MEDWAY VALLEY PALAEOLITHIC PROJECT FINAL REPORT:

THE PALAEOLITHIC RESOURCE IN THE MEDWAY GRAVELS (ESSEX)

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SUMMARY

At its heart the *Medway Valley Palaeolithic Project* (MVPP) is about aiding the curatorial community in managing the Lower/Middle Palaeolithic resource contained in the aggregate extraction landscape. Although implemented in the Medway region (which, from the Palaeolithic/Pleistocene perspective, includes both the Kent Medway basin and southeast Essex), many of its methods and outcomes are directly transferable to the wider aggregate resource. Within the context of this broad goal, the project included:

- Development of a Medway region *Palaeolithic Research Framework*, incorporating: (a) an integrated chronological and stratigraphic framework for sand/gravel aggregate deposits; (b) a regional framework of cultural change/patterning and hominid settlement history; and (c) regional research priorities

- Characterisation and predictive modeling of the Palaeolithic resource in the Medway region, identification of zones of significance and research priorities

- Specification of appropriate methods for evaluation/excavation of Palaeolithic remains within different zones of the Medway Palaeolithic resource

- Enhancement of Palaeolithic SMR datasets in the Medway region

The MVPP has built on previous work, in particular the *Southern Rivers Palaeolithic Project* (SRPP) and *The English Rivers Palaeolithic Survey* (TERPS) in the 1990s, and on the *Thames Estuary Survey of Mineral Extraction Sites* (TESMES). These projects were essentially about collating known information on Palaeolithic find-spots, and relating them to existing British Geological Survey (BGS) mapping.

The MVPP built on this work in three main directions. Firstly, fieldwork was carried out to validate and develop the essential chrono-stratigraphic framework. Current geological attribution of most Pleistocene aggregate deposits is highly suspect, with inconsistencies between adjacent map-sheets and major problems of correlation between more widely separated groups of deposits. The fieldwork focused on dating, environmental sampling and artefact recovery.

Secondly, the MVPP has involved a more detailed analysis of previous Palaeolithic finds from aggregate deposits in the study region, including: recording of typology and condition and reviewing provenance information. These data have contributed to assessing the significance of surviving aggregate bodies, as well as in constructing a regional framework of Palaeolithic occupation and cultural change.

Thirdly, while previous projects have generally produced relevant information from which to develop a predictive model, this step has not yet been taken. The MVPP has combined collation and analysis of findspot information with better understanding of the Pleistocene framework to, for the first time, generate a GIS *Palaeolithic Resource Predictive Model* that both characterises the Palaeolithic resource and predicts zones of higher interest and significance. This model (Section 7 of the report) is perhaps the most important product of MVPP, not so much in itself, but as a starting point for a future dynamic resource, that can predict areas of interest based on algorithms applied to relatively simple raw data.

In course of addressing these core curatorial objectives, MVPP has also contributed to a number of national and regional Palaeolithic research priorities. These primarily concern developing the framework of cultural change and settlement history in the Medway region, and comparing/contrasting this with that of other parts of southeast England. In addition, work has been carried out that has enhance understanding of a number of key sites; in particular: (a) Cuxton in Kent, where we have done new dating analyses, and recovered important new finds; and (b) Westcliff High School for Girls, in Southend, where we have identified lithic artefactual evidence of pre-Anglian hominin presence.

The Cuxton site has been reliably dated by OSL to *c.* 230,000 years before present (BP) the start of Marine Isotope Stage 7, making it the youngest site in the country with its almost exclusively handaxe-focused material culture. In addition, we recovered at Cuxton, immediately beside each other and in the same specific archaeological level, two magnificent specimens of contrasting types of handaxe — a cleaver and a ficron (cf. cover image). Confirmation of (a) the deliberate manufacture of specific types of handaxe, and (b) the co-occurrence of contrasting types within the same material cultural tradition, has a number of implications for our thinking about the cognitive capabilities of these early hominins.

In marked contrast to the spectacular finds at Cuxton, but no less important, a single small flint waste flake was recovered by MVPP sieving of Clinch Street/Canewdon Gravel at Westcliff High School for Girls. This gravel is, however, dated to *c.* 600,000 BP, before the Anglian glaciation, and thus this one unprepossessing piece of flint is the earliest evidence of hominin presence in Essex or Kent.

The project also recognised the need to promote understanding and appreciation of aggregates archaeology to the widest possible audience beyond the curatorial and professional archaeological constituency, and included a number of initiatives aimed at achieving this.

1 INTRODUCTION

This archive report is a summary report on the scope, core achievements and archive constituents of the *Medway Valley Palaeolithic Project* (MVPP), focusing on the Essex part of the study region. It synthesises a new dating and stratigraphic framework for the aggregate resource, and integrates this with a record of early hominin settlement. In addition, it identifies research priorities for different areas of the study region, and provides a strategic overview of how to approach curation of the Palaeolithic resource within the current curatorial framework. This overview encompasses both an overall research framework and guidelines on suitable field methods.

This report provides one aspect of the overall output of the project. A number of digital resources have also been delivered directly to the Essex County Council historic environment team. These comprise GIS polygons identifying the Palaeolithic remains and potential in different zones of the project region, and an enhanced database of information about Palaeolithic finds and sites.

2 BACKGROUND

2.1 Circumstances of project

The MVPP was developed in response to the priorities and objectives of the Aggregates Levy Sustainability Fund. The project was focused within the Thames Gateway development area on sand/gravel aggregate deposits in southeast Essex and north Kent associated with the palaeo-Medway River. This area has a long history of aggregate extraction, as well as still containing a substantial aggregate resource liable for future extraction or impact by other development.

2.2 Curatorial consultation and involvement

The project was developed following consultation with curators for Kent and Essex, where the project is located. It followed from work carried out under ALSF round 1 on the project *Thames Estuary Survey of Mineral Extractions Sites* (TESMES) based at Essex County Council, but also implemented on the Kent side of the Thames Estuary.

The TESMES project included a review of Palaeolithic remains recovered from aggregate extraction sites in the Thames Gateway. It became clear that in order to make sense of these, and also to improve the capability to manage the aggregate extraction landscape, it would be helpful (a) to take account of remains recovered from aggregate deposits in unextracted areas and (b) to carry out a dating and correlation programme of aggregate deposits to place them in a synthesised chrono-stratigraphic framework. Therefore the *Medway Valley Palaeolithic Project* was conceived to address these aims.

2.3 Aggregate extraction and curation of the Palaeolithic resource

There is a strong and unavoidable correspondence of interest between Palaeolithic archaeology and aggregate extraction. The great majority of sands and gravels used as aggregates were formed during the Pleistocene and so contain evidence of the Palaeolithic. In the study region for this project, there has been substantial extraction since the second half of the 19th century.

While previous extraction has inevitably impacted upon the Palaeolithic archaeological resource, it has also provided exposures of the sediments, and there is a long history of co-operation and tolerance between Palaeolithic investigators and commercial quarrying. Early hand-digging and screening of gravel provided ideal conditions for the recognition and recovery of artefacts, and quarry owners such as the Associated Portland Cement Company cooperated with archaeological investigation on numerous occasions. Our current understanding of the Palaeolithic would be much reduced without the opportunities afforded by previous aggregate extraction. Far from being in conflict with the needs of Palaeolithic archaeology, ongoing and future aggregate extraction can be of benefit, so long as appropriate mitigating investigations are carried out.

The current planning legislation provides for mitigating the archaeological impact of all development, including aggregate extraction, under PPG 16 (DoE 1990). However, substantial unmitigated impact upon Palaeolithic evidence has taken place prior to PPG 16. This impact can to a large extent still be mitigated through study of surviving quarry faces and of material recovered from known sites, and this is one objective of this project.

Secondly, the piecemeal nature of mitigation work under PPG 16 — which is inevitably focused on areas chosen for development and hence can deliberately avoid key archaeological sites — means that it has been impossible to target key areas that can increase curatorial understanding of the region. Carrying out such targeted work under ALSF complements, and enhances the value of, other work carried out under PPG 16.

2.4 Study region

The project is focused on aggregate deposits in north Kent and southeast Essex associated with the Medway River (Fig. 1). In the present day, the Medway rises in Ashurst Forest, in the centre of the Weald, and flows northwards through Kent, through Maidstone and through the Chalk escarpment of the North Downs to join the Thames Estuary at Chatham. Earlier in the Quaternary, the river drainage of the Thames Estuary was very different. The Thames had a more northerly route, and the Medway flowed across southeastern Essex to its confluence with the Thames. Thus substantial sand/gravel aggregate deposits in southern and eastern Essex are also associated with the early Medway.

The project region comprises the Medway Valley north of Maidstone, the Hoo peninsula and the southeast quarter of Essex, up to Clacton-on-Sea. The early Medway sand/gravel aggregate deposits here have in many places produced Palaeolithic and palaeo-environmental remains. The region has been divided into eight contiguous areas, four in Kent (KT 1–4), and four in Essex (EX 1–4). Each contains distinct bodies of sand/gravel aggregate deposits with particular problems, potential and Palaeolithic remains (Table 1).

2.5 Archaeological and geological background

2.5.1 The Pleistocene

The initial Palaeolithic occupation and subsequent settlement of Britain has taken place against the backdrop of the Quaternary period, characterised by the onset and recurrence of a series of alternating cold–warm/glacial–interglacial climatic cycles. Over 60 cycles (or marine isotope stages) have been identified over the last 1.8 million years, numbered by counting back from the present-day interglacial (MIS 1), with interglacials having odd numbers and glacials even numbers. These stages have been dated by a combination of radiometric dating and tuning to the astronomical timescale of orbital variations, which are now known to have been a fundamental causative agent of the climatic fluctuations. The Quaternary is divided into two epochs — the Holocene and the Pleistocene. The Holocene represents the present-day interglacial. The Pleistocene represents the remainder of the Quaternary and is divided into Early, Middle and Late parts (Table 2). The Middle and Late Pleistocene are of most relevance to British Palaeolithic archaeology, with the first occupation of Britain occurring *c.* 700,000 years before present (BP) in the Middle Pleistocene, and continuing thereafter with regular gaps.

2.5.2 The Palaeolithic

The Palaeolithic covers the time span from the initial colonisation of Britain in the Middle Pleistocene, possibly as long as 700,000 years ago (Parfitt *et al.* 2005), to the end of the Late Pleistocene, corresponding with the end of the last ice age *c.* 10,000 years ago. Thus the Palaeolithic period occupies almost 700,000 years, and includes at least ten major glacial–interglacial cycles (cf. Table 2), accompanied by dramatic changes in climate, landscape and environmental resources. At the cold peak of glacial periods, ice-sheets 100s of metres thick would have covered most of Britain, reaching on occasion as far south as London, and the country must have been uninhabitable. At the warm peak of interglacials, mollusc species that now inhabit the Nile were abundant in British rivers, and tropical fauna such as hippopotamus and forest elephant were common in the landscape. For the majority of the time, however, the climate would have been somewhere between these extremes.

The British Palaeolithic has been divided into three broad, chronologically successive stages — Lower, Middle and Upper — based primarily on changing types of stone tool (Table 3). This framework was developed in the 19th century, before any knowledge of the types of human ancestor associated with the evidence of each period, and without much knowledge of the timescale. This tripartite division has nonetheless broadly stood the test of time, proving both to reflect a general chronological succession across Britain and northwest Europe, and to correspond with the evolution of different ancestral human species. Lower and Middle Palaeolithic remains have been shown to date before *c.* 50,000 BP, and to be associated with the extinct Neanderthal lineage and their ancestors ('Archaics'). Upper Palaeolithic remains date from *c.* 40,000 BP, and are associated with the first appearance of modern type humans.

The MVPP is only concerned with Lower and Middle Palaeolithic evidence associated with the Archaic humans of the Middle and early Late Pleistocene. Besides the fact that there is no known Upper Palaeolithic evidence in the Medway study region, the sand/gravel aggregate deposits that are the focus of the project were mostly formed during the Middle and early Late Pleistocene, and so the Lower and Middle Palaeolithic is inevitably the focus of their consideration as an archaeological resource.

2.5.3 Palaeolithic of the Medway region

The study region has been divided into eight stretches for the MVPP (Fig. 1), four in Kent and four in Essex, downstream from south to north:

KT 1 — Maidstone
KT 2 — Medway Gap
KT 3 — Rochester
KT 4 — Hoo Peninsula

EX 1 — Rochford/Southend
EX 2 — Dengie Peninsula
EX 3 — Mersea Island
EX 4 — Clacton/Holland

The remainder of this report focuses on the Essex part of the overall MVPP region, and the Kent part is covered by a separate, complementary report (Wenban-Smith *et al.* 2007a).

Geological mapping and a substantial body of Quaternary research (eg. Lake *et al.* 1977 & 1986; Bridgland 1983a; Roe 1999; Bates *et al.* 2002; Bridgland 2003) have provided a basic understanding of the distribution in each of these areas of aggregate and other Pleistocene deposits of relevance to the Lower/Middle Palaeolithic. Deposits in some areas (such as Rochford/Southend and Clacton/Holland) are relatively abundant and well-mapped. In other areas (such as the Dengie Peninsula) the deposits are scarcer.

The sand and gravel aggregate deposits in these areas have produced quite numerous finds of Palaeolithic archaeological material, recently summarised in the surveys of the *English Rivers Palaeolithic Project* (Wessex Archaeology 1996 & 1997; Fig. 2). In total 30 sites are reported in this survey (Table 4). A few key sites at Clacton-on-Sea have produced large quantities of finds. Most sites are, however, find-spots of much more limited numbers of implements, often only single handaxes. However, these are usually the result of very limited investigation and chance finds, and may still represent significant sites.

A detailed review of the Pleistocene and Palaeolithic background of the study region was presented in the original Project Design (Wenban-Smith 2004); the main points are reiterated here.

EX 1 — Rochford/Southend
Pleistocene deposits in this area are particularly complex. There are no less than six distinct mapped terrace gravels: Foulness, Barling, Rochford, Southchurch, Chalkwell and Canewdon. There is, as usual, still some uncertainty for many isolated gravel patches over how they fit into this framework, and it has also been recently suggested (Bridgland 2003) that deposits mapped as Rochford Gravel are in fact equivalent to those mapped as Southchurch Gravel. In addition to the gravels, there are at least four sets of deeply cut

channels filled with fine-grained clays/silts: Southend, Shoeburyness, Rochford and Barling. Present knowledge of the extent, age and relationship with each other of these channel-fills is very poor. It is also hard to integrate them with the altitudinally higher terrace gravels, which nonetheless seem to occupy a broadly similar age range. The channel-fills are generally fossiliferous, giving them some potential for bio-stratigraphical correlation and absolute dating of molluscs through measurement of amino acid racemisation. There is one important stratigraphic tie point, where the Barling Gravel overlies the Barling Channel.

Palaeolithic find-spots are relatively abundant in the area, perhaps due to the high amount of extraction and urban development in places. Quite a few handaxes have been recovered from the Southchurch Gravel at Southend, and from one site (Baldwin's Farm Pit) in the Barling Gravel.

EX 2 — Dengie Peninsula

This area contains two buried channels (Burnham and Asheldham/Tillingham) and five mapped terrace gravel bodies (Barling, Asheldham, Caidge, St Laurence and an un-named gravel over the Tillingham Channel). Only a few Palaeolithic finds have been recovered, all apparently from the Asheldham Gravel, which is the predominant unit in the area.

EX 3 — Mersea Island

This is a relatively small area, and is known to contain at least two major deposits, one channel-fill (Cudmore Grove Channel) and one gravel (Mersea Island Gravel). It is possible, however that there is also a second gravel (the Upper Mersea Island Gravel) and a second channel fill deposit (represented at the East Mersea Restaurant site). The Cudmore Grove Channel is richly fossiliferous, as are the channel-fill deposits at the Restaurant site. The area contains an important stratigraphic relationship, where the (lower) Mersea Island Gravel cuts across the top of the Cudmore Grove Channel. Handaxes have been found at the western end of the island, probably associated with the putative Upper Mersea Island Gravel. Palaeolithic artefacts have also been found at the eastern end from the base of the Cudmore Grove Channel, and, possibly, the lower Mersea Island Gravel.

EX 4 — Clacton/Holland

This is also a relatively small area, but one with significant deposits of high Palaeolithic importance. There is one channel filled with fine-grained deposits (Clacton Channel) and three gravel terraces (Wigborough, Upper Holland and Lower Holland).The gravel deposits are only known to have produced Palaeolithic artefacts at one point, where the Upper Holland Gravel outcrops on the sea-front. Otherwise Palaeolithic remains from the area comprise the abundant material excavated on a number of occasions (Oakley & Leakey 1937; Singer *et al.* 1973; Bridgland *et al.* 1999) from the Clacton Channel deposits and recovered from the foreshore. The former include refitting undisturbed flint artefacts, and the latter include a broken wooden spear point, the only wooden Lower Palaeolithic artefact known from Britain. The lithic material comprises a distinctive core/flake industry lacking handaxes, and forms one of the definitive collections of the eponymous Clactonian industry. The channel-fill deposits also contain an abundance of other palaeontological remains such as mammals, pollen and molluscs, the study of which has established that they date to the Hoxnian interglacial (MIS 11), *c.* 400,000 BP (Bridgland 1994).

Overview

A number of key points can be made:

- Present geological mapping has probably over-simplified the complexity of the sequences within each of the study areas. Correlation of deposits between adjacent areas is also problematic.

- No overall dating framework exists, although Bridgland (2003) has attempted a framework for the extensive terraces on the Hoo based on their proposed correlation with Thames (upstream) and Thames-Medway (downstream in Essex) gravels. The majority of the mapped deposits probably span the last 0.5 million years but deposits laid down during the earlier Middle and Lower Pleistocene are also present.

- Molluscan and other biological evidence is scarce in the Essex Medway gravels, which has made dating harder. However, they typically contain sand-rich beds that would be suitable for dating by optically stimulated luminescence (OSL), yet this approach was not systematically applied, prior to MVPP.

- Existing artefact surveys have collated information on find-spots and the present whereabouts of artefactual material. However, they do not use this information to provide specific recommendations on Palaeolithic potential and significance for areas of sand/gravel deposits, or to develop a broader picture of the history of Palaeolithic settlement and cultural change of the region. The present lack of dating and correlation also hampers attempting this task.

- The number of *in situ* finds from gravel pits suggests much more abundant material could be recovered if properly investigated, eg. from Baldwins Farm Pit (Southend/Rochford, EX 1) and Goldsands Road (Dengie Peninsula, EX 2)

- In light of the evidence from the Norfolk site of Pakefield that England was occupied as long ago as *c.* 700,000 BP, far earlier than previously realised, there is a need to start investigating pre-Anglian deposits for early occupation evidence — eg. the Canewdon/Clinch Street (Southend/Rochford, EX 1) and Belfairs/High Halstow Gravels (Dengie Peninsula, EX 2).

2.6 Research context

2.6.1 National framework

Research themes and priorities

The English Heritage publication *Exploring our Past* (1991) identified three main themes for Palaeolithic research — physical evolution, cultural development and global colonisation. More recently a working party of the Prehistoric Society has defined three main strands for a national Palaeolithic Research Framework (English Heritage/Prehistoric Society 1999):

- Identification of research themes and priorities
- Development of specific projects of immediate relevance
- Education and dissemination initiatives

While regularly under review, and subject to changing emphasis in light of new discoveries and research directions, a comprehensive list of fourteen current core national research themes and priorities (N 1–15) is given (Table 5), and these have provided an overarching academic context for MVPP research objectives.

The resource

The main resource for addressing these themes is lithic and faunal evidence from Middle and Late Pleistocene contexts. Undisturbed horizons have been rightly highlighted (Roe 1980; English Heritage 1991) as of particular significance for their stratigraphic and chronological integrity, and their fascinating glimpses into short-lived episodes of activity. Disturbed and transported material, such as predominates in fluvial contexts, has in contrast been generally downgraded in its potential significance, to the extent that some in the curatorial environment would regard such material as being of insufficient significance to merit any mitigation in advance of destruction. However, besides avoiding the risk of writing off large quantities of the finite Palaeolithic resource just because we don't yet know what to do with it (cf. Chippindale 1989), the study of such material *complements* the evidence from undisturbed sites by bringing a different chronological and spatial perspective to bear. Collections of transported artefacts represent a time and space-averaged sample, giving a more representative view of lithic production and diversity than the evidence from a few square metres representing one afternoon in the distant past. Such evidence may be of more value in documenting and explaining general patterns of material cultural change, since it is less vulnerable to local heterogeneity caused by, for instance, specific tasks or raw material availability.

Besides the direct evidence of human activity, such as artefacts and cut-marked faunal remains, associated biological evidence plays a central role. It can be used to:

- Reconstruct the palaeo-climate and local environmental context of early hominid activity

- Date the sedimentary context of any archaeological evidence, both through chronometric means such as OSL or Amino acid dating, and by biostratigraphic comparison (particularly for mammalian assemblages)

- Identify depositional and post-depositional processes of sedimentary contexts

Even where direct archaeological evidence is absent, the study of biological evidence has a major contribution to make to Palaeolithic research. As mapping and lithostratigraphic correlations of depositional units are developed in a region, accurate dating of even a few key units can provide foundations to tie in the whole sequence, and its contained archaeological horizons, with the wider national and global frameworks. Dating will most likely be achieved from the study of biological evidence — pollen, large vertebrates, molluscs or small vertebrates — from archaeologically sterile deposits. Thus a central aspect of the Palaeolithic archaeological agenda in any region has to be the discovery and study of such deposits.

Key points — Palaeolithic remains

In summary, the following key points can be made concerning how national Palaeolithic research goals can be addressed:

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

2.6.2 Palaeolithic research priorities in the Thames Estuary

At the regional level, the *Archaeological Research Framework for the Greater Thames Estuary* (Williams & Brown 1999, Section 3.2) defines an overall framework objective for Palaeolithic archaeology and Pleistocene palaeoenvironment of:

- *To increase understanding of the physical evolution of the Thames Estuary during the Pleistocene, and of the social and cultural strategies of early human populations in relation to changes in environment and climate*

This would be taken forward by the specific regional objectives (R) of:

R 1 Developing the framework for, and understanding of, environmental and climatic change during the Pleistocene

R 2 Developing knowledge of the evolution of the Thames drainage system at the regional level, and relating this to other regional terrestrial sequences and the global Oxygen Isotope framework

R 3 Developing appreciation of human interaction with this environment through identifying key areas where primary context sites might be preserved and where evidence relating to current research objectives might be located

The MVPP addressed all three of these specific regional objectives through investigation of both the surviving aggregate resource and remains previously recovered from aggregate deposits. Artefacts in museum collections from known find-spots and contexts were examined. Combined with field investigations to date the source deposits, and new sampling for biological remains, it will be possible to, for the first time, provide a wider picture of Palaeolithic settlement history and cultural change in the region, within the wider framework of Pleistocene landscape and climatic change. The project also involved an intensive survey at a single site to investigate our models of site formation and to test/enhance the effectiveness of present methods of investigation.

2.7 Aims and objectives

2.7.1 Strategic aims

The core aim of the project was to aid the curatorial community in developing the capacity to manage the Palaeolithic archaeological heritage of the aggregate extraction landscape in the study region. Within this context, there were also intended to be significant contributions towards (a) addressing recognised national and regional research priorities and (b) promoting wider public understanding and appreciation of the Palaeolithic.

The project builds on previously collated information about Palaeolithic finds and Quaternary evidence in aggregate extraction landscapes. It combined study of artefact collections from aggregate deposits with (b) fieldwork at key sites. This involved environmental sampling and dating studies to develop an overall framework of settlement history and cultural change within a more secure Pleistocene chrono-stratigraphic context. Enhanced data on Palaeolithic sites and new fieldwork locations can now be incorporated in the SMR, and the overall framework provides an essential context for future curatorial management of aggregate extraction landscapes.

The MVPP had two further strategic aims. Firstly, to test and develop current protocols for field evaluation and interpretation of artefactual remains in sand/gravel aggregate deposits. Secondly, to explore development of a national *Palaeolithic Resource Predictive Model*. The MVPP pilot study will use the data collected in the MVPP region to develop, for the first time, a predictive curatorial tool that characterises the Palaeolithic resource and identifies zones of Palaeolithic significance within the context of national and regional research priorities. Thus MVPP provides both (a) a necessary and useful development of curatorial capacity in the core Kent/Essex study region, and (b) a pilot for subsequent expansion of characterisation and modeling into other regions.

2.7.2 Specific objectives

Eight specific project objectives were identified (cf. Table 6, which identifies how these related to national and regional research priorities):

1 — Palaeolithic resource characterisation

To characterise the Palaeolithic resource in the study region, and so provide baseline information for the curatorial community on the distribution, Palaeolithic content and significance of fluvial sands/gravels that are vulnerable to aggregate extraction.

2 — Pleistocene resource distribution and framework

To improve mapping of the distribution of Pleistocene fluvial sands and gravels in the study region, and develop an integrated chronological and lithostratigraphic framework, supported where possible by interpretation of climate, environment and depositional processes/regimes. This will provide a context for (a) future investigations in the region carried out in relation to aggregate extraction and other development and (b) archaeological material already recovered.

3 — Hominid settlement history and cultural development

To provide an integrated framework of hominid settlement history and cultural change/patterning in the study region. This will arise from combining the improved characterisation with the integrated chronological framework. This will provide a context and enhanced research framework for past, present and future Palaeolithic investigations in areas of sand/gravel due for aggregate extraction.

4 — Key sites initiative

To provide an improved context for known Palaeolithic sites, such as Baldwins Farm and Goldsands Road. These sites have produced Palaeolithic remains, and all are associated with areas of sand/gravel that either have already been, or may in the future be, the target of development or further aggregate extraction.

5 — Predictive Palaeolithic modeling

The landscape of the study region was divided into zones of different Palaeolithic potential, characterising the Pleistocene context and highlighting areas of high potential, with summaries of the nature of Palaeolithic evidence, its significance within the context of national and regional research frameworks, and signposting appropriate approaches to field investigation. This was produced as a GIS layer with linked attribute tables suitable for integration with county SMRs and HERs.

This element of the project serves as a pilot for expanding predictive Palaeolithic modeling beyond the study region, building on the work of other projects such as *Palaeolithic Archaeology of the Sussex/Hampshire Coastal Corridor*, the *National Ice Age Network* and *Palaeolithic Rivers of SW Britain*.

6 —Palaeolithic resource curation

To develop improved methodology for the field evaluation, characterisation and interpretation of Palaeolithic evidence in Pleistocene sand and gravel bodies threatened by aggregate extraction. This will include development of a simplified guide for curatorial use summarising the Palaeolithic research framework, the types of evidence that contribute to Palaeolithic research and suitable methods for field investigations, particularly evaluation in advance of extraction or other development.

7 — SMR enhancement

To contribute to enhancement of the quantity and quality of Palaeolithic SMR information available to aid curators.

8 — Community appreciation

To promote public appreciation and understanding of "Early Man" and "The Ice Age", through an integrated range of multimedia resources (web, leaflets, posters) and accessible events (talks, displays).

2.7.3 Relevance to ALSF priorities

The project produces a number of benefits corresponding to the priorities of the ALSF in: (a) promoting environmentally friendly extraction and transport (ALSF Objective 2); and (b) reducing local effects of aggregate extraction (ALSF Objective 3). The project:

(a) Develops the capacity to manage the aggregate extraction landscape

(b) Collates and assesses baseline information on the Quaternary archaeology of the study

(c) Helps improve curatorial decision-making wrt evaluation/mitigation of Quaternary archaeology of aggregate deposits

(d) Develops improved/appropriate methods for field investigations of aggregate deposits

(e) Develops an up-to-date research framework for Palaeolithic archaeology in the study area

(f) Identifies areas of aggregate of potentially higher Palaeolithic significance

(g) Mitigates previous and ongoing aggregate extraction impact where not addressed under present planning conditions

(h) Helped develop understanding and appreciation of Quaternary archaeology in the wider community

2.7.4 Addressing research framework priorities

The project also contributes to a number of current objectives in:

- The national Palaeolithic research framework (English Heritage/Prehistoric Society 1999; Table 5)
- The Greater Thames Estuary regional research framework (Williams & Brown 1999)

3 METHODS AND PRIMARY DATA

Detailed expositions of the methods employed are provided in the original MVPP Project Design (Wenban-Smith 2004) and the subsequent assessment report (Wenban-Smith 2006a). In summary, there were five main elements of the project, supplemented by a range of specialist analyses on material recovered from fieldwork (Table 7).

3.1 Data design and documentation

An Access database was constructed to record information on museum collections of lithic artefacts and fieldwork locations. The structure of the database followed the requirements and guidance of Kent and Essex curatorial staff, and duplicated key SMR entry fields and thesauri. The database and recording protocols were developed and circulated between the other related ALSF projects *National Ice Age Network* and *Trent Valley Palaeolithic Project*, and improved as the project developed. The database also includes a system of lithic technological/typological analysis evolved by FF Wenban-Smith over the last decade for Lower/Middle Palaeolithic material that could perhaps become more widely applied.

The current version of the database structure and lithic analysis system is appended (Appendix 2).

3.2 Museum collections study

All known Palaeolithic material in the study region was traced using the information provided in the *Southern Rivers Palaeolithic Project* (Wessex Archaeology 1993), in published sources, in county gray literature and in SMRs. All published primary sources were examined to verify information on the location and context of finds, associated faunal remains and palaeo-environmental evidence. Relevant archival material held in museums and libraries in the study area was also sought. All information on find-spots in the study region and locations of collection holdings was recorded on the project database. All lithic material was examined and characterised technologically and typologically, using the classificatory system developed in the first element of the project (cf. Appendix 2, Annex 1). Data was also recorded on raw material, condition, cortical condition and a digital record shot made of all handaxes, cores, flake-tools and Levalloisian flakes. Several artefacts listed in the Southern Rivers Projects were not located where listed, and so could not be looked at. Conversely, many museums held relevant material not listed in the SRPP and ERPP, and this was recorded for MVPP.

In addition to recording lithic information, all material was attributed to a "Field event" and information collected on its period, instigator, nature *etc.* (cf. Appendix 2, Section 6). Different collection/recovery events at a site were given different Field Event identifiers, based on the same letter code but with an incrementing numerical suffix. New fieldwork events carried out for MVPP were integrated into this record of field events. Unique codes were chosen, and sequential codes were developed for MVPP fieldwork at sites with historical collections. For instance different collecting events at Baldwins Farm Gravel Pit were given event codes BF01, BF02, BF03 and BF04.

A full record of field events for artefacts reflecting: MVPP work; sites represented in museum collections; and known sites for which the artefacts could not be located is appended (Appendix 3). Overall, material from 10 different sites in the study region was looked at in museum collections, comprising almost 260 artefacts (Table 8). Some collections were excluded from study, due to either insufficient provenance (eg. the material from Lion Point, Clacton), or because published analyses were more than sufficient to characterise the material, for instance from the Jaywick Sands and Golf Course excavations at Clacton-on-Sea, published by Oakley & Leakey (1937) and Singer *et al.* (1973) respectively.

For each museum collection studied, summaries were prepared listing the quantities of technological categories (cores, flakes, flake-tools, handaxes *etc.*), the types represented and the presence of any distinctive technological approaches (such as Levalloisian), with an associated breakdown of the proportions of artefacts in different conditions.

The lithic analysis was followed by a reconsideration of all evidence as to the provenance of each collection, taking account of both published information and information discovered during analysis such as date of collection or collector. So far as possible all collections were then tied in with the lithostratigraphic model developed during the project (cf. Section 3.3).

3.3 Geological data collection and modeling

Geological mapping and borehole records in the project area were reviewed, including unpublished annotated large scale maps in the British Geological Survey archive. A range of published and unpublished literature was also consulted for primary geological data, particularly grey literature arising from commercial archaeological investigations and unpublished PhD theses (eg. Roe 1994; Bridgland 1983). In Essex, it was found that all borehole data was already incorporated in recent research work.

In total, 300 borehole and other sedimentary records were accumulated from these sources. This body of material was then supplemented by 34 sediment logs recovered from test pits, boreholes and section cleaning carried out specifically for MVPP (cf. Section 3.5).

Stratigraphical details of the sedimentary sequences were entered into Rockworks 2004 stratigraphical software (see Table 9 for the data categories held within the database). Solid and Drift Geological mapping were overlaid onto OS landline data, and then point data representing (a) artefact find spots and (b) MVPP fieldwork sites were added.

This body of work guided attribution of mapped geological deposits to different groups (a) within each of the study areas and (b) between study areas, leading to development of a new lithostratigraphic framework for the region (cf. Section 5). This model then provided the baseline for artefact collection provenancing and identification of new areas of Palaeolithically relevant deposits (cf. Section 6).

3.4 Dissemination and community engagement

A web-site was developed that gives background information on the project, as well as a general and accessible overview of the Palaeolithic. The link to this site is:

http://www.arch.soton.ac.uk/Research/MedwayValley/welcome/index.php

This site was supplemented by a leaflet (reproduced as Appendix 9) that was widely distributed to schools, museums, curators, education officers and libraries within the project area, as well as to all landowners and aggregate extractors contacted in course of the project. The leaflet gives a very basic introduction to the project and the Palaeolithic, and provides the link to the web-site for more information.

An addition to these tangible products, a number of presentations/outreach events took place aimed at expanding the horizons of a diverse audience including farmers, aggregate extractors and the wider public community (cf. Section 4.2).

3.5 Fieldwork

Fieldwork was carried out at 15 sites. Over 25 test pits were dug, five sections were cleaned and three boreholes were done. Field data from six other sites were also brought into the project, and these provided information (and samples) from two test pits, one section and four further boreholes. Summary details of the investigations at different sites are appended (Appendix 4); and full details of the sedimentary sequences seen in the MVPP fieldwork are also given (Appendix 5).

The greatest numbers of sites were in the area EX 1 (Rochford/Southend). OSL dating samples were taken from 24 different horizons, with 22 of these being represented by duplicate pairs. There were also a range of bulk environmental and clast lithological and samples (Appendix 4). Lithic artefact recovery was very sparse, with small quantities of lithic material found at five sites (although, as seen in Section 6.2, even one lithic artefact can lead to major conclusions). Larger faunal finds were particularly scarce, with material being recovered from only one site (Barling Gravel Pit).

3.5.1 Phases of fieldwork

Fieldwork was carried out in three main phases:

- Systematic investigation (test pits, boreholes and cleaning of sections in old quarries) of mapped terrace deposits in each of the four study areas EX 1–4; the focus of this work was on exposing sediments suitable for OSL dating or with palaeo-environmental remains, and on sieve-sampling for lithic artefacts.

- Supplementary investigations of a number of key sites that were thought to be of particular potential importance. Key sites that were investigated included Westcliff High School for Girls, where we investigated (successfully) for evidence of early Palaeolithic occupation in pre-Anglian gravels, and Bradwell Hall, where we investigated Tillingham Channel deposits, and recovered a rare example of the bio-stratigraphically important Rhenish molluscan assemblage.

- An intensive test pit and sieve-sampling survey of a specific site earmarked for aggregate extraction

3.5.2 Methods of test pit excavation and sampling

The methods used for test pit excavation and sampling were broadly similar for all fieldwork phases. A detailed exposition is provided in the original Project Design (Wenban-Smith 2004). In summary:

Test pit excavation

Each fieldwork site was given a unique project code, and each test pit a unique number within the site sequence and its location tied in with OS mapping. Test pits were dug with mechanical excavator and were one bucket-width wide, 3–4m long and *c.* 4m deep. Excavation ceased at a shallower depth if pre-Quaternary deposits were reached. Each test pit was taken down in horizontal spits of 15cm, respecting the interface between geological contexts when changes are encountered. The stratigraphic sequence was recorded as excavation progressed.

When Pleistocene sediments suitable for on-site sieving are encountered, samples of 100 litres were numbered and set aside at regular (*c.* 25cm) intervals as excavation progressed, and dry-sieved on site through a 1cm mesh for recovery of lithic artefacts and biological evidence. When the sediment was not suitable for dry sieving, excavation proceeded in shallower spits of 5cm, looking carefully for the presence of any archaeological evidence. Consequently the position of anything found was provenanced to a specific spit sample of known depth within a unique geological context from a unique test pit location.

OSL sampling and *in situ* dosimetry measurement

All bodies of sediment suitable for OSL dating (ie. dominated by coarse silt/fine sand, and constituting a lens of minimum thickness 15cm and ideally 30–40cm) had light-sealed tube-samples taken supplemented by *in situ* gamma-ray dosimetry measurements. Pairs of samples were usually taken. On some occasions blocks of sediment from locations to which direct access could not be achieved were recovered and light-sealed, but without supplementary gamma-ray dosimetry. Whilst not ideal, reasonable dates can still be obtained from such samples, which mostly comprised borehole U4s and pieces of sediment from the base of deep test pits.

Sampling for palaeo-environmental remains

When suitable sediments were encountered, samples were taken for a range of biological palaeo-environmental remains, namely: pollen, molluscs, ostracods, plant macro-fossils and small vertebrates.

Clast lithological sampling

Major gravel beds were sampled for clast lithological analysis. A certain amount of work has already been done in the study region by Bridgland (1983a, b; 1988) and the technique provides an important means of establishing whether gravel bodies are pre- or post the Anglian glacial period, and whether they are of Thames origin, Medway origin or joined Thames/Medway origin.

3.5.3 Boreholes

Certain sediment bodies were too deeply buried to be accessed by test-pit. Many of these have already been investigated by drilling of boreholes, for instance in the Shoeburyness and Bradwell-on-Sea areas, and these were brought into the project. In addition to this material, three new boreholes were carried out for MVPP in Essex: in Southend; Rochford; and Burnham-on-Crouch (cf. Appendix 4). A drill-rig and crew were hired to take a continuous series of 10cm diameter U4 tube-samples and intervening drill-shoe samples down to the base of Pleistocene deposits. These were then sealed for later analysis. A certain amount of sub-sampling has been already been done for environmental assessment.

Of the three boreholes, the one at Southend failed to find sediments of the postulated Southend Channel, but the other two provided good continuous sequences of U4/shoe samples through relevant deposits (the Rochford Channel and the Burnham Channel respectively).

3.5.4 Intensive test pit survey

This aspect of the project involved intensive test-pitting and sieving at one location, aimed at investigating the spatial and vertical distribution of Palaeolithic remains within a gravel body, and testing/establishing the most appropriate sampling volumes and test pit density for field evaluation and artefact recovery. After much difficulty a suitable site earmarked for gravel extraction was identified at Roke Manor Farm in the Test Valley, Hampshire. There was a proven history of artefact finds in nearby gravel bodies, notably the seminal site of Dunbridge, and the extraction footprint formed a transect across the terrace. Over 40 test pits were dug on a closely spaced grid to try and resolve any spatial clustering of artefact finds.

The gravel extraction area at Roke Manor Farm, Romsey, Hants (SU 335 237) comprised approximately 8 hectares. The site was thought suitable for the intensive survey as:

- It was at a level, and in an area, where there is a history of previous Palaeolithic finds, with some sites producing rich concentrations (Eg. Dunbridge)

- The earmarked plot includes two distinct gravel bodies at separate elevations — the westerly end of the site contains a gravel body outcropping between *c.* 60 and 62 m OD; the easterly end contains a gravel body outcropping between *c.* 55 and 58 m OD. Thus investigation allowed the possibility of discovering contrasts in the remains from the different periods represented by each gravel deposit

- The main east–west axis of the earmarked plot runs at right angles across the main flow of the river channel that laid down the two gravel bodies. The site includes areas of gravel both at the palaeo-channel bank and at different distances towards the centre of the palaeo-channel. This makes it possible to investigate whether Palaeolithic remains are more likely to occur near the channel bank, or are evenly distributed across the deposit

Forty-three test pits were dug at intervals of *c.* 40m. These were strung out along the main east–west axis of the site, with a series of north–south transects (Fig. 3). Unfortunately, hardly any artefacts were found in the sieved samples from the gravel deposits, despite two handaxes being found as surface finds in one part of the site. Therefore it was not possible to pursue the objectives of this part of the project.

Although not the desired result, the almost complete lack of artefact recovery in fact serves to support one of the ideas the study was designed to test: namely that artefacts are not evenly dispersed throughout aggregate bodies, but are concentrated in accumulations that can legitimately be thought of as "sites".

3.6 Specialist analyses

Following from assessment (cf. Wenban-Smith 2006a), specialist work was focused on the aspects of the field archive that directly led to delivery of the enhanced regional chrono-stratigraphic and Palaeolithic framework. Work was thus focused on dating (OSL and AAR), lithic analysis and molluscan analysis.

3.6.1 Lithic analysis

The methods of lithic analysis duplicated those of the museum collection study (cf. Section 3.2), apart from artefacts weren't individually photographed. Summary details of the lithic material recovered from MVPP fieldwork are provided (Table 10), and these (along with the details from the museum collection study) have been incorporated in the data and GIS project (cf. Section 7) provided to ECC.

3.6.2 Optically stimulated luminescence (OSL) dating

Methods for the OSL dating analysis are described in detail in the specialist report (Appendix 6), also submitted independently to English Heritage (Schwenninger *et al.* 2007). Eleven of the 24 sampled horizons (cf. Appendix 4) were selected for analysis. This selection focused upon the most important archaeological sites (such as Barling Gravel Pit) and locations that were of particular importance as stratigraphic tie points (such as the Lower Mersea Island Gravel at Cudmore Grove. Summary details of the OSL results are provided (Table 11), and the implications of these are considered further in Sections 5 and 6.

3.6.3 Amino acid racemisation (AAR) dating

Methods for the AAR dating analysis are described in detail in the specialist report (Appendix 7), also submitted independently to English Heritage. Samples from six different sites were dated, and two sets of material were dated from two of the sites (Bradwell Hall, in the Tillingham Channel; and Barling Gravel Pit, in the Barling Gravel). Summary details of the AAR sites, sampling horizons and dating results are provided (Table 12), and the results are incorporated and discussed further in Sections 5 and 6.

3.6.4 Molluscan analysis

Samples with molluscs potentially worthy of analysis were recovered from three MVPP fieldwork sites (cf. Appendix 4), and material from two further site archives (the boreholes done by Roe at Shoeburyness and East Hyde) was also brought in. Suitable specimens for AAR dating were picked out and passed to the AAR dating specialist (K Penkman). The full report is provided as an appendix (Appendix 8), and the results are taken account of where appropriate in Sections 5 and 6.

3.6.5 Lithic analysis

For the excavated collections, basic recording and technological/typological analysis took place as was done for the museum collections in phase 1 of the project (cf. Section 2.2; Appendix 2).

4 PROJECT OUTPUTS

4.1 Curatorial resources

The main outputs of this phase of the MVPP are digital/curatorial resources for ECC. These comprise:

- Updated field event and lithic find-spot records for incorporation in existing SMRs (to be delivered directly to ECC as worksheets within an Excel file)

- A GIS *Palaeolithic Resource Predictive Model* project that delimits, characterises and prioritises the Palaeolithic resource in the study region, identifying areas of known importance as well as areas of uncertainty, and identifying research priorities for different zones, (to be delivered directly to ECC as a GIS project with appropriate shape and attribute tables)

- An accompanying report *Palaeolithic Archaeology and Development Control* outlining a revised research framework for the region and reviewing the significance and potential of different types of Palaeolithic evidence and appropriate methods of intervention. Apart for the regionally specific research framework, much of this manual would have wider national relevance in setting out goals, priorities and methods of Palaeolithic archaeology, particularly within the context of development control (this is covered in Sections 6 and 8 of this report).

Details of the digital files submitted to ECC are summarised (Table 13). The range of data submitted in the Excel worksheets within the file GIS (EX-extra).xls is reviewed in more detail in Section 7, as is the overall content and philosophy of the GIS project.

4.2 Community dissemination

As well as the web-site and leaflet detailed above (Section 3.4), a number of events/activities took place over the course of the project directed at the wider public.

- A junior outreach session was held at Aylesford Primary School, Maidstone, talking in general terms about the idea of the past, what archaeologists do and the survival and interpretation of things, with a focus on the Stone Age so far as feasible for young children. The session incorporated handling experience of a range of archaeological artefacts, clothing and equipment and was, in the words of one young participant "much less boring than she had expected".

● A public lecture was given in Maidstone Museum to talk about the project

● The spectacular finds from Cuxton were publicised in the local press and an article was consequently placed on the main BBC web site, with a link to the MVPP site, which generated an enormous number of hits

● An assembly was held at the West Cliffe High School for Girls, Southend, providing a basic introduction to the Palaeolithic/Pleistocene and the MVPP work in Essex, and this was supplemented by an article for inclusion in the school magazine.

● During fieldwork at Foulness we had a round-table discussion session at the Foulness Museum with eight members of the local community. These included landowners and other interested parties as well as Peter Carr, the Chairman of the Foulness Conservation and Archaeology Society. We discussed the aims of our fieldwork and the types of questions we hoped to answer in terms of landscape and sea level change in the area. This proved a very useful meeting as Peter Carr in particular was very knowledgeable about the local area, and provided useful advice on the best locations for test pits. We supplied the museum with brochures and details of the project website.

4.3 Academic publication

Academic publication has not been part of the programme to date due to the limitation of resources for post-excavation work, although it is planned to produce some academic output in the following year (cf. Section 9). Some of the site-specific results, notably the spectacular results from the test pits at Cuxton and the recovery of lithic artefacts from pre-Anglian gravels at Southend are definitely of national importance.

Furthermore the development of an overall regional chronostratigraphic framework and the accompanying history of Palaeolithic settlement and cultural change will be of interest to the national academic community, as well as to the regional curatorial staff. A preliminary note on the finds from Cuxton was published (Wenban-Smith 2004), but this publication did not include the key information of the OSL dating result from the site, which is of particular interest and importance.

4.4 Archive

In addition to the above archival material associated with specialist analysis, the project has produced a substantial paper archive (Table 14) supporting the sampling and artefact recovery, as well as a large collection of digital photographs resulting from fieldwork (c. 250) and the museum collection study (c. 1200).

The written archive from MVPP fieldwork is divided into three sections, detailing fieldwork data for the Kent, Essex and the Roke Manor intensive study site respectively (cf. Table 14). The layout for each is identical and is set out as follows: The *Site index* provides summary information (including location and geology) for sites in each county, listed by four regions (EX1-EX4 and KT1-KT4), while each site will also have appropriate *Site layout/location maps*. Each site has a *Site investigation summary,* in which information relating to the test-pits, sections and/or boreholes that may have been carried out is recorded. Each will be provided with its NGR, surface height and context data, along with a list of any samples that were taken from particular contexts and any finds from those contexts. *Section drawings* are stored for each test-pit or section investigated, giving context descriptions, and written *Borehole logs* are also in this part of the archive. The *Sediment samples* section of the archive gives information on each sample taken from a site (sample number, context, sample size), what it was sampled for, and when and by whom the analysis process was carried out. The *OSL samples* section records which sites had such samples taken and details codes and times for each sample. The *Finds* section lists each artefact found at each site (by context), while the *Photos* section details each digital photograph that was taken at each site (including direction and a description of the photograph). The *Survey sheets* are provided to keep information regarding the various height levels that were recorded during the surveying of test-pits or sections. Finally, the last two parts of the archive hold correspondence, notes and administrative information (a) by site and (b) non-site specific.

These latter three sections have not been digitally entered, whereas all other sections have been typed up into Word tables. There is also a digital file with test pit survey data from the Roke Manor intensive study.

In total, the paper archive comprises almost 600 items. Agreement has been reached that the artefacts and relevant accompanying paper archive from the project will be lodged at the Southend Central Museum, Victoria Avenue (archaeological curator: Ken Crowe) once all reporting and analysis has been completed.

5 GEOLOGICAL FRAMEWORK

5.1 Geological and Geochronological Framework for eastern Essex

There are four parts to the Essex section of the Medway Valley Palaeolithic Project (MVPP): the Foulness (EX1) and Dengie (EX2) Peninsulas and downstream deposits on Mersea Island (EX3) and in the Clacton area (EX4). The area is defined by the River Blackwater to the north and the Thames to the south, with the River Crouch bisecting EX1 and EX2, running east-west. Topographically, the area is low-lying (largely below 20 m O.D., with a maximum height near the Rayleigh Hills of c. 70 m O.D.), and underlain by Tertiary beds – mostly London Clay, but also Bagshot and Claygate Beds. The higher areas are those where the bedrock is capped by Pleistocene gravels of various ages (e.g. in the Rayleigh Hills).

The Pleistocene geology of this region is of two types: gravel deposits at various heights, and low-lying fine-grained channel deposits often cut directly into London Clay bedrock. Determining the stratigraphic relationships between these deposits is difficult, since deposits do not always overlie each other, are often spatially discontinuous and dissected, and occur at overlapping height ranges within the topographically subdued landscape. Previous workers have stopped short of providing a stratigraphic framework that integrated the two sets of deposits.
Work undertaken during the MVPP has integrated the two types of deposits into a single stratigraphic framework and provided dated tie-points within this sequence, creating a geochronological framework for the deposits in this region.

5.2 Previous research on the eastern Essex gravel bodies

BGS mapping of the Foulness and Dengie peninsulas in the 1970's (e.g. Lake *et al.*, 1986) recognised several altitudinally distinct gravel bodies, frequently covered with either 'head' or 'brickearth' deposits. This work, however, failed to suggest links between the two areas, despite the outcrops clearly trending south-west / north-east across both peninsulas.

Bridgland (1983a,b; 1988) split the gravel aggradations broadly into (1) a High-level East Essex Gravel Group characterised by Wealden Medway lithologies (Bridgland, 1994) and (2) a Low-level East Essex Gravel Group marked by an influx of local and exotic lithologies typical of gravels in the Lower Thames (Bridgland, 1980). The high-level gravels are less continuous and attributed to a time period during which the Medway flowed north across eastern Essex and was confluent with the Thames on the Tendring Plateau near Clacton, shifting gradually south over time (Bridgland, 1995). The low-level gravels, in contrast, post-date the diversion of the Thames, which occurred during the late Anglian (Gibbard, 1977; 1979). At this time, the Thames and Medway converged on the coast of north Kent, as at present. However, the combined Thames-Medway initially flowed north along the former course of the Medway, crossing eastern Essex and still entering the North Sea near to Clacton (e.g. Bridgland, 1983a,b). Following this, the increasingly restricted distribution of the lower, more southerly, units shows that the Thames-Medway gradually migrated to it's current position, forming submerged terrace features that have been correlated with the upstream Lower Thames terraces (e.g. Bridgland *et al.,* 1993).

This Project deals mainly with the more extensive Low-level East Essex Gravels. Various aggradations within this group have been mapped for each of the study regions and previously proposed correlations are shown (Table 15).

5.3 Previous research on the fine-grained low-lying channels of eastern Essex

BGS mapping in the 1970's also recognised a series of low-lying channels, often with gravel at the base, infilled with fine-grained interglacial deposits containing fossils mostly with estuarine affinities (Lake *et al.*, 1977; 1986). Including the previously-known Clacton channel deposit (e.g. Brown, 1840), there are seven significant channel fragments reported in eastern Essex (Table 16). These occur at different levels in relation to sea-level, as does the marine transgression recorded within the deposits (Roe, 1999; Figure 4) and have been divided into 'high-level' (Southend, Tillingham and Clacton) channels and 'low-level' (Shoeburyness, Barling, Burnham and Cudmore Grove) channels, with the Rochford Channel intermediate between these.

In addition, there are further spatially-restricted channel deposits that do not fit into this framework. For example, in the foreshore at Cudmore Grove vertebrate evidence from the East Mersea Restaurant Site (Bridgland *et al.,* 1995) and Hippopotamus Site (very laterally-restricted but thought to be equivalent – Bridgland and Sutcliffe, 1995) suggests an Ipswichian (last interglacial) age for this channel fragment. The situation is even more complicated at Clacton, where there are multiple channels. In addition to the high-level channel listed below, there are lower-level channels of unknown age (iii, vi and v – Warren, 1955) south-west of the Bridgland *et al.* (1999) investigations, and a Holocene channel near the Martello Tower (Bridgland *et al*., 1999).

The age of the larger channels has been unclear, because the biostratigraphy is often undiagnostic and the stratigraphic relationships with the gravels are complicated. However, those high-level channel deposits that have been studied have a clear biostratigraphic signature, with distinctive pollen and a 'Rhenish fauna' (Bridgland *et al.,* 1999; Roe, 2001) and are correlated with the estuarine deposits at Swanscombe and attributed to the Hoxnian Stage. In contrast, the low-level deposits lack Rhenish elements and distinctive pollen, and it is not clear how they relate to the higher-level deposits.

5.4 Stratigraphic relationships between the gravels and fine-grained channels

Roe (1994) analysed many borehole records, suggesting how the low-lying fine-grained deposits related to gravel deposits in their local settings (Table 17). A full stratigraphic framework including both gravels and channel deposits was not attempted because of the lithological and altitudinal similarity of the various gravel bodies and her focus on the channel deposits.

5.5 Stratigraphic synthesis from boreholes analysed during MVPP

5.5.1 Methods

Borehole records from the four study regions were entered into a Rockworks 2006 database for interrogation. The relationships between the different lithological deposits were examined and, once clarified, stratigraphic interpretations of each borehole record were made using a stratigraphic framework that is an amalgamation of that used by Bridgland (1988; Table 15) and Roe (1994; Table 17). It was chosen because it provided different names for deposits in each of the study regions and therefore did not assume any correlations before these had been undertaken. Some further names have also been assigned (e.g. Foulness Gravel for the gravels on the Foulness peninsula rather than the Binney / Taplow / Mucking suggested by Bridgland [2003]).

As part of the analysis, a number of individual borehole records were removed from the dataset. These comprised duplicate records and records of deposits not central to the analysis, such as those that appeared to be modern intertidal deposits and where gravel had been reworked into clay-rich colluvial 'head' deposits. Initial analysis was undertaken at the level of each study region, with the aim of clarifying the following points:

- Is each mapped gravel body a coherent group of sediments, falling into an altitudinally-constrained envelope?
- Are the relationships between the channel fills and gravel bodies the same as those described by Roe (1994; Table 17)?
- What is the combined stratigraphy for this region?

Further analysis of a combined dataset sought to test the correlations previously proposed in Table 15. The detailed relationships within the Asheldham Gravel debated by Bridgland (1994, 1995) and Gibbard *et al.* (1996) were not tested because the borehole data was at too low a resolution.

5.5.2 Region EX1

Figure 5 shows the distribution of boreholes included in the final dataset within region EX1 and Figure 6 and 7 the entire dataset projected onto two south-west to north-east and north-west to south-east trending profiles. The multiple records mean that the stratigraphic relationships outlined below are robust. The following conclusions (summarised in Table 18) were reached following analysis of the boreholes and integration of previous research:

- The Southchurch Gravel deposit, as mapped, is a coherent body of sediment. It is clear from Figure 8 (a south-west to north-east trending profile from Southend to Rochford) that the Southchurch Gravel in the Southend area is altitudinally coherent with that mapped northeast of Rochford. In addition, the gravel is clearly lower than the High-level Gravel and higher than the Barling Gravel. This latter relationship is also seen in Figure 9 (a west to east trending profile from Southend to Foulness). It is therefore mapped after Bridgland (2003). There appears to be some altitudinal overlap with the less extensive Rochford Gravel (Figures 7 and 8), particularly at the Saltings in the north (SALT_05_TP2).

- The Rochford Gravel of Bridgland (1988) was later remapped as Southchurch Gravel (Bridgland *et al.*, 1993; Table 15), assuming that the lower elevation of this deposit was a result of later erosion. However, in this project, the Rochford Gravel was reinstated to enable this assumption to be tested. Borehole analysis showed very few gravel deposits that could be unequivocally assigned to the Rochford Gravel, with many of those recognised by Roe (1994) thin and too clay- or silt-rich to comprise convincing fluvial gravel. Those records that were interpreted as fluvial gravel and retained in the database were of two types:

  (a) Gravel recorded in boreholes in the inside loop of the Rochford Channel (including the OSL-dated site at Doggetts Farm). This is adjacent to and altitudinally lower than the Rochford Channel deposits, with no direct relationship to them. This gravel is also noticeably higher than the Barling Gravel (Figures 10 and 11). Initial borehole investigation suggested that it was most continuous with the Rochford Channel Gravel, as mapped beneath Rochford Channel deposits. However, OSL dates from Doggetts Farm (Table 18) suggest that this gravel post-dates deposition of the Rochford Channel. These deposits were therefore mapped as Rochford Gravel, after Bridgland (1988). However this interpretation should be noted as equivocal, not least because these gravels are considerably altitudinally lower than the Rochford Gravel overlying the Rochford Channel described below.

(b) Thin layers (< 1 m) of fluvial gravel also overlie the Rochford Channel, as shown in Figure 12 (taken along the length of the curved channel). These too have been mapped as Rochford Gravel, after Bridgland (1988). This interpretation is also equivocal because of the differences from the other mapped spread of Rochford Gravel.

- The Barling Gravel is clearly an altitudinally distinct body of sediment in both Figures 8 and 9. It was mapped after Bridgland (1988).

- There is also a much less extensive gravel deposit overlain by a considerable thickness (up to 10 m) of Holocene marine sands and other intertidal deposits. It is clear from Figure 9 that this is a distinct body of gravel, altitudinally separated from all the other mapped gravels apart from the Shoeburyness Channel Gravel, from which it is spatially distinct. It has been named the Foulness Gravel but was not mapped because it does not have a surface exposure.

- There is no borehole evidence for the Southend Channel mapped by Bridgland *et al*. (2001). In addition, targeted field interventions undertaken as part of the Medway project failed to recover material from this deposit. For this reason, it is unclear whether or not the Southend Channel deposit exists. It is therefore not included in Table 18 and not mapped.

- The stratigraphic relationships suggested for the Shoeburyness Channel (incised into Southchurch Gravel and overlain by Barling Gravel - Table 17) are confirmed by Figure 9 and shown in more detail in Figures 13a and 13b. It should be noted that the Barling Gravel is more extensive in the north (13a) than the south (13b). The extent of the channel is mapped after BGS mapping of sheets 258/259 with some further detail.

- Roe (1994; Table 17) suggests that the Rochford Channel is overlain by a thin layer of Rochford Gravel, followed by Barling Gravel. In contrast, Figures 10 to 12 show that the Barling Gravel is considerably altitudinally lower than the Rochford Channel and is nowhere seen to overlie it. The extent of the channel is therefore mapped after BGS mapping of sheets 258/259 and the gravel overlying it assigned to the Rochford Gravel only (see above).

- The relationship between the Shoeburyness and Rochford Channels requires some explanation. The two are AAR-dated to the same temperate stage, yet the Shoeburyness Channel is lower lying than the Rochford Channel (Figures 6 and 7), which is often taken as an indicator of younger deposition. The explanation probably lies in the nature of estuarine deposition. It seems likely, given the sea-level history at each site (Roe, 1999; Figure 4) that the two channels were cut at different times. Initial freshwater temperate sedimentation took place in the Shoeburyness Channel, with later deposition in a higher-level abandoned channel (Rochford Channel) within the Southchurch Gravel as sea-level rose. The location of the study region at the mouth of a large estuary is coherent with deposition of sediments at a wide range of altitudinal levels, as observed here.

- The Barling Channel is too laterally-restricted to be mapped, but has been included in Table 18 for completeness, in conjunction with a personal communication concerning the age of the Channel from Dr Kirsty Penkman

5.5.3 Region EX2

Figure 14 shows the distribution of boreholes included in the final dataset within region EX2 and Figure 15 the entire dataset projected onto a south-west to north-east trending profile. Again, there are sufficient borehole records to allow robust conclusions to be drawn about the deposits within this region. The following conclusions (summarised in Table 19) were reached following analysis of the boreholes:

- The Asheldham Gravel appears to be broadly coherent, although with quite a wide altitudinal range (Figure 15). However, it is clearly lower than the High-level gravel and higher than the Dammer Wick Gravel and therefore mapped as a single body of sediment. The most problematic records are those in the north-east corner, near Bradwell Power station. Borehole records assigned to the Asheldham Gravel in this area are all altitudinally lower than would be expected in relation to boreholes further south on the peninsula, even those within a few miles of the site (Figure 16). It is possible that these boreholes near Bradwell power station should be assigned to an intermediate-height gravel body similar to the Rochford Gravel. However, since there is no clear evidence on which to reassign these records they have remained mapped as Asheldham Gravel, after Bridgland (1988).

- There are no borehole records for the patch of deposits mapped as Marsh Road Gravel by Bridgland (1988). They are also not recorded by recent BGS mapping. For these reasons, they are not mapped in the Medway project.

- There are a limited number of borehole records for the Dammer Wick Gravel near Burnham-on-Crouch, and it has a restricted spatial extent. However, it looks broadly coherent (Figure 15) and the name was retained, after Bridgland (1988). The extent of this deposit, however, was remapped, based on individual borehole records showing a different spatial distribution of the Burnham Channel deposits.

- Figures 17 and 18 suggest that, rather than being overlain by the Dammer Wick Gravel, as argued by Roe (1994; Table 17), the Burnham Channel is instead incised into it. None of the boreholes recording the Burnham Channel show any gravel overlying these deposits, and Figure 17 shows this relationship very clearly. This change is reflected in Table 19. In addition, the mapped extent of the Burnham Channel has been changed in the present project, because some deposits had been wrongly assigned to 'head' in the most recent BGS mapping.

- Previous interpretations of the stratigraphic context of the Tillingham Channel have varied. Bridgland (2003) suggests that it is 'sandwiched' between a two-part Asheldham Gravel. In contrast, Gibbard *et al.* (1996; Table 17) argue that the Tillingham Channel is incised into the Asheldham Gravel and only overlain by a thin veneer of ‘fine-grained’ gravel which they attribute to a small local stream (Figure 19). However, borehole investigations in the Medway project showed very little evidence for this interpretation, with no gravel recognised overlying the Tillingham Channel deposits, either at East Hyde (Figure 20) or at Bradwell Hall (Figure 21 – very similar cross-section location to Figure 19). Therefore it is suggested that the ‘fine-grained gravel’ does not overlie the Tillingham Channel, although it has been recognised at other locations, including adjacent to Tillingham Channel deposits at Bradwell Hall, in test pits 2 and 5. There are therefore two changes to the mapped distribution of Tillingham Channel deposits and fine-grained gravels:

(a) Fine-grained gravels are mapped at locations where they were identified by Gibbard *et al*. (1996), but do not overlie Tillingham Channel deposits.

(b) None of the boreholes near Bradwell Power station yielded convincing evidence of Tillingham Channel deposits. Therefore the channel boundary previously mapped there was not included in the Medway GIS.

It should be noted that the OSL dates for the Dammer Wick Gravel suggest that the Burnham Channel dates from MIS 5e, the Ipswichian (last) interglacial. This is a somewhat surprising conclusion, given the similar altitude to the Shoeburyness and Cudmore Grove Channels, which date from MIS 9 (Tables 18 and 20). However, it may be possible, given the wide range of heights at which deposition occurs within estuaries. In addition, multiple channels of different ages are found at similar altitudes at both East Mersea and Clacton (Bridgland *et al*., 1995; 1999). Unfortunately, despite drilling at North Wick Farm, the Burnham Channel did not yield material suitable for AAR dating, which might resolve this issue further.

5.5.4 Region EX3

Figure 20 shows the sparse distribution of boreholes included in the final dataset within region EX3. From this it is possible to say very little about the deposits, but the following conclusions were nonetheless reached:

- Gibbard *et al*. (1996) suggested that the Mersea Island Gravel mapped by Bridgland (1983; 1988) might instead comprise two altitudinally distinct aggradations. Figure 23 suggests that this is correct, and these two gravels have therefore been mapped accordingly.

- Figure 23 also shows that the stratigraphic relationships proposed by Roe (1994; Table 17) for the Cudmore Grove Channel were correct. This deposit is exposed in the foreshore at East Mersea and a direct relationship with the overlying gravels can be observed in the cliffs at this site.

The final proposed stratigraphy for EX3 is shown in Table 20, including new dating from the East Mersea Restaurant Site funded by English Heritage as part of the Medway project and a personal communication concerning the age of the Cudmore Grove Channel from Dr Kirsty Penkman. The former has not been mapped because it has such a spatially-restricted distribution.

5.5.5 Region EX4

Figure 24 shows the poor distribution of boreholes included in the final dataset within region EX4. From this it is again possible to say very little, but some tentative conclusions were reached (Table 21).

The different Holland Gravel records are joined by a surprisingly steep gradient. However, the records from Medway field interventions do not reach bedrock and cannot therefore be used with any great confidence. For this reason, the mapping suggested by Bridgland (1988) was accepted.

Because of the lack of data from these sites, the stratigraphy and age attributions shown are based entirely on the interpretation of Bridgland (1988, 2003; *et al*., 1999).

5.6 Eastern Essex correlations

The data from Figures 26 and 27 and Tables 18 to 21 has been integrated to give the final interpreted sequence and correlations shown above (Table 22). The following points should be noted in relation to this scheme:

- The gravel correlations between EX1 and EX2 are believed to be secure (i.e. the Southchurch / Asheldham Gravels and the Barling / Dammer Wick Gravels), because of the large numbers of borehole records on which these are based.

- It is not clear whether the Rochford Gravel in EX1 has any correlative deposits in EX2, although the lower-level Asheldham Gravel deposits near Bradwell Power station may instead be of Rochford Gravel age.

- It has proved difficult to correlate the gravels in regions EX3 and EX4 with EX1 and EX2 although it seems likely that they are of broadly equivalent age to the Southchurch / Asheldham Gravels rather than the Barling / Dammer Wick Gravels. However, in both EX3 and EX4, there are two different gravels mapped, and it is not clear from Figure 27 which of these correlates to the Southchurch / Asheldham Gravel. This is largely because of the uncertainty in gradient introduced by the boreholes near Bradwell Power station and, to a certain extent, the record from Saltings. For these reasons, the correlations shown in Figure 11 are deliberately broad for EX3 and based on the age attributions of Bridgland (2003) for EX4. It should be noted that the correlation proposed by Bridgland (2003 - Southchurch / Asheldham / Wigborough Gravels assigned to MIS 10) is not followed because it has been shown in this project that the Southchurch / Asheldham Gravel stratigraphically precedes the Tillingham Channel, and this latter has been AAR-dated to MIS 11.

- Correlations between interglacial channel fills are based on local stratigraphic relationships and AAR dating where available. It was not believed to be useful to try and correlate on altitudinal grounds given the wide range of altitudes at which sediments are deposited within estuarine systems.

6 PALAEOLITHIC SYNTHESIS AND RESEARCH PRIORITIES

6.1 Introduction

At the outset of the project four areas for separate study were defined along different stretches of the joined Thames-Medway in Essex downstream from the point of confluence late in the Anglian in the Thames Estuary (cf. Section 2.4). These areas were:

- Rochford/Southend (EX 1)
- Dengie Peninsula (EX 2)
- Mersea Island (EX 3)
- Clacton/Holland (EX 4)

These areas were based on natural hiatuses in the downstream survival of Thames-Medway deposits, primarily caused by eastward draining tributaries such as the Crouch and Blackwater. The details of the Pleistocene deposits in these areas are fully reviewed above (cf. Chapter 5) so they are not reiterated here. In essence, the main feature of the area is the co-occurrence of: (a) outcropping river gravel formations deposited in colder climatic phases; and (b) substantial and deeply buried lower lying channels cutting across the bedrock landscape and filled with fine-grained alluvial/estuarine silts and clays deposited during warm interglacial phases.

The abundance of biological remains in the buried channels makes them relatively easy to date by a combination of biostratigraphy and the recently developed amino acid racemisation protocol. MVPP has used this latter approach at a number of sites, resulting in the reliable dating of all the channel-fill deposits apart from one (the Burnham Channel). However there still remain numerous uncertainties over the dating and correlation of the various gravel formations in the region. Besides being curatorially useful in identifying the archaeological contents and potential of the various gravel bodies, the work of MVPP in synthesising the records of Palaeolithic finds, alongside the results of the MVPP field investigations, can help in resolving the dating/correlation of these gravel bodies based on (a) whether or not artefacts are present at all, and (b) if present, their typological/technological characteristics.

This summary chapter briefly reviews the geological framework and associated Lower/Middle Palaeolithic evidence in each of the Essex study areas, and provides summaries of priorities for future research in the individual study areas and the region as a whole.

6.2 Rochford/Southend (EX 1)

6.2.1 Rochford/Southend — overview

This area contains numerous small outcrops of high-level pre-Anglian gravels (Daws Heath, Oakwood, High Halstow, Clinch Street/Canewdon, Dagenham/Chalkwell) between Benfleet and Southend (Bridgland 2003). North and east of Southend there are three main sediment bodies relating to the post-Anglian Thames/Medway: the Southchurch Gravel, the Rochford Channel and the Barling Gravel. The Southchurch Gravel is the oldest, and (mostly, it is thought, cf. Section 5.5.2) dates to the late Anglian and the Hoxnian (MIS 12–11, c. 450,000 to 350,000 BP); the Rochford Channel cuts down through the Southchurch Gravel, and dates to the earlier of the Saalian complex interglacials (MIS 9, c. 340,000 to 300,000 BP); and the Barling Gravel cuts through the Rochford Channel, and dates to a cold phase in the range MIS 8 to MIS 6 (300,000 to 125,000 BP). The Barling Gravel has generally been assumed to date to MIS 8, on the basis that is the next cold period after MIS 9, but the dating results of MVPP fieldwork were unequivocally MIS 6.

There are a number of surface handaxe finds in Leigh-on-Sea and Prittlewell that may be related to high level pre-Anglian gravel bodies (Wessex Archaeology 1996). Those in Leigh-on-Sea occur at the foot of a steep landslipped London Clay slope above which there is an outcrop of Oakwood Gravel. Those in Prittlewell occur in the vicinity of a patch of Head gravel downslope from an outcrop of Dagenham gravel. All these finds are most likely residual discards from post-Anglian occupation, but their presence serves as a reminder that the high level pre-Anglian gravels should not be overlooked as a possible source of artefacts, particularly in light of the ever-increasing evidence of pre-Anglian occupation being recovered from the Norfolk coastal area (Parfitt *et al.* 2005).

A test pit dug by MVPP into the Canewdon/Clinch Street Gravel in the grounds of the Westcliff High School for Girls (TQ 850875) produced a small rolled flake (Fig. 28). Although small flakes can be produced by natural processes when gravel bodies are formed, this one is quite convincing with numerous dorsal scars, a well-defined ventral bulb, and the platform crushed by what look like repeated attempts to remove a dorsal flake or abrade the platform overhang. Technologically, it corresponds exactly with the pre-Anglian flake-core industry made on small flint pebbles identified at Pakefield (Parfitt *et al.* 2005). This is the most convincing evidence for pre-Anglian occupation in the MVPP study region.

The Southchurch Gravel has produced reasonably abundant finds comprising a number of quite fresh condition handaxes (mostly cordate/ovate and one sub-cordate). All these handaxe finds occur in the southern outcrop of the gravel at Southend. Their fresh condition suggests that they are not derived from earlier deposits. The abundance of handaxe finds suggests that this part of the gravel is unlikely to be earlier than the first part of the Hoxnian (MIS 11), and that it may well represent a similar period of time to the Swanscombe Middle Gravel, a deposit not too far (c. 30 km) upstream to the southwest. A fresh condition core was also found by MVPP fieldwork in the more northerly outcrop of the Southchurch Gravel in this area, at Saltings (TQ 920945).

The Rochford Channel has not produced any artefact finds. Whether this is because it is so deeply buried that potential artefact-rich horizons have never been exposed for investigation, or because the depositional regime was associated with environments not suitable for occupation is uncertain. By comparison with the artefact-rich deposits of the Clacton Channel, one might expect undisturbed evidence of occupation at various horizons, perhaps most likely along its western banks between Southend and Ashingdon where it cuts past gravel-rich head deposits that might have provided a raw material source.

The Barling Gravel is the most abundant source of artefacts in this area. Handaxes have been found at six sites, the most prolific of which was Baldwins Farm, where three have been found, as well as a core and a selection of flakes, all artefacts being in fresh or slightly rolled condition, indicating a minimum of transport and disturbance. The handaxes are generally pointed, although at least one cleaver is known (from Shoeburyness). Levalloisian material is also known from the Barling Gravel, from Martins Gravel Pit at Great Stambridge.

6.2.2 Rochford/Southend — key questions/areas for further investigation

- Is the MVPP dating result (MIS 6) for the Barling Gravel correct? Does the Barling Gravel contain deposits of both MIS 8 and MIS 6?
- Further investigation for pre-Anglian occupation in Canewdon/Clinch Street Gravel at Southend
- Is there more evidence of pre-Anglian occupation in the other high level gravels between Southfleet and Benfleet?
- Undisturbed artefact-rich occupation horizons within and/or at base of fine-grained clay/silt beds capping Southchurch Gravel
- Can more Levalloisian material be recovered?

6.3 Dengie Peninsula (EX 2)

6.3.1 Dengie Peninsula — overview

The area contains a strip along its east side characterised by numerous small outcrops of various high level pre-Anglian gravels (Bridgland 2003). To the east of this zone, there is a substantial body of gravel, locally named the Asheldham Gravel (although widely held to equate with the Southchurch Gravel in the Southend area, EX 1 (cf. Section 5.5). This gravel body extends intermittently northeastward to the northeast tip of the Dengie Peninsula.

Running parallel to the east of the Asheldham Gavel and abutting the main southwestern body, cutting through it in places, is the Burnham Channel. Similarly, further north there is another deep channel filled with fine-grained sediments that cuts through the raised Asheldham Gravels, in this case the Tillingham Channel. Although these channels appear almost contiguous, the Burnham Channel is substantially younger, being cut through the Dammerwick Gravel.

Deposits equivalent to the Barling Gravel are only present as a small outcrop in the southernmost part of the area, where they are mapped as Dammerwick Gravel.

The only Lower/Middle Palaeolithic artefacts recorded in the area are associated with the southwestern body of Asheldham Gravel between Burnham-on-Crouch and Southminster (Wessex Archaeology 1997). Three of the four find-spots have produced handaxes (all of the ones for which there is information are pointed); and the fourth produced a collection of cores, debitage and flake-tools described by Warren (1933) as typically Clactonian. Warren might have been unduly influenced in this interpretation by his desire to recreate the sequence known at Swanscombe (lower gravel/silt deposits with non-handaxe Clactonian material overlain by sands/gravels with handaxes). Nonetheless, it is possible Warren was correct, and that not only is the Swanscombe cultural sequence replicated, but that the Asheldham Gravel contains direct downstream correlates of the Swanscombe deposits, the artefact-bearing beds of which are dated to MIS 11, between c. 400,000 and 375,000 BP. In addition to these records, an MVPP test pit at Burnham Wick Farm (TQ 960958) produced a well-rolled flake-tool.

Neither the Tillingham nor the Burnham Channels have produced any artefacts. As discussed above, in relation to the Rochford Channel, this might be merely because artefact-bearing levels have never been exposed for investigation. The Tillingham Channel is reliably dated to MIS 11 by mollusc biostratigraphy and amino acid dating, and human occupation of the region is known to have been prolific at this period. If archaeological remains are present, they are liable to be of high quality and well-preserved, as further downstream at Clacton.

The Dammerwick Gravel has not produced any artefacts, although, if the correlation with the Barling Gravel is correct, it might be expected to contain material.

Overall, the Dengie Peninsula is a key area for addressing, and perhaps resolving, a number of problems concerning the Middle Pleistocene chrono-stratigraphic framework, and the associated history of cultural change. In the southern part of the area, we have the Burnham Channel (of uncertain date) and the Asheldham Gravel (SW), which is known to contain handaxes, and perhaps also Clactonian horizons. Further north, we have the Tillingham Channel (known to be MIS 11) which cuts through the Asheldham Gravel (NE), for which no finds are known. Clarifying the number of different gravel bodies that contribute to the Asheldham Gravel in its different parts, and their lithostratigraphic relationships with the Tillingham and Burnham Channels would help establish a more robust framework, within which the various cultural remains could be integrated. The presence of handaxes in the southwestern Asheldham Gravel indicates it is younger than the Clacton Channel and the first part of MIS 11, and this fact needs to be accommodated in any eventual framework.

6.3.2 Dengie Peninsula — key questions/areas for further investigation

- Dating the Burnham Channel
- Artefacts from Dammerwick Gravel
- Artefacts from more northeasterly outcrops of Asheldham Gravel
- Confirming dating and correlation of various Asheldham Gravel outcrops
- Investigating for continuation of Dammerwick/Barling Gravel under Dengie Marshes
- Investigation of artefactual content of NE outcrops of Asheldham Gravel

6.4 Mersea Island (EX 3)

6.4.1 Mersea Island — overview

Mersea Island contains four main deposits: the Upper Mersea Island Gravel, the Lower Mersea Island Gravel, the Cudmore Grove Channel and the Hippo/Restaurant Last Interglacial site channel (Bridgland 1994) (the latter not formally named as yet). The Upper Mersea Island Gravel is probably related to the Blackwater River, rather than the Thames-Medway, and is probably broadly similar in age to the Asheldham Gravel. The Cudmore Grove Channel has been dated to MIS 9 by amino acid dating (cf. Section 5.5), and is overlain by the Lower Mersea Island Gravel, which has been dated (as part of MVPP) by OSL to *c.* 230–240k BP, near the end of MIS 8 and the beginning of MIS 7 (cf. Table 11).

Most of the artefacts known from the area are stray surface finds from the shore (Wessex Archaeology 1997). These comprise two handaxes from the western end of the island, found at the foot of an outcrop of Upper Mersea Island Gravel; and a handaxe and some flakes from the eastern end of the island, found at the foot of the exposure of Lower Mersea Island Gravel. No information could be found on the typology and/or condition of any of these artefacts, and their relation to any of the gravel bodies is highly suspect.

In addition to these finds, a mint condition flake has been recovered from gravel (the Cudmore Grove Channel Gravel) at the base of the Cudmore Grove Channel (Bridgland *et al.* 1988). This is the only find whose provenance is reliably known, and it may be indicative of more abundant and undisturbed material if more intensive investigations were able to take place, although there are clearly numerous practical difficulties in such an enterprise. It is not possible to attempt to characterise the cultural tradition represented on the basis of a single flake.

6.4.2 Mersea Island — key questions/areas for further investigation

- Are there other buried channels in the foreshore area?
- Where do the known channels extend inland?
- What is the age and origin of the Upper Mersea Island Gravel
- What is the artefactual content of the two gravel bodies present on the island
- Further investigation of archaeological content of the Cudmore Grove Channel Gravel: undisturbed horizons? Cultural tradition?

6.5 Clacton/Holland (EX 4)

6.5.1 Clacton/Holland — overview

This area is approaching the edge of the area previously covered by the Anglian ice sheet. The predominant gravel body (the Holland Gravel) represents in its lower part (the Lower Holland Gravel) a pre-Anglian river course, and in its upper part (the Upper Holland Gravel) Anglian glacial outwash deposits (Bridgland 1994). Parallel with the southern edge of the Holland Gravel, and cutting through it in places, lies a different, altitudinally lower gravel body (the Wigborough Gravel). Further south, cutting in an arc across the southwest corner of Clacton-on-Sea are the even lower lying deposits of the Clacton Channel. These also cut through the Holland Gravel, but are directly overlain by the Wigborough Gravel, establishing that the latter post-dates the former.

The Clacton Channel deposits have been reliably dated to the Hoxnian interglacial, MIS 11 (*c.* 425,000 to 380,000 BP) (Bridgland 1994). They have been an abundant source of faunal and artefactual remains for over a century, and the locale is the definitive location for the eponymous Clactonian lithic industry. Besides the abundant artefact collections from the foreshore, significant quantities of material have been recovered under more controlled conditions during two major excavations: one in 1933 at Jaywick Sands (Oakley and Leakey 1937); and one in 1969 and 1970 on the golf course (Singer *et al.* 1973). The concentration of mint condition material and the presence of refitting material (cf. Wymer 1985) at the latter site confirms the identification of an undisturbed occupation surface, and much of the material in the Clacton Channel probably relates to broadly contemporary activity in the vicinity.

The majority of the large foreshore collections in the vicinity of Lion Point is probably associated with the MIS 11 channel deposits, but some artefacts may be derived from different, older deposits. In particular, the handaxes in the Lion Point collection are typologically very similar to one recently recovered from pre-Anglian deposits on the Norfolk coast at Happisburgh (Larkin pers. comm.), and these could have derived from the Holland Gravel. Some material from the foreshore was recovered in context, particularly the broken tip of a wooden (yew) spear. This is the only British example of such a tool, although it is implicit in the evidence of spearing from bone damage at Boxgrove (Pitts & Roberts 1997) and actual wooden spears have been found at the site of Schöningen in Germany (Thieme 1997).

Just one artefact is known from the vicinity that may be related to the deposits other than the Clacton Channel (other than the handaxes above which are attributed on typological grounds). This is a rolled core found under the gravel cliffs at Holland-on-Sea (Wymer 1985), at a location where both Lower and Upper Holland Gravel beds are present. However, it was not found *in situ*, and it is technologically identical to numerous Clactonian cores from the MIS 11 channel. Therefore there is a reasonable possibility that it has been washed along the beach by wave action, rather than originating in the Holland Gravel.

6.5.2 Clacton/Holland — key questions/areas for further investigation

- What is the age of the Wigborough Gravel, and does it have any archaeological content?
- Can any more wooden artefacts be found?
- How far and where do buried channel deposits extend offshore?
- Are there other undiscovered channels in the vicinity?
- How old is the Lower Holland Gravel, and does it contain pre-Anglian artefactual remains?

6.6 Conclusions and regional priorities for further work

Overall, the earliest reliable evidence in the Essex part of the MVPP study region is the flake from the pre-Anglian Canewdon/Clinch Street Gravel at Southend (Fig. 28), probably dating to MIS 14, *c.* 600,000 BP. Following the Anglian glaciation, the region contains abundant and nationally important material dating to the first half of MIS 11 in the Clacton Channel, in its northeastern part, and moderately abundant Lower/Middle Palaeolithic material dating to the second half of MIS 11 (and perhaps also MIS 10) in the Asheldham Gravel in its southwestern part. The material from the first part of MIS 11 in the Clacton area is dominated by cores, flakes and flake-tools, an assemblage type (called Clactonian, after the Clacton type site) known from other contemporary sites in the region such as Barnham and Swanscombe.

There is little material dating to MIS 9. There is reasonably abundant material in the Barling Gravel, although the dating of this latter deposit remains uncertain. Stratigraphically, it overlies a number of deposits dating to MIS 9, but the OSL dating for MVPP (at Barling Gravel Pit) provided an apparently reliable date, repeated in three separate samples that gave consistently close results in MIS 6 (cf Table 18). The archaeological material from the Barling Gravel was also dominated by handaxes, but there was in addition some Levalloisian content. Clarifying the date and archaeological content of the Barling Gravel is important in the region, and indeed nationally, since we are currently very much in the dark over whether Britain was occupied in later MIS 7 through to 6, and if so, what were the lithic industrial traditions of the inhabitants.

Overall regional framework priorities, to be addressed alongside the area-specific priorities listed above, include:

- Seeking archaeological remains in the various deep-lying channels other than the Clacton Channel; if any remains are present, they may be similarly undisturbed, besides likely be associated with excellent faunal preservation
- Looking for evidence of pre-Anglian occupation in the various high-level river gravels
- Resolving the dating and correlation of the Southchurch Gravel, the Asheldham Gravel in the SW of the Dengie Peninsula and the Asheldham Gravel in the NE of the Dengie Peninsula; and clarifying the number of different gravel bodies within each of these mapped formations
- Dating the Burnham Channel, and clarifying its relationship with other channels and gravel formations in the region
- Identifying Lower/Middle Palaeolithic remains from MIS 9, which are conspicuously lacking in the region studied, although sites of this period are known in the wider region, for instance at Purfleet
- Confirming/re-assigning the dating of the Barling Gravel, and investigating its archaeological content in more detail

7 GIS *PALAEOLITHIC RESOURCE PREDICTIVE MODEL*

7.1 Introduction

The overall concept of the model is to create a GIS resource for the MVPP area that: (a) presents and synthesizes information about the Palaeolithic and Pleistocene resource; and (b) identifies/predicts areas of Palaeolithic potential and importance. The structure and data incorporated in this model have been discussed and agreed with Essex and Kent County Council's Heritage Conservation teams to fit in with their existing SMR resource. The digital datasets that comprise the PRPM are summarised in Table 13, and have been delivered directly to ECC. The remainder of this section comprises companion text to the digital material, briefly summarising the philosophy behind the PRPM and specifying the datasets and attribute options contained within it.

The MVPP Palaeolithic GIS model includes two main themes:

- Palaeolithic site characterisation
- Palaeolithic assessment zones

7.2 Palaeolithic site characterisation

The Essex study area includes a number of Palaeolithic artefact find-spots, documented in the English Rivers Project volumes 1 and 3 (Wessex Archaeology 1996 & 1997). In addition to these there are certain findspots of important environmental remains that are not necessarily in the SRPP and ERPP, but that are of Palaeolithic importance. There are also sites in the "grey literature" that have been discovered/investigated subsequent to the SRPP/ERPP. Finally, there are also some further sites investigated during MVPP fieldwork in 2005 that have produced Palaeolithic artefactual and/or zoological remains.

Each site is represented by a point grid reference, and has a related table of data that characterises it and specifies its importance in relation to English Heritage's MPP criteria (Table 23). It is then be possible to filter the sites shown by combinations of these data, creating a powerful and flexible tool for representing/investigating information about the Palaeolithic resource.

7.3 Palaeolithic assessment zones

Using the enhanced Pleistocene base map with the Solid and Drift geology and the records of Palaeolithic finds, zones of Palaeolithic significance were hand-drawn onto the original base maps developed as part of the working method for investigating the geological framework of the area. These zones (Eg. Fig. 29, representing the Southend/Rochford area EX 1) were then digitised and georeferenced as polygons within a GIS project. Although the geological and OS data is not licensed for further distribution, the resulting polygons are the main end-product of the process, and these have been passed on to ECC, where they can be re-integrated into the ECC HER which has its own licensed geological and landline data.

Each zone has an associated attribute table that synthesises the Palaeolithic site data and identifies key research framework objectives, landscape zone priorities and strategies for investigation (Table 24).

A key aspect of the PRPM is that it provides a pilot attempt to automatically generate predictions on Palaeolithic potential, based on the occurrence and distribution of artefactual finds and biological remains. These are represented in fields #8–14 of the zonal attributes (cf. Table 24). These include both a primary level of automatically generated data (such as polygon area, and find density within polygons) and also a secondary level (such as higher/lower than average find density in a polygon). One point of subsequent critique for this model will be to compare and contrast the automatically generated assessments of importance (field #14) with those that are the product of specialist consideration (field #15); it is of course possible to tinker with the rules governing the automatic assessments, and this is one possible avenue of future expansion of the PRPM.

A second, and more fundamental, possible future development of PRPM is a move towards a more dynamic model. As it stands, the current version of PRPM is a static model, in that these data have been generated independently, and then the values fed into fixed attribute tables that are part of the model. An improved second generation PRPM would be more dynamic, in that it would incorporate coding that continually revised its predictions and auto-generated content, as additional data was discovered and fed into primary data tables supporting the model.

This would be a key improvement upon the *Southern Rivers Palaeolithic Project*, which is the current main curatorial resource for the Lower/Middle Palaeolithic, which (although without doubt of great utility as a starting point for reviewing the history of early finds in an area) is essentially a static snapshot of information, most of which originates with Roe's survey of the 1960s (Roe 1968a). As was shown by MVPP, when it came to trying to examine the material listed in the SRPP, much of it could not be located.

8 PALAEOLITHIC ARCHAEOLOGY, DEVELOPMENT CONTROL AND A RESEARCH FRAMEWORK FOR THE ESSEX MEDWAY

8.1 Development control and Palaeolithic archaeology

PPG 16 serves as a powerful tool to mitigate the impacts of development activity upon the archaeological resource. For this to take place it is, however, vital that those who carry out the curatorial functions of developing archaeological programmes and imposing archaeological planning conditions have a confident understanding of:

- The nature of the Palaeolithic resource
- Palaeolithic research priorities (both national and regional)
- Appropriate methods of investigation to realise the potential of the resource

The Palaeolithic poses particular problems since, unlike all other archaeological periods, the main evidence of human activity is not archaeological features or structures (as in the conventional archaeological resource) but artefacts, and occasionally other evidence (such as cut-marked faunal remains), contained within naturally deposited sediments. Thus it has been possible for some in the curatorial environment to overlook (and sometimes actively dismiss) Palaeolithic remains as "natural" rather than archaeologically relevant, particularly when, as is usually the case, they have been subject to some degree of disturbance by the natural burial processes that have led to their preservation. It has in the past often been easy, therefore, for some in the curatorial environment to focus on artefacts from undisturbed occupation surfaces as the only type of Palaeolithic evidence worthy of mitigation, and disregard the evidence from a wide range of other contexts. Part of the following discussion directly addresses this perspective, and attempts to explain why derived material is of importance for Palaeolithic research.

A second potential area of disagreement concerns the importance of various faunal and palaeoenvironmental remains. Despite the value of biological and palaeo-environmental remains in enhancing understanding of the wider landscape, in other parts of which human activity may well be contemporarily occurring, some curators and consultants are reluctant to impose archaeological conditions under PPG 16 unless there is direct evidence of human activity. This is not solely a concern of the Palaeolithic/Pleistocene research community but has equal resonance for the wider archaeological community.

This section attempts to provide a curatorial introduction to the Palaeolithic resource, explaining how, alongside undisturbed remains, the significant Palaeolithic resource also embraces disturbed/transported artefacts, as well as faunal remains, palaeo-environmental evidence and artefactually sterile deposits. All these types of evidence contribute to addressing national and regional research priorities (cf. Sections 2.6 and 8.3). Even though the importance of a patch of Pleistocene river gravel may be less immediately apparent than a well-defined Roman villa, both have their role to play in studying the respective periods, and both are worthy of appropriate evaluation and mitigation under PPG 16.

It is not possible to provide a recipe book of methods for each and every situation. The Palaeolithic resource is too diverse. Nonetheless, some guidelines are presented on how the key archaeological investigative stages of desk-based assessment, field evaluation and mitigation should be approached.

8.2 The Palaeolithic Resource

8.2.1 Pleistocene deposits

The Palaeolithic resource comprises all material remains and deposits that contribute to investigating the Palaeolithic period, and addressing national and regional research priorities. Palaeolithic occupation has taken place through the Pleistocene period, thus the artefactual and faunal evidence of human behaviour and occupation is contained within Pleistocene deposits. These also contain biological, lithological and palaeo-environmental evidence that help in dating the deposit, and providing information of the local climate and environment at any particular time. Such information is essential if we are to carry out core research objectives such as dating sites, constructing a framework of cultural change and development, and understanding human activity and behaviour in its environmental and landscape context.

The core resource for the Palaeolithic is, therefore, *all* Pleistocene deposits. All of these are not necessarily significant, but all have the potential to be so. It is then necessary to consider, for any preserved patch of Pleistocene deposits, what Palaeolithic remains are present, and what is the potential information available for addressing Palaeolithic research priorities.

8.2.2 Palaeolithic remains and relevant information

The most widely recognised type of Palaeolithic remains are lithic artefacts. Handaxes are the most commonly found and easily recognised type of lithic artefact, but the earliest lithic technology embraces simple core and flake strategies and attention should also be paid to their recognition. However, lithic artefacts are just one of a wide range of evidence relevant to Palaeolithic research. This can be divided into three main categories: human activity, biological/palaeoenvironmental evidence and intrinsic sedimentological data (Table 25).

Human activity

Besides lithic artefacts, which also incidentally include stones with batter marks used as percussors, there are several other ways in which the direct evidence of human activity can leave traces. Artefacts can be made from other material such as wood, bone and antler. These are much more perishable, and so rarely found. They are only preserved under certain combinations of swift burial, usually by fine-grained clay-silt sediments that promote anaerobic conditions. The alkalinity of coarser sands and gravels in areas of Chalk bedrock also often aids faunal preservation. However, because of this rarity, one should be particularly aware of the possibility of their recovery from suitable contexts. Other forms of activity can also leave direct traces, such as cut-marks on dietary faunal remains or decoration of stones. Although no decorated/carved objects are yet known from the Lower/Middle Palaeolithic, there is some evidence of a capacity for ritual behaviour at this period (for instance the deposition of Neanderthal and *Homo erectus* skeletons in association with grave goods in Spain), so it is not out of the question that evidence of this type could be found.

Secondly, humans can move or re-arrange natural objects. Lithic raw material can be collected and transported, without any sign of knapping. And there is also the possibility of simple features and structures, such as stone pavements. Again, none are known from Britain as yet, and the claims for this type of evidence from Africa and southern France are questionable, but one should still be open to the possibility of such evidence.

Finally, there is the question of the earliest evidence of fire. On the continent and the Middle East, there is reliable evidence for the controlled use of fire for at least the last 100,000 years, ie. coincident with the occupation of northwestern Europe by the Neanderthals in the last Ice Age. However there is little evidence of this period in Britain, and no uncontroversial evidence of the use of fire before the Upper Palaeolithic. There is no doubt that natural fires were a regular occurrence through the Pleistocene, probably often caused by lightning strikes. The evidence of these fires is preserved in deposits of the time, in the form of burnt out tree stumps, spreads of charcoal and then reworked charcoal fragments that enter fluvial sedimentary systems. There has never been any evidence that reliably links any of this evidence, which regularly crops up on Palaeolithic sites, with human control of fire. Nonetheless, one should still recognise the possibility of more satisfactory evidence occurring at some point.

Biological/palaeo-environmental

One of the key categories of evidence for researching the Palaeolithic is biological/palaeo-environmental evidence. This is often large mammalian, small vertebrate or molluscan, but there is a wide range of other evidence that may be present (cf. Table 25). This may be present at the same sites as artefactual remains, either in the same horizon or in stratigraphically related horizons. Or it may be present at sites where direct evidence is absent. In all these cases, the evidence has the same value and potential for Palaeolithic research, and should be recognised as significant. It can help in dating the deposit, and providing information of the local climate and environment at any particular time. Such information is essential if we are to carry out core research objectives such as dating sites, constructing a framework of cultural change and development, and understanding human activity and behaviour in its environmental and landscape context

Intrinsic sedimentological

Besides artefactual and environmental evidence, there is a range of other information associated with Pleistocene deposits that is relevant to Palaeolithic research objectives (Table 25). Information on their height above OD, their three-dimensional geometry, their position in the landscape and their sedimentary characteristics are all integral to interpreting their origin and date. Other factors such as the range of lithologies represented in the solid clasts, heavy mineral signatures and the occurrence of sand bodies suitable for OSL dating also have a role to play.

8.2.3 Disturbance and integrity

The burial and preservation of Palaeolithic remains is dependent upon where they have been deposited in the landscape, and which depositional processes have acted upon that part of the landscape. A wide range of processes are possible, ranging from total dispersal by glacial action, solifluction or high energy fluvial torrents, to gentle burial by fine-grained aeolian, colluvial or alluvial processes, leaving evidence essentially undisturbed. Thus Palaeolithic remains, and lithic artefacts in particular which are relatively indestructible, have the potential to be preserved and recognisable, although usually showing signs of wear-and-tear, after substantial transport and disturbance.

Consequently, understanding and interpretation of Palaeolithic remains is heavily dependent upon interpretation of the depositional and post-depositional processes that have affected them between their original deposition and their present context. Evidence from both disturbed and undisturbed sites has a role to play in addressing Palaeolithic research priorities. What is most important is, therefore, not necessarily to identify a lack of disturbance, but to be confident about the degree of disturbance. This knowledge then underpins the spatial/chronological scale at which the evidence can be interpreted.

Undisturbed horizons have been rightly highlighted (Roe 1980; English Heritage 1991) as of particular significance for their stratigraphic and chronological integrity, and their fascinating glimpses into short-lived episodes of activity. Disturbed and transported material, such as predominates in fluvial contexts, has in contrast been widely downgraded in its potential significance, to the extent that some in the current curatorial environment would regard such material as being of insufficient significance to merit any protection or research in advance of destruction. However, besides avoiding the risk of writing off large quantities of the finite Palaeolithic resource just because we don't yet know what to do with it (cf. Chippindale 1989), it is becoming clear that the study of such material in fact *complements* the evidence from undisturbed sites by bringing a different chronological and spatial perspective to bear. Collections of transported artefacts represent a time and space-averaged sample, giving a more representative view of lithic production and diversity than the evidence from a few square metres representing one afternoon in the distant past. Such evidence may in fact be of more value in documenting and explaining general patterns of material cultural change, since it is less vulnerable to local heterogeneity caused by, for instance, specific tasks or raw material availability.

8.2.4 Significance

English Heritage (1998) has published eleven criteria, any of which are deemed sufficient to identify a Palaeolithic site as of national importance (Table 26). Assessment of significance depends upon the extent to which the evidence in a particular deposit can contribute to addressing national and regional research priorities. The English Heritage criteria successfully pinpoint a number of situations where there is particularly high potential to address a number of research priorities. It should be noted that remains in a primary undisturbed context represent just one of these criteria. Many sites without undisturbed remains may meet these criteria for national importance. Thus, by these guidelines, the absence of undisturbed primary context remains is not a basis for disregarding the potential of a Palaeolithic site, and failing to carry out mitigating archaeological works.

Furthermore, national importance should not serve as the bar for initiating mitigating works. It provides a useful means of measuring the relative significance of sites for, for instance, dispersing grant-aid funds, considering whether to preserve remains *in situ* or for attributing some form of statutory protection. Many sites that are not of national importance in themselves may contain good evidence that contributes to addressing national and regional research priorities, and impacts upon these should be mitigated.

Finally, and this is a key strategic point, significant knowledge — ie. knowledge that contributes to both national and regional research priorities — can also be acquired, not only from single sites with high quality evidence, but also from repeated observations at sites with evidence that is in itself of little apparent potential. The incremental accumulation of information from, for instance, a single mapped fluvial terrace can lead, over time, to a reliable picture of the density, distribution and nature of Palaeolithic remains. This can not be achieved other than through a coherent strategy of investigation that recognises this from the outset, and sets in place a standardised methodology that leads to systematic small-scale data gathering exercises at every impact occasion. A single event may involve excavation of a couple of test pits, sieving of eight 100 litre gravel samples and recovery of no evidence. This in itself fails to provide sufficient information to make a more general summary of the Palaeolithic remains in a body of gravel that may cover several hundred hectares. However, once this exercise has been repeated a hundred times over a period of maybe 20 years, *then* we will actually begin to learn something that can make a major contribution to core national and regional research objectives.

An important corollary is to recognise the significance of finding no Palaeolithic artefacts. When investigating patterns of human colonisation and settlement, identifying the absence of human presence at particular periods is just as important as identifying presence. Thus, as discussed above (Section 8.2.1), it is necessary to focus upon Pleistocene deposits as the core resource for Palaeolithic investigation, and then one relevant fact for a body of sediment is the presence/prevalence of artefacts — a result of "no artefacts" would be just as significant an observation as "many pointed handaxes". The significance and potential of this data is tied in with the degree of spatial disturbance and chronological integrity of a deposit, which is why assessing this is such an important aspect of evaluation (cf. Section 8.2.3).

8.3 Research Framework for the Essex Medway

It was recognised in the 1980s that the present structure of archaeological curation and investigation in advance of development requires a framework of academic and research priorities against which to consider the significance of sites and to guide their investigation. The seminal English Heritage publication *Exploring our Past* (1991) identified three main themes — physical evolution, cultural development and global colonisation. More recently a working party of the Prehistoric Society has defined three main strands for a national Palaeolithic Research Framework (English Heritage/Prehistoric Society 1999):

- Identification of research themes and priorities
- Development of specific projects of immediate relevance
- Education and dissemination initiatives

8.3.1 National Research themes and priorities

While regularly under review, and subject to changing emphasis in light of new discoveries and research directions, a comprehensive list of fourteen core national research themes and priorities (N 1–15) can be put forward (cf. Table 5).

8.3.2 Broad themes

Broad themes for a regional research framework encompass:

1. Human activity
2. Spatial distribution of stratigraphic units
3. Chronology

4. Palaeogeography
5. Environmental change

8.3.3 Specific regional research priorities

Regional and sub-regional priorities for the specific study areas EX 1–4 have been specified above (Section 6). Particular aspects that have been highlighted in more than one area include:

1. Establishing evidence for Pre-Anglian occupation, (likely to be found in high-level gravel outcrops in Southend/Rochford and Dengie Peninsula). In particular attention should be given to sieving for artefacts and fieldwalking programmes where these deposits are present

2. Investigating for Lower/Middle Palaeolithic artefactual evidence in the various channel deposits of the region. These are usually deep-lying, and so have been little investigated, but, as evidenced by the prolific evidence from the Clacton Channel, any remains present may be abundant, minimally disturbed and associated with good faunal and palaeo-environmental material.

3. Recovery of larger and well-provenanced artefact assemblages from gravel bodies such as the Barling and Asheldham Gravel.

4. Investigation of spatial concentration of finds within terrace bodies — are they evenly scattered, or do they occur as distinct spatial concentrations; similarly, are finds evenly dispersed vertically through a gravel body, or are they associated with a specific horizon?

8.3.4 Suggestions for strategic projects

A number of strategic projects can be identified that follow from the regional research priorities and landscape zone objectives. This list is not intended to be exhaustive or prescriptive. Many other worthy projects could be developed, and aspects from the different projects suggested could be extracted and woven together to form projects of different focus. All serve the multiple and complementary aims of:

- Improving the ability to curate the Palaeolithic heritage in the Essex Medway region

- Developing understanding of the character and distribution of the Pleistocene archaeological resource in this region

- Addressing national and regional research priorities

Systematic fieldwalking of Pleistocene terrace exposures

Most of our current understanding of the Palaeolithic of the region comes from stray finds and amateur collection from quarries. However this knowledge results mostly from the unstructured research activities of a few individuals, often many decades ago. A few areas have been intensively searched on a regular basis, a few on a one-off basis but most have not been searched at all, particularly the higher terrace spreads in the Rochford/Southend area and the Dengie Peninsula. The region is agricultural in places, with some arable fields that may regularly be available for fieldwalking. A project could be developed that applies a systematic and controlled fieldwalking survey of these areas. This (a) may pick up entirely new significant concentrations/sites [for instance the major new Wiltshire site of Harnham (Bates & Wenban-Smith 2003) was found following identification of a concentration of handaxe finds in a ploughed field]; and (b) would lead to a more balanced view of the distribution of Palaeolithic remains and settlement across the region. Such a project could also serve as a useful means of engaging with local archaeological groups and museums and promoting wider understanding of and interest in the Palaeolithic and Pleistocene.

Research investigations

There are a number of sites, for instance Goldsands Road (Burnham-on-Crouch) and Roots Hall Gravel (Southend) and Martins Gravel Pit (Rochford) where we are already aware that Palaeolithic remains were once present, but we lack large collections or (in the instance of the Levalloisian material from Martins Gravel Pit, information on its context and provenance. All these sites would benefit from further investigations, perhaps involving a machine-dug test pit programme, aimed at (a) providing more controlled information on artefact context, presence, density and intra-site distribution, (b) better understanding of the nature, sequence and extent of Pleistocene deposits at the site, and (c) application of dating techniques such as OSL to date the deposits.

An intensive study at a single site

Unfortunately, the attempt to do this as part of MVPP was frustrated by the lack of artefacts at the only site that could be found for such an invasive investigation. However, carrying out such a study remains an urgent priority, since its results will underpin our thinking on the nature of the Lower/Middle Palaeolithic resource contained in sand/gravel aggregates. The central issue to resolve is whether lithic artefacts are present within sand/gravel deposits as tight concentrations at specific horizons, or whether they are homogenously distributed throughout deposits in which they occur. If the former (which is my suspicion) then we can be justified in thinking of such remains as representing proper sites, rather than scattered and derived remains of sites; and this will have implications for how we approach the investigation and interpretation of lithic artefacts from sand/gravel deposits.

8.3.5 Dissemination, education and community involvement

The English Heritage/Prehistoric Society Palaeolithic Research Framework (1999) emphasised the importance of disseminating results to the wider community, and encouraged a more proactive role in this through education and outreach initiatives. Early prehistory, even more possibly than other areas of archaeology, is an area that stimulates the public imagination with its combination of Ice Age climate, exotic extinct animals and Early Man. However, general awareness is limited of the nature of the evidence, its presence all around and the potential for public contribution to advances in knowledge. In general, mechanisms are already in place, with an existing framework of professionals in the museum and education world whose remit already covers promoting wider appreciation and understanding of the archaeological heritage. There is, however, perhaps a need to get the Palaeolithic and Pleistocene higher on the agenda of those whose work already lies in this area. There are a number of avenues that could be developed.

Portable Antiquities Scheme

This scheme is already in place with officers based at regional centres around the country. While originally conceived in relation to metal-detecting, it can also serve as a first point of contact for reporting the recovery of lithic antiquities. This aspect can be flagged up in the outreach publicity material for the scheme and the antiquities officers can be given basic training in the identification of lithic artefacts. The *Lithic Studies Society* has held training days and developed a standardised recording proforma for lithic antiquities. Details are available from Elizabeth Walker at the National Museums & Galleries of Wales, Cardiff.

Popular dissemination and community/educational outreach

Perhaps greater efforts should be made, and resources applied, as part of the reporting requirements of both small and large projects, to working with museum and education officers in disseminating results in more publicly accessible form. This could include:

- Wider reporting of even small finds/projects in local media
- Visits to schools with artefacts and fossils to give short talks
- Teacher packs with visual resources and information summaries
- Public access open-days to sites
- Collaboration with museums over exhibitions and web resources
- Web-sites
- Production/distribution of leaflets, posters and CDs
- Public lectures, knapping demonstrations, artefact identification sessions

Specific recommendations for action

- Contact with Portable Antiquities Officer, training in lithics identification and development/application of a standardised proforma for recording lithic finds

- Increased emphasis in development control work for reporting requirements concerning public/community dissemination

- Increased emphasis in reporting objectives for larger strategic and development control projects of public/popular dissemination and museum/education liaison

- A specific strategic project whose prime objective is promoting understanding and appreciation of the Palaeolithic in the wider community

8.4 Strategy and methods

The core aim of these proposals is to ensure that the maximum and optimum Palaeolithic archeological knowledge is recovered from deposits impacted by development. There is already a strong curatorial framework concerned with mitigating the archaeological impact of development, and involving the collaboration of three principal parties: developers and their consultants, the Local Planning Authority advised by the archaeological curators and commercial contractors. Custom and practice within this framework have, however, developed in relation to the needs of the post-Palaeolithic archaeological heritage. Nonetheless the current framework is also suitable for mitigating impact upon the Palaeolithic resource. Thus the overall strategy suggested is not for revolution in law or planning guidance, but for evolution of current practices and curatorial thinking. The potential of the existing curatorial and legislative framework for effective recognition and mitigation of the Palaeolithic can then be fully realised.

8.4.1 Curatorial awareness

Perhaps the most important issue is to raise awareness and understanding of the Palaeolithic amongst the key players in the curatorial system — namely local authority curators, consultants and contractors. Ultimately it is the local authority curators who have the role of advising on the extent of archaeological conditions on planning applications under PPG 16. However consultants often also have a major role in advance of planning applications in determining the amount and scope of archaeological work that accompanies planning applications, as well as in determining archaeological programmes that satisfy the requirements of local authority curators. In most regions good communications between those involved in these two functions are an integral part of delivering satisfactory archaeological mitigation. Therefore it is vital that those active in these functions, as well archaeological contractors, recognise that the Palaeolithic is as much a part of the heritage as the Neolithic, the Roman or the Medieval, and have a good and shared understanding of (a) the nature of the resource, (b) the types of evidence that contribute to addressing national and regional research priorities and (c) appropriate methods of investigation.

Hopefully dissemination of documents such as this, alongside maximum engagement with bodies such as the Association of Local Government Archaeological Officers (ALGAO), English Heritage, the Council for British Archaeology and the Institute of Field Archaeologists, can play a role in developing awareness and evolving curatorial practice and thinking.

8.4.2 Desk-based assessment

From previous experience outside the study region, we are not confident that DBAs always correctly identify the potential Palaeolithic impact of developments or infrastructural projects. The scope and accuracy of DBAs are clearly heavily dependent upon initial baseline resource characterisation. They are also affected by (a) access and availability of the best possible information and (b) use made of this information.

There is one particularly fruitful source of information that should also be taken account of at the DBA stage. Most development projects, and particularly larger ones, have a range of geo-technical investigations that are carried out early in project cycle. These often involve excavation of test pits and bore-holes. Besides the point that these in themselves have archaeological impact, and perhaps should be monitored, they also provide an excellent opportunity for archaeological knowledge to be gathered on a site piggy-backing on the geo-technical investigations. These investigations provide exposures that reveal the presence and nature of any Pleistocene sediments present. All that is required is monitoring by a person with appropriate expertise, who can record the stratigraphic sequence, and observe and recover Palaeolithic remains if present.

We suggest that good practice for DBAs should include information from archaeological monitoring of geo-technical investigations. Implementation of this suggestion requires engagement with the consultancies and archaeological contractors who habitually carry out DBAs before large development projects. This is currently the case in Kent for instance, where consultancies such as CgMs Ltd now habitually organise monitoring of geo-technical investigations in sensitive Palaeolithic landscapes. The results have in many cases obviated the need for a Palaeolithic aspect to conventional evaluation, and thus resulted in cost reductions rather than increases.

Access to the best information then needs to be complemented by appropriate interpretation. Again, in the future, this could substantially be addressed through a GIS model. Presently, this is probably most effectively carried out by specialists who can combine interpretation of geological mapping with understanding of the potential of the Palaeolithic remains found, or potentially likely to be present, to contribute to current research priorities. Hopefully those involved in DBA preparation can be encouraged to assimilate information in documents such as this, and take further account of the Palaeolithic resource. Key factors to identify and consider are:

- Presence/nature of Pleistocene deposits
- Presence/nature Palaeolithic remains
- Relevance to national/regional research priorities

8.4.3 Evaluation

It is necessary, in areas where there is potential for Pleistocene deposits and Palaeolithic remains, that special methods are applied to investigating their presence and potential. Identification of such areas depends in the first place on the quality of the baseline resource characterisation and the DBA. In these areas deeper test pits need to be dug. A detailed proforma method statement for Palaeolithic evaluation test pits is given in Appendix 10. A key aspect of this is the application of standardised sedimentological recording and volume controlled sieving.

In areas where there is not thought to be even the possibility of Pleistocene deposits, there is no need to carry out a full Palaeolithic/Pleistocene evaluation. However, significant deposits may be found in unsuspected areas, and these may then require further evaluation specifically in relation to their Palaeolithic potential. This has been the case in a number of recent projects, which make useful case studies.

At Red Barns (Hants), an undisturbed floor of Palaeolithic artefacts was found 2.5m beneath the ground surface, in an area mapped as Chalk bedrock, but in fact covered by a thick layer of colluvial deposits (Wenban-Smith *et al.,* 2000). The remains were identified during monitoring of drainage works for later archaeological remains during construction of a housing development. At the Swan Valley Community School (Kent), the development was 500 m from the nearest mapped boundary of Pleistocene deposits, yet a handaxe and fluvial sands/gravels were found in the base of the conventional 30m evaluation trenches. Further deeper test pits identified artefact-bearing fluvial deposits across the site, and ultimately a full archaeological programme was requested by Kent County Council to mitigate the Palaeolithic impact of the school construction (Wenban-Smith & Bridgland, 2001). Finally, at Harnham (Wilts), handaxes were found on a ploughed field surface adjacent to a conventional trench, and varied Pleistocene deposits of uncertain origin were present in the base of the trenches. Subsequent deeper test pits then led to discovery of a complex suite of deposits in a restricted area, with abundant Palaeolithic artefacts, humanly modified faunal remains and undisturbed primary context material (Bates & Wenban-Smith, 2003; Whittaker et al., 2004).

In all three of these areas, particularly at Red Barns, Lower/Middle Palaeolithic remains would have been regarded as very unlikely on the basis of geological mapping and previous find history. How this unpredictability can be factored into desk-based assessments and programmes for investigation is problematic. Although it is probably impractical to insist on Palaeolithic evaluation in all areas, even those where remains are thought unlikely, it would be good practice to at least ask the question as part of conventional evaluation: "Have Pleistocene deposits been encountered, and if so what is their nature and Palaeolithic potential?".

As discussed above, much relevant information can also be gathered from monitoring of geo-technical investigations. If this has not been carried out for the DBA, then such monitoring should be carried out and the information fed into the evaluation stage of the archaeological curation cycle.

8.4.4 Mitigation

If Palaeolithic remains are found, or expected, to be present, it is advisable to take specialist advice on their potential and suitable methods for investigation. As discussed above (Section 8.2.4) significant contributions to Palaeolithic knowledge can be gained from both one-off studies of single high quality sites and the incremental long term accumulation of relevant data from sites that in themselves are of low significance, and possibly lacking in remains altogether. The best example of this is fluvial terrace deposits. Although it is in fact uncertain (and a subject of current research) how long a time period is represented by their deposition, material within such deposits is generally thought to be datable to the level of the marine isotope stage, ie. a period of *c.* 30,000 years. Far from being the disaster that some (used to the more precise dating of later periods) might think, these deposits thus represent relatively tightly defined time capsules within a period of 600,000 or 700,000 years of Palaeolithic occupation. There is a lot of knowledge to be gained from large-scale and long term sampling of such terrace deposits, leading to a full picture of the nature and prevalence of any contained Palaeolithic archaeological remains. This can easily be achieved through accumulated evaluation and mitigation test pit investigations. Urbanised regions, where they overlie Pleistocene terraces, are particularly suitable for development of such a programme, since there is likely to be regular development scattered over the terrace, and works such as foundations or services trenches will provide regular opportunities for sampling.

9 FURTHER WORK

Three main avenues for further work can be identified: (1) Academic reporting; (2) OSL enhanced dating and validation programme; (3) Enhanced and standardised Lower Middle Palaeolithic resource characterisation and a more dynamic *Palaeolithic Resource Predictive Model*.

Academic reporting

Firstly, reporting to date has focused upon the core curatorial objectives of developing a Palaeolithic research framework for aggregates in the Kent and Essex Medway areas. This has been achieved, and if the end product is found to be of value, there is great scope for expanding the same approach to cover adjacent areas. However, there is also scope for further, more academic reporting of the results. This aspect was not included in the current programme, but discussions are taking place with a view to carrying this out over the coming year.

OSL enhanced dating and validation programme

Secondly, the project generated a significant quantity of samples for OSL dating, only a small proportion (c. 25%) were actually analysed. This resource has potential in two areas:

(a) further analysis, particularly of further samples from stratigraphic series at the same site, can provide more dates for the overall Chrono-stratigraphic framework and refine the accuracy of the results using Bayesian analysis;

(b), and perhaps most importantly, almost all of the dated samples have an undated duplicate from exactly the same location. Many of the OSL dates were significantly younger than expected, and one factor that *might* be playing a role is the specific lab where the dating work is carried out. Two different labs were used for the majority of ALSF OSL work: Jean-Luc Schwenninger at Oxford, and Phil Toms at Gloucester. Without casting any aspersions at all, it would be of scientific value to test the consistency of dating results when archaeologically identical samples are submitted to these different laboratories. Further validation/testing of the results can also be achieved through application of single grain analysis.

Carrying out these analyses would both provide expanded and improved dating results, and validate the consistency of the results in different areas of the country resulting from the work of the two labs involved; ultimately after all, we are trying to build from a regional to a national Palaeolithic picture, and confirming the consistency of the dating results in the different regions will help in this goal. Preliminary discussions have already taken place with a view to moving this forward also over the coming year.

Enhanced Lower/Middle Palaeolithic resource characterisation and a more dynamic *Palaeolithic Resource Predictive Model*

Finally, in the longer term, the GIS *Palaeolithic Resource Predictive Model* should be reviewed in conjunction with curators at both national and county levels. There are various aspects that can be modified. Firstly, there is the selection of data that is fed into it at the outset. Secondly, one could reconsider how these data are used to identify/predict zones of importance, and whether it will ever be possible to develop algorithms that match specialist assessment — my own view on this is that it probably won't, but algorithms can be useful in a triage between areas of definite importance, areas of almost certain unimportance and areas of definite uncertainty; and these assessments can then form the starting point for involvement of specialists. Thirdly, there is potential for a move from the static pilot model developed here, towards a more dynamic model. This needs to be tied in with an SMR enhancement programme that codifies relevant data and thesauri for the Lower/Middle Palaeolithic resource.

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