

HOUSEHOLD PRODUCTION IN THE MIDDLE BRONZE AGE OF SOUTHERN AND EASTERN ENGLAND: THE MID TERM CAR PARK (MTCP) ASSEMBLAGE, STANSTED AIRPORT, ESSEX, ENGLAND

Andrew P. McLaren¹

ABSTRACT

This paper presents and discusses the results of a technological analysis of a sizeable chipped flint assemblage recovered from a recently excavated Middle Bronze Age (c.1600–1150 BC) settlement at Stansted Airport, Essex, England. Technological data for this assemblage attest to highly localised raw material procurement and a general lack of control, or concern over, both core reduction and tool production processes. On-site core reduction can be characterised as simple, unsystematic and generally wasteful. Dominated by miscellaneous retouched flakes and scrapers, the retouched component of the assemblage suggests a similarly expedient or informal approach to tool production on the site. Together, these findings are consistent with those of other Middle Bronze Age chipped flint assemblages from southern and eastern England. Existing explanatory models for assemblages of this period have emphasised progressive functional substitution and the changing social role of chipped stone artefacts as key influences on the organisation of lithic technology. Whilst recognising the major interpretive value of these models, it is argued here that two other critically important influences, namely, sedentism and raw material availability, have to date been overlooked.

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Keywords: Middle Bronze Age, core reduction, flint, raw material availability, sedentism, tool production.

INTRODUCTION

In keeping with wider European developments, recent decades have witnessed a slow but steady growth of interest amongst British lithic specialists concerning later Bronze and Iron Age flintworking technologies (e.g. Saville 1980, 1981a & 1981b; Ford *et al.* 1984; Winham 1985; Ford 1987; Herne 1991; Gardiner 1993; Edmonds 1995; Brown 1991; Robins 1996; Young & Humphrey 1999; Butler 2001; Ballin 2002; Pollard 2002; Humphrey 2003, 2004 & 2007; Martingell 2003; Bishop 2006; Brown & Bradley 2006). The gross technological and typological characteristics of chipped stone assemblages from these periods are now well established. Much has been made, for example, of the paucity of formal tool types evident in later Bronze and Iron Age assemblages as well as their ostensible crudity. Closely tied to the latter, the absence of evidence for any form of specialised flintwork from these periods has also been emphasised (cf. Rosen 1997; Migal 2004; Höberg 2009). Studies have also highlighted important changes in the character of chipped stone procurement and deposition

from the Middle Bronze Age onwards, with highly localised raw material procurement and the paucity of evidence for the provision of chipped stone tools as funerary goods featuring prominently in discussions (e.g. Edmonds 1995; Young & Humphrey 1999; Pollard 2002; Humphrey 2004 & 2007; Bishop 2006).

To date, two major explanatory models have been advanced to account for these phenomena, both of which were developed out of geographically extensive reviews of the published literature and/or analyses. The first and arguably most influential of these was proposed by Ford *et al.* (1984) as part of their pioneering investigation into Bronze Age flintworking in Britain and posits functional substitution as the sole stimulus behind technological change in post-Neolithic chipped stone assemblages. Ford *et al.* (1984) attributed the decline in formal tool types and technical finesse evident over the course of the Bronze Age to the progressive replacement of chipped stone artefacts by functionally equivalent metal alternatives. The incentive to invest time and effort in flint production, they suggested, diminished over time, with more

¹AECOM Australia Pty Ltd, Level 8, 17 York Street, Sydney NSW 2000. Email: andrew.mclaren@aecom.com.

attention paid to the manufacture of *ad hoc* or expedient tools. The second and more recent model focuses on the changing social role of chipped stone artefacts during the latter half of the 2nd millennium BC. According to this model, this period witnessed an erosion of the central role of chipped stone artefacts in processes of social reproduction and its movement towards a purely functional and utilitarian role in the domestic sphere (Brown 1991; Herne 1991; Edmonds 1995; Young & Humphrey 1999; Humphrey 2003, 2004 & 2007). The functional impact of metal is acknowledged but is suggested to account unsatisfactorily for broader patterning in the technology and contextual associations of Bronze and Iron Age chipped stone assemblages.

This paper contributes to existing debates on Bronze and Iron Age flintworking in Britain by presenting and discussing the results of a technological analysis of a sizeable chipped flint assemblage recovered from a recently excavated Middle Bronze Age (c. 1600–1150 BC) settlement on the site of what is now the Mid Term Car Park (MTCP) at Stansted Airport in Essex, England. The primary goal of this analysis was to elucidate the procurement and production components of the chipped stone *chaînes opératoires* in operation on the MTCP site. Technological data for this assemblage are consistent with those of other Middle Bronze Age settlement assemblages from southern and eastern England, attesting to highly localised raw material procurement and a general lack of control, or concern over, both core reduction and tool production. Existing explanatory models for assemblages of this period emphasize progressive functional substitution and the changing social role of chipped stone artefacts as key influences on the organisation of lithic technology. The major interpretive value of these models is recognised. However, it is argued here that two other critically important influences, sedentism and raw material availability, have to date been overlooked.

THE MID TERM CAR PARK (MTCP) SETTLEMENT

From 1999 to 2004, Framework Archaeology undertook a series of large-scale excavations at Stansted Airport in Essex, England, in response to proposed developments within the

Stansted Airport Limited landholding (Figure 1). Of these, one of the largest areas subjected to detailed excavation lay in the south-eastern portion of the landholding on the site of the then-proposed Mid Term Car Park (MTCP). Archaeological mitigation for the MTCP site, which covered an area of approximately thirteen hectares, incorporated desk-based assessment, evaluation through fieldwalking and trial trenching and detailed open area excavation (Cooke *et al.* 2008: 3). Of relevance here was the discovery and excavation in the south-central portion of the site of an enclosed Deverel-Rimbury settlement comprising multiple roundhouses and associated features (Figure 2). Radiocarbon dates and stratigraphic evidence suggest two major phases of occupation on the MTCP site, with the possibility of a third transitional Middle–Late Bronze Age phase. Investigations also revealed a contemporary round barrow c. 500 m north-east of the settlement. Pre-Middle Bronze Age features identified on the MTCP site included six Early Neolithic pits, two Early Neolithic tree throws, a single Late Neolithic tree throw, and a localised *in situ* spread of Late Neolithic flintwork. Critically, only two of these features — one Early Neolithic pit and a Late Neolithic tree-throw — were located inside the Middle Bronze Age settlement, the remainder a considerable distance from it (see Cooke *et al.* 2008, 26, Figure 3.8). The *in situ* spread of Late Neolithic flintwork was located approximately 75 m to the east of the round barrow in the north-eastern corner of the excavation area. Remaining evidence for pre-Middle Bronze Age activity comprised a single featureless grog-tempered body sherd of tentative Early Bronze Age date from an Early Neolithic tree throw and a small quantity of residual Neolithic pottery and flints in Middle Bronze Age features (Cooke *et al.* 2008, 25–29).

THE CHIPPED STONE ASSEMBLAGE

Assemblage size and composition

A total of 4829 chipped stone artefacts was recovered from phased and unphased Middle Bronze Age features on the MTCP site. Two quartzite hammerstones were also recovered. Although an exact figure is unavailable, consultation of the excavation archive suggests that most artefacts were retrieved during hand excavation of features following topsoil



Figure 1. Map of eastern England showing the location of Stansted Airport in Essex. County boundaries marked in light grey.

stripping and without the use of sieves. The remaining pieces, predominantly chips, were recovered from a limited number of wet-sieved bulk soil samples. Given that most features on the MTCP site were half-sectioned or otherwise partially sampled, the excavated assemblage represents only a sample of material from stratified contexts. The results presented in this paper relate to a technological analysis of 4372 pieces or 90.5% of the

excavated assemblage. A complete analysis was not possible given that a proportion (22.4%, $n=459$) of the material from the original (F.324078) and recut (F.324080) barrow ditches was missing from the excavation archive at the time of analysis. It is, however, worth noting that this was the only feature found to be missing material during analysis and that of the missing pieces, 168 (36.6%) were chips. Of the material analysed for this study, 4297 (98.3%) pieces were classified as technologically and typologically consistent with a Middle Bronze Age date; the remaining 75 pieces were classified as diagnostically residual and excluded from analysis. Table 1 provides a typological breakdown of the non-diagnostically residual component of the MTCP assemblage. As indicated, three main categories of stone artefacts were recovered from the settlement and its associated round barrow: 1) waste flakes; 2) cores; and 3) amorphous knapping debris. These were accompanied by a variety of retouched implements made on flakes and non-flake blanks, with miscellaneous retouched flakes and scrapers dominating.



Figure 2. Unphased site plan for MTCP settlement (redrawn from Cooke et al. 2008, 41 & 58, Figures 4.10 & 4.28).

<i>Type</i>	<i>Number</i>	<i>%</i>
Waste flake	1528	35.56
Blade-like waste flake	58	1.35
Redirecting flake	13	0.30
Flake shatter	277	6.45
Angular shatter	341	7.94
Chip	1389	32.32
Blocky Fragment	216	5.03
Single platform core ^a	45	1.05
Multiple platform core ^b	131	3.05
Bifacial core	20	0.47
Tested piece	50	1.16
Core fragment	107	2.49
Unmodified utilised flake	15	0.35
Misc. retouched flake	36	0.84
Notched flake	3	0.07
End scraper	9	0.21
Side scraper	5	0.12
Side and end scraper	7	0.16
Non-flake scraper	18	0.42
Piercer	11	0.26
Awl	3	0.07
Fabricator	1	0.02
Barbed and tanged arrowhead	1	0.02
Misc. retouched angular shatter	4	0.09
Pounder	1	0.02
Hammerstone spall	6	0.14
Hammerstone	2	0.05
Total	4297	100

Table 1. Typological breakdown of the non-diagnostically residual component of the MTCP chipped flint assemblage. (^aIncludes single non-flake piercer ^bIncludes single non-flake scraper).

Raw material procurement

With the exception of two quartzite hammerstones, the MTCP assemblage consists entirely of chipped flint. External surfaces and patination states indicate a near exclusive reliance on complete and thermally fractured cobbles procured from one or more secondary geological deposits, with some minor evidence for the recycling of patinated flintwork (n=6, 0.14%), some of which is also diagnostically residual. Both forms of raw material appear to have been readily accessible to the occupants of the MTCP settlement. Cobble flint is available in abundance in the boulder clay underlying the settlement as well as the gravel beds of creeks in its immediate vicinity (Cooke *et al.* 2008, 13). Boulder clay flint was most likely accessed as a by-product of the digging of settlement and funerary-related features. The construction of the settlement's enclosure ditches and barrow, for example, will have generated large quantities of flint. Indeed, it is possible that the latter functioned as a "point"

source for raw material (cf. Saville 1980; Drewett 1982; Ballin 2002). For the most part, exploited raw material packages are characterised by thin, abraded and variably stained cortical surfaces. Patinated thermal fracture planes are also common. Knapping quality is, on the whole, reasonably high. Thermal flaws are not uncommon, as evidenced by the relatively large number of core fragments in the assemblage (n=107). However, in most cases, these do not appear to have posed a significant reduction obstacle or deterrent. Metrical data for complete cores (n=246) suggests that the cobbles available for reduction on and in the immediate vicinity of the MTCP settlement were relatively small in size. These exhibited an average maximum linear dimension of 59.1±11.5 mm (range: 37.2–106.3 mm) and an average weight of 61.1±46.6 g (range: 15–441 g). Histograms for core size and weight show a clustering in size between 41 and 70 mm (82.9%; Figure 3A), with a peak between 51 and 60 mm (42.3%),

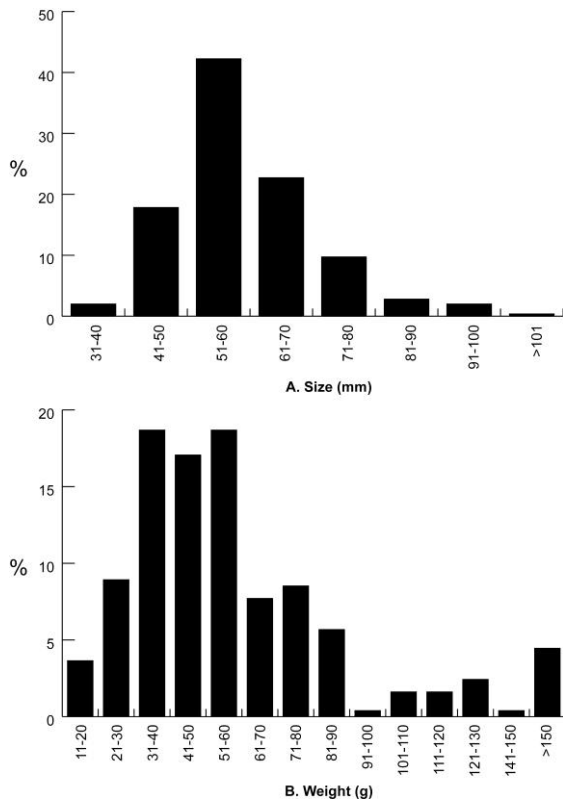


Figure 3. Histograms for the size (A) and weight (B) of complete cores (n=246).

and in weight between 31 and 60 g (54.5%; Figure 3B).

Core reduction

Two hundred and forty-six complete cores were identified in the non-diagnostically residual component of the excavated assemblage, with a further 107 core fragments also recorded (Figure 4). All display detachment scars consistent with direct freehand percussion using hand-held hammerstones (Cotterell & Kamminga 1979 & 1987; Cotterell *et al.* 1985). Examination of flake scar patterning on complete cores indicated a degree of variability in the methods employed by Middle Bronze Age knappers to reduce stone on the MTCP site. Cores were thus classified into four different types, based principally on the number and placement of striking platforms but also taking into account extent of reduction. These included: 1) single platform cores (n=45); 2) multiple platform cores (n=131); 3) bifacial cores (n=20) and 4) tested pieces (n=50).

Multiple platform core reduction was the most widely employed method of reduction on the MTCP site, with cores of this type accounting for 53.3% of the complete core assemblage

(n=131; Figure 4, A–D). Multiple platform core reduction involved detaching flakes in more than one direction from two or more platforms on the core. The selection of striking platforms during reduction appears to have been entirely opportunistic in nature. Figure 5 shows the relative proportions of the number of surviving striking platforms on cores of this type. An equal number of two (n=53) and three (n=53) platform variants can be compared with markedly smaller numbers of four (n=19) and five (n=6) platform examples. As Table 2 indicates, these figures correlate well with the number of flakes removed per core. Determining initial blank types for multiple platform cores was sometimes difficult given the extent of reduction. Nevertheless, they appear to have been most frequently made on cobbles (n=125) followed by flakes (n=5) and recycled flintwork (n=1). Two multiple platform cores were recycled for use as hammerstones. Multiple platform cores displayed an average maximum linear dimension of 59.8 ± 11.1 mm (range: 37.2–106.3 mm) and an average weight of 66.7 ± 54.9 g (range: 16–441 g). An average of six flakes was detached from multiple platform cores with ten or less removals (n=114). Eighteen (13.6%) specimens exhibited more than ten removals.

Single platform core reduction involved detaching flakes from a single striking platform, with removals orientated in roughly the same direction (Figure 4, E–H). Forty-five single platform cores were recorded during analysis, accounting for 18.2% of the total core assemblage. Scar patterning on these cores indicate that they were reduced via a series of overlapping flake removals, extending either partially (n=34) or fully (n=11) along the selected striking platform. Single platform cores were manufactured on cobbles (n=38) and flakes (n=7). They exhibited an average maximum linear dimension of 57.1 ± 10.9 mm (range: 38.9–95.1 mm) and an average weight of 60.5 ± 41.2 g (range: 23–240 g). An average of four flakes was detached from single platform cores with ten or less removals (n=43). Only two specimens exhibited more than ten removals. Bifacial core reduction involved the detachment of flakes from a single striking platform, but from two faces on the core. A relatively small number of bifacial cores was recorded (n=20, 8.1% of the total

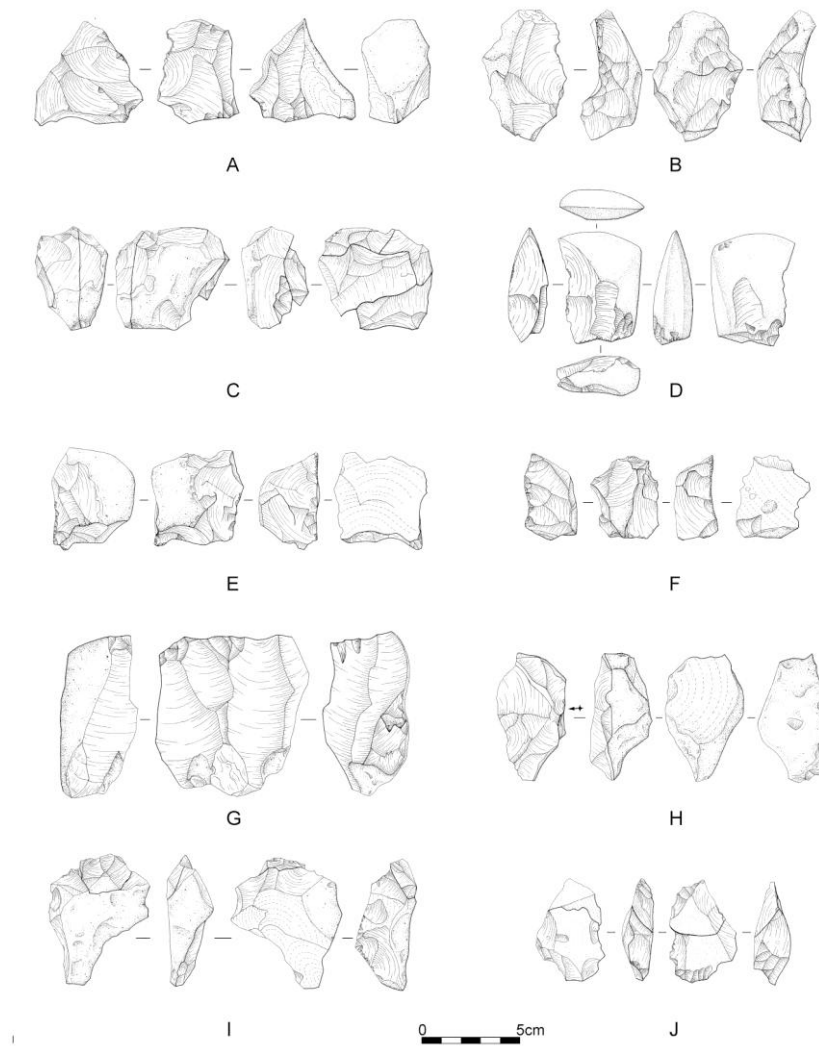


Figure 4. Selection of flake cores from MTCP settlement. A–D: multiple platform (D manufactured on recycled polished Neolithic axe fragment), E–H: single platform, and I and J: bifacial. Note C, I and J drawn with flake refits. E recycled for use as a piercer.

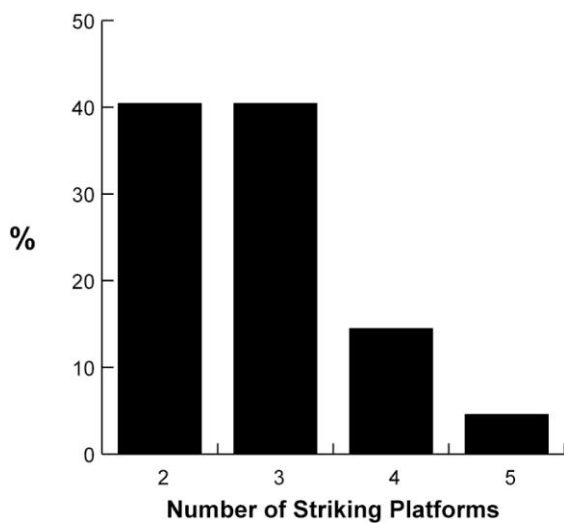


Figure 5. Relative frequencies of the number of surviving striking platforms on multiple platform cores (n=131).

complete core assemblage) in the assemblage (Figure 4, I and J).

Flake scar patterning on these cores indicate an unsystematic application of what Toth (1997, 369) has termed the “2 x unifacial” bifacial reduction method, whereby flakes were removed unifacially from one surface of the core followed by rotation and removal of flakes from the opposite face, as opposed to the bifacial alternate technique. Rotation between core faces appears to have been relatively frequent, with knappers typically executing multiple short (e.g. 2–4 flake) removal sequences as opposed to two extended ones. Bifacial cores were made on cobbles (n=17) and flakes (n=7).

They displayed an average maximum linear dimension of 62.3 ± 14.5 mm (range: 39.6–98.8 mm) and an average weight of 51.2 ± 29.1 g (range: 16–122 g). An average of five flakes was detached from bifacial cores with ten or less removals ($n=18$). Two specimens had more than ten removals.

Tested piece reduction involved the unsystematic removal of one or two flakes from a stone package, presumably to test the quality of the raw material, followed by discard. Fifty tested pieces, comprising 20.2% of the complete core assemblage, were recorded. Tested pieces were made on cobbles ($n=42$) and flakes ($n=8$). The majority (82%, $n=41$) of specimens exhibited two removals. Single striking platform variants were also most common (74%, $n=37$). Tested pieces displayed an average maximum linear dimension of 57.9 ± 11.8 mm (range: 44.2–97.9 mm) and an average weight of 51 ± 27.6 g (range: 15–142 g).

Flakes per core	<i>Number of striking platforms</i>			
	2	3	4	5
1 to 5	34	18	1	0
6 to 10	17	30	12	1
10+	2	5	6	5

Table 2. Association between the number of striking platforms and flakes removed from multiple platform cores ($n=131$).

Core reduction — general observations

Recorded core attributes indicate a simple, unsystematic and generally wasteful approach to core reduction on the MTCP settlement. Calculation of the flake-to-core ratio for the non-diagnostically residual component of the MTCP assemblage provides a value of 6.7 flakes per core. Though based solely on number of removals and not core size, an important distinction when considering the *intensity* as opposed to *frequency* of individual core reduction episodes, this demonstrably low ratio suggests frequent and typically short-lived core reduction “events” as opposed to sustained, intensive ones. Cortical data for cores that were interpreted as having been manufactured on complete cobbles ($n=101$) provide further support for this suggestion. As Figure 6 indicates, relatively few (16.8%, $n=17$) had more than 75% of their cortex

removed prior to discard. The majority fell within the 26–50% bracket (41.6%, $n=42$). However, an equal proportion retained more than 50% of their cortex at discard. Middle

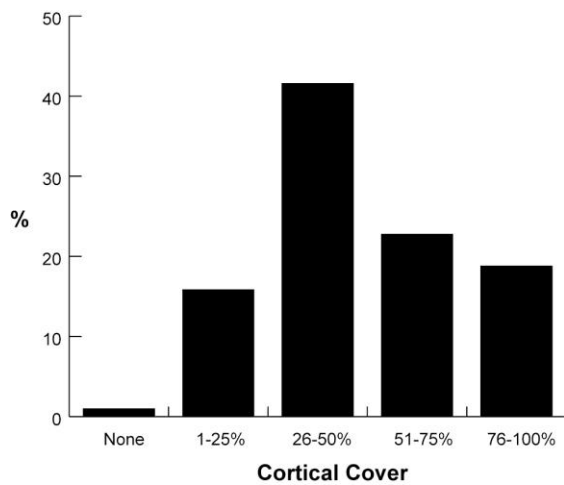


Figure 6. Relative amounts of cortex remaining on cores interpreted as having been made on complete cobbles ($n=101$).

Bronze Age knappers on the MTCP site, it must be concluded, seldom reduced cores to their full potential prior to discard. Rather, reduction appears to have been geared simply towards the expedient production of flakes suitable for immediate use or secondary modification via retouch. At the same time, the percentages of cores exhibiting aberrant terminations on one or more core faces (81.4%, $n=201$), incipient cones on striking platforms (27.1%, $n=67$) and partially crushed striking platforms (16.3%, $n=40$) suggest a general lack of control, or concern over, the reduction process. So too the paucity of evidence for platform preparation in the complete core assemblage, with only five cores (2% of the total) exhibiting probable evidence for the preparation of striking platforms in the form of limited overhang removal.

A final yet important issue to address here concerns the question of whether the single, multiple and bifacial cores identified in the MTCP assemblage do, in fact, represent discrete *chaînes opératoires* as opposed to sequential stages along a single reduction continuum. As highlighted by Kuhn (1995) and others (e.g. Volkman 1983; Baumler 1988; Wallace & Shea 2006), cores can and frequently do change form over the course of reduction. Naturally, this observation has important implications for the interpretation of typological variability in core assemblages.

For instance, with respect to the MTCP core assemblage, we can propose a hypothetical model of sequential core reduction in which unmodified cobbles or flakes were routinely transformed from single platform cores into multiple or bifacial types prior to discard (Figure 7). Rotation of bifacial cores outside of the bifacial plane during reduction will have resulted in the production of multiple platform cores. Tested pieces (n=50) are not shown as their classification is based solely on number of removals.

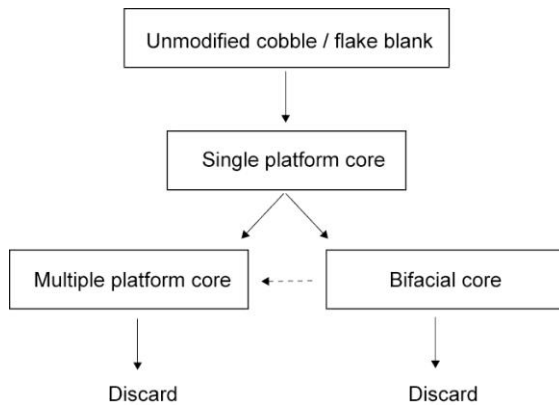


Figure 7. Hypothetical model of sequential core reduction and transformation on the MTCP settlement.

Following Kuhn (1995, 99), a simple yet effective measure of the validity of the proposed model is that of core size. If valid, multiple and bifacial cores should be smaller than their single platform counterparts, having been more extensively “consumed” prior to discard. However, if these types represent discrete — or at least relatively discrete — reduction trajectories, all three should be reduced to approximately the same extent and there should be no systematic differences in their sizes. As shown in Table 3, the average sizes of single, bifacial and multiple platform cores on the MTCP site favour the latter alternative. Not only are multiple and bifacial cores slightly larger than their single platform counterparts, all three types are remarkably similar in size. Differences between types are also statistically non-significant (Table 4). Together, these data suggest that core type has little relationship to variation in the extent of reduction on the MTCP site, thus supporting the hypothesis that at least three different yet equally viable methods of core reduction were in operation on the settlement. This is not, of course, to deny a degree of technological and

morphological overlap between single, multiple and bifacial cores in the MTCP assemblage. Rather, the point is made that a rigid transformational model in which the various core types represent different stages along a single reduction continuum is inappropriate.

<i>Statistic</i>	<i>Single</i>	<i>Bifacial</i>	<i>Multiple</i>
Mean (mm)	57.1	62.3	59.8
Std dev.	10.9	14.5	11.1
CV	19%	23%	19%
Min (mm)	38.9	37.2	39.6
Max (mm)	95.1	106.3	98.8
Count (n)	45	20	131

Table 3. Descriptive statistics for the maximum linear dimensions of single, bifacial and multiple platform cores.

<i>Comparison</i>	<i>Significance value</i>
Single vs. multiple	t=-1.435 df=174 p=0.153
Single vs. bifacial	t=-1.607 df=63 p=0.113
Bifacial vs. multiple	t=-.896 df=149 p=0.372

Table 4. T-test results for comparisons of mean maximum linear dimensions of single, bifacial and multiple platform cores.

The flake assemblage

A total of 1619 unretouched flakes was recorded in the non-diagnostically residual component of the excavated assemblage. Of these, 1528 (94.4%) were classified as complete waste flakes, 58 (3.6%) as complete blade-like waste flakes, 39 (2.4%) as broken flakes, thirteen (0.8%) as redirecting flakes, fifteen (0.9%) as unmodified utilised flakes and five (0.3%) as hammertone spalls. 35 (2.2%) specimens were burnt. 277 flake shatter pieces were also recorded, 82% (n=226) of which retained a complete or partial distal termination. Complete flakes were generally small in size, with an average length of 29.3±10.9 mm (range: 8.2–83.3 mm), average width of 28.1±10.4 mm (range: 8.3–79.4 mm) and average thickness of 8.1±4.2 mm (range: 1.2–37.8 mm). A comparison of the lengths of complete unretouched flakes (n=1580) and the longest core scars (n=246) in the assemblage

shows that the two are similarly distributed (Figure 8). This supports the inference that the former were struck from the cores discarded on-site. Figure 9A presents the relative frequencies of flake size classes for complete unretouched flakes. As shown, the majority (55.1%, $n=870$) of specimens was less than 40 mm in maximum dimension, with few exceeding 60 mm (5.6%, $n=89$). These data are consistent with the size of the cobbles available for reduction on and in the immediate vicinity of the MTCP site.

Flake length–width comparisons indicate a population of predominantly short, broad flakes; 81.9% ($n=1293$) of blanks exhibit a length/breadth ratio between 0.6–1.5 (Figure 9B). 58 flakes attained blade proportions but none was deemed to be a blade *stricto sensu*. Following Ballin (2002, 12), platform remnants can be characterised as typically large and broad, with an average width of 15.2 ± 7.3 mm (range: 1.5–60.6 mm), average depth of 6.2 ± 3.4 mm (range: 0.9–23.5) and average width:depth ratio of 2.7. These data are congruent with minimal platform preparation and direct freehand percussion using hard hammers. Finally, a plot of flake shape, determined by dividing flake surface area by thickness and plotting the mean value against each platform width to thickness ratio class, indicates a diverse *range* of flake shapes within the unretouched flake population (Figure 10). This variability is important as it supports the hypothesis that all stages of core reduction were occurring on the MTCP site. Viewed in conjunction with the metrical data above, it also highlights the lack of technological standardisation in the flake assemblage.

Figure 11A shows the relative frequencies of primary, secondary and tertiary flakes in the unretouched flake assemblage. As shown, the majority (68.5%, $n=1082$) of flakes exhibited partially corticated dorsal surfaces, with comparatively few (21.2%, $n=334$) non-cortical examples. Though pronounced, this disparity was expected given both the size of the raw material size packages available to knappers on the MTCP site and a typically non-intensive approach to core reduction. Primary flakes accounted for only 10.3% ($n=163$) of the total flake assemblage. Nevertheless, their presence indicates the initial reduction of cobbles on the site. This

observation applies to both the settlement ($n=1346$) and barrow ($n=234$) flake assemblages, which contained roughly equivalent proportions of primary flakes (10.3% and 10.7% respectively). Figure 11B shows the varying frequencies of striking platform types in the flake assemblage. Plain unprepared platforms were the most common form recorded, accounting for almost 70% of the assemblage (69.6%, $n=1100$).

These attest to the detachment of flakes following one or more rotations between core faces. Cortical platforms were also well represented in the assemblage (28.4%, $n=450$), a finding consistent with the on-site reduction of unmodified cobbles. In keeping with the near absence of evidence for the preparation of striking platforms observed in the complete core assemblage, preparation was evidenced by only thirty flakes, all of which displayed crudely trimmed platforms.

The relative frequencies of dorsal flake scar orientations observed in the non-primary flake assemblage ($n=1417$) are presented in Figure 11C. Interestingly, dorsal scars orientated at or close to 90 degrees to the striking platform were most common (41.8%, $n=592$), followed by irregular (37.2%, $n=527$), parallel (11.9%, $n=168$), opposed (1.5%, $n=21$) and indeterminate (7.6%, $n=108$) orientations. Taken at face value, the high frequency of 90 degree orientations in the assemblage would appear to be at odds with the numerical dominance of multiple platform cores in the MTCP assemblage. On closer inspection, however, it would appear that these data are consistent with the representation of core types in the complete core assemblage. When combined, irregular, parallel and opposing orientations — all potential products of multiple platform core reduction — account for 54.7% ($n=716$) of the classifiable total, a figure congruent with the representation of multiple platform cores at 53.3%. It is, however, also pertinent to note that a percentage of those flakes with 90 degree orientations is likely to have been the product of multiple platform core reduction; twelve multiple platform cores in the assemblage, for example, exhibited striking platforms orientated at right angles to one another. Such a pattern will have resulted in flakes with dorsal scar configurations indistinguishable

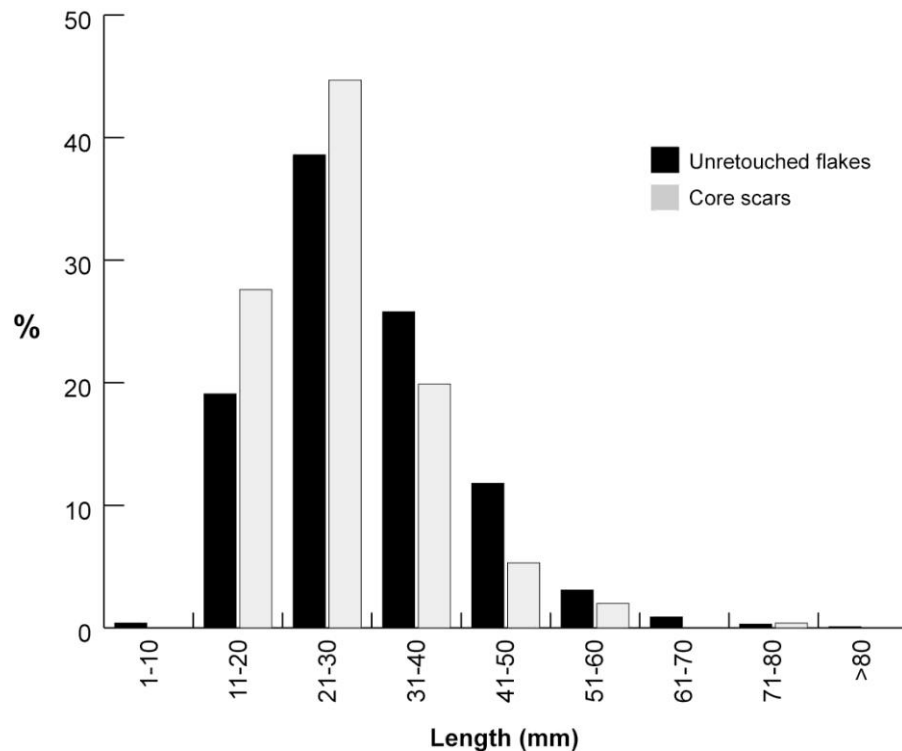


Figure 8. Comparison of complete unretouched flake lengths (n=1580) and maximum core scar lengths (n=246).

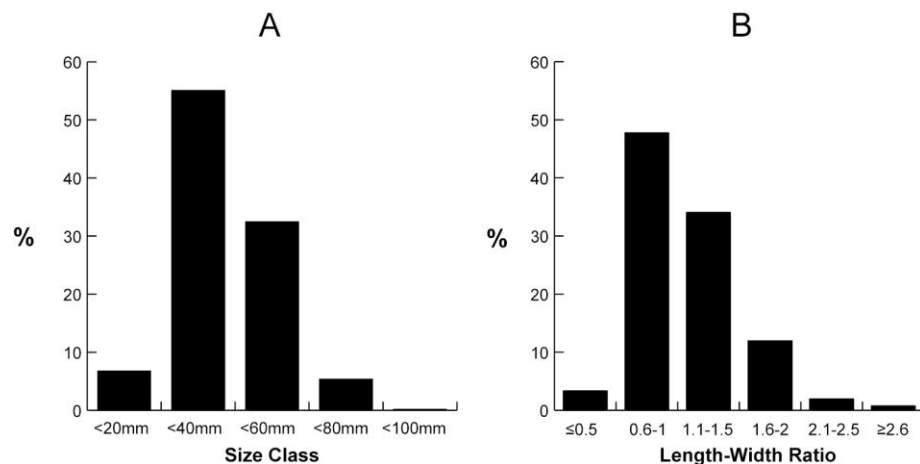


Figure 9. A) relative frequencies of complete unretouched flake size classes; B) length-width ratio classes for complete unretouched flakes.

from those generated during single platform core reduction. Finally, flake termination data support an expedient and relatively uncontrolled approach to core reduction on the MTCP site. As shown in Figure 11D, a near equal number of feather (n=748, 47.3%) and hinge (n=759, 48%) terminations was recorded in the assemblage, with slightly more of the latter. Step and plunging terminations were comparatively poorly represented at 1.1% (n=17) and 3.5% (n=56) respectively.

Retouched and unmodified utilised flake and non-flake blanks

A total of 116 retouched and unmodified utilised flake and non-flake blanks was recorded in the non-diagnostically residual component of the excavated assemblage (Figure 12). Table 5 provides a typological breakdown of this tool sub-assemblage. In common with other Middle Bronze Age settlement assemblages from the study region (e.g. Blackpatch: Drewett 1982; Bishops Canning Down: Gingell 1992; Down Farm: Barrett *et al.* 1991; Itford Hill: Burstow & Holleyman 1957; Grimes Graves: Saville 1981b; Herne 1991; Thorny Down: Stone 1941), miscellaneous retouched flakes and

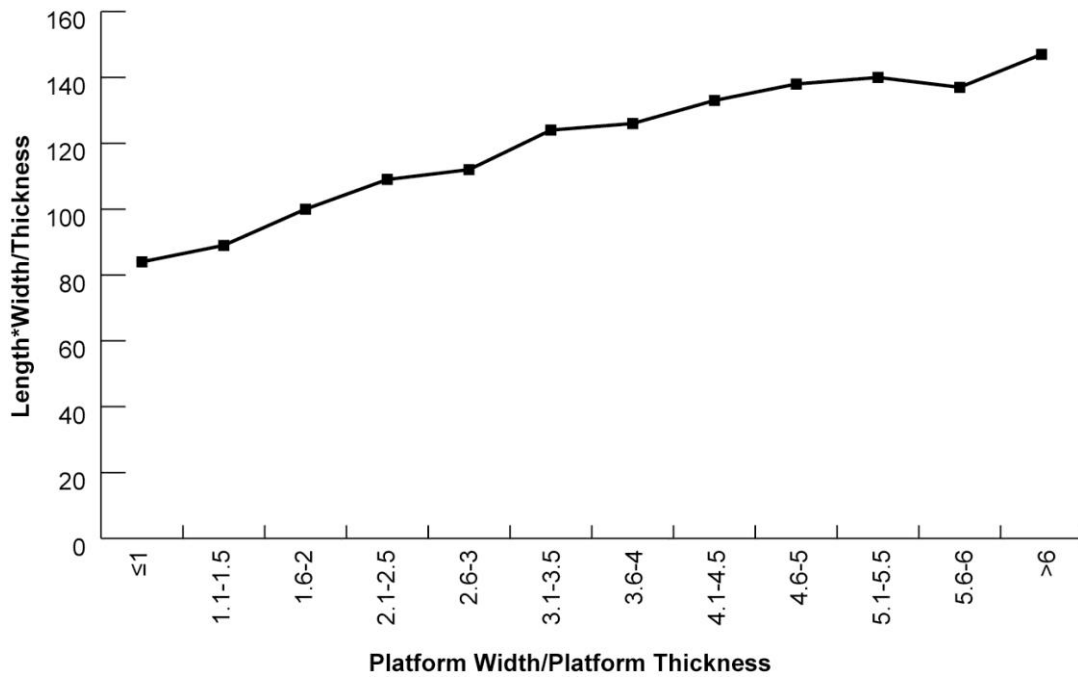


Figure 10. Shape plot for complete unretouched flakes (n=1580).

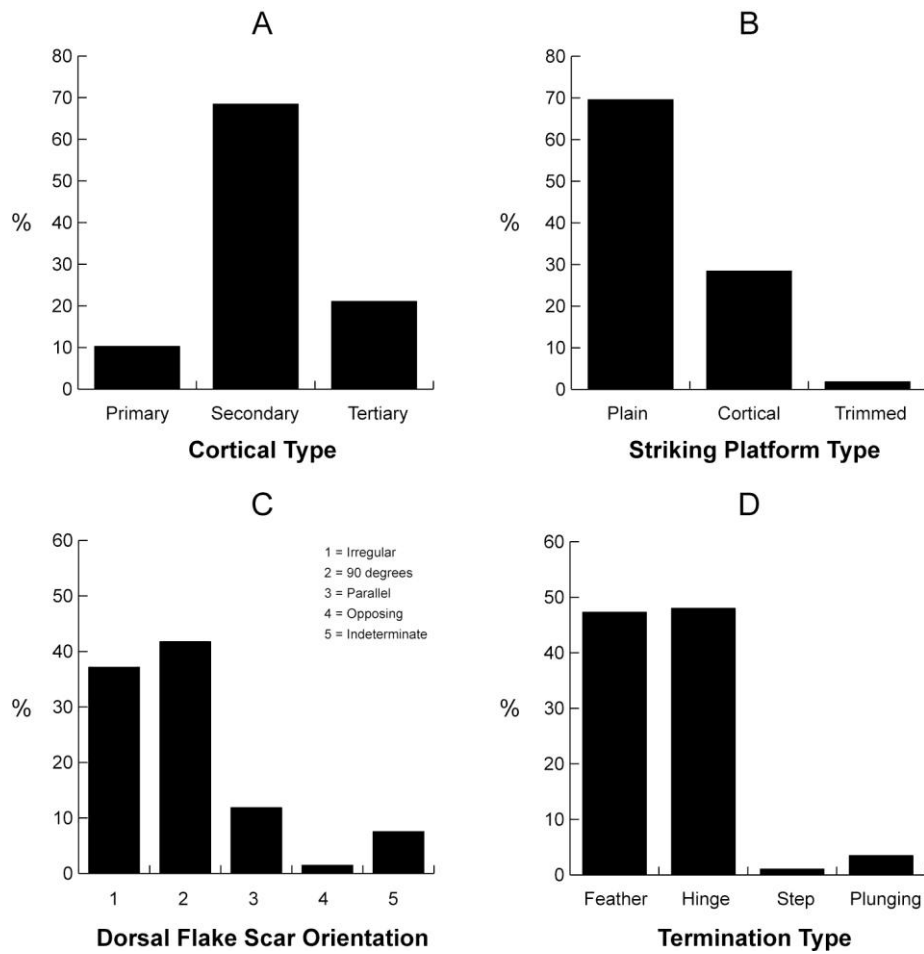


Figure 11. Relative frequencies of: A) primary, secondary and tertiary complete unretouched flakes; B) striking platform types on complete unretouched flakes; C) dorsal flake scar orientations on complete non-primary flakes (n=1417); and D) terminations on complete unretouched flakes

<i>Type</i>	<i>No.</i>	<i>%</i>
Unmodified utilised flake	15	12.9
Misc. retouched flake	36	31
Notched flake	3	2.6
End scraper	9	7.8
Side scraper	5	4.3
Side and end scraper	7	6
Non-flake scraper	19	16.4
Piercer	12	10.3
Awl	3	2.6
Fabricator	1	0.9
Barbed and tanged arrowhead	1	0.9
Pounder	1	0.9
Misc. retouched angular shatter	4	3.4
Total	116	100

Table 5. Tool types and frequencies in the MTCP assemblage.

scrapers predominate, with boring implements (*i.e.* piercers and awls) and unmodified utilised flakes also well represented. Other common Middle Bronze Age implements include three notched flakes and a single fabricator. A lone barbed and tanged arrowhead of Green's (1980) "non-fancy" Sutton type was also recovered from a secure Middle Bronze Age context, its presence of particular interest given the effective absence of evidence for Early Bronze Age activity on the MTCP site. Barbed-and-tanged arrowheads are typically assigned an Early Bronze Age date. However, their continued production into the Middle Bronze Age in the study region is attested by excavated examples (*e.g.* Akerman & Stone 1857; Bradley 1977; Clarke & Lavender 2008; Cooke *et al.* 2008; Regan 2004).

Blank selection and tool production

The majority (73.3%, $n=85$) of retouched and unmodified utilised tools was manufactured on, or comprised, flakes. Most (95.3%, $n=81$) were contemporarily struck. However, four (4.7%) exhibited fresh retouch through variably patinated surfaces indicating the scavenging and re-use of patinated blanks. A fifth specimen exhibiting two-phase patination — the site's single fabricator — was manufactured on a true, diagnostically residual blade, potentially of Early Mesolithic date. Cross-comparison of eight potential selection criteria for complete flake-blank tools suggests that overall flake size was likely the sole criterion for selection on the MTCP site, with knappers consistently selecting larger flakes for immediate use or retouch (Table 6). A

probable exception here is the flake on which the barbed and tanged arrowhead was made. Of the 30 implements manufactured on non-flake blanks, 24 (80%) were on complete or thermally fractured cobbles, four (13.3%) on angular shatter pieces and two (6.7%) on cores. Excluding the single barbed and tanged arrowhead, shaped exclusively by pressure retouch, all retouched implements from the MTCP site exhibit retouch consistent with direct freehand percussion using hard hammers. Taken at face value, the invasiveness and generally small size of retouch on the fabricator (Figure 12: P) are suggestive of its production via pressure retouch. However, notable differences in the depths of retouch scars on the implement, particularly on its dorsal surface, are more consistent with direct hard hammer percussion.

DISCUSSION

The MTCP assemblage joins a growing number of excavated chipped flint assemblages from Middle Bronze Age settlement contexts in southern and eastern England. Settlements and settlement-related deposits from this period have been investigated archaeologically since the late 19th century (*e.g.* Pitt-Rivers 1898), with most sites producing relatively large quantities of struck flint (*e.g.* Stone 1936 & 1941; Burstow & Holleyman 1957; Saville 1981b; Drewett 1982; Barrett *et al.* 1991; Herne 1991; Woodward 1991; Gingell 1992; Ladle and Woodward 2003). Unfortunately, major differences in excavation extent, sampling strategies and the quality of published lithic analyses preclude meaningful quantitative comparisons between sites. Nonetheless, examination of the available literature reveals a number of key technological similarities between the MTCP assemblage and existing Deverel-Rimbury settlement assemblages from the region. These are listed in Table 7 and, taken together, are more or less consistent with what Högborg (2009) and others (*e.g.* Aperlo 1994; Rosen 1997; Knarrström 2001; Olesen & Eriksen 2007) have termed "household production".

Defined by Högborg (2009, 219) as an "*ad hoc* technology whereby flakes were struck from simple cores with hard technique that gave a high degree of fragmentation, and a small proportion of formal tools in relation to the amount of flakes in each assemblage",

Blank selection criteria	Waste flakes	Tools	Significance value	Selected trait
Length (mm)	Mean=29.1 SD=10.8 N=1565	Mean=43.8 SD=11.6 N=78	p=.000 t=-11.703 df=1641	Longer
Width (mm)	Mean=28 SD=10.4 N=1565	Mean=38.7 SD=10.1 N=78	p=.000 t=-8.903 df=1641	Wider
Thickness (mm)	Mean=8 SD=4.2 N=1565	Mean=12.4 SD=4 N=78	p=.000 t=-8.894 df=1641	Thicker
Laminarity	Mean=1.1 SD=0.4 N=1565	Mean=1.2 SD=0.4 N=78	p=.083 t=-1.736 df=1641	None
Cortex type	Counts: Primary=163 (10.4%) Secondary=1071 (68.4%) Tertiary=332 (21.2%)	Counts: Primary=8 (10.3%) Secondary=61 (78.2%) Tertiary=9 (11.5%)	p=.112 X ² =4.385 df=2	None
Platform type	Counts: Plain=1088 (69.5%) Cortical=447 (28.6%) Prepared=30 (1.9%)	Counts: Plain=50 (69.4%) Cortical=22 (30.6%) Prepared =0 (0%)	n/a Expected count <5	None
Termination type	Counts: Feather=738 (47.2%) Other=827 (52.8%)	Counts: Feather=24 (41.4%) Other=34 (58.6%)	p=.387 X ² =.749 df=1	None
Dorsal scar pattern	Counts: Irregular=519 (40.1%) 90 degrees=588 (45.4%) Parallel=167 (12.9%) Opposing =21 (1.6%)	Counts: Irregular=33 (50.8%) 90 degrees=27 (41.5%) Parallel=5 (7.7%) Opposing =0 (0%)	n/a Expected count <5	None

Table 6. Blank selection criteria statistics for MTCP tool assemblage.

household production is a phenomenon with a wide temporal and geographical distribution (e.g. Ford *et al.* 1984; Brandt and Jantzen 1994; Martial 1994; Rosen 1997; Knarrström 2001; van Gijn & Niekus 2001; Prost 2002; Migal 2004; Eriksen 2007; Humphrey 2007; Olesen & Eriksen 2007; Högberg 2009). In contrast to their similarities, the only notable difference between the MTCP and existing Deverel-Rimbury settlement assemblages from the study region concerns the presence, in the former, of a barbed and tanged arrowhead and its absence from all but one (Westbury: Bradley 1977) of the latter. This difference,

however, must not be overplayed. As noted above, though rare, barbed and tanged arrowheads have been recovered from secure Middle Bronze Age contexts in the study region.

How, then, to interpret the technology of the MTCP assemblage and, more broadly, that of Middle Bronze Age settlements across southern and eastern England? As noted earlier, there are currently two broad explanatory models available for this task, both of which were developed out of geographically extensive reviews of the published literature

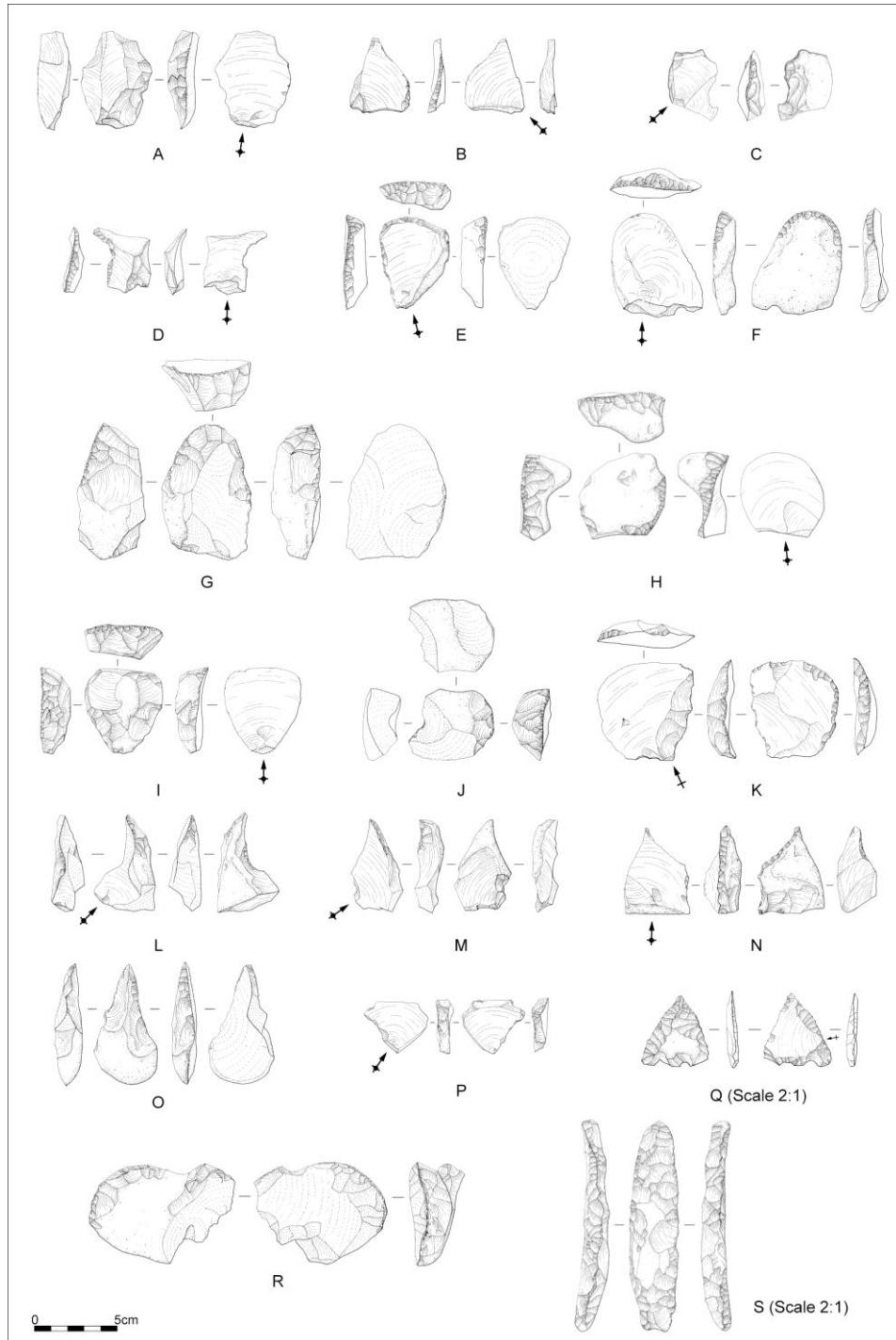


Figure 12. Selection of retouched tools from the MTCP settlement. A and B: miscellaneous retouched flakes, C and D: notched flakes, E–K: scrapers, L–N: piercers, O and P: awls, Q: barbed and tanged arrowhead, R: pounder, and S: fabricator.

and/or analyses. The first was proposed by Ford *et al.* (1984) as part of their pioneering investigation into Bronze Age flintworking in Britain and posits functional substitution as the sole stimulus behind technological change in post-Neolithic chipped flint assemblages. The second and more recent model, in contrast, focuses on the changing social role of chipped stone artefacts during the latter half of the 2nd

millennium BC. Proponents of this model (e.g. Brown 1991; Herne 1991; Edmonds 1995; Young & Humphrey 1999; Humphrey 2007) argue that this period witnessed an erosion of the central role of chipped stone artefacts in processes of social reproduction and its movement towards a purely functional and utilitarian role in the domestic sphere. The functional impact of metal is acknowledged

1. An exclusive reliance on highly localised raw materials.
2. Universally simple and unsystematic core reduction involving direct freehand percussion with hard hammers.
3. A general lack of control, or concern over, the reduction process, evidenced by:
 - a. Irregular core morphologies;
 - b. High frequencies of high terminations in waste flake assemblages;
 - c. Very low frequencies of platform preparation in waste flake assemblages;
 - d. A lack of convincing evidence for the systematic rejuvenation of cores during reduction;
 - e. Predominance of short, squat flakes with length:breadth ratios around 1:1;
 - f. The frequent rejection of cores prior to exhaustion;
 - g. Frequent incipient cones on core striking platforms.
4. A restricted range of formal tool types, with scrapers and boring implements (i.e. piercers and awls) dominating.
5. A lack of standardised tools.
6. Overall size being the dominant criterion for tool blank selection.

Table 7. Key technological similarities between Middle Bronze Age settlement assemblages in southern and eastern England.

but is suggested to account unsatisfactorily for broader patterning in the technology and contextual associations of Bronze and Iron Age chipped stone assemblages.

Conceived and developed on a pan-British scale, both of these models have considerable interpretive value. It is, for example, now widely accepted that the Middle Bronze Age saw a major increase in the number and diversity of bronze artefacts in circulation in England, with the Thames Valley and Cambridgeshire Fens, both in the study region, particularly important foci for production and deposition (Champion 1999; Barber 2003). That this burgeoning metalworking industry will have had a functional impact on contemporary chipped stone tool technology is undeniable. This said, as touched on by Herne (1991), it is important that the suggestion that fewer and fewer functions were being fulfilled by flint tools over the course of the Bronze Age be demonstrated, not simply assumed. It can, for example, be argued that Ford *et al.*'s argument for a progressive reduction in the functional roles of chipped flint tools is contradicted by their parallel observation of a major increase in the use of *ad hoc*, or expedient, tools. Why, then, it must be asked, do we see such a marked decline in the diversity of formal tool types being produced over the course of the 2nd millennium BC? According to Ford *et al.* (1984), the answer lies simply with the progressive replacement of such tools by functionally equivalent metal alternatives. This is a simple and attractive argument. However, as suggested by scholars

such as Brown (1991) and Edmonds (1995), the changing social role of chipped stone artefacts may have been an equally important factor. If, as these scholars have suggested, the latter half of the 2nd millennium BC saw a rapid decline in the symbolic investiture of chipped stone tools, it seems reasonable to suggest that there will have been an ever-decreasing incentive for knappers to create or maintain rigid distinctions between tool forms, the archaeological result of which, it follows, is tool assemblages dominated by miscellaneous retouched flakes and the like. By the middle of 2nd millennium BC, the mental approach to flintknapping in southern and eastern England may well have been one dominated by perceptions of function as opposed to form (cf. Högberg 2004 & 2009).

As alluded to above, a socially-driven model of technological change is also highly attractive, not least because it is based on the notion that flintknapping, like all human technologies, is a intrinsically social phenomenon, whose various components — procurement, production, use, maintenance and discard — will have been inextricably enmeshed in processes of social reproduction. Although difficult to quantify archaeologically, the argument that changes in how Bronze Age knappers perceived chipped stone artefacts socially were likely to have had a significant influence on the amount of effort they were willing to invest into the procurement, production and use of such artefacts is entirely reasonable. As scholars such as Barrett (1994), Bradley (1998) and Brück (1999a, 1999b,

2001 & 2006) have proposed, the later half of the 2nd millennium BC appears to have witnessed a dramatic “shift of emphasis” in the means by which Bronze Age communities across Britain reproduced structures of social relations and political authority, with agricultural production and land inheritance becoming increasingly important to this process during this period. Chipped stone tools were clearly still widely made and used throughout the Middle Bronze Age. However, unlike the Neolithic and Early Bronze Age, there is little evidence to suggest that they continued to play, *in their own right*, a role in the constitution of ideas about the self and society. This role appears to have become increasingly entwined with other aspects of material production and consumption (principally metalwork) as well as the organisation of settlement space (see, in particular, Needham 1993; Hill 1995; Parker Pearson 1996; Parker Pearson & Richards 1994; Brück 1999a & 1999b).

Whilst recognising the major interpretive value of models based on functional substitution and/or dynamic social change, I would argue that these were almost certainly not the only factors influencing the organisation of Middle Bronze Age lithic technology in the study region; at least two other critically important influences are likely to have been at play. The first comprises the widespread sedentism that, for most scholars at least, defines this period in this and other parts of Britain. Unlike the Neolithic and Early Bronze Age, for which relatively high degrees of residential mobility have been postulated (e.g. Whittle 1997; Brück 1999c; Thomas 1999), the archaeological record of the Middle Bronze Age in southern and eastern England is replete with evidence for permanent settlement based on mixed-farming regimes. That this fundamental shift in the structure of settlement and subsistence will have influenced the organisation of Middle Bronze Age lithic technology has to date been overlooked (cf. Bradley 1987; Edmonds 1987 for the Early-Late Neolithic transition). This is unfortunate given the now extensive literature concerning the relationship between the adoption of “expedient” or “informal” core technologies and increased sedentism (e.g. Shott 1986; Koldehoff 1987; Parry & Kelly 1987; Johnson 1989; Andrefsky 1991; McDonald 1991; Teltser 1991; Kelly 1992;

Seddon 1992; Barut 1994; Kuhn 1994; Odell 1994, 1996 & 1998; Young 1994; Cowan 1999; Stafford 1999; Wallace & Shea 2006).

		LITHIC QUALITY	
		High	Low
LITHIC ABUNDANCE	High	Formal and informal tool production	Primarily informal tool production
	Low	Primarily formal tool production	Primarily informal tool production

Figure 13. Andrefsky’s (1994) contingency table for the relationship between raw material availability and informal/formal tool production (redrawn from Andrefsky 1994, 30, Figure 2).

Central to these studies is the idea that, unlike mobile groups whose toolkits must be organised to maximise transportability whilst simultaneously buffering against unforeseen risks, sedentary groups do not need to expend extra effort in the production of “formal” cores or tools (*sensu* Andrefsky 1994; Wallace and Shea 2006) given that portability, maximum utility and uncertainty of raw material availability are not pressing issues for them. Rather, “informal” cores and tools, those that have been manufactured with minimal effort and are unstandardised with regard to form, are all that is required. As Andrefsky (1991, 130) has put it, “sedentary groups can manufacture, use, and discard tools according to the needs of the moment”. Generated in the context of permanent settlement, the expedient character of the MTCP assemblage must be assessed in this light. The same argument, of course, applies to other Deverel-Rimbury settlement assemblages from the study region.

Closely linked to increased sedentism is the issue of raw material availability (*sensu* Andrefsky 1994). As eloquently demonstrated by Andrefsky (1994), and highlighted, if at times indirectly, by numerous other scholars (e.g. O’Connell 1977; Gould 1980; Torrence 1983; Wiat & Hassen 1985; Bamforth 1986; Parry & Kelly 1987; Kuhn 1991; Goodyear 1993; Ingbar 1994; Macdonald 1995 & 2008;

Odell 1996; Amick 1999; Randolph Daniel 2001; Sievert & Wise 2001), settlement configuration alone is unlikely to have been the sole factor conditioning the relative production and use of formal versus informal cores and tools; the abundance and quality of lithic raw materials would appear to be equally, if not more important determinants. In his oft-cited study of inter-assemblage variation in three different areas in the western United States, for example, Andrefsky (1994) observed similar relative frequencies of formal and informal tools between mobile and sedentary populations in areas characterised by high lithic abundance and quality. Moreover, sedentary populations occupying areas in which lithic raw materials were neither locally abundant nor of suitable quality were found to rely predominantly on formal tools, leading Andrefsky (1994: 31) to propose that “that if all other variables are held constant, quality and abundance of raw materials may structure stone-tool production in a predictable manner” (Figure 13). In a similar vein, Bamforth (1986), using both ethnographic and archaeological data, has convincingly argued that intensity of tool maintenance and recycling will vary in response to raw material availability.

These observations have important interpretive implications for the current research. It will be recalled that we are dealing in this study with an assemblage generated in the context of high lithic abundance and reasonably high raw material quality. Most, if not all of the raw material packages exploited by Middle Bronze Age knappers on the MTCP site were likely derived from surface and near-surface deposits on and/or in its immediate vicinity. The construction of the settlement’s enclosure ditches and associated barrow, it has been noted, will have generated large quantities of cobble flint, effectively eliminating the need to move beyond the immediate environs of the site for raw material. At the same time, raw material quality appears to have been reasonably high across the board. Both factors, I would argue, are likely to have influenced the organisation of lithic technology on the MTCP site. Put simply, the Middle Bronze Age knappers occupying the MTCP settlement had no need to conserve raw materials or to invest additional energy in the production of formal tools or cores. Raw material availability —

both in terms of quality and abundance — was simply not an issue for them. It seems prudent, therefore, to conclude that the technological expediency of the MTCP assemblage is at least a partial product of the lithic environment in which it was created. Given that the majority of Middle Bronze Age assemblages in southern and eastern England were generated in similarly “lithic-rich” contexts, the probable influence of raw material availability on the organisation of lithic technology on these settlements must also be acknowledged.

CONCLUSION

Building on the arguments above, I would like to conclude this paper by suggesting that, despite their major interpretive value, the two explanatory models currently available for Middle Bronze Age flintworking in southern and eastern England are in need of refinement. That functional substitution (Ford *et al.* 1984) and dynamic social change (Herne 1991; Brown 1995; Edmonds 1995; Young & Humphrey 1999) will have influenced the organisation of Middle Bronze Age lithic technology in the study region is not in question here. However, to believe that either individually or in combination these were the only factors influencing its organisation is, at best, problematic. As proposed in this paper, sedentism and raw material availability were likely also highly influential. It is, therefore, imperative that existing explanatory models are adjusted to account for these phenomena. Failure to do so will only hinder our ability to gain a more nuanced understanding of the organisation of Middle Bronze Age flintworking technology in southern and eastern England.

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