

Fluvial archives as a framework for the Lower and Middle Palaeolithic: patterns of British artefact distribution and potential chronological implications

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Abstract

With the adoption of an 'expanded chronology' for the Middle Pleistocene, based on the greater number of warm and cold episodes evident in the marine oxygen isotope record from deep ocean cores, has come the recognition of a meaningful progression of artefact types, something that could not be achieved with reference to the previous 'compressed chronology'. In Britain, at least, it has been established that Levallois knapping techniques appeared in MIS 9–8, that *bout coupé* handaxes are indicative of MIS 3 and, rather more tentatively, that assemblages with twisted ovate handaxes in significant numbers represent MIS 11 occupation. Added to these key markers, it is now possible to suggest that further tool types occur preferentially in deposits of particular age: assemblages with significant proportions of cleavers and 'ficron' handaxes appear to be correlated with deposits formed at around the time of the MIS 9 interglacial. This newly recognized patterning within the Lower and Middle Palaeolithic record differs markedly from the previous use, in the mid-20th Century, of archaeological typology as a means of dating Pleistocene sequences, which was based on a relative refinement of tool making that is now recognized to be unrelated to age. Indeed, the authors would wish to emphasize that, even with reference to the new scheme presented here, the archaeological record should only be seen as dating evidence 'of last resort'.

Introduction

It has long been known that river gravels are an important repository for Palaeolithic artefacts and, since the earliest days of collector-based research, it has been recognized that some bodies of gravel are richer sources than others and that particular types of artefact occur preferentially in certain deposits. Data and collections of this sort come especially from southern Britain (including East Anglia), from France and from the Iberian countries, although important assemblages and localities are also found in the Netherlands, Germany and further east in Europe (for recent reviews, see Bridgland *et al.* 2006; Santonja & Villa 2006; Mishra *et al.* 2007). Turning this knowledge into a coherent and cogent stratigraphical tool has proved a more difficult undertaking, however, and despite several attempts (e.g. Breuil 1932; Collins 1969; Roe 1981) modern-day archaeologists have all but abandoned the notion that valuable patterns exist in the Lower–Middle Palaeolithic record. This apparent lack of 'cultural patterning' has led to a number of more process-driven explanations for the variation in stone tools (McNabb 1992; Ashton *et al.* 1992; McPherron 1994; White 1998). While not denying that these behavioural, technological and theoretical

explanations of stone-tool variation have potential validity, it would now appear that the absence of a chronological pattern stemmed largely from the use of a previous 'compressed chronology' that recognized too few climatic cycles and in which many sites could not be dated. This required previous generations to work within the context of an incomplete, incorrect and restrictive framework, within which different climate cycles were conflated (Bridgland *et al.* 2006; Mishra *et al.* 2007). With the adoption of an 'expanded chronology' for the Middle Pleistocene, based on the marine oxygen isotope stages (MIS) from deep ocean cores, comes the recognition of a meaningful sequence of artefact types that can be tied to patterns of climatic change and human dispersal (Pettitt & White 2012).

The understanding of river terrace sequences was similarly impeded by the application of the erstwhile compressed chronology, which postponed acceptance of the notion, now well established (Bridgland 1996, 2000; Bridgland & Maddy 2002; Bridgland *et al.* 2004a; Antoine *et al.* 2007; Bridgland & Westaway 2008a, b), that terrace formation was climatically driven, often in approximate synchrony with 100 ka glacial–interglacial cycles. This new paradigm was used recently as a template for a sophisticated dating scheme based on amino acid diagenesis (racemisation) in the opercula of gastropods of the genus *Bithynia*, a scheme that was also applied to the British Palaeolithic record (Penkman *et al.* 2011, 2013). Armed with this new extended chronology, the archaeological record from fluvial sequences has proved useful for the provision of chronological pinning points for the uplift modelling of terrace sequences, with the aim of achieving a pattern of dating, especially in sequences where other means of age determination are scarce or absent. One such is the sequence in the former Solent River, southern England (Westaway *et al.* 2006; Fig. 1). Although reservations have been expressed (Briant *et al.* 2006, 2009; Ashton & Hosfield 2010), the results appear robust and, if anything, have proved prescient in the light of later findings (Bridgland *et al.* 2012; Harding *et al.* 2012). In addition to the age-indicative artefacts and assemblages from southern Britain discussed previously (White 1998a; White & Jacobi 2002; Westaway *et al.* 2006), it is now possible to suggest further patterns in terms of tool types that occur preferentially in deposits of particular age.

This paper thus sets out a provisional scheme based on the observed patterning in the British Palaeolithic record from fluvial contexts. Unlike similar schemes laid out in the early–mid 20th Century, it has not been constructed on the basis of typology and linear progression, but with reference to independent geological, biostratigraphical and geo-chronological dating frameworks. In other words, it represents the end result of a simple pattern recognition exercise; substantial revision can be anticipated as understanding of the Quaternary and Palaeolithic records improves. Should this scheme prove to be robust, it might be considered as a last-resort dating estimation tool, for sequences in which other methods of age determination are lacking. The authors are of course aware of the many theoretical and practical problems in using typology, an issue that has chequered the history of archaeology; thus they would emphasize that use of this scheme should invariably be undertaken with care and be based on large assemblages rather than individual artefacts. Whether it can be extended to a wider geographical region, whether different patterns can be determined

elsewhere or whether such patterns are potentially a function of sample size, are all topics for future consideration.

Long-established patterns of artefact distribution in time: Modes 1, 2 & 3

It has been evident for many years that at a number of British localities 'Mode 1' assemblages (i.e. those lacking handaxes or evidence of handaxe manufacture), usually attributed to the Clactonian Industry (Breuil 1932; Warren 1951; White 2000), occur stratigraphically below 'Mode 2' assemblages (i.e. those containing handaxes or evidence of handaxe manufacture). The most notable amongst these are Swanscombe and Purfleet, both in the Lower Thames (e.g., Wymer 1968, 1999; Fig. 1, inset). Old ideas that the Mode 1 assemblages represented an earlier, more primitive industry have long been supplanted by the realisation that handaxe makers were in Britain before the sediments at any of these sites were laid down, as demonstrated by the late Cromerian-Complex handaxe assemblages at sites such as Boxgrove, as well as (probably in reworked form) within Anglian (MIS 12) Thames gravels such as at Highlands Farm Pit, Oxfordshire (Bridgland 1994; Wymer 1999). It is also now well established that the Mode 1 assemblages, occur in different terraces of different ages; at Swanscombe the occupation dates from early MIS 11, whereas at Purfleet it dates from the transition from MIS 10 to MIS 9 (Schreve *et al.* 2002; Bridgland *et al.* 2012). This repeated industrial succession, which is underpinned by lateral correlatives of the Clactonian element in both terraces (Swanscombe with the Clacton type locality and Purfleet with the site at Globe Pit, Little Thurrock: Bridgland 1994, 2006; Fig. 1), has been interpreted as a pattern of arrival of hominins from different areas of the continent, bringing with them different knapping traditions, that was common to these two climate cycles (White & Schreve 2000). McNabb (2007) has questioned the veracity of the MIS 9 Clactonian at Purfleet on the basis of an insufficient number of artefacts, although he has yet to state what constitutes an acceptable number (or why) and has failed to address the fact that the lateral correlative deposit at Little Thurrock yielded several hundred similar artefacts. The issues of archaeological systematics, whereby one handaxe that may or may not belong with the rest of the assemblage takes precedence over all else, also need to be taken into consideration (White 2000).

In recent years much older occurrences of Mode 1 Lower Palaeolithic archaeology have been claimed, from sites at Pakefield and Happisburgh 3 on the North Sea coast of East Anglia (Parfitt *et al.* 2005, 2010; Fig. 1). In both cases the assemblages are too sparse and the discoveries too limited for their Mode 1 credentials to be considered unequivocal (just 34 and 78 artefacts respectively), although they fit with the apparent exclusivity of Mode 1 assemblages seen in the rest of Europe at this time (Pettitt & White 2012; see, however, Voinchet *et al.* 2010). The Happisburgh assemblage has been claimed to be as old as 1 Ma (MIS 25–21), based on its associated fossils and evidence from palaeomagnetism (Parfitt *et al.* 2010; Preece & Parfitt 2012), although Westaway (2011) has advocated a much younger age, in MIS 15c, on the assertions that the reversal is merely an early Middle Pleistocene palaeomagnetic excursion and that the pollen and fossils are derived. Similarly the Pakefield artefacts were attributed to

estuarine sediments of the Bytham River of potential MIS 19 or MIS 17 age (Parfitt *et al.* 2005; Preece & Parfitt 2012), whereas Westaway (2009a, b) attributed the deposits in which they occur to MIS 15e. Notwithstanding the disagreements over the precise ages, if these limited-size assemblages can be taken at face value (and the numbers are too small to be certain), it would seem that there was an initial late Early Pleistocene to mid-Cromerian-Complex non-handaxe phase of hominin occupation of Britain and NW Europe.

Another potentially important non-handaxe industry is that from Beds B2 and C at High Lodge, near Thetford (Norfolk: Fig. 1), the geological content of which has been interpreted as a raft of Cromerian-Complex interglacial sediment within the local Anglian till (Ashton *et al.* 1992). This is one of a number of sites controversially reinterpreted as the product of a late Middle Pleistocene glaciation that reached the Fen Basin and produced a complex of glacio-deltaic outwash gravels (Gibbard *et al.* 2009, 2012). Although the inclusion of several Bytham Sand and Gravel localities within this glacial complex, including the prolific Palaeolithic site at Warren Hill, can be roundly rejected (Bridgland *et al.* in press; see below), High Lodge is considerably more enigmatic. Its pre-Anglian interpretation is heavily dependent on the association of a premolar fragment attributed to an extinct rhinoceros that did not survive the Anglian glaciation (*Dicerorhinus etruscus* = *Stephanorhinus hundsheimensis*) and on sedimentological reasoning. The contemporaneity of the fauna must be open to doubt, given its condition, while revised understanding of the glacial stratigraphy of East Anglia might also demand a review of the stratigraphy. Archaeologically, High Lodge is even more controversial, having yielded a well-made scraper assemblage, predicting the Middle Palaeolithic, beneath gravel that has yielded a typical Lower Palaeolithic Acheulian handaxe assemblage similar to the fresh material at nearby Warren Hill. Early interpretations assumed that the handaxe assemblage must be older than the scrapers and had been derived from elsewhere. In the late 1980s and early 1990s, however, when there was a rush of new interpretations aimed at freeing archaeology from the tyranny of typological dating, a MIS 13 date for the scraper assemblage was readily accepted (Ashton *et al.* 1992). Today there is reason to be more circumspect, since there is still nothing else like the High Lodge scrapers from Britain or NW Europe older than MIS 9–7, whereas the handaxes could quite feasibly have been derived from Warren Hill or similar MIS13 deposits locally. The condition of these handaxes would not contradict that suggestion.

The first appearance of prepared-core (Levallois) knapping technology (Fig. 2), heralding the transition to Mode 3, is well established as an age marker, having been flagged as such by Wymer (1988, 1999) and pinned down to the beginning of MIS 8 (Moncel & Combier 1992; Bridgland 1994, 1998, 2006; Rolland 1995; Schreve *et al.* 2002) or, in more recent reviews, somewhat earlier, within MIS 9 (Westaway *et al.* 2006; Bridgland *et al.* 2012). Westaway *et al.* (2006) regarded the first appearance of Levallois as the most significant of the archaeological age indicators that they used for modelling terrace incision by the Solent River (see above); having taken it to have occurred at the MIS 9–8 transition, they found from their modelling that there was a better fit with the various data if Levallois had first appeared in MIS 9b. Further study of the Purfleet complex of localities, in conjunction with the building of the high-speed Channel Tunnel rail-link (Bridgland *et al.* 2012), found evidence that the upper

gravel there, in which Levallois artefacts appear for the first time (instrumental in providing the age marker), might well represent part of MIS 9 rather than (as previously supposed) MIS 8. However, it is difficult to determine this with certainty, as the uppermost part of the sequence is typically decalcified (Schreve *et al.* 2002) and thus devoid of fossils as a guide to palaeoenvironmental conditions.

In Britain there is a further marker of sorts, in that fresh artefacts disappear from sequences following MIS 7, there having evidently been no human occupation of the British peninsula in MIS 6 or MIS 4, or of island Britain during MIS 5e (Sutcliffe 1995; Wymer 1999; White & Schreve 2000; Bridgland 2006; Lewis *et al.* 2011). Although the record of human occupation in NW Europe during the last interglacial is somewhat sparse (Speleers 2000), it is now clear that hominins reached the part of the continent nearest to Britain, thanks to the well-dated artefact-bearing tufa at Caours, near Abbeville, northern France (Antoine *et al.* 2006, 2007). Dated by U/Th and TIMS (average from 10 dates) to 122 ka, the Late Pleistocene age of this deposit also conforms with its low-level position within the Somme terrace sequence (in the minor tributary Scardon valley). The archaeological assemblage is very much of Middle Palaeolithic 'Mode 3' type, with Levallois flakes and cores (Fig. 2b). The tufa overlies gravel that can be correlated with the Étouvie Formation (low terrace) of the Somme, itself the source of numerous Levallois flakes (Antoine *et al.* 2006, 2007; Bridgland *et al.* 2006). As was noted by Mishra *et al.* (2007), the evidence from Caours suggests that the absence of hominins from Britain during MIS 5e resulted from its island status rather than a wider regional migration pattern.

Age-indicative artefact types within Mode 2

Pre-Anglian handaxes

Modern advances in the recognition of handaxe types of age significance were pre-empted by the division of handaxe assemblages into typological sub-groups by Roe (1968). Within the now-outmoded chronostratigraphical paradigm of the late 1960s (see above), Roe was unable to make meaningful observations about the temporal distribution of these assemblage types but it is clear that he believed that they might be of age significance. The subsequent claim that British assemblages with twisted ovate handaxes in significant numbers represent occupation during MIS 11 or at the MIS 11–10 transition (White 1998a; Fig. 3), which sparked a revival of ideas that the variety of handaxe types might have chronological meaning, was essentially a reinterpretation of Roe's Group VI. It is astonishing to note that Warren (1926) came to a similar conclusion about such assemblages, albeit within an even more archaic dating paradigm.

There are now reasons to suppose that, at an assemblage level, the prevalence of particular Lower Palaeolithic handaxe forms can indeed be grouped in terms of age within the Middle Pleistocene, which might allow the general character of an Acheulian assemblage to be of assistance if the geological context from which it is sourced is undated. Roe's (1968) groups again provide a starting point (Table 1). His Groups V and VII are associated with deposits

regarded as pre-Anglian in age; Group VII is dominated by well-made 'rounded' ovate forms, whereas Group V is characterized by crude metrical 'ovates'. The celebrated assemblages from Boxgrove, West Sussex (a raised-beach locality: Roberts & Partfitt 1996; Fig. 1) and High Lodge (see above), are examples in which the accomplished standard of knapping that is typically represented might have delayed the acceptance of the localities as pre-Anglian. To these can be added the unabraded handaxes from Warren Hill, Mildenhall, and the (presumably) reworked assemblage from the Late Anglian Black Park Terrace at Highlands Farm Pit, Oxfordshire (Table 1; Fig. 1). The basal part of the sequence at Corfe Mullen, in the Stour valley ~10 km to the NW of Bournemouth (Wymer 1999; Fig. 1), is another source of artefacts assigned to Group VII and may also be pre-Anglian in age (McNabb *et al.* 2012).

Group V comprises assemblages that are dominated by handaxes made with an economy of removals using a hard-hammer, a type often regarded as primitive and once commonly referred to as 'Early Acheulian'. That name has indeed been associated with two of the sites (Fig. 1) that have contributed to this group, Fordwich in Kent (Roe 1976a, b; Bridgland *et al.* 1998) and Farnham (Terrace A) in Surrey (Oakley 1934; Roe 1976a, b; Fig. 4). Both are in high-level terraces in south-bank Thames tributaries and both lie too far south of the influence of the Anglian glaciation for this to be used in determining an unequivocally pre-Anglian age, although they come from the highest artefact-bearing terraces in both cases. Also in this group is the assemblage of well-worn handaxes from Warren Hill, as well as that from cave breccia in Kent's Cavern, Torquay (Devon: Fig. 1). The age of the latter is controversial, but the most recent dating, using the ^{10}Be method, favoured a MIS 12 date for the emplacement of the breccia, implying that the handaxes it contains were derived from a MIS 13 land surface on the plateau above the cave (Lundberg & McFarlane 2007).

The gravel at Warren Hill, one of the most prolific sources of artefacts in Britain, was once regarded as glacial in origin (Solomon 1933) but was subsequently attributed to the pre-Anglian Bytham River system on the basis of its clast composition (Bridgland & Lewis 1991; Wymer *et al.* 1991; Bridgland *et al.* 1995). Hardaker (2012) has recently reviewed the archaeology from this site. Attribution to the pre-Anglian Bytham fluvial system has, however, been questioned by Gibbard *et al.* (2009, 2012), who have advocated a late Middle Pleistocene glacial origin, in something of a reversion to the Solomon interpretation. As noted above, this has been thoroughly refuted by Bridgland *et al.* (in press) on stratigraphical and palaeo-geographical grounds, but it is also worth noting that the fit of the Warren Hill artefact types with the pre-Anglian clusters might well be regarded as additional ammunition against this controversial interpretation. However, in the interests of avoiding circularity, it should also be noted that Groups V and VII survive perfectly well without the inclusion of the Warren Hill assemblages within them.

Post-Anglian handaxes

The non-pointed handaxes from pre-Anglian contexts are almost invariably straight edged. Assemblages from early post-Anglian deposits, however, often

include a significant proportion of 'twisted ovate' type, as already noted. These are handaxes, usually ovate or cordiform in plan, in which the final episode of flaking has differentially worked the diagonal edges on opposite faces, creating a markedly twisted edge (Fig. 3). That Z-shaped are much more common than S-shaped twists has been taken to indicate that the earlier knappers had a predisposition to right-handedness comparable with that of modern humans (White & Plunkett 2004). There has been much debate about whether this form was accidental (Evans 1897; Layard 1904; White 1998b), although the large proportion of some assemblages that they represent is suggestive of a deliberate social tradition. White (1998a) concluded that British assemblages with high proportions of twisted ovates all belong to the terminal Hoxnian (MIS 11) or to the transition into the subsequent (MIS 10) cold stage. An important basis for this conclusion was the incidence of assemblages with twisted handaxes from the Boyn Hill–Orsett Heath terrace of the Thames, including those from the Upper Loam at Swanscombe (Roe 1968) and the probably equivalent Wansunt Loam at Dartford Heath (Smith & Dewey 1913; Tester 1951, 1976, Wenban-Smith & Bridgland 2001). The occurrence of an assemblage including twisted-ovate handaxes from the Old Milton Gravel was used by Westaway *et al.* (2006) as one of their pinning points for age calibration of the terrace sequence of the Solent River (see above). Briant *et al.* (2009) expressed a degree of scepticism regarding the contextual integrity of this assemblage. Recently, however, White *et al.* (2013) have identified a further occurrence of an assemblage rich in twisted ovates, from Dierden's Pit (Ingress Vale), 0.5 km to the NW of the primary Swanscombe locality (the Swanscombe Skull Site National Nature Reserve), and have suggested that it and the others from north Kent date from MIS 11a. It is also important to note that the modelled dating of the Solent sequence agrees well with an independently obtained chronology obtained from OSL (optically stimulated luminescence) dating (Briant *et al.* 2006; Westaway *et al.* 2006), which helps offset the fears concerning the circularity of using artefacts as a means of calibration for the modelling.

Whereas the concentration of twisted handaxes in contexts dating from MIS 11–10 has been established for several years, the idea that there are particular types of tools characteristic of the next climate cycle, MIS 9–8, is a more recent suggestion. It now seems that assemblages with significant proportions of cleavers and 'ficron' handaxes occur preferentially, in British sequences, in deposits formed at around the time of the MIS 9 interglacial (Wenban-Smith 2006; Pettitt & White 2012). Interglacial conditions were restricted in that marine isotope stage to a short-lived but very warm episode of no more than ~4000 years, which coincides with substage 9e (Siddall *et al.* 2003; Bridgland *et al.* 2012). As ever, both types occur throughout the Lower Palaeolithic but are far more prevalent during this one short episode. In the Thames this climate cycle is represented by the sediments of the Lynch Hill–Corbets Tey terrace, which have provided such notable Palaeolithic assemblages as those from Furze Platt (Fig. 1), renowned for its classic ficron forms (cf. Fig. 5), and Stoke Newington. The assemblage from Purfleet, in the Lower Thames, is smaller and includes relatively few handaxes (Bridgland *et al.* 2012), but that from Cuxton, in the tributary Medway valley (Fig. 1), includes a significant proportion of ficrons and cleavers (Cruse 1989; Figs 5, 6) and is from terrace sediments that are now regarded as correlative with the Lynch Hill–Corbets Tey

Formation of the Thames (Bridgland 2003). The presence of cleavers (Fig. 6) in these assemblages is more difficult to interpret. White (2006) suggested that they were not a deliberate form but rather the end-result of a widespread resharpening practice that transformed the shape of typical broad-ended ovate handaxes. He also noted that British 'cleavers' fell into that category only in metrical terms and were very different to the accepted technological definition of a cleaver used elsewhere in the Old World. Nonetheless, whether by design or as the product of prevailing technological practices, they too appear to have chronological significance.

All of these sites now attributed to MIS 9–8 coincide with Roe's (1968) Group I. In addition to the assemblages from these localities there are numerous isolated finds of ficron handaxes and cleavers, including discoveries from the now built-up area of London. For both types there is a strong coincidence between find spots and outcrops of the Lynch Hill Gravel; examples include ficrons from Ealing Common (Fig. 5B) and Stoke Newington and cleavers from Glasshouse Street (Marylebone), South Woodford (Fig. 6) and Stoke Newington (Fig. 1). Although not recorded in Roe's groups, it is noteworthy that handaxe assemblages that can now be attributed to the MIS 9 climate cycle have a higher proportion of scrapers than those representing MIS 11 (White, in press). This might be another reason to doubt the accepted age of the High Lodge scraper industry, which, after 20 years of puzzlement still has no parallels amongst assemblages of pre-Anglian vintage (Ashton & McNabb 1992; see above).

The Lower–Middle Palaeolithic transition

The appearance of Levallois during MIS 9–8 is accompanied by the disappearance of the handaxe (White *et al.* 2006) and leads ultimately to the extirpation of human populations for some 120,000 years (cf. Bridgland 1994, 1998, 2006; Sutcliffe 1995; Lewis *et al.* 2011). The re-occupation of Britain occurred during MIS 4–3 and is characterized by a later Middle Palaeolithic tool kit that includes the final handaxe variety to be considered to have age significance: the flat-buttet cordate or '*bout coupé*' (White & Jacobi 2002; Fig. 7). This characteristic type of implement is typical of mid-Devensian (MIS 3) assemblages, as exemplified by that discovered in recent years at Lynford, Norfolk (White 2012; Fig. 1). *Bout coupé* handaxes are also known from the Thames, seemingly derived from the Devensian gravels below the floodplain, although most have come from dredging from below water-level and so their context has not been recorded with precision. In the Solent, low-terrace sites yielding *bout coupé* handaxes provided another of the pinning points used by Westaway *et al.* (2006) in their modelling of incision in that former river system. Importantly, Levallois is absent from this period, the main form of core working being based around discoidal reduction.

Synthesis: potential age significance

Artefacts are a problematic dating tool. Even optimal high-resolution assemblages are likely to have accumulated in their geological contexts over tens, hundreds or even thousands of years. As such they can only be regarded as

palimpsests, reflecting the aims and desires of countless generations of hominins, not snapshots of a group's identity. The issue is further confounded by factors such as the influence of raw materials, levels of tool-reuse and resharpening, and tool function, all of which operate to reduce any signal of the original maker's habits and intentions. Historical abuses, whereby artefact typology and the assumed ordering of types (seriation) were often used in dating models as key constraints, sometimes even taking precedence over geological feasibility (cf. King & Oakley 1936), have also tarnished typology as a dating tool. The issue has, however, scarcely been revisited in the interval since significant advances were made in the interpretation of Quaternary chrono- and climato-stratigraphy, as a result of the adoption of the oceanic oxygen-isotope record as a global template. Thus it can be argued that British archaeologists have for too long shunned any notion that a meaningful cultural pattern exists. After failing to find any real order in the Lower Palaeolithic record, Roe (1981: p. 271) suggested that poor dating, or rather the lack of a cogent chronological sequence, lay at the root of the problem. The observations presented here show that he was right and that such patterns do indeed exist in the fluvial archive. It is hoped that the successes in determining a cultural pattern in Britain, presented here, can be followed by extending this type of assessment of artefact assemblages and their contexts to the European mainland.

It is clear that the change in stone-tool types being made by Lower and Middle Palaeolithic hominins occurred over millennial timescales (Nowell & White 2010). The reasons why hominins chose to make one type of handaxe rather than another are also open to question (cf. Gamble 1998; White 1998a, b) but fall outside the scope of the present review. In this paper it is argued that, once sites are correctly dated, clear patterns emerge in the archaeological record: not just of oscillations between Mode 1 and Mode 2 or the emergence of new methods of core-working such as Levallois, but differences in the preferred form of handaxes in different marine isotope stages. Unlike previous claims, these are not regarded as reflecting an early, middle and late Acheulian. Nor are they directional, predictable or constant. Instead they probably reflect the ebb and flow of populations over geological timescales, each wave bringing a new flavour to the mix or completely replacing what went before.

Thus there have been significant advances in the understanding of Pleistocene archaeological assemblages in recent decades. The importance of the extension of the geochronological context has been emphasized already, but there have also been revisions in views about the palaeoclimatic context for periods of hominin occupation. In contrast to an earlier assumption, at least by implication, that there had generally been human occupation during interglacials (cf. Wymer 1968, 1988), there was until recently a widely held view that hominins favoured more open landscapes and might have avoided the densely forested periods of interglacial optimum temperatures (Gamble 1986, 1987), an opinion largely fuelled by the paucity of artefacts from MIS 5e right across NW Europe (prior to the confirmation of the Caours tufa as dating from this stage – see above). Critics of this view (e.g. Roebroeks *et al.* 1992) have pointed out that interglacial occupation could be detected throughout Europe, and there is now clear evidence for occupation within forest environments as early as MIS 11 (11c), including preserved hearths from which burnt artefacts have been recovered as part of a primary-context Acheulian assemblage, at Beeches Pit,

West Stow, Suffolk (Preece *et al.* 2006, 2007; Gowlett *et al.* 2005; Fig. 1). Although that is not a fluvial site, it is located along the course of the former Bytham (Ingham) River, now drained by the River Lark in the opposite direction (Westaway 2009a); the Hoxnian sediments there, which include tufa, overlie Anglian (MIS 12) glacial outwash that, in all probability, was feeding into the emerging Lark system during Anglian deglaciation.

Wider comparisons

In some respects the island status of Britain may well have assisted the recognition of patterns of distinct faunal as well as artefact signatures from the different interglacials in southern England. Pioneering advances in this respect were achieved by Schreve (2001a, b), working on mammalian assemblages, and the patterns thus recognized in fluvial archives (Bridgland & Schreve 2004) were matched to some extent with sites in NW Europe, in Germany, the Netherlands and France (Schreve & Bridgland 2002; Bridgland *et al.* 2004b; Schreve *et al.* 2007). Albeit lagging somewhat behind the mammalian evidence, it is now pertinent to make comparisons between British and continental Palaeolithic assemblages, to explore the extent to which the signatures now evident within the sequences in southern England can be seen on European fluvial archives. Indeed, it has already been established that the broader-brush patterns are comparable, but nonetheless open to question. Thus the earliest occupation of the nearby continent would appear, from the record in the Somme, to date from MIS 15 (Tuffreau & Antoine 1995; Antoine *et al.* 2003). Indeed, that stage would seem to have seen the first handaxe makers in western Europe, based on evidence from fluvial and cave sites in France (Barsky & de Lumley 2005; Bridgland *et al.* 2006) and from the Atapuerca cave system in Spain; Raposo & Santonja 1995; Pérez-González *et al.* 1999), but reconciliation of the paucity of evidence for Mode 1 archaeology in the early Middle Pleistocene of the European Continent north of Iberia with the new discoveries from Norfolk (see above) remains a problem; it perhaps arises from the difficulty in recognizing Mode 1 artefacts, especially if made from poorer-quality raw material than flint. Two phases of human settlement have been distinguished, however, in the Middle Loire valley of France: Mode 1 (Early Palaeolithic) at around 1.1 Ma and Mode 2 (Acheulian) at around 0.7 Ma (Voinchet *et al.* 2010).

The first appearance of Levallois (Mode 3) has been considered coeval in continental Europe and in Britain (White & Ashton 2003; White *et al.* 2011). There have been claims of earlier European Levallois occurrences, such as in the Garenne Formation (MIS 12–11) of the Somme (Tuffreau & Antoine 1995), although these may instead be by-products of handaxe manufacture (Bridgland *et al.* 2006), as with similar anomalously early Levallois-like artefacts from British sites such as Rickson's Pit, Swanscombe (White *et al.* 2011).

Turning, then, to the more recently explored patterns in handaxe types, there is some indication of comparable evidence from Europe. The assemblage discovered in the 'Sables Roux' (Atelier Commont), overlying the Garenne Formation of the Somme at Saint-Acheul, includes numerous twisted handaxes and various tools of 'Middle Palaeolithic style'. This deposit is located within slope-derived sediments overlying, and clearly not directly related to, the Garenne Formation. The assemblage has been interpreted as the youngest

Acheulian industry from the Somme, representing a transitional facies between Acheulian and Middle Palaeolithic (Tuffreau 1987). An age in MIS 9 has been suggested tentatively, but a late MIS 11 age for the twisted handaxes must be a distinct possibility.

Much further afield, the FLAG 2010 meeting in the Tagus, Portugal, included a visit to the Vale do Forno, near Alpiarça, where a large assemblage of Acheulian artefacts, made predominantly from quartzite, includes several that qualify as ficrons and cleavers (Mozzi *et al.* 2000; Fig. 5C, D). These finds are from sandy and sometimes organic beds within a complex sequence forming Terrace 4 of the Tagus in its lower Portuguese reach, regarded as Late Pleistocene by Mozzi *et al.* but now shown to be significantly older by subsequent research, including optically stimulated luminescence dating (Martins *et al.* 2010). This is, of course, an isolated point of comparison and is floated here as an indication of the type of evaluation of artefact assemblages that might be fruitful in future. It is not that a pan-European synchronous 'ficron event' is anticipated, but rather that patterns similar to those in the UK might also occur at other regional levels. Their timings could have been completely different and, where occupation was more sustained, their patterns might have become even more blurred by continuous over-printing as shape preferences drifted over time. However, by creating a Europe-wide chrono-cultural map, it might prove possible to determine source populations in southern European refugia for the regular glacially-driven abandonment of large parts of the north, including the UK. Indeed, Britain can be regarded as a population sink, requiring 'topping up' from other parts of Europe during periods of population collapse or extinction. British cultural patterns will therefore largely reflect practices in proximal, and maybe more distal, parts of Europe. Contrastingly some may reflect indigenous developments during periods of isolation.

Conclusions

This paper has presented novel ideas about patterns recently detected in the types of handaxes occurring in fluvial terrace deposits of particular age, predominantly in Britain. These are an extension of previously recognized patterns in broader artefact categories, essentially Mode 1 (Clactonian), Mode 2 (Acheulian) and Mode 3 (Levallois), now of quite well established age significance, in Britain and further afield. The wider significance of the newly identified artefact type-age correlations, or even their application beyond individual regions, remains to be demonstrated. No such cultural patterns could ever have been recognized before a sound and detailed age model for the river-terrace contexts was developed. Now that this is available it is timely to be seeking a deeper understanding of Lower and Middle Palaeolithic activities, as recorded in the Quaternary fluvial sedimentary archive.

The task ahead is to develop a dating framework across Europe, alongside a European Rivers Palaeolithic Project (an extension of the English Heritage-funded 'The English Rivers Palaeolithic Project'; Wymer 1999) that would provide a database of stone-tool assemblages. From these a chrono-cultural picture of European hominin activities would emerge, providing for the first time a continental-scale cultural geography of the Lower and Middle Palaeolithic.

Britain, as a frequently isolated north-western extension, is a good laboratory for exploring these potentials, but is marginal to the real story that could emerge from a pan-continental study. Unlike for similar attempts in the past, the understanding of the fluvial contexts and the dating tools with which to achieve these aims are now available.

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Tables

Table 1 – British handaxe traditions according to Roe (1968) with inferred ages after White (in press).

Figures

Fig. 1 Location map showing places and river systems discussed in the text in southern Britain and the nearby continent. An inset shows the sites in the Lower Thames.

Fig. 2 Middle Palaeolithic material with Levallois artefacts. A. Cores from Lion Pit, West Thurrock (from Pettitt & White 2012). B–D – Levallois cores and flakes from the MIS 5e site at Caours, Somme valley (photographs from Pierre Antoine, with thanks). Levallois is absent from Britain after MIS 7–6, and there is currently no convincing record of any human presence between MIS 6 and MIS 4. Scales are in cm.

Fig. 3 Twisted ovate handaxes. A. Elveden, Suffolk, after Paterson & Fagg (1940). B. Foxhall Road, Ispwich, from White & Plunkett (2004).

Fig. 4 Pre-Anglian handaxes: illustrations of two crudely made handaxes from Farnham Terrace A (from Oakley 1939).

Fig. 5 Examples of 'ficron' handaxes. A. Cuxton, Kent (photo courtesy Francis Wenban-Smith). B. Ealing Common, London, found *c.* 1850 (Gunnersbury Park Museum (accession no 82.17), from Cotton & Philo (1982). C. Furze Platt (from Lacaille, 1940). D. Vale do Forno, Alpiarça, Portugal (from Mozzi *et al.* 2000). Scales are in cm.

Fig. 6 Examples of cleavers. A. Cuxton, Kent (photo courtesy Francis Wenban-Smith). B. South Woodford, London Borough of Redbridge, after Pettitt & White (2012). C. Glasshouse Street, Piccadilly, Central London (Image Copyright Museum of London.' Accession number A11663). D. Vale do Forno, Alpiarça, Portugal (from Mozzi *et al.* 2000). Scales are in cm.

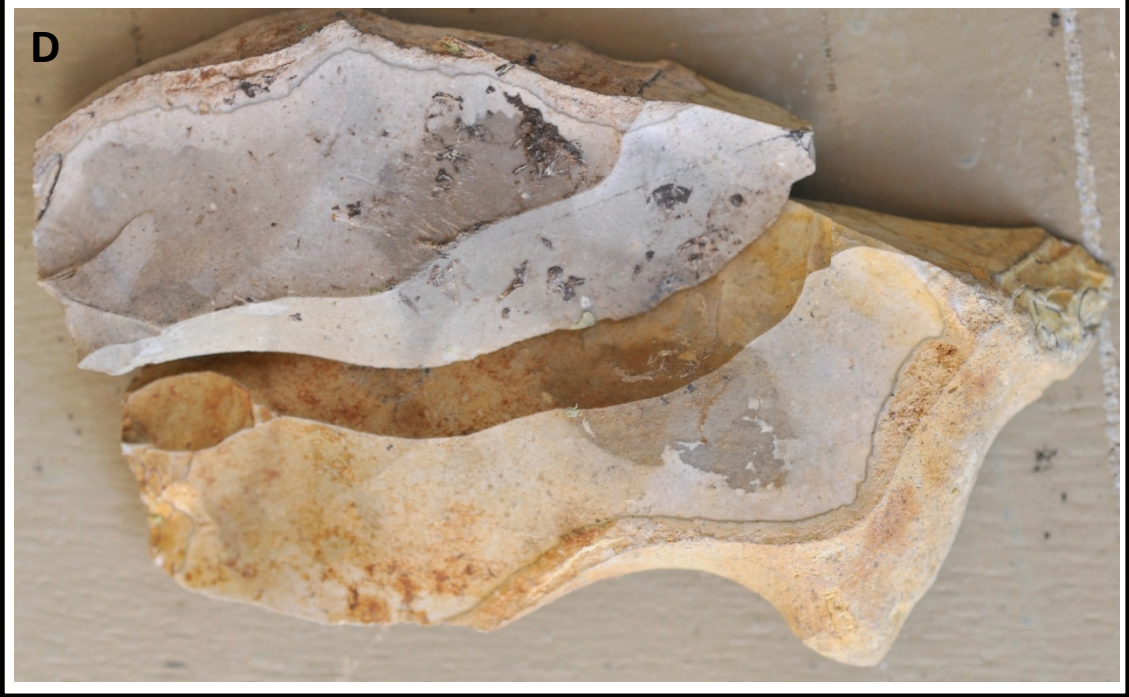
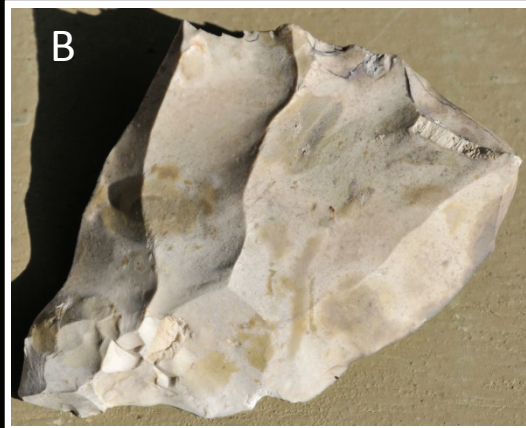
Fig. 7 *Bout coupé* handaxes (from Calkin & Green 1949). A. Southbourne Broadway, Bournemouth, Dorset. B. Castle Lane, Muscliff, Bournemouth, Dorset. Scale is in cm.

← Pointed Tradition →			← Ovate Tradition →		
Group I (with cleavers)	Group II (with ovates)	Group III (plano-convex)	Group V (crude, narrow)	Group VI (more pointed)	Group VII (less pointed)
MIS 9-8	MIS 11	MIS 9	MIS 15-13	MIS 11	MIS 13
Furze Platt	Swanscombe MG	Wolvercote	Fordwich	Elveden	High Lodge
Bakers Farm	Chadwell St Mary		Farnham terrace A	Bowman's Lodge	Warren Hill fresh
Cuxton	(Hoxne UI)		Warren Hill worn	Swanscombe UL	Highlands Farm
Stoke Newington	Dovercourt		(Kents Cavern Breccia)	(Wansunt)	Corfe Mullen
	Hitchin			(Foxhall Road Grey Clays)	(Boxgrove)
	(Foxhall Road Red Gravel)			(Hoxne LI)	
				MIS 13-12	
				Caversham	
				Middle Palaeolithic	
				Shide, Pan Farm	
				Oldbury	

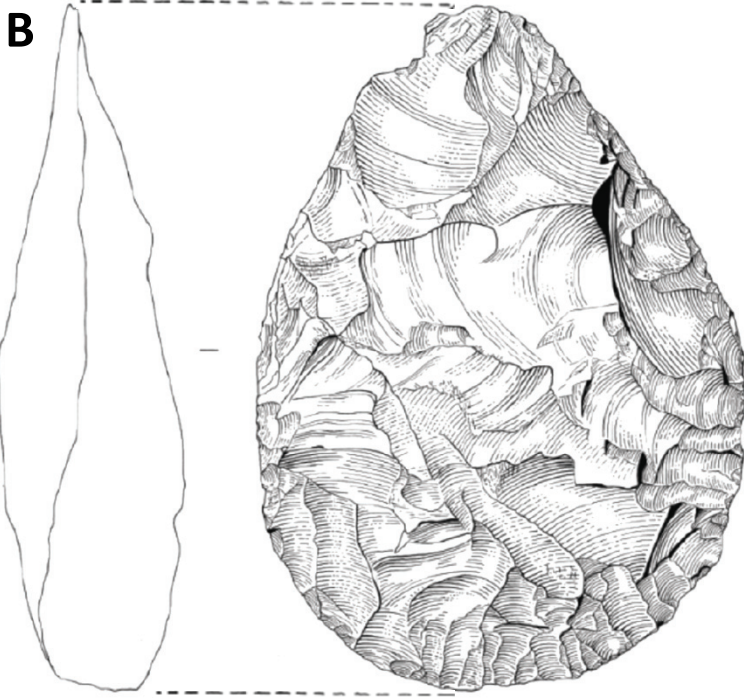
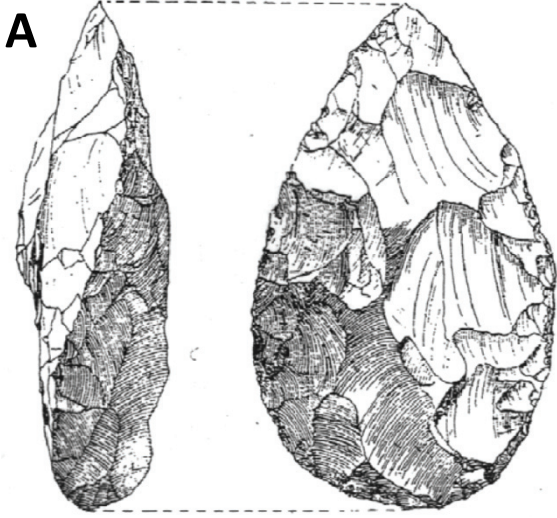
Table 1

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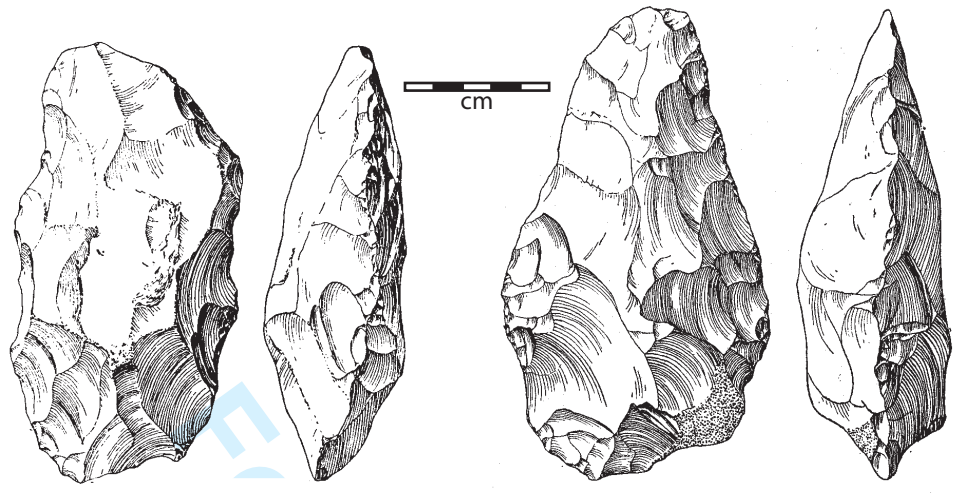
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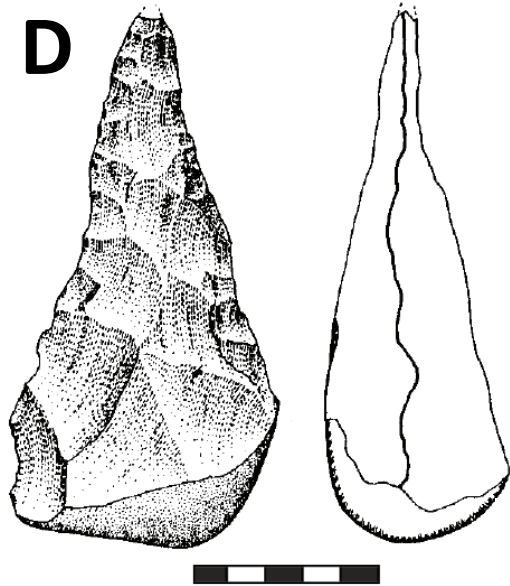
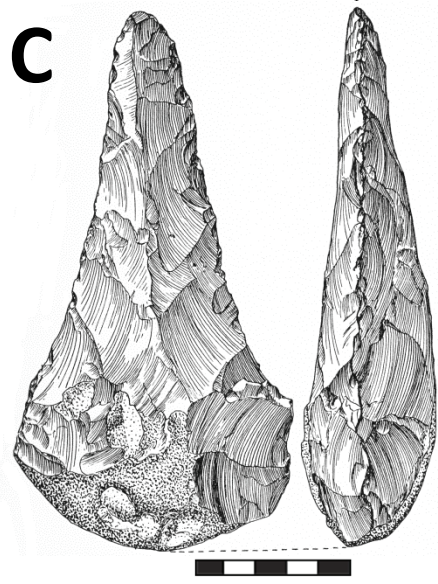
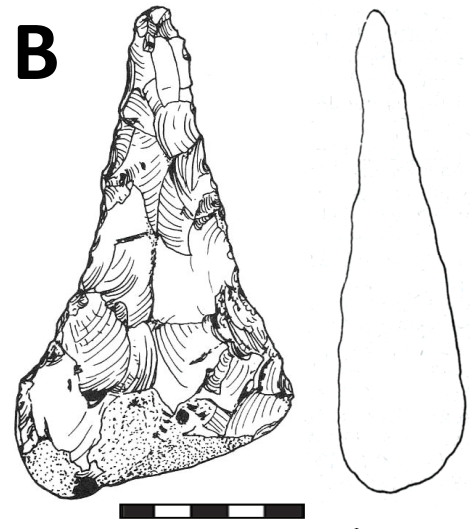
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