Chapter 22

Discussion and conclusions: Clactonian elephant hunters, north-west European colonisation and the Acheulian invasion of Britain?

by Francis Wenban-Smith

INTRODUCTION

The preceding chapters have presented detailed studies of different aspects of the site: stratigraphy, sedimentology, palaeontology, palaeobotany and archaeology. In this final chapter, the disparate specialist analyses are integrated to (a) provide an overview of the history of landscape development and climatic/environmental change through the parts of the Middle Pleistocene represented in the deposit sequence, (b) present the evidence of hominin occupation and activity within this framework and (c) consider some of the wider implications of the evidence.

The site presents narratives and resonances at different temporal and spatial scales. At one level, it provides a 'just-so' story about a locale, with deep explanatory roots for the present-day geomorphology, which in turn has structured the pattern of land usage, aggregate extraction, road networks and urban development, providing a fundamental connection between the present environment and the geological past. The archaeological and palaeontological evidence populate this ancient landscape with hominin and other faunal and floral life, likewise providing roots for the contemporary experience. At a wider level, the evidence from the site contributes to our wider understanding of the British Lower Palaeolithic, complementing information from broadly contemporary horizons at nearby Barnfield Pit (Conway *et al.* 1996) and from further afield in East Anglia. In particular: East Farm Pit, Barnham (Ashton *et al.* 1998); Beeches Pit, West Stow (Hallos 2004; Gowlett *et al.* 2005) and Clacton-on-Sea (Oakley and Leakey 1937; Singer *et al.* 1973). Additionally, the evidence from Southfleet Road integrates into the sparse web of similarly undisturbed sites from across the Lower/Middle Pleistocene Old World, for example: Boxgrove, UK (Roberts and Parfitt 1999); Aridos, Spain (Villa 1990); Notarchirico, Italy (Piperno *et al.* 1998); Gesher Benot, Israel (Goren-Inbar *et al.* 1994) and Mwanganda's Village, Malawi (Clark and Haynes 1970), to provide a series of snapshots of early hominin life across the grand sweep of Palaeolithic time.

At a deeper level, the investigation and analysis of the Southfleet Road site provides a series of case-studies. In the first case, it is a multi-disciplinary Palaeolithic investigation, with the lithic analysis that is the long-standing focus of Palaeolithic archaeology supported by Quaternary Earth Science and zoological work. Second, it is a case-study of a lithic analytical approach, incorporating traditional technological and typological characterisation, but complementing these with analysis of the *chaîne opératoire* and the spatial organisation of lithic production. Third, it is a case-study of the contrasting approaches to interpretation of the Lower/Middle Palaeolithic record that are crystallised in the specific 'Clactonian debate' that has persisted since the 1930s (Oakley and Leakey 1937; Singer *et al.* 1973; Ohel 1979; Ashton *et al.* 1994; Wenban-Smith 1998; White 2000) and to which the evidence from the Southfleet Road site is highly germane. Like other great debates of Old World early Palaeolithic archaeology, such as the so-called 'Mousterian' debate (Binford and Binford 1966; Binford 1973; Bordes 1981; Dibble and Rolland 1992), the Clactonian debate concerns not just the story derived from the lithic evidence, but a clash of more fundamental perspectives on the nature of the early archaeological record, and in particular the lithic record, and how to approach its interpretation.

The archaeological evidence through the sequence takes a variety of forms. Sparse lithic evidence incorporated into the lower deposits, formed by active processes such as landslips, slopewash or river torrents (Phase 3), provides evidence of occupation in the general area at, or before, the horizons from which the evidence was recovered. The paucity of this evidence makes it impossible, however, to develop an idea of the wider lithic cultural/industrial tradition.

At other horizons, most notably in clayey deposits (Phase 6) thought to have been formed at the edge of a fluctuating waterbody at the foot of a slope forming its western bank, undisturbed remains of hominin activity have been found, representing flint tool manufacture and exploitation of a single elephant carcass over a restricted period, perhaps between one day and a week. This evidence thus provides a clear snapshot of hominin activity involving flint tool manufacture at the site of a single large food resource. While the space-time envelope of this undisturbed evidence is restricted, making it of questionable utility for determining a wider industrial tradition, it is complemented by a much larger accumulation of technologically similar material from the same stratigraphic horizon, in the concentration south of Trench D. While some of this latter material may likewise be undisturbed, the majority is thought to have been slightly mixed and transported by slopewash processes, perhaps only a few metres, and to represent a sample from a more sustained accumulation of lithic technological events in the bank margin zone between the floodplain and the clayey slope rising to the west of the site. It thus provides a significantly more robust basis for identifying the presence of a distinct lithic industrial tradition sustained throughout the period represented by the persistence of the floodplain edge as a place of activity. The tradition that emerges is based on the loosely structured reduction of locally obtained flint nodules to produce flake blanks of various sizes and shapes. The larger (or more conveniently shaped) of these were then selected for use or secondary flaking and transformed into a variety of simple flake-tools, often with clear notch removals, thought to have been particularly efficacious for cutting meat and skin.

A slightly wider temporal and spatial scale of interpretation is provided by the lithic material from Phase 7, thought to represent mass movement of deposits downslope from the high ground to the west, and thus containing reworked evidence of lithic activity broadly contemporary with that from the underlying Phase 6, but from a much wider landscape catchment. The evidence is nonetheless technologically and typologically indistinguishable from that from Phase 6, further reinforcing the notion of the sustained production by a hominin group inhabiting the Swanscombe locale during the period represented by deposition of the Phase 6 sediments (and probably also the upper Phase 5 sediments). Of a lithic industrial tradition based upon cores, flakes and simple flake-tools, but entirely lacking in bifacial handaxes.

Although the tight time-space envelope of the activity around the elephant skeleton makes it, paradoxically, less useful for determination of lithic industrial tradition – *contra* the thinking of the 1960s and 1970s, whereby one of the main drivers of the importance of finding undisturbed sites was to achieve culturally pure lithic artefact samples without reworked contamination from older occupations – the undisturbed horizon of elephant exploitation at the site can be securely linked with the rich palaeo-environmental remains of the tufaceous channel (Phase 6b) by means of the recovery within it of foot bones originating from the elephant skeleton. The association therefore provides a firm, and exceptionally rare, instance where Middle Pleistocene hominin presence and activity can be placed, not only in a landscape context, but also in a specific climatic and environmental context. In this instance, it can be placed firmly in the fully temperate interglacial climatic optimum of MIS 11, probably Ho-II of the Hoxnian interglacial. At this time the environment of south-east Britain would have been predominantly forested, although without doubt with various more open grassy spaces maintained by grazing herbivores, perhaps mostly in riparian riverbank situations as in this instance. Thus, although clearly contradicting the position of Gamble (1986) which was based primarily on the atypical record of the Late Pleistocene, when Britain was not apparently inhabited in the peak interglacial maximum of MIS 5e, questions still remain about the degree of hominin penetration into major tracts of more densely forested parts of the landscape, away from the river systems that have also (perhaps misleadingly) provided the depositional conditions for preservation of most archaeological evidence from the period.

Higher in the sequence, there is a stratigraphic unconformity between Phase 7 and Phase 8. The fluvial gravels of Phase 8 truncate the underlying sequence, representing a depositional hiatus of uncertain duration and a major change in the activity of the depositional environment, which was relatively placid throughout Phases 4-7. The archaeological remains of Phase 8 present a major contrast to those of the underlying sequence. They include both mint condition and abraded material, thus providing evidence of both activity at the site contemporary with deposition of the river gravels and activity in the wider catchment area. Not only are they technologically and typologically very different, being dominated by the presence of often finely made handaxes of a range of forms, often finely made (sharply pointed, flat sub-cordate and twisted cordate examples are all found) alongside a range of flake-tools including large unifacial side-scrapers, but they are also characterised by being part of a wholly different organisational approach to the lithic technological system.

In the earlier deposits, there was no evidence of the lithic technology being organised in the landscape. At all the different spatial/temporal scales at which the evidence survived, there was a uniform picture of lithic production as a floating *ad hoc* response to immediate need. Reduction sequences were often started and finished at the same spot using readily available raw material to make tools for immediate use and discard, with no sign of any spatial patterning of activity in the landscape. In Phase 8, there is in contrast a preponderance of finished, intensely worked handaxes, but a distinct lack of waste debitage commensurate with their manufacture. This reflects a significant re-alignment of the organisation of the lithic technological system in relation to mobility and the encountering of resources. It does not necessarily reflect increased mobility, but it reflects both a greater spatial separation of tool use and discard from the place of manufacture, and the spatially structured repetition of this process in the landscape. These are archaeological characteristics that could be taken as reflecting a greater degree of cognitive anticipation and logistic planning, and which represent a more modern human style of technological practice in a 'cultural' geographic framework as opposed to the less actively constructed 'niche geography' of much non-human animal behaviour, in Binford's (1987b) terms. Thus, this contrast raises the question of whether not only is there a straightforward technological/typological industrial/cultural contrast between the archaeological remains of Phase 8 and the underlying deposits. But does this contrast (if accepted) also reflect a more deep-rooted difference in cognitive capabilities and behavioural practices, one that perhaps could relate to different hominin species, or evolutionary lineages; this is considered further below.

In the remainder of this chapter, different aspects of the results of the work at the site are recapped in more detail, starting with an overview of the basic results and progressing through a series of discussions of the interpretive implications within the wider context of current Palaeolithic research. It culminates in some thoughts about methods of investigation of Palaeolithic sites and particular issues with carrying out Palaeolithic archaeology in advance of development, as opposed to on a purely research-led basis.

OVERVIEW: STRATIGRAPHY, DATING, ENVIRONMENT AND ARCHAEOLOGY

The complete sequence of the site is summarised here (Table 22.1). Geomorphologically, the site was situated throughout its depositional history in the base of a north-south trending valley, with a high gentle slope rising to the west, and possibly a steeper cliff or bank to the east.

Phase 1 ('Tilted Block') and Phase 2 (Parallel-bedded sand/clay)

The bottom two Phases (1-2) of the stratigraphic sequence, present at the southern end of the main site, are of uncertain date, and lack any biological or archaeological evidence. Phase 1 (the 'Tilted Block') attests to significant disruption of the underlying Chalk bedrock in the site area, reinforced by data from test pits and boreholes in the surrounding area (see Chapter 4). This disruption, although poorly understood and to-date little investigated, is probably critical to the site's existence, providing a locale both locally rich in flint raw material and prone to depositional aggradation, thus ensuring both hominin activity and subsequent preservation of the resulting evidence in conjunction with various zoological and floral remains.

Phase 2 (Parallel-bedded sand/clay) seems to represent a phase of infilling of a very uneven local landscape, whereby sumps and local depressions within a landscape characterised by cliffs and jagged pinnacles of chalk became infilled by silt/sand deposited by quiet water or slopewash, interspersed with episodes of standing water represented by clay bands typically 10-20mm thick. This phase of the sequence is unconformably truncated by deposits of Phase 3 (Chalky/silty/gravelly sand), and these phases of the site sequence may be separated by a significant hiatus. However, the inferred depositional environments of Phases 2 and 3 are remarkably similar in parts, perhaps indicating a not-so-great time separation.

Phase 3

The basal sediments of Phase 3 are medium-coarse silty/sandy flint gravel beds rich in chalk pebbles and comminuted Tertiary shell fragments (context 40061) that seem to have been fluvially deposited in their lower parts, although probably including significant slopewash input. These deposits dip and thicken to the east of the main site, extending below 18m OD, with their base not reached. Clast lithological analysis of these deeper eastern gravelly sediments (Wessex Archaeology 2006b) confirmed a south-bank Thames tributary origin, namely an early course of the Ebbsfleet. The upper sediments of Phase 3 are characterised by a much-reduced flint gravel component and a lack of sedimentary structure. They comprise (contexts 40028 and 40062) clayey/silty sand with occasional small flint and chalk pebbles and Tertiary shell fragments, with these inclusions becoming smaller and less common eastward across the site. The upper parts of the Phase 3 sequence are thought to have been deposited in much quieter water, again with significant slopewash input having a stronger influence further west within the site area, towards the western valley side. The top of these sediments is decalcified in places (context 40063), perhaps indicating a break in deposition or a period of emergence as a short-lived landsurface, although there is no sign of soil development. The Phase 3 sediments are both distorted by post-depositional ground movement (Chapter 4) and unconformably truncated by the Phase 5 sediments, so their original geometry is unknown.

Ostracod remains within the upper part of Phase 3 (Chapter 11) consisted of a rich freshwater fauna typical of fully temperate interglacial conditions, with a range of species typical of quiet swampy waterbodies and springs, surrounded by rich vegetation, and prone to periodic drying. The ostracod assemblage indicated a mean July temperature of 17-21°C and a mean January temperature of –4 to –1°C, indicating a similar climate to the present day, but with slightly greater seasonality. It also included one particular species, *Ilyocypris quinculminata*, that is of biostratigraphic significance, not being known from any sites younger than MIS 11. Its two occurrences in the area of the Hoxnian stratotype, Coleman's Farm, Rivenhall and Hoxne itself, are both, incidentally, in deposits attributed to the 'true' Hoxnian of MIS 11c, in fully temperate sediments stratigraphically underlying the Arctic Bed of stratum C (cf. Ashton *et al.* 2008). A few vertebrate remains were recovered from Phase 3 sediments (Chapter 7), the only identifiable specimen being the well-preserved skull of a wild aurochs, *Bos primigenius*, supporting the ostracod evidence for a temperate climate. The only molluscan remains recovered from the Phase 3 sediments were quite numerous *Bithynia* opercula, which provided an AAR result suggesting a date within MIS 11 that was statistically separable as earlier within MIS 11 than Phases 5 and 6 of the site sequence (Chapter 13). Although tempting to take this result at face value, it was concluded that the Phase 3 *Bithynia* opercula were probably derived and had also perhaps been compromised by poor preservation in light of (a) the abundant biostratigraphic and AAR dating evidence that Phases 5 and 6 correlated with the main earlier temperate phase of MIS 11 (the Hoxnian) and (b) the absence of a cool episode and major depositional hiatus between Phases 3 and 5. It was

Table 22.1 The full sequence at the Southfleet Road site: archaeological, palaeontological and dating summary

Site phase	*Archaeological remains*	*Industry*	*Biological remains*	*Climate*	*Palaeo-environment*	*Dating, zonation*
11 - Not *in situ* (out-of-context, or from modern made ground)	Various flint artefacts	18th C gunflint cores; derived Palaeolithic material	-	-	-	Post-Medieval
10 - Holocene (various Late Prehistoric features)	Various pottery and flint artefacts	Neolithic?	-	-	-	MIS 1
9 - Brickearth bank (colluvial, including reworked aeolian deposits?)	Handaxes, debitage	Acheulian	-	?	?	MIS 2-5d? MIS 6-10? MIS 11a-b?
8 - Sandy gravel (fluvial, palaeo-Ebbsfleet)	Common handaxes, pointed and twisted cordate forms; large scrapers and other flake-tools; occasional debitage	Acheulian	-	Temperate/cooling?? (no direct evidence, but inferred from models of fluvia sequence deposition where return to gravel deposition accompanies cooling conditions)	Becoming more open? (no direct evidence, but inferred from models of fluvial sequence deposition where return to gravel deposition accompanies cooling conditions)	MIS 10?? MIS 11a-c? Ho III-IV??
7 - Mixed clay/gravel (syncline infill - slopewash, landslip)	Cores/flakes (varied condition)	Clactonian (derived)	Wood pieces (mostly fragmentary and decayed)	Temperate	Woodland in vicinity Ho II-III?	MIS 11c
6 - Grey clay, with organic-rich beds and tufaceous channel-fill deposits (quiet water, periodically drying, with slopewash input)	Abundant cores, flakes, notched tools and flake-knives (all mint); some refitting Elephant carcass with refitting lithic scatters	Clactonian	Woodland fauna (bank vole, wood mouse, land snails - including *Discus ruderatus*) Freshwater aquatic fauna Straight-tusked elephant Narrow-nosed rhinoceros	Fully temperate	Local shady, damp woodland (alder carr) near river or stream, with open grassland in area	MIS 11c Ho IIb-c
5 - Clay-laminated sand (fluvial)	Cores, flakes, notched tool	Clactonian?	Grassland fauna with woodland elements (Straight-tusked elephant, lion, aurochs, rabbit, ground squirrel, deer) Freshwater fish	Fully temperate	Grassy, herbaceous floodplain with patchy reed beds and woodland	MIS 11c Ho II

Table 22.1 (continued)

Site phase	*Archaeological remains*	*Industry*	*Biological remains*	*Climate*	*Palaeo-environment*	*Dating, zonation*
4 - Sandy/gravelly clay (lacustrine, periodically drying)	-	-	Ostracods [in nearby test pits for Station Quarter South - Wessex Archaeology 2006b]	Fully temperate	- Ho II	MIS 11c
3 - Chalky/silty/gravelly sand (quiet water, with slopewash input)	Flaked nodule, two flakes	Clactonian??	Aurochs skull Ostracods	Fully temperate	Patches of herbaceous meadows and open grassland	MIS 11c Ho II
2 - Parallel-bedded sand/clay (lacustrine/slopewash?)	-	-	-	-	-	Earlier Middle Pleistocene?
1 - Tilted block (bedrock upheaval/collapse?)	-	-	-	-	-	Early-Middle Pleistocene?

therefore concluded that the Phase 3 sediments were of similar age to the overlying sediments of Phases 5-6, and likewise attributable to the early temperate stage of the Hoxnian interglacial.

Phase 3 is the lowest level of the site sequence with firm evidence of hominin activity. Lithic artefacts indisputably of hominin origin are present in the basal deposit (context 40061), as well as in the overlying context 40028 (Chapter 16). The fresh condition of these artefacts suggests occupation in the site vicinity contemporary with formation of the deposits, probably on the bank of the waterbody thought to have been present. The artefact assemblage comprises two technologically undiagnostic flint flakes and a nodule from which at least one flake was been struck off. Although compatible with the rich flake/core industrial traditions of higher site levels (Phase 6 in particular), there are far too few lithic remains to postulate any attribution of industrial/cultural affinity.

Phase 4 (Sandy/gravelly clay)

Phase 4 sediments were virtually absent at the main site, but were extensive and well-developed a short distance to the east, seen in test pits dug in 2006 (Chapter 4). The western edge of the Phase 4 sediments was seen in the narrow exposure of Log 40011 on the western side of the main site, where they were only about 200mm thick, and where they included sandy and gravelly beds/patches. To the east of the site, they consisted of fine homogenous clayey silts up to three metres thick, present between about 20 and 23m OD, with trace colour patterns from polygonal cracking due to periodic desiccation. They contained a distinctive fully temperate interglacial ostracod fauna indistinguishable from that of Phase 3, including the biostratigraphically significant *Ilyocypris quinculminata* (Chapter 11). These sediments are therefore thought to represent a still, muddy lake or pond, periodically drying up and probably butting up against, and perhaps interdigitating with, sediments of Phase 3. Molluscs were also present in the sediments seen in the 2006 test pits, suggesting a low-energy freshwater habitat (Chapter 4). No other fauna or flora are known; nor have Phase 4 sediments produced any artefactual remains.

Phase 5 (Clay-laminated sand)

Phase 5 sediments extend as a significant sheet of deposits about two metres thick across the whole length of the main site, dipping gently northward and unconformably truncating the underlying sediments of Phases 2 and 3. They predominantly consist of fine-medium sand, interspersed with undulating clayey/silty laminations and occasional gravel lenses; the former becoming more developed and more closely spaced towards the top of the sequence, and the latter better developed towards the bottom of the sequence. Wavy and cross-cutting bedding structures with thick homogenous sand beds in the bottom part of Phase 5 attest to very rapid fluvial deposition. This continues up through the sequence with episodes of higher energy marked by gravel lenses and quieter episodes marked by the clay/silt laminations. The uppermost part of the Phase 5 sequence (distinguished as context 40067) is marked by a significant increase in the frequency and thickness of the clay/silt laminations, as well as a marked increase in their waviness, to the point of being significantly contorted. This is thought to represent both a change in the environment of deposition, with an increase in the prevalence of quiet conditions, and perhaps occasional desiccation, and *in situ* deformation due to loading by overlying sediments whilst saturated. Gravity folding (*boudinage*) was also seen in the clay/silt laminations, and this is thought to have been associated with post-depositional re-arrangement of the sediments into the synclinal basin they now form.

Some faunal remains were recovered from the upper parts of the Phase 5 sediments, comprising occasional large mammal remains (Chapter 7), small vertebrate remains from a few bulk samples taken where decalcification was less pronounced (perhaps due to lenses rich in derived Tertiary shell fragments: Chapter 7) and occasional *Bithynia* opercula from these same bulk samples, which were used for amino acid dating (Chapter 13). The small vertebrates included numerous fish and amphibians, confirming the waterlain nature of the upper Phase 5 sediments, likewise supported by the presence of *Bithynia* opercula, which would have been more resistant to decay than other Pleistocene molluscan remains, which were absent. The larger mammal remains included lion, aurochs and deer; the smaller mammals included rabbit, ground squirrel (*Spermophilus* sp.), and a range of shrews and voles including water shrew (*Neomys* sp.), water vole (*Arvicola cantianus*), northern vole (*Microtus oeconomus*) and bank vole (*Clethryonomys glareolus*). As a whole, the vertebrate assemblage indicates a fully temperate climate and a well-vegetated waterside habitat with local grassland, scrubby woodland and some drier meadows/grassland with sandy substrate suitable for rabbit burrowing. Some of the large mammalian bones show cracking and splitting from exposure on a landsurface, indicating at least episodic drying up of the waterbody in this part of the sequence.

A small collection of 18 lithic artefacts was recovered from the upper parts of the Phase 5 deposits, 13 of them in mint/fresh condition and the remainder in more abraded condition. The latter assemblage (if not intrusive from the overlying Phase 8 gravel) is thought to represent hominin activity in the vicinity of the watercourse, transported by fluvial activity . The former group is thought to represent minimally disturbed evidence of intermittent activity on the spot, coinciding with temporary drying up of the watercourse and the exposure of short-lived landsurfaces. Technologically and typologically the collection (although of small size) conforms to the classic Clactonian industrial tradition, as also represented in Phase 6 (see below) with (a) the production of flakes by a simple, unstructured approach to core reduction and (b) the secondary working of flakes to produce simple notched flake-tools.

Phase 6 (Grey clay, with organic-rich beds and tufaceous deposits)

The Phase 6 sediments were mostly grey brecciated clay, with occasional angular flint pebbles and cobbles of nodular flint, and were present in the central and southern parts of the main site, conformably overlying the Phase 5 fluvial sands. They dipped gently and thickened towards the central part of the site, where their surface formed a steep-sided synclinal basin, thought to result from post-depositional deformation of the sediments. The Phase 6 clays then thinned in the northern part of the site, becoming vestigial, and being unconformably truncated by the Phase 8 fluvial gravels. Where they were higher in the southern part of the site, the Phase 6 clays were internally relatively homogenous with faint sandy and silty facies. Where lower in the central part of the site, they were thicker and more complex in their lower parts, with brown organic-rich beds (context 40078), well-defined iron-pans dividing the basal clayey beds (Phase 6a) and including a small channel-cutting filled with tufaceous sediments (Phase 6b). Taking into account the geomorphological context of the site, the nature of the sediments, their geometry and the soil micromorphological analyses (Chapters 4 and 5), the Phase 6 sediments are thought to mostly represent slopewash deposits entering from the west into a stagnant, swampy waterbody that periodically dried up exposing temporary landsurfaces. The investigated site is thought to represent the west shore of this waterbody, at its junction with the slope of the western valley side, in a zone that thus oscillated as water levels fluctuated between saturation, and thus prone to peat formation, and exposure as drier land.

The Phase 6 sediments contained the main archaeological horizon of the site, with (a) the elephant skeleton (extinct straight-tusked elephant, *Palaeoloxodon antiquus*) and its associated lithic scatter in the central western part of the site and (b) the lithic concentration in the southern part of the site, south of Trench D. It also produced the majority of biological remains. Large vertebrate remains were found scattered throughout the grey clays that constituted the majority of Phase 6. These were often tiny weathered scraps, although occasional larger and better-preserved remains were also present in the lower-lying parts of the deposit in the central part of the site, notably the remains of the elephant skeleton, a rhinoceros skull (*Stephanorhinus hemitoechus*) and a rhinoceros jaw (*S. kirchbergensis*). The elephant skeleton was associated with a thin dark-brown horizon within the basal part of the Phase 6 clay (context 40078), on the west side of the central part of the site. This horizon was rich in fragments of rotted organic material, which produced a sparse and poorly preserved pollen assemblage attributable to the early temperate zone Ho-II of the Hoxnian (Chapter 12). The small channel of a short-lived stream filled with tufaceous and other calcareous sediments (Phase 6b) was found in the central part of the site, incorporated within the lower part of the Phase 6 clay approximately 15m to the north-east of the elephant skeleton. The Phase 6b sequence was rich in a range of palaeo-environmental remains, including molluscs, ostracods and small vertebrates, as well as larger mammalian fossils. Crucially, these included foot bones from the elephant, thus establishing precise contemporaneity of the tufaceous channel and its environmental evidence with the elephant skeleton and its pollen assemblage.

The faunal remains from the tufaceous channel provide a clear picture of a fully temperate interglacial climate, perhaps slightly warmer than the present day, with a local mosaic of habitats that included closed-canopy woodland, grassland and wetland habitats bordering a stream. Biostratigraphic indications from the mammalian evidence (Chapter 9) provide firm support for dating the Phase 6 deposits to MIS 11, the Hoxnian (*sensu* Swanscombe, Barnfield Pit phases I and II; and *sensu* Strata D-E at the Hoxne type site). In particular these include the co-occurrence of species not known in the UK after MIS 11 (pine vole *Microtus* (*Terricola*) cf *subterraneus*, shrew *Sorex (Drepanosorex)* and mole *Talpa minor*), with species known in Britain only from MIS 11 or later in the UK (narrow-nosed rhino *S. hemitoechus*, Merck's rhino *S. kirchbergensis*, aurochs *Bos primigenius*, water vole *Arvicola cantianus*). The morphology of the aurochs horn cores, the fallow deer and the red deer are also similar to the specific forms known from securely dated MIS 11 horizons at sites such as Clacton and Swanscombe. Further confirmation of an MIS 11 date is provided by the amino acid analyses on numerous *Bithynia* opercula from the tufaceous channel-fill, which clearly show levels of racemization matching accepted MIS 11 horizons at Barnham, Barnfield Pit, Hoxne and Beeches Pit (Chapter 13).

There are two quite distinct main areas of lithic artefact recovery within the Phase 6 clay. Firstly, there is a tight cluster of approximately 80 lithic artefacts immediately beside the elephant skeleton, categorised as 'Assemblage 6.3' in this study (Chapter 17). Their spatial association with the elephant remains, their high degree of refitting and their tight clustering combine to indicate a completely undisturbed assemblage reflecting manufacture of flint tools on the spot for butchery of the elephant carcass. Interpretation of these remains is hampered by the incomplete survival of the site, the elephant having been chopped in half by mechanical bulk ground extraction before its discovery, leading not only to loss of some of the skeleton, but also to loss of whatever archaeological evidence was surrounding its western parts. However, based on the recovered remains, the assemblage around the elephant comprised one percussor, four cores, four reduction episodes (Groups A-C and E), four presumed flake-tools and a minimum of thirteen separate pieces of raw material, nine of them represented by single pieces of debitage. The percussor was found in seven pieces (Group D), and is thought to have broken during attempted reduction of one of the larger cores found incompletely reduced with several refitting flakes (Group B). The longer reduction sequences all represent the early stages of reduction, by simple unstructured flaking, of pieces of nodular flint, presumably locally obtained. The flake-tools comprise a single-notched flake and three flakes that were not secondarily flaked, but were interpreted as tools on the basis of visible use-wear on suitable sharp edges. Technologically and typologically the material conforms to the classic Clactonian industrial/cultural repertoire, discussed further below. It is suggested that the site represents a combination of knapping activity associated with initial discovery of the elephant's carcass (or following its killing), expediently producing flint tools from locally-obtained raw material to butcher it for meat or other nutritious tissue, in conjunction with discarded tools from subsequent visits (perhaps during a period of around 1 week when the meat retained freshness), that were not made at the spot, but were brought to it in the knowledge of the awaiting carcass.

The elephant was not mired in soft sediment, but died at the spot when the ground was exposed as a dry land surface, judging by the lack of disturbance to the underlying sediments. The immediate area would probably have been mostly wooded, densely in patches, although with some more open areas with shrubs and grasses; and the ground would have sloped up to the west from the elephant carcass. The edge of a quiet waterbody would probably have been close by to the east, where there would probably have been soft clayey sediments and swampy conditions. The rise and westward expansion of this waterbody not long after the death of the elephant (and its butchery) led to its preservation due to its submergence and the consequent growth of peaty horizons in conjunction with burial by slopewash sediments.

The second main area of lithic artefact recovery is the much denser concentration of nearly 1900 flint artefacts found in the Phase 6 clay at the southern end of the site, to the south of Trench D, approximately 30m to the south of the elephant skeleton. These are grouped for analysis here as 'Assemblage 6.1' (Chapter 18). Although a few were in abraded condition, and so regarded as older reworked intrusions, the great majority (more than 1850 artefacts, of which approximately 110 were chips < 20mm long) were in very fresh condition, and regarded as a single assemblage. The artefacts forming the assemblage were found within the lower part of the Phase 6 clay in a stratigraphically equivalent horizon to the elephant skeleton and the tufaceous channel, and are presumed to be broadly (and probably in at least part, exactly) contemporary with Assemblage 6.3 from around the elephant. However, with the exception of the poorly preserved and fragmented jaw of a Merck's rhinoceros found right at the northern edge of the concentration, there were no identifiable faunal (or other palaeoenvironmental) remains found in association with them. The assemblage was altitudinally higher (having been recovered in a sub-horizontal band between *c* 27 and 27.5m OD) than that from by the elephant skeleton (which occurred in a narrow band approximately 150mm thick that sloped between *c* 24 and 24.5m OD). This may reflect a higher and drier position less conducive to biological preservation and more conducive to hominin occupation. However, in light of the gross post-depositional sedimentary deformation represented by the synclinal basin in the central part of the site, it is uncertain what the relative topography of these locales would have been in MIS 11, and what impact this might have had on the distribution of hominin activity.

The artefacts of Assemblage 6.1 mostly comprised waste debitage (90%), cores (5%), and flake tools (4%). The assemblage was strongly spatially clustered with northern and southern areas of high concentration (up to 25 artefacts per m^2) interspersed with areas of very low concentration. However, the clustering did not conform to patterns reflecting undisturbed knapping scatters; likewise, the lack of microdebitage and the refitting results – only about 8% of the assemblage refitted, without long and closely-spaced refitting sequences – did not suggest a palimpsest of entirely undisturbed artefactual remains from activity on the spot. There were, however, several instances of refitting material with short separations suggesting a minimum of disturbance. It was concluded that most of the artefactual material had been mixed and transported a short distance by slopewash processes, but that it still represented contemporary activity from the immediate vicinity, in the bankside area of the waterbody. It was also concluded that, in amongst the general mass of slightly moved material, was a small element of entirely undisturbed material representing artefacts recovered from the precise position where they had been discarded.

Assemblage 6.1 represents a consistent picture of the minimally structured (or perhaps, entirely unstructured) reduction of locally obtained pieces of nodular flint raw material, producing flake blanks that were then either used without further modification as cutting tools, or secondarily worked into simple flake-tools. The most common form of secondary working was the striking of one (or more) small flakes from one edge of a flake, leaving a sharp concave notch (or more than one notch, often linearly aligned), that would have provided excellent cutting edges. The presence of macroscopic use-wear on the sharp edges of these notches, as well as on sharp edges of some unworked flakes, supports their interpretation as cutting tools. There was just one example in the un-derived fresher condition material of a simple core-tool, and no examples of bifacially-shaped handaxes or debitage from their manufacture. Typologically and technologically, Assemblage 6.1 exactly conforms to the Palaeolithic industrial tradition labelled as 'Clactonian' since the 1920s (Breuil 1926; Warren 1926; Wymer 1968, 34-44; Wymer 1985, 277-283; Roe 1981, 70), as represented in the Lower Loam and Lower Gravel at Barnfield Pit, Swanscombe (Ashton and McNabb 1996), the pale silt (unit 5) at Barnham (Ashton 1998) and at Clacton-on-Sea itself (Warren 1951and 1958; Oakley and Leakey 1937; Singer *et al.* 1973). Subject to subsequent debate, the status of the Clactonian is discussed separately below, along with the industrial/cultural attribution of Assemblage 6.1. The lithic material represented an even balance of all stages of production of the *chaîne opératoire*, suggesting lithic production as mostly an expedient response to need, leading to a homogenous distribution of knapping remains around the occupied landscape.

In addition to these two main concentrations of lithic remains, there was a general background noise within the Phase 6 grey clay of a low density of scattered isolated lithic artefacts, categorised as 'Assemblage 6.2' in this study. Totalling only about 125 artefacts, this assemblage mirrored Assemblages 6.1 and 6.3 in its typological and technological characteristics. Having been recovered by watching mechanical excavation rather than by hand excavation, Assemblage 6.2 is probably slightly biased towards larger artefacts. It includes three refitting pairs of artefacts, each pair with a separation distance of less than two metres, suggesting a minimum of disturbance, if any. The assemblage is thought to have formed in the same way as Assemblage 6.1, with a combination of the entirely undisturbed remains of activity discarded during periodic exposure of a dry surface, and material gently transported in by slopewash from the bankside area to the west. Various isolated large mammal remains were also found dispersed throughout the same area of the Phase 6 grey clay as Assemblage 6.2, including some with evidence of hominin interference (Chapter 7). There are however, apart from around the elephant skeleton, no spatial associations between any specific lithic and faunal remains that suggest a causative connection between them.

Phase 7 (Mixed clay/gravel)

Phase 7 sediments were well-developed in the central part of the site, filling the U-shaped synclinal basin of the 'skateboard ramp'. The basal junction with the top of Phase 6 sediments was generally sharp, but was nowhere erosive and unconformable, suggesting no major depositional hiatus. Phase 7 deposits were absent at the northern and southern ends of the site, where the Phase 8 gravel that unconformably overlay them had its base cut down to the Phase 6 clay. The Phase 7 sediments mostly consisted of variably gravelly brecciated clay, with a thick basal sand/silt bed in the trough of the synclinal basin. They were mostly structureless, although there were some thin parallel sand/silt/clay beds in the synclinal trough. Their upper, more gravelly parts contained occasional concentrations of what looked like rotted and charred plant macro-remains and produced an assemblage of variably stained/abraded lithic artefacts (Chapter 19). Sediments of this phase continue to the west and north-west of the site, seen in various nearby investigations extending upslope as a substantial clayey/gravelly mass, and interpreted as a local mass movement deposit, originating from west or north-west of the site (Chapter 4). This is thought to have overridden the site, perhaps causing the synclinal trough by lateral pressure due to a major landslip event when the ground conditions were saturated, or by the weight of slipped sediments compressing softer organic-rich sediments in the centre of the trough.

The Phase 7 sediments thus continue the depositional trends of the underlying sequence of Phases 3-6, representing a phase when slopewash processes became more pronounced. A more extensive and significant downslope movement of deposits to the east caused much greater sediment accumulation at the site, completely over-riding the swampy valley floor, rather than providing minor input to its western side. Despite their great thickness, they probably formed very rapidly, and represent an insignificant portion of Pleistocene time. No biological remains were found in the basal sand/silt beds filling the synclinal trough to provide information on climate and environment. The rotted wood and other plant remains in the overlying clayey gravel suggest a continuation of temperate conditions, and there is no sedimentary evidence of climatic deterioration between Phases 6 and 7.

The lithic remains contained in the Phase 7 deposits are thus probably broadly contemporaneous with those from the underlying Phase 6, and may include material gathered from higher up the valley sides, as well as from closer at hand on the valley floor at the foot of its western flank. They therefore provide an important record of hominin activity and lithic production from a wider catchment area than represented in the Phase 6 deposits. Technologically and typologically, the lithic material is identical to that from Phase 6. It also likewise represents an even balance of the different stages of lithic production, suggesting that expedient tool making was being carried out across the slightly wider landscape, and not just the bankside occupation area of the valley floor.

Phase 8 (Ebbsfleet gravel)

The Phase 8 deposits comprise gravels, sandy/clayey in places, that cut unconformably across the underlying sequence. They dip gently from south to north, directly overlying deposits of Phase 6 at *c* 27.5m OD at the south end of the site, and cutting into deposits of Phase 5 at *c* 25.5m OD at the north end. In between, they cut into the deposits of Phase 7 filling the synclinal trough of the 'skateboard ramp' in the central part of the site.

Clast lithological analysis has established that these are fluvial gravels, representing an early course of the Ebbsfleet (Chapter 6). Numerous investigations in unquarried areas to the north and north-west of the site have revealed the continuation of the gravel body, heading towards a confluence with the Thames some 300m further north (Chapter 4). They contain no biological remains to help with dating or palaeoclimate/environment, but on geomorphological grounds they can be broadly correlated with the Lower Middle Gravel of the Swanscombe 100-ft terrace at Barnfield Pit, widely accepted as dating to the Hoxnian, MIS 11 (see for example Bridgland 1994).

It was not immediately clear that the Phase 8 gravels were also archaeologically important. Initial examination of the extensive exposures in the main east-facing and west-facing site sections failed to produce any artefacts, apart from two flakes that were found loose on the gravel surface, and were therefore not indisputably from the deposit. However, it then became clear through systematic sieving and careful watching of mechanical excavation both that the gravels were a reasonably rich source of lithic artefactual remains, and also that there is a major technological and typological contrast between the lithic material from Phase 8 and that from underlying deposits.

The Phase 8 gravels produced an assemblage of 180 artefacts, including more than 30 handaxes. The majority of artefacts were in fresh (32%) or slightly abraded (44%) condition, with the remainder mint (8%) or very abraded (16%). Thus, although some of the assemblage probably represents undisturbed remains of activity on the spot, on temporarily exposed gravel bars on the floodplain, most were probably transported a short distance from a slightly wider catchment area, or had been subject to reworking within the gravel. None was sufficiently abraded to be considered as signicantly transported or reworked from significantly older deposits, so the assemblage was treated as a whole for analysis, sub-divided into three depositional phases based on internal stratigraphy within the gravel.

Although not supported by quantitative data, the impression was formed that artefacts were most abundant in the lower parts of the gravel and became scarcer higher up. This is contrary to the sizes of the recovered assemblages, but allows for the fact that much greater volumes of sediment were excavated from the higher parts of the gravel. In general, the Phase 8 handaxe collection shows great diversity, with both pointed and ovate forms present from top to bottom of the sequence. The more ovate handaxe forms (most of which have a Z-twisted profile) are more common in the bottom part of the gravel, with those found higher up invariably in abraded condition, potentially reflecting a history of derivation from the basal gravel layers. Although there was clearly an emphasis on handaxe manufacture, there was also a small but significant element of flake-tools, comprising simple utilised flakes and partly-trimmed flake-knives, and also convex unifacially flaked side-scrapers, similar in appearance to the Mousterian 'Quina-type' scrapers of south-west France.

Complementing these contrasts in technology and typology between Phases 6 and 8, there is also a radically different structure to the spatial organisation of the *chaîne opératoire*. In Phase 6, all the evidence suggests firstly: that the *chaîne opératoire* was not spatially organised around the landscape, but generally started and finished in the same part of the landscape in relation to encounters with resources leading to lithic production; and secondly, that that the distribution of lithic remains across the landscape was homogenised by the spatially unpatterned distribution of these encounters.

In contrast, there is a clear pattern in the evidence from the Phase 8 gravels of a consistent spatial organisation of the technological *chaîne opératoire*. The quantity of debitage recovered is far less than commensurate with manufacture of about 30 handaxes, indicating that they were mostly made elsewhere in the landscape, before becoming abandoned at, or in the vicinity of, the site. This is a complementary pattern to that represented at, for instance, the site at Red Barns in Hampshire (Wenban-Smith *et al.* 2000; Wenban-Smith 2004b). There it appears that an exposure of flint-rich chalky slope-wash deposits served as a location for the manufacture of handaxes that were then mostly taken away, leaving a disproportionate amount of debitage in relation to the small number of handaxes found.

There thus seem to be both technological/typological and behavioural/organisational contrasts between the hominin behaviour of Phases 6 and 8, as reflected in the lithic remains; possible implications of this are further considered below.

Phase 9 (Brickearth bank)

The Phase 9 brickearth deposits were present at the northern end of the main site, conformably overlying the northward-dipping surface of the Phase 8 gravels, with a base level of *c* 26m OD. They continue to the north, where they were substantially cut into by groundworks, with the truncated surface forming a sloping bank covering an area approximately 100 x 25m. Numerous test pits were dug above the higher western side of this bank in 2006, allowing further examination of the brickearth sediments and establishing that their uppermost surviving parts reached at least 30m OD.

Although with thin sand and gravel beds at their base, the Phase 9 deposits mostly comprise a thick homogenous body of reddish-brown sandy/clayey silt, colloquially known as 'brickearth'. The main brickearth body contains occasional lenses and patches of fine gravel, and occasional faint parallel clayey/sandy beds dipping gently to the east, transverse to the north-south axis of the Ebbsfleet valley. These deposits are therefore presumed to be primarily colluvial in origin, reflecting slopewash from higher ground to the west, probably with an aeolian component.

They lack any biological remains that could contribute to dating them, or give any indication of climate or palaeo-environment. There was no evidence for a major depositional hiatus or climatic deterioration between the top of the Phase 8 gravel and the base of the brickearth. Hence the most likely age of the basal part of the deposit is late MIS 11 or MIS 10, if one accepts the Phase 8 gravels as belonging to MIS 11. However, the Phase 9 brickearth body could be of younger age, or could contain a series of colluvial deposits of different ages without clear lithostratigraphic junctions between them. An OSL dating result of *c* 60k BP was obtained from towards the top of the brickearth, and a result of *c* 280k BP from its base (Chapter 14). Although these dating results should be treated with great caution in light of the anomalous results from lower in the sequence, they suggest that the brickearth, despite the lack of visible internal lithostratigraphic boundaries, might include different phases of deposition.

A collection of 14 lithic artefacts was recovered from the truncated surface of the brickearth, exposed by mechanical excavation of a sloping bank through it. These artefacts, which included a substantial subcordate handaxe, were scattered across the sloping bank, over an area approximately 100 x 20m. None of them was found *in situ* in the brickearth, and they were in varied condition and with different degrees of patination. All however, appeared to be of Lower/Middle Palaeolithic origin. The handaxe was strongly stained and patinated on one side, but not the other, suggesting prolonged exposure prior to burial.

A few pieces of waste debitage were recovered *in situ* from the brickearth at the main site, establishing that the deposit does contain lithic material. These were mostly technologically undiagnostic, apart from one flake that represented the later stages of thinning/shaping a handaxe. Finally, a magnificent pointed handaxe in mint condition was recovered from the upper part of the brickearth in one of the 2006 test pits (Fig. 4.42). This artefact was also stained brown on one face, with the other entirely unstained, likewise suggesting a period of exposure prior to burial.

The Phase 9 brickearth is without doubt equivalent to the 'ferruginous loam' reported by Carreck (1972, 61) exposed in the quarry faces to the east of Southfleet Road. He suggested on the basis of its general height above OD that it might be related to 'the Boyn Hill Terrace', but was unable to examine it closely. This interpretation can now be ruled out, since the deposit is underlain in many places by Ebbsfleet gravels, and is now thought to be mostly a mixed colluvial/aeolian slopewash deposit lining the west flank of the Ebbsfleet valley; it remains an incompletely understood deposit, of uncertain date and depositional origin. It does, however, contain mint condition Lower/Middle Palaeolithic artefacts, and merits further investigation where it survives to the north of the site and to the east of Southfleet Road.

Phase 10 (Holocene features)

Holocene features cut into the Pleistocene deposits produced various Late Prehistoric lithic and ceramic material, not considered in this volume. In amongst this material was found a single, secondarily-worked flake from the lower fill (context 40133) of a pit (context 40129), which had staining, patination and abrasion suggested derivation from Palaeolithic times. It was not recognisable as any of the types used in the analysis, so was classified as a 'miscellaneous flake-tool' and adds nothing to the understanding of the site. It was included with other derived Palaeolithic material from modern made ground, under assemblage group 11.1, discussed below.

Phase 11 (Modern made ground; not in situ*)*

The lithic collection from the site included about 50 artefacts that were not provenanced to Pleistocene contexts. Apart from those whose Pleistocene provenance had become misplaced during the excavation or post-excavation process, this collection included artefacts found loose around the site and from deposits thought to be modern made ground from above the Pleistocene sequence. The Phase 11 collection mostly comprised a variety of derived Lower/Middle Palaeolithic material, including 12 handaxes (or broken parts of), a core, and a selection of flake-tools and waste debitage, all similar to material from the known main artefact-bearing deposits of Phases 6-8.

However, in amongst this material was a distinctive assemblage of 12 artefacts (grouped as 'Assemblage 11.2') that immediately stood out during analysis because of its mint condition and unpatinated/unstained appearance, and its curious technological characteristics. It mostly comprises quite large and very chunky flint flakes, violently struck, with notch scars from secondary flake-flakes struck sideways across the ventral surface, sometimes a single notch and sometimes double opposing notches (often with the distal ends of their flake scars intersecting). This assemblage was identified as an 18th century gunflint industry, at least one major practitioner of which (William Levett) is known to have been active in the Northfleet area (Chapter 21).

It seems likely that the same local availability of flint raw material as stimulated hominin activity at the site in the Hoxnian interglacial, outcropping in the late 18th century on the side of the Southfleet Road, led to its exploitation some 400,000 years later for a wholly different purpose, although by remarkably similar means.

THE ELEPHANT: SITE FORMATION AND HOMININ EXPLOITATION

Hominin exploitation of megafauna in the Pleistocene is a major topic of current debate (Gaudzinski and Turner 1999; Gaudzinski *et al.* 2005; Delagnes *et al.* 2006; Yravedra *et al.* 2012; Rabinovich *et al.* 2012; Sacca 2012; and subsidiary references), evolving from critiques of the later 20th century (such as Binford 1981; Isaac and Crader 1981; Isaac 1983; Gamble 1987; Nitecki and Nitecki 1987; Villa 1990). Questions began to be asked about whether the co-occurrence of megafaunal remains and lithic artefacts in the same depositional horizon implied hominin megafaunal exploitation, and if there was hominin exploitation, what was its nature? Was it primary targeted hunting, systematic scavenging or marginal expedient scavenging? And what was the importance of megafaunal remains for purposes other than nutrition? The discussion below is focused upon Proboscidean remains, and particularly sites with *Palaeoloxodon antiquus*, but is also broadly applicable to other megafauna such as hippopotamus and rhinoceros, apart from in relation to specifically Proboscidean behaviour and anatomical characteristics.

There are two main types of site pertinent to these questions (cf. Gaudzinski *et al.* 2005). Firstly, there are widely spread scatters, sometimes of high density, where megafaunal remains and lithic artefacts both occur in the same horizon, but with no strong co-association of spatial clustering, and several (or numerous) individuals represented. Here (for example at Cotte St. Brelade – Scott 1986; Torralba – Binford 1987a; Lynford – Boismier *et al.* 2012; Castel di Guido – Sacca 2012; Revadim Quarry – Rabinovich *et al.* 2012), debate focuses on the presence/absence of direct signs of hominin interference with the faunal remains, and upon indirect signs of hominin exploitation in the profile of the faunal assemblage, in particular: skeletal elements, age and seasonality. Secondly, there are undisturbed single-carcass sites, where remains of a single individual are found, often in association with lithic artefacts. For these sites (for example Mwanganda's Village – Clark and Haynes 1970; Olduvai FLK North – Leakey 1971; Barogali – Berthelet and Chavaillon 2001; Lehringen and Gröbern – Weber 2000; Aridos 1 and 2 – Santonja and Villa 1990, Yravedra *et al.* 2010) the spatial association of lithic artefacts provides a strong *a priori* indication of associated hominin activity. Once alternative non-hominin taphonomic factors have been duly considered, debate can focus on the nature of the hominin exploitation, rather than whether there is a hominin role at all. There are also other, more intermediate sites (such as Benot Ya'aqov – Goren-Inbar *et al.* 1994; Ariendorf 2 – Gaundzinski *et al.* 2005; Notarchirico – Cassoli *et al.* 1999; PRERESA – Yravedra *et al.* 2012; and perhaps also Nadung'a 4 – Delagnes *et al.* 2006) where remains of single carcasses, perhaps associated with clusters of lithic remains, are disguised against a background of other lithic and faunal remains.

The Southfleet Road site exemplifies the second site type, providing clear evidence of the co-association of an undisturbed cluster of lithic artefacts with the carcass of a large adult male elephant, in the prime of its life (at an estimated 35-40 years old) and weighing perhaps 8000-10,000kg. The presence of several distinct reduction episodes, the exceptionally high degree of artefact refitting (79% of artefacts >20mm), the tight clustering of the refitting flints (weighing from 1 to *c* 1400g), their presence in the same narrow band of sediment as the elephant bones and the fine-grained nature of the containing sediment combine to indicate that the lithic remains represent on-the-spot knapping and discard (Chapter 17). Within the context of a surrounding lithic and faunal find density of well below $1/m^2$, the close juxtaposition of the cluster of lithic remains with the elephant skeleton is unlikely to be coincidental.

Considering the vanishingly small likelihood that either the elephant coincidentally died immediately beside a freshly made knapping scatter, involving several reduction episodes on the same spot, or that the knapping activity occurred immediately beside a fresh elephant carcass in a bankside location otherwise lacking obvious resources, but had no connection with it, it is beyond reasonable doubt to assume that the lithic remains at the spot represent undisturbed evidence from hominin exploitation of the elephant carcass. Even though there is no evidence of cut marks or deliberate breakage, it is well-established that elephant remains can be butchered without leaving many recognisable marks (Haynes 1991; Haynes and Krasinski 2010). Also, the poor preservation of many of the surviving elephant bones has destroyed/obscured many elements from which cut marks or breakage might have been identified (Chapter 8).

The available quantity of meat and other edible remains would depend upon whether the hominins had first access to the fresh carcass, or whether they were lower down the exploitation chain. This in turn depends partly upon whether the beast was hunted or scavenged. This is considered further below. It is intuitively likely that one of the prime benefits of an elephant carcass would be its meat. Without doubt, the fresh carcass would have had a huge amount of meat, and this would probably have been desirable to the Southfleet Road hominins and exploited by them. However, an even more desirable resource would have been its fat, and more fatty and nutritional parts of the carcass such as brain, trunk, tongue, offal and pads within the feet. Other instances of Middle Pleistocene elephant carcass butchery show breakage of the skull to get at the brain (for example Gesher Benot Ya'aqov – Goren-Inbar *et al.* 1994), and removal of the jaw, probably to get at the tongue (for example Notarchirico – Cassoli *et al.* 1999). At Southfleet Road, the skull remnants are too fragmentary and poorly preserved to consider whether or not the skull might have been broken into. The mandible is, however, missing and no sign of it, or of the robust molars that it would have contained, was found. This seems likely to represent hominin behaviour as it would not easily have become naturally disarticulated. In addition, one of the feet was found about 20m to the east of the rest of the elephant, in the upper part of the tufaceous channel sequence. Although feet are one of the body parts of dead elephants that are most prone to natural detachment and carnivore scavenging, the well-preserved bones of this foot showed no sign of carnivore interference, suggesting that this too may reflect hominin activity.

Although a systematic functional assessment of the associated lithic assemblage was not attempted, lithic production seemed (as with the much greater lithic concentration in the southern part of the site) to be focused on the manufacture of sharp-edged flake blanks of medium-large size. These could either be used unmodified as cutting tools, or could be used as blanks for creation of simple notched cutting tools. Four flake-tools were found near the elephant, one of them being a notched tool, and the other three being unworked flakes with signs of macro-wear on their main sharp edge suggesting minor damage during use for cutting. A fifth tool was also evidenced by the flake-flake from creation of a notched tool (which was itself absent). And three gaps in the reduction sequence of refitting Group C suggest a further three flakes selected and extracted as tools. Refitting Group D was interpreted as a broken knapping percussor; and marks of percussion on core D.40494 were interpreted as failed flake removals, perhaps leading to breakage of the percussor represented by Group D. Although this interpretation is preferred, these could also represent evidence of a heavier duty tool component, used for bashing at solid parts of the elephant skeleton, particularly the skull. It is however thought unlikely that any attempt at marrow extraction was carried out, as elephant bones do not have easily accessible marrow, but require special processing to extract it from hollows within the bones (Sacca 2012). It is also thought unlikely that any use was made of elephant bone as a raw material for tool manufacture. Flint raw material was locally abundant, and the use of elephant bone as a knapping raw material is only known – in the European Middle Pleistocene – from Italy (Gaudzinski *et al.* 2005; Sacca 2012), and is thought to be a response to scarcity of good lithic raw material.

Unfortunately, the absence of part of the site compromises consideration of the size of the hominin group potentially involved in exploitation of the elephant. Based on the surviving evidence, there were four cores reduced at the site from their early stages, and there is evidence of 13 separate pieces of raw material, including individual flakes. There is evidence of one percussor; and of perhaps eight flake-tools in use. It is suggested here that exploitation of the elephant might have involved an initial episode of lithic production from local raw material when the fresh carcass was first exploited, followed by further visits bringing tools made elsewhere to the carcass while it retained sufficient freshness to remain edible. On this basis, one could postulate a band of between four and 13 individuals, with the low end of this range being preferred on the balance of probability and the evidence of four core reduction episodes from first exploitation of the beast.

Comparative data on elephant and other megafaunal butchery sites is hard to obtain, particular as most comparator sites include a greater potential degree of unrelated background material. At Aridos 1, eight cores were found, with three quartzite percussors, two biface tips and 39 flake-tools (Santonja and Villa 1990). At Aridos 2 (less completely preserved), four cores were found, together with five tools of various types, including a cleaver, a biface and three flake-tools (ibid.). At Notarchirico, one percussor was found in the area of the main elephant, together with 4 four handaxes, five 'chopper/cores' and three flake-tools (Cassoli *et al.* 1999). At Gröbern, a smaller group of flakes was recovered which could be divided into about six different original raw material pieces (Weber 2000). And at Gesher Benot Ya'aqov, there were nine handaxes found in close association with one elephant skull (Goren-Inbar *et al.* 1994), although it is uncertain to what extent these were associated with its exploitation, or are part of a general background of archaeological material in the sediments. Perhaps the best and most completely recovered comparator site is the horse butchery site GTP 17 at Boxgrove (Pitts and Roberts 1997; Pope 2002, 95). Here, eight distinct refitting scatters were found, representing the manufacture of eight handaxes, all of which were absent from the excavated site, and so were therefore taken away after use. Taken together, and notwithstanding a host of uncertainties over how these tool kits relate to hominin band numbers, a consistent picture emerges of about 6-10 as the number of individuals represented by the key data of core quantity, handaxe quantity or raw material pieces represented. Bearing in mind that some of the Southfleet Road site was lost to mechanical excavation, this corresponds well with the earlier band-size estimate of '4-13 and probably at the low end of the range' of those directly involved in exploitation of the elephant. Other studies (such as Gamble and Steele 1999) suggest 20-40 as the overall size of Lower Palaeolithic groups in north-west Europe at this time. Therefore we can perhaps envisage that the elephant was exploited by part of a larger hominin group, and that meat and other nutritious elements were transported back to other group members.

More problematic, however, is consideration of whether the elephant was found dead and scavenged after other carnivores had first access, whether it was found freshly dead (or in a wounded/disabled state, making its final dispatch an easy task) allowing first access to it, or whether it was hunted and killed. The possibility that it was found stuck in muddy sediments at the edge of the waterbody can be discounted. The sediment layer under the skeleton was undisturbed, and the bones were found in a narrow band at one horizon suggesting it died and initially decomposed on a dry ground surface. It is suggested here that this surface was later submerged by rising water level and slopewash deposits, leading to burial and preservation of the skeleton and its associated archaeological remains. There is also no local landscape feature such as a cliff or gully that would have led the elephant to become trapped in this location.

Although it should be emphasised that there is no direct evidence to support the notion that it was hunted, there are however certain factors that make this a likely possibility. Firstly, it is wrong to assume that hominins lacking technology such as guns, nets, metal-working and bows would be incapable of hunting a healthy elephant, despite the great size disparity. There is extensive ethnographic evidence that elephants could be successfully hunted with nothing more than a sturdy wooden thrusting spear (Zwilling 1942; Movius 1950; Adam 1951). Secondly, there is clear evidence that wooden spears were part of European Lower/Middle Palaeolithic technology. This includes the puncture wound on the Boxgrove GTP 17 horse scapula (Pitts and Roberts 1997); the spear point from Clacton-on-Sea (Wymer 1985); and the spears from Schöningen (Thieme 1997). There is also evidence that these were successfully used for elephant hunting in the early Late Pleistocene at Lehringen (Movius 1950; Adam 1951). Thirdly, there is no evidence of other carnivore activity affecting the Southfleet Road skeleton. Although much of the bone is in poor condition and thus does not preserve the crucial evidence, the well-preserved foot bones found in the tufaceous channel show no sign of carnivore activity, and these would be one of the first pieces of the elephant that they would have scavenged. This suggests that the hominins had first access to the fresh carcass and may well have protected it for a period thereafter.

Finally (and perhaps paradoxically), the great size of the elephant and the fact that it was a male in its prime makes it more, rather than less, likely that it was hunted and killed by hominins. Such beasts are less likely to die of natural causes in the present day (Conybeare and Haynes 1984; Haynes 1991), and would have been more able to withstand other carnivore predators such as lions. Furthermore, if one considers other *Palaeoloxodon* single carcass archaeological sites in the Lower/Middle Palaeolithic there is a disproportionately high presence of larger adult males (for example at Lehringen, Gröbern and Aridos 2; not to mention Upnor, although no hominin association has been demonstrated for this latter). Together with the large adult male from Southfleet Road, these rare discoveries are perhaps the faint archaeological echo of a pattern of Proboscidean exploitation by hunting across the European Lower/Middle Palaeolithic.

ELEPHANT HUNTING AND THE ECOLOGY OF HOMININ ADAPTATION IN THE NORTH-WEST EUROPEAN MIDDLE PLEISTOCENE

Another point of continuing debate since the 1970s is the ecology of hominin adaptations in Europe during the Middle Pleistocene and the implications for hominin behaviour and patterns of colonisation and settlement into more northerly latitudes, with their reduced growing seasons and greater seasonality (Geist 1978; Gamble 1986, 1987 and 1993; Roebroeks *et al.* 1992; Roebroeks 2001; 2007). The joy (or perhaps, the curse) of palaeoanthropology is that there are few enough firm facts, and great enough imprecision in those we do have, to have free rein in imagining the past in a variety of ways, and from diverse intellectual perspectives. Thus there has been a pincer movement, whereby from one direction the Palaeolithic past is deduced from ecological principles, with suitably supportive facts highlighted from the archaeological record (perhaps Gamble 1987). From the other, a vast collection of facts (particularly environmental and lithic data) has been accumulated as building blocks for the overall picture (cf. Roebroeks 2007), without necessarily being integrated into a coherent vision of ecologically viable adaptations, and so without recognition/consideration of any behavioural implications. What of course one hopes from a pincer movement, is that at some point the prey is cornered; and perhaps we are reaching that point in the problem of the Middle Pleistocene settlement of north-westerly Europe, particularly that part north of the Pyrenees and north-west of the Alps.

As summarised by Roebroeks (2001), the intensity of investigation in north-west Europe since the mid-19th century provides a robust basis for accepting the broad pattern of occupation revealed. It indicates that (with the exception of a few earlier incursions, such as at Pakefield and Happisburgh on the Norfok coast – Parfitt *et al.* 2005; 2010) it is only in MIS 13, *c* 500,000 years BP, that hominin settlement appears to have become more sustained as far north as Great Britain. Gamble (1986; 1987) suggested, based on the combination of ecological theory and the occupational history of the last interglacial/glacial cycle, that Middle Pleistocene hominins were not able to survive in the dense peak-interglacial forests of north-west Europe. Particular difficulties were presumed to be posed by the seasonality of the more abundant plant resources, and the locking up of the less abundant (but nutritionally essential) animal biomass in either small parcels, not viable and too difficult to hunt in forested conditions, or in large dangerous herbivores that bred too slowly to form the basis of a hominin diet, even if they could be hunted. Then Gamble (ibid.) emphasised the material cultural evidence of widening social networks in the upper Palaeolithic and Mesolithic as the key to overcoming this ecological bind. However, apart from the fact that it is questionable whether this last interglacial/glacial cycle provides a valid model for the earlier Middle Pleistocene, there are as pointed out by Roebroeks *et al.* (1992) and confirmed by subsequent discoveries (Caours, France – Antoine *et al.* 2006; Beeches Pit, England – Preece *et al.* 2007) numerous records of Middle Pleistocene occupation in association with fully interglacial forested environments. There are also numerous records for occupation in temperate but not densely forested environments where there would have been the same seasonality, although a greater proportion of nutritious biomass in herds of medium-large herbivores.

So, *was gebt*? Primarily, hunting; at the time of Gamble's initial work in this area (Gamble 1986; 1987) there was no good evidence for successful large herbivore hunting, and, as summarised by Binford (1985), in a reaction to the long-standing trope of 'Man the Hunter', early hominin occupation of more northerly latitudes (and indeed also tropical ones) was widely thought to be underpinned by marginal tool-assisted scavenging of carcasses resulting from carnivore predation and natural death. Since then, there has been a growing body of evidence that Middle Pleistocene hominins were in fact successful hunters of large-medium size mammals. At Boxgrove *c* 500,000 BP, apart from the evidence of horse-hunting and butchery at GTP 17 (Pitts and Roberts 1997), cut-marks and skeletal elements at the main Q1B excavation area suggest preferential hunting and exploitation of other larger mammals such as rhinoceros and the larger species of deer (SA Parfitt, pers. comm.). At Schöningen, besides the spear itself (Thieme 1997), the associated faunal assemblage dominated by horse bones reflects their hunting (Voormolen 2008). And, returning to the Proboscidean megafaunal theme, there is of course the Lehringen elephant with the spear embedded in its ribs, provocatively claimed as a 'snow-probe' by Gamble (1987). As discussed by Roebroeks (2001), the practice of hunting large herbivores in the Middle Pleistocene can also be associated with social and behavioural developments such as language, co-operation, strategic planning and the development of gender-based social structures. All of these contribute to the ability to maintain a viable adaptation in more challenging northern latitudes, whether in more open cool or mild conditions, or in densely-wooded peak interglacial conditions. It does, however, still seem to be only anatomically modern humans in the Upper Palaeolithic who solved the problem of surviving in peak glacial conditions; even then, not in the more northerly parts of Europe such as Great Britain, northern France and 'Benelux' (Otte 1990).

Complementing the evidence of hunting, more detailed evidence for environmental conditions at several sites associated with peak interglacial forested environments suggests that these were not necessarily situated within unbroken forest tracts, but were within a mosaic landscape that might support a greater density of herbivores, and might likewise make them easier to locate and hunt. This is for instance the case at Beeches Pit (Preece *et al.* 2007), Barnham (Ashton *et al.* 1998) and the occupation horizons associated with the Lower Loam at Barnfield Pit, Swanscombe (Conway *et al.* 1996), as well as here at Southfleet Road.

Building on Roebroeks' (2001) assessment, and Geist's remarkably prescient analysis – 'The only niche open [for Middle Pleistocene hominin northward colonisation] is that of a supercarnivore, who can despatch very large, slow, dangerous herbivores, and also the [other] large carnivores [lions, wolves *etc.*]' (Geist 1978, 281-282) – it is suggested here not only that large mammal hunting was an important aspect of more northerly adaptations in the Middle Pleistocene, but more specifically that (1) elephant hunting in particular was a crucial part of this adaptation, facilitating viable adaptations in more-wooded environments and (2) that elephant hunting may have underpinned northward colonisation at the start of the Middle Pleistocene, based on the substantive history of megafaunal exploitation in the Lower and early Middle Pleistocene in Africa and the near East. As discussed above, although just one instance of a single elephant carcass in the northern European Middle Pleistocene can be directly interpreted as hunted on the basis of firm evidence – that of Lehringen, based on the wooden spear between its ribs – the age/size profile of the assemblage of *c* 6-8 individuals found as single carcasses with archaeological associations is markedly different from a natural death profile and indicative of targeted hunting. Part of the ecological thinking of Gamble's initial model was that megafauna such as rhino and elephant were too slow reproducing to underpin a hominin adaptation, besides presumed difficulties in hunting and locating them. However, this is unlikely to have been an important factor considering the tiny hominin populations of the time, and the much larger megafaunal populations. Prime adult males would in fact have been the most expendable element of the megafaunal adaptation, having been ejected from the matriarchal herd at maturity and then roaming in bachelor groups, with occasional reconnection with the matriarchal herd for mating (Haynes 1991). Thus, the loss of some prime males would have had a negligible effect on the overall stability of the megafaunal population, but would have conversely been crucially important in aiding the survival of a small hominin group, considering the quantity of meat and other nutritional parts on a single fresh carcass.

LITHIC TECHNOLOGY, MOBILITY AND THE ORGANISATION OF PRODUCTION

Turning to lithic technology, there are two main archaeological horizons at the site, with deeply contrasting lithic material culture, in terms of both (a) technological pathways and resulting tools, and (b) the spatial organisation of lithic production. In Phases 6 and 7 (the latter regarded as containing derived evidence from the former), there is a consistent representation of the same lithic material cultural signature at three different spatial/temporal scales: short-term activity beside the elephant carcass, medium-term bankside activity, and medium/long-term activity in the slightly wider local landscape represented in the assemblage from Phase 7. The technological *chaîne opératoire* typically involves the expedient collection and use of local flint raw material in response to an encounter with a resource. The piece of flint was then rapidly reduced to a collection of medium-large flakes and irregular waste by a minimally structured reduction pathway involving a combination of episodes of alternate flaking, new platform selections and repeated flake removal from single platforms. Selected larger pieces with sharp edges and convenient handling properties were then either used without further modification, or turned into simple tools, mostly by single or double notching, and/or removal of sharp projections to facilitate handling. Although these tools can be grouped into 'types' *post hoc*, it is entirely uncertain whether these types would have been meaningful to the makers, and it is suggested here that they may represent stages of progression along a continuum of reduction/use intensity. The overall functionality of the lithic industry is clearly aimed at a cutting capability, although heavier cores and rounded nodular flint pieces could have been used for various heavier-duty percussion tasks. The nature and location of battering on several pieces clearly suggests flint knapping, but these pieces could also have been used for other tasks such as breaking bones for marrow, or breaking into an elephant skull to get the brain.

Although there is some suggestion of tool movement around the landscape, leading to some tools being resharpened and abandoned separately from their debitage scatters, there is no apparent spatial structuring of the stages of lithic production within the local landscape. All stages of production are equally represented in the various assemblages studied, even though completed individual reduction sequences are mostly not present. Although reduction sequences were therefore not necessarily always started and finished on the same spot, or even within the site area, there was not, at this scale, any spatial structure to the knapping activity. The technological *chaîne opératoire* was either entirely completed within the site area, or was equally likely to have started as finished. This matches a model of primarily expedient exploitation of a resource whose precise location was unpredictable within a site catchment area. Over time, this has created a homogenous lithic signature, with an equal representation of early and late reduction stages and discarded tools, similar at different spatial/temporal scales.

This contrasts greatly with the signature from Phase 8. Here we have a lithic material culture dominated by bifacial handaxes, and with virtually no evidence of flake production from simple cores. In terms purely of reduction pathway and implicit cognitive capability behind their manufacture, these core tools present a deeply significant contrast. Compared to the (relatively easy, but not as simple as one might think) task of producing a series of flakes in an unstructured manner, the production of handaxes involves the skilful (try it!) removal of an (often long) series of thinning/shaping flakes. The whole sequence of knapping is aimed at producing a single bifacial tool, generally symmetrical in both plan and cross-section, with a sinuous and moderately sharp edge around most of its perimeter. TThere is thus a much greater investment of time and effort in producing a single tool. There is much debate about the cognitive implications of handaxe manufacturing and symmetry (Lycett 2008; Kohn and Mithen 1999; Machin *et al.* 2005; Spikins 2012), and also over the extent to which the range of finished forms we find in the archaeological record were deliberately intended from the outset, or result from factors such as raw material type or resharpening intensity (White 1998). Although no consensus has been reached in this debate, most with practical experience of experimental handaxe replication regard it a skilled craft requiring advanced cognitive capabilities to plan the reduction pathway to achieve an intended end product (see discussion in Wenban-Smith 2004b). Whether intentionally shaped or not, the handaxes found in Phase 8 show a variety of forms, ranging from sharply pointed to bluntly sub-cordate and cordate, many of the latter with markedly twisted profiles.

Of much greater import, however, is that there is also a significant contrast in the organisation of the production of the lithic assemblage from the Phase 8 gravel. There is a major imbalance between the quantity of handaxes present (most of them well-worked with scars from numerous flake removals) and the quantity of debitage. It is clear that handaxes have been preferentially brought to the site and discarded (even if not necessarily used at the site), having been manufactured elsewhere, outside the catchment zone of the Phase 8 fluvial gravel. This is unlikely to be a taphonomic or recovery bias, since much of the debitage from the handaxe manufacture would have been larger and less mobile than the dominant small-medium flint pebble clasts of the containing gravel. Much of the debitage would have been of similar size to the smaller handaxes, and equally as recognisable as the handaxes during machine excavation. Much of the lithic assemblage is also in fresh or moderately fresh condition suggesting not too much disturbance and transport. Furthermore, in the comparative situation of the Swan Valley School site (Wenban-Smith and Bridgland 2001), a much higher proportion of debitage was recovered from slightly coarser gravel, suggesting that fluvial action does not typically winnow out handaxe-making debitage. Therefore it seems inescapable that the dominance of handaxes is a behavioural organisational signal, reflecting a structured use of the landscape, with repeated discard at the site over the medium term represented by the formation of the gravels.

This complements evidence from other sites, such as Red Barns in Hampshire (Wenban-Smith *et al.* 2000; Wenban-Smith 2004b), where the reverse seems to be the case, and where there is strong evidence of a raw material source used for handaxe manufacture on-the-spot, from which finished tools were then exported prior to use/discard elsewhere. Likewise, further evidence for the association of handaxe-making adaptations with a more structured relationship between mobility and lithic production is provided by the GTP 17 horse butchery site and Q1B at Boxgrove. At the former location, raw material has been brought a short distance from its source, knapped, and then all the handaxes taken away from the location. At the latter, about 700m to the west, there is a disproportionate concentration of handaxes in relation to the associated debitage, reflecting a general pattern of import/discard of handaxes, as in the Phase 8 gravel at Southfleet Road. What of course would be desirable is to connect through refitting some of the handaxes at Q1B with the debitage from GTP 17. Regardless of whether this latter can be achieved, there is a consistent pattern of structured lithic production across the landscape. This can be equated to a logistically organised adaptation, with technological production integrated into pattern of mobility in a manner that suggests deliberate operational planning, and anticipation of tool-using encounters with key resources, rather than a more expedient adaptation dominated by tool manufacture and use as a response to such encounters. This also ties in with interpretations of more advanced cognitive capability based on the manufacture of handaxes, and, as pointed out by Roebroeks (2001), with the notion that survival in the more challenging seasonal environments of NW Europe would also mandate greater planning and anticipatory capabilities.

Of course, the absence of the evidence for these capabilities in the ostensibly simpler technology of Phase 6 is not in itself definitive that these capabilities were not present. The fact of a viable adaptation in the fully temperate conditions of Phase 6, probably supported by the hunting of large dangerous herbivores such as elephant, in itself suggests a high degree of capability. Nonetheless, the lithic evidence shows a greater degree of technological skill and cognitive capability and a more structured approach to lithic production in Phase 8, suggesting a more logistically planned adaptation. As discussed immediately below, this could be pertinent to current discussion of the continental distribution of on-the-one-hand core/flake industries, and on-the-other handaxe industries, and of the apparently rapid replacement of the former by the latter in southern Britain early in the interglacial of MIS 11, and more debatably perhaps also in MIS 9.

THE CLACTONIAN: CLASSIFICATORY FICTION, EVOLVED TRADITION OR HOMININ PHYLUM?

One of the major debates of Lower/Middle Palaeolithic archaeology over the last 50 years has been over the existence or otherwise of a distinctive Clactonian industrial tradition (Wenban-Smith 1998; White 2000; and quoted references). The analysis of lithic artefacts has been a fundamental part of Palaeolithic research since its beginning. Predicated upon the apparently straightforward notion that lithic material cultural practices, and in particular tool types and knapping techniques, were in some way shared between a hominin group, and then transmitted down to younger generations, the European Palaeolithic has been constructed as a story of cultural development and interaction through the Middle and Late Pleistocene, with specific cultural traditions occurring within a framework of Lower, Middle and Upper Palaeolithic stages. By the start of the 20th century, the NW European Lower and Middle Palaeolithic was divided into three epochs, Chellean, Acheulian and Mousterian (G and A de Mortillet 1900), presumed to be applicable at a pan-European scale. In this framework the first Chellean developmental stage was represented by large simple handaxes, the second Acheulian stage by more finely-made handaxes in conjunction with flake-tools and the third Mousterian stage purely by flake-tools.

In the first part of the 20th century more controlled research led to a more detailed framework for the Pleistocene of NW Europe incorporating four glacial-interglacial cycles (Penck and Brückner 1909), and contradictions in the existing linear developmental framework began to be exposed. Smith and Dewey (1913) recovered a large assemblage consisting exclusively of cores and large flakes, some of them interpreted as retouched into tools, from the Lower Gravel at Swanscombe, stratified beneath levels (the Middle Gravels) containing Chellean and Early Acheulian types of handaxe. Additionally, Warren (1922) made a large collection of similar material from the Elephant Bed at Clacton-on-Sea between 1911 and 1916. The Clacton material was attributed by Breuil (in Warren 1922) to a Mesvinian industry, based on its similarity to material recovered from Mesvin in Belgium. Breuil subsequently divided the Belgian Mesvinian into early and later stages, and having retained the term Mesvinian for the later material, suggested the term Clactonian for the earlier material from Clacton, Swanscombe and Mesvin, after the site at Clacton-on-Sea (Warren 1926; Breuil 1926; 1932).

Breuil also noted that, during the climatic oscillations accompanying the Palaeolithic, there seemed to be a repeated pattern in different interglacials of an early and sharp replacement of flake/core-based industrial traditions with handaxe-based traditions. Therefore Breuil (1926; 1932) re-wrote the Lower Palaeolithic as a story of the parallel and contemporaneous development of two separate industrial traditions practised by culturally separate human groups, one using predominantly bifacial technology in warmer conditions, and the other using exclusively core and flake tool technology in colder conditions. These groups moved north and south following climatic zones and their associated fauna in conjunction with the climatic oscillations of the Pleistocene, leading to the occasional superposition of interglacial Acheulian industries above late glacial or early interglacial Clactonian industries, for instance as at Swanscombe.

Breuil's (1932) definition of the Clactonian lithic industry specified that it was based on flakes and cores, and lacked handaxes. The cores were worked in an *ad hoc* fashion, to produce large flakes with wide striking platforms. The resulting cores could be large or small, and ended up in a variety of shapes with differing degrees of reduction. The flakes were either left unretouched or made into crude scrapers with a minimum of retouch. There were also occasional partly bifacially worked tools, but never regular and symmetrical handaxes, such as found in Chellean and Acheulian industries.

Acheulian industries, in contrast, were characterised primarily by the presence of numerous well made symmetrical handaxes. Breuil and Koslowski (1931; 1932; 1934) divided the Acheulian industrial tradition into seven stages, based on their assessment of changing handaxe shapes and presumed dating of the Somme valley sequence, in northern France. All these stages include pointed and ovate forms, with and without features such as tranchet sharpening and worked butts. It was recognised that flake-tools were an integral, although subsidiary, element of these Acheulian industries. These were presumed to have been mostly made on debitage from handaxe manufacture, although it was recognised that some unstandardised core and flake technology was also practised.

This framework was then substantially reinforced, at least in Britain, by work at several sites in the ensuing decades. Firstly, work by Paterson (1937) at the East Anglian site of Barnham identified the same sequence of events as at Barnfield Pit. Levels with exclusively flake-core technology were overlain by a level with handaxes, all in a sequence thought to post-date the Anglian glaciation and therefore broadly contemporary with the Barnfield Pit sequence. Further work at the Clacton-on-Sea type site by Oakley and Leakey (1937), put a greater focus on secondarily worked types of flake-tools in Clactonian assemblages, with recognition of four types of scrapers (nosed, trilobed hollow, discoidal/quadrilateral and butt-end) and two types of points (triangular and beaked). This, perhaps undue, focus on secondary working as a means of creating 'definable types' (ibid. p 226) of scraping edges was also compromised by the difficulty of distinguishing secondary working from natural abrasion, and many of these scraper types would today be regarded as abraded, unworked waste debitage. Oakley and Leakey provide clear illustrations of types interpreted here as a 'single notch' (ibid. p. 229, fig 3, no. 8) and a 'knife' (ibid. p. 229, fig 3, no. 3), classified by them as an 'end-scraper' and a 'trimmed flake, with nibbling from use' respectively. Subsequently, Warren (1951) provided a definitive typological overview of the Clactonian from Clacton-on-Sea. It both emphasised the importance of a range of simple core-tools, including cores used as heavy-duty tools, and also tidied the range of flake-tools into groups approaching the more technologically-based classifications used in this volume, although still with a strong emphasis on the shape of the outcome rather than its technological basis or presumed functionality. Warren still retained at least six different types of 'trimmed flakes', including: side-scrapers, bill-hook forms, sub-crescent forms, flake-points and piercers. Amongst these, 'sub-crescent forms' were essentially the type of flake-tool classified here as 'single notch', described by Warren (ibid., p. 117) as 'flakes with one deep and broad secondary facet struck out of one of the side edges'.

At the Globe Pit, Little Thurrock, Wymer (1957) and Snelling (1964) recovered substantial Clactonian assemblages from gravels thought (then) to underlie brickearths attributed to the Hoxnian interglacial. At Swanscombe, excavations by Wymer (Ovey 1964) and Waechter (Conway *et al.* 1996) confirmed a sharp transition within the Hoxnian interglacial from a flake/core industrial tradition (in the Lower Gravel and Lower Loam) to a handaxe-based Acheulian tradition in the overlying Lower Middle Gravel. At Clacton, Kerney and Turner used a combination of molluscan and pollen analysis to tie in the Clacton sequence with the Barnfield Pit deposits and the now-well-understood sequence of pollen zones through the Hoxnian (Turner 1970; Kerney 1971; Turner and Kerney 1971). This established that Warren's Clactonian industry at Clacton-on-Sea was broadly contemporary with that in the Lower Loam at Barnfield Pit, both dating to the early temperate pollen zone HoIIb-c. Supported by the attribution of a handaxe industry at Hoxne to zone HoIIc, Wymer (1974) then reiterated Breuil's original framework of parallel cultural phyla, suggesting a rapid replacement in SE England early in the Hoxnian of groups with a Clactonian industry by Acheulian groups with handaxe-based industrial traditions.

This culture-historical orthodoxy (cf. Trigger 1989) has since been subject to numerous challenges. As articulated by Singer *et al.* (1973, 8) as long ago as the early 1970s, there are three main possible explanations of the apparent archaeological pattern:

1. *Separate groups* – the two industries represent separate, contemporary hominin groups, with different stone-working traditions and possibly also physical origins

2. In situ *evolution* – Clactonian and Acheulian industries are the chronologically sequential products of a single hominin group, with the latter developing out of the former

3. *Technological facies* – the Clactonian industry is essentially a classificatory fiction, merely a contemporary facies of the Acheulian produced under particular circumstances by the same group.

Although recovering a substantial well-provenanced Clactonian assemblage from their excavations on the Golf Course site near Jaywick Sands, these authors did not, however, take a view on which of these explanations they preferred.

Option 3 was substantially aired in the 1990s, primarily by McNabb and Ashton, in conjunction with new investigations at the critical site of Barnham (McNabb and Ashton 1992; 1995; Ashton *et al.* 1994; 1998) and publication of Waechter's work at Swanscombe (Conway *et al.* 1996). Although not addressing the apparent chronological ordering of the two industrial traditions within the British Hoxnian, the essence of this position is that the long-standing distinction between Clactonian and Acheulian industries is a theoretical misconception based on the inappropriate pigeon-holing into one or other industry of a fundamentally similar technological record whose main element of variability is the proportion of handaxes in assemblages. Thus, the absence of handaxes at some sites does not represent a non-handaxe cultural tradition – the Clactonian – but the non-handaxe end of a technological continuum involving the differential distribution across the landscape of different lithic assemblages by a single hominin group with a varied technological repertoire. Factual evidence presented in support of this argument is: (a) typically 'Clactonian' core and flake technology in many Acheulian industries; (b) handaxes and their distinctive manufacturing debitage in Clactonian industries; and (c) evidence of handaxe manufacture contemporary with the main *in situ* Clactonian horizon at Barnham. It is also suggested that one reason why Clactonian industries may have been produced was a lack of suitable raw material for handaxe manufacture.

This option has, however, been rejected by most British Palaeolithic archaeologists, even before discovery and reporting of the Southfleet Road site (Wenban-Smith 1995b and 1998; Wymer 1998; Roe 1996; White 2000; Pope 2002. M. B. Roberts, pers. comm.). There are several key factors in this rejection:

1. The non-bifacial element of Acheulian industries is uncontroversial and was recognised both in the original definition of Acheulian industries and by the Abbé Breuil when he first distinguished Clactonian industries.

2. There is in fact no unequivocal evidence of handaxe manufacture in any well-provenanced Clactonian horizon. All of the claimed instances are from out-of-context collections lacking reliable stratigraphic provenance: the beach at Clacton-on-Sea; talus slopes in Rickson's Pit; and loose material on the surface of Waechter's Swanscombe excavations. Concerning the beach finds at Clacton-on-Sea, we now know from finds at Happisburgh amongst other places that handaxe-making took place in East Anglia prior to the Anglian glaciation (Parfitt et al. 2010), not to mention subsequently (Wymer 1985), so occasional stray handaxe finds in amongst the more abundant derived Clactonian material on the beach foreshore are to be expected. At Rickson's Pit: (a) it is very unclear how the recorded sections (Dewey 1932) relate to the Clactonian horizons of the Lower Gravel and Lower Loam at Barnfield Pit; (b) there is in any case no record of where the handaxe-manufacturing debitage was recovered; and (c) as demonstrated by more recent excavations immediately to the west at Swan Valley School (Wenban-Smith and Bridgland 2001), it would almost certainly have been recovered loose from the surface of a section capped by, or consisting of, Lower Middle Gravel (or reworked material from it) which would have definitely and uncontroversially have contained evidence of handaxe manufacturing. At Waechter's excavation, the exposed surface of the Lower Loam was at the foot of sections containing Lower Middle Gravel, and it is highly likely that these would have contained handaxes, and that a handaxe might have dropped onto the Lower Loam surface.

3. There are no handaxes, nor any debitage from their manufacture, amongst the thousands of well-provenanced artefacts recovered from throughout the Lower Gravel at Swanscombe. Considering that this is a fluvial deposit, and therefore incorporates a time-averaged collection from the surrounding catchment area over what is likely to have been a substantial time period, it seems inconceivable that if handaxes were being made by the same hominin group as responsible for the abundant Clactonian material, no evidence of this would have been found from the Lower Gravel. Although not all debitage from handaxe manufacture is recognisable as such, experimental replication (Wenban-Smith 1996: 94-100 and fig 3.29, p 131) has suggested that between 5% and 20% (depending upon size, shape and reduction intensity) can be identified, greatly multiplying the archaeological visibility of handaxe manufacture beyond the implement itself. Even if every single handaxe had been exported from the catchment area, it is certain that some distinctive debitage from their manufacture would have become incorporated in the contemporary fluvial deposits and been subsequently recovered.

4. At Barnham, it has been claimed by Ashton *et al.* (1994 and 1998) that the main horizon with evidence of handaxe manufacture (in Area IV-4) can be shown to be contemporary with the main undisturbed Clactonian horizon, on the surface of the Cobble

Layer in Area I. Prior to more critical discussion, it is accepted that there is good evidence of handaxe manufacture at Area IV-4 and that it comes from the upper part, and surface of, a gravel-rich bed, overlain by fine-grained deposits. The earlier of these two publications (Ashton *et al.* 1994, 586, fig 2), showed the sequence at Area I as comprising the Cobble Layer (with the Clactonian material) overlain by a thin bed of grey silt-and-clay, overlain in turn by a thin band of dark brown/black clay (which contained a handaxe). The sequence at Area IV-4 showed the horizon with handaxe-manufacturing debitage (which was interpreted as equivalent to the Cobble Layer at Area I) as being directly overlain by the same dark brown/black clay as contained the handaxe at Area I. Thus, rather than proving contemporaneity, these observations were equally compatible with handaxe-making taking place later than Clactonian flake/core production. In the subsequent publication, the stratigraphic sequence at Area IV-4 was reinterpreted (Lewis 1998, 35, fig 4.8) so that the top of the gravel there was divided from the dark brown/black clay (now 'unit 6') by the same grey silt-and-clay as at Area I (now 'unit 5e'), providing stronger evidence of apparent contemporaneity. However, it seems clear from synthesis of the other published sections in the 1998 volume, and particularly the sections from Area IV-5 which link Area I with Area IV-4 (Fig. 22.1), that the gravel bed associated with the bifacial evidence at Area IV-4 is not in fact equivalent to the Cobble Layer (now 'unit 4') at Area I. The pale silt/sand of unit 5 can be traced down into the centre of the pit from Area I to the west end of the long section of the Area IV-5 extension (Lewis 1998, 40, fig 4.11). Then, it can clearly be seen in this section that this pale silt/sand becomes overlain to the east by a new gravel layer, which in turn becomes overlain further to the east by a new silt/sand layer. These two new layers can then be traced south and east, via sections 1 and 3 of Area IV-5 (Lewis 1998, 36, fig 4.9), to correlate with the sequence at Area IV-4. Thus the gravel layer at Area IV-4 containing the handaxe-making evidence in its upper part is *not* directly equivalent to the Cobble Layer at Area I, but occurs in the upper part of a quite distinct gravel bed, divided from the Cobble Layer at Area I by further silt/sand deposition. There is, therefore, a chronological hiatus of uncertain duration between the Clactonian and handaxe-manufacturing horizons.

5. Investigations at Barnham (Wenban-Smith and Ashton 1998) have shown that the raw material available to the knappers at the Area I Clactonian horizon (in the cobble layer) was perfectly suitable for handaxe manufacture. Furthermore, work at Red Barns (Wenban-Smith *et al.* 2000) has shown that the poor quality frost-fractured raw material at Red Barns was nonetheless used for a handaxe-dominated industry, even in an area of Chalk bedrock where fresher flint nodules were probably abundant nearby. These observations refute poor raw material availability/quality as an explanation for why a handaxe-manufacturing hominin group should choose not to do so in certain places.

6. One aspect of the archaeological record not addressed by Ashton and McNabb is the consistent stratigraphic superposition of Acheulian horizons above Clactonian horizons in the British Hoxnian. Generally, biostratigraphic and chronometric approaches to dating are insufficiently precise to allow relative date ordering within the Hoxnian of distinct Clactonian and Acheulian horizons between different sites, so the key facts here are the repeated instances of stratigraphic superposition of Clactonian above Acheulian at Swanscombe, Barnham and now Southfleet Road. These all point one way, suggesting that the latter follows the former, rather than contemporaneity. Furthermore, the molluscan evidence from Swanscombe allows comparison with the Hoxnian pollen framework at Clacton, and confirms that the handaxe-bearing Middle Gravels post-date the Clactonian horizons at Clacton, as well as at Swanscombe (Kerney 1971). The only possible dating anomaly is at Beeches Pit (Preece *et al.* 2007). Here an attempt has been made to use another aspect of the molluscan record, the relative proportions of *Discus ruderatus* and *Discus rotundatus*, to suggest that the deposits associated with handaxe manufacturing at locality AH (layer 3) are broadly contemporary with the Clactonian horizons at Swanscombe, and Barnham. However, there is an (admittedly minor) presence of *D ruderatus* in the only known mollusc record from the lower Middle Gravels (Kerney 1971, fig 3), suggesting that the presence of this species is not incompatible with Acheulian horizons that are known to overlie Clactonian ones. Also, as accepted by Preece *et al.* (2007, 1281), the temporal resolution of the proposed Hoxnian replacement of *D ruderatus* by *D rotundatus* is insufficient to distinguish between genuine contemporaneity of Clactonian and Acheulian, or rapid change from the former to the latter. Furthermore, as discussed further below, the apparent stratigraphic suddenness of this change need not indicate particular rapidity in calendar terms.

The evidence from Southfleet Road provides an important addition to the British Lower/Middle Palaeolithic record. The size and technological/typological consistency of the artefactual assemblages from Phases 6 and 7 validate identification of the Clactonian as a genuine industrial tradition in south-east England in the Hoxnian. Crucially, the Southfleet Road collection includes assemblages representing three complementary spatial/temporal scales: short-term activity at one spot (Assemblage 6.3); medium-term activity in a bankside locale (Assemblages 6.1 and 6.2); and medium-term activity over a slightly wider valley-side landscape (Phase 7 material). The quantity of artefacts in Assemblage 6.1

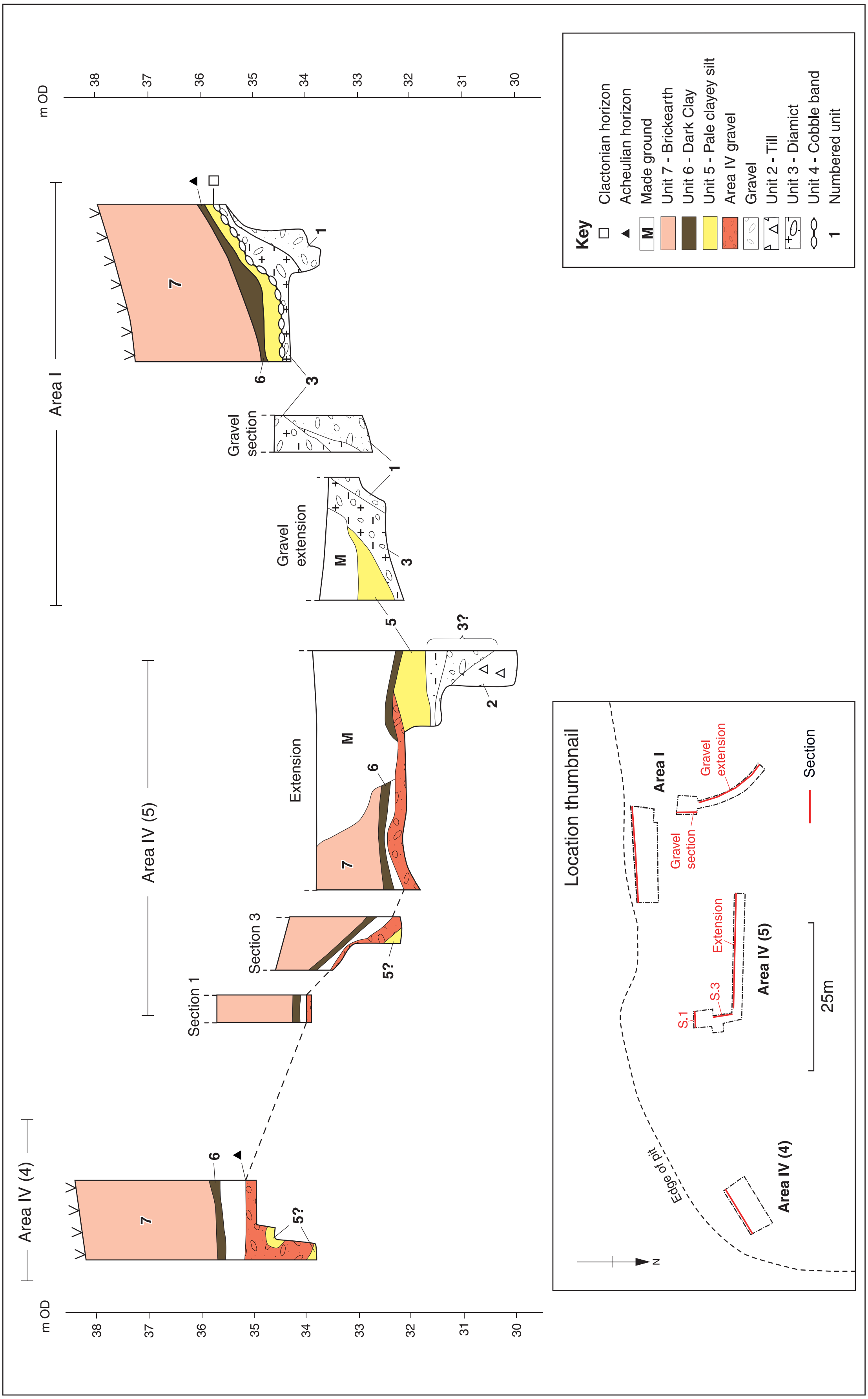

Figure 22.1 Clactonian and Acheulian horizons at East Farm Pit, Barnham

is greater than the other well-provenanced assemblages of Barnham (unit 5, Area I – Ashton 1998), Clacton-on-Sea (the fresh condition material from the Marl and the Gravel at the golf Course excavation – Singer *et al.* 1973) and Swanscombe (assemblages from Waechter's excavations in the Lower Loam and the Lower Gravel – Conway *et al.* 1996). Taken together, these facts seem to reflect a consistent Clactonian lithic tradition in a variety of situations over a sustained period across south-east England, rather than a variably applied technological facies.

The molluscan, pollen and vertebrate evidence combine to suggest the Clactonian occupation in Phase 6 of the site sequence was in the early-temperate substage, zone Ho II, broadly contemporary with Clactonian horizons at Barnfield Pit, Barnham and Clacton-on-Sea. With a dated sequence of technological change duplicating that from Barnfield Pit and Barnham, this adds to the evidence suggesting replacement of Clactonian industries by Acheulian ones in Britain in the Hoxnian interglacial of MIS 11. This information is summarised here, attempting to illustrate the imprecision of the relationship of the key archaeological horizons to the Hoxnian pollen zone framework (Fig. 22.2). The only slight anomaly in this consistent pattern, now that the archaeological evidence from Hoxne is regarded as from a much later temperate episode in MIS 11 (Ashton *et al.* 2008), is the apparent presence of handaxe-manufacturing at area AH at Beeches Pit in late zone HoII/early zone HoIII, based on the slight preponderance of *Discus ruderatus* (Preece *et al.* 2007). This does not however undermine the proposed sequence of lithic industrial change due to both the imprecision of dating this molluscan faunal attribute, and uncertainty over the duration of occupation represented in area AH and its precise relationship with the mollusc sequence of layer 3.

So, having ruled out the suggestion that the Clactonian and Acheulian are contemporary facies of a single technological complex, and accepting them as distinct and chronologically successive cultural/industrial entities, at least within the British Hoxnian, is it possible to prefer either of options 1 or 2, or some more subtle explanation as discussed by White and Schreve (2000)? Pertinent to this, is a brief consideration of some evidence from beyond the British Hoxnian, from later periods and from the continental European mainland. Firstly, it is often suggested that there are other instances of 'Clactonian' occupation in Britain early in MIS 9 at Globe Pit, Purfleet and Cuxton (for example Bridgland 1994; White and Schreve 2000; Schreve *et al.* 2002; Stringer 2006). There is thus a repeated pattern in successive interglacials of early Clactonian colonisation of Britain followed by a later wave of colonisation by 'different regional populations with different technological repertoires' (White and Schreve 2000, 18). This apparent repetition of a similar sequence of colonisation in separate interglacials irresistibly raises the spectre of Breuil's original model of parallel cultural phyla (Breuil 1926; 1932), implying at least two unchanging material cultural traditions that

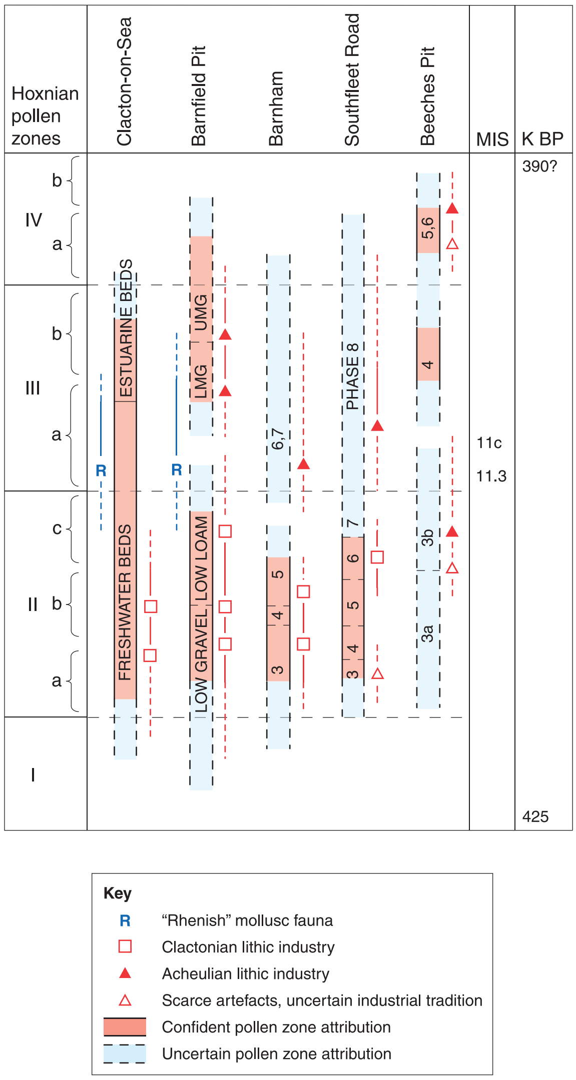

Figure 22.2 Relationship of Clactonian and Acheulian horizons at key localities to Hoxnian pollen zones

somehow persist in northern Europe between early MIS 11 and MIS 9. The suggestion is that this persists in a Central-Eastern European cultural refugium, possibly associated with a distinct hominin evolutionary lineage. However, critical to this whole line of discussion is the identification of Clactonian in MIS 10/9 in Britain, and this is in fact by no means robustly established.

At Purfleet (Palmer 1975; Schreve *et al.* 2002) and Cuxton (Cruse 1987), the claimed Clactonian presence is based upon far too few artefacts to be accepted as representative of a sustained cultural tradition, and also lacks the notched flake-tool component that is a typical element of the MIS 11 Clactonian assemblages. Furthermore, the age of the Cuxton sequence is at present very uncertain; the latest OSL results (Wenban-Smith *et al.* 2007) suggest a date in MIS 7, although this result is now under more careful scrutiny (Wenban-Smith *et al.* in prep.). So, even though the sparse material from the lower deposits of these two sites does not show evidence of handaxe manufacture, they must on present evidence be discounted as contributing to this debate.

At Globe Pit (Wymer 1957; Bridgland and Harding 1993), there is indeed a substantial lithic assemblage that is technologically and typologically sufficiently similar to the Clactonian as recognised in MIS 11, to be regarded as attributable to it. Also, it comes from a gravel deposit that has unanimously (in recent times, although not through most of the 20th century, cf. Hinton and Kennard 1900; West 1969; and Evans 1971) been regarded as part of the MIS 10-9-8 Corbets Tey/Lynch Hill Formation, and indeed is now suggested as the stratotype (the Little Thurrock Gravel) for the lower part of this Formation (Schreve *et al.* 2002). Although the gravel containing the lithic material dips down to the south (underpinning the earlier slopewash interpretations) rather than resting on a sustained sub-horizontal bench, it is firmly regarded by Bridgland (1994; in Schreve *et al.* 2002; and pers. comm. 2013) as the valley-side feather-edge of an indisputably fluvial deposit on the basis of sub-horizontal bedding within it. Although this seems like strong evidence, examination of much wider exposures of Pleistocene deposits on Kentish valley sides (ie, in association with the improvement of the M25/A2 junction near Dartford, see Wenban-Smith *et al.* 2010), has shown that what might look like clear fluvial bedding within an *in situ* terrace deposit in a small exposure can be revealed as part of a much wider slopewash deposit when more fully examined. Therefore, there is still some scope for continuing debate over whether the artefact-bearing gravels at Globe Pit are *in situ* fluvial deposits of late MIS 10, as generally accepted. Notwithstanding this quibble, of greater import is that the artefacts themselves do not represent *in situ* occupation, but are a reworked/transported assemblage. Assessing the degree of reworking and transportation depends upon the extent to which edge-nibbling on various flakes is regarded as natural abrasion or hominin flake-tool manufacture. Considering their gravel context, the former is more likely, which suggests a lesser degree of fresh condition material than reported by Wymer (1957). Bearing in mind these observations, and even accepting the gravel as part of the Corbets Tey/Lynch Hill formation, it seems quite possible that as suspected by West (1969) the contained Clactonian material is derived from older MIS 11 deposits, rather than contemporary with the gravel formation. Even though no artefacts were found in the higher Orsett Heath Formation terrace gravels a short distance to the north during section cleaning in the 1990s (Bridgland and Harding 1993), this was by no means an exhaustive investigation. In any case, an absence of lithic material in the surviving deposits would not establish that none was ever present; it is quite possible that the putative Clactonian-artefact-bearing part of this Formation has now disappeared during the downcutting and gravel reworking associated with the transition from MIS 11 to MIS 9. Thus there is currently insufficient evidence to be confident that there is a repetition of genuinely Clactonian occupation in Britain in the early part of the MIS 10-9-8 cycle, so most of the remainder of this discussion focuses upon the Clactonian/Acheulian transition in Britain in MIS 11.

There is however one point to be made before continuation of this discussion. If one did regard the Clactonian industrial tradition as persisting in a central-eastern European refuge area, and perhaps associated with a distinct hominin lineage, then one could point to the clear contrasts in the organisation of lithic production between Clactonian and Acheulian adaptations, the more spatially structured pattern of landscape use in Acheulian adaptations and the evidence of more logistically organised behaviour, to suggest a fundamentally different adaptation that could perhaps reflect the different cognitive capabilities of a different hominin lineage. In the almost total absence of a skeletal record we are presently in the dark over the association (or otherwise) of hominin physiologies with lithic material culture through the Middle Pleistocene. However, the increasing evidence from DNA analyses, such as the discovery of the distinct eastern European Denisovans regarded as a sister group of Neanderthals (Krause *et al.* 2010; Reich *et al.* 2010), suggests that there might be surprises in store. One such surprise could be the association of non-handaxe industries from Eastern Europe with a distinct hominin lineage, possibly even Denisovans.

Back in Britain, and discounting the above possibility, it has long been suggested in support of option 1 that the apparently rapid replacement of Clactonian by Acheulian in the British Hoxnian reflects the direct replacement of one hominin group by another (Breuil 1926; 1932; Wymer 1974; White and Schreve 2000; Stringer 2006). Although this might appear rapid at the Pleistocene geological scale, it must however be emphasised that the period during which this change took place, between HoIIb and HoIIIa, spans at least 5,000 years (Turner 1970), and probably more. This is therefore ample time for an isolated hominin population, on what would probably at that time have been the island of Britain (Preece 1995) to have developed a different lithic industrial tradition that involved both different techno-logical/typological practices and a wholly different organisation of production integrated with a more logistically organised adaption. Crucial to this debate is the history of Britain through the Hoxnian as an island or a peninsula. It is widely accepted (Gibbard 1995; White and Schreve 2000) that the Straits of Dover were initially formed in the Anglian. The subsequent onset of peak MIS 11 interglacial conditions and accompanying sea level rise happened slightly more slowly than in some other interglacials (eg MIS 9) allowing a period of peninsularity early in the Hoxnian during which hominins and other fauna were able to colonise Britain before it was isolated as an island due to rising sea level. The puzzlingly late influx of 'Rhenish' species in the Swanscombe and Clacton-on-Sea MIS 11 sequences (Meijer and Preece 1995) could be taken as indicating an early period of insularity. Despite the late advent of Rhenish species, it is hard to see from other evidence of temperature and sea-level history through MIS 11c (Tzedakis *et al.* 2001; Waelbroeck *et al.* 2002), which can be regarded as the true Hoxnian of the Swanscombe, Clacton and Barnham sequences (Ashton *et al.* 2008), how peninsularity could have been re-established before the climatic dip of MIS 11b that would have allowed colonisation by new hominin groups. Consequently it is hard to imagine firstly, how a new hominin group could reach Britain at this time, secondly, if there were separate groups in Britain and north-west Europe at this time how they could maintain their cultural separation and distinct industrial traditions through the early Hoxnian, or thirdly, if that was the case, why there has been no evidence of the handaxe-manufacturing tradition from the first part of the Hoxnian.

Therefore option 2 is preferred here, namely that the initial Hoxnian population of south-east Britain had a Clactonian lithic industrial tradition, based on a minimally spatially organised *chaîne opératoire*, and mostly associated with the expedient use of locally found raw material in response to tool-using need. This then developed over a period of maybe 5,000 years into a handaxe-based Acheulian industrial tradition, integrated within a more spatially and logistically organised *chaîne opératoire*, and associated with the transport and use of bifacial tools, provisioned and carried in advance of anticipated tool-using need. As previously discussed by both Wenban-Smith (1998) and White and Schreve (2000), there are a multiplicity of factors that could underpin this development. The Clactonian could, for instance, work well as the adaptation of a small, mobile pioneer population, but more stable adaptations in interglacial environments could then encourage population growth and the development of more logistically organised adaptations that could also support social transmission of the more difficult skills of handaxe manufacture (cf. Mithen 1994). Alternatively, changing raw material or animal resource availability could stimulate transition from a primarily expedient tradition of tool-use to one in which it became more important to carry a tool in anticipation of use, and this could have encouraged development of a handaxe-based lithic industrial tradition. The Clactonian assemblages of Phases 6 and 7 contain the seeds of this behavioural transition, with some evidence of interruption of *chaîne opératoires*, and movement of tools around the landscape in anticipation of use. Likewise, the simple core-tool and the ambiguous chunky flake-core/flake-tool elements of Clactonian assemblages provide the seed of the technological transition toward more intensively worked and deliberately shaped handaxes.

Whichever interpretive option is preferred, the key point here is that interpreting the Lower/Middle Palaeolithic material cultural record is by no means a simple matter of data collection and application of an agreed theoretical framework. Every stage of the interpretive process is highly contested. The selection of lithic attributes as 'data' is highly integrated with theoretical preconceptions, and these in turn underpin subsequent interpretations. Thus, although debate over the interpretation of 'the Clactonian' is at one level a debate about what was happening in Britain in the Hoxnian, it is also a debate about perspectives on the Lower/Middle Palaeolithic record. It involves preconceptions on: (a) time-depth and continuity, ie. whether we see the record as representing tiny snippets or substantial slices of Pleistocene time; (b) hominin groups and adaptations, how we model their density, distribution and networks, both across a region and down through time; and (c) material cultural traditions and change, how variable we think might be their material cultural output, how new generations of hominins maintain and acquire material cultural practices, and what factors might stimulate change. Whatever perspectives a modern worker takes on these matters, will then inevitably inform both the selection/characterisation of relevant data and also the resulting interpretation. Therefore, what is required is not just uncritically to inherit a dataset, or a conception of relevant data, but to try and explore the foundations of the data, and to articulate the perspectives underpinning its interpretation. Here, it has been argued that the Pleistocene depositional record artificially conflates vast stretches of prehistoric time, that depositional and taphonomic processes need to be more carefully considered and that the term 'Clactonian' has been misapplied to some small lithic assemblages. Although unarticulated, there are also widely shared preconceptions, unchallenged in this analysis, that the hominin groups of this era are very low density, maintaining stable lithic industrial traditions over substantial time periods, transmitted by observation and practice from one generation to the next.

At a wider scale, this explanation for the British situation does not directly contradict the notion of an eastern European non-handaxe province, and a southern/western European province with a handaxe-making industrial tradition in the Middle Pleistocene. It merely argues that, in the island of Britain in the Hoxnian, it seems more likely that *in situ* evolution of the lithic industrial tradition has taken place rather than a second wave of colonisation. It does however put an increased emphasis on appreciating the long time-depth and intermittence of the depositional archive of this period, leaving a highly punctuated and conflated Palaeolithic record, with vast periods of time entirely absent and short periods disproportionately represented in rapidly formed sediment accumulations, leading to a potentially misleading record of periods of stability interspersed by rapid change. It also emphasises (a) the potential, in conjunction with short-term stability, for long-term flexibility and cyclical drift within the overall context of lithic-assisted adaptations as an aid to survival, and (b) the importance of investigating not only the technological/typological characterisation of the lithic products, but also the spatial organisation of the *chaîne opératoire*. Thus bearing in mind, for instance, the record of pre-Anglian handaxe-based occupations in Britain (for example at Boxgrove and Happisburgh) and the unifacial flake-tools of High Lodge (Ashton *et al.* 1992), it implies that handaxe-based and flake-tool-based lithic technological adaptations are liable to fade and recur over vast timescales, as changing parts of an integrated social and behavioural solution to the problem of survival in the always slightly different, but climatically and environmentally also broadly cyclical, Pleistocene world.

PALAEOLITHIC ARCHAEOLOGY AND DEVELOPMENT CONTROL: SITES, METHODS AND THE RESEARCH FRAMEWORK

The history of discovery, fieldwork and post-excavation analysis at Southfleet Road provides a case-study from which some valuable lessons can be learnt. In the first place, the site was very nearly missed altogether, only being discovered at a late stage of the HS1 development programme in the Ebbsfleet Valley, after the archaeological programme was thought to have been completed. This occurred for a number of reasons. Firstly, at the very outset of the HS1 project in the early 1990s, I prepared an overview (Wenban-Smith 1992) of the Palaeolithic priorities and acceptability of different rail link routes through the Ebbsfleet Valley for inclusion in the overall survey of cultural effects along the HS1 corridor (Oxford Archaeology 1994). This incorporated two mistakes. First, I took the available geological mapping of the area (British Geological Survey 1977) at face value as an accurate representation of the distribution and nature of the Pleistocene deposits, and this underpinned my assessment of Palaeolithic potential for uninvestigated areas. Second, I was focused on deposits surviving within the quarried parts of the Ebbsfleet Valley affected by the HS1 route, rather than those around the edge of the main quarried area. Thus, although the Swanscombe 100-ft terrace deposits on the west side of the valley were identified as a Palaeolithic concern the area where the elephant was later found at the far south-west edge of the HS1 area (which at that time had not been defined as such) was overlooked. This area was at that time mapped as 'Thanet Sand below Head' deposits and, had it been on my radar, I would have regarded it as the lowest category of Palaeolithic importance, 'Palaeolithic priority Category 5' (Pleistocene deposits of low Palaeolithic potential; monitoring of works with option of rescue excavation recommended). Likewise, the stretch of 'ferruginous loam' identified by Carreck (1972, 61) to the north of the elephant site (Chapter 2) was not deemed significant as it had been seen at the top of the quarry face below the east side of Southfleet Road, and so was not going to be affected by the rail link works. It was only after subsequent work in the area, particularly investigations in advance of the Swan Valley Community School in the late 1990s (Wenban-Smith and Bridgland 2001) and in Eastern Quarry in 2005 (Wessex Archaeology 2006a) that the presence of extensive deep spreads of unmapped Pleistocene sediments with high Palaeolithic potential was recognised extending south of Swanscombe towards the elephant area. Had I been aware of this in the early 1990s, then the unquarried area where the elephant was later found would have been higher on my agenda, even though it was far away from the different route options being considered at that time.

This emphasises that while BGS mapping is an essential starting point for the consideration of Palaeolithic potential, since any important Palaeolithic remains will be contained in Pleistocene sediments, it cannot be regarded as precisely accurate for the distribution, thickness or nature of Pleistocene sediments. A key task for any desk-based archaeological assessment in advance of development must be, therefore, to look at the geomorphological context of a site in relation to Pleistocene mapping in the general region, and to consider the possible presence and likely nature/potential of any unmapped deposits. Other similar examples include the sites of Red Barns, Hampshire (Wenban-Smith *et al.* 2000) and Harnham, Wiltshire (Bates *et al.* in prep.) where nationally important Lower/Middle Palaeolithic discoveries have been made in areas mapped as Chalk bedrock.

Secondly, it is important for assessment (and mitigation) of the archaeological impact of major development projects to take a wide view of potential impact, taking account of related infrastructural development and not just the headline project. In this case, focus at the beginning, and at every subsequent stage of the archaeological process, was on the route of the HS1 track, the link to the existing North Kent line, the new pylons (ZR3A and ZR4) and the footprint of the Ebbsfleet International station. Less attention was paid to field evaluation in other areas where there would be ancillary landscape remodelling and other impacts such as roads and services. The elephant was found at the south-western edge of the overall area of HS1 development in the Ebbsfleet Valley, well away from the track and the station. Despite being an area of substantial landscape remodelling, this area received no archaeological attention prior to the December 2003 investigations (Chapter 3), leading to the elephant (and the other Palaeolithic and later prehistoric archaeological remains) only being discovered after substantial groundworks had already taken place.

Thirdly, the investigation of the site highlights and exemplifies some of the issues concerning the importance, or otherwise, of fluvial gravel deposits as a Lower/Middle Palaeolithic resource. Many (perhaps most) archaeologists and curators continue to regard such gravel deposits as essentially 'disturbed', lacking *in situ* occupation horizons and therefore not meriting investigation in advance of development, whether or not artefactual (or faunal) remains are suspected, or known, to be present. In this instance, it was not apparent at first that the Phase 8 gravel capping the site contained any flint artefacts. It was only after a high volume of systematic sieving, extensive section cleaning and the start of mechanical reduction that artefacts began to be recovered. By the end of the project an assemblage of 180 artefacts had been recovered, including more than 30 handaxes, emphasising that apparently sterile gravel bodies may in fact contain an abundant archaeological resource when more thoroughly investigated.

Furthermore, many of the artefacts from the gravel were in mint or fresh condition, reflecting a minimum of disturbance. The likelihood was that they were recovered close to where they had been discarded during activity on the gravelly braided floodplain of the palaeo-Ebbsfleet; thus gravel deposits can contain minimally disturbed evidence, as also established at other sites such as Lynford, Norfolk (Boismier *et al.* 2012). However, an even more important point to take on board is that the more-disturbed artefactual evidence from fluvial gravels provides an important complement to the undisturbed evidence, giving information on lithic industries in the slightly wider landscape over the medium-term period during which a fluvial gravel body was formed. At the wider Pleistocene timescale, the evidence from individual gravel bodies is the most suitable unit from which to develop a wider picture of hominin presence across Britain, and of the broad trajectories of lithic material cultural change and regional variation. Therefore, far from being unworthy of targeted investigation, fluvial gravel bodies are a key resource for investigating the Lower/Middle Palaeolithic and addressing current research priorities.

Excavations at the site also highlight a number of practical matters concerning field methods for Palaeolithic/Pleistocene investigations. Firstly, the concurrent programme of environmental assessment allowed important progression in understanding the palaeoenvironmental potential of different horizons, leading to modification of the sampling programme and targeting of the most appropriate deposits while fieldwork was in progress. While a balance must always be struck, this obviated the need for a massively redundant field sampling programme involving a large volume of precautionary sampling from deposits of uncertain potential.

Secondly, the exposure of long, deep Pleistocene sequences on both sides of the main site spine illustrated how complex Pleistocene stratigraphy can be, with beds drastically dipping, thinning, thickening or disappearing over short distances, and important stratigraphic junctions being almost indistinguishable at some points. Many beds exhibited complex 3-dimensional geometry, and the spectacular synclinal basin in the central part of the site was only revealed when transverse cross-sections were dug across the main site spine, to link the two long north-south faces. These long exposures and the unexpected synclinal geometry in the centre of the site demonstrate the difficulty (and the likely inaccuracy) of modelling sub-surface Pleistocene sequences between widely spaced test pits across a site. This has also been repeatedly demonstrated at many other major continuous sections in the HS1 works in the Ebbsfleet Valley, for instance at Trench 3776 TT at the ZR4 pylon site and in Trenches 3971 TT and 3972 TT (Wenban-Smith *et al.* forthcoming). Clearly, any test pits are better than none; and many are better than few. However, even with many it is important to bear in mind (a) that the subsurface deposit model may not be especially accurate, (b) that important stratigraphic boundaries may only become apparent when wider exposures are seen and (c) that site areas where particularly important remains or deposits are present may be restricted in extent and unpredictably located. This last point is well-exemplified at Southfleet Road not only by the restricted areas of the Phase 6 clay containing the elephant skeleton and the larger concentration south of Trench D, but also by the restricted extent of the tufaceous channel and the very patchy preservation of ostracod and small vertebrate remains in the deposits of Phases 3 and 5 respectively.

Finally, it is worth recapping that, although the main north-south spine of the site that underlay the old Southfleet Road is now gone, having been throughly investigated in the work reported throughout this volume, Pleistocene deposits of high potential still survive in the immediate vicinity. First, the curving and sloping bank to the west of the new Southfleet Road cutting is formed by *in situ* Pleistocene deposits equivalent to Phases 6-9 of the main site sequence. These survive close beneath the current ground surface and continue further west into the arable field within the perimeter of the National Grid Northfleet West Substation property. Field evaluation here has demonstrated the continuation of some areas of high Palaeolithic importance (Museum of London Archaeology 2011). Secondly, the Phase 8 palaeo-Ebbsfleet gravels and underlying deposits of Phases 3-5 are still present directly under the new Southfleet Road surface and to its east, north of a line through Trench B. Thirdly, deposits of Phases 3-6 are still present to the east of the old site spine, south of the same line through Trench B, where they have been investigated by test pits dug for the Station Quarter South field evaluation (Wessex Archaeology 2006b). Finally, undisturbed deposits are still present close beneath the current ground surface in the area of Transects 1-3 to the north-east of the main site (Fig. 3.11; Fig. 21.1). The western half of this area contains deposits of Phases 8 and 9, the palaeo-Ebbsfleet gravel and the brickearth; the eastern half contains deposits of uncertain correlation to the site sequence (Fig. 4.34; Fig. 21.1), but which are thought to be broadly equivalent to Phases 3-6. These latter deposits have been shown to contain fresh condition lithic artefacts and faunal remains; they are thus of high Palaeolithic potential and require targeted field evaluation prior to any further proposed development impact.

CONCLUDING THOUGHTS

by Francis Wenban-Smith and Stuart Foreman

So, a little over nine years after the site was recognised and fieldwork began, and after a three-year-programme of painstaking specialist analyses, how might we sum up its importance? This major investment of time and resources, leading to production of this volume, is in itself testament to the recognition by Stone Age specialists and curatorial authorities that the site was of undoubted national and international importance. The discovery of any undisturbed remains of this great age (roughly 400,000 years ago) is an incredibly rare event in itself, valued for the insight provided into the life of early hominins. To recover the specific evidence of the butchery of a single large animal, and in particular of the evocative extinct beast the straight-tusked elephant *Palaeoloxodon antiquus*, with the flint tools lying where they were dropped beside the carcass, takes it onto a higher plane; such recoveries are noted and celebrated across the globe, feeding into academic research and public consciousness. In Britain, the only comparable discovery is the horse-butchery site GTP 17 at Boxgrove (Pitts and Roberts 1997; Pope 2002). In Europe, there are maybe 6-7 sites of this nature known from the full earlier Stone Age period prior to the advent of modern humans roughly 40,000 years ago, and a similar number are known from the wider Old World and Middle East (discussed in the preceding sections of this chapter, and see also Gaudzinski *et al.* 2005; Surovell *et al.* 2005; and Yravedra *et al.* 2012).

The Ebbsfleet Elephant will take its place in this pantheon of great sites, contributing to academic debate in future years. In the words of Mark Roberts (Institute of Archaeology, University College London), Director since the early 1980s of the seminal Boxgrove project that did so much to kick-start modern Palaeolithic multidisciplinary investigations, and can be said to have trained the current generation of Palaeolithic researchers:

> *"The site has an extremely important bearing on some of the major research questions and debates of the British Palaeolithic. The geological sequence and palaeoenvironmental evidence links it with other internationally important archaeological sites in the Swanscombe area and south-east England, addressing the long-standing debate over post-Anglian Clactonian and Acheulian industries. This volume includes a comprehensive synthesis of the current state of knowledge, and the site's contribution to the debate".*

Its impact and importance go beyond the academic domain, however. This is the first time that a major Palaeolithic site has been brought to publication entirely through developer-funding, and the authors hope that the standard has been set at a suitably high level. By demonstrating what can be achieved, the HS1 project in the Ebbsfleet Valley has helped to raise the profile of Palaeolithic archaeology as a mainstream concern in developer-funded archaeology. Palaeolithic specialists, perhaps more than archaeologists from other periods, benefit most greatly from large-scale development that exposes deep-lying deposits to reveal important new discoveries. The history of archaeological discovery in the Ebbsfleet Valley begins with the start of quarrying in the late 19th century, and will no doubt continue in the 21st century as 'Ebbsfleet' is reinvented as a new settlement on very ancient foundations. Exceptionally important Palaeolithic discoveries, where they are accompanied by an appropriate level of research and publication, can be regarded as a positive benefit arising from the development, rather than merely as 'mitigation' of an environmental impact. The Southfleet Road site certainly falls into this category. Apart from the headline discovery of the elephant butchery area, numerous other aspects of the site combine to make it of foremost importance, amongst which the rich faunal remains from the tufaceous channel and the abundant lithic artefacts from the rest of the site.

A common complaint from developers is that the most important finds often seem to emerge late in the day of a planned excavation, when all assigned resources have been expended. The discovery of the Southfleet Road site certainly conformed to this perceived pattern, which is equally frustrating for archaeologists. Archaeological work in a developer-funded environment is firstly about identifying and avoiding important remains, wherever possible. And where avoidance is not possible, it then becomes about managing the risk of significant discoveries and ensuring that available time and resources are targeted effectively at identifying and understanding important sites before they are lost. Since the methods do not yet exist to reliably detect ephemeral prehistoric archaeological sites in deep and complex sediment sequences, even in a locale with a long history of previous investigation such as the Ebbsfleet Valley, identifying important Palaeolithic sites is like looking for a needle in a haystack. We have to accept that even the best-managed projects will potentially affect significant sites.

It is to the great credit of those involved in managing the HS1 construction project that, once the importance of the elephant site became clear, generous additional time and resources were made available to conduct a thorough investigation. This was completed to the demanding standards expected by the HS1 archaeological Statutory Consultees (formed from English Heritage, Kent County Council Heritage Environment Conservation) in spite of the extreme pressure on the construction team to finish building the access road to the new Ebbsfleet International station. The subsequent investigation of the site, more than any other excavated along the HS1 route, is a testament to the exceptionally high standards of environmental management adopted by the HS1 project and its Statutory Consultees, deservedly recognised in Heritage and Construction industry awards.

Given the extremely valuable results it is to be hoped that the Southfleet Road site does not remain for long a one-off example. Sites with Palaeolithic potential are perhaps more at risk than most of being covertly bypassed as 'too-difficult-to-deal-with' in the developer-funded environment. The characteristic combination of deep deposit sequences and very sparse and irregularly distributed remains places the Palaeolithic period among the most troublesome 'final frontiers' of British Archaeology. It remains a work-in-progress to educate all participants in the development-related curatorial process (curators, consultants and contractors) in how to manage the risk of disturbing important Palaeolithic remains most effectively, and how to investigate them most appropriately when they are encountered. The undoubted international importance of the Southfleet Road site, and the research results presented in this volume, will we hope provide encouragement on the curatorial side that it is worth persevering with the mysteries of the Palaeolithic. Even more importantly, we hope that they will engage and inspire developers, engineers and construction workers that archaeological work produces results of interest and importance, and that the British archaeological community has the experience, methods and capacity to investigate and record such sites highly effectively. In particular it is hoped that the high standards set through the work on High Speed 1 will be adopted in development of the new High Speed 2 line linking London to northern Britain, and ultimately lead to discovery and investigation of the archaeology along HS2 for the benefit of future generations.

Critical to the success of this project has been the close interaction between university- and museum-based specialists and archaeologists from the local government/ commercial sector. The involvement of academic specialists was regarded as essential in this case because of the intrinsically difficult and multi-disciplinary nature of Palaeolithic archaeology. High-level management decisions were made by the archaeologists within the HS1/ RLE Environment Team, advised by their external Palaeolithic specialist Mark Roberts in discussion with the Statutory Consultees (in particular Lis Dyson of Kent County Council), with input from the archaeologists involved on the site (Francis Wenban-Smith, and Richard Brown and Darko Maricevic of Oxford Archaeology). Oxford Archaeology brought to the team the organisational capacity needed to deal with a substantial detailed excavation in the face of imperative construction deadlines, and long experience of working with engineers and planners. However as major Palaeolithic excavations are a rare occurrence in the world of developer-funded archaeology, the RLE and OA archaeological teams were more than usually reliant on the depth of expertise provided by the specialist team. OA were able to deploy a number of excavators with previous Palaeolithic excavation experience, Mark Roberts' Boxgrove project having featured as a training ground for several of the project team. However many of the team had no prior period-specific experience; guidance and training in procedures specific to the Palaeolithic period was therefore essential and was provided by members of the specialist team working on-site in a supervisory role, in particular Francis Wenban-Smith (general excavation strategy, lithics recovery and recording), Martin Bates (geoarchaeological recording), and Simon Parfitt and colleagues from the Natural History Museum (faunal remains recovery and recording). This level of collaboration is a model that can and should be applied more widely to other periods, particularly in the case of the most significant discoveries. Hopefully the various segments of the archaeological profession can learn valuable lessons from the experience, as in this case.

Finally, this volume provides a record of Palaeolithic and other Quaternary investigations into a substantial volume of Pleistocene sediments that were bulk-extracted as part of the major infrastructural development of the HS1 track and Ebbsfleet International station. Although some material remains, mostly faunal fossils and lithic artefacts, were recovered and are now saved for posterity in museum collections, supported by an archive of paper records, drawings, survey records and photographs, it is salutary to remember that everything reported in this volume is a remembrance of something vanished. That which was, is gone, and it is ultimately for this reason that archaeological investigations take place in advance of development, to discover, and preserve, the story of the land and the people of it; a story that establishes and maintains connection with the physical environment and its past occupants. Thus this story is presented here; a history of landscape development integrated with the climatic and environmental fluctuations of the Pleistocene, during which at various points hominin ancestors lived and knapped, and encountered an elephant. Then much later their distant descendants quarried, built and knapped some more, and finally dug and built again, at a vaster scale with modern mechanisation wreaking rapid and drastic change unimaginable to the earliest inhabitants.

Perhaps the most surprising aspect of this story is, besides any more spiritual connection it might support, the evident physical connection between the deep Pleistocene landscape history and the present day pattern of occupation, use and infrastructural development. Thus, the town of Swanscombe is exactly situated on the level spread of the local outcrop of the Boyn Hill/ Orsett Heath terrace of the Thames. The chalk hills around the town have mostly been quarried away, but the surviving network of roads likewise echoes the deep-

Figure 22.3 Manor Community Primary School, Swanscombe, Olympic torch

rooted Ice Age landscape structure, mapping onto ancient drainage pathways and terrace remnants. At Southfleet Road, it is perhaps not entirely coincidental that the elephant was preserved beneath the road: this road following a fold in the landscape; this fold directly resulting from the influence of the synclinal basin on the subsequent fluvial landscape; and the synclinal basin probably fundamentally related to the depositional environment and landscape topography that led to preservation of the elephant skeleton, and perhaps also to its demise on the spot where it was (much) later rediscovered.

Besides the contribution to academic research and and public understanding of the Stone Age in Britain, the most rewarding aspect of this story has, however, been its impact on the next generation. At the time of writing, the Olympic torch is criss-crossing the land; the Dartford area having been omitted from the route, the local schools designed and paraded their own torches. Inspired by both this new discovery and the earlier discovery of an isolated tusk and Palaeolithic flint tools during construction of the neighbouring Swan Valley school, the children of Manor Community Primary School, Swanscombe, have looked to this engagement with the evidence of the past in their torch (Fig. 22.3), adopting the shape of the tusk and the colour and texture of the associated flint tools, and fronted by the great beast *Palaeoloxodon antiquus* itself. What more appropriate legacy could there be of our archaeological endeavour?