LATE QUATERNARY (UPPER PALAEOLITHIC,
MESOLITHIC AND LATER PREHISTORIC)
HUMAN ACTIVITY IN THE DARENT VALLEY AT
LULLINGSTONE COUNTRY PARK, EYNSFORD, KENT

Hugo Anderson-Whymark and Matt Pope

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COUNTRY PARK, EYNSFORD, KENT**

by

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Front cover: Photographs showing a number of Terminal Upper Palaeolithic (TUP) flint cores with refits, faceting on the butt end of a TUP long blade and a TUP bruised blade all excavated from Lullingstone Country Park

Back cover: (from left to right) Photograph of EA1 [4] showing an *in situ* flint scatter; photograph showing the excavation and surveying of EA1; illustration of TUP core 1 (flint no 4) without refits

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SUMMARY

A programme of archaeological and geoarchaeological fieldwork was carried out on behalf of Kent County Council at Lullingstone Country Park, Eynsford, Kent, ahead of development work to extend the existing car park and other associated works. Three phases of fieldwork were carried out: a first-stage evaluation (March 2009); a second-stage evaluation with geoarchaeological test pits (June 2009); and a third stage comprising a watching brief during groundworks and further test pits (between September 2010 and February 2011). A further small-scale phase of watching brief was undertaken (between September and December 2012) which uncovered no archaeological remains.

The first-stage evaluation revealed two significant features: a prehistoric, perhaps Mesolithic, pit and a 3.1m-wide driveway, which could also be traced within an extensive system visible as cropmarks. A potentially very significant worked flint scatter was also revealed, which became the focus of further fieldwork. The second-stage work, comprising seven geoarchaeological test pits, one of which was targeted on the flint scatter and pit feature, recovered further significant quantities of Terminal Upper Palaeolithic and Mesolithic worked flint.

Subsequent post-excavation analysis of the worked flint showed that it consists of a Terminal Upper Palaeolithic long blade assemblage, which was recovered as an *in situ* scatter preserved within head deposits, an *in situ* Mesolithic scatter preserved within the same head deposits and within a tree throw or pit, and residual Neolithic and Bronze Age flintwork recovered predominantly from topsoil and subsoil. The *in situ* scatters demonstrate a high degree of preservation and, as such, document hunter-gatherer groups at the transition from the last cold stage into the earliest part of the Holocene. The geoarchaeological investigations demonstrated the preservation of a full sedimentary archive at the site, spanning perhaps the last Eemian (Ipswichian) interglacial (MIS 5e), through the last cold stage (MIS 5D – MIS 2) and into the current warm Holocene interglacial.

These important archaeological investigations, within the footprint of the Lullingstone Country Park, have shown that such sites, as part of slope deposits spanning the Lateglacial and early Postglacial periods, provide opportunity for the recovery of very localised high-resolution lithic artefacts scatters preserved at the interface between different depositional events.

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The on-site work was led by Greg Priestley-Bell, with geoarchaeological evaluation undertaken by Matt Pope and Martin Bates. The project was managed for ASE in the field by Neil Griffin and Jon Sygrave and in post-excavation by Dan Swift and Louise Rayner. The field team comprised Robert Beck, Nicola Elphick, Rob Cole (survey), Lesley Davidson (survey), Cat Douglas, David Dunkin, David Honess, Chris Russell, Ben Sharp and Michelle Statton. Report figures were prepared by Fiona Griffin, Antonio Reis and Justin Russell.

Specialist assessment work was undertaken by Chris Butler (worked flint), Anna Doherty (pottery), Luke Barber (post-Roman pottery; stone), Sarah Porteus (ceramic building material), Lucy Allott (environmental samples) and Gemma Ayton neé Driver (animal bone). Elements of these assessments have been drawn into this report but the full reports are available in the site archive.

Earlier drafts of this report were discussed with and commented upon by Edward Blinkhorn and Chantal Conneller and their advice and suggestions were gratefully received in regard to the interpretation of the stone artefact scatters

CHAPTER 1 INTRODUCTION

Greg Priestley-Bell and Matt Pope

1.1 OVERVIEW

This report describes the discovery and excavation of high resolution Lateglacial and early Postglacial flint scatters, recovered from the surface of slope deposits on margins of the River Darent at Lullingstone Country Park, near Eynsford, Kent (Fig 1.1; NGR 552609, 163822).

The archaeological investigations were commissioned by Kent County Council (KCC) and carried out by Archaeology South-East (UCL Institute of Archaeology) ahead of the redesign and extension of the car park facilities at the country park. The project was challenging, involving separate stages with different methodologies employed in response to both the archaeology and the progress of the construction project. This report outlines how these challenges were met and provides a detailed record of the stone age archaeology recovered from part of an extensively deep Late Pleistocene and Early Holocene sedimentary sequence.

The sedimentary profile recorded at the site shows a sequence of sediment bodies moving with depth through Holocene colluvium, Lateglacial/early Postglacial head deposits and older Late Pleistocene slope sediments. Below this sequence an organic sediment horizon, which may date back to the last interglacial (130,000–110,000 years ago), was identified immediately overlaying an even earlier fluvial deposit. Within the upper part of the sequence, preserved at the top of the head deposits and sealed by colluvium, significant localised lithic artefact concentrations were identified.

Three clear phases of stone age activity were identified: Lateglacial hunter-gatherer cultures were represented by a localised scatter of technologically distinct Terminal Upper Palaeolithic 'long-blade' flint artefacts, early Postglacial hunter-gatherer groups by a more diffuse scatter of Early Mesolithic flint artefacts and, within the colluvium, the stone artefacts of agricultural and pastoral groups of the Neolithic and Bronze Age.

While the later prehistoric material was found as diffuse spreads within colluvial hillwash and within ditch features, the Terminal Upper Palaeolithic and Mesolithic material was found with a high degree of horizontal and spatial discreteness, as two largely separate but close and minimally overlapping concentrations. The sharp condition of the artefacts and their spatial clustering suggested a high-resolution archaeological signature, an assessment which was borne through in analysis by a successful refitting programme indicating that

both scatters were well preserved. This report details the technological features of these assemblages alongside contextual information relating to their deposition. We conclude by offering the Lullingstone sequence as representative of a regionally important landscape which has the potential to document, in very high resolution, cultural and technological changes in hunter-gatherer populations at the very end of the last ice age and into the emerging world of the Early Holocene.

1.2 SITE LOCATION

The site was located close to the west bank of the River Darent where it cuts through the North Downs between Shoreham and Eynsford; Lullingstone Castle lies approximately 650m to the north. The site consisted of a grassed overspill car park and grassland immediately to the west of Lullingstone Country Park visitor centre. The archaeological work was undertaken in response to a condition attached to planning consent for the construction of a new car park adjacent to the existing visitor centre car park (planning ref: SE/08/TEMP/0025). Additional works comprised the alteration to the line of the existing western boundary fence, the widening of the entrance drive, planting along the southern boundary and the construction of a footpath to the north of the visitor centre building, together with potential further excavations for petrol interceptors and drainage.

The site lay within an area of high archaeological potential, with a number of Roman and Iron Age settlements located nearby within the park. Extensive soilmarks/cropmarks of enclosures and trackways are visible from aerial photographs of the immediate area, including a trackway running through the southern part of the site. Possible lynchets have been identified on the valley side. At least three Mesolithic tranche axes are recorded as surface finds from just to the west of Lullingstone Castle, while records at Dartford Museum suggest that many flint implements were collected in the middle of the last century by W. Meates and E. Greenfield from the Darent valley. Unfortunately very few of these finds survive.

Fig 1.1 Site location. Based on Ordnance Survey data © Crown copyright and database right 2013

1.3 PROJECT BACKGROUND

The fieldwork for this project was carried out in three main stages: Stage 1 evaluation (March 2009); Stage 2 geoarchaeological test pitting (June 2009); and Stage 3 comprising a watching brief during groundworks and further test pits (between September 2010 and February 2011). A further small-scale phase of watching brief was undertaken (between September and December 2012) which uncovered no archaeological remains.

The first-stage evaluation comprised the mechanical excavation of six archaeological trial trenches (Fig 1.2; Trenches 1–6), with a geoarchaeological sondage sited within one of the trenches (Pope & Priestley-Bell 2009a). Significant archaeology was recorded in Trenches 4b and Trench 6 (see below). The sondage excavated at the western end of Trench 6 revealed a combination of both periglacial head deposits and later Holocene colluvium. The presence of lithic material within the upper facies of the Pleistocene head deposits, while not ruling out introduction through later Holocene disturbance, was seen as potentially significant.

In June 2009, in order to explore further the sequence and its relationship with the underlying Cretaceous bedrock and the alluvial sequence of the Darent River, KCC advised that a second-stage evaluation should be undertaken, consisting of the excavation of seven geoarchaeological test pits (Fig 1.3, GTP1–7; Pope & Priestley-Bell 2009b). The test pits were located with the aim of providing a transect perpendicular to the valley and to assess the lateral extent of sediments recorded in Trench 6. The seventh test pit (GTP1) was hand-dug adjacent to Trench 6, close to the find-spot of flintwork, and was then further extended to follow the extent of apparently *in situ* worked flint and associated lithic material.

In August 2010, in view of the results of the second-stage evaluation, KCC amended the site development plan to limit the reduction depth of the new car park area to 0.30m; deeper excavation would be permitted only in a few small impact zones which would be agreed in advance. A condition for an archaeological watching brief was placed on all groundworks associated with the development. In order to assess and characterise the lithic material present within the topsoil before the reduction of the area, KCC also specified a series of ten machine-dug 1m² test pits (Fig 1.3, TP1–10).

1.4 REPORT CONVENTIONS

A context number is a unique number assigned to each archaeological unit identified in the field. Context numbers are shown in square brackets: [000]. Contexts recorded in evaluation trenches are shown as [0/00], where the first number indicates the trench number.

Bulk environmental samples are shown in angle brackets: <00>; where samples derive from a geoarchaeological test pit (GTP) these are prefixed with the GTP number: <GTP0/0>. Monolith samples are shown as <M0>.

1.5 SITE ARCHIVE

The archive from all phases of the project, including all finds and environmental material and the paper and digital records, are currently housed with Archaeology South-East until a suitable repository can be identified.

Fig 1.2 Location of trenches and watching brief areas in relation to soilmarks/cropmarks. Based on Ordnance Survey data © Crown copyright and database right 2013

Fig 1.3 Plan of trenches, geoarchaeological test pits (GTPs) and Extension Area I (EA1) showing excavated features in relation to soilmarks/cropmarks

CHAPTER 2 THE ARCHAEOLOGICAL INTERVENTIONS: METHODOLOGIES AND RESULTS

Greg Priestley-Bell and Matt Pope

2.1 SCHEME OF WORKS AND EXCAVATION METHODOLOGY

A phased programme of archaeological investigation, each involving different recovery and recording methodologies as appropriate, was applied during the works at the Lullingstone site as the nature of the lithic artefact spreads and their context became apparent. These works were carried out in accordance with KCC specification documents (KCC 2009a; KCC 2009b; KCC 2009c; KCC 2010).

STAGE 1: EVALUATION TRENCHES

The first stage of the project involved the excavation of six evaluation trenches, each measuring 20 × 1.8m. Each was excavated through topsoil to the surface of the underlying colluvium and then into the top of the head deposits (see Fig 1.2).

STAGE 2: GEOARCHAEOLOGICAL INVESTIGATION AND HAND EXCAVATION OF GEOARCHAEOLOGICAL TEST PIT 1

Seven 3.0 × 2.0m test pits were machine-excavated across the site as part of a geoarchaeological investigation of the deeper sediment sequence (see Fig 1.3). Aside from GTP1, the geoarchaeological test pits (GTP2–7) were machine-excavated under supervision in 50mm spits.

In GTP1, lithic artefacts were noted below topsoil. The machine excavation was halted and due to the volume of lithic material encountered in the initial spits, the remainder of this test pit was hand-dug in spits of even depth, until what appeared to be *in situ* lithic material was identified. From this point, all lithic material in excess of 10mm was recorded in three dimensions; this included a quantity of unworked fire-cracked flint. All spoil was sieved through a 10mm mesh.

GTP1 was extended by 2.0m to the east in order to follow the extent of an apparent *in situ* flint scatter; the scatter was not seen to extend in any other direction. The lithic material was revealed, recorded and lifted in a series of spits, each measuring between 5–15mm thick depending upon the density and distribution of the finds. Spoil was sieved and the resultant finds were recorded by the square metre. Excavation continued downwards until no new significant lithic material was being uncovered.

STAGE 3: TEST PIT SIEVING AND WATCHING BRIEF

The final stage of work comprised a watching brief augmented by a series of test pits with topsoil sieving (KCC 2010). The watching brief entailed the continuous monitoring of groundworks, specifying that all excavations would be undertaken in shallow spits using a flat-bladed bucket to enable archaeological remains to be recorded prior to disturbance. All unstratified finds were collected and recorded by 20m square (A1, A2 etc) over a 40 × 60m grid (Fig 2.1). An apparently *in situ* assemblage (EA1 on Fig 1.3) of potentially Terminal Upper Palaeolithic (TUP) flintwork was recorded individually in three dimensions for all pieces over 10mm; the longest pieces were given separate levels for their proximal and distal ends. The following information was recorded for each piece: compass orientation of the long axis, the primary angle and direction of dip, the position of the striking platform/proximal end, and whether dorsal or ventral was uppermost. The material was exposed, hand-drawn on to a composite plan and lifted by 5–15mm spit: the exact depth of spit was dependent on the distribution and density of the material.

As part of the watching brief, a series of ten 1m² test pits (TP1–10) based on a 20 × 20m grid were machine-excavated across the site under archaeological supervision (Fig 2.1). The pits were machine-excavated to a maximum depth of 0.30m in order to assess the lithic material within the topsoil. Where underlying archaeological deposits were encountered, the mechanical excavation ceased and the features hand-cleaned. Topsoil was sieved on site through a 10mm mesh in order to recover archaeological artefacts.

2.2 RESULTS

STAGE 1: EVALUATION TRENCHES

The first-stage evaluation was located in the area immediately to the west of the existing paved car park. Here the site was covered by turf and topsoil ([1]) to depths between 0.20 and 0.30m; the topsoil consisted of dark reddish-brown silt with many flints. In two trenches (T1 and T2) topsoil overlay a 0.20m-thick layer of made ground ([1/002] and [2/002]) consisting of dark reddish-brown clayey silt with

Fig 2.1 Plan of gridded watching brief area

occasional flints. The made ground was associated with the light landscaping of the overspill car park. In all evaluation trenches, topsoil and/or made ground overlay colluvium ([1/003], [2/003] and [3/002] et al) consisting of mid reddish-brown clayey silt. The underlying deposit, described as 'natural' in the first stage evaluation ([1/004], [2/004] and [3/003] et al), was light/mid yellowish-brown clay silt with localised patches of chalk peagrit and flints. The depths of the deposits are approximate, as no clear interfaces could be identified. Significant archaeology was identified in Trench 4 (excavated in two sections: a and b) and Trench 6.

TRENCH 4

Two features were recorded in Trench 4, although full investigation was hampered by the close proximity of trees to the trench edge and the presence of a footpath and concrete base, which meant the trench had to be excavated in two parts, with Trench 4a on a slightly different alignment (Fig 2.2). At the south end of Trench 4a, located against the north-facing baulk and extending almost across the full width of the trench, a cut feature was identified extending beyond the trench. The trench could not be extended further because of trees, with the result that the feature was only partially excavated and is poorly understood. The feature contained a single fill but produced no finds, so dating and function is uncertain. It may have been a tree throw or pit but little more can be said based on the evidence recorded.

The second feature, in Trench 4b, was a substantial ditch [4/006], with the remnant of an associated bank [4/009] on its southern edge (Figs 2.2 and 2.3). The ditch measured 3.15m wide, with a maximum depth of 1.0m, and contained two fills. The lower fill, [4/008], produced small quantities of poorly preserved charcoal and burnt flint and 13 pieces of struck flint, including a Mid–Late Bronze Age denticulate (see Table 4.1). The upper fill, [4/007], appeared to sit within a recut and produced no finds. Bank [4/009] was within/below a localised dumped deposit, [4/010], that perhaps represented a spread of disturbed bank material.

This trench was targeted on a portion of a trackway identified on an aerial photograph (see Fig 1.3). Although ditch [4/006] does not correspond with the position of the targeted soilmark as currently rectified – the excavated ditch was located *c* 4.5m north of the suggested location of the soilmark – the dimension and alignment are a good match and suggest that ditch [4/006] is the same feature as represented and as such probably formed the northern ditch of a trackway. The worked flint assemblage present in a lower fill is not diagnostic enough to be precise in terms of dating but a later prehistoric date

(Middle Bronze Age to Iron Age) is likely. An enclosure, also seen on aerial photographs, at the western end of the trackway appeared to be laid out in such a way as to enable the sorting and separation of livestock.

TRENCH 6

A single feature, a possible pit, [6/006], was identified in this trench, located against the north-facing baulk and extending beyond the trench edge (Figs 2.4 and 2.5). A single fill, [6/007], was identified, containing charcoal, burnt flint and 41 pieces of struck flint of predominantly Mesolithic date (see Table 4.1). The exact level at which the cut of [6/006] appeared was unclear, both during machining and in the resultant vertical section. Some darkening of the fill [6/007] was certainly visible at a higher level than that at which the cut could be positively identified. A slope deposit (head), [6/003], produced a small quantity of struck flint, including pieces of TUP character.

A single poorly preserved bovid-sized long-bone fragment was recovered from an underlying head deposit [6/008] at the eastern end of the trench (Fig 2.4). The bone was in very poor condition and could not be identified to species. Unfortunately, it also failed to provide sufficient quality collagen for a ¹⁴C measurement.

STAGE 2: GEOARCHAEOLOGICAL INVESTIGATION

The second-stage evaluation covered mainly the same area to the west of the paved car park as the first-stage evaluation and involved primarily the geoarchaeological assessment of the site by test pitting. Only GTP5 was positioned to the east of the paved car park (see Fig 1.3). The results from GTP2–7 are described in Chapter 3; those from GTP1, excavated by hand owing to the volume of lithic artefacts encountered below topsoil, are described here.

At GTP1 topsoil [20] was 0.20m thick and was the same as the topsoil recorded as [6/001] in nearby evaluation Trench 6. It overlay subsoil [21], which was *c* 0.10m thick and produced a small, mixed assemblage of worked and fire-cracked flint, together with ceramic building material. Deposit [21] overlay *c* 0.70m-thick deposit [22], which produced a significant quantity (142 pieces) of worked flint and fire-cracked flint, together with nine pieces of prehistoric pottery. The pottery includes two abraded sherds from one vessel of probable Early Bronze Age date, possibly Beaker to judge from the traces of fingernail decoration. The other sherds are all flint-tempered and, although not closely datable, are likely to be Late Bronze Age to Iron Age date (Doherty 2009). The struck flint assemblage is predominantly Mesolithic/Early Neolithic in date (see Table 4.2).

Fig 2.2 Plan and sections of Trench 4 features

Fig 2.3 Photograph of ditch [4/006] (1.0m vertical scale; 2.0m horizontal scale)

The mixed nature of the finds suggested that deposit [22] was the result of colluvium/hillwash. This was confirmed by micromorphological assessment, which indicated that deposits [21] and [22] were the result of erosion and colluvial burial (see below).

Deposit [22] overlay deposit [23], the upper unit of the underlying head deposit. A significant scatter of struck flint, predominantly Mesolithic though also containing some TUP and Neolithic material and associated burnt flint, emerged during the excavation of the

Fig 2.4 Plan and sections of features in Trench 6

Fig 2.5 Photograph of pit [6/006] (0.5m vertical scale; 2.0m horizontal scale)

upper 0.10m of deposit [23]. The horizontal disposition of the material (Fig 2.6) suggested a high likelihood that the material was minimally disturbed, in primary context, and that some of the material may have been *in situ*. This observation was confirmed later by further excavation and subsequent refitting (Fig 2.7). The pattern that was revealed indicated two scatters of lithic material: one larger and more diffuse, of Mesolithic character (centred on GTP1; Figs 2.8 and 2.9); the other smaller and tightly focused to the south, and exclusively TUP in terms of technology (in EA1; see Figs 2.10 and 2.11). GTP1 was extended by 2.0m to the east during excavation to allow the full extent of the scatter to be established. Six monolith samples were taken to assess for the presence of a buried land surface at the level of the artefact concentration.

Geoarchaeological investigations suggest that the scatter in GTP1 sat at the boundary between Holocene colluvium, which contained late prehistoric flintwork, and largely sterile Pleistocene brickearth. The boundary between each was impossible to isolate through field observation because of the similarity of depositional environment. The brickearth formed the most recent phase of a deep sequence of Pleistocene sedimentation with up to 3.5m of periglacial head deposits overlying organic-rich silts and other fluvial facies. It was also noted that these deposits might relate to an earlier interglacial phase (possible Stage 5) and would be the first noted occurrence of this phase anywhere in the Darent valley.

Approximately 5.0m of the initial evaluation Trench 6 was also re-excavated. Feature [6/006] was re-examined and a further sample taken, which produced charred hazelnut (*Corylus avellana*) shell and charcoal. Although the fill [6/07] could be identified, the lower sides and base of the cut were unclear, suggesting the feature had been disturbed by animal burrows or tree roots.

During the mechanical excavation of GTP7, a small circular feature, [24], measuring 0.20m in diameter and 0.80m

in depth was recorded. The fill, [25], contained a significant quantity of charcoal but no other material to elucidate its function further.

STAGE 3: TEST PIT SURVEY AND WATCHING BRIEF

The final stage of work on the site comprised a test pit survey, to assess the lithic material present within the topsoil before the reduction of the new car park area, and a watching brief on all the associated groundworks (see Fig 1.3). The topsoil from the test pits (TP1–10) produced some 1158 pieces of flint, together with a significant quantity of fire-cracked flint and a small amount of pottery; no other archaeological features were identified in the test pits. Scanning of the topsoil derived from ground reduction produced a further 300 pieces of flint (see Table 4.4).

The watching brief on the reduction of the new car park area identified an *in situ* scatter of TUP long blade material from a discrete area, recorded as EA1, [4], immediately to the south of the GTP1 Mesolithic scatter (see Fig 1.3). The extent of the initial truncation of the EA1 area by machine stripping prior to hand excavation was unclear.

2.3 THE OBSERVED RELATIONSHIP OF THE LITHIC SCATTERS

As described above, the head deposit that contained the *in situ* Terminal Upper Palaeolithic (TUP) and Mesolithic lithic scatters was encountered during the stage-one evaluation (Trench 6), through geoarchaeological test pitting (GTP1) and the watching brief (EA1). In each of these interventions the head deposit was excavated using different techniques and methodologies, influencing artefact recovery and presenting challenges when interpreting the stratigraphic relationship of the two *in situ* scatters.

The head deposits in Trench 6 ([6/003] and [6/008]) were removed by machine, resulting in the recovery of only a small number of artefacts, but indicating that the head deposit increased in depth towards the south. In the adjacent GTP1, the head deposit [23] (and [26] probably the same deposit differentiated by more frequent gravel inclusions) was comprehensively excavated by hand in seven *c* 10mm spits, with spoil sieved through a 10 mm² mesh. Most finds were allocated to a 1m square on a lettered grid, but where the scatter was considered to be entirely *in situ* flint locations were recorded in three dimensions: these finds are presented in the tables as spit '3a' although their precise location in

Fig 2.6 Plan of EA1, GTP1 and Trench 6 showing excavated features and flint scatter

relation to the spits is unclear. In the watching brief (EA1) the main concentration of TUP lithics, including long blades, was identified immediately south of GTP1 during removal of a small area of the head deposit, [4], by machine; the majority of this deposit was below the impact level and is preserved *in situ* (Fig 2.10). A $c 3.0 \times c 4.5$ m area centred on the main artefact concentration was hand-excavated and the location of all flints was recorded in three dimensions and on hand plans (Fig 2.11).

In the watching brief area the head deposit was truncated and any flints in the top of this deposit will have been lost.

Analysis of the lithic assemblage (see below) has revealed that the two lithic scatters contained within the head deposit are both likely to be *in situ* or at least minimally disturbed, but technologically the scatters are very different. One involves the production and use of classic TUP long blades, while the second includes the production of small narrow blades from

Fig 2.7 Plot of 3D recorded flint scatter showing refitting groups (solid line indicates refits; points without lines indicate non-refitting, related flints)

Fig 2.8 Photograph of GTP1, [23], spit 2, with flint scatter in situ (0.2m scale bar)

Fig 2.9 Photograph of GTP1, [23], spit 5, with flint scatter in situ (0.2m scale bar, nearer; 0.1m scale bar, further)

single-platform cores and microliths, the latter indicated by the presence of microburins, traits characteristic of Mesolithic assemblages. The contemporaneity or otherwise of these scatters required careful consideration as microliths are found in some long blade assemblages and the scatters are not completely spatially or stratigraphically separate. Indeed, the densest concentrations of each scatter are less than 3.0m apart and knapping refits occur between the long blade scatter in EA1, [4], and flints from GTP1, [23], spits 3 and 4 (Fig 2.7); the latter also yielded blade refits to single-platform blade cores considered to be Early Mesolithic.

The scatter of Mesolithic flintwork in GTP1, however, did not extend into EA1 in the same manner. In EA1 some Mesolithic flint was noted in [3] (which was mostly lost to machining), which lay above the main TUP scatter in [4], with the notable exception of one microburin which might have worked down through the soil profile since it is small enough to have been moved by worm or root action. Moreover, the upper three spits of GTP1, [23], contained a considerable number of small uncorticated flakes probably of Neolithic date, yet only six of these intrusive flakes were

present in EA1, [4]. This indicates a potentially complex stratigraphic relationship between these two adjacent areas, with TUP–Neolithic stratigraphy compacted or admixed in GTP1 (possibly owing to some vertical movement as indicated by soil micromorphology, but possibly also in part to animal disturbance), but clearly defined (although truncated by machining) in EA1 a few metres to the south. This relationship may be explained by the presence of deeper head deposits in EA1 perhaps indicating different rates of deposit accumulation between the two scatters (see Fig 4.1).

Fig 2.10 Photograph of EA1, [4], *in situ* flint scatter

Fig 2.11 Photograph of EAI flint scatter during excavation

CHAPTER 3 GEOARCHAEOLOGICAL AND PALAEOENVIRONMENTAL CONTEXT

3.1 SEDIMENTARY SEQUENCE

Martin Bates and Matt Pope

In order to contextualise the archaeological horizons identified, and to determine if any archaeological horizons lay more deeply buried seven geoarchaeological test pits were excavated at the site. They enabled the development of a Pleistocene sedimentary model for the locale, framing both the context of the Terminal Upper Palaeolithic (TUP) and Mesolithic flintwork, as well as providing an understanding of the Pleistocene development of the valley sedimentation. The test pits measured 2.0 × 2.5m in extent and were each excavated to a depth in excess of 3.5m, extending where possible to maximum reach of the machine. The pits were excavated using a toothless bucket and were dug in 250mm spits unless a stratigraphic boundary or lithological change was encountered. Observations of lithology, colour and structure were made for each stratigraphic unit. Sediment samples were sifted in order to determine the presence of stone artefacts for each 250mm spit of the Pleistocene sediments. Further 40 litre palaeoenvironmental bulk samples were taken for later assessment of potential for suitable sediments as well as grab samples for micropalaeontology, molluscs and pollen assessment.

The sequences excavated in the test pits across the site revealed evidence for a range of different sediment types with grain sizes varying from clays to gravels. The detailed sequences present in six of the test pits are tabulated below and inferred environments of deposition are stated (Tables 3.1–3.5; for locations see Fig 1.3).

Study of the test pit sequences reveals that seven broad lithological packages of sediment were identified from I (base) to VII (most recent):

- I. This body of sediment was present only in GTP3, where a yellowish-red medium sand was encountered at the base of the test pit, and GTP5, where sands and gravels were present at the base of the sequence. This body of sediment was likely to have been deposited by high-energy fluvial systems, perhaps under braided channel conditions, during a climatic cold phase.
- II. This body of sediment was encountered only in GTP6, where it consisted of a lower sequence of organic-rich silts (IIa) and an overlying gravel (IIb). These deposits were likely to have been deposited in fluvial or aquatic environments of low (IIa) to high (IIb) energy. The deposit contained biological material from organic silts which indicate that aquatic environments certainly contributed to their formation. Field observations suggested that perhaps deposition of IIa under temperate conditions in a flood plain or channel is likely, while IIb may have been deposited under more active conditions, perhaps in cooler climates. These deposits were likely to rest on deposits of phase I or might have reflected a lateral equivalent of it.
- III. This body of sediment consisted of bedded sands and sandy silts that, in places, contained gravel bands. These deposits occurred in GTP2–4, where appreciable thicknesses of sands were present. Very thin elements of these deposits also existed in GTP5–7. These sediments appeared to be thickest upslope and thinner towards the modern river. At the base of these sediments fossiliferous deposits were present in GTP4. Molluscs from these deposits include both grassland faunas (*Pupilla muscorum*) and those indicative of damp or muddy ground conditions (Succinidae). The environment of deposition of these sediments appeared to be slope-related and deposition, under cool climate conditions where there was washing of sediment downslope, probably occurred seasonally.
- IV. This body of sediment was somewhat variable, ranging from chalk pellet gravels with occasional flint clasts to deposits rich in angular flint clasts set in a chalky matrix with chalk pellets. They could also be interbedded with sandy deposits similar to those of phase III. These deposits were found in all test pits. A slope-derived origin for these sediments was likely with deposition expected to have occurred under cold climate solifluction conditions, probably seasonally during the spring/summer. Again these deposits appeared thicker upslope.
- V. This body of sediments was a predominantly fine-grained silt/sand with some clay. These sediments were found in all test pits. It was likely to be a slope-wash deposit laid down during cool to cold climate conditions.
- VI. This body of sediments was predominantly fine-grained colluvial silt/sand with some clay; in many respects these deposits were similar to those of phase V, except that they

Depth below ground surface (m)	Lithology	Sample no; depth below ground surface (m)	Inferred environment of deposition
0.00–0.40	10YR 4/3 dark brown silt with very common angular flint clasts (<100mm); structureless and compact; common ceramic building material fragments, occasional flint flakes (sharp and fresh) ---abrupt contact---		topsoil
0.40–0.63	7.5YR 4/6 strong brown sandy very fine silt; common large to very large and angular flint clasts (<200mm); dense and compact, structureless ---dipping/sharp contact---		solution hollow fill
0.63–0.84	10YR 6/6 brownish-yellow very fine sand with some angular flint clasts; networks of fine dendritic root canals filled with carbonate precipitate ---grades downwards---		cold-climate solifluction deposits
0.84–1.60	10YR 6/6 brownish-yellow bedded chalky pellet gravels and very fine silty sand beds (silty sands contain dendritic root patches similar to above); beds are approximately 100mm thick and dip downslope with a wavy pattern; common large (<150mm) angular flint clasts throughout unit; generally loose and unconsolidated ---diffuse contact---	<GTP2/1>; 1.05 (O) <GTP2/2>; 1.30 (O) <GTP2/3>; 0.90–1.0 (bucket)	cold-climate solifluction deposits
1.60–1.75	as above but dense concentration of flint clasts within chalky pellet gravel matrix ---diffuse contact---		cold-climate solifluction deposits
1.75–2.00	10YR 4/6 dark yellowish-brown very fine sand and silt; bedded with thin discontinuous seams of silt and sand; occasional chalky pellet bands; relatively loose and unconsolidated ---abrupt contact---	<GTP2/4>; 1.80 (O) <GTP2/5>; 2.0 (O)	cold-climate colluvial slope-wash deposits
2.00–2.75	10YR 4/6 dark yellowish-brown silt and fine sand with occasional patches of precipitate-filled root canals ---sharp contact---	<GTP2/6>; 2.70 (O)	cold-climate colluvial slope-wash deposits
2.75–2.80	10YR 4/6 dark yellowish-brown chalky pellet gravel with large angular flints and some iron staining; soft and loose ---sharp contact---	<GTP2/7>; 2.80 (bucket)	cold-climate solifluction deposits
2.80–3.90	10YR 4/6 dark yellowish-brown fine silty sand and chalky pellets; well bedded and unconsolidated ---sharp contact---	<GTP2/8>; 3.70 (O)	cold-climate colluvial slope-wash deposits
3.90–	10YR 6/4 light yellowish-brown chalky pellet gravel; clast-supported with very little silt matrix; clasts are 2–4mm, sub-rounded and rolled, possibly bedded ---base of test pit 4.10m---		cold-climate solifluction deposits Pleistocene sediments not bottomed

CBM = ceramic building material; O = ostracod

Table 3.1 GTP2 Descriptions and inferred environment (colour codes refer to Munsell 1992)

appeared more compact in places and contained more abundant angular gravel. Differentiating sediments of phases V and VI was difficult in most instances as little physical evidence for a hiatus in sedimentation existed between the two groups. These sediments were found in all test pits. It was likely to be a slope-wash deposit laid down during mild climate conditions. It was at the

boundary between phases V and VI where Mesolithic flintwork was preserved as discrete scatters of primary context debitage.

VII. This was the modern topsoil.

The arrangement of sediments west to east across the site is shown in Fig 3.1 while an overview of observations from all

Depth below ground surface (m)	Lithology	Sample no; depth below ground surface (m)	Inferred environment of deposition
0.00–0.15	10YR 4/3 dark brown silt with very common angular flint clasts (<100mm); structureless and compact; common CBM fragments, occasional flint flakes (sharp and fresh) ---abrupt contact---		topsoil
0.15–0.30	10YR 4/3 brown silt with some sand; angular flint clasts (2–4cm) with occasional chalk clasts; loose and unconsolidated ---abrupt contact---		cold-climate colluvial slope-wash deposits
0.30–1.35	10YR 6/6 brownish-yellow very fine sandy silt becoming coarser sandy silt with depth; structureless and massive and slightly pliable; complex of dendritic roots in places filled with precipitate ---sharp contact---		cold-climate colluvial slope-wash deposits
1.35–1.45	thin seam of angular flint gravel with matrix as above ---abrupt contact---		cold-climate solifluction
1.45–3.00	10YR 4/6 dark yellowish-brown sand with silt and chalk pellets (<4mm) ---abrupt contact---	<GTP3/1>; 1.80 (O)	cold-climate colluvial slope-wash deposits
3.00–3.40	10YR 4/6 dark yellowish-brown very fine sand and silt becoming sandier with depth ---abrupt contact---	<GTP3/2>; 3.0 (O) <GTP3/3>; 3.30 (O)	cold-climate colluvial slope-wash deposits
3.40–3.80	2.5Y 7/3 pale yellow silt, very well bedded; moderately cohesive and pliable; variable in colour ---sharp contact---	<GTP3/4>; 3.60 (O)	low-energy flood-plain fines in interglacial (?)
3.80–	5YR 5/6 yellowish-red medium to coarse sand; soft and unconsolidated ---4.00m base of test pit---		high-energy fluvial system Pleistocene sediments not bottomed

CBM = ceramic building material; O = ostracod

Table 3.2 GTP3 Descriptions and inferred environment (colour codes refer to Munsell 1992)

Depth below ground surface (m)	Lithology	Sample no; depth below ground surface (m)	Inferred environment of deposition
0.00–0.25	10YR 4/3 dark brown silt with very common angular flint clasts (<100mm); structureless and compact; common CBM fragments, occasional flint flakes (sharp and fresh) ---abrupt contact---		topsoil
0.25–0.70	10YR 4/3 brown silt with some sand and clay; structureless and massive; occasional rare flint clasts (<0.50mm); dense and compact ---abrupt contact---		Colluvial slope-wash deposits
0.70–0.90	7.5YR 4/6 strong brown silt with very common angular flint clasts (3→100mm); clast-supported in places; dense and compact ---abrupt contact---		cold-climate colluvial slope wash deposits
0.90–3.00	10YR 6/6 brownish-yellow silt; very loose and friable with common chalk pellets and flint clasts (<10mm); occasional very large flint cobbles (<200mm); dense and structureless ---abrupt contact---		cold-climate solifluction
3.00–3.20	10YR 6/4 light yellowish-brown sandy silt to silty sand; very well bedded in places with occasional white carbonate flecks; soft and unconsolidated ---diffuse contact---	<GTP4/1>; 3.10 (O)	cold-climate colluvial slope-wash deposits
3.20–3.60	2.5Y 6/3 yellowish-brown silty fine sand with molluscs and chalk pellets; some red staining in places ---sharp contact---	<GTP4/2>; 3.20 (O)	cold-climate colluvial slope-wash deposits
3.60–4.20	10YR 6/6 brownish-yellow chalk pellet gravel with flint clasts; silty matrix; soft and pliable; locally bedded; contains molluscs in places including <i>Pupilla muscorum</i> and ? <i>Succinea</i>	<GTP4/3>; 4.10 (bucket)	cold-climate colluvial slope-wash deposits; Pleistocene not bottomed

CBM = ceramic building material; O = ostracod

Table 3.3 GTP4 Descriptions and inferred environment (colour codes refer to Munsell 1992)

Depth below ground surface (metres)	Lithology	Sample no; depth below ground surface (m)	Inferred environment of deposition
0.00–0.40	10YR 3/2 dark greyish-brown silt with common flint clasts ---abrupt contact---		topsoil
0.40–0.72	10YR 5/6 yellowish-brown slightly sandy silt; very common red brick fragments (<50mm) and common flint clasts (<100mm) (subangular); loose and unconsolidated ---abrupt contact---		colluvial slope-wash deposits
0.72–1.20	10YR 5/6 yellowish-brown sandy silt to silty sand; occasional flint clasts (<100mm); clasts are sub-angular; flint flakes are present; structureless and massive ---abrupt contact---		cold-climate colluvial slope-wash deposits
1.20–2.20	7.5YR 4/6 strong brown sandy clay-silt; structures and massive at top; occasional patches of angular flint clasts; sand in matrix becomes slightly coarser with depth; no clear structure; no flints below top 200mm ---abrupt contact---		cold-climate colluvial slope-wash deposits
2.20–2.60	10YR 6/6 brownish-yellow chalk pellet gravel (pellets <10mm); pellets are sub-angular in shape; matrix supported with sandy silt matrix; occasional angular flint clasts; moderately cohesive and possibly bedded ---abrupt contact---		cold-climate solifluction
2.60–2.75	7.5YR 5/4 brown fine silty sand; very clean with no chalk clasts or flints ---sharp contact---	<GTP5/1>, 2.6 (O)	cold-climate colluvial slope-wash deposits
2.75–2.90	10YR 6/4 light yellowish-brown sand with fine gravel ---sharp contact---	<GTP5/2>, 2.8 (O)	cold-climate fluvial
2.90–	2.5Y 6/4 light yellowish-brown chalky gravel; very loose and unconsolidated, clasts poorly sorted (2→100mm) ---base of test pit 3.20m---	<GTP5/3>, 3.1 (O)	cold-climate solifluction Pleistocene not bottomed

O = ostracod

Table 3.4 GTP5 Descriptions and inferred environment (colour codes refer to Munsell 1992)

recorded test pits is shown in three dimensions in Fig 3.2.

They demonstrate the thickening of colluvial sediments (VI) and brickearth (V) towards the valley bottom. Beneath these, Pleistocene head deposits generally (IV, III) attenuate towards the valley centre where they overlie fluvial deposits containing the interglacial organics horizons (I, II).

The sedimentary sequence can be interpreted as representing four major climate cycles commencing with the sands and gravels of phase I (cold), temperate deposits of phase II, cold series of deposits (phases III–V) and a subsequent warm event (phases VI and VII). Assuming that the sequences are continuous, or at least without major gaps in sedimentation being present in the sequence (ie, longer than a single glacial/interglacial cycle), and adopting a count from the top approach, then phases VI and VII belong to the Holocene, phases III–V to the last cold stage or Devensian, phase II to the last interglacial

(Ipswichian) and phase I to the penultimate cold stage. The ascription of the two most recent phases to the Holocene is supported by the presence of the flint artefacts. Evidence to support the dating of the older sequences is more problematic. The superficial similarity of the phase III sediments to sediments preserved beneath the Roman villa at Ebbsfleet, dated to the last cold stage (Wenban-Smith et al in prep), and in the Darent valley (Wenban-Smith & Bates 2011) may indicate age equivalence, but similar depositional conditions do not necessarily indicate similar timing of deposition.

Further support for a relatively recent date for the sequences comes from the position of the sequence adjacent to the modern river (ie, the deposits form the lowest and by implication, youngest deposits in the valley). However, local British Geological Survey (BGS) mapping immediately downstream of the site shows sediments mapped as Crayford Silt Member and Lynch Hill

Depth below ground surface (m)	Lithology	Sample no; depth below ground surface (m)	Inferred environment of deposition
0.00–0.20	topsoil ---abrupt contact---		topsoil
0.20–0.80	10YR 4/6 dark yellowish-brown silt with some sand; scattered angular flint clasts (<100mm); occasional flakes of flint, red CBM fragments and charcoal ---abrupt contact---		colluvial slope-wash deposits
0.80–1.60	7.5YR 5/6 strong brown silty sand with diffuse patches of angular flint cobbles (<80mm) – probably remnant beds; dips down slope where noted; soft and structureless ---abrupt contact---		cold-climate colluvial slope-wash deposits
1.60–1.80	10YR 6/6 brownish-yellow chalk pellets and silty matrix; soft and unconsolidated ---abrupt contact---		cold-climate solifluction
1.80–2.25	10YR 5/8 yellowish-brown medium to fine sand; soft and contains white chalk pellets in places; possible remnant bedding ---abrupt contact---		cold-climate colluvial slope-wash deposits
2.25–2.35	10YR 6/6 brownish-yellow chalky pellet gravel with silty matrix ---abrupt contact---		cold-climate solifluction
2.35–2.80	10YR 5/8 yellowish-brown medium fine sand ---abrupt contact---		cold-climate colluvial slope-wash deposits
2.80–3.60	10YR 6/6 brownish-yellow chalk pellet gravel with angular flint clasts (<200mm); grades downwards into chalk and flint rubble with beds of sand; towards base becomes chalk pellet gravel again ---diffuse contact---		cold-climate solifluction
3.60–3.70	10YR 6/4 light yellowish-brown medium sand; soft and unconsolidated ---abrupt contact---		?high-energy river deposit
3.70–3.90	reddish-brown flint gravels ---abrupt contact---		high-energy river deposit
3.90–	2.5Y 5/3 light olive-brown silt (light at top becoming darker with depth); some iron staining; molluscs, plant fragments all visible ---base of test pit 4.10m---		temperate flood-plain fines or channel fills Pleistocene not bottomed

CBM = ceramic building material

Table 3.5 GTP6 Descriptions and inferred environment (colour codes refer to Munsell 1992)

Gravel Member at elevations below (Crayford Silt Member) and equivalent to (Lynch Hill Gravel Member) the sediments at the site. Current understanding of these deposits would place the Crayford Silt within the penultimate interglacial while the age of the Lynch Hill is even older. Some difficulties do exist, however, in using these terms within the context of a Thames tributary valley far from the confluence with the Thames, and so the derivation of ages from these correlations should be treated with care. It is worth bearing in mind that similar issues have been identified in the much better-dated sequences in the Darent valley where BGS mapping and terrace ascription has been found to be inaccurate (Wenban-Smith & Bates 2011).

The following key points are therefore noted.

- Head deposits comprise Holocene colluvium overlying Pleistocene brickearth. The preserved scatters of Mesolithic flintwork originate from the junction between the Pleistocene and Holocene colluvial units although a clear lithological boundary indicative of an actual land surface was impossible to trace in the field.
- The underlying Pleistocene deposits are fossiliferous in places and a range of biological material is present, including both organic material and shell.
- Organic material at the base of the sequences may date back to the penultimate interglacial.

Fig 3.1 Sediments in GTPs shown west to east

3.2 PALAEOENVIRONMENTAL EVIDENCE

INTRODUCTION

Palaeoenvironmental characterisation of the deeper sedimentary sequence and archaeological levels was derived from two main sources: micropalaeontological analysis of samples of the sediment; and preserved plant remains and other indicators within the bulk samples taken from the site.

MICROFOSSILS

John E Whittaker

Fourteen samples were analysed in order to reconstruct the palaeoenvironment from the contained organic remains (especially the freshwater ostracods) and in order to support or refute the sedimentological interpretation that the deposits logged beneath the site were predominantly cold-climate solifluction or colluvial slope-wash deposits. It was also hoped analysis might throw light on the suggestion of possible fluvial interglacial deposits at the base of the Pleistocene succession.

Six samples from a 2.65m section in GTP2 (interval 1.05–3.70m) were examined for microfossils (Table 3.6). Samples <GTP2/1> and <GTP2/2> were thought to be cold-climate solifluction deposits and <GTP2/3>, <GTP2/4>, <GTP2/6> and <GTP2/8> to be cold-climate colluvial

Fig 3.2 Sedimentary record from GTP1–7 shown in three dimensions

slope-wash deposits. Sample <GTP2/2> (depth 1.3m) was completely barren of organic remains, being made up merely of chalk debris. Samples <GTP2/1>, <GTP2/3>, <GTP2/4>, <GTP2/6> and <GTP2/8>, however, contained rhizoliths; this was particularly so in the case of <GTP2/6>, where the coarse fraction of the residue (>250 microns) was made up almost entirely of these tubes. Earthworm granules occurred in <GTP2/4>, <GTP2/6> and <GTP2/8> (below 2.0m). Molluscs occurred in only two samples (<GTP2/4> and <GTP2/8>), but those from the latter were merely scraps. Freshwater ostracods occurred in only one sample (<GTP2/8>, depth 3.70m) and even here they were not common though the presence of the cold/cool indicator *Limnocytherina sanctipatricii* (see Whittaker & Horne 2009) was significant. Nevertheless, the presence of tubes (externally with a calcareous crust or sand/silt grains, internally with impressions of stems and rootlets), found commonly in GTP2 and GTP3 (but not in GTP4 and GTP6), must also have some climatic and ecological significance. These are what Candy (2005, 16) calls rhizoliths, and they reflect:

the drying out of the environment and the formation of fully terrestrial conditions either as a result of the initiation of a drier climate ... or because of sediment infilling/lateral migrations of the channel system. Rhizoliths, along with other calcrete types, are typically used to indicate the existence of a dry climate, either a semi-arid climate or a humid climate with pronounced dry months ... As rhizoliths may form over relatively short periods of time, ie the lifetime of the root, these features may not represent a long-lived

period of land surface stability and soil development but could reflect a relatively short-lived land surface.

The rhizoliths, therefore, may manifest the typical aridity that accompanies periglacial tundra-like conditions. Moreover, according to Wetternich et al (2005), who have made a study of Siberian permafrost sequences and their ostracod faunas going back 60,000 years ago, the presence of *Limnocytherina sanctipatricii* itself also suggests arid climatic conditions with higher evaporation rates than at present.

Four samples were examined from a 1.90m section in GTP3 (interval 1.80–3.70m) (Table 3.7). According to the sedimentological analysis <GTP3/1>–<GTP3/3> were all thought to be cold-climate slope-wash deposits, whereas the lowest sample, <GTP3/4> (depth 3.70m), was interpreted as low-energy flood-plain fines in a possible interglacial sequence. There was very little microfossil evidence to support this differentiation, however. All the samples contained rhizoliths; in <GTP3/4>, the coarse residue (>250 microns) was again made up almost entirely of these tubes. Molluscs were present but not common. Freshwater ostracods occurred in <GTP3/2>–<GTP3/4> but the faunas were poor and in no way diagnostic (except perhaps for the fact that cold/cool indicators were missing). Earthworm granules were totally absent, which may indicate some ecological dissimilarity with GTP2 and GTP4, in which they did occur.

Three samples were examined from a 1.0m section in GTP4 (interval 3.10–4.10m) (Table 3.8). All these samples were said to be cold-climate colluvial slope-wash deposits. All contained molluscs and the faunas were the best seen in the Lullingstone sequence. A superficial analysis identified *Pupilla muscorum* (very common and usually with a great

Organic remains						
Sample no	<GTP2/1>	<GTP2/2>	<GTP2/3>	<GTP2/4>	<GTP2/6>	<GTP2/8>
Depth (m)	1.05	1.30	1.80	2.00	2.70	3.70
Rhizoliths	x		x	x	x	x
Molluscs				x		x
Earthworm granules				x	x	x
Freshwater ostracods						x
Ecology Cold-climate solifluction/colluvial slope-wash deposits						
Freshwater ostracods						
Sample no	<GTP2/1>	<GTP2/2>	<GTP2/3>	<GTP2/4>	<GTP2/6>	<GTP2/8>
Depth (m)	1.05	1.30	1.80	2.00	2.70	3.70
<i>Limnocytherina sanctipatricii</i> *						x*
<i>Candona neglecta</i>						x

x = present (several specimens); * cool/cold indicator species

Table 3.6 Microfossils from GTP2

Organic remains				
Sample no	<GTP3/1>	<GTP3/2>	<GTP3/3>	<GTP3/4>
Depth (m)	1.80	3.00	3.30	3.70
Rhizoliths	x	x	x	x
Molluscs		x		x
Freshwater ostracods		x	x	x
Ecology Solifluction/colluvial slope-wash deposits				
Freshwater ostracods				
Sample no	<GTP3/1>	<GTP3/2>	<GTP3/3>	<GTP3/4>
Depth (m)	1.80	3.00	3.30	3.70
<i>Candona neglecta</i>		xx	o	o
<i>Pseudocandona</i> sp (juveniles)		x		

o = one specimen; x = present (several specimens); xx = common

Table 3.7 Microfossils from GTP3

many whorls) and a flaring gastropod (?*Succinea*). Earthworm granules and slug plates were found in <GTP4/2> and <GTP4/3> but freshwater ostracods occurred only in <GTP4/2> (depth 3.20/3.30m) and were not diagnostic. It may be that the occurrence of common molluscs (of wet and damp places) with slug plates and earthworm granules, and the total lack of rhizoliths, indicates that this sequence represented generally wetter ground and that they were indeed colluvial slope-wash deposits.

Organic remains			
Sample no	<GTP4/1>	<GTP4/2>	<GTP4/3>
Depth (m)	3.10	3.20/3.30	4.10
Molluscs	x	x	x
Earthworm granules		x	x
Slug plates		x	x
Freshwater ostracods		x	
Ecology Colluvial slope-wash deposits			
Freshwater ostracods			
Sample no	<GTP4/1>	<GTP4/2>	<GTP4/3>
Depth (m)	3.10	3.20/3.30	4.10
<i>Candona neglecta</i>		x	
<i>Pseudocandona</i> sp (juveniles)		x	
<i>Ilyocypris bradyi</i>		x	

x = present (several specimens)

Table 3.8 Microfossils from GTP4

One sample, <GTP6/1>, was examined from GTP6 (depth 4.10m), a brown organic silt inferred to have been deposited in low-energy aquatic environments (Table 3.9). The sample contained plant debris, molluscs, earthworm granules, slug plates, insect remains and freshwater ostracods. Unfortunately the freshwater ostracods, although relatively abundant, were not very diagnostic. The lack of any cold/

cool indicators suggests milder conditions, but only one out of the 13 other samples from other contexts examined, which are undoubtedly cold-climate deposits, produced cool/cold indicators. It is unfortunate that the *Pseudocandona* was preserved only as small juveniles and *Candona neglecta* and the *Cyclocypris* can occur in almost any type of water body. Perhaps the only significant find, if it can be confirmed in any future study, was a large species of *Ilyocypris*, possibly *I. getica*. This can be confused with *I. biplicata* (wrongly synonymised with *I. gibba* by Meisch 2000), but if the identification of *I. getica* can be proven it would attest to this indeed being an interglacial deposit. *I. getica* is today considered a circum-Mediterranean species (ibid) with more scattered northerly occurrences (including south and southwest Britain) being 'best explained by their passive transport, most probably by migrating birds, towards the north'.

Organic remains	
Sample no	<GTP6/1>
Depth (m)	4.10
Plant debris	x
Molluscs	x
Earthworm granules	x
Slug plates	x
Insects	x
Freshwater ostracods	x
Ecology ?Interglacial channel deposit	
Freshwater ostracods	
Sample no	<GTP6/1>
Depth (m)	4.10
<i>Candona neglecta</i>	xx
<i>Pseudocandona</i> sp (juveniles)	xx
<i>Cyclocypris ovum/laevis</i>	xx
<i>Ilyocypris getica</i> *	x

x = present (several specimens); xx = common

* = species at the northern limit of its distribution

Table 3.9 Microfossils from GTP6

BULK SOIL SAMPLES

Dawn Mooney

Fifteen bulk soil samples were taken during the three stages of work carried out at the site in order to recover environmental remains such as charred plant macrofossils, wood charcoal, fauna and mollusca as well as to assist artefact recovery and identify material suitable for scientific dating. Bulk soil samples <1>–<3> were taken from prehistoric ditch and pit fills during the first-stage evaluation work at the site (Allott 2009a), and a further ten (<10>–<19>) were taken from pits and colluvial deposits containing Mesolithic flints during the second-stage evaluation

work (Allott 2009b). The remaining two samples were taken from EA1, [4], spits 2/3 and 4 during the watching brief work.

The provenance of the samples is detailed in Table 3.10. The environmental material retrieved from these samples was assessed for its potential to provide scientific dating evidence for deposits at the site. Following this assessment, a fragment of cattle/horse bone from [6/008], a fragment of hazelnut (*Corylus avellana*) shell from [4], spit 4 and a piece of oak charcoal from [4], spits 2/3 were submitted to the Scottish Universities Environmental Research Centre, East Kilbride (SUERC) for radiocarbon analysis in October 2013.

METHODOLOGY

The bulk soil samples were processed in their entirety in a flotation tank. The flots and residues were retained on 500µm and 250µm meshes respectively and air-dried prior to sorting. The residues were passed through graded sieves (8, 4 and 2mm) and each fraction sorted for environmental and artefact remains (Table 3.10). The flots were scanned under a stereozoom microscope at ×7–45 magnifications and an overview of their contents recorded (Table 3.11). Identifications of macrobotanical remains were made using modern comparative

material and reference texts (NIAB 2004; Cappers et al 2006; Jacomet 2006). Nomenclature used follows Stace (1997).

Charred wood remains were fractured along three planes (transverse, radial and tangential) according to standardised procedures (Gale & Cutler 2000). Specimens were viewed under a stereozoom microscope for initial grouping, and under an incident light microscope at magnifications up to ×400 to facilitate identification of the woody taxa present. Taxonomic identifications were assigned by comparing suites of anatomical characteristics visible with those documented in reference atlases (Hather 2000; Schoch et al 2004), and by comparison with modern reference material held at UCL Institute of Archaeology. Identifications have been given to species where possible, but genera, family or group names have been given where anatomical differences between taxa are not significant enough to permit satisfactory identification.

RESULTS OF ARCHAEOBOTANICAL ASSESSMENT

The bulk samples produced small assemblages of environmental remains including wood charcoal fragments (predominantly <4mm in size), charred plant macrofossils and molluscs. Occasional poorly preserved charred cereal grains were noted in

Bulk soil sample no	Context no	Spit no	Context/deposit type	Sample volume (l)	Sub-sample volume (l)	Charcoal (>4mm)	Weight (g)	Charcoal (<4mm)	Weight (g)	Charred botanicals	Weight (g)	Bone and teeth	Weight (g)	Marine molluscs	Weight (g)	Land snail shells	Weight (g)	Other (eg industrial residues, pot, CBM)
<1>	[4/008]		ditch fill	40	40		**		<1			*	<1	***	4			FCF */24g
<2>	[6/007]		pit fill	20	20	**	4	***	2	*	<1			*	<1			FCF */60g - flint */2g
<3>	[6/008]			10	10		*		<1			***	8	*	<1			FCF */10g
<10>	[25]		fill of small burnt pit	5	5		*		<1									
<11>	[23/5] E		scatter	40	40	**	4	***	4							*	<1	flint ***/6g - FCF **/52g
<12>	[23/5] E		scatter	10	10	*	<1	*	<1									flint **/4g - FCF */8g
<13>	[23/5] F		scatter	10	10			**	<1									
<14>	[6/007]		pit fill	20	20	*	2	**	4	* hazelnut shell frag	<2							flint **/2g - FCF */40g
<15>	[23/4] H		land surface	20	20			**	2									flint **/<2g - FCF */<2g
<16>	[23/4] I		land surface	10	10													flint **/4g - FCF */4g
<17>	[23/4] J		land surface	20	20		*		<1									flint **/4g - FCF */4g
<18>	[23/5] C&E		soil around flint nodule	10	10		*		<1									flint */<2g - FCF */1g
<19>	[25/5]		soil directly below flint nodule	2	2			**	2									
-	[4]	2+3	head deposit	20	20			**	<2							*	<2	flint **/18g - FCF */166g
-	[4]	4	head deposit	10	10		*		<2	* hazelnut shell frag	<2							flint ***/62g - FCF */<2g

CBM = ceramic building material; FCF = fire-cracked flint

Table 3.10 Residue quantification (* = 1–10, ** = 11–50, *** = 51–250, **** = >250) and weights in grams

Bulk soil sample no	Context no	Spit no	Flot volume (ml)	Uncharred (%)	Sediment (%)	Seeds (uncharred)	Insects (modern)	Charcoal (>4mm)	Charcoal (<4mm)	Charcoal (<2mm)	Crop seeds (charred)	Identifications	Preservation	Other botanical (charred)	Identifications	Preservation	Bone	Land snail shells
<1>	[4/008]	-	15	20	20					**								***
<2>	[6/007]	-	<5	30	40			*(1)		**								**
<3>	[6/008]	-	5	80	10				*	**	*	Cerealia	+				* very small frags	**
<10>	[25]	-	<2	60				I	*	**								*
<11>	[23/5] E	-	50	80	5	*	*	*	*	***	I	Cerealia indet	+	I	indet charred plant remains	+		**
<12>	[23/5] E	-	24	95		*			*	**								*
<13>	[23/5] F	-	30	70				*	*	**								**
<14>	[6/007]	-	<2	80	5		*		*	*				*	(2) indet frags	+		**
<15>	[23/4] H	-	70	90				*	**	**								**
<16>	[23/4] I	-	20	85	10				*	**								**
<17>	[23/4] J	-	60	80	10			*	**	**				I	<i>Corylus avellana</i> frag	+		**
<18>	[23/5] C&E	-	10	95						**								*
<19>	[23/5]	-	<2	98														*
-	[4]	2+3	15	65	30					*								**
-	[4]	4	5	85	10					*								**

Table 3.11 Flot quantification (* = 1–10, ** = 11–50, *** = 51–250, **** = >250) and preservation (+ = poor, ++ = moderate, +++ = good)

the flots of <3> and <11>, and a single charred vetch/tare (*Vicia/Lathyrus*) seed was collected from the residue of <2>. Charcoal fragments were moderately well preserved and have been identified as oak (*Quercus* sp) and possible hazel/alder (cf *Corylus/Alnus* sp). Charred fragments of hazelnut shells were noted in <14> and <17>, and from [4], spit 4. Molluscs were present in relatively small quantities in each bulk sample. Small quantities of worked flint and fire-cracked flint were recovered from several of the samples, but no other artefacts were recovered.

RESULTS OF RADIOCARBON DATING

The radiocarbon results (Table 3.12) are quoted in accordance with the international standard known as the Trondheim convention (Stuiver & Kra 1986). They are conventional radiocarbon ages (Stuiver & Polach 1977). 2-Sigma calibrated dates, obtained using IntCal04 (Reimer et al 2004), are also given at the 95.4% and 68.2% confidence levels. The sample

of cattle/horse bone submitted from [6/008] did not return a result, as it was found to contain insufficient carbon for measurements to be conducted. The hazelnut shell fragment from [4], spit 4 returned a radiocarbon date of 7313±27 BP, equivalent to 6231–6084 cal BC. The oak charcoal submitted from EA1, [4], spits 2 and 3 returned a date of 3729±29 BP, equivalent to 2205–2033 cal BC.

DISCUSSION

Environmental remains were scarce in the bulk samples. The single cereal grain in <11> provides evidence for disturbance as it was found within a deposit containing Mesolithic flint. An animal burrow, noted during excavation, is the likely source of this contaminant. Hazelnut shell fragments in <17> are perhaps more likely to be contemporary with the worked flint assemblage, however, as no potential sources of contamination were observed during excavation.

Laboratory code	Sample ID	Material & context	δ13C (‰)	Radiocarbon age (BP)	Calibrated date (95.4% confidence)	Calibrated date (68.2% confidence)
SUERC-49677	ASE_DS_00190	charred hazelnut (cf <i>Corylus avellana</i>) shell from EA1, [4], spit 4	-25.1	7313±27	6231–6084 cal BC	6226–6101 cal BC
SUERC-49681	ASE_DS_00191	oak (<i>Quercus</i> sp) charcoal from EA1, [4], spits 2+3	-23	3729±29	2205–2033 cal BC	2197–2045 cal BC
n/a	ASE_DS_00192	cattle/horse bone fragment from [6/008]	-	sample failed		

Table 3.12 Results of radiocarbon dating

3.3 SOIL MICROMORPHOLOGY ASSESSMENT

Richard I Macphail

Six 130mm-long monoliths (<M1>–<M6>) from Trench 6 were assessed for information in relation to site formation processes. Standard descriptive and interpretative methods were employed (Hodgson 1997; Goldberg and Macphail 2006).

Brief descriptions and characterisation of the soil profile are given (Table 3.13 and Fig 3.3). They show an upper unit, [21] and [22], consistent with ploughsoil and colluvium. Considering the origin of the colluvium, the Soil Survey of England and Wales characterises local soil cover as being typical argillic brown earths (eg, Fyfield 4 soil association) formed in Mesozoic and Tertiary sand and loam at Lullingstone (Jarvis et al 1983; 1984); this soil type fits the descriptive findings from <M1>–<M6> of a deep, stoneless, coarse, loamy and sandy soil (Table 3.13). For example, the soil has a fine sandy silt loam to fine loamy sand texture and diagnostically has clay void and ped coatings (Jarvis et al 1984, 176–8, 379). Normally, an argillic brown earth has a topsoil enriched in organic matter/affected by agricultural activities (Ah/Ap), an upper subsoil clay-depleted horizon (Eb) and a lower subsoil clay-enriched horizon (Bt). It can be suggested that the profile at Trench 6 has lost its *in situ* upper Ah and Eb horizons through erosion, and instead a part-colluvial Ap horizon is now present as [21]/[22]. This horizon is anomalously stony and has clearly been influenced by the colluviation of chalky rendzinas and stagnogleyic palaeoargillic brown earths formed in plateau drift and Clay-with-Flints (Jarvis et al 1983). This ‘new’ ploughsoil is consistent with the archaeological interpretation to be of later prehistoric/recent origin.

Below this lay [23], from which came the bulk of the lithic material relating to TUP and Mesolithic occupation. An example of a microflake, rubefied fire-cracked flint and

fine fragments of charcoal were found apparently embedded within the soil matrix (Fig 3.3). This may be *in situ* Mesolithic material and is consistent with occupation evidence of localised burning, perhaps as habitation fires. Context [23] was also characterised by earthworm burrows and root channels originating from the prehistoric/modern stony Ap topsoil ([21]/[22]), and thus this could be the source of later prehistoric artefacts.

Towards the base of [23], slope-laid deposits predominated. Silt loam and fine loamy sand soils are unstable and were prone to erosion and colluviation even before arable agriculture affected the landscapes of Europe; for example, minor clearances could trigger downslope soil movement (Imeson et al 1980; Evans 1992; Goldberg and Macphail 2006, 193–202). At Peacock Farm, Bracknell, Surrey (Mesolithic and Neolithic) and at the A2/A282/M25 improvement at Dartford Crossing, Kent (Neolithic) fine loamy and fine sandy (argillic) soils similar to those at Lullingstone showed a history of erosion and colluvial burial, whereas the sandy soils at Star Carr, North Yorkshire developed colluvium associated with Mesolithic occupation itself. It can therefore be suggested that site formation in relationship to the TUP and Mesolithic finds at Lullingstone developed in a similar way. The assessment of the micromorphological analysis is consistent with burial and preservation of an ephemeral land surface as part of Late Pleistocene and Early Holocene slope processes.

3.4 GEOARCHAEOLOGICAL DISCUSSION

Matt Pope

The evidence obtained from the investigation of the stratigraphic sequences and the palaeoenvironmental material

Context no	Relative depth (m)	Sample no and depth (m)	Descriptive notes
[21]/[22]	49.52–49.49 (49.45)	<M1>	lowermost part of Ap horizon ([21]/[22]): dark brown (7.5YR3/2) moderately weak, very poorly humic, fine sandy silt loam – fine sandy loamy sand; massive; slightly stony with very small and small stones (0.5–10mm) – sub-angular flints (chalk present); many very fine roots; sharp, irregular boundary
[23]	49.49(49.45)–~48.60	<M1> <M2> <M3> (49.45–~49.15m)	Bt1 ([23]): brown to dark brown (7.5YR5/4–4/4) moderately weak fine sandy silt loam – fine sandy loamy sand; massive with underlying medium prismatic structure; very slightly stony with very small stones (including 5mm flake at 49.485m and rubefied [red 2.5YR5/8] 8mm-size fire-cracked flint at 49.45m); 1–2mm- and 4mm-size charcoal traces at ~49.40m and ~49.20m; many micropores; clay coatings present; few very fine roots; few 10–2-mm broad vertical brown to dark brown (7.5YR3/2–4/2) burrow fills; smooth diffuse boundary
[23]	49.49(49.45)–~48.60	<M4> <M5> <M6>	Bt(g)2 ([23]): brown to dark brown (7.5YR5/4–4/4) moderately weak fine sandy silt loam – fine sandy loamy sand, with very few fine yellowish-red mottles; massive with underlying medium prismatic structure; very slightly stony with very small stones (<3mm); abundant micropores; many clay void and ped coatings; rare very fine roots

Table 3.13 Soil monolith descriptions from Trench 6 (colour codes refer to Munsell 1992)

Fig 3.3 Photograph of soil monoliths for Trench 6 with interpretation labels (Ap = topsoil/ploughsoil; Fl = flake; Ch = charcoal; Rf = rubefied fire-cracked flint)

from the site is consistent with observations made in other locations in north Kent during the last decade, where complex sequences of sediments spanning much of the last cold stage (and earlier in places) are now known to mantle the valley sides (Wenban-Smith & Bates 2011; Wenban-Smith et al in prep). The evidence indicates that a fluvial sequence of sands and organic silts (belonging to either the end of MIS (marine isotope stage) 6 or MIS 5e) (phases I–II) was buried by a complex of cold-stage slope-wash deposits (where grassland cover and low-energy downslope processes dominate) (phases III–V). These deposits were subsequently overlain by Holocene colluvium (phase VI). The findings of this study contradict those published on the local BGS mapping.

The recognition that a major unconformity exists at the top of the Pleistocene sequence (top of phase V) is significant because this represents the land surface from the Late Pleistocene until it was buried by Holocene colluviation. Although the boundary between these two units is difficult to discern in the field and no obvious palaeosol has been developed at this interface, this fact should not be unsurprising given the similar derivation of the parent material for both Late Pleistocene and Early Holocene sediments and the slope processes of formation. The presence of this land

surface, therefore, has implications for the nature of archaeological material existing on this surface and its preservation, ie allowing for a possible palimpsest of archaeological remains spanning TUP, Mesolithic and potential Neolithic archaeology which might be anticipated on this surface. There are also implications for the identification of other similar, important horizons in the field.

The wider recognition that sedimentary sequences preserving long records of Pleistocene environmental change exist in the tributary valleys of northern Kent is important both for recording and understanding climate change but also for their potential to preserve palaeolithic archaeology. Sequences in the Darent valley (Wenban-Smith et al 2010) have been shown to contain archaeological remains in early Devensian contexts (although it is worth noting that the significance of these remains continues to be debated) and, along with similar sequences in the Ebbsfleet valley (Wenban-Smith et al in prep), they document potential locations in the landscape (away from our major river systems) where important archaeological remains may exist. Additionally such sequences document landscape response to environmental change beyond our major river systems – an important consideration when our templates for environmental change are driven by conclusions drawn from the major river systems.

In terms of discussing the significance of the TUP and Mesolithic flintwork, it is important to note that this material exists as part of an exceptionally long and important sedimentary sequence, potentially spanning MIS6, MIS 5e and through the last glaciation to the present day. The position of the lithic scatters, overlain by later colluvium at an apparent boundary with the underlying periglacial head, does not allow for both assemblages to be easily separated on stratigraphic grounds at the level observed in the geoarchaeological test pitting, although some vertical separation was observed during hand excavation in area EA1 between the TUP and Mesolithic lithic scatters. This is a feature observed in other boundaries at the interface between the Late Pleistocene and Early Holocene, for example at Three Ways Wharf, where both technologies existed in a geologically contemporaneous period (Lewis & Rackham 2011). This phenomenon may be due to the balance between relatively low rates of sediment accumulation, perhaps reflecting increasing vegetation on slopes, and the rapid speed of the change from Terminal Upper Palaeolithic to Early Mesolithic lithic traditions.

CHAPTER 4 THE STONE ARTEFACT ASSEMBLAGES

Hugo Anderson-Whymark

4.1 INTRODUCTION AND QUANTIFICATION

In total, 2284 flint artefacts and 349 pieces (2.2kg) of burnt unworked flint were recovered from the two phases of evaluation and a watching brief (Tables 4.1–4.4). The lithic assemblage comprises three main elements.

1. A Terminal Upper Palaeolithic (TUP) long blade assemblage that was recovered as an *in situ* scatter preserved within head deposits. A dense scatter c 0.8m in diameter was revealed during the watching brief (EA1, [4]) and this was surrounded by a lower-density artefact spread extending into the areas investigated by evaluation Trench 6 and GTP1 ([23]).
2. An *in situ* Mesolithic scatter preserved within the same head deposits as the TUP scatter, but confined to GTP1 ([23]) and a tree throw/pit ([6/006]) in the adjacent evaluation Trench 6, with the exception of a couple of flints.

3. An extensive spread of residual Neolithic and Bronze Age flintwork that was predominantly recovered from topsoil and subsoil, although some intrusive flints were present in the upper spits of GTP1 ([23]).

This report presents a detailed characterisation of the lithics recovered from the *in situ* TUP and Mesolithic scatters and offers interpretations of the activities undertaken. The residual Neolithic and Bronze Age lithics are of little regional significance and they are not considered in detail.

4.2 METHODOLOGY

The flint assemblage was recorded on to a Microsoft Access database using standard morphological and typological descriptions (Bamford 1985, 72–7; Healy 1988, 48–9; Bradley 1999, 211–27; Butler 2005). A blade is defined as a flake with

	Trench 1	Trench 2	Trench 3	Trench 4	Trench 6		Grand total				
	Topsoil [1]	Topsoil [1]	Topsoil [1]	Ditch [4/006] fill [4/008]	TUP head [3]	EM pit [6/006] fill [6/007]					
Artefact type											
Flake	1	2	1	10	1	11 (1)	27				
Blade					2	1	3				
Bladelet					1†	4	5				
Blade-like flake					1		1				
Irregular waste				1			1				
Sieved chips 4–10mm						3	3				
Sieved chips 2–4mm						19	19				
Crested blade						1	1				
Rejuvenation flake, tablet						(1)	1				
Denticulate (Middle–Late Bronze Age)				1			1				
Fragment of invasively retouched flake – ? Neolithic–Early Bronze Age knife				1			1				
Grand total	1	2	1	13	5	41	63				
				No	Wt (g)	No	Wt (g)	No	Wt (g)	No	Wt (g)
Burnt unworked flint				2	301.7	21	221.4	41	405.1	64	928.2
				No	%	No	%	No	%	No	%
Burnt flints*						2				2	4.9
Broken flints*				1		3		7		11	26.8
Retouched flints*				2						2	4.9

TUP = Terminal Upper Palaeolithic; EM = Early Mesolithic; * percentage excludes chips; † = intrusive Early Mesolithic flint; (0) = residual TUP flints

Table 4.1 The flint assemblage from the first-stage evaluation by trench, context and artefact type

Artefact type	Unstratified		Subsoil [21]	Subsoil/head transition [22]	GTP1 TUP and EM head [23]														[26] =[23]	GTP5 Unstratified	Grand total
				-	Spit 1	Spit 2	Spit 3	Spit 3a†	Spit 4	Spit 5	Spit 6	Spit 7									
	No	Wt (g)	No	Wt (g)	No	Wt (g)	No	Wt (g)	No	Wt (g)	No	Wt (g)	No	Wt (g)	No	Wt (g)	No	Wt (g)	No	Wt (g)	
Flake	5 (1)	2	97	4 (1)	67 (1) 82#	59 (2) 20#	50 (1) 6#	75 (5) 2#	67 (3) 1#	40	16	11	1	13	632						
Blade	5		5		5 (1)	6 (1)	10 (1)	24 (1)	7 (2)	4 (1)	1	4 (1)		1	80						
Bladelet	3		6		22	13	17 (2)#	36 (1)	8	13	2	7			130						
Blade-like flake			1		3	5	3	7	2	1	1				23						
Irregular waste	1		1		3	2	5	12	2	3	1	1			30						
Chip			28		9	14	12	67 (1)	22	8	9	1			171						
Sieved chips 4–10mm									47	48					95						
Sieved chips 2–4mm										174					174						
Microburin			1		2	1	2								6						
Crested blade					3		1	2 (1)	3	1 (1)					13						
Rejuvenation flake, tablet					1	1		2 (1)				1			6						
Single-platform blade core			1				2	1							4						
Opposed platform blade core								1	(1)						2						
Tested nodule/bashed lump			1		1	1		1							4						
Single-platform flake core					1			1							2						
Multi-platform flake core		1					1								2						
End scraper					1#										1						
Side scraper			1												1						
Other scraper							1#								1						
Piercer										2					2						
Serrated blade/flake						1#									1						
Truncated blade (proximal)						1									1						
Retouched flake							1	1	2						4						
Miscellaneous retouch							1								1						
Hammerstone											1				1						
Grand total	15	3	142	5	202	127	116	242	167	296	31	25	2	14	1387						
	No	Wt (g)	No	Wt (g)	No	Wt (g)	No	Wt (g)	No	Wt (g)	No	Wt (g)	No	Wt (g)	No	Wt (g)	No	Wt (g)	No	Wt (g)	
Burnt unworked flint								218	1068.4	8	10	47	62.3		273	1140.7					
Burnt flints*	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	
Broken flints*	4				3	2.6			2	1.0	4	3.5	1	1.0	4	2.3	5	5.1	2	3.0	
Retouched flints*					32	28.1	2		14	7.3	40	35.4	40	38.5	53	30.3	36	36.7	26	39.4	
					1	0.9			1	0.5	2	1.8	3	2.9	1	0.6	2	2.0	2	3.0	
												</									

TUP = Terminal Upper Palaeolithic; EM = Early Mesolithic; * percentage excludes chips; † = Plotted Finds 1–597; (0) = definitively TUP flints; # = intrusive probably Neolithic flints

Table 4.2 The flint assemblage from the second-stage evaluation by geoarchaeological test pit, context, spit and artefact type

	EM head [3]		TUP head [4]		Grand total	
Artefact type						
Flake	1†		78 {6}		85	
Blade	1†		38		39	
Bladelet			8		8	
Blade-like flake			4		4	
Irregular waste			5		5	
Chip			4		4	
Sieved chips 4–10mm			31		31	
Sieved chips 2–4mm			37		37	
Microburin			1†		1	
Crested blade			11		11	
Rejuvenation flake, core face/edge	1†				1	
Rejuvenation flake, tablet			5		5	
Rejuvenation flake, other			2		2	
Opposed-platform blade core	1†		4		5	
Bruised blade/flake			7		7	
Retouched flake			1		1	
Grand total	4		242		246	
	No	Wt (g)	No	Wt (g)	No	Wt (g)
Burnt unworked flint			12	130.3	12	130.3
	No	%	No	%	No	%
Burnt flints*			1	0.6	1	0.6
Broken flints*	3		81	47.6	84	48.3
Retouched flints*			1	0.6	1	0.6

TUP = Terminal Upper Palaeolithic; EM = Early Mesolithic; * percentage excludes chips; † = Mesolithic flints; {0} = intrusive probably Neolithic flints

Table 4.3 The flint assemblage from watching brief EA1 by context and artefact type

a length to breadth ratio of 2:1 or higher and a bladelet is a small blade less than 40mm in length; blade-like flakes exhibit traits of true blades, for example parallel sides, but do not achieve blade proportions. Chips are flakes with a maximum dimension of less than 10mm. Core typology follows Bradley (1999, 212), rather than the commonly adopted classification of Clark (Clark et al 1960), as the former is more informative for reduction strategies. Additional information was recorded on the condition of the artefacts including burning, breakage, the degree of edge damage and the degree of cortication. Unworked burnt flint was quantified by weight and number. A copy of the catalogue has been deposited with the archive.

Metrical and technological attribute analysis was undertaken on all assessable flints from EA1, [4] and GTP1, [23], spits 3–7, excluding any intrusive Neolithic flints. Metrical attributes were recorded following Saville (1980). Technological attributes recorded include butt type (see below), extent of dorsal cortex, termination type, flake type (see below), hammer mode (Onhuma & Bergman 1982), platform abrasion and the presence of dorsal blade scars.

Butt type (after Inizan et al 1992):

- cortical – completely covered by cortex
- plain – formed by one removal
- with more than one removal – more than one flake scar on striking platform
- faceted – a series of negative bulbs along the dorsal edge, forming part of flake scars truncated at the ventral edge by detachment of the flake
- linear – long slender butt
- punctiform – negligible butt
- other – any other butt type.

Artefact type	Topsoil [1] or subsoil [2]	Topsoil [1] test pits 1–9	Subsoil [2]	Unstratified	[30]	Total
Flake/blade/bladelet/blade-like flake/irregular waste/ core	63	288	29	196 (2)	2	580
Rejuvenation flake, tablet				1 (1)		2
Rod-shaped fabricator		1				1
End scraper				2		2
Side scraper				1		1
End and side scraper				1		1
Disc scraper				1		1
Total	63	289	29	205	2	588

(0) = definitively Terminal Upper Palaeolithic flints – these comprise a tablet rejuvenation and a flake in fresh condition and probably disturbed from an *in situ* context and a heavily edge-damaged residual medial blade segment from sieving of unstratified spoil

Table 4.4 The flint assemblage recovered from topsoil, subsoil or as unstratified finds during the watching brief. These artefacts were rapidly scanned for diagnostic debitage and tools; a detailed catalogue was not made

Flake type (after Harding 1990):

- preparation flake – dorsal surface is covered by in excess of 75% cortex
- side trimming flake – cortex remaining on one side of the flake
- distal trimming flake – cortex present on the distal end of the flake
- miscellaneous trimming flake – some cortex remaining but in none of the above positions
- ‘non-cortical flake’ – all non-cortical flakes
- rejuvenations – core face/edge rejuvenations, tablets, crests
- thinning flakes.

4.3 THE TERMINAL UPPER PALAEOOLITHIC LONG BLADE SCATTER (EA1, [4]; GTP1, [3]; TRENCH 6, [6/003])

INTRODUCTION

In total, 273 flints weighing 8.233kg are considered to belong to the long blade scatter (Table 4.5), a figure that excludes intrusive Mesolithic and Neolithic debitage (see Tables 4.1–4.4

for details). The vast majority of these flints (*c* 85%) were recovered from a discrete *in situ* scatter excavated during the watching brief as EA1, [4] (Fig 4.1). The remaining artefacts were predominantly recovered from a low-density artefact spread surrounding this scatter that extended into GTP1, [23], [26] and Trench 6, [6/003]. Only four flints were recovered as unstratified finds and two of these probably result from machine disturbance of the scatter. This indicates that the TUP scatter was comparatively localised.

CONDITION

The *in situ* flintwork is in fresh condition, indicating that the scatter was probably buried by sediment shortly after deposition. Small nicks are, however, present on the edges of a few flints, potentially indicating some trampling or artefact movement during formation of the scatter.

The vast majority of the flints in the long blade scatter exhibit a distinctive moderate creamy white cortication, but subtle differences are present between artefacts; in particular, the flints from core 1 (see below) are only very lightly corticated. In general, however, the cortication present on the long blades is distinctly different from the light white cortication present on the ‘Mesolithic’ scatter from GTP1 and the typically uncorticated intrusive Neolithic flakes of small

	Trench 6				GTP1						EAI		Watching brief			
	Head [6/003]		Pit 6, fill [6/007]‡		Unstratified‡		Head [23]		[26] = [23]		Head [4]		Unstratified ‡			
Artefact type	No	Wt (g)	No	Wt (g)	No	Wt (g)	No	Wt (g)	No	Wt (g)	No	Wt (g)	No	Wt (g)	Total No	Total Wt (g)
Flake	1	4.5	1	14.5	1	11.3	13	246.1			78	1533.8	1	7.4	95	1817.6
Blade	2	90.9					8	80.9			38	978.9	1	10.5	49	1161.2
Bladelet											8	8.7			8	8.7
Blade-like flake	1	1.2					1	24.1			4	29.9			6	55.2
Irregular waste											5	30.5			5	30.5
Chip							1	0.2			4	1.1			5	1.3
Sieved chips 4–10mm											31	5.2			31	5.2
Sieved chips 2–4mm											37	1.2			37	1.2
Rejuvenation flake, tablet			1	10			1	15.8			5	23.9	1	27.1	8	76.8
Rejuvenation flake, other											2	13.2			2	13.2
Crested blade							2	33	1	22.7	11	471.7			14	527.4
Opposed-platform blade core							1	130.3			4	3781.8			5	3912.1
Edge-retouched flake											1	1.5			1	1.5
Bruised blade/flake*											7	620.6			7	620.6
Grand total	4	96.6	2	24.5	1	11.3	27	530.4	1	22.7	235	7502	3	45	273	8232.5
Burnt unworked flint	21	221.4									12	130.3			33	351.7
Burnt flints	1	4.5									2	0.8			3	5.3
Broken flints	2	5.7					10	67.7	1	22.7	79	1162.6	1	10.5	93	1269.2
Retouched flints											1	1.5			1	1.5

‡ = residual Terminal Upper Palaeolithic flintwork; * four of these bruised blades are utilised crested blades, a further two are on large early blade removals and one is on an early side-trimming flake

Table 4.5 The Terminal Upper Palaeolithic long blade assemblage by context and artefact type, excluding later mixed/intrusive flintwork

Fig 4.1 Schematic representation of the vertical relationship of the lithic scatters

squat proportions (Table 4.6). This indicates that the degree of cortication broadly correlates to the technological attributes and relative date of flints in the assemblage, but the degree of cortication cannot be used to separate the assemblages with absolute confidence and its use as a dating tool is treated with caution (see Brown 1995, 67–71 for discussion of cortication for dating). Artefacts have therefore been dated on technological attributes alone.

		EA1	GTP1	
		Head [4]	Head [23]	
Degree of cortication	Data	TUP	TUP	EM
Uncorticated	No	1		66
	%	0.6		15.4
Light cortication	No	16	10	301
	%	10.1	50.0	70.3
Moderate cortication	No	126	10	56
	%	79.2	50.0	13.1
Heavy cortication	No	16		5
	%	10.1		1.2
Total no		159	20	428
Total %		100	100	100

TUP = Terminal Upper Palaeolithic; EM = Early Mesolithic

Table 4.6 Technological attributes of selected flint assemblages from Lullingstone Country Park: degree of cortication

The TUP assemblage contains a high proportion of broken artefacts (46.5% of the assemblage excluding chips), but there is no evidence for intentional breakage or the production of regular blade segments (eg, flexion breaks: see Anderson-Whymark 2011). This may indicate that the process of knapping large blades and flakes resulted in a high incidence of

breakage. It is, however, notable that distal blade fragments outnumber proximal fragments, albeit in a comparatively small sample (14/30.4% versus 9/19.6%; Table 4.7), while the number of proximal and distal flake fragments is broadly equal (22/28.2% versus 20/25.6%; Table 4.8). This may indicate that some proximal blade fragments may have been removed from the scatter.

Levels of burning were exceptionally low among the struck flints (3 flints/5.3g/1% of the assemblage). No definitively TUP flints were burnt within EA1, raising the possibility that the three small burnt worked flints (a chip, a blade fragment and a flake) are intrusive elements from the Mesolithic scatter, which contains a higher proportion of burnt worked flints (26 pieces/2.3% of the assemblage excluding chips; see Table 4.19). The burnt unworked flint is not intrinsically datable, but it may be significant that a large quantity (314 pieces/1.546kg; see Table 4.19) was recovered from GTP1 tightly associated both horizontally and vertically with the Mesolithic flintwork (see Fig 5.2), but only a small quantity (33 fragments/351g) was recovered from [6/003] and EA1, [4]. Given the possibility for intrusive burnt worked and unworked flint among the TUP assemblage, it is not possible to suggest unequivocally that the long blade scatter was associated with a fire but it must remain a possibility. In the absence of burnt diagnostic TUP flints it is clear, however, that the production of long blades and the activities for which they were used (eg, utilisation of bruised blades) were not directly associated with a fire.

	EAI		GTP1			
	Head [4]		Head [23]			
	TUP		TUP		EM	
Completeness of unretouched blades and bladelets	No	%	No	%	No	%
Distal fragment	14	30.4	2	33.3	23	17.8
Medial fragment	7	15.2			5	3.9
Proximal fragment	9	19.6			16	12.4
Complete blade/bladelet	16	34.8	4	66.7	85	65.9
Total	46	100	6	100	129	100

TUP = Terminal Upper Palaeolithic; EM = Early Mesolithic

Table 4.7 Completeness of unretouched blades and bladelets in TUP and EM assemblages

	EAI		GTP1			
	Head [4]		Head [23]			
	TUP		TUP		EM	
Completeness of unretouched flakes	No	%	No	%	No	%
Distal fragment	22	28.2	1	11.1	64	25.5
Medial fragment	5	6.4	1	11.1	20	8.0
Proximal fragment	20	25.6	3	33.3	47	18.7
Complete flake	31	39.7	4	44.4	120	47.8
Total	78	100	9	100	251	100

TUP = Terminal Upper Palaeolithic; EM = Early Mesolithic

Table 4.8 Completeness of unretouched flakes in TUP and EM assemblages

THE ASSEMBLAGE: REDUCTION STRATEGIES

The TUP assemblage, broadly located in EA1, contains five opposed-platform blade cores; the vast majority, if not all, of the flake and blade debitage derives from the reduction of these cores (Table 4.9). Cores 2–4 (Figs 4.2–4.4, 4.5, nos 1–2, 4.6, no 3) account for the greater part of the assemblage. These three were all manufactured from nodules of a distinctive

banded flint that was imported from another, possibly nearby, location in the form of prepared cores with a good proportion of the cortex removed. Core 1 (Figs 4.6, no 4, 4.7) results from the attempted reduction of an unprepared nodule of poor-quality gravel flint, probably of local origin. The final core, core 5 (Figs 4.8 and 4.9), which is manufactured from a good-quality flint with white speckled inclusions, was probably imported in a near-exhausted state as only a final plunging flake ([6/003]) has been refitted to the core (GTP1, [23]) and only one other long blade ([6/003]) of this distinctive raw material has been identified in the assemblage.

The cores and the associated flake debitage demonstrate a consistent reduction strategy orientated towards the production of blades up to c 200mm in length; the main face typically yielded blades measuring between 70mm and 160mm. The key aspects of the reduction strategy are outlined below.

RAW MATERIAL SELECTION

Flint from five separate cores is present in the TUP assemblage and these can be grouped in three main flint types:

1. Core 1 was manufactured from an elongated flint nodule, measuring 240+mm long by 91+mm wide and 70+mm thick, and weighing c 2.5kg in its original form. The flint is a translucent light brown with opaque mid grey cherty inclusions in the centre of the nodule, but numerous thermal flaws render the flint as poor quality. The cortex measures 1–2.5mm thick and is buff-coloured with a slight weathered and eroded surface; a c 1mm-thick bright white band is present beneath the cortex. This nodule was not prepared before it was worked on site and reduction was abandoned when thermal flaws were

Artefact type	Core 1		Core 2		Core 3		Core 4		Core 3 or 4		Core 5		Unassigned		Total No	Total Wt (g)
	No	Wt (g)	No	Wt (g)	No	Wt (g)	No	Wt (g)	No	Wt (g)	No	Wt (g)	No	Wt (g)		
Flake	4	141.3	21	972.3	7	47.4	5	63.1	3	126.6			54	459.5	94	1810.2
Blade	1	12.5	9	206.6	18	464.5	5	66.8	2	172.2	2	128.0	11	100.1	48	1150.7
Bladelet													8	8.7	8	8.7
Blade-like flake					1	23.7							5	31.5	6	55.2
Chip			1	0.2									4	1.1	5	1.3
Sieved chips 4–10mm													31	5.2	31	5.2
Sieved chips 2–4mm													37	1.2	37	1.2
Irregular waste													5	30.5	5	30.5
Rejuvenation flake, other					2	13.2									2	13.2
Rejuvenation flake, tablet			1	13.5	1	3	2	5.4					3	27.8	7	49.7
Crested blade	3	141.8	3	189.1	4	154.7							4	41.8	14	527.4
Bruised blade/flake			3*	249.8	3*	236.4	1*	134.4							7	620.6
Retouched flake									1	1.5					1	1.5
Opposed-platform blade core	1	1781	1	880.2	1	430.5	1	690.1			1	130.3			5	3912.1
Grand total	9	2076.6	39	2511.7	37	1373.4	14	959.8	6	300.3	3	258.3	162	707.4	270	8187.5

*Two bruised blades from core 2, one from core 3 and one from core 4 are utilised crested blades

Table 4.9 The TUP long blade assemblage by core and artefact type, excluding later mixed/intrusive and unstratified flintwork

Fig 4.2 Photograph of TUP long blade core 2 with refits (refit group 2)

revealed. This nodule was probably procured as a surface find in close proximity to the site and may be interpreted as opportunistic working of local materials.

2. Cores 2–4 are manufactured from three nodules of a very distinctive banded flint that probably originate from the same source, although there are subtle differences in the colour and cortex of each nodule. The majority of the flints are corticated, precluding identification of the original colour, but occasional modern nicks indicate the nodules were translucent light to mid brown with some dark brown-black banding and occasional large grey inclusions. The nodules are free from thermal fractures and of excellent quality for flaking. The cortex is typically buff-coloured and unabraded, but very occasional thermal pot lids were noted on the surface and in some places the original ‘cortex’ is an ancient, white, heavily corticated, thermal fracture. A butterscotch-coloured band measuring 2–3mm thick was observed directly beneath the cortex on all three cores and a reddish-orange band was observed

on core 2. The condition of the cortex indicates that these nodules were probably obtained from a source on or close to the chalk but the distinctive band beneath the cortex results from a chemical alteration, indicating the nodules were probably obtained from a secondary derived source, such as Clay-with-Flints (Shepherd 1972). Cores 2–4 were prepared before they arrived at the current site, making it difficult to estimate the original weight of the nodules, but in each case the original nodule was probably an elongated irregular ovoid, with a length in excess of 300mm and a weight of *c* 2–4kg.

3. Core 5 is manufactured from a high-quality mid brown flint that exhibits numerous small speckled inclusions. As this core was extensively worked when it was imported to the scatter, no cortex is present, precluding discussion of a specific raw material source, but it is significant that this flint differs from the banded raw material used for cores 2–4, which were specifically prepared for working in the current scatter. It is therefore likely that this core was

Fig 4.3 Photograph of TUP long blade core 3 with refits. Note the crest that was removed in three successive blows (refit group 3).

procured at a different location, perhaps some distance away (see below, 'Core abandonment', for observations on the extensive working of this core, in relation to those worked solely at this location).

CORE PREPARATION

Core-preparation flakes are poorly represented in the TUP scatter and refitting has confirmed that only core 1 was worked from a raw nodule (see Tables 4.10 and 4.11). Core 5 was imported after extensive working at another location, while the nodules for cores 2–4 were prepared away from the current scatter, presumably at the location the raw material was found.

Core 1 provides an insight into the early core techniques since it was abandoned before it was extensively worked, owing to flaws, and it has been possible to refit many of the early removals (refit group 1). These refits reveal that following selection of an elongated nodule a series of removals were struck from the ends of the nodule establishing two opposed platforms located *c* 240mm apart. A series of flakes and broad

Fig 4.4 Photograph of TUP long blade core 4 with refits (refit group 4)

		EAI	GTPI	
		Head [4]	Head [23]	
Dorsal extent (%)		TUP	TUP	EM
0	No	92	8	273
	%	58.6	42.1	65.2
1–25	No	48	6	90
	%	30.6	31.6	21.5
26–49	No	10	3	18
	%	6.4	15.8	4.3
50–74	No	3	2	17
	%	1.9	10.5	4.1
75–99	No	4		14
	%	2.5		3.3
100	No			7
	%			1.7
Total No		157	19	419
Total %		100	100	100

TUP = Terminal Upper Palaeolithic; EM = Early Mesolithic

Table 4.10 Technological attributes of selected flint assemblages from Lullingstone Country Park: extent of dorsal cortex

blades was subsequently struck from each end, removing a significant quantity of cortex from one side and the top surface

Fig 4.5 TUP core 2 (flint no 1) and core 3 (flint no 2), illustrated without refits

		EAI		GTPI	
		Head [4]		Head [23]	
Flake type		TUP	TUP	EM	
Preparation flake	No	4		21	
	%	2.6		5.0	
Side trimming flake	No	19	2	61	
	%	12.3	10.5	14.7	
Distal trimming flake	No	10	3	28	
	%	6.5	15.8	6.7	
Miscellaneous trimming flake	No	22	3	40	
	%	14.2	15.8	9.6	
Non-cortical flake	No	79	7	255	
	%	51.0	36.8	61.3	
Rejuvenation flake	No	21	4	11	
	%	13.5	21.1	2.6	
Total No		155	19	416	
Total %		100	100	100	

TUP = Terminal Upper Palaeolithic; EM = Early Mesolithic

Table 4.11 Technological attributes of selected flint assemblages from Lullinstone Country Park: flake type

of the core. One of these long scars was used as a platform to strike a series of broad cortical and side trimming flakes down one side of the core, creating a prominent unifacial crest. The platform was carefully faceted and a crest measuring 186mm

long by 32.5mm wide and 18.2mm thick was successfully propagated along the majority of the length of the core. An attempt was then made to adjust the angle of the platform, but this encountered a thermal flaw, resulting in an irregular removal and the abandonment of the core at this early stage.

Refitting indicates that cores 2–4, which were prepared off site, were dressed in a similar fashion to core 1. Core 2 probably arrived at the current location as a roughly shaped nodule from which a number of large cortical flakes had been removed. The presence of a small number of cortical trimming flakes indicates further shaping in the current scatter, while a short refitting sequence demonstrates the preparation of at least one initial crest (refit group 2). In contrast, a particularly complete refitting sequence for core 3 (refit group 3) reveals that it was imported with two parallel crests established at one end of the core and a third at the opposing end; the first and subsequent removals in the current scatter were all long blades. The earliest platforms revealed by refitting were 260mm apart. Core 4 probably arrived in a state of advanced preparation similar to core 3, although only one non-refitting crested blade relating to this core was found in the scatter (refit group 4).

Fig 4.6 TUP core 4 (flint no 3) and core 1 (flint no 4), illustrated without refits

Fig 4.7 Photograph of TUP long blade core 1 with refits (refit group 1)

LONG BLADE REDUCTION

After the preparation of unifacial crests along the sides of the cores, blade reduction was initiated by careful faceting of the platform or by roughly abrading the platform edge and striking a removal *c* 7–10mm from the core edge (Tables 4.12 and 4.13; Fig 4.10). Notably, faceting and platform-edge abrasion were rarely employed together (Table 4.14). It is probable that direct percussion was employed, but it is unclear what tool was used. The percussion cones on the majority of the early removals are large, typically measuring 5–11mm in width, but exhibit diffuse bulbs with a prominent lip on the edge of the percussion cone; bulbs of this character are found in the majority of long blade assemblages. A single flint hammerstone weighing 220.9g was recovered from among the

Fig 4.8 TUP core 5 (flint no 5) shown with the final plunging blade removal refitted SF2492

Fig 4.9 Photograph of TUP long blade core 5 (refit group 5) with refits abrasion

Mesolithic scatter in GTP1, but the attributes on the artefacts are characteristic of 'soft'-hammer percussion using a substantial, heavy, hammer. The author has produced comparable bulbs with a large elk antler hammer, but other experiments indicate that soft sandstone hammerstones can produce comparable bulbs (Barton 1986). Many of the smaller flakes and blades exhibit smaller (<5mm wide) diffuse bulbs

with lipped edges to the percussion cone, potentially indicating the use of a lighter soft hammer, possibly manufactured of antler (Onhuma & Bergman 1982). Evidence for hard-hammer percussion, ie the use of a hard stone such as flint or quartzite, is scarce and confined to seven small flakes; five of these weigh less than 2g, and considering the vagaries involved in the identification of hammer mode it is possible that these are misidentifications (see Table 4.15).

Within the refitted core reduction sequences, unifacial cresting was employed to initiate blade removal; all subsequent blade removals were propagated along the ridges created by earlier blade removals and there is no evidence for the use

Fig 4.10 Photograph of detail of faceting on the butt of TUP long blade, flint no 15

		EAI	GTP1	
		Head [4]	Head [23]	
Butt type		TUP	TUP	EM
Cortical	No	8		15
	%	7.8		4.8
Plain	No	30	6	154
	%	29.1	40.0	49.2
>1 removal	No	20	4	33
	%	19.4	26.7	10.5
Faceted	No	18	1	3
	%	17.5	6.7	1.0
Linear	No	6	1	20
	%	5.8	6.7	6.4
Punctiform	No	11	1	65
	%	10.7	6.7	20.8
Other/unclassified	No	10	2	23
	%	9.7	13.3	7.3
Total No		103	15	313
Total %		100	100	100

TUP = Terminal Upper Palaeolithic; EM = Early Mesolithic

Table 4.12 Technological attributes of selected flint assemblages from Lullingstone Country Park: butt type

		EA I	GTPI	
		Head [4]	Head [23]	
Platform-edge abrasion		TUP	TUP	EM
No abrasion	No	49	9	178
	%	48.5	60.0	57.1
Light edge-abrasion	No	29	5	134
	%	28.7	33.3	42.9
Heavy edge-abrasion	No	23	1	
	%	22.8	6.7	
Total No		101	15	312
Total %		100	100	100

TUP = Terminal Upper Palaeolithic; EM = Early Mesolithic

Table 4.13 Technological attributes of selected flint assemblages from Lullingstone Country Park: platform-edge abrasion

Butt type		Platform-edge abrasion			Grand total
		No abrasion	Light abrasion	Heavy abrasion	
Cortical	No	5	2	1	8
	%	62.5	25.0	12.5	100
Plain	No	20	7	9	36
	%	55.6	19.4	25.0	100
>1 removal	No	6	12	6	24
	%	25.0	50.0	25.0	100
Faceted	No	15	2	2	19
	%	78.9	10.5	10.5	100
Linear	No	1	4	2	7
	%	14.3	57.1	28.6	100
Punctiform	No	3	6	2	11
	%	27.3	54.5	18.2	100
Other/unclassified	No	8	1	2	11
	%	72.7	9.1	18.2	100
Total No		58	34	24	116
Total %		50.0	29.3	20.7	100

Table 4.14 Cross-table highlighting the relationship between butt category and platform-edge abrasion for TUP flints

		EA I	GTPI	
		Head [4]	Head [3]	
Hammer mode		TUP	TUP	EM
Soft: lipped bulb <5mm wide	No	21	3	99
	%	20.4	20.0	31.8
Soft: lipped bulb >5mm wide	No	32	5	5
	%	31.1	33.3	1.6
Hard: no lip, prominent cone	No	6	1	16
	%	5.8	6.7	5.1
Indeterminate	No	44	6	191
	%	42.7	40.0	61.4
Total No		103	15	311
Total %		100	100	100

TUP = Terminal Upper Palaeolithic; EM = Early Mesolithic

Table 4.15 Technological attributes of selected flint assemblages from Lullingstone Country Park: hammer mode

of cresting as a form of core rejuvenation (e.g. Fig 4.12, nos 10 and 11, and Fig 4.13, nos 13 and 15). The established crests were, however, not entirely straight and in many cases a crest was gradually removed in a sequence of two to three progressively longer blades (eg, on core 3 a crest was removed by three removals at one end and two at the other; Fig 4.3). After the crests were removed, reduction proceeded with the removal of blades typically measuring half to two thirds of the core length, struck from each end of the core with regular rotation between the platforms, potentially after every removal. This reduction strategy ensured that the core face remained slightly convex throughout the reduction process, so ensuring that each removal was comparatively straight. Complete blades form 32% of the assemblage in EA1 and many examples have a high length to breadth ratio (Tables 4.16 and 4.17). The vast majority of flake and blade removals exhibit a feathered termination (72.3%; Table 4.18)

Refitting also revealed that the platforms on each core were frequently rejuvenated, particularly in the early stages of reduction where the platforms appear to have been reshaped between every removal, resulting in a significant reduction in the length of each core and its products during working (Fig 4.15). Seven core rejuvenation tablets were identified in the assemblage, but in each case these are comparatively thin

Fig 4.11 Flint nos 6, 8–9

Above: Fig 4.12 Flint nos 10–12
Right: Fig 4.13 Flint nos 13–15

Fig 4.14 Photograph of core 3 showing refitted final blade removals (refit group 3)

Context	Date	% Flakes with length:breadth ratio of 2:1 or higher	% Flakes with dorsal blade scars
EAI, head [4]	TUP	32.0 (sample: 75 flints)	23.9 (38 of 159 flakes)
GTPI, head [23]	TUP	69.2 (sample: 13 flints)	10.0 (2 of 20 flakes)
GTPI, head [23]	EM	34.8 (sample: 250 flints)	25.4 (87 of 342 flints)

TUP = Terminal Upper Palaeolithic; EM = Early Mesolithic

Table 4.16 Technological attributes of selected flint assemblages from Lullingstone Country Park: proportion of blades and dorsal blade scars

Length/breadth index value	Lullingstone TUP		Lullingstone EM		Springhead TUP	
	No	%	No	%	No	%
<0.6	2	2.4	2	1.1	4	6.8
0.6–1.0	15	17.9	34	18.1	17	28.8
1.1–1.5	26	31.0	32	17.0	21	35.6
1.6–2.0	13	15.5	44	23.4	6	10.2
2.1–2.5	7	8.3	37	19.7	3	5.1
2.6–3.0	6	7.1	12	6.4	5	8.5
3.1–3.5	8	9.5	14	7.4	3	5.1
3.6–4.0	5	6.0	7	3.7		
4.1–4.5	2	2.4	3	1.6		
4.6–5.0			3	1.6		
>5.0						

TUP = Terminal Upper Palaeolithic; EM = Early Mesolithic

Table 4.17 Comparison of length/breadth index values for unretouched flakes 20mm or more in length from TUP and EM flint assemblages at Lullingstone Country Park. ATUP long blade assemblage from Springhead is included for comparison

		EAI	GTPI	
		Head [4]	Head [23]	
Termination type		TUP	TUP	EM
Hinge	No	7		26
	%	6.3		7.7
Step	No	5	1	7
	%	4.5	6.3	2.1
Plunging	No	18	4	34
	%	16.1	25.0	10.1
Feather	No	81	11	269
	%	72.3	68.8	79.6
Other/unclassified	No	1		2
	%	0.9		0.6
Total No		112	16	338
Total %		100	100	100

TUP = Terminal Upper Palaeolithic; EM = Early Mesolithic

Table 4.18 Technological attributes of selected flint assemblages from Lullingstone Country Park: flake termination type

removals that rejuvenate only a small portion of the platform; none remove the platform in its entirety (see Fig 4.11, nos 6, 8). Three further flakes have been classified at 'Rejuvenation flake, other' as their butts reveal that they have been struck into the platform. However, refitting has revealed that the majority of rejuvenation flakes are simply classed as flakes and blades as they have only small butts, making it difficult to identify

traces of the core face (see refitted examples in Figs 4.2–4.4). It is therefore considered likely that the majority of flakes that are less than 60mm in length have been struck as rejuvenation flakes; this potentially indicates that *c* 50–100 rejuvenation flakes and blades are present in the assemblage. One distinctive technological feature associated with platform-rejuvenation flakes is the presence of a plunging distal end; with the exception of the final removal on core 5, none of the removals struck from the core faces were plunging.

Fig 4.15 Photograph of detail of refitted core 3 showing the ventral (inner) surface of the early removals

The blade products vary significantly in size through the reduction process. The longest surviving blade – the crest struck from core 5 – measures 186mm in length (see above for full details; Fig 4.8, no 5), but a refit on a broken crested/bruised blade (core 3; Fig 4.13, no 13) indicates that this blade was originally 192mm long by 36.8mm wide and 18.5mm thick. There are, however, only 19 blades (including six broken and one refitted example) that measure over 100mm: the average blade/bladelet measures 91.4mm long (with a standard deviation (SD) of 33.2mm) by 29mm wide (SD 13.9mm) and 12.2mm thick (SD 13mm; Fig 4.16). In addition to the distinctive size of the long blades, they are notable as their edges and dorsal blade scars

are relatively sinuous; no attempt has been made to produce regular, parallel-sided, prismatic blades.

Fig 4.16 Length to breadth graphs of the Lateglacial flints from EA1 and GTP1, [23]

CORE ABANDONMENT

As previously noted, the working of core 1 was abandoned early in reduction because of the poor quality of the flint, but the remaining cores were extensively worked before abandonment. Cores 2–4 were abandoned at a similar stage of reduction while still seemingly workable and of substantial size, weighing 880.2g, 430.5g and 690.1g respectively, with core faces measuring between 127.8mm and 141.7mm long and 62.4mm and 78mm wide. A few small hinge fractures were present on the faces of cores 2 and 3, but these knapping errors could easily have been removed from the opposing platform (a distinct advantage of opposed platform working in general). The final removals from the cores are, however, all *c* 50–60mm long, perhaps indicating that they were abandoned because blades of the desired size could no longer be produced.

Core 5, as noted above, was probably imported to the scatter having been extensively worked at another location. The only evidence for working in this scatter comes from a refit between the core and a final plunging blade removal that resulted in the core's abandonment. The only other flint related to this core is a long blade that does not refit and may also have been manufactured elsewhere and imported. The degree of working on core 5 is especially interesting as it is considerably narrower, thinner and lighter (38.3mm wide by 28.5mm thick, weighing 207.1g) than the other cores in the assemblage because of the more extensive working of the core's sides and back. The overall length of the core (129.5mm) is, however, comparable to cores 2–4 when abandoned and the final removals were up to 100mm long. This may simply reflect that the core remained productive for a longer period than cores 2–4, but it is more likely that as a scarce mobile resource this core was worked with particular care to ensure that it produced blades of the desired size for longer. In this respect it is notable that the platform edges of this core are particularly heavily abraded.

RETOUCHED TOOLS AND UTILISATION

The TUP assemblage contained only one retouched tool and the evidence for utilisation was largely confined to the presence of the characteristic 'bruising' on the sides of five long blades and one flake. Micro-edge flaking characteristic of use rather than edge damage, as visible to the naked eye, was observed on only one 112mm blade, from [6/003] (core 5). No attempt was made to identify microwear traces.

The sole retouched artefact is a fragmentary edge-retouched flake, measuring just 20mm+ long by 21mm+ wide and 2.7mm thick, which exhibits limited abrupt edge retouch along one side (EA1; Fig 4.11, no 9). It should also be noted that a microburin was recovered from square E/F in EA1, [4] but this is considered on technological grounds (ie it was produced on a narrow blade) to belong to the Mesolithic scatter considered below (see Fig 4.22, no 30).

Seven blades and flakes exhibit the extensive edge damage or bruising that is characteristic of long blade assemblages (Figs 4.12, 4.13, nos 10–15, 4.17, no 16, and 4.18–4.20). These bruised blades and flakes, or *lames machurées*, are all large, early, long blade removals, including four crested blades, and all have been refitted in sequences belonging to cores 2 (three examples), 3 (three examples) and 4 (one example). The bruised blades vary in size, with length measurements in the range 97.1–166.5mm, width measurements in the range 36.8–88.4mm, and thicknesses in the range 14.0–22.5mm; weights vary between 65.2g and 134.4g. The flake scars from

the edge damage typically extend a few millimetres in face of the artefacts, but this damage is notably less intense than that observed on bruised blades in other long blade assemblages (eg, Springhead (Bates & Stafford 2013, 160–62) and Goring (Barton 1995)). The precise function of these blades remains open for debate, but the degree of damage suggests use against a hard material and experimental work has shown that similar damage can be produced by chopping bone or antler (Barton 1986). Such an activity is consistent with the interpretation of long blade scatters as short-term sites associated with the processing and butchery of large herbivores, such as reindeer and horse (Lewis & Rackham 2011).

Fig 4.17 Flint no 16

It should also be noted that refitting has demonstrated that a number of blades have been removed from the scatter, presumably for use or further modification at another location. A small number of large long blades were absent, but in all the knapping sequences blades from towards the end of the sequence, measuring c 60–100mm in length, were most notably absent. For example, on core 3 a significant void is present within the sequence (see Fig 4.4).

Fig 4.18 Photograph of TUP bruised blade, flint no 13; refits to core 3

Fig 4.19 Photograph of TUP bruised blade, flint no 15; refits to core 3

DISCUSSION OF TERMINAL UPPER PALAEOLITHIC LITHICS

Assemblages characterised by large blades have long been recognised as a distinct feature of certain Lateglacial assemblages, but it was not until 1998 that Nick Barton developed a strict range of criteria for the classification of ‘long blade’ assemblages. These criteria include the presence of blades over 120mm in length, the presence of bruised blades and flakes, a dominance of blade debitage, the presence of a high

Fig 4.20 Photograph of TUP bruised blade, flint no 11; refits to core 2

proportion of opposed-platform cores, the faceting of platforms and the use of ‘soft stone’ hammers for percussion (1998, 159). The current assemblage meets all these criteria; indeed, it is a classic example of a long blade scatter and represents an important addition to the corpus.

Barton (1998) identified 28 long blade find-spots in Britain; several more discoveries can now be added, including Launde, Leicestershire (Cooper 2006), Springhead, Kent (Bates & Stafford 2013, 160–62; Anderson-Whymark in prep) and Guildford Fire Station, Surrey (Gerry Thacker, pers comm). An *in situ* scatter with affinities to the assemblage from Launde, but lacking blades over 120mm, has also recently been excavated at Tucklesholme Quarry, Nottinghamshire (author’s data). The distribution of these sites is distinctive, with two clusters in south-east England: one located in East Anglia, and the second extending along the River Thames and its tributaries (Barton 1995, 162, fig. 21.4). The location of the current site complements the Thames valley distribution and two of the find-spots are located at Springhead, c 10km north of the current excavations. The formation of the English Channel in the Holocene, which separated Britain from mainland Europe, has created an artificial division from European assemblages, where parallels can be found in the Belloy-type scatters of northern France and early Ahrensburgian in Belgium and northern Germany (Barton 1998, 162).

Close parallels for the core reduction strategies, morphology of the blade products and the overall composition of the assemblage at Lullingstone can be found in the scatters at Springhead (Burchell 1938; Anderson-Whymark in prep)

and Goring, Oxfordshire (Allen 1995; Barton 1995). The removal of partial tablet rejuvenations in the early stages of reduction is particularly distinctive. The limited range of retouched tools and the absence of microliths is also notable. Microliths, particularly Zonhoven points and obliquely blunted points, which do not appear to have been produced using the microburin technique, have been recorded on a small number of long blade sites such as Launde (Cooper 2006) and Three Ways Wharf, Uxbridge (Lewis & Rackham 2011). Barton (1998, 160) raised the question of inter-assemblage variability and the possibility that sites contemporary with long blade scatters but of a different character are present in the landscape, but remain largely unidentified. The interpretation of long blade scatters as knapping sites, with bruised blades involved in this process, is central to this argument. In the absence of these large and distinctive elements, these scatters would appear to be of a considerably different character and might not be recognised as part of the same technology.

Moreover, Barton observed that small blades appear to have been removed from long blade scatters, presumably for use elsewhere in the landscape. This observation is certainly true for Lullingstone, where virtually all the large blades, most of which exhibit bruising, are present in the scatter, while numerous small blades have been removed. The scatter at Launde highlights this assemblage variability particularly well because while it contains 'long blades', bruised blades are absent and numerous small blades and blades were produced, some of which were modified into microliths (Cooper 2006).

The date of long blade assemblages is, however, sufficiently vague that these differences in assemblage composition may be of chronological significance. The stratigraphic location of long blade scatters, including Lullingstone, point towards a latest Pleistocene/earliest Holocene date but the evidence from scientific dating is exceptionally limited. At Three Ways Wharf, Uxbridge, radiocarbon dates of $10,270 \pm 100$ BP (OxA-1788) and 10010 ± 120 BP (OxA-1902) were obtained on horse bones associated with a long blade scatter (Lewis 1991; Lewis & Rackham 2011). A comparable date of 10200 BP was obtained at Avington VI, Hampshire as an average OSL (optically stimulated luminescence) date of sediments enclosing the long blade scatter (Barton et al 1998; Froom & Cook 2005). Attempts to radiocarbon-date a poorly preserved 'cattle-sized' bone loosely associated with the current scatter unfortunately failed owing to a low collagen yield and no other remains were present for potential dating. The date of the current scatter, and where precisely the long blade tradition sits within the Lateglacial period, therefore, remains open to debate.

4.4 THE MESOLITHIC SCATTER (GTP1, [23]; EA1, [3])

INTRODUCTION

Approximately 1100 flints of a very different technology to the TUP scatter are considered to derive from a Mesolithic scatter centred on GTP1, [23] (Table 4.19). In the absence of diagnostic artefacts, such as microliths, it has proven difficult to refine the date of this scatter on typological or technological grounds. However, a charred hazelnut shell from GTP1, [4], spit 4 yielded a radiocarbon date of $6231-6084$ cal BC at 95.4% probability (SUERC 48677, 7313 ± 27 BP) that probably relates to the formation of this scatter.

As discussed above, typologically Mesolithic flintwork was recovered throughout the deposit (spits 1–7) but there was admixing with a small number of TUP flints and intrusive Neolithic–Bronze Age flintwork was present particularly in the upper spits (1–3). The limits of this scatter were not clearly defined as it was truncated by Trench 6 to the west and watching brief machining in the other directions, but it appears to have been comparatively discrete. A small number of flints from EA1, [3] and a single microburin from EA1, [4], square E/F, probably relate to this scatter rather than to the TUP assemblage.

CONDITION

The Mesolithic flintwork is in fresh condition and the artefacts are free from edge damage. The majority of the flints exhibit a light white cortication, which is notably paler than the earlier, technologically diagnostic TUP flint. Cortication is variable, however, and it has not been used as an aid to dating (see Table 4.6).

RAW MATERIAL

The raw material was a good-quality flint free from thermal fractures. The flintwork is typically corticated to some degree, so it is not possible to determine its original colour, but small, mid grey, cherty inclusions c 5–10mm in diameter were present in many of the flints. Comparatively few exhibited cortical surfaces, as much of the cortex appears to have been removed from cores before they arrived at this site but, where present, the cortex is unabraded and measures 1–2mm thick. It is difficult to propose a source on the available evidence, but flint of this general character is available in close proximity to the site. It is notable that none of the 'Mesolithic' flintwork is manufactured from banded flint comparable to the TUP assemblage and there is no evidence for the reworking of TUP flintwork. This may indicate that the main density (if not all) of the TUP scatter was no longer visible when the Mesolithic scatter was generated.

	EVI				GTPI						EAI				Total No	Total Wt (g)
	Head [6/003]‡		Pit 6, fill [6/007]		Subsoil/ head [22]*		Head [23]		[26]		Head [3]		Head [4]‡			
Artefact type	No	Wt (g)	No	Wt (g)	No	Wt (g)	No	Wt (g)	No	Wt (g)	No	Wt (g)	No	Wt (g)		
Flake			11	39.7			389	1548.3	1	7.1	1	1.6			402	1596.7
Blade			1	3.7			61	254.2			1	6.4			63	264.3
Bladelet	1	0.6	4	1.9			119	150.4							124	152.9
Blade-like							21	27.8							21	27.8
Irregular waste							28	293.7							28	293.7
Microburin					1	0.4	5	3.3					1	7	7	10.7
Chip							142	33.0							142	33.0
Sieved chips 4–10mm			3	0.2			95	7.2							98	7.4
Sieved chips 2–4mm			19	0.3			174	4.3							193	4.6
Rejuvenation flake, core face/edge											1	34.9			1	34.9
Rejuvenation flake, tablet							5	25.3							5	25.3
Crested blade			1	3.6			10	62.1							11	65.7
Single-platform blade core					1	31.8	3	268.8							4	300.6
Opposed-platform blade core							1	67.3			1	25.9			2	93.2
Tested nodule/bashed lump							3	240							3	240
Single-platform flake core							2	66.6							2	66.6
Multi-platform flake core							1	184.4							1	184.4
Piercer/mèche de forêt							2	1.5							2	1.5
Retouched flake							4	10							4	10
Truncated blade							1	2							1	2
Miscellaneous retouch							1	65.4							1	65.4
Hammerstone							1	220.9							1	220.9
Grand total	1	0.6	39	49.4	2	32.2	1068	3536.5	1	7.1	4	68.8	1	7	1116	3701.6
Burnt unworked flint			41	405.1			273	1140.7							314	1545.8
Burnt flints	1	0.6					25	90.8							26	91.4
Broken flints	1	0.6	7	20.2			216	447.5			3	42.9			227	511.2
Retouched flints							8	78.9							8	78.9

‡ = intrusive Early Mesolithic flintwork; * = mixed assemblage of Mesolithic and Neolithic flintwork; only diagnostic EM artefacts are shown in this table

Table 4.19 The Early Mesolithic flint assemblage, excluding definitively TUP and intrusive flintwork

TECHNOLOGY

As with the TUP flintwork, the Mesolithic cores appear to have been imported from another location in a prepared or partly worked state, with much of the cortex removed. Two cores are particularly well dressed with flaking extending around the back of the core (Fig 4.21, nos 18 and 20), but other examples exhibit a flat cortical back.

The majority of cores are orientated towards the production of blades under 70mm long from either a single platform (four examples; Fig 4.21, nos 17–19) or opposed platforms (two examples; Fig 4.21, nos 20 and 21), but three flake cores and three tested nodules were also recovered. Blade production was initiated by the removal of a bidirectional (one example; Fig 4.21, no 22) or unifacial (ten examples; Fig 4.21, no 23) crested blade, and the six complete examples measure between 27.1mm and 70mm long (average 45.1mm), between 15mm and 31.9mm wide (average 22.2mm) and between 5.2mm and 15mm thick

(average 8mm). These crested blades provide a good indication of the maximum size of blades produced in the assemblage as there is no evidence that cresting was used as a rejuvenation technique on partially worked cores. During core reduction the platform angle was periodically adjusted by the removal of a platform tablet (five examples; Fig 4.22, no 24), but these typically removed only part of the platform rather than the whole surface required for classification as platform tablets *sensu stricto*.

Examination of the bulbs of percussion indicates that the vast majority of flakes were struck using a soft hammer percussor, such as an antler hammer (see Table 4.15), following light abrasion of the platform edge (see Table 4.13). The only hammerstone recovered, however, was made of flint and weighs 220.9g – but it could have been used for tasks other than flint knapping.

Of 248 complete flakes and blades that were measured, the longest (a crested blade) measures 70mm, while the average flake measures only 29.1mm long (SD 13.1mm) by 18.2mm wide (SD

Fig 4.21 Flint nos 17-23

Fig 4.22 Flint nos 24-31

8.8mm) and 4.6 mm thick (SD 2.6mm). Of these flints 34.8% were of blade proportions (see Table 4.16); this is consistent with Mesolithic blade-orientated reduction strategies (Ford 1987).

Owing to time constraints, refitting was not systematically attempted for the Mesolithic scatter. However, during the course of the analysis 17 artefacts from three different cores were refitted, indicating that a good proportion of the assemblage may refit (refit groups 6,7 and 9). Two refitting sequences confirm the reduction strategies described above. The first sequence, (refit group 6), demonstrates blade production from a single-platform flake core with the removal of crest and a platform tablet (Fig 4.23), while the second, (refit group

7), comprises a sequence of small bladelets removed from an opposed platform core and again demonstrates platform tablet rejuvenation (Fig 4.24).

Fig 4.23 Photograph of Mesolithic single-platform core with refits (refit group 6)

Fig 4.24 Photograph of back of Mesolithic opposed-platform core with refits, flint no 20 (refit group 7)
Note the minimally prepared cortex

RETOUCHED TOOLS AND UTILISATION

Retouched tools form only 0.8% of the assemblage excluding chips. The tools comprise two piercers (Fig 4.22, nos 25 and 26), one blade with a proximal truncation (Fig 4.22, no 27), three minimally edge-retouched flakes (not illustrated), one broken edge-retouched flake/possibly unfinished microlith (Fig 4.22, no 28) and a miscellaneously retouched flake that exhibits two small flake removals and irregular edge retouch

(Fig 4.22, no 29). These artefacts are all compatible with a Mesolithic date.

In addition to the retouched tools, the production of microliths is demonstrated by the presence of seven proximal microburins (eg, Fig 4.22, nos 30–31). All the examples recovered are notched on the right-hand side (as viewed with the butt end facing the viewer and the dorsal surface uppermost) and reflect the snapping of blades that measured between 5.8mm and 18.6mm wide (average 10.8mm). The length of the microburins varies between 12.1mm and 21.5mm wide (average 16.2mm), while they are between 2.2mm and 5.3mm thick (average 3mm). Considering the size of the blades produced in this scatter in relation to the microburins it seems plausible that the microliths produced are likely to have been of proportions comparable to Early Mesolithic broad-blade forms.

In addition to the formal retouched tools, five flakes and four blades exhibit fine microchipping on their edges that is consistent with use damage. No microscopic examination for use wear was undertaken so it was not possible accurately to quantify the degree of use, although the limited number of retouched tools and low proportion of macroscopically visible use damage may indicate that few pieces have been used.

DISCUSSION OF MESOLITHIC LITHICS

The presence of a large number of chips and production debitage (cores, rejuvenations, irregular waste and crested blades), combined with the limited range and proportion of tools, suggests that the Mesolithic scatter resulted from *in situ* knapping. The production of microliths, as indicated by the presence of microburins, is notable as this indicates the production or maintenance of a composite tool. The small number and limited range of retouched and utilised artefacts supports the suggestion that a limited range of tasks was undertaken at this location. Indeed, the presence of two piercing/boring tools may indicate a very specific activity. The overall impression is, therefore, that the scatter formed over a comparatively short time frame, for the performance of a few specific tasks. The presence of a small number of burnt worked flints and pieces of burnt unworked flint, in addition to the charred hazelnut shell recovered from environmental samples (see Chapter 3.2), indicates a small fire but this need not indicate any more than short-term activity.

4.5 RESIDUAL AND INTRUSIVE FLINTWORK

A large quantity of flintwork was recovered from the topsoil, subsoil and colluvium, and further artefacts were recovered as unstratified finds; most of the artefacts were not catalogued

in detail, but technologically/typologically diagnostic pieces were recorded (see Tables 4.1–4.4). The vast majority of these flints exhibit extensive post-depositional edge damage, indicating considerable movement from their original place of deposition. The material is dominated by broad hard-hammer flakes most characteristic of the Neolithic or Bronze Age; only three potentially TUP flints and a small number of potentially Mesolithic blades were identified. This suggests that the TUP and Mesolithic scatters were preserved in deposits that have not been significantly truncated, so that further scatters may perhaps survive in the unexcavated head deposits. The only artefacts of note are a Neolithic–Early Bronze Age rod-shaped fabricator, a serrated flake (intrusive in GTP1, [23]) and a few Neolithic/Bronze Age scrapers.

ILLUSTRATION CATALOGUE (Fig 4.25)

Terminal Upper Palaeolithic long blade scatter, flint nos 1–16 (Figs 4.5 and 4.6, 4.8, 4.11–4.13, 4.17)

1. Opposed-platform flake core; core 2; Wt 880.2g; EA1, [4], SF1052. TUP.
2. Opposed-platform flake core; core 3; Wt 430.5g; EA1, [4], SF1027. TUP.
3. Opposed-platform flake core; core 4; Wt 690.1g; EA1, [4], SF1081. TUP.
4. Opposed-platform flake core; core 1; Wt 1781g; EA1, [4], SF1026. TUP.
5. Opposed-platform flake core; core 5; Wt 130.3g; GTP1, [23], SF2504. With final plunging blade removal refitted; Wt 76.6g; [6/003], SF2492. TUP.
6. Core rejuvenation tablet; core 2; Wt 13.5g; EA1, [4], SF1124. TUP.
7. Core rejuvenation tablet; core 4; EA1, [4], SF2520. TUP. (Currently missing and not illustrated.)

8. Core rejuvenation tablet; core 3; Wt 3g; EA1, [4], SF2510. TUP.
9. Broken retouched flake; core 3 or 4; Wt 1.5g; EA1, [4], SF1110. TUP.
10. Broken bruised crested blade; core 2; Wt 86.1g; EA1, [4], SF1125. TUP.
11. Bruised crested blade; core 2; Wt 87.5g; EA1, [4], SF1094. TUP.
12. Bruised blade; core 2; Wt 76.2g; EA1, [4], SF1033. TUP.
13. Bruised crested blade; core 3; Wt 102.2g; EA1, [4], SF1031. TUP.
14. Bruised flake; core 3; Wt 65.2g; EA1, [4], SF1045. TUP.
15. Bruised crested blade; core 3. Wt 69g; EA1, [4], SF1036. TUP.
16. Bruised blade; core 4; Wt 134.4g; EA1, [4], SF1028. TUP.

Mesolithic scatter, flint nos 17–31 (Figs 4.21 and 4.22)

17. Single-platform blade core; Wt 31.2g; GTP1, [23], spit 3, SF2201. Mesolithic.
18. Single-platform blade core; Wt 67.2g; GTP1, [23], spit 3, SF2005. Mesolithic.
19. Single platform blade core; core refit group 9; Wt 31.8g; GTP1, [22], SF2489. Mesolithic.
20. Opposed-platform blade core; refit group 7; Wt 67.3g; GTP1, [23], spit 3a, SF150. With rejuvenation flake tablet; Wt 3g; GTP1, [23], spit 3a, SF120 and rejuvenation flake tablet; Wt 6.8g; GTP1, [23], spit 1, SF2340 refitted. Mesolithic.
21. Opposed-platform blade core; Wt 25.9g; EA1, [3], SF2560. Mesolithic.
22. Bidirectional crested blade; Wt 32.1g; GTP1, [23], spit 1 baulk, SF2301. Mesolithic.
23. Unidirectional crested blade; Wt 6g; GTP1, [23], spit 1 extension, SF2313. Mesolithic.
24. Core rejuvenation tablet; core refit group 6; Wt 7.1g; GTP1, [23], spit 2 square I, SF2072. Mesolithic.
25. Piercer; Wt 0.8g; GTP1, [23], spit 5 baulk, SF2403. Mesolithic.
26. Piercer; Wt 0.7g; GTP1, [23], spit 5, SF2391. Mesolithic.
27. Truncated flake; Wt 2g; GTP1, [23], spit 2, SF2115. Mesolithic.
28. Edge-retouched flake; Wt 6g; GTP1, [23], spit 4, SF2358. Mesolithic.
29. Miscellaneous retouch on flake; Wt 0.8g; GTP1, [23], spit 3, SF2254. Mesolithic.
30. Proximal microburin; Wt 7g; EA1, [4] square E/F, SF2515. Mesolithic.
31. Proximal microburin; Wt 0.3g; GTP1, [23], spit 3 square I extension, SF2216. Mesolithic.

Fig 4.25 Location of illustrated TUP flints

CHAPTER 5 INTERPRETATIVE FRAMEWORK: ISOLATING SITE FORMATION AND BEHAVIOURAL SIGNATURES

Matt Pope

5.1 METHODOLOGICAL FRAMEWORK

The technological analysis, outlined in detail above, upheld the initial impression of the lithic scatters as they were excavated: namely that artefacts in fresh condition and from three periods (TUP, EM and later Neolithic/Early Bronze Age) were present at the site, and that the TUP and EM material lay largely separated in two discrete scatters at the same broad stratigraphic level. Further observation that the material seemed to be in very fresh condition, and within fine-grained sediment was also upheld by the analysis. The high likelihood that some of the material might have been preserved *in situ* therefore needed to be addressed. In order to test this, and to develop a robust behavioural interpretation, it was necessary to move beyond direct consideration of the lithic artefact assemblage in technological terms, and to assess the nature of the site formation processes at work at the site. In this section, appropriate tests of assemblage composition and distribution are applied in order to isolate post-depositional transformations of the material before providing a behavioural interpretation of the scatters.

5.2 THE DISPOSITION OF THE LITHIC ARTEFACT SCATTERS IN TRENCH 6, GTP1 AND EA1

Analysis of the lithic assemblage clearly showed that the two lithic scatters were very different in terms of technology. One, located within EA1, involved the production and use of classic TUP long blades. The other, located at GTP1/Trench 6, is characterised by the production of small narrow blades from single-platform cores and microlith production, the latter indicated by the presence of microburins, traits characteristic of Mesolithic assemblages. But contemporaneity or otherwise of these scatters required careful consideration as microlithic technology can be found in some long blade assemblages and the scatters are not completely spatially or stratigraphically separate. Indeed, the densest concentrations of each scatter are less than 3.0m apart and one knapping refit, part of refit group 2, occurs between the long blade scatter in EA1, [4], and flints from GTP1, [23] (see Fig 2.7). GTP1 also yielded blade refits to single-platform blade cores considered to be Early Mesolithic.

The scatter of Mesolithic flintwork in GTP1, however, did not extend into EA1 in the same manner. While some Mesolithic flint was noted in EA1 [3] (which was mostly lost to machining), this material lay above the main TUP scatter in [4], with the notable exception of one microburin which might have worked down through the soil profile, it being small enough to have been moved by worm or root action. Moreover, while the upper three spits of GTP1, [23], contained a considerable number of small uncorticated flakes probably of Neolithic date, only six of these intrusive flakes were present in EA1, [4].

This indicates a potentially complex stratigraphic relationship between these two adjacent areas: TUP–EM and Neolithic material is more admixed in the GTP1 area, possibly owing to some vertical movement, as indicated by soil micromorphology, or potentially due in part to animal disturbance. The scatter in EA1 is more clearly defined and contains less admixture of later flintwork. This might in part be an effect of truncation by machining or be explained by the presence of deeper head deposits in EA1 perhaps indicating different rates of deposit accumulation between the two scatters (see Fig 4.1). Another possibility is that the EA1 material was introduced into the head deposits by burial, which is discussed further below.

5.3 ASSEMBLAGE INTEGRITY: ASSEMBLAGE COMPOSITION AND DISTRIBUTION BY SIZE

While the relatively small size of the excavation does not permit detailed spatial analysis, the overall distribution of artefacts within EA1 and GTP1 suggests the clear separation of TUP and Early Mesolithic activities. Plotting of the artefacts by type/tool type suggests scope for discussion of spatial separation of activities (Fig 5.1). However such discussion must be based on a sound understanding of site formation processes. It has already been stated that, in geoarchaeological terms, the assemblages are indistinguishable in terms of time-depth, being contemporary in sedimentary/stratigraphic terms. However, it is a reasonable assumption, on the basis of our understanding of the cultural chronology of this period, that there would have been a clear time interval between the formation of the TUP and Early Mesolithic signatures. The depositional context of

slope deposits also means that the possibility of downslope movement should be considered for both scatters.

In order to address these issues, size sorting of lithic assemblages, the key taphonomic indicator of post-depositional movement (Schick 1986; Pope 2002), was considered the best place to begin. Movement will tend to reorganise assemblage composition locally according to the size of artefacts. Unmodified assemblages based on knapping alone should show all sizes of artefact loosely clustering in their original knapping scatters over areas roughly 0.25-1.0m in extent. Movement will be indicated by wide dispersal of these scatters and rearranging or complete removal of some elements depending on size.

Inspection of the plot shown in Fig 5.2 shows the spatial distribution patterns for different size classes between the EA1 scatter and that from GTP1 are distinct. GTP1 shows a broad spread of debitage of all sizes within a 3.0 x 1.5m area. The southern and western limits of this scatter seem to have been constrained, while the northern and eastern extents cannot confidently be said to have been delimited as they extend to the edge of the excavation area (Fig 5.1).

The vast majority of this debitage is of Early Mesolithic character, and vertically constrained within 0.2m depth of deposit. The plot does not show clear knapping scatters indicative of exceptionally high resolution, short term occupation, nor however does it show complete dispersal or secondary size sorting (separation of large and small artefacts). The apparently well-defined limits to the overall distribution and spatial overlap between all size-classes are factors consistent with a signature of moderately superimposed knapping and functional activities. It is not unreasonable to talk of this scatter as an occupation horizon preserved in a primary sedimentary context (ie relating directly to the sediment from which they were recovered in spatial and temporal terms). Small clusters of debitage observable within the GTP1 scatter, maybe from *in situ* knapping however the quantity of currently recorded refits (Fig 5.3) are not numerous enough to support this. Burnt artefacts and burnt unworked flints tightly match the distribution pattern of the worked flint, sitting vertically constrained within the scatter and can be considered part of the same occupation signature (Fig 5.2).

The spatial distribution of the EA1 scatter, in contrast, shows a cluster of debitage from a number of demonstrable refitting groups, tightly constrained within a 1.0 x 1.0 m area, with a smaller outlying sub-scatter of a few pieces to the northwest. The superimposition of all size classes in such a tight area, argues strongly against any post-depositional movement. It is however, so exceptionally constrained, that it does not match the expectations of what five knapping sequences, superimposed

broadly in the same area, might look like. This signature could only occur by the reduction of successive nodules in exactly the same position, or by the deliberately piling up or shallow burial of material, in this location by human agency. While no visible features were found associated with this scatter, the latter option of burial should not be dismissed as it would explain why there is no evidence for even minimal horizontal dispersal of the lithic artefacts associated with this scatter.

Refit distances are for the most part small and consistent with knapping and human scale behavioural movement, and largely all refits are constrained to either the EA1 or GTP1 scatter. The refits that cross, do so from the EA1 scatter into the GTP1 scatter and are conspicuous by their length compared to others. One explanation for this would be the discovery and removal of the artefact from the earlier TUP scatter in EA1 by later Mesolithic individuals. This would suggest at least a small part of the scatter in EA1 was still visible/accessible during the later episode of occupation.

In order to drill down into this observed difference between the two scatters, and to test our assumption that both are in primary context, each scatter was analysed in terms of assemblage composition by artefact size. In Figs 5.4 and 5.5 the size class distribution curves are presented for the two assemblages, showing striking dissimilarities which must be accounted for. Fig 5.4 shows progressively smaller counts for progressively larger lithic artefact size classes. This curve matches perfectly the expectation for a primary context or *in situ* scatter, with the normally abundant small debitage fragments present in the correct proportions and not winnowed away by fluvial or colluvial processes. This confirms that the GTP1 Early Mesolithic material represents an intact assemblage meeting the expectation of on-site blade/microlith production as suggested by the technological analysis.

In contrast, the size class curve for the TUP material from the EA1 scatter (Fig 5.5), shows an inversely proportioned profile. Small material is largely absent and material is progressively abundant for larger size classes. Even though the technology is aimed at producing large blades, the resulting debitage curve should be dominated by small debitage elements; consequently this does not match the expectations for *in situ* or minimally disturbed knapping scatters (Schick 1986; Pope 2002). Possible explanations for this curve profile might include:

- archaeological recovery was biased towards the larger pieces
- fluvial or colluvial processes removed the smaller material leaving the larger pieces behind
- human agency in the past selectively discarded larger pieces at the site.

Fig 5.1 Distribution of artefact and tool types across EAI and GTP1

Fig 5.2 Artefact distribution by size class

Fig 5.3 Refitting lithic artefacts in GTPI and EAI

Discriminating between these options requires reading the archaeological signature as a whole and careful consideration of the circumstances of discovery. The first explanation can be discounted: although the EA1 scatter was discovered during a watching brief phase, excavation methodology was meticulous, undertaken by hand and explicitly aimed at recovering all artefacts over 10mm in length. The second explanation is also considered unlikely, the scatter is tightly defined, showing no spatial size sorting indicative of even low-energy sediment or surface water flow; artefacts showed no preferred orientation in the ground, and the sedimentary context (identical to that of the GTP1 scatter) showed no indications of sediment movement, gullies or channels.

This leaves the third explanation a possibility, that the TUP lithics in the EA1 scatter were treated in a selective manner prior to discard at the site. A possible scenarios might be that the material was collected by hand from primary knapping scatters at another location, leaving small material behind, and that the larger pieces were transported an unknown distance to be discarded in the EA1 area. Another option is that the TUP material at EA1 was collected selectively and buried within the EA1 area within a shallow pit, and that the smaller material left on the surface was truncated and removed either by sedimentary processes, or by machining prior to identification during the watching brief.

Some support for the pit hypothesis comes from the vertical arrangement of the TUP material in the EA1 area (Fig 5.6) which shows a profile for the tightly constrained scatter which tapers with depth as would be expected from shallow burial.

5.4 BEHAVIOURAL INTERPRETATION OF THE TERMINAL UPPER PALAEOOLITHIC, MESOLITHIC SCATTERS AND LATER PREHISTORIC STONE ARTEFACTS

LATEGLACIAL

The TUP material attests to long blade manufacture and use at the site, with bruised blades suggesting the working and transformation of tough material such as antler or bone. The long blade removals are made from very large flint nodules, perhaps easily accessible in the open landscape of the Pleistocene–Holocene transition. These hunter-gatherer groups represent the first groups to recolonise Britain after the hiatus caused by the Younger Dryas cold stage. Lullingstone can now take its place alongside other sites in south-east England which preserve this very definite and distinctive signature of a colonisation event at the Pleistocene–Holocene transition.

Fig 5.4 Size class distribution curve for lithic artefacts from area GTP1

Fig 5.5 Size class distribution curve for lithic artefacts from area EA1

Fig 5.6 Vertical distribution of artefacts across areas EA1 and GTP1

Important comparable assemblages within the Thames drainage have been recovered from Springhead (Jacobi 1982), Riverdale (Barton 1991), North Cray and Underdown (Gardiner et al 2015) all also in Kent; from Three Ways Wharf in the Colne Valley, Greater London (Lewis and Rackham 2011) and from Church Lammas, near Staines in Surrey (Bird 2006). As with other long blade sites in southern Britain and the continent, all show a possible preference for landscape contexts flanking major rivers and their tributaries. Hunting of open-landscape, cold-adapted species such as horse and reindeer may have taken place in these environments and the possibility of seasonal occupation must be considered. The highly localised nature of the TUP flintwork, with waste material from a number of individual reduction sequences forming a tight cluster of overlapping material (Fig 5.2), is not thought to be the result of any natural site formation process. It appears more likely that this material was placed in one location, or perhaps shallowly buried, before the site was finally abandoned. This may have been to facilitate tidying a living area, or the material might have been piled up or buried to conserve it within the landscape. This would make sense if the group was operating episodically in the locale over an extended period of time, perhaps returning seasonally. Claims for similar kinds of caching behaviour has been documented in the Vale of Pickering (Conneller and Schadla-Hall 2003) but is previously undocumented in southern Britain. It might be that long blade production sites, with their abundant useable blades, provided sources for flint acquisition by groups revisiting valleys on a seasonal basis.

EARLY POSTGLACIAL

The GTP1 scatter occurs at the same broad stratigraphic horizon (Fig 5.6) but is of a totally different technological character. In the absence of firm dating evidence we are reliant on the technological features of this assemblage clearly demonstrating Early Mesolithic traits to confirm the GTP1 scatter was left by early Postglacial hunters. In terms of environmental context we know that after 9500 cal BC the effects of Early Holocene global warming would have led to the rapid afforestation of the landscape and a changeover in large mammal species in south-east England (Scaife 1988; Allen & Gardiner 2009). The lithic assemblages attest to small blade manufacture, probable microlith manufacture but no clear spatial patterning for these activities was discernible with any confidence. Activities relating to the maintenance and production of new types of hunting gear are possible, potentially associated with the use of the bow within the increasingly closed woodland landscape of the Darent valley

at this time. Piercers, scrapers and burnt material may attest to other maintenance and domestic activities at the site. The scatter was however too small in extent and density of material to argue for anything more than short-term occupation.

Whether the possible pit feature in Trench 6 relates to this period, or was formed by a natural process such as a tree-throw, was not resolvable during excavation. Large 'pits' containing Mesolithic flintwork have been historically documented in the region and claimed as parts of dwelling structures at Hassocks (Butler 1989) and Selmeston (Clark 1934), both in Sussex, and at Abinger in Surrey (Leakey 1951). However these structures have come under more recent scrutiny and may represent natural voids acting as capture points for stone artefacts (Newell 1981). Now that Lullingstone has provided another example where Early Postglacial artefacts are associated with a possible 'pit'-like feature, it add further impetus to bringing these features under more systematic analysis within the wider record of the period (Blinkhorn 2012).

The micromorphological evidence (see Chapter 3.3) suggests that colluvial slope processes and episodic soil formation acted as the main depositional agents preserving the artefact scatters. Deposits from the Lateglacial part of the sequence derive from the valley sides, steepened by periglacial and fluvial erosion. Slope movement then continues until a stable profile is achieved and the return of more widespread vegetation cover after the Younger Dryas further stabilises the landscape. Subsequent slope deposit/colluvium formation in the Early Postglacial, which contain the TUP and EM stone artefact scatters, might have an anthropogenic component relating to the local clearance of vegetation and subsequent soil movement. Charcoal within the deposits containing Mesolithic flintwork may be cultural in origin and relate to the on-site or local use of fire, which may also account for the small number of burnt artefacts and wider distribution of burnt flints

MID-HOLOCENE

Colluviation continues into later prehistory and these deposits, containing stone artefacts of Neolithic and Bronze Age affinity, evidence the transformation of the landscape by farming communities. The colluvium itself is the most important 'artefact' of this later period – documenting the erosion of brown earths from the valley sides under pressure from agriculture and grazing. Here the stone artefacts were providing technological solutions to the daily activities of those farming communities responsible for further deforestation and farming of the surrounding chalk downland.

CHAPTER 6 CONCLUSIONS: HIGH-RESOLUTION ARCHAEOLOGY AND LONG-TERM RECORDS OF LANDSCAPE CHANGE IN THE CHALKLAND RIVER VALLEYS

Matt Pope

6.1 LULLINGSTONE IN REGIONAL CONTEXT

When considered within its wider landscape, the Lullingstone Country Park site is typical of many other stretches of the Darent valley as it cuts through the Kent North Downs. Indeed it is typical of many other stretches of river valley dissecting the chalk escarpments of Kent, Sussex or Surrey within the wider Wealden region. What the archaeological investigations within the footprint of the Lullingstone Country Park have shown is that such sites, with slope deposits spanning the end of the Pleistocene and Early Holocene, provide an opportunity for the recovery of very localised high-resolution lithic artefact scatters preserved at the interface between different depositional events or the margins of the river flood plains.

The geoarchaeological investigations at the site have also demonstrated that these near-surface slope deposits must also be considered as part of much deeper sequences of head deposits. These can be shown at Lullingstone to preserve a full sedimentary archive spanning a period from the last Eemian (Ipswichian) interglacial (MIS 5e), through the last cold stage (MIS 5d – MIS2), and into the current warm Holocene interglacial. This sedimentary archive should be expected to contain not only deeper traces of human activity within the lower part of the sedimentary sequence but also a rich record of palaeoenvironmental proxies not investigated in the scope of this work.

Detailed analysis of the lithic artefacts recovered from the slope deposits and their interfaces appears to document hunter-gatherer groups at the transition from the last cold stage into the earliest part of the Holocene. In the absence of direct dating from the site, we might use comparisons with two other key Lateglacial sites in southern Britain with similar lithic technologies: Three Ways Wharf, Uxbridge, Middlesex and Avington, Berkshire. Dates from Three Ways Wharf, were obtained of 10,270±100 BP (OxA-1788) and 10,010±120 BP (OxA-1902; Lewis 1991; Lewis & Rackham 2011). From Avington VI, Berkshire, OSL dates from around 10,200 calendar years BP were obtained (Barton et al 1998; Fromm & Cook 2005; Gardiner et al 2015). More widely, and bearing in mind the limits of the radiocarbon calibration curve around 10,000 BP, the Terminal Upper Palaeolithic long blade sites of

southern Britain are generally thought to fall between 10,300 BP to 9,700 BP (10,200–9200 cal BC; Gardiner et al 2015).

The geoarchaeological context of the Lullingstone assemblages was unfortunately not conducive to dating. The vertical overlap of TUP and Early Mesolithic material within the same sediment body counted against the possibility of separating the assemblages through either OSL or radiocarbon dating. Not only was it impossible to firmly separate the Terminal Upper Palaeolithic material from that of the Early Mesolithic on stratigraphic grounds, the presence of later prehistoric flint work within the TUP and GTP1 scatters testifies to wider movement of artefacts and sediment vertically within the depositional profile.

These facts should not detract from the high degree of preservation of the TUP and Early Mesolithic scatters, which should themselves be considered as being broadly in primary context and to a high degree in situ. The lack of clear stratigraphic separation between the two technologies attests more to the rapid turnover between the two compared technologies and to the slow accretion of slope deposits during this period, one in which we might expect rapidly rising global temperatures and associated afforestation of the local landscape and consequent stabilisation of the slopes.

The excavations at Lullingstone Country Park have therefore produced a new data set to throw light on the colonisation history of southern Britain during the transition from the Lateglacial to the early Postglacial landscapes. As such Lullingstone can take its place alongside a handful of other sites which record locally dense, high-resolution signatures of long blade manufacture and associated tool use. The site is typical also of TUP finds from the Somme Valley (Fagnart and Coudret 2000), indicating that the Terminal Upper Palaeolithic populations of Britain were not isolated from, and almost certainly have their origins in, the adjacent areas of continental Europe. Indeed the wider distribution of these cultures, their affinities with wider Ahrensbergian populations of Northern Europe, and the role southern Britain played in their annual movement patterns are probably questions which can only be addressed by considering our own insular record directly alongside that of continental Europe and the now submerged

landscapes of Doggerland and La Manche. In this respect the Lullingstone TUP scatter is an important dataset providing high-resolution technological and behavioural data.

6.2 LULLINGSTONE AND IMPLICATIONS FOR FUTURE RESEARCH

The wider importance of the site is underlined when one considers that the TUP and Mesolithic scatters, sit within one very discrete horizon of a deep sedimentary sequence spanning in excess of 100,000 years. The possibility that organic deposits 4m below ground level date to the Eemian interglacial is considered highly likely, although this could not be proven within the scope of these works. These deposits although of significant depth (c 4m) were not beyond the reach of stepped trenching and appeared above the water table during the time of excavation. More importantly, these warm stage deposits were not buried under deep Holocene alluvium and might be present at even shallower depths elsewhere in the Darent Valley depending on the topography of the valley sides.

Lullingstone Country Park therefore provides a reminder that significant sedimentary archives of the last 120,000 years, and locally preserving high-resolution stone age archaeology, fauna and palaeoenvironmental material, flank the valley bottoms of the Chalkland Valleys within southern Britain. These records may span the assumed hiatus in human occupation between MIS 6 and MIS 3 in the British Isles, reoccupation by Neanderthal groups and their subsequent replacement by modern human hunters. These records further span the Last Glacial Maximum, reoccupation by Lateglacial hunter-gatherers and Holocene landscape use through to the present. The Lullingstone record is important because it documents both particular moments in time as well as long term landscape and climatic change. It is a reminder that we have yet to fully document the potential of Chalkland Valleys in southern England to tell the story of colonisation history and landscape change in the wider region.

BIBLIOGRAPHY

- Allen, M J, & Gardiner, J P, 2009 If you go down to the woods today: a re-evaluation of chalkland Postglacial woodland or grassland: implications of land to prehistoric people, in *Land and people: papers in memory of John G Evans* (eds M J Allen, N Sharples & T O'Connor), *Prehist Soc Res Pap*, **2**, 49–66
- Allen, T G, with Barton, N, & Brown, A, 1995 *Lithics and landscape: archaeological discoveries on the Thames Water pipeline at Gatehampton Farm, Goring, Oxfordshire 1985–92*, Thames Valley Landscapes Monogr Ser, **7**
- Allott, L, 2009a The environmental samples, in Pope & Priestley-Bell, 2009a
- Allott, L, 2009b Environmental samples, in Pope & Priestley-Bell, 2009b
- Anderson-Whymark, H, 2011 Intentional breakage in the British Neolithic, *Lithics*, **32**, 16–22
- Anderson-Whymark, H, in prep The late glacial to Bronze Age flint assemblage, in Wenban-Smith et al
- ASE, 2009a An archaeological evaluation at Lullingstone Country Park, Castle Road, Eynsford, Kent, unpub ASE rep no 2009052
- ASE, 2009b An archaeological evaluation (2nd stage) at Lullingstone Country park, Castle Road, Eynsford, Kent: assessment report, unpub ASE report no 2009127
- Bamford, H, 1985 *Briar Hill: excavation 1974–1978*
- Barton, N, 1986 Experiments with long blades from Sproughton, near Ipswich, Suffolk, in *Studies in the Upper Palaeolithic of Britain and northwest Europe* (ed D A Roe), *BAR Int Ser*, **296**, 129–41
- Barton, N, 1995 The long blade assemblage, in Allen, 54–64
- Barton, N, 1998 Long blade technology and the question of British Late Pleistocene/Early Holocene lithic assemblages, in Ashton, A, Healy, F, & Pettitt, P, *Stone Age archaeology: essays in honour of John Wymer*, *Lithic Studies Soc Occas Pap*, **6**, 158–64
- Barton, N, 1991 Technological innovation and continuity at the end of the Pleistocene in Britain, in Barton et al, 234–45
- Barton, N, Roberts, A J, & Roe, D A (eds), *The Late Glacial in north-west Europe: human adaptation and environmental change at the end of the Pleistocene*, *CBA Res Rep*, **77**
- Barton, N, Antoine, P, Dumont, S, & Hall, S, 1998 New OSL dates from the late glacial archaeological site of Avington VI, Kennet valley, Berkshire, *Quat Newsl*, **85**, 21–31
- Bates, M, & Stafford, E, 2013 *Thames Holocene. A geoarchaeological approach to the investigation of the river floodplain for High Speed 1, 1994–2003*
- Bird, D, 2006 *Surrey Archaeological Research Framework 2006*
- Blinkhorn, E, 2012 *The Mesolithic and the Planning Process in England* Unpublished PhD Thesis: University of York.
- Bradley, P, 1999 Worked flint, in *Excavations at Barrow Hills, Radley, Oxfordshire: Vol 1, The Neolithic and Bronze Age monument complex*, Thames Valley Landscapes Monogr Ser, **11**, 211–27
- Brown, A, 1995 The Mesolithic and later flint artefacts, in Allen, 65–84
- Burchell, J P T, 1938 Two Mesolithic ‘floors’ in the Ebbsfleet valley of the Lower Thames, *Antiq J*, **18**, 397–401
- Butler, C, 1989 An Early Mesolithic site and later flintwork from Hassocks, West Sussex, *Sussex Archaeol Collect*, **127**, 230–35
- Butler, C, 2005 *Prehistoric flintwork*
- Candy, I, 2005 Secondary precipitates, in Ashton, N, Lewis, S, Parfitt, S, Candy, I, Keen, D, Kemp, R, Penkman, K, Thomas, G, Whittaker, J, & White, M, Excavations at the Lower Palaeolithic site at Elveden, Suffolk, UK, *Proc Prehist Soc*, **71**, 16
- Cappers, R T J, Bekker, R M, & Jans, J E A, 2006 *Digital seed atlas of the Netherlands*, Groningen Archaeol Ser, **4**, Barkhuis, Netherlands
- Clark, J G D, 1934 A Late Mesolithic settlement site at Selmeston, Sussex, *Antiq J*, **14**(2), 134–58
- Clark, J G D, Higgs, E S, & Longworth, I H, 1960 Excavations at the Neolithic site of Hurst Fen, Mildenhall, Suffolk, 1954, 1957 and 1958, *Proc Prehist Soc*, **26**, 202–45
- Conneller, C, & Schadla-Hall, T, 2003 Beyond Star Carr: The Vale of Pickering in the 10th Millennium BP, *Proc Prehis Soc*, **69**, 85–105
- Cooper, L, 2006 Launde, a terminal Palaeolithic campsite in the English midlands and its north European context, *Proc Prehist Soc*, **72**, 53–93
- Doherty, A, 2009 The prehistoric pottery, in Pope & Priestley-Bell 2009b
- Evans, R, 1992 Erosion in England and Wales – the present the key to the past, in *Past and present soil erosion* (eds M Bell & J Boardman), 53–66
- Fagnart, J P, & Coudret, P, 2000 Le Tardiglaciaire dans le Nord de la France. *Mémoires du Musée de préhistoire d'Ile-de-France*, (7), 111–128
- Ford, S, 1987 Chronological and functional aspects of flint assemblages, in Brown, A G, & Edmonds, M R, *Lithic analysis and later British prehistory: some problems and approaches*, *BAR Brit Ser*, **162**, 67–81
- Froom, R, & Cook, J, 2005 *Late glacial long blade sites in the Kennet valley: excavations and fieldwork at Avington VI, Wawcott XII and Crown Acres*
- Gale, R, & Cutler, D, 2000 *Plants in archaeology*
- Gardiner, J, Allen, M, Lewis, J, Wright, J, & Macphail, R I, 2015 *A Long Blade Site at Underdown, Herne Bay, Kent and a Model for habitat Use in the Early Post-Glacial*, Wessex Archaeology <http://www.kentarchaeology.org.uk/10/016.pdf>
- Goldberg, P, & Macphail, R I, 2006 *Practical and theoretical geoarchaeology*
- Harding, P, 1990 The worked flint, in *The Stonehenge Environs Project* (ed J Richardson), *Engl Heritage Archaeol Rep*, **16**, 15–25
- Hather, J G, 2000 *The identification of the northern European woods: a guide for archaeologists and conservators*
- Healy, F, 1988 *The Anglo-Saxon cemetery at Spong Hill, North Elmham: Part VI, Occupation in the seventh to second millennia BC*
- Hodgson, J M, 1997 *Soil survey field handbook*, Soil Survey and Land Research Centre Technical Monogr, **5**
- Imeson, A C, Kwaad, F J P M, & Mucher, H J, 1980 Hillslope processes and deposits in forested areas of Luxembourg, in *Timescales in geomorphology* (eds R A Cullingford, D A Davidson & J Lewin), 31–42
- Inizan, M-L, Roche, H, & Tixier, J, 1992 *Technology of knapped stone*, Meudon, France
- Jacobi, R M, 1982 Later hunters in Kent: Tasmania and the earliest Neolithic, in *Archaeology in Kent to AD 1500: in memory of Stuart Eborall Rigold* (ed P E Leach), *CBA Res Rep*, **48**, 12–24
- Jacomot, S, 2006 Identification of cereal remains from archaeological sites, 2nd edn, https://ipna.unibas.ch/archbot/pdf/Cereal_Id_Manual_engl.pdf (accessed 23 March 2015)
- Jarvis, M G, Allen, R H, Fordham, S J, Hazleden, J, Moffat, A J, & Sturdy, R G, 1983 *Soils of England and Wales. Sheet 6. South East England*
- Jarvis, M G, Allen, R H, Fordham, S J, Hazleden, J, Moffat, A J, & Sturdy, R G, 1984 *Soils and their use in south-east England*, Soil Survey of England and Wales Bull, **15**
- KCC, 2009a Manual of specifications: Part A, Specification for an archaeological evaluation of land at Lullingstone Country Park, Castle Road in Eynsford near Sevenoaks, unpub rep
- KCC, 2009b Manual of specifications, Part B, KCC evaluation – trial trenching requirements, unpub rep
- KCC, 2009c Specification for an archaeological test pit evaluation of land at Lullingstone Country Park, Castle Road in Eynsford near Sevenoaks, unpub rep
- KCC, 2010 Specification for an archaeological watching brief with topsoil sieving and contingency for specialist early prehistoric input at Lullingstone Country Park, Castle Road in Eynsford near Sevenoaks in Kent, unpub rep
- Leakey, L S B, 1951 *Preliminary excavations of a Mesolithic site at Abinger Common, Surrey*, Surrey Archaeol Soc Res Pap, **3**
- Lewis, J, 1991 A late glacial and early post-glacial site at Three Ways Wharf, Uxbridge, London: interim report, in Barton et al, 246–55
- Lewis, J, & Rackham, D J, 2011 *Three Ways Wharf, Uxbridge: a Lateglacial and Early Holocene hunter-gatherer site in the Colne valley*, *MOLA Monogr Ser*, **51**

- Meisch, C, 2000 Freshwater Ostracoda of western and central Europe, in *Süßwasserfauna von Mitteleuropa*, 8/3 (eds J Schwoerbel & P Zwick), 1–522, Heidelberg and Berlin
- Munsell, 1992 *Munsell soil color charts*, rev edn, New York
- Newell, R R, 1981 Mesolithic Dwelling Structures: Fact and Fantasy in Mesolithikum in Europa 2. Internationales Symposium, Potsdam, 3. bis 8. April 1978. Bericht. *Veröffentlichungen des Museums für Ur-und Frühgeschichte Potsdam* Potsdam, **14**, 235–284
- NIAB, 2004 (1986) *Seed identification handbook: agriculture, horticulture and weeds*, 2nd edn
- Onhuma, K, & Bergman, C A, 1982 Experimental studies in the determination of flake mode, *Bull Inst Archaeol, London*, **19**, 161–71
- Pope, M I, 2002. The Significance of Biface-Rich Assemblages: Acheulean Landscape Use with Special Reference to Boxgrove, (Doctoral Dissertation), Southampton.
- Pope, M, & Priestley-Bell, G, 2009a An archaeological evaluation at Lullingstone Country Park, Castle Road, Eynsford, Kent, unpub ASE rep no 2009052
- Pope, M, & Priestley-Bell, G, 2009b An archaeological evaluation (2nd stage) at Lullingstone Country Park, Castle Road, Eynsford, Kent, unpub ASE rep no 2009127
- Reimer, P J, Baillie, M G L, Bard, E, Bayliss, A, Beck, J W, Bertrand, C, Blackwell, P G, Bronk Ramsey C, Buck, C E, Burr, G, Cutler, K B, Damon, P E, Edwards, R L, Fairbanks, R G, Friedrich, M, Guilderson, T P, Hughen, K A, Kromer, B, McCormac, F G, Manning, S, Reimer, R W, Remmele, S, Southon, J R, Struwer, M, Talamo, S, Taylor, F W, van der Plicht, J, & Weyhenmeyer, C E, 2004 IntCal04 terrestrial radiocarbon age calibration, 0–26 cal kyr BP, *Radiocarbon*, **46**(3), 1029–58
- Saville, A, 1980 On the measurement of struck flakes and flake tools, *Lithics*, **1**, 16–20
- Scaife, R G, 1988 The elm decline in the pollen record of south-east England and its relationship to early agriculture, in *Archaeology and the flora of the British Isles* (ed M Jones), Oxford Univ Comm Archaeol Monogr, **14**, 21–33
- Schoch, W, Heller, I, Schweingruber, F H, & Kienast, F, 2004 *Wood anatomy of central European species*, www.woodanatomy.ch (accessed 24 March 2015)
- Scott, E M, 2003 The Third International Radiocarbon Intercomparison (TIRI) and the Fourth International Radiocarbon Intercomparison (FIRI) 1990–2002: results, analysis, and conclusions, *Radiocarbon*, **45**, 135–408
- Shepherd, W, 1972 *Flint: its origin, properties and uses*
- Stace, C, 1997 *New flora of the British Isles*
- Stuiver, M, & Kra, R S, 1986 Editorial comment, *Radiocarbon*, **28**, ii
- Stuiver, M, & Polach, H A, 1977 Reporting of 14C data, *Radiocarbon*, **19**, 355–63
- Wenban-Smith, F F, & Bates, M R, 2011 Palaeolithic and Pleistocene investigations, in Simmonds, A, Wenban-Smith, F F, Bates, M R, Powell, K, Sykes, D, Devaney, R, Stansbie, D, & Score, D, *Excavations in north-west Kent 2005–2007. One hundred thousand years of human activity in and around the Darent valley*, Oxford Archaeol Monogr Ser, **11**, 17–59
- Wenban-Smith, F F, Bates, M R, & Schwenninger, J-L, 2010 Early Devensian (MIS 5d–5b) occupation at Dartford, south-east England, *J Quat Sci*, **25**, 1193–9
- Wenban-Smith, F F, Stafford, E C, & Bates, M R, in prep *Prehistoric Ebbsfleet: excavations and research in advance of the High Speed 1 and South Thameside Development Route 4, 1989–2003*
- Wetterich, S, Schirrmeister, L, & Petrzniuk, E, 2005 Freshwater ostracods in Quaternary permafrost deposits in the Siberian Arctic, *J Paleolimnology*, **34**, 363–76
- Whittaker, J E, & Horne, D J, 2009 Pleistocene, in *Ostracods in British stratigraphy* (eds J E Whittaker & M B Hart), Micropalaeontological Soc Spec Publ, **3**, 447–67

Between 2009 and 2011, Archaeology South-East carried out a series of excavations and watching briefs in advance of development at the Lullingstone Country Park, near Eynsford, Kent. The work, commissioned by Kent County Council, revealed a deep sequence of Pleistocene and Holocene slope deposits in the Darent river valley. In the upper part of this sequence high-resolution and apparently *in situ* stone artefacts were recovered which spanned the end of the last glacial period and into the Early Holocene.

Key findings include a rich cluster of refitting Terminal Upper Palaeolithic flint artefacts characteristic of Lateglacial hunter-gatherer 'longblade' cultures and a more diffuse spread of Early Mesolithic flintwork, including microliths, as part of a preserved land surface. In addition later Neolithic and Bronze Age flintwork was found within and on the surface of Holocene colluvial deposits.

Deeper geoarchaeological survey revealed these archaeologically-rich surface deposits were only the upper part of a deep sequence of sediments which spanned a period in excess of 100,000 years. At the base of this sequence, at 4m depth, organic deposits likely to date to the last interglacial period were recovered. These were overlain by cold climate solifluction deposits and in turn Holocene deposits which include Bronze Age bank and ditch features.

This volume also includes results of a detailed programme of stone artefact refitting. This was targeted at the Terminal Upper Palaeolithic and Mesolithic material, giving insights into the technology and behaviour of hunter-gatherers occupying southern Britain at the transition between the last ice age and the emerging world of the Holocene.

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