be desirable to carry out further test pit investigations in these areas, targeted at the high points of each brickearth spread, and to carry out sedimentological and further dating work to try and establish the date and mode of formation of these deposits more confidently.

It would also be desirable to target the high point of the brickearth spread south of the investigated site at Otterpool Manor Farm (site OMF 13), and to investigate further the southern part of the brickearth spread at Charing Heath (south of site HF 13, in vicinity of BGS borehole TQ96NW90), where it was thought that buried fluvial terrace deposits of the upper Stour might be present.

5.5.4. Intra-Wealden Palaeolithic remains

Finally, it would be very desirable to systematically target Pleistocene terrace deposits of the Upper Stour and its tributaries within the Weald basin, to establish whether they hold a record of Palaeolithic settlement, to link them into a unified chrono-stratigraphic framework, and to improve curatorial understanding of their nature and potential. A small number of Palaeolithic remains have been reported from within the Weald, and it also contains some mapped terrace deposits linked to the Upper Stour basin and headwaters. This would be an important area to improve understanding of the hominin occupational history, since it contains limited and diverse lithic raw materials, so it might be possible to improve understanding of how activity and mobility were constrained, or otherwise, by the distribution of lithic raw materials, and whether this changed through the Palaeolithic, for instance between the Lower, Middle and Upper Palaeolithic.

5.6. Potential and justification for analysis and further reporting

There is also potential to carry out some further analysis on the fieldwork archive, alongside some analysis of material that hasn't been studied from previous work at some of the fieldwork sites.

Small vertebrate and molluscan remains

The focus of the Stour project was on identifying the potential of Pleistocene deposits encountered through assessment of their palaeo-environmental remains, rather than carrying out full analyses of them. Therefore the project has produced a substantial quantity of palaeo-environmental remains (in particular small vertebrate and molluscan remains), all from Chislet Court Farm, whose abundance and high quality of preservation have been noted, but which have not been subject to more detailed analysis.

Analysis of this material would both further address the initial aims of the Stour project, and also address some of the current research priorities for the British Palaeolithic. In particular, further analysis would:

- improve understanding of the correlation, date and mode of formation of the deposits containing these faunal remains in the Chislet area
- provide a more-robust tie point for dating of the Stour terrace staircase in the Canterbury/Chislet area, and thus (a) contextualise a substantial quantity of Palaeolithic remains already found, and (b) help curators identify terrace deposits as of greater or lesser potential based on their presumed date in conjunction with existing frameworks of Palaeolithic occupation of the region
- provide details of a rare example of a non-analogue vertebrate faunal assemblage from a pre-Devensian intra-glacial warm episode, thought most likely on the basis of AAR dating carried out for this project to date within MIS 8; detailed analysis and reporting of the small vertebrate and molluscan remains might also produce biostratigraphically significant data that could then be applied to date other sites

Particle-size analyses

Another element of the project fieldwork archive that remains unexplored is particle-size analyses from some of the brickearth deposits encountered. Interpretation of deposit formation processes in this report (presented on a site-by-site basis in Sections *4.2.2* through to *4.2.9*) was based on field examination of the sediments encountered, and consideration of their topographic situation and large-scale geometry within the landscape. More detailed laboratory analysis of the particle-size profile of these brickearth sediments can provide a more-reliable indication of formation process, and in particular whether or not a body of sediment is an *in situ* loessic deposit, a decayed alluvial deposit, or a slopewash deposit incorporating a combination of particles of diverse origins (for example a mix of particles derived from local bedrock, loessic and alluvial deposits). Brickearth sediments at three sites in particular — Chislet Court Farm, Manston [The Loop] and Dreal's Farm [Hundred Acres Field] — would benefit from more-detailed laboratory analysis.

At Chislet Court Farm, the extensive spreads of brickearth there have been subject to a substantial programme of OSL dating (*Section 4.2.4*) which has indicated deposition towards the end of the last Ice Age in MIS 2, during the Last Glacial Maximum between c. 24,000 and 18,000 BP. Carrying out particle-size analysis would establish whether or not this deposition was predominantly by slopewash, predominantly by wind, or by a combination. This would have curatorial implications, since these processes would have different effects on Palaeolithic material, either burying it gently with no disturbance, or burying it with potentially greater disturbance, apart from maybe in a few favoured locations where slopewash covered level ground. The results from Chislet Court Farm could also be extrapolated to other similar spreads of Late Devensian brickearth across Kent, and would thus also have wider curatorial implications.

At The Loop, OSL dating has suggested that the brickearth found there dates to the very end of the Devensian, c. 12.68 ± 1.09 kBP. The investigated site is not quite the highest point in the local landscape, being at the edge of the plateau high-point, but it is not in a situation where one would expect slopewash accumulation. It would be important to use particle-size analysis to clarify the depositional process of the brickearth, since this would have curatorial implications as discussed above — particularly in conjunction with the reported recognition (Canterbury Archaeological Trust 2003) of a buried palaeo-landsurface with lithic artefacts from the Upper Palaeolithic and the Mousterian sealed under the brickearth at the site. There are three unused OSL samples from The Loop that could be used for particle-size analysis. These have no potential for OSL dating, since the sediment was so tough that the sampling tube crumpled, and it was not possible to obtain a solid plug of sediment suitable for OSL measurement.

At Dreal's Farm [Hundred Acres Field], OSL dating has indicated deposition considerably earlier, towards the beginning of the last Ice Age in MIS 5d-5a. Preliminary results from the sequence of particle-size samples through the thick sequence of Plateau Brickearth there in TP 1 suggest predominantly loessic sediments. OSL dates from this deposit indicate an age of at least 100,000 BP (**Table 10**), making it a potential important example of loessic deposition from the early Devensian. This would be of curatorial importance, since (a) it would thus have potential to contain, or bury, evidence of rare early Neanderthal occupation of Britain, and (b) if the sediment was confirmed as loessic, the relatively gentle and steady process of deposition would lead to any archaeological remains being undisturbed. There would also be the same curatorial implications for other similar deposits in similar topographic situations, so the results would have wider value than at just this one site. However, interpretation of the sediment's formation is complicated by the presence of relatively numerous large flint clasts in the overlying deposits, which could be taken to suggest that the locale may have also been subject to slopewash deposition despite being currently a plateau of high ground, or to some other unrecognised process. A thorough analysis of particle-size through the sequence at TP 1 can therefore play a role in resolving this conundrum and establishing with greater confidence how the Plateau Brickearth formed here.

Archives from previous work

Archival material and records from "grey" pre-development projects associated with the two of the Stour project's fieldwork sites have also come to light as a result of the Stour project's work. In particular, there are (a) geoarchaeological records and lithic artefacts from a pipeline through the Chislet Court Farm site, resulting from work done by Canterbury Archaeological Trust between 1992 and 1994 (Parfitt 1996), and (b) a collection of lithic artefacts from a 2003 field evaluation of brickearth deposits at The Loop, Manston (Canterbury Archaeological Trust 2003). Both these sets of material provide important additional data.

For Chislet Court Farm, it was discovered after fieldwork had been completed that there had been a Canterbury Archaeological Trust field investigation between 1992 and 1994 in conjunction with construction of the Herne Bay Pipeline through the site (Parfitt 1996). During CAT's work for this pipeline, numerous geoarchaeological test pits and boreholes were carried out in the Chislet area, and exposed sequences were recorded during construction of the pipeline. Two handaxes and two struck flint waste flakes were also recovered. There is great potential to integrate CAT's geoarchaeological archive from this work with the test pit and geophysical survey records from the Stour project. This would lead to a more detailed sub-surface deposit model, and may contribute to improving understanding of the number and depth of terraces in the Stour terrace staircase here, and improving mapping of their spatial extent. The integration of well-provenanced lithic artefacts within the terrace framework can improve understanding of the dating of episodes of hominin settlement in the area, and provide curatorial value in helping identify which terrace aggradations might have higher potential for artefact recovery and evidence of hominin activity.

For The Loop, one of the reasons that this was chosen as a site for the Stour project was the reported presence of a palaeo-landsurface with mint condition Late Upper Palaeolithic and Mousterian flint artefacts, underlying a spread of Plateau Brickearth (mapped on Thanet as "Head 1" brickearth). The landsurface was identified, and the artefacts recovered, during field evaluation in 2003 in advance of proposed construction of a food preparation factory for Evron Foods (Canterbury Archaeological Trust 2003). However, it is questionable whether the artefacts have been examined by anyone with sufficient experience of Upper and Middle Palaeolithic lithic material for these cultural attributions to be confidently accepted. It was hoped to examine these artefacts as part of the Stour project, but they could not be located in time for examination to take place and the results integrated into the reporting programme. However, their whereabouts has now been established, and permission granted to examine them. If there is an undisturbed palimpsest here, preserving lithic remains from the Middle Palaeolithic through to the upper Palaeolithic, then this would be a nationally important site meriting curatorial protection. Therefore it is necessary to establish the true situation with as great confidence as possible, to allow appropriate curatorial safeguarding measures to be implemented.

Preliminary costings and an outline programme for analysis and reporting are provided as an appendix (**Appendix 8**).

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Table 1. Core project team

Role	*Name*	*Organisation*	*Responsibilities*
Project Executive	Lis Dyson	Kent County Council, Heritage Conservation Manager	Overall accountable officer
Project Manager	Paul Cuming	Kent County Council, Historic Environment Manager	Preparation of Project Design, lead on information management, HER integration and GIS toolkits
Project Specialist	Bryan Geake	Kent County Council Senior Planning policy Officer	Represents minerals planners and developers
Project Specialist	Lois Jarrett	Ashford Borough Council Planning Team	Represents views of planners and developers
Project Specialist	Richard Cross	Canterbury City Council	Provision of advice on Canterbury planning issues
Project Specialist	Francis Wenban-Smith	Department of Archaeology, University of Southampton	Preparation of Project Design, specialist Palaeolithic expertise, fieldwork leader and geological modelling
Project Specialist	Martin Bates	School of Archaeology, University of Wales, Trinity St. David (Lampeter)	Geo-archaeological specialist, fieldwork, geological modelling and geophysical surveying
Project Specialist	James Cole	Department of Archaeology, University of Southampton	GIS modelling, fieldwork and geophysical surveying
Project Specialist	Jake Weekes	Canterbury Archaeological Trust	Grey literature and geotechnical records: collation and review

Table 2. Fieldwork summary: site investigations and objectives

Site-code	*Site-name*	*NGR-E NGR-N*	*Geology & background*	*Fieldwork objectives*	*Date/s of fieldwork*	*Test pits, other work*
CCF 13	Chislet Court Farm	622000 164400	East side of Blean plateau, dipping eastward to Wantsum Channel, with patches of mapped Head Gravel in amongst wide spread of Head Brickearth; overlies varying Solid bedrock, from west to east: London Clay, Oldhaven Beds, Woolwich Beds, Thanet Sand, Chalk	- Brickearth origin and date/s - Buried Stour terrace deposits, including re-investigation of Wear Farm Pit - Palaeolithic artefacts - Palaeo-environmental sampling	4th - 6th Sep 2013	Test pits 1-6 Wear Farm Pit surveys "QRA Section 1" survey
					9th -12th Sep 2013	Test pits 7-20 Transects 1-3 surveys
					18th Sep 2013	Test pits 21-22
CCF 14	Chislet Court Farm	622380 165020	Same as for CCF 13, above	- geophysical surveying - further palaeo-environmental sampling in Wear Farm Pit	18th -19th Mar 2014	Test pits 7-20 Transects 1-3 surveys
HAF 13	Hundred Acres Field, Dreal's Farm	619500 144700	Patch of Head Brickearth capping Clay-with-Flints plateau of North Downs, re-attributed to "Plateau Brickearth" in Stour PP; various handaxe find-spots in vicinity, including two *bout coupé* handaxes	- Brickearth origin and date/s - Palaeolithic artefacts	3rd Sep 2013	Test pits 1-4
HF 13	Heath Farm School	592800 148750	Spread of Head Brickearth towards foot of Wealden scarp, in vicinity of mapped terrace outcrops of Great Stour western headwaters; Solid bedrock comprises Sandgate Beds	- Brickearth origin and date/s - Buried Stour terrace deposits - Palaeolithic artefacts	17th Sep 2013	Test pits 1-4
OMF 13	Otterpool Manor Farm	611150 136250	Patch of Head Brickearth overlying Hythe Beds within Weald, to east of East Stour headwaters, on possible previous eastward drainage path towards Hythe/Channel	- Brickearth origin and date/s - Buried Stour terrace deposits - Palaeolithic artefacts	16th Sep 2013	Test pits 1-3
SOF 13	Somali Farm	631500 168800	Patch of Older "Head 1" Brickearth, over Chalk	- Brickearth origin and date/s - Palaeolithic artefacts	2nd Sep 2013	Test pits 1-6
THL 13	The Loop, Manston	631700 166700	Patch of Older "Head 1" Brickearth, over Chalk; Palaeolithic artefacts including Long Blade core and Mousterian handaxe reported on palaeo-landsurface under Late Glacial loess (Allen & Green 2003)	- Brickearth origin and date/s - Palaeolithic artefacts - buried palaeo-landsurface?	13th Sep 2013	Test pits 1-2

Table 3. PCA attribute table and field entry explanations

Attribute	*Field entry*
PCA #	SP_[nn] - Unique ID for *Stour Basin Palaeolithic Project* Palaeolithic Character Areas - PCAs
Summary description	Short summary text of geomorphological situation and likely Pleistocene deposits
Explanatory deposit notes	Explanation of likely Pleistocene deposits, how they are likely to have formed, and key factors behind identification of PCA that distinguish it from other PCAs
Likely age of deposits	Short summary text giving likely age (in broad Pleistocene blocks) of deposits likely to be present
Palaeolithic background	Overview of previously recorded and likely Palaeolithic artefact remains, based on known finds from PCA and similar deposits
Pleistocene environmental background	Overview of previously recorded and likely palaeo-environmental remains, based on known finds from PCA and similar deposits
Likelihood of Palaeolithic remains*	Attribution based on likely type/s of deposit present and previous artefact and palaeo-environmental find records, supported by brief explanatory text **
Likely importance of Palaeolithic remains*	Attribution based on likely type/s of deposit present, and supported by brief explanatory text **
Palaeolithic potential*	Attribution based on matrix of likelihood and importance, and supported by brief explanatory text **
Development control - possible options	Possible approaches to development control (for Palaeolithic archaeology), but to be determined on site-by-site basis
Key HER records	Listing of key HER records - following provisional Stour Project UIDs
Key geo logs	Any BGS borehole logs, or other key records, that are representative of the PCA
Key sources	Particularly important published sources - following standard reference format of [Name] [Year], eg. Evans 1897
Any other comments	Any particular points not covered by other fields

* For these records, "Palaeolithic" embraces both artefactual and palaeo-environmental remains

** See p 3 for criteria for different categories of likelihood, importance and potential

Table 4. Criteria for different grades of Likelihood and Importance of Palaeolithic remains in PCAs

Attribution	*Likelihood*	*Importance*
HIGH	High likelihood of Pleistocene deposits with lithic or palaeo-environmental remains	Undisturbed occupation surfaces or minimally disturbed concentrations; abundant remains from deposits of good stratigraphic and chronological integrity, biological associations; deposits with important lithostratigraphic sequences and relationships
MODERATE	Reasonable likelihood of deposits with remains	Less abundant disturbed artefactual and/or faunal remains from units of reasonable stratigraphic and chronological integrity; deposits with moderate lithostratigraphic sequences and relationship
LOW	Remains are known to occur, but rare	Disturbed remains from deposits of low stratigraphic and chronological integrity; deposits with minimal lithostratigraphic sequences and relationships
VERY LOW	Remains very unlikely to occur	Thought extremely unlikely for there to be any Pleistocene deposits containing remains, any remains found will be residual and reworked
UNKNOWN	Insufficient information on which to assess likelihood	Insufficient information on which to assess importance

Table 5. Matrix for combining Likelihood and Importance to derive PCA Palaeolithic Potential

Palaeolithic potential	*Likelihood*	*Likely importance*	*Suggested development control response*
HIGH	High	High, Moderate	Pre-condition DBA and field evaluation, retaining option of refusal if important enough remains are found. Refusal would need to be weighed against benefits of mitigation in improving understanding of the resource and addressing current research framework objectives (as well as other social/economic factors), particularly when an impact affects part of a more-extensive resource, and doesn't destroy 100% of it
	Moderate	High	
MODERATE	High	Low	Post-condition DBA and field evaluation
	Moderate	Moderate	
	Low	High	
LOW	Moderate	Low	None?
	Low	Moderate	
	Very low	Moderate, High	
VERY LOW	Moderate	Very low	None
	Low, Very low	Low, Very low	
UNKNOWN	Unknown	High, moderate, low or very low	None? This grade is a problem, as it represents the age-old issue of "absence of evidence is not evidence of absence". Furthermore, unexpected Palaeolithic finds in areas of unknown potential could be of high importance.
	High, moderate, low or very low	Unknown	

Table 6. Project output summary.

Stage	*Product*	*Details*
1	P1	Project Design (KCC Heritage Conservation 2013)
2	P6	Collate/synthesise Palaeolithic and palaeo-environmental information in project area into a single list
	-	Collate revised Palaeolithic information into set of relational tables matching HER structure
3.1	P15	Fieldwork Written Schemes of Investigation
3.3	P16	Fieldwork Summary Report (Wenban-Smith 2014a)
	-	Fieldwork supplementary digital data S1 - Survey data from fieldwork, with all test pit outlines, survey transects and post-Pleistocene feature outlines
	P17a	Assessment report and draft UPD for specialist analyses and dating work (Wenban-Smith 2014b)
	P17b	Revised and updated Project Design (KCC Heritage Conservation 2014a)
	P18	Collate assessment, geophysical and other specialist results into Final Fieldwork Report (Wenban-Smith 2015)
4.1	P20	Sub-surface models of key areas within overall project area
	P21	Hard copy 2D Pal Character Areas (PCAs)
	P22	PCA attribute tables
	P23	Representative geological logs to complement PCAs
4.2	P25	PCA layer added to Kent HER, with links to attribute tables and geological logs
5.1	P28	Stakeholder consultation report (KCC Heritage Conservation 2014b)
5.2	P29/P30	Guidance for planners/developers
	P31	Toolkit for curators
6.1	P33	Public talk in Canterbury, 10th February 2015
	P34	Public talk in Maidstone, 18th November 2014
6.2	P35	Web-pages hosted by KCC
	P36	Web-pages hosted by Southampton University
	P37	Web-pages hosted by Canterbury Archaeological Trust
	P38	Enhanced HER records available on-line
	P39	Submit report and archive to ADS
	-	Presentation at English Heritage Seminar, Palaeolithic and Mesolithic Enhancement, 20th January 2014
	-	Presentation at HER Forum, 9th July 2014
	-	E-conference, Forum on Information Standards in Heritage (FISH), 23rd - 24th October 2014
	P41	Seminar for EH and curators, (possibly joint with Essex CC)
6.3	P42	Final Report (KCC Heritage Conservation 2015)

Table 7. Fieldwork archive overview

Site-code	*CCF 13*	*CCF 14*	*HAF 13*	*HF 13*	*OMF 13*	*SOF 13*	*THL 13*	*Total*
PAPER ARCHIVE								
Test pit logs	21	2	4	4	3	6	2	43
Sample register sheets	5	3	1	-	-	1	-	10
OSL sample registers	1	-	1	1	1	1	1	6
Finds registers	1	-	1	-	-	-	1	3
Digital photo register sheets	8	1	1	1	1	1	1	14
MATERIAL ARCHIVE								
Bags of mixed post-Palaeolithic finds	3	-	-	-	-	-	-	3
Lithic finds	5	-	1	-	-	-	1	6
OSL samples	17	-	2	1	3	4	4	31
Sediment samples - total	**114**	**32**	**7**	**-**	**-**	**2**	**-**	**155**
Bulk samples	30	4	-	-	-	-	-	34
Spot-sediment samples	80	18	7	-	-	2	-	107
Monoliths - 50cm	3	-	-	-	-	-	-	3
Kubiena tin - 12cm	1	-						1
DIGITAL ARCHIVE								
Photos - JPGs	223	25	34	18	21	26	21	368
OSL gamma-dosimetry spectra - Chn files	15	-	2	1	3	2	1	23
Survey data - Excel spreadsheet	Data from all sites on different worksheets within one spreadsheet: "Stour PP - test pit outlines & surveys.xls"							1
Sediment sub-sampling register - Excel spreadsheet	Data from all sites on different worksheets within one spreadsheet: "Stour PP, sediment sample index - all.xlsx"							1
Geophysical survey data	Data from the ERT survey							1

Table 8. Lithic artefacts and other finds [* from 10-litre environmental bulk sample; + from 100-litre spit-sieve sample]

Site-code	*Test pit*	*Context*	*Sample*	*Find no.*	*Summary description*
CCF 13	1	102-105	-	-	Pottery, shell (oyster?) and burnt flint recovered during machining
		106	-	-	Pottery, shell (oyster?), bone, flint artefact and burnt flint recovered during machining
	2	202	-	-	Pieces of brick/tile, pottery and flint ?artefacts recovered during machining
	5	512	<21> *	-	Flint flake (glossy black flint, unstained and unpatinated), hard-hammer struck, slightly abraded
	6	605	<26> +	-	Flint flake, artefact
	10	1003	<52> +	-	Small flint chip/flake, probably natural
		1007	<53> +	-	Small flint flake, probably artefact
	11	1101	-	Δ.1	Flint handaxe, stained/abraded; found at base of ploughsoil and retained by landowner
HAF 13	2	202	-	Δ.1	Small flint flake found 15cm below base of plough-soil during section cleaning, mint condition and lightly patinated on part of ventral surface
THL 13	1	104	-	Δ.1	Small flint flake found beside OSL-03, 1m below ground surface, mint condition and lightly patinated in places

Table 9. OSL sampling in field, and selection for subsequent analysis [laboratory codes of analysed samples are given in Table 10].

Site-code	Test pit	Context	Context description	OSL #	Chosen for analysis
CCF 13	1	107	Sand/silt - "Head brickearth"	OSL-01	-
				OSL-02	Yes
	2	204	Sand/silt - " Head brickearth"	OSL-03	Yes
				OSL-04	Yes
	5	505	Sand/silt - " Head brickearth"	OSL-05	Yes
		510	Bedded fluvial sand - terrace	OSL-06	Yes
	10	1006	Sand - slopewash?	OSL-07	-
		1008	Gravelly sand - slopewash? Terrace remnant?	OSL-08	-
	13	1302	Sand/silt - " Head brickearth", top part	OSL-09	Yes
		1304	Sand/silt - " Head brickearth", bottom part	OSL-10	Yes
	16	1603	Sand/silt - " Head brickearth", top part	OSL-11	Yes
		1605	Sand/silt - " Head brickearth", middle part	OSL-12	-
		1606	Sand/silt - " Head brickearth", bottom part	OSL-13	Yes
	21	2102-a	Sand/silt - " Head brickearth", upper part (decalcified)	OSL-14	-
		2102-b	Sand/silt - " Head brickearth", middle part (un-decalcified)	OSL-15	Yes
		2103	Sand/silt - " Head brickearth", bottom part	OSL-16	Yes
		2106	Silt/sand with clayey laminations - slopewash deposits or terrace remnants?	OSL-17	Yes
HAF 13	1	103	Sand/clay-silt - "Plateau brickearth", upper part	OSL-01	Yes
		104	Silty sand - " Plateau brickearth", lower part	OSL-02	Yes
HF 13	4	404	Sand/silt - " Head brickearth"	OSL-01	Yes
OMF 13	2	203	Sandy/clayey silt - " Head brickearth", top	OSL-01	-
		204	Clayey silt - " Head brickearth", middle	OSL-02	Yes
		205	Sandy silt - "Head brickearth", bottom	OSL-03	-
SOF 13	2	203	Sand/silt - " Head 1 brickearth" [= Plateau brickearth]	OSL-01	Yes
				OSL-02	Yes
	5	503	Sand/silt - " Head 1 brickearth" [= Plateau brickearth]	OSL-03	Yes
		505	Sand/silt - slopewash deposits under Plateau/Head 1 brickearth	OSL-04	Yes
THL 13	1	104	Sandy silt - " Head 1 brickearth" [= Plateau brickearth], upper part	OSL-01	-
				OSL-03	-
		105	Sandy silt - " Head 1 brickearth" [= Plateau brickearth], bottom part	OSL-02	-
				OSL-04	Yes

Table 10. OSL dating results, tabular summary

Site-code	OSL sample no.	Test pit	Context	RLAHA lab code	OSL age - ka BP	Error +/-	Dating result notes
CCF 13	OSL-02	1	107	X-6419	20.58	2.06	-
	OSL-03	2	204	X-6420	20.30	1.84	-
	OSL-04	2	204	X-6421	20.26	3.08	-
	OSL-05	5	505	X-6422	18.50	2.32	-
	OSL-06	5	510	X-6423	246.94	30.04	-
	OSL-09	13	1302	X-6424	19.54	3.59	-
	OSL-10	13	1304	X-6425	*142.69*	*45.38*	Close to saturation, can be regarded as minimum age; big error reflects potential bleaching
	OSL-11	16	1603	X-6430	2.04	0.41	-
	OSL-13	16	1606	X-6429	23.35	2.13	-
	OSL-15	21	2102-b	X-6426	20.03	3.30	-
	OSL-16	21	2103	X-6427	26.74	3.63	-
	OSL-17	21	2106	X-6428	*137.22*	*34.15*	Close to saturation, can be regarded as minimum age
HAF 13	OSL-01	1	103	X-6411	*143.25*	*23.65*	Close to saturation, can be regarded as minimum age
	OSL-02	1	104	X-6412	119.91	18.61	-
HF 13	OSL-01	4	404	X-6418	18.84	1.79	-
OMF 13	OSL-02	2	204	X-6410	19.36	2.23	-
SOF 13	OSL-01	2	203	X-6414	1.04	0.15	-
	OSL-02	2	203	X-6415	0.79	0.26	-
	OSL-03	5	503	X-6416	16.77	1.80	-
	OSL-04	5	505	X-6417	20.98	3.33	-
THL 13	OSL-04	1	105	X-6413	12.68	1.09	-

Table 11. Amino acid dating from Chislet Court Farm, CCF 13 and CCF 14: samples with *Bithynia* opercula selected for analysis [sent to Kirsty Penkman, University of York, on 7th February 2014, CCF 13 material, and on 7th May 2014, CCF 14 material]

Site-code	Test pit	Context	Sample <>	Number of opercula	Context description and preliminary interpretation	Notes
CCF 13	5	512	<21>	n=8	Soft sandy gravel - probably a fluvial terrace deposit [base-level not reached]	Sample is from base of test pit, and also contains small vertebrates and other molluscan remains
CCF 13	6	607	<37>	n=18	Soft bedded sands, with wavy sub-parallel clay-silt laminations - fluvial terrace deposit [base-level not reached]	Sample is from middle of a vertical series of samples through the sandy fluvial deposits, in which small vertebrates and other molluscan remains are generally abundant
CCF 14	21	2119	<245>	n=4	Slightly silty fine sand, with fine wavy and discontinuous laminations c. 2-3mm thick	Sampled context is from towards base of TP 21 sequence, and contains range of ostracods, several freshwater forms and also common *Cyprideis torosa*, brackish-tolerant
CCF 13	22	2204-b	<106>	n=20+	Silty sand with common chalk pellets, rich in visible mollusc shells; occurs as a widespread band *c.* 10-15cm thick below fine-grained "brickearth" deposits and above sandy gravel deposits, the latter thought to be fluvial terrace deposits - mode of deposition of context 2204 is uncertain	This is from the same deposit as sample <1.2> of Bridgland *et al.* (1998), from which rich assemblages of small vertebrate and molluscan remains were recovered, but from which no amino acid dating has yet been carried out

Table 12. Summary of palaeo-environmental remains from Chislet Court Farm, CCF 13 and CCF 14

Test pit	*Context*	*Sample/s*	*Deposit-type*	*Small vertebrates*	*Molluscs*	*Ostracods*	*Interpretation: deposit formation, climate and palaeo-environment*
1	107	<1>	Silt/sand towards base of sequence, interdigitating with basal chalk-rich slopewash deposits (-0.15 - 0.50m OD)	-	-	Diverse range of obligate cold climate freshwater species, extinct in Britain between MIS 11 and MIS 5	Small, shallow, cold pools located in low-centred ice-wedge polygons (or in small thermokarst depressions) that warmed (and maybe dried out) during the summer season.
3	306	<15>	Slightly sandy clay-silt, at very base of sequence (3.75 - 3.90m OD)	-	A few hydrobid molluscs were seen in the ostracods sample, but no specialist mollusc report is available	Abundant and *in situ* population of *Cyprideis torosa*, a brackish species of tidal river estuaries, mudflats and creeks	Tidal estuarine alluvium of an earlier course of the Stour; sea-level at least as high as present day, therefore suggesting interglacial conditions
5	511	<20>	Soft gravelly sand towards base of sequence, with flint pebbles(5.30 - 5.70m OD) *Diffuse junction with underlying 512*	Moderately common, including *Microtus* sp. (field vole), *Arvicola* sp. (Watervole) and a cyprinid fish	-	-	Fluvial deposits, probably temperate
	512	<21>	Soft gravelly sand at base of sequence, with flint and chalk pebbles (5.15 - 5.30m OD)	Moderately common, including *Microtus* sp. (field vole) and ?eel	Scarce molluscs including *Bithynia* opercula, no analysis yet done	-	Fluvial deposits, probably temperate
6	606	<29>	Gravelly/sandy clay-silt (9.45 - 9.55m OD) *Sharp unconformable junction with underlying 607*	Moderately common, including watervole (*Arvicola* sp.), possibly bank vole (?*Clethrionomys*), frog/toad limb bones and a fish vertebra	-	-	Fluvial deposits, probably temperate
	607, upper	<30>-<35>	Soft sand, with parallel wavy-bedded clay-silt laminae dipping N/NE towards test pit 22 (9.00 - 9.45m OD)	Moderately common, including watervole (*Arvicola* sp.), field vole (*Microtus* sp.) a frog/toad limb bone and pike teeth	-	-	Fluvial deposits, probably temperate
	607, middle	<36>	Soft sand, with parallel wavy-bedded clay-silt laminae dipping N/NE towards test pit 22 (8.90 - 9.00m OD)	Abundant, including voles (*Microtus oeconomus*, *Microtus arvalis/agrestis*), mole (Talpa europaea) and a possible bird limb bone	Abundant, but no analysis yet done	-	Fluvial deposits, probably temperate

	607, lower	<37>-<38>	Soft sand, with parallel wavy-bedded clay-silt laminae dipping N/NE towards test pit 22 (8.40 - 8.90m OD) *Diffuse lower junction to 608*	Rare, including vole (*Microtus oeconomus*), a frog/toad limb bone, and piece of fish bone	Abundant, including numerous *Bithynia* opercula, but no analysis yet done	Uncertain - not investigated	Fluvial deposits, probably temperate
21	2106, middle & upper	<206>, <208>, <210>, <212>	Clayey/silty sand with nodular carbonate concretions (7.65 - 7.95m OD)	-	-	Sparse assemblage, mixed brackish and freshwater	Fluvial deposits, slight tidal influence, probably temperate
	2106, lower & 2113	<214>, <216>, <218>, <227>, <228>	Clayey/silty sand with nodular carbonate concretions, finely laminated (7.55 - 7.65m OD)	-	-	Sparse assemblage, mixed brackish and freshwater	Fluvial deposits, slight tidal influence, probably temperate
	2114-2117	<229>-<238>	Silt/sand, finely bedded (7.40 - 7.55m OD)	-	-	Moderately abundant, with very abundant brackish presence (*C torosa*) and reasonable diversity of freshwater forms	Fluvial deposits, tidal influence, probably temperate
	2119-2120	<239>-<242>, <245>	Silt/sand, finely bedded, dipping and wedging out to north (7.25 - 7.40m OD)	Part/s of small mammal teeth seen in ostracod sample, but not yet seen by specialist	Rare molluscs, including 3 *Bithynia* opercula	Moderately abundant, with very abundant brackish presence (*C torosa*) and reasonable diversity of freshwater forms	Fluvial deposits, tidal influence, probably temperate
	2121	<243>-<244>	Sand (7.15 - 7.25m OD)	Part/s of small mammal teeth seen in ostracod sample, but not yet seen by specialist	-	Moderately abundant, with very abundant brackish presence (*C torosa*) and reasonable diversity of freshwater forms	Fluvial deposits, tidal influence, probably temperate
22	2203b	<92>, <97>-<99>, <103>, <104>	Slightly silty sand, with moderately common small chalk and flint pebbles (9.35 - 9.90m OD) *Sharp conformable junction with underlying 2204*	-	Moderately common, but no analysis yet done	Sparse assemblage, mixed brackish and freshwater	Fluvial deposits, slight tidal influence, probably temperate
	2204	<100>, <101>, <106>, <107>, <111>	Gravelly/silty sand (9.20 - 9.35m OD) *Sharp conformable junction with underlying 2205*	Very abundant, including voles (*Microtus oeconomus*, *Arvicola cantianus* and *Microtus agrestis*/*arvalis*), pika (*Ochotona* cf *pusilla*), shrew, wood lemming (*Myopus schisticolor*), frog/toad limb bones, pike teeth and numerous cyprinid fish remains including tench (*Tinca tinca*)	Very abundant, including temperate freshwater species (*Belgrandia*) and terrestrial species (clausiliids) - but no specialist mollusc analysis available	Moderately abundant, with very abundant brackish presence (*C torosa*) in upper part, becoming scarcer at base, and reasonable diversity of freshwater forms throughout	Fluvial deposits, tidal influence; strongly continental climate with warm summers and seasonal aridity