The Purfleet Interglacial: An examination of change and complexity in core and flake technology during the final Lower Palaeolithic

RAWLINSON, AARON,ANDREW

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Aaron Andrew Rawlinson

Despite major advances in the understanding of the British Lower-Middle Palaeolithic over the last 25 years including an enhanced chronological framework, detailed excavations and re-evaluations of older sites, Marine Isotope Stage 9 (MIS 9) remains under-researched. MIS 9 represents the final interglacial of the Lower Palaeolithic and while handaxes remain predominant, other technological trends including non-handaxe assemblages, increases in the importance of flake tools and the beginnings of Levallois have been argued to characterise the period. Drawing on previous work on MIS 9 and wider debates regarding the Lower and Middle Palaeolithic, this thesis offers a new analysis of the core and flake component from over 20 sites correlated to MIS 9.

Evidence for a non-handaxe signature at the beginning of the interglacial is upheld, but no new sites can be identified. The non-handaxe signature represents a separate but comparable occurrence to the Clactonian of MIS 11 with parallels observed in mainland Europe. There is no evidence for an increase in flake tools during MIS 9, or any connection to Prepared Core Technology (PCT). Nevertheless, there is evidence that well-made flake tools relate to Group I assemblages during MIS 9. Additionally, well-made flake tools are related to other periods of handaxe manufacture in both Britain and Europe. Evidence for early PCT can be found outside of Purfleet in smaller amounts related to the Acheulean of MIS 9. However, some sites correlate to the later occurrence of full Levallois during MIS 8/7. The evidence from Britain fits within the wider global context, displaying multiple origins for PCT based on its immanence within the Acheulean. The results of this study are used to both characterise the archaeology of MIS 9 and define the position of the interglacial within the British Palaeolithic and its wider context.

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Statement of copyright

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Chapter One: Introduction

Studies of the Lower Palaeolithic have always been dominated by one class of artefact - the handaxe. The period has often been pigeon-holed as monotonous, with no major changes until the breakthrough of Levallois technology allowed the Neanderthals to emerge into Middle Palaeolithic landscapes, bringing with them a host of traits including advancements in hunting, landscape use and advanced treatment of raw materials (Scott, 2011:169). Prior to the expansion of the Palaeolithic framework and adoption of Marine Isotope Stages (MIS) in Britain (Shackleton, 1987; Bassinot *et al.,* 1994; Bridgland, 1994) this view was warranted (Wymer, 1968; Roe, 1981), but the recognition of MIS 9 and MIS 7 in the terrestrial record has allowed more precision in the study of the Lower-Middle Palaeolithic transition.

Recent work has characterised the transition as not a single event but a longer process of 'Neanderthalisation' (Scott, 2011; White *et al.,* 2011). Recently, there has been a renewed focus on the culture of Palaeolithic hominins, including temporally and geographically significant handaxe groups (White *et al.,* 2018; 2019), the recognition of temporally significant non-handaxe assemblages (White, 2000; White and Schreve, 2000; Ashton *et al.,* 2016; McNabb, 2020) and the appraisal of the Early Middle Palaeolithic (EMP) characterised by the appearance of Levallois and decline in handaxes (Scott, 2011). This has shown that the British Palaeolithic is more dynamic than previously acknowledged, and that there is more to the Lower Palaeolithic than the handaxe.

Over the last few decades considerable work has gone into improving our knowledge of the Palaeolithic, including the Ancient Human Occupation of Britain (AHOB) project, with £3.3 million of funding from the Leverhulme Trust between 2001-2011 (Ashton *et al.,* 2011). Advances have included characterising discrete periods of the Lower Palaeolithic with major discoveries such as Boxgrove in MIS 13 (~524-474ka BP) (Roberts and Parfitt, 1999; Pope *et al.,* 2020) and the reassessment of MIS 11 (~427- 364ka BP) sites (Ashton *et al.,* 1998; 2005; 2008; 2016; Gowlett *et al.*, 2005), offering both detailed snapshots of Palaeolithic life and clear broader scale cultural changes (Bridgland and White, 2014; 2015; White *et al.,* 2018; 2019). New excavations have extended the Lower Palaeolithic back to the Lower Pleistocene, with Pakefield and Happisburgh III potentially dating to MIS 17 (0.75 ma BP) and MIS 25 or 21 (0.97-0.93ma BP or 0.86-0.82ma BP) respectively (Parfitt *et al.,* 2005; 2010).

An improved chronology and better 'data hygiene' allowed White and Jacobi (2002) to split the Middle Palaeolithic into an EMP in MIS 7 and a Late Middle Palaeolithic (LMP) in MIS 3, with a period of hominin absence during MIS 5e. Despite a lack of freshly excavated sites, MIS 7 (~245-180ka BP) has been examined in detail by Scott (2011), giving for the first time a clear understanding of Levallois in Britain and of the EMP. This has allowed more recent syntheses of the Palaeolithic in Britain to be richer and more ordered than before (McNabb, 2007; Pettitt and White, 2012; Ashton, 2017). There remains one omission: MIS 9 or, as it is often informally known, the Purfleet Interglacial (c.350-290ka BP).

The relative lack of focus on MIS 9 is understandable. There have been few new sites and excavations, and a perception of an absence of interesting research questions in comparison to the earliest occupation of Britain or Levallois within the EMP. While MIS 9 is archaeologically rich, the majority of sites are known from the work of older collectors, meaning that what we know of the interglacial comes from only a handful of published sites (Purfleet, Cuxton, Little Thurrock, Stoke Newington and Wolvercote). Exploring whether the characteristics observed at these sites are representative of the whole of Britain during MIS 9 still needs to be reviewed.

The most well published site, due to numerous excavations under modern conditions, and which also gives the interglacial its unofficial name, is Purfleet (Wymer, 1968; Palmer, 1975; Schreve *et al.,* 2002; Bridgland *et al.*, 2013). From the work at Purfleet and other sites correlated to the interglacial, a number of traits have been identified (Pettitt and White, 2012; White and Bridgland, 2018). Firstly, handaxes characterise the majority of the archaeology and White *et al.* (2018; White and Bridgland, 2018) have suggested that MIS 9 fits in with the wider trend of temporally significant handaxe groups. The ongoing work of Dale (Pers. Comm. 2021) is investigating if, as claimed by White and Bridgland (2018), handaxes from the interglacial belong to Roe's (1968b) Group I, characterised by pointed handaxes with the co-occurrence of ficrons and cleavers. What is equally intriguing is a number of characteristics of the core and flake working set out by White and Bridgland (2018): the re-appearance of non-handaxe assemblages (previously thought to be characteristic of the Clactonian during MIS 11), an increase in the importance of flake tools and the appearance of prepared core technology (PCT). Figure 1.1 shows the current understanding of how these technologies fit with the chronology of MIS 9 and the Lower-Middle Palaeolithic of Britain.

Given the position of MIS 9 on the boundary between the Lower and Middle Palaeolithic, the increase in flake tools and beginnings of PCT could show either the origins or intensification of

Middle Palaeolithic behaviours. The often-overlooked nature of MIS 9 and the importance of the questions raised by these seemingly anomalous types of core and flake working form a substantial blind spot in our knowledge of the British Palaeolithic. These avenues of research fit well within the current ideas of culturally significant lithic assemblages and a longer period of 'Neanderthalisation'.

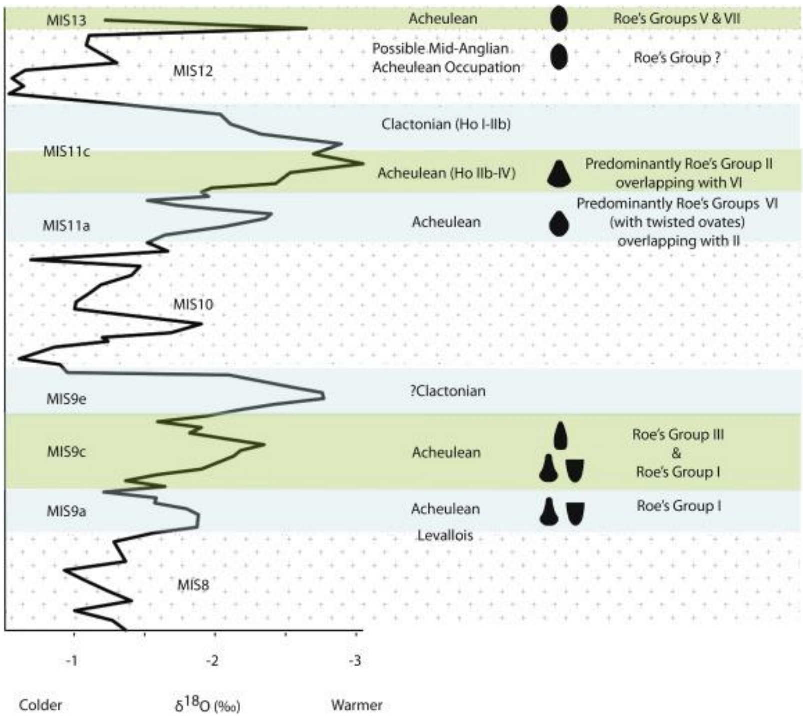


Figure 1.1 Summary of Lower Palaeolithic archaeological trends according to White *et al.* (2018:125).

1.1 Research questions

The aim of this research is to expand our knowledge of the behaviour of MIS 9 hominins through an analysis of their technology. In line with White and Bridgland (2018) MIS 9 is used in this thesis as a shorthand for the entire of the interglacial as well as the transitions from MIS 10 and to MIS 8, with additional precision when available or relevant. Focusing on core and flake working, this thesis will go beyond the preliminary observations of White and Bridgland (2018) and interrogate these patterns, including their chronology within MIS 9. This will be achieved by examining museum collections from sites correlated to MIS 9 (Appendix A). In the examination of the assemblages, three main elements will be analysed concerning the atypical features of Lower Palaeolithic (especially Acheulean) technology:

1. Are there non-handaxe assemblages in Britain dating from MIS 9? How do these compare to the Clactonian in MIS 11?
2. Was there an increase in the number of flake tools during MIS 9? If so, what is the significance? Is it just quantity or is there an increase in elaboration?
3. What is the nature, timing and spread of the earliest PCT technologies? Is it prevalent or has Levallois been projected everywhere based on the site of Purfleet?

The results of these questions will be placed within their wider context to evaluate the significance of the MIS 9 interglacial to the Lower-Middle Palaeolithic transition, and what this can tell us about wider hominin behaviour. The discussion will also evaluate how the British record fits with wider trends in Europe.

The analysis of these assemblages will also provide modern appraisals of MIS 9 sites, many of which have not been fully studied within the modern framework.

1.2 Thesis outline

This thesis covers three distinct but interconnected phenomena, underpinned by the changes in lithic technology and what this informs us about hominin behaviour.

Chapter Two presents an up-to-date summary of the current knowledge of MIS 9 including its environments, fauna and hominins within the wider context of the Lower and Middle Palaeolithic. Chapter Two also outlines the main research background of the Clactonian, flake tools and PCT, including research history, definitions, the main debates and the current consensuses.

Chapter Three details the methodology used to examine the research questions stated above, including the challenges and limitations of working with the MIS 9 record.

Chapter Four introduces the sites examined in this thesis, offering concise backgrounds including history of work, geology, dating and archaeology. Most sites in this thesis are pertinent to two main research questions and in some cases all three. Therefore, the results of the site analyses will be presented in **Chapter Five** on a site-by-site basis, providing updated evaluations for each site.

The three main research questions are addressed in the subsequent three chapters.

Chapter Six evaluates the evidence for non-handaxe assemblages in MIS 9, before comparing the MIS 9 sites to the traditional Clactonian of MIS 11. The British record will then be situated within its wider European context before examining the implications for the debates over non-handaxe assemblages and the behaviour of hominin groups.

Chapter Seven examines trends and patterns in the flake tools of MIS 9 and contextualises them within the wider British Lower and Middle Palaeolithic, with comparisons to European sites.

Finally, **Chapter Eight** will examine the evidence for PCT in Britain during MIS 9 including timing and geographical extent. This will then be compared to earlier claims of PCT and the EMP sites of Scott (2011), before being situated in the continental European record, with parallels to more global trends examined. This assessment will be used as the basis to evaluate the debates and ideas surrounding the origins and character of PCT.

Chapter Nine will attempt to bring together these diverse threads to conclude what this research has added to our knowledge of MIS 9 and assess the implications for the life of hominins in the Lower and Middle Palaeolithic periods. The chapter will address new questions that have been uncovered and suggest how to move forward.

Chapter Two: Research Background

While MIS 9 is now recognised in the terrestrial record, its characterisation remains unclear compared to other periods. This stems from the lack of detailed studies of MIS 9 (cf. Schreve *et al.,* 2002; Bridgland *et al.*, 2013), and despite White and Bridgland (2018) establishing the importance of the interglacial there are still a number of challenges facing the interpretation of the period. These include correlating sites to (and within) the interglacial, the restricted environmental record (Roe *et al.,* 2009; Bridgland *et al.,* 2013) and an increasingly complex hominin fossil and DNA record (Galway-Witham *et al.,* 2019). Understanding these factors is important before examining the archaeology of the period.

The archaeology of MIS 9 is both rich and diverse containing 'Clactonian' assemblages, Acheulean assemblages and early signs of PCT, as well as the suggestion of an increase in flake tools (White and Bridgland, 2018). Chapter One has explained the importance of these in relation to MIS 9, but these are all areas of debate in the Lower-Middle Palaeolithic and have long histories of study and interpretation that need to be reviewed.

While it is not possible to give complete accounts of all of these subjects, this chapter will present the main histories, debates and current consensuses on these issues, with special focus on concerns pertinent to this thesis.

2.1 MIS 9: a new interglacial

Until the 1990's only four interglacials were recognised in Britain: the Cromerian, the Hoxnian, the Ipswichian and the Flandrian/Holocene (Stringer, 2011a). These were divided by three glacial periods: the Anglian, the Wolstonian and the Devensian (Stringer, 2011a). Work on Palaeolithic Britain, including major works on Lower Palaeolithic archaeology such as Wymer (1968) and Roe (1981), previously placed the Palaeolithic sites of Britain into this framework. Nevertheless, Roe (1981) and Wymer (1985) both voiced discontent with this situation, and attempts by Mitchell (1973), Bowen (1978), Wymer (1985) and Coulson (1990) were made to overcome the problem. Interglacials were mainly recognised through pollen which obscured both MIS 9 and MIS 7, but the mammalian fauna indicated a more complex picture (Sutcliffe, 1976; Stuart, 1982; Current, 1989; Lister, 1992; Thomas, 2001; Roe *et al*, 2009:2342). Since the early 1990's, independent but cross-disciplinary work involving geology (Bridgland, 1994:30), vertebrates (Schreve 2001a: 1697; 2001b:67), invertebrates (Keen, 1990; 2001; Penkman, 2004; Penkman *et al.* 2011; 2013), amino-acid geochronology (Bowen *et al.,* 1989;1995) and archaeology (Bridgland and White, 2014; 2015) has provided a more nuanced framework by correlating these terrestrial records with evidence from ice cores and deep-sea cores (Shackleton, 1987; Bassinot *et al.,* 1994; Bowen*,* 1999). The MIS framework (Figure 2.1) has since become the standard for Quaternary scientists (Pettitt and White, 2012).

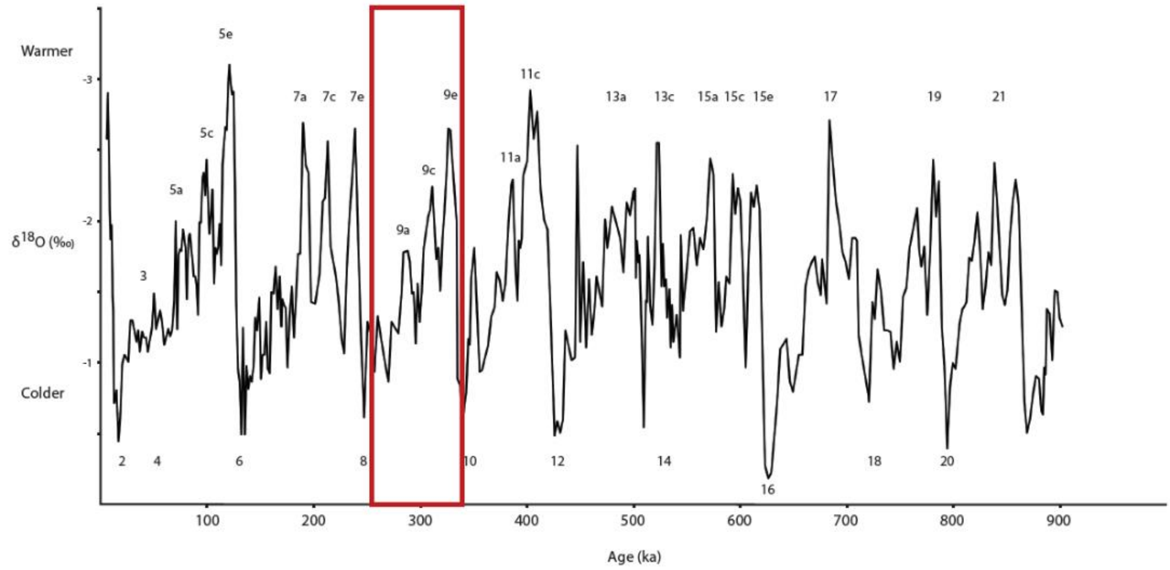


Figure 2.1 MIS curve, with MIS 9 indicated within red box (White and Bridgland, 2018:166).

The recognition that the Wolstonian represented MIS 10-6 allowed the separation of MIS 9 and MIS 7 from each other and the adjacent interglacials (Roe, 1995). The previous framework was expanded to include four interglacials in the Middle Pleistocene (MIS 13, MIS 11, MIS 9, MIS 7), and some MIS stages now have sufficient resolution to discuss changes at a sub-stage level (Preece *et al.,* 2006; Ashton *et al.,* 2008; 2016). This work has built a chrono-stratigraphic sequence based on a robust framework that can be tested through other means such as amino acid racemisation (AAR) (Penkman, 2004; Penkman *et al.,* 2008; 2011), Optically Stimulated Luminescence (OSL) (Briant *et al*., 2012) and Electron Spin Resonance (ESR) (Zhou *et al.,* 1997). The sequence is supported by evidence from mammalian faunas (Schreve,2001a;2001b), molluscs (Keen, 1990; White *et al.,* 2017) and, more controversially, archaeology (Westaway *et al.,* 2006; Bridgland and White, 2014; 2015; White *et al.,* 2018). Sceptics of this system argue that this extended framework has not been properly verified and prefer to rely instead on the palynological evidence (Gibbard, 1985; 1995; Gibbard and Lewin, 2002). This fails to pick up any variation outside of the Hoxnian and Ipswichian, and is not widely used (McNabb, 2007; Pettitt and White, 2012; Scott, 2011; Ashton, 2017).

The MIS framework has allowed for the first time an examination of MIS 9 and MIS 7. The EMP was poorly understood due to the previous framework and whilst debate around certain sites is on-going, the EMP is better understood due to these advances (Scott, 2011). Bridgland and White (2014; 2015) have demonstrated that this expanded framework has allowed the recognition of a sequence of artefact types tied to the patterns in climate and hominin dispersal. While the recognition of further interglacials in the terrestrial record has allowed researchers to untangle much of the Middle Pleistocene, MIS 9 remains relatively unexplored (Bridgland *et al.,* 2013:417; White and Bridgland, 2018).

The corpus of MIS 9 sites

The dating and characteristics of individual sites will be addressed in Chapter Four, but a general overview of the context of MIS 9 archaeology is appropriate here (Figure 2.2). Bridgland's (1994) work on the Thames and its tributaries correlated the Corbets Tey Terrace (Lower Thames) and Lynch Hill Terrace (Middle Thames) to MIS 10-9-8, with the Wolvercote formation considered to be the equivalent in the Upper Thames (White and Bridgland, 2018). This has led to the attribution of the five 'flagship sites' in the Thames, and tributaries, to MIS 9 including Purfleet, Little Thurrock, Cuxton, Stoke Newington, and Wolvercote (Table 2.1). These sites have been used to characterise the interglacial as showing three different signatures: non-handaxe, handaxe and PCT. What is less certain is if these characteristics are known from other sites that can be correlated to MIS 9 (Table 2.2).

Finding equivalents in other river systems is difficult, and work is on-going. The synthesis of the Wash fluvial network by Boreham *et al.* (2010) provided an up-to-date evaluation of several river systems in eastern England. Many of the terraces were attributed to MIS 11 and MIS 5e prior to the recognition of MIS 9 and MIS 7 (Boreham *et al.,* 2002:398). The terraces of these rivers formed differently to those in the Thames and so need critical independent study (Boreham *et al.,* 2010). An overview is presented in Figure 2.3. MIS 9 is absent in the Trent-Witham and Welland due to prior glaciation (Boreham *et al.,* 2010). The March Gravels of the Nene could date to MIS 9, and the Orton Lougeville member dates between MIS 11-9. While these areas are unclear, there is also limited archaeology with only rare find spots of occasional interest. The site of Redhills, Thetford has been correlated with MIS 9 in the Little Ouse, but this site is handaxe-dominated and therefore of little interest to this thesis. The Huntington Road/Observatory gravels of the Cam, although discontinuous, correlates sites such as Travellers Rest Pit to the interglacial (Boreham *et al.,* 2010). The Biddenham member of the Great Ouse allows the correlation of the sites of Biddenham and Kempston to MIS 9 (Boreham *et al.,* 2010). The Nar valley offers a possible correlation of MIS 9 to the site of Southacre.

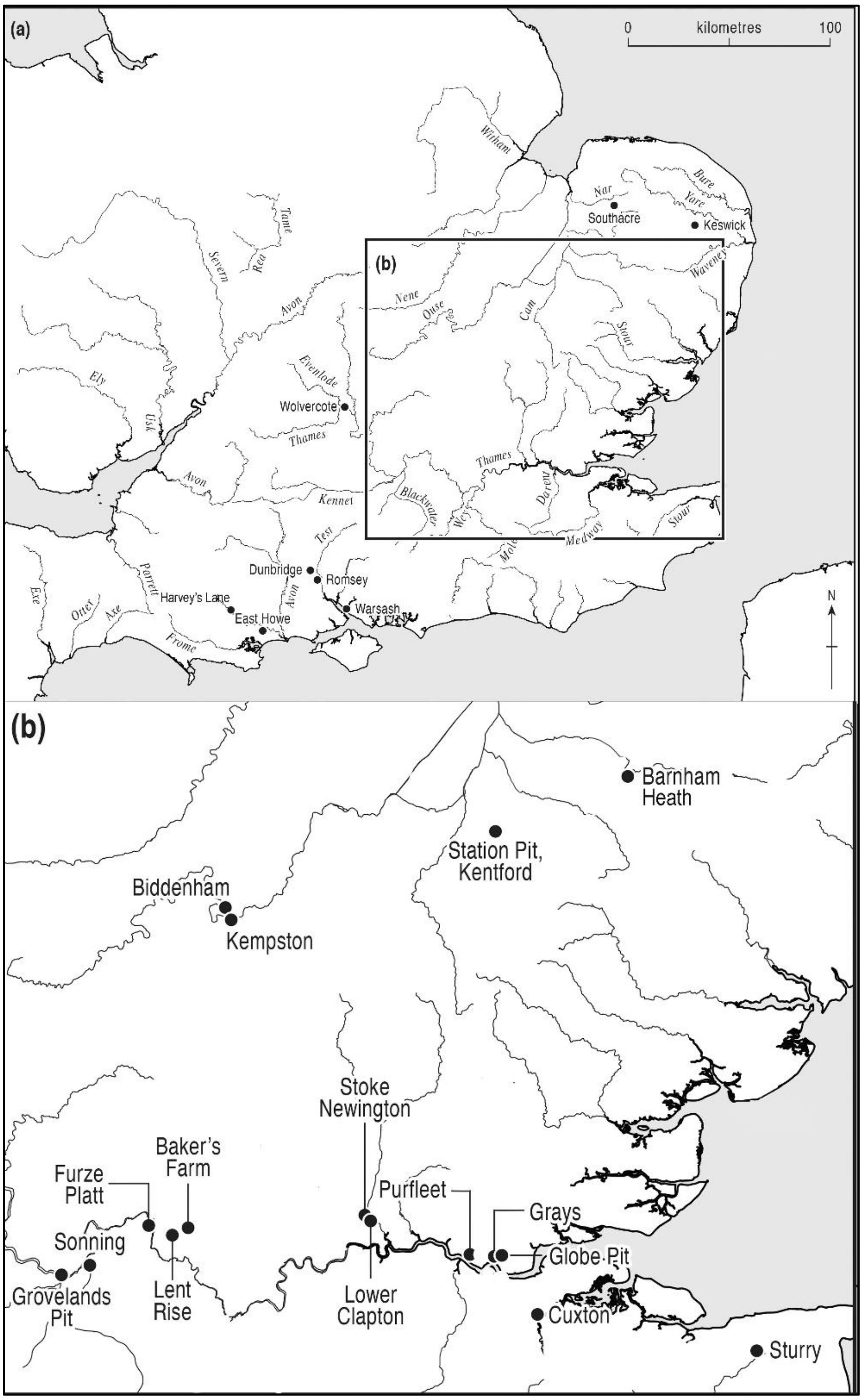


Figure 2.2 Map of MIS 9 sites (modified after Rawlinson *et al.,* submitted)

Table 2.1 'Flagship' sites of MIS 9 (modified after White and Bridgland, 2018:176).

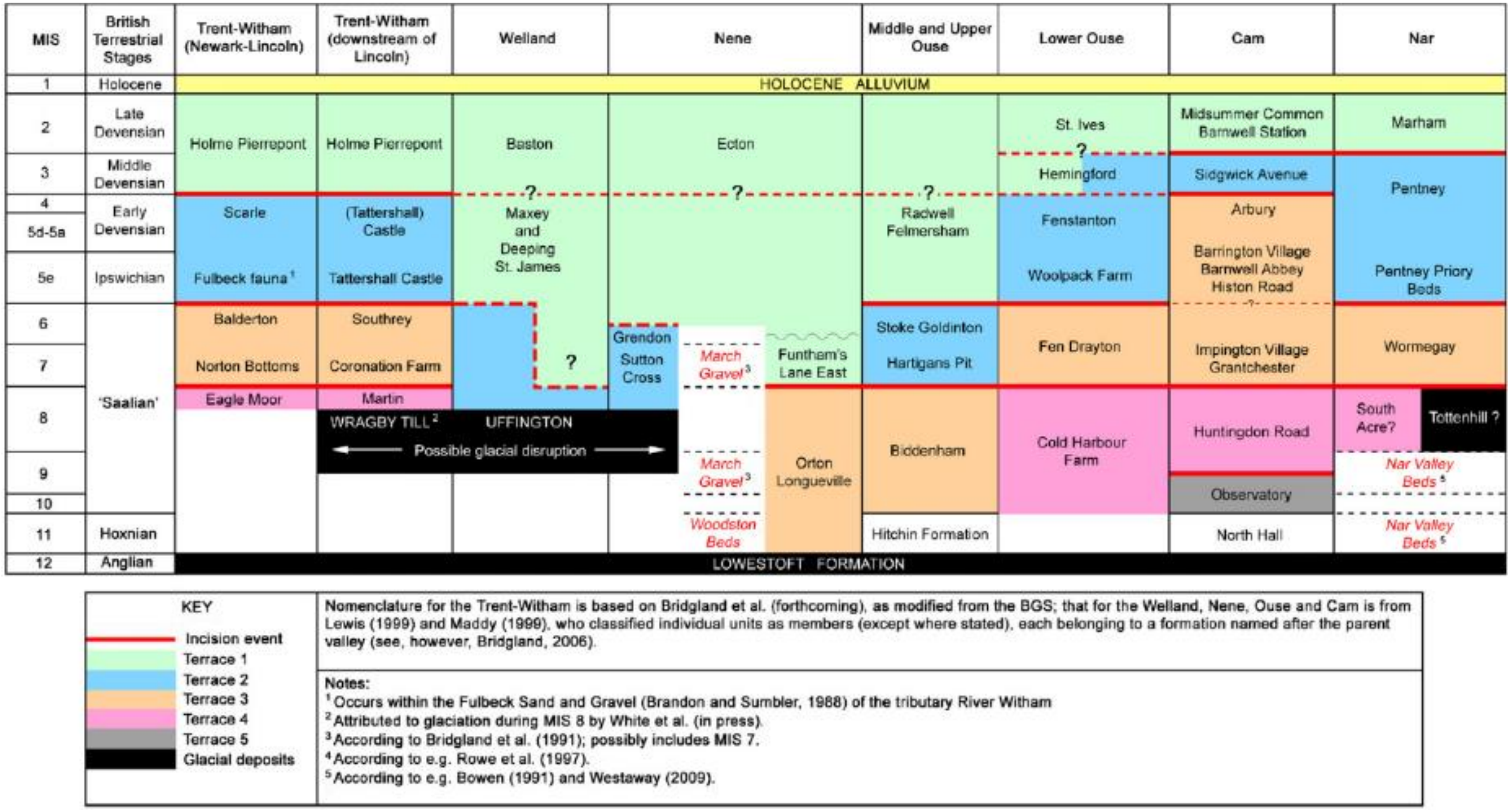
Site	Age	Archaeology	Context	Selected References
Purfleet	MIS 10-9-8	- Layers 1-3 Non-Handaxe assemblage lateral equivalent to Globe Pit. - Layers 4-6 Acheulean assemblage - Layers 6/8 Botany Member PCT	- Long sequence through the Lynch Hill/Corbets Tey Formation of the Thames	Palmer, 1975; Schreve., *et al* 2002; Bridgland., *et al* 2013
Globe Pit, Little Thurrock	Late MIS 10 /Early MIS 9	Non-handaxe assemblage containing numerous flakes & cores	- Basal part of Lynch Hill/Corbets Tey Formation of the Thames - Lateral equivalent of overlying brickearth (Grays Brickearth) contains MIS 9 fauna	Bridgland and Harding 1993; Bridgland 1994; White 2000
Stoke Newington	MIS 9	In situ 'floor' containing handaxes, débitage, scrapers and cores. Conjoins present. Rolled artefacts occurred lower down the sequence Roe's group I	- 2-3m of fine sand at the confluence of the Lea and Thames - Represents a part of MIS 9 that predates the organic deposits at the Nightingale Estate, Hackney, although the age difference is probably minor	Green., *et al* 2004
Wolvercote Channel	MIS 9	Acheulean assemblage with group of plano-convex 'slipper-shaped' handaxes Roe's group III	- 4.5m deep sediment-filled channel cut into Wolvercote Terrace Gravel on the west bank of the Upper Thames, south of its confluence with the River Cherwell	Tyldesley 1986a;1986b; Bridgland 1994, 1996
Cuxton	MIS 9-8	2 main assemblages: 1) Non-handaxe assemblage from lower gravel 2) Acheulean assemblage from upper gravel, includes ficrons, cleavers and six disputed proto-Levallois artefacts. Roe's group I	- Remnant of Medway terrace gravel, situated on a Chalk spur between the Medway and a tributary valley - Bridgland (2003) proposed an MIS 10/9/8 date for the Cuxton sequence, a suggestion supported by recent OSL dates that gave an absolute age compatible with an MIS 8 age for the Acheulean material; OSL determinations which indicate an MIS 7 age are considered too	Tester 1965; Cruse 1987; Bridgland 2003; Wenban-Smith 2006

Table 2.2 Secondary context sites of MIS 9 (modified after White and Bridgland, 2018:174).

System	Area	Sites	MIS	Archaeology	Context	Main collectors	References
Thames	Maidenhead	Pits in Furze Platt area incl. Cannoncourt Farm	10-9-8	Acheulean	-Lynch Hill Terrace 4m of bedded gravel, overlain by a pebbly, silty clay.	Treacher, Lacaille	Wymer 1968; Bridgland 1994
	Farnham Royal	Baker's Farm	10-9-8	Acheulean PCT	-Lynch Hill Terrace-Similar to Furze Platt. Ill-sorted fluvial gravels overlying Reading beds. -Artefacts associated with lowest part of stratified gravels.	Treacher, Lacaille	Wymer 1968
	Burnham	Lent Rise	10-9-8	Acheulean PCT	-Lynch Hill Terrace-similar to Furze Platt. Ill-sorted but stratified gravel overlain by brickearth.	Lacaille	Wymer 1968
	Reading	Grovelands Pit	10-9-8	Acheulean	-Lynch Hill Terrace -Bluff gravel between the Lynch hill and Taplow terraces. -4 meters of gravel underlain by sand and clay.	Treacher	Wymer 1968
	Grays Thurrock		10-9-8	Acheulean	-Related to the Lynch Hill/ Corbets Tey formation, precise provenance of archaeology uncertain due to general provenance stated. -Artefacts associated with thin deep-red seam of gravel	WG Smith; Hinton and Kennard	Wymer 1968
	Lower Clapton		10-9-8	Acheulean	Lynch Hill Terrace. Linked to Palaeolithic floor at Stoke Newington.	WG Smith	Bridgland 1994
	Sonning	Sonning Railway Cutting	10-9-8	Acheulean PCT	-Lynch Hill Terrace -Gravel removed during the widening of Great Western Railway. - East end of the cutting, and therefore part of the Lynch Hill	Shrubsole; Treacher	Wymer 1999
Kentish Stour	Sturry	Pits incl. Homersham's East and West	10-9-8	Acheulean	-Terrace 2 of the Stour. -25m Terrace - Loose, open framework gravel. -Variable gravels with large scale cross bedding	Rice, R Smith	Bridgland *et al.,* 1998a;1998b
Solent	Bournemouth	East Howe, Brixey & Good's Pit, Redhill Common	10-9-8	Acheulean PCT	-Stour Terrace 8. -19 m above the Stour.	Local collectors	Westaway et al 2006

	Dunbridge	Several pits covering two terraces	?	Acheulean PCT	-Belbin/Mottisfont terraces of Test. -Two gravel terraces: upper Belbin Formation and a Lower Mottisfont formation.	Local collectors; Harding and Bridgland	Harding *et al*., 2012, Davis *et al.,* submitted
	Romsey	Several pits	?	Acheulean ?	Terrace 4 of the Test ~41 m O.D.,	Local collectors	Davis et al. submitted
	Warsash	Several pits	10-9-8	Acheulean PCT	-Top of Terrace 3 of Test. - Varying thickness of gravel across four pits (New, Park, Dykes, and Newbury). - Split in Lower and Upper Warsash terraces.	Codrington; Draper; Mogridge	Westaway *et al.,* 2006, Davis *et al*., 2016, Hatch *et al.,* 2017
Great Ouse	Biddenham/Kempston	Several pits	10-9-8	Acheulean PCT	-Terrace 3 gravels, sands and silts 'Biddenham member', at 14.5-18m OD. - Archaeology associated with organic beds with rich temperate signatures.	WG Smith; Wyatt	Harding *et al.,* 1991b; Boreham *et al.,* 2010
Little Ouse	Barnham Heath	Newport's Pit	11-9	Acheulean PCT	-6-8m above the flood plain -5.8m of sandy gravels resting on disturbed chalk with archaeology coming from the base	Brown	Wymer 1985
Kennett	Kennett/Kentford	Station Pit	10-9-8	Acheulean	-Terrace 3 -4-5m of gravel well bedded gravel.	Wright and Whitaker	Boreham *et al.,* 2010
Nar	Southacre	Bartholomew's Hills Pit and Thorpe Gravel Pits	10-9-8	Acheulean PCT?	-Terrace 4 -Sandy cross bedded gravel, no distinction.	Sainty	Boreham *et al.,* 2010
Yare	Keswick		?	Acheulean PCT?	-Yare Valley Gravel at 15m above the river. -Little detailed recording.	No formal work, Lawrence	Cranshaw 1983; Wymer 1985

Figure 2.3 Corelation of major rivers in eastern England (Boreham *et al.,* 2010:296).



Attempts to build a framework of the Solent area have proved more difficult and controversial (Bridgland, 2001; Westaway *et al.,* 2006; McNabb 2007; Ashton and Hosfield, 2010; Hatch *et al.,* 2017). In their discussion of MIS 9, White and Bridgland (2018) attributed the following to the interglacial: Terrace 10 of the Stour, Terrace 9 of the Hampshire Avon, Terrace 4 of the Test and the Taddiford Farm/Ensbury/High Cliff/Beckton Farm Terrace of the Solent and its tributaries. The derived nature of most of the Solent archaeology and clear issues with collection bias, due to the predominance of handaxes, makes studying the region difficult (Davis *et al.,* 2016). There are concerns that the work of Bridgland (1994) is less applicable in the Solent (McNabb, 2007; Davis *et al.,* 2016), and these issues will be addressed in Chapter Four where relevant. Recent work has contested the work of Westaway *et al.* (2006) and has adjusted the correlations (Hatch *et al.,* 2017). Many of the sites referenced as containing Levallois by Westaway *et al.* (2006) contain only a few flakes with cores being rare. The scarcity of core and flake artefacts from the Solent allows for a broad-scale approach in targeting sites of interest that can be clarified in Chapter Four.

A problem in all regions is correlation of sites to specific sub-stages (Westaway *et al.,* 2006; White and Bridgland, 2018). While some sites (as detailed below) give clear indications of climatic conditions, many lack this information, and even at Purfleet it is unknown whether the climate cycle represents the whole interglacial or just a sub-stage such as MIS 9e (White and Bridgland, 2018). Further work is needed to clarify this, but where possible this will be addressed in the following chapters.

2.2 Environment

MIS 9 (328- 301kya) was a shorter interglacial than MIS 11 or MIS 13, lasting 27,000 years in its entirety (Bassinot *et al.,* 1994). The interglacial is further divided into three warm periods (9e, 9c, 9a) and two cold periods (9d, 9b). Based on the decrease in $\delta^{18}O$ throughout the period, it is likely that the interglacial became steadily colder, like MIS 5 (Pettitt and White, 2012:60). MIS 11 and MIS 9 have similar pollen records both containing pollen type x which was once thought to be a type fossil of MIS 11 (Roe *et al.,* 2009: 2343). Terrestrial data is scarce and much of what is currently available could correlate either with the interstadial MIS 9e or the entire period (White and Bridgland, 2018). An overall impression of the interglacial is hard to provide as the evidence is fragmentary but using evidence from Cudmore Grove, Purfleet and Hackney Ashton (2017:161) described the climate as having warmer summers and cooler winters. Ashton (2017:161) further described the presence of mixed woodlands around valley edges containing a wide range of flora and fauna including straight tusked elephants, red, roe ad fallow deer, macaques, horse, bison, red squirrel and wood mouse. While this offers an impression of the interglacial, an account of the detailed variation between sites is more productive when assessing the archaeology. Below is an account of the current knowledge of MIS 9 environments based on a handful of key environmental sites. Other environmental evidence from individual sites shall be discussed within the individual site backgrounds.

Finding a MIS 9 sequence

Cudmore Grove, Essex, a river channel fill deposited by the River Blackwater, represents the most complete environmental sequence for MIS 9 (Holman *et al.,*1990; Roe *et al.,* 2009:2343-2344). Not only does this sequence span a significant part of MIS 9, it also contains high resolution evidence for dating, climate, environments and sea levels (Figure 2.4). Unfortunately, there is a dearth of archaeology at the site with only three unstratified flakes and a scraper (Roe *et al.*,2009: 2365).

Cudmore Grove provides both a regional and local reconstruction detailing interglacial conditions from the thermophilous plant and animal remains (Roe *et al.* 2009:2366). CG1 and CG2 have been correlated to span early pollen zone II until late pollen zone III, where boreal forest is replaced by mixed oak woodland, with temperate conditions and soil ripening (Figure 2.4; Roe *et al.,* 2009:2366). In contrast, CG3 demonstrates post temperate conditions of Pollen zone IV where soils deteriorated, and forests declined (Roe *et al.,* 2009:2366). Despite a depositional hiatus, the current consensus is that only one interglacial is represented, and that although a pre-temperate stage appears to be missing, this could be present at Barling (Roe *et al.,* 2009; Pettitt and White, 2012:92).

The site of Barling potentially represents the pre-temperate to early temperate pollen biozones I-III of MIS 9 (Bridgland *et al.,* 2001:831). Barling contains two pollen zones, the lower of which (BAR1) is dominated by boreal forest containing birch and pine, but also contains some possibly reworked thermophilous species such as chestnut, hazel, lime and ash (Bridgland, 2001). BAR2 sees the rise of oak and elm replacing birch with grasses and sedges also present, and it is possible that the canopy became closed (Bridgland *et al.,* 2001:830). The fauna shows warmer conditions than present, with the mutual climatic range (MCR) from beetles placing the summer temperature at 17-26˚C and winter temperature between -11 and 13˚C (Bridgland *et al.,* 2001:835). These temperature ranges are broad and the winter estimate in particular lacks any real utility, but with further taxa this can be refined (Pettitt and White, 2012:93). *Cyprinid* require a summer temperature of at least 18˚C and the ivy and bracken would not survive extreme winters (Bridgland *et al.*, 2001:830). Pettitt and White (2012:93) tie the site to Cudmore Grove through the presence of nodded *C. torosa* at the top of the sequence indicative of a marine influence and high sea levels during zone II.

Unit	Name	Local pollen assemblage zones	Diatom zones ldaz	Ostracoda and Mollusca	Vertebrates and Coleoptera	Depositional environment	Climate	Palynological sub-stage (after Turner & West, 1968)
6	Upper sands and gravels (Mersea Island Member)	barren	barren	barren	barren	Fluviatile – braided regime. Post-depositional periglacial processes, including ice-wedge formation	?Cold and periglacial	?
5	Grey clays	*Alnus, Pinus* and Ericales. Pollen may be re-worked				Slow-moving water, favouring clay flocculation, possibly marine	Late interglacial?	Post-temperate (IV)?
4	Organic clays	*Alnus-Quercus-Carpinus, Pinus* and *Abies.* Ericales expands **lpaz CG-3**	**ldaz CGD3**			Lagoonal backwater with episodic saltwater penetration	Interglacial	Late-temperate (III)
3	Detritus muds			Sparse ostracod fauna with low numbers of *C. torosa* Freshwater molluscan fauna with some brackish taxa	Rich mammalian, avian, herpetofaunal and fish assemblage (54 taxa) 65 coleopteran taxa	'Lag' deposit with allochthonous material derived from proximal freshwater and estuarine sources, probably following erosive episode	Full interglacial. Temperatures ~2°C warmer than in southern England today	
2d	Silty clays: *Upper silty clays*	**lpaz CG-2** *Quercus-Pinus,* some *Corylus*	**ldaz CGD2b-c**	**Ostracod Zone 2** Brackish-water Mollusca	barren	Outer estuary	Interglacial	Early-temperate (II)
2c	Silty clays: *Shelly silts*		**ldaz CGD2a**			Significant estuarine channel		
2b	Silty clays: *Lower silty clays*	**lpaz CG-1** *Pinus-Betula-Quercus*	**ldaz CGD1**	**Ostracod Zone 1** Low numbers of *C. torosa*		Tidally-influenced river channel	Early interglacial with water temperatures similar to Scandinavian rivers today	
2a	Silty clays: *Sandy clays*	No pollen. *Elatine* macrofossils reflect temperate conditions	barren	barren	*Bos* or *Bison* (femur)	Low-energy river channel, eutrophic with sandy substrate and marginal saltwater influence	Early interglacial	?
1	Basal sands and gravels	barren			Elephant (molar)	Fluviatile	Early interglacial or cold stage?	barren

Figure 2.4 Summary of environmental data from Cudmore Grove (from Roe *et al.,* 2009:2367).

Correlating environmental evidence with the archaeology

The deposits at Purfleet preserve environmental evidence alongside archaeology (Figure 2.5; Bridgland *et al.,* 2013:468). There is a complex sequence of changing environments with a major warm episode sandwiched between two cold-climate events, possibly representing the entirety of MIS 9 (Schreve *et al.,* 2002:1456). The basal layers (Beds 1-3), associated with the non-handaxe signature, were deposited under cold climate conditions during MIS 10/9 (Bridgland *et al.,* 2013:438). Climatic amelioration is seen in Bed 3, based on the molluscs and the presence of *cyprinid* and evidence of temperate woodland from the presence of fallow deer (*Dama dama)* (Bridgland *et al.,* 2013:440).

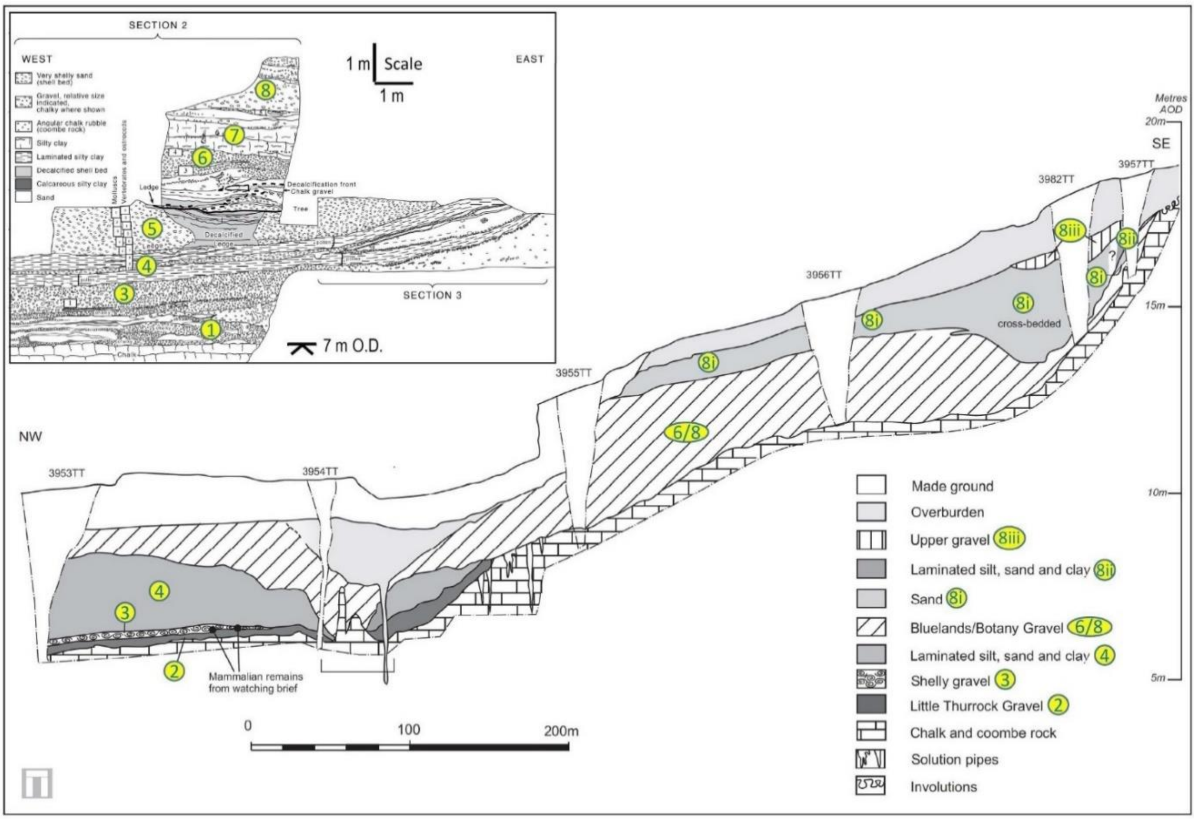


Figure 2.5 HS1 section at Purfleet (Schreve *et al.,* 2019:110).

Bed 4 represents early interglacial conditions with mixed temperate woodland rich in alder, spruce and oak along with smaller quantities of lime, ash and elm (Schreve *et al.,*2002:1442; Bridgland *et al.* 2013). July temperatures of at least 15-17˚C are indicated by the remains of green frog (*Rana ridibunda/lessonae/esculenta)* (Schreve *et al.,*2002:1442; Bridgland *et al.* 2013). Reconstructions of the local environment shows a mature vegetated water body with a marshy floodplain surrounded by woodland and open grassland (Schreve *et al.,* 2002:1439). Laminated silty clays show evidence for tidal sedimentation during a period of high sea level despite weak evidence for salinity (Schreve *et al.,*2002:1455).

Bed 5 demonstrates an increase in flow energy and the development of a sand flat where pollen has not been preserved, but a limited molluscan fauna indicates a mosaic of marsh or swamp close to the river with grassland shrubs and woodland (Schreve *et al.,*2002). Bed 5 yielded a rich faunal assemblage, mostly fish, micro-mammals and avian fossils, along with the humerus of a Roe deer (*Capreolus capreolus*) (Schreve *et al.,*2002:1441). The Greenland bed contains *cyprinids* and pike which require still or slow flowing water and a summer temperature of at least 18˚C, suggesting interglacial conditions (Schreve *et al.,* 2002:1442). The presence of white-toothed shrew (*Crocidura sp*) is a strong indicator for conditions warmer than present and this is further supported by the presence of fallow deer and straight-tusked elephant (Schreve, *et al.,* 2002:1442).

Beds 6 and 8 were deposited under cooling conditions, possibly during MIS 9/8 but alternatively could represent the cooling period from MIS 9e-d (Bridgland *et al.,* 2013). Faunal evidence, while limited, is consistent with more open conditions, especially the presence of horse (Schreve *et al.,*2002:1442). Overall, the conditions seem to have involved more extreme seasonality and warmer summers throughout the interglacial (Bridgland *et al.,* 2013:469). The mutual ostracod temperature range is 16-21˚C for July and -3 and 3˚ for January (Bridgland *et al.,* 2013:469). The analysis of stable isotopes and the presence of *Emys orbicularis* points to MIS 9 being on average 2˚C warmer than present (Bridgland *et al.,* 2013:472).

Three smaller sites, dated to MIS 9, have produced both archaeology and significant environmental data. The site of Grays Thurrock is primarily known as a faunal site (see Chapter Four for archaeology and other issues) where collection took place multiple times from the 1830's (Morris, 1836; Whitaker, 1889; Schreve, 1997:305). The faunal specimens in the Natural History Museum were collected between 1845-1850 by W. Ball, and further material was collected in 1900 at Orsett Road, Grays (Schreve, 1997:305-6). While there had been previous confusion over provenance, due to the use of 'Grays' as a generic name for the area as well as Grays brickfield, Schreve (1997:307) determined that, due to the timings of collection, the material came from Grays brickearths and particularly the eastern pit. Grays is correlated to the Corbets Tey formation (Bridgland, 1994) and represents one of the best-preserved Middle Pleistocene faunal sites containing 1579 specimens representing 27 species (Schreve, 1997:312). Schreve (1997:324) noted the disappearance of key Hoxnian signatures in Grays, and that Grays demonstrates similarities to Purfleet and Cudmore Grove (Schreve, 2002:1443).

Nightingale estate, Hackney, contains organic deposits of the River Lea that represent a short time period, maybe only a few years (Green *et al.,* 2006:89). While no artefacts have been found, it is probably slightly later than Stoke Newington (Green *et al.,* 2006:111). Stoke Newington itself is thought to date to the earlier part of MIS 9, probably contemporary with the Purfleet Middle Gravels (Green *et al.,* 2004; Simon Lewis Pers. Comm, 2019). Nightingale estate can be correlated with the late temperate stage at Cudmore Grove with summer temperatures between 18- 19˚C and winter temperatures between -4 and 1˚C based on flora and fauna showing continental conditions (Green *et al.,* 2006:103). There is evidence of mixed woodland dominated by oak with small amounts of beech, ash, elm and lime with a hazel shrub layer (Green *et al.,* 2006:100). Plant macro fossils are dominated by grasses, open ground herbaceous species and aquatics which, along with beetles and molluscs, indicate marsh and wet grassland with scarce woodland and dry ground (Green *et al.,* 2006:100).

The end of MIS 9, or one of its cold substages, is represented by the Wolvercote channel, Oxfordshire, in the Upper Thames (Tyldesley, 1986a). Wolvercote yielded a fauna that reflects temperate but cooling conditions (Schreve, 1997: 356). The fauna is undiagnostic but a correlation with MIS 9 is likely based on all the evidence (Bell, 1904:123 Sandford,1924; Schreve 1997:356; Tyldesley, 1986a:5). Blair (1923:562) described a small assemblage of coleopteran in the peat layer that indicates a climate similar to modern times but slightly cooler. Duigan (1956:371) obtained plant remains including *Draba incana* which was used to argue for a cold, possibly artic or sub-arctic, climate when the peat was formed (Brigss *et al.*, 1985:142). The pollen also shows a change from pine-dominated forest to open conditions (Briggs *et al.,*1985). The scarce amount of pollen found by Briggs *et al.* (1985:175) shows a progressive cooling of the climate during the filling of the channel with a tree-covered (mainly Pinus) environment.

Fauna

The fauna of MIS 9 (Table 2.3) and the surrounding glacial periods (Table 2.4) is better understood after Schreve's (1997; 2001a) work distinguishing MIS 9 fauna from MIS 11 which, given the similarities of the pollen profiles, remains crucial to the separation of the interglacials. Small mammals indicative of MIS 11 such as *Talpa minor, Trogontherium cuvieri, Oryctolagus cuniculus* and *Microtus (Terricola) subterraneus* are not present at Purfleet and Cudmore Grove (Schreve, 2001a:1698). Additionally, Grays Thurrock and Cudmore Grove contain water shrew *Neomys cf. browni,* which is a transitional form (Schreve, 2001a:1698). Lion is poorly represented with only a single find at Cauliflower Pit, Ilford which contrasts with the high carnivore numbers, such as brown bear (*Ursus arctos)* which appear to have replaced cave bears (*U. spelaeus)* from MIS 11 (Schreve, 2001a:1698). The remains of water vole (*A.t. cantiana)* also show a more derived morphology than those assigned to MIS 11 (Schreve, 2001a:1698). Both hyena (*C. Crocuta)* and elk (*Alces sp*.) are unknown in MIS 11, although elk is rare in all British contexts (Schreve, 2001a:1698). Diagnostic antlers from deer have not been recovered and so the species of *Dama dama* cannot be identified, but their smaller remains seem to rule out the *D. d. clactoniana* of MIS 11 (Schreve, 2001a:1698).

Taxon	
Insectivora	
Crocodura cf. leucodon	Bicoloured shrew
Sorex minutus	Pygmy shrew
Sorex 20raneus	Eurasian shrew
Neomys cf. browni	Water Shrew
Primates	
Macaca sylvanus	Macaque
Homo sp.	Human
Chiroptera	
Eptesicus serotinus	Serotine bat
Rodentia	
Scuirus	Squirrel
Castor fiber	European beaver
Clethrionomys glareolus	Bank vole
Arvicola t. cantiana	Water vole
Microtus arvalis	Common vole
Apodemus sylvaticus	Wood mouse
Cetacea	
Tursiops truncatus	Bottle-nosed dolphin
Carnivora	
Canis lupus	Wolf
Vulpes vulpes	Fox
Ursus arctos	Brown beer
Mustela cf. putorius	Pole cat
Meles meles	Badger
Lutra lutra	Otter
Crocuta crocuta	Spotted hyaena
Proboscidea	
Palaeoloxodon antiquus	Straight-tusked elephant
Perissodactyla	
Equus ferus	Horse
Stephanorhinus hemitoechus	Extinct steppe (narrow-nosed) rhinoceros
Stephanorhinus kirchbergensis	Extinct forest (Merck's) rhinoceros
Artiodactyla	
Sus scrofa	Pig
Megaloceros giganteus	Extinct giant deer
Dama dama	Fallow deer
Cervus elaphus	Red deer
Capreolus capreolus	Roe deer
Bos primigenius	Aurochs
Bos priscus	Bison

Table 2.3 Fauna of MIS 9 (after Pettit and White, 2012:65-67).

Taxon		**MIS 10**	**MIS 8**
Primates			
Homo sp.	Humans	Present	Present
Carnivora			
Panthera leo	Lion		Present
Proboscidea			
Palaeoloxodon antiquus	Straight-tusked elephant		Present
Mammuthis primigenius	Woolly mammoth		Present
Perissodactyla			
Equus ferus	Horse		Present
Coelodonta antiquatis	Woolly rhino		Present
Artiodactyla			
Cervus elephas	Red deer		Present
Bos primigenius	Aurochs		Present
Bos priscus	Bison		Present
Ovibos moschatus	Musk-ox	Present	

Table 2.4 Fauna of MIS 10 and MIS 8 (after Pettit and White, 2012:65-67).

There are several factors that also distinguish the fauna from later interglacials, such as the presence of macaque (*Macaca sylvana*) (Schreve, 2001a:1698). The low occurrence of lion could be significant due to its higher presence in later interglacials (Schreve, 2001a:1698). The presence of horse *(Equus ferus*), hominins and rhinoceros *S. kirchbergensis* clearly distinguishes MIS 9 from Ipswichian-age sites (Schreve, 2001a:1699). Combined with the work of Bridgland (1994), this demonstrates that not only are these assemblages older than the Ipswichian, but also older than MIS 7 placing them within MIS 9 (Schreve, 2001a:1699).

Schreve (2001a:1699) created a MIS 9 mammalian assemblage zone (MAZ) using the sites of Purfleet, Grays Thurrock, Belhus Park and Cudmore Grove. Unfortunately, while Schreve (2001b:72) demonstrated the complexity of sub-stages during MIS 11 and MIS 7, the poorer record for MIS 9 has meant that the period is often treated in a more homogenous way.

Summary

Our knowledge of the environment of MIS 9 is still relatively poor, with a scarcity of the long environmental sequences available for other periods. Many sites often hang unconstrained in time within MIS 9 due to a lack of environmental evidence, so building interpretations of the archaeology is challenging. The longer environmental sequences examined only represent one period of warming and cooling with no substage variation which could mean that the evidence fits into just one sub-stage or that the variation in the interglacial is less pronounced (White and Bridgland, 2018). It is currently difficult to fit Wolvercote and Hackney into the longer sequences of Cudmore Grove and Purfleet. The importance of Purfleet lies in it being the only environmental site with a long sequence that is also archaeologically rich, perhaps showing three distinct occupations. The early non-handaxe signature seems to relate to an early occupation in the interglacial similar to the Clactonian of MIS 11 (White and Schreve, 2000) and the development of PCT relates to climatic deterioration at the end of the interglacial (Bridgland *et al.,* 2013). Despite the problems relating to MIS 9, the period is key to our understanding of the transition from the Lower to Middle Palaeolithic.

2.3 Hominins

Changes in Palaeolithic technology have often been linked to changes in hominins (Foley and Lahr, 1997; Moncel *et al.,* 2011). The capacity for hominins to deal with colder climates through innovations such as fire, clothing and other adaptations appears to increase through time and is linked to longer and more permanent occupation of northern Europe (Ashton *et al.,* 2018). Hosfield and Cole (2018) have argued that the increase in cranial capacity after 500kya created a sustained change in north-western Europe, with larger and more prolonged occupations. This increase could be attributed to more complex use of space and landscape with increasing group size and language (Dennell, 2018:268). Changes, both around 500kya and during the Lower to Middle Palaeolithic transition, are not just changes in lithic technology but part of wider behavioural packages (Hosfield and Cole, 2018; Galway-Witham *et al.,* 2019). Wadley (2018:238) argued that hominins between 400-130kya had brain sizes similar to anatomically modern humans (AMH), but the importance was mental flexibility. Hominins have been present in Britain during MIS 13, MIS 11 and MIS 9 and at least parts of MIS 12 and MIS 10 (Pettitt and White, 2012). There is increasing evidence for earlier incursions at the sites of Pakefield and Happisburgh III (Parfitt *et al.,* 2005; 2010), but occupation was not continuous (Gamble, 1999; Dennell *et al.,* 2011). With no direct fossil evidence in Britain for MIS 9, the subject of which hominins were responsible for the record is unclear.

Homo heidelbergensis

Homo heidelbergensis is the *de facto* hominin species for much of the British Lower Palaeolithic, despite loose definitions of its chronological range and variability (Hopkinson, 2007:294; Dennell *et al.,* 2011:1513). Identified from a jawbone discovered in 1907 at Mauer near Heidelberg, *Homo Heidelbergensis* is assigned the time span 780-130kya by Buck and Stringer (2014). *Homo heidelbergensis* were tall and strongly built, with a brain (1200cc) in the lower range of *Homo sapiens* (1350cc), but larger than *Homo antecessor* (1000cc) (Buck and Stringer, 2014). Their gait and statue were similar to *Homo sapiens* with males being around 1.75m (Stringer, 2011). Only two sites are traditionally thought to contain *Homo heidelbergensis* remains in Britain: the Swanscombe skull (Wymer, 1964) and the Boxgrove tibia and incisors (Robert and Parfitt, 1999), neither of these are attributed to MIS 9. *Homo heidelbergensis* are associated with advances in hunting, technology (particularly the handaxe), developments in language, increases in material culture including ideas of ownership and the use of hides tied together by strong social networks (Gamble, 1999:269; Ashton, 2017).

Homo heidelbergensis is often treated as a chronospecies succeeding *Homo antecessor* but predating the Neanderthals (Bermúdez-de-Castro *et al.,* 2017:22-27). Its relation to these hominins is controversial and ill-defined (Hublin, 2009; Hawke, 2017). Mounier *et al.* (2009:241-3) used comparative morphology to argue that *Homo heidelbergensis* is a distinct Afro-European group, although conceded that the record is sparse. *Homo heidelbergensis* is sometimes conceived as a European-only taxon, with *Homo rhodesiensis* representing the African equivalent (Hublin, 2009:16023; Stringer, 2012:101). Manzi (2016:255) argued the Middle Pleistocene hominin picture is complex and has the potential to involve multiple groups, differing lineages and a large degree of diversity termed 'the muddle in the middle' (Isaac, 1975). Despite many unknown factors including its origins, relation to other taxa and high levels of diversity, Manzi (2016:258-260) still argued that *Homo heidelbergensis* is a crucial taxon.

Neanderthals

There is increasing evidence of the early evolution of Neanderthal traits in European hominins between 600-450kya (Hublin and Pääbo, 2006; Orlando *et al*., 2006; Bischoff *et al*., 2007; Rightmire, 2008, Endicott *et al*., 2010; Green *et al.,* 2010; Meyer *et al.,* 2014; 2016). Much has been written about Neanderthals and perspectives have changed over the years (Stringer and Gamble, 1993; Mellars, 1996; Scott, 2011:1; White *et al.,* 2014:36). MIS 5-3 (100-40kya) is considered the traditional Neanderthal occupation of Europe, with 'classic Neanderthals' appearing in MIS 5 around 130kya (Hublin, 2009). While most work on Neanderthals focusses on comparisons to AMH (Shipman, 2008), their relationship to Lower Palaeolithic hominins is equally important.

The current fossil record makes these relationships difficult to clarify due to the fragmentary remains between MIS 10-6 (Hublin, 2009:16022). Neanderthal traits have been pushed back due to new discoveries, especially those at Sima de los Huesos (Meyer *et al.,* 2014; 2016). Hublin (2009:16024) asserted that the Swanscombe skull is Neanderthal, along with later hominins such as Steinheim, meaning that Neanderthals predated MIS 11. Hublin (2009:16025) argued that it is possible to push back the term Neanderthal to include all derived features in earlier hominins. However, the term Neanderthal carries with it connotations for other aspects of behaviour which new evidence is showing is increasingly complex including art (Hoffmann *et al.,* 2018a), burial (Pettitt, 2011), advanced hunting (White *et al.,* 2016*;* Gaudzinski-Windheuser *et al.,* 2018), symbolism and decoration (Hoffmann *et al.,* 2018b). The presence of Neanderthal traits in the morphology of earlier hominins and the introduction of Middle Palaeolithic technology such as Levallois does not equate to an instant change to 'classic Neanderthals'. It is more feasible that Neanderthal behaviour developed gradually much like their morphology.

Denisovans

Discovery of the Denisovans has further complicated the situation (Stringer and Barnes, 2015:15542; Jacobs *et al.,* 2019:594). Denisova Cave, in the Altai mountains of Siberia, was occupied for a long period of time stretching back to at least the early Middle Palaeolithic, but the site has been reused by subsequent populations (Stringer and Barnes, 2015:15542). Precise dating is problematic due to the complex cave stratigraphy with issues including freeze thawing, slumping and subsidence (Jacobs *et al.,* 2019:594). The cave contains artefacts from the early Middle Palaeolithic to the Upper Palaeolithic, as well as the remains of four Denisovans, two Neanderthals and a hybrid (Jacobs *et al.,* 2019:594).

Knowledge of Denisovans is limited as they are almost entirely known through their DNA, unsupported by Palaeoanthropology with only one finger bone and a handful of teeth recovered (Stringer and Barnes, 2015:15543; Gibbons, 2015). Work on Denisovan DNA has shown that they share a common ancestor with *Homo sapiens* and Neanderthals but the timing of this is widely debated. Krause *et al.* (2010:894) placed the divergence from AMH around a million years ago, with Denisovans splitting from Neanderthals around 400-390kya (Reich *et al.,* 2010; Slon *et al.,*2018:113). Rogers *et al.* (2017) demonstrated that there was a bottleneck after the Denisovans diverged in Africa at around 600kya. Recent work by Petr *et al.* (2020) argued for a Y chromosome split between Denisovans and both Neanderthals and AMH around 700kya.

Admixture

The interaction and admixture between species including *Homo heidelbergensis,* Neanderthals, Denisovans, AMH and other possible species has been established over the last decade (Reich *et al*., 2010; Meyer *et al*., 2015, 2016; Hsieh *et al.*, 2016; Galway-Witham *et al.,* 2019). Previous work had assumed either minimal or no interbreeding between distinct hominin species (Hudjashov *et al*., 2007; Oppenheimer, 2009; Soares *et al*., 2009). Theories were based on the idea of a recent African origin with *Homo heidelbergensis* an ancestor to both *Homo sapiens* and Neanderthals splitting around 400kya (Galway-Witham *et al.,* 2019). Models were often used to explain this scenario such as the human revolution model by Mellars and Stringer (1989), suggesting that behavioural modernity only appeared with the appearance of AMH in Europe. Others such as Klein (2009) and Trinkaus (1981) focused on physical adaptions of hominins in various regions (Galway-Witham *et al.,* 2019).

The discovery of the Denisovans has been accompanied by an increased understanding of interbreeding between hominin species through work on DNA (Green *et al.,* 2010; McCoy *et al.,* 2017). A recent study has demonstrated the existence of the offspring of a female Neanderthal and male Denisovan, showing interaction and interbreeding between the species (Slon *et al.,* 2018:113). There is further indirect evidence of interbreeding demonstrating frequent admixture (Slon *et al.,* 2018:1136). Perhaps the key aspect of the Denisovan discovery is how incomplete our knowledge of Middle Pleistocene hominins is.

Dennell *et al.* (2011:1514) described the populations of Europe being split between core and periphery groups. Britain has been abandoned for much of the last 500,000 years and so any groups in Britain are likely to be periphery groups to the core ones in Europe (Dennell *et al.,* 2011:1514). It is probable that the whole of northern Europe was repeatedly colonised from various sources, with groups later becoming extinct (Dennell *et al.,* 2011:1522). This pattern of demographic discontinuity could account for the rich and varied archaeology of the period from a complex history of hominin occupation. The hominin record is looking increasingly complex (Figure 2.6).

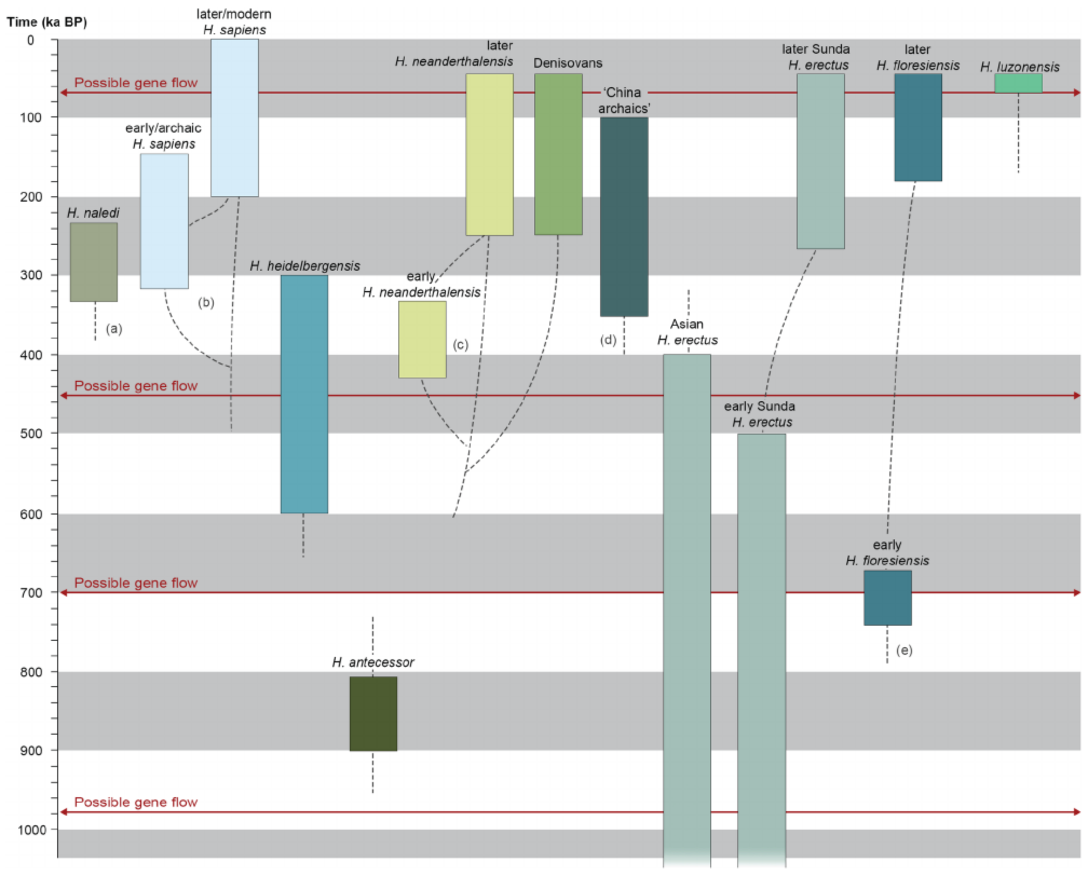


Figure 2.6 Inferred relationship between hominin species (Galway-Witham *et al.,* 2019:357).

Transition

Theories involving a simple division between *Homo heidelbergensis* and Neanderthals no longer seems tenable due to the complexity of both the archaeology and anthropology (Davis and Ashton, 2019). Gamble (2018:3) argued that there was no major revolution but small cumulative changes that showed signs of increasingly complex social lives. This is linked to the common notion that *Homo heidelbergensis* slowly evolved into Neanderthals (Locht *et al.,* 2018:217). The hominin remains at the site of Gruta da Aureira, Portugal show traits of both Neanderthals and *Homo heidelbergensis* (Daura *et al.,* 2017). Stringer (2006:89) classified the Swanscombe skull (MIS 11) as early Neanderthal, while others have argued it is *Homo* *heidelbergensis* with Neanderthal features making it part of the Neanderthalisation process (Mounier *et al.,* 2009). Therefore, during MIS 11 and MIS 9 the change from *Homo heidelbergensis* could be observable with no clear distinction (Rightmire, 1998:223).

The search for origins is intrinsically problematic, and it is therefore important to focus on transitions which are often not as clear cut as traditionally seen, lacking clear watershed moments (Foley *et al.,* 2016:2). In the early Middle Pleistocene, incipient Neanderthal features are seen in hominins such as Mauer (Germany), Boxgrove (England), Tautavel (France), Arago (France), Petralona (Greece) and Vértesszőlős (Hungary) (Hublin, 1998:299). Later hominins from the sites of Reilingen (Germany), Blizingsleben (Germany), Sima de los Huesos (Spain), Steinheilm (Germany) and Swanscombe (England) show closer affinities to Neanderthals around MIS 11-9 (Hublin, 1998:299). Some specimens such as Aroeira 3 show a mixture of *Homo heidelbergensis* and Neanderthals traits around MIS 11 (Daura *et al.,* 2017). Afterwards, hominins from Biache-Saint-Vaast (France), Ehringsdorf (Germany), La Chaise-Suard (France), Fontechevade 2 (France), Le Lazaret (France) and Pontnewydd (Wales) around MIS 7-6 show almost full Neanderthal features and are almost indistinguishable from later 'classic Neanderthals' from MIS 4 onwards (Hublin, 1998:301). Work by Hublin (1998:301) shows the accretion of Neanderthal traits from around or before 450,000kya showing no rapid change. Hublin (1998:302) contended it is hard not to refer to hominins with Neanderthal features as such. Mounier *et al.* (2009:241-3), however disagreed, stating that a few Neanderthal traits does not make hominins Neanderthals.

If the the origin of Neanderthals is ~400,000kya, as suggested above, MIS 9 could represent the tipping point between the last *Homo heidelbergensis* populations and the first fully-fledged Neanderthals. It is likely that the *Homo heidelbergensis*-Neanderthal relationship was a gradual change better marked on a spectrum. Behaviourally, Ashton (2017:155) has suggested that hominins at the start of MIS 9 act like *Homo heidelbergensis* but change during the interglacial. If this watershed moment occurs during MIS 9 it could account for the diverse range of technology in the interglacial. With the complex nature of hominin relations in the Middle Pleistocene, it is possible different hominin groups could be responsible for distinct lithic traditions. Stringer (2011a:3-4) suggested that early Neanderthals were making handaxes whilst surviving populations of more archaic hominins were responsible for core and flake technology. This could show multiple lineages within Europe during the Middle Pleistocene which may have differing technological repertoires explaining the diverse nature of lithic technology during MIS 9. It is possible that the early occurrences of Levallois technology could be the result of changes in hominins (Moncel *et al.,* 2011:38). Ashton (2018:151) has suggested that there is a geographical split of *Homo heidelbergensis* in Eastern Europe and early Neanderthals in Western Europe. This represents a restricted use of the term *Homo heidelbergensis* and a wider usage of Neanderthals.

Recent work by Petr *et al.* (2020) has argued that the Y chromosome of AMH introgressed into Neanderthal populations between 370-100kya, thus having an impact on late Neanderthal populations. Petr *et al.* (2020) argued that earlier Neanderthal populations such as Sima de los Huesos are likely to have a Y chromosome lineage more akin to the Denisovans. Evidence from both Greece (Harvati *et al.*,2019) and the Levant (Zaidner Weinstein-Evron, 2020) is showing a more complex dynamic between Neanderthals and AMH. This adds further complexity to the record and these factors could have major implications for the archaeological record we see across Europe.

Summary

There is no way to be certain which hominins occupied MIS 9 Britain, or whether there were distinct hominin species during the interglacial due to the lack of hominin remains. While hominins from this period are likely to be classified as *Homo heidelbergensis*, Neanderthals or some point in between, we also have the discovery of Denisovans and on-going DNA revelations to further complicate matters. With more data and studies coming out, the 'Muddle in the Middle' appears to be getting more complicated. Both Ashton *et al.* (2016) and McNabb (2020) have cautioned that with so many unknowns it is premature to pin any technology on specific hominins. The previously advocated model of *Homo heidelbergensis* creating Lower Palaeolithic assemblages and Levallois emerging with Neanderthals and *Homo sapiens* around 300kya seems too simplistic (Hawks, 2017:9761). With current evidence showing early Neanderthal (and possible Denisovan) lineages going back over two-hundred thousand years before the beginnings of Levallois, it is no longer wise to assume that the origins of a species and a technology as being linked (Hawks, 2017:9762).

2.4 Culture

The idea of cultural signatures in the Palaeolithic has often been used to explain differences in technology, most infamously with the Clactonian (White, 2000; McNabb, 2007), but also twisted ovates (White, 1998a) and more recently wider patterns in handaxe variation (White *et al.,* 2018; 2019). This raises the question of whether rather than distinct hominin species, variation seen during MIS 9 could indicate different cultures (Galway- Witham *et al.,* 2019). The identification of distinct cultures is often accepted in AMH but dismissed in other hominins

(Galway-Witham *et al.,* 2019). Galway-Witham *et al.* (2019) pointed to evidence of behavioural differences between groups, even in non-human primates (McGrew, 1998; Whiten et al., 1999; van Schaik et al.,2003), although others have questioned if this represents a conscious cultural difference (Gruber *et al.*, 2015). Despite this, there is increasing evidence of cultural distinctions during the Lower Palaeolithic with non-handaxe assemblages, handaxe assemblages and PCT all being discussed in relation to the increased interest of 'culture' (White and Bridgland, 2018; Davis and Ashton, 2019). This has been notably controversial after the culture history of the early twentieth century (O'Connor, 2007) and there has been resistance to the term, especially in relation to assemblage types such as the Clactonian (McNabb, 2007) and wider Acheulean variation (Bates *et al.,* 2014). However, the ideas promoted by White *et al.* (2018; 2019) of temporal and/or geographically significant patterns are in the process of gaining wider acceptance (Davis *et al.,* 2017; Hosfield *et al.*, 2018; Davis and Ashton, 2019; Shipton, 2018;2019a;2019b;2020; Shipton and White, 2020; McNabb, 2020).

Davis and Ashton (2019) cautioned that scepticism may be due to previous loose uses of the term 'culture' which led some archaeologists to use culture in a way to describe artefact assemblages that has little to do with culture. Davis and Ashton (2019:1) tried to overcome this by defining culture as "people with a common set of practices and beliefs that persist through time". This ties in with Shipton and White's (2020) characterisation of archaeological 'cultures' as suites of co-occurring traits. The problem is that many elements associated with culture, such as social values, communication and language, lack strong evidence in the Palaeolithic (Henrich, 2015). While culture has been ascribed to non-human primates (Hopper *et al.,* 2007; Whiten *et al.,* 2017), Davis and Ashton (2019) argued that this was constantly reinvented and it is the persistence through time which shows a major change. However, many of the behaviours associated with hominins are underlined by cultural behaviours such as hunting, hide removal and fire (Davis and Ashton, 2019). These are all considered to be in place by MIS 9 (Pettitt and White, 2012; Ashton, 2017; Moncel *et al.,* 2020) and therefore the question is not if culture exists, but if it persists both temporally and/or geographically and whether we can recognise it (Davis and Ashton, 2019).

Examining culture requires the probing of the temporal and geographical breadth of such cultures and whether any localisations are noticeable (Shipton and White, 2020). Shipton and White (2020) discussed culture in relation to the concept of normativity; a societal way of making, saying and doing things which offers a greater level of uniformity (Claidiere and Whiten, 2012). Handaxe types have been suggested as an early manifestation of this (Shipton and White, 2020). While sub-stages may be conflated, recent work has shown that traditions can be observed in handaxes (White *et al.,* 2019) and could represent different waves of occupation (Shipton and White, 2020). In MIS 11 we potentially see three distinct waves of occupation: Clactonian, Acheulean and a distinct Acheulean group making twisted ovates (Davis and Ashton, 2019). Davis and Ashton (2019) suggested that when the climate was stable, hominins became 'habituated' in localities, and this led to local signatures and cultures. In the Lower and Middle Palaeolithic period we are missing vast amounts of cultural information, but from what we have it is likely that there was a mosaic of different cultures tied to environmental changes during the period (Davis and Ashton, 2019). It could be argued that non-handaxe groups, trends in flake tools and groups with PCT operated in a similar way related to the social norms discussed by Shipton and White (2020).

2.5 Handaxes

While the focus of this thesis is not on handaxes, they make up the majority of work on the Lower Palaeolithic having been produced over a period of 1.5 million years (Stout *et al.,* 1999:576). Despite the diversity of MIS 9, the majority of sites are dominated by handaxes and evidence for handaxe manufacture (White and Bridgland, 2018). In addition, previous collection bias has favoured handaxes and has disproportionately impacted the study of non-handaxe assemblages, flake tools and PCT (Pope *et al.,* 2016:85-86). Therefore, the current work on handaxes from MIS 9 by Luke Dale directly impacts elements of this study, and is referenced to when relevant.

Studies normally focus on handaxes, especially morphometric variation (Wymer, 1968; Roe, 1968), symmetry (Machin *et al.,*2007; Hodgson, 2009; White and Foulds, 2018; McNabb *et al.*, 2018) and function (Keeley, 1980; Mitchell, 1996;1997). Roe's (1968b:1981) efforts to attach temporal significance to handaxe shape were previously dismissed for more functional concerns such as raw material (White, 1995) and reduction (McPherron, 1996). Experimental work (Eren *et al*., 2014; Shipton and Clarkson, 2015) has demonstrated that this does not explain the full variation of handaxes. Although an evolutionary scheme moving from crude to refined has long been overturned (Wymer, 1985:371), recent work has demonstrated the temporal significance of certain handaxe types (White and Jacobi, 2002; Bridgland and White, 2014; 2015; White *et al.,* 2018;2019). The social significance of handaxes has also been widely discussed (Gamble, 1999) including arguments favouring their use in sexual selection (Kohn and Mithen, 1999) or as indicators for trustworthiness (Spikins, 2012). Otte (2003:183) and

Machin (2009:37) both concluded that a multitude of factors contribute to handaxe manufacture, including cultural, technological and environmental constraints.

Most importantly for this thesis is the suggestion that MIS 9 corresponds with Roe's (1968b) Group I, characterised by pointed handaxes, with the co-occurrence of ficrons and cleavers (Figure 2.7; White and Bridgland, 2018). The significance of this is currently being examined by Dale (Pers. Comm. 2021) and compliments the temporal aspects of the non-handaxe assemblages, flake tools and PCT analysed in this thesis. The importance of an increase in re-sharpening on both handaxes and flake tools has been suggested by White and Bridgland (2018) and could be related to the beginning of the Middle Palaeolithic. While Roe (1981:16) admitted it was hard to resist grouping similar objects in lieu of other dating evidence, current studies are taking advantage of the expanded framework and more accurately placing sites within the MIS framework. This ensures that temporal groupings are evidence-led rather than agenda driven.

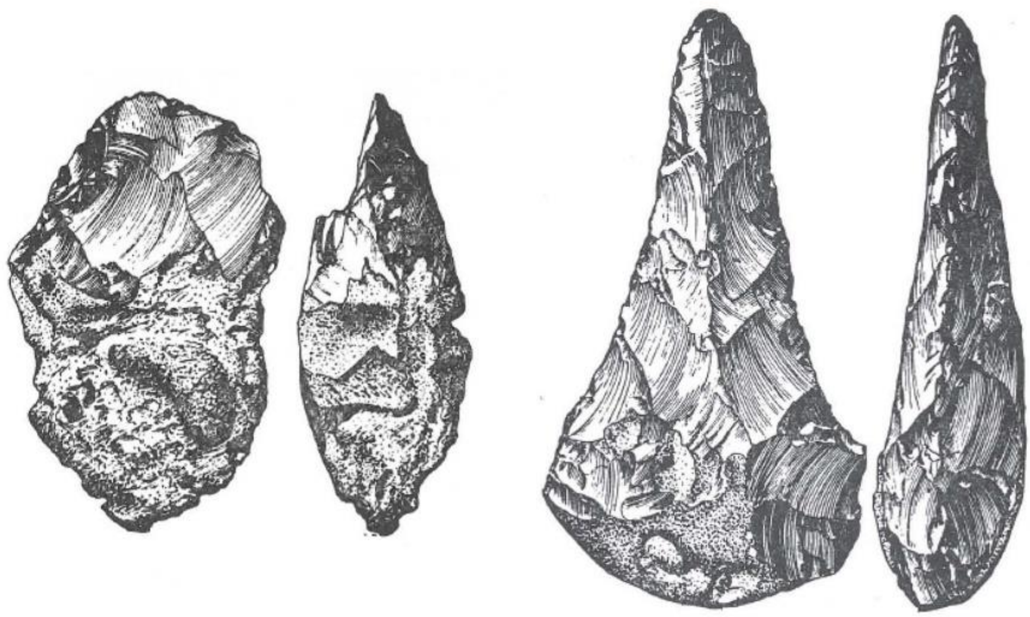


Figure 2.7 Examples of Cleaver (left) and ficron (right) from Furze Platt after Wymer, 1968 (White *et al.,* 2018:127).

2.6 The Clactonian and non-handaxe assemblages

Despite the dominance of handaxes in the Lower Palaeolithic, their absence at certain sites has created one of the most enduring debates in the study of the British Lower Palaeolithic. These non-handaxe sites are labelled Clactonian, after the site of Clacton-on Sea, Essex (White, 2000). The sites traditionally assigned to the Clactonian are Clacton, Swanscombe, Barnham and Little Thurrock (Wymer, 1968:41). Whilst the first three are now dated to MIS 11 and are commonly still referred to as Clactonian, Little Thurrock can now be dated to MIS 10/9 along with a number of other sites which potentially show a separate non-handaxe signature (White, 2000; White and Bridgland, 2018). The legitimacy and meaning of this MIS 9 non-handaxe signature are still contested (McNabb, 2007; Wenban-Smith, 2013; White and Bridgland, 2018; McNabb, 2020). In order to examine the non-handaxe sites of MIS 9, it is important to first contextualise them within the wider framework. Pettitt and White (2012:175) summarise the traditional definition of the Clactonian as follows based on the works of Wymer (1968;1974):

- The Clactonian is considered to be a distinct primitive core and flake industry often related to the production of chopper-tools and flake tools, but lacking handaxes.
- It is the product of a habitually non-handaxe making culture, possibly linked to the chopper tool industries of Asia.
- Its primitive nature is indicative of the earliest occupation of Britain, with little evidence of chronological overlap with Acheulean industries.
- It is thought to have entered Britain from the east, via central Europe and Asia.

2.6.1 Discovery and establishment

A non-handaxe assemblage was recognised at Clacton from the 1890's through the work of Kenworthy (1898) and Warren (1911; 1912a:15) who found simple flakes, scrapers and pseudo-Mousterian artefacts. The finds at Clacton were originally described as a primitive flake industry similar in age to the Acheulean (Warren,1922:598; 1923b:614). This was later refined to the early part of the Acheulean (Warren 1924:38). Warren (1924:38) suggested that this core and flake industry with rudimental flake tools and side choppers was the remains of a primitive race that lived side by side with other hominins. The term Mesvinian was originally adopted due to similarities to the Belgium sites of Spiennes and Mesvin (Breuil, 1926:178; O'Connor, 2007:263), but was later abandoned when the Belgian sites were discovered to be mixed.

Warren (1926) coined the term Clactonian in a footnote to a paper where he suggested the Clactonian was a parallel culture to the Acheulean and an ancestral form of the Mousterian, an idea later expanded by Breuil (1932). The Clactonian was later adopted for sites in Britain with a distinct non-handaxe culture, such as Swanscombe and Barnham, where sub-divisions were later implemented (Breuil,1932:126; Chandler, 1932; Oakley and Leaky, 1937:217; Paterson, 1937). Over time positive identifiers were associated with the Clactonian and this led to the acceptance of mixed assemblages having Clactonian elements, such as Hoxne (Paterson and Fagg, 1940). From this, the Clactonian developed into a major interpretive and dating tool, evidenced in work at the time such as that of King and Oakley (1936).

2.6.2 Clactonian typologies and culture history

There have been many attempts to create a typology of the Clactonian and define it beyond the lack of handaxes (Pettitt and White, 2012:173-174). Table 2.5 summarises the main typologies previously used and examples of 'Clactonian artefacts' are illustrated in Figure 2.8.

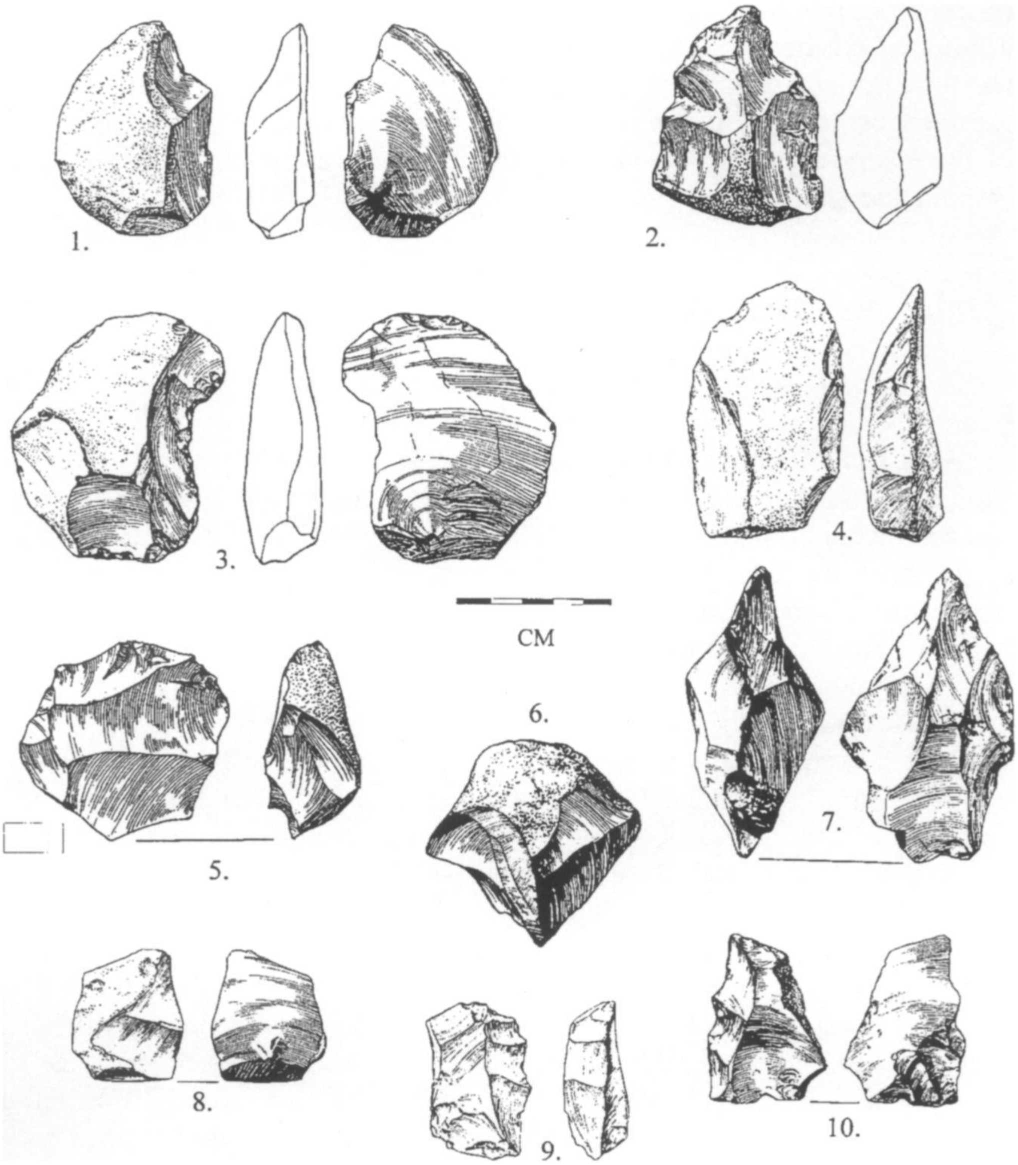


Figure 2.8 'Clactonian artefacts' from Clacton-on-Sea 1) Notch 2) worked flake 3) Bill hook form 4) side scraper 5) biconical core 6) chopper-core 7) proto biface core 8) flake 9) denticulate 10) bifacial denticulate (White, 2000:3 after Wymer, 1985).

<table>
<tr><th>Archaeologist</th><th>Typology</th></tr>
<tr><td>Warren (1922:598;1923b; 1924:38)</td><td>Large flakes.
Trimmed flakes.
Cores, including discoidal cores.
Choppers.
Pointed implements.</td></tr>
<tr><td>Chandler (1929:86-92; 1932:377)</td><td>Flakes- Large, obtuse angle, prominent bulb of percussion (sometimes two), unfaceted, thick and wide, rare secondary working.

Cores- potential chopper cores, large. Crude handaxes or tortoise cores.
Use of anvil stones with bruised edges.

Flake tools- Strepy points</td></tr>
<tr><td>Oakley and Leaky (1937:226-236)</td><td>Flakes- Similar to Chandler, also notes use of bold flaking.

Cores- seen as a waste product dedicated to producing flake tools, potentially utilised as a secondary purpose. Tortoise core element-knapping only on one side to use as a chopper.

Flake tools- Identifies many tool types including nosed scrapers, trilobed hollow scrapers, discoidal scrapers, triangular points, beaked points and butt end scrapers.

Handaxes not completely absent.</td></tr>
<tr><td>Paterson (1937:135)</td><td>Seen as part of an evolutionary scheme, and more of a technical term than a culture.

Flakes- struck on an anvil, big bulbs, conical, multiple strikes with shattered butts.

Cores- including choppers and core tools.
Flake tools- Points, side scrapers, notches, nosed scrapers.</td></tr>
<tr><td>Warren (1951:113-128)</td><td>Flakes- broad platform, strong bulb, low flaking angle.

Cores- Some minimally exploited.
Anvil stones.

Core tools- Pointed nodule tools, choppers, axe edged tool, discoidal forms. (Some of these could grade into crude handaxes).

Flake tools- Side scrapers, bill-hook forms, endscraper, bulb-scraper, sub-cresent forms, proto-Mousterian points and Notches.</td></tr>
<tr><td>Wymer (1968:35-38)</td><td>Flakes (same as Warren, 1951).

Cores- pebble chopper cores, bi-conical chopper cores, proto-handaxe cores.

Non-standardised flake tools.</td></tr>
</table>

Table 2.5 Clactonian typologies (after White, 2000; Pettitt and White, 2012).

During the 1920's-1950's, the examination of flaking angles stemming from Warren's (1922;1923b) observations from Clacton became widespread. It was argued that flaking angles in the Clactonian demonstrated a cruder, less controlled form of knapping, often associated with anvil working, than that of the Acheulean (McNabb, 2007). For culture historians such as Breuil (1932), Chandler (1935), Paterson (1937) and Warren (1951), this became a major source of data and a point of comparison factoring in the curve of the bulb of percussion and focusing on internal flaking angles. While this did demonstrate a difference between the Clactonian and the Acheulean, it was due to the belief that hard hammer working was only found in the Clactonian and so hard hammer flakes (Clactonian) were being compared to soft hammer flakes (Acheulean). Therefore, this created a clear difference (McNabb, 2007). McNabb's (1992;2007) research revealed that this is a false dichotomy and once hard hammer flakes from both Clactonian and Acheulean contexts are examined, there is no difference. The difference being observed was one of flaking mode, and therefore using flaking angles to classify a site as Clactonian is redundant in modern studies.

Both the typologies and focus on flaking angles were a product of the culture history approach of the 1930's-70's where, within these schemes, type fossils were assigned to periods (McNabb, 2007:160). Early explanations of the Clactonian were focused on culture history, including Breuil's (1932:126) ideas linking the Acheulean with interglacials, and the Clactonian with cold climates representing distinct cultural groups moving with two discrete climatic zones (Wenban-Smith, 1998:91). This definition of the Clactonian was based on its status as an *ad hoc* working of core and flakes without refined handaxes. Conversely, the Clactonian was considered an offshoot of the pebble-flake tool culture of Asia by Oakley (1949), and later by Warren (1951:109). This idea later became common in discussions of the Clactonian (Wymer, 1968:34; Rolland,1992:70). Based on these ideas, Breuil and his adherents saw the Clactonian everywhere as it was easy to recognise and fitted their evolutionary view of the Palaeolithic (McNabb, 2007:273). Early attempts to curtail this trend were made by Louis Leakey (1934;1947) who cautioned against the distinction of Clactonian flakes and cores but maintained the significance of a Clactonian culture.

The arrival of processual archaeology caused major changes to Palaeolithic archaeology, but the Clactonian was still viewed as a crude culture with little skill (Oakley, 1964; Wymer, 1974; White, 2000:14). Wymer (1974:411) examined the sites of Clacton, Hoxne and Swanscombe, and noted that there was a large degree of variation in the assemblages refuting previous typologies, but argued that they were united by a lack of formal tool types including handaxes. Wymer (1974:413) observed that the Clactonian preceded handaxes with only a brief overlap between the two cultures. The short time period between the two led Wymer (1974) to suggest that the Acheulean populations could have caused the demise of the Clactonian populations. One dissenting voice was Ohel (1979) who argued that little separated Clactonian and Acheulean working, but this was widely rejected by others (replies to Ohel, 1979; Wymer 1985).

2.6.3 Contesting the Clactonian

During the 1990's the Clactonian was unravelled with many elements stripped away, and some researchers began to argue against its existence (McNabb and Ashton, 1992:9; Ashton and McNabb, 1992:168; Ashton *et al.* 1994). It was argued that there were no undisputed Clactonian sites, and that there was limited evidence that the Clactonian was a separate industry (McNabb, 2007:302). While McNabb (2007:372-375) acknowledged that hominins at the time had culture, he saw no evidence that the Clactonian should be considered cultural as it lacked distinctive and socially important elements. This fitted the trend of archaeological cultures and historical traditions becoming less fashionable among Palaeolithic archaeologists (Bosinski, 1995:265).

McNabb (1992) began by refuting that the Clactonian was primitive or lacking in skill (Ashton, 2016:50). Although doubts about classifying individual flakes as Clactonian had a longer history (Leakey, 1934;1947; Wymer, 1968:35), previous work was based on the principle of there being fundamental differences between Clactonian and Acheulean core and flake working (Kelley, 1937:15). McNabb's (1996a:429) examination of the Clactonian found no evidence to separate the core and flake working of Clactonian and Acheulean sites. This included the rejection of chopper cores as a significant functional type, as the original meaning of the term by Lartet and Christy (1964;1865-75) had been broadened by Warren (1926; 1951) to such a degree that it became meaningless (Ashton *et al.,* 1992). Experiments by Ashton *et al.* (1992b) demonstrated that many of the items described as 'choppers' were cores, and that their prior importance was based on Warren's (1951) narrow definition of cores. Based on this evidence McNabb (1996a:429) argued that core and flake working did not change until the advent of Levallois. This impacted the interpretation of sites that claimed to show the Clactonian mixed with Acheulean contexts (Newcomer, 1971:88).

The Clactonian was therefore left as only being defined in negative terms, the only remaining indicator being the lack of handaxes (Ashton, 2016:50). Furthermore, the Clactonian was argued to be an artificial industry arising from classification, and that handaxes were in fact present (McNabb, 1996a:428). Examinations of handaxes in Clactonian contexts (Figure 2.9) often reported crude non-classic handaxes appearing infrequently within the assemblages, with McNabb and Ashton (1992:9) recording five at Clacton and one at Swanscombe. Chandler (1932:377) had previously dismissed the supposed rough handaxes as being cores, but McNabb and Ashton (1992:4) claimed that handaxes were on a spectrum and traditionally Palaeolithic archaeologists had only focused on the more refined. McNabb and Ashton (1992:4) termed those found in Clactonian contexts 'non-classic' handaxes and linked them to raw material and functional explanations.

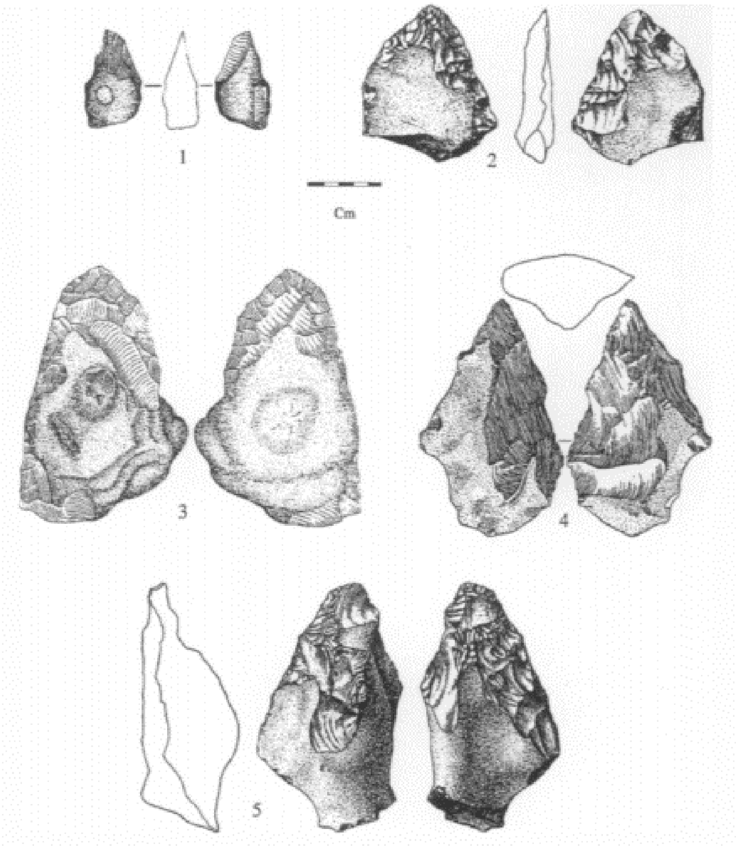


Figure 2.9 Examples of 'non-classic bi-faces' 1+3) Bed 2a Little Thurrock 2) ?Lower gravel Rickson's Pit, Swanscombe 4+5) Lower Gravel Barnfield Pit Swanscombe (White, 2000:17).

Finally, the corpus of new MIS 13 Acheulean sites, predating the traditionally seen 'earliest occupation' of the Clactonian sites, proved that the Clactonian was not the 'primitive' workings of the earliest hominins in Britain (Ashton *et al.,* 1994:585). These included an assemblage at Waverly Wood (Shotton *et al.,* 1993:320; Keen *et al.,* 2006:460), the handaxes and refined scrapers of High Lodge (Ashton, 1992:124) and well-made ovate handaxes at Boxgrove (Wenban Smith, 1999:394; Austin *et al.*,1999:319; Pope, 2002:99; Pope *et al.,* 2020). This again drew into question the distinctiveness of the Clactonian. Evidence of contemporary Clactonian and Acheulean sites at Barnham was also used to dismiss the status of the Clactonian preceding the Acheulean (Ashton *et al.,* 1994:585).

2.6.4 Defending the Clactonian

It was clear that the old definition of the Clactonian could not be maintained, but denying its existence was going too far for some who argued that the Clactonian was culturally significant (Wenban-Smith, 1998; White, 2000). White (2000:15) argued that the limited range of options open to knappers meant that technological convergence was inevitable. Due to the reductive nature of flint knapping, there are a limited number of possibilities which underlie the work, described by Rolland (1981:20; 1992:83), as 'the rule of limited possibilities' governing lithic technology.

The work of McNabb (1992) had therefore refuted mixed Clactonian sites such as Denton's Pit, Reading (White, 2000:22) but had not explained the absence of handaxes at unmixed sites. It is impossible to separate genuinely mixed assemblages from Acheulean ones and this has led to a small number of non-handaxe sites. For example, Grovelands Pit potentially contains a non-handaxe component but its relationship to the Acheulean component is uncertain (White, 2000:32). Further examples are given by Ohel (1979:709) who argued that Southacre, Norfolk and sites around Reading were also mixed sites. It is likely that non-handaxe assemblages are underrepresented in the archaeological record as it only takes a handaxe or a thinning flake to classify a site as Acheulean, yet requires a large core and flake assemblage for it to be Clactonian (White, 2000:23). While there are only a handful of Clactonian sites, it could be an accident that more have not been identified and new controlled excavations are needed to uncover them (Ohel, 1979:709). It is possible that early excavations have obscured Clactonian sites or mixed them with Acheulean material (Ohel, 1979:709). When the secondary context of many Lower Palaeolithic sites is considered it is surprising that we have the number of Clactonian locations that we do.

The idea of 'non-classic' handaxes in the Clactonian was not new and was already accepted by Warren (1951:109) who noted attempts at handaxes along with crude pointed implements, choppers and minimally worked cores in Clactonian contexts. The distinction drawn is that in non-handaxe assemblages handaxes are never the goal as in Acheulean industries (Wenban-Smith, 1998:91). In the case of large assemblages one non-classic handaxe is not enough to overturn the current orthodoxy (Wenban-Smith, 1998:94). Pettitt and White (2012:178-179) demonstrated the problems with many of the claimed handaxes in Clactonian contexts and argued that where no problems had been found (such as Barnham's cobble band) the material had been reclassified. Many of the other claimed handaxes have dubious provenance with only seven actual contenders, none being *in situ,* and only examples from Little Thurrock and Barnham coming from excavated contexts (White, 2000:20). These 'non-classic' bifaces have always been a grey area of classification but changing the boundaries does not explain away the differences between assemblages (Pettitt and White, 2012:181). McNabb (2007) has since conceded that the importance of these 'non-classic' bifaces had been overstated.

While traditional Clactonian sites are no longer considered the earliest occupation of Britain, numerous factors point to a more complex pattern. The recently excavated assemblages at the earliest British sites of Pakefield and Happisburgh III do not contain handaxes, but these were much earlier than the Clactonian and were the product of different hominins (Parfitt *et al.,* 2005; 2010). The revised Pleistocene chronology reaffirmed the chronological importance of the Clactonian and identified the non-handaxe signature in MIS 9, including Purfleet, Globe Pit and Cuxton (White, 2000). The two non-handaxe signatures both precede Acheulean sites in their respective interglacials and are therefore still chronologically significant (White, 2000:34; McNabb, 2020). This pattern allows the examination of distinct non-handaxe signatures and rather than disproving the Clactonian it is perhaps the key to understanding these assemblages.

2.6.5 A new definition

An updated definition of the Clactonian has been advocated by White (2000:34-35; Pettitt and White, 2012:183-184), following the debate over its existence:

- A Lower Palaeolithic industry of unprepared core and flake working, containing flake tools. May contain very rare crude bifacially worked artefacts, often confused with handaxes. The core and flake working cannot be separated from that of the Acheulean, although it lacks soft hammer working.
- Only the presence or absence of handaxes defines the Clactonian. While other differences are debated, these are poorly defined.
- The Clactonian does not mark the earliest occupation of Britain. The Clactonian is present during the recolonisation of Britain at the end of MIS 12 into early MIS 11, and this pattern is repeated during MIS 10-9.

Furthermore, McNabb (2020) has defined the Clactonian as maximising the frequency of sharp edges and as demonstrating an expedient response to the needs of hominins.

2.6.6 Towards an explanation

If we acknowledge that there is something to be explained in the Clactonian despite the scepticism towards it, then we must identify what the Clactonian signifies. There have been many attempts at explaining the Clactonian and what it represents for the Lower Palaeolithic since the original culture history interpretations, and these can be split into two broad alternative lines of interpretation. The first represents a separate tool-making tradition where handaxes have not developed or have been phased out, possibly due to pressures or changes (Rolland, 1998:199). The alternative is that the Clactonian is a facies of the Acheulean showing the extreme elasticity of the culture (Oakley, 1964:257; Rolland, 1998:199).

A preparatory stage

Ohel (1979:700-705) rejected the idea of the Clactonian being a separate culture due to the similarity between Clactonian and Acheulean core and flake working. The Clactonian was seen as a preparation phase, with Clactonian flake and cores representing early-stage Acheulean work (Ohel, 1979:711). The lack of tool types was also linked to the concept of a preparatory area, and this would also explain the occurrence of non-classic handaxes in Clactonian contexts (Ohel, 1979:712; Ohel and Lechevalier, 1979:101).

There have been many criticisms of this approach, for example Wymer (1979:719) queried why no classic handaxes were made on the spot and argued that the Clactonian represented an industry containing finished tool types. Ashton (1998c:255) also refuted the idea of the Clactonian being a preparatory area for the Acheulean as there is no evidence that Clactonian artefacts represent early stage working when compared to Acheulean sites. Evidence from both Clactonian and Acheulean assemblages show complete reduction sequences, with a lack of handaxe-related material at Clactonian sites (Wenban-Smith, 1998:93). Roe (1979:718) gave multiple explanation why the Clactonian is not a preparatory phase. Firstly, there is no evidence that Clactonian and Acheulean sites are contemporary which questions how the sites could be connected in this way (Roe, 1979:718). Furthermore, the evidence from Clactonian sites shows a wide array of activities being undertaken with no specialisation (Roe, 1979:718). Lastly, the similarity of the core and flake working could be a baseline technology and have nothing to do with a shared culture (Roe, 1979:718).

Functional variation

It has been suggested that the Clactonian represents a functional variation of traditional Acheulean assemblages (Boskinski, 1995:265). Rolland (1992:88) argued that the Clactonian was an atypical variant of the Acheulean but conceded that a chronological overlap was unlikely. Common suggestions include differences in hunting, scavenging, butchery and other uses of tools such as woodworking, which is often seen as being predominant in the Clactonian (Pettitt and White, 2012:184). Clactonian sites were seen by McNabb (1992) as places where handaxes were not required to solve certain problems that occurred elsewhere. Sharon and Barsky (2016:30) suggested the difference was functional based on the evidence of the alternative use of the assemblage types at various sites such as Swanscombe and Barnham. This did not take into consideration that the change in technology was always one-way.

Functional explanations for the Clactonian lack support from the archaeological record (White and Schreve, 2000:15). Handaxes have long been seen as an efficient tool for skinning animals, but it is clear that butchery and animal processing occurred in both the Clactonian and Acheulean (Wymer, 1964:30). In an examination of the fauna from the lower gravels and lower loams at Barnfield Pit, Swanscombe (Waechter collection) and the fauna from Wymer's excavations at Hoxne, Binford (1985:316-317) argued that while Swanscombe could show scavenging and Hoxne hunting, both displayed evidence of butchery from cut marks on animal bones. Experimental work with butchery and handaxes by Mitchell (1996;1997) has shown the utility of handaxes for animal butchery which far exceeds that of core and flake assemblages. There is no explanation why populations who knew how to make handaxes would forego a more efficient tool.

The work of Keeley (1980) examining the Clactonian sites of Clacton and Swanscombe, and comparing them to the Acheulean site at Hoxne, has demonstrated that there is no noticeable difference between Clactonian and Acheulean use-wear. Keeley (1980:119) found no specialisation at the sites and that a wide range of activities took place, including meat processing and wood working. However, tool types at Hoxne were more formalised with 'elegant' scraper retouch, and the proportion of meat processing tools to wood working was higher (Keeley, 1980:156-8). Keeley (1980:159) concluded that the cultures overlapped in function and that although the Clactonian was based on negative data, it was still a cultural difference. Despite the evidence, Keeley (1993:135) did not completely dismiss the idea of the Clactonian being a variant of the early Acheulean.

Raw Material

Claсtonian industries could also be a consequence of raw material availability, and it is often suggested that the Clactonian assemblages were made on diminutive sources such as small, rounded pebbles (Oakley and Leaky, 1937:233; Singer *et al.* 1973:36-7). This would fit with current knowledge about hominins relationship to raw material as long-distance procurement of raw material was rare in the Lower Palaeolithic, with raw material often found in a small (0-3km) radius (Féblot-Augustins, 1999:204). The key weakness in the argument is that there seems to be no demonstrable difference in the quality or quantity of raw material at Clactonian and Acheulean sites (Bridgland and Harding, 1993:276). The raw material at Little Thurrock was varied and came from many sources, showing a deliberate use of raw material (Bridgland and Harding, 1993:276). Wymer (1964:42) also demonstrated that the raw material at Swanscombe was of a good quality and so raw material could not be used to explain the Clactonian assemblage. A survey concluded that raw material could not explain most non-handaxe sites, and in addition Acheulean sites with a paucity of raw material, such as Foxhall Road, still produced handaxes (White, 2000:41). It is important not to treat raw material in a deterministic way as while most material was local, hominins would have been capable of transporting material over longer distances White, 2000:42).

A contrasting theory saw the Clactonian linked to short term *ad hoc* use of abundant raw material (Ohel, 1979:710-1). This technology was opportunistic and expendable with little specialisation, and while the technology was distinct, it was episodic from hominins who did not need handaxes (Ohel, 1979:710-1). This fails to explain the complete lack of handaxes or their manufacture (Ohel, 1979:686). Furthermore, there is evidence of a long-lived Clactonian culture at Swanscombe, not a short *ad hoc* camp (Pope *et al.,* 2016:91).

Environment and Social life

Collins (1969:287) noted distinct differences between Clactonian and Acheulean assemblages and linked the Clactonian to forests and woodland with primarily non-hunting people, and the Acheulean with more open landscapes where populations were focused on hunting. Work by Turner and Kerney (1971:89) cast doubt on this by showing that the plant macro fossil and pollen evidence from Clacton is from a varied environment with marshland, dry grassland and uplands having a fairly dense, mixed oak forest. This indicates a mixture of environments also observed at other sites, disproving any connection between Clactonian assemblages and specific environments (Pettitt and White, 2012:185).

Mithen (1994:3) more effectively connected the technology of the Lower Palaeolithic to both environmental factors and the social life of hominins. Mithen (1994:3) identified four characteristics relating to the social life of the Lower Palaeolithic hominins:

1. Limited linguistic and symbolic capacities.
2. Dependency on a generalised stone tool technology.
3. Variable social organisation.
4. An enhanced capacity for imitation.

These inform Mithen's (1994:3) argument that social learning is linked to social behaviour and tool use, and that social learning is based on group size. Small group sizes are linked to interglacial periods (temperate woodlands), with larger groups needed to survive glacial periods (non-temperate open environments), and Mithen (1994:10; 1996:158) saw this as a basis for the change in lithic technology. It is acknowledged that other than handaxes, Clactonian and Acheulean sites are the same, and therefore the Clactonian is likely to be a restricted version of the Acheulean (Mithen, 1994:10-11). The Clactonian is defined as lacking distinctive tool types, indicative of the absence of mental templates and short varied knapping sequences requiring less skill (Mithen, 1994:13-14). In contrast, the Acheulean is seen as being based on strong social learning with clear cultural differences, and a higher degree of skill (Mithen, 1994:14-16). Mithen (1994:16) associated the Clactonian with individual learning, while linking the Acheulean to group learning, but placed them on a spectrum rather than a strict division. These different types of learning are linked to group size, which is affected by environmental conditions. Therefore, the changes in environment were linked to changes in technology (Ashton, 1998c:255). Mithen (1994:17) accepted that the resolution of the palaeoclimatic data is not ideal, but that due to the functional similarity of stone tools a social distinction is likely to be the cause. Many have since questioned the assumptions this is based on (McNabb and Ashton, 1996; Wenban-Smith, 1996; Ashton, 1998c:255). Both Clactonian and Acheulean sites are found in similar environments, and the chronology of the British Lower Palaeolithic suggests Acheulean sites are found further into the interglacial than those of the Clactonian (White and Schreve, 2000).

Resource and Landscape

After the failure of previous models to adequately explain the Clactonian, the combination of artefact facies and raw material by Ashton (1998c) provided a more nuanced approach to the Clactonian (White, 2000:43). Ashton (1998c:255) pointed to the work of Collins (1969) and Mithen (1994) as examples of explanations trying to maintain the distinct nature of the

Clactonian by assigning it to specific landscapes or climatic zones but argued that these are not supported by the evidence.

To overcome these issues, Ashton (1998c) developed the 'static resource model' to explain the variation in non-handaxe assemblages. This examined the variation in artefact densities with dense sites being located next to a static resource (Ashton, 1998c:256). In contrast, mobile resources would leave various small-find spots throughout the landscape (Ashton, 1998c:256). A source of flint would be classed as a static resource, while kill sites would be mobile, linking the theory into raw material quality (Ashton, 1998c:256). The uncertain quality of material at Barnham is likely to have encouraged a focus on core and flake working, whereas the more stable raw material at Elveden led to handaxes being more common (Ashton, 1998c:256-257; Ashton *et al.,* 2005). This difference in landscape use was used to examine variation in the archaeological record, although its utility is dependent on the resolution of archaeological and environmental evidence (Ashton, 1998c:258). Ashton's (1998c:258) model was tested against Barnham and Elveden, explaining the difference in technology at these sites, but Pettitt and White (2012:188) contended that the model functions as an extrapolated interpretation of Barnham and Elveden, lacking the potential to predict patterns of further evidence as it does not fit a number of sites including Little Thurrock and Foxhall Road.

Pope and Roberts (2005:95) discussed the difference between fixed and mobile resources, and how this variation in occupational intensity could affect the number of handaxes at a site, but this does not explain the lack of handaxes altogether. If Clactonian and Acheulean assemblages were tied to raw materials in this way, it would be expected that Clactonian assemblages could occur whenever raw material resources vary, but this is not the case and the Clactonian occurs in temporally restricted periods (White and Schreve, 2000). Additionally, both assemblage types are found next to varying sources of raw material (Pettitt and White, 2012:188). There is currently no evidence to suggest a difference in the distances either industries were curated, or why Acheulean populations would abandon handaxe manufacture (White, 2000:44).

Early settlers

The occupation of Britain over the last 500,000 years was discontinuous with climate, environment and sea level being key factors and drivers to population change (Aldhouse-Green, 1998:142). The work of Bridgland (1994) has helped clarify the temporal relationship between the Clactonian and Acheulean (Wenban-Smith, 1998:90). It has been suggested that human occupation during MIS 11 began with Clactonian populations until the appearance of later Acheulean populations, despite there being earlier handaxe sites in MIS 13 (White *et al.,* 2018). White and Schreve (2000:1-2) presented a model to explain this pattern based on the changing island-peninsula dynamic of Britain detected in the Quaternary record. This allows the study of Britain as part of a much wider European landscape which could help explain variation in lithic technology. While work had previously been hindered by the compression of the Pleistocene record, the recognition of further interglacials allowed more nuanced chronologies (White, 2000). White and Schreve's (2000:2) model suggested that Clactonian and Acheulean populations are distinct pulses of occupation, and the lack of non-handaxe assemblages in MIS 8-7 is due to the appearance of Levallois. This pattern is based on a model of the changing nature of Britain's relation to the European mainland during the Lower Palaeolithic and contains three stages (White and Schreve, 2000:11-13):

1. Cold stage peninsula- Residency and abandonment- Britain contains a mosaic environment for hominins, but as conditions worsen hominins are pushed further and further towards the south and east until total abandonment and/or extinction.
2. Late glacial/ Early interglacial peninsula – Human colonisation residency- With the warming climate Britain becomes habitable again and is recolonised.
3. Interglacial island- Residency and isolation- Britain is cut off and isolated from the rest of Europe, before leading back into phase one.

While it is likely that this simplifies the ebb and flow of populations, it establishes a framework and demonstrates the turnover of Britain's populations (White and Schreve, 2000:14). This has many implications for our understanding of Lower Palaeolithic archaeology, showing that there was no continuous population or persistent culture (White and Schreve, 2000:14). The colonisation events could explain the variation in lithic technology, either due to different source populations or the process affecting social organisation (White and Schreve, 2000:15). It has previously been suggested that non-handaxe populations were early pioneers (Wymer, 1974:421), and this is supported by the timing of the non-handaxe signatures during MIS 11 and MIS 9. During MIS 11, Clactonian sites are always found in lower levels than Acheulean assemblages and a similar correlation (although less clear) is seen in MIS 9 (White and Schreve, 2000:17).

Despite the non-handaxe assemblages of Britain being associated with the early part of phase two in White and Schreve's (2000:18) model, with Acheulean assemblages appearing later, there is no straight forward explanation for this pattern. A number of options have been suggested, but all agree that the significance lies in early colonisation and describe the Clactonian as a separate tradition (White and Schreve, 2000:18). There is a division between the traditionally Acheulean south and south-west of Europe compared to the presence of significant non-handaxe populations in northern, central and eastern Europe (McBurney, 1950:171; Svoboda, 1989:65-66). It is therefore possible that a difference between incoming populations could explain the variation. The reason for a delayed Acheulean occupation could be due to one or more of the following factors: physical barriers, ecological barriers, distance and social factors (White and Schreve, 2000:19).

There is also the possibility that the Clactonian represents a technologically impoverished Acheulean during colonisation (Narr, 1979:717; Mithen, 1994), and would remove the need to link non-handaxe assemblages to those in Europe (White and Schreve, 2000:19). This would concur with the work of Schick and Toth (1993:278) who argue that a disruption to the social maintenance of Acheulean culture caused by migration into new areas could cause the loss of cultural knowledge. This has been observed by Henrich (2004:208) in Tasmania where 10,000 years of cultural isolation caused a loss of technology. The development of Acheulean technology is seen by Wenban-Smith (1998:95) as developing over numerous generations from an *ad hoc* core and flake industry to a diverse Acheulean technology, possibly tied to the availability of raw material. Due to the social investment and technological complexity of maintaining the Acheulean culture, Wenban-Smith (1998:96) argued that this could have disappeared only to re-emerge later. However, there is no reason why there is one cause for both non-handaxe signatures and it could be a combination of factors (White and Schreve, 2000:20).

Recent developments

Due to the improved understanding of the Middle Pleistocene and further fieldwork at Barnham, the interpretation of the site has been updated with wide-ranging implications for non-handaxe assemblages, which includes a common Ho II timing for the change of non-handaxe and handaxe cultures during MIS 11 (Ashton *et al.,* 2016:837-40). This has led to some who previously contested the Clactonian to conclude that non-handaxe assemblages are a valid phenomenon (Ashton *et al.,* 2016; McNabb, 2020). Whilst current fieldwork has validated the Clactonian, it still lacks an explanation. Despite discussions of the two archaeological signatures representing different hominins (Stringer*,* 2011a; 2012; Manzi *et al.,*2016) the evidence for this is not strong, and the relationship between Middle Pleistocene hominins is complex (Ashton *et al,* 2016:840). For Ashton *et al.* (2016:841), it is more likely that the differences in archaeological cultures can be explained through changing landscapes and resources that created differing traditions which might include changes in fire use, hunting and hide working. Despite speculation, the only real difference is the presence and absence of handaxes, and this is often connected to movement of hominins due to changes in climate (Ashton *et al.,* 2016:842). McNabb (2020:49) recently argued that nothing cultural underlines the Clactonian and it is a pragmatic technology that could have been the result of “endless convergent evolution”. According to McNabb (2020), answers lie in either the understanding of how knowledge was passed on or the identification of genuine knapping patterns on the continent.

2.6.7 The current state of the Clactonian

The introduction of a robust chronology has improved our understanding of the Clactonian debate through the White and Schreve (2000) model. While Ashton (2016:50) argued that individually Barnham could be a functional variant and Clacton could be due to small raw material, Swanscombe is much harder to explain due to its time depth, thousands of artefacts and an abundance of raw material. Work on MIS 11 has placed the Clactonian assemblages in pollen zone Ho IIb- Ho IIc across Swanscombe, Barnham and Clacton (Ashton, 2016:50). All Acheulean sites during MIS 11 are either later or slightly overlap with Clactonian sites (Ashton, 2016:50). Ashton (2016:51) suggested then that non-handaxe populations could be the result of initial reoccupations, potentially from areas in Europe where handaxes were not made, that were later replaced by Acheulean groups. There is no satisfactory explanation to refute the Clactonian, and there is a pattern in its occurrence that requires further study.

While the White and Schreve (2000:50) model is a chronology and not an explanation, it has expanded the Clactonian to a European scale where it can be seen as reflecting differences in societies (White, 2000:52-54). Work by Bosinkski (1995:265) acknowledged the presence of non-handaxe assemblages throughout Europe, and it is important to understand this phenomenon on a wider scale. The recent trend in focusing on a redefined concept of culture (Davis and Ashton, 2019; Shipton and White, 2020) fits well with the current evidence of the Clactonian.

The MIS 9 non-handaxe signature has been overlooked compared to the traditional MIS 11 Clactonian due to the lack of major sites and excavations, but this is vital to our understanding of the Clactonian. While previous sceptics such as Ashton *et al.* (2016) and McNabb (2020) have accepted the MIS 11 Clactonian, the MIS 9 non-handaxe sites are still contentious, especially when labelled Clactonian. Ashton (2016:51) pointed out that the term Clactonian hinders progress in the examination of non-handaxe assemblages due to historical baggage. This is especially true of MIS 9 non-handaxe assemblages as they lie outside the long held traditional MIS 11 Clactonian (Ashton, 2017:314). Therefore, the term non-handaxe assemblage will be used rather than Clactonian to describe the assemblages examined in this thesis dated to MIS 9, which can then be compared to the Clactonian of MIS 11.

2.7 Lower Palaeolithic flake tools

Flake tools have often been treated as an epiphenomenon in the Lower Palaeolithic, especially in Acheulean contexts (Smith, 1894; Evans, 1897; Breuil, 1932; Kelley, 1937; Wymer, 1968;1985; Roe, 1981; McNabb, 2007; Pettitt and White, 2012). This is perhaps due to their perceived scarcity, as the 100 flake tools required by Bordes (1961) for meaningful analysis is practically unknown in the British Lower Palaeolithic (McNabb, 2007). As a result, accounts of the Lower Palaeolithic often lack detailed analyses of flake tools in favour of focusing on the Clactonian, handaxes or Levallois technology. When flake tools are discussed, it is normally only in relation to one of these categories (Mithen, 1996:132-136). Compared to the other areas examined in this thesis, remarkably little has been written to explore the nature of Lower Palaeolithic flake tools. Despite this, the discussion and analysis of flake tools is a vital part of the study of MIS 9, due to the suggestion by Pettitt and White (2012) and White and Bridgland (2018) that many of the British Lower Palaeolithic sites that contain significant numbers of flake tools can be correlated to MIS 9. White and Bridgland (2018) suggested that this could be linked to an increase in handaxe resharpening or pre-empt the emergence of Levallois technology.

2.7.1 History

The perception of flake tools being insignificant in Acheulean contexts possibly originates from the definition of the Acheulean by de Mortillet (1867; 1869; 1872) as an exclusively handaxe-based industry, with the use of flakes tools distinguishing the succeeding Mousterian epoch. This was contested by Earnest d'Acy (1878;1894a;1894b) who observed that Mousterian technology, including flake tools, could be found within Acheulean assemblages, even at the type site. This persuaded de Mortillet (1883; de Mortillet and de Mortillet 1881) that Saint-Acheul was 'impure' and abandoned the Acheulean altogether, replacing it with the Chellean, named after Chelles-sur-Marne. The Acheulean was later re-established as a transitional industry with both handaxes and flake tools (d'Ault Du Mesnil, 1889; de Mortillet 1891).

The origins of Palaeolithic archaeology in antiquarianism and collecting from gravel pits fostered a keen interest in handaxes, especially those with higher levels of elaboration and aesthetic appeal (Schick and Toth, 1993:60; O'Connor, 2007). This history of collection bias has reinforced a view of the Palaeolithic dominated by handaxes with flake tools being inconsequential (Wymer, 1968:61; Roe, 1981:126). Early work by Evans (1897:527) and Worthington Smith (1894) focused mainly on 'implements', the majority of which were handaxes. Although, Smith (1894:3) did clearly acknowledge that tools were made for different purposes, terming some flake tools scrapers, and likening more refined examples to handaxes.

When rich flake tool industries including Clacton-on-Sea (Warren, 1923b; 1958; Oakley and Leakey, 1937) and High Lodge (Evans, 1897) were found, they generally lacked handaxes. This led to contemporary workers arguing that they were culturally and technologically aligned with the Mousterian rather than the Acheulean. Later, Breuil (1932: 160) began describing flake tools as indicative of the Clactonian. Subsequently, flake tools have often been studied through the lens of various cultures (e.g. Lev, 1973). In the 1930's, Harper Kelley (1937) attempted to reinforce that flake tools were, in fact, an important element of Acheulean technology and illustrated many examples from both Britain and the continent (Figure 2.10).

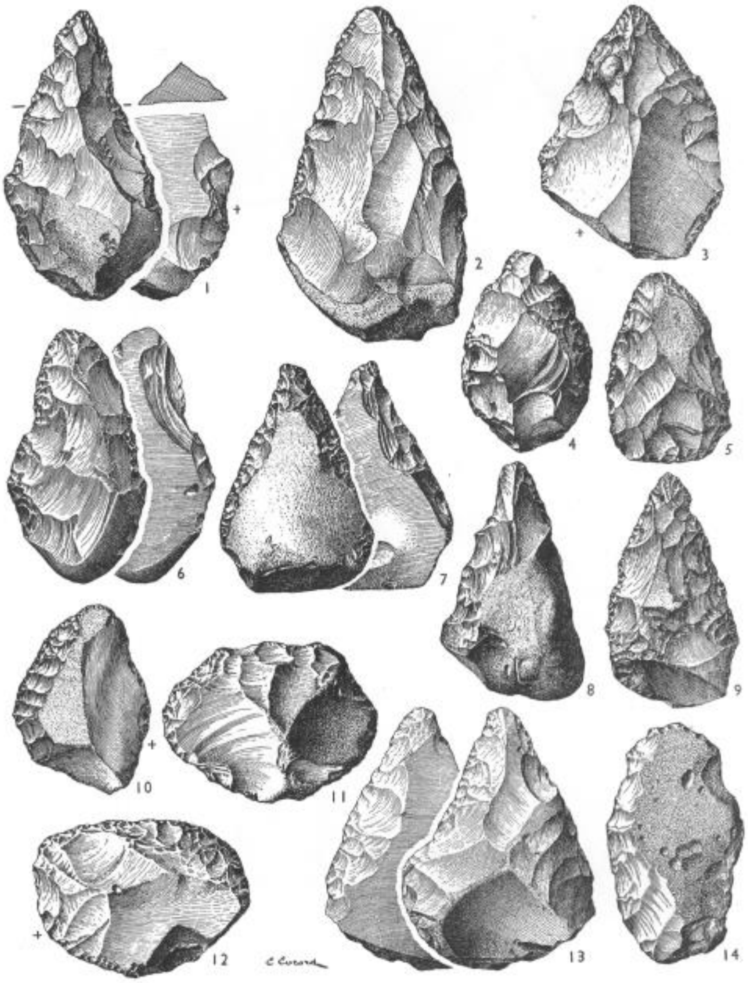


Figure 2.10 Examples of Acheulean flake tools including Romsey, Dunbridge and Swanscombe (Kelley, 1937:26).

In one of the few studies of the variation of flake tools in the British Lower Palaeolithic, Lev (1973:2) discussed three issues with their study; relying on old collections, low numbers and unsure provenance. Lev (1973:7), through a Bordian analysis, offered an overview of his results with little synthesis. Lev (1973:375) eliminated sites with less than 50 tools and divided the remaining sites into three groups based on typology: Charentian in Acheulean contexts, flake tools related to Levallois and flake tools related to the Clactonian. The findings of this work no longer fit with the current consensus or chronology and are therefore mainly redundant.

The continued consensus remains that an increase in flake tools coincides with the beginning of the Middle Palaeolithic and advent of PCT (Roe, 1981; Coulson, 1990; Gamble and Roebroeks, 1999; White and Jacobi, 2002; Roe, 2005; Monnier, 2006; Santonja and Villa, 2006; Scott, 2011; Malinsky-Buller, 2016a). Many have argued that a lack of flake tools prior to this is just a fact of the British Acheulean record (McNabb, 2007; Pettitt and White, 2012), yet flake tools are found throughout the entire British Palaeolithic including the earliest sites of Happisburgh III and Pakefield (Parfitt *et al.,* 2005;2010). Therefore, these should be examined as an element of Lower Palaeolithic technology.

2.7.2 Study of flake tools

Flake tools are defined in this thesis as flake blanks that have been further modified through retouch to create a tool and do not include unmodified but utilised flakes (Inizan *et al.,* 1999:81). Whilst basic flake removals can be utilised as tools for cutting, retouch can be used to create a wide array of flake tools including scrapers, borers, backed knives, notches and denticulates (Wymer, 1968:11, Ashton, 2017:54). Unlike the Clactonian, Acheulean and Levallois, flake tools are not a specific mode of technology, industry or culture and are present in all of these industries (Wymer, 1968:18; Schick and Toth, 1993:99; Pettitt and White, 2012:145). Flake tools in the Lower Palaeolithic are usually thought to be simple, and without planned form (Ashton *et al.*, 2016).

Due to the marginalisation of flake tools, there is no unified methodology for analysing them, and analysis often focusses on typological approaches based on Bordes (1961). This is still not widely accepted or implemented within Britain as it is often considered overly complicated with numerous categories that have limited relevance to the British Lower Palaeolithic (McNabb, 2007:336). Debenath and Dibble (1994:70) argued that many categories were subjective points on a spectrum and that a strict use of Bordes (1961) can be restrictive. Unlike Levallois which has moved beyond Bordes' (1961) typology to a more technological approach, the study of flake tools is often still constrained by typological approaches deeply rooted in 19th century antiquarianism (Bisson, 2000:41). Bisson (2000:41) acknowledged the debt owed to Bordes (1961), but also explained the need to go beyond mere typological categorisation.

Traditionally British Palaeolithic flake tools have been described, then divided into categories and presented as a proportion of other artefacts (Ashton, 1998b:219). Ashton (1992:139) classified flake tools according to Bordes (1961) but argued that this prohibited a more nuanced examination of flake tool technology. Ashton (1992:146) therefore proposed to classify them by the process they were made in a more technological way:

1: Single or several flake removals to create notches or flaked flakes.

2. Flakes with several removals forming a denticulated edge.

3. Flakes that have been retouched to make scrapers.

There have been additional attempts to move towards a more technological approach of examining how flake tools were made and used rather than focusing on static end shapes (Tixier, 1974; Inizan *et al.,*1999; Scott, 2011). One of the issues facing the analysis of flake tools is distinguishing natural edge damage from deliberate retouch (Inizan *et al.,* 1999:81). Flakes described as retouched can often be unmodified flakes that have edge damage, whilst genuine flake tools could be obscured from edge damage (Ashton and McNabb, 1992:166). It is therefore important to treat potential flake tools with caution.

2.7.3 Significance of flake tools

As flake tools are often only mentioned anecdotally, it is hard to examine patterns in the Lower Palaeolithic (Roe, 1981:113). This is in contrast with Western Europe where flake tools are described by Dormonichev and Golovanova (2010:335) as being variable, small and standardised, part of both Acheulean and non-handaxe assemblages. Traditionally flake tools have been seen as more common in the Clactonian, especially notches and denticulates, alongside crude core or nodule tools (Wymer, 1968:38). However, flake tools in Clactonian contexts show little distinction to those in Acheulean contexts (McNabb, 2007:11). The handaxe makers of the Acheulean are known to have made flake tools, but the importance of these remains neglected (McNabb, 2007:137).

McNabb (2007:336) argued that flake tools in the Lower Palaeolithic were very conservative with few formal types. This characterised flake tools as coming from an expedient generalised tool kit with a lack of diversity in cores, flakes and flake tools (McNabb, 2007:345). This concurs with Roe (1981:13), who argued that flake tools show *ad hoc* working to serve a specific end. As unmodified flakes were used for an array of tasks, flake tools are likely to have been extensions of these with retouch for specific tasks or the rejuvenation of the edge (Wymer, 1968:61). Therefore, it is likely that there were few standardised tool types and that true side scrapers were rare (Wymer, 1968:61). Nevertheless, it is also possible for handaxes to be made on flakes and the line between flake tool and handaxe made on a flake can be a grey area (Roe, 1981:74). Mishra *et al.'s.* (2010) work in India has shown the production of Acheulean handaxes on large flake blanks, indicating that these *Chaîne opératoires* are not always distinct. Furthermore, it is clear that handaxes and flake tools are not separate as handaxes have been found alongside well-made scrapers (Roe, 1981:74), and Wymer (1999:194) observed higher degrees of standardisation in flake tools during the Acheulean than in Mode I technologies. Unfortunately, the numbers of flakes tools and quality of the sites makes exploring behaviour at an ethnographic level difficult (McNabb, 2007:342) and ideas, including the idea that flake tools were an adaption to cooler conditions (Hosfield, 2011b), remain untested. The flake tools we do have hint at a wider technology and more complex picture, especially at sites such as High Lodge and Hoxne (Hosfield, 2011b). Using data from High Lodge, Hosfield (2013) challenged the idea that flake tools lack standardised forms, or that they show the absence of focused decision making.

Function of flake tools

The purpose of flake tools is often disputed (Keeley, 1980; Newcomer et al. 1986; Bamforth 1988; Pettitt and White, 2012) despite nomenclature that often implies specific functions such as 'scraper' (Roe, 1981:13; Schick and Toth, 1993:151). One attempt to decipher the function of flake tools has been use-wear analysis by Keeley (1980:175), but its utility is still debated (Pettitt and White, 2012:163). The work of Keeley (1980, 1993) and Mitchell (1996;1997) identified tools being used to process wood and animal remains from a handful of sites including Hoxne, Clacton, Swasncombe and Boxgrove. Keeley (1993:131) found that most tasks in the Lower Palaeolithic could be achieved with unmodified flakes, but that tasks such as scraping, bone chopping and boring needed specific flake tools. At the site of Hoxne, little standardisation was found, with the majority of blanks being selected based on size and shape, with a small degree of specialisation amongst side scrapers (Keeley, 1993:133). The types of tasks that Keeley (1980; 1993) identified as having been carried out using flake tools include plant processing, boring, hide cutting, hide scraping and woodwork.

Others such as Newcomer *et al.* (1986:216) and Bamforth (1988:21-22) were pessimistic about the application of use wear and, whilst not dismissing it completely, called for a boarder approach. Flake tools show evidence of being used for butchery, but there is no agreement on their purpose or effectiveness (Key and Lycett, 2017:738). Handaxes are often considered superior as they are a more complex industry than simple core and flake working (Key and Lycett, 2017:737). The experimental work carried out by Mitchell (1996:65) advocated the utility of handaxes over flakes but did not include flake tools in the experiment. The conditions needed for use-wear are often unachievable in the Lower Palaeolithic (Pettitt and White, 2012:163), especially the old collections from secondary context sites which forms the basis of this research. Nonetheless it has been suggested that changes in function, including increases in hide working and advances in clothing, could explain an increase in flake tools during MIS 9 (Pettitt and White, 2012:169).

Reduction

For Dibble (1988:49), variation between scrapers represented one of the most significant variations within the Lower and Middle Palaeolithic. Work by Dibble and Rolland (Dibble, 1986; 1987;1995; Rolland and Dibble, 1990; Dibble and Rolland, 1992) has suggested that differential 'reduction' (specifically resharpening) can explain the Mousterian variation noted by Bordes (1961) which also has implications for the Lower Palaeolithic. This assumes that flake tool categories transition into each other through retouch (Shea, 2013:162). Dibble (1988:49) illustrated this using two examples (Figure 2.11). The first was the re-use of two edges showing evolution from a side scraper to a double scraper and then a convergent scraper (Dibble, 1988:52). Secondarily the reduction of a side scraper to a transverse scraper (Dibble, 1988:52). Work by Hiscock and Clarkson (2008) refuted this idea by demonstrating the multiple pathways and histories of flake tools at Combe Grenal, finding no evidence that all tools transitioned from one form to another (Figure 2.12).

For some, reduction models are too deterministic (Kuhn, 2014:158), and ignore many factors such as tool function, method of production, raw material and culture (Kuhn, 1992:126; Kuhn, 2014:17). The idea has some traction in the Lower Palaeolithic as Keeley (1993:131) suggested that the resharpening of flakes used for scraping could be responsible for retouch in the Lower Palaeolithic, and this could explain minimally and semi-invasively retouched flakes. Brumm and McLaren (2011:201-2) went further, suggesting that the High Lodge scrapers were the result of both resharpening and blank form affecting the invasiveness in a continuous process making convergent scrapers the unintended outcome of "mindless reduction". An increase in resharpening of both handaxes (especially linked to cleavers) and flake tools in MIS 9 has been suggested by White and Bridgland (2018) as a possible reason for an increase in flake tools during the interglacial.

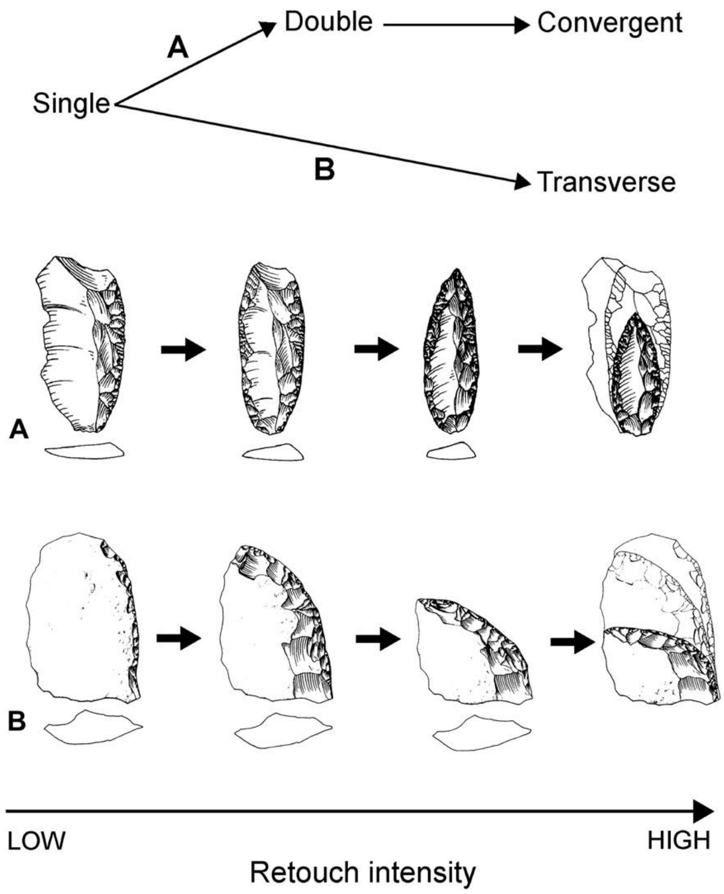


Figure 2.11 Dibble's Reduction hypothesis (Brumm and McLaren, 2011:190).

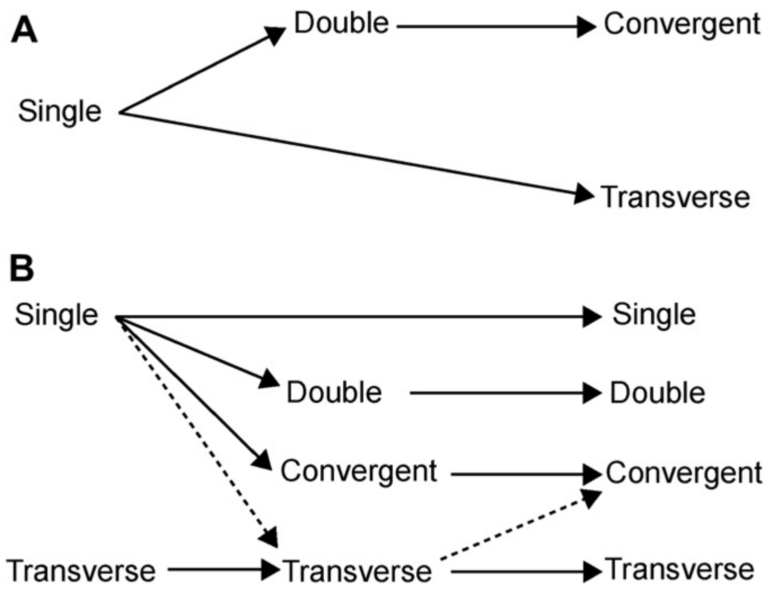


Figure 2.12 Hiscock and Clarkson's alternative model (Brumm and McLaren, 2011:191).

The beginning of the Middle Palaeolithic

It is often thought that flake tools become more refined through time (Coulson, 1990; Monnier, 2006; Santonja and Villa, 2006; Scott, 2011; Malinsky-Buller, 2016a), although High Lodge is a notable outlier (Brumm and McLaren, 2011). The adoption of Levallois is described as a way of making more standardised flake tools during the Middle Palaeolithic, and their importance and recognition is greater in later periods (Roe, 1981; Gamble and Roebroeks, 1999; White and Jacobi, 2002; Monnier, 2006; Scott, 2011; Malinsky-Buller, 2016a). Handaxes are assumed to be replaced by flake tools made from the Levallois technique during the Lower to Middle Palaeolithic transition (Schick and Toth, 1993:289; Scott, 2011). This is often linked to the production of more carefully shaped flake blanks and tools, with the intention of hafting (Villa et al., 2009; Hardy et al., 2013; Rots, 2013; Iovita and Katsuhiro, 2016; Picin, 2018; Moncel *et al*., 2020).

There have been some suggestions that during later periods of the Acheulean, flake tools show higher levels of standardisation and refinement leading up to this point (Wymer, 1968:61; Lamotte and Tuffreau, 2016; Moncel *et al*., 2020). It is possible that this is due to an increase of learning and standardisation during this time (Schick and Toth, 1993:50-51). MIS 9 is where this transition is most likely to happen relating to the earliest signs of PCT (White and Bridgland, 2018).

2.7.4 Summary

The rarity of flake tools in Lower Palaeolithic assemblages has led to both the current lack of research and the lack of a clear methodology for their study. Pettitt and White (2012:146) listed 18 localities with over 50 flake tools, but of these 15 are thought to belong to MIS 9 (Baker's Farm, Biddenham, Cuxton, Furze Platt, Grays Thurrock, Grovelands Pit, Kempston, Keswick, Lent Rise, Lower Clapton, Purfleet (Botany Pit), Station Pit (Kennett), Stoke Newington (Common and Geldeston Road), and Sturry). An analysis of these sites is needed to test if it is a coincidence or a temporal trend during the Lower to Middle Palaeolithic transition. Links to other changes in technology including non-handaxe assemblages, handaxe variation and early PCT are important, as well as indications of function and resharpening.

2.8 Levallois and prepared core technology

While no single feature defines the Middle Palaeolithic, the invention of Levallois is often used as an indication of the boundary between the Lower and Middle Palaeolithic (White and

Ashton, 2003:598; Scott, 2011:2; White and Pettitt, 2011). This is justified by Levallois' status as the only major technological innovation during the Middle Pleistocene and the first major invention since the advent of the handaxe (Bar-Yosef and Dibble, 1995: ix; White and Ashton, 2003: 598), making it a watershed moment in the cognitive development of hominins heralding further changes in social life, behaviour and cognition (Lubin, 1965:23; Tuffreau, 1982:137; Ranov, 1995:70; White *et al.,* 2011:53). Interest in Levallois stems from its importance to chronological, cultural, technological and cognitive issues (Schlanger, 2013:85). Levallois is the most ubiquitous form of Mode 3 technology, which is underpinned by the idea of predetermination (Gamble, 2013: 166). While Levallois is synonymous with Neanderthals, the Middle Palaeolithic (Gamble, 1999:174; Ashton, 2017:166; Locht *et al.,* 2018:215), and the developing mammoth steppe (Gamble and Roebroeks, 1999:6), there is evidence of it having much older roots (Scott, 2011:3).

2.8.1 History of Levallois

Reboux (1867;1869:222) undertook work at Levallois-Perret in the 1860's, where he found wide oval flakes with sharp edges and coined the term Levallois to describe them (Read, 1911:35; Monnier, 2006:715; O'Connor, 2007:100). Reboux's work was highly contested and his terminology and groupings changed many times through indecision (Schlanger, 2013:77). One of the earliest descriptions of Levallois in Britain came from the work of Spurrell (1884:133) at Northfleet, who described many of the key features of Levallois:

> "A flint stone being selected, and trimmed coarsely round the sides, was worked on its upper surface into the form of a flat dome; then from one end the whole of this prepared surface was detached by a single blow".

Spurrell (1884:113) described many products as 'turtle backed' and observed that some had been retouched into flake tools. These finds are comparable to artefacts previously discussed by Evans (1863:75) from the lower deposits in the Somme Valley.

However, the discovery at Levallois-Perret was overshadowed by work in the Dordogne at Le Moustier, where an industry of side scrapers and flakes from prepared cores were discovered in association with Neanderthal remains (Lartet and Christie, 1864a; 1865-75; Klaatsch and Hauser, 1909; Wymer, 1968:73). De Mortillet's (1873:436; 1883:255-256) work placed Levallois as a successor to handaxes in his evolutionary scheme. Commont (1908:535; 1909; 1912) later adopted Levallois as an index fossil for the Mousterian. While Commont (1912) argued for a lineal development, this was gradual with a period of overlap, and in its earliest manifestation

Levallois was itself an intermediate between handaxes and later blade tools (Chazan, 1997:723). Commont (1909: 120-127) observed that the new type of flaking that occurred during the earliest Mousterian could take over the role of the handaxe with more efficient production leading to the decline in handaxes. This led to Sollas (1911) suggesting that the development of Levallois represented a major evolutionary step in Palaeolithic technology.

During the early twentieth century, the evolutionary sequence of the Acheulean being replaced by Levallois was questioned by some including Peake (1930:383), who demonstrated the existence of Levallois and Mousterian artefacts before the abandonment of handaxes. Others such as Peyrony (1930) began to develop explanations involving parallel phyla, the result of different cultural groups during the Mousterian. This was extended to the whole of the Lower and Middle Palaeolithic by Breuil (1926:178-9; 1932) who synthesised the evidence and concluded that there was a considerable overlap between Acheulean and Levallois. Breuil (1926; 1932) argued that this was due to different species, an idea previously speculated on by Commont (1912: 248-250). Breuil's scheme separated core and flake cultures from handaxe cultures and established a connection between the Clactonian and Levallois (Oakley and King, 1945:51-52; Monnier, 2006:716). Based on this, Breuil (1932:573) saw Levallois as an intermediate between the Clactonian and the Mousterian which ran parallel to handaxe cultures (O'Connor, 2007:284). Breuil and Koslowski's (1932) chronology placed the earliest Levallois alongside the Upper Acheulean during the Riss, and this was adopted by British workers such as King and Oakley (1936: 60-61) who noted Late Acheulean and early Levallois at Swanscombe.

More modern approaches became popular after the work of Bordes (1950a; 1950b;1953a;1953b; 1961) in the 1950's who developed a complex typology based on a branching evolutionary model of technology that diversified through time (Ranov, 1995:69; Monnier, 2006). Previous work was criticized for creating a false equivalence between Levallois and the Mousterian, as while Levallois is a part of Mousterian assemblages, it also exists in other assemblage types (Wymer, 1968:73). Wymer (1968:73) considered this a particular problem with British sites, citing the cataloguing undertaken by Reginald Smith (1931) as an example.

During the 1980-90's, more technological and experimental approaches were adopted by Boëda (1988;1995), Dibble (1989) and Van Peer (1992), but a lack of chronological understanding persisted. In the Ronen *et al.* (1982) conference proceedings, work on the Lower-Middle Palaeolithic transition was hindered by the compression of the quaternary framework. The correlation of the Quaternary framework with the MIS curve rectified this, giving higher chronological resolution and establishing a stricter division between the Lower and Middle Palaeolithic (Monnier, 2006).

The improved chronology allowed White and Jacobi (2002) to divide the British Middle Palaeolithic into the EMP and the Late Middle Palaeolithic (LMP), the first being characterised by Levallois and the decline of handaxes, and the LMP being characterised by handaxes and Mousterian tools referred to as Mousterian of the Acheulean tradition (MTA). The work of Scott (2011) demonstrated that MIS 8/7 sites contained Levallois and lacked handaxes. However, the presence of a simpler form of prepared core working at Purfleet (White and Ashton, 2003), amongst other sites (Bolton, 2015), still leaves some uncertainty as to whether a form of PCT was contemporary with the Acheulean.

2.8.2 Defining Levallois

Modern definitions of Levallois are varied but are underlain by the concept of predetermination (White and Jacobi, 2002:125). This has changed little from Commont's (1909:122) definition of the predetermined preferential removal of flakes shaped by previous working, in order to determine their shape and size (Sellet, 1995:27). Conceptually, Levallois is split into two phases (Figure 2.13). First, flakes are removed to shape the core before a phase of targeted exploitation (White *et al.,* 2011:54). Levallois allows a higher degree of standardisation in flakes and flake tools as the intention is to produce a limited number of preferential removals (Gamble and Roebroeks, 1999:5). This can be seen in the final removal being one (or a number) of these larger removals (Figure 2.13), the attention spent on specific platform preparation and in the repetition of the act on certain cores (Van Peer, 1995:4). Conversely, Dibble (1989: 424) has argued that Levallois is not just about the removal of one flake but rather the entire sequence.

Levallois technology uses a volumetric appreciation of raw material to create regular and repeated work which is utilised to control the final shape and size of the flake (Roe, 1981:78; Gamble, 2013:166; Ashton, 2017:166). Levallois can also be defined as a common *Chaîne opératoire* which unites the diversity of Levallois material including oval or rectangular Levallois flakes, long and thin Levallois blades or triangular Levallois points (Bar-Yosef and Dibble, 1995: ix; Plisson and Beyries, 1998:5; Gamble, 1999:214-217). The predetermination of the removals is hard to identify which has led to some contention in how intentional some removals are, as well as how to recognise Levallois working (Clark, 1977:32; Sellet, 1995:26).

This is particularly contentious for earlier occurrences of PCT (White *et al.,* 2011:54). While understanding the exact intentions of hominins is not possible, clear planned sequences can be seen in Levallois (Chazan, 1997; Pettitt and White, 2012). Definitions of Levallois are closely tied to ways to recognise Levallois (outlined below), but all definitions revolve around the preparation of a parent core in order to predetermine the size and shape of desired end products (Scott, 2011; Pettitt and White, 2012:247).

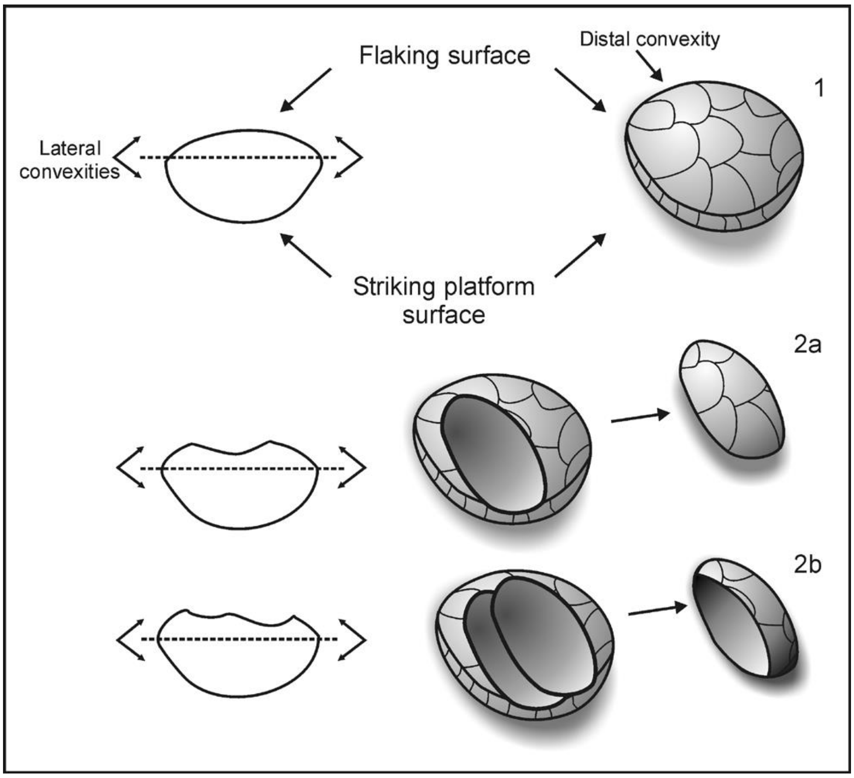


Figure 2.13 The Levallois concept (Scott, 2011:12 after Boëda, 1988).

2.8.3 Recognition and study of Levallois

Original work

Early definitions lacked methods for recognising and studying Levallois with descriptive terms such as tortoise and turtle cores being common (Spurrell, 1884). Commont (1909:122-126) later emphasised the preparation of the striking platforms of cores, and flakes that showed evidence for faceting and large bulbs (Scott, 2011:10). These typological hallmarks remained popular (Oakley, 1949; Breuil and Kelley, 1954) prior to the work of Tixier *et al.* (1980), although it has remained important in some schemes (Sellet, 1995:33). Commont (1909) also suggested the analogous relationship to handaxes explained the decline in handaxes where Levallois was found. Distinguishing between Clactonian, Acheulean and Levallois was problematic for many and Kelley (1937) lists only faceting and predetermination as indicators, whilst Breuil (1932) noted predetermination, a discoidal or rectangular shape and signs of retouching. During this period, Levallois was seen as a part of general Palaeolithic assemblages and its status shifted depending on the archaeological fashions of Commont (1908), Breuil (1932) and Oakley and King (1949), amongst others.

Bordes' typology

Various older concepts were consolidated by the work of Bordes (1950a; 1950b;1953a;1953b; 1961), whose wider work helped define the Middle Palaeolithic (Pettitt, 2009). A central role was given to predetermination in Bordes' (1961) classic typological definition of Levallois (Chazan, 1997:724; Pettitt, 2009:201). Bordes (1961:17) emphasised the identification of Levallois through the observation of tortoise cores, the predetermined nature of the work and, more vaguely, flakes made from the Levallois method. The checklist developed by Bordes (1950b:21) gave analysts a specification to identify Levallois and a focus on broader technological industries rather than type fossils. Whilst admitting it was difficult to recognise certain characteristics especially on flakes, Bordes (1950a;1950b) argued it was possible with expertise, and that the main cause of error was the inexperience of the analyst (Sellet, 1995:26; Chazan, 1997:224). Bordes' (1950b:21) work discarded the need for faceted butts and allowed a greater degree of variability. Bordes' (1980) final work on Levallois underlined the importance of determining the shape of the product through careful preparation.

Whilst Bordian analysis became established as the main way to compare sites, there was increased criticism of the typological approach (Gamble, 1999:213). One of the main criticisms was the fact that Levallois flakes can be produced in a number of ways, making it difficult to identify Levallois end-products (Van Peer, 1992:4; Sellet, 1995:26; Chazan, 1997:724). It is important to avoid the typological trap of assuming a final product is indicative of a certain reduction strategy (Baulmer, 1995:16). 'The Levallois problem' became apparent from disagreements between researchers over the classification of Levallois, with wide variations in counts for the same sites (Copeland, 1983:17; Perpère,1986:117-118; Dibble,1995:94; Baulmer, 1995:19; Vermeersch, 1995) and difficulty with atypical examples (Van Peer, 1992:5). Tuffreau (1995: 423) argued that due to the strong link between handaxe making and Levallois, the identification of Levallois in Acheulean contexts was problematic. The relationship between the technique used and the end product needed clarification in order to solve this problem. To overcome this, Levallois needed to be treated like a dynamic technology that was used for several different ends rather than a static end point (Sellet, 1995:37).

Towards a technological approach

Bradley (1975:235), Marks and Volkman (1987:11) and Van Peer (1995:2) all attempted to overcome these problems through reconstruction and refitting, but this proved difficult as complete sequences are rare, especially in earlier PCT (Chazan, 1997:728; Audouze, 1999). The idea that only richer assemblages could be used for meaningful work on Levallois remained popular (Dibble, 1995; Gilead, 1995). It was the work of Boëda (1988; 1995; 1997; 2001) that overcame these issues by developing a technological approach which allowed for greater flexibility (Chazan, 1997:724; Gamble, 1999:217). The work of Boëda (1995) did not rely on static end-products, but conceived Levallois in terms of volume (Van Peer, 1992:8). Previously, the homogeneity of Levallois had led to its classification but narrowed the way it was studied (Delagnes, 1995:201). Boëda (1995:41) claimed that the work of Bordes (1961) was not able to account for the range of different Levallois material, and that the binary of Levallois or non-Levallois was limiting (Boëda, 1995:42; Schlanger, 1996:238). Boëda (1988:13) advocated the flexibility of Levallois and its ability to produce a range of products.

Boëda's (1995:43) technological analysis focused on the technical 'know how' (savoir-faire) and cultural 'know how' (connaissance) needed to achieve an operational sequence which was developed from refitting and experiments. It was observed that the same ends could be achieved through different methods and therefore that endpoints were not always conclusive, as seen in Levallois flakes associated with handaxes (Boëda, 1995:44). Additionally, Levallois cores produce flakes with many different properties (Boëda, 1995:45). It is therefore unwise to base the identification of Levallois technology at a site on a handful of flakes. It is important to understand that there can be a disconnect between the method of knapping and the end product (Boëda, 1995:45). Without cores it is hard to be sure that Levallois exists at a site, and it is possible to create "an operational schema which never existed" as the Levallois method lies within the technical acts that created it and not with the finished end product (Boëda, 1995:44-45).

The reconstruction of *Chaîne opératoires* is difficult in the Lower and Middle Palaeolithic due to the prevalence of time-averaged assemblages, the less advanced operational schema, and that it is often only possible to study sections of the *Chaîne opératoire* (Boëda *et al.*, 1990:77). The *Chaîne opératoires* of the Lower-Middle Palaeolithic are split into *façonnage* (reducing material progressively until its final form) and *débitage* (dividing of material through specific methods for future use), and Levallois and other PCTs combine these two into a new *Chaîne opératoire* (Boëda *et al.*, 1990:44; White and Pettitt, 1995). It is argued that *débitage* existed before *façonnage* and that Levallois has its roots in the Acheulean by combining these two, previously discrete, methods (Boëda *et al.*, 1990:45; White and Pettitt, 1995). The Levallois *Chaîne opératoire* is based around the volumetric concept of the core and the manner of its exploitation (Boëda *et al.*, 1990:53). Boëda (1995) outlined six criteria underpinning Levallois, as shown in Figure 2.14.

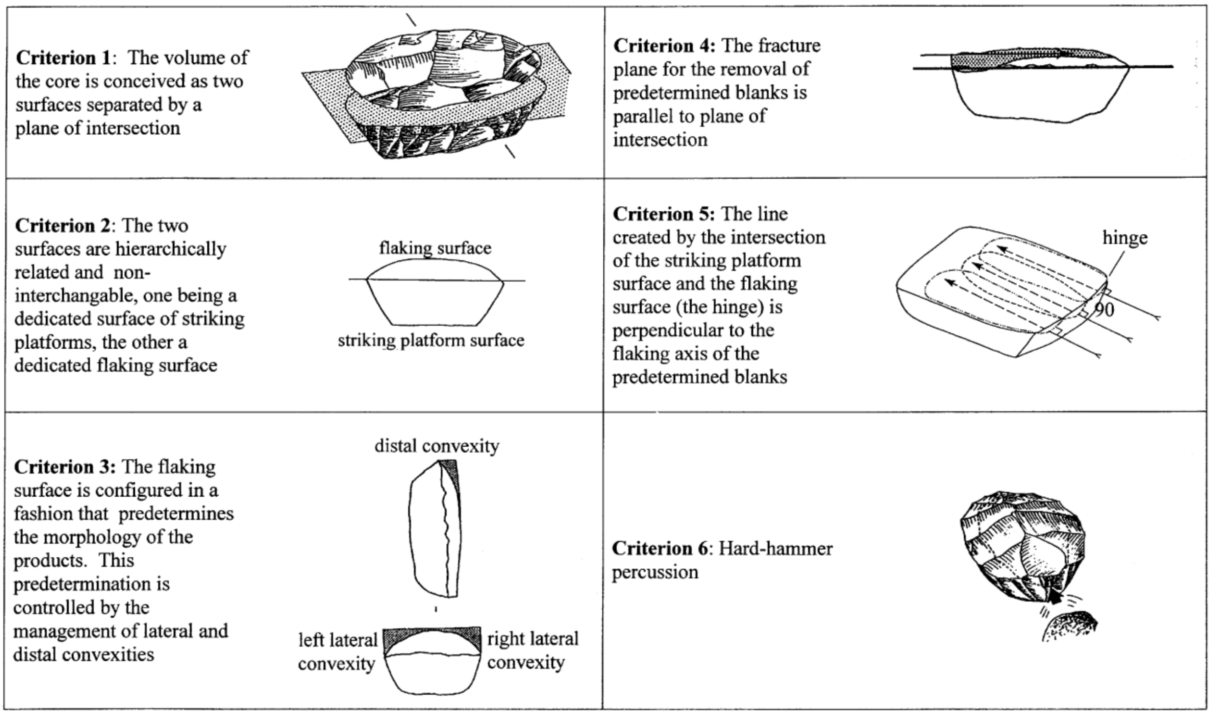


Figure 2.14 Criteria for identifying Levallois (White and Ashton, 2003:602 after Boëda, 1995).

For Boëda (1988;1995), these six criteria were indivisible. Boëda (1995:63-67) expressed the need for assemblages to be analysed in their entirety and for variability to be taken into consideration. Due to the difficulties in quantifying predetermination, Boëda (1988:14) used these criteria to make the study more objective. This has allowed more variability in the record and split Levallois into two stages, preparation and exploitation, with the entire process being planned out (Scott, 2011:12). Material would have been selected for Levallois working based on its properties and morphology, and the raw material may be tested or altered (Boëda *et al.*, 1990:53). There are many different ways to achieve the same objective (Boëda *et al.*, 1990:55), but the crucial part is that the surface is shaped for the removal of a preferential flake or can be exploited to give recurrent removals (Boëda *et al.*, 1990:55). Lineal preferential removals are present when the core is configured for one removal, whilst recurrent removals involve several removals from one flaking surface (Boëda, 1995:56). Ranov (1995:76) argued that previous studies that have identified Levallois must be questioned and re-examined as they may have misidentified the material based on a typological outlook. The move towards a technological approach to Levallois has meant that previous assemblages not typologically recognised as Levallois have been re-evaluated (Kuhn, 1995:157).

Criticism

While Boëda's (1988;1995) work has been crucial to the study of Levallois, his approach has not been without criticism. These can be split into three areas; the methodology, the limits of the definition and questions how discrete types are (Scott, 2011:12). Boëda (1988; 1995) did not put forward a formal methodology for analysing material, but combined experiments and diacritical analysis (Scott, 2011:12). It is hard to place removals within his scheme of primary, secondary and tertiary removals as there is often little evidence for this sequence with refitting being rare (Scott, 2011:13). Scott (2011:13) also pointed out that the importance lies with the analysis of the core surface.

Van Peer (1992:88) criticised this focus on one surface as he felt this underestimated the number of surfaces used. Van Peer (1992:66) added further criteria to Boëda's (1988;1995) work including an under surface which is intensely prepared and strict measurement of angles. It is further argued that the variability noted by Boëda (1988;1995) could be artificially created and not represent discrete units (Scott, 2011:14). The work of Boëda (1988;1995) has helped study the considerable variability within Levallois, but it does not explain how to treat material that does not fit all six criteria (Schlanger, 1996:237). Ignoring the Levallois characteristics of this material is restrictive and excludes material naturally endowered with convexities (Scott, 2011:14). Scott (2011:14) therefore suggested that convexities need not be emplaced, and that the criteria should be used as a heuristic device rather than a checklist. This broadening of the definition of Levallois has allowed for more variation (Scott, 2011:14) with many such as Copeland (1983:24) recognising material that is 'semi-Levallois' or 'Levallois like'.

2.8.4 Lower Palaeolithic prepared core industries

Signs of core preparation found in the Lower Palaeolithic are often described as Proto-Levallois, and these normally exhibit some, but not all, of the characteristics of Levallois flaking (Sharon, 2007:61). Other terms such as reduced Levallois, pseudo-Levallois and tortoise cores were previously used (Bordes, 1961; Callow, 1976; Roe, 1981). Malinsky-Buller (2016b) identified a number of terms that separate the technology from the idea of predetermination, and therefore Levallois, such as recurrent non-Levallois (Ameloot-van der Heijden, 1993), central surface cores (Barzilai *et al.,* 2006) and preferential surface debitage (Zaidner, 2014). Malinsky-Buller (2016b) adopted the term 'hierarchical core working', taking the treatment of the two surfaces as the key for identification. This type of core working has been found prior to fully developed Levallois in a number of regions (de la Torre and Mora, 2005; Zaidner, 2014). Malinsky-Buller (2016a) identified that these hierarchical cores are what many researchers discuss as the beginnings of Levallois technology. The terms above will be used interchangeably, with preference for PCT (especially when talking more broadly and including full Levallois) and Proto-Levallois.

The crude nature of Proto-Levallois material has caused its lack of recognition in the record due to collection bias (Wymer, 1968:73). The work of Boëda (1988) did not account for Proto-Levallois, believing all criteria had to be present. White and Ashton's (2003) work on Botany Pit established a Proto-Levallois site during MIS 9/8 in Britain. This has been explained by the convergence of technology due to the immanence of Levallois within the Acheulean, fitting in with a wider trend of earlier PCT (White and Ashton, 2003; White *et al.,* 2011). While Proto-Levallois is recognised at Botany Pit, its presence outside of the Thames is more tenuous (Ashton, 2018:153). Proto-Levallois is recognised as imposing a plane of intersection and a hierarchy on the material, but without controlling the distal and lateral convexities often creating flat cores (Figure 2.15; White and Ashton, 2003; Bolton, 2015).

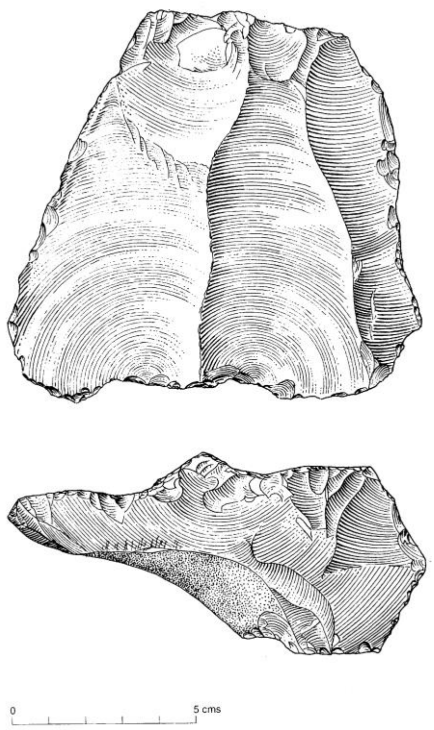


Figure 2.15 Example of Proto-Levallois from Botany Pit conforms to criteria of Figure 2.14 except number 3 (White and Ashton, 2003:600).

By keeping the cores flat and removing cortex, the knapper is maintaining the surface in order to maximise the flaking surface (White and Ashton, 2003; Bolton, 2015:24). Cores conform to all of Boëda's (1988) criteria apart from the control of lateral and distal convexities (White and Ashton, 2003). Even more than Levallois products, products from simpler cores are difficult to identify, limiting work on the technology to the cores (Bolton, 2015:217).

Bolton (2015) examined evidence for other examples of Proto-Levallois in Britain in order to gain a better understanding of the origins of Levallois and examine the 'Proto-Levallois' phenomenon. Bolton (2015:239) preferred the term simple prepared cores (SPC) (after White and Ashton, 2003) to avoid confusion about the nature of these assemblages. Bolton (2015:9) took a temporally broad approach to SPC's and, while mainly examining sites from MIS 11-9, also examined earlier sites including sites that lacked dating. Bolton (2015:198) accepted that the total number of SPC's at sites are low, but still argued that SPC technology is more widespread than previously thought. Bolton (2015) concluded that this technology while conceptually similar was distinct and did not demonstrate the same behavioural or cognitive capacity as Levallois, in part due to less signs of predetermination.

For Scott *et al.* (2019) Purfleet is the earliest site that has secure dating and shows EMP characteristics. Scott *et al.* (2019) argued that other forms of simple PCT occur in four situations:

1. Alongside full Levallois
2. In old undated collections
3. In old collections dated ambiguously between MIS 11-7
4. As individual examples

These four contexts all need to be examined as the idea of PCT comes with interpretive baggage (Scott *et al.,* 2019). This re-analysis of early PCT is needed to understand what this technology represents.

2.8.5 The Lower/Middle Palaeolithic transition and its relation to Levallois

The current concept of Levallois is rooted in Acheulean technology, but with changes occurring during the transition to the Middle Palaeolithic (Rolland, 1988:179; Dibble and Rolland, 1992; Mellars, 1996:4; Goren-Inbar and Belfer-Cohen, 1998:205). Contrary to this, Wenban-Smith (2013:9) referred to the early appearance of PCT at sites such as Red Barns and argued for the relegation of the Lower-Middle Palaeolithic transition as an important boundary. Wenban-

Smith (2013:9) suggested that the Middle Palaeolithic only occurs after MIS 5e and assigned most of the Middle Pleistocene (MIS 12-5e) to a joint Lower and Middle Palaeolithic stage. This is at odds with most contemporary views (McNabb, 2007; Scott, 2011; Pettitt and White, 2012; Ashton, 2017). While it is acknowledged that some PCT occurred prior to the Middle Palaeolithic, it is argued that it is the dominance of Levallois, decline in handaxes and greater levels of standardisation that define the Middle Palaeolithic change around late MIS 9/8 (Goren-Inbar and Belfer-Cohen, 1998:206; Klein, 1999:411; White and Jacobi, 2002:125). The adoption of Levallois links to other fundamental changes in hominin behaviour (Rolland, 1995:346) including larger populations with higher levels of innovation (Hosfield, 2005:231-232), increases in cognitive ability (Schlanger,1996:231; Foley and Lahr, 1997:9), the increased importance of mental templates (Picin, 2018:300), logistical approaches to stone tools and changes in hunting practices (Gowlett, 1984:186; White *et al.,* 2011:57).

Origins

A point of contention is whether there was a single origin for Levallois or multiple (Scott, 2011:3). Europe is often thought to lack a proto-stage akin to Africa where the gradual emergence of Levallois can be seen from core and flake working such as Victoria West (Foley and Lahr,1997:12; White and Ashton, 2003: 598). This led to the 'Mode 3 hypothesis' by Foley and Lahr (1997) in which there is a single origin of Mode 3 in Africa, dispersed by *Homo helmei* during MIS 8/7*.* Foley and Lahr (1997:13-14) dismissed evidence of PCT before 350kya, and then only accepted PCT in Africa at ~350kya with the appearance of full Levallois ~250,000kya. Despite this theory, there is no evidence for a *Homo helmei* incursion into Europe from Africa (Scott, 2011:171). Alternatively, Clark (1977:33-34) argued that Levallois was invented in Europe and later spread to Africa. Work on African material led to Tryon *et al.* (2006:199-201) arguing for a deeper antiquity for Levallois material, and Clarks model no longer fits the current data.

For others, Levallois did not arrive fully formed but evolved out of the Acheulean (Copeland, 1995:172). Bordes (1971:3) argued that Levallois was the combination of previous knapping strategies with the addition of predetermination. This suggested that it could have been invented on numerous occasions. White and Pettitt (1995:27-29) saw Levallois as the combination of *débitage* and *façonnage,* two schema that were previously separate in the Lower Palaeolithic. The varying degrees and relation between the use of *débitage* and *façonnage* are responsible for the mosaic nature of assemblages around the transition and these changes were not linear but came and went allowing for greater temporal variability

(White and Pettitt, 1995:29). Otte (1995:117) also classified Levallois as a technology of convergence based on three factors: the mechanical properties of material, conceptual capacities of the knapper and the needs of the group. The conditions Levallois developed in would have common elements including similar motor habits, raw material use, technical knowledge and functional needs (Villa, 2001:121). Convergence through the accidental discovery during handaxe manufacture is considered inevitable by Rolland (1995:346), as Cagny-la Garenne possibly shows the accidental use of handaxes as cores (Tuffreau, 1982:139-142).

It is therefore possible that Levallois does not have a single origin due to the evidence of temporal and geographical variety, with Otte (1995:117) noting examples in Japan, Europe, Africa and central Asia. While Africa does show early examples of PCT, such as Tachengit and Tabala, a number of earlier occurrences make a single origin in Africa unlikely (Rolland, 1995:346; Scott, 2011:170-171). Examples of earlier PCT provides Europe with a proto stage (White and Ashton, 2003:599; Scott, 2011:171; Bolton, 2015; Hérisson *et al.*, 2016a; Picin, 2018; Moncel *et al.,* 2020) showing the *in situ* development of Levallois (Moncel and Combier, 1992:1286; Rolland, 1995:333). The different versions of Mode 3 technology should not be viewed in a progressive line but seen as independent expressions (White *et al.,* 2011:60). If Levallois developed independently in various ways in distinct places and at different times, it is futile to try and find an origin (Scott, 2011:171).

Before the transition

Previous work has neglected the emergence of PCT, and especially its predominance during the Lower to Middle transition (Rolland, 1999:319). The traditional view of Levallois being a major breakthrough has had to adjust due to increasing evidence for multiple origins (White *et al.,* 2011:53). It is likely that the transition to PCT had many false starts before becoming embedded in the Middle Palaeolithic (White and Ashton, 2003: 605). The current evidence shows that Levallois has older roots which challenges the transitions status as a major change in behaviour (Valoch, 1982; 1995; Bosinski, 1982:174; White *et al.,* 2011:53). Shultz *et al.* (2012: 2137) suggested that innovations appear and disappear at sites, showing how the technology is either expendable or lost at different times.

The earliest examples of PCT in Africa, the Levant, Asia and Europe (Table 2.6) have long been controversial (Bar-Yosef, 1982:31). In Africa, the Fauresmith, Sangoa, Stellenbosch and Victoria West are all considered transitional industries which are primarily prepared core industries heavily influenced by raw material, but these remain poorly defined and dated for the most part (Herries, 2011:2-3). There is a large degree of variation in these techniques and many are often seen as Proto-Levallois (White *et al.,* 2011:56). Victoria West, while similar to Levallois technology, is considered distinct (McNabb, 2001:37), involving medium sized cores with a single large side struck removal (Sharron, 2007:48). Fauresmith assemblages contain handaxes which have been made on flakes, and the wider use of PCT to create large cutting tools (LCT) is noted in other industries (Herries, 2011:3-8).

Site	Continent	Dating	Evidence	References
Nyabussosi, Uganda	Africa	~ 1.5mya	Cores with a preferential surface of preparation, and prepared striking platforms. Much more akin to Middle Palaeolithic.	Texier, 1995:650
ST Complex, Peninj, Tanzania	Africa	~ 1.6-1.4 mya	Cores (~40) have many of Boëda's (1988;1995) criteria, two surfaces cut by a plan of intersection, hierarchal, centripetally prepared and stuck with a hard hammer. Also fits Van Peer's (1992) phases of Levallois.	Torre *et al.* 2003
Canteen Koppie, Stratum 2a, South Africa	Africa	~1,1 mya	Victoria West cores (69)	McNabb and Beaumont, 2011
Tabun Cave, Israel	Asia	780kya	Levallois Core	Ronen, 1995:294
Wonderwork Cave MU4, South Africa	Africa	~600-500kya	Prepared cores, blades, Levallois points, convex 'scrapers', and small handaxes	Beaumont and Vogel, 2006
Kathu Pan 1:4a, South Africa	Africa	~600-500kya	Occurrence of Levallois points, prepared cores and handaxes. 100+ prepared cores representing >25% of the assemblage.	Porat *et al.*, 2010; Wilkins and Chazan, 2012; Walker *et al.,* 2014.
Rooidam 2 and 3, South Africa	Africa	~600-500kya	Prepared cores and blades no Levallois points	Beaumont and Vogel, 2006
Leakey Handaxe Area (LHA) and the Factory Site (FS) Kapthurin Formation, Kenya	Africa	~284–510kya	large Levallois removals struck from boulder cores. 18 flakes and 4 cores (LHA). 1 flake and 6 cores (FS).	Deino and McBrearty, 2002; Tryon 2006; Tryon *et al.,*2005
Casablanca, Morocco	Africa	~500-320kya	Highly variable Levallois technology	Raynal *et al.,* 1995;2001; Tryon, 2005:137
Gesher Benot Ya'aqov , Israel	Asia	~750kya	Bifaces made from Levallois flaking, evidence for planning and preparation. Small flakes and flake tools also produced through method.	Goren-Inbar 1992; Goren-Inbar *et al.,* 2000;2008 Madsen and Goren-Inbar, 2004
Fréville Terrace, Rue Marcellin Berthelot, St Acheul, France	Europe	MIS 14	Two liner preferential Levallois cores	Tuffreau and Antoine, 1995; Tuffreau 1995
Garenne terrace level, Somme Valley, France	Europe	MIS 12	Several preferential flake cores	Tuffreau and Antoine, 1995; Tuffreau 1995

Table 2.6 Early examples of PCT in Africa, the Levant, Asia and Europe.

Rolland (1995:341) described the later developments of Levallois in southern Africa as much closer to classic Levallois. Riet Lowe (1945:50) noted a deep history of Levallois cores alongside handaxes in South Africa. PCT is observed in several regions of Africa and whilst dating for these is tentative (Rolland, 1995:345; Van Baelen, 2017), it seems the transition is gradual (Marean and Assefa, 2005:103). Riet Lowe (1932;1945) argued that prototypes were without parallel in Europe which he reasoned was due to changing raw materials in Africa and not Europe. This is reflected in the work of Kuhn (1995:157) who suggested that small raw material was inhibiting the use of fully fledged Levallois. However, looking for the origins of Levallois in Africa ignores the possibility of Levallois evolving independently in other locations (Rolland, 1995:345).

In the near-east there is reference to Levallois flakes in Acheulean assemblages, sometimes referred to as Proto-Levallois (Copeland, 1995:171), which could indicate the use of PCT by Acheulean populations. After studying a site with handaxes, cleavers and flake tools, Copeland (1995:172) began to doubt the credentials for Levallois within the Acheulean of the near east. In Israel, Lebanon and Syria the gradual introduction of Proto-Levallois can be seen, but Copeland (1995:178) suggested that these are from handaxe production. Levallois finds seem more common at surface or open-air sites (Copeland, 1995:178) and are rarer at *in situ* sites. Copeland (1995:180) claimed that some of the identification of Levallois is erroneous but does not rule out the origins of Levallois being in the Lower Palaeolithic. Work in Turkey by Yalçinkaya (1995:410) discussed Levallois during the end of the Lower Palaeolithic and the entire Middle Palaeolithic.

Early signs of PCT are seen prior to MIS 9 in Europe (Moncel *et al.,* 2020), but some have argued that this is restricted in nature and the true adoption is only established during MIS 9-8 simultaneously across the Acheulean world (Gowlett *et al.* 2018:258; Picin, 2018:300). Purfleet is arguably one of the earliest uncontested Levallois sites in Europe (White and Ashton, 2003:604). Ashton (2017:166), nevertheless, argued that while the beginning of Levallois technology can be seen at Botany Pit, full Levallois was not developed until late MIS 8/7 where it is accompanied by a decrease in handaxe numbers (Monnier, 2006:726). White *et al.* (2011:57) and Rolland (1995:345) on the other hand argue that Levallois is seen earlier than this, around c.300kya or MIS 9/early MIS 8, with some full Levallois at Botany Pit (alongside other areas of Purfleet), and earlier in France (Gamble ,1999:221). There are still detractors (Wenban-Smith, 2013; Bates *et al.,* 2014) who have argued that Levallois only appears in MIS 7, and question earlier sites including Botany Pit, either on the basis of dating or technology.

Tuffreau (1995:423) argued that before MIS 8 the appearance of Levallois was only sporadic and could be serendipitous occurrences from handaxe working as the similarities between Levallois cores and handaxes have long been noticed, as well as between handaxe related flakes and Levallois flakes (Leroi-Gourhan, 1964; Copeland, 1995:172). Misunderstandings like this explain Levallois being erroneously attributed to earlier periods of the Lower Palaeolithic and is a cautionary tale on accepting the presence of Levallois on little evidence (Baulmer, 1995:16). Pettitt and White (2012:253) argued that while it may be tempting to dismiss these early occurrences, they all show the intelligent application of a concept that combines two previous discrete methods into a new schema. Based on this evidence, it follows that as soon as the Acheulean began there was a potential for Levallois (Pettitt and White, 2012:254). The record currently supports the hypothesis that the Late Acheulean included some PCT without the need for external input (Mosquera *et al.,* 2013: 135).

While the utility of the Lower-Middle Palaeolithic divide has been questioned (Goren, 1982:117-118), this is unwarranted as despite numerous sites dating prior to the transition, the important distinction is that these are usually isolated incidents and do not constitute a permanent change in lithic technology (Roe, 1982:179). While the evidence does not support the view that Levallois and other PCT solely relate to the Middle Palaeolithic, most sites before the Middle Palaeolithic lack any evidence for Levallois (Pettitt and White, 2012:249).

2.8.6 Summary

The current consensus is of multiple origins for PCT (Picin, 2018:300). Previously the compression of the Quaternary framework with only two post-Anglican cycles led to a distorted view of Levallois and its origins in Britain (Scott, 2011:5). The expanded framework has allowed more space for the Middle Palaeolithic to exist, and this can be seen in the work of Scott (2011) which has characterised the EMP of Britain. The earlier forms of PCT apparent from the work of White and Ashton (2003) and Bolton (2015) require further clarification regarding geographical spread, relation to MIS 9 and relation to both the Acheulean and EMP. This thesis aims to evaluate the early PCT in Britain, allowing for a detailed analysis of the status of PCT during MIS 9 and the Lower to Middle Palaeolithic transition. Chapter Eight will also set the British record in its European and global context through an updated synthesis of early PCT.

2.9 Characterising the Purfleet Interglacial

While advances in our understanding of Middle Pleistocene chronology has increased our knowledge of MIS 9 and its environments, our knowledge of the archaeology from the period is still lagging behind that of other periods. It is becoming increasingly evident that the period is essential in answering many questions about the behaviour of hominins during the Palaeolithic more widely, especially concerning non-handaxe groups, the use of flake tools and the development of PCT. The transition between the Lower and Middle Palaeolithic is still an under researched period, especially in Britain, and the work discussed in this chapter demonstrates the need for further research.

Pope *et al*. (2016:86) stated that in the absence of new discoveries and excavations, major changes in our understanding of the Palaeolithic are possible with careful work on extant collections. This is not only possible for MIS 9, but necessary due to a lack of both previous work and recent discoveries. This thesis aims to build on the work presented in the current chapter in order to advance our knowledge of MIS 9.

Chapter Three: Methodology

The aim of this research was to enhance our understanding of the final Lower Palaeolithic in Britain by re-evaluating the archaeology from a representative sample of sites dating to MIS 9, targeting the research questions highlighted in Chapter One. In addition to the theorical background laid out in Chapter Two, a robust methodology was essential in testing the current hypotheses (White and Bridgland, 2018). Sites were selected, recorded and analysed to not only deepen our knowledge of MIS 9, but to also offer comparisons to other periods and regions. This was done in order to create an understanding of the changes and continuity between the Lower and Middle Palaeolithic set within its European context. This chapter outlines how sites were selected and how artefacts were analysed.

3.1 Site selection

One of the major obstacles to our knowledge of MIS 9 is the paucity of well-excavated and documented primary context 'flagship' sites. Usually, these sites are preferred for lithic analysis in order to evaluate *Chaîne opératoires* at an individual level, building fifteen-minute snapshots of Palaeolithic life (Gamble, 1996:64). In contrast the more common 'dredgers', often representing tens of thousands of years, are only able to examine broader aspects of hominin behaviour (Gamble, 1996:66; Hosfield, 1999:14). Ignoring these secondary context sites or those that have not been formally excavated, around 85% of Lower Palaeolithic localities, would be ignoring over 100 years of collection (Harris *et al.,* 2019). This would leave MIS 9 defined narrowly by a handful of sites (White and Bridgland, 2018). Gamble (1996:64) argued that rather than abandoning 'dredgers' in pursuit of the next Boxgrove, it is important to build a framework that could use data from the majority of secondary context sites. At MIS 9 sites it is not currently possible to observe ethnographic detail, but an impression of the broad changes over the interglacial can be studied. Hosfield (1999:16) sets out four key issues with secondary context sites:

- Lack of documentation
- Lack of chronological precision
- Lack of representative samples
- Lack of spatial precision

While the lack of documentation is an obstacle, where possible records have been used to give further context to the MIS 9 assemblages. The lack of chronological precision also proved difficult, but the advances in our knowledge of Quaternary contexts and chronology (see Chapter Two) has allowed sites to be correlated to the interglacial. However, indication for their place within MIS 9 is still problematic. The lack of representative samples, across Lower Palaeolithic sites of all ages, is what has hitherto impacted the themes of this thesis. Collection bias has heavily affected the composition of these assemblages with a clear bias towards handaxes, particularly at Wolvercote (Tyldesley, 1986a;1986b). This study has evaluated the evidence available taking into consideration winnowing and collection bias, and these factors are considered in the interpretation of the archaeology. The lack of spatial precision is unavoidable, but due to the questions asked by this thesis regarding wider changes in hominin behaviour it has not been a major issue.

The five sites referred to as 'flagship' sites by White and Bridgland (2018) are Purfleet, Stoke Newington, Wolvercote, Cuxton and Little Thurrock. While many of these sites are almost in primary context, there are issues with excavation and documentation at almost all of these sites, with much of the work coming from older collections and excavations (see Chapter Four). Even if the evidence from these sites was better recorded, it is still important not to answer broad questions with such a small sample (Hosfield, 1999:5), especially when these sites are geographically restricted to the Thames and its tributaries. Appropriate secondary context sites were selected from regional and national gazetteers and overviews, including the works of Roe (1968a; 1981), Wymer (1968;1985;1999), 'The English Rivers Project' (TERPS) database (Wymer 1993;1996;1997), McNabb (2007), Pettitt and White (2012) and White and Bridgland (2018). Sites were chosen based on the criteria detailed below, and backgrounds are provided in the following chapter.

Dating and provenance

Sites reliably dated to MIS 9 were the focus, encompassing the end of MIS 10 and the beginning of MIS 8. If sites lacked accurate dating but there was a precedent for assigning the site to MIS 9, for example Sturry (Scott, 2002), then work was undertaken to re-examine them. While some of the flagship sites have dating evidence, such as biostratigraphy, OSL and AAR at Purfleet (Bridgland *et al.*, 2013), most of the sites do not. Work was concentrated on the areas correlated to MIS 9 as detailed in Chapter Two. Primarily, these were the Lynch Hill and Corbet Tey Formation in the Thames Valley (Bridgland, 1994), areas correlated to MIS 9 in the Solent by Westaway *et al.,* (2006), Davis *et al.* (2016) and Hatch *et al.* (2017) and the areas of eastern England correlated to the interglacial by Boreham *et al.* (2010). The work on the temporary significance of handaxe groups by White *et al.* (2018) was also used as an additional factor incorporating the on-going work of Dale (Pers. Comm. 2021). A list of sites was created after an extensive literature review, taking a broad approach in order to evaluate any potential outliers. The condition of the assemblages was analysed to assess if the material was derived, as well as whether all the material was contemporary or if there were separate assemblages.

Certain locations, such as Stoke Newington and Lower Clapton, are broad names of related localities rather than discrete sites. Attempts have been made to provenance the material and justify their inclusion in the study, these are detailed in Chapters Four and Five. While Stoke Newington could be separated into different assemblages (Common, Geldeston Road and Abney Park Cemetery), these did not show any differences in technology or condition and so are treated together. Other sites such as Lower Clapton, Grays Thurrock and many of the Solent sites lack information to split the assemblage and are treated together out of necessity. As a result, these should be treated with more caution. Where this is significant, as in the case of Barnham Heath, this is discussed in the relevant section.

Archaeology

From the sites attributed to MIS 9 those reported to contain archaeological assemblages of interest to the thesis, such as large core and flake assemblages, large numbers of flake tools, or claims of PCT, were prioritised. In the case of non-handaxe assemblages, debates on the Clactonian (McNabb, 1992; Wenban-Smith, 1998; White, 2000; McNabb, 2007) have led to the three sites of Globe Pit, Cuxton and the Little Thurrock member at Purfleet being well known. McNabb's (1992;2007) work rejecting typologically Clactonian artefacts has precluded a search for all sites where 'Clactonian artefacts' were previously reported, such as Southacre and Grovelands Pit (Roe, 1981:148). Furthermore, work on mixed and derived sites was unviable unless there were clear distinctions in condition. This has meant that no further non-handaxe signatures could be identified, although elements previously considered diagnostic of the Clactonian have been discussed at numerous sites.

The examination of flake tools was a direct appraisal of Pettitt and White's (2012:146) claim, expanded by White and Bridgland (2018), that 15 out of the 18 Acheulean flake tool contexts with 50 or more flake tools recorded in Roe (1968a) date to MIS 9. This provided a list of sites to examine. A review of the literature and databases was also conducted to identify further assemblages with significant flake tool components, especially those related to PCT.

To examine the claims of Proto-Levallois and Levallois material, sites that were found to have references to PCT were prioritised. Due to the ambiguity of Levallois, and especially Proto-

Levallois flakes, the focus was on sites that contained cores. The rarity of significant core and flake assemblages amongst MIS 9 sites led to a wider assessment of core and flake working where there were larger numbers.

Geography

A broad geographical scope across the entire of Britain was adopted in order to expand our knowledge of MIS 9 beyond the Thames and its tributaries, but several factors hindered this. While Wymer (1988; 1999) noted the richness of MIS 9, especially in the Middle Thames and the Solent, sites in East Anglia are sparse compared to other interglacials. As the Trent did not exist in its modern form until MIS 8, MIS 9 is absent (White and Bridgland, 2018). White and Bridgland (2018) argued that, like most of the Lower Palaeolithic, MIS 9 is also underrepresented in the South-west and Midlands. A review of the literature has not changed this and the sites in this thesis can be split roughly into three areas: the Thames Valley and its tributaries, the Solent and its surrounding areas, and eastern England.

Without further fieldwork, only the three current non-handaxe sites are available for analysis which restricts the scope to the Thames and Medway area. This may be a genuine pattern in the archaeology, or it could be down to the resolution of data. The sites containing flake tools expand beyond the Thames Valley, but there is a lack of any sites from the Solent area in Pettitt and White's (2012) list, possibly due to collection practices, however, sites including Warsash and Dunbridge have been used for comparisons in the Solent. The research area with the greatest geographical breadth is PCT with sites in the Thames, Solent and eastern England. Whilst a more geographically diverse range of sites would be ideal, the MIS 9 record currently prohibits this.

3.2 Data collection procedure

After site selection, research into the location of collections was undertaken and permission to study the material was sought. It was important to examine as much material as possible, especially when assessing the numbers of flake tools and PCT. As collections are often split between different museums in an attempt to give regional museums a 'type series' (Harris *et al.,* 2019:13-14), the main collections were targeted (Appendix A). Unfortunately, the lack of access to certain museums and collections has left some gaps in the data collection originally intended. The unknown location of Palmer's (1975) Purfleet artefacts after the closure of the Passmore Edward's Museum has made work on the site difficult, although later excavations at the site and its well-published nature makes this less of a loss to this thesis (Schreve *et* *al.,*2002; Bridgland *et al.,* 2013). Three East Anglian sites, Southacre, Keswick and Whitlingham, have collections almost entirely based at Norwich Castle Museum and the closure of this museum to researchers has meant that these sites have gone mainly unexamined in this thesis, thus leaving East Anglia underrepresented in this study. Less critically, the WG Smith collection at Luton Museum was inaccessible, but sites based at Luton were well represented by collections at the British Museum and a database of finds was provided by Luton Museum.

As much material as possible, given the dispersed nature of some collections, was analysed to build a complete view of the assemblages and to ensure that as many examples of PCT and flake tools were examined. The major collections for each site were targeted based on a review of the literature and databases. In the case of the non-handaxe assemblages, it was important to take a holistic approach and to examine if there was a change between the non-handaxe and handaxe levels at sites such as Purfleet and Cuxton. While it was the aim to analyse all material, this proved difficult at some sites. Due to the size of the Botany Pit assemblage, every tenth flake was recorded but all material was visually examined for signs of retouch and PCT traits. The Barnham Heath material curated by the Pitt Rivers Museum could not be analysed in full but was examined for signs of retouch and PCT traits. The Sturry assemblage was examined in less detail with only the flakes previously described as flake tools examined in full. The lack of access to collections due to the on-going coronavirus pandemic prevented finishing a full analysis of Sturry, as well as examining Twydall, which was highlighted by Beresford (2018) during this research as potentially relevant to this thesis.

A number of sites including Iver, Ruscombe, Bowman's Lodge and some sites in the Solent were briefly examined for comparison. The lack of full analysis of these sites means they are used for discussion in Chapters Six, Seven and Eight, but no formal background or results are presented in Chapters Four or Five.

3.3 Lithic analysis

Chazan (1997:719) outlined four overlapping systems that have been used to analyse lithic assemblages.

1. **Typological approach**- Tools seen as finalities which are characterised by their shape and the location/characteristics of retouch as used by Bordes (1961). Artefacts are usually grouped as cultural entities, such as Mousterian and Acheulean. Binford (1973) advocated a typological evaluation that was more closely related to function.

2. **Grade approach**- While similar to the typological approach, this approach has more focus on splitting artefacts into evolutionary grades. Focus is on showing the progress over time, but these can be split into cultures.
3. **Normalist**- This approach rejects typology as a meaningless construct imposed by the analyst. The approach aims for a more quantitative approach, which includes raw material, resharpening, tool function, rejuvenation and environmental stress. To achieve this the entire assemblage needs to be analysed.
4. **Technological approach**- The finalities are deemed inadequate, and the emphasis is on examining the manufacture of tools. As it is the behaviour and not the tool that is important, it is necessary to examine the method of manufacture and not the product.

While typologies are useful to categorise artefacts, classification should always be a secondary goal after the understanding of the behaviour they represent (Chazan, 1997:733). Chazan (1997:720) advocated that technology should be explored using three concepts: technique, method and *Chaîne opératoire.* These can be applied to any human act, with a tool acting as connection between the body and the physical world (Chazan, 1997:720). 'Technique' is the nature of the transfer of energy, for example hard or soft hammer (Chazan, 1997:720). 'Method' is the conceptual model held by the person carrying out the act, but the nature of this representation is debatable, as is the intentionality (Chazan, 1997:723). *Chaîne opératoire* ties these ideas together and shows the process of technical acts (Chazan, 1997:723).

The concept of *Chaîne opératoire*, conceived by Leroi-Gourhan, has had a major impact on how archaeologists study technology (Audouze, 2002:286). It can be summed up as follows:

> "Techniques are at the same time gestures and tools, organized in sequence by a true syntax which gives the operational series both their stability and their flexibility. The operational syntax is generated by memory and is born from the dialogue between the brain and the material realm" (Leroi-Gourhan, 1993:230-234).

This concept examines the interplay between events, actions and gestures that create artefacts in order to analyse the lithic reduction sequence and the subsequently connected forms of social meaning (Gamble, 1999:83-4).

The approach taken in this thesis aimed to achieve a technological understanding and builds on the methodologies of Ashton (1998d), McNabb and Ashton (1996c), Inizan *et al.* (1999), White and Plunkett (2004) and Scott (2011). Using methodologies that have been established and used to examine Palaeolithic sites over the last few decades contextualises the research in current Palaeolithic frameworks and allows for easy comparison to the wider Lower and

Middle Palaeolithic. These approaches are grounded in the technological paradigm which Inizan *et al.* (1999:13) describes as a "science of human actions" studying the technical systems within Palaeolithic cultures. The *Chaîne opératoire* approach, from procurement to discard, has been used when analysing artefacts beginning with an observation of the artefacts condition and process of manufacture before making inferences (Inizan *et al.,* 1999:14-16). The artefacts studied are a combination of material, technology, function and style (Whittaker, 1994:270), and these factors all need to be covered during lithic analysis.

While the technological approach is favoured in this methodology, some typological observations have been recorded. Typological classification is a useful heuristic device and is often the first step to aid description (often by size, function or age) and helps decide on further work by selecting relevant methodologies (Andrefsky, 1998:59; Waddington, 2004:51). Methodologies were chosen and shaped around the specific research questions outlined in Chapter One and issues discussed in Chapter Two.

3.4 Condition

Observations regarding the condition of assemblages were recorded to assess the taphonomic processes that the artefacts have undergone (Scott, 2011:212). This was done in order to understand the relationships within the assemblages and whether there were discrete units (Ashton, 1998a:186). Examples include the non-handaxe and handaxe material from Cuxton and Purfleet, as well as whether PCT deviated from the condition of the wider Acheulean assemblages at sites such as Biddenham and Kempston. Due to this, prepared cores and flakes were recorded separately to assess any notable differences. Given the secondary context of the sites, it was important to demonstrate if the material came from the same context (Schick, 1986:1;1987:789; Villa, 1982:267). Condition was also used to assess how derived the material was to inform the dating of assemblages.

Following the work of Schick (1986), the flake size distribution (including flake tools and Levallois flakes) of the assemblages was examined for evidence of winnowing and to evaluate how representative they were compared to experimental data. Ashton *et al.* (2005:26) listed numerous ways of evaluating material including depositional environment, condition, orientation, spatial distribution, refitting and size distribution. Many of the collections used in this thesis were excavated or collected before modern techniques therefore much of this information, including orientation and spatial distribution, is not available. In lieu of this, information on the lithics themselves can hold information on post-depositional factors such as rolling and geomorphic processes, and this was the starting point of analysing assemblages (Shackley, 1975:501; Harding *et al.,* 1987; Hosfield, 2011a:48; Bertran *et al.,* 2012:3149).

The following observations were made on all material:

Length, width and thickness of artefacts (mm)- Recorded for all artefacts to evaluate site formation and collection bias.

Abrasion- Recorded to evaluate the depositional environment and how derived the artefacts were. This was distinguished by how sharp or rounded the edges of the artefacts were, as well as other factors which show signs of rolling, recorded separately below. Recorded as:

- Fresh
- Lightly abraded
- Moderately abraded
- Heavily abraded

Edge damage- Recorded separately to condition after White and Plunkett (2004:166) as while related, edge damage can be caused by trampling and other *in situ* processes rather than rolling. This was distinguished by signs of damage to the edges of the artefacts from localised minor damage on an otherwise sharp edge, to major damage all the way around an artefact. Recorded as:

- None
- Light edge damage
- Moderate edge damage
- Heavy edge damage

Patination- Recorded to evaluate the exposure of material caused by physical and chemical alterations (Inizan *et al.,* 1999:91). The categories are based on the coverage and density of the patination. Recorded as:

- None
- Light patination
- Moderate patination
- Heavy patination

Staining- To examine contaminants in the depositional environments and identify discrete assemblages. Recorded as present or absent.

Scratching- To examine post-depositional movement. Recorded as present or absent.

Battering- To examine post-depositional movement, or possible anthropogenic activity. Recorded as present or absent.

3.5 Technology

Recording was customised for different categories of artefacts and based on technological analysis. After an initial assessment of the artefact, observations were recorded related to a number of factors involving the manufacture and use of the artefact (Inizan *et al.,* 1999:90). This technological approach to artefacts allows a meaningful examination of motor dexterities and cognitive abilities (Inizan *et al.,* 1999:99). Many of the collections have not undergone a modern evaluation through technological methods.

3.5.1 Flakes

Flakes represent the majority of artefacts studied and can be indicative of various technologies. The lack of soft hammer flakes can distinguish non-handaxe sites from those with handaxes (White, 2000). Ashton (1998d) argued that the analysis of flakes supports core analysis with emphasis placed on butt type, the dorsal scar pattern and amount of residual cortex.

Flakes were also examined for signs of retouch and PCT traits. Flakes with Levallois traits or retouch were recorded separately using the criteria below. McNabb (1992:450-1) discussed the need to keep measurements to a minimum with only length, width and thickness recorded, while other attributes come from observation such as percussion mode, cortex, bulb and scar and butt type. Chips (under 2cm) were not recorded in full but counted. Due to the secondary context and collections histories at most sites, these were not common.

The following attributes were recorded:

Length, width and thickness of flakes- Recorded in mm with length being measured parallel to the axis of percussion and width perpendicular to the axis of percussion.

Broken/type of break- Recorded to indicate either knapping or post-depositional breaks.

Cortex- The percentage of cortex left on the dorsal surface was recorded to relate the flake to its stage in the knapping sequence.

Flake type- Recorded as a judgment of the stage of knapping the flake belonged to (after Ashton, 1998d:290; Figure 3.1):

1. Cortical surface and butt.
2. Either >50% cortical dorsal surface and cortical butt or cortical surface and non-cortical butt.
3. Either <50% cortical dorsal surface and cortical butt or >50% cortical dorsal surface and non-cortical butt.
4. Either non-cortical dorsal surface and cortical butt, or <50% cortical surface and non-cortical butt.
5. Non-cortical dorsal surface and non-cortical butt.

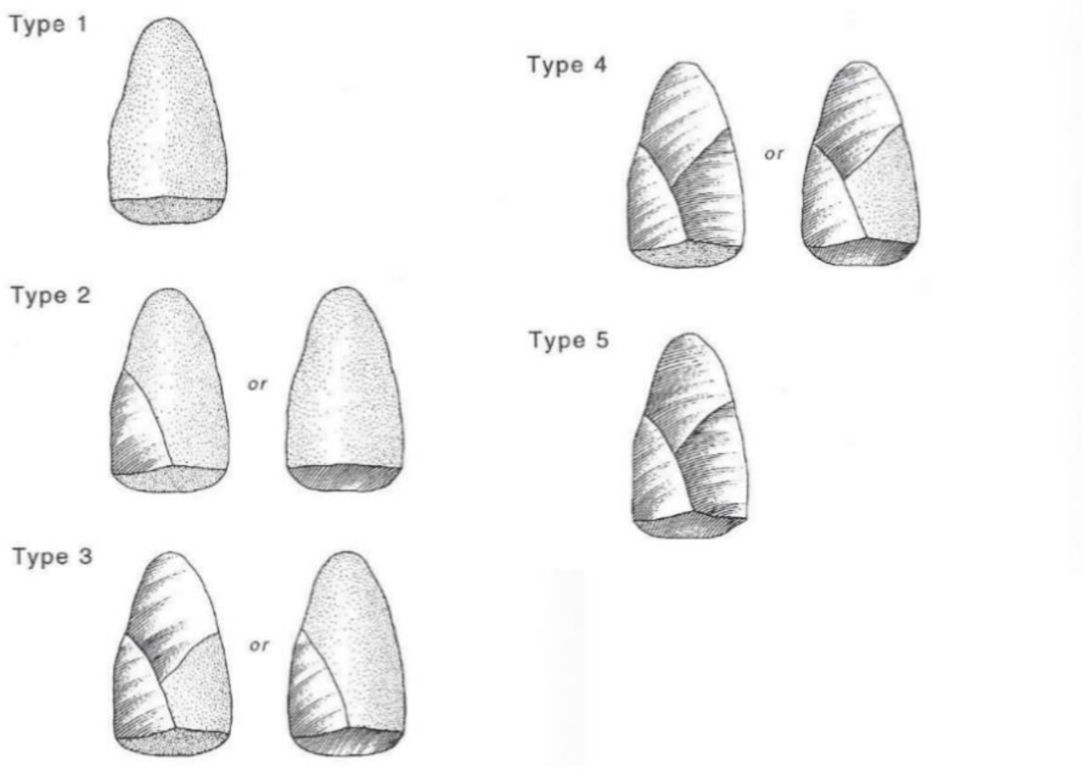


Figure 3.1 Flake type (after Ashton, 1998d:289).

Dorsal scar count- Previous removals identified from the dorsal side of the flake.

Dorsal scar pattern- Simplified from the methodologies of Ashton (1998d) and Ashton and McNabb (1996c). These categories relate to how the core that produced the flake was worked, focussing on the complexity of the patterns (Figure 3.2):

- Unidirectional
- Bidirectional
- Multidirectional
- Natural or cortical

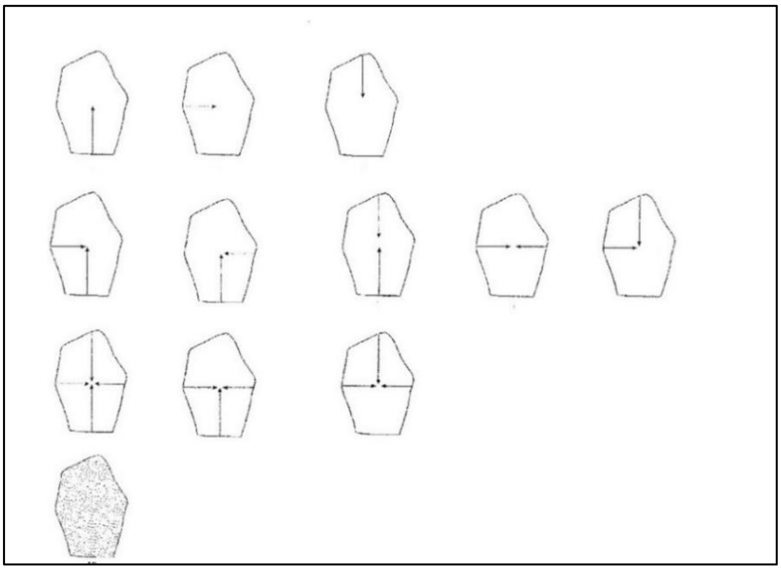


Figure 3.2 Dorsal scar pattern. Top line Uni, Second Bi, Third Multi and Bottom cortical (after Ashton and McNabb, 1996c:289).

Butt type- The nature of the butt was recorded to assess the type of percussion, preparation and technology (Figure 3.3):

1. Plain- formed from part of a single flake scar.
2. Dihedral- formed at the intersection of two or more flake scars.
3. Cortical- covered in cortex.
4. Natural- natural surface without cortex.
5. Marginal- formed at the edge of a core forming a narrow, indeterminate butt.
6. Soft hammer.
7. Mixed- formed from a combination of cortical/natural and flake scars.
8. Faceted- Shows evidence of preparation.
9. Missing- butt not present due to broken flake.
10. Broken- formed due to butt shattering.

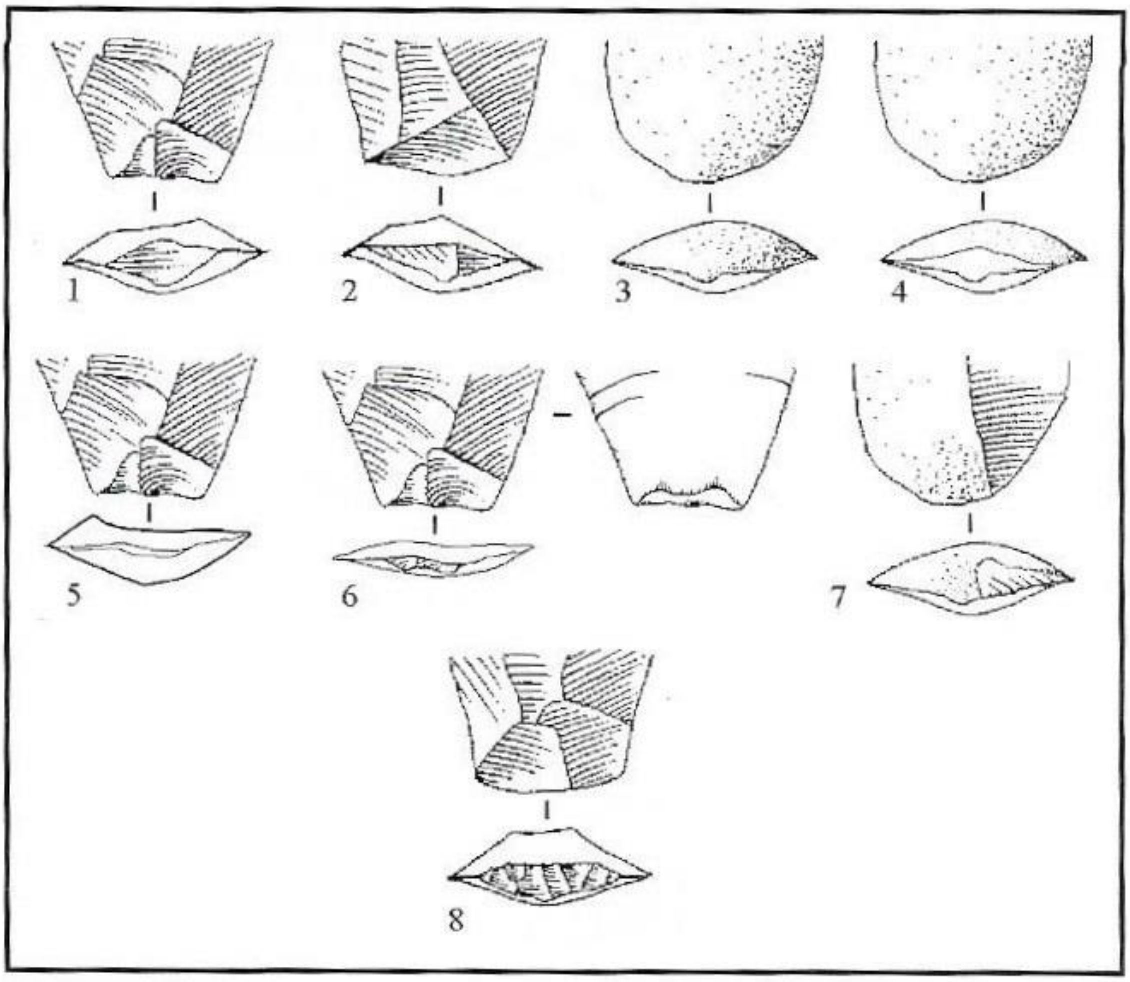


Figure 3.3 Butt type (after Scott, 2011:219).

3.5.2 Cores

Cores were studied through the technological approach advocated by Ashton and McNabb (1996c) replacing typological approaches, as cores were often by-products of technical acts rather than products (White and Plunkett, 2004:164). This could be challenged if there was a clear pattern in the occurrences of certain core types. The shape of cores was examined by McNabb (1992:305) who identified end flaked cores, side flaked cores, globular cores, conical and bi-conical cores, but the current consensus is that most core shapes were arbitrary stopping points and not informed by mental templates (McNabb, 2007:318). The lack of excavated primary contexts also meant that many cores may have been preferentially collected due to their shape, making any typological work biased. Some typological observations were noted when necessary. This was more significant in relation to chopper cores and their role in non-handaxe contexts.

Length, width and thickness- Recorded in (mm).

Typology- Cores were placed in one of the following broad categories (Scott, 2011):

- Migrating platform cores (MPC)- generic term for undiagnostic cores made up of core episodes, with minimal organisation.
- Discoidal- Core divided by plane of intersection but not hierarchically.
- Chopper cores- evidence of modification to one edge opposite a cortical 'grip'.
- Proto-Levallois
- Levallois

The intersection of handaxe roughout and core is subjective (McNabb, 2007:329), but where a handaxe attempt has clearly been abandoned these have been classed as roughouts. Where it is more subjective, and the nodule could have been worked as a core, this has been recorded with a note of the potential of the artefact to be a roughout.

The work of Ashton *et al.* (1992b) concluded that the classification of chopper tools is arbitrary, and the artefacts are primarily cores not tools. Warren's (1926; 1951) definition of chopper tools (artefacts with a zigzag edge opposite a thick back, adapted to be grasped in the hand) was rejected for this research as being too broad in line with Ashton *et al.* (1992b). A restricted definition concordant with the original by Lartet and Christy (1865-75) (artefacts with one end of a core worked unifacially or bifacially opposite a cortical edge) was used to discuss possible chopping tools and assess why certain assemblages may have been classed as Clactonian.

Core episodes- The sequences of working were interpreted, and the cores were divided into reduction episodes (Ashton and McNabb, 1996b:244). This process interrogates the history of the core rather than focusing on a static end shape (Ashton, 1998b:205).

Reduction episodes were characterised as follows (Figure 3.4):

- Single removal, Type A- Single removal from the surface of the core, linked to other core episodes.
- Parallel flaking, Type B- Two or more removals in a parallel direction from the same or adjacent platform.
- Alternative flaking, Type C – One or more removals form the platform or platforms of the next set of removals. The core is turned at least once but could be turned multiple times.

- Unrelated single removal, Type D- Single removal that cannot be associated with any other removal.

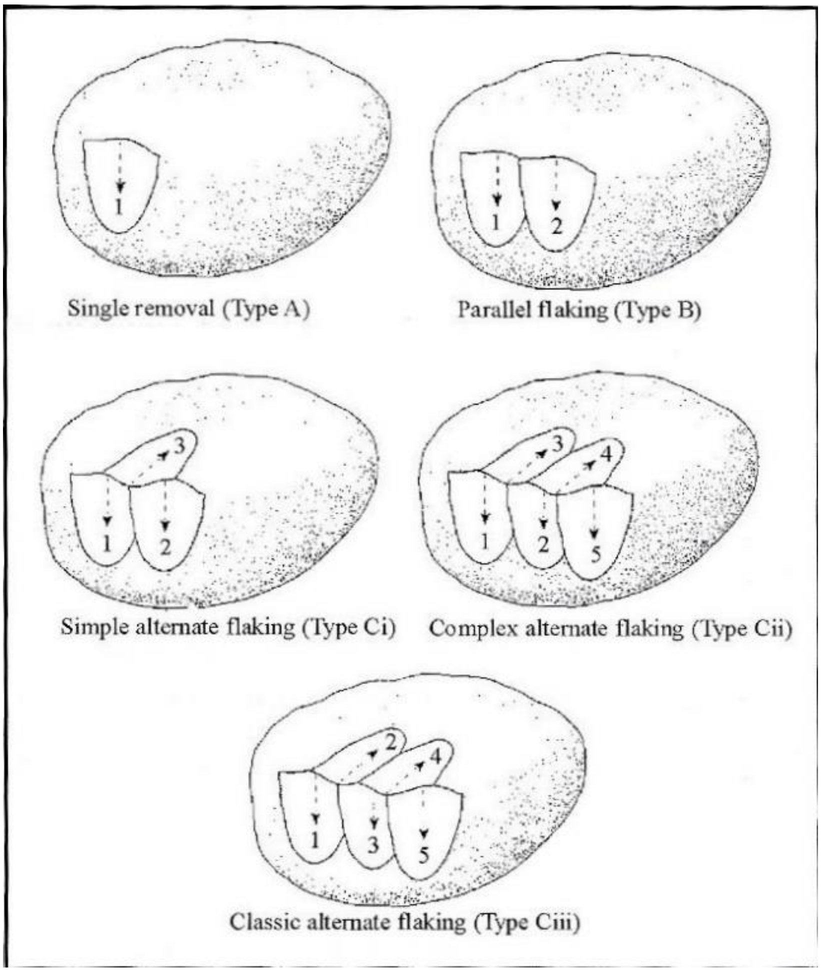


Figure 3.4 Core episodes (Scott, 2011:217 after Ashton and McNabb, 1996c).

The number of removals per episode was also recorded.

The method for analysing cores is detailed by McNabb (2007:324), with the researcher starting with the final (often most complete scar) and tracing the sequence backwards until a full episode has been recorded. This is then repeated with all episodes and recorded in order of how they relate to each other.

Cortex- The amount of remaining cortex was recorded to evaluate the level of exploitation.

3.5.3 Flake tools

This research aimed to identify flakes that have been fashioned into tools through retouch or edge modification (Tixier, 1974; Inizan *et al,* 1999:81). It is important to recognise the difference between genuine retouch and natural edge damage that can occur in derived assemblages especially within gravel contexts (Lord, 1993:22; Baumler, 1995:14; Andrefsky, 1998:79; Inizan *et al.,* 1999; McNabb, 2007: 338). Bosinski (1995:263) argued that it is difficult to separate natural damage from worked flint, and Wenban-Smith (1998:91) has noted that flake tools previously identified by older studies would now be dismissed as natural edge damage. Additionally, while unretouched flakes can be used as tools, these are separate to flake tools (McNabb, 2007).

Previous work on British Lower Palaeolithic flake tools has often been limited to typological descriptions, rather than in-depth studies with clear methodologies for their analysis (Ashton and McNabb, 1996c; Ashton, 1998d; White and Plunkett, 2004). This is in part due to the low numbers of flake tools and the perception of their lack of significance. The complexity, and arguably unsuitability for the British Lower Palaeolithic, of Bordes' (1961) typology has meant it has rarely been implemented in full (Debenath and Dibble, 1994). Bisson (2000:43) has argued that Bordes (1961) should only be used as a way of 'systematic organisation' and not an end in itself.

Following Bisson (2000:43), this study, whilst incorporating elements of Bordes' (1961) typology, attempts to go beyond it, and focus more on technological analysis used by Inizan *et al*. (1999), Scott (2011) and Malinsky-Buller (2016a;2016b), especially invasiveness and regularity. Malinsky-Buller (2016a) differentiated between true scrapers and flakes with simple retouch. Whilst distinct categories will not be used in the same way in this thesis, the presence of 'elaborate' flake tools will be discussed. Elaborate flake tools are defined as flake tools which show evidence for higher levels of invasive retouch, regularity, longer sequences of retouch and complex forms (which include double scrapers, convergent scrapers and bifacial working). It is hoped that these methods will help evaluate the extent and character of retouch in a more appropriate way for the Lower Palaeolithic and show more nuanced variation.

A judgement was made on artefacts that could be classed as handaxes made on flakes or more invasively worked flake tools. Examples that clearly had a bulb of percussion and were retouched were classed as flake tools. The potential of a false dichotomy is discussed in Chapter Seven.

The following attributes were recorded (Inizan *et al.*, 1999; Scott, 2011):

Length, width and thickness of flake tool- Recorded in mm.

Length of retouch- Recorded in mm.

Typology- Flake tools were divided into scrapers, notches and denticulates. The scrapers were further sub-divided into side-scrapers, end-scrapers, convergent scrapers, double scrapers and convergent/unifacial scrapers, with more unusual forms also being noted.

Location of retouch- Recorded the part of the flake retouched:

- Distal
- Proximal
- Right
- Left
- Continuous except butt
- Continuous
- Both edges

Position of retouch- Recorded where the flake has been retouched in relation to the dorsal surface (Figure 3.5):

- Direct- Retouch on the dorsal surface (1).
- Inverse- Retouch on the ventral surface (2).
- Alternate- Retouch on opposite edges on both faces (3).
- Bifacial- Retouch of both faces on the same edge (4+5).

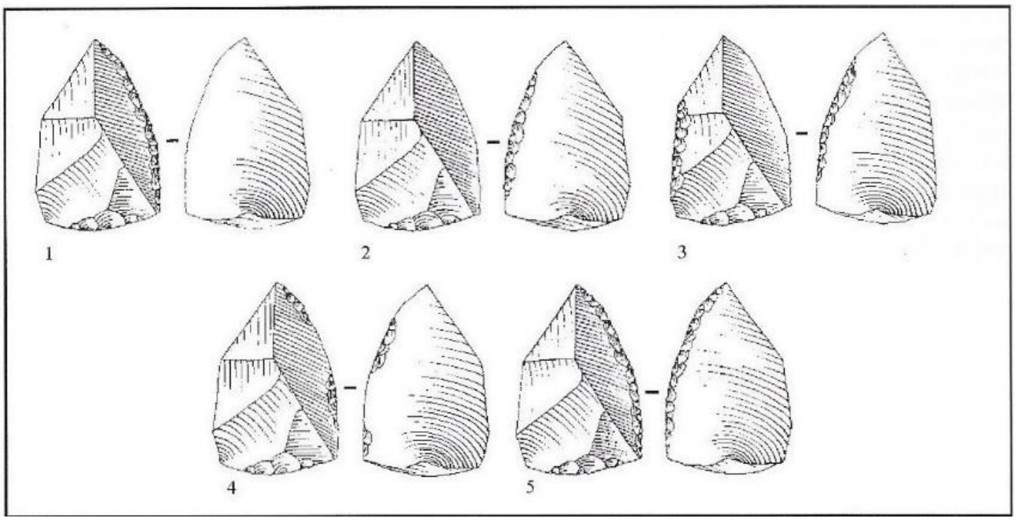


Figure 3.5 Position of retouch (modified after Inizan *et al*., 1999 and Scott, 2011).

Distribution of retouch-Recorded whether the retouch is continuous or more *ad hoc* (Figure 3.6):

1. Continuous
2. Discontinuous

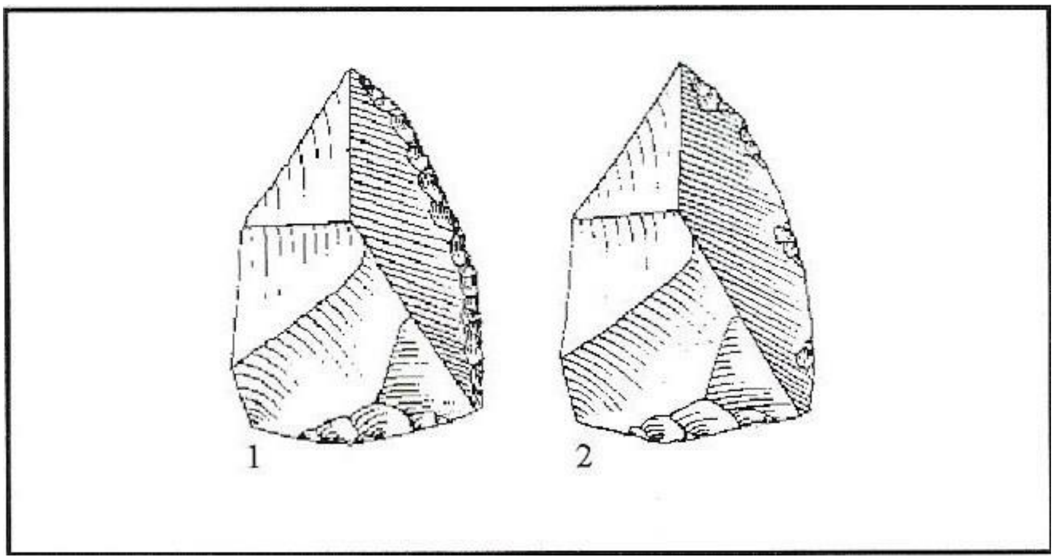


Figure 3.6 Distribution of retouch (modified after Inizan *et al.,* 1999 and Scott, 2011).

Angle- Recorded to measure the angle of retouch:

- Abrupt (approaching 90^o)
- Semi-abrupt (c.45^0)
- Low

Regularity of retouch- Recorded to show the difference between purposefully created tools and more arbitrary removals:

- Regular
- Irregular

Form of retouched edge- (Figure 3.7):

1. Rectilinear
2. Convex
3. Concave
4. Notch
5. Denticulate

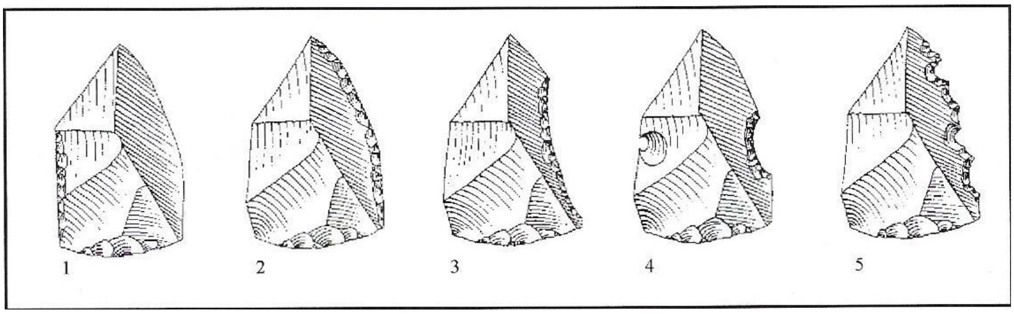


Figure 3.7 Form of retouched edge (modified after Inizan *et al*., 1999 and Scott, 2011).

Extent of retouch- Recorded to establish level of working (Figure 3.8):

1. Minimally invasive- evidence of retouch but limited to small removals from the edge.
2. Semi-invasive- evidence of retouch further into the surface, but large areas still natural.
3. Invasive- evidence of larger or more dedicated retouch across a large proportion of the surface.

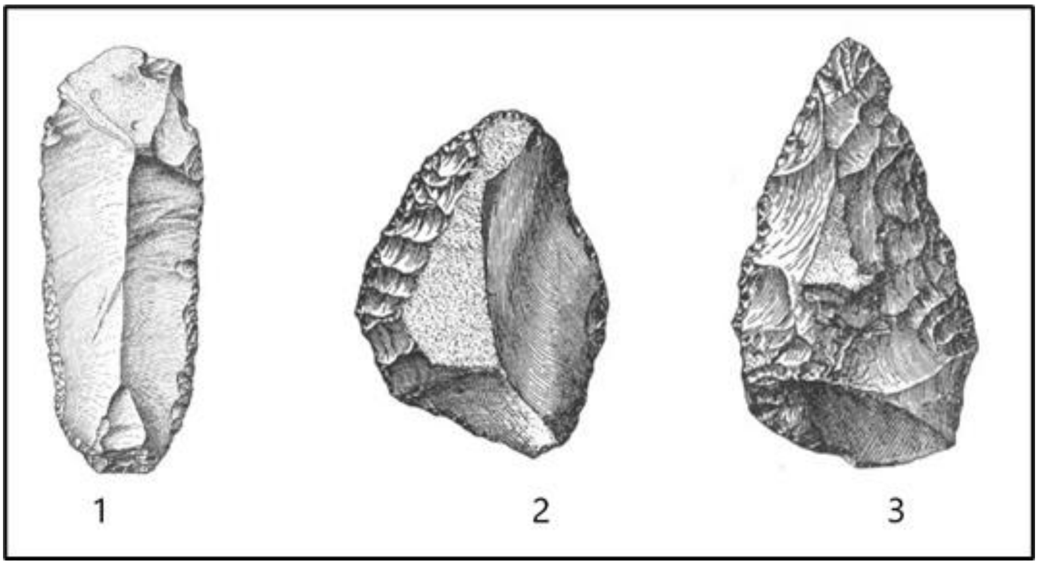


Figure 3.8 Extent of retouch (Examples from Kelley, 1937).

Morphology of retouch- Recorded to compare between tools and show the variety in styles of retouch (Figure 3.9):

1. Scaly
2. Stepped
3. Parallel
4. Sub-parallel

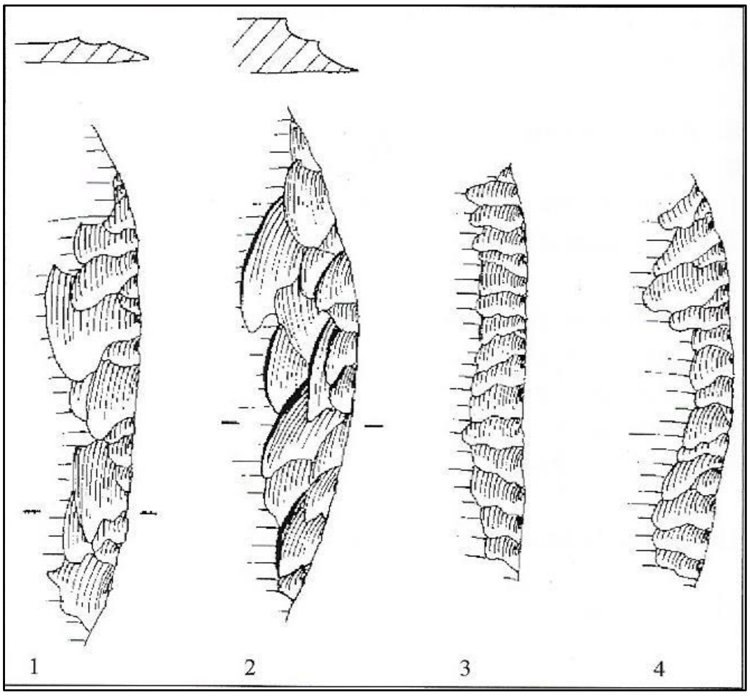


Figure 3.9 Morphology of retouch (Scott, 2011:224).

3.5.4 Prepared core technology (Cores)

Boëda's (1986;1995) list of criteria was used to evaluate prepared cores (Figure 3.10). When examining cores, Boëda's (1986;1995) criteria has been treated as a guide rather than a checklist. This was especially relevant for earlier PCT that lack the control of the distal and lateral convexities in line with White and Ashton (2003). Baumler (1995:19) argued that all cores have some degree of preparation and should be viewed as a spectrum. Even if Levallois was defined in a more restrictive way, the genuine signature of variation cannot be ignored and this needs to be considered (Baumler, 1995:20). Cores have been examined in a way to reflect this variation.

The following characteristics were recorded for Proto-Levallois and Levallois cores, some elements are stripped back from Scott (2011) as more diverse and complex forms of preparation were not present:

Length, width and thickness- Recorded in mm along the primary axis of preferential removal.

Typology- Recorded whether the core was Levallois, Proto-Levallois or uncertain.

Blank type- Recorded original nature of raw material.

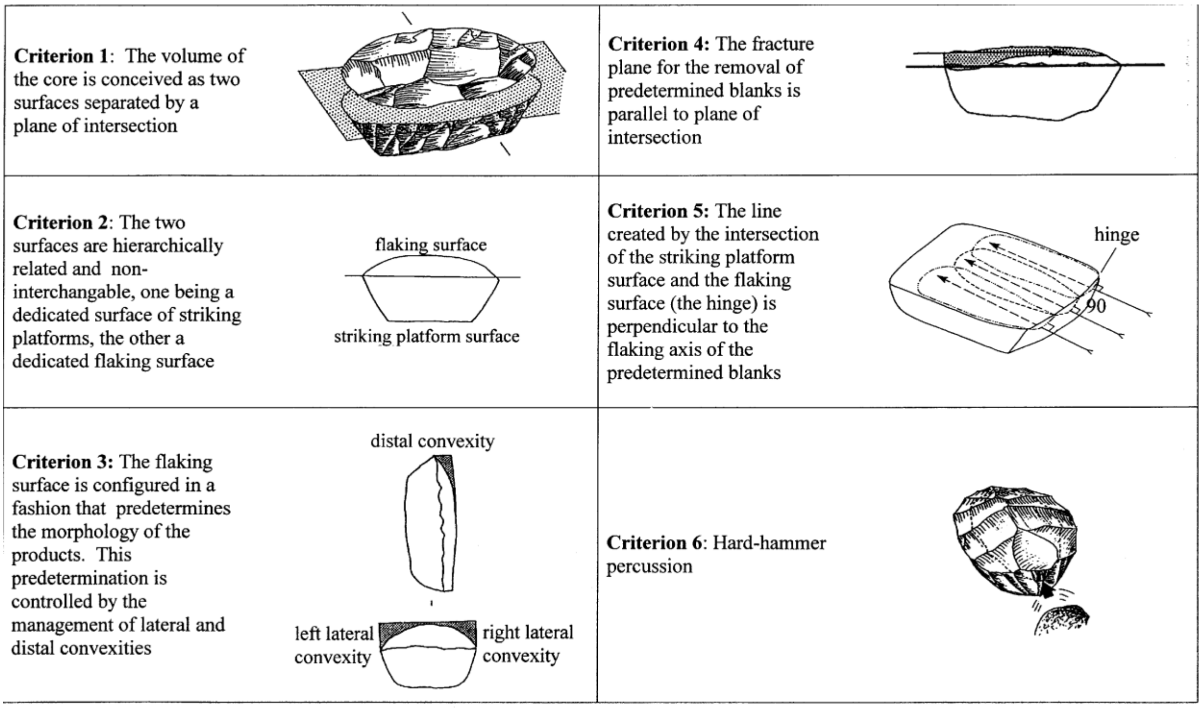


Figure 3.10 Boëda's Levallois criteria (White and Ashton, 2003:602 after Boëda, 1995).

Method of exploitation- Recorded the scars of preferential removals (Figure 3.11):

- Unexploited-Conforms to Levallois or Proto-Levallois but lacks evidence of preferential removal (1).
- Lineal- Single flake removed (2).
- Recurrent-Two or more preferential removals (3-5)
- Re-prepared but unexploited- Similar to unexploited but with previous evidence of removals (6)

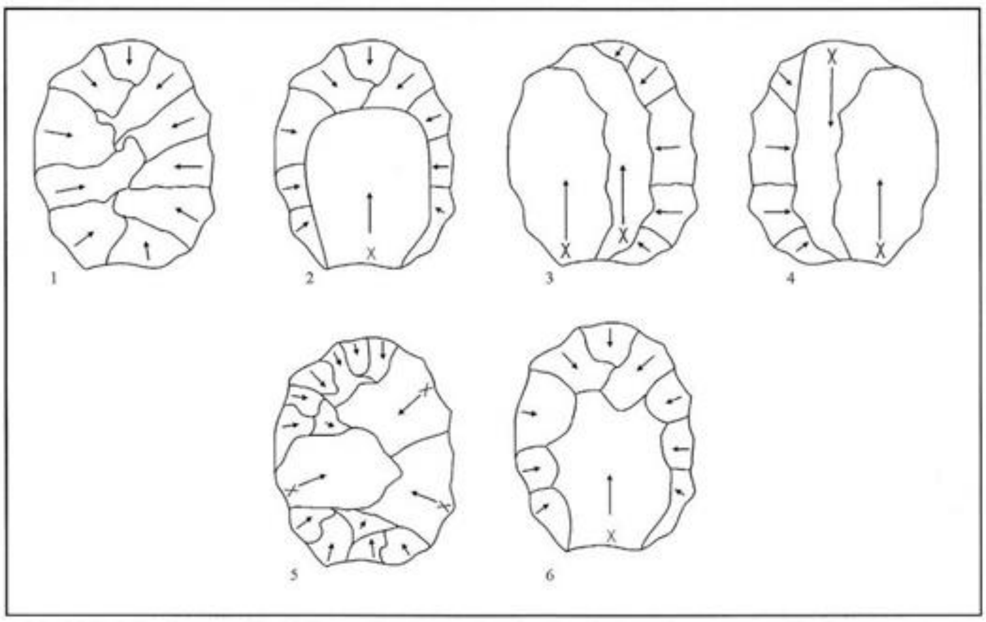


Figure 3.11 Method of exploitation of final flaking surface (after Scott, 2011:215).

Method of preparation of final flaking surface- Recorded pattern of preparatory flake scars preceding the preferential removal on the flaking surface (Figure 3.12):

1. Unipolar
2. Bipolar
3. Convergent
4. Centripetal

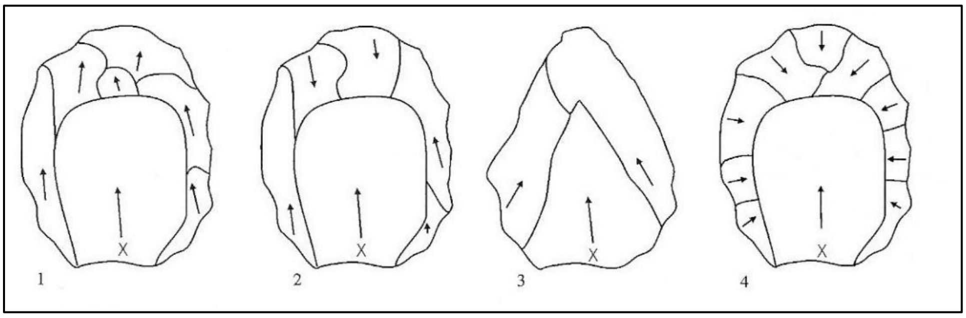


Figure 3.12 Method of preparation of final flaking surface (after Scott, 2011:214).

Evidence of previous flaking surface- Recorded evidence of previous phases of Levallois or Proto-Levallois working.

Morphology of products- Evaluated the typology of subsequent:

- Flake
- Point
- Blade
- Unexploited

Number of Levallois/preferential flake scars.

Length and width (mm) of preferential flake scars.

Number of preparatory flake scars on final flaking surface- Recorded to measure the extent of preparation.

Number of preparatory flake scars on final striking platform surface- Recorded to measure the extent of preparation.

The distinction between Proto-Levallois and Levallois often lies within the preparation of lateral and distal convexities the following were recorded to analyse this difference.

Pattern of additional accentuation of convexities - Provides evidence for more developed Levallois distinguished from Proto-Levallois (Figure 3.13):

- None
- Distal
- One lateral edge
- Both lateral edges
- Distal and one lateral edge
- Distal and both lateral edges

Description of additional accentuation of convexities - Extent of convexities used to control the core:

- Invasive
- Semi-invasive
- Minimally invasive
- Mixed
- None

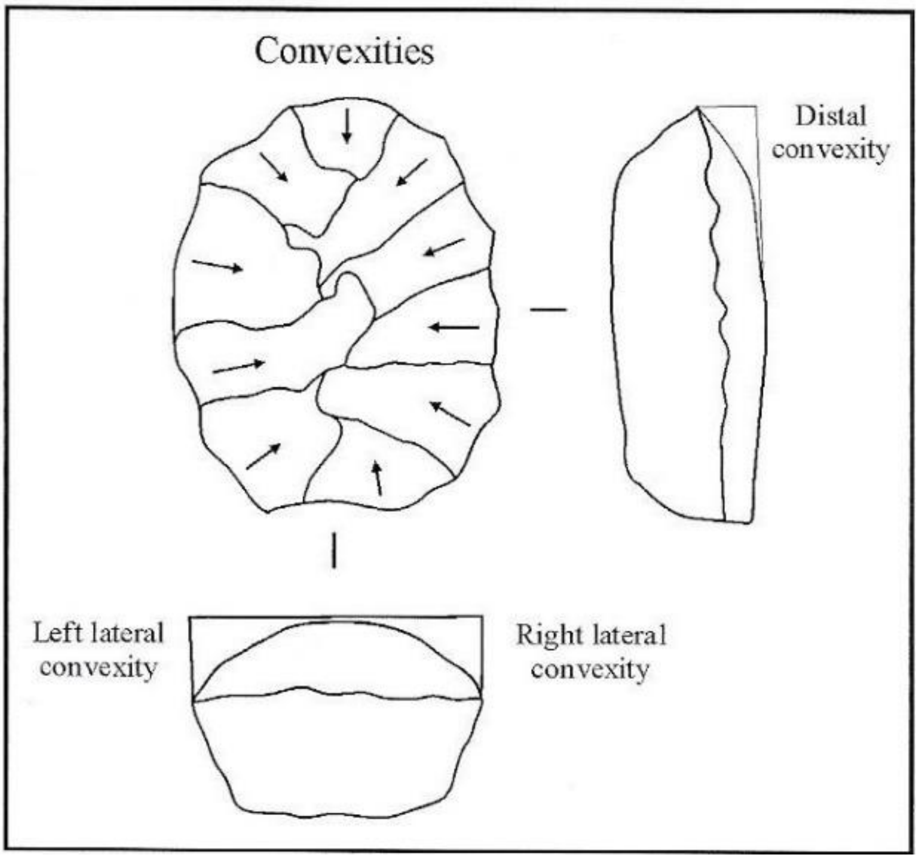


Figure 3.13 Schematic of distal and lateral convexities linked to Levallois working (Scott, 2011:213).

Distribution of preparatory scars on striking platform surface- Recorded extent and style of preparation:

- None
- Distal
- Right
- Left
- All over
- Distal and one edge
- Distal and both edges
- Proximal and distal
- Proximal
- Proximal and one edge
- Proximal and both edges

Percentage of cortex on the striking platform surface.

Position of cortex on striking platform surface- Recorded how prepared the striking platform surface was:

- None
- One edge only
- More than one edge
- All over
- Central
- Central and one edge
- Central and more than one edge

3.5.5 Prepared core technology (Products)

The identification of Levallois products, and Proto-Levallois flakes in particular, is problematic as they can resemble handaxe flakes (Sellet, 1995:26-27). The presence of Levallois flakes within Acheulean contexts should therefore be treated with caution, and while it may be possible to find convincing examples, higher quantities and/or prepared cores are needed to clearly demonstrate an industry. Roe (1981:80) illustrated this point with material at Barnfield

Pit which contained no cores but a handful of ‘Levallois flakes’. Due to the sparse nature this site cannot be used to demonstrate Levallois in a traditionally Acheulean assemblage.

The main issue is that Proto-Levallois flakes often lack Levalloisian characteristics, with less prepared butts and only a flat profile being a strong indicator (Malinsky-Buller, 2016b). It is therefore likely that counts are low due to this issue, especially in secondary context sites.

To confidently identify Levallois flakes, Scott (2011:218) presented the following checklist:

- Hard hammer percussion.
- Large number of dorsal scars, particularly in a complex pattern.
- Removed from the surface rather than the volume of the core, making the flake relatively flat.
- Signs of distal and lateral convexities being controlled.
- May retain evidence of faceting or other methods of platform preparation.
- May retain evidence of deliberate convexity accentuation, including small peripheral flake scars.

Levallois products were examined for retouch and were also treated as flake tools if identified.

Even though this method improves on older typological approaches which were focused on regularity of flakes, platform faceting and the pattern of scars (Bordes, 1961), the problem of equifinality still remains and there is no clean cut between non-Levallois flakes and Levallois flakes (Sellet, 1995:27). Due to this, the certainty of flakes being a Levallois product was recorded as (Scott, 2011:218):

- Possible
- Probable
- Definite

In addition to the information for regular flakes, the following observations were recorded:

Butt type- Recorded in line with regular flakes (Figure 3.3), but usually:

- Faceted
- Dihedral
- Plain
- Broken

Morphology of product- Recorded to access whether cores at certain sites were being used to produce certain products:

- Flake
- Point
- Blade
- Indeterminate

Number of previous Levallois removals- A record of previous Levallois removals evidenced by invasive scars which cut previous preparatory flake scars (Scott, 2011:219). This was to investigate the prevalence of prepared cores being reused for further flakes.

Number of preparatory scars- A count of the scars that were used to prepare the preferential flake removal, measuring the level of preparation.

Remaining Cortex- Recorded as percentage to assess level of previous work.

Method of exploitation- Based on the positioning of previous scars, and whether the flake can be determined to be the only removal (Scott, 2011:220). This examines the way the cores were utilised to create preferential flakes (Figure 3.14):

1. Lineal- No previous Levallois flake scars, removed complete flaking surface.
2. Single removal- No previous Levallois flake scars, core could be exploited again without re-preparation.
3. Unipolar recurrent- One or more Levallois removals on the same axis.
4. Bipolar recurrent- One or more Levallois removals in in either opposition or both opposition and the same direction to the flake.
5. Centripetal recurrent- One or more Levallois removal removed in various directions.
6. Indeterminate- Not possible to classify exploitation phase.

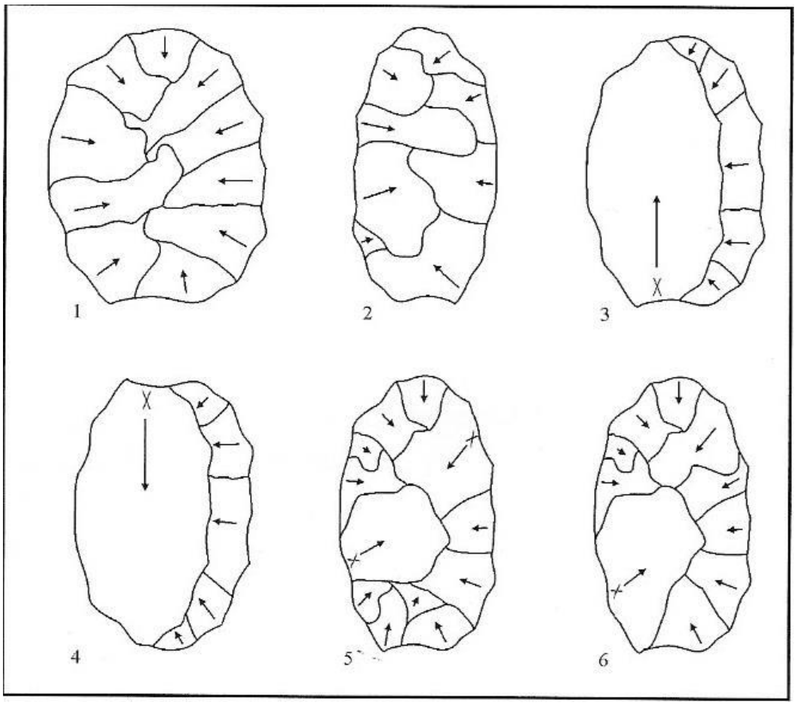


Figure 3.14 Scar patterns indicative of method of exploitation (after Scott, 2011:220).

Method of preparation- Inferred from the direction of the preparatory flake scars (Figure 3.15):

1. Unipolar
2. Bipolar
3. Convergent unipolar
4. Centripetal

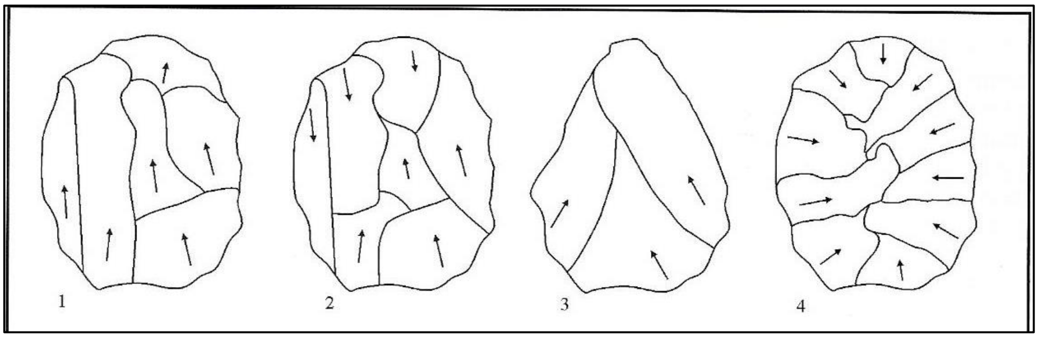


Figure 3.15 Method of preparation as indicated by dorsal scar pattern of Levallois flakes (Scott, 2011:220).

Pattern of additional accentuation of convexities- Flakes that overshoot may retain evidence of accentuation of distal and lateral convexities (Scott, 2011:221), key to differentiating Proto-Levallois and developed Levallois:

- None
- Distal
- One lateral edge
- Both lateral edges
- Distal and one lateral edge
- Distal and both lateral edges

Description of additional accentuation of convexities - Measured to what extent accentuation of convexities shaped the core, and could show the difference between Proto-Levallois cores and Levallois cores:

- Invasive
- Semi-invasive
- Minimally invasive
- Mixed

3.5.6 Handaxes

The focus of this thesis is not on handaxe variation, and the handaxes from MIS 9 have been studied by Luke Dale whose work shall compliment this thesis with an appraisal of handaxes during MIS 9. Data from Dale (Pers. Comm. 2021) will be used for comparison in the discussion and could inform the dating of sites where other factors are lacking.

3.5.7 Refitting

Assemblages were examined for refits where possible, but most sites do not enable extensive refitting (Inizan *et al.,* 1999:94).

3.6 Summary

The methodology outlined in this chapter demonstrates an adaption of various methodologies used over recent decades based on a technological approach (Ashton and McNabb, 1996c; Ashton, 1998d; White and Plunkett, 2004; Scott, 2011). This was done in order to utilise tried and tested methods whilst ensuring relevance to the current research questions. This approach has ensured that the results of this thesis (Chapter Five) were comparable to studies covering adjacent periods in order to examine the change and continuity seen during the Lower-Middle Palaeolithic as discussed in Chapters Six, Seven and Eight.

Chapter Four: Site Backgrounds

This chapter presents essential background information on the sites analysed in this thesis, selected according to the criteria set out in Chapter Three. The results are presented in the succeeding chapter which will form the basis of later discussion chapters. The following should not be considered exhaustive, and focus is placed on justifying the inclusion of sites in the study, as well as providing information relevant to the research questions laid out in Chapter One. The sites are presented geographically as MIS 9 sites cluster around a number of locations, many of which show regional similarities.

4.1 Thames

The Thames is the most prolific area for archaeology assigned to MIS 9. Most are known from historic records which were synthesised in both Wymer (1968) and Roe (1981), with later re-evaluation of chronology during Bridgland's (1994) work on Thames. The historic focus on the Thames has meant that it contains all five of the 'flagship sites' (Purfleet, Stoke Newington, Cuxton, Globe Pit and Wolvercote). In addition to these well-known sites, there are a number of lesser known sites which expand our understanding of the Thames during MIS 9.

4.1.1 Essex (Lower Thames)

The following sites centre around Thurrock, Essex and have been central to developing our understanding of the archaeology of MIS 9.

Purfleet

Purfleet, Essex is a series of Palaeolithic sites within the fluvial sands and gravels of the Corbets Tey terrace in the Lower Thames (Figure 4.1) (Bridgland *et al.,* 1995). Purfleet is comprised of four pits: Bluelands, Greenlands, Esso and Botany (Bridgland, 1994; Bates *et al.,* 1998: 72). The Purfleet deposits are known for their tripartite structure showing evidence of 'Clactonian', Acheulean and Levalloisian industries, as well as faunal remains (Bridgland *et al.,* 2013:419). The significance of Purfleet to MIS 9 is demonstrated by its unofficial label 'The Purfleet Interglacial' (McNabb, 2007:162).

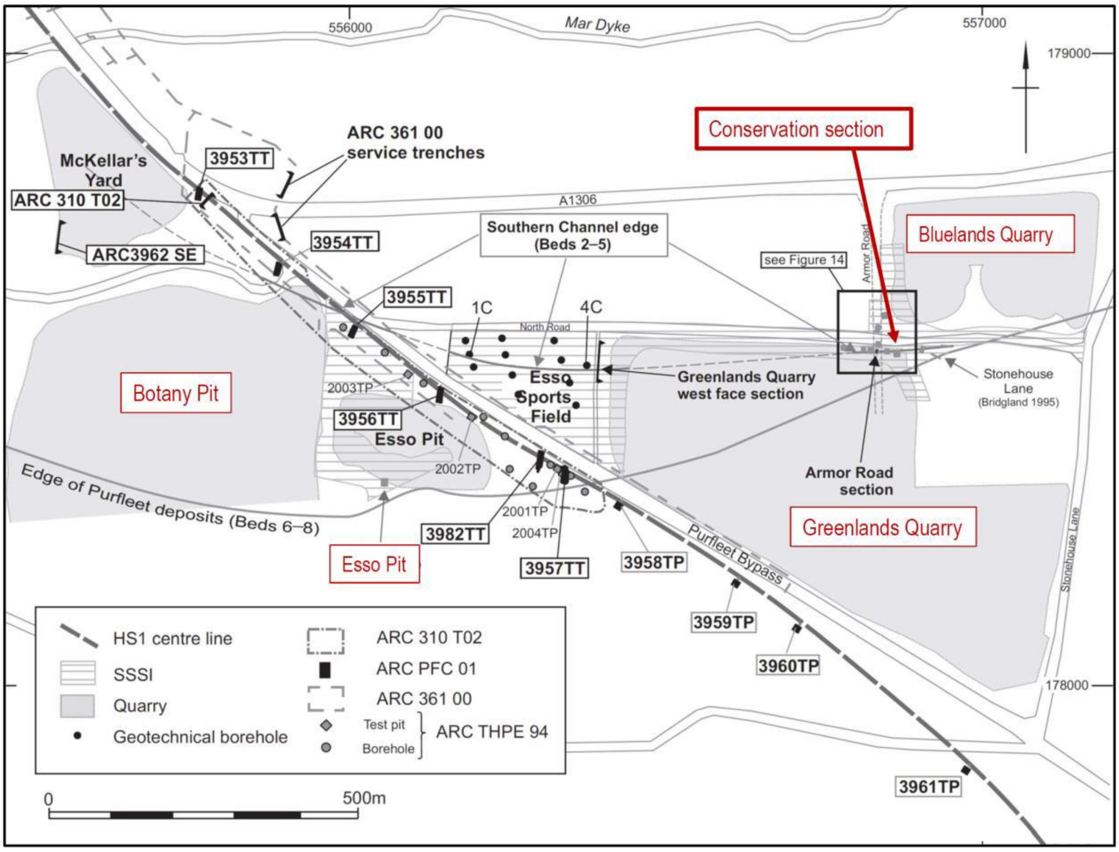


Figure 4.1 Map of the Four Pits at Purfleet from the HS1 work (Schreve *et al.,* 2019:107).

Excavation history

The first reference to Purfleet was made by Dewey *et al.* (1924:54), but no systematic work was carried out until Andrew Snelling's work in the 1960's at Botany Pit (Wymer, 1968; Snelling, 1975). Later in the 1970's, Palmer (1975) opened a section in Greenlands Pit exposing rich shell beds with molluscs and mammalian fauna, alongside archaeology from small excavations at both Bluelands and Greendlands Pits. It is unknown when Esso Pit was originally excavated, but it appears to show similarities to Botany Pit and several artefacts were excavated in 1986 by the Geological Conservation Review (Schreve *et al.* 2002:1425). A series of trial trenches were excavated in 1993 by the Field Archaeology Unit of Essex County Council which recovered vertebrate remains and lithics (Hollman, 1995; Bridgland *et al.,* 1995). Further excavations were undertaken in 1995 and 1996 in Greenlands Pit (Bates, 1998), in 1997 with the Armor Road extension (Schreve *et al.,* 1998:2) and most recently excavations were undertaken by Bridgland *et al.* (2013) relating to work on HS1.

Geology

The Purfleet sediments were once thought to have been a terrace of the Mar Dyke (Wymer, 1968:312; Palmer, 1975), but are now considered an abandoned meander loop of the Thames (Bridgland *et al.,* 2013). Bridgland (1994:218) described the Purfleet deposits as complex, with interglacial sediments laid down between two cold stage gravels, exposed over the four pits. Bluelands and Greenlands Pits reveal the edge of a river channel up to one kilometre wide and five meters deep (Bridgland *et al*., 2013:438). A detailed description of the Purfleet sequence has been given in Chapter Two and is summarised in Table 4.1.

Member	Bed	Thickness	Archaeology	Pit	Environment
Botany Member	8. Botany Gravel	2m	Proto-Levallois/Levallois	Greenlands, Bluelands, Botany	Cold?
	7. Grey-brown silty clay, weathered	<0.75m			Temperate?
Purfleet Member	6. Bluelands Gravel	Up to 6m	Acheulean	Bluelands, Greenlands,Esso, Botany	Cold?
	5. Greenlands Shell Bed	Up to 2m	? a few flakes		Temperate
	4. Laminated Silty Clay	<0.25m			Temperate
	3. Shelly Gravel	<0.75m	Non-handaxe (cf. Clactonian)	Greenlands,Bluelands	Temperate
Little Thurrock Member	2. Little Thurrock Gravel	<0.4m	Non-handaxe (cf. Clactonian)	Greenlands,Bluelands	Cold
	1. Angular chalk rubble (Coombe Rock) lying on Chalk	1m	Non-handaxe (cf. Clactonian)	Greenlands,Bluelands	Cold

Table 4.1 Summary of geology, archaeology and environments from Botany Pit (modified after White and Bridgland, 2018:170).

Dating

Snelling (1975) argued that the interglacial sediments were Hoxnian based on the molluscs and the presence of *Valvata piscinalis,* a species unrecognised in post-Hoxnian sites. Schreve *et al.* (1998:8) have since questioned the importance of this indicator. Palmer (1975:12) argued that Purfleet was a similar age to Swanscombe, although the Levallois was considered younger, a conclusion also supported by Snelling (1975). Based on pollen, Hollin (1977:38) correlated the site to the Ipswichian. When examining the evidence from molluscs alongside surface heights, Allen (1977) concluded that the site represented a new interglacial. The mammalian fauna from Purfleet is distinguishable from both the Hoxnian and the Ipswichian, and Schreve (1997) used the site to create the Purfleet MAZ. Based on the revised terrace model of Bridgland (1994:228), as well as the examination of mollusc and vertebrate remains, Purfleet is now considered to span MIS 10-8 (Schreve *et al.* 2002:1426; Bridgland *et al.,* 2013: 419; Schreve *et al.,* 2019). Additionally, OSL dates by Eddie Rhodes have given an age of ~324 ka BP (Pettitt and

White, 2012:257), and further OSL and AAR dating has suggested a MIS 9 date (Penkman *et al.,* 2011, 2013). It is debated whether the sequence at Purfleet represents the whole of the MIS 9 interglacial, or only a substage (Bridgland *et al.,* 2013). This has wide ranging implications for the archaeology.

Archaeology (Botany Pit)

Purfleet has been used as a benchmark for the first appearance of PCT in Britain since the discovery of Proto-Levallois and Levallois amongst the thousands of artefacts recovered at Botany Pit (Bates *et al.,* 1998:72; Bridgland *et al*., 2013:419). Sediments at Botany Pit were composed of ~3.4m of sand and gravel laying on chalk bedrock 10 m OD, correlating with the top of the Bluelands and Greenlands sections dating to late MIS 9-8 (Bates *et al.,* 1998:72; Bridgland *et al.,* 2013). Roe (1968a) noted that material from Botany Pit included 12 handaxes, 175 non-Levallois cores, 1005 retouched flakes, 2419 flakes, 98 Levallois cores and 31 Levallois flakes. Despite claims of flake tools from the site, Wymer (1985:313) observed that the Snelling material showed little secondary working of the flakes. Nevertheless, handaxes made on flakes are present (White and Ashton, 2003:603). The Snelling collection was examined by White and Ashton (2003) which found that there were three methods of core working: MPC (49%), Proto-Levallois (43%) and discoidal (8%). White and Ashton (2003) demonstrated the significance of this new form of core working but flakes with signs of preparation were scarce. Other studies by Scott (2011) and Bolton (2015) came to similar conclusions with the terms Proto-Levallois or SPC often being used to describe the prepared cores.

Archaeology (other locales)

Palmer's (1975) excavations at Bluelands and Greenlands Pits expanded the work at Botany and indicated the presence of three industries (Bates *et al.,* 1998:72). Greenlands Pit produced a few finds whilst Bluelands Pit contained three layers of gravel with Palaeolithic implements (Palmer, 1975:4). Despite different layers with technological differences, Palmer (1975:5) treated Purfleet as one Acheulean assemblage with a 'Clactonian element' (Schreve *et al.* 2002:1424). Wymer (1985: 312) suggested a tripartite sequence which was established through further work by Schreve *et al.* (2002), showing the non-handaxe layers overlain by Acheulean layers which are further overlain by layers containing PCT (Bridgland et al., 2013:419).

The Little Thurrock gravel (Beds 1-3) in Bluelands and Greenlands Pits yielded a non-handaxe assemblage (Figure 4.2) dominated by hard hammer flakes from MPCs with some flake tools (Bridgland *et al*., 2013:456). A chopper core is noted, but no evidence of handaxe manufacture has been found (Schreve *et al.,* 2002:1451). McNabb (2007) has questioned the non-handaxe classification due to the low number of artefacts (around 100 cores, flakes and flake tools), but these have come from numerous excavations and are distinct from a slightly larger Acheulean assemblage (Bridgland *et al.,* 2013). Furthermore, the layers can also be correlated to the non-handaxe site of Little Thurrock (Schreve *et al.,* 2019). Schreve *et al.* (2002:1451) claimed that the Clactonian at Purfleet was a "moot point", as recent excavations have not recovered enough material to re-evaluate it.

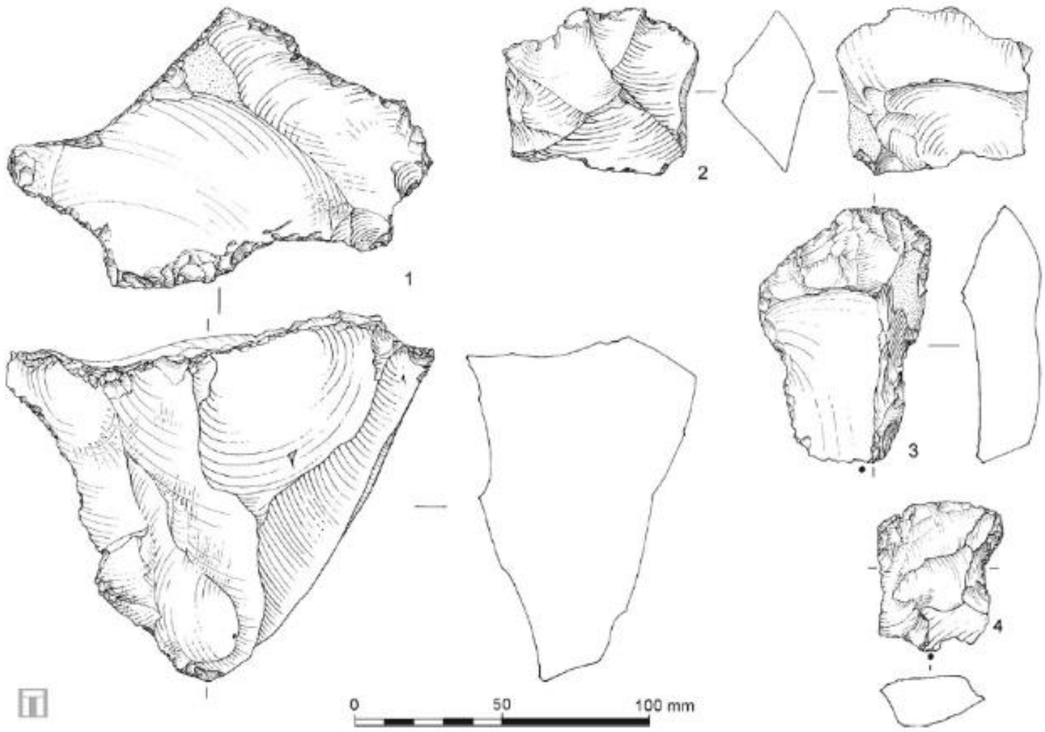


Figure 4.2 Non-handaxe artefacts from the Little Thurrock gravel Beds 1-3 (Bridgland *et al.,* 2013:453).

Despite being the least contentious, White and Bridgland (2018) pointed out that the Acheulean is the most underrepresented signature at the site. The handaxes at the site are few in number and crude (White and Bridgland, 2018). The Acheulean material comes from the Bluelands gravel (Bed 6) in Bluelands and Greenlands Pits (Schreve *et al.,* 2002). During the Schreve *et al.* (2002:1451) excavations, the Bluelands gravel yielded the largest assemblage with 76 artefacts, these were found throughout the layer but with concentrations in the sandy levels above the shell bed and near the cobble band (Figure 4.3; Schreve *et al.,*2002:1452). Palmer (1975:7) noted a large array of flake tools coming from Bluelands and Greenlands Pits, but from the Schreve *et al.* (2002:1454) excavations only three were considered deliberate flake tools.

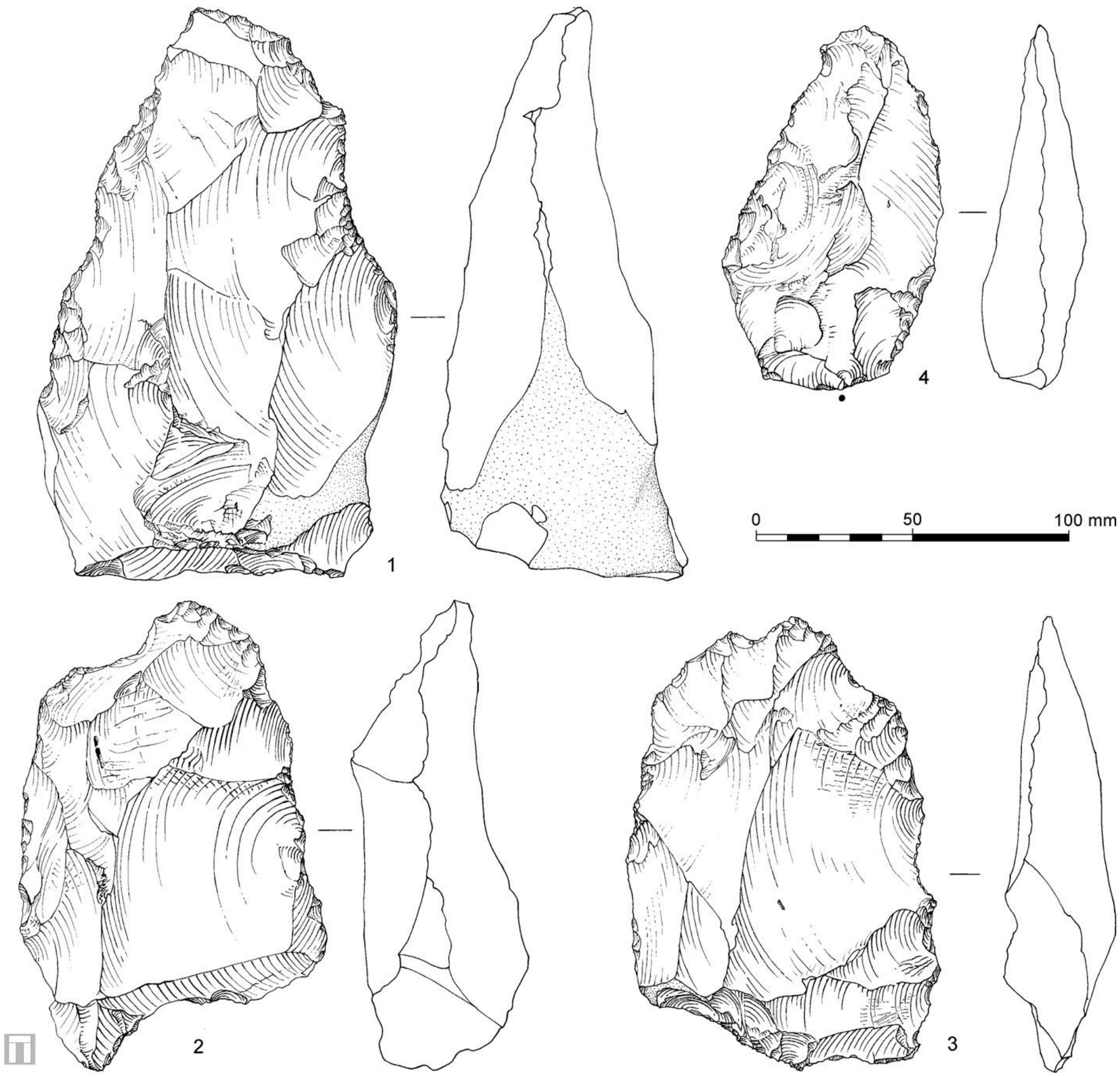


Figure 4.3 Handaxes from Beds 6/8 at Bluelands and Greenlands Pits (Bridgland *et al.,* 2013:461).

PCT has been noted at Purfleet outside of Botany Pit (Figure 4.4). Palmer (1975:12) described the Proto-Levallois at Bluelands and Greenlands Pits as less developed than at Botany Pit. The amount of recorded PCT at Bluelands and Greenlands Pits is small, and none of it appears to be in primary context (Schreve *et al.,* 2002:1455). Two cores reminiscent of Proto-Levallois technology came from recent work at Bluelands (Schreve et al., 2002:1452). During the HS1 works, Beds 6/8 contained evidence of both Levallois cores and handaxes (Bridgland *et al.,* 2013:456). The HS1 collection showed remarkable similarity to that at Botany Pit (Bridgland *et al.,* 2013:457), and work on both collections showed that the cores conformed to Boëda's (1986) criteria apart from criterion three. The Armor Road section showed evidence of a full Levallois technology within the Botany gravels (Bridgland *et al.,* 2013:459), rather than the Proto-Levallois at Botany Pit discussed by Ashton and White (2003). Recently it has been suggested that this could show Levallois technology within MIS 9 during fully interglacial conditions, rather than during the MIS 9-8 transition (Bridgland *et al*., 2013:472).

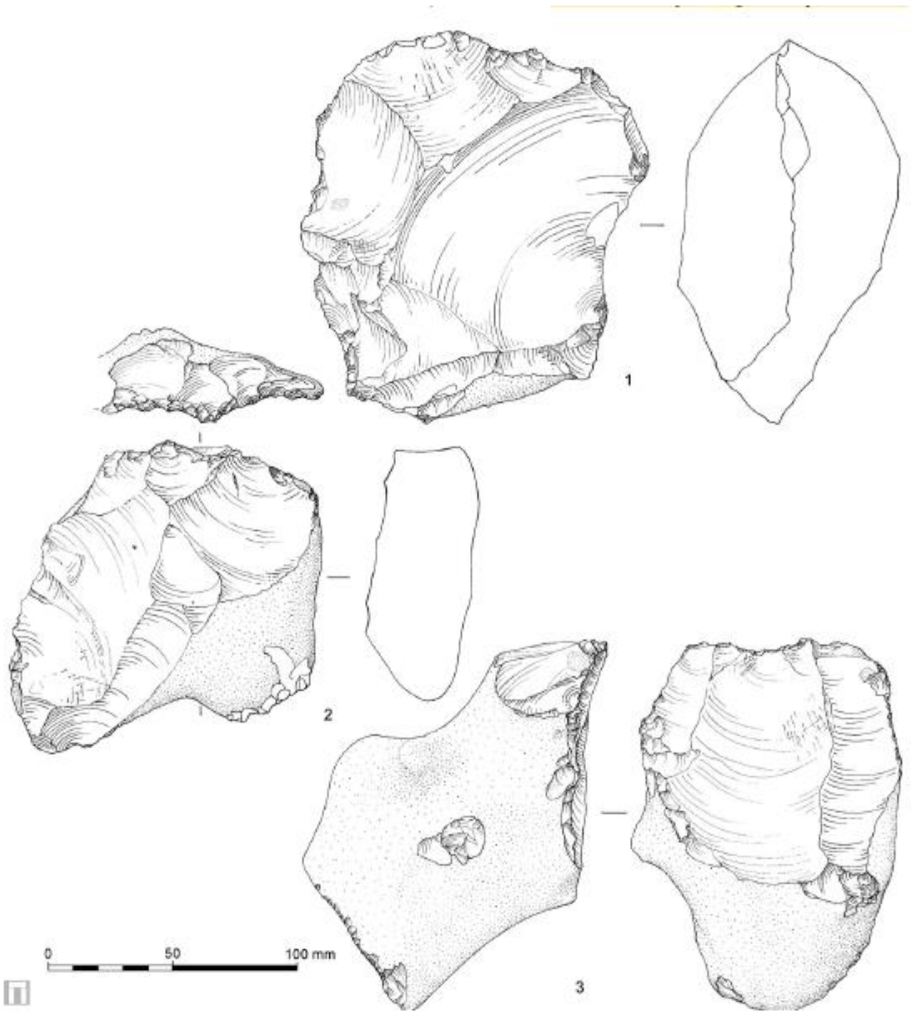


Figure 4.4 Examples of Proto-Levallois from Bluelands/ Botany gravel (Bridgland *et al.,* 2013:458).

Summary

Purfleet is a rare occurrence of a well-dated superimposed chronological sequence showing different industries (Bridgland *et al.,* 2013:458). The absence of Acheulean material below the Bluelands gravels demonstrates an early non-handaxe assemblage, and the PCT can be seen in higher levels. The richness of Botany Pit and connections to PCT also make the site crucial in examining the nature of flake tools in MIS 9. For these reasons, Purfleet is a significant site which could define MIS 9 as the turning point between the Lower and Middle Palaeolithic, and much of this thesis focuses on whether these characteristics are more widespread during MIS 9.

Globe Pit, Little Thurrock

A non-handaxe assemblage, similar to those found in MIS 11, is known from Globe Pit, Little Thurrock (Figure 4.5; Bridgland and Harding, 1993:263). Due to this, the age of the deposits has been controversial, but recent correlation with MIS 9 makes the site key to debates surrounding the non-handaxe assemblages of MIS 9 (White, 2000; McNabb, 2020).

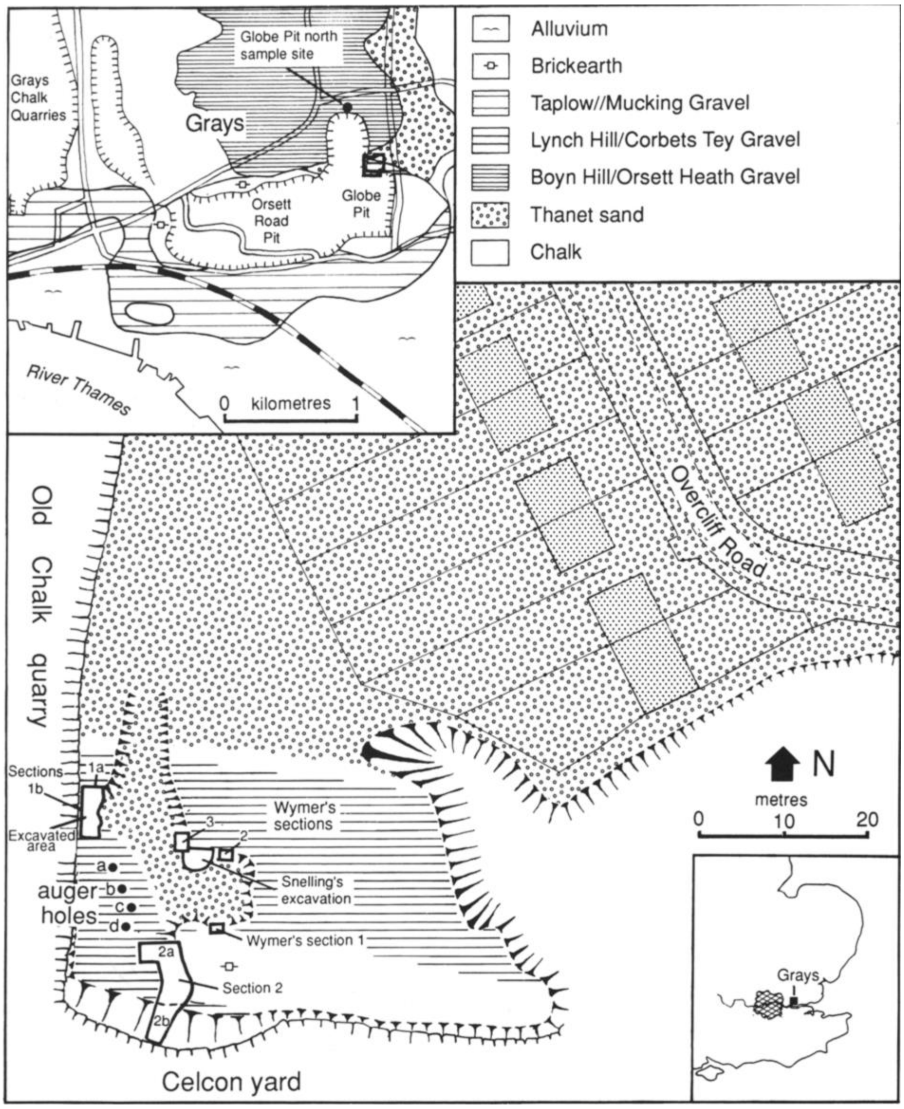


Figure 4.5 Map of Globe Pit, Little Thurrock (Bridgland and Harding, 1993:264).

Excavation history

There is a long history of collection in the area often related to faunal remains at Grays, and early accounts include the work of Spurrell (1892:194) and Worthington Smith (1894:214). Wymer (1968:34) mentioned that his father was collecting 'Clactonian artefacts' at Little Thurrock around 1910. Subsequently, the site has been investigated numerous times, namely by Wymer (1957) in 1954, Hart *et al.* (1960) in 1959, Snelling (1964) in 1961 and Bridgland and Harding (1993) in 1983.

Geology

Globe Pit lies on the feather edge of the Lynch Hill/Corbets Tey formation (Bridgland, 1994:229). Figure 4.6 shows Beds 1-2 made up of ~1m of basal gravel, overlain by ~5m of brickearth (Bed 4) capped by an upper sand and gravel (Bed 5). The basal sand and gravels are well-bedded and interpreted as either a single alluvial aggregation over two benches, Thanet Sands at ~15m OD and ~6m OD on Chalk (Bridgland and Harding, 1993:270), or distinct gravels separated by downcutting and solifluction evidenced in Bed 3 (Conway, 1996:45). Bed 2a is probably unrelated to the other archaeology as it is a heavily cemented and iron-panned erosional surface, with most of the existing material appearing to come from Bed 1 (Bridgland, 1994). While the assemblage was thought to be derived by Bridgland and Harding (1993:274-7), they argued the condition of the artefacts was not indicative of having moved far.

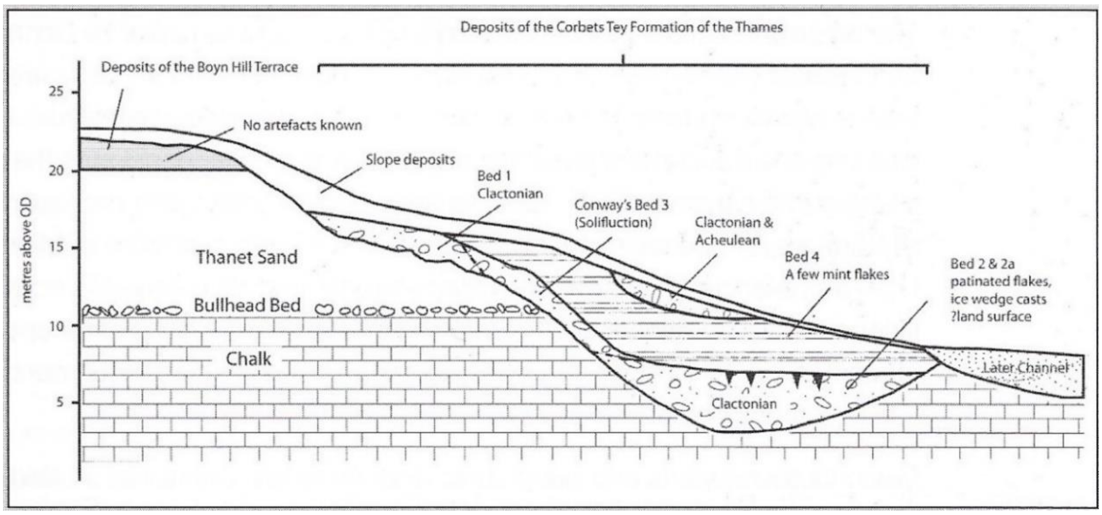


Figure 4.6 Stratigraphy of Little Thurrock (Pettitt and White, 2012:131; after Wymer (1985) Bridgland (1994) and Conway (1996)).

Dating

Globe Pit was originally correlated with the Clactonian at Swanscombe (King and Oakley, 1936; Oakley and Leaky, 1937:240), and aminostratigraphy correlated the site to MIS 11 (Bowen *et al.,* 1989:50-51). This contradicts other lines of evidence, and Wymer (1999:71) dismissed an MIS 11 date on the basis of biostratigraphy and the sites relationship to Grays Thurrock. The gravels have been correlated to the Lynch Hill/Corbets Tey formation and therefore to MIS 10/9 (Bridgland, 1994:237). No faunal remains have been found, but the scarce pollen record from the site shows a distinctly interglacial environment with tree pollen, mainly oak, pine and grasses (West, 1969:278), similar to that at Purfleet (Hollin, 1977:43).

Archaeology

A non-handaxe industry with flakes, cores and flake tools (TERPS recorded 20 cores and 565 flakes as minimum totals) has been recovered from Bed 1. King and Oakley (1936:57; Oakley and Leaky, 1937:255) stated that the only flint artefacts from Little Thurrock were Clactonian in nature. Wymer (1957:161) excavated three areas, half of the finds were slightly rolled with the rest being sharp and a few being mint, and in total 289 flakes and five cores were recovered (Wymer, 1968:317). The assemblage is not heavily derived and shows no evidence for handaxe manufacture (Wymer, 1957:166). Non-classic handaxes and thinning flakes found out of context made Conway (1996:45-46) question if the site could still be called Clactonian. The two non-classic bifaces examined by White (2000:19), along with a number of cores and flakes, are said to have come from Bed 2a, making the connection to the rest of the assemblage uncertain.

Further work has verified the non-handaxe signature. Snelling (1964:201) collected 280 flakes (some with retouch), two hammerstones, two other core tools and two 'waste cores'. Eighty-two artefacts were recovered during the 1983 clearing and 108 the following summer by Bridgland and Harding (1993:267). A possible handaxe thinning flake was recovered but considered unrelated due its distinct condition (Bridgland and Harding, 1993:278). Wymer (1968:317) described some evidence of secondary working but a lack of specialised tools, despite Kennard (1904:112) previously assigning a scraper from the site to 'Le Moustier'.

Summary

Globe Pit is key to understanding the non-handaxe signature of MIS 9, as it is the best preserved and most substantial non-handaxe site dated to MIS 9.

Grays Thurrock

Due to the various sites in the Thurrock/Grays area, the nature of extant material labelled as 'Grays' is complicated. The material listed from Grays is Acheulean in character and is considered to contain a high proportion of flake tools (Roe, 1968a).

Excavation history

Grays, first mentioned in the works of Morris (1836:261), was discovered in the 19th century during the exploitation of large brickyards and tramway cuttings (Figure 4.7; Schreve, 1997:305). Work was undertaken in three different pits – Western, Central and Eastern - the second having a rich mammalian fauna (Morris, 1936:262). Grays is thus discussed in generic terms rather than as a specific locality (Hinton and Kennard, 1900:337). The most recent work was by Hinton and Kennard who examined a section on Orsett Road in 1900 (Schreve, 1997:306).

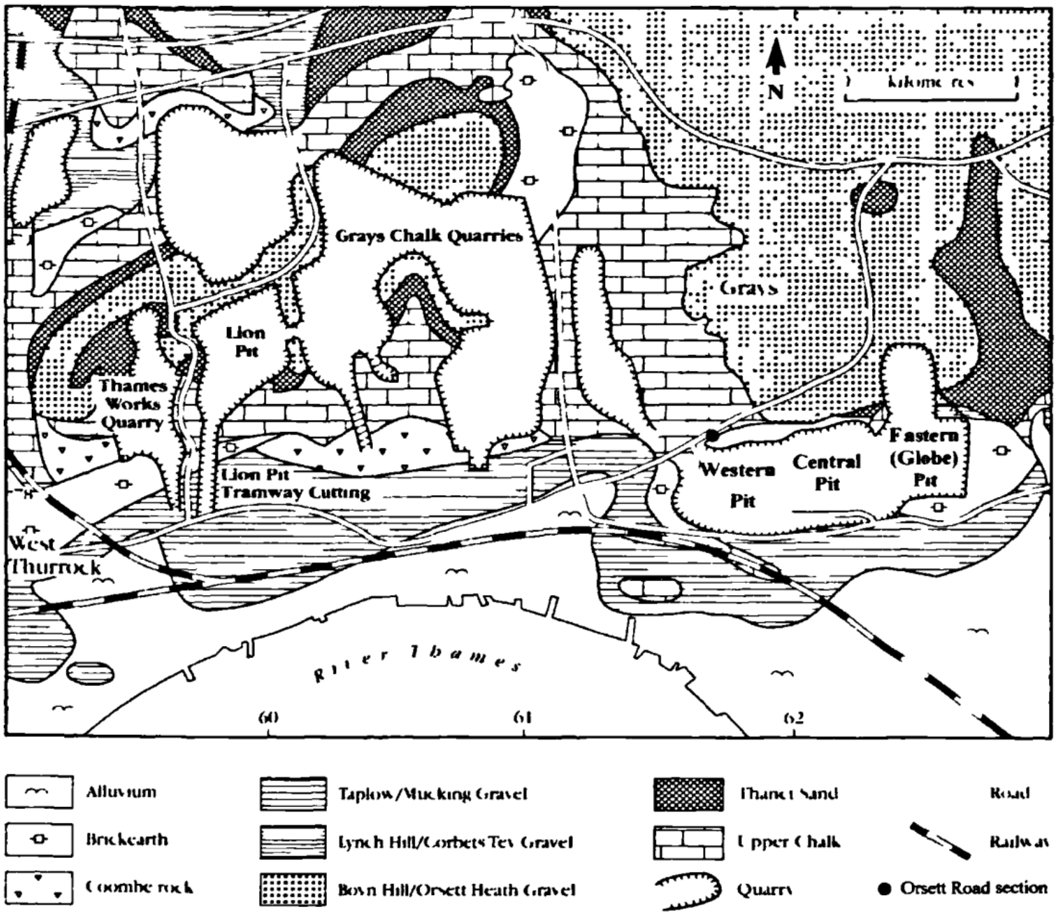


Figure 4.7 Map of the Thurrock area (Schreve, 1997:306 edited from Bridgland, 1994).

Schreve (1997:307) demonstrated that the faunal remains marked as Grays must come from the main brickfield at Grays Thurrock, as Abbot (1890: 476) was the first to mention fauna from West Thurrock, long after the classic Grays fauna had all been collected (apart from Hinton's (1904) work clearly labelled Orsett Road). Contemporary Geological Survey plans show the working of East and Little Thurrock but none to the West (Schreve, 1997:307). This may demonstrate the origin of the fauna, but there is no such documentation to tie the archaeology to a date or place (Whittaker, 1889:419), although cutmarks on the faunal remains indicate hominin activity (Schreve, 1997).

Geology

Details of the geological context of the Grays artefacts are scarce. Hinton and Kennard (1900:344) described faunal remains found in the shell beds but recorded that little of these deposits remained. Gravels at Socketts Heath (90ft OD) produced frequent Palaeolithic implements, from 16ft of evenly bedded and false-bedded gravel with staining (Hinton and Kennard, 1900:341). Other sections with artefacts included: one to the east of Chalk Pit Farm similar to Socketts Heath, an exposure at Hangman's Wood showing the junction between gravels and Thanet sands, and a section by the road leading to Orsett. Sections, such as those at Orsett Road between Grays and Little Thurrock, Milwood Lane, Tramway Cutting and Tunnel cement works were described as containing several species of large mammals and molluscs but lacking archaeology (Abbott,1890; Hinton and Kennard, 1900:345). Lion cement works also contained 12ft of coarse unstratified gravel, from which Whitaker and Reid pulled many artefacts (Hinton and Kennard, 1900:344). Whitaker (1889:418-419) described work in the valley between two ridges of irregular height, exposed in three different pits. Faunal remains come from the middle pit but with little archaeology. Whitaker (1889:420) claimed that there were two series; a lower fossiliferous zone with gravel and overlying brickearth where the mammals and molluscs occurred, and an upper unfossiliferous zone.

Dating

A Hoxnian date was proposed for Grays by Kennard (1916:254-5; Bridgland, 1994:212), based on faunal and archaeological comparisons (which included Little Thurrock) with Clacton and Swanscombe. Palynological work by West (1969) and Hollin (1971;1977) informed Gibbard's (1994;1995) work which assigned Grays to the Ipswichian (Schreve, 1997:309). The differences between West Thurrock, Little Thurrock and Grays were established using the fauna and archaeology, and this work assigned Little Thurrock and Grays to MIS 11, with West Thurrock being correlated to MIS 5e (Bridgland, 1994:238). Since the recognition of MIS 9 and 7 in the terrace staircase, the sites are thought to correlate to these two interglacials (Bridgland, 1994:238). Based on the faunal remains, Schreve (1997:323) demonstrated that Grays is younger than Swanscombe but older than Aveley with a similar MAZ to Purfleet.

Archaeology

Wymer (1985:307) argued that as Grays was known only as a general location, there was no way of establishing provenance as the names Little Thurrock and Grays Thurrock have been used interchangeably (Smith, 1894: 247; cf. Bridgland, 1994:271). This has been noted by McNabb (2020) with some of Wymer's early find from Little Thurrock labelled as 'Grays'. Warren (1923a:38-9) recorded only natural flints from Grays, but Kennard (1916:256) noted lithics of "St. Acheul" character. Smith (1894:247) described finding artefacts from Grays and illustrated a flake tool (Figure 4.8). Roe (1968a:61) recorded 12 handaxes, four cores, 56 retouched flakes and 25 flakes from Grays. Other material is unmarked or labelled as 'Little Thurrock or Grays Thurrock' which Roe (1968a:61) claimed is similar in character. This includes nine cores, 97 retouched flakes and ten flakes. Roe (1981:206) described a small group of handaxes from Grays as being typical of his Group II.

Figure 4.8 Borer from Grays (Smith, 1894:247).

Summary

Despite being a well-known faunal locality, the context of the archaeology from Grays is poorly understood (Schreve, 1997:312). An examination of the site flake tools is warranted but may have limited value due to the uncertainty of the context the artefacts came from.

4.1.2 London (Middle Thames)

Some key sites from WG Smith's work in London have been correlated to MIS 9. Due to the importance of Stoke Newington these have been key to characterising the interglacial.

Stoke Newington

Stoke Newington, located in north-east London at the confluence of the Lea and Thames (27m OD), is renowned for the preservation of Worthington Smith's 'Palaeolithic floor' (Beaumont and Chalkley, 1903; Woodward, 1909:80; Warren, 1912b; Bromehead, 1925). The large core and flake assemblages from the area contain a high level of flake tools, but no evidence of PCT.

Excavation history

Worthington Smith (1879:277) observed a thin stratum containing flint artefacts at Stoke Newington during his investigations of east London in 1878. Smith (1884:357; 1894:190) identified the stratum in the south side of Stoke Newington common before rediscovering it north of the common and throughout the local area. Smith's (1884; 1894) 'Palaeolithic floor' was richest between Kyverdale Road and Alkham Road (Figure 4.9). Smith oversaw further work and requested that workmen recorded the locations of further artefacts (Wymer, 1968:297). Warren (1912b) independently observed a continuation of the floor at Geldeston Road and collected fresh artefacts including handaxes (Roe, 1981:175). Many attempts to relocate the area have proven unsuccessful, only yielding undiagnostic worked flints and waste flakes (Roe, 1981:173). Further work was carried out in the 1980's by Harding and Gibbard (1983) and later by Green *et al.* (2004; 2006) adding geological context.

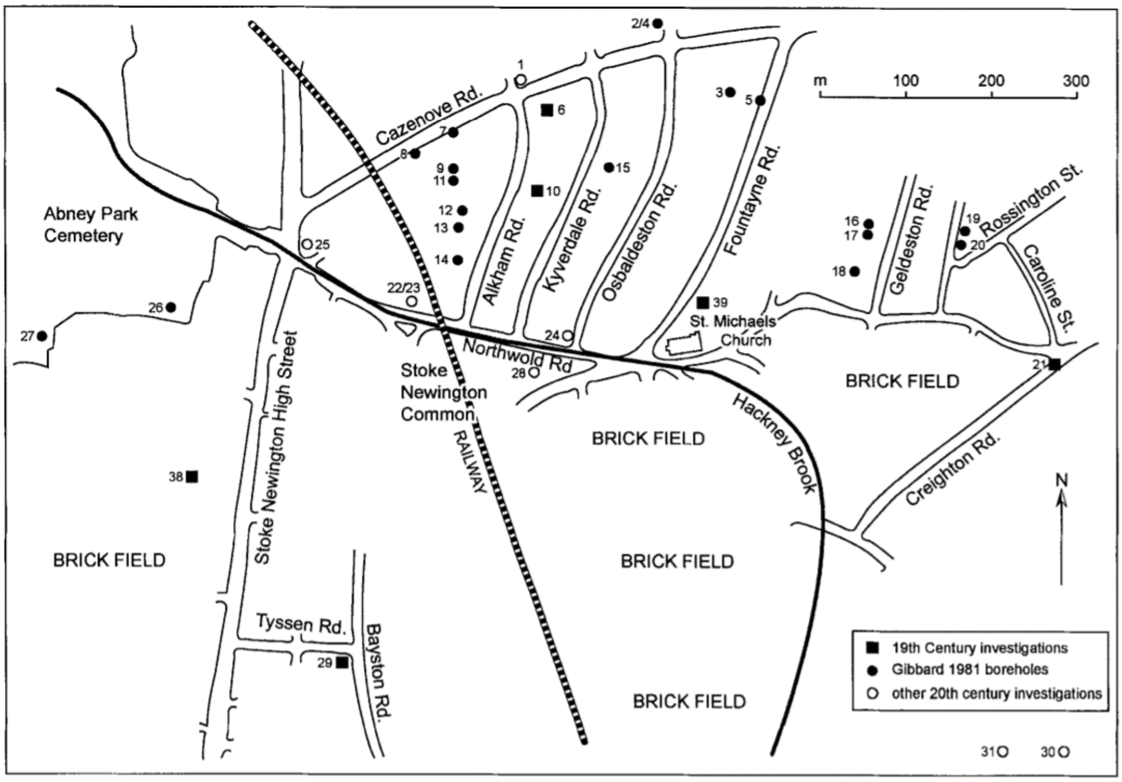


Figure 4.9 Stoke Newington area showing areas of investigation (Green *et al.,* 2004:194).

Geology

The local geology consisted of London clay overlain by ocherous gravel (Smith, 1894:204). The Palaeolithic floor was a distinct gravelly layer 2-3 inches thick within fine sand, which varied in depth from the surface 4-20ft (Roe, 1981:173). Sediments above the floor contained sand, loam and contorted drift showing signs of solifluction, disturbance and reworking from a periglacial episode (Roe, 1981:173). Two assemblages were thought to have existed in the underlaying gravel: one at the bottom rolled and stained, and another at the top in fresher condition, although little time was thought to divide them (Smith, 1894; Wymer,1968:299). From Smith's (1894) threefold division:

1. Implements of oldest age (base of gravels)
2. Implements of medium age (top of the gravel ’12 ft. stratum)
3. Implements of least age (the ‘floor’ in the brickearth)

Wymer (1968:299) could only identify two layers, with only 19 finds that could be related with certainty. While many different street names and localities exist, it is thought that conditions were consistent between them (Wymer, 1968:299).

Green *et al.* (2004:193) stated that the majority of the finds came between Northwold Road and Cazenove Road. Smith (1894: 204) indicated that the occurrence of artefacts on the Palaeolithic floor was localised which could explain why the attempts to relocate the Palaeolithic floor have been unsuccessful (Green *et al.,* 2004:193).

Dating

Gibbard (1994:189) correlated Stoke Newington to the Ipswichian based on pollen, disputing other evidence such as amino acid dating by Miller *et al.* (1979:541-2). Green *et al.* (2004:204-6) in their evaluation of the site concluded that it represented aggregation during MIS 9, as the height of the Stoke Newington sands is altitudinally below the MIS 11 terrace, but above the Hackney Downs gravel. Interglacial conditions are inferred from terrestrial and freshwater molluscs, found in the buff-coloured sands on top of the ocherous gravel, as well as from a temperate flora (King and Oakley, 1936:60; Green *et al.,* 2004). Smith (1884) recorded 45 species of molluscs and 24 species of mammal, of which the molluscan fauna is stratigraphically significant with *Corbicula fluminalis* (Pre-Ipswichian) *and Belgrandia marginata* supporting the MIS 9 correlation (White *et al.,* 1999:7). Positioning the site within MIS 9 is still debated, but recent work has indicated Stoke Newington could come from an early part of MIS 9 (Simon Lewis Pers. Comm. 2019).

Archaeology

Smith (1884:371) noted over 1000 implements, and the *in-situ* preservation led to refitting at the site (Figure 4.10). Greenhill (1884:339) described the artefacts from lower down to be more abraded. Between 200-300 unabraded implements are quoted as an estimate of surviving materials, with flakes and rougher pieces being more likely to be discarded (Wymer, 1968:297). Material is provenanced to numerous areas by Roe (1968a) with three large assemblages at Abney Park Cemetery, Geldestone Road and the Common. Roe (1981:154) assigned the handaxes from Stoke Newington to his Group I.

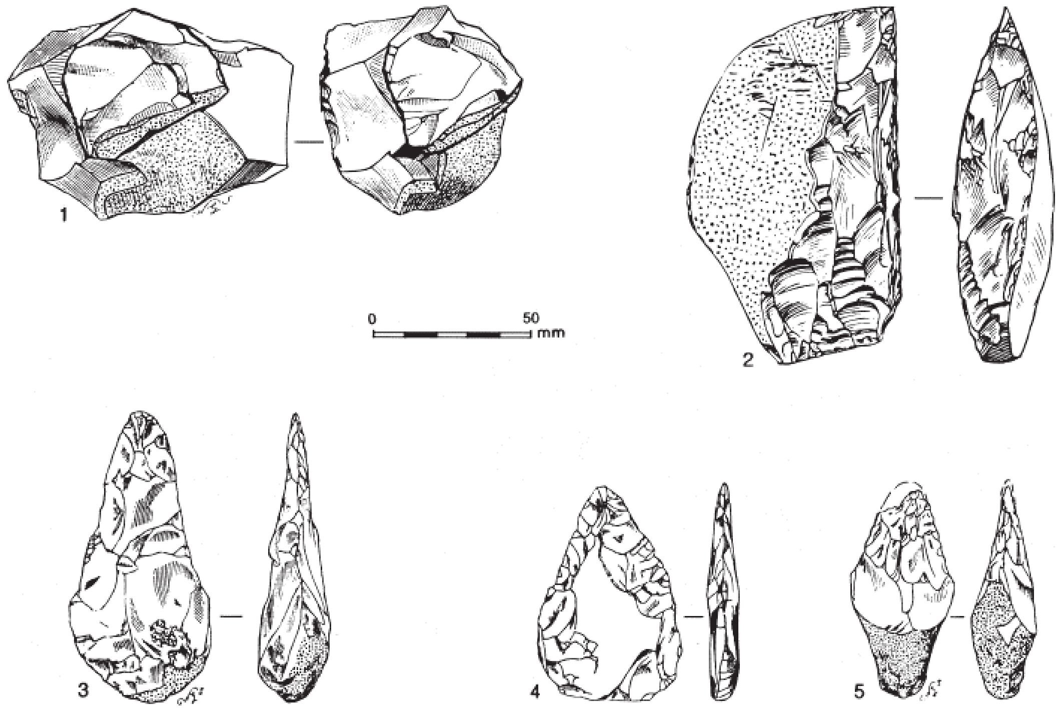


Figure 4.10 Artefacts from the 'Palaeolithic floor' (1) conjoining flakes (2) side scraper (3-5) small pointed handaxes (Wymer, 1999:64).

Warren (1942:174) described a Clactonian industry that had previously been referred to as Mousterian in nature. This refers to the finely made flake tools at the site which cannot be separated from the main assemblage. Some of the flake tools approach the levels of retouch expected at Mousterian sites (Roe, 1981:175). An analysis of the artefacts in the British Museum in mint or sharp condition by Wymer (1968:299) showed a high proportion side scrapers described as coming from the floor alongside the handaxes. Wymer (1968:318) questioned the lack of Levallois at the site given the characteristics of the rest of the assemblage and related sites.

Summary

Stoke Newington is renowned for the size and variety of the assemblage. The study of the previously suggested 'Clactonian traits', numbers of flake tools and whether the lack of Levallois is genuine make this site pertinent to this thesis.

Lower Clapton

Lower Clapton, one mile east of the Hackney Downs (Smith, 1879:277), was discovered during Worthington Smith's work in the gravels of north-east London (Evans, 1897:586). The site is of interest due to its connection to Stoke Newington and as one of the 15 flake tool sites listed by Pettitt and White (2012).

Excavation history

A handaxe from Dunlance Road, described as a rude implement, found by Mr. J. Anscombe between 1869-1878, is the only implement with a precise provenance (Smith, 1894:189; Smith, 1879:275). Smith (1879:275) was unaware of previous finds in north-east London (apart from the three he notes) making it one of the first discoveries in the area. The artefacts were excavated or collected during Smith's work in the area between 1877-1909 (Juby, 2011:138). Smith (1879:277) worked in several pits, two of the larger ones remained open at the time he wrote. Smith (1879:277) recorded that during 1878 he found pointed implements, including a knife-like flake, in the pits and roads of Lower Clapton.

Geology

Artefacts are only given the general provenance of 'Lower Clapton' (Smith, 1894:214). Lower Clapton is described by Tylor (1869:95) as having a base of yellow false bedded sands, with a series of stratified brickearths and clays with veins of gravel, and a covering bed that was indented into the brickearth. Smith (1879:227) compared the stratigraphy to that of Shacklewell but noted the lack of shells. The site has been linked to the Palaeolithic floor of Stoke Newington (Evans, 1897: 586). This is based on Smith's (1879:277) account that the artefacts were found *in situ* in a "thin deep-red seam of gravel" which he recorded ten metres below the surface. A 'mammoth' shoulder blade was found in relation to one artefact (Smith, 1926:20).

Dating

The dating of Lower Clapton is based on its relationship to the site of Stoke Newington, (Smith, 1894:205), but this connection is unclear (Wymer, 1999:47). White and Bridgland (2018) have correlated the site with the Lynch Hill terrace, and therefore with MIS 9.

Archaeology

Roe (1981: 204) placed the handaxes from Lower Clapton in his Group I, like Stoke Newington. TERPS and Roe (1968a) noted that there are 159 handaxes, 210 flakes with four cores. Smith (1879:277; 1894) recorded worked flakes along with the handaxes and counts in Roe (1968a) and TERPS show 69 flake tools. Levallois is also recorded in TERPS and Roe (1968a), but there is little mention of this elsewhere.

Summary

Lower Clapton is often overlooked due to its lack of recording and modern excavations. It still maintains an important position due to its relation to Stoke Newington. The flake tools from the site are important to this thesis, along with reports of Levallois, and so despite a lack of context and information the study of this site is essential.

4.1.3 Maidenhead (Middle Thames)

The sites around Maidenhead (Figure 4.11): Baker's Farm, Furze Platt and Lent Rise, are often discussed together due to their proximity and similarity (Smith, 1924:46; Roe, 1981:167; McNabb, 2007:170). Lacaille (1940) collected from these sites and wrote extensively on them, describing similar geology and archaeology referring to Clactonian, Acheulean and Levallois artefacts. Collection in these areas stopped with a change in gravel extraction methods (Lacaille, 1940:253). Handaxes from the three sites are attributed to Roe's (1968b) Group I, although variation between the sites exist, with cores and flakes contributing to these observations (McNabb, 2007:170). From typological attributes it has been argued that there is a small element of Clactonian artefacts (Lacaille, 1940:254). The 'Clactonian' artefacts are argued to come from the base of the sections, although there is no proven separation from handaxes (Lacaille, 1940:254-6). Many flakes are recorded as having further retouch to create more elaborate tools (Lacaille, 1940:255). Implements suggesting the advent of Levallois are referenced as coming from the area including 'tortoise cores' (Lacaille, 1940:254). It was suggested by Lacaille (1940:261) that Levallois developed *in situ* from previous 'Clactonian' technology and that it was an early precursor to more developed examples.

Furze Platt

Furze Platt is one of the most prolific sites in MIS 9 (Treacher, 1896:17; Treacher, 1904:18; Treacher and White, 1909:201). In addition to thousands of handaxes, there are claims of Levallois and numerous flake tools (Roe, 1981:10-11).

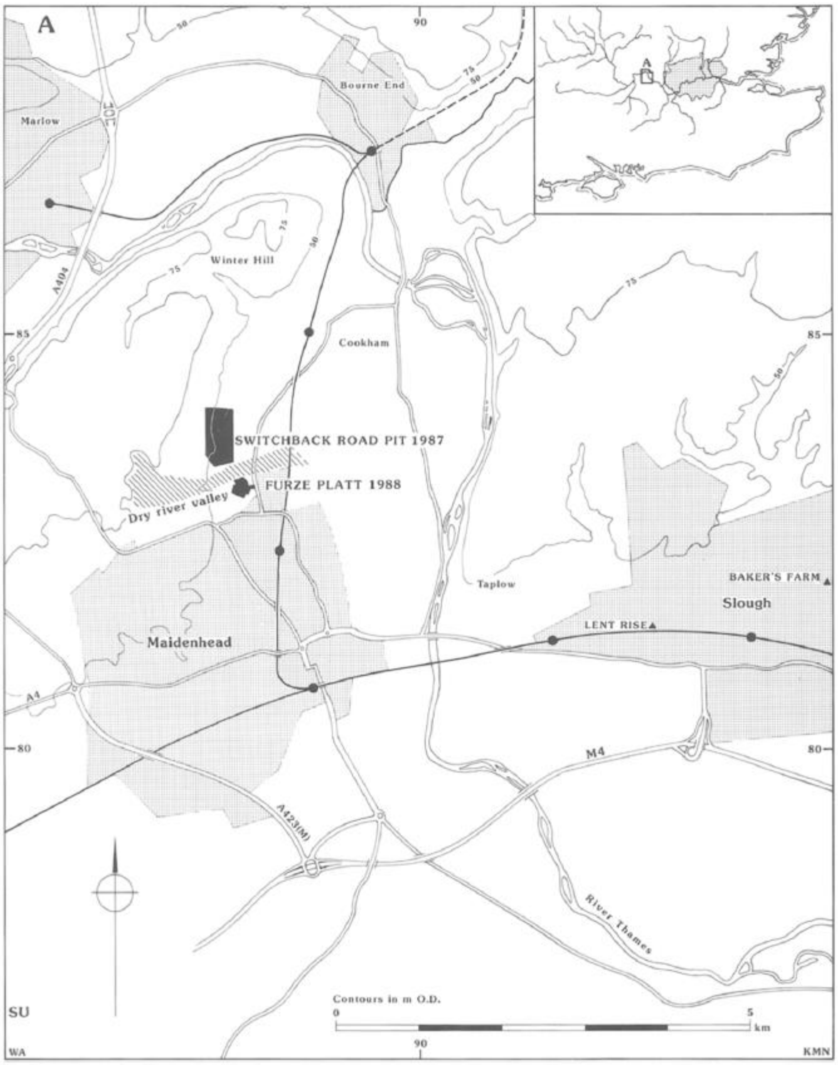


Figure 4.11 Map of the MIS 9 Maidenhead sites (Harding *et al.,* 1991a:26).

Excavation history

Furze Platt was first mentioned by Treacher (1896:17) who recorded a level of unrolled artefacts mixed with fine sand. Implements were recovered during work at Cooper's Pit until 1909, but the main period of collection took place at Cannoncourt Farm Pit between 1909-1931 (Wymer, 1968:221). Artefacts were found by workers and put aside for collectors (Wymer, 1968:221; Bridgland, 1994:156). This created collection bias with often only exceptional finds and handaxes passed on to collectors (Lacaille, 1940:253). Wymer (1968:221) cut sections at Cannoncourt Farm in 1953-4, and a section was cut at the site during the 1977 INQUA field trip (Harding *et al.,*1991a:29). Formal excavations were later carried out in Cannoncourt Farm Pit and Cooper's Pit by Harding *et al.* (1991a) due to residential development (Figure 4.12).

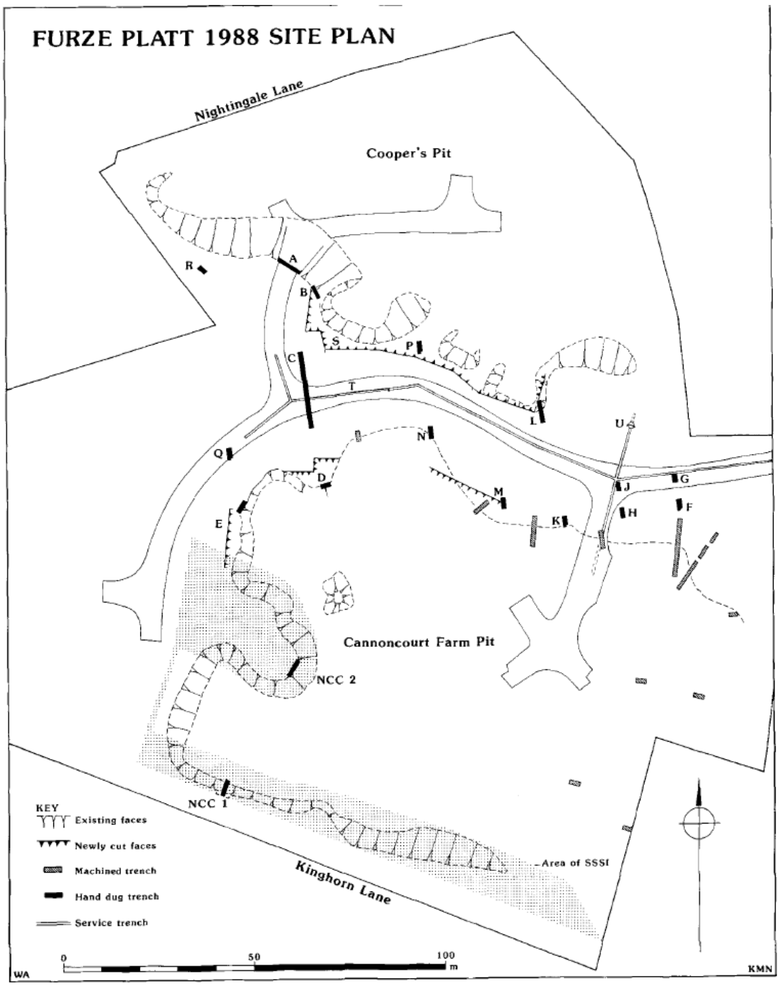


Figure 4.12 Site plan of the 1988 Excavation at Cannoncourt Farm (Harding *et al.,* 1991a:28).

Geology

The sequence at Furze Platt is described by Lacaille (1940:248; Figure 4.13) as stratified but ill-sorted reddish-brown gravel (1), coarse at the base and resting on an undulating chalk bench. This is capped by a solifluction deposit of varying thickness (2), capped locally by brickearth (3), and then by aeolian deposits in places (4). Roe (1981:166) classed the site as a single deposit. Treacher (1904:18) described that in the 8ft of gravel most of the implements occur in the bottom 2ft, concurring with Sherlock and Noble's (1922:43) observation that the artefacts resting at the bottom of the gravel on chalk represented a Palaeolithic workshop. Faunal remains are mentioned by Wymer (1968:225) but seem to have been undiagnostic, other than deer antler.

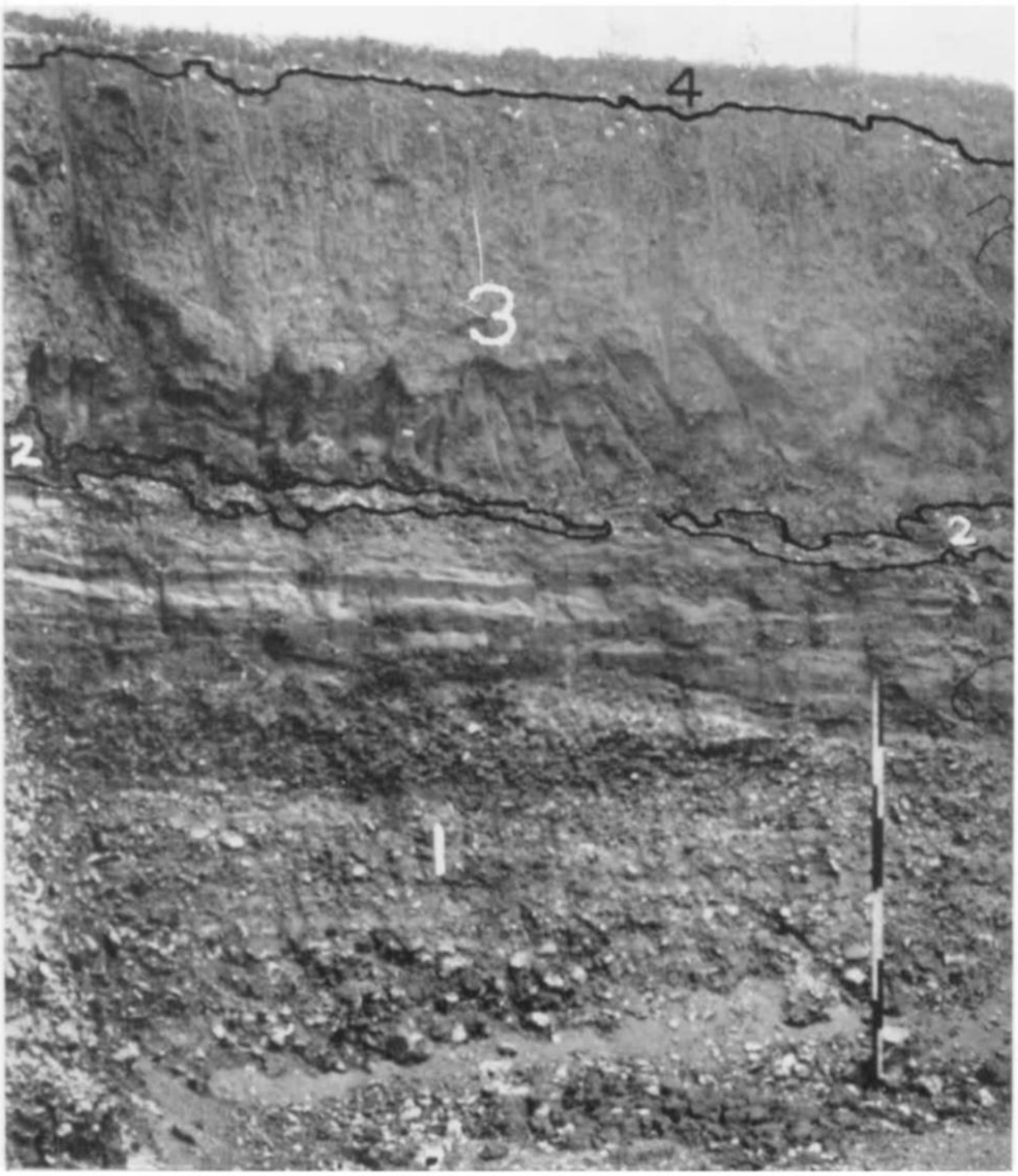


Figure 4.13 Lacaille's recording at Furze Platt 1) Fluvial gravel 2) solifluction 3) Brickearth 4) Topsoil (Lacaille, 1940: Pl. XLIV).

Harding *et al.'s* (1991a) work clarified previous assessments showing a bedrock of chalk, overlain by redeposited chalk from solifluction, with two divisions in the gravels; the lower showing 1.1-1.5m of coarse yellow horizontally bedded gravel, and the upper 1.5-2m of medium coarse gravel in a sandy matrix (Harding *et al.,* 1991a:33-35). This was capped by a layer of brickearth (Figure 4.14).

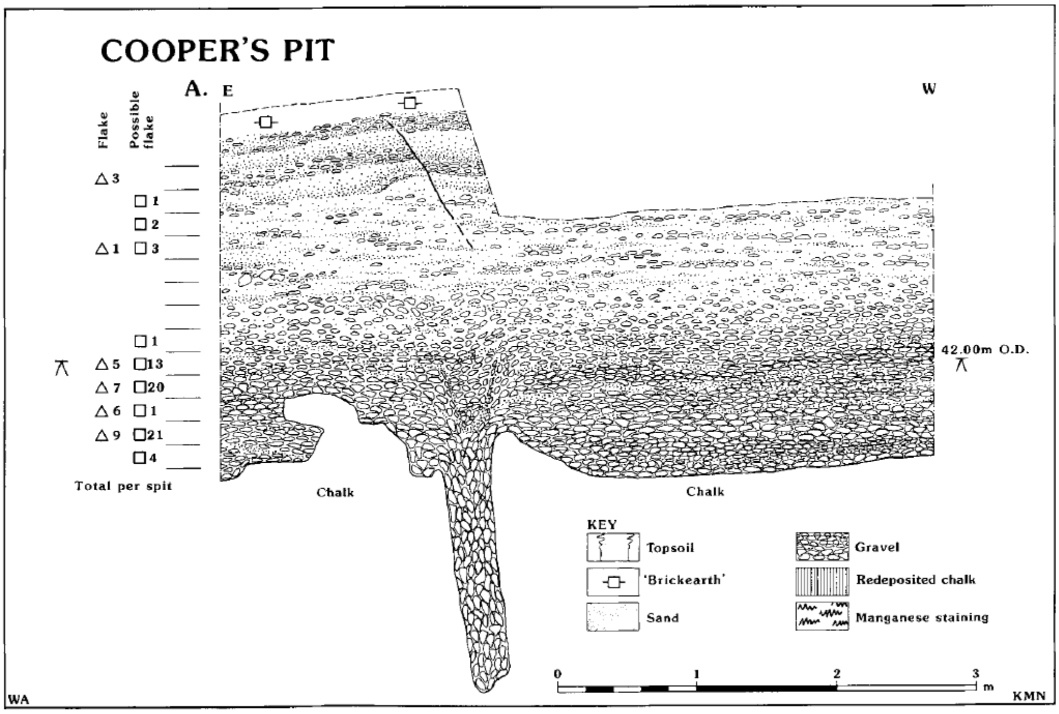


Figure 4.14 Section drawing from Cooper's Pit, Furze Platt (Harding *et al.,* 1991a:32).

Dating

Furze Platt was dated to MIS 10-8, possibly late MIS 9/MIS 8, based on lithostratigraphy and its relation to the Lynch Hill terrace by Bridgland (1994:157). This concurs with the work by Harding *et al.,* (1991a:37) demonstrating the relationship between the site and the Lynch Hill gravels.

Archaeology

Roe (1968a:10-11) recorded 1666 handaxes, over 100 flake tools, over 200 flakes, two cores and two Levallois flakes from Cannoncourt Farm Pit alone with further material labelled as Maidenhead or from various pits, most notably Cooper's Pit. The handaxes from the site, which include the largest handaxe in Britain (Figure 4.15), are predominantly pointed forms including cleavers (Wymer, 1968:222), placing Furze Platt in Roe's (1968b) Group I. Derived 'Chelles' are associated with an Upper Pit at Furze Platt (Treacher and White, 1909:198).

Only exceptional flakes, most likely considered to be flake tools, were collected for most of the work at Furze Platt, but Lacaille (1940:253) noted that when inspected flakes were numerous, and Shrubsole (1906:175) described their abundance. Harding *et al.* (1991:46) suggested that some of these could be caused by natural collision. The flakes recovered by Harding *et al.* (1991a:46) showed evidence of rolling, hard hammer percussion and relations to handaxe production. Flakes with further retouch are common in the deposits with flake tools described as being made on thick flakes with retouch on the edge (Lacaile, 1940:255). These flake tools may account for claims of Clactonian at the site (Figure 4.16).

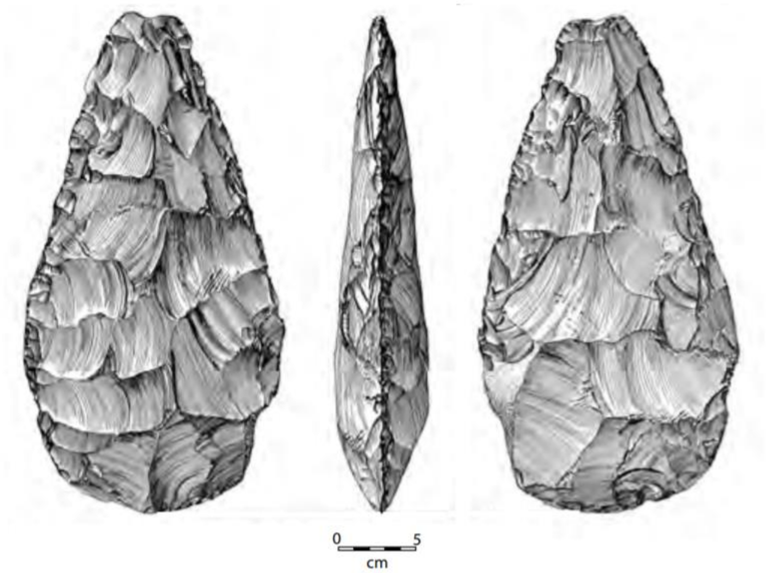


Figure 4.15 The Furze Platt giant (Pettitt and White, 2012:203).

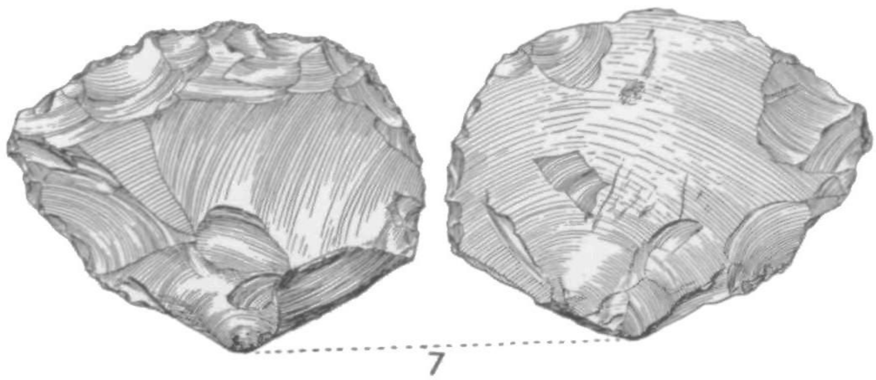


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Figure 4.16 A 'Clactonian' scraper from Furze Platt (Lacaille, 1940: P1.XLVI).

Early Levallois is thought to come from above the main assemblage around the middle of the section (Figure 4.17; Lacaille, 1940:254). Roe (1981:171) noted the limited use of Levallois at the site and compared it to Cuxton, but Wymer (1968:225) argued that Levallois was absent. Harding *et al.* (1991a:48) cautioned that faceting did not equate to Levallois and that evidence for Levallois was limited and inconsistent.

Figure 4.17 Proposed Levallois flake from Furze Platt (Lacaille, 1940:XLII).

Lent Rise

At Lent Rise, Burnham (Figure 4.11), large quantities of artefacts have been recovered from where several pits have merged (Wymer, 1999:61). The site is of relevance due to the amount of flake tools recorded and accounts of Levallois (Roe, 1968a:27).

Excavation history

Gravel extraction took place at the joining of two roads, Lent Rise and Stomp Road, where two gravel pits (Almond's Pit and Stomp Pit) joined (Wymer, 1968:233). Mr G. Almond worked at Almond's Pit until 1937 (Lacaille, 1940:249). Additionally, a site in Mr. Haycock's garden, although small, produced a series of Acheulean implements. The site has not been subject to formal excavation.

Geology

Oakley (1937:276) described the pit as being on the edge of the terrace, showing disturbed ill-sorted but stratified gravels that were overlain by brickearth. The upper section of the gravels is disturbed possibly through cryoturbation and solifluction (Wymer, 1968:233). Deposits at the site are 8-16 feet thick resting on chalk (Wymer, 1968:23). Roe (1981:167) described the area as more disturbed than Furze Platt and Baker’s Farm despite the gravel being typical of the terrace (Lacaille, 1940:249).

Dating

Oakley (1937:276) described Lent Rise as belonging to the Lower Boyn Hill terrace, now recognised as the Lynch Hill terrace, which is correlated with MIS 10-9-8 (Bridgland, 1994; Wymer, 1999).

Archaeology

The assemblage is recorded by Wymer (1968:233-6) as containing an abundance of pointed handaxes including ficrons and cleavers (Smith, 1926; Head, 1955:31). Lacaille (1960) used the site to illustrate his work on cleavers. TERPS only recorded handaxes and a handful of flakes, while Roe (1968a:27) recorded 120 handaxes, 54 flake tools, 66 flakes, two cores and three Levallois flakes. Lacaille (1942:5) described flake tools as common and characterised them as being opportunistically retouched on broken flints.

According to TERPS there is no Levallois at the site, but Lacaille (1940:260) claimed most of the Levallois material came from here with only a little at Baker’s Farm. Lacaille (1940:260) considered Lent Rise to have the largest amount of Levallois compared to Baker’s Farm and Furze Platt (Figure 4.18).

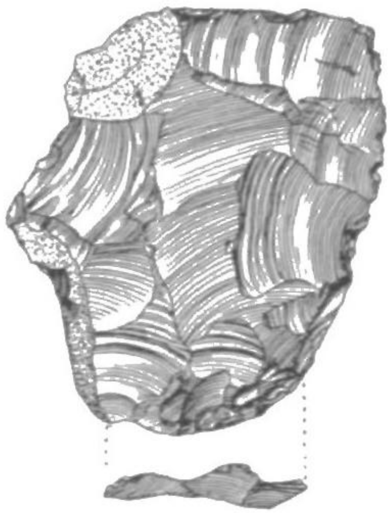


Figure 4.18 Proposed Levallois flake from Lent Rise (Lacaille, 1940:XLII).

Baker’s Farm

Baker’s Farm, Slough (Figure 4.11), is also noted for numerous flake tools and some Levallois material making it pertinent to this thesis (Roe, 1968a:29).

Excavation history

The Baker's Farm gravel pits were located a quarter of a mile east of Biddles Farm (Figure 4.13), and have subsequently been built over (Wymer, 1968:239). Treacher and Lacaille among others collected here between the World Wars, recovering hundreds of finds (Wymer, 1968:239). No formal excavations are known.

Geology

Baker's Farm is located on the Lynch Hill terrace (Roe, 1981:166). The archaeology was recovered near the base of the gravel, with some stray finds higher up (Roe, 1981:166). The ill-sorted fluvial gravels at Baker's Farm overlie the Reading beds directly (Lacaille, 1940:250). The lower part of the stratified gravel contained artefacts, but the only faunal remains reported was a tooth of a species of *Equus* (Lacaille, 1940:251). Figure 4.19 demonstrates the similarity to the site of Furze Platt.

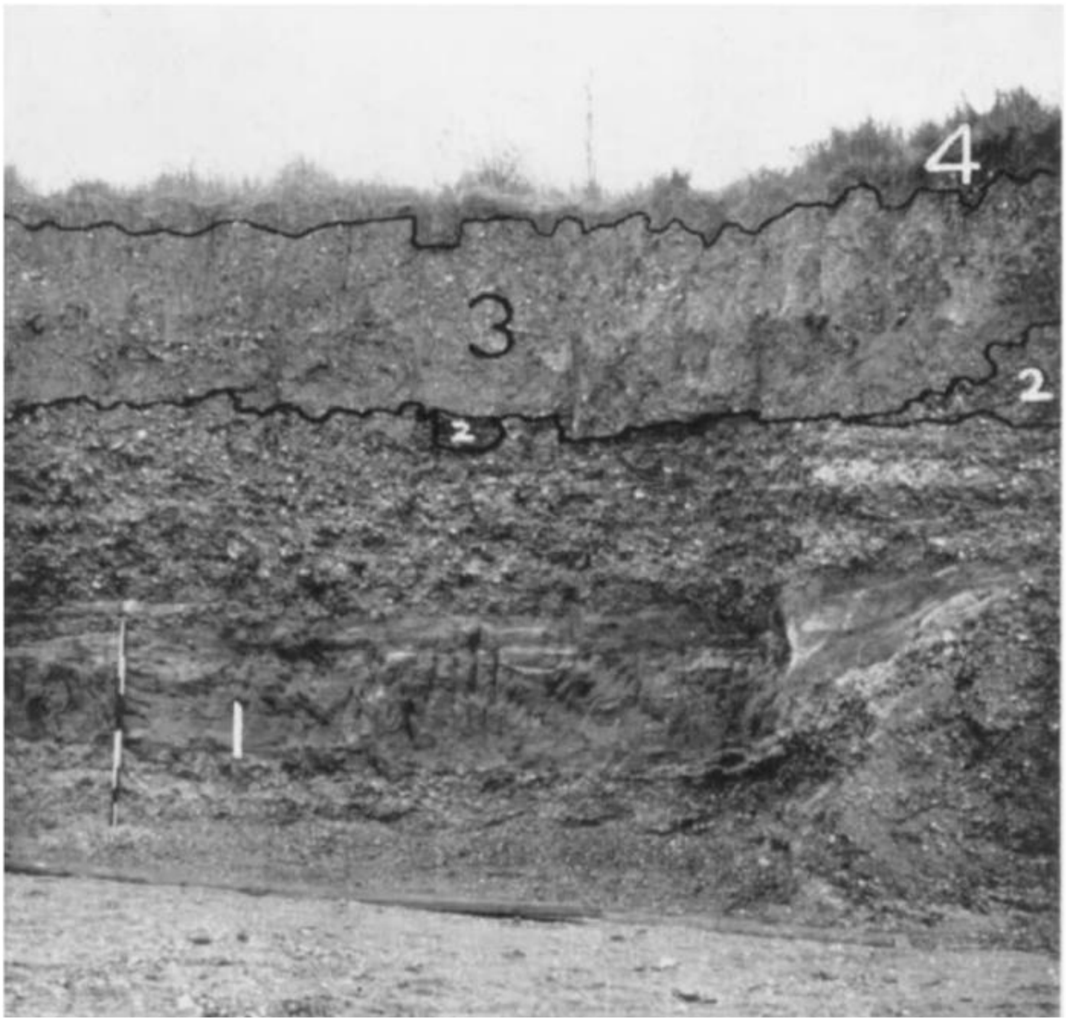


Figure 4.19 Lacaille's recording at Baker's Farm 1) Fluvial gravel 2) solifluction 3) Brickearth 4) Topsoil (Lacaille, 1940: Pl. XLIV).

Dating

The position of Baker's Farm on the Lynch Hill terrace, and relationship to Furze Platt correlates it to MIS 10-8 (Wymer, 1968:239; Bridgland, 1994).

Archaeology

Over 380 handaxes including a high proportion of points and cleavers, two Levallois cores, three Levallois flakes, 101 flake tools and 197 flakes were recorded by Roe (1968a:27). Lacaille (1940:256) separated the material into slightly abraded and fresher artefacts with some staining, but more recent examinations argue that the archaeology appears to be one assemblage (Wymer, 1968; Roe, 1981:166). Similar to Lent Rise, cleavers were common and the site was also used by Lacaille (1960) in his evaluation of cleavers. Due to these factors, the assemblage has been assigned to Group I (Figure 4.20; Roe, 1981:154).

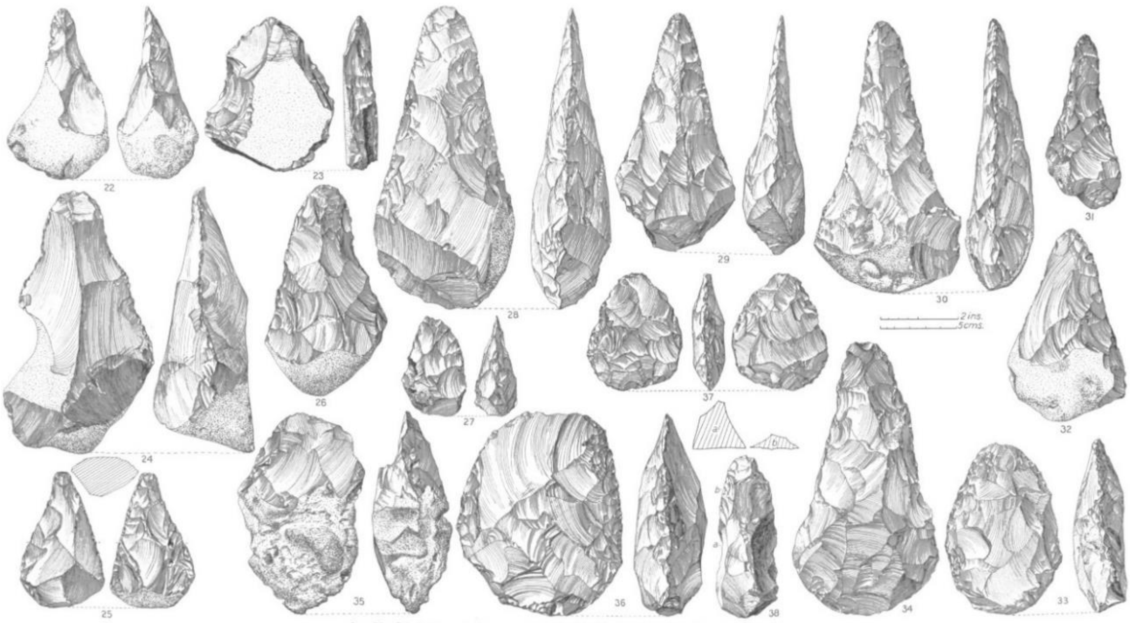


Figure 4.20 Group I Handaxes from Furze Platt, Baker's Farm and Lent Rise (Lacaille, 1940: PI. XLVIII).

Despite similarities with the other Maidenhead sites, claims of the Clactonian are predominantly associated with Baker's Farm. These claims stem from Breuil's (1932:150) descriptions of elaborate flake tools of the 'earliest Clactonian', four of which were described and illustrated (Figure 4.21). Breuil's identification was the first suggestion of Clactonian in this area and was compared to that at Swanscombe, while others were also compared to the fine scrapers at High Lodge (Lacaille, 1940:254). There are several types of scraper including some resembling handaxes (Wymer, 1968:239). Flakes that have been bifacially worked, and other advanced signs of work, are common with examples of broad scrapers with delicate working (Lacaille, 1940:258).

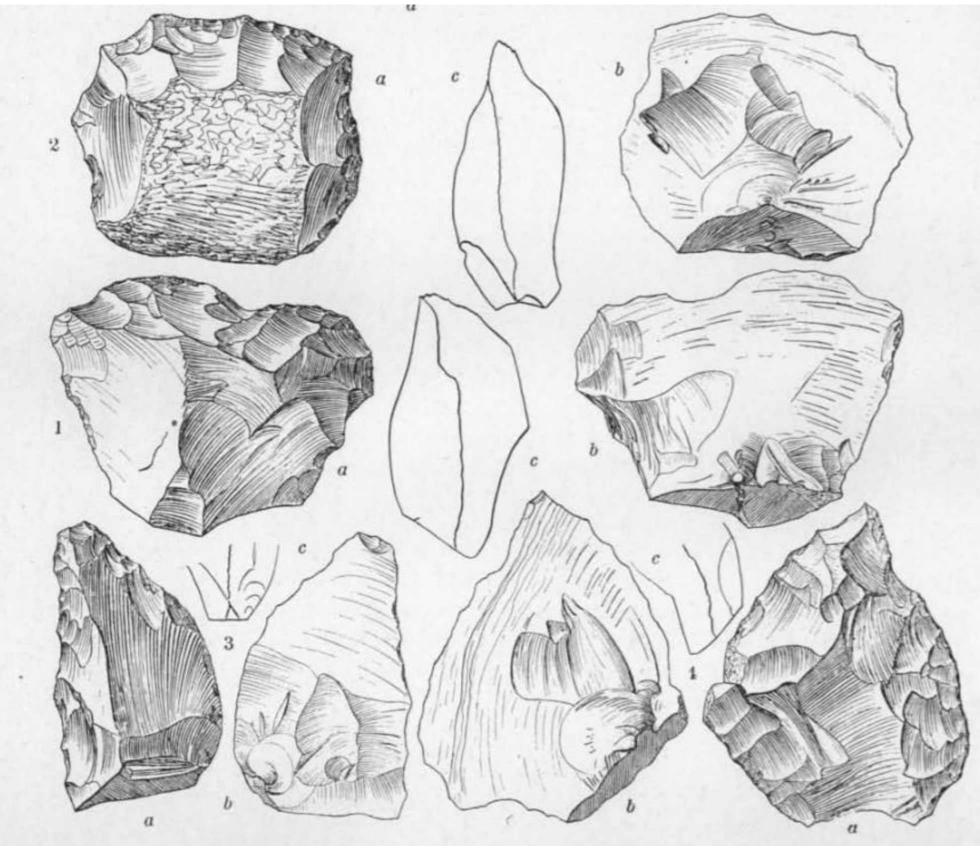


Figure 4.21 Examples of ‘Clactonian’ scrapers from Baker’s Farm (Breuil, 1932:153).

While Lacaille (1940:258) did not consider Baker’s Farm as rich in Levallois as Lent Rise, several examples were noted (Figure 4.22). Wymer (1968:241) described a Levalloisian flake with a well-faceted striking platform and described a tortoise core on a large flake.

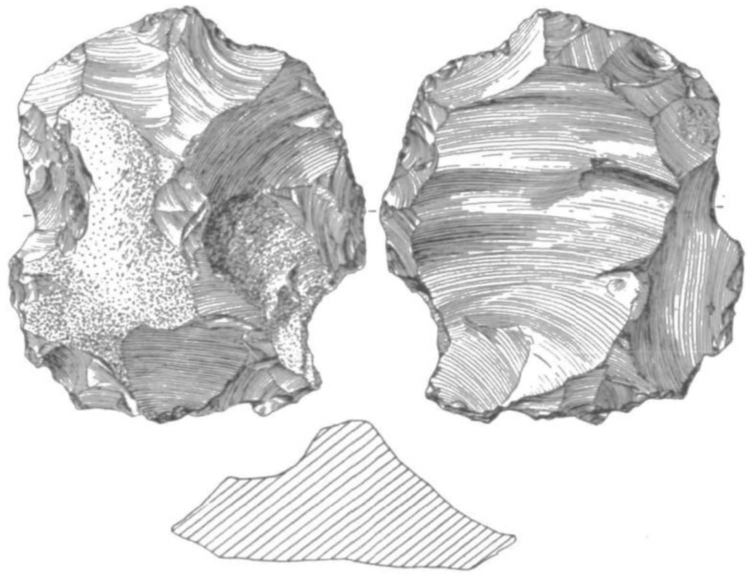


Figure 4.22 Struck tortoise core from Baker’s Farm (Lacaille, 1940: PLXLIX).

Summary

The three sites around Maidenhead form an important group correlated to MIS 9 that have yielded handaxe assemblages characteristic of MIS 9 (White and Bridgland, 2018; Dale, Pers. Comm. 2021). Further claims surrounding core and flake working are still to be resolved, including 'Clactonian elements', flake tools and PCT.

4.1.4 Reading (Middle Thames)

The sites around Reading have received less attention than those in London and Maidenhead but show similar patterns.

Grovelands Pit

Artefacts were discovered at Grovelands Pit from 1879 near the junction of the Kennet and Thames (Blake, 1903:70). The site has a large core and flake assemblage with claims for 'Clactonian traits' and advanced flake tools (Roe, 1968a:18).

Excavation history

The discovery of Palaeolithic finds from Grovelands Pit has been attributed to the work of Dr J Stevens (King, 1887:9; Shrubsole, 1906:173). Grovelands was exploited for road material during numerous excavations (Shrubsole, 1890:586; Treacher, 1904: 18). Finds were not restricted to one period of collection with Shrubsole (1902:382) finding various flakes during field outings. Some of the archaeology was collected from gravel heaps at the site (Anon, 1902:69).

Geology

Distinct levels of gravel were observed by Jones (1884:347), with artefacts possibly showing numerous occupation levels (Treacher, 1904:18). Early accounts of the site described flints found *in situ* alongside faunal remains (Stevens, 1881:1-3; 1882; 1896). Shrubsole (1884:193) described two "facets" being excavated with the bottom producing more artefacts, and the occurrence of artefacts in the higher whiter gravels possibly relating to a later period. Although Shrubsole (1890:586; Shrubsole and Whitaker, 1902:382) later argued that while there were two separate gravels they could be contemporary as despite different conditions, the artefacts displayed no difference in technology.

Material was extracted from the bluff between the Lynch Hill and the Taplow gravels with little detailed stratigraphy (Roe, 1981:148-9). Some contemporary accounts report the pit was devoid of stratification (Blake, 1898:306) and most material can only be assigned to pit level

(Smallcombe and Collins, 1946:64). Wymer (1968:155) described a sketch by Stevens as showing:

Topsoil- 1ft

Mixed soil and gravel- 1 ½ft

Gravel- 13ft

Reading sand- 15ft

Reading clay-2ft

Chalk with flints

The stratigraphy of the pit is noted for being rough and irregular before being cut off by the slope (Blake, 1903:70).

Dating

While often attributed to MIS 9 due to its relationship to the Lynch Hill terrace, the relationship between Grovelands Pit and Lynch Hill is not clear cut. Wymer (1968:155) noted that the bluff between the Lynch Hill terrace and the Taplow gravel is very steep, and material was found from working into this bluff. Roe (1981:149) attributed most of the archaeology to the Lynch Hill terrace despite the material having slumped down. While animal bones were found in sand, two feet from the base of the gravel in association with artefacts, including mammoth, straight tusked elephant, rhinoceros, horse, red deer and ox, they offer little to date the site (Stevens, 1896:4; Wymer, 1999:59). Scott (2007:127) demonstrated that straight tusked elephants are the only proboscideans during MIS 9, making the recording of mammoth at the site problematic, although the identification of mammoth could be due to outdated terminology. Bridgland and Schreve (2002) showed that rhinoceros are thought to be absent from early MIS 7 and present for MIS 9. Overall, Grovelands most likely dates to MIS 9 but its collection history and lack of recording leaves some ambiguities.

Archaeology

At Grovelands Pit archaeology was abundant at the base but found throughout (Blake, 1898:306). Despite being varied and prolific, Shrubsole (1890:587) described artefacts as sparsely scattered and hard to find *in situ* (Blake, 1903:70). Shrubsole (1884:195) argued the implements lacked finely pointed handaxes and mainly consisted of ovates of moderate size with abrasion (Blake and Stevens, 1885:210; Evans, 1897:592; Treacher, 1904:18). There is a significant cordate collection along with four cleavers, and early accounts claimed that pointed handaxes were in a worse condition and crude (Shrubsole, 1890:588; 1906:174). Roe (1981) argued that the handaxes fell outside any of his groupings but were mixed with frequent ovates.

There are records of retouched flake tools including a series of well-made scrapers on large bulbous flakes (Wymer, 1968:155; Roe, 1981:238) leading to the site being described as having Mousterian affinities (Shrubsole, 1906:174; Smith, 1915:102). However, the site lacked Levallois material (Smallcombe and Collins, 1946:64). References to Clactonian like core and flakes (Wymer, 1988:90) are much harder to substantiate, but chopper cores have been described (Barnes *et al.,* 1929:145). Handaxes found at the base of the gravels in association with the fauna are more rolled than the core and flake work and Roe (1981:149) argued the two are a different series. However, McNabb (2007:172) has argued that these previous accounts of a distinction in condition are not supported by the assemblages as condition is variable throughout handaxes, cores and flakes. In addition, McNabb (2007) noted the 'High Lodge' style scrapers and pointed out that these are not common in Clactonian assemblages.

Summary

The site is potentially mixed but shows signs of elaborate flake tools and it has been argued the site demonstrates a distinct non-handaxe layer. The handaxes deviate from what is seen at most MIS 9 sites and there are no records of the site producing Levallois material. Overall, a re-evaluation of the site is outstanding.

Sonning Railway Cutting

Sonning Railway Cutting is only briefly discussed in the literature, primarily by Wymer (1968). The Great Western Railway cutting lies to the south of Sonning, Berkshire, near Reading (Blake, 1903:73). An assemblage was collected from the east of the cutting near Twyford and Charvil Hill (Shrubsole, 1906:175) which contained a Levalloisian element.

Excavation history

The Great Western Railway cutting in the Reading area was widened between 1891-2, with Treacher collecting artefacts from the gravels (Blake, 1903:73; Wymer, 1968:172). Treacher's notes state that the collection at Oxford came from the east end of the cutting, and therefore part of the Lynch Hill terrace and not the higher terrace to the west which is closer to Reading (Wymer, 1968:172). The origins of later finds by George Smith are more ambiguous (Wymer, 1968:173).

There are many findspots referred to as Sonning (such as Sonning Common and Golf links), but these are diverse and could be from distinct levels to the Sonning Railway Cutting. Peake (1931:22) stated that most of the finds come from the cutting, but that some were known from the golf course. Even Sonning Cutting, near Sonning Hill, which has produced a handful of artefacts is probably separate to the larger collection from Sonning Railway Cutting near Charvil Hill (Wymer, 1968:171-2).

Geology

The artefacts originate from gravel removed during the widening of the Great Western Railway, and some could have come off spoil heaps (Shrubsole, 1906:175). Wymer (1999) attributed Sonning Railway Cutting to the Lynch Hill gravels. Other sites noted as 'Sonning' are also attributed to the Lynch Hill gravels (Wymer, 1999).

Dating

Wymer (1968:77) classified the site as Hoxnian. Its position on the Lynch Hill terrace now suggests an MIS 9 correlation (Wymer, 1999).

Archaeology

In his analysis of the 29 artefacts held at Reading Museum, Wymer (1968:172) noted the presence of a 'Proto-tortoise core' and Levalloisian flakes. The handaxes are of a predominantly pointed nature, with some sub-cordate types also present (Wymer, 1968:172). Wymer (1968:77) classed Sonning Railway Cutting as a Proto-Levallois industry, representing the earliest appearance of Levallois in Britain. Roe (1968:21) recorded 13 handaxes, five retouched flakes, three flakes and five Levallois flakes but does not list the Levallois core unlike Wymer (1968). Peake (1931:22) referred to sharp material of a 'Le Moustier' nature.

Summary

Although Sonning Railway Cutting is a small assemblage, with little documentational evidence, it is important due to its Levalloisian element noted by Wymer (1968).

4.1.5 Wolvercote, Oxfordshire (Upper Thames)

Wolvercote is located 3km north of Oxford, on the west bank of the Upper Thames. Despite being a key site for MIS 9, the collection bias favouring handaxes at the site, has meant that it is of limited value for this thesis.

Excavation history

The site was discovered during the late 1800's, but no formal excavations have ever been undertaken. There have been several examinations, prior to the brick pits closure in the 1930's (Tyldesley, 1986a:3) by Bell (1894, 1904) and Sandford (1924,1926). During the mid-1980's, attempts to relocate the sediments by Bridgland and Harding (1986) proved unsuccessful, but work by Briggs *et al.* (1985) and Tyldesley (1986a:8) examined a temporary exposure at the east of the pit.

Geology

The Wolvercote channel (Figure 4.23) is 4.5m deep, infilled by calcareous sandy gravel, with laminated silt clay overlaying gravel on top of Oxford Clay (Bell, 1904; Sandford, 1924;1926; Ashton, 2001). The fauna and other environmental evidence (see Chapter Two) was found alongside the archaeology within the gravel and is suggestive of climatic cooling at the end of an interglacial (Pettitt and White, 2012:126).

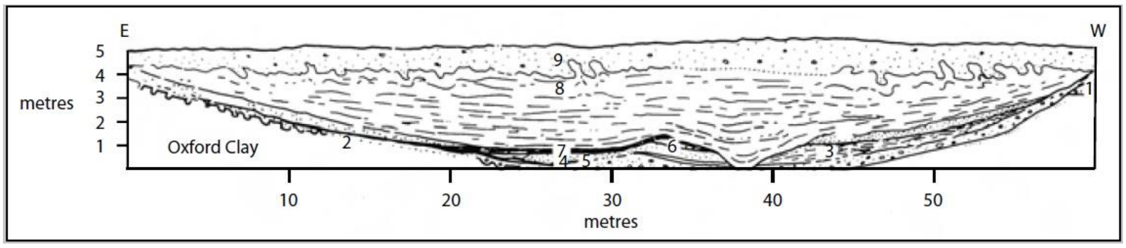


Figure 4.23 Section through the Wolvercote Channel (Pettitt and White, 2012:126).

Dating

There have been multiple suggestions for the age of Wolvercote based on typology, normally associated with the late Acheulean, especially the Micoquian of the continent (Sandford,1924:168; Roe, 1981:123), with Roe (1994) suggesting a MIS 7 or MIS 5e date. Tyldesley (1986a:1;1986b:24) thought this reasoning was weak, and Wymer (1968:90) attributed Wolvercote to the Hoxnian. While the terraces of the Upper Thames are difficult to correlate (Maddy *et al.,* 1991:218), Bridgland (1994) argued that there is a tentative correlation with the Lynch Hill terrace. Nevertheless, a MIS 11 date is still possible (Ashton, 2001:200; McNabb, 2007:140).

Archaeology

Wolvercote is an Acheulean site dominated by handaxes. Bell (1904:123) described shoe-like handaxes (Figure 4.24), being flat or nearly so on one side, and these have since been classed as slipper-shaped plano-convex pieces (Pettitt and White, 2012: 126). There are a large number of well-made pointed handaxes, but only eight show the classic 'Wolvercote' style

(Tyldesley, 1986a:93). Roe (1981:122) noted an abundance of soft hammer work on the handaxes in order to shape them. It has been argued that the plano-convex shape could be explained by the use of large flakes to create handaxes (Roe,1981:122; McNabb, 2007:167). Others are shown to be worked from nodules showing an intent to create the shape, often with the flatter face worked first (Roe, 1981:123). Roe (1981:107) described an 'evolved Acheulean', and placed Wolvercote in its own group (Group III).

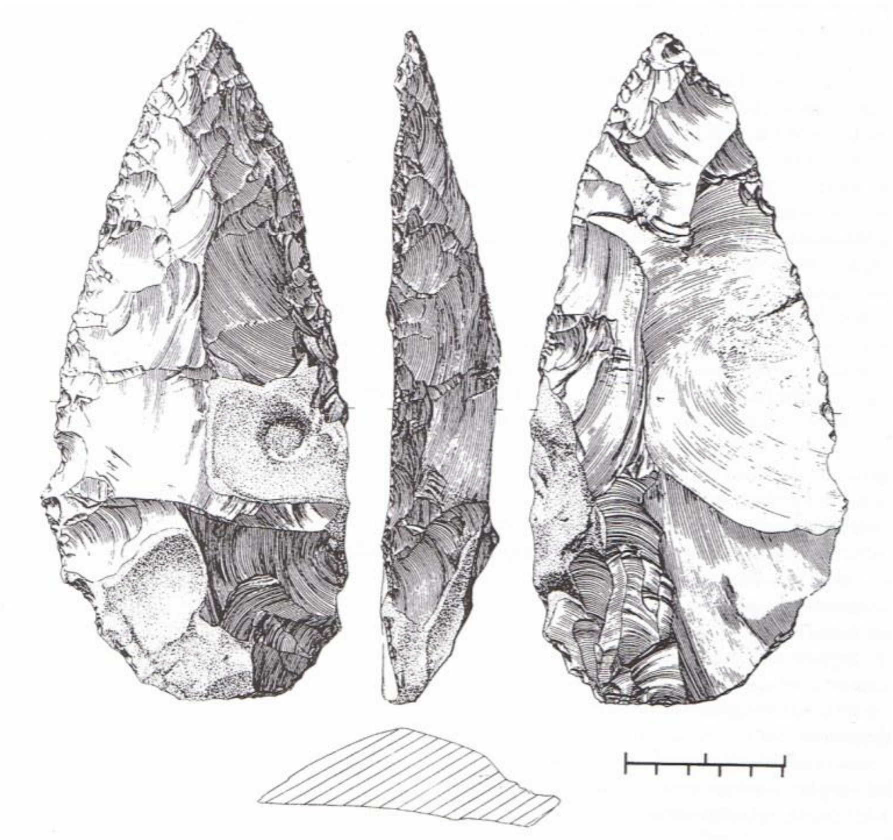


Figure 4.24 Plano-convex handaxe from Wolvercote (Ashton, 2001:202).

Cores and flakes are scarce at the site, but some flake tools are mentioned including two points, two side scrapers, one backed knife, one double side scraper and one unspecialised implement (Tyldesley, 1986a;1986b). There is no recorded evidence of Levallois or separate non-handaxe elements (Tyldesley, 1986a:92). While Roe (1981:122-6) noted that some flake tools are more elaborate, Tyldesley (1986b:23) argued that the flake tools are unremarkable.

Summary

The site of Wolvercote may have little to add to this thesis but its importance to MIS 9 means that the small number of cores and flakes available are still worth examination especially as some handaxes seem to have been made on flakes.

4.1.6 Kent

While outside of the main Thames Valley, the tributaries and related areas in Kent offer interesting comparisons to the main Thames sites. Cuxton is often considered the only site that replicates the tripartite structure seen at Purfleet (White and Bridgland, 2018).

Cuxton

Cuxton, situated on the west bank of the Medway in Kent, preserves a potential tripartite sequence reminiscent of Purfleet (White and Bridgland, 2018).

Excavation history

Recognition of Cuxton dates back to at least 1889 with George Payne (1893) detailing the discovery of flint artefacts. In 1902 a further four handaxes were found by collectors (Tester, 1965). The Rectory site was excavated by Tester between 1962-63, producing over 600 artefacts (Tester, 1965). Later excavations by Cruse to the south of Rochester Road in 1984 with the Maidstone Area Archaeology group (Cruse *et al.*, 1987) and by Wenban-Smith (2006) during the Medway Valley Palaeolithic Project (MVPP) have subsequently enhanced our knowledge of the site and produced further artefacts (Figure 4.25).

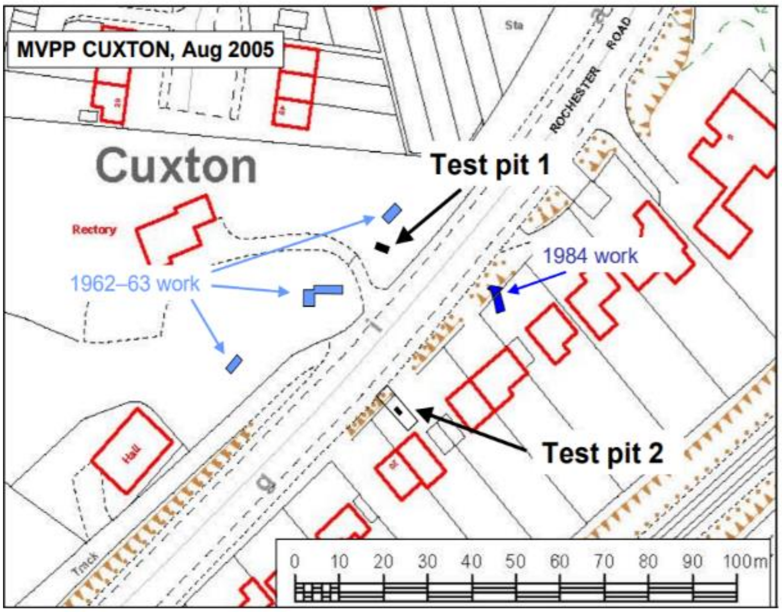


Figure 4.25 Map of Cuxton showing Tester, Cruse and MVPP excavations (Wenban-Smith, 2006:13).

Geology

The site is situated on a small patch of Medway terrace gravel which lies on top of chalk containing isolated flints and occasional bands of flint (Shaw and White, 2003: 305). Tester's (1965:33) original excavation revealed a thin Pleistocene sequence: 0.5m of sand and gravel laid on top of chalk and chalk breccia, overlain by 0.6m of loam capped by chalk rubble (Figure

4.26). Cruse *et al.*'s (1987:42-43) sequence recorded a deeper, over 3m, layer of fluvial sand and gravel laying on the same base demonstrating a more complex stratigraphy. The MVPP trench was at 22 Rochester Road, ~40m south west of Cruse's trench containing a thin fluvial gravel on a chalk terrace bench 17OD rich in handaxes (Wenban-Smith, 2006:11). Organic preservation was poor throughout the site, and Tester (1965) described a lack of significant faunal remains.

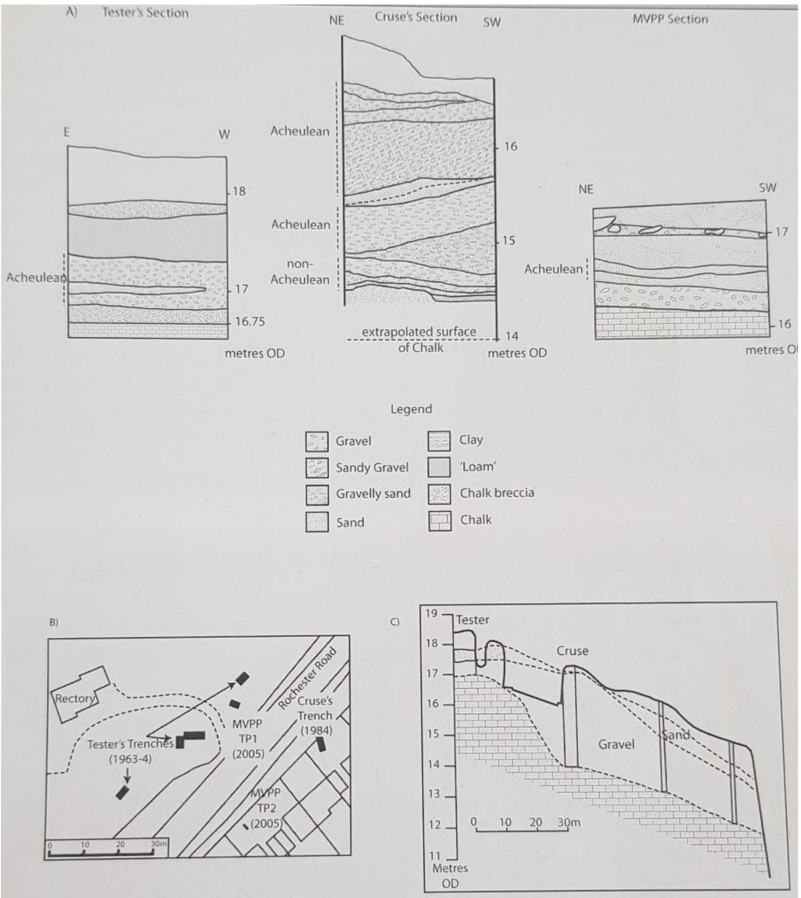


Figure 4.26 Comparison of sections from the three excavations at Cuxton (Pettitt and White, 2012:129).

Dating

The terrace deposits are ~18.5m OD but correlation with surrounding terraces is debated due to the absence of fossils (Bridgland and White, 2015). Dines *et al.* (1954:116) placed Cuxton on the second terrace. After the Cruse *et al.* (1987:73) excavation, the sequence was correlated with Binney gravel dating to the Mid Devensian. Bridgland (1996:33; 2003) later argued that Cuxton was actually on terrace three, either the Binney Gravel or the older Stoke Gravel, and could be correlated with either the Lynch Hill/Corbets Tey formation or the Taplow/Mucking formation. The former was preferred due to the nature of the deposits as a "degraded and landscape remnant" (Pettitt and White, 2012:128). OSL dates by the MVPP have dated Cuxton to MIS 8, agreeing with the Lynch Hill/Corbets Tey correlation (Pettitt and White, 2012:128). Nevertheless, Wenban-Smith *et al.* (2007) suggested a MIS 7 date which is out of line with the archaeology and the stratigraphy at the site (Bridgland and White, 2015).

Archaeology

Tester's (1965:30) excavation produced a large Acheulean assemblage with Roe (1968a:147) recording 212 handaxes, 12 cores, 70 retouched flakes, 400+ flakes, three Levallois cores and six flakes. These artefacts were thought to have come from throughout the gravel, with some from the loam above (Roe, 1981:170). The excavation in 1984 exposed two separate assemblages; a non-handaxe assemblage (n=118) from the lower gravel and a handaxe assemblage (n=102) separated by a depositional hiatus (Cruse *et al.,*1987:39). Overall, 220 artefacts are thought to have been recovered with nine handaxes and 23 flake tools (Cruse *et al.*, 1987:43), not including a further 90 unstratified finds. The handaxes are only found in the upper levels, and flake tools are much more common in the lower levels (Cruse *et al.,* 1987:66). Callow (In Cruse *et al*., 1987:66) examined the lack of handaxes in the lower sequences and deduced that neither sampling nor sorting by the river explains the absence of handaxes. Callow (In Cruse *et al*., 1987:71) purposefully avoided the term Clactonian, and McNabb (2007:98) argued the site yielded too small an assemblage from too small an area to be classed as Clactonian.

The Acheulean assemblage is described as being dominated by pointed handaxes with cleavers and ficrons (Tester, 1965:38; Wenban-Smith, 2006:12), leading Roe (1968b) to assign Cuxton to his Group I. MVPP recovered a further 20 handaxes from a test pit dug off Rochester Road including the second largest handaxe ever found in Britain (Figure 4.27; Wenban-Smith, 2006:11).

Tester (1965:40) noted signs of core preparation (Figure 4.28) but argued that associated flakes show little difference from Acheulean flakes. Bridgland (1996:33) discussed Levallois material but noted that it is only known from Tester's excavations. Callow (In Cruse *et al.*, 1987:59) found the evidence for Levallois in Tester's material unconvincing and explained the proposed Levallois as by-products of other knapping strategies. Bolton (2015) examined the Levallois element and argued that only four examples of SPC were present.

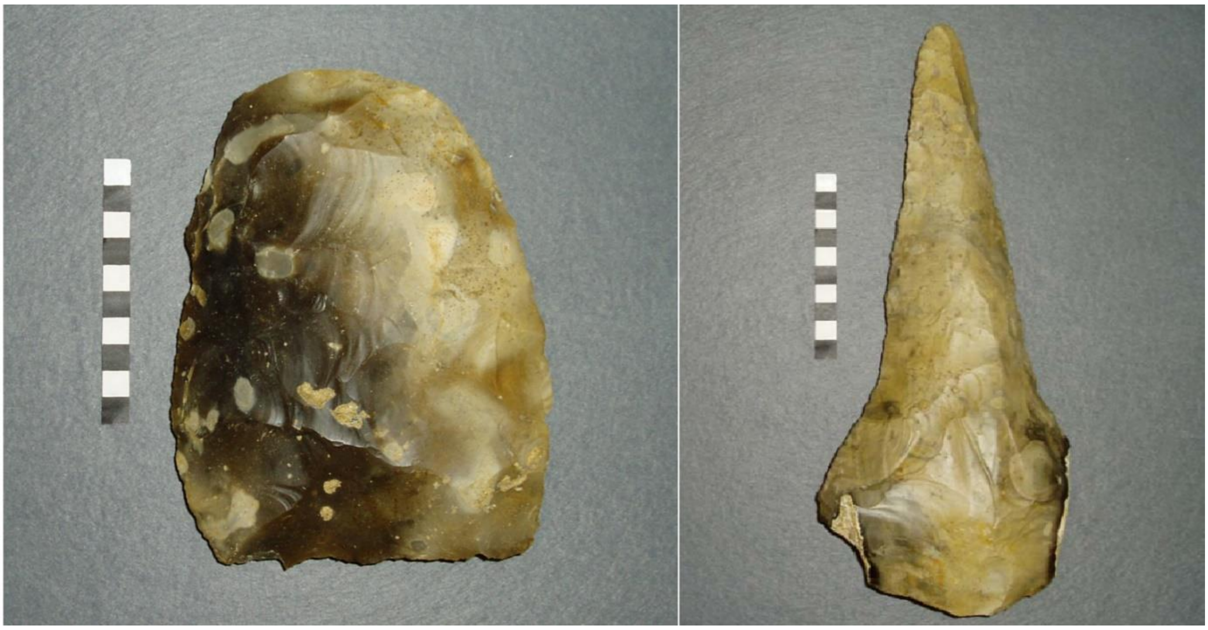


Figure 4.27 Large cleaver and ficron from the MVPP excavations at Cuxton (Wenban-Smith, 2006:15-16).

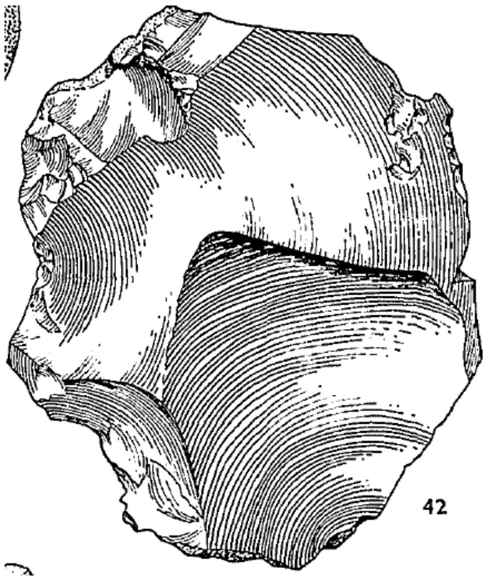


Figure 4.28 Proto-Levallois Core from Tester’s excavation at Cuxton (Tester, 1965:56).

The Tester assemblage is recorded as having more than 50 flake tools (White and Bridgland, 2018). Tester (1965:39) noted the difficulty in distinguishing between natural damage and retouch on the flake tools (Figure 4.29), and Cruse *et al.* (1987:59) later described the tools as poorly made with little alteration to the overall shape of flakes.

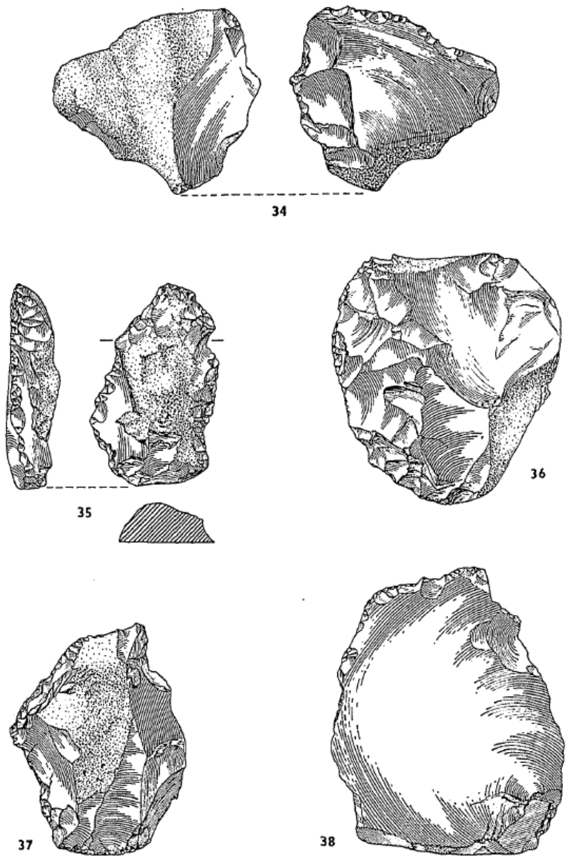


Figure 4.29 Examples of flake tools from Tester's excavation at Cuxton (Tester, 1965: 55).

Summary

Cuxton is crucial to the study of MIS 9 as it is the only potential parallel to Purfleet, addressing all three focuses of this study. Although Cuxton has a lot of potential, further study is needed to clarify these elements.

Sturry

Sturry is situated two miles north of Canterbury on the Stour (Smith, 1933:166) and is often attributed to MIS 9 (Scott, 2002; Bridgland *et al.,* 1998b). The presence of Levallois material and numerous flake tools has previously been noted (Wymer, 1999:103).

Excavation history

Dr A.G. Rice recognized the potential of Sturry and in the early 1920's work was conducted by Reginald Smith to investigate and compare the artefacts to those of the Thames and Somme (Dewey *et al.,*1925; Bridgland *et al.,* 1998b:42). Homersham's West Pit is the only pit where controlled excavations were undertaken (Scott, 2002; Figure 4.30). Bridgland *et al*. (1998b:44) opened three new sections in October 1997, but only two of these exposed the full extent of the sediments.

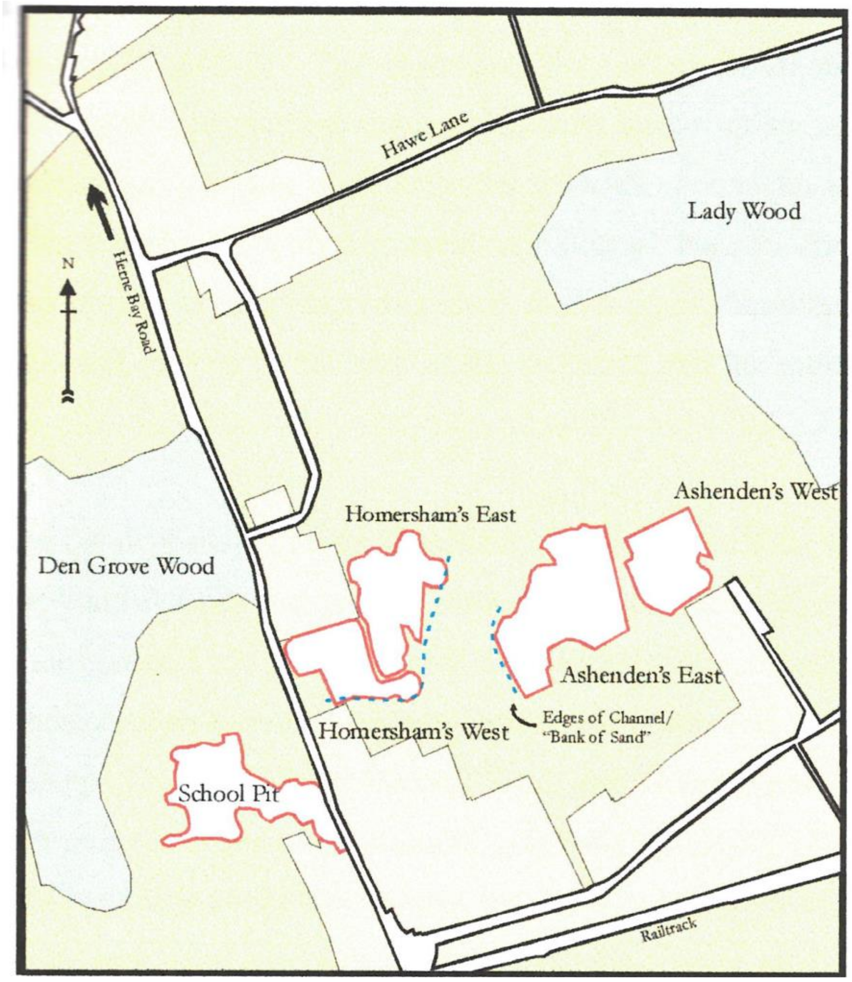


Figure 4.30 Map of gravel pits at Sturry (Scott, 2002:23).

Geology

The site is associated with the second terrace of the Stour, despite the deposits not forming one terrace but occupying a west-east trending channel cut into Thanet sand (Bridgland *et al.,* 1998b:43). At Homersham's Pit, Dewey *et al.* (1925:278) described three levels: the top at 60ft, the middle at 30ft and the lowest 15ft OD. Section W in the east side of Homersham's West Pit is shown in Figure 4.31. The red gravels are associated with 'St Achuel' artefacts, with artefacts of 'St Achuel II' or Le Moustier' type above, and 'Chelles' at the top (Dewey and Smith, 1925:122; Dewey *et al*, 1925:281). Bridgland *et al*. (1998b:44) observed that most of the sequence was loose, open framework gravel that was difficult to relate to Dewey's markers. The new sections also showed variable gravels with large scale cross bedding, aligning with much of the previous work.

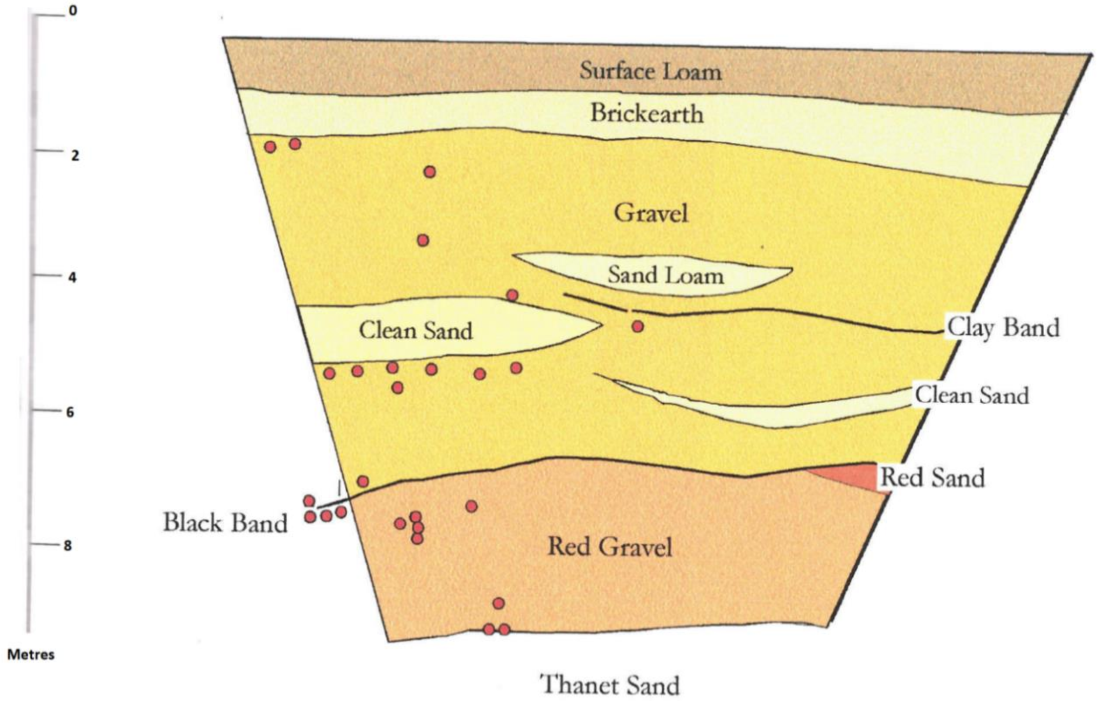


Figure 4.31 Section W with artefact positions (Scott, 2002:38).

Dating

Dating is debated, Coleman (1952:76) argued the site was older than Swanscombe, but Holmes (1981:73) later described the deposits as Ipswichian. It is widely accepted that Sturry is younger than the nearby site of Fordwich (Roe, 1981:104). Sturry is often associated with MIS 10/9/8 due to the presence of Levallois (Bridgland, 1998a). McNabb (2007:214) suggested that the site lies in the 8-7-6 climatic cycle partially based on Levallois, although Scott (2002) noted only one unambiguous Levallois artefact and this is from the lower gravel. Bridgland *et al*. (1998c:53) suggested that the Stour could be incised at near its present depth by the Mid-Pleistocene and subsequent down cutting. This could indicate an older date for the archaeology.

Archaeology

The archaeology was split into three zones: St Achuel, Le Moustier and Chelles (White, 1998b:51). Work conducted by the British Museum between 1921–3 at Homersham's Pit produced 310 handaxes (Figure 4.32), with 500 coming from a wider area assumed to be the same terrace gravel (Wymer, 1999:103). The distinction between the Acheulean and Mousterian is unclear but might be due to a difference in scraper forms as handaxes are found throughout (White, 1998b:51). Fordwich types, or 'Chelles', were found worn in the upper deposits or fresh within 'rafted' sediment in a frozen state (White, 1998b:51). Disturbance at the site shows there is a mixture of material (Roe,1981:105). Ince's collection studied by Scott (2002:33) is mainly comprised of handaxes, with cores and flakes being underrepresented. The handaxes were predominantly ovates, 12% of which have twisted edges (Scott, 2002:42-52). Roe (1968b) claimed Sturry does not have a robust sample for detailed analysis, but that they align with the types found at Swanscombe and Hoxne. The amount of twisted ovates in the assemblage questions the sites attribution to MIS 9 given the recent work of White *et al.* (2019).

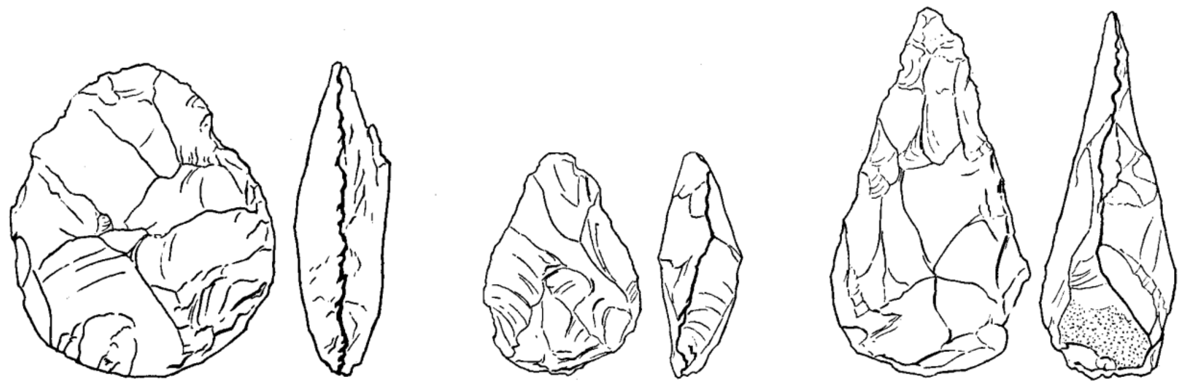


Figure 4.32 Handaxes from Sturry (Dewey and Smith, 1925:123).

Holmes (1981:75) described a tortoise core element from the middle of the sequence, and this is linked to small occurrences throughout the region. Dewey and Smith (1925:130) described twelve of these cores in rolled condition with no provenance given. Scott (2002:53) recorded one possible prepared core (Figure 4.33) along with some faceted flakes linked to the red gravel. Additionally, Roe (1968a) recorded 71 flake tools, some of which were described by Dewey and Smith (1925:125) including both notches and scrapers.

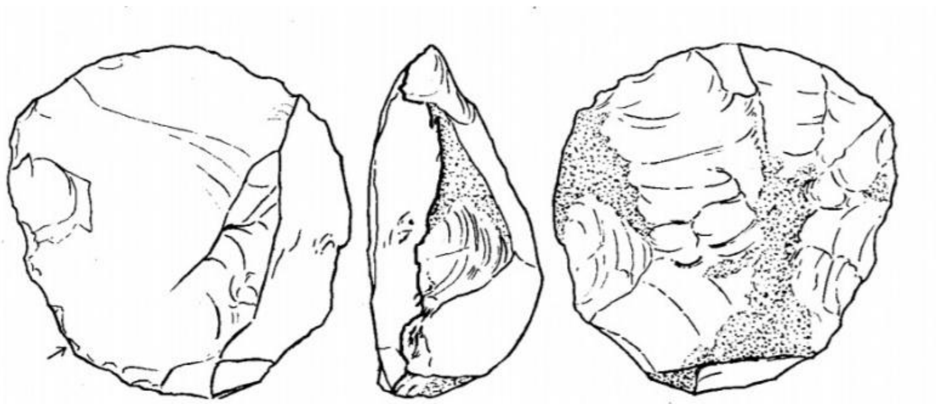


Figure 4.33 Tortoise core from Sturry (Dewey and Smith, 1925:132).

Summary

Sturry is problematic for both its dating and the mixed nature of the technology. The handaxes differ from other MIS 9 sites, and the Levallois and flake tools have not been fully examined. It is examined here due to the previous precedent and will be used with caution.

4.2 Eastern England

The east of England has received less attention despite Wymer's (1985) work. While recent excavations and re-evaluations by the British Museum and partners (Ashton *et al.,* 1992; 1998*;* 2008*;* 2016; Davis *et al.,* 2017) have added to our knowledge of the Lower Palaeolithic in eastern England, none of the major sites from these studies can be correlated to MIS 9. However, the study of a number of sites is vital to expanding our knowledge of MIS 9, as well as testing the hypotheses developed from the Thames sites.

4.2.1 Bedfordshire

Two locations in Bedfordshire, Biddenham and Kempston, are interconnected and offer important comparisons to the Thames sites including 'Clactonian elements', large amounts of flake tools and potential PCT.

Biddenham

Palaeolithic artefacts were recovered from Biddenham, Bedford in the Great Ouse Valley two years after the establishment of human antiquity (Prestwich 1860;1861; Evans 1860). Subsequently, Biddenham became the first prolific find-spot in Britain (Wymer, 1999:123). Previous research has claimed Clactonian artefacts, PCT and large numbers of flake tools came from the site (Knowles, 1853; Roe, 1981; Harding *et al.,* 1991b), making it pertinent to this thesis.

Excavation history

Artefacts from Biddenham (Figure 4.34) were discovered by James Wyatt (1861b:243; 1862) in April 1861 and formed part of early discussions by Prestwich (1861:366; 1864) and Evans (1863), with Wyatt (1861a:76) comparing the site to Abbeville. Two handaxes, an ovate and a point were originally found by Wyatt (1861a:80). This led to further discoveries of Palaeoliths and molluscs at Biddenham and neighbouring sites (Wyatt 1862:113). Most of Wyatt's later finds came from Deep Spinney Pit (Wymer,1999:123) which was reopened over a century later by Harding *et al.* (1991b:87). The limited excavations by Harding *et al.* (1991b) confirmed the presence of both archaeology and fauna at the site and concurred with Wyatt (1862:80) that the archaeology was situated at the bottom of the deposit. Other collections come from the work of Knowles (1953) who worked in the gravel pits at Biddenham, most likely Deep Spinney Pit, between 1900-1911 (Roberts, 2013:184). It is noted by Roberts (2013:185) that Knowle's work focused on collecting all material, not just handaxes, which may have addressed previous biases.

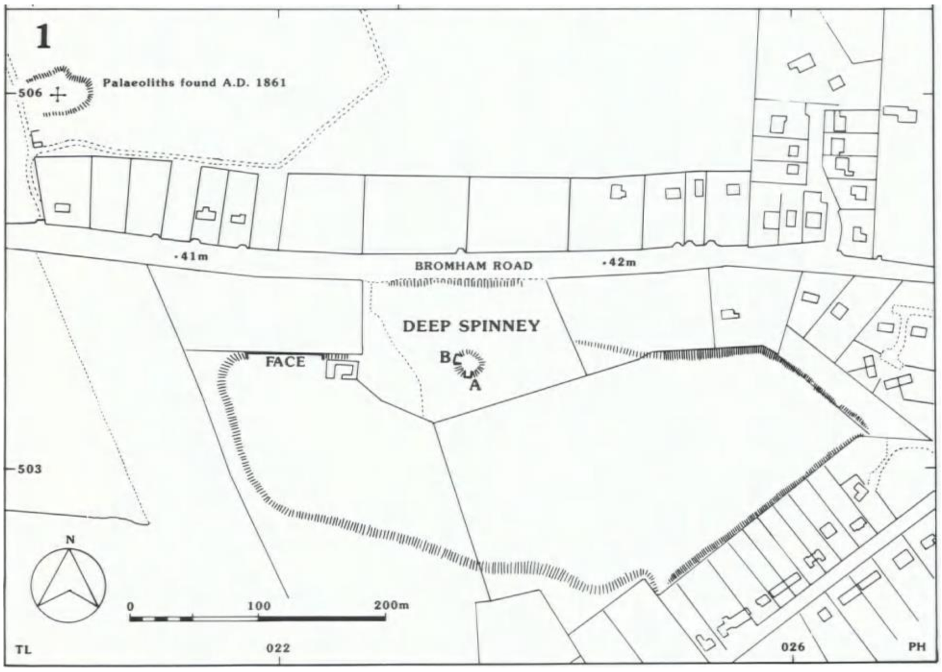


Figure 4.34 Map of the Biddenham area (Harding *et al.,* 199b1:88).

Geology

The deposits at Biddenham are part of the third terrace of the Ouse called the 'Biddenham member', at 14.5-18m above the flood plain (Boreham *et al.,* 2010:399). The archaeology is associated with the gravels, sands and silts exposed in a series of pits at this level (Harding *et al.,* 1991b:87). Roe (1981:211) described the deposits as disturbed and classed the archaeology as mixed in agreement with Wyatt's (1861b:242) assessment that the pits in the area were varied. Handaxes are alleged to have been found *in situ* alongside elephant tusks and organic beds with rich temperate signatures (Wymer, 1999:123). Wyatt (1861a) described finds coming from an area of work that had produced many faunal remains. The mollusc assemblage indicates temperate conditions (Evans, 1863:70; Harding *et al.,* 1991b:87). While the recording of material was admirable for the time, Roe (1968) and Wymer (1999:123) were still unable to provide a precise provenance for the material, although it is accepted that the material came from these gravels.

Harding *et al.'s* (1991b:87) excavation exposed the bottom two meters of the seven meters of fluvial sediment, with the top three and a half meters exposed elsewhere with no archaeology or fauna. Work focused on two new sections (Figure 4.35) in the basal deposits, just above Oxford clay, both of which contained archaeology (Harding *et al.,* 1991b:87). Beds and lenses of shelly clay were interbedded with the gravel (Harding *et al.,* 1991b:87).

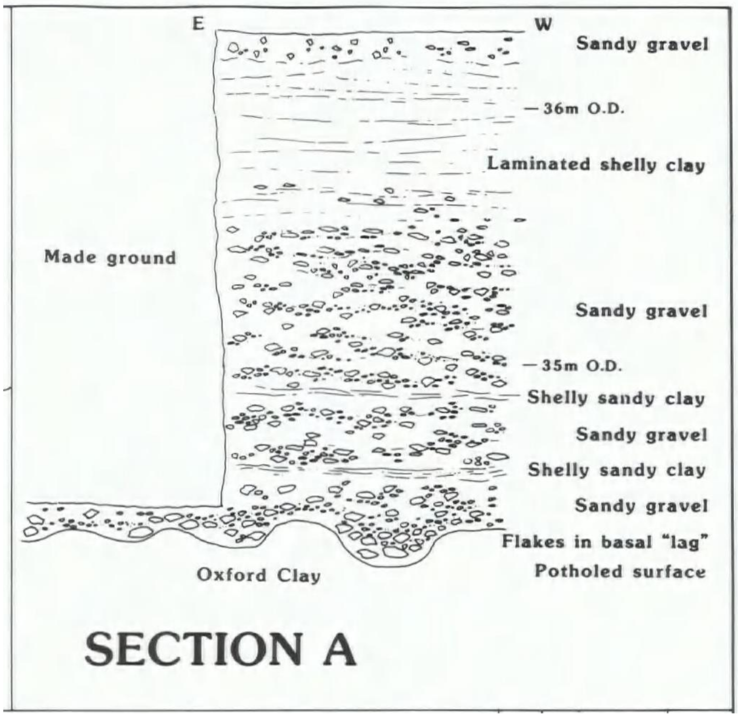


Figure 4.35 Section A from Harding *et al.* (1991b:88) excavations at Biddenham.

Dating

The Acheulean locality at Biddenham is of a different age to nearby fauna sites, some of which include *Hippopotamus major* (Evans,1897: 534; Prestwich, 1861:366), which is not part of the MIS 9 MAZ (Schreve, 1997). Prestwich (1861;367; 1864:254) stated that there is no hippopotamus at Biddenham, but noted the bones and teeth of *Rhinoceros tichorhiniis, Elephas primigenius,* ox, horse and deer.

Wymer (1999:121) deemed the site to be a mixture of Lower and Middle Palaeolithic assemblages. The Biddenham deposits on terrace three of the Ouse were the highest in the valley but younger than the Anglian boulder clay, making Biddenham younger than MIS 12 (Wymer, 1999:121). The Levallois element of the site has been used to argue that the site could be MIS 7 or later, but this remains uncertain (Wymer, 1968:124). The correlation of Stoke Goldington, situated at the floodplain level dated to MIS 7, means the Biddenham gravels must be older than that interglacial (Wymer, 1999:123). The Levallois at the site was the only factor that stopped Wymer (1999:122) stating that Biddenham dated to MIS 9. Harding *et al.* (1991b:90) and Boreham *et al.* (2010:399) suggested an MIS 10-8 date based on the archaeology and fauna, but Pettitt and White (2012:140) warned that it could be MIS 11. The analysis of handaxes by Dale (Pers. Comm. 2021) has demonstrated a strong affinity with other Group I MIS 9 handaxe sites.

Archaeology

Roe (1968a) recorded 304 handaxes, 15 roughouts, 9 cores, over 50 retouched flakes, more than 265 flakes, four Levallois cores and 19 Levallois flakes. Biddenham is dominated by pointed handaxes but was not assigned to Group I by Roe (1981:211), although Dale (Pers. Comm. 2021) does place Biddenham in this group. Despite Biddenham being dominated by handaxes, Knowles (1953) compared the large core and flake assemblage to that of the Clactonian presented by Warren (Roberts, 2013:185), although this idea has never been fully evaluated. Knowles (1953) described the presence of 'flake implements' including scrapers, as well as Clactonian, tortoise and disc cores, demonstrating variety in the material. Evans (1897:536) mainly discussed handaxes but mentions that some flakes have been shaped into scrapers, and Biddenham is one of the MIS 9 sites noted to contain over 50 flake tools (White and Bridgland, 2018).

Several Levallois cores and flakes are claimed to have been found amongst a large Acheulean assemblage (Roe, 1981:224). Harding *et al.* (1991b:87) recovered a flake with faceting but this was not diagnostic of Levallois. Roe (1981:191) described the site as having a form of Proto-Levallois and compared the material to that of Purfleet. No analysis of the Knowles collection, including most of the Levallois, had been undertaken (Roberts, 2013:185) prior to the work of Bolton (2015) who confirmed the presence of early PCT.

Summary

Biddenham offers an opportunity to examine all three technologies studied in this thesis. The importance of the Proto-Levallois material, flake tools and claims of Clactonian material by Knowles (1953) needs to be further examined to understand both the site and MIS 9. The site could be mixed or could have been described as such due to technological diversity.

Kempston

Kempston, Bedford, is often linked to Biddenham due to its proximity and similar character (Luke, 2007). Examination of the site is pertinent for the same reasons as Biddenham.

Excavation history

While Kempston was discussed as part of the early work at Biddenham (Wyatt, 1862:112), it was only later that artefacts were discovered (Wyatt, 1864:187). Wyatt (1864) related all these finds to the same deposits as Biddenham (Wymer, 1999:123). When discussing Biddenham, Evans (1897:531) described Kempston as a related site, and Worthington Smith (1894:116) discovered handaxes at Kempston in 1881. Most finds from the area date from the late 19th to the early 20th centuries during the exploitation of the gravel quarry (Luke, 2007:21). Typically, the handaxes were mostly recovered by workmen leading to a number of potential collection biases (Luke, 2007:21). Work is known to have been conducted in Foulke's Pit, but most artefacts have only a general provenance (Luke, 2007). No formal excavations at the site are known.

Geology

Handaxes and Levallois material are described as originating from the bottom of the sections with sporadic abraded finds above (Evans, 1897:535; Dewey,1930:152). Wyatt (1861:77) compared the site to Biddenham, even before the discovery of artefacts, on the basis of the geology. Stratigraphically the site is similar to that at Biddenham and both sites are described by Dewey (1930:152) as a wide spread of gravel 40ft above the current river with a lower section of evenly bedded sandy gravels and the material above being irregular.

Dating

Kempston, like Biddenham, is on the third terrace of the Ouse (Luke, 2007:24). This, as well as the similarities to Biddenham both in geology and archaeology, have led to the site being placed in MIS 10-9-8 (Boreham *et al.,* 2010; White and Bridgland, 2018; Dale, Pers. Comm. 2021).

Archaeology

Roe (1968a:4) lists material as coming from seven pits, but most artefacts are classed as having a general provenience. Among the latter, Roe (1968s:4) recorded 445 handaxes, nine roughouts, two cores, 54 retouched flakes, 236 flakes, one Levallois core and nine Levallois flakes. Most of the other pits have a handful of handaxes and flakes, 12 at both Foster's Pit and Bunyan Road, but Foulke's Pit contained 65 handaxes, two roughouts, one core, nine retouched flakes, 12 flakes and a Levallois flake (Roe, 1968a:4).

Little has been written about the character of the archaeology. A handful of handaxes were deposited at the Pitt Rivers Museum by Smith (Roberts, 2013:186), but are not described. Wyatt (1861a:85) noted that the archaeology from Kempston seemed more rolled than that at

Biddenham and that it also came from the lowest part of the sections. Seven artefacts from Jarvis Pit were described by Pinder (1988:109) from a private collection including four handaxes, a flake and two rough cores, but these lacked any contextual information about their discovery (Figure 4.36). Similar to Biddenham, while pointed handaxes dominate Roe (1981:211) did not place Kempston in Group I, however, Dale (Pers. Comm. 2021) has done so.

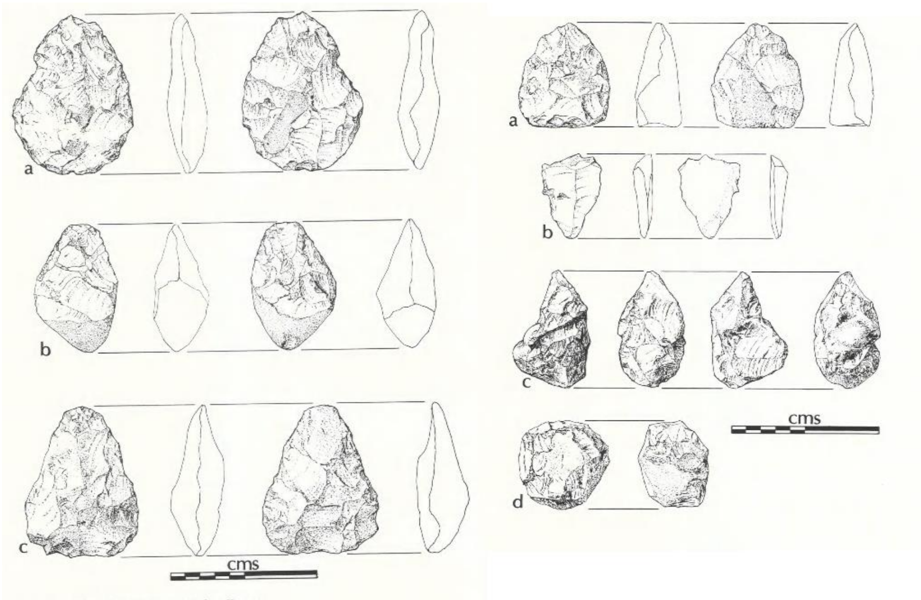


Figure 4.36 Artefacts from Jarvis Pit (Pinder, 1988:110-111).

Kempston is known for containing a Levalloisian element mixed with the Acheulean assemblage but this has not been fully examined (Roe, 1981:224). Additionally, Evans (1897:536) mentioned flakes trimmed into flake tools from the site, and alongside Biddenham, Kempston is one of White and Bridgland's (2018) 15 flake tools sites.

Summary

Despite the lack of formal excavation and the low profile of the site, the relation between Kempston and Biddenham is secure. Therefore, Kempston is likely to date to MIS 9. The site has great potential for evaluating both Levallois and flake tools in MIS 9 and potentially non-handaxe assemblages due to its links with Biddenham.

4.2.2 East Anglia

The sites in East Anglia, traditionally an important region for the Lower Palaeolithic (Wymer, 1985), are underrepresented in MIS 9. The following sites also contain issues of provenance and dating.

Station Pit, Kennett/Kentford

Station Pit near the Cambridgeshire- Suffolk border has yielded large quantities of handaxes, over 50 flake tools and potentially PCT (Roe, 1968a:37). Confusion over the provenance of material described as either Kennett or Kentford has hampered the study of the site. The material listed under Kennett, Cambridgeshire in Roe (1968a:37), has since been re-evaluated as being mixed with Kentford, Suffolk (Figure 4.37; Wymer, 1985:96). Evans (1897:539) described artefacts as coming from gravels near Kennett station. Wymer (1985:96) subsequently argued that there are no gravels around Kennett station. Wymer (1985) later merged the material labelled Kennett and Kentford together.

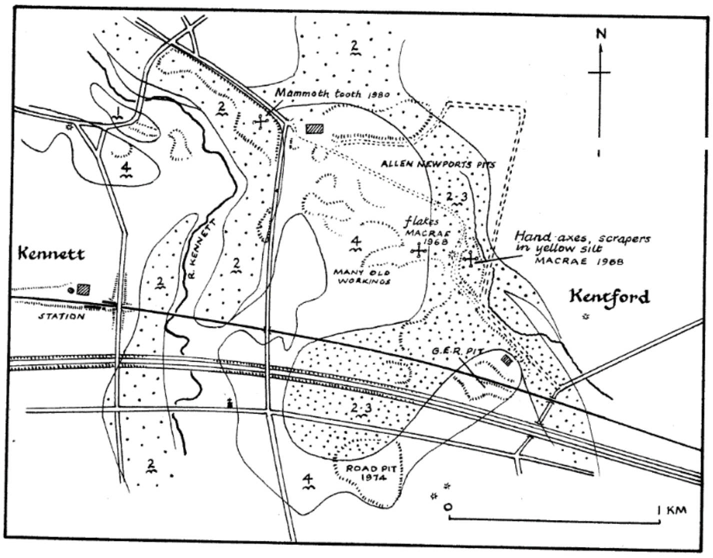


Figure 4.37 Map showing the location of Kennett and Kentford gravel pits with artefact locations marked (Wymer, 1985:97).

Excavation history

The first reference to artefacts from Kennett is the discovery of implements by Mr. A.G. Wright in 1884-85 during the extraction of ballast in Great Eastern Railway (GER) Pit (Whitaker *et al.,*1891:76). This included the discovery of fauna mainly too fragmentary to identify, although examples included *Bos, Cervus, Elephas primigenius, Equus, Rhinoceros and Hippopotamus* (Whitaker *et al.,*1891:76). Wright (1886) described three surface finds but referred to previous work at the ballast pit a quarter of a mile from Kennet station. The GER Pit was inspected by Wymer (1985:97) on several occasions. In 1968 MacRae collected around 250 artefacts, mainly flakes, but also ten handaxes, three cores and two scrapers found *in situ* containing both rolled and fresh material (Wymer, 1985:98). Large gravel pits were still open between Kentford and the railway in 1980, but many were disused or back filled (Wymer, 1985:96).

Geology

Wymer (1985:98) described the area between Kentford Heath and the railway as a bed rock of chalk with 4-5m of gravel well-bedded apart from cryoturbation at 1.5m, possibly decalcified. Wymer (1985:98) described a coarse gravel up to three meters thick, recorded in the GER Pit banked against a gravel consisting of chalk pebbles, which contained artefacts. The flint in the area is classed as sub-angular and battered, lacking larger pieces (Wymer, 1985:98). Wymer (1985:98) suggested that the gravels could be a glacial outwash due to an incursion of a chalky lens of solifluction deposits. In the area MacRae worked, there was a metre of yellow silt between the gravel and the chalk (Wymer, 1985:98).

Dating

Wymer (1999:121) discussed the site in relation to the March Gravels, and described the material as Devensian (Bristow, 1990). The Acheulean material known from these gravels makes this unlikely, but it is possible that the gravels are heavily mixed especially with the potential Levallois material (Wymer, 1999:121). The gravels of the River Kennett are associated with MIS 11-8 but reworking cannot be discounted. Wymer (1999:128) classed the gravels as Terrace Four of the Kennett, but Boreham *et al.* (2010:402) attributed the gravels to the third terrace ~25-30 OD. Wymer (1985) previously noted a higher level of gravel which was distinct. Kennett is treated as MIS 9 in both Pettitt and White (2012) and White and Bridgland (2018).

Archaeology

'Station Pit' is taken to reference the GER pit where Wymer (1985:98) argued most of the material derived from, or from similar gravels. Roe (1968a:37) recorded 144 handaxes, one core, 55 flake tools, 78 flakes, and two Levallois flakes with other artefacts coming from associated pits. Roe (1981:208) described between 200-300 handaxes from the Kennett area, principally Station Pit and Worlington Road Pit, but with a mixture in condition and many with no exact provenance. Roe (1981:208) placed the site with his group VI, and Wymer's analysis concurred showing an assemblage dominated by ovates and cordates, unusual for MIS 9.

Reports of Levallois flakes are known from the site, and a tortoise core was described by Smith (1926; Wymer, 1985:98). There are descriptions of convergent scrapers and end scrapers from the site (Roe, 1981:208), some of which are illustrated by Wymer (Figure 4.38). Little evidence can be found on the character of the flake tools at the site.

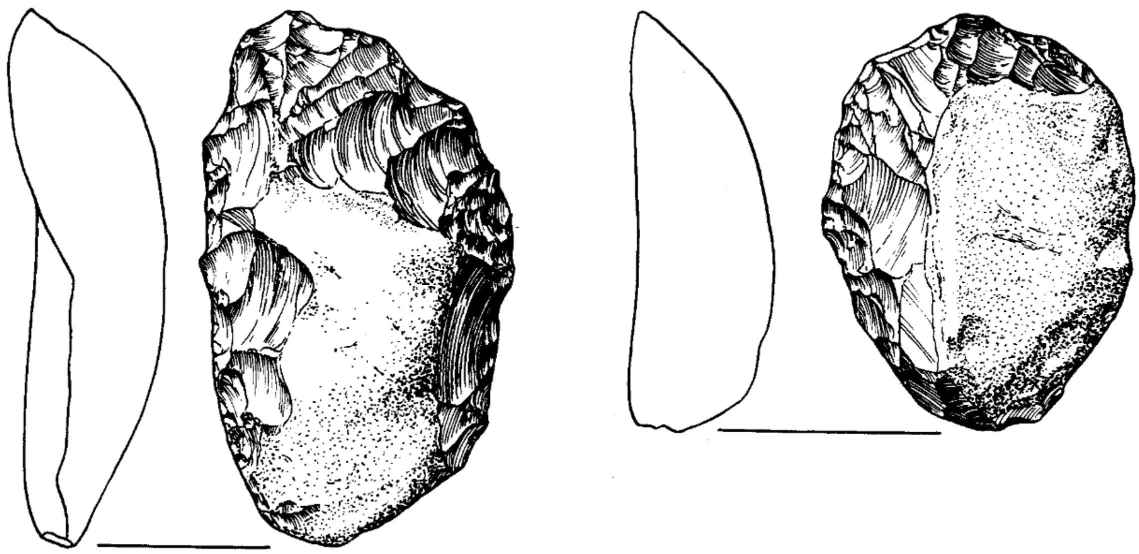


Figure 4.38 Two flake tools from Allen Newport's Pits, Kentford (Wymer, 1985:99).

Summary

Kennett/Kentford is a difficult site to date or contextualise. The archaeology seems atypical of MIS 9. The evidence for Levallois is slight and flake tools from the site have not been well described. The site has been analysed but caution is needed in its interpretation.

Barnham Heath

Barnham Heath, Suffolk is located near the Norfolk border close to the separate MIS 11 site Barnham East Farm (Roe, 1981:205; Wymer, 1985). The site has produced a large Acheulean assemblage with some Levalloisian material.

Excavation history

Gravel Pits were dug on Barnham Heath during the middle of the 20th century (Ashton and Scott, 2016). F. Russel exhibited a handaxe from 'Barnham Common' in 1913 at a meeting of the Prehistoric Society of East Anglia, but prior to 1947 this work was small scale (Wymer, 1985:124). Expansion of the pits was overseen by Basil Brown, a well-known collector associated with Ipswich Museum, between 1947-55 (Wymer, 1985:124). Little was published from the site and the records, notebooks and weekly updates held in Ipswich Museum do not add much context to the artefacts (Wymer, 1985:124; Ashton and Scott, 2016).

Geology

The site is located to the south of the Little Ouse river on a distinct terrace feature 6-8m above the flood plain (Wymer, 1985:123). The site had mainly been dug away by 1985 (Wymer, 1985:123). A section drawn by Basil Brown in October 1947 shows 5.8m of sandy gravels resting on disturbed chalk with archaeology coming from the base (Figure 4.39). Earlier deposits of white clay and gravel near the base were observed to have no archaeology and were thought to be glacial outwash (Wymer, 1985:124).

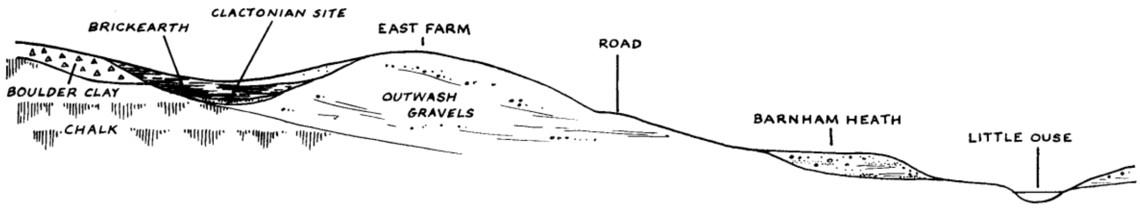


Figure 4.39 Barnham Heath in the wider context of the Ouse (Wymer, 1985: 123).

Dating

The geology and archaeology of the site are poorly understood due to terraces in the area lacking definition, contextual information and chronological control (Davis *et al.,* 2017:39). The Levallois from the site has led many to characterise the site as belonging to MIS 7 (McNabb, 2007; Pettitt and White, 2012). The site is associated with the modern River Ouse, placing it between 400-200kya and therefore MIS 11-MIS 7 (Davis *et al.,* 2017:29). The character of its handaxes has shown similarities to MIS 9 sites (Dale, Pers. Comm. 2021).

Archaeology

Roe (1981:205) described the site as containing a mixed assemblage with Clactonian, Acheulean and Levalloisian material. Unfortunately, unlike Purfleet and Cuxton the material is not stratified. Wymer (1985:126) noted the occurrence of both rolled and sharp chopper cores as well as crude handaxes which included the presence of some proto-handaxes.

The handaxes from the site are described as having a clear Group I element by Roe (1981:205), being dominated by pointed handaxes and some large cleavers. While pointed handaxes were dominant, Wymer (1985) argued more ovate material occurred in a different condition. A Proto-Levallois industry which lacked fully fledged Levallois (Figure 4.40) was also attributed to the site, but could be from a lower terrace (Wymer, 1985:126; Ashton and Scott, 2016). The Proto-Levallois represents the largest collection of Levallois material in the Brecklands (Davis *et al.,* 2017:40). Wymer (1999:141) described five Levallois cores and three flakes, an unusually large amount for the area as Levallois is often only found as stray finds.

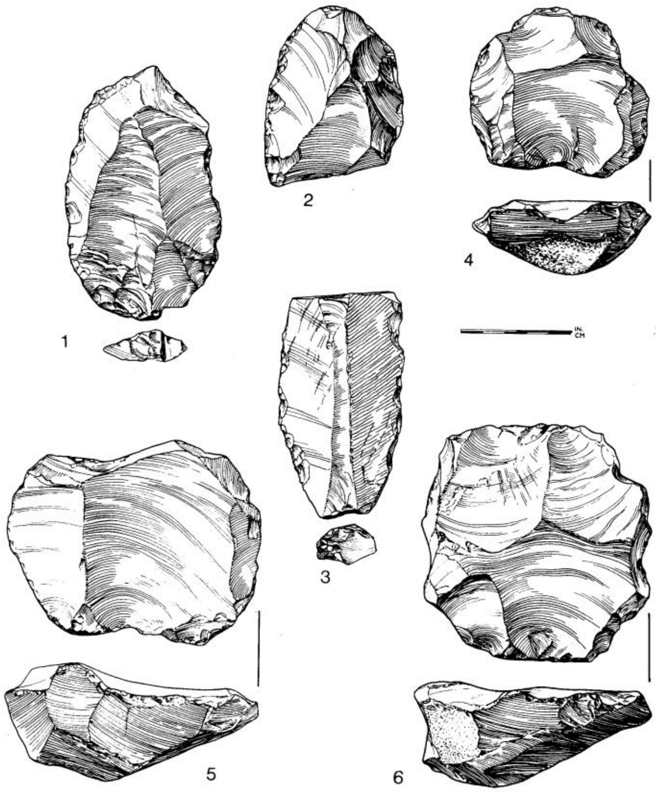


Figure 4.40 Examples of Proto-Levallois material from Barnham Heath (Wymer, 1985:125).

TERPS and Roe (1968a) record different amounts of material from the site summarising below:

Type of material	Roe (1968a)	TERPS
Handaxe	500	230+
Cores	120	12+
Flakes	350	Numerous
Levallois core	5	5
Levallois flake	3	3

Table 4.2 Summary of Barnham Heath assemblage.

Summary

Barnham Heath is a large assemblage that has been understudied due to the lack of dating and contextual evidence. Its archaeology offers a good comparison to the other sites in this thesis. The supposed early industry of chopper cores, large flakes and proto-handaxes ties into questions around non-handaxe assemblages, while the Proto-Levallois material relates to other examples during MIS 9. The site was interpreted with caution due to the uncertainties around dating.

4.2.3 Other sites in East Anglia

The study of East Anglia has been hindered by the factors discussed in Chapter Three. The following are brief overviews of sites which could not be studied in full, but still inform aspects of the discussion chapters and should therefore be prioritised for future work.

Southacre

Sainty originally discovered artefacts at Southacre in the Nar valley in 1934 (Clark *et al*, 1937:438; Sainty and Watson, 1944:184). By 1957, several pits were being worked with the most notable being Bartholomew's Hill Pit, though most artefacts were recorded just as 'Southacre' (Wymer, 1985:45). Rescue work was carried out between 1996-1999 during commercial work at Thorpe Gravel Pit by MacRae, who discovered an assemblage of around 350 artefacts (MacRae, 1999:5).

Sainty and Watson (1944:184) described Southacre as lacking stratification. Roe (1981:149) described the deposits the artefacts were found in to be an outwash gravel that would provide an upper age limit (Ventris, 1986; Wymer, 1988). The dating of Southacre remains controversial (MacRae, 1999:5). McNabb and Ashton (1995:297) dated the site to post-MIS 9 and McNabb (2007:205) placed the site within the MIS 7 Levallois sites. Boreham *et al.* (2010:402) modelled Southacre as MIS 9, but this is in part due to the nature of the archaeology at the site.

The site is noteworthy for having elaborate flake tools and early Levallois working within an Acheulean assemblage. The site contained scrapers ranging from rough retouch to controlled shaping (Sainty and Watson, 1944:186; Roe, 1981:148). McNabb (2007:205) described these as High Lodge type flake tools, although the site is not listed by White and Bridgland (2018). Wymer (1985:45) stated that Southacre is the best example of Proto-Levallois in East Anglia. Sainty and Watson (1944:184) described tortoise cores coming from the site as well as several Levallois flakes with prepared platforms. Later counts record three Levallois cores and nine Levallois flakes. Original reports described a handaxe and 'several flakes of Clactonian type' from the Little Eastern gravels at Southacre (Sainty, 1935:100) and Roe (1981:148) compared the site to the Clactonian due to the presence of chopper cores and large flakes. Work by MacRae (1999:5-7) at Thorpe Pit added material including 15 handaxes, five Levallois cores (Figure 4.41), three regular cores and over two hundred flakes. The handaxes are mainly pointed in nature but crude ovates are also present (MacRae, 1999:7). The Levallois working at the site shows small removals which MacRae (1999:9) described as being not as advanced as standard Levallois, perhaps showing the technology in its infancy.

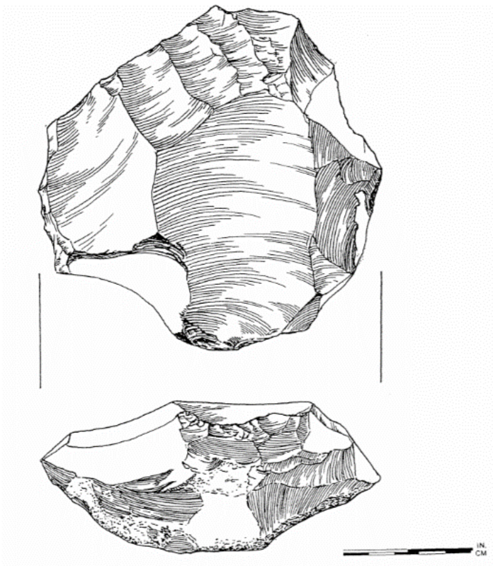


Figure 4.41 Proto-Levallois core from Southacre (MacRae, 1999:8).

Keswick and Whitlingham

Keswick is a virtually unpublished site on a 50ft terrace of the River Yare that is often linked to the nearby site of Whitlingham (Sainty and Clarke, 1946; Roe, 1981:171; Wymer, 1999:132). The site has never been formally excavated (Roe, 1981). The gravel was dug between the 1950's and 1970's, with little recording, and it was filled in by the time Wymer visited in 1972 (Wymer, 1985:62). Through the work of collectors, principally Mr. D. Lawrence and Norwich Castle Museum, artefacts were recovered in large quantities (Wymer, 1985:62). While most of the material is only recorded as being from Keswick and there are multiple pits, it is thought all the material came from one place. A large working gravel was marked at 42ft, produced at least 100 implements, 1 ox tooth and a fused vertebrate, possibly horse (Cranshaw, 1983:61). McNabb (2007:177) detailed issues with dating the site but agreed Keswick was contemporary to Whitlingham and most likely MIS 9. Both Wymer (1985:62) and Roe (1981:171) described a single industry that was fresh or slightly rolled. Roe (1981:171) described the site as a typical Group I assemblage with pointed handaxes, ficrons, cleavers and flake tools, as well as examples of Levallois (one core and two flakes). Although, Callow (1976:42) had described an absence of Levallois. While Keswick was one of Pettitt and White's (2012) flake tool sites Roe (1968a) only listed 49 flake tools.

Whitlingham was excavated, but systematic work proved difficult (Sainty, 1927 and Boswell:182). Sainty (1951:162) referred to bones of elephant, horse and deer, after previously describing a lack of faunal remains (Saintly and Boswell, 1927:186). Roe (1968a) recorded over 200 handaxes but does not list numbers for other material. Any PCT or flake tools may have been previously overlooked. The archaeology is in a similar condition to Keswick and it was also assigned to Roe's Group I (Roe, 1981:170). Finely made scrapers similar to High Lodge were mentioned by Wymer (1985:66). Wymer (1999:133) stated that no Levallois has come from the site, but no detailed analysis seems to have taken place. Sainty and Boswell (1927:189) described Mousterian techniques and a possible transitional Mousterian. Sainty and Boswell (1927:187) recorded 543 finds with only 173 handaxes, suggesting there is a lost component from Roe's (1968a) count. Particularly intriguing is the mention of 26 scrapers and 35 worked flakes, with a separate mention of another 50 scrapers (Sainty and Boswell, 1927:185-7).

Summary

Unfortunately, examination of these sites has not been possible (see Chapter Three), but it is clear that similarities exist to the other sites in this study and literature will be used to supplement the current research.

4.3 The Solent

The Solent is the least understood of the three broad areas under study. The non-handaxe phenomenon observable in the Thames during MIS 9, would be difficult to recognise in the Solent due to the requirement of well-preserved sites and levels of provenance not found in the region (Westaway *et al.,* 2006:2217). Pettitt and White (2012) list no Solet sites as having over 50 flake tools. This leaves PCT as the main focus for this thesis.

Warsash

Warsash is situated south-east of Southampton on the terraces of the River Test and is one of the richest Palaeolithic locations in the Solent area (Roe, 1981:127). Its correlation with MIS 9, and the presence of Levallois material in close association with a handaxe assemblage, makes it essential to this thesis.

Excavation history

Evans (1897:547) described the discovery of a well-made pointed implement *in situ* by Mr. Codrington near Warsash. Collecting intensified with the increase of gravel extraction between the 1920's and 1970's (Davis *et al.,* 2016:560). Burkitt *et al* (1939:39) described how Mr. Mogridge of Winchester Museum collected material from gravel pits in the Warsash area over several years. Burkitt *et al.* (1939:39) visited the site to record sections and discuss the findings with workmen. Typical of most collectors in the region, Mogridge recorded no provenance (Davis *et al.,* 2016:560). Other collections are known from the area, but little documentation exists. Further work was undertaken in 2010-11 by Davis (2013) and Hatch (2014).

Geology

Artefacts from Burkitt *et al.* (1939:40) came from four pits near each other (New, Park, Dykes, and Newbury) with varying thickness of gravel. The gravels are described as not being homogenous, indicating that they were not laid down during the same period (Burkitt *et al.* 1939:40). Work in Newbury's Pit (Figure 4.42) provided a section that was representative of the area (Burkitt *et al.,* 1939:40). The Test has been split into five terraces, with most of the Warsash area on top of the third terrace (Hatch *et al.,* 2019). This terrace has been split into two by Westway *et al.* (2006): the Lower (Mottisfont) and Upper (Belbin) Warsash terraces. The Mogridge material can all be assigned to the Lower Warsash terrace, along with all material collected prior to 1945 due to the records of work (Davis *et al.,*2016: 564). An assemblage of handaxes is assigned to the Hamble terrace, but unlike the Lower Warsash gravels contains no Levallois material (Davis *et al.,* 2016: 564).

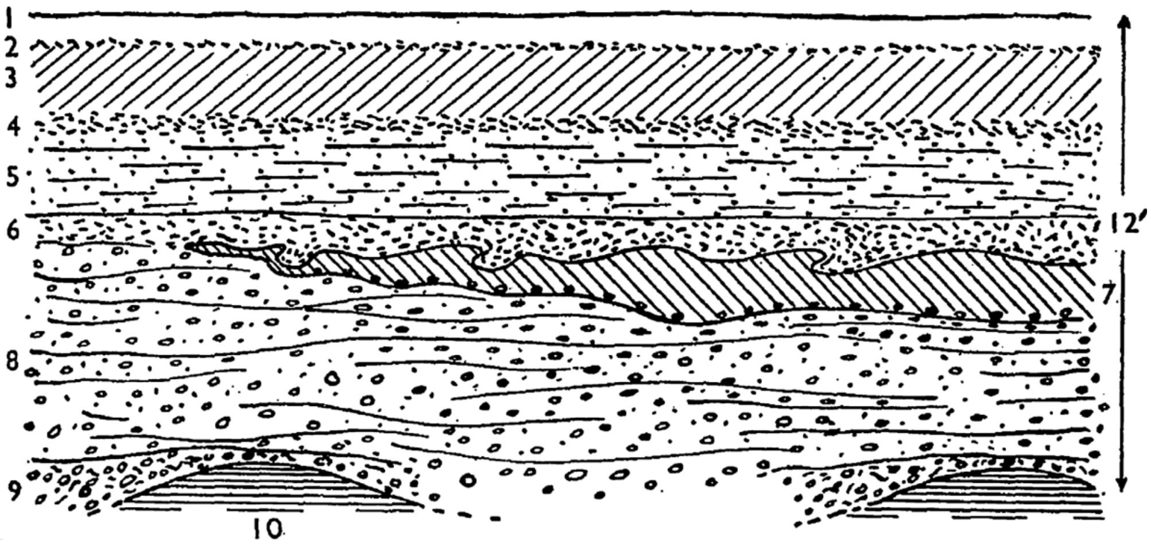


Figure 4.42 Section from Newbury's Pit, Warsash (Burkitt et al., 1939). (1) Black pebbly sand; (2) thin basal layer of angular gravel; (3) buff stony loam; (4) fine angular gravel; (5) fine, even bedded, gravelly sand with occasional sand lenses; (6) fine gravel; (7) non-ferruginous, grey, clayey sand; (8) coarse, loose, ferruginous gravel; (9) coarse brown gravel conglomerate; (10) Barton Sand (Davis et al., 2016:561).

Dating

There are problems dating the site, exacerbated by issues with the provenance of much of the material. The site is often interpreted as containing material from different periods (Roe, 1981:129), and OSL dating has recently been debated (Westaway *et al.,* 2006; Harding *et al.*, 2012; Briant, 2012; Hatch *et al,* 2017). The Hamble terrace is commonly dated to MIS 7 with the Lower Warsash terrace dated to between MIS 8-7, and the Upper Warsash Terrace to between MIS 12-9 (Westaway *et al.,* 2006; Harding *et al*, 2012; Briant, 2012; Hatch *et al,* 2017).

Archaeology

TERPS recorded 609 artefacts from Warsash split over 15 different sites (475 handaxes and 24 Levallois artefacts), the majority of which are under a general entry (Davis *et al.,* 2016:563). Warsash is one of a number of sites in the Southampton and Bournemouth area that Roe (1981:205) classed as part of his Group I (Davis *et al.,* 2016:560; Figure 4.43). Handaxes made on flake blanks are common and some of these are only unifacially worked (Davis *et al.,* 2016:566). Later handaxes, including *bout coupés*, are found in fresher condition and are likely to be from fine grained deposits overlying the terrace deposits (Davis *et al.,* 2016:565). The late Acheulean material has been compared to Wolvercote due to the presence of plano-convex handaxes (Roe, 1981:127). While it has been suggested that handaxes from the Hamble terrace could be from MIS 7, their derived nature makes it probable that they are older (Davis *et al.,* 2016:570).

Burkitt *et al.* (1939) described a stratigraphic distinction between the handaxes and Levallois. Most of the Levallois material (34 artefacts, mainly flakes) from the site is distinct in condition, being fresher and more patinated (Hatch *et al.,* 2019; Figure 4.44). While the handaxes may date to MIS 9, the Levallois material could mirror the situation in the Thames at the sites of Creffield Road and Yiewsley (Scott, 2011). At these sites fresh Levallois, attributed to MIS 8/7, has been recovered in overlying gravel containing rolled handaxes (Shackley,1981; Davis *et al.,* 2016:570). The Levallois examined by Davis *et al.* (2016:568) shows a homogeneous group centred around centripetal surface preparation, lineal removals and faceted striking platforms although some variation was noted. Davis *et al.* (2016:571) identified the material as Levallois as opposed to Proto-Levallois. The fresh Levallois material potentially dates to late MIS 8/7 (Davis *et al.,* 2016:571), and this fits in with the evidence for handaxes as the Levallois clearly post-dates them.

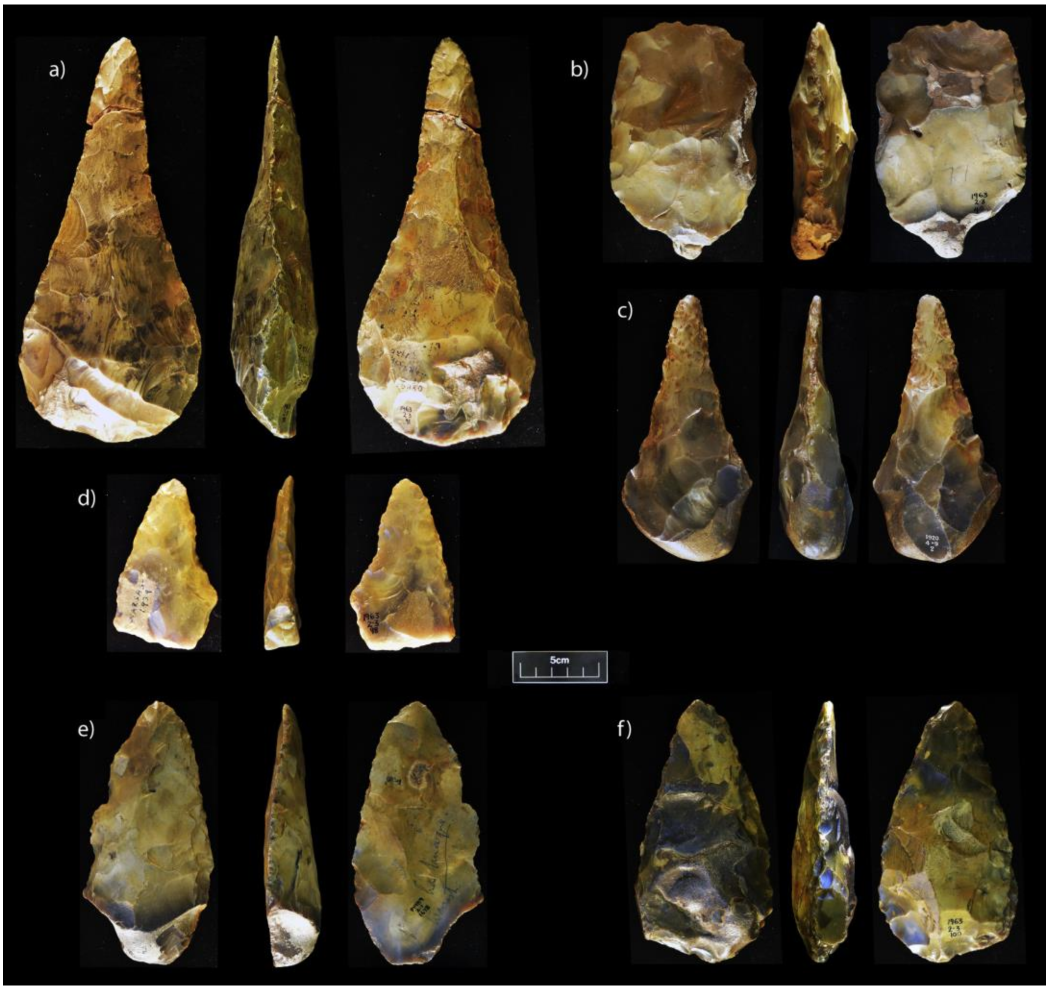


Figure 4.43 Handaxes from Warsash (Davis *et al.,* 2016:567).

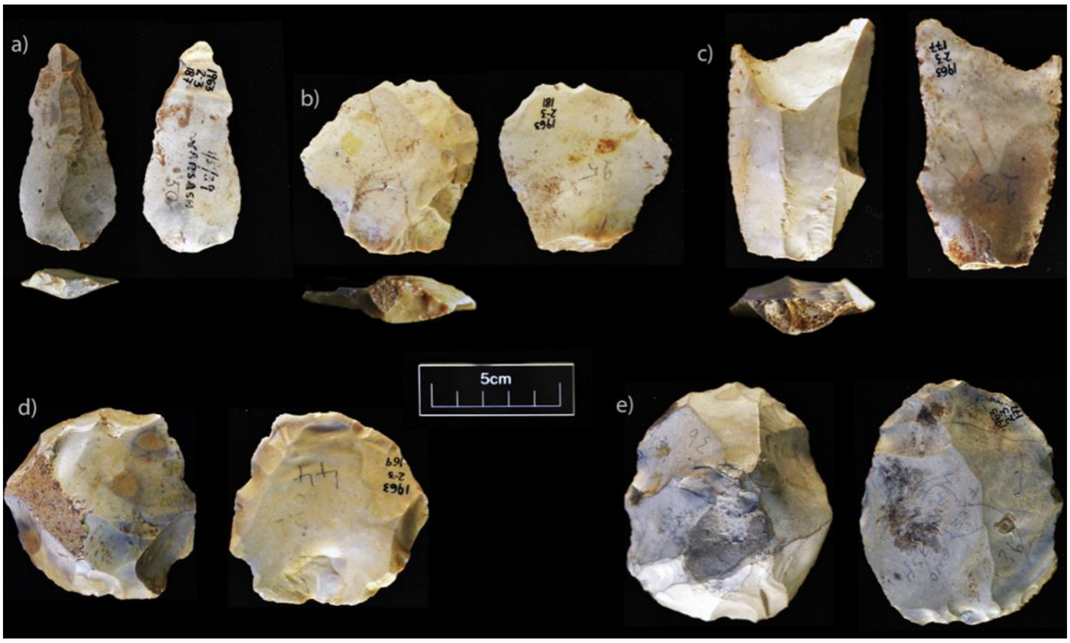


Figure 4.44 PCT from Warsash (Davis *et al.,* 2016:569).

Summary

Warsash is a key site due to the scarcity of PCT in the Solent. While the handaxe material probably dates to MIS 9 it is likely that the PCT is later, possibly within the following climate cycle. The examination of the Levallois artefacts will be used to compare Warsash to sites in the Thames and eastern England, as well as other Solent sites with PCT.

Dunbridge

Dunbridge, Hampshire, in the Test Valley is one of only a handful of prolific sites in the Solent. It is preliminarily dated to MIS 9 and has yielded PCT (Harding and Bridgland, 2019).

Excavation history

Early in the 20th century, the largest assemblage of Palaeolithic artefacts from Hampshire was discovered at Dunbridge with over 1000 handaxes recovered (Harding, 1998:72). The earliest mention of gravel extraction can be traced back to 1874 in a small pit, later extended along with a further pit and the quarry at Kimbridge Farm (Harding *et al.,* 2012:586). Dale (1912:115; 1918) discussed how finds were the result of manual gravel extraction, and workmen did not provide precise locations for many finds. No work in the area can be accounted for after 1945 until the site was classified as a Site of Special Scientific Interest (SSSI) during the 1980's (Harding *et al.,* 2012:585). In 1987 an evaluation was conducted starting with test pitting (Harding, 1998:73). Further work was undertaken as a systematic watching brief between 1991-2007 (Harding *et al.,* 2012:586).

Geology

Dale (1912) argued that two levels were distinguishable within the gravels. Two levels were also identified by White (1912); the Upper Belbin and Lower Mottisfont, and this was supported by the work of Booth (2002). The gravel from the original Dunbridge Pit was considered to be the Belbin stage while the Mottisfont stage was represented by material from Kimbridge (Harding *et al.,* 2012:586). Dale (1918) considered fresh material from a white layer to be more recent than the rest of the finds. Modern evaluations (Figure 4.45) suggested that the upper white gravel contained mint artefacts, and that the lower stained gravel contained rolled handaxes (Roe, 1981:206; Harding, 1998:72; Hosfield and Chambers, 2004).

In 1992, work in the north east corner of the pit showed five meters of well-bedded sand and gravel on the surface of the Reading Beds (Harding, 1998:73). The top two meters of gravel showed signs of cryoturbation. No faunal or paleoenvironmental evidence was recovered during the work of Harding *et al*. (2012:595).

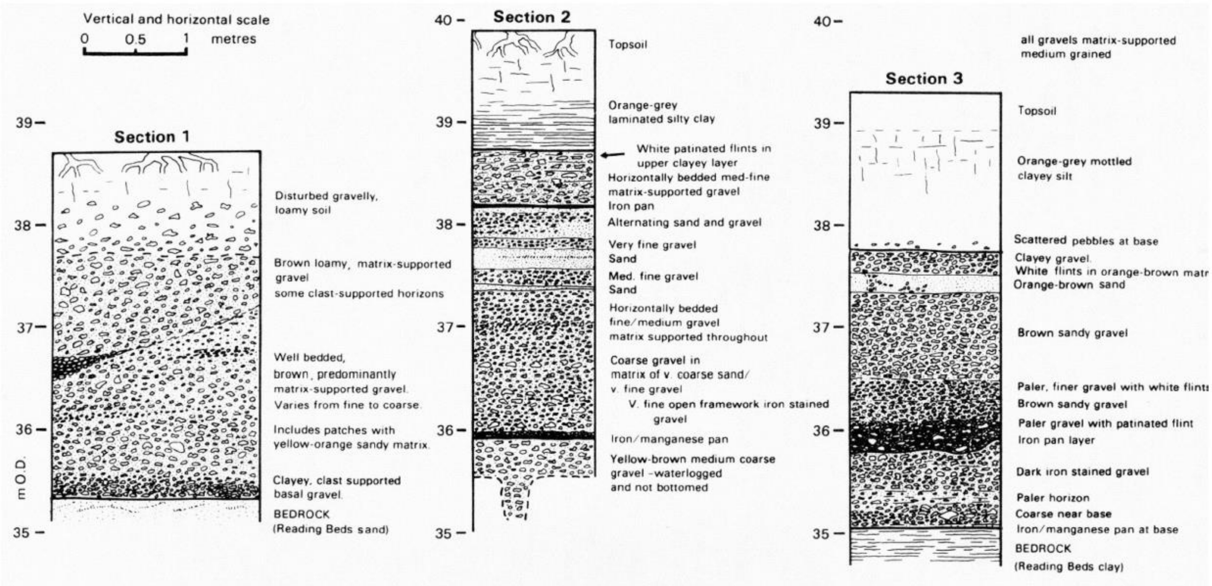


Figure 4.45 Sections from 1980's excavations at Dunbridge (Harding and Bridgland, 2019:160 after Bridgland and Harding, 1987).

Dating

Older OSL samples dated Dunbridge to 314 +/- 24 kya with a 95.4% confidence limit for the gravels being ~ 338-290 kya, placing the assemblage within MIS 10 or MIS 9 (Westaway *et al.,* 2006). Later, other OSL samples (Briant et al., 2006,2009; Schwenninger et al., 2006, 2007; Briant and Schwenninger, 2009) were used by Harding *et al.* (2012) to date the Belbin terrace to MIS 9b. This was supported by further work and Hatch *et al.* (2017) attributed the Belbin/Upper Warsash terrace to MIS 9 (?12-9) and the Mottisfont terrace to MIS 8-7.

Archaeology

Dunbridge is dominated by handaxes, predominantly points alongside some well-made ovates (Roe, 1981:206). The material recovered by Harding *et al.* (2012) provided a much more representative sample of material as it recorded a higher proportion of flakes and cores which were previously overlooked.

During the watching briefs 163 finds were recovered, but only 47 from the pit itself with the rest found on the reject heap (Harding, 1998:73). Most artefacts were recovered in the Belbin terrace (Harding *et al.,* 2012:599). The handaxes recovered concurred with prior assessments of Dunbridge material (Hosfield and Chambers, 2004) in showing pointed implements along with two ficrons, three cleavers and some ovates (Harding *et al.,* 2012:599). The 114 flakes found at the site demonstrate tool manufacture, but this collection was biased towards large and easily recognisable flakes (Harding *et al.,* 2012:596). Well-made flake tools (Figure 4.46) are known from both the work of Dale (1918) and the watching brief (Harding *et al.,* 2012:599).

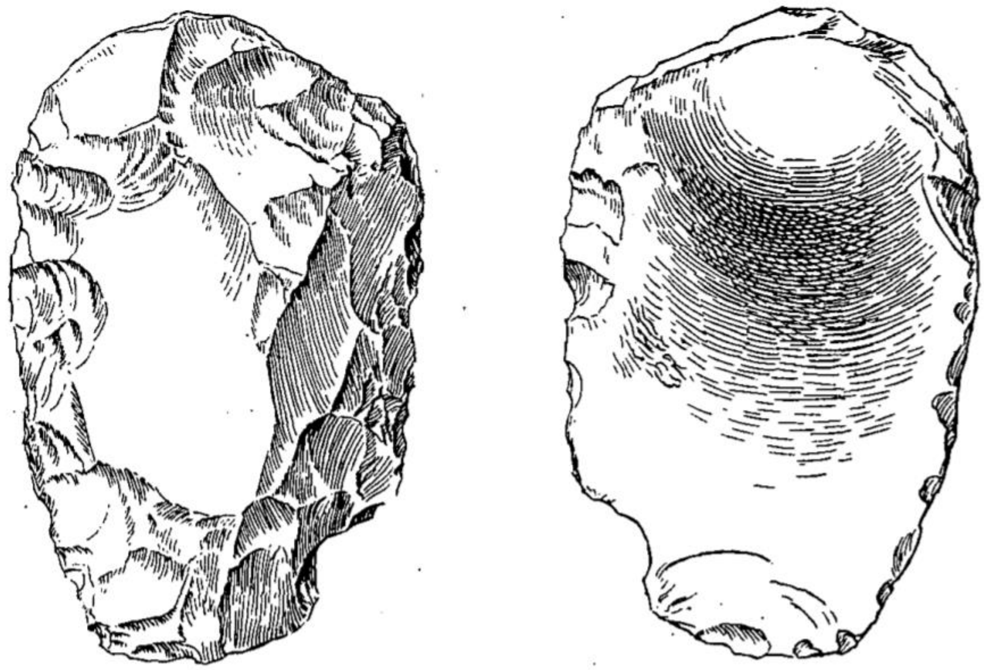


Figure 4.46 'Le Moustier' implement, Dunbridge (Dale, 1912:110).

During the watching brief, three Proto-Levallois cores were recovered (Figure 4.47), rolled and stained which is indicative of the main Belbin gravel, and can be provenanced from this area due to the date of discovery (Harding *et al.,* 2012: 595; Harding and Bridgland, 2019). The fully fledged Levallois have a yellow staining on top of a patina and show standardisation in the use of raw material (Harding *et al.,* 2012:595). These cores probably come from the top of the gravels where a similar condition of material is found (Harding *et al.,* 2012:595). Harding and Bridgland (2019) argued that while these cores come from the Belbin gravel, their fresher condition may show that they relate to a different occupation.

The remainder of cores are described as typical Lower Palaeolithic MPCs (Harding *et al.,* 2012:595). Others have questioned the meaning of the Levallois and Proto-Levallois at the site (Hatch *et al.,* 2017; Davis *et al.,* 2019; Briant *et al.,* 2019). *Bout coupé* handaxes, associated with MIS 3, have been noted from the area but are likely unrelated to the main assemblage due to differentiation in condition and the lack of records of their discovery or context (Roe, 1981:257; Harding and Bridgland, 2019).

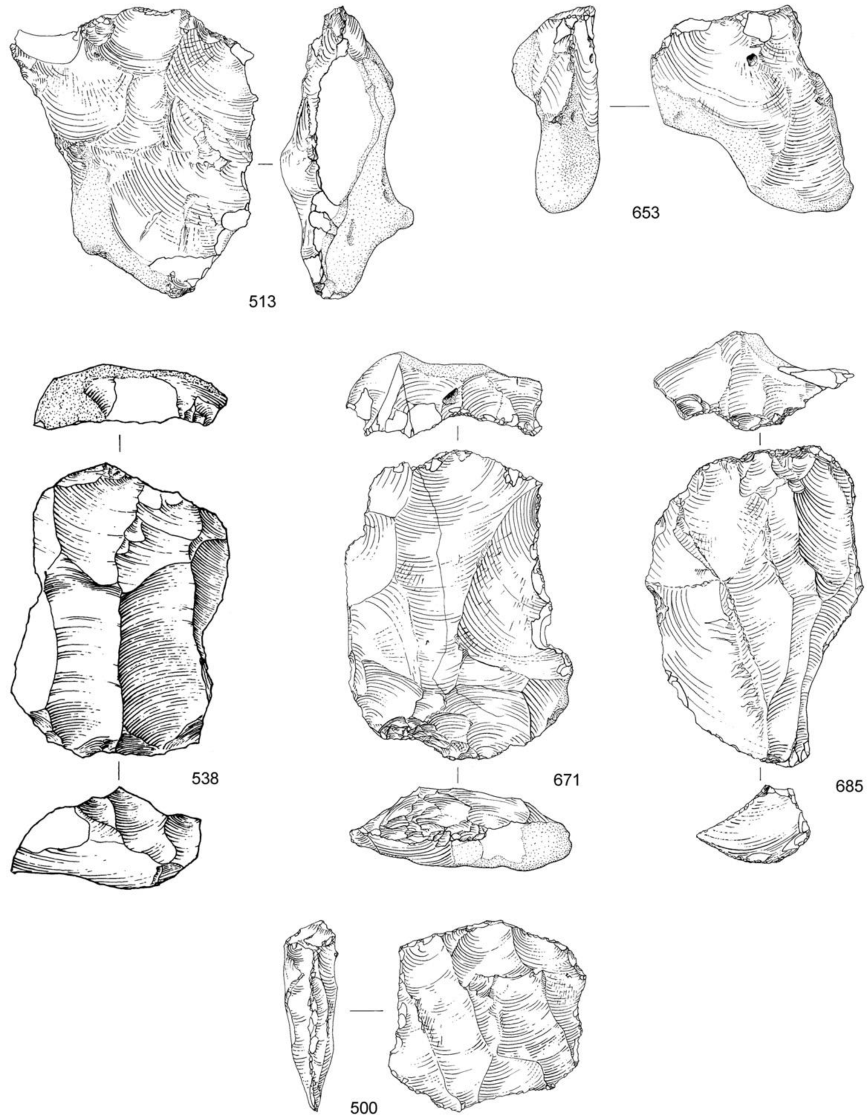


Figure 4.47 PCT from Dunbridge (Harding *et al.,* 2012:598).

Summary

Dunbridge has been an overlooked site in previous studies due to issues with dating, context and the lack of a representative sample. More recent work has established context and added a significant core and flake component to the assemblage. The evidence for early PCT is crucial to the examination of this technology in the Solent.

Other findspots in the Solent

Despite the early recognition of the archaeological richness of the Solent area (Evans, 1897), our knowledge of the region is limited in comparison to the Thames and East Anglia (Wenban-Smith, 2001). Material is difficult to provenance and there is a lack of primary context sites (Bury, 1923; Roe, 1975). In addition to the two major sites above, large quantities of artefacts have been found especially around Bournemouth, but these are primarily small assemblages or single find spots from old quarries or building sites (Bridgland, 2001). Work from quarrying and collecting fed into attempts to understanding the terraces of the Solent in the 1940's (Green 1943;1946;1947; Boswell, 1946; Calkin and Green, 1949). Some more significant assemblages are known from Canford, Corfe Mullen, Redhill Common, Boscombe and Pokesdown (Bridgland, 2001) but most sites lack contextual information and dating remains contentious (Westaway *et al.,* 2006; Hatch *et al.,* 2017). It is not possible to construct full site backgrounds, but a more general overview follows.

Regarding MIS 9, Bridgland (2001) compared the Taddiford Farm gravel and its equivalents to the Lynch Hill terrace of the Thames which included the presence of some Levallois. This is backed up by Roe's (1981:205) discussion of Group I material in Bournemouth and Hampshire including some Levallois. The bias towards handaxes in the Solent has meant there is a dearth of Levallois, with only 67 artefacts (Davis *et al.,* 2016). It has been argued that this could be due to lower populations or different traditions (Ashton and Hosfield 2010; Davis *et al.,* 2016:558). On closer examination this may be a symptom of a much wider issue, the lack of core and flake retrieval at Solent sites. Table 4.3 shows sites that have been claimed to contain PCT. What is noticeable is that most sites contain no cores, and flakes are present in small numbers with no sites having over 50, even at sites with large collections of handaxes such as Dunbridge and Warsash. Therefore, there arguably is not only a scarcity of Levallois in the Solent, but a lack of core and flake collection in comparison to sites in the Thames.

Ashton and Hosfield (2010:745) detailed a list of 'supersites' which contain the majority of material from a single terrace. These sites demonstrate the apparent bias in the collection of the Solent, as while they contain large numbers of handaxes, in most cases the core and flakes from these sites number only a handful. The one exception is Wood Green which contains over 150 flakes (mainly unretouched), but only one core.

Despite this poor record, some inferences can be made. The work conducted by Davis *et al.* (2016:571) tentatively suggested that Levallois appeared contemporarily throughout the entire Solent and that it paralleled what was happening in the Thames during MIS 9/8 and MIS 8/7. The issue still lies in the paucity of Levallois material in the Solent, meaning there is a lack of data to make more convincing inferences (Davis *et al*., 2016:571), especially where the examination of Proto-Levallois and the later EMP is concerned.

	Handaxes	Cores	Flakes	Flake tools	Levallois cores	Levallois flakes
Warsash	366	0	28	30	15+	7+
Dunbridge	953	3	24	16	0	3
Harvey's Lane	28	1	39	14	1	0
Brixey & Goods Pit	73	0	35	7	0	5
Fisherman's Walk	50+	0	10	5	1	2
Moordown	50+	0	0	1	0	1
Winton	50+	0	1	1	0	3
Corfe Mullen	150+	3	20	30	2	1
Talbot Woods	60	0	2	4	0	0
West Howe- Council pit	23	0	3	4	0	1
Edgehill Road Gravel Pit	1	0	1	0	0	1
King's Park - Boscombe	186	0	18	11	0	1
Thistlebarrow Pit	107	0	5	0	0	4
Brownwich Farm	7	0	0	0	0	0
Test Road Materials Pit	74	0	6	5	0	0
Hill Lane, Southampton	11	0	1	0	0	0
Belbin's Pit, Romsey	112	0	3	5	0	3
Colden Common	65	0	5	3	0	1
Hook	<50	0	0	3	0	0
Cams	1	0	0	0	0	0
Lee-on-Solent	65	0	1	0	0	1
Ashfield, Romsey	6	0	0	0	0	1

Table 4.3 Numbers of artefacts from Solent sites containing PCT (Roe, 1968a).

Some further sites can be investigated for PCT that could date to MIS 9. In the Stour, Terrace 10 (Ensbury Park) has been considered the equivalent of the Taddiford gravel and correlated to MIS 9 by Westaway *et al.* (2006). Sites including Moordown, Queens's Park Boscombe, Edgehill Road Winton, Fishman's Walk Pokesdown and some of King's Park Boscombe (the majority are Terrace 9) are considered to contain Levallois artefacts. Romsey is related to Terrace 4 of the Test, within a similar range to the site of Dunbridge and contains some Levallois artefacts (Westaway *et al.,*2006). There is little evidence of Levallois in the Frome or Avon terraces (Westaway *et al.,* 2006; Egberts *et al.* 2019). These sites also contain handaxes, but the relationship between these handaxes and the small quantities of rolled and fresh Levallois artefacts is unclear (Davis *et al.,* 2016).

Larger collections of PCT come from the later sites Harvey's Lane, Canford (Stour Terrace 9) and East Howe (Stour Terrace 8) (Westaway *et al.,* 2006; Hatch, 2014). These have been characterised by Davis *et al.* (2016) as forming a group of Proto-Levallois alongside Dunbridge. The evidence for Proto-Levallois is uniformly rolled and stained, matching the condition of associated handaxe material from the sites (Davis *et al.,* 2016:571). The relation with sites from Stour Terraces 9 and 10 would mean that the full Levallois predates the Proto-Levallois, leading Davis *et al.* (2016:571) to describe the connection between the two as "sparse and contradictory".

The site of Red Barns, Portsmouth, thought to date between MIS 11-9, is also argued to contain some PCT (Westaway *et al.,* 2006). Three excavations since 1973 have uncovered >6000 artefacts including 19 handaxes, with the majority being debitage (Gamble and ApSimon 1986; Wenban-Smith, 2000; Wenban-Smith *et al.* 2000). The handaxes are point dominated and some of them are plano-convex in shape, possibly being linked to the site of Wolvercote (Wenban-Smith *et al.,* 2000; Westaway *et al.,* 2006). Wenban-Smith *et al.* (2000) described 'Levallois-like' cores, two of which were later confirmed by Bolton's (2015) analysis of SPC.

Roe (2001) conceded that Clactonian sites in the Solent were rare due to the lack of large core and flake assemblages, but considered Rainbow Bar as having potential. Rainbow Bar is a gravel bar, exposed at low tide, first discovered by Draper (1951), with little contextual information or evidence for dating the archaeology (McNabb, 2007). Some potential handaxes (or 'proto-handaxes') have been noted along with Holocene material and the site is probably mixed with no evidence of dating, making it of limited use despite the work of Hack (1998;1999;2000;2004;2005). McNabb (2007:100) described the site as "a frustrating mystery" and despite showing Lower Palaeolithic characteristics with some Clactonian affinities, the material is of little use.

Summary

These sites demonstrate that the evaluation of non-handaxe assemblages in the Solent is impossible without further work. Flake tools have been recovered in smaller amounts, but some do show signs of invasive retouch. The PCT, whilst sparse, offers some familiar characteristics seen in the Thames and eastern England and is worth further exploration.

4.4 Summary

The information in this chapter constitutes the current knowledge of the sites examined by this thesis. It demonstrates that while MIS 9 is rich in archaeology there are still many unknowns. While many sites, especially in the Thames, can be securely dated to MIS 9 there are a number of problematic sites. Sturry, Station Pit, Kennett/Kentford and Grays Thurrock all have issues with dating and provenance of material and therefore have been interpreted with caution. Issues with dating and reports of distinction in the condition of PCT at Barnham Heath, Warsash and a number of Solent sites are important to consider, especially in relation to EMP sites dating to MIS 8/7 (Scott, 2011).

Through this study and the work of Dale (Pers. Comm. 2021), old collections from these sites have been used to improve our knowledge of MIS 9 by implementing the methodologies discussed in Chapter Three. As well as addressing the research questions, detailed in Chapter One, this work has also updated and clarified our understanding of individual sites, and these results are presented in the following chapter.

Chapter Five: Results

The results from the examination of the sites from Chapter Four are presented in this chapter, arranged alphabetically within the three regions (Thames, eastern England and the Solent), in order to provide an account of each site individually. Table 5.1 offers an overview of all the main assemblages examined during this research. Appendix A provides further details of the museums visited during this research and the locations of the collections studied.

Site	Flakes	Flake tools	Cores	Prepared cores	Levallois flakes	All material
Thames						
Baker's Farm	259	47	3	3	1	313
Botany Pit, Purfleet	458	114	167	134	5	878
Cuxton (Cruse 1-6)	110	10	4	1*	-	125
Cuxton (Cruse 7+)	162	-	3	-	-	165
Cuxton (Tester)	429	32	23	4	-	488
Furze Platt	324	39	2	-	-	365
Grays Thurrock	124	13	3	-	-	140
Grovelands Pit	122	59	28	-	-	209
Globe Pit	551	4	10	-	-	565
Lent Rise	120	18	1	1	2	142
Lower Clapton	19	14	1	-	-	34
Purfleet (Greenlands, Beds 5-6)	72	5	4	1	-	82
Sonning Railway Cutting	23	6	1	2	4	36
Stoke Newington	481	50	13	-	-	544
Sturry	34	26	11	1*	-	72
Wolvercote	13	2	-	-	-	15
Eastern England						
Barnham Heath	308	16	32	17	3	376
Biddenham	517	47	13	13	14	604
Kempston	125	27	5	3	5	165
Station Pit Kennett/ Kentford	168	28	5	-	-	201
Solent						
Dunbridge	117	15	14	4	-	150
East Howe	35	2	2	3	3	45
Harveys Lane	55	-	1	5	1	62
Warsash	87	28	8	3	7	133

Table 5.1 Summary of sites/assemblages analysed in Chapter Five. (*Previously recorded as prepared, classed separately to test difference in condition).

The wider significance of these results will be discussed in the succeeding three chapters. Sites have been examined in full where possible but, as laid out in Chapter Three, where this has not been possible smaller scale examinations have taken place and these are grouped at the end of each section under 'miscellaneous sites'. At smaller sites, flake size analysis has not been possible and other inferences should be treated with greater caution.

5.1 The Thames

5.1.1 Baker's Farm

Condition

The assemblage shows signs of moderate abrasion and edge damage (Table 5.2).

	Flakes	Flake tools	Cores	Prepared cores	Levallois flakes	All material
n	259	47	3	3	1	313
Abrasion						
Light	14.29	17.02	33.30	0.00	0.00	14.70
Moderate	74.52	72.34	33.30	100.00	100.00	74.12
Heavy	11.20	10.64	33.30	0.00	0.00	11.18
Edge Damage						
Light	17.76	21.28	66.67	0.00	0.00	18.53
Moderate	72.59	68.09	33.33	100.00	100.00	71.57
Heavy	9.65	10.64	0.00	0.00	0.00	9.90
Patina						
None	31.66	34.04	66.67	33.33	100.00	32.59
Light	60.62	53.19	33.33	66.67	0.00	59.11
Moderate	5.79	10.64	0.00	0.00	0.00	6.39
Heavy	1.93	2.13	0.00	0.00	0.00	1.92
Staining						
None	77.61	51.06	66.67	100.00	100.00	73.80
Yes	22.39	48.94	33.33	0.00	0.00	26.20
Scratching						
None	98.84	95.74	100.00	100.00	100.00	98.40
Yes	1.16	4.26	0.00	0.00	0.00	1.60
Battering						
None	100.00	100.00	100.00	100.00	100.00	100.00

Table 5.2 Condition of artefacts from Baker's Farm.

No discrete assemblages could be identified, and the PCT was only present in small numbers.

Site formation

The flake size distribution is concordant with the condition of the artefacts, showing a winnowed assemblage with evidence of collection bias (Figures 5.1+5.2).

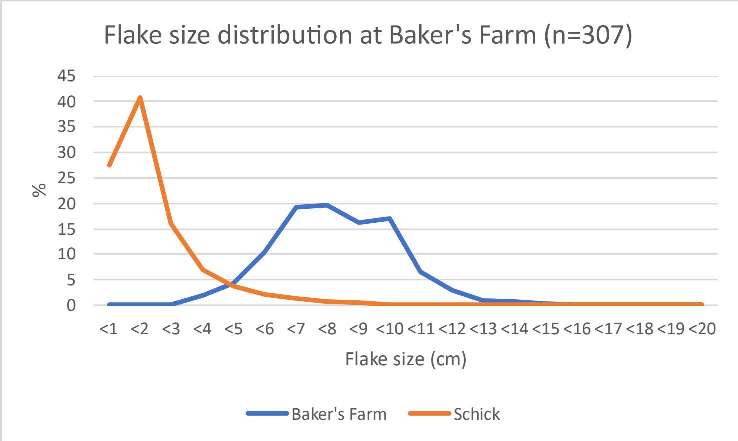


Figure 5.1 Flake size analysis of Baker's Farm.

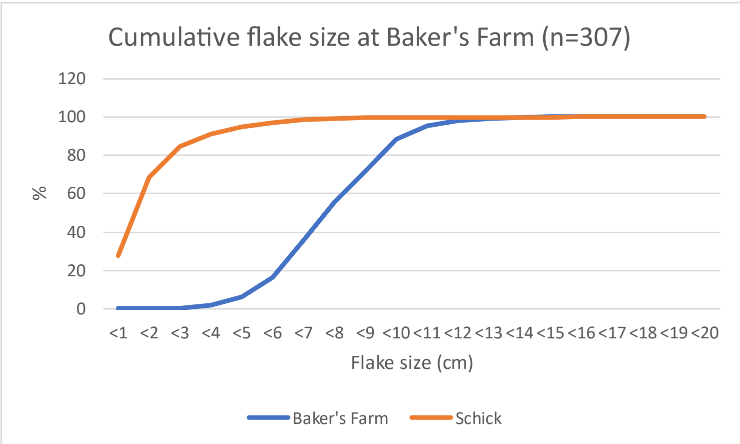


Figure 5.2 Cumulative flake size at Baker's Farm.

Non-handaxe

There is no evidence of a non-handaxe signature at the site and no separate assemblages can be identified in either the documentation or the artefacts themselves.

Flakes

Soft hammer flakes are present in the assemblage, with a larger proportion of indeterminate flakes (Table 5.3). The flakes come from all stages of the knapping process, but later stages of knapping dominate the assemblage. While there are examples of longer, more complex dorsal scar patterns, the majority display evidence of four or fewer removals in a unidirectional or bidirectional pattern. The flakes are regular in size, with little evidence of elongation (Table 5.4).

Butt type	%	Hammer mode	%
Plain	56.4	Hard	69.5
Marginal	23.2	Indeterminate	23.2
Missing	7.34	Soft	7.34
Mixed	6.18		
Conical	3.47		
Dihedral	1.93		
Cortical	1.54		

Dorsal scar count	%	Dorsal scar pattern	%
0	5.41	Natural	5.41
1	15.1	Uni	57.9
2	31.3	Bi	29
3	25.1	Multi	7.72
4	13.9		
5	5.79		
6	2.32		
7	0.77		
8	0		
9	0.39		

Cortex	%	Flake type	%
0	29.3	1	3.47
5	13.5	2	3.86
10	21.6	3	2.7
15	1.16	4	61
20	13.1	5	29
25	0.39		
30	8.88		
40	2.32		
45	0.39		
50	2.7		
60	1.93		
70	1.16		
75	0.77		
80	0.77		
90	0.39		
100	1.54		

Whole/broken	%	Type of break	%
Whole	91.5	None	91.5
Broken	8.49	Missing Butt	8.11
		Lateral snap	0.39

Table 5.3 Technology of flakes from Baker's Farm (n=307).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	76.8	72.4	19.1	0.984
Median	75.7	69.8	18.0	0.924
Min	32.2	21.9	5.1	0.360
Max	134.9	140.3	89.5	2.217
SD.	19.119	21.097	9.371	0.327

Table 5.4 Average dimensions of flakes from Baker's Farm (n=307).

Cores

Six cores from Baker's Farm were available for analysis. Three show signs of preparation while the remainder are MPCs. The unprepared cores show high levels of utilisation (Table 5.5). Core episodes usually demonstrate short alternative or parallel working, with some single removals. One core shows a more elaborate episode (six removals) with the core being turned multiple times. The three cores are regular in size, levels of elongation and flattening (Table 5.6).

Field Artefacts #	Stratigraphic context	Type	Cortex %	# episodes	# removals	Episode 1	Episode 2	Episode 3
OUM	Treacher	MPC	20	3	10	6C	3C	1D
1 B1/15 a	Lacaille collection	MPC	5	2	4	3C	1D	
1 B1/15 b	Lacaille collection	MPC	25	2	5	2B	3C	

Table 5.5 Technological analysis of cores from Baker's Farm (n=3).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)
Mean	97.3	72.8	36.1	0.768	0.494
Median	92.4	70.5	38.0	0.763	0.494
Min	87.9	58.9	26.5	0.528	0.450
Max	111.5	88.9	43.9	1.011	0.539
SD	12.530	15.128	8.849	0.242	0.045

Table 5.6 Average dimensions of cores from Baker's Farm (n=3).

Flake tools

Forty-seven flake tools were analysed from Baker's Farm (Table 5.7), compared to the 101 listed by Roe (1968a). Many artefacts have been dismissed as being naturally edge-damaged flakes. The extent of retouch on the flake tools varies, but the majority show evidence of semi-invasive retouch. On average the retouch is continuous, direct and regular, although a large proportion exhibit irregular retouch. The site is dominated by side, end and convergent scrapers. There are examples of more *ad hoc* retouched tools including a notch and a denticulate. Some of the convergent scrapers approach the refinement of flake handaxes. Flake tools from the site show no links to PCT. On average flake tools from Baker's Farm are larger than regular flakes, but not more elongated (Table 5.8).

Type of flake tool	%	Extent of retouch	%
Side scraper	40.4	Minimally Invasive	38.3
End scraper	25.5	Semi-invasive	34.0
Convergent scraper	14.9	Invasive	27.7
Notch	6.4		
Double scraper	4.3		
Retouched flake	4.2		
Convergent scraper/ unifacially worked handaxe	2.1		
Denticulate	2.1		
Distribution	**%**	**Position of retouch**	**%**
Continuous	89.4	Direct	93.6
Discontinuous	10.6	Inverse	6.4
Location of retouch	**%**	**Form of retouch**	**%**
Distal	36.2	Convex	66.0
Right	27.7	Concave	10.6
Convergent on distal	10.6	Rectilinear	8.5
Left	10.6	Notch	6.4
Convergent right and distal	6.4	Convex and concave	6.4
Left and right	4.3	Denticulate	2.1
Proximal	2.1		
Left ventral	2.1		
Angle of retouch	**%**	**Regularity**	**%**
Semi-abrupt	91.5	Regular	66.0
Abrupt	8.5	Irregular	34.0
Morphology of retouch	**%**	**Length of retouch**	**mm**
Sub-parallel	36.2	Mean	70.8
Scaly	25.5	Median	64.8
Stepped	17.0	Min	15.7
Parallel	10.6	Max	163.3
Notch	6.4	SD	35.5
Denticulate	4.2		

Table 5.7 Technological analysis of flake tools from Baker’s Farm (n=47).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	84.3	76.1	24.7	0.931
Median	83.1	76.6	24.9	0.926
Min	57.1	44.8	8.3	0.504
Max	141.0	105.1	37.5	1.427
SD	16.846	14.694	7.661	0.237

Table 5.8 Average dimensions of flake tools from Baker’s Farm (n=47).

PCT

PCT has been attributed to Baker's Farm, but the evidence for these claims is scarce. There are three possible prepared cores from the site (Table 5.9).

Type of prepared core	**%**	**Blank type**	**%**
Proto-Levallois	66.6	Nodule	100
?Levallois	33.3		

Method of preparation	**%**	**Method of exploitation**	**%**
Centripetal	66.6	Lineal	66.6
Bipolar	33.3	Unexploited	33.3

Earlier surface	**%**	**Type of products**	**%**
None	100	Flake	66.6
		None	33.3

Number of preferential Removals	**%**	**Position of scar on striking surface**	**%**
0	33.3	All around	66.6
1	66.6	Distal and two edges	33.3

Preparation on striking surface	**%**	**Preparation on flaking surface**	**%**
6	33.3	6	33.3
7	33.3	7	33.3
8	0	8	33.3
9	0		
10	33.3		

% Cortex on striking platform surface	**%**	**Position of cortex on striking platform surface**	**%**
0	33.3	Central and one edge	66.6
10	33.3	None	33.3
20	0		
30	0		
40	33.3		

Pattern of accentuated convexities	**%**	**Description of accentuated convexities**	**%**
None	66.6	None	66.6
Distal and edges	33.3	Minimal	33.3

Table 5.9 Technological analysis of prepared cores from Baker's Farm (n=3).

These cores demonstrate both centripetal and bipolar preparation. Two of the cores do not demonstrate the accentuated convexities seen in more fully developed Levallois cores, but show preparation of both the flaking and striking platforms with long sequences of removals in order to produce a flake. One core shows more similarities to developed Levallois. All three cores are large in size and show higher levels of both elongation and flattening than the MPCs

(Table 5.10). This could show the deliberate exploitation of a flat surface to create flakes. The negative scars show small removals with moderate evidence for elongation (Table 5.11).

	Length (mm)	Width(mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)
Mean	171.8	123.1	44.9	0.713	0.373
Median	175.3	111.4	40.3	0.602	0.348
Min	155.2	90.2	36.0	0.581	0.323
Max	185.0	167.6	58.3	0.956	0.447
SD	15.199	39.997	11.831	0.211	0.065

Table 5.10 Average dimensions of prepared cores from Baker's Farm (n=3).

	Length (mm)	Width(mm)	Elongation (W/L)
Mean	77.3	59.9	0.766
Median	77.3	59.9	0.766
Min	71.2	47.4	0.666
Max	83.4	72.3	0.867
SD	8.627	17.607	0.142

Table 5.11 Average dimensions of preferential flake scars from Baker's Farm (n=2).

In addition to the cores a possible Levallois flake was identified. The flake is faceted, with evidence of five bipolar removals made in preparation and exploited linearly. The dimensions of the flake show a higher level of elongation than the cores (Table 5.12).

	Length (mm)	Width (mm)	Thick (mm)	Elongation (W/L)
OUM 2537	135.7	59.1	16.1	0.436

Table 5.12 Dimensions of possible Levallois flake from Baker's Farm.

Summary

Baker's Farm shows core and flake working typical of the Acheulean, but with the addition of a small amount of PCT. The flake tools while not as prevalent as previously thought do show examples of invasive and focused retouch amongst more *ad hoc* flake tools. The PCT at the site makes Baker's Farm comparable to the sites of Botany Pit, Cuxton and Biddenham, but the small amount of material makes further interpretation difficult.

5.1.2 Botany Pit

Condition

The material is in a light to moderately abraded condition with light to moderate edge damage (Table 5.13). It is not possible to separate distinct assemblages at the site, although the prepared cores show marginally higher levels of patination.

	Flakes	Flake tools	Cores	Prepared cores	Levallois flakes	All material
n	458	114	167	134	5	878
Abrasion						
Light	31.66	30.70	15.57	19.40	80.00	26.88
Moderate	68.34	69.30	84.43	79.85	20.00	73.01
Heavy	0.00	0.00	0.00	0.75	0.00	0.11
Edge Damage						
Light	50.66	33.33	25.75	70.15	100.00	46.92
Moderate	48.47	66.67	74.25	29.85	0.00	52.62
Heavy	0.87	0.00	0.00	0.00	0.00	0.46
Patina						
None	27.51	24.56	29.94	18.66	40.00	26.31
Light	69.43	74.56	67.66	63.43	60.00	68.79
Moderate	3.06	0.00	2.40	17.91	0.00	4.78
Heavy	0.00	0.88	0.00	0.00	0.00	0.11
Staining						
None	98.25	96.49	100.00	99.25	80.00	98.41
Yes	1.75	3.51	0.00	0.75	20.00	1.59
Scratching						
None	99.13	91.23	98.80	100.00	100.00	98.18
Yes	0.87	8.77	1.20	0.00	0.00	1.82
Battering						
None	100.00	100.00	100.00	99.25	100.00	99.89
Yes	0.00	0.00	0.00	0.75	0.00	0.11

Table 5.13 Condition of material from Botany Pit.

Site formation

The flake size analysis demonstrates the presence of smaller flakes, but there is evidence of winnowing or collection bias (Figures 5.3 + 5.4).

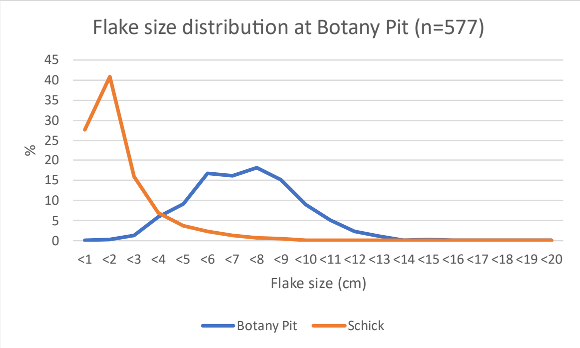


Figure 5.3 Flake size analysis at Botany Pit.

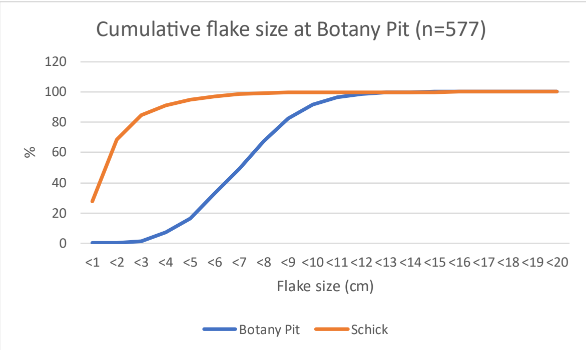


Figure 5.4 Cumulative frequency of flake size at Botany Pit.

Non-handaxe

No evidence for a non-handaxe signature has been suggested at Botany Pit. The site correlates with the higher levels of Greenlands and Bluelands Pits above the non-handaxe signature.

Flakes

The flakes from Botany Pit contain a small proportion of diagnostic soft hammer flakes, despite handaxes being scarce at the site (Table 5.14). There is a large indeterminate category that incorporates flakes with marginal, missing, dihedral or mixed butts. The dorsal scar patterns and counts show a range from cortical or short sequences to longer multi-directional patterns, although simple unidirectional patterns are more common. All stages of knapping are represented but the final stage is underrepresented compared to other sites. These factors could be indicative of less intensive working. The average dimensions of the flakes from Botany Pit show smaller flakes with little evidence of elongation (Table 5.15).

Butt type	%	Hammer mode	%
Plain	62.66	Hard	74.02
Marginal	18.34	Indeterminate	20.52
Mixed	5.90	Soft	5.46
Missing	5.68		
Conical	2.84		
Cortical	2.84		
Fragment	0.87		
Dihedral	0.66		
Faceted	0.22		

Dorsal scar count	%	Dorsal scar pattern	%
0	14.85	Natural	14.85
1	23.58	Uni	60.70
2	29.91	Bi	20.96
3	19.00	Multi	3.49
4	7.64		
5	3.93		
6	0.87		
7	0.00		
8	0.22		

Cortex	%	Flake type	%
0	17.03	1	11.57
5	5.68	2	14.41
10	14.85	3	5.02
20	17.03	4	53.06
30	10.04	5	15.94
40	4.80		
50	4.80		
60	3.71		
70	4.59		
80	4.37		
90	8.73		
100	4.37		

Whole/broken	%	Type of break	%
Whole	93.45	None	93.45
Broken	6.55	Missing butt	5.46
		Distal fragment	0.44
		Lateral snap	0.22
		Broken Distal	0.22
		Fragment	0.22

Table 5.14 Technological analysis of flakes from Botany Pit (n=458).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	68.8	61.8	20.8	0.941
Median	68.3	60.5	19.6	0.888
Min	18.2	8.5	2.9	0.248
Max	140.0	129.2	60.2	2.608
SD	21.554	20.598	9.511	0.317

Table 5.15 Average dimensions of flakes from Botany Pit (n=458).

Cores

The largest proportion of cores are MPCs (Figure 5.5). As well as a large proportion of prepared cores, several cores show minor degrees of preparation which blurs the line between MPCs and PCT. Other categories represented include choppers cores and discoidal cores. The prepared cores are predominantly Proto-Levallois with a few examples of more developed Levallois.

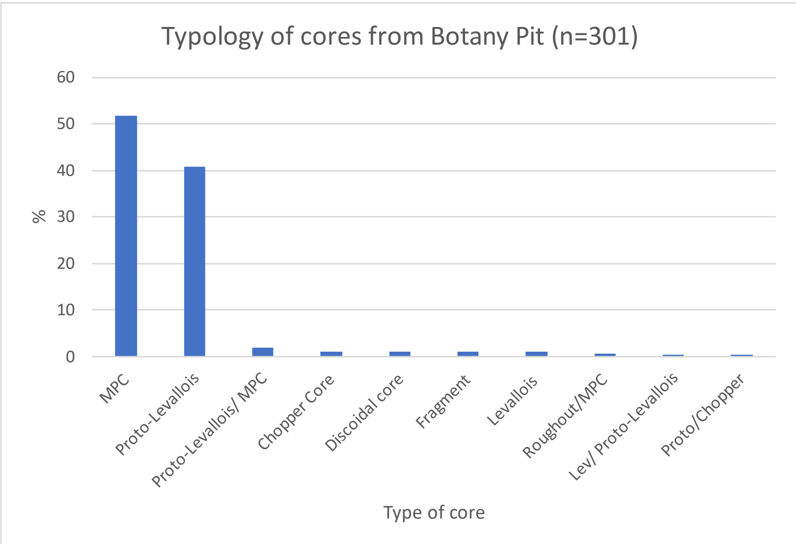


Figure 5.5 Typology of cores from Botany Pit (n=307).

The amount of residual cortex on the unprepared cores is varied, but often shows a lack of complete utilisation (Figure 5.6). The discoidal cores show long sequences of working on two surfaces but no hierarchical relationship between the two as in PCT. These cores are rare but not unknown in the Lower Palaeolithic (White and Ashton, 2003). The chopper cores are typical showing alternative working on one end. There are a few examples of potential handaxe roughouts. The rest of the cores are MPCs that show a mixture of parallel, alternative and single knapping episodes the length of these knapping sequences shows a large degree of variety (Appendix B).

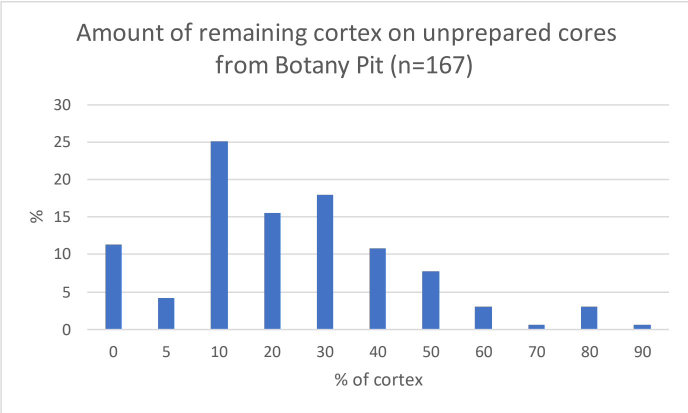


Figure 5.6 Remaining cortex on unprepared cores at Botany Pit (n=167).

The unprepared cores range in size (Table 5.16). There are some large cores, but most are mid-range in size with some diminutive examples. On average, cores were evenly sized and show little signs of elongation. Few cores show evidence of flattening except the discoidal cores.

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)
Mean	95.3	87.9	50.1	0.969	0.581
Median	94.3	86.3	49.7	0.932	0.570
Min	34.6	42.3	13.4	0.361	0.176
Max	186.3	170.8	93.5	2.333	1.080
SD	24.808	20.758	15.844	0.294	0.168

Table 5.16 Average dimensions of unprepared cores at Botany Pit (n=167).

Flake Tools

The number of flake tools attributed to the site has previously been inflated (Table 5.17). While 114 flake tools were identified this is most likely due to the large assemblage. Over half of the flake tools are retouched irregularly, with around 12% showing discontinuous *ad hoc* retouch. There is little evidence for invasive retouch with over 40% of the flakes only showing minimal signs of retouching. The majority of the flake tools are types of scraper, often with convex retouch, sometimes on multiple sides, but with no evidence of convergent scrapers. Notches and denticulates are found in lower numbers. Over 100 artefacts listed as flake tools were dismissed as being naturally edge damaged, and the number of flake tools was much lower than anticipated. None of the flake tools could be linked to PCT. On average flake tools are larger than regular flakes from the site with no evidence for enhanced elongation (Table 5.18). Flake tools at Botany Pit are not remarkable in quantity or quality given the substantial amounts of material recovered from the site.

Type of flake tool	%	Extent of retouch	%
Side scraper	60.53	Minimally invasive	42.11
End scraper	14.04	Semi-invasive	51.75
Denticulate	9.65	Invasive	6.14
Double scraper	6.14		
Notch	7.02		
Triple scraper	2.63		
Distribution	**%**	**Position of retouch**	**%**
Continuous	87.72	Direct	88.60
Discontinuous	12.28	Inverse	11.40
Location of retouch	**%**	**Form of retouch**	**%**
Left	30.70	Convex	57.89
Distal	28.95	Concave	13.16
Right	21.05	Denticulate	9.65
Both left and right	6.14	Rectilinear	8.77
Inverse right	3.51	Notch	6.14
Inverse left	2.63	Left Concave right convex	1.75
Both laterals and distal	1.75	Left convex right concave	0.88
Both distal and right	1.75	Both convex and concave	0.88
Ventral Right	0.88	Double notch	0.88
All around	0.88		
Proximal	0.88		
Both distal and Left	0.88		
Angle of retouch	**%**	**Regularity**	**%**
Semi-abrupt	95.61	Irregular	51.75
Abrupt	4.39	Regular	48.25
Morphology of retouch	**%**	**Length of retouch**	**%**
Sub-parallel	50.88	Mean	60.39
Scaly	28.07	Median	59.00
Notch	15.79	Min	23.80
Stepped	5.26	Max	183.00
		SD	21.31

Table 5.17 Technological analysis of flake tools from Botany Pit (n=114).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	76.5	69.1	24.3	0.945
Median	73.3	66.5	23.4	0.924
Min	44.2	37.1	12.1	0.412
Max	129.1	133.7	47.4	1.898
SD	17.766	17.325	6.716	0.296

Table 5.18 Average dimensions of flake tools from Botany Pit (n=114).

PCT

Little separates the PCT from the rest of the assemblage, and no separation can be made between examples of full Levallois and Proto-Levallois. The site is dominated by Proto-Levallois cores, with a few ambiguous cores and a small amount of full Levallois (Table 5.19). The cores show a mixture of preparation methods of the flaking surface, predominantly centripetal and unipolar, with some convergent and bipolar working. The scant evidence of convergent preparation could be linked to points being rare with most of the cores being exploited for flakes. The majority of flakes were removed linearly with ~13% of cores showing recurrent working, usually of only two flakes but some examples of three removals were observed. The remainder of the cores are unexploited and could show abandoned attempts of prepared cores.

Type of prepared core	**%**	**Blank type**	**%**
Proto-Levallois	91.8	Nodule	100.0
Proto-Levallois/ MPC	4.5		
Levallois	2.2		
Lev/ Proto-Levallois	0.7		
Proto/chopper	0.7		
Method of preparation	**%**	**Method of exploitation**	**%**
Centripetal	44.8	Lineal	78.4
Unipolar	43.3	Recurrent	13.4
Bipolar	11.2	Unexploited	8.2
Convergent	0.7		
Earlier surface	**%**	**Type of products**	**%**
None	100.0	Flake	91.0
		Unexploited	8.2
		Point	0.7
Number of preferential removals	**%**	**Position of scar on striking surface**	**%**
0	8.2	Proximal	41.8
1	79.1	Proximal and distal	32.1
2	11.9	Proximal and one side	13.4
3	0.7	All around	8.2
		Two sides	1.5
		Proximal and more than one side	1.5
		None	0.7
		Both edges and proximal	0.7

Table 5.19 Technological analysis of prepared cores from Botany Pit (n=134).

The scars on the striking platform show the use of proximal and distal edges to prepare the core, although sometimes lateral edges have been utilised and some cores show extensive preparation around the whole core (Table 5.20). On average, between two and seven removals have been used to prepare the core, but both simple and complex working can be observed. Remaining cortex on the striking surface ranged from 0-90%. The more developed Levallois cores show accentuated convexities on the dorsal and lateral edges, that were prepared centripetally and exploited linearly.

Preparation on striking surface	**%**	**Preparation on flaking surface**	**%**
0	0.7	0	1.5
1	9.0	1	5.2
2	23.9	2	17.9
3	20.9	3	17.9
4	15.7	4	19.4
5	11.2	5	15.7
6	11.2	6	9.0
7	2.2	7	7.5
8	3.0	8	3.0
9	0.0	9	0.7
10	1.5	10	2.2
11	0.0		
12	0.0		
13	0.7		
% Cortex on striking platform surface	**%**	**Position of cortex on striking platform surface**	**%**
0	0.7	Central and more than one end	53.0
5	1.5	Central and one end	19.4
10	2.2	Central	14.9
20	3.7	One edge	6.0
25	1.5	More than one edge	1.5
30	6.0	Proximal	1.5
40	8.2	Central and distal	1.5
50	11.9	Central and two side	1.5
60	11.2	None	0.7
70	13.4		
80	23.9		
90	15.7		
Pattern of accentuated convexities	**%**	**Nature of accentuated convexities**	**%**
None	97.8	None	97.8
Distal both lateral edge	1.5	Semi-invasive	2.2
Distal one lateral edge	0.7		

Table 5.20 Further technological analysis of prepared cores from Botany Pit (n=134).

The average dimension of prepared cores is similar to the unprepared cores with comparable degrees of elongation but more evidence of flattening (Table 5.21). The dimensions of the preferential flake scars are on average smaller than both the flakes and Levallois flakes found, with similar degrees of elongation (Table 5.22). This is understandable given the smaller size of prepared cores at the site. The diagnostic Levallois flakes are larger than average and are slightly more elongated than regular flakes (Table 5.23). It is important to be cautious here due to the low sample size.

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)
Mean	93.8	90.5	44.8	0.991	0.500
Median	93.6	88.8	42.3	0.948	0.459
Min	53.0	58.7	18.7	0.495	0.275
Max	145.9	151.4	86.0	1.743	1.309
SD	17.753	18.952	14.221	0.248	0.153

Table 5.21 Average dimensions of prepared cores from Botany Pit (n=134).

	Length (mm)	Width (mm)	Elongation (W/L)
Mean	67.9	55.6	0.882
Median	68.6	54.4	0.835
Min	26.6	23.0	0.237
Max	111.3	96.2	2.041
SD	19.101	16.243	0.351

Table 5.22 Average dimensions of preferential removals from Botany Pit (n=142).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	81.7	61.4	15.4	0.753
Median	88.1	59.0	16.1	0.834
Min	67.3	39.5	9.9	0.448
Max	92.6	81.2	23.6	0.877
SD	12.444	17.405	5.439	0.177

Table 5.23 Average dimensions of Levallois flakes from Botany Pit (n=5).

The diagnostic Levallois flakes from Botany Pit show similar technology to the cores (Table 5.24). While flakes are predominant there is an example of a Levallois point. Lineal exploitation is more common but there is an example of recurrent exploitation. Dorsal scar patterns show between five and seven removals with no cortex and faceting on four of the flakes. Bipolar preparation dominates in contrast to the cores, but this could be due to the low sample size, or more complex centripetal working could be obscured. One flake in the sample lacked faceting and had an angle more akin to handaxe working. The dearth of Levallois flakes could be due to the difficulty in identifying the products of Proto-Levallois cores in comparison to more developed Levallois.

Confidence of Levallois	%	Butt type	%
Possible	40	Faceted	80
Probable	40	Plain	20
Unlikely	20		
Morphology of product	**%**	**Previous removals**	**%**
Flake	80	0	80
Point	20	1	20
Dorsal scar count	**%**	**Preparation scars**	**%**
1	0	1	0
2	0	2	0
3	0	3	0
4	0	4	0
5	40	5	40
6	20	6	20
7	40	7	40
Method of preparation	**%**	**Method of exploitation**	**%**
Unipolar	20	Lineal	80
Bipolar	60	Recurrent	20
Centripetal	20		
Cortex	**%**		
0	100		

Table 5.24 Technological analysis of Levallois flakes from Botany Pit (n=5).

Summary

This research agrees with White and Ashton (2003), Scott (2011) and Bolton (2015) that Botany Pit shows early PCT with some signs of more developed Levallois. What this study can add is that the flake tools from the site do not show elaboration of form or connections to the PCT.

5.1.3 Cuxton

Material from both the Cruse and Tester excavations was examined, with the Cruse material split into the proposed ‘non-handaxe’ assemblage (Layers 1-6) and handaxe assemblage (Layers 7+). The Tester material was treated as one mixed assemblage.

Condition

The Cruse material was lightly abraded with light edge damage, with the Acheulean layer showing higher levels of abrasion (Table 5.25). The Acheulean material showed slightly higher levels of patination. The potential 'prepared core' from the non-handaxe layer is very lightly abraded but falls within the range of the assemblage. The Tester material is a larger sample showing moderately abraded material with moderate edge damage, with no distinct assemblages (Table 5.26).

	Cruse 1-6	Cruse 1-6	Cruse 1-6	Cruse 1-6	Cruse 1-6	Cruse 7+	Cruse 7+	Cruse 7+
	Flakes	**Flake tools**	**Cores**	**Prepared cores**	**All material**	**Flakes**	**Cores**	**All material**
n	110	10	4	1	125	162	3	165
Abrasion								
Light	70.91	60.00	50.00	100.00	69.60	51.85	0.00	50.91
Moderate	26.36	40.00	50.00	0.00	28.00	39.51	66.67	40.00
Heavy	2.73	0.00	0.00	0.00	2.40	8.64	33.33	9.09
Edge Damage								
Light	87.27	70.00	75.00	100.00	85.60	79.63	0.00	78.18
Moderate	11.82	30.00	25.00	0.00	13.60	19.75	66.67	20.61
Heavy	0.91	0.00	0.00	0.00	0.80	0.62	33.33	1.21
Patina								
None	49.09	10.00	0.00	0.00	16.80	12.35	33.33	12.73
Light	31.82	40.00	75.00	100.00	49.60	51.23	0.00	50.30
Moderate	18.18	50.00	25.00	0.00	32.80	32.10	66.67	32.73
Heavy	0.91	0.00	0.00	0.00	0.80	4.32	0.00	4.24
Staining								
None	83.64	80.00	50.00	100.00	82.40	96.91	66.67	95.15
Yes	16.36	20.00	50.00	0.00	17.60	3.09	33.33	4.85
Scratching								
None	96.36	100.00	100.00	100.00	96.80	96.36	66.67	96.36
Yes	3.64	0.00	0.00	0.00	3.20	3.64	33.33	3.64
Battering								
None	100.00	100.00	100.00	100.00	100.00	100.00	66.67	99.39
Yes	0.00	0.00	0.00	0.00	0.00	0.00	33.33	0.61

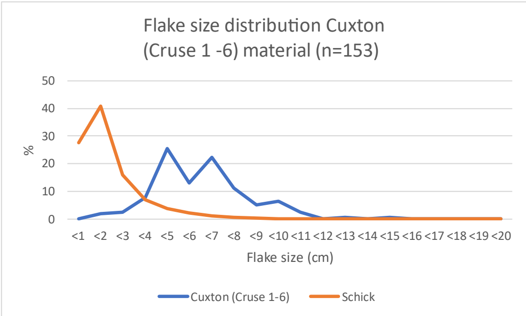
Table 5.25 Condition of Cruse material from Cuxton.

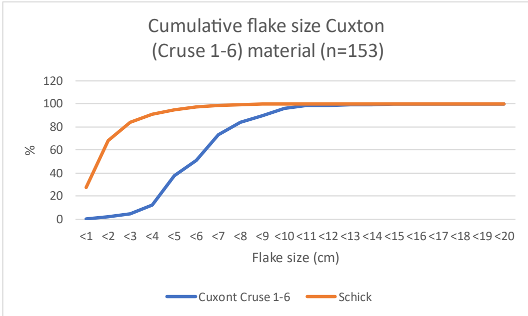
	Flakes	Flake tools	Cores	Prepared cores	All material
n	429	32	23	4	488
Abrasion					
Light	22.43	21.21	21.74	25.00	22.34
Moderate	67.06	66.67	69.57	75.00	67.21
Heavy	10.51	12.12	8.70	0.00	10.45
Edge Damage					
Light	51.17	69.70	17.39	100.00	51.23
Moderate	48.13	27.27	82.61	0.00	47.95
Heavy	0.70	3.03	0.00	0.00	0.82
Patina					
None	7.01	9.09	4.35	0.00	6.97
Light	46.03	48.48	26.09	100.00	45.70
Moderate	42.99	42.42	69.57	0.00	43.85
Heavy	3.97	0.00	0.00	0.00	3.48
Staining					
None	89.49	93.94	91.30	100.00	89.96
Yes	10.51	6.06	8.70	0.00	10.04
Scratching					
None	97.20	96.97	100.00	100.00	97.34
Yes	2.80	3.03	0.00	0.00	2.66
Battering					
None	99.77	100.00	100.00	100.00	99.80
Yes	0.23	0.00	0.00	0.00	0.20

Table 5.26 Condition of Tester material from Cuxton.

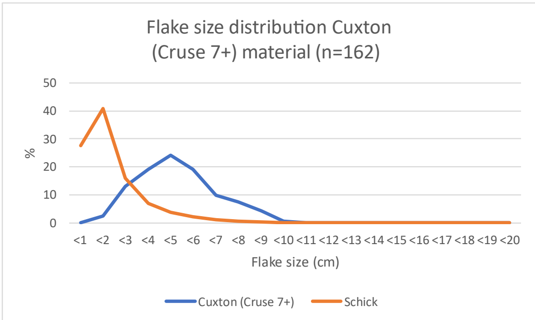
Site formation

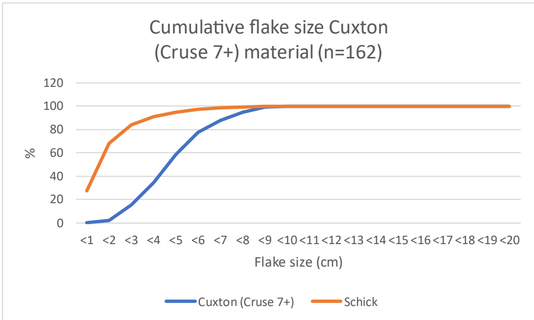
Cruse's non-handaxe layer lacks smaller flakes indicating some level of collection bias and winnowing (Figures 5.7+5.8). While the Acheulean layer shows more of a regular curve, it still lacks smaller elements due to winnowing and collection bias (Figures 5.9+5.10). The flake size analysis from the Tester material is similar showing a lack of smaller flakes (Figures 5.11+5.12).



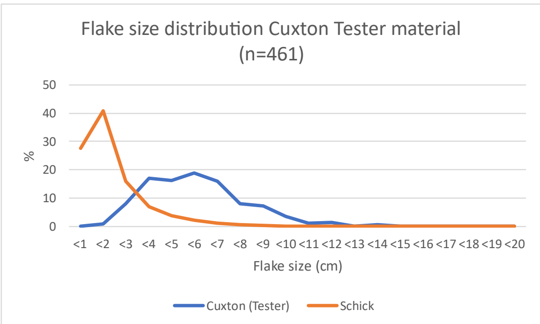


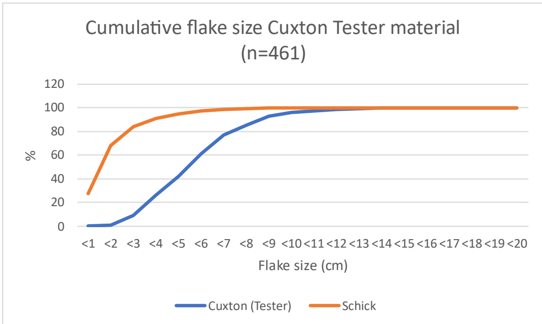
Figures 5.7+5.8 Flake size analysis and Cumulative Flake size of Cuxton (Cruse 1-6).





Figures 5.9+10 Flake size analysis and Cumulative Flake size analysis of Cuxton (Cruse 7+).





Figures 5.11+5.12 Flake size analysis and cumulative Flake size analysis of Cuxton (Tester).

Non-handaxe

This study verified a non-handaxe assemblage represented by Cruse’s layers 1-6 containing no handaxes or soft hammer flakes. This was overlain by Layers 7+ which yielded soft hammer flakes and handaxes. While there is a slight difference in condition between the assemblages, this cannot be demonstrated with the Tester material, either with the flakes or the difference between chopper cores and MPCs. While Flake tools are only found in the non-handaxe layers from the Cruse excavation they are found throughout the Tester material.

Flakes

The main difference between the two sections of the Cruse excavation is the lack of soft hammer flakes and handaxes in the lower section (Table 5.27+5.28). The number of marginal butts is also higher in the Acheulean section. Otherwise, the two sections are similarly dominated by unipolar dorsal scar patterns and later stage flake working.

Butt type	%	Hammer mode	%
Plain	40.91	Hard	80.91
Marginal	29.09	Indeterminate	19.09
Mixed	10.00		
Cortical	8.18		
Missing	7.27		
Dihedral	3.64		
Conical	0.91		
Dorsal scar count	**%**	**Dorsal scar pattern**	**%**
0	20.91	Natural	18.18
1	33.64	Uni	53.64
2	26.36	Bi	16.36
3	10.91	Multi	11.82
4	6.36		
5	0.91		
5 + (3 Ventral)	0.91		
Cortex %	**%**	**Flake type**	**%**
0	17.27	1	17.27
5	8.18	2	8.18
10	10.91	3	6.36
15	4.55	4	51.82
20	8.18	5	16.36
30	9.09		
40	10.00		
50	6.36		
60	2.73		
70	2.73		
75	0.91		
80	2.73		
100	16.36		
Whole/broken	**%**	**Type of break**	**%**
Whole	92.73	None	92.73
Broken	7.27	Proximal snap	2.73
		Distal fragment	1.82
		Missing butt	1.82
		Fragment	0.91

Table 5.27 Technological analysis of flakes from Cuxton (Cruse 1-6) (n=110).

Butt type	%	Hammer mode	%
Marginal	44.44	Hard	50.00
Plain	26.54	Indeterminate	40.12
Missing	11.11	Soft	9.88
Mixed	10.49		
Cortical	5.56		
Conical	1.23		
Dihedral	0.62		
Dorsal scar count	**%**	**Dorsal scar pattern**	**%**
0	29.01	Natural	29.63
1	35.19	Uni	51.85
2	20.99	Bi	8.64
3	9.26	Multi	9.88
4	2.47		
5	2.47		
6	0.62		
Cortex %	**%**	**Flake type**	**%**
0	15.43	1	22.22
5	1.23	2	14.20
10	14.20	3	6.17
15	0.62	4	41.98
20	10.49	5	15.43
30	8.02		
40	7.41		
50	6.17		
60	5.56		
70	2.47		
80	6.17		
100	22.22		
Whole/broken	**%**	**Type of break**	**%**
Whole	87.65	None	87.65
Broken	12.35	Missing butt	10.49
		Distal fragment	1.23
		Right side missing	0.62

Table 5.28 Technological analysis of flakes from Cuxton (Cruse 7+) (n=162).

The Tester collection contains a small but significant proportion of soft hammer flakes alongside the handaxes from the excavation (Table 5.29). Other traits are similar to the Cruse material apart from a small increase in longer multi-directional dorsal scar patterns.

Butt type	%	Hammer mode	%
Marginal	32.24	Hard	65.97
Plain	29.91	Indeterminate	32.17
Mixed	17.99	Soft	1.63
Missing	14.72		
Cortical	2.80		
Dihedral	1.64		
Conical	0.70		
Dorsal scar count	**%**	**Dorsal scar pattern**	**%**
0	20.79	Natural	20.79
1	27.57	Uni	49.07
2	24.07	Bi	13.79
3	14.02	Multi	16.36
4	8.18		
5	4.21		
6	0.93		
8	0.23		
Cortex %	**%**	**Flake type**	**%**
0	14.49	1	13.08
5	5.14	2	15.65
10	11.92	3	5.84
15	0.23	4	50.93
20	15.65	5	14.49
30	13.08		
40	4.44		
50	5.84		
60	3.97		
70	5.61		
80	4.21		
90	2.34		
100	13.08		
Whole/broken	**%**	**Type of break**	**%**
Whole	84.58	None	84.58
Broken	15.42	Missing butt	13.32
		Distal snap	0.70
		Medial fragment	0.70
		Left break	0.23
		Proximal snap	0.23
		Distal fragment	0.23

Table 5.29 Technological analysis of flakes from Cuxton (Tester) (n=429).

Both Cruse's assemblages lack smaller flakes. The higher proportion of smaller flakes in the handaxe layer could be due to handaxe manufacture (Table 5.30 + 5.31). The average flake size from the Tester material lies within the range of the Cruse material (Table 5.32).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	56.7	53.0	17.0	0.981
Median	53.3	48.6	15.7	0.902
Min	16.3	12.7	3.5	0.228
Max	123.4	120.0	44.6	2.404
SD	19.976	20.705	8.205	0.361

Table 5.30 Average dimensions of flakes from Cuxton (Cruse 1-6) (n=110).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	47.6	42.5	12.7	0.928
Median	45.9	40.3	11.7	0.893
Min	16.2	13.8	2.1	0.386
Max	90.8	100.3	44.2	1.950
SD	16.307	17.026	6.595	0.335

Table 5.31 Average dimensions of flakes from Cuxton (Cruse 7+) (n=162).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	55.3	53.9	17.0	1.012
Median	52.9	50.8	15.1	0.971
Min	13.1	11.9	2.8	0.264
Max	138.8	171.2	80.0	2.550
SD	21.684	22.820	10.271	0.325

Table 5.32 Average dimensions of flakes from Cuxton (Tester) (n=429).

Cores

Four of the cores from Cruse's lower layer are MPCs but unusually one core has previously been referred to as a SPC by Bolton (2015). The remaining cortex on the unprepared cores shows moderate levels of utilisation (Table 5.33). These cores have been exploited through the use of alternative removals from numerous episodes. The cores are large and show little sign of elongation, but some flattening (Table 5.34).

Collection	Field Artefacts #	Stratigraphic context	Type	Weight	Cortex %	# episodes	# removals	Episode 1	Episode 2	Episode 3
Cruse collection	Box 1e	Layer 2 trench 1	MPC	251.7	20	3	7	3C	3C	D
Cruse collection	10 1 124	L 5 1+2	MPC	868.3	40	3	8	5C	2C	D
Cruse collection	10 1 38	L4 T1	MPC	325.5	40	1	7	7C		
Cruse collection	10 1 39	L4 T1	MPC	916.7	40	2	7	4C	3B	

Table 5.33 Technological analysis of cores from Cuxton (Cruse 1-6).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)
Mean	104.7	95.6	55.1	1.017	0.643
Median	103.7	91.4	51.6	0.890	0.620
Min	63.3	66.3	41.3	0.573	0.310
Max	148.1	133.4	76.0	1.712	1.024
SD	40.541	31.168	14.859	0.504	0.310

Table 5.34 Average dimensions of cores from Cuxton (Cruse 1-6) (n=4).

The Acheulean layers contain no prepared cores, but there are examples of a single removal core and two MPCs (Table 5.35). These cores show more variation in the levels of utilisation. The cores contain fewer episodes of working and less alternative flaking. Cores from the Acheulean layers were smaller and showed more elongation but less flattening (Table 5.36).

Collection	Field Artefacts #	Stratigraphic context	Type	Weight	Cortex %	# episodes	# removals	Episode 1	Episode 2
Cruse collection	10 1 143	L7 T 1+2	Single removal	139.6	90	1	1	1A	
Cruse collection	10 1 208	L 9/10 T1/2	MPC	583.7	60	2	6	2B	4C
Cruse collection	10 1 265	LU T1	MPC	184.3	10	2	3	2B	1A

Table 5.35 Technological analysis of cores from Cuxton (Cruse 7+).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)
Mean	78.1	57.2	48.8	0.725	0.829
Median	71.3	59.4	32.2	0.800	0.845
Min	70.3	38.1	30.1	0.542	0.507
Max	92.6	74.1	84.1	0.833	1.135
SD	12.596	18.101	30.589	0.159	0.314

Table 5.36 Average dimensions of cores from Cuxton (Cruse 7+) (n=3).

Overall few distinctions between the cores in the two layers (see below for PCT) can be observed but too few examples are available for detailed comparison.

A larger collection of cores is available from Tester (Table 5.37). Apart from broken fragments these are split into three groups: MPCs, chopper cores and prepared cores. The unprepared cores show various levels of utilisation, as well as a mixture of approaches to knapping from short sequences, concentrated alternative working to create a chopper core and well-turned MPCs. The cores are large and show some evidence for both elongation and flattening (Table 5.38).

Collection	Stratigraphic context	Field Artefacts #	Type	Cortex %	# episodes	# removals	Episode 1	Episode 2	Episode 3	Episode 4
Tester coll	T4	10 8 335	MPC	40	2	2	1A	1A		
Tester coll	T4	10 8 407	Chopper core	70	2	4	3D	1D		
Tester coll	T1	10 8 408	MPC	70	1	2	2C			
Tester coll	T4	10 8 409	Chopper core	70	1	2	2C			
Tester coll	T2	10 8 410	Chopper core	50	2	4	4c			
Tester coll	T1	10 8 411	MPC	20	2	6	4C	2B		
Tester coll	T4	10 8 413	MPC	60	2	5	4C	1D		
Tester coll	T1	10 8 412	MPC	40	2	5	1A	4C		
Tester coll	T4	10 8 415	Chopper core	40	1	4	4C			
Tester coll	T1	10 8 416	Chopper core	70	1	4	4C			
Tester coll	T4	10 8 414	MPC	40	3	6	1A	2B	3B	
Tester coll	T2	10 8 484	MPC	20	3	7	3B	2C	2B	
Tester coll	T3	10 8 523	MPC	30	1	2	2B			
Tester coll	T4	10 8 524	MPC	30	1	3	3C			
Tester coll	T1	10 8 532	Broken	40	2	2	1D	1D		
Tester coll		10 8 534	MPC	30	2	4	2C	2B		
Tester coll	T1	10 8 580	Chopper core	60	1	4	4C			
Tester coll	T4	10 8 582	MPC	40	4	9	2C	4C	2B	1D
Tester coll	T4	10 8 664	MPC	20	3	7	3C	2C	2B	
Tester coll	T4	10 8 718	Chopper core	60	1	3	3C			
Tester coll	T3	10 8 722	MPC	70	3	5	2B	2B	1D	
Tester coll	T5	10 8 721	MPC	60	1	4	4B			
Tester coll	T4	10 8 720	MPC	40	3	5	3B	1A		

Table 5.37 Technological analysis of cores from Cuxton (Tester).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)
Mean	100.7	73.5	48.0	0.755	0.682
Median	102.5	71.4	46.4	0.729	0.685
Min	62.2	47.0	31.9	0.459	0.391
Max	150.9	125.4	81.1	1.109	1.086
SD	27.617	21.998	12.466	0.203	0.180

Table 5.38 Average dimensions of cores from Cuxton (Tester) (n=23).

Flake Tools

Only 10 flake tools were identified from Cruses' excavation, all from the non-handaxe layer (Table 5.39). Some flakes previously recorded as flake tools have been dismissed as natural edge damage. Two denticulates were analysed but the rest were scrapers with continuous semi-invasive retouch. There is no evidence of these flake tools being crude or 'Clactonian' in nature. The flakes tools are larger than regular flakes but show only slight levels of elongation (Table 5.40).

Type of flake tools	%	Extent of retouch	%
Side scraper	60	Semi-invasive	90
Denticulate	20	Invasive	10
End scraper	10		
Convergent scraper	10		
Distribution of retouch	**%**	**Position of retouch**	**%**
Continuous	100	Direct	90
		Inverse	10
Location	**%**	**Form**	**%**
Right	50	Convex	50
Left	20	Denticulate	20
Distal	10	Concave	20
Left and right	10	Convex and concave	10
Ventral right	10		
Angle of retouch	**%**	**Regularity**	**%**
Semi-abrupt	90	Regular	70
Abrupt	10	Irregular	30
Morphology of retouch	**%**	**Length of retouch**	**mm**
Sub-parallel	40	Mean	56.47
Scaly	30	Median	50.75
Parallel	20	Min	28.8
Notches	10	Max	93.8
		SD	21.50365

Table 5.39 Technological analysis of flake tools from Cuxton (Cruse 1-6) (n=10).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	68.4	60.2	21.3	0.911
Median	66.1	58.8	19.9	0.890
Min	40.7	40.2	9.0	0.639
Max	105.8	99.9	42.9	1.260
SD	21.102	16.839	10.703	0.205

Table 5.40 Average dimensions of flake tools from Cuxton (Cruse 1-6) (n=10).

Flake tools from Tester’s excavation are similar (Table 5.41). Various forms of semi-invasive scrapers are the most prevalent tool with some notches and denticulates. There are many flakes labelled as tools that show no signs of genuine retouch. The flake tools were larger than regular flakes but showed no signs of elongation (Table 5.42).

Type of flake tool	%	Extent of retouch	%
Side scraper	53.13	Minimally invasive	15.63
Notch	12.50	Semi-invasive	68.75
End scraper	12.50	Invasive	15.63
Denticulate	9.38		
Double scraper	6.25		
Convergent scraper	3.13		
Point	3.13		
Distribution	**%**	**Position of retouch**	**%**
Continuous	84.38	Direct	84.38
Discontinuous	15.63	Inverse	12.50
		Bifacial	3.13
Location of retouch	**%**	**Form of retouch**	**%**
Right	37.50	Convex	68.75
Left	21.88	Rectilinear	12.50
Distal	18.75	Concave	15.63
Ventral left	6.25	Double convex and concave	3.13
Left and right	6.25		
All around	3.13		
Ventral right	3.13		
Proximal	3.13		
Angle of retouch	**%**	**Regularity**	**%**
Semi-abrupt	96.88	Regular	75.00
Abrupt	3.13	Irregular	25.00
Morphology of retouch	**%**	**Length of retouch**	**mm**
Sub-parallel	50.00	Mean	56.94
Scaly	18.75	Median	54.75
Stepped	12.50	Min	13.80
Parallel	9.38	Max	146.50
Notch	9.38	SD	31.42

Table 5.41 Technological analysis of flake tools from Cuxton (Tester) (n=32).

	Length(mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	69.1	67.8	23.1	1.058
Median	69.6	67.2	22.1	1.015
Min	31.2	31.6	8.8	0.493
Max	142.7	111.6	53.6	2.256
SD	22.032	22.254	10.647	0.450

Table 5.42 Average dimensions of flake tools from Cuxton (Tester) (n=32).

PCT

No Levallois flakes were among either of the Cuxton assemblages. Five cores previously labelled as SPC/Proto-Levallois were analysed. The prepared cores from the Tester excavation were similar to the cores from Botany Pit (Table 5.43).

Type of prepared core	%	Blank type	%
Proto-Levallois	100	Nodule	100
Method of preparation	**%**	**Method of exploitation**	**%**
Centripetal	75	Linear	50
Bipolar	25	Bipolar recurrent	25
		Unexploited	25
Earlier surface	**%**	**Type of products**	**%**
None	100	Flake	75
		Unexploited	25
Number of preferential removals	**%**	**Position of scar on striking surface**	**%**
0	25	Distal and proximal	75
1	50	Distal and proximal and one lateral edge	25
2	25		
Preparation on striking surface	**%**	**Preparation on flaking surface**	**%**
0	0	0	0
1	0	1	25
2	25	2	0
3	25	3	25
4	0	4	25
5	25	5	0
6	25	6	0
		7	0
		8	25
% Cortex on striking platform Surface	**%**	**Position of cortex on striking platform surface**	**%**
30	25	All over	75
40	0	One edge	25
50	0		
60	0		
70	25		
80	50		
Pattern of accentuated convexities	**%**	**Nature of accentuated convexities**	**%**
None	100	None	100%

Table 5.43 Technological analysis of prepared cores from Cuxton (Tester) (n=4).

These cores show bipolar or centripetal preparation of the flaking surface: two linearly exploited, one bipolar and one unexploited. While one core shows only one flake removal to create a striking platform, most contain multiple removals. These are on the proximal and distal ends of the core similar to many examples from Botany Pit. There is no evidence of control of the convexities of the cores. The cores are on larger nodules showing some signs of flattening but little elongation (Table 5.44). The preferential removals are on average larger than regular flakes from the site, but are not more elongated (Table 5.45).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)
Mean	128.2	107.3	49.1	0.847	0.459
Median	128.8	106.8	47.9	0.813	0.449
Min	105.9	95.6	42.0	0.735	0.401
Max	149.2	120.0	58.4	1.027	0.537
SD	17.725	10.111	6.874	0.126	0.066

Table 5.44 Average dimensions of prepared cores from Cuxton (Tester) (n=4).

	Length (mm)	Width (mm)	Elongation (W/L)
Mean	70.4	67.7	1.066
Median	75.5	65.2	0.864
Min	43.4	60.1	0.689
Max	87.2	80.2	1.848
SD	16.385	7.546	0.457

Table 5.45 Average dimensions of preferential removals from Cuxton (Tester) (n=4).

The example from the non-handaxe section (Cruse), could question the nature of the assemblage. However, the core is small and irregular (Table 5.46) with only two scars that could be considered striking platform preparation. The core is probably a fragment of a much larger core and shows few diagnostic traits of PCT.

Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)
44	82.2	21.6	1.868	0.263

Table 5.46 Dimensions of potential SPC from Cuxton (Cruse 1-6).

Summary

The non-handaxe assemblage from the site can be verified from the Cruse excavation but there is no evidence of this in Tester's assemblage. Flake tools from the site are not as numerous as previous publications have stated but are present at the site. The 'prepared core' from the Cruse excavation is not diagnostic of PCT. The prepared cores from the Tester excavation are similar to Botany Pit. Overall, the site show similarities to the Purfleet sequence.

5.1.4 Furze Platt

Condition

The assemblage is in a light to moderately abraded condition with light to moderate edge damage (Table 5.47). No discrete components could be identified.

	Flakes	Flake tools	Cores	All material
n	324	39	2	365
Abrasion				
Light	17.59	23.08	0.00	18.08
Moderate	67.59	69.23	50.00	67.67
Heavy	14.81	7.69	50.00	14.25
Edge Damage				
Light	24.69	30.77	0.00	25.21
Moderate	66.67	66.67	50.00	66.58
Heavy	8.64	2.56	50.00	8.22
Patina				
None	31.79	7.69	50.00	29.32
Light	53.70	74.36	0.00	55.62
Moderate	12.96	15.38	50.00	13.42
Heavy	1.54	2.56	0.00	1.64
Staining				
None	70.68	61.54	50.00	69.59
Yes	29.32	38.46	50.00	30.41
Scratching				
None	96.91	97.44	100.00	96.99
Yes	3.09	2.56	0.00	3.01
Battering				
None	100.00	100.00	100.00	100.00
Yes	0.00	0.00	0.00	0.00

Table 5.47 Condition of artefacts from Furze Platt.

Site formation

Flake size analysis shows a minimally derived site containing smaller elements (Figures 5.13+

5.14). There are still issues with collection bias, handaxes were prioritised and smaller elements of the assemblage were probably overlooked.

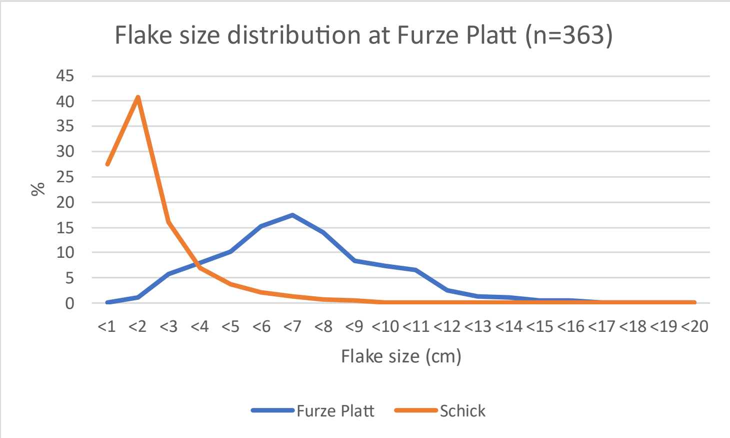


Figure 5.13 Flake size analysis of Furze Platt.

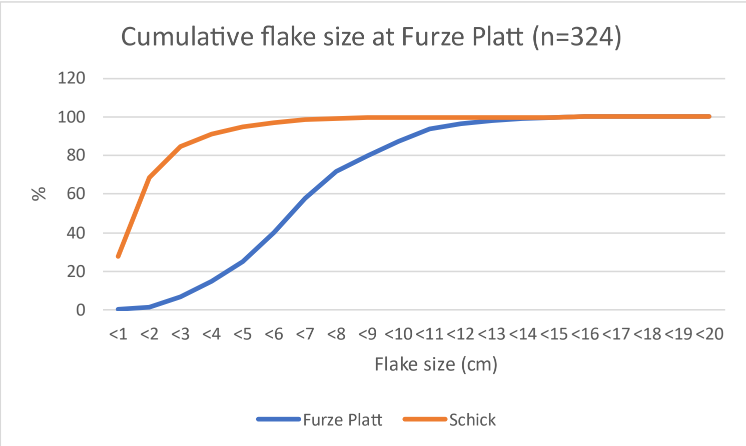


Figure 5.14 Cumulative flake size at Furze Platt.

Non-handaxe

There is no evidence of a separate non-handaxe layer.

Flakes

The flakes show evidence of handaxe manufacture through the presence of soft hammer flakes, with a larger number of indeterminate flakes (Table 5.48). The dorsal scar counts, and patterns show a range of working including long multidirectional sequences. Flakes represent all stages of working, but later stages are more common. The flakes are a range of sizes showing the collection of smaller material (Table 5.49). There is little evidence of elongation.

Butt type	%	Hammer mode	%
Plain	45.99	Hard	72.53
Marginal	34.57	Indeterminate	19.44
Missing	8.64	Soft	8.02
Mixed	8.33		
Cortical	0.93		
conical	0.93		
Faceted	0.31		
Dihedral	0.31		

Dorsal scar count	%	Dorsal scar pattern	%
0	14.51	Natural	14.81
1	22.53	Uni	50.00
2	29.32	Bi	19.75
3	16.05	Multi	15.43
4	9.88		
5	4.32		
6	2.78		
7	0.62		

Cortex	%	Flake type	%
0	24.69	1	13.58
5	7.72	2	6.48
10	14.20	3	8.02
15	3.09	4	49.38
20	13.89	5	22.53
25	1.23		
30	9.57		
40	5.56		
50	3.40		
60	2.47		
70	2.47		
80	3.40		
90	2.78		
100	5.56		

Whole/broken	%	Type of break	%
Whole	91.05	None	91.05
Broken	8.95	Missing butt	8.64
		Distal snap	0.31

Table 5.48 Technological analysis of flakes from Furze Platt (n=324).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	66.1	59.9	17.8	0.969
Median	63.2	57.9	16.7	0.949
Min	14.0	12.3	3.1	0.251
Max	157.0	151.0	82.4	2.484
SD.	26.870	23.089	9.697	0.328

Table 5.49 Average dimensions of flakes from Furze Platt (n=324).

Cores

Only two cores were examined from Furze Platt, both are MPCs with a number of removals in parallel sequences (Table 5.50). No examples of alternative flaking were observed. Both cores have surface areas with less than half the cortex remaining, showing the utilisation of these cores also evident in the knapping sequences. The cores from Furze Platt are large and show signs of elongation (Table 5.51). However, the sample is too small to base firm conclusions on, and they may have been collected due to these features.

Field Artefacts #	Stratigraphic context	Type	Cortex %	# episodes	# removals	Episode 1	Episode 2	Episode 3	Episode 4
1 A11 10a	Belmont Park Road	MPC	50	2	3	2B	1A		
OUM 2145	Furze Platt	MPC	20	4	9	2B	3B	2B	2B

Table 5.50 Technological analysis of cores from Furze Platt (n=2).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)
Mean	123.8	91.1	57.6	0.737	0.636
Median	123.8	91.1	57.6	0.737	0.636
Min	121.0	86.3	54.2	0.682	0.566
Max	126.6	95.8	60.9	0.792	0.706
SD.	3.960	6.718	4.738	0.078	0.099

Table 5.51 Average dimensions of cores from Furze Platt (n=2).

Flake tools

While many flakes previously recorded as flake tools were dismissed as naturally edge damaged, 39 flake tools were examined including some well-made invasive scrapers (Table 5.52). Retouch is mainly direct, continuous, regular and convex. Flake tools show evidence of long sequences of retouch which have created side, end and convergent scrapers, one of which is reminiscent of a flake handaxe. Notches and denticulates are also found in low numbers. On average, flake tools were larger than regular flakes but showed similar degrees of elongation (Table 5.53).

Type of Flake Tool	**%**	**Extent of Retouch**	**%**
Side scraper	46.15	Minimally invasive	17.95
End scraper	17.95	Semi-invasive	56.41
Convergent scraper	12.82	Invasive	25.64
Notch	10.26		
Double scraper	7.69		
Unifacial handaxe / convergent scraper	2.56		
Denticulate	2.56		
Distribution	**%**	**Position of Retouch**	**%**
Continuous	94.87	Direct	92.31
Discontinuous	5.13	Inverse	5.13
		Bifacial	2.56
Location of Retouch	**%**	**Form of Retouch**	**%**
Distal	30.77	Convex	76.92
Left	25.64	Concave	12.82
Right	17.95	Both convex and concave	5.13
Convergent on distal	12.82	Rectilinear	5.13
Left and right	5.13		
Left ventral	2.56		
Distal and left	2.56		
Distal and proximal	2.56		
Angle of Retouch	**%**	**Regularity**	**%**
Semi-abrupt	97.44	Regular	84.62
Abrupt	2.56	Irregular	15.38
Morphology of Retouch	**%**	**Length of Retouch**	**mm**
Sub-parallel	56.41	Mean	78.45
Stepped	20.51	Median	71.00
Scaly	15.38	Min	35.40
Parallel	5.13	Max	169.90
Denticulate	2.56	SD	35.99

Table 5.52 Technological analysis of flake tools from Furze Platt (n=39).

	Length (mm)	**Width (mm)**	**Thickness (mm)**	**Elongation (W/L)**
Mean	80.4	74.1	23.2	0.990
Median	79.6	70.8	23.1	0.990
Min	50.5	41.2	7.7	0.362
Max	113.9	121.0	34.5	1.889
SD	17.160	19.567	6.260	0.401

Table 5.53 Average dimensions of flake tools from Furze Platt (n=39).

PCT

No PCT was examined during the study.

Summary

Furze Platt is a site dominated by handaxes and their manufacture. There is no convincing evidence of a non-handaxe signature or PCT. While the lack of PCT may be due to the lack of cores collected, the site offers an interesting comparison to Stoke Newington which also lacks PCT. Like Stoke Newington, Furze Platt is notable for the quality of some of the flake tools from the site despite there being fewer than previously suggested.

5.1.5 Grays Thurrock

Condition

The material is moderately abraded with light edge damage, and while not *in situ* does not appear to have moved far (Table 5.54). There are no discrete assemblages.

	Flakes	Flake tools	Cores	All material
n	124	13	3	140
Abrasion				
Light	20.16	23.08	33.30	20.71
Moderate	79.84	76.92	66.60	79.29
Edge Damage				
Light	65.32	76.92	66.60	66.43
Moderate	34.68	23.08	33.30	33.57
Patina				
None	29.03	76.92	33.30	28.57
Light	58.06	23.08	33.30	59.29
Moderate	9.68	0.00	0.00	8.57
Heavy	3.23	0.00	33.30	3.57
Staining				
None	100.00	100.00	100.00	100.00
Scratching				
None	100.00	100.00	100.00	100.00
Battering				
None	100.00	100.00	100.00	100.00

Table 5.54 Condition of Grays material.

Site formation

The flake size analysis shows no evidence of major winnowing as most artefacts are between 3-7cm (Figures 5.15+ 5.16). Some disturbance and collection bias, especially for material under 2cm, is apparent.

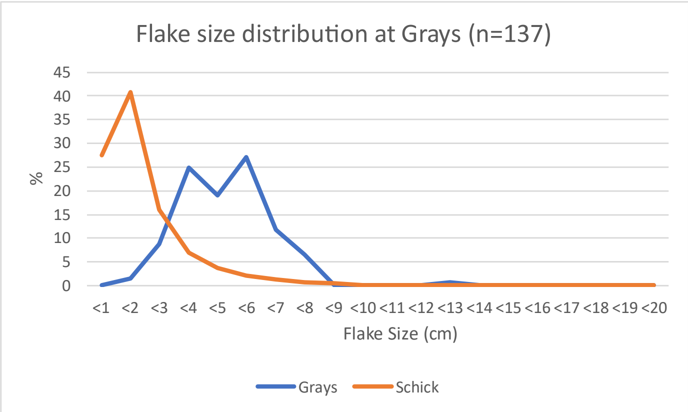


Figure 5.15 Flake size analysis at Grays.

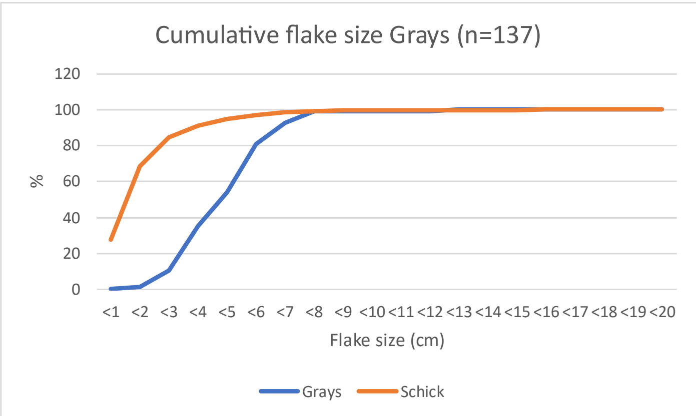


Figure 5.16 Cumulative flake size analysis at Grays.

Non-handaxe

There is no distinction of a non-handaxe assemblage at the site. The only possible ‘Clactonian trait’ is the presence of a rolled chopper core.

Flakes

The assemblage includes a number of soft hammer flakes, with a higher proportion of indeterminate flakes probably also handaxe related (Table 5.55). The dorsal scar patterns on the flakes show simpler working than many other sites with unidirectional work dominating, often with only one or two removals. While all stages of knapping are represented, later stages dominate. Flakes from the site are smaller on average, with little signs of elongation (Table 5.56), this could be due to the lack of larger flakes or the presence of a more representative sample of smaller flakes.

Butt type	%	Hammer mode	%
Plain	59.68	Hard	77.42
Marginal	16.13	Indeterminate	14.52
Mixed	10.48	Soft	8.06
Missing	8.06		
Conical	4.84		
Cortical	0.81		
Dorsal scar count	**%**	**Dorsal scar pattern**	**%**
0	10.48	Natural	10.48
1	48.39	Uni	73.39
2	27.42	Bi	8.87
3	10.48	Multi	7.26
4	3.23		
Cortex	**%**	**Flake type**	**%**
0	29.84	1	1.61
5	4.03	2	14.52
10	19.35	3	4.03
20	12.10	4	50.00
30	7.26	5	29.84
40	6.45		
50	4.03		
60	1.61		
70	4.03		
80	1.61		
90	8.06		
100	1.61		
Whole/broken	**%**	**Type of break**	**%**
Whole	91.94	None	91.94
Broken	8.06	Missing Butt	8.06

Table 5.55 Technological analysis of flakes from Grays (n=124).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	47.2	46.1	14.2	1.022
Median	47.4	43.5	13.3	0.973
Min	18.1	11.1	5.5	0.333
Max	121.4	94.3	36.2	2.406
SD.	15.229	15.234	5.555	0.321

Table 5.56 Average dimensions of flakes from Grays (n=124).

Cores

Two MPCs and a chopper core were analysed from the site (Table 5.57). The cores from Grays show substantial amounts of utilisation, apart from the chopper core which has a much higher amount of residual cortex. One MPC shows two alternative flaking sequences, but the other shows only parallel working and independent flaking episodes. The chopper core shows more focused working on one end possibly making a core tool. The cores are small, possibly due to utilisation, without large degrees of elongation (Table 5.58). On average the cores do not show signs of flattening except for in one case one which could also be due to higher levels of working.

Field Artefacts #	Stratigraphic context	Type	Cortex %	# episodes	# removals	Episode 1	Episode 2	Episode 3
1-4 490	General Grays Thurrock	MPC	0	3	4	2B	1A	1A
1-4 491	General Grays Thurrock	MPC	20	2	5	3C	2C	
1-4 492	General Grays Thurrock	Chopper	60	1	3	3C		

Table 5.57 Technological analysis of cores from Grays.

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)
Mean	64.3	55.8	36.9	0.873	0.698
Median	69.4	50.0	34.4	0.876	0.780
Min	49.2	43.1	33.6	0.674	0.463
Max	74.2	74.3	42.6	1.071	0.852
SD	13.267	16.389	4.981	0.198	0.207

Table 5.58 Average dimensions of cores from Grays (n=3).

Flake tools

Only 13 flake tools were identified from Grays, with others being dismissed as naturally edge damaged (Table 5.59). There is little evidence for invasive working with some flake tools showing very minimal retouch. Most of the flake tools are side or end scrapers. There is a high proportion of inverse working showing, along with some discontinuous and irregular working, more *ad hoc* styles of retouch. This is also apparent in the shorter sequences of retouch and smaller flake tools. A number of notches and denticulates were also identified at the site. The flake tools are larger on average than the flakes from Grays but show less evidence for elongation (Table 5.60). The size of flake tools is below the average of other sites.

Type of flake tool	%	Extent of retouch	%
End scraper	30.77	Minimally Invasive	15.38
Side scraper	30.77	Semi-invasive	76.92
Notch	15.38	Invasive	7.69
Double scraper	7.69		
Denticulate	7.69		
Bi-facial scraper	7.69		
Distribution	**%**	**Position of retouch**	**%**
Continuous	76.92	Direct	69.23
Discontinuous	23.08	Inverse	23.08
		Bifacial	7.69
Location of retouch	**%**	**Form of retouch**	**%**
Distal	46.15	Convex	53.85
Left ventral	23.08	Notch	15.38
Right	23.08	Left convex right concave	7.69
Left and right	7.69	Rectilinear	7.69
		Concave	7.69
		Denticulate	7.69
Angle of retouch	**%**	**Regularity**	**%**
Semi-abrupt	84.62	Regular	76.92
Abrupt	15.38	Irregular	23.08
Morphology of retouch	**%**	**Length of retouch**	**mm**
Sub-parallel	61.54	Mean	48.12
Scaly	15.38	Median	49.10
Notch	15.38	Min	21.90
Denticulate	7.69	Max	79.30
		SD	16.48

Table 5.59 Technological analysis of flake tools from Grays (n=13).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	52.8	54.4	18.5	1.065
Median	55.0	51.4	16.9	1.078
Min	30.5	36.4	11.1	0.590
Max	73.1	84.7	28.5	1.645
SD	12.962	14.029	4.838	0.276

Table 5.60 Average dimensions of flake tools from Grays (n=13).

PCT

Unlike the nearby sites at Purfleet, Grays does not have any PCT attributed to the site. No evidence of PCT was analysed during this study.

Summary

While the provenance of the Grays material is disputed (see Chapter Four) there is little of relevance to the main themes of this thesis. The assemblage is a typical Acheulean handaxe site with no evidence for a non-handaxe signature or PCT. The flake tools from the site are few in number and are not distinctive in nature.

5.1.6 Grovelands Pit

Condition

The artefacts show signs of moderate abrasion and edge damage (Table 5.61). Just over 10% show heavier signs of abrasion but these are not technologically distinct.

	Flakes	Flake tools	Cores	All material
n	122	59	28	209
Abrasion				
Light	5.74	13.56	7.14	8.13
Moderate	82.79	74.58	82.14	80.38
Heavy	11.48	11.86	10.71	11.48
Edge Damage				
Light	7.38	27.12	14.29	13.88
Moderate	83.61	72.88	85.71	80.86
Heavy	9.02	0.00	0.00	5.26
Patina				
None	22.13	20.34	17.86	21.05
Light	36.89	33.90	35.71	35.89
Moderate	39.34	42.37	42.86	40.67
Heavy	1.64	3.39	3.57	2.39
Staining				
None	95.08	89.83	85.71	92.34
Yes	4.92	10.17	14.29	7.66
Scratching				
None	100.00	98.31	100.00	99.52
Yes	0.00	1.69	0.00	0.48
Battering				
None	100.00	100.00	100.00	100.00
Yes	0.00	0.00	0.00	0.00

Table 5.61 Condition of Grovelands Pit artefacts.

Site formation

Flake size analysis demonstrates that the site has been subject to winnowing or collection bias due to a lack of smaller flakes (Figures 5.17+5.18).

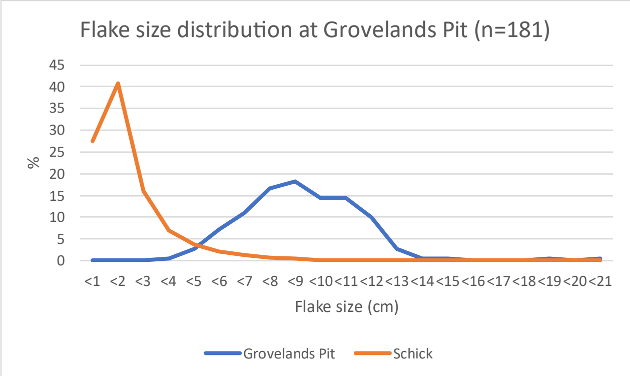


Figure 5.17 Flake size analysis at Grovelands Pit.

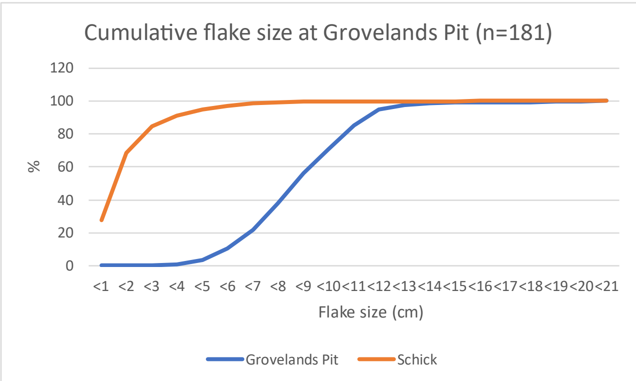


Figure 5.18 Cumulative flake size at Grovelands Pit.

Non-handaxe

Claims for a non-handaxe signature cannot be substantiated. There is no record of material coming from a discrete layer, and evidence for handaxe manufacture cannot be separated from other core and flake working and flake tools. Chopper cores, denticulates and notches are also not distinct in condition.

Flakes

The flakes from Grovelands Pit show typical characteristics of an Acheulean assemblage, including soft hammer flakes and flakes with marginal and dihedral butts (Table 5.62). A high proportion of flakes show evidence for complex multidirectional dorsal scar patterns, some up to ten removals. Other flakes contain shorter unidirectional or bipolar sequences. The full range of knapping is present but later stages are more commonly represented. On average flakes from Grovelands Pit are larger due to the lack of small flakes, but do not show any indication of elongation (Table 5.63).

Butt type	%	Hammer mode	%
Plain	65.57	Hard	84.43
Missing	11.48	Indeterminate	10.66
Conical	6.56	Soft	4.92
Marginal	6.56		
Mixed	5.74		
Dihedral	3.28		
Cortical	0.82		

Dorsal scar count	%	Dorsal scar pattern	%
0	0.82	Natural	0.82
1	8.20	Uni	42.62
2	22.95	Bi	21.31
3	30.33	Multi	35.25
4	15.57		
5	9.02		
6	7.38		
7	2.46		
8	1.64		
9	0.00		
10	1.64		

Cortex	%	Flake type	%
0	38.52	1	0.82
5	13.11	2	3.28
10	25.41	3	0.82
15	1.64	4	57.38
20	11.48	5	37.70
30	3.28		
40	2.46		
50	0.82		
60	0.82		
70	1.64		
80	0.82		

Whole/broken	%	Type of break	%
Whole	87.70	None	87.70
Broken	12.30	Missing platform	11.48
		Broken butt	0.82

Table 5.62 Technological analysis of flakes from Grovelands Pit (n=122).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	86.8	77.8	25.6	0.930
Median	85.2	73.8	24.5	0.923
Min	32.7	32.1	12.2	0.358
Max	182.4	170.9	74.0	1.984
SD.	22.499	25.652	8.868	0.310

Table 5.63 Average dimensions of flakes from Grovelands Pit (n=122).

Cores

A larger core assemblage was analysed from Grovelands Pit with the majority being MPCs (Table 5.64). The remainder included examples of fragments and chopper cores. The remaining cortex on the Grovelands Pit cores shows varied amount of utilisation, but most cores were well-exploited. This can also be seen in the technological evidence from the cores which show long alternative sequences of removals, with some cores having up to five episodes of removals. The cores show evidence of up to eleven removals showing well turned and utilised cores. Many of the cores were previously recorded as 'choppers' but show little evidence of belonging to that category.

Field Artefacts #	Type	Cortex %	# episodes	# removals	Episode 1	Episode 2	Episode 3	Episode 4	Episode 5
RED 1946 77 44	Chopper	70	1	9	9C				
RED 1946 77 40	MPC	50	1	8	8C				
RED M1946 45	MPC	40	3	11	6C	2B	3B		
RED 1946 77 476	MPC	0	3	5	2B	2B	1D		
RED 1946 77 42	MPC	40	3	6	4B	1D	1D		
RED 1946 77 65	MPC	10	2	8	5C	3B			
RED 1946 77 36	MPC	40	1	4	4C				
RED 1946 77 37	MPC	20	2	3	1D	2B			
RED 1959 252 1	Chopper	40	2	9	5C	4C			
RED MG 1962 201 11	MPC	5	3	6	4C	1D	1D		
RED MG 1962 201 3	MPC	5	2	4	2B	1D	1D		
RED MG 1962 201 9	MPC	20	2	10	6B	4B			
Red Mg 1962 201 10	MPC	10	3	7	4B	2C	1D		
RED MG 1962 201 2	MPC	10	3	8	5C	2B	1D		
RED MG 1964 2015 9	MPC	20	2	7	5C	2C			
RED MG 1962 201 4	MPC	30	3	7	4C	2B	1D		
RED MG 1962 201 12	MPC	5	3	4	2B	1D	1D		
RED MG 201 7	MPC	5	5	8	2B	2c	2B	1D	1D
RED MG 1962 201 5	MPC	5	4	10	3C	3C	2C	2B	
RED MG 1962 201 1	MPC	5	3	9	3C	4C	2B		
Red MG 1962 201 6	Core fragment	10	2	6	4B	2B			
RED MG 1964 2015 7	MPC	5	5	10	6C	1D	1D	1D	1D
RED MG 1964 2007 1	MPC	30	2	5	3B	2B			
RED MG 2015 8	MPC	10	4	8	4C	2C	1D	1D	
RED MG 1962 201 13	MPC	10	4	8	3C	2C	2B	1D	
RED MG 1946 77 74	MPC	60	2	6	4B	2B			
RED MG 77 39	MPC	0	4	11	4C	4C	2B	1D	
2015 3.1	MPC	10	2	5	3C	2C			

Table 5.64 Technological analysis of cores from Grovelands Pit (n=28).

The size of the cores varies and could represent different levels of utilisation (Table 5.65). On average the cores are large with little evidence for elongation. There is a moderate amount of flattening which could be due to the heavy use of these cores.

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)
Mean	112.6	100.4	56.7	0.931	0.597
Median	104.7	98.4	55.9	0.914	0.602
Min	46.0	61.2	28.6	0.629	0.271
Max	195.4	153.3	81.3	1.513	1.027
SD	38.281	24.964	15.591	0.175	0.210

Table 5.65 Average dimensions of cores from Grovelands Pit (n=28).

Flake tools

While 59 flake tools were analysed from Grovelands Pit, this is short of the 101 recorded by Roe (1968a:18). Many flakes previously reported as being retouched show no evidence of being tools. On average, the flake tools from Groveland's Pit are larger than regular flakes, but do not show increased elongation (Table 5.66). The largest flake tools show examples of unusually large scrapers being made.

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	90.2	86.5	27.8	1.007
Median	88.5	85.5	26.9	0.966
Min	46.6	45.1	13.9	0.493
Max	202.1	189.3	71.2	2.242
SD	24.446	24.295	9.699	0.340

Table 5.66 Average dimensions of flake tools from Grovelands Pit (n=59).

The flake tools show semi-invasive to invasive retouch more consistently than most Lower Palaeolithic sites (Table 5.67). The majority of these flakes were retouched into side, end, double and convergent scrapers. Some flake tools show evidence of handaxe attempts on flakes with several of the flake tools grading into flake handaxes, and this is reflected in a higher proportion of bifacial working. Conversely, a high proportion show irregular retouch with some discontinuous retouch, possibly showing more *ad hoc* working including denticulates and notches. Despite the evidence of some irregular working, on average the flake tools show long sequences of retouch to create more elaborate flake tools. The site shows variety from well-made elegant to more crude flake tools.

Type of flake tool	%	Extent of retouch	%
Side scraper	40.68	Minimally Invasive	18.64
End scraper	22.03	Semi-invasive	40.68
Double scraper	8.47	Invasive	40.68
Denticulate	6.78		
Convergent scraper/ handaxe on flake	6.78		
Notch	6.78		
Convergent scraper	5.08		
Bifacially worked	1.69		
Side scraper+ notch	1.69		

Distribution	%	Position of retouch	%
Continuous	74.58	Direct	89.83
Discontinuous	25.42	Inverse	5.08
		Bifacial	5.08

Location of retouch	%	Form of retouch	%
Left	33.90	Convex	61.02
Distal	28.81	Concave	18.64
Right	11.86	Notch	6.78
left and right	6.77	Rectilinear	5.08
Right + distal	3.39	Denticulate	3.39
All around other than butt	3.39	Left concave right convex	1.69
All around	1.69	Left convex right concave	1.69
Convergent	1.69	Convex and notch	1.69
All round	1.69		
Ventral left	1.69		
Left + distal	1.69		
Distal and side	1.69		
Left and inverse right	1.69		

Angle of retouch	%	Regularity	%
Semi-abrupt	98.31	Regular	52.54
Abrupt	1.69	Irregular	47.46

Morphology of retouch	%	Length of retouch	mm
Sub-parallel	54.24	Mean	85.6
Stepped	20.34	Median	74.1
Notched	13.56	Min	29.6
Parallel	6.78	Max	251.0
Scaly	5.08	SD	45.089

Table 5.67 Technological analysis of flake tools from Grovelands Pit (n=59).

PCT

The site shows no convincing evidence of PCT. One flake has some Levalloisian characteristics, but the angle of the flake indicates it is unlikely to be from a prepared core. Similarly, some of the cores show evidence of a flat surface being worked but none show any convincing evidence of even simple preparation.

Summary

Grovelands Pit is an Acheulean assemblage containing cores, flakes, flake tools and handaxes. There is no evidence for a separate non-handaxe signature, as previously suggested, or PCT. The flake tools from the site are numerous and show invasive retouch.

5.1.7 Lent Rise

Condition

The artefacts are moderately abraded with moderate edge damage, but some show evidence of more extensive abrasion (Table 5.68). There is no convincing separation in the assemblage.

Site formation

Lent Rise shows signs of collection bias or winnowing (Figures 5.19+ 5.20). This is in line with the derived condition of the artefacts.

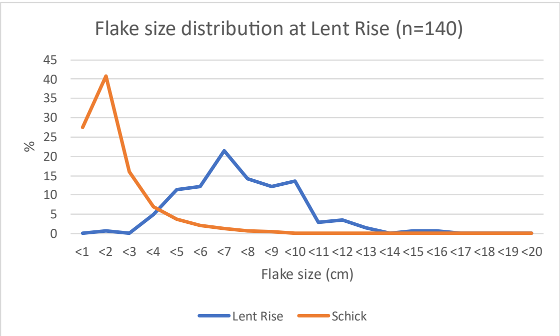


Figure 5.19 Flake size analysis at Lent Rise.

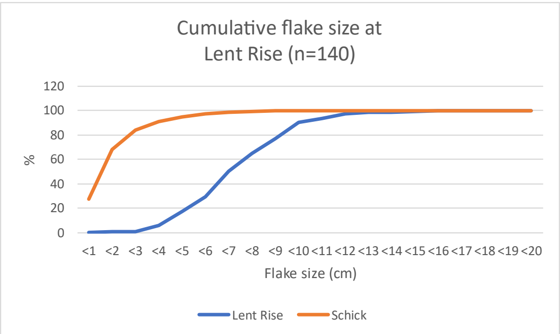


Figure 5.20 Cumulative flake size analysis at Lent Rise.

	Flakes	Flake tools	Cores	Prepared cores	Levallois flakes	All material
n	120	18	1	1	2	142
Abrasion						
Light	5.00	38.89	0.00	100.00	50.00	10.56
Moderate	69.17	55.56	100.00	0.00	50.00	66.90
Heavy	25.83	5.56	0.00	0.00	0.00	22.54
Edge Damage						
Light	7.50	50.00	0.00	0.00	50.00	13.38
Moderate	75.00	50.00	100.00	100.00	50.00	71.83
Heavy	17.50	0.00	0.00	0.00	0.00	14.79
Patina						
None	30.83	33.33	100.00	100.00	0.00	30.28
Light	48.33	61.11	0.00	0.00	50.00	50.70
Moderate	19.17	5.56	0.00	0.00	0.00	16.90
Heavy	1.67	0.00	0.00	0.00	50.00	2.11
Staining						
None	30.83	55.56	0.00	100.00	0.00	35.21
Yes	69.17	44.44	100.00	0.00	100.00	64.79
Scratching						
None	92.50	100.00	100.00	100.00	100.00	93.66
Yes	7.50	0.00	0.00	0.00	0.00	6.34
Battering						
None	99.17	100.00	100.00	100.00	100.00	99.30
Yes	0.83	0.00	0.00	0.00	0.00	0.70

Table 5.68 Condition of material from Lent Rise.

Flakes

While most flakes are hard hammer flakes, there are a proportion of soft hammer flakes and indeterminate flakes (Table 5.69). There are a wide range of dorsal scar counts and patterns ranging up to complex multidirectional sequences of up to eight removals, although simple shorter sequences are more common. The remaining cortex of the flakes demonstrates that all stages of knapping are present, but that later stages are represented more.

Butt type	%	Hammer mode	%
Plain	50.00	Hard	87.50
Marginal	25.00	Indeterminate	8.33
Missing	13.33	Soft	4.17
Mixed	6.67		
Cortical	4.17		
Dihedral	0.83		
Dorsal scar count	**%**	**Dorsal scar pattern**	**%**
0	19.17	Natural	19.17
1	19.17	Uni	45.00
2	33.33	Bi	24.17
3	15.83	Multi	11.67
4	7.50		
5	1.67		
6	1.67		
7	0.83		
8	0.83		
Cortex	**%**	**Flake type**	**%**
0	28.33	1	14.17
5	7.50	2	6.67
10	17.50	3	2.50
15	4.17	4	50.83
20	5.83	5	25.83
30	14.17		
40	5.00		
50	2.50		
60	1.67		
70	2.50		
75	0.83		
80	3.33		
100	6.67		
Whole/broken	**%**	**Type of break**	**%**
Broken	15.83	None	84.17
Whole	84.17	Missing butt	11.67
		Proximal break	1.67
		Butt shatter	0.83
		Breaks on left and right	0.83
		Distal break	0.83

Table 5.69 Technological analysis of flakes from Lent Rise (n=120).

On average the flakes from Lent Rise are regular in size (Table 5.70). Some flakes are large and are likely to be primary removals from cores or handaxes. On average, flakes show a small degree of elongation.

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	71.3	62.1	18.7	0.923
Median	68.2	59.1	17.7	0.874
Min	19.3	23.0	3.7	0.304
Max	154.1	108.2	43.8	2.964
SD.	22.729	20.521	8.578	0.359

Table 5.70 Average dimensions of flakes from Lent Rise (n=120).

Cores

Only two cores were recorded from Lent Rise, one with signs of preparation. The other is a small MPC that has had four removals in one episode of working, leaving only a small proportion of cortex (Table 5.71).

Field Artefacts #	Stratigraphic context	Type	Length	Width	Thickness	Cortex %	weight	# episodes	# removals	Episode 1
1 B9 4j	Lacille collection	MPC	50.8	59	31.2	20	95.6	1	4	4C

Table 5.71 Technological analysis of core from Lent Rise.

Non-handaxe

It has not been suggested that Lent Rise has a non-handaxe assemblage and no evidence was found in this study.

Flake tools

Eighteen flake tools were recorded from Lent Rise with other flakes being rejected as having natural edge damage. On average the flake tools from Lent Rise are marginally larger than unretouched flakes and show more evidence of elongation (Table 5.72).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	76.9	61.0	19.2	0.836
Median	77.8	57.6	19.1	0.722
Min	38.5	23.0	5.4	0.365
Max	120.3	115.1	38.2	1.535
SD	21.350	24.071	8.422	0.356

Table 5.72 Average dimensions of flake tools from Lent Rise (n=18).

Over a quarter contained very minimal retouching including a denticulate (Table 5.73), the rest were side, end, convergent or double scrapers. The majority of the retouch is continuous, direct and regular with a proportion of tools showing evidence of invasive retouch. There is no connection between the flake tools and Levallois technology.

Type of flake tool	%	Extent of retouch	%
Side scraper	55.56	Minimally invasive	27.78
End scraper	11.11	Semi invasive	33.33
Convergent scraper	11.11	Semi invasive right distal minimally	16.67
Unifacial handaxe or end scraper	11.11	Invasive	22.22
Double scraper	5.56		
Denticulate	5.56		
Distribution	**%**	**Position of retouch**	**%**
Continuous	88.89	Direct	94.44
Discontinuous	11.11	inverse	5.56
Location of retouch	**%**	**Form of retouch**	**%**
Right	33.33	Convex	77.78
Distal	27.78	Rectilinear	11.11
left	16.67	Double concave	5.56
Left converging with distal	11.11	Denticulate	5.56
Ventral right	5.56		
Left + right	5.56		
Angle of retouch	**%**	**Regularity**	**%**
Semi-abrupt	88.89	Regular	83.33
Abrupt	11.11	Irregular	16.67
Morphology of retouch	**%**	**Length of retouch**	**mm**
Sub-parallel	50.00	Mean	61.0
Scaly	22.22	Median	53.3
Stepped	16.67	Min	21.7
Parallel	11.11	Max	136.5
		SD	31.187

Table 5.73 Technological analysis of flake tools from Lent Rise (n=18).

PCT

One potential prepared core was identified from Lent Rise, but later damage obscures the flaking surface. The core could show signs of simple centripetal preparation left unexploited, but the later damage makes this unclear. By itself, the core is not convincing evidence of PCT at the site.

Two possible Levallois flakes were found at the site both faceted with only five percent of cortex remaining prepared bipolarly and exploited lineally (Table 5.74). One of the removals is a point whilst the other is a flake. The preparation scars are fairly simple with the flake being the most prepared with four removals. The two products show an increased size compared to the regular flakes as well as higher degrees of elongation (Table 5.75). While this could be significant the number of artefacts is too low to be confident.

Confidence of Levallois	**%**	**Butt type**	**%**
Possible	100	Faceted	100
Morphology of products	**%**	**Previous removals**	**%**
Flake	50	0	100
Point	50		
Dorsal scar count	**%**	**Preparation scars**	**%**
0	0	0	0
1	0	1	0
2	50	2	50
3	0	3	0
4	50	4	50
Method of preparation	**%**	**Method of exploitation**	**%**
Bipolar	100	Linear	100
Cortex	**%**		
5%	100		

Table 5.74 Technological analysis of Levallois flakes from Lent Rise (n=2).

	Length (mm)	**Width (mm)**	**Thickness (mm)**	**Elongation (W/L)**
Mean	90.7	54.7	14.2	0.600
Median	90.7	54.7	14.2	0.600
Min	61.5	36.3	10.4	0.590
Max	119.9	73.1	17.9	0.610
SD	41.295	26.022	5.303	0.014

Table 5.75 Average dimensions of Levallois flakes from Lent Rise (n=2).

Summary

Lent Rise shows a typical derived Acheulean assemblage subject to both winnowing and collection bias. There is no evidence of a non-handaxe signature at the site, but there is potential early PCT at the site, its low numbers and ambiguous nature makes this difficult to interpret. The flake tools from the site appear in much lower numbers than previously thought.

5.1.8 Little Thurrock (Globe Pit)

Condition

The assemblage shows moderate signs of abrasion but only light edge damage (Table 5.76). There are no signs of distinct assemblages.

	Flakes	Flake tools	Cores	All material
n	551	4	10	565
Abrasion				
Light	16.52	25.00	0.00	16.28
Moderate	80.94	75.00	90.00	81.06
Heavy	2.54	0.00	10.00	2.65
Edge Damage				
Light	79.13	50.00	50.00	78.94
Moderate	20.87	50.00	50.00	21.06
Patina				
None	8.53	25.00	25.00	8.50
Light	62.98	50.00	50.00	62.65
Moderate	24.86	25.00	25.00	25.13
Heavy	3.63	0.00	0.00	3.72
Staining				
None	96.01	100.00	100.00	95.58
Yes	3.99	0.00	0.00	4.42
Scratching				
None	99.64	100.00	100.00	99.65
Yes	0.36	0.00	0.00	0.35
Battering				
None	99.82	100.00	100.00	99.82
Yes	0.18	0.00	0.00	0.18

Table 5.76 Condition of material from Globe Pit, Little Thurrock.

Site formation

The Globe Pit assemblage contains a higher degree of smaller flakes but shows some evidence of winnowing or collection bias (Figures 5.21+5.22). Some simple refits can be observed in the assemblage, which could be evidence of a more intact assemblage than other sites, but could also be due to breakages rather than technological refits. The average dimensions of the flakes show smaller flakes with little evidence of elongation (Table 5.77).

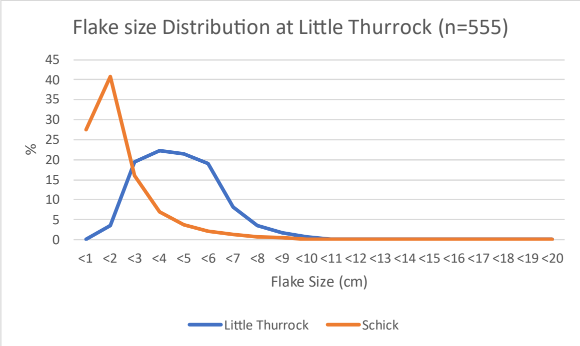


Figure 5.21 Flake size analysis at Globe Pit, Little Thurrock.

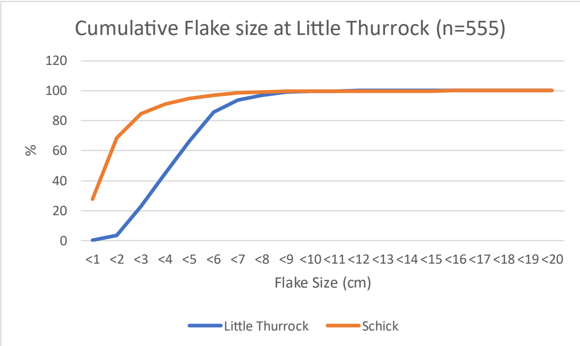


Figure 5.22 Cumulative flake size at Globe Pit, Little Thurrock.

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	43.4	40.9	13.7	1.002
Median	41.8	38.4	12.4	0.954
Min	10.2	11.4	2.7	0.249
Max	112.1	99.1	40.3	2.696
SD	16.202	14.923	6.234	0.351

Table 5.77 Average dimensions of flakes from Globe Pit, Little Thurrock (n=551).

Non-handaxe

As well as having no handaxes there are no soft hammer flakes at the site (Table 5.78). The indeterminate flakes from the site are primarily broken and the sample is large enough to be reasonably sure that soft hammer flakes have not been overlooked. There are examples of flakes with marginal and dihedral butts, but these are rare and can be found in other forms of working. The dorsal scars show a preference for shorter patterns. While flakes came from all stages of working, the majority came from later stages showing the full exploitation of cores.

Butt type	%	Hammer mode	%
Plain	59.53	Hard	90.56
Mixed	14.34	Indeterminate	9.44
Missing	10.16		
Marginal	9.98		
Cortical	4.36		
Dihedral	1.27		
Conical	0.36		

Dorsal scar count	%	Dorsal scar pattern	%
0	18.15	Natural	17.79
1	45.01	Uni	67.51
2	26.68	Bi	11.25
3	7.44	Multi	3.45
4	2.00		
5	0.73		

Cortex	%	Flake Type	%
0	23.41	1	15.43
5	5.44	2	7.99
10	15.06	3	3.45
20	14.34	4	49.91
30	5.63	5	23.23
40	6.72		
50	3.45		
60	1.63		
70	4.17		
80	4.17		
90	3.81		
100	12.16		

Whole/broken	%	Type of break	%
Whole	89.47	None	89.47
Broken	10.53	Missing butt	9.44
		Fragment	0.54
		Broken in two	0.36
		Distal snap	0.18

Table 5.78 Technological analysis of flakes from Globe Pit, Little Thurrock (n=551).

The majority of cores at Globe Pit are MPCs (Table 5.79). There is also a simple core with one removal that was then abandoned. No chopper cores were found at the site or anything previously thought to be diagnostic of the Clactonian. The cores show a range of remaining cortex, indicating a differing of degrees of utilisation. Some of the cores only have small *ad hoc* working while some are well turned and exploited. Many of the cores from the site are diminutive with only a few short sequences, but some show evidence of longer sequences. On average the cores are small with some evidence for flattening and elongation (Table 5.80).

Field Artefacts #	Type	Weight	Cortex %	# Episodes	# Removals	Episode 1	Episode 2	Episode 3	Episode 4	Episode 5
1- 4 295	MPC	192	30	4	8	2B	2C	3C	1D	
1- 4 296	MPC	36	0	3	6	4C	1D	1D		
1- 4 297	MPC	27	20	1	2	2B				
1- 4 331	MPC	34	0	4	8	4C	2B	1D	1D	
1- 4 332	MPC	154	20	2	4	2B	1D			
1- 4 361	MPC	33	40	1	5	5C				
1- 4 420	MPC	55	20	1	1	1A				
1-3- 242	single removal	338	80	1	1	1A				
1-3- 243	MPC	93	20	2	4	3C	1D			
1-3- 246	MPC	?	30	2	4	3B	1D			

Table 5.79 Technological analysis of cores from Globe Pit, Little Thurrock.

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)
Mean	72.6	52.1	33.2	0.751	0.643
Median	73.0	48.9	29.3	0.689	0.658
Min	40.3	32.6	19.6	0.533	0.369
Max	120.8	77.9	62.9	1.134	0.935
SD	22.888	14.809	14.098	0.212	0.196

Table 5.80 Average dimensions of cores from Globe Pit, Little Thurrock (n=10).

Flake Tools

Despite Little Thurrock (General) being recorded as having an abundance of flake tools in Roe (1968a), only four flake tools were analysed. On average the flake tools from the site are larger than non-retouched flakes and show higher degrees of elongation (Table 5.81). While this could be evidence of selecting certain blanks, the sample size is too small to make any firm conclusions. The scrapers showed semi-invasive retouch with a mixture of distribution, position, regularity and location (Table 5.82). An example of a 'Clactonian notch' was examined. Overall, there is nothing distinctive in the flake tools.

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	59.2	44.9	12.7	0.799
Median	57.4	37.4	13.5	0.891
Min	39.9	35.5	9.1	0.433
Max	82.0	69.1	14.8	0.980
SD	20.372	16.205	2.526	0.248

Table 5.81 Average dimensions of flake tools from Globe Pit, Little Thurrock (n=4).

Type of flake tool	**%**	**Extent of retouch**	**%**
Side scraper	50	Semi-invasive	100
Notch	25		
Double scraper	25		
Distribution	**%**	**Position of retouch**	**%**
Continuous	50	Direct	50
Discontinuous	50	Inverse	50
Location of retouch	**%**	**Form of retouch**	**%**
Right	50	Concave	50
Distal	25	Convex	25
Left and right	25	Rectilinear	25
Angle of retouch	**%**	**Regularity**	**%**
Semi-abrupt	100	Irregular	50
		Regular	50
Morphology of retouch	**%**	**Length of retouch**	**mm**
Sub-parallel	75	Mean	52.3
Notch	25	Median	55.1
		Min	13.8
		Max	85.3
		SD	29.365

Table 5.82 Technological analysis of flake tools from Globe Pit, Little Thurrock (n=4).

PCT

There is no prior mention of PCT at Little Thurrock and none of the material examined shows signs of PCT.

Summary

Globe Pit can be classified as a non-handaxe site due to the absence of handaxes and evidence for their manufacture. Flake tools make up a small proportion of the overall assemblage. No PCT was identified.

5.1.9 Lower Clapton

Condition

Material from Lower Clapton shows a moderately derived assemblage with some more heavily abraded material (Table 5.83). Flake tools appear to be less abraded with less evidence of edge damage, but this may be due more abraded examples being harder to detect. There is no convincing differentiation between components of the assemblage, although this would be difficult with such low artefact numbers. Due to the low artefact numbers, and the lack of certainty over the provenance of material from the area the assemblage should be interpreted with caution.

	Flakes	Flake tools	Cores	All material
n	19	14	1	34
Abrasion				
Light	26.32	21.43	0.00	23.53
Moderate	57.89	78.57	100.00	67.65
Heavy	15.79	0.00	0.00	8.82
Edge Damage				
Light	26.32	100.00	0.00	55.88
Moderate	63.16	0.00	100.00	38.24
Heavy	10.53	0.00	0.00	5.88
Patina				
None	78.95	50.00	100.00	78.95
Light	21.05	50.00	0.00	21.05
Staining				
None	31.58	50.00	0.00	38.24
Yes	68.42	50.00	100.00	61.76
Scratching				
None	89.47	92.86	100.00	91.18
Yes	10.53	7.14	0.00	8.82
Battering				
None	100.00	92.86	100.00	97.06
Yes	0.00	7.14	0.00	2.94

Table 5.83 Condition of artefacts from Lower Clapton.

Site formation

Although based on a low number of artefacts, there is a distinct lack of smaller material reflecting the derived nature of the assemblage (Figures 5.23+5.24).

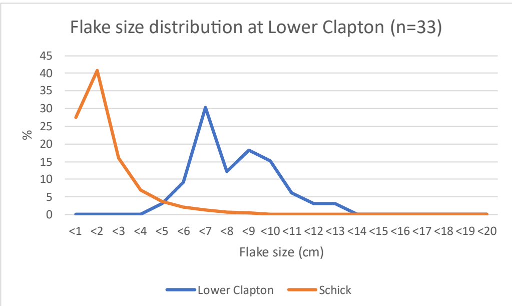


Figure 5.23 Flake size analysis at Lower Clapton.

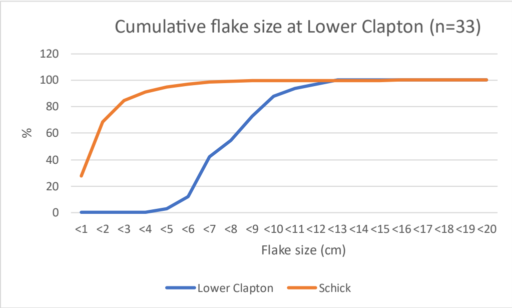


Figure 5.24 Cumulative flake size at Lower Clapton.

Flakes

The flakes show examples of soft hammer working but are dominated by hard hammer flakes (Table 5.84). The dorsal scar patterns and counts show evidence of long sequences of removals as well as more simple working. While largely from the later stages of working the remaining cortex demonstrates the full range of working.

Butt type	**%**	**Hammer mode**	**%**
Plain	57.89	Hard	89.47
Mixed	21.05	Indeterminate	5.26
Cortical	15.79	Soft	5.26
Missing	5.26		
Dorsal scar count	**%**	**Dorsal scar pattern**	**%**
0	15.79	None	15.79
1	26.32	Uni	57.89
2	26.32	Bi	10.53
3	10.53	Multi	15.79
6	10.53		
7	5.26		
8	5.26		
Cortex	**%**	**Flake type**	**%**
0	15.79	1	0.00
5	5.26	2	21.05
10	26.32	3	0.00
20	15.79	4	63.16
30	15.79	5	15.79
40	5.26		
60	5.26		
80	5.26		
90	5.26		
Whole/broken	**%**	**Type of break**	**%**
Whole	89.47	Missing butt	10.53
Broken	10.53	None	89.47

Table 5.84 Technological analysis of flakes from Lower Clapton (n=19).

The flakes at the site were regular in size with little evidence of elongation (Table 5.85).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	77.6	76.3	27.3	1.005
Median	71.5	69.4	26.6	0.905
Min	45.4	35.1	14.5	0.646
Max	115.7	142.0	44.2	1.630
SD	19.239	24.890	8.490	0.297

Table 5.85 Average dimensions of flakes from Lower Clapton (n=19).

Cores

One large MPC from Lower Clapton was studied with little remaining cortex showing heavy utilisation, having been worked with alternative and parallel core episodes (Table 5.86).

Field Artefacts #	Type	Length	Width	Thickness	Cortex %	# episodes	# removals	Episode 1	Episode 2	Episode 3	Episode 4	Episode 5
IK25/26	MPC	133.6	111.6	71.4	10	5	11	C5	B2	B2	D1	D1

Table 5.86 Technological analysis of Lower Clapton core.

Non-handaxe

There is no evidence of a non-handaxe assemblage at the site.

Flake tools

The flake tools were found in low numbers and some artefacts labelled as flake tools can be dismissed as natural edge damage. On average the flake tools are larger than the regular flakes but with few signs of elongation (Table 5.87).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	80.9	76.8	25.3	1.023
Median	81.6	66.2	24.5	0.905
Min	52.0	58.0	17.1	0.551
Max	120.1	120.5	36.7	1.817
SD	17.939	18.536	6.355	0.424

Table 5.87 Dimensions of flake tools from Lower Clapton (n=14).

There is a degree of more invasive retouch at the site represented by convergent scrapers (Table 5.88). Retouch was mainly convex, regular and continuous, with higher degrees of working. However, there is no relation to PCT. Material from Luton Museum (including over 50 flake tools and other implements) could not be examined. Examination of the Luton material would likely dismiss some of these flake tools, but also identify genuine examples.

Type of flake tool	%	Extent of retouch	%
End scraper	28.57	Minimally invasive	7.14
Convergent scraper	21.43	Semi-invasive	50.00
Side scraper	21.43	Invasive	42.86
Double scraper	14.29		
Denticulate	7.14		
Unifacial handaxe	7.14		
Distribution	**%**	**Location of retouch**	**%**
Continuous	85.71	Distal	28.57
Discontinuous	14.29	Right	21.43
		Converging on the distal end	14.29
		Both sides	14.29
		Left	7.14
		Distal and right	7.14
		All around	7.14
Position of retouch	**%**	**Form of retouch**	**%**
Direct	85.71	Convex	92.86
Inverse	14.29	Concave	7.14
Angle of retouch	**%**	**Regularity**	**%**
Semi-abrupt	100.00	Regular	92.86
		Irregular	7.14
Morphology of retouch	**%**	**Length of retouch**	**mm**
Stepped	35.71	Mean	82.2
Sub-parallel	21.43	Median	80.1
Parallel	14.29	Min	26.4
Scaly	14.29	Max	181.0
Denticulate	7.14	SD	35.918
Stepped/ Parallel	7.14		

Table 5.88 Technological analysis of flake tools from Lower Clapton (n=14).

PCT

No PCT was recorded in this study.

Summary

With such a small sample and its nature as a general locality, it is hard to infer much about the assemblage from Lower Clapton other than that it displays typical Acheulean characteristics. Study of the Luton material should be conducted in the future. The flake tools from the site show evidence of invasive working, but higher numbers are needed before making further conclusions.

5.1.10 Purfleet (Greenlands)

Condition

Only a small amount of material from Purfleet could be studied, mostly from the Bluelands member associated with handaxe manufacture. As full analysis of the site was not possible, this section is limited and will focus on the *in situ* finds from Beds 5-6. The material is lightly to moderately abraded (Table 5.89). While the prepared core is less abraded than that of the unprepared cores, this is only a singular example and should be treated with caution.

	Flakes	Flake tools	Cores	Prepared cores	All material
n	72	5	4	1	82
Abrasion					
Light	51.39	0.00	25.00	100.00	47.56
Moderate	48.61	100.00	75.00	0.00	52.43
Edge Damage					
Light	84.72	60.00	25.00	100.00	80.49
Moderate	13.89	40.00	75.00	0.00	18.29
Heavy	1.39	0.00	0.00	0.00	1.22
Patina					
None	27.78	20.00	0.00	100.00	26.83
Light	63.89	80.00	66.67	0.00	65.85
Moderate	1.39	0.00	0.00	0.00	1.22
Heavy	6.94	0.00	0.00	0.00	6.10
Staining					
None	94.44	100.00	75.00	100.00	93.90
Yes	5.56	0.00	25.00	0.00	6.10
Scratching					
None	100.00	100.00	100.00	100.00	100.00
Battering					
None	100.00	100.00	100.00	100.00	100.00

Table 5.89 Condition of artefacts from Purfleet (Greenlands Bed 5-6).

Site formation

While smaller artefacts are present at the site, there are some signs of disturbance or collection bias (Figures 5.25+5.26).

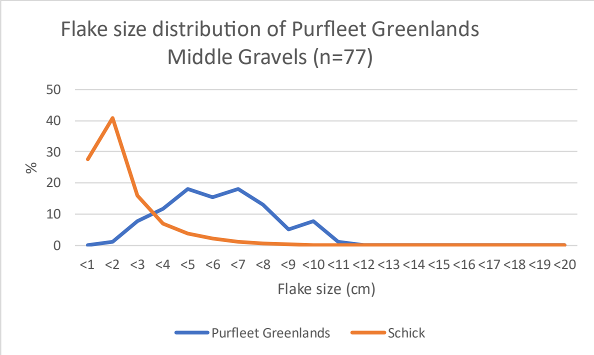


Figure 5.25 Flake size analysis at Purfleet (Greenlands, Beds 5-6).

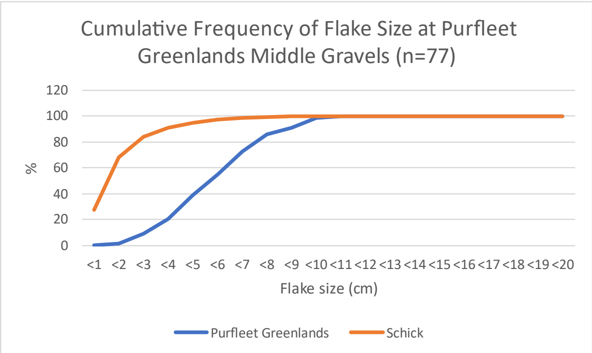


Figure 5.26 Cumulative flake analysis at Purfleet (Greenlands, Beds 5-6).

Non-handaxe

The assemblage studied here is from the handaxe layers, but a number of finds were *ex-situ* with three flakes attributed to the non-handaxe layer. While nothing observed refuted the widely published observations of White (2000), White and Schreve (2002), Schreve *et al*. (2002) and Bridgland *et al.* (2013), there is not enough new data to base a comparison, and little differentiates the handaxe layers from the rest of the finds. Due to the lack of other material, Chapter Six will rely on previous studies of Purfleet.

Flakes

Flakes from Beds 5-6 represent all stages of the knapping process with both soft and hard hammer working (Table 5.90). The diversity is also seen in a mixture of butt types including an example of faceting that shows no other signs of Levallois working. Flakes also show a mixture of dorsal scar patterns and counts. The flakes show a regular range of sizes with some smaller flakes analysed, with few signs of elongation (Table 5.91).

Butt type	%	Hammer mode	%
Plain	43.06	Hard	61.11
Marginal	25	Indeterminate	20.83
Mixed	12.5	Soft	18.05
Cortical	8.33		
Missing	5.55		
Conical	4.18		
Dihedral	1.39		

Dorsal scar count	%	Dorsal scar pattern	%
0	15.28	Natural	15.28
1	15	Uni	43.06
2	22.22	Bi	31.94
3	12.5	Multi	9.72
4	15.28		
5	5.56		
6	2.78		
7	1.39		

Cortex	%	Flake type	%
0	16.67	1	2.78
5	2.79	2	15.28
10	15.27	3	15.28
20	11.11	4	47.22
30	16.67	5	13.89
40	2.78		
50	5.56		
60	4.17		
70	2.06		
80	4.17		
90	11.11		
100	6.94		

Whole/broken	%	Type of break	%
Whole	93.06	None	93.06
Broken	6.94	Missing butt	5.56
		Lateral snap	1.39

Table 5.90 Technological analysis of flakes from Purfleet (Greenlands, Beds 5-6) (n=72).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	56.2	51.3	17.7	0.951
Median	54.6	51.1	16.8	0.904
Min	15.7	8.8	3.2	0.266
Max	104.9	110.9	52.7	1.799
SD.	20.566	21.396	10.949	0.351

Table 5.91 Average dimensions of flakes from Purfleet (Greenlands, Bed 5-6) (n=72).

Cores

The cores found *in situ* are associated with the handaxe layer from the site and are MPCs (Table 5.92). One core shows signs of preparation similar to the cores at Botany Pit. The unprepared cores from the site show different levels of remaining cortex demonstrating variation in utilisation. The MPCs show long sequences of removals with multiple episodes of alternative and parallel working. The cores are large and show signs of elongation and flattening (Table 5.93). There is little difference between the cores found *in-situ* and two *ex-situ* cores. The latter are smaller on average, but the sample is small.

Type	Context	Cortex %	# episodes	# removals	Episode 1	Episode 2	Episode 3	Episode 4	Episode 5
MPC	Middle Gravels	10	5	13	4C	3B	2C	3C	1D
MPC	Middle Gravels	30	2	3	2B	1D			
MPC	Middle Gravels	60	4	6	2B	2B	1A	1D	
MPC	Middle Gravels	40	3	6	4C	1D	1D		
MPC	Ex-situ	40	3	6	4C	1D	1D		
MPC	Ex-situ	40	2	7	5C	2B			

Table 5.92 Technological analysis of cores from Purfleet (Greenlands).

	Length (mm)		Width (mm)		Thickness (mm)		Elongation (W/L)		Flattening (Th/W)	
	All cores	In-situ	All cores	In-situ	All cores	In-situ	All cores	In-situ	All cores	In-situ
Mean	110.3	123.4	88.2	96.6	60.9	70.2	0.850	0.830	0.672	0.712
Median	98.2	116.1	75.9	99.5	47.5	61.4	0.819	0.781	0.626	0.657
Min	64.3	67.6	60.7	60.7	39.4	39.9	0.636	0.636	0.577	0.577
Max	193.6	193.6	126.6	126.6	118.0	118	1.121	1.121	0.959	0.959
SD	49.197	55.564	28.951	33.285	30.590	34.790	0.206	0.229	0.145	0.169

Table 5.93 Average dimensions of cores from Purfleet (Greenlands) (All cores *n*=6; *In-situ n*-4)).

Flake tools

Five flake tools were analysed from the site, all from Beds 5-6. The flake tools are larger than regular flakes but show less elongation (Table 5.94). These artefacts are mainly side scrapers with irregular, minimal to semi-invasive retouch (Table 5.95). Many flakes contain natural edge damage which is often mistaken for retouch.

	Length (mm)	Width(mm)	Thickness (mm)	Elongation (W/L)
Mean	71.7	94.9	24.2	1.356
Median	72.9	106.7	25.1	1.551
Min	51.8	44.5	16.1	0.610
Max	91.0	119.0	30.3	1.774
SD	13.993	29.898	5.633	0.460

Table 5.94 Average dimensions of flake tools from Purfleet (Greenlands) (n=5).

Type of flake tool	%	Extent of retouch	%
Side scraper	80	Minimally Invasive	60
Ad hoc tool	20	Semi-invasive	40
Distribution	**%**	**Position of retouch**	**%**
Continuous	100	Direct	80
		Inverse	20
Location of retouch	**%**	**Form of retouch**	**%**
Distal	60	Convex	60
Right	20	Concave	20
Ventral left	20	Rectilinear	20
Angle of retouch	**%**	**Regularity**	**%**
Semi-abrupt	100	Irregular	80
		Regularity	20
Morphology of retouch	**%**	**Length of retouch**	**mm**
Sub-parallel	60	Mean	56.1
Scaly	40	Median	49.4
		Min	35.2
		Max	78.0
		SD	18.046

Table 5.95 Technological analysis of flake tools from Purfleet (Greenlands) (n=5).

PCT

One prepared core from the handaxe layers was identified as simple and remained unexploited. The flaking surface had been prepared centripetally, but little work had been done to prepare the striking platform. While the core could show simple working across a surface, it also shows a hierarchical relationship between the two platforms. Some other cores showed signs of preparation, but only this core could be likened to other Proto-Levallois. The dimensions of the prepared core are similar to other cores from the site (Table 5.96).

Length (mm)	Width(mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)
101	**78.5**	**48.1**	**0.777**	**0.612**

Table 5.96 Dimensions of prepared core from Purfleet (Greenlands).

Summary

The small amount of material analysed here offers a look at Acheulean layers at Purfleet but does not expand our knowledge of the technology of the site. There is not enough material to re-evaluate the evidence for a non-handaxe assemblage. The flake tools at the site are low in number and not remarkable, and the single example of Proto-Levallois is basic, but not out of place with other MIS 9 examples

5.1.11 Sonning Railway Cutting

Condition

The material is moderately abraded in nature (Table 5.97). No discrete components could be identified, but this may not be possible with such a small sample.

	Flakes	Flake tools	Cores	Prepared cores	Levallois flakes	All material
n	23	6	1	2	4	36
Abrasion						
Light	30.43	16.67	0.00	0.00	25.00	25.00
Moderate	60.87	66.67	100.00	50.00	75.00	25.00
Heavy	8.70	16.67	0.00	50.00	0.00	25.00
Edge Damage						
Light	47.83	16.67	100.00	0.00	100.00	47.22
Moderate	52.17	83.33	0.00	100.00	0.00	52.78
Patina						
None	39.13	33.33	100.00	0.00	50.00	38.89
Light	39.13	66.67	0.00	50.00	50.00	44.44
Moderate	21.74	0.00	0.00	50.00	0.00	16.67
Staining						
None	91.30	100.00	100.00	100.00	75.00	91.67
Yes	8.70	0.00	0.00	0.00	25.00	8.33
Scratching						
None	100.00	100.00	100.00	50.00	100.00	97.22
Yes	0.00	0.00	0.00	50.00	0.00	2.78
Battering						
None	100.00	100.00	100.00	100.00	100.00	100.00

Table 5.97 Condition of artefacts from Sonning Railway Cutting.

Site formation

Flake size analysis shows a lack of smaller flakes typical for a derived and collected site (Figures 5.27+5.28), but this is difficult with such as small sample.

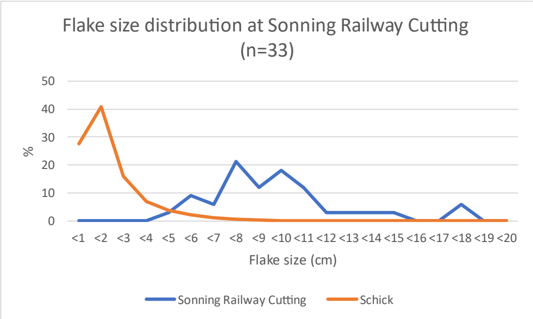


Figure 5.27 Flake size analysis at Sonning Railway Cutting.

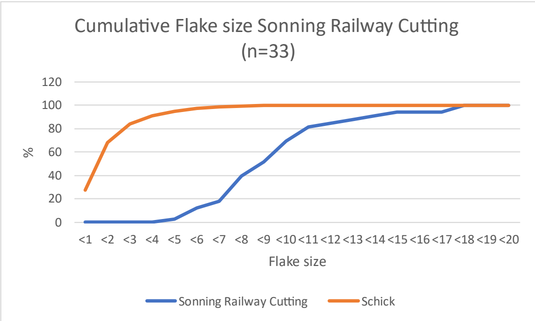


Figure 5.28 Cumulative flake size at Sonning Railway Cutting.

Non-handaxe

There is no evidence of a non-handaxe assemblage.

Flakes

The flakes from Sonning Railway Cutting are large but show little evidence of elongation (Table 5.98). There are a range of flakes with some soft hammer working and further indeterminate flakes showing marginal and dihedral butts (Table 5.99). One flake shows evidence of faceting but no other signs of Levallois working. The flakes are biased towards the later stages of working and show complex multidirectional sequences.

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	83.6	69.3	17.8	0.871
Median	80.9	72.3	15.9	0.813
Min	43.7	28.0	9.1	0.471
Max	141.1	109.9	34.1	2.000
SD.	22.187	19.240	7.554	0.331

Table 5.98 Average dimensions of flakes from Sonning Railway Cutting (n=23).

Butt type	%	Hammer mode	%
Plain	60.87	Hard	56.52
Missing	13.04	Indeterminate	34.78
Marginal	13.04	Soft	8.70
Dihedral	8.70		
Faceted	4.35		
Dorsal scar count	**%**	**Dorsal scar pattern**	**%**
2	13.04	Uni	21.74
3	8.70	Bi	17.39
4	21.74	Multi	60.87
5	13.04		
6	30.43		
7	13.04		
Cortex	**%**	**Flake type**	**%**
0	43.48	1	0.00
5	21.74	2	0.00
10	26.09	3	0.00
20	8.70	4	56.52
		5	43.48
Whole/broken	**%**	**Type of break**	**%**
Whole	86.96	None	86.96
Broken	13.04	Missing Butt	13.04

Table 5.99 Technological analysis of flakes from Sonning Railway Cutting (n=23).

Cores

Out of three cores found at Sonning Railway Cutting, one is a simple MPC (Table 5.100). It has been well utilised with a mixture of alternative and parallel removals. The core is large and shows evidence of both elongation and flattening.

Type	Cortex %	# episodes	# removals	Episode 1	Episode 2	Episode 3	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)
MPC	20	3	6	2C	3B	1D	155.3	90.1	47.2	0.580	0.5239

Table 5.100 Technological analysis and dimensions of unprepared core from Sonning Railway Cutting.

Flake tools

Six flake tools are known from Sonning Railway Cutting, all side or convergent scrapers with semi-invasive to invasive retouch (Table 5.101). Unfortunately, the small amount of these makes any generalisations difficult. The most remarkable element is that a convergent scraper shows signs of being made on a Levallois flake. The flake tools are larger than regular flakes but do not show large degrees of elongation (Table 5.102).

Type of flake tool	%	Extent of retouch	%
Side scraper	83.33	Semi-invasive	83.33
Convergent scraper	16.67	Invasive	16.67
Distribution	**%**	**Position of retouch**	**%**
Continuous	100.00	Direct	100.00
Location of retouch	**%**	**Form of retouch**	**%**
Left	50.00	Convex	66.67
Distal	16.67	Concave	33.33
Right	16.67		
Convergent on distal	16.67		
Angle of retouch	**%**	**Regularity**	**%**
Semi-abrupt	83.33	Regular	66.67
Abrupt	16.67	Irregular	33.33
Morphology of retouch	**%**	**Length of retouch**	**mm**
Sub-parallel	66.67	Mean	114.0
Scaly	16.67	Median	76.0
Stepped	16.67	Min	45.3
		Max	295.2
		SD	92.093

Table 5.101 Technological analysis of flake tools from Sonning Railway Cutting (n=6).

	Length (mm)	Width(mm)	Thickness (mm)	Elongation (W/L)
Mean	110.9	83.7	27.5	0.814
Median	99.5	87.3	25.6	0.736
Min	77.1	68.8	20.3	0.538
Max	172.2	92.6	35.1	1.139
SD	37.429	8.861	5.766	0.246

Table 5.102 Average dimensions of flake tools from Sonning Railway Cutting (n=6).

PCT

Two prepared cores were analysed from Sonning showing a mixture of Proto-Levallois and more fully developed Levallois traits. Both were used to produce flakes linearly after centripetal preparation (Table 5.103). One core was heavily rolled, but so were other elements of the assemblage. Both cores show high levels of preparation around the striking platform and some semi-invasive control of the lateral convexities. On average, the prepared cores are in a similar size range to the MPC found (Table 5.104). Little evidence for elongation was found but there is a large degree of flattening suggesting high levels of exploitation.

Type of prepared core	%	Blank type	%
Proto-Levallois/Levallois	100	Nodule	100
Method of preparation	**%**	**Method of exploitation**	**%**
Centripetal	100	Lineal	100
Earlier surface	**%**	**Type of products**	**%**
None	50	Flake	100
Yes	50		
Number of preferential removals	**%**	**Position of scars on striking surface**	**%**
1	100	All around	100
Preparation on striking surface	**%**	**Preparation on flaking surface**	**%**
6	50	6	50
8	50	8	50
% Cortex on striking platform surface	**%**	**Position of cortex on striking platform surface**	**%**
0	50	Central	100
40	50		
Pattern of accentuated convexities	**%**	**Description of accentuated convexities**	**%**
Distal and both sides	100	Semi-invasive	100

Table 5.103 Technological analysis of prepared cores from Sonning Railway Cutting (n=2).

	Length (mm)	Width(mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)
Mean	100.7	92.0	36.9	0.919	0.403
Median	100.7	92.0	36.9	0.919	0.403
Min	79.9	75.7	31.6	0.891	0.389
Max	121.4	108.2	42.1	0.947	0.417
SD	29.345	22.981	7.425	0.040	0.020

Table 5.104 Average dimensions of prepared cores from Sonning Railway Cutting (n=2).

There is evidence of a number of preparation scars both centripetally and bipolarly. The preferential removal scars show small removals with slight elongation (Table 5.105).

	Length (mm)	Width(mm)	Elongation (W/L)
Mean	65.3	55.0	0.848
Median	65.3	55.0	0.848
Min	62.5	47.6	0.700
Max	68.0	62.3	0.997
SD	3.889	10.394	0.210

Table 5.105 Average dimensions of preferential removal scars from Sonning Railway Cutting (n=2).

Four potential Levallois flakes were identified. Most were faceted, one of which showed signs of being the product of a recurrent Levallois core (Table 5.106). The Levallois flakes are on average larger than both regular flakes and flake tools and show higher degrees of elongation (Table 5.107).

Confidence of Levallois	%	Butt type	%
Possible	50	Faceted	75
Probable	50	Dihedral	25
Morphology of products	**%**	**Previous removals**	**%**
Flake	100	0	75
		1	25
Dorsal scar count	**%**	**Preparation scars**	**%**
5	50	5	50
6	0	6	0
7	25	7	25
8	25	8	25
Method of preparation	**%**	**Method of exploitation**	**%**
Centripetal	50	Lineal	75
Bipolar	50	Recurrent	25
Pattern of additional accentuation of convexities	**%**	**Description of additional convexity**	**%**
None	25	Semi-invasive	25
Distal and one edge	25	None	75
Cortex	**%**		
None	50		
5	25		
10	0		
20	25		

Table 5.106 Technological analysis of Levallois flakes from Sonning Railway Cutting (n=4).

	Length (mm)	Width(mm)	Thickness (mm)	Elongation (W/L)
Mean	119.0	67.1	16.4	0.578
Median	111.0	62.0	17.3	0.585
Min	81.7	51.7	10.6	0.485
Max	172.2	92.6	20.3	0.657
SD	40.472	17.705	4.182	0.081

Table 5.107 Average dimensions of Levallois flakes from Sonning Railway Cutting (n=4).

Summary

The small assemblage from Sonning Railway Cutting indicates the presence of PCT alongside more regular Acheulean working, including handaxes. While this should not be overstated due to the lack of a larger assemblage, it shows similarities to other MIS 9 sites.

5.1.12 Stoke Newington

Condition

The material is in a light to moderately abraded condition with light to moderate edge damage (Table 5.108). Despite finds being recorded as coming from different areas such as the Common, Geldeston Road and Abney Park Cemetery, the condition and technology of these artefacts did not form discrete groups. Similar conclusions were reached by Dale (Pers. Coms. 2021) with handaxes from the site.

	Flakes	Flake tools	Cores	All material
n	481	50	13	544
Abrasion				
Light	12.68	24.00	7.69	13.60
Moderate	78.17	66.00	61.54	76.65
Heavy	9.15	10.00	30.77	9.74
Edge Damage				
Light	29.11	28.00	7.69	28.49
Moderate	65.90	66.00	76.92	66.18
Heavy	4.99	6.00	15.38	5.33
Patina				
None	17.88	28.00	61.54	19.67
Light	44.91	36.00	38.46	43.93
Moderate	33.89	34.00	0.00	33.27
Heavy	3.33	2.00	0.00	3.13
Staining				
None	91.27	84.00	69.23	90.07
Yes	8.73	16.00	30.77	9.93
Scratching				
None	98.54	98.00	100.00	98.53
Yes	1.46	2.00	0.00	1.47
Battering				
None	100.00	100.00	100.00	100.00

Table 5.108 Condition of artefacts from Stoke Newington.

Site formation

While smaller elements are present, these are still underrepresented due to collection bias and possible winnowing (Figures 5.29+5.30). The site is considered to be a primary context site, and this is evidenced by some refitting material.

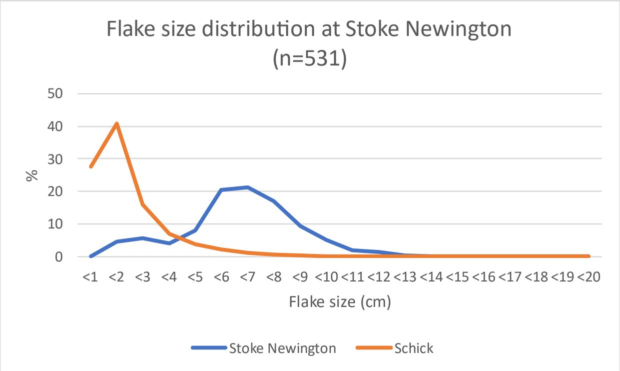


Figure 5.29 Flake size analysis at Stoke Newington.

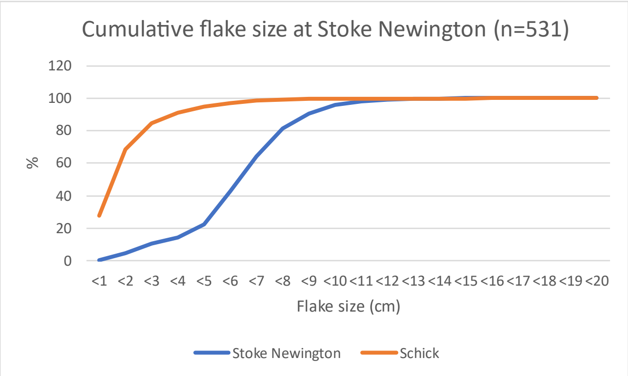


Figure 5.30 Cumulative flake size at Stoke Newington.

Non-handaxes

Only the presence of a chopper core could previously be seen as an indication of a non-handaxe signature (see Chapter Two), but the material shows no signs of a separate non-handaxe signature.

Flakes

There are a low number of diagnostic soft hammer flakes, but many are indeterminate while showing soft hammer traits such as marginal butts and complex dorsal scar patterns also indicative of handaxe manufacture (Table 5.109). Flakes represent all stages of working but are biased towards later stages. Flakes from the site ranged from small to large but with a smaller mean and median with a low degree of elongation (Table 5.110).

Butt type	%	Hammer mode	%
Plain	45.32	Hard	78.38
Marginal	31.60	Indeterminate	20.17
Mixed	11.64	Soft	1.46
Missing	8.52		
Cortical	1.66		
Dihedral	1.25		

Dorsal scar count	%	Dorsal scar pattern	%
0	11.02	Natural	11.02
1	29.31	Uni	49.48
2	28.48	Bi	17.88
3	14.97	Multi	21.62
4	8.32		
5	4.57		
6	1.25		
7	1.66		
8	0.21		
2 (+1 ventral)	0.21		

Cortex	%	Flake type	%
0	29.94	1	10.60
5	6.03	2	6.44
10	11.43	3	3.74
15	3.33	4	50.52
20	12.68	5	28.69
25	0.83		
30	10.81		
40	5.20		
50	3.53		
60	2.70		
70	2.91		
75	0.21		
80	3.33		
90	0.21		
100	6.86		

Whole/broken	%	Type of break	%
Whole	91.06	None	91.06
Broken	8.94	Missing butt	7.28
		Fragment	0.62
		Snapped	0.21
		Distal snap	0.21
		Medial fragment	0.21
		Chipped and missing butt	0.21
		Left break	0.21

Table 5.109 Technological analysis of flakes from Stoke Newington (n=481).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	61.6	57.7	17.0	0.990
Median	63.2	57.4	16.1	0.927
Min	9.9	7.6	1.9	0.090
Max	145.2	515.0	56.6	10.383
SD	22.286	29.882	8.501	0.539

Table 5.110 Average dimensions of flakes from Stoke Newington (n=481).

Cores

Most cores at Stoke Newington are basic MPCs, with a few core fragments relating to MPCs (Table 5.111). One of the cores is described as a chopper with alternative removals but is otherwise consistent with the rest of the assemblage. The cores from Stoke Newington all have less than half of the cortex remaining, showing high degrees of utilisation with almost a quarter having no remaining cortex. The cores show alternative and parallel working to produce flakes. Despite the low percentage of remaining cortex there are few longer sequences of working and only a maximum of three episodes per core. There are examples of elongated cores at the site, and some show a degree of flattening (Table 5.112). Overall, the cores are of average size with a large degree of variation.

Field Artefacts #	Stratigraphic context	Type	Cortex %	Weight	# Episodes	# Removals	Episode 1	Episode 2	Episode 3
1L 15 19d	Geldeston Rd	MPC	30	1424.2	1	5	5C		
1L 15 20	Stoke Newington Common	MPC	0	384	3	6	3C	2C	1D
1L 15 20c	Stoke Newington Common	MPC	20	196	3	3	D	D	D
1L 16 12	Geldeston Rd	MPC	50	403	3	8	2B	4C	2B
1L 16 22a	Geldeston Rd	MPC	30	242.1	1	4	4c		
1L 16 22b	Geldeston Rd	MPC	20	184.5	3	4	2C	1A	1D
1L 16 22c	Geldeston Rd	Fragment	0	132	1	1	1A		
1L 16 22d	Geldeston Rd	Fragment	30	254.8	1	3	3C		
1L 17 12j	Geldeston road	Chopper Core	10	108.9	1	4	4C		
1L 16 2 b	Campbell ex SN common	MPC	20	142.3	2	7	4B	3B	
1l 16 2c	Campbell ex SN common	MPC	0	132.8	2	4	2C	2C	
1L 16 2e	Campbell ex SN common	MPC	30	463.9	2	6	4C	2B	
1L 16 4v	Campbell ex SN common	MPC	40	61.1	1	3	3C		

Table 5.111 Technological analysis of cores from Stoke Newington (n=13).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)
Mean	92.1	68.7	43.3	0.846	0.645
Median	82.2	72.8	37.3	0.747	0.633
Min	48.9	36.2	22.3	0.395	0.301
Max	211.3	92.1	92.7	1.751	1.110
SD	42.653	17.104	20.471	0.363	0.267

Table 5.112 Average dimensions of cores from Stoke Newington (n=13).

Flake Tools

Many flakes labelled as flake tools were dismissed as being the result of natural edge damage. However, the 50 genuine flake tools do demonstrate that more invasively worked tools were present with side, end and convergent scrapers being common (Table 5.113). Retouch was predominantly continuous, direct, convex and regular. Overall, the flake tools are well-made and display lengthy episodes of retouch, with examples of tools which resemble flake handaxes present at the site. The flake tools do not show any relation to PCT. On average flake tools were larger than regular flakes, but slightly less elongated (Table 5.114).

Type of flake tool	**%**	**Extent of retouch**	**%**
Side scraper	54	Minimally invasive	6
End scraper	22	Semi-invasive	60
Convergent scraper	14	Invasive	34
Double scraper	6		
Unifacial convergent scraper	2		
Handaxe/ side scraper	2		
Distribution	**%**	**Position of retouch**	**%**
Continuous	86	Direct	98
Discontinuous	14	Bifacial	2
Location of retouch	**%**	**Form of retouch**	**%**
Right	30	Convex	82
Distal	26	Rectilinear	12
Left	16	Left Convex right concave	2
Left and right	12	Concave	2
Right and distal	6	Right convex and left concave	2
Converging left and right	2		
Left and distal	8		
Angle of retouch	%	Regularity	%
Semi-abrupt	96	Regular	70
Abrupt	4	Irregular	30
Morphology of retouch	**%**	**Length of retouch**	**mm**
Sub-parallel	52	Mean	77.2
Stepped	28	Median	74.0
Parallel	10	Min	28.3
Scaly	10	Max	152.9
		SD	28.548

Table 5.113 Technological analysis of flake tools from Stoke Newington (n=50).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	70.4	67.4	22.3	1.034
Median	71.3	63.2	21.6	0.918
Min	37.4	34.8	11.5	0.419
Max	122.1	106.5	35.5	2.335
SD	18.189	17.671	5.545	0.419

Table 5.114 Average dimensions of flake tools from Stoke Newington (n=50).

PCT

There is no evidence of PCT at the site.

Summary

There is no evidence for the presence of non-handaxe or PCT at Stoke Newington, but while flake tool numbers are lower than previously recorded, the flake tools show well-made scrapers. These were collected alongside handaxes and are a part of the Acheulean assemblage.

5.1.13 Sturry

Dating issues with Sturry (detailed in Chapter Four) and work by Scott (2002) meant that work on Sturry primarily focused on the flake tools from the site. Material at the British Museum was visually examined but not recorded in-depth apart from those labelled as flake tools and cores.

Condition

The assemblage was in a moderately abraded condition with some more heavily abraded artefacts (Table 5.115). The biased sample analysed restricts a flake size analysis.

Flakes

Flakes were regular in size with some evidence of elongation (Table 5.116). The flakes from the site show Acheulean characteristics, including some soft hammer flakes, and working akin to other sites including the predominance of the later stages of the process, with some examples of complex dorsal scar patterns (Table 5.117).

	Flakes	Flake tools	Cores	Prepared core	All material
n	34	26	11	1	72
Abrasion					
Light	23.53	11.54	9.09	0.00	16.67
Moderate	61.76	65.38	72.73	100.00	65.28
Heavy	14.71	23.08	18.18	0.00	18.06
Edge Damage					
Light	20.59	19.23	72.73	0.00	27.78
Moderate	67.65	76.92	27.27	100.00	65.28
Heavy	11.76	3.85	0.00	0.00	6.94
Patina					
None	35.29	7.69	36.36	0.00	25.00
Light	41.18	50.00	54.55	0.00	45.83
Moderate	11.76	34.62	0.00	100.00	19.44
Heavy	11.76	7.69	9.09	0.00	9.72
Staining					
None	100.00	73.08	72.73	100.00	84.72
Yes	0.00	26.92	27.27	0.00	15.28
Scratching					
None	100.00	92.31	100.00	100.00	97.22
Yes	0.00	7.69	0.00	0.00	2.78
Battering					
None	100.00	100.00	100.00	100.00	100.00

Table 5.115 Condition of Sturry assemblage.

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	78.9	70.8	18.0	0.963
Median	73.3	62.5	17.9	0.894
Min	35.0	35.5	8.8	0.312
Max	147.2	209.4	36.8	2.734
SD	25.929	35.282	7.037	0.457

Table 5.116 Dimensions of flakes from Sturry (n=34).

Butt type	%	Hammer mode	%
Marginal	47.06	Hard	41.18
Plain	26.47	Indeterminate	44.12
Mixed	17.65	Soft	14.71
Missing	5.88		
Cortical	2.94		

Dorsal scar count	%	Dorsal scar pattern	%
1	8.82	Uni	55.88
2	35.29	Bi	23.53
3	26.47	Multi	20.59
4	5.88		
5	8.82		
6	5.88		
7	5.88		
8	2.94		

Cortex	%	Flake type	%
0	44.12	1	0.00
5	5.88	2	2.94
10	20.59	3	5.88
20	8.82	4	47.06
30	8.82	5	44.12
40	2.94		
50	5.88		
80	2.94		

Whole/broken	%	Type of break	%
Whole	94.12	None	94.12
Broken	5.88	Missing Butt	5.88

Table 5.117 Technology of flakes from Sturry (n=34).

Cores

The majority of cores were MPCs and no major distinctions can be seen in the other cores which include examples of a chopper core, discoidal core and potential prepared core (Table 5.118). The remaining cortex on the cores varied but all cores had more than half of their cortex removed. The cores were worked with parallel and alternative working mainly creating MPCs. The chopper core shows the typical alternative knapping on one end of the core. The discoidal core only has parallel working on one side as the other side was too abraded to record, but showed prior working. The cores show little degree of elongation but do show some flattening which could suggest well utilised cores (Table 5.119).

Field Artefacts #	Type	Weight	Cortex %	# episodes	# removals	Episode 1	Episode 2	Episode 3	Episode 4	Episode 5
365	MPC	368.3	0	4	11	5C	4B	1D	1D	
362	MPC	481.1	45	2	10	5C	5C			
304	Chopper core	360.1	40	1	7	7C				
301	MPC	247.9	20	2	6	3C	2B	1A		
381	Discoidal	375.3	5	1	5	5B				
366	MPC	517.7	10	2	14	12C	2B			
93	MPC	316.5	0	2	4	3C	1A			
351	MPC	842.2	30	3	10	4C	4C	2C		
385	MPC	238	5	2	6	4C	2B			
113	MPC	779.2	25	3	13	7C	4C	2B		
Box 11	MPC	135.2	10	2	6	3C	3B			

Table 5.118 Technology of cores from Sturry.

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)
Mean	112.9	86.6	44.8	0.771	0.520
Median	110.1	84.0	45.0	0.745	0.499
Min	74.7	56.8	24.7	0.561	0.415
Max	150.2	127.2	63.5	0.975	0.756
SD	21.680	19.883	12.455	0.126	0.109

Table 5.119 Dimensions of unprepared cores from Sturry (n=11).

Flake tools

The flake tools were larger than regular flakes with higher degrees of elongation (Table 5.120). While many flake tools were rejected as naturally edge damaged, 26 genuine flake tools were examined (Table 5.121). In some cases, abrasion made flakes hard to classify. The sample examined showed the presence of semi-invasive to invasively retouched scrapers, primarily with continuous and regular retouch. Flake handaxes were present at the site and some of the convergent scrapers resemble unifacial handaxes. Notches and more irregular scrapers were also present.

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	91.1	61.9	22.3	0.708
Median	89.0	61.1	21.0	0.680
Min	50.0	38.6	9.0	0.440
Max	146.2	94.5	40.5	1.350
SD	23.229	15.072	7.057	0.211

Table 5.120 Dimensions of flakes tools from Sturry (n=26).

Type of flake Tool	%	Extent of retouch	%
Side scraper	65.38	Minimally Invasive	0.00
Convergent scraper	23.08	Semi-invasive	76.92
Notch	7.69	Invasive	23.08
Double scraper	3.85		
Distribution	**%**	**Position of retouch**	**%**
Continuous	92.31	Direct	96.15
Discontinuous	7.69	Inverse	3.85
Location of retouch	**%**	**Form of retouch**	**%**
Right	38.46	Convex	88.46
Left	30.77	Notch	7.69
Converging on distal	19.23	Concave	3.85
Ventral left	3.85		
All around	3.85		
Left and right	3.85		
Angle of retouch	**%**	**Regularity**	**%**
Semi-abrupt	100.00	Regular	76.92
		Irregular	23.08
Morphology of retouch	**%**	**Length of retouch**	**mm**
Stepped	53.85	Mean	105.6
Sub-parallel	34.62	Median	99.8
Notch	7.69	Min	15.9
Scaly	3.85	Max	249.0
		SD	50.408

Table 5.121 Technology of flake tools from Sturry (n=26).

PCT

The one potential prepared core is undiagnostic and, especially by itself, is not convincing of PCT at Sturry. It potentially shows a lineal removal with convergent preparation, but the angles of the striking platform are unconvincing. This could be a discoidal core or a handaxe roughout that has been referred to as a 'tortoise core' rather than PCT.

Summary

Only a small sample from Sturry could be examined, but this shows typical Acheulean traits. There was no evidence of non-handaxe signatures and the evidence for PCT is unconvincing. Flake tools from the site show similarities to other MIS 9 sites.

5.1.14 Wolvercote

Despite its renowned handaxes and importance to MIS 9, Wolvercote suffers from a paucity of cores and flakes. No PCT is known from the site and flake tools are not considered important. The following results are of limited use due to only 15 artefacts being analysed.

Condition

The artefacts from Wolvercote are lightly to moderately abraded and edge damaged, demonstrating that the site could be close to primary context (Table 5.122).

	Flakes	Flake tools	All material
n	13	2	15
Abrasion	76.92	50.00	73.33
Light	23.07	50.00	26.67
Moderate			
Edge Damage			
Light	76.93	50.00	73.33
Moderate	23.07	50.00	26.67
Patina			
None	38.46	0.00	33.33
Light	30.77	100.00	40.00
Moderate	23.08	0.00	20.00
Heavy	7.69	0.00	6.67
Staining			
None	92.31	100.00	93.33
Yes	7.69	0.00	6.67
Scratching			
None	100.00	100.00	100.00
Battering			
None	100.00	100.00	100.00

Table 5.122 Condition of material from Wolvercote.

Flakes

No cores were examined from the site. The majority of flakes are indeterminate, but soft hammer flakes and the presence of marginal and dihedral butts indicates handaxe manufacture (Table 5.123). The dorsal scar patterns show the presence of long complex multidirectional patterns. The flakes on average are small, but larger examples are present. The flakes show little sign of elongation (Table 5.124).

Butt type	%	Hammer mode	%
Plain	38.46	Hard	15.38
Marginal	30.77	Indeterminate	76.92
Missing	23.08	Soft	7.69
Dihedral	7.69		
Dorsal scar count	**%**	**Dorsal scar pattern**	**%**
0	7.69	Natural	7.69
1	7.69	Uni	38.46
2	7.69	Bi	30.77
3	38.46	Multi	23.08
4	15.38		
5	15.38		
6	7.69		
Cortex	**%**	**Flake type**	**%**
0	53.85	1	0.00
10	7.69	2	7.69
20	15.38	3	0.00
30	7.69	4	38.46
40	7.69	5	53.85
90	7.69		
Whole/broken	**%**	**Type of break**	**%**
Whole	76.92	None	76.92
Broken	23.08	Missing Butt	23.08

Table 5.123 Technological analysis of flakes from Wolvercote (n=13).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	59.9	51.7	14.6	0.927
Median	53.4	52.7	14.3	0.965
Min	21.4	16.4	5.7	0.363
Max	140.1	83.3	27.3	1.586
SD	28.975	21.474	6.903	0.345

Table 5.124 Average dimensions of flakes from Wolvercote (n=13).

Flake tools

Only two flake tools were analysed from Wolvercote; a natural piece of flint was retouched to create a point while the other tool was a standard side scraper (Table 5.125). Little more can be inferred from this evidence due to the low sample size. The flake tools are larger and show more signs of elongation (Table 5.126).

Type of flake tool	%	Extent of retouch	%
Point	50	Semi-invasive	50
Side scraper	50	Invasive	50
Distribution	**%**	**Position of retouch**	**%**
Continuous	100	Direct	50
		Inverse	50
Location of retouch	**%**	**Form of retouch**	**%**
Right ventral	50	Convex	50
Distal	50	Rectilinear	50
Angle of retouch	**%**	**Regularity**	**%**
Semi-abrupt	100	Regular	100
Morphology of retouch	**%**	**Length of retouch**	**mm**
Sub-parallel	100	Mean	46.3
		Median	46.3
		Min	42.9
		Max	49.6
		SD	4.738

Table 5.125 Technology of flake tools from Wolvercote (n=2).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	98.0	43.5	16.6	0.463
Median	98.0	43.5	16.6	0.463
Min	48.4	24.2	5.2	0.425
Max	147.6	62.8	27.9	0.500
SD	70.145	27.294	16.051	0.053

Table 5.126 Average dimensions of flake tools from Wolvercote (n=2).

Summary

The site of Wolvercote can add little to our knowledge of core and flake working in MIS 9. While the lack of flake tools could be significant it is more likely that collection at this site focused on handaxes. Without further excavations Wolvercote can do little to address the research questions of this thesis.

5.2 Eastern England

5.2.1 Barnham Heath

The following analysis is based on material from Ipswich Museum, on loan to the British Museum. Material held in the Pitt Rivers Museum was examined, but circumstances did not allow for the full recording of this material. All material was examined for retouch and PCT. The general character of the material is consistent between both collections.

Condition

Overall, Barnham Heath material is derived, being in moderate condition with moderate edge damage (Table 5.127). Evidence for staining, battering and scratching are low. Unlike other sites such as Biddenham and Kempston, there is a difference in the condition of material between elements of the assemblage detailed below.

	Flakes	Flake tools	Cores	Prepared cores	Levallois flakes	All material
n	308	16	32	17	3	376
Abrasion						
Light	6.49	31.25	9.38	47.06	66.60	10.11
Moderate	88.96	62.50	78.13	52.94	33.30	84.84
Heavy	4.55	6.25	12.50	0.00	0.00	5.05
Edge Damage						
Light	21.75	62.50	12.50	82.35	100.00	26.06
Moderate	75.32	37.50	87.50	17.65	0.00	71.54
Heavy	2.92	0.00	0.00	0.00	0.00	2.39
Patina						
None	31.49	25.00	28.13	11.76	33.30	30.05
Light	54.87	56.25	43.75	76.47	33.30	54.79
Moderate	10.06	18.75	25.00	5.88	33.30	11.70
Heavy	3.57	0.00	3.13	5.88	0.00	3.46
Staining						
None	1.95	100.00	96.88	100.00	100.00	98.14
Yes	98.05	0.00	3.13	0.00	0.00	1.86
Scratching						
None	92.21	100.00	96.88	100.00	100.00	93.09
Yes	7.79	0.00	3.13	0.00	0.00	6.91
Battering						
None	100.00	100.00	100.00	100.00	100.00	100.00
Yes	0.00	0.00	0.00	0.00	0.00	0.00

Table 5.127 Condition of Barnham Heath material.

Site Formation

There is a lack of material below five centimetres, with the majority of flakes between 7-14cm, demonstrating a degree of winnowing or collection bias (Figures 5.31+5.32).

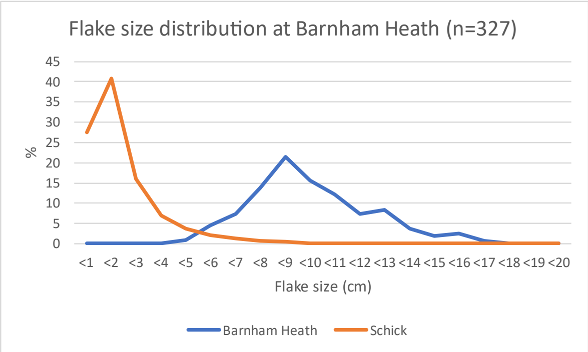


Figure 5.31 Flake size at Barnham Heath.

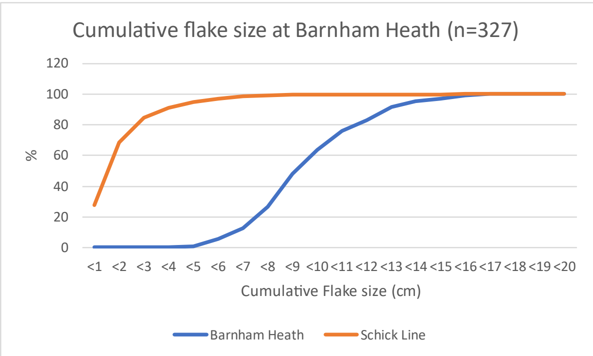


Figure 5.32 Cumulative frequency at Barnham Heath.

Flakes

The average dimensions of flakes indicates a lack of smaller artefacts (Table 5.128). Barnham Heath shows typical Acheulean technology, including handaxes and soft hammer flakes (Table 5.129). The relatively low count of soft hammer flakes could be due to winnowing and collection bias. Analysis of the flakes shows that later elements of the reduction sequence are the most represented. The dorsal scar patterns and counts show evidence of long complex sequences with multidirectional removals.

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	95.4	84.1	26.1	0.912
Median	91.5	83.9	24.5	0.867
Min	48.5	20.7	6.0	0.238
Max	168.9	205.1	65.6	1.947
SD	23.970	25.637	11.332	0.293

Table 5.128 Dimensions of flakes from Barnham Heath (n=308).

Butt type	%	Hammer mode	%
Plain	52.92	Hard	77.92
Marginal	19.48	Indeterminate	16.56
Missing	10.06	Soft	5.52
Mixed	6.82		
Cortical	3.90		
Dihedral	3.90		
Conical	2.60		
Faceted	0.32		
Dorsal scar count	**%**	**Dorsal scar pattern**	**%**
0	4.22	Natural	4.22
1	17.86	Uni	58.12
2	28.90	Bi	21.75
3	22.40	Multi	15.91
4	13.96		
5	7.14		
6	3.57		
7	1.62		
9	0.32		
Cortex %	**%**	**Flake type**	**%**
0	34.09	1	3.90
5	6.49	2	7.14
10	23.05	3	2.60
20	15.58	4	53.57
30	6.49	5	32.79
40	1.95		
50	3.25		
60	4.87		
70	0.65		
80	1.62		
90	0.97		
100	0.97		
Whole/broken	**%**	**Type of break**	**%**
Whole	87.01	None	87.01
Broken	12.99	Missing Butt	9.42
		Lateral snap	1.95
		Distal fragment	0.65
		Proximal fragment	0.32
		Split in half	0.32
		Chipped	0.32

Table 5.129 Technological analysis of flakes from Barnham Heath (n=308).

Cores

A large assemblage of cores was examined with the majority being MPCs, along with handaxe roughouts and undiagnostic chopper core/MPC's (Table 5.130).

Field Artefacts #	Stratigraphic context	Type	Cortex %	# episodes	# removals	Episode 1	Episode 2	Episode 3	Episode 4
IPS Box 90 19 no number 2		MPC	20	3	6	3B	2C	1D	
IPS Box 111 948 63	Label- Example of 'Clactonian artefacts'	Chopper/ MPC	40	1	3	3C			
IPS Box 111 948 63b	Label- Example of 'Clactonian artefacts'	Chopper/ MPC	70	1	6	6C			
IPS Box 111 948 63c	15'-18' deep oct 1947 Label- Example of 'Clactonian artefacts'	MPC	30	2	6	5C	1D		
IPS Box 111 1938. 6 24	Label- Example of 'Clactonian artefacts'	MPC	30	3	6	3C	2C	1D	
IPS Box 111 1948 63d	15'-18' deep oct 1947 Label- Example of 'Clactonian artefacts'	Roughout /MPC	30	3	8	3C	4B	1D	
IPS Box 111 948 63e	Label- Example of 'Clactonian artefacts'	Roughout /MPC	10	4	15	6C	7C	1D	1D
IPS Box 128a	?	MPC	60	2	4	3C	1D		
IPS Box 128b	15'-18' deep oct 1947 '	MPC	30	3	6	2B	3B	1D	
IPS Box 128c	1947 10	MPC	60	1	5	5C			
IPS Box 128d		MPC	5	3	4	2B	1D	1D	
IPS Box 128e	1948 34	Roughout /MPC	30	2	8	4B	4B		
IPS Box 128f	1948 63	MPC	20	3	5	2B	2B	1D	
IPS Box 128g	1948 63	MPC	20	3	5	2B	2B	1D	
IPS Box 128h		MPC	20	4	4	1D	1D	1D	1D
IPS Box 128i		MPC	20	3	4	2B	1D	1D	
IPS Box 128j		MPC	10	2	8	7C	1D		
IPS Box 128k		MPC	20	3	6	4C	1D	1D	
IPS Box 129a	1948 63	Chopper/ MPC	90	1	5	5C			
IPS Box 129b		MPC	0	4	7	3C	2C	1D	1D
IPS Box 129c		MPC	10	1	5	5C			
IPS Box 129e		Roughout /MPC	5	2	4	3C	1D		
IPS Box 129f		MPC	20	3	6	2B	3B	1D	
IPS Box 129g		MPC	50	1	4	4C			
IPS Box 129j		MPC	30	4	10	4B	4c	1D	1D
IPS Box 129k		MPC	10	2	5	4C	1D		
IPS Box 129l		MPC	40	4	8	4C	2B	1D	1D
IPS 127 C1		Flat MPC	10	3	6	3C	2B	1A	
IPS 127 C2		MPC	40	1	3	3B			
IPS 127 C3		MPC	20	4	5	2C	1D	1D	1D
IPS 127 C4		MPC	40	1	3	3C			
IPS 127 C5		MPC	30	2	4	3B	1D		

Table 5.130 Technological analysis of cores from Barnham Heath.

The second component is the prepared cores with similarities to other MIS 9 sites. This could include a 'flat MPC' which shows some traits of preparation. The unprepared cores show a full range of cortex, from well-utilised cores to examples with only a few removals. The MPCs show typical Lower Palaeolithic core working with episodes of alternative and parallel removals. The 'roughout/MPC' cores show potential shaping towards a handaxe. The 'chopper core/MPC' cores have a single alternative sequence of removals on one end of a core to potentially create a core tool. The cores are large on average, but with a range of sizes, and with little evidence of elongation (Table 5.131).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)
Mean	121.5	108.0	57.7	0.948	0.582
Median	106.5	101.6	56.0	0.802	0.555
Min	47.2	34.4	33.1	0.343	0.199
Max	193.1	198.2	104.3	1.988	1.195
SD	35.667	38.501	17.741	0.412	0.217

Table 5.131 Average dimensions of unprepared cores from Barnham Heath (n=32).

Flake tools

Barnham Heath was not one of the 15 MIS 9 flake tools sites (Pettitt and White, 2012), but Roe (1968a) described the count as 'numerous' with no total available. The dimensions of the flake tools show a preference for large flakes compared to other sites, but this is primarily due to the presence of large flakes from the site, and the flake tools are smaller on average than regular flakes (Table 5.132). Some flakes show natural edge damage that could be confused with retouch, but 16 flake tools were identified providing a small sample to analyse (Table 5.133). These tools were all scrapers, mainly side scrapers with semi-invasive, convex, sub-parallel retouch, although a quarter had more invasive working. Some flake tools contained more abrupt retouch to create heavy duty scrapers and end scrapers. Unlike other sites there are no convergent scrapers or signs of bifacial retouch. No connections to PCT were found, although on average the flake tools are considerably less abraded and edge damaged than the whole assemblage, and this could be a sign that they relate to later occupations. Caution is needed due to the small sample and the lack of distinctive technological factors.

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	88.6	81.8	32.5	0.964
Median	82.0	74.8	32.5	0.866
Min	65.1	49.2	19.1	0.414
Max	155.2	126.7	47.0	1.595
SD	22.847	24.255	8.380	0.327

Table 5.132 Dimensions of flake tools from Barnham Heath (n=16).

Type of flake tools	%	Extent of retouch	%
Side scraper	68.75	Minimally invasive	6.25
Double scraper	12.5	Semi-invasive	68.75
End scraper	12.5	Invasive	25
Heavy duty scraper	6.25		
Distribution of retouch	**%**	**Position of retouch**	**%**
Continuous	87.5	Direct	87.5
Discontinuous	12.5	Inverse	12.5
Location	**%**	**Form**	**%**
Right	50	Convex	81.25
Distal	25	Concave	6.25
Left	6.25	Distal convex right concave	6.25
Left ventral	6.25	Left convex right concave	6.25
Both distal and right	6.25		
Both left and right	6.25		
Angle of retouch	**%**	**Regularity**	**%**
Semi-abrupt	81.25	Regular	68.75
Abrupt	18.75	Irregular	31.25
Morphology of retouch	**%**	**Length of retouch**	**mm**
Sub-parallel	68.75	Mean	84.3
Stepped	18.75	Median	86.6
Left sub parallel right notched	6.25	Min	43.1
Scaly	6.25	Max	124.0
		SD	23.328

Table 5.133 Technological analysis of flake tools from Barnham Heath (n=16).

PCT

Barnham Heath has one of the larger collections of PCT that possibly dates to MIS 9 (Table 5.134), which are characterised by lower levels of abrasion and edge damage, more noticeably than the flake tools. Due to the technological differences between this material and the Acheulean material, the parsimonious interpretation is that it represents a later occupation, but this could be later in the interglacial and the stratigraphy of this site does not make it clear. The three cores that are classed as developed Levallois cannot be easily separated, although two of them are lightly abraded with light edge damage.

Type of prepared Core	%	Blank type	%
Proto-Levallois	70.59	Nodule	94.12
Levallois	17.65	Natural flake	5.88
?Levallois	5.88		
?Proto-Levallois	5.88		
Method of preparation	**%**	**Method of exploitation**	**%**
Centripetal	47.06	Lineal	70.59
Bipolar	35.29	Unexploited	29.41
Unipolar	11.76		
Convergent unipolar	5.88		
Earlier surface	**%**	**Type of products**	**%**
None	100.00	Flake	64.71
		None	29.41
		Point	5.88
Number of preferential removals	**%**	**Position of scar on striking surface**	**%**
0	29.41	All around	47.06
1	70.59	Proximal and distal	11.76
		Proximal distal and one edge	17.64
		Proximal	11.76
		One edge and proximal	11.76
Preparation on striking surface	**%**	**Preparation on flaking surface**	**%**
3	11.76	1	5.88
4	17.65	2	5.88
5	17.65	3	5.88
6	11.76	4	17.65
7	23.53	5	11.76
8	0.00	6	5.88
9	5.88	7	29.41
10	0.00	8	0.00
11	5.88	9	11.76
12	5.88	10	5.88
% Cortex on striking platform surface	**%**	**Position of cortex on striking platform surface**	**%**
0	5.88	One edge	29.41
10	23.53	Central	29.41
20	11.76	Central and one edge	11.76
30	23.53	Distal and two edges	11.76
40	11.76	Proximal	5.88
50	11.76	Proximal and one edge	5.88
60	0.00	None	5.88
70	0.00		
80	11.76		
Pattern of accentuated convexities	**%**	**Description of accentuated convexities**	**%**
None	76.47	None	76.47
Distal and both lateral edges	17.65	Minimally invasive	11.76
Proximal	5.88	Invasive	11.76

Table 5.134 Technological analysis of prepared cores from Barnham Heath (n=17).

The majority of the prepared cores are Proto-Levallois showing no accentuated convexities while three of the examples of Levallois show the distal and lateral convexities being accentuated with different levels of invasiveness. These Levallois cores are centripetally prepared with lineal removals. A further core could possibly show a Levallois core creating a point, although the character of the accentuated convexities is more ambiguous. The remainder of the cores show simple preparation, like at Botany Pit, with some remaining unexploited. The cores have been prepared either unipolarly, bipolarly or centripetally to create flakes. There is no evidence for recurrent removals. There is a high degree of variation in the amount of preparation from a few simple removals to long sequences often all the way round a core. The '?Proto-Levallois' core is made on a natural flake but shows prepared traits The prepared cores from Barnham Heath (Table 5.135) are larger than the sites of Biddenham and Kempston and show high degrees of flattening, but little elongation.

	Length (mm)	Width(mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)
Mean	98.0	98.4	44.0	1.024	0.446
Median	96.7	98.3	39.3	1.016	0.476
Min	69.3	65.7	16.8	0.597	0.223
Max	147.5	129.4	75.7	1.315	0.595
SD	23.902	21.471	14.762	0.178	0.099

Table 5.135 Dimensions of prepared cores from Barnham Heath (n=17).

A comparison between the dimensions of the preferential scars and the Levallois flakes shows that the flakes are larger (Table 5.136+5.137). The site could lack these larger cores, or it is possible they were reused.

	Length (mm)	Width (mm)	Elongation (W/L)
Mean	66.1	57.6	0.890
Median	64.6	52.3	0.940
Min	36.9	39.1	0.563
Max	92.9	81.8	1.212
SD	18.419	16.407	0.179

Table 5.136 Dimensions of preferential scars from prepared cores from Barnham Heath (n=11).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	90.8	69.5	18.3	0.765
Median	96.1	60.0	17.1	0.795
Min	75.5	58.4	16.1	0.608
Max	100.9	90.1	21.8	0.893
SD	13.494	17.858	3.044	0.145

Table 5.137 Dimensions of Levallois flakes from Barnham Heath (n=3).

One of the three potential Levallois products from Barnham Heath lacks a faceted butt and could be related to handaxe manufacture (Table 5.138). All three are flakes exploited lineally. The flakes were prepared centripetally or bipolarly with between four and eight removals. Only one flake has remaining cortex and this is only a small amount. The flakes fit within the technology of the prepared cores, but the sample is small. Some flakes were labelled Levallois but show large amounts of cortex or angles more associated with handaxe manufacture.

Confidence of Levallois	**%**	**Butt type**	**%**
Possible	66.67	Faceted	66.67
Unlikely	33.33	Plain	33.33
Morphology of products	**%**	**Previous removals**	**%**
Flake	100.00	0	100.00
Dorsal scar count	**%**	**Preparation scars**	**%**
0	0.00	0	0.00
1	0.00	1	0.00
2	0.00	2	0.00
3	0.00	3	0.00
4	33.33	4	33.33
5	33.33	5	33.33
6	0.00	6	0.00
7	0.00	7	0.00
8	33.33	8	33.33
Method of preparation	**%**	**Method of exploitation**	**%**
Centripetal	66.67	Lineal	100.00
Bipolar	33.33		
Cortex	**%**		
None	66.67		
5%	33.33		

Table 5.138 Technological analysis of Levallois flakes from Barnham Heath (n=3).

Summary

The site of Barnham Heath is a mixed assemblage which is primarily a derived Acheulean assemblage that yielded handaxes, cores and flakes. Despite the presence of chopper cores that were previously argued to show Clactonian affinities, there is no further evidence of a non-handaxe signature. The PCT appears to be in a less abraded state which could represent a later occupation. Due to the lack of documentation, it cannot be completely dismissed that it is a part of the wider variation within the Acheulean assemblage. The flake tools are not notably different in condition or technology and are therefore hard to place.

5.2.2 Biddenham

Condition

The assemblage from Biddenham shows moderate signs of both abrasion and edge damage indicating that while the material is not *in situ* it has also not travelled large distances (Table 5.139). Patination of artefacts varied, but no patterns can be seen in this.

	Flakes	Flake tools	Cores	Prepared cores	Levallois flakes	All material
n	517	47	13	13	14	604
Abrasion						
Light	2.71	4.26	7.69	15.38	7.14	3.15
Moderate	87.23	80.85	84.62	84.62	85.71	86.59
Heavy	10.06	14.89	7.69	0.00	7.14	10.26
Edge Damage						
Light	23.60	31.91	30.77	15.38	50.00	24.67
Moderate	74.85	68.09	69.23	84.62	50.00	74.01
Heavy	1.55	0.00	0.00	0.00	0.00	1.32
Patina						
None	18.38	21.28	23.08	0.00	35.71	18.54
Light	40.81	38.30	15.38	38.46	14.29	39.57
Moderate	31.72	27.66	53.85	46.15	42.86	32.62
Heavy	9.09	12.77	7.69	15.38	7.14	9.27
Staining						
None	92.46	93.62	7.69	100.00	92.86	92.55
Yes	7.54	6.38	92.31	0.00	7.14	7.45
Scratching						
None	99.42	100.00	100.00	100.00	100.00	99.50
Yes	0.58	0.00	0.00	0.00	0.00	0.50
Battering						
None	99.81	100.00	100.00	100.00	100.00	99.83
Yes	0.19	0.00	0.00	0.00	0.00	0.17

Table 5.139 Comparison of the condition of Biddenham material.

Site formation

The assemblage has been subject to winnowing (Figures 5.33+ 5.34). There is an over representation of medium-sized flakes (5cm-9cm), and a lack of material smaller than three centimetres, possibly due to collection bias.

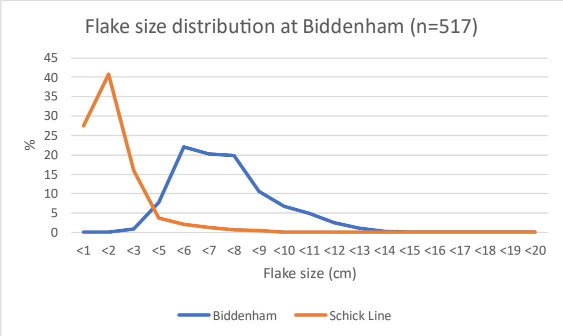


Figure 5.33 Flake size analysis at Biddenham.

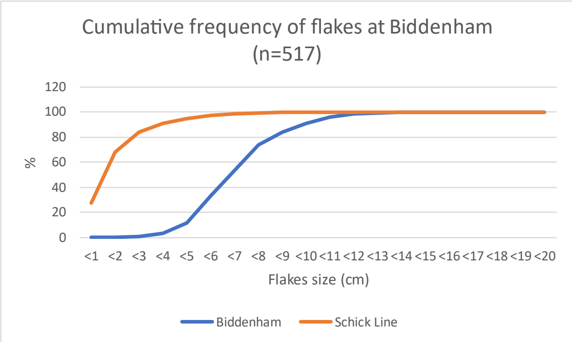


Figure 5.34 Cumulative flake size at Biddenham.

Flakes

Flakes from Biddenham conform with a typical Acheulean assemblage. Smaller flakes are absent, but the averages are within a typical range (Table 5.140).

	Length (mm)	Width (mm)	Thick (mm)	Elongation (W/L)
Mean	69.4	58.8	16.3	0.887
Median	67.5	55.4	15.3	0.840
Min	21.4	9.2	3.6	0.207
Max	147.7	149.4	81.0	2.202
SD	19.517	19.850	7.600	0.318

Table 5.140 Average dimension of flakes from Biddenham (n=517).

While the percentage of soft hammer flakes is low, there is a larger number of indeterminate flakes that have soft hammer features or missing butts (Table 5.141). The butt types show typical Acheulean working with some marginal and dihedral butts related to handaxe manufacture. The flakes display a range of dorsal scar patterns and counts which include long sequences of multidirectional removals. Flakes from the later stages of working are well represented and show longer reduction sequences.

Butt type	%	Hammer mode	%
Plain	46.23	Hard	71.57
Marginal	26.50	Indeterminate	21.28
Missing	8.12	Soft	7.16
Mixed	6.58		
Cortical	6.00		
Dihedral	4.26		
Conical	1.55		
Faceted	0.77		
Flake type	**%**	**Dorsal scar pattern**	**%**
1	3.87	Natural	5.03
2	7.54	Uni	54.93
3	2.32	Bi	22.63
4	44.87	Multi	17.41
5	41.39		
Cortex %	**%**	**Dorsal scar count**	**%**
0	42.17	0	5.03
5	3.09	1	16.25
10	15.47	2	30.75
15	0.39	3	23.02
20	12.38	4	15.67
30	9.09	5	6.00
40	2.32	6	1.55
50	2.13	7	1.16
60	4.06	8	0.39
70	2.32	9	0.19
80	2.13		
90	1.16		
100	3.29		
Whole/broken	**%**	**Type of break**	**%**
Whole	90.72	None	90.72
Broken	9.28	Missing butt	6.58
		Distal end	0.97
		Lateral snap	0.58
		Fragment	0.39
		Missing butt and break at the side	0.39
		Proximal end	0.19
		Broken in half	0.19

Table 5.141 Technological anlaysis of flakes from Biddenham (n=517).

Cores

Biddenham is distinguished by having a number of prepared cores similar to those found at Botany Pit, which make up half of the core assemblage. The second largest group are MPCs (Table 5.142). Other cores from the site are more unusual. Both the 'flat core' and the '?MPC' core show signs of Proto-Levallois traits but not enough to be fully diagnostic. Discoidal cores are also rarer, but are found at other sites, including Botany Pit. The unprepared cores show a range of remaining cortex with most having been considerably exploited. The sequence of removals often demonstrates multiple episodes of several removals often with alternative flaking, typical of well exploited MPCs. The cores show little evidence of elongation but do show some flattening which could suggest well utilised cores (Table 5.143).

Field Artefacts #	Collection	Type	Cortex %	# episodes	# removals	Episode 1	Episode 2	Episode 3
1 A1 26a	Worthington Smith Coll	MPC	40	3	9	1A	5B	3B
Bed 2423	Macdonald coll	MPC	10	3	12	3B	3C	6C
Bed 2433	Macdonald coll	MPC	50	3	7	4B	2B	1A
Bed 1988 186.2	Spinney Pit Section 2	MPC	10	3	7	5C	1D	1D
PRM 1911 81 169		Discoidal	20	3	8	4C	3C	1D
PRM 1911 81 95	Purch	Discoidal	20	3	5	2C	2B	1D
PRM 1906 6 13	Knowles	Discoidal	10	2	13	9C	4C	
PRM 1911 81 5	Knowles	?MPC	40	1	4	4C		
PRM 1911 81 15		Flat core	50	2	8	5B	3B	
PRM 1909 66 10		MPC	40	1	2	2C		
PRM 1909 66 163	Knowles	Discoidal	30	3	7	2C	2B	3C
PRM 1909 6650	Knowles	MPC	20	3	4	2C	1D	1D
PRM 1909 66 41	Knowles	MPC	20	2	4	2C	2B	

Table 5.142 Technology of unprepared cores at Biddenham.

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)
Mean	94.3	78.6	31.7	0.867	0.413
Median	77.0	74.2	30.7	0.848	0.381
Min	55.7	50.8	17.1	0.579	0.251
Max	215.8	156.0	55.1	1.309	0.721
SD	41.780	29.375	12.380	0.220	0.125

Table 5.143 Average dimensions of unprepared cores at Biddenham (n=13).

Non-handaxe

It has not been possible to isolate a non-handaxe assemblage. Soft hammer flakes are evident in both lightly and moderately abraded condition, but no diagnostic heavily abraded examples were found. While this could be significant, other factors such as collection and recognition of highly abraded soft hammer flakes, and the fact that handaxes are found in heavily abraded condition dismisses wider implications. There is no evidence of anything that was previously considered to be diagnostic to the 'Clactonian'.

Flake tools

The analysis of material from Biddenham identified 46 flake tools (Table 5.144), 47 including a flaked flake. At least 27 flakes that were labelled as flake tools can be dismissed as naturally edge damaged flakes. Biddenham is therefore on the threshold of Pettitt and White's (2012) 50 flake tools, but these came from a large sample of over 500 flakes.

Type of flake tool	**%**	**Extent of retouch**	**%**
Side scraper	50.00	Invasive	43.48
Convergent scraper	10.87	Semi-invasive	28.26
End scraper	8.70	Minimally invasive	28.26
Notch	6.52		
Double scraper	4.35		
Double scraper with denticulate	4.35		
Flake handaxe	4.35		
Handaxe on a flake or convergent scraper	4.35		
Natural fragment with retouch	2.17		
Uniface	2.17		
Denticulate	2.17		
Distribution	**%**	**Position of retouch**	**%**
Continuous	91.30	Direct	80.43
Discontinuous	8.70	Inverse	13.04
		Bifacial	6.52
Location of retouch	**%**	**Form of retouch**	**%**
Right	28.26	Convex	71.74
Distal	26.09	Concave	17.39
Left	19.57	Both concave and convex	6.52
All around	6.52	Notch	2.17
Both left and right	6.52	Rectilinear	2.17
Convergent on left and right	6.52		
Left and distal	2.17		
Proximal	2.17		
Both distal and left	2.17		
Morphology of retouch	**%**	**Length of retouch**	**mm**
Semi-parallel	52.17	Mean	85.7
Scaly	21.74	Median	75.0
Stepped	13.04	Max	201.7
Notch	8.70	Min	24.4
Both sub-parallel and denticulate	2.17	SD	47.380
Parallel	2.17		

Table 5.144 Technological analysis of flake tools from Biddenham (n=46).

Flake tools from Biddenham are predominantly scrapers, with smaller proportions of denticulates and notches. The most remarkable thing about the Biddenham assemblage is the number of convergent scrapers. Further tools can be placed on a continuum between convergent scrapers and flake handaxes, including a 'unifacial handaxe/flake tool'. There is no link between the flake tools and PCT, and the flake tools cannot be separated from the Acheulean assemblage. Retouch is predominantly continuous, convex and often semi-parallel. Handaxe attempts are evident in the flake tools with bifacial working, but the majority still showed direct working onto the flake. There is only one example of abrupt retouch which was used to fashion a heavy-duty scraper. Overall, the flake tools are longer, wider and thicker than flakes but with similar elongation (Table 5.142), but there are larger unretouched flakes in the assemblage.

	Length (mm)	**Width** (mm)	**Thickness** (mm)	**Elongation (W/L)**
Mean	77.2	66.4	21.7	0.888
Median	73.5	60.5	21.1	0.790
Min	37.2	21.7	6.8	0.511
Max	118.9	142.7	46.4	1.873
SD	18.161	25.085	8.540	0.370

Table 5.145 Average dimensions of flake tools from Biddenham (n=46).

PCT

At Biddenham 13 prepared cores have been identified (Table 5.146). Of these, 12 are examples of Proto-Levallois but one is more developed approaching full Levallois. All the cores were made on nodules of flint. Cores were either prepared with centripetal or bipolar working. While one core was unexploited, most showed signs of one lineal removal with another showing two recurrent removals. From the shape of the cores, it was possible to infer that the products were all flakes with no evidence for the preparation of points. The preparation scars on both surfaces showed a range from simple preparation (between one and two) to long complex patterns of up to 13 removals. The proximal and distal ends were usually worked showing both centripetal and bipolar working, but some showed working all the way around. Simply prepared examples were similar to those at Botany Pit, Purfleet. The core which showed fuller Levallois with semi-invasive accentuated convexities on the distal and lateral sides was not distinct in condition.

Type of core	%	Blank type	%
Proto-Levallois	92.31	Nodule	100.00
Levallois	7.69		
Method of preparation	**%**	**Method of exploitation**	**%**
Centripetal	61.54	Lineal	84.62
Bipolar	38.46	Recurrent	7.69
		Unexploited	7.69
Presence of earlier flake surface	**%**	**Products**	**%**
None	100.00	Flake	92.31
		Unexploited	7.69
Number of preferential removals	**%**	**Position of scars on striking platform**	**%**
0	7.69	Proximal and distal	30.77
1	84.62	All around	23.08
2	7.69	Proximal and two edges	15.38
		One edge	7.69
		One edge, proximal and distal	7.69
		Proximal	7.69
		Proximal and one side	7.69
Preparation scars on striking surface	**%**	**Preparation scars on the flaking surface**	**%**
1	7.69	2	7.69
3	15.38	3	23.08
4	7.69	4	23.08
5	7.69	6	7.69
6	30.77	7	7.69
7	15.38	8	15.38
8	7.69	12	7.69
12	7.69	13	7.69
% of cortex on striking platform	**%**	**Position of cortex on striking platform**	**%**
0	23.08	Central and more than one edge	46.15
20	7.69	None	23.08
30	15.38	One edge and central	23.08
60	7.69	Central	7.69
80	30.77		
90	15.38		
Pattern additional convexities	**%**	**Description of additional convexities**	**%**
None	92.31	None	92.31
Lateral and Distal	7.69	Semi-invasive	7.69

Table 5.146 Technological analysis of prepared cores from Biddenham (n=13).

The size of the prepared cores from Biddenham are smaller than average with little evidence of elongation (Table 5.147). The cores show a high degree of flattening which could show high levels of utilisation.

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)	Flattening Th/W)
Mean	83.1	81.0	31.4	0.984	0.390
Median	79.3	73.3	28.8	0.955	0.368
Min	54.0	54.6	17.4	0.703	0.198
Max	135.9	133.1	54.8	1.507	0.691
SD	20.530	23.480	12.684	0.210	0.120

Table 5.147 Dimensions of the prepared cores from Biddenham (n=13).

The dimensions of Levallois flakes are significantly larger than the preferential removals from prepared cores (Tables 5.148 + 5.149). This could be due to collection bias with only larger Levallois flakes having notable features and therefore more likely to be collected. The Proto-Levallois cores have less features and their products are likely to show less signs of being prepared. It is significant that the more fully Levallois core represents the highest length of product.

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	87.6	61.8	14.0	0.720
Median	83.2	56.5	13.2	0.724
Min	60.3	41.1	7.9	0.426
Max	137.7	116.9	33.2	0.954
SD	23.878	18.092	6.336	0.131

Table 5.148 Dimensions of Levallois flakes from Biddenham (n=14).

	Length (mm)	Width (mm)	Elongation (W/L)
Mean	54.5	43.2	0.818
Median	60.1	38.0	0.870
Min	29.9	25.8	0.425
Max	77.4	72.7	1.164
SD	13.3	16.4	0.288

Table 5.149 Dimensions of preferential scars from Biddenham (n=13).

While several flakes with Levallois features were examined, one flake is unlikely to be related to Levallois working as the angle indicates that the flake bit into the flaking surface, more reminiscent of handaxe manufacture (Table 5.150). A few other flakes are more ambiguous and could be handaxe related. None of the flakes showed signs of previous Levallois removals, but the majority exhibited faceting on the butt with others having dihedral butts. The flakes show high numbers of dorsal scars with bipolar or centripetal preparation being the most common. There are examples of Levallois points in contrast to the absence of convergent preparation in the prepared cores. The flakes do not show any signs of recurrent exploitation, but this is rare in the cores as well.

Confidence of Levallois	%	Butt type	%
Possible	78.57	Faceted	85.71
Probable	14.29	Dihedral	14.29
Unlikely	7.14		

Morphology of product	%	Previous removals	%
Flake	85.71	0	100.00
Point	14.29		

Dorsal scar count	%	Preparation scars	%
1	0.00	1	0.00
2	0.00	2	0.00
3	21.43	3	21.43
4	28.57	4	28.57
5	7.14	5	7.14
6	21.43	6	21.43
7	7.14	7	7.14
8	7.14	8	7.14
9	0.00	9	0.00
10	7.14	10	7.14

Method of preparation	%	Method of exploitation	%
Unipolar	7.14	Lineal	100.00
Bipolar	21.43		
Centripetal	57.14		
Convergent	14.29		

Cortex	%
0	69.23
5	23.08
10	7.69

Table 5.150 Technological analysis of Levallois flakes from Biddenham (n=14).

Summary

No separate assemblages are evident and previous claims of 'Clactonian' material is most likely based on outdated notions of typology. The Acheulean component is typical of a secondary context collected assemblage but differs from other sites in its PCT. The amount of flake tools at the site has been previously exaggerated and based on the above analysis falls into a typical Acheulean range with no PCT traits. What is harder to dismiss is the PCT at the site. The site represents a convincing amount of prepared core material that is akin to other MIS 9 sites.

5.2.3 Kempston

Condition

Table 5.151 shows that Kempston resembles Biddenham, as it is characterised by moderate abrasion and edge damage, although overall Kempston shows higher levels of more heavily abraded material. Like at Biddenham no discrete assemblages could be isolated, and there is little documentation beyond collector. While not *in situ,* the assemblage is not majorly derived.

	Flakes	Flake tools	Cores	Prepared Cores	Levallois Flakes	All material
n	125	27	5	3	5	165
Abrasion						
Light	4.00	7.41	20.00	0.00	40.00	6.06
Moderate	68.80	66.67	80.00	100.00	60.00	69.09
Heavy	27.20	25.93	0.00	0.00	0.00	24.85
Edge Damage						
Light	8.80	25.93	40.00	0.00	80.00	14.55
Moderate	76.00	66.67	60.00	100.00	20.00	72.73
Heavy	15.20	7.41	0.00	0.00	0.00	12.73
Patina						
None	30.40	37.04	20.00	33.30	0.00	30.30
Light	27.20	29.63	60.00	33.30	40.00	29.09
Moderate	28.00	22.22	0.00	33.30	60.00	27.27
Heavy	14.40	11.11	20.00	0.00	0.00	13.33
Staining						
None	66.40	92.59	100.00	66.60	100.00	72.73
Yes	33.60	7.41	0.00	33.30	0.00	27.27
Scratching						
None	96.00	100.00	80.00	100.00	100.00	95.76
Yes	4.00	0.00	20.00	0.00	0.00	4.24
Battering						
None	100.00	100.00	100.00	100.00	100.00	100.00
Yes	0.00	0.00	0.00	0.00	0.00	0.00

Table 5.151 Analysis of the condition of material from Kempston.

Site formation

Kempston lacks material under three centimetres, and has an overabundance of mid-sized flakes, likely due to collection bias or natural winnowing (Figures 5.35+ 5.36).

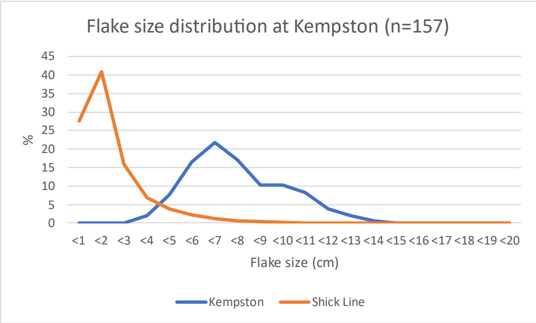


Figure 5.35 Flake size analysis at Kempton.

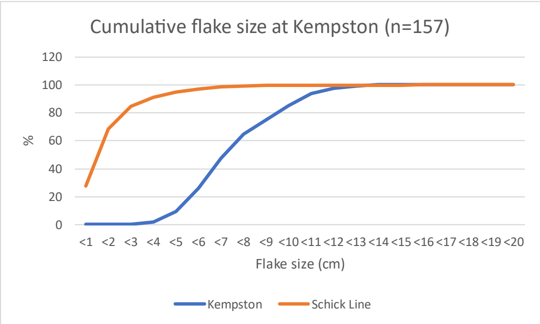


Figure 5.36 Cumulative flake size at Kempston.

*Flake*s

Overall, the flakes from Kempston show typical Acheulean technology. The dimensions of the flakes from Kempston demonstrate a lack of smaller artefacts similar to Biddenham (Table 5.152). The small proportion of soft hammer flakes could be due to collection bias (Table 5.153). The butt types show handaxe working especially the high proportion of marginal butts and the presence of dihedral butts. The dorsal scar patterns and scar counts show a wide range with some long sequences of multidirectional removals. The later stages of production are better represented.

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	74.8	58.8	18.6	0.829
Median	70.5	58.0	16.5	0.770
Min	31.1	24.6	7.1	0.293
Max	130.8	134.8	45.3	2.244
SD	20.037	18.455	8.098	0.303

Table 5.152 Dimensions of flakes from Kempston (n=125).

Butt type	%	Hammer mode	%
Plain	53.6	Hard	81.6
Marginal	25.6	Indeterminate	16
Missing	8	Soft	2.4
Mixed	6.4		
Cortical	3.2		
Dihedral	2.4		
Conical	0.8		
Dorsal scar count	**%**	**Dorsal scar pattern**	**%**
0	10.4	Uni	44
1	20	Bi	19.2
2	24.8	Multi	26.4
3	17.6	Natural	10.4
4	14.4		
5	8		
6	4		
7	0.8		
Cortex	**%**	**Flake type**	**%**
0	50.4	1	9.6
5	2.4	2	5.6
10	9.6	3	4.8
15	2.4	4	32.8
20	3.2	5	47.2
30	10.4		
40	5.6		
50	4		
60	3.2		
70	2.4		
80	0.8		
90	1.6		
100	4		
Whole/ broken	**%**	**Type of break**	**%**
Whole	90.4	None	90.4
Broken	9.6	Missing butt	7.2
		Chipped	1.6
		Distal end broken	0.8

Table 5.153 Technological analysis of flakes from Kempston (n=125).

Cores

The cores from Kempston have a prepared core component alongside MPCs and a chopper core. The cores demonstrate a range of remaining cortex showing no complete utilisation (Table 5.154). The MPCs show various episodes with numerous removals in both alternate and parallel patterns, as well as single removals. One core resembles a chopper core but could be a crude handaxe and is not distinctive in condition.

Field Artefacts #	Stratigraphic context	Type	Cortex %	# episodes	# removals	Episode 1	Episode 2	Episode 3
Bed 2302		MPC	50	2	8	5C	3B	
Bed 2342	Foulkes Pit	MPC	20	3	8	3C	4C	1D
Bed 2340B	Foulkes Pit	MPC	10	3	8	3C	3C	2C
Bed 1991 135	Foulkes Pit	MPC	30	1	2	2B		
MAA 1923 1078 B4		Chopper core/handaxe	40	2	9	6C	3C	

Table 5.154 Technological analysis of cores from Kempston.

The cores show a low degree of elongation but do show some flattening, suggestive of well utilised cores (Table 5.155).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)
Mean	86.1	84.4	51.0	0.985	0.589
Median	86.6	76.7	41.9	1.007	0.545
Min	54.3	54.7	29.8	0.711	0.411
Max	118.4	121.7	97.0	1.211	0.797
SD	25.027	29.036	27.581	0.189	0.151

Table 5.155 Average dimensions of cores from Kempston (n=5).

Non-handaxe

As at Biddenham there is no evidence that a non-handaxe signature is present at Kempston. While Kempston is similar to Biddenham, with artefacts mainly being moderately abraded, almost a quarter of the artefacts are classed as heavily abraded. Edge damage is more evenly split with light and heavy edge damage. There are fewer examples of diagnostic soft hammer flakes at Kempston, but these are found within a large collection of handaxes and a significant number of indeterminate flakes. The soft hammer flakes do not differ in condition to the main flake assemblage. No changes can be seen in flake tools when considering condition, typology and extent of retouch. The only distinguishing feature in the cores is the 'chopper core/crude handaxe', but the ambiguity of this artefact, consistency with the rest of the assemblage and uniqueness in the collection mean it is unlikely it is evidence of a non-handaxe signature.

Over 25% of the artefacts from Kempston show some evidence of staining, but the technology of this material including its flake tools, cores and flakes are not technologically distinct. This material includes soft hammer working, handaxes and PCT. The stained material is therefore likely to be a part of the broader Acheulean assemblage.

Flake Tools

Twenty-seven flake tools were recorded from Kempston, far below the numbers recorded by

Roe (1968a). Over 20 flakes were recorded that were either falsely listed as flake tools, or had significant edge damage that could have been mistaken for deliberate retouch. Kempston is dominated by side and end scrapers, lacking notches and denticulates (Table 5.156). The convergent scrapers, points and handaxe attempts seen at Biddenham are also common at Kempston. Kempston displays a tendency towards more invasive retouch. There is no connection to PCT.

Type of flake tool	**%**	**Extent of retouch**	**%**
Side scraper	44.44	Minimally invasive	11.11
End scraper	22.22	Semi invasive	51.85
Convergent scraper/ handaxe attempt	18.52	Invasive	37.04
Convergent scraper	7.41		
Point	3.70		
Bifacial knife	3.70		
Distribution of retouch	**%**	**Position of retouch**	**%**
Continuous	96.30	Direct	92.59
Discontinuous	3.70	Bifacial	7.41
Location of retouch	**%**	**Form of retouch**	**%**
Converging left and right	25.93	Convex	77.78
Distal	25.93	Rectilinear	18.52
Left	25.93	Both convex and concave	3.70
Right	18.52		
Converging on distal and right	3.70		
Angle of retouch	**%**	**Regularity of retouch**	**%**
Semi-abrupt	100.00	Regular	81.48
		Irregular	18.52
Morphology of retouch	**%**	**Length of retouch**	**mm**
Sub-parallel	55.56	Mean	83.9
Stepped	29.63	Median	69.4
Scaly	11.11	Min	35.9
Parallel	3.70	Max	218.6
		SD	46.608

Table 5.156 Technological analysis of flake tools from Kempston (n=27).

The retouch, apart from some anomalies, is direct continuous retouch. The flake tools show more concentrated work than the *ad hoc* retouch sometimes thought to categorise the Lower Palaeolithic. Retouch converging between two sides is common, akin to other sites. The morphology of the retouch is similar to that at Biddenham and shows the majority of the retouch being refined sub-parallel working.

The average dimensions of flake tools at Kempston differ from those at Biddenham as the flake tools are shorter on average than unretouched flakes and show little sign of elongation (Table 5.157).

	Length	Width	Thickness	Elongation (W/L)
Mean	71.3	65.7	21.4	1.038
Median	64.1	69.2	20.6	0.958
Min	34.1	22.2	14.3	0.213
Max	121.6	96.5	33.1	2.027
SD	23.940	16.424	4.989	0.442

Table 5.157 Dimensions of flake tools from Kempston (n=27).

PCT

PCT is also present at Kempston, albeit in smaller amounts, reflecting the difference in assemblage size between Biddenham and Kempston (Table 5.158). There were no examples of full Levallois, but three cores are classed as Proto-Levallois with evidence of centripetal preparation on nodules. One core shows evidence of an earlier flaking surface and evidence of recurrent removals. The cores have been well prepared with several flake removals all around the striking platform and complex scar patterns on the flaking surface.

Two of the cores show minimal knapping to accentuate the convexities of the lateral sides and could be argued to be Levallois. The cores were used to produce flakes and two show evidence of faceting. The recurrent core shares some traits with discoidal cores but has more in common with Proto-Levallois from Biddenham. One of the cores could be an accidental Proto-Levallois core produced from a handaxe attempt, similar to those found at Cagny la Garenne (Moigne *et al.,* 2016).

On average the cores from Kempston are larger and more elongated than those at Biddenham, although it is a much smaller assemblage (Table 5.159). Like Biddenham the removal scars from the cores are smaller than the flakes found. However, with such a small sample caution is needed (Tables 5.160 and 5.161).

Type of prepared core	%	Blank type	%
Proto-Levallois	100.00	Nodule	100.00
Method of preparation	**%**	**Method of exploitation**	**%**
Centripetal	100.00	Recurrent	33.30
		Lineal	66.60
Presence of earlier flake surface	**%**	**Products**	**%**
Yes	33.30	Flake	100.00
No	66.60		
Number of preferential removals	**%**	**Position of scars on striking platform**	**%**
1	66.60	All around	100.00
2	33.30		
Number of preparation scars on flaking surface	**%**	**Number of preparation scars on striking surface**	**%**
6	66.67	5	66.67
9	33.33	8	33.33
Amount of cortex on striking platform	**%**	**Position of cortex on striking platform**	**%**
0%	33.30	None	33.30
10%	33.30	One edge	66.60
20%	33.30		
30%	0.00		
40%	0.00		
50%	0.00		
Pattern of additional convexities	**%**	**Description of additional convexities**	
Lateral	66.60	Minimal	%
None	33.30	None	66.60

Table 5.158 Analysis of prepared cores from Kempston (n=3).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)
Mean	94.2	96.4	38.3	1.026	0.395
Median	92.4	89.3	36.9	1.029	0.428
Min	77.1	83.5	28.0	0.966	0.314
Max	113.2	116.5	49.9	1.083	0.442
SD	18.120	17.619	11.014	0.058	0.071

Table 5.159 Dimensions of prepared cores from Kempston (n=3).

	Length (mm)	Width (mm)	Elongation (W/L)
Mean	73.4	60.6	0.827
Median	74.6	65.6	0.899
Min	70.2	48.3	0.647
Max	75.4	67.8	0.934
SD	2.800	10.680	0.157

Table 5.160 Dimensions of preferential removals from prepared cores from Kempston (n=3).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	91.2	58.9	12.3	0.664
Median	92.4	59.7	11.8	0.605
Min	67.8	53.2	8.5	0.557
Max	106.2	62.3	15.8	0.919
SD	14.937	3.418	3.136	0.146

Table 5.161 Dimensions of Levallois flakes from Kempston (n=5).

Five flakes from Kempston are possible Levallois products that show either faceted or dihedral butts (Table 5.162). There is an example of a Levallois point not seen in the cores. There is no evidence of previous Levallois removals or recurrent exploitation, but the previous preparation scars form a complex dorsal scar pattern. The scars show mainly bipolar or centripetal preparation apart from the convergent preparation for the point. Some flakes were labelled as Levallois or Mousterian but show little evidence.

Confidence of Levallois	**%**	**Butt type**	**%**
Possible	100	Faceted	80
		Dihedral	20
Morphology of product	**%**	**Previous removals**	%
Flake	80	0	100
Point	20		
Dorsal scar count	**%**	**Preparation scars**	%
5	40	5	40
6	20	6	20
8	20	8	20
9	20	9	20
Method of preparation	**%**	**Method of exploitation**	%
Bipolar	40	Lineal	100
Centripetal	40		
Convergent	20		
Cortex	**%**		
0	80		
10	20		

Table 5.162 Technological analysis of Levallois flakes from Kempston (n=5).

Summary

The site of Kempston is similar to the larger site of Biddenham showing a typical Acheulean assemblage that cannot be separated into discrete components. The flake tools, like those at Biddenham, show higher levels of invasive and convergent retouch but with no links to the PCT. While only having small amounts of PCT, when examined alongside Biddenham the material demonstrates the presence of early PCT around Bedford similar to that at other MIS 9 sites.

5.2.4 Station Pit, Kennett/ Kentford

Condition

The artefacts (Table 5.163) show signs of major abrasion and considerable amounts of edge damage indicative of mass movement and winnowing. There is no evidence of distinct assemblages, although the lack of provenance and collection history means artefacts may come from different areas.

	Flakes	Flake tools	Cores	All material
n	168	28	5	201
Abrasion				
Light	11.31	10.71	0.00	10.95
Moderate	54.17	71.43	40.00	56.22
Heavy	34.52	17.86	60.00	32.84
Edge Damage				
Light	16.07	25.00	0.00	16.92
Moderate	75.60	71.43	100.00	75.12
Heavy	8.33	3.57	0.00	7.96
Patina				
None	14.29	17.86	0.00	14.43
Light	31.55	39.29	0.00	31.84
Moderate	30.95	35.71	60.00	32.34
Heavy	23.21	7.14	40.00	21.39
Staining				
None	91.07	100.00	80.00	92.04
Yes	8.93	0.00	20.00	7.96
Scratching				
None	94.64	96.43	80.00	94.53
Yes	5.36	3.57	20.00	5.47
Battering				
None	98.21	96.43	100.00	98.01
Yes	1.79	3.57	0.00	1.99

Table 5.163 Condition of artefacts from Station Pit Kennett/ Kentford.

Site formation

The artefacts demonstrate signs of either winnowing or collection bias (Figures 5.37+5.38). The majority of flakes are 6-10cm suggesting major disturbance in the assemblage.

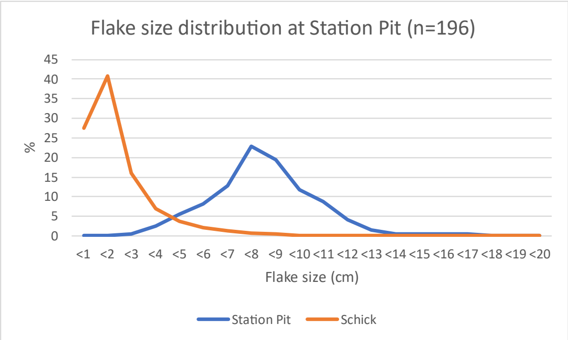


Figure 5.37 Flake size analysis at Station Pit.

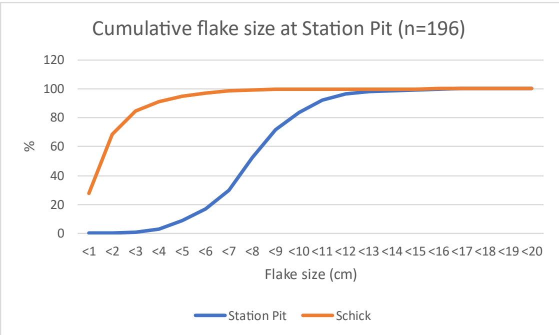


Figure 5.38 Cumulative flake size analysis at Station Pit.

Non-handaxe

There are no claims of 'Clactonian' material at the site, and no evidence was found in this study.

Flakes

The flakes from the site show a typical range of Acheulean working. There is a lack of smaller flakes which is reflected in the average flake size. There is evidence for a small degree of elongation, but not enough to be significant (Table 5.164).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	78.5	65.8	20.1	0.874
Median	78.1	64.1	19.0	0.876
Min	26.3	12.7	4.6	0.335
Max	162.9	126.3	42.5	1.804
SD.	20.270	19.854	7.698	0.292

Table 5.164 Average dimensions of flakes from Station Pit (n=168).

A number of flakes show diagnostic soft hammer working and a larger proportion show features such as marginal and dihedral butts (Table 5.165). A range of dorsal scar patterns were observed including long complex multidirectional patterns with a clear bias towards later stages of working.

Butt type	%	Hammer mode	%
Plain	47.02	Hard	76.79
Marginal	23.21	Indeterminate	16.07
Mixed	13.10	Soft	7.14
Missing	10.71		
Dihedral	2.98		
Cortical	1.19		
Conical	1.19		
Broken	0.60		
Dorsal scar Count	**%**	**Dorsal scar pattern**	**%**
0	2.96	Natural	2.96
1	10.65	Uni	42.60
2	21.89	Bi	31.36
3	29.59	Multi	22.49
4	18.93		
5	10.06		
6	2.96		
8	0.59		
9	1.18		
7(3 ventral)	0.59		
Cortex	**%**	**Flake type**	**%**
0	60.12	1	1.79
5	5.95	2	0.60
10	17.26	3	0.60
20	8.93	4	38.10
30	3.57	5	58.93
40	2.38		
50	0.60		
60	0.60		
80	0.60		
Whole/broken	**%**	**Type of break**	**%**
Whole	87.50	None	87.50
Broken	12.50	Missing butt	10.12
		Smashed butt	0.60
		Snap at distal	0.60
		Half a flake	0.60
		Right snap	0.60

Table 5.165 Technological analysis of flakes from Station Pit (n=168).

Cores

The five cores from the site are all MPCs (Table 5.166). One core shows only a single parallel episode while the others contain multiple episodes of alternative flaking. The small amount of remaining cortex show high levels of utilisation.

Field Artefacts #	**Stratigraphic context**	**Type**	**Cortex %**	**# episodes**	**# removals**	**Episode 1**	**Episode 2**	**Episode 3**	**Episode 4**
1 1 B13 18	Ballast pit	MPC	20	2	8	5C	3B		
8 1 B13 21	GER pit	MPC	10	2	4	3C	1D		
Kentford	Suffolk	MPC	10	1	4	4B			
Kentford	Suffolk	MPC	10	2	5	3C	2C		
SE D285	Rubble drift pit E of Kentford village	MPC	10	4	16	7C	6C	2B	1D

Table 5.166 Technological analysis of cores from Station Pit.

The cores from Station Pit are large but do not show large degrees of elongation (Table 5.167). There is some evidence of increased flattening and this is probably due to increased utilisation.

	Length (mm)	**Width (mm)**	**Thickness (mm)**	**Elongation (W/L)**	**Flattening (Th/W)**
Mean	95.5	78.0	36.9	0.826	0.500
Median	99.3	64.1	35.1	0.927	0.524
Min	62.7	58.1	33.6	0.563	0.344
Max	114.6	106.3	42.9	0.984	0.678
SD	21.557	22.280	4.101	0.176	0.131

Table 5.167 Average dimensions of cores from Station Pit (n=5).

Flake tools

While many artefacts labelled as flake tools were dismissed as naturally edge damaged, 28 were verified (Table 5.168). Over a fifth of the tools contain only minimal retouch with the majority showing semi-invasive working. On average, the retouch was continuous, direct and convex, forming side scrapers. A number of notches and denticulates were also present. Two tools were convergent scrapers, one of which could represent an abandoned handaxe attempt. While these tools show longer sequences of retouch, other flake tools show only short *ad hoc* sequences.

Type of flake tool	%	Extent of retouch	%
Side Scraper	75.00	Minimally Invasive	21.43
Denticulate	10.71	Semi-invasive	60.71
Convergent scraper/unifacial handaxe	7.14	Invasive	17.86
Notch	3.57		
End scraper	3.57		
Distribution	**%**	**Position of retouch**	**%**
Continuous	85.71	Direct	85.71
Discontinuous	14.29	Inverse	14.29
Location of retouch	**%**	**Form of retouch**	**%**
Left	39.29	Convex	67.86
Right	35.71	Concave	17.86
Distal	10.71	Rectilinear	7.14
All around	7.14	Denticulate	3.57
Proximal	3.57	Convex and concave	3.57
Distal + right	3.57		
Angle of retouch	**%**	**Regularity**	**%**
Semi-abrupt	92.86	Regular	67.86
Abrupt	7.14	Irregular	32.14
Morphology of retouch	**%**	**Length of retouch**	**mm**
Sub-parallel	67.86	Mean	82.0
Scaly	14.29	Median	70.7
Denticulate	10.71	Min	19.6
Stepped	7.14	Max	184.7
		SD	39.868

Table 5.168 Technological analysis of flake tools from Station Pit (n=28).

The flake tools were on average larger than regular flakes from the site and show evidence of elongation (Table 5.169).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	90.6	60.5	23.2	0.727
Median	88.7	58.9	22.3	0.617
Min	39.4	33.9	9.6	0.365
Max	158.0	95.2	46.8	1.444
SD	27.614	15.944	9.316	0.294

Table 5.169 Average dimensions of flake tools from Station Pit (n=28).

PCT

Previous mentions by Smith (1926) of a Levallois flake and tortoise core could not be substantiated.

Summary

The site of Station Pit is difficult to provenance, but the evidence we have has shown no signs of a non-handaxe signature or PCT. The site is a derived Acheulean assemblage. Flake tools from the site represent typical Acheulean technology and are not found in the numbers previously suggested.

5.2.5 Miscellaneous eastern England sites

It has not been possible to gain access to the main collections from Southacre and Keswick due to the temporary closure of Norwich Castle Museum to outside researchers. Both sites are recorded as containing flake tools and PCT. A handful of artefacts from both sites have been examined from collections at the British Museum and Royal Holloway which allows for some preliminary observations.

Material from Southacre is in a light to moderately abraded condition with low level of patination. The two artefacts from Keswick are in a similar condition. The flakes from Southacre show a typical range for Acheulean assemblages. The flakes come from the later stages of knapping and show evidence of soft hammer work, and multidirectional dorsal scar patterns. A single soft hammer flake from Keswick is a further example of this technology.

Southacre contains one example of an elongated, invasive convergent scraper. It is in moderate condition and is similar to invasive convergent scrapers from other MIS 9 sites. Keswick also contains an invasive, but less elongated, double scraper in moderate condition. Neither show relation to PCT. These examples show glimpses of what the wider collections could contain, but no firm conclusions can be drawn. Available literature is used in the following chapters in the absence of more in-depth studies.

5.3 The Solent

5.3.1 Dunbridge

Condition

Artefacts from Dunbridge show moderate signs of abrasion and edge damage (Table 5.170). Variation in condition and patination is observable especially between prepared and unprepared cores. Lightly and heavily abraded flakes are both scarce in the assemblage. Handaxes from the site show a similar variation.

	Flakes	Flake tools	Cores	Prepared cores	All material
n	117	15	14	4	150
Abrasion					
Light	3.42	13.33	0.00	50.00	5.33
Moderate	85.47	86.67	71.43	50.00	83.33
Heavy	11.11	0.00	28.57	0.00	11.33
Edge Damage					
Light	11.11	13.33	7.14	0.00	10.67
Moderate	79.49	80.00	78.57	100.00	80.00
Heavy	9.40	6.67	14.29	0.00	9.33
Patina					
None	35.90	40.00	14.29	25.00	34.00
Light	33.33	33.33	50.00	75.00	36.00
Moderate	18.80	13.33	21.43	0.00	18.00
Heavy	11.97	13.33	14.29	0.00	12.00
Staining					
None	88.03	93.33	92.86	100.00	89.33
Yes	11.97	6.67	7.14	0.00	10.67
Scratching					
None	97.44	93.33	100.00	100.00	97.33
Yes	2.56	6.67	0.00	0.00	2.67
Battering					
None	100.00	100.00	100.00	100.00	100.00

Table 5.170 Condition Dunbridge material.

Site Formation

The flake size distribution shows evidence of winnowing or collection bias (Figures 5.39+5.40).

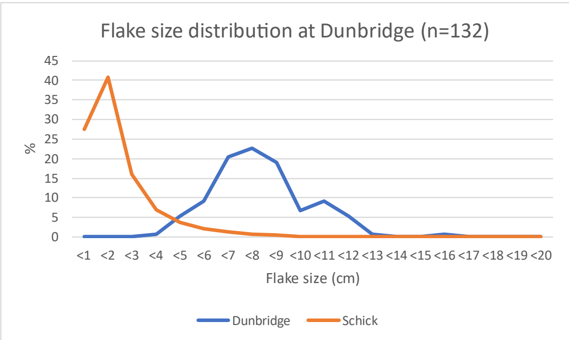


Figure 5.39 Flake Size at Dunbridge.

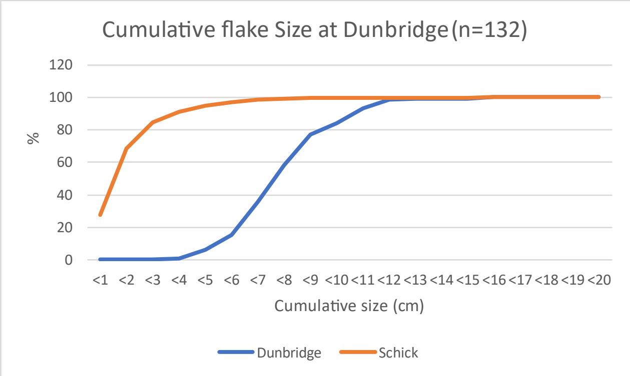


Figure 5.40 Cumulative frequency of flakes at Dunbridge.

Non-handaxe

There is no evidence of a separate non-handaxe assemblage at the site based on either condition or technology. The presence of a single chopper core, similar to other Solent sites, does not provide enough evidence for a distinct non-handaxe layer.

Flakes

The flakes show traits of an Acheulean assemblage. Whilst lacking smaller flakes, the average size of flakes is still similar to comparable sites (Table 5.171). Only a small proportion of flakes show signs of elongation. There are a small number of diagnostic soft hammer flakes which are probably underrepresented (Table 5.172). Many of the indeterminate flakes show soft hammer traits such as marginal or dihedral butts. There are a range of dorsal scar patterns and counts which represent both simple and complex working. The larger assemblage gives a better understanding than the smaller sites of East Howe and Harvey's Lane.

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	76.6	67.4	23.0	0.908
Median	74.9	66.4	21.1	0.878
Min	37.6	17.8	7.2	0.158
Max	122.8	119.6	47.6	1.988
SD	18.240	18.053	8.435	0.251

Table 5.171 Average flake size at Dunbridge (n=117).

Butt type	%	Hammer mode	%
Plain	68.38	Hard	78.63
Marginal	7.69	Indeterminate	15.38
Mixed	7.69	Soft	5.98
Missing	5.13		
Conical	4.27		
Broken	3.42		
Cortical	1.71		
Dihedral	1.71		
Dorsal scar count	**%**	**Dorsal scar pattern**	**%**
0	9.40	Natural	9.40
1	21.37	Uni	57.26
2	32.48	Bi	23.93
3	17.09	Multi	9.40
4	13.68		
5	3.42		
6	0.85		
7	1.71		
Cortex %	**%**	**Flake type**	**%**
0	29.91	1	7.69
5	0.85	2	11.97
10	18.80	3	5.98
20	10.26	4	45.30
30	4.27	5	29.06
40	7.69		
50	5.98		
60	4.27		
70	2.56		
80	5.13		
90	3.42		
100	6.84		
Whole/broken	**%**	**Type of break**	**%**
Whole	88.89	None	88.89
Broken	11.11	Missing butt	7.69
		Lateral snap	2.56
		Distal snap	0.85

Table 5.172 Technological analysis of flakes from Dunbridge (n=117).

Cores

The cores from Dunbridge are primarily MPCs with one example of a chopper core. The significant element of Dunbridge is the association with a handful of Proto-Levallois cores. The unprepared cores from Dunbridge show different levels of remaining cortex showing a range of levels of utilisation of the cores (Table 5.173). The utilisation of these cores can be observed through multiple episodes with several removals, demonstrating alternative and parallel working. The chopper core shows one end of the core being exploited to make its distinctive shape. The possible Proto-Levallois core (along with some others) show some traits such as working across a flat flaking surface, but is not diagnostic enough to classify it as a Proto-Levallois core. These are common at other sites and could show a continuum between MPCs and Proto-Levallois.

Field Artefacts #	Type	Cortex %	# episodes	# removals	Episode 1	Episode 2	Episode 3	Episode 4	Episode 5
HCMS 643	MPC	40	4	6	2B	2B	1D	1D	
HCMS 663	MPC	60	2	5	4C	1A			
HCMS 636	MPC	0	1	5	5C				
HCMS 650	MPC	20	2	8	5C	3C			
HCMS 665	MPC	20	5	8	2C	3C	1D	1D	1D
HCMS 666	MPC	20	3	5	1A	2C	2C		
HCMS 683	MPC/ Possible SPC	40	3	8	4C	2C	2B		
HCMS 580	MPC	40	3	9	3C	4C	2C		
HCMS 579	MPC	20	3	9	5C	3C	1D		
HCMS 568	MPC	40	3	6	4C	1D	1D		
HCMS 661	Chopper core/MPC	60	2	4	3C	1A			
HCMS 586	MPC	10	4	8	3B	2C	2B	1D	
HCMS 588	MPC	20	3	8	4C	1A	3B		
HCMS 513	MPC	40	1	6	6C				

Table 5.173 Technological analysis of unprepared cores from Dunbridge (n=14).

The cores represent a range of sizes but are large on average (Table 5.174). Some of the cores show signs of flattening which could be due to Proto-Levallois traits. Length and width were similar showing a lack of elongation.

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)
Mean	105.7	95.7	52.9	0.943	0.579
Median	96.0	88.8	47.6	0.841	0.624
Min	74.0	59.6	25.4	0.606	0.292
Max	192.6	162.9	78.0	1.506	0.821
SD	32.510	27.783	15.478	0.283	0.186

Table 5.174 Average dimensions of unprepared cores from Dunbridge (n=14).

Flake Tools

The 15 flake tools examined from Dunbridge were all scrapers. These were characterised by direct, semi-abrupt, sub-parallel or stepped, semi-invasive and convex retouch (Table 5.175). Almost half of the flake tools show irregular retouch with a proportion showing discontinuous working. The convergent scrapers, along with a handful of the other tools, could show handaxe attempts on flakes similar to other sites such as Biddenham and Kempston. Some flake tools were discounted as natural edge damage.

Type of flake tools	%	Extent of retouch	%
Side scraper	60.00	Minimally invasive	13.33
Double scraper	20.00	Semi-invasive	66.67
Convergent scraper/unifacial handaxe	13.33	Invasive	13.33
End scraper	6.67	Left Invasive right semi-invasive	6.67
Distribution of retouch	**%**	**Position of retouch**	**%**
Continuous	80.00	Direct	100.00
Discontinuous	20.00		
Location	**%**	**Form**	**%**
Left	40.00	Convex	80.00
Left and right	20.00	Left concave right convex	13.33
Right	13.33	Rectilinear	6.67
Convergent on distal	13.33		
Both left and distal	6.67		
Distal	6.67		
Angle of retouch	**%**	**Regularity**	**%**
Semi-abrupt	100.00	Regular	53.33
		Irregular	46.67
Morphology of retouch	**%**	**Length of retouch**	**mm**
Sub-parallel	73.33	Mean	93.6
Stepped	26.67	Median	87.3
		Min	50.1
		Max	187.0
		SD	39.315

Table 5.175 Technological analysis of flake tools from Dunbridge (n=15).

On average, the flake tools are slightly larger than regular flakes (Table 5.176). The flake tools do not show high levels of elongation.

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	88.6	70.1	26.2	0.853
Median	83.1	61.1	23.8	0.801
Min	45.7	55.1	16.3	0.400
Max	152.6	114.3	52.6	1.917
SD	25.680	16.997	9.784	0.346

Table 5.176 Dimensions of flake tools from Dunbridge (n=15).

PCT

There are four prepared cores from Dunbridge made on nodules (Table 5.177). One core was prepared unipolarly, while the others were more typically bipolarly prepared from two opposing edges. While half of the cores are unexploited the others were used to produce a linear flake removal and all show signs of preparation. Most of the cores show several removals on both the striking and flaking platforms, but the smallest of the cores has only had minimal preparation exploiting natural convexities. None of the cores show signs of accentuated convexities. The striking platforms of the cores remains heavily cortical with flakes removed to prepare the platforms of the flaking surface. The Proto-Levallois cores show less signs of abrasion on average, but with such a low number this should be treated with caution. Handaxes from the site include both rolled and fresh examples.

Type of prepared core	**%**	**Blank type**	**%**
Proto-Levallois	100	Nodule	100
Method of preparation	**%**	**Method of exploitation**	**%**
Unipolar	25	Lineal	50
Bipolar	75	Unexploited	50
Earlier surface	**%**	**Type of products**	**%**
None	100	Flake	50
		None	50
Number of preferential removals	**%**	**Position of scar on striking surface**	**%**
0	50	Proximal	25
1	50	Proximal and distal	75
Preparation on striking surface	**%**	**Preparation on flaking surface**	**%**
3	25	1	25
4	25	7	50
6	25	8	25
7	25		
% Cortex on striking platform surface	**%**	**Position of cortex on striking platform surface**	**%**
50	25	All over apart from one edge	75
80	50	Central and one edge	25
90	25		
Pattern of accentuated convexities	**%**	**Description of accentuated convexities**	**%**
None	100	None	100

Table 5.177 Technological analysis of prepared cores from Dunbridge (n=4).

The prepared cores are similar in size to the unprepared cores (Table 5.178). The cores show higher levels of elongation and are notably flatter than unprepared cores.

	Length (mm)	Width(mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)
Mean	106.9	74.3	30.9	0.695	0.421
Median	111.6	77.7	31.2	0.694	0.430
Min	84.7	59.4	20.0	0.683	0.271
Max	119.7	82.3	41.1	0.709	0.554
SD	15.701	10.663	8.739	0.012	0.130

Table 5.178 Dimensions of prepared cores from Dunbridge (n=4).

The preferential removal scars show smaller removals than regular flakes at the site (Table 5.179), but there were no PCT flakes to compare. One flake (500) previously identified by Harding and Bridgland (2019) is undiagnostic and could be from handaxe manufacture. If this were considered a Levallois flake it would fit in with the prepared core assemblage.

	Length (mm)	Width(mm)	Elongation (W/L)
Mean	61.3	49.5	0.814
Median	61.3	49.5	0.814
Min	56.8	47.8	0.726
Max	65.8	51.2	0.901
SD	6.364	2.404	0.124

Table 5.179 Dimensions of preferential removals from prepared cores at Dunbridge (n=4).

LMP

The *bout-coupé* attributed to the site has 'probably Dunbridge' written on the side. Given its anomalous nature it should be discounted unless further evidence is found (Harding and Bridgland, 2019:161).

Summary

Recent excavations at Dunbridge have allowed a larger core and flake sample to be recovered from a site previously dominated by handaxes. Dunbridge is characterised as a derived Acheulean site with few flake tools. The presence of PCT demonstrates similarities to assemblages from the Thames.

5.3.2 East Howe

Condition

Material from East Howe is in a moderate to heavily abraded state, with moderate edge damage (Table 5.180). The assemblage does not have discrete components although the sample size is small.

	Flakes	Flake tools	Cores	Prepared cores	Levallois flakes	All material
n	35	2	2	3	3	45
Abrasion						
Moderate	85.71	100.00	100.00	66.60	100.00	86.67
Heavy	14.29	0.00	0.00	33.30	0.00	13.33
Edge Damage						
Light	11.43	0.00	0.00	0.00	33.30	11.11
Moderate	88.57	100.00	100.00	100.00	66.60	88.89
Patina						
None	45.71	0.00	50.00	66.60	0.00	42.22
Light	25.71	100.00	50.00	0.00	66.60	31.11
Moderate	22.86	0.00	0.00	33.30	33.30	22.22
Heavy	5.71	0.00	0.00	0.00	0.00	4.44
Staining						
None	85.71	0.00	0.00	0.00	0.00	84.44
Yes	14.29	100.00	100.00	100.00	100.00	15.56
Scratching						
None	94.29	100.00	100.00	100.00	100.00	95.56
Yes	5.71	0.00	0.00	0.00	0.00	4.44
Battering						
None	100.00	100.00	100.00	100.00	100.00	100.00

Table 5.180 Condition of material from East Howe.

Site formation

Analysis is concordant with the condition evidence in showing a derived assemblage with winnowing (Figures 5.41+5.42). The small sample size and collection bias have contributed to an unusual flake size distribution dominated by mid-sized flakes.

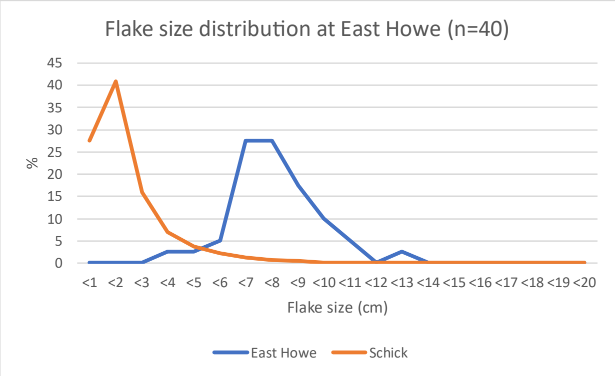


Figure 5.41 Flake size analysis at East Howe.

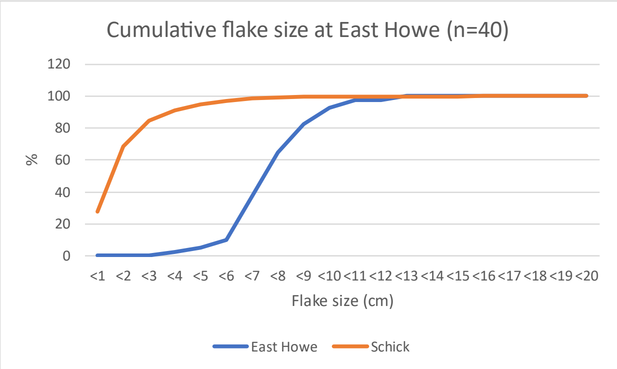


Figure 5.42 Cumulative frequency of flake size at East Howe.

Non-handaxe

There have been no suggestions of a non-handaxe assemblage at East Howe. The lack of soft hammer flakes is probably due to collection bias and a small sample size, and some of the flakes have indicators of soft hammer work, alongside handaxes from the site. The only hint of Clactonian affinities at East Howe is the presence of chopper cores.

Flakes

While the sample size is restrictive, East Howe shows a flake assemblage that is typical apart from the lack of soft hammer flakes. The average size of flakes shows a lack of both smaller and larger flakes. It is likely that smaller flakes were missed during collection (Table 5.181).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	75.0	59.9	17.9	0.811
Median	72.9	56.5	18.5	0.780
Min	38.8	16.7	5.5	0.318
Max	125.7	115.5	39.0	1.319
SD	17.701	20.226	7.538	0.244

Table 5.181 Average flake size from East Howe (n=35).

Despite lacking diagnostic soft hammer flakes, a substantial number of the flakes have marginal or dihedral butts and are indeterminate (Table 5.182). The dorsal scar patterns show less complexity than usual, with the majority being unipolar with between one and three removals. There is a higher proportion of later stage flakes.

Butt type	**%**	**Hammer mode**	**%**
Marginal	28.57	Hard	80.00
Plain	22.86	Indeterminate	20.00
Missing	20.00		
Mixed	17.14		
Dihedral	8.57		
Faceted	2.86		
Dorsal scar count	**%**	**Dorsal scar pattern**	**%**
0	5.71	Natural	5.71
1	20.00	Uni	62.86
2	31.43	Bi	8.57
3	20.00	Multi	22.86
4	8.57		
5	5.71		
6	5.71		
8	2.86		
Cortex	**%**	**Flake type**	**%**
0	45.71	1	2.86
5	2.86	2	8.57
10	14.29	3	0.00
20	17.14	4	42.86
30	2.86	5	45.71
40	2.86		
60	5.71		
70	5.71		
90	2.86		
Whole/broken	**%**	**Type of break**	**%**
Whole	77.14	None	77.14
Broken	22.86	Missing butt	20.00
		Distal snap	2.86

Table 5.182 Technological analysis of flakes from East Howe (n=35).

Cores

Prepared cores dominate the assemblage, with the remaining two being a MPC and a chopper core. There is no difference in condition between the types of core apart from one Proto-Levallois core showing higher signs of abrasion and patination.

The unprepared cores both show a single episode of alternate removals to shape one end of a core (Table 5.183). One could be an attempt at making a core tool. The remaining cortex on the two cores varies but shows a lack of complete utilisation.

Field Artefacts #	Type	Cortex %	Weight	# episodes	# removals	Episode 1
Box 60	MPC	60	187.7	1	4	4C
MAA Z 29459.2	Chopper	30	258	1	6	6C

Table 5.183 Technological analysis of unprepared cores at East Howe.

The unprepared cores at East How are small, limiting their potential for exploitation (Table 5.184). While one core shows a high level of flattening this may be natural as the remaining cortex does not indicate the core has been heavily exploited.

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)
Mean	67.1	75.1	39.5	1.151	0.550
Median	67.1	75.1	39.5	1.151	0.550
Min	59.3	65.8	30.0	0.880	0.355
Max	74.8	84.4	49.0	1.423	0.745
SD	10.960	13.152	13.435	0.384	0.275

Table 5.184 Average dimensions of unprepared cores at East Howe (n=2).

Flake Tools

Only two flake tools could be examined from the site. On average, the flake tools are larger than regular flakes from East Howe (Table 5.185). Both are scrapers with regular, convex, sub-parallel and semi-invasive to invasive retouch (Table 5.186). These tools show no Levallois traits. Due to the small number of flake tools, little more can be inferred.

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	90.7	82.6	26.9	0.896
Median	90.7	82.6	26.9	0.896
Min	82.0	60.6	25.1	0.739
Max	99.3	104.5	28.7	1.052
SD	12.233	31.042	2.546	0.222

Table 5.185 Average dimensions of flake tools from East Howe (n=2).

Type of flake tools	%	Extent of retouch	%
Side scraper	50	Semi-invasive	50
Convergent scraper	50	Invasive	50
Distribution of retouch	**%**	**Position of retouch**	**%**
Continuous	100	Direct	100
Location	**%**	**Form**	**%**
Left	50	Convex	100
Convergent left and distal	50		
Angle of retouch	**%**	**Regularity**	**%**
Semi-abrupt	100	Regular	100
Morphology of retouch	**%**	**Length of retouch**	**mm**
Sub-parallel	100	Mean	139.1
		Median	139.1
		Min	81.2
		Max	197
		SD	81.883

Table 5.186 Technological analysis of flake tools from East Howe (n=2).

PCT

The Proto-Levallois cores are larger than the unprepared cores from the site and show evidence of flattening (Table 5.187). The three Proto-Levallois cores analysed lack accentuated convexities and display no signs of previous Levallois surfaces (Table 5.188). One of the cores is unexploited but the other two have been exploited linearly to produce flakes. Typical of many MIS 9 Proto-Levallois cores the proximal and distal ends of the striking platform have been simply prepared with removals. The preparation on the flaking surface is more varied with unipolar, bipolar and centripetal working.

	Length (mm)	Width(mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)
Mean	131.3	111.5	43.7	0.887	0.413
Median	137.8	96.0	45.0	0.694	0.469
Min	108.4	95.7	37.6	0.650	0.263
Max	147.7	142.7	48.5	1.316	0.507
SD	20.440	27.049	5.565	0.373	0.131

Table 5.187 Average dimensions of prepared cores from East Howe (n=3).

Type of prepared core	%	Blank type	%
Proto-Levallois	100	Nodule	100
Method of preparation	**%**	**Method of exploitation**	**%**
Unipolar	33.3	Lineal	66.6
Bipolar	33.3	Unexploited	33.3
Centripetal	33.3		
Earlier surface	**%**	**Type of products**	**%**
None	100	Flake	66.6
		None	33.3
Number of preferential removals	**%**	**Position of scar on striking surface**	**%**
0	33.3	Proximal and Distal	100
1	66.6		
Preparation on striking surface	**%**	**Preparation on flaking surface**	**%**
4	66.6	4	33.3
7	33.3	5	33.3
		8	33.3
% Cortex on striking platform surface	**%**	**Position of cortex on striking platform surface**	**%**
10	33.3	One edge	33.3
50	33.3	Central and one edge	33.3
70	33.3	Central and more than one edge	33.3
Pattern of accentuated convexities	**%**	**Description of accentuated convexities**	**%**
None	100	None	100

Table 5.188 Technological analysis of prepared core technology from East Howe (n=3).

The preferential flake scars are larger than the Levallois flakes found (Table 5.189 + 5.190). This contrasts with the majority of sites in the study, but the small sample from East Howe and the larger size of the prepared cores should both be noted. In addition, these averages are also within the range of regular flakes from the site.

	Length (mm)	Width(mm)	Elongation (W/L)
Mean	88.3	75.7	0.859
Median	88.3	75.7	0.859
Min	86.7	68.6	0.763
Max	89.9	82.8	0.955
SD	2.263	10.041	0.136

Table 5.189 Average dimensions of preferential scars on prepared cores from East Howe (n=2).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	71.9	56.5	15.7	0.793
Median	72.2	54.1	15.5	0.841
Min	64.3	51.4	14.9	0.649
Max	79.2	64.1	16.8	0.888
SD	7.455	6.691	0.971	0.127

Table 5.190 Average dimensions of Levallois flakes from East Howe (n=3).

There are two probable Levallois flakes from East Howe and one possible flake, but no points (Table 5.191). Two of the flakes contain faceting, while one has a dihedral butt. All flakes lack cortex and two show higher numbers of preparation scars in a mixture of centripetal and unipolar preparation. The condition of the material fits within the general Acheulean assemblage. While one of the cores is more heavily abraded, so are over 15% of the flake assemblage. There are no indications that the PCT is separate to the Acheulean.

Confidence of Levallois	**%**	**Butt type**	**%**
Probably	66.6	Faceted	66.6
Possible	33.3	Dihedral	33.3
Morphology of products	**%**	**Previous removals**	**%**
Flake	100	0	100
Dorsal scar count	**%**	**Preparation scars**	**%**
2	33.3	2	33.3
6	33.3	6	33.3
8	33.3	8	33.3
Method of preparation	**%**	**Method of exploitation**	**%**
Unipolar	66.6	Lineal	100
Centripetal	33.3		
Cortex	**%**		
None	100		

Table 5.191 Technological analysis of Levallois flakes from East Howe (n=3).

Summary

East Howe is a small Acheulean assemblage that is dominated by handaxes. The flakes, flake tools and unprepared cores show small glimpses of other components of the Acheulean. The significance of the site is the PCT associated with the Acheulean material.

5.3.3 Harvey's Lane

Condition

The artefacts are in a moderate to heavily abraded condition with evidence for moderate edge damage (Table 5.192). No discrete assemblages can be identified within the Harvey's Lane material.

	Flakes	Cores	Prepared cores	Levallois flakes	All material
n	55	1	5	1	62
Abrasion					
Moderate	61.82	100.00	40.00	100.00	61.29
Heavy	38.18	0.00	60.00	0.00	38.71
Edge Damage					
Light	1.82	0.00	0.00	100.00	3.23
Moderate	98.18	100.00	100.00	0.00	96.77
Patina					
None	41.82	0.00	80.00	100.00	45.16
Light	20.00	0.00	0.00	0.00	17.74
Moderate	27.27	0.00	20.00	0.00	25.81
Heavy	10.91	100.00	0.00	0.00	11.29
Staining					
None	38.18	0.00	0.00	100.00	43.55
Yes	61.82	100.00	100.00	0.00	56.45
Scratching					
None	98.18	0.00	0.00	100.00	96.77
Yes	1.82	100.00	100.00	0.00	3.23
Battering					
None	100.00	100.00	100.00	100.00	100.00

Table 5.192 Condition of material from Harvey's Lane.

Site Formation

Flake size distribution shows a derived site lacking smaller flakes, but the sample size is small (Figures 5.43+ 5.44).

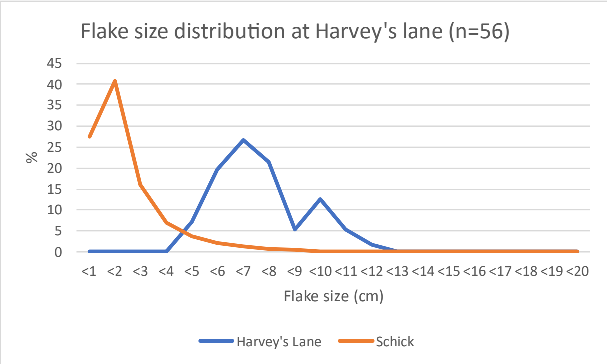


Figure 5.43 Flake size at Harvey's Lane.

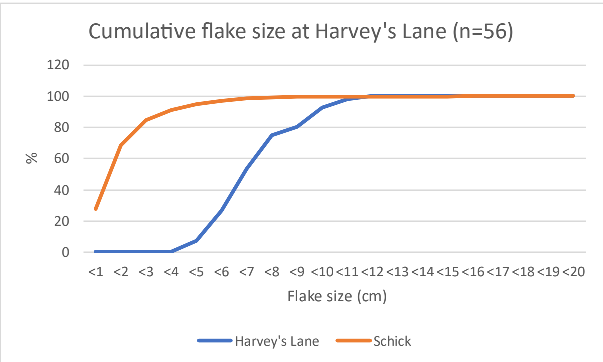


Figure 5.44 Cumulative flake size at Harvey's Lane.

Non-handaxe

Harvey's Lane has not been characterised as containing a non-handaxe signature, and the site does not contain any evidence for a separate assemblage.

Flakes

Flakes were medium sized with little evidence for elongation (Table 5.193). The flakes show typical Acheulean traits such as marginal and dihedral butts, despite lacking any diagnostic soft hammer flakes (Table 5.194). Like East Howe, complex dorsal scar patterns are rare with flakes having simple unipolar dorsal scar patterns, with only a few removals. Flakes show a full range of working with the majority being from the later stages.

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	71.7	61.6	22.1	0.897
Median	66.4	60.7	19.1	0.902
Min	44.3	29.7	8.3	0.461
Max	114.5	97.1	53.7	1.540
SD	17.446	15.862	9.209	0.276

Table 5.193 Average dimensions of flakes from Harvey's Lane (n=55).

Butt type	%	Hammer mode	%
Plain	49.09	Hard	85.45
Marginal	23.64	Indeterminate	14.55
Mixed	12.73		
Missing	10.91		
Dihedral	3.64		
Dorsal scar count	**%**	**Dorsal scar pattern**	**%**
0	5.45	Natural	5.45
1	30.91	Uni	69.09
2	36.36	Bi	10.91
3	16.36	Multi	14.55
4	9.09		
5	1.82		
Cortex %	**%**	**Flake type**	**%**
0	34.55	1	5.45
10	14.55	2	9.09
20	12.73	3	9.09
30	9.09	4	41.82
40	5.45	5	34.55
50	9.09		
60	3.64		
70	1.82		
80	3.64		
90	1.82		
95	1.82		
100	1.82		
Whole/ broken	**%**	**Type of break**	**%**
Whole	89.09	None	89.09
Broken	10.91	Missing butt	10.91

Table 5.194 Technological analysis of flakes from Harvey's Lane (n=55).

Cores

Six cores were recovered from Harvey's Lane. The only unprepared core is a chopper core. The chopper core shows an alternative episode of several removals working one end of the core (Table 5.195). The core is large and heavy and shows more traditional chopper core traits than those from East Howe.

Type	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)	Cortex %	Weight	# episodes	# removals	Episode 1
Chopper core	128.1	130.2	55.2	1.016	0.424	70	1114.1	1	7	7C

Table 5.195 Technological analysis of unprepared core from Harvey's Lane.

Flake Tools

No flake tools were recovered from Harvey's Lane, but some naturally damaged flakes could have previously been interpreted as flake tools.

PCT

Five prepared cores were identified at the site. The cores are made on nodules and show traits of being prepared, but two are not completely diagnostic (Table 5.196).

Type of prepared core	**%**	**Blank type**	**%**
Proto-Levallois	60	Nodule	100
Proto-Levallois/MPC	40		
Method of preparation	**%**	**Method of exploitation**	**%**
Unipolar	20	Lineal	40
Bipolar	60	Unexploited	20
Centripetal	20	Recurrent	40
Earlier surface	**%**	**Type of products**	**%**
None	100	Flake	80
		None	20
Number of preferential removals	**%**	**Position of scar on striking surface**	**%**
0	20	Proximal and Distal	100
1	40		
2	40		
Preparation on striking surface	**%**	**Preparation on flaking surface**	**%**
2	40	2	40
3	20	3	20
4	20	7	20
5	20	9	20
% Cortex on striking platform surface	**%**	**Position of cortex on striking platform surface**	**%**
20	20	Central and more than one end	60
50	40	Central and one end	20
70	20	One edge	20
90	20		
Pattern of accentuated convexities	**%**	**Description of accentuated convexities**	**%**
None	100	None	100

Table 5.196 Technological analysis of prepared cores from Harvey's Lane (n=5).

The cores all lack accentuated convexities, but have been prepared unipolarly, bipolarly and centripetally. All preparation is on the distal and proximal edges of the striking platform, common in MIS 9 Proto-Levallois cores. One of the cores was left unexploited while the rest show a mixture of lineal and recurrent exploitation. There is no evidence of points being prepared. The striking surfaces have been minimally prepared with a few removals. This is in contrast to the flaking surface which tends to have been prepared more intensely with little cortex remaining.

The cores are large but with little evidence of elongation (Table 5.197). The average flattening is not distinct from the chopper core although the lower range of ~0.2 shows that some of these cores were flatter in nature.

	Length (mm)	Width(mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)
Mean	102.7	105.4	42.6	1.113	0.410
Median	91.7	98.9	36.5	0.849	0.427
Min	68.7	75.1	32.1	0.746	0.263
Max	143.5	138.6	62.5	1.802	0.513
SD	33.524	24.964	13.125	0.453	0.104

Table 5.197 Average dimensions of prepared cores from Harvey’s Lane (n=5).

The preferential flake scars on the core show evidence for removals that were wide (Table 5.198), but smaller than regular flakes from the site.

	Length (mm)	Width(mm)	Elongation (W/L)
Mean	52.7	63.2	1.349
Median	46.8	62.7	1.324
Min	31.5	48.5	0.617
Max	78.6	81.4	2.041
SD	19.628	10.961	0.517

Table 5.198 Average dimensions of preferential scars from prepared cores at Harvey’s Lane (n=6).

One probable Levallois flake was identified (Table 5.199). The flake contains a complex dorsal scar pattern showing centripetal preparation with a faceted butt. While this is an isolated find it adds to the picture of the PCT at the site. Typical of other sites the flake is larger than the negative scars left on the prepared cores.

Confidence	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)	Cortex %	Butt Type	Dorsal Scar Count	Morphology of product	# of previous Levallois	# of prep scars	Method of exploitation	Method of Preparation	Pattern of convexities
Probable	76.7	52.5	12.9	0.684	5	Faceted	6	Flake	None	6	Lineal	Centripetal	None

Table 5.199 Technology of Levallois flake from Harvey’s Lane.

Summary

Harvey's Lane offers another small but significant PCT site in the Solent. The assemblage is dominated by handaxes and typical Acheulean working with no signs of a non-handaxe signature or flake tools. Its significance lies in the presence of PCT.

5.3.4 Warsash

Condition

The artefacts are in a moderate to heavily abraded state with moderate evidence of edge damage (Table 5.200). The prepared cores from the site show lower levels of abrasion and higher levels of patination. These findings correspond with the observations of Davis *et al.* (2016) of Levallois material being fresher, although this difference is less marked in the flakes and only includes small amounts of material. The flake tools from the site are in similar condition to the flakes and cores.

Site formation

Flake size analysis shows high levels of winnowing and collection bias consistent with the condition of the artefacts (Figures 5.45+5.46).

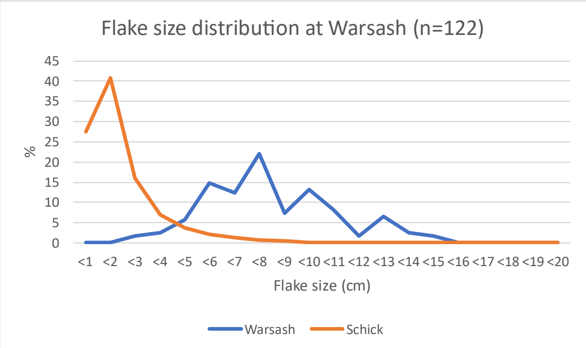


Figure 5.45 Flake size analysis at Warsash.

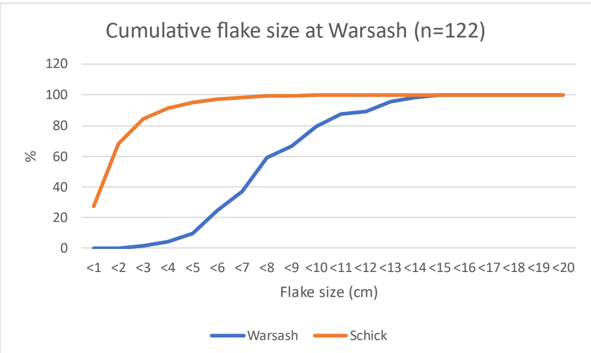


Figure 5.46 Cumulative flake size analysis at Warsash.

	Flakes	Flake tools	Cores	Prepared cores	Levallois flakes	All material
n	87	28	8	3	7	133
Abrasion						
Light	14.94	25.00	0.00	66.67	0.00	16.54
Moderate	68.97	67.86	75.00	33.33	100.00	69.92
Heavy	16.09	7.14	25.00	0.00	0.00	13.53
Edge Damage						
Light	36.78	57.14	25.00	100.00	57.14	42.86
Moderate	62.07	42.86	75.00	0.00	42.86	56.39
Heavy	1.15	0.00	0.00	0.00	0.00	0.75
Patina						
None	27.59	32.14	25.00	0.00	0.00	26.32
Light	28.74	39.29	12.50	33.33	28.57	30.08
Moderate	18.39	21.43	25.00	66.67	14.29	20.30
Heavy	25.29	7.14	37.50	0.00	57.14	23.31
Staining						
None	89.66	96.55	75.00	100.00	42.86	87.22
Yes	10.34	3.45	25.00	0.00	57.14	12.78
Scratching						
None	96.55	100.00	100.00	100.00	100.00	97.74
Yes	3.45	0.00	0.00	0.00	0.00	2.26
Battering						
None	100.00	96.43	100.00	100.00	100.00	99.25
Yes	0.00	3.57	0.00	0.00	0.00	0.75

Table 5.200 Condition of artefacts from Warsash.

Non-handaxe

There are no convincing signs of a separate non-handaxe signature.

Flakes

The flakes include a significant proportion of soft hammer working, alongside indeterminate flakes with marginal and dihedral butts (Table 5.201). The dorsal scars show evidence of long multidirectional patterns although on average sequences were shorter and often unidirectional. The flakes represent all stages of the knapping process but are bias towards later stages.

Butt type	%	Hammer mode	%
Plain	47.13	Hard	73.56
Marginal	35.63	Indeterminate	10.34
Dihedral	9.20	Soft	16.09
Mixed	5.75		
Conical	1.15		
Cortical	1.15		
Dorsal scar count	**%**	**Dorsal scar pattern**	**%**
0	1.15	Natural	1.15
1	8.05	Uni	47.13
2	17.24	Bi	21.84
3	32.18	Multi	29.89
4	14.94		
5	11.49		
6	8.05		
7	2.30		
8	3.45		
9	1.15		
Cortex	**%**	**Flake type**	**%**
0	55.17	1	1.15
5	6.90	2	2.30
10	18.39	3	2.30
20	6.90	4	40.23
30	5.75	5	54.02
40	1.15		
50	2.30		
70	2.30		
100	1.15		
Whole/broken	**%**	**Type of break**	**%**
Whole	98.85	None	98.85
Broken	1.15	Lateral snap	1.15

Table 5.201 Technological analysis of flakes from Warsash (n=87).

The average flake size shows a lack of smaller flakes (Table 5.202). There is some evidence of elongation in the flakes.

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	74.5	56.7	16.4	0.810
Median	71.5	54.2	14.3	0.732
Min	26.4	21.3	5.0	0.360
Max	132.9	129.5	97.0	2.780
SD.	23.548	21.006	10.895	0.369

Table 5.202 Average dimensions of flakes from Warsash (n=87).

Cores

The cores examined from Warsash included three prepared cores. The rest are primarily MPCs, with examples of a chopper and discoidal core (Table 5.203). The latter two examples are not distinct in condition. The remaining cortex on the cores varies, with the discoidal core showing heavy utilisation and the rest showing larger amounts of residual cortex. The cores also show short sequences of removals with only a few exceptions such as the discoidal core. Many of the cores show evidence of parallel sequences rather than alternative working.

Field Artefacts #	Type	Cortex %	# episodes	# removals	Episode 1	Episode 2	Episode 3
131	MPC	50	1	7	7C		
133	Discoidal	5	2	14	8B	6B	
134	Chopper core	40	2	5	1A	4C	
136	MPC	40	2	5	4B	1A	
Port 1965 58 3	MPC	70	1	4	4C		
Port 1965 4	MPC	30	3	5	2B	2B	1D
Port 1965 58 2	MPC	40	2	4	2B	2B	
2174	MPC	30	3	8	4C	2B	2B

Table 5.203 Technological analysis of cores from Warsash.

The cores from Warsash are regular in size, with evidence for slight elongation and flattening (Table 5.204).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)
Mean	95.0	81.7	54.1	0.850	0.709
Median	91.7	76.8	53.9	0.832	0.696
Min	65.2	53.3	37.3	0.718	0.296
Max	126.0	125.9	74.9	1.010	1.013
SD	19.203	24.487	12.882	0.113	0.227

Table 5.204 Average dimensions of cores from Warsash (n=8).

Flake tools

Over half of the 28 flake tools examined were invasively retouched (Table 5.205). The majority of the retouch is direct, continuous, convex and regular. The tools are side, convergent and end scrapers. On average, the flake tools show long sequences of retouch with some possibly showing attempts at flake handaxes. The flake tools show no connection to the PCT.

Type of flake tool	%	Extent of retouch	%
Side scraper	57.14	Minimally Invasive	17.86
Convergent scraper	17.86	Semi-invasive	28.57
End scraper	10.71	Invasive	53.57
Double scraper	7.14		
Unifacial handaxe	3.57		
Notched Side Scraper	3.57		
Distribution	**%**	**Position of retouch**	**%**
Continuous	82.14	Direct	100.00
Discontinuous	17.86		
Location of retouch	**%**	**Form of retouch**	**%**
Right	42.86	Convex	75.00
Convergent on distal	14.29	Rectilinear	10.71
Distal	14.29	Concave	10.71
Left	10.71	Both convex and concave	3.57
Left and right	10.71		
All around	7.14		
Angle of retouch	**%**	**Regularity**	**%**
Semi-abrupt	96.43	Regular	71.43
Abrupt	3.57	Irregular	28.57
Morphology of retouch	**%**	**Length of retouch**	**mm**
Sub-parallel	57.14	Mean	102.3
Stepped	28.57	Median	82.8
Scaly	10.71	Min	30.6
Parallel	3.57	Max	300.1
		SD	61.069

Table 5.205 Technological analysis of flake tools from Warsash (n=28).

On average flake tools from Warsash are larger than regular flakes, but do not show evidence of increased elongation (Table 5.206).

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	90.2	78.2	25.5	0.902
Median	86.7	78.7	24.6	0.863
Min	39.5	22.3	7.5	0.296
Max	148.4	139.0	57.1	1.621
SD	29.828	29.819	10.978	0.327

Table 5.206 Average dimensions of flake tools from Warsash (n=28).

PCT

A mixture of Proto-Levallois and Levallois cores are known from Warsash (Table 5.207). These cores were made on nodules and centripetally prepared. There are examples of both lineal and recurrent exploitation, as well as an unexploited core. The cores show evidence for long sequences of preparation on both the striking and flaking surfaces. Two examples show developed Levallois traits such as control of the accentuated convexities, which is rare for MIS 9 examples. On average the prepared cores were smaller than regular cores and were less elongated, but with a higher degree of flattening (Table 5.208).

Type of prepared core	**%**	**Blank type**	**%**
Levallois	66.67	Nodule	100.00
Proto-Levallois	33.33		
Method of preparation	**%**	**Method of exploitation**	**%**
Centripetal	100.00	Lineal	33.33
		Unexploited	33.33
		Recurrent	33.33
Earlier surface	**%**	**Type of products**	**%**
None	100.00	Flake	66.67
		None	33.33
Number of preferential removals	**%**	**Scars of striking platform**	**%**
0	33.33	All around	66.67
1	33.33	Distal and proximal	33.33
2	33.33		
Preparation on striking surface	**%**	**Preparation on flaking surface**	**%**
7	33.33	5	33.33
8	33.33	6	33.33
10	33.33	7	33.33
% Cortex on striking platform surface	**%**	**Position of cortex on striking platform surface**	**%**
10	33.33	Central	100.00
20	33.33		
30	33.33		
Pattern of accentuated convexities	**%**	**Description of accentuated convexities**	**%**
None	66.67	None	66.67
Lateral	33.33	Minimally Invasive	33.33

Table 5.207 Technological analysis of prepared cores from Warsash (n=3).

	Length (mm)	Width(mm)	Thickness (mm)	Elongation (W/L)	Flattening (Th/W)
Mean	78.3	86.5	35.8	1.105	0.405
Median	76.1	91.3	32.4	1.061	0.355
Min	71.7	76.1	20.1	1.055	0.264
Max	87.2	92.0	54.9	1.200	0.597
SD	7.988	8.985	17.647	0.082	0.172

Table 5.208 Average dimensions of prepared cores from Warsash (n=3).

Seven Levallois flakes were identified many of which had faceted butts and showed a high level of preparation through centripetal or bipolar dorsal scar patterns (Table 5.209). The flakes show evidence of being removed in a linearly, and contain either no or minimal residual cortex. The flakes along with the cores show a form of PCT at the site.

Confidence of Levallois	**%**	**Butt type**	**%**
Possible	71.43	Facetted	71.43
Probable	28.57	Plain	28.57
Morphology of product	**%**	**Previous removals**	**%**
Flake	100.00	0	100.00
Dorsal scar count	**%**	**Preparation scars**	**%**
5	28.57	5	28.57
6	14.29	6	14.29
7	14.29	7	14.29
8	14.29	8	14.29
9	14.29	9	14.29
12	14.29	12	14.29
Method of preparation	**%**	**Method of exploitation**	**%**
Centripetal	71.43	Lineal	100.00
Bipolar	28.57		
Cortex	**%**		
0	85.71		
5	14.29		

Table 5.209 Technological analysis of Levallois flakes from Warsash (n=7).

The Levallois flakes are larger than regular flakes from Warsash as well as the preferential flake scars from the prepared cores (Table 5.210+5.211). They also show higher degrees of elongation.

	Length (mm)	Width (mm)	Thickness (mm)	Elongation (W/L)
Mean	94.7	67.8	15.5	0.728
Median	93.6	64.3	15.1	0.680
Min	78.3	56.9	12.4	0.608
Max	120.6	86.1	19.1	1.100
SD	13.931	11.159	2.752	0.170

Table 5.210 Average dimensions of Levallois flakes from Warsash (n=7).

	Length (mm)	Width (mm)	Elongation (W/L)
Mean	66.6	50.2	0.811
Median	70.8	58.0	0.819
Min	51.7	27.1	0.350
Max	77.4	65.4	1.265
SD	10.898	16.588	0.374

Table 5.211 Average dimensions of preferential removals from Warsash (n=4).

Summary

The site of Warsash shows an Acheulean core and flake assemblage in a derived condition. There is no evidence of a non-handaxe signature, and the core and flake working are indicative of Acheulean handaxe manufacture. Flake tools from the site, while being few in number, show a number of well-made flake tools. The PCT from Warsash likely represents a later assemblage.

5.3.5 Miscellaneous Solent

From the additional Solent sites mentioned in Chapter Four, representative samples could not be examined. However, several observations could be made. The following PCT could be identified. Levallois flakes were identified from Kings Park and Thistlebarrow Pit. These flakes show faceted butts with either convergent or centripetal preparation. Evidence for fully developed Levallois cores came from sites such as Moordown, Troke's Winton and Fishermans Walk showing lineal removals from centripetally prepared cores. Dating this material is problematic, and the sites lacked wider assemblages to analyse.

A prepared core was analysed from Red Barns (Table 5.212). This matched the observations of Bolton (2015) who described two SPCs in fresh condition but with heavy patination which were centripetally prepared before being lineally exploited to produce flakes.

Field Artefacts #	Length (mm)	Width (mm)	Thickness (mm)	Elongation W/L	Flattening Th/W	Condition	Patination	Edge damage
Port 1976 359	146.4	112.1	66.2	0.76571	0.590544	Light	Heavy	Light

Method of prep	Method of exploit	Description of products	# def Lev scars	Number of prep on flaking surface	Number of prep on striking surface	Scars on striking platform	Position of cortex on striking platform surface
centripetal	Lineal	Flake	1	4	7	Proximal and distal and one edge	Central and one edge

Table 5.212 Technological analysis of prepared core from Red Barns.

Eight flakes from Cams, Fareham, listed as Levallois in Portsmouth Museum were more indicative of handaxe manufacture. These flakes showed marginal or dihedral butts with clear evidence for soft hammer working. It has been suggested by Roe (1968a) that Romsey contained evidence for Levallois. The 15 flakes examined show no signs of Levallois technology. The flakes show simple working with short simple dorsal scar patterns from the later stages of knapping. Other than two simple scrapers, nothing of note was analysed, from a small sample.

Material in Portsmouth Museum from Rainbow Bar was examined (25 cores, 3 flakes) which showed clear evidence of derived Lower Palaeolithic core and flake working, but it was clear that this could not be isolated from artefacts from other periods.

5.4 Summary- Core and flake working in MIS 9 Britain

The results presented in this chapter characterise the archaeology of MIS 9 as typical of the Acheulean during the British Lower Palaeolithic (Tables 5.213+ 5.214). The only distinctions are the non-handaxe signature during MIS 10/9 and appearance of PCT later in the interglacial. However, most sites are characterised by handaxe manufacture, represented in this study by the presence of soft hammer flakes. This concurs with the work of Dale (Pers. Comm. 2021) who has classified many of the sites above as Roe (1968b) Group I assemblages. This collaborates the pattern forwarded by White *et al.* (2018; White and Bridgland, 2018), and is evidence of temporal variation in the British Acheulean. Little regional or temporal variation can be seen in this study, but this is more likely to be noticeable in the handaxes of the period.

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Table 5.213 Summary of unprepared cores from MIS 9 sites.

Site	*n*	Type of core					Average number of Core episodes	Average number of removals	PCT
		MPC	Chopper	Discoidal	Fragment	Misc.			
Non-handaxe assemblages									
Cuxton (Cruse 1-6)	4	100	-	-	-	-	2.25	7.25	
Globe Pit	10	90	-	-	-	10	2.10	4.30	
Handaxe assemblage									
Baker's Farm	3	100	-	-	-	-	2.33	6.33	Y
Barnham Heath	32	75	9.38	-	-	15.23	2.47	5.75	Y
Biddenham	13	53.85	-	30.77	-	15.38	2.46	6.92	Y
Cuxton (Cruse 7+)	3	66.6	-	-	-	33.3	1.67	3.33	
Cuxton (Tester)	23	65.22	30.43	-	4.34	-	1.91	4.30	Y
Dunbridge	14	85.71	7.14	-	-	7.14	2.79	6.79	Y
East Howe	2	50	50	-	-	-	1	5	Y
Furze Platt	2	100	-	-	-	-	3	6	
Grays Thurrock	3	66.6	33.3	-	-	-	2	4	
Grovelands Pit	28	85.71	7.14	-	3.57	3.57	2.71	7.21	
Harvey's Lane	1	-	100	-	-	-	1	7	Y
Kempston	5	80	20	-	-	-	2.2	7	Y
Lent Rise	1	100	-	-	-	-	1	4	
Lower Clapton	1	100	-	-	-	-	5	11	
Purfleet (Greenlands, Beds 5-6)	4	100	-	-	-	-	3.5	7	Y
Sonning Railway Cutting	1	100	-	-	-	-	3	6	Y
Station Pit, Kennett/Kentford	5	100	-	-	-	-	2.2	7.4	
Stoke Newington	13	76.92	7.69	-	15.38	-	1.85	4.46	
Sturry	11	81.82	9.09	9.09	-	-	2.18	8.36	
Warsash	8	75	12.5	12.5	-	-	2	6.5	Y
Prepared core technology assemblage									
Botany Pit	167	93.41	1.80	1.80	1.80	1.20	2.35	6.44	Y

Table 5.214 Summary of flakes from MIS 9 sites.

Sites	***n***	**Hammer**			**Flake type**					**Dorsal scar pattern**				**Butt Type**							
		Hard	Ind.	Soft	1	2	3	4	5	Nat.	Uni.	Bi.	Multi.	Plain	Marginal	Mixed	Dihedral	Cortical	Faceted	Missing	Misc.
Non-handaxe assemblages																					
Cuxton (Cruse 1-6)	110	80.91	19.09	-	17.27	8.18	6.36	51.82	16.36	18.18	53.64	16.36	11.82	40.91	29.09	10	3.64	8.18	-	7.27	0.91
Globe Pit	551	90.56	9.44	-	15.43	7.99	3.45	49.91	23.23	17.79	67.51	11.25	3.45	59.53	9.98	14.34	1.27	4.36	-	10.16	0.36
Handaxe assemblage																					
Baker's Farm	307	69.5	23.2	7.34	3.47	3.86	2.7	61	29	5.41	57.9	29	7.72	56.4	23.2	6.18	1.93	1.54	-	7.34	3.37
Barnham Heath	308	77.92	16.56	5.52	3.90	7.14	2.60	53.57	32.79	4.22	58.12	21.75	15.91	52.92	19.48	6.82	3.90	3.90	0.32	10.06	2.60
Biddenham	517	71.57	21.28	7.16	3.87	7.54	2.32	44.87	41.39	5.03	54.93	22.63	17.41	46.23	25.60	6.58	4.26	6	0.77	8.12	1.55
Cuxton (Cruse 7+)	162	50	40.12	9.88	22.22	14.20	6.17	41.98	15.43	29.63	51.85	8.64	9.88	26.54	44.44	10.49	0.62	5.56	-	11.11	1.23
Cuxton (Tester)	429	65.97	32.17	1.63	13.08	15.65	5.84	50.93	14.49	20.79	49.07	13.79	16.36	29.91	32.24	17.99	1.64	2.80	-	14.72	0.7
Dunbridge	117	78.63	15.38	5.98	7.69	11.97	5.98	45.30	29.06	9.40	57.26	23.26	9.40	68.38	7.89	7.69	1.71	1.71	-	5.13	7.69
East Howe	35	80	20	-	2.86	8.57	0	42.86	45.71	5.71	62.86	8.57	22.86	22.86	28.57					20	
Furze Platt	324	72.53	19.44	8.02	13.58	6.48	8.02	49.38	22.53	14.81	50	19.75	15.43	45.99	34.57	8.33	0.31	0.93	0.31	8.64	0.93
Grays Thurrock	124	77.42	14.52	8.06	1.61	14.52	4.03	50	29.84	10.48	73.39	8.87	7.26	59.68	16.13	10.48	-	0.81	-	8.06	4.84
Grovelands Pit	122	84.43	10.66	4.92	0.82	3.28	0.82	57.38	37.7	0.82	42.62	21.31	35.25	65.57	6.56	5.74	3.28	0.82	-	11.48	6.56
Harvey's Lane	55	85.45	14.55	-	5.45	9.09	9.09	41.82	34.55	5.45	69.09	10.91	14.55	49.09	23.64	12.73	3.64	-	-	10.61	-
Kempston	125	81.6	16	2.4	9.6	5.6	4.8	32.8	47.2	10.4	44	19.2	26.4	53.6	25.6	6.4	2.4	3.2	-	8	0.8
Lent Rise	120	87.50	8.33	4.17	14.17	6.67	2.50	50.83	25.83	19.17	45	24.17	11.67	50	25	6.67	0.83	4.17	-	13.33	-
Lower Clapton	19	89.47	5.26	5.26	0	21.05	0	63.16	15.79	15.79	57.89	10.53	15.79	57.89	-	21.05	-	15.79	-	5.26	-
Purfleet (Greenlands, Bed 5-6)	72	61.11	20.83	18.05	2.76	15.28	15.28	47.22	13.89	15.28	43.08	31.94	9.72	43.06	25	12.5	1.39	8.33	-	5.55	4.18
Sonning Railway Cutting	23	56.52	34.78	8.70	0	0	0	56.52	43.48	0	21.74	17.39	60.87	60.87	13.04	-	8.70	-	4.35	13.04	-
Station Pit, Kennett/Kentford	168	76.79	16.97	7.14	1.79	0.60	0.60	38.10	58.93	2.96	42.60	31.36	22.49	47.02	23.21	13.10	2.98	1.19	-	10.71	1.79
Stoke Newington	481	78.38	20.17	1.46	10.60	6.44	3.74	50.52	28.69	11.02	49.48	17.88	21.62	45.32	31.60	11.64	1.25	1.66	-	8.52	-
Sturry	34	41.18	44.12	14.71	0	2.94	5.88	47.06	44.12	0	55.88	23.53	20.59	26.47	47.06	17.65	-	2.94	-	5.88	
Warsash	87	73.56	10.34	16.09	1.15	2.30	2.30	40.23	54.02	1.15	47.13	21.84	29.89	47.13	35.63	5.75	9.20	2.25	-	-	1.15
Wolvercote	13	15.39	76.92	7.69	0	7.69	0	38.46	53.85	7.69	38.46	30.77	23.08	38.46	30.77	-	7.69	-	-	23.08	-
PCT assemblage																					
Botany Pit	458	74.02	20.52	5.46	11.57	14.41	5.02	53.60	15.94	14.85	60.70	20.96	3.49	62.66	18.34	5.90	0.66	2.84	0.22	5.68	3.71

From a core and flake perspective, little can be added to our understanding of change during the period as variation is low outside of changes in handaxes. Both the preservation and collection of cores and flakes varies, but without these biases the technology is mainly homogenous. Unprepared cores are predominantly MPCs with examples of chopper cores, discoidal cores and more ambiguous examples (Table 5.213). Discoidal cores are not found in non-handaxe assemblages in the period and are most common at sites with evidence for PCT. Despite previous work suggesting a link between chopper cores and non-handaxe assemblages (Paterson, 1937; Warren, 1951; Wymer, 1968), none are known from the non-handaxe sites during MIS 9, although they are present in many of the handaxe assemblages. The average number of core episodes and core removals are not clearly divided along the lines of non-handaxe and handaxe sites, further showing a lack of distinction between the core working at these assemblage types.

Data from the flakes also reinforces this lack of distinction by demonstrating that the only major difference between the assemblage types is the presence of soft hammer flaking in the handaxe assemblages (Table 5.214). While Harveys Lane and East Howe also lack soft hammer flakes, handaxes are known from these sites and the flake sample is small enough to miss soft hammer flakes, especially given the collection history in the Solent.

All assemblage types have yielded flakes which span all phases of working, with the only exceptions being sites with small samples. Globe Pit has a lower proportion of multidirectional dorsal scar patterns, which is also notable at Botany Pit. This could either show the lack of more complex dorsal scar patterns due to the lack of handaxe manufacture, or it could reflect lower levels of collection bias, with more basic flakes from the sites being collected. Butt types are similar across all assemblage types, other than faceting being exclusive to handaxe and PCT assemblages.

The core and flake working reflect previous conclusions (McNabb, 1992; 2007; 2020) that little differentiates the core and flake working of handaxe and non-handaxe assemblages. While the proportion of more complex dorsal scar patterns does seem to be linked to handaxe manufacture, it is one of proportion rather than a diagnostic trait. In addition, the flakes from the non-handaxe assemblage from Cuxton do not fit this pattern. The lack of difference in the cores also shows this is a direct reflection of handaxe working and not how cores and flakes were worked.

While the general core and flake working from the MIS 9 assemblages is typical of the Lower Palaeolithic, the lack of handaxe manufacture at Globe Pit, Cuxton and Purfleet requires further examination alongside other claims of ‘Clactonian’ working. Only three sites contain 50 or more flake tools, but while this is lower than previously thought there are further interesting patterns which will be discussed in Chapter Seven. The early signs of PCT are more widespread than Purfleet, but the significance of these needs to be examined further.

Chapter Six: MIS 9 Non-Handaxe Assemblages

The results of this study have shown that while the core and flake working of non-handaxe and handaxe assemblages do not differ outside of handaxe manufacture, there is a noticeable non-handaxe signature at the beginning of the interglacial. As the traditional Clactonian sites are well dated to early MIS 11, prior to handaxe making groups during the interglacial (Ashton *et al.,* 2016) it is important to emphasise that the non-handaxe sites of MIS 9 almost certainly represent a separate occurrence restricted to MIS 10/9. The presence of non-handaxe assemblages does not necessitate the return of the same group, which is why it is problematic to treat the non-handaxe assemblages of MIS 11 and MIS 9 as one unified Clactonian culture.

While the Clactonian has a long history of debate (detailed in Chapter Two), the MIS 9 non-handaxe stage signature is a more recently observed phenomenon (White and Schreve, 2000; White and Bridgland, 2018) due to advances in our understanding of the chronology of the Palaeolithic. The fledgling nature of the MIS 9 non-handaxe signature is inevitably treated with scepticism, even among those who have accepted the Clactonian (McNabb, 2007; 2020; Fluck, 2011; Wenban-Smith, 2013; Ashton, 2017). The aim of this chapter is to analyse the current evidence for this elusive non-handaxe signature (presented in Chapter Five) and place it in its wider context to examine what it can add to our knowledge of the Lower Palaeolithic.

6.1 Non-handaxe sites in MIS 9

While the non-handaxe signature during MIS 9 is not necessarily the same as the classic Clactonian of MIS 11, Pettitt and White's (2012:183) updated definition of the Clactonian is still a useful heuristic device to test the presence of these non-handaxe sites. The first step is that a site must have a separate Lower Palaeolithic core and flake industry, unprepared but probably undistinguishable from regular Acheulean assemblages. A number of tools, especially notches, denticulates and choppers, were often thought to be indicators of non-handaxe signatures, but it has become clear that their presence is not as significant as once thought (McNabb, 1992). McNabb (2007:100) has argued that over 500 artefacts are needed for a non-handaxe classification, preferably over 1000, and that time-depth is important to illustrate that these were not short-lived non-handaxe events in the landscape. Table 6.1 summarises sites dated to MIS 9 that have been described as being non-handaxe sites or containing 'Clactonian traits' (Figure 6.1).

Table 6.1 Summary of sites previously claimed to have Clactonian elements.

Site	Reason for association with Clactonian	Reference to 'Clactonian'	Amount of material examined	Acceptance of non-handaxe status	
				Y/N	Reason
Globe Pit, Little Thurrock	-Lack of handaxes and handaxe manufacture.	King and Oakley, 1936 Wymer, 1957	565	Yes	-Assemblage shows no signs of handaxe manufacture.
Cuxton	- Lack of handaxes and handaxe manufacture in a distinct layer preceding the Acheulean.	Cruse *et al.,* 1987	125 (Cruse 1-6) compared to 165 (Cruse 7+) and 488 (Tester)	Yes	-Cruse's layers 1-6 show no signs of handaxe manufacture. -Distinct from Layers 7+
Purfleet (Beds 1-3)	-Lack of handaxes and handaxe manufacture in a distinct layer preceding the Acheulean.	Palmer, 1975; Wymer, 1985	A few examples examined. Actual assemblage ~100	Yes	-While analysis was limited nothing contradicted previous work and the site is well recorded by Schreve *et al.,* 2002; Bridgland *et al.,* 2013. -Equivalent to Globe Pit
Grovelands Pit	- 'Clactonian artefacts' including chopper cores and retouched flakes (sometimes referred to as Mousterian). -Claims of distinct condition from handaxes	Barnes *et al.* ,1929; Roe, 1981; Wymer, 1988	209	No	-There is no clear distinction between core and flake working and handaxes, and no evidence of a separate assemblage. -Flake tools more advanced than other non-handaxe sites.
Baker's Farm	-Small number of artefacts at base of section. - Claims of 'Earliest Clactonian' and compared to Swanscombe. -Some flakes compared to Mousterian.	Breuil, 1932; Lacaille, 1940	313	No	-No proven separation from handaxe manufacture. -No distinction in condition.
Stoke Newington	-Large number of cores and flakes. -Chopper cores, denticulates and notches. -Clactonian III- advanced 'Mousterian character'.	Warren, 1912b; 1942	544	No	-No evidence of separation from handaxe manufacture. -No distinction in condition. -Flake tools more advanced than other non-handaxe sites.
Remenham	-Large core and flake assemblage with minimal evidence of handaxe manufacture.	Wymer, 1968	N/A	No	-Two handaxes found alongside assemblage. -Mixture with later prehistoric material. -Solution hollows.
Twydall	-Link to MIS 9 Group I sites. -Large core and flake collection. - 'Typologically Clactonian artefacts'.	Cook and Killick, 1924; Beresford, 2018	N/A	?No	-No evidence for a clear separation. -Based on Clactonian typologies rather than genuine separation. -Re-analysis outstanding (cf. Chapter 3).
Biddenham	-Large core and flake assemblage compared to Warren's collections. - Flake implements' including scrapers - 'Clactonian tortoise and disc cores'	Knowles, 1953	604	No	-No evidence of separation from handaxe manufacture. -No distinction in condition.
Kempston	-Similarity to Biddenham	N/A	165	No	-No evidence of separation from handaxe manufacture. -No distinction in condition.
Barnham Heath	-Mixed site with large core and flake component. - 'Clactonian cores'.	Roe, 1981	376	No	-No evidence of separation from handaxe manufacture. -No distinction in condition between handaxes and an unprepared core and flake assemblage. - 'Clactonian cores' are handaxe roughouts or chopper cores.
Southacre	-Flakes of Clactonian type. -Chopper cores and large flakes.	Sainty, 1935	N/A	?No	-Based on typological grounds. -No clear evidence of separation from handaxe manufacture. -Re-analysis outstanding (cf. Chapter 3).
Rainbow Bar	-Large core and flake assemblage with no evidence of handaxe manufacture.	Draper, 1951	28	No	-Heavily mixed, including later prehistoric material. -Little evidence for dating.

Figure 6.1 Location map of British sites discussed in Chapter Six.

Thames

The least disputed MIS 9 non-handaxe site is Globe Pit, Little Thurrock. The 565 artefacts examined from the site show no signs of handaxe manufacture. The site contains no chopper cores, but a mixture of simple and more complex MPCs. In agreement with McNabb (1992), there are no distinctively Clactonian characteristics at the site apart from the absence of soft hammer flakes and handaxes. The flake types do not show a particular stage of working with both large cortical flakes and smaller flakes with minimal cortex. Less than 15% show bi or multidirectional scar patterns showing a bias towards simple unidirectional removals. The flake tools from the site are low in number and mainly show typical Lower Palaeolithic flake tools along with one example of a 'Clactonian notch'.

What distinguishes this site is its lack of handaxe manufacture. The assemblage is only lightly abraded and has yielded smaller artefacts, indicating that the site is not majorly derived. This would increase the likelihood of finding smaller, more fragile soft hammer flakes. Globe Pit is the largest non-handaxe assemblage in MIS 10/9, lacks signs of handaxe manufacture and is dated to MIS 10/9 (Bridgland, 1994:237; Schreve, 1997; White, 2000:27 White and Schreve, 2000), making it the most convincing example of the non-handaxe signature in MIS 9.

However, concerns around the lack of time-depth represented by the channel margin still persist (McNabb, 2007:164).

While Purfleet, Little Thurrock member is more contested than Globe Pit (McNabb, 2007; Fluck, 2011) as a result of its small sample size of around 100 artefacts and low artefact density, the site has been excavated numerous times across an extensive area with no evidence of handaxe manufacture found (Schreve *et al.* 2002; Bridgland *et al.,* 2013). The main collection from the Palmer excavations cannot currently be located but is documented in Palmer (1975). Re-evaluation of the site has therefore been challenging. The Purfleet site, like others such as Biddenham, were originally labelled as Clactonian on the basis of typology, with Palmer (1975:12) only noting Clactonian elements within a Middle Acheulean industry. This was then expanded on by Wymer (1985:312), who established the tripartite sequence (Bridgland *et al.,*2013) including a separate non-handaxe layer in the basal gravels.

While the typological classification has been dismissed at other sites, Purfleet offers a stratigraphically distinct layer at a well understood site with the Acheulean attributed to Bed 6 later in the interglacial (Schreve *et al.,* 1998; Schreve *et al.,* 2002; Bridgland *et al.,* 2013). This, along with the correlation of the non-handaxe layer with Globe Pit, Little Thurrock, make this a viable non-handaxe site despite the low number of artefacts. From the material examined the only technological difference between the non-handaxe and Acheulean layers at Purfleet is the lack of handaxe manufacture in the basal gravels. Without a larger collection of material, the non-handaxe signature at Purfleet will remain contested but it is an interesting site which has expanded on the phenomenon observed from Globe Pit.

The site of Cuxton, also contested by McNabb (2007) and Fluck (2011) due to the small area of excavation, replicates the tripartite stratigraphy of Purfleet. No distinction could be made within the Tester material as it is likely that the Tester (1965) excavation only yielded artefacts from the higher handaxe assemblage. While no difference in condition could be substantiated within the Tester material, a slight difference could be noted in the Cruse material. Without the detailed recording this could have been overlooked.

Notches and denticulates are present in the Tester material but are not distinct in condition. There are no notches in Cruse's non-handaxe layer and denticulates only make up 20% of the flake tools, the rest being scrapers. While all the flake tools from Cruse's excavation come from the non-handaxe layer there are only ten of them. The flake tools are not technologically distinct compared to the Tester flake tools. The Tester material shows a mixture of MPCs, chopper cores (Figure 6.2) and PCT, but the Cruse material contains no chopper cores. The flakes from Cruse's excavation show a distinction between the two layers, with soft hammer flakes and handaxes only present in the higher levels. All stages of manufacture are accounted for in the flake types in both layers, refuting the idea of a roughing out area. Cruse's non-handaxe material, despite being low in number (125) and so failing McNabb's (2007) minimum number of artefacts, demonstrates a clearly distinct non-handaxe layer.

Figure 6.2 Chopper cores from Cuxton (Tester).

One remarkable occurrence is a potential prepared core (Figure 6.3) in the non-handaxe layer examined by Bolton (2015). The presence of PCT within the non-handaxe layer would challenge current understanding of the relationship between non-handaxe, Acheulean and PCT assemblages. While the core does look suggestive of preparation and has two flakes bipolarly removed off a flat surface, it is too small and undiagnostic with little evidence for preparation on the striking surface. Cruse (1987) referred to the core as 'miscellaneous', and it is dissimilar to the PCT from Botany Pit, Biddenham and even the Tester cores from Cuxton (Chapter Eight). Parsimoniously, the core represents a simple core fragment with little evidence of preparation. The other cores show simple alternative knapping to create MPCs, typical of core working in the Lower Palaeolithic.

Figure 6.3 Simple core previously referred to as a SPC (82.2mm).

Outside of the three established non-handaxe sites, other assemblages that have been mentioned as containing 'Clactonian' affinities can be dismissed as being based on outdated typological grounds. While older references including the works of Wymer (1968;1985) and Roe (1981) claimed other sites showed potential Clactonian working, there is no evidence to substantiate these claims. The assemblage from Grovelands Pit contains chopper cores, notches, denticulates and other simple flake tools, but these cannot be separated from evidence of handaxe manufacture by condition or excavation records.

Similar suggestions about Baker's Farm (Breuil, 1932; Lacaille, 1940) can be refuted on the same grounds with no clear evidence for a separate occupation. At Baker's Farm notches and denticulates (Figure 6.4) represent small proportions of the flake tools (6% and 2% respectively) with no chopper cores. Claims of the Clactonian may have come from some of the invasively retouched flake tools from these sites. This would be similar to Warren's (1942:174) claims of 'Clactonian III' at Stoke Newington, which was based on the large number of flakes, cores (including choppers) and well-made flake tools from the site rather than any distinct non-handaxe layer. These artefacts come from the same contexts (and share the same condition) as the handaxes and handaxe thinning flakes.

Figure 6.4 Notched flake from Baker's Farm.

Remenham was excluded from this study as there are issues with the dating of the site due to the artefacts coming from two solution hollows (Wymer, 1968:202-204; McNabb, 2007:171). In addition, two handaxes have been found in relation to the cores and flakes (Wymer, 1968:202-204; McNabb, 2007:171). Within the solution hollows, later prehistoric finds were also found showing disturbance (McNabb, 2007:171). There are too many unknowns to classify Remenham as a Lower Palaeolithic non-handaxe site, but further work in the area could help re-evaluate the archaeology.

Another site suggested to show Clactonian working is Twydall in Kent (Beresford, 2018). A recent study by Beresford (2018) has linked the site to MIS 9 after work has reaffirmed Roe's (1968b) Group I classification of the handaxes from the site. Material from Twydall was first collected by George Baker in 1908 and then by Cook and Killick in 1909-1910 (Cook and Killick, 1924). In the 1960's Andrew Woodcock collected another 1139 artefacts from the foreshore (Beresford, 2018:26). As cores and flakes represented over 80% of the material, there have been suggestions of a Clactonian industry (Roe, 1981:151; Beresford, 2018:28). Despite this, there has been no demonstration of a distinct non-handaxe layer. Roe (1981:231) noted that the working was more advanced than other Clactonian sites, and that handaxes and cleavers were found amongst the material. The lack of publication of the site and the confusion over context and dating has left Twydall out of major summaries of the Clactonian (White, 2000; McNabb, 2007). From the rest of this study and McNabb's work (1992;2007), it is likely that cores and flakes at Twydall represent Acheulean core and flake working. Unless a separation can be demonstrated the site cannot be proven to represent a non-handaxe signature.

The core and flake working at the other sites in this thesis conform with typical Lower Palaeolithic technology including some elements previously considered Clactonian in low numbers. The only major technological variation is the beginnings of PCT, as discussed in Chapter Eight.

Eastern England

Many sites in eastern England have large core and flake components leading to claims of Clactonian working (Knowles, 1953). The sites of Biddenham and Kempston show no convincing evidence for non-handaxe signatures. Handaxes and soft hammer flakes are found throughout both sites with no evidence of separate layers or distinctions in condition. The non-prepared cores are low in number but are typical of the Lower Palaeolithic with nothing to distinguish them from the broader Acheulean assemblage. One chopper core was examined from Kempston but was not distinct in condition, and chopper cores are also found within Acheulean contexts. Flakes and flake tools also show little distinction based on technology or condition. Therefore, claims of non-handaxe assemblages at these sites cannot be upheld by the current evidence.

The claims of Clactonian working at Barnham Heath are likely to have come from either the large proportion of cores and flakes, and/or the presence of chopper cores at the site. None of the flake tools are examples of previously diagnostic Clactonian artefacts. The cores that are labelled as being Clactonian artefacts are examples of handaxe roughouts or chopper cores. In addition there is an absence of the documentation of discrete layers at the site, with no clear differentiation in condition or technology between the handaxes and 'Clactonian artefacts'. Without further excavations to confirm a separate layer, the chopper cores are just evidence of base line technology being used at the site.

Southacre could not be evaluated due to the lack of access to the Norwich Castle Museum collections but based on previous literature, claims for Clactonian artefacts were founded on large flakes and chopper cores (Sainty, 1935:100). As demonstrated above, this typological approach is not enough to classify a site as containing a non-handaxe assemblage. Further study of the site may lead to a more nuanced understanding, but currently Southacre does not contain evidence for a distinct non-handaxe layer.

Based on the lack of any stratigraphic distinction, there is no evidence that a non-handaxe signature is present in eastern England, unlike the Thames. Any claims for 'Clactonian elements' are based on outdated definitions of the Clactonian, long since dismissed by McNabb (1992; 2007). The essential question here is whether this is a genuine absence, or an artifice created by the collection practices of the past.

The Solent

Little has been written about the potential for MIS 9 non-handaxe assemblages in the Solent area. This is not surprising given the dominance of handaxes in the Solent collections, a problem that also impedes the following chapters. Roe (2001:49-50) acknowledged the probability that individual industries were likely to be mixed in the Solent. This has led to a poorer understanding of the stratigraphy and age of many of the sites, although recent work has tried to rectify this (Westaway *et al.,* 2006; Davis *et al.,* 2016; Hatch *et al.*, 2017).

The only site Roe (2001:49) suggested as a Clactonian site was Rainbow Bar. From personal observation, while the site shows Lower Palaeolithic working in a moderate to heavily abraded condition it is also mixed with later prehistoric finds. Roe (2001:49) suggested that some bifaces and non-classic handaxes had been recovered from the site making it difficult to be sure of a non-handaxe classification. Reports of handaxes (Hack, 2000; 2004), Levallois (Draper, 1951) and later prehistoric material (McNabb, 2007:99) cast doubt on the sites dating and non-handaxe credentials. Its mixed nature, and lack of dating evidence make this site of limited value to this study.

The study of non-handaxe sites in the Solent is problematic and will remain so until further fieldwork offers larger and more systematically excavated sites. There are significant issues surrounding collection bias relating to Palaeolithic archaeology and these are exacerbated in the Solent (Hosfield, 1999:19). Hosfield (1999:23) recorded that a large number of flakes are known from the Solent area (6240) alongside around 170 cores. However, the excavated site of Red Barns comprises over 5150 of these. The site of Romsey also contains over 1000 flakes (Wymer, 1999). This leaves a huge dearth in flakes and cores throughout the rest of the Solent when compared to over 8000 handaxes (Wymer, 1999). The sites of Corfe Mullen, Wood Green, Dunbridge and Kimbridge all show the poor collection of cores and flakes (Wymer, 1999; Hosfield, 2001). The disparity in the practices of various antiquarians has had a major effect on the records we now have, due mainly to a focus on handaxes (Hosfield, 1999:32).

With the lack of primary context or *in situ* sites, along with paucity of core and flake collection or recognition, it is unsurprising that the Solent has little to add to our knowledge of British non-handaxe sites. As with the MIS 11 Clactonian, it is important to evaluate whether this absence is a genuine one.

Summary

This study has shown that while the corpus of MIS 9 non-handaxe sites cannot be expanded there is no reason to dismiss Purfleet, Cuxton or Globe Pit. The debates over the validity of the Clactonian, and the current definition, now allows us to dismiss many of the sites which have previously been noted as having Clactonian elements. There is a clear difference between the three sites accepted here as genuine non-handaxe signatures, and those which were only referred to as Clactonian due to old typologies or large core and flake collections. It is important to retain this clear distinction. This is why Twydall should not be considered unless there is substantial evidence of a clear separation of a non-handaxe layer. The correlation of Twydall with Roe's Group I by Beresford (2018), and previous discussion of Clactonian at the site, which would both fit in with the MIS 9 non-handaxe signature, is not enough without clear independent evidence from the site. This study maintains that, currently, the only difference between the non-handaxe signature and Acheulean of MIS 9 is the presence or absence of handaxe manufacture, and all typological attributions should be dismissed.

Wenban-Smith (2013:462) stated that the Clactonian of MIS 9 was much more ambiguous than the secure one of MIS 11. According to Wenban-Smith (2013:467) there are too few artefacts at Purfleet and Cuxton to accurately assign a culture and notes a lack of notched tools. This contradicts both the work of McNabb (1992;2007) and this research which shows that notched tools cannot be treated as diagnostic of non-handaxe assemblages. While Wenban-Smith (2013:468) does not dismiss the artefacts at Globe Pit, he questions the dating of the site arguing that the artefacts are derived from an older terrace. Given the lack of heavily abraded material and the work of Bridgland (1994) and Schreve *et al.* (2002), the notion that Globe Pit dates to MIS 11 seems improbable. As it is well established that the Clactonian was not the first occupation of Britain and succeeds an earlier Acheulean occupation, there is no reason why it could not reoccur in MIS 9.

While still having reservations about the size of the assemblages, the small area of excavation at Cuxton, time depth at Globe Pit and the density of the Purfleet non-handaxe layer, McNabb (2020) does not dispute the non-handaxe characteristic of the MIS 9 sites just the term Clactonian being applied. In order to evaluate how similar the MIS 9 non-handaxe signature is to the traditional Clactonian a comparison is offered below. This is essential in order to demonstrate that these sites are not just snapshots of core and flake working, but a distinct tradition during MIS 10/9.

6.2 The evidence from MIS 11

The British MIS 11 non-handaxe sites make up the traditional Clactonian. The sites all come from early Hoxnian contexts dated by biostratigraphy and the stratigraphic relation to the Anglian Till (Pettitt and White, 2012:183; Davis and Ashton, 2019). There have been claims of handaxes or bifaces in these contexts, but these have been persuasively critiqued by White (2000) and Pettitt and White (2012:178-9). McNabb (2007:14) later accepted that none of the 'bifaces' provided evidence to overturn any of the main Clactonian sites.

Clacton-on-Sea

The type site of the Clactonian is not one site but a five-kilometre stretch of foreshore including West Cliff, the Golf Course, the Butlin's site, Jaywick Sands and Lion Point (McNabb, 2007:63). The fluvial sediments are found within a former channel of the Thames, with overlying estuarine sediments (Davis and Ashton, 2019). Originally discovered by Kenworthy (1898), the site gained attention through extensive work and collection by Warren (1912b; 1922; 1923b; 1924; 1933; 1951; 1955; 1958). In contrast to the MIS 9 sites, Clacton has cores, flakes and flake tools in their thousands (Roe, 1968a) due to the duration and intensity of research. The site, like Globe Pit, Little Thurrock, lacks an overlying Acheulean assemblage, and represents a Lower Palaeolithic assemblage without handaxes.

As the original Clactonian site, definitions of the Clactonian have been based either on Clacton, or Clacton and one or more other sites. Reports of chopper cores (Figure 6.5) and distinctive flake tools by Warren (1922:598; 1924:38; 1951:113-128), Chandler (1929:86-92; 1931; 1932:377), Oakley and Leaky (1937:226-236), Paterson (1937:135) and Wymer (1968:35-8) led to their central role in definitions of the Clactonian. Warren's (1951:133) later analysis showed that choppers represented only 3% of the assemblage. The biconical chopper cores attributed to the site were described by Singer *et al.* (1973:32) as being exhaustedly knapped cores.

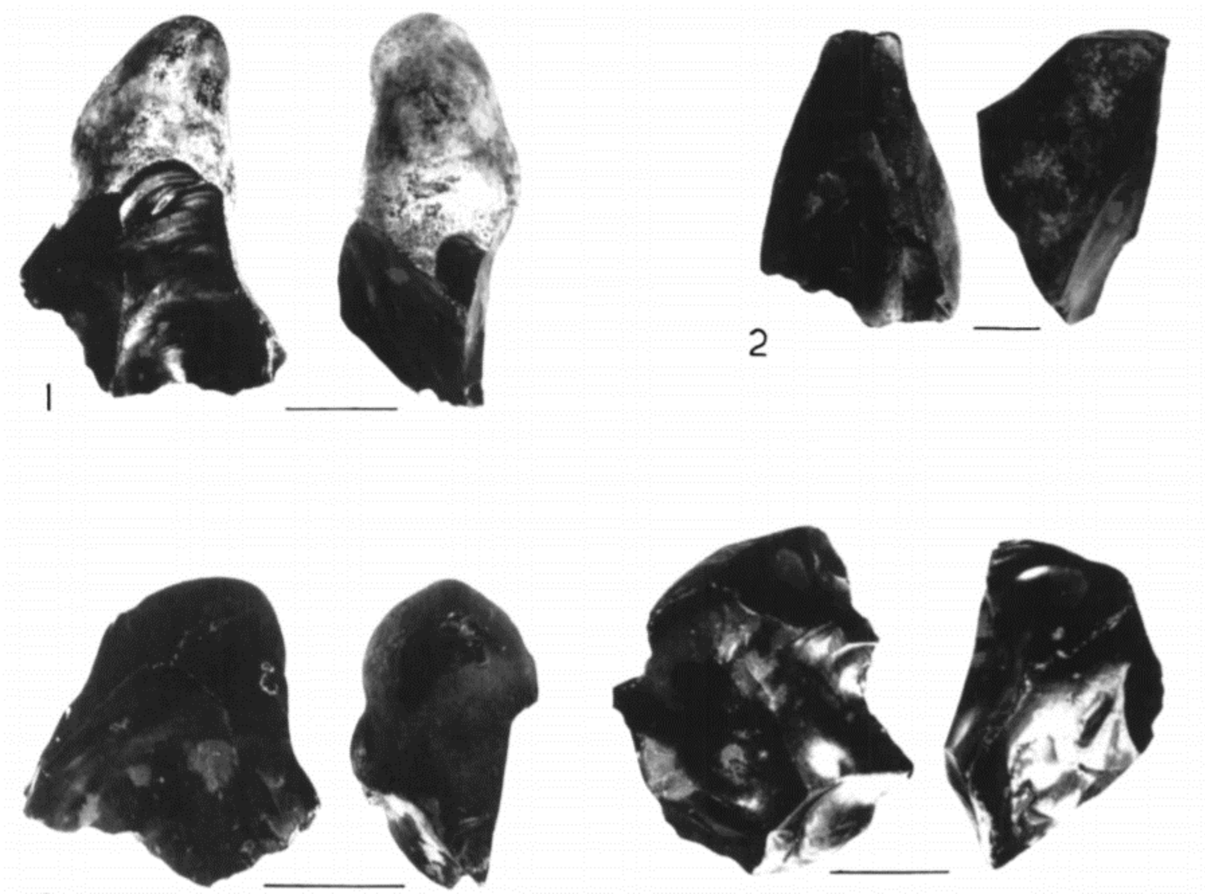

Figure 6.5 Chopper cores from Clacton (Singer *et al.,* 1973:plate I).

Warren's (1951:133) analysis also showed that the two largest flake tool groups were lightly trimmed flakes and side scrapers. Flakes were retouched into various scrapers and denticulates but there was no standardisation or traits indicative of the Clactonian (Singer *et al.,* 1973:43). This is similar to non-handaxe sites of MIS 9 where traditionally diagnostic tools are underrepresented. This suggests that the classic Clactonian features are less significant than previously thought. Singer *et al.* (1973:43) detailed a large amount of finds and emphasised that their uniting feature was their non-specialised nature. Singer *et al.* (1973) and McNabb (1992;2007) seem to concur that nothing distinguishes non-handaxe and handaxe sites other than the presence of handaxes. Reviewing the evidence from Clacton has illustrated similarities to MIS 9 non-handaxe sites and has shown that the lack of previous diagnostic Clactonian features is not unusual.

Swanscombe

Swanscombe is a site of international renowned due to its succession of Palaeolithic assemblages that span most of the Hoxnian interglacial (MIS 11c) (Ovey, 1964; Conway *et al.,* 1996; Davis and Ashton, 2019). The site has three distinct phases; the first (Phase I, Lower Gravels and Lower Loam) yielded a large core and flake assemblage, the second (Phase II, Middle Gravels) an Acheulean assemblage dominated by pointed handaxes and lastly (Phase III, Upper Loam and alluvial sediments possibly dating to later MIS 11c or MIS 11a) an assemblage of ovate handaxes, including twisted ovates (Davis and Ashton, 2019; Figure 6.6).

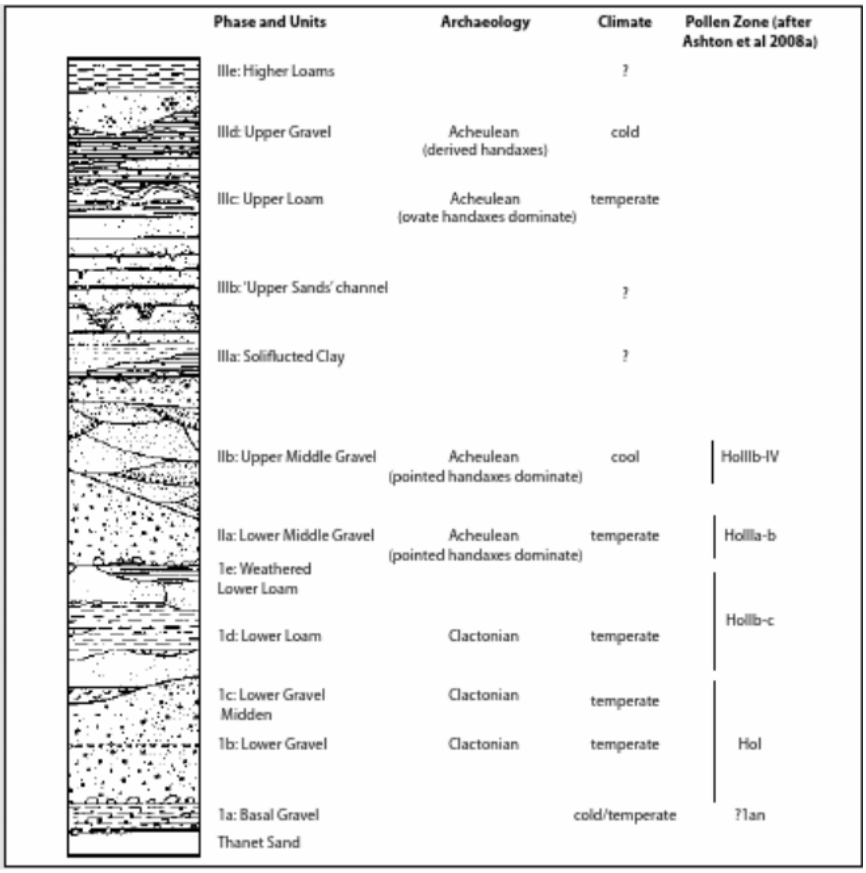

Figure 6.6 Stratigraphy at Swanscombe (Pettitt and White, 2012:56).

Archaeology from Swanscombe has been known since at least 1885 with Henry Stopes collecting large amounts of material (Wymer, 1968:334). Since then, there has been a long history of research (Smith and Dewey, 1913;1914; Swanscombe Committee, 1938; Paterson, 1940; Ashley-Montagu, 1949; Wymer, 1955;1964; Ovey, 1964; Waechter, 1970;1971;1973; Conway *et al.,* 1996). Smith and Dewey (1913:183; 1914) recognised the non-handaxe layer at the site comparing some finds to the Strepy culture, but mainly noting only the absence of handaxes. This fitted well with current ideas of unilateral development (McNabb, 1996:31). After Warren (1926) coined the Clactonian, Chandler (1929:81) was influenced by Breuil to assign Swanscombe to this culture after noting similarities including a lack of formal tools and presence of chopper cores (McNabb, 1996b:36). Later, Chandler (1931:175) subdivided the

Clactonian at the site based on an evolutionary scale, showing the influence of both culture history and the growing concept of the Clactonian. Wymer (1968:336) described chopper cores, crude flake tools and flakes, which resulted in him upholding the Clactonian nature of the Lower Gravels (McNabb, 1996b:50).

Conway *et al.* (1996) wrote up the previously unpublished Waechter excavations providing the most recent analysis of the site. Ashton and McNabb (1996b:210) concluded that the cores, flakes and flake tools were similar across all levels with little distinction. Cores and flakes showed simple MPCs with some alternative flaking. The main difference between the layers was the presence or absence of soft hammer flaking (Ashton and McNabb, 1996b:210). Retouched flake tools from the site were rare with many being flaked flakes. Some examples of notches, denticulates and scrapers were present in all layers (Ashton and McNabb, 1996b:213).

The trends in Lower Palaeolithic archaeology led to the rejection of cultural explanations and the minimisation of difference for the Clactonian at Swanscombe (Ashton and McNabb, 1996b:234). Nevertheless, the existence of a separate core and flake industry was still maintained (Conway *et al.,*1996:239), similar to the sites examined in this study. Old typological concerns of certain tool types and the importance of chopper cores are not substantiated when the sites are examined in the wider Lower Palaeolithic context. Few differences can be found apart from the presence or absence of handaxe manufacture. Although no recent large-scale excavations have been undertaken like at Barnham and Ebbsfleet, the level of past excavations and research interest has made Swanscombe one of the most detailed sites in the British Lower Palaeolithic.

Barnham

Although outside the Thames, Barnham East Farm is broadly contemporary with Clacton and Swanscombe (McNabb, 2007:93). The site has been excavated numerous times and is well published (Paterson, 1937; Wymer, 1985; Ashton *et al*, 1998; Ashton *et al*, 2016). A non-handaxe site was uncovered by Paterson (1937; 1942; 1945) and later confirmed by Wymer (1985). Due to earlier reports by Clarke (1913), both Paterson (1937) and Wymer (1985) acknowledged that an Acheulean layer might overlie the Clactonian material (Ashton *et al.,* 2016:837). Paterson (1937) split the site into various layers (A-F), which variously included notches, denticulates, scrapers and simple cores. While A-D were considered worn, the fresh industry (E) contained 'more advanced cores' along with flakes and flake tools (Figures 6.7 +6.8), but no signs of handaxe manufacture (Paterson, 1937). Paterson (1937) argued that the flakes from this industry did not need further retouch, implying that most of the flakes were unmodified. The overlying industry (F) was described as Acheulean (Paterson, 1937).

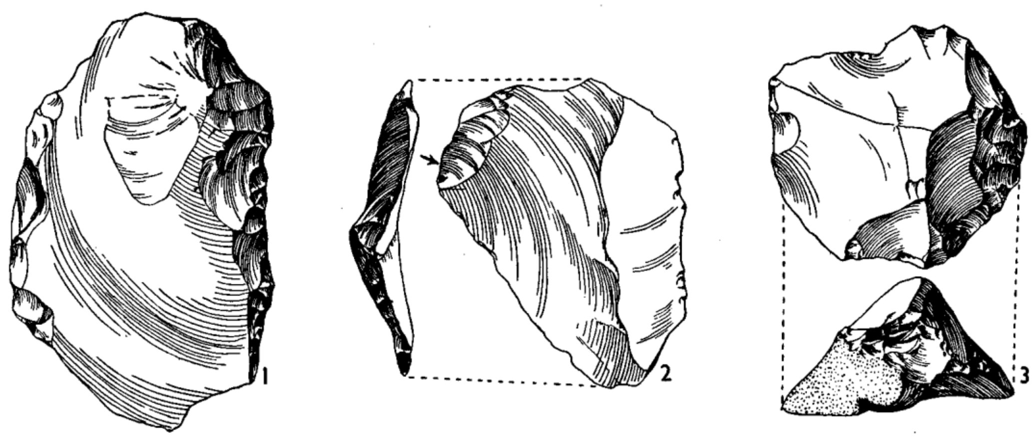

Figure 6.7 Flake tools from Barnham industry (E) (Paterson, 1937:122).

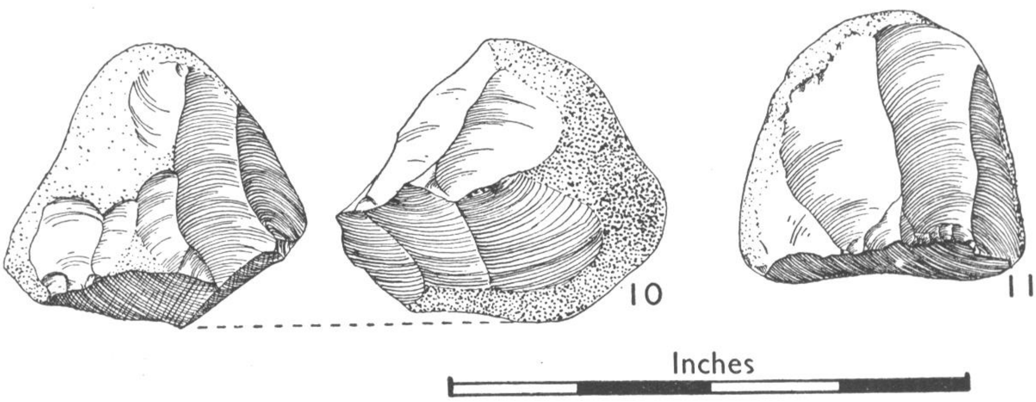

Figure 6.8 Cores from Barnham industry (E) (Paterson,1937:122).

Barnham was interpreted in the progressive culture history approach of the time with Paterson (1937: 126-135) arguing that there was a proliferation of tool types through the sequence, and that this showed *in situ* development. It is not clear why, but Paterson (1937:135) argued that the lithics were distinct from the Clactonian but agreed to refer to the site as "the Barnham sequence of the Clactonian". After small scale excavations, Wymer (1985:116) agreed with Patterson (1937) and noticed both derived and fresh Clactonian artefacts split into level A-E, although he argued that industries A-E were inseparable.

Excavations by the British Museum between 1989-1994 cast doubt on the Clactonian credentials of the site (Ashton *et al.,* 1998). In Area I, a fresh Clactonian assemblage of cores, flakes and flake tools was found, but in comparison, Area IV which was considered broadly contemporary contained handaxes and over 250 soft hammer flakes (Ashton *et al.,* 2016:838). Ashton's (1998b:206-219) analysis concluded there was little difference between the cores and flakes in both assemblages, with perhaps more intense flaking in Area I. There was little difference in the character of flake tools but they were more common within Area I which also contained the only denticulates. Due to the apparent contemporality of the areas and other changes in the academic zeitgeist, the site was considered to not represent a culturally distinct Clactonian.

Current work led by the British Museum at Barnham has shown a more complex picture (Ashton *et al.,* 2016). The new Area VI has demonstrated that Area IV is a time-averaged assemblage, whilst other parts of the site show discrete Clactonian (Unit 5) and Acheulean (Unit 6) signatures (Ashton *et al.,* 2016:839; Figure 6.9). This demonstrates a distinction between the two assemblage types, repeating the pattern seen at Swanscombe. The precision of the excavation is beyond that of many Lower Palaeolithic sites and it is due to this that a mixed assemblage has been able to be better understood. It is likely that many other Lower Palaeolithic sites contain more complex sequences, but these are lost either due to excavation practices or poor preservation. Barnham is proof that the Clactonian spread outside of the Thames valley in MIS 11. It is important to examine why this is not also seen in MIS 9 and question whether there is a genuine absence of non-handaxe sites outside the Thames in Britain during this period.

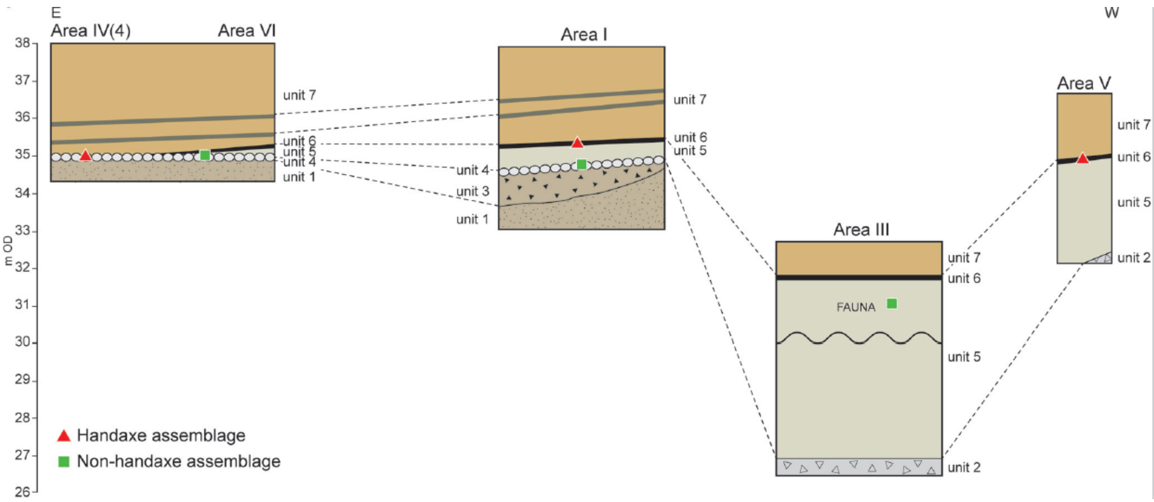

Figure 6.9 Correlation of the areas at Barnham (Ashton *et al.,* 2016: 839).

Ebbsfleet

The Elephant Butchery Site in Ebbsfleet Valley, discovered during excavations associated with

HS1 in 2003, is an example of how modern excavation practices can improve our understanding of non-handaxe assemblages (Wenban-Smith, 2006). The mint condition Clactonian assemblage (around 100 cores and flakes) at Phase Six of the site, associated with the remains of a straight tusked elephant (*Palaeoloxodon antiqus*) within a rich organic clay, gives a snapshot of Lower Palaeolithic life (Wenban-Smith, 2006:471; Wenban-Smith, 2013:447). A larger assemblage was found slightly higher to the south, and an Acheulean horizon (Phase Eight) was stratified above (Wenban-Smith, 2013).

The artefacts from the Elephant Butchery Site show a core and flake industry with no clear distinguishing features. The elephant butchery area contains 77 artefacts with only one flake tool, a single notch (Figure 6.10), found alongside large cores with simple alternative and parallel reduction sequences (Wenban-Smith, 2013:363). Around 40 unmodified flakes were recovered, but some were classified as flake tools by Wenban-Smith (2013:361) due to signs of utilisation.

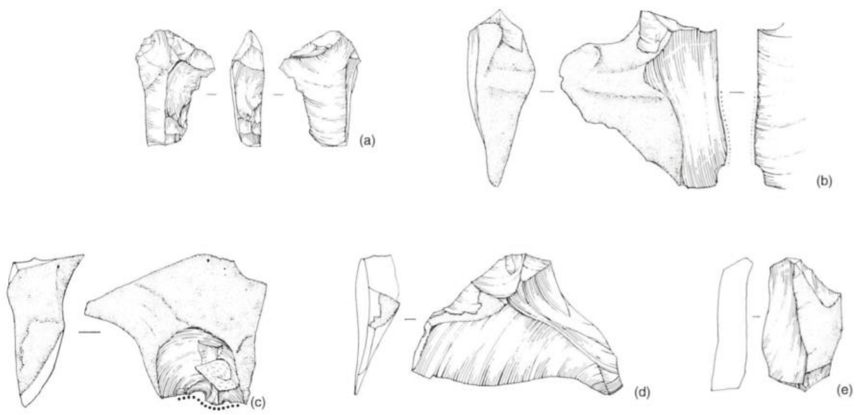

Figure 6.10 Flakes including some flake tools from Ebbsfleet, Elephant Butchery Site (Wenban-Smith, 2013:363).

The larger collection of material from other areas of Phase Six contain around 2000 artefacts. Cores represent a small proportion of the assemblage (4.8% of Phase 6.1 and 9.8% of Phase 6.2) and flake tools an even smaller proportion (4.1% of Phase 6.1 and 3.3% of Phase 6.2) (Wenban-Smith, 2013:389). Wenban-Smith (2013:392) noted only one core tool with the rest representing simple MPC cores, although some of the descriptions and illustrations are reminiscent of chopper cores with alternate working on one side of the core (Figure 6.11). At least 72 flake tools were recovered with 42 being notches or denticulates (Wenban-Smith, 2013:401). Notches are mentioned by Wenban-Smith (2013:401) in a way that alludes to their typological importance. While important at Ebbsfleet, this study has shown notches are not universally common in non-handaxe contexts and that they occur in Acheulean contexts, concordant with the work of McNabb (1992;2007).

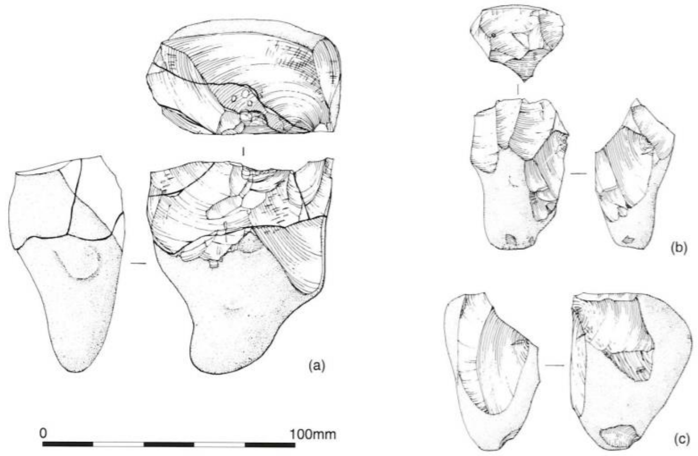

Figure 6.11 Core resembling chopper cores from Ebbsfleet, Phase 6 trench D (Wenban-Smith, 2013:395).

Phase Eight is Acheulean in character with pointed handaxes and twisted cordates alongside large scrapers that grade into handaxes, one of Quina type (Wenban-Smith, 2013:432). This phase also contained poor quality cores and rolled material including notches which Wenben-Smith (2013:429) argued were derived from Phase Six. Chapter Seven will discuss flake tools in detail, but one possible distinction between non-handaxe and handaxe sites are the presence of these invasive and well-made scrapers that grade into flake handaxes. Unfortunately, this is also a negative identifier and does not add a way to identify non-handaxe sites.

Wenban-Smith (2006:479) interpreted the Butchery Site as an example of on-the-spot knapping with no sign of handaxe manufacture. The overlying handaxe gravel has been compared to the sequences at Swanscombe (Wenban-Smith, 2006:479). The size and condition of the assemblages from Ebbsfleet show convincing evidence of temporally distinct Clactonian and Acheulean industries adding to the clear picture of the Clactonian being an early MIS 11 non-handaxe signature across the south-east (Wenban-Smith, 2013:467). McNabb (2020) argued that the evidence indicates the absence of handaxe manufacture at three different scales at the site, demonstrating 'habitual behaviour'. This demonstrates what a modern excavation can uncover and, like the sites above, conforms to the modern consensus that no distinctive markers of the Clactonian exist.

6.3 MIS 11 and MIS 9: a comparison

Analysis of MIS 9 sites and comparison to MIS 11 above has shown that neither contain distinctive tool types or positive indicators to define the Clactonian, which is based entirely on the absence of handaxe manufacture. No chopper cores can be related to the non-handaxe layers during MIS 9, although many sites that have a claimed Clactonian element, such as Grovelands Pit, yielded examples. The same can be said for flake tool types; while Cuxton and Globe Pit both have examples of notches and denticulates, these do not dominate the assemblages and a lack of formal tool types describes the sites more accurately. No artefact type is restricted to just non-handaxe layers, with examples of chopper cores, denticulates and notches throughout the Lower Palaeolithic.

This is also seen in the MIS 11 sites where the modern consensus seems to be a lack of significant artefact types (Conway *et al.,*1996; Ashton *et al.,* 1998b; Wenban-Smith, 2013). As detailed in Chapter Two, the significance of these artefact types has previously been overstated (Chandler,1929; Paterson, 1937; Wymer, 1968) alongside the significance of flaking angles (Warren, 1923; Breuil, 1932; Chandler, 1932). Due to the lack of positive cultural identifiers, we cannot link the MIS 11 Clactonian with the non-handaxe stage of MIS 9. Both MIS 11 and MIS 9 appear to contain a period where groups of hominins did not make handaxes prior to the appearance of handaxe manufacture later in the interglacial.

The main difference between MIS 11 and MIS 9 non-handaxe sites is the size of the assemblages and how well established they are. The sites of MIS 11 all have a long research history with periods of intensive research, or in the case of Ebbsfleet, the benefit of large-scale modern excavation. Comparing the collection history of Clacton to Globe Pit can explain the differences in their recognition. While both were discovered in the late 19th century (Spurrell, 1892:194; Kenworthy,1898), Clacton received the attention of Warren, amongst others, over an extended period of time. In contrast, after being mentioned, almost in passing by King and Oakley (1936), Globe Pit was only formally investigated later by Wymer (1957) in 1954 before a re-evaluation by Bridgland and Harding (1993), although others including Wymer's father had collected there. The material from Clacton was collected during, and was the basis for, the surge of interest in the Clactonian (White, 2000; McNabb, 2007), giving it central position in the British Lower Palaeolithic. The 'Clactonian elements' at Purfleet were first mentioned by Palmer (1975), and while further excavations (Schreve *et al.,*1998; 2002; Bridgland *et al.,* 2013) have added to our understanding, it is not comparable to the long research history at the MIS 11 Clactonian sites. The non-handaxe signature at Cuxton was discovered during the 1980's (Cruse *et al.,* 1987) when scepticism towards the Clactonian was increasing, and re-examination of the site would help affirm its non-handaxe credentials.

This shows a clear disparity in the research history and extent of excavations at the non-handaxe sites in Britain. The work at Clacton, Swanscombe and Barnham occurred during the height of interest in the Clactonian and have long histories as significant Palaeolithic sites. In comparison, the MIS 9 handaxes sites have a much lower profile and have received less attention with fewer and smaller scale excavations. Due to the lower number of artefacts, MIS 9 sites have been easier to dismiss than their MIS 11 counterparts (Fluck, 2011). Any re-evaluation of these sites requires further fieldwork to tackle these criticisms.

6.4 The wider European context

Comparisons to the continent are difficult due to problems with correlation between sites and differing academic perspectives, which has previously been examined by Fluck (2011). Due to this, the division between handaxe and non-handaxe sites in continental Europe is obscured (Ashton *et al.*, 2016:840). McNabb (2007; 2020) and Fluck (2011) have argued that there is no evidence of Clactonian-like core and flake assemblages in Europe, but that there are genuine non-handaxe assemblages. For these reasons the Clactonian is usually discussed as a British Phenomenon (White, 2000; McNabb, 2007), but explanations could be tied to the wider European trends.

Historically the idea of non-handaxe groups in Europe has been complicated, changing with new discoveries and theories. Eastern and central Europe is traditionally seen as an area of non-handaxe groups and a possible source for populations moving into Britain (Collins 1969; White, 2000). Italy also has a tradition of classifying non-handaxe sites as Clactonian or Tayacian such as Visogliano (Palma di Cesnola, 1996; Abbazzi et al. 2000). In contrast France and Spain are considered Acheulean strongholds where potential non-handaxe assemblages such as Tayacian or Colombanien sites are explained by a flexible Acheulean, raw material or site use (Cook *et al.,* 1982; Rolland, 1986; Monnier and Molines, 1993; Monnier, 1996; Ravon *et al.,* 2016a;2016b). Despite the differing research backgrounds and the lack of information from certain areas, there are still interesting parallels between Britain and the European mainland that can be outlined.

Fluck (2011:173) argued that non-handaxe sites in Europe showed a flexible Acheulean, especially in the case of France and Spain. In these traditionally Acheulean parts of Europe some sites lack handaxes, but only in certain areas and none have been found in the otherwise rich Somme valley (McNabb, 2007:218). This is similar to the geographical containment of non-handaxe sites in Britain. McNabb (2007:223) claimed French prehistorians do not consider non-handaxe sites a separate industry but a general trend leading to the Mousterian. However, there seems little connection between non-handaxe sites and the Mousterian, and in Britain there is no evidence for such a connection. Any site that has connections with the Mousterian or Levallois technology should not be treated as a non-handaxe assemblage relating to the Clactonian, but as evidence for Middle Palaeolithic behaviour.

Some French researchers such as Jaubert and Servelle (1996) use the term pre-Acheulean, but this is easily confused with earlier Mode I assemblages and assumes that non-handaxe assemblages must be earlier than Acheulean sites. Bridgland *et al.* (2006) pointed out a number of potential non-handaxe sites in Iberia with early dates. These could be explained by raw material at the sites (McNabb, 2007:232) or as part of the earliest occupation of Europe by non-handaxe groups. Any sites of an early date should be treated with caution as they are likely to correspond with much older Mode I sites such as Pakefield (Parfitt *et al.,* 2005) and Happisburgh III (Parfitt *et al.,* 2010) in Britain, Atapuerca -Trinchera Dolina (Campaña *et al.,* 2016) and the Orce Basin (Oms *et al.,* 2011) in Spain and Pirro Nord and Monte Poggiolo in Italy (Arzarello *et al.,* 2016). It is important to discount sites from being either Mode I or Middle Palaeolithic before making comparisons to the non-handaxe sites of MIS 11-9 in Britain.

Fluck's (2011) work demonstrated some of the flaws (mentioned above) in the term non-handaxe assemblage. Their work draws on 108 sites, many of which only contain small assemblages, but conflated early Mode I assemblages and Middle Palaeolithic assemblages with the more traditional MIS 11-9 non-handaxe assemblages associated with the Clactonian. This has made it easier to dismiss non-handaxe sites in Europe. Ashton *et al.* (2016:840) narrowed these sites down to 14 that have over 50 artefacts and date to the late Middle Pleistocene (Figure 6.12). Nevertheless, many of these sites had raw material that limited handaxe production (Ashton *et al.,* 2016). Table 6.2 shows that most of the sites where raw material is a factor are located in southern or western Europe such as France, Italy and Greece. Only the site of Vértesszőlős, Hungary seems to show evidence of poor raw material in the more traditional non-handaxe area (Fluck and McNabb, 2007). The rest of the sites show evidence, much like in MIS 11 and MIS 9 Britain, of non-handaxe assemblages being used when there is no lack of raw material. These sites are mainly dated to MIS 11-MIS 9, although caution should be taken as some sites such as Bolomor, Spain could be Middle Palaeolithic (Santonja et al. 2000; Rosell et al., 2015), and Petralona, Greece has numerous problems with dating and context (Tourloukis, 2010; Tourloukis and Harvati, 2018). The technology of these sites is linked by a lack of classic handaxes with other characteristics such as notches, denticulates, chopper cores, heavy duty tools and simple flake tools, but not uniformly across all sites. As it has been shown above, this represents a base line technology across the Lower Palaeolithic.

Figure 6.12 Key non-handaxe sites MIS 11-9 (Ashton *et al.,* 2016:841).

Table 6.2 Key non-handaxe sites discussed by Fluck (2011) and Ashton *et al.* (2016).

Country	**Site**	**Dating**	**Handaxes**	**Lithics #**	**Lithics characteristics**	**Raw Material restriction**	**Interpretation**	**References**
France	Aze, Saône-et-Loire	400 to 350kya	Absent	~300	Flakes, flakes tools	No raw material restrictions	Opportunistic exploitation of material	Combier, *et al.,*2000; Moncel, *et al.,* 2001; Barriquand *et al*., 2006
France	Les Tares, Perigord	>300ka	Absent	6000	Flakes and simple flake tools	No raw material restrictions	Compared to High Lodge and Mousterian	Delpech *et al*., 1995; Geneste and Plisson, 1996; Giot *et al.,* 1998; Hallégouet and Molines, 2001; Molines *et al.,* 2001
France	Coudoulous 1, Vallée de Garonne, Lot	MIS 11-9	Absent	Few	Pebble tools	Poor raw material	Poor raw material used to exploit fauna Some claims of Middle Palaeolithic	Brochier, 1976; Bonifay and Clottes, 1979 Jaubert and Mourre, 1996; Jaubert and Servelle, 1996
Spain	Bolomor, La Valldigna, Valencia	350kya-100kya	Absent	Large quantities over several layers	Denticulates, large cores, some scrapers	No raw material restrictions	Acheulean without handaxes later classified as Middle Palaeolithic	Fernàndez Peris *et al.,* 2000; Santonja *et al.,* 2000; Fernández Peris, 2006; Rosell *et al.,* 2015
Italy	Casella di Maida, Catanzare	Beginning of the Mindel'/MIS 11?	Absent	205 pebble tools and 210 flake tools	Pebble and flake tools	Use of quartz and quartzite	Part of Italian pebble tool culture	Gambassini and Ronchitelli, 1981; Palma di Cesnola, 1996
Italy	La Polledrara, Rome	MIS 9	Absent	250	Choppers and chopping tools, scrapers, Bone handaxes notches and denticulates	Limited raw material	Small pebble tools alongside larger bone tools	Palma di Cesnola, 1996; Anzidei, 1996; 2001
Italy	Visogliano, Duino-Aurisina, Trieste	Mindel	Absent	>100 over 4 layers	Choppers and flakes tools but few denticulates or notches	No raw material restrictions	Some layers attributed to Tayacian	Palma di Cesnola 1996; Abbazzi et al. 2000

Poland	Rusko 33 and 42 Lower Silesia, Southern	MIS 9	Absent	Rusko 33- ~350 lithics. Rusko 42 ~3700.	Small flakes, cores, some flake tools	No raw material restrictions	Hafted microliths (cf.Trzebnica 2 and Bilzingsleben)	Burdukiewicz, 2003
Poland	Trezebina 2, Lower Silesia, Southern Poland	MIS 9	Absent	1400	Large choppers and small flake tools including side scrapers, denticulates and borers.	No raw material restrictions	Hafted microliths (cf. Bilzingsleben)	Burdukiewicz, 1993; Svoboda *et al.*, 1996
Ukraine	Korolevo, Transcarpathia	MIS 11?	No handaxes buts some bifacial elements	Only 30 in layer VII others unknown	Scrapers, denticulates	Pebbles, andesite	Isolated site with some bifacial elements possible	Villa, 2001; Koulakovska *et al.*, 2010
Hungary	Vértesszőlős, Gerecse	350kya	Absent	1916	Small quantize and flint flakes, cores and tools	Limited raw material	Previously thought to be Buda culture, now thought to be microlith	Vertes, 1965; Kretzoi and Vertes, 1965; Valoch, 1968; Kretzoi and Dobosi, 1990; Moncel, 2003; Dobosi, 2003; Fluck and McNabb, 2007
Germany	Schöningen	MIS 11-9	Absent	1500+ many more over different areas	Denticulates and notches, heavy duty tools	No raw material restrictions	Horse hunting, wooden tools, hafted composite tools	Mania, 1995; Burdukiewicz and Ronen,2003; Thieme, 2003; 2005
Germany	Bilzingsleben	412-320kya	Absent, some bone handaxes and bifacial elements	140,000	Small artefacts, some evidence of PCT	No raw material restrictions	Primary context campsite	Mania and Weber, 1986; Svoboda, 1987; Schwarcz *et al.,* 1988; Mania, 1991; Brühl 2003; Mania and Mania, 2003
Greece	Petralona	Problematic >350kya/ Skull c. 150-200ka.	Absent	Not well published	Quartz tools some geofacts	Limited raw material	Problematic due to numerous issues	Hennig *et al.,*1982; Ikeya, 1982; Liritzis, 1982; Poulianos, 1982, 1983; Stringer, 1983; Bailey, 1995; Tourloukis, 2010; Tourloukis and Harvati, 2018

In eastern and central Europe, McNabb (2007:240-3) and Fluck (2011: 119-120) dismissed the idea of the area being a "homeland of the Clactonian" due to differences in technology and the presence of some bifaces at non-handaxe sites. This contradicts the long-standing notion of there being no handaxe sites in Germany prior to MIS 8 established by Obermaier (1924) and corroborated by McBurney (1950). Meisenheim I, Bilzingsleben and Schöningen in Germany all lack handaxes, but McNabb (2007) argued that they contain some bifacial working. While this may be the case, the lack of classic handaxes is still vital to the question of non-handaxe sites as bifacial worked material is not unique to the Acheulean and the lack of genuine handaxes purported by Obermaier (1924) and McBurney (1950) stands up at these sites (Table 6.2). In eastern Europe McNabb (2007:240-3) argued against the culturally distinct non-handaxe culture often referred to as Buda due to a lack of convincing cultural links between sites. While this questions the idea of a unified culture, it does not dismiss the idea that this region contains non-handaxe assemblages, but merely disputes the reasons behind it. In fact, having a non-handaxe industry with no positive indicators is more in line with the British record, as the Clactonian and MIS 9 non-handaxe signature also lack any positive identifiers. What is important at these sites is the absence of handaxes, as it has been shown above that this is the only reliable way of testing non-handaxe assemblages.

The current evidence shows a predominance of non-handaxe sites in central and eastern Europe with a few in France and Spain (Ashton *et al.,* 2016:840). Ashton *et al.* (2016:840) argued that there is recognition of variation within the French Acheulean with Colombanien sites either lacking handaxes or containing only rare examples. These examples of variation could be down to differences in site function and/or raw material.

From the evidence in Table 6.2, the difference between Acheulean populations in the south west and non-handaxe populations in central and eastern Europe can be substantiated. Non-handaxe sites within the south and west of Europe could show similar phenomena to the non-handaxe sites in Britain. The only thing that these sites have in common is a lack of handaxe manufacture. Twenty years ago, White (2000:54) argued for more work in Europe and a broader view of the Clactonian in order to build new interpretations, and while some have done so (Fluck, 2011; Ashton *et al.,* 2016), further work is needed. It no longer seems sensible to ask if non-handaxe assemblages exist in Europe during the late Middle Pleistocene, but instead why they exist and what can they tell us about hominins during the Lower Palaeolithic.

6.5 Explaining non-handaxe assemblages: what can MIS 9 add to the debate?

Fluck (2011:211) offered four explanations for the appearance of 'non-biface assemblages'; the earliest Mode I technology, a default knapping pattern, sites being miscategorised despite associated bifacial technology and the earliest Middle Palaeolithic. The MIS 10/9 non-handaxe sites are clearly not the earliest occupation of Britain due to a long history of prior handaxe manufacture (Ashton *et al*., 1992; Roberts *et al*., 1995; Roberts, 1999). No bifacial technology was found amongst the MIS 9 sites in this study. Particularly pertinent to the examination of MIS 9 is the suggestion that non-handaxe sites could show early Middle Palaeolithic behaviour, but the evidence from this analysis shows no signs of this at Globe Pit or the non-handaxe layers of Cuxton and Purfleet. At Cuxton and Purfleet the PCT is clearly stratified above the non-handaxe layer. The cores and flake tools from the non-handaxe sites are Lower Palaeolithic in nature and comparable to MIS 11 Clactonian sites. The only explanation left is the baseline technology of knapping that McNabb (2007), Fluck (2011) and Cole (2011) all concluded was present in all hominins using basic hard hammer knapping. This suggestion is compatible with a distinct non-handaxe signature (White, 2000; White and Schreve, 2000). What we are left with is a need to explain why non-handaxe assemblages of this kind would occur. The observation by McNabb (1992;1996b) that the non-handaxe assemblages share a baseline technology with handaxe populations is supported by the results of this study, but it does not explain the chronology of these sites. The sites of MIS 9 should no longer be overlooked as they are a vital part of understanding the phenomenon.

An activity facies

The suggestion of non-handaxe assemblages being an Acheulean activity facies is not supported by the MIS 9 evidence. The ideas of Svoboda (1989) suggesting the Clactonian is related to woodworking is also unsustainable as there is no link to these environments and it would not explain the chronology of the sites. Any other functional explanation has similar problems as addressed by White (2000:40), chiefly the geological timescales of these sites rather than specific *in situ* events such as Boxgrove (Roberts, 1999). This is seen also in MIS 11 and in the wider European context. White (2000:40) argued that for these sites to be an activity facies, then handaxe making populations must have forgone the manufacture of handaxes for long periods of time. The increasing recognition of the cultural importance of handaxes (White *et al*., 2018;2019) makes this an unlikely scenario unsupported by the evidence from MIS 9.

A preparatory stage

Ohel's (1979) idea that the Clactonian could represent a separate period of working is disputed by the evidence above as there is no difference in the knapping stages represented by non-handaxe and handaxe sites. Non-handaxe assemblages in MIS 9, like MIS 11, represent entire sequences of working, and not just roughing out. Additionally, the complete lack of any soft hammer working also seems improbable if handaxe-making groups were starting their knapping in this area.

Raw material

Raw material explanations fail to explain the non-handaxe sites in MIS 9. There is no evidence that the raw material at these sites was of low quality or that hominins relied on diminutive cores, unlike some European non-handaxe sites such as Vértesszőlős (Moncel, 2003). Globe Pit, Little Thurrock shows varied sources of raw material and not simple *ad hoc* usage (Bridgland and Harding, 1993:276). All three MIS 9 sites either have later handaxe sites nearby or stratified above, akin to Swanscombe and Barnham (Wymer, 1985). A raw material explanation for non-handaxe assemblages especially in time-averaged assemblages is too deterministic, does not address the chronology of the sites and contradicts the culturally significant role of handaxes (White et al., 2018; 2019).

This can also be seen as a weakness in Wenban-Smith's (1998) theory of *ad hoc* versus planned behaviour that still relies on raw material explanations and is inconsistent with the evidence from MIS 9. Additionally, there is no evidence of changing access to raw material, including the flint rich post-glacial landscape proposed by Wenban-Smith (1998). Wenban-Smith (1998) does not give an explanation for the return of handaxe manufacture later in the interglacial, and if this was introduced from the outside a more parsimonious explanation would be two distinct cultural groups as suggested by White and Schreve (2000:18). It also does not explain why the MIS 9 non-handaxe sites, like the MIS 11 Clactonian sites (White, 2000:45), appear only at the beginning of their respective interglacials. White (2000:45) argued that if the abandonment of handaxes was an option for hominins at flint rich sites then non-handaxe assemblages could appear anytime raw material is plentiful. The MIS 9 sites of Purfleet and Stoke Newington both have abundant raw material, but the sites differ in lithic technology. In the case of Purfleet, technology changed through time showing that raw material is unlikely to cause such drastic changes in technology.

Static resource model

Ashton's (1998c) static resource model cannot be used to explain the MIS 9 non-handaxe sites as it does not fit the sites of Globe Pit, Purfleet or Cuxton (White, 2000:43). Since the re-evaluation of Barnham by Ashton *et al.* (2016), the model no longer fits adequately with any of the non-handaxe sites. This model influenced McNabb's (2007:246) suggestion that the closest explanation to the Clactonian was White's (2000) proposition four with the co-existence of Acheulean and non-handaxe makers. There is no evidence for this and what would need to be addressed is the lack of evidence regarding non-handaxe assemblages throughout MIS 11 and MIS 9, rather than just the beginning of the interglacials.

Hominins

Developments in our understanding of Middle Pleistocene hominins has raised questions over whether these changes in assemblage type could reflect distinct species of hominins (Ashton *et al.,* 2016). Whether the hominin record represents a single lineage, or different lineages, would affect interpretations of non-handaxe assemblages either as a local development or population replacement (McNabb, 2020). The idea of a single evolutionary lineage developing handaxe manufacture would question a second non-handaxe period in Britain, but this idea seems outdated when considering the evidence of earlier Acheulean sites (Lewis *et al.,* 2019; Pope *et al.,* 2020).

While critical of reviving the idea of Breuil's (1926,1932) parallel phyla, Wenban-Smith (2013:467) conceded that with changes in our understanding of Middle Pleistocene hominins, and the different levels of planning and organisation between non-handaxe and handaxe groups, different species of hominins could explain the divide. Wenban-Smith (2013:467) suggested that the Denisovans in eastern Europe could help explain some of the variation. Any attempt to map industries onto the hominin record is hindered by the paucity, especially in Britain, of hominin remains. Wenban-Smith's (2013) link to the Denisovans is hard to assess due to the dearth of material evidence and sites, but it does demonstrate our continuously changing view of hominin evolution.

The expansion of the term Neanderthal to include hominins from Swanscombe, Sima de los Huesos and Steinheim has suggested that these could represent Acheulean groups with older hominins associated with non-handaxe industries (Stringer, 2012). The identification of the species of the Boxgrove hominin would then be crucial to this debate as there is clear evidence of well-made handaxes from Boxgrove and other MIS 13 sites (Ashton *et al.,* 2016:841). Others such as Manzi (2016) argue for a broader definition of *Homo Heidelbergensis* to cover these hominins which undermines the theory. This confusion is only added to by examples such as Aroeira 3 cranium from Gruta da Aroeira which, while dated to MIS 11, displays a mixture of

Homo heidelbergensis and Neanderthal traits associated with a handaxe assemblage (Marks *et al.,* 2002; Daura *et al.,* 2017). The growing complexity of the record and changes to our understanding make any explanation based on this evidence tenuous, and many have cautioned against using differences in hominins as an explanation, especially while the status of *Homo heidelbergensis* is still debated (Ashton *et al.,* 2016; McNabb, 2020).

Culture

It may be more parsimonious to describe distinct cultural groups within the Lower Palaeolithic rather than different species. However, McNabb (2007; 2020) has argued against simplistic cultural explanations on the basis that non-handaxe assemblages lack any culturally distinctive forms, unlike Acheulean assemblages. Non-handaxe assemblages represent a background of hard hammer working inevitable due to pragmatic concerns (McNabb, 2020). While this may be true, it still shows the absence of handaxes, and if handaxes have cultural meaning (White *et al.,* 2018; 2019) their absence is also a cultural matter. Therefore, an explanation is still needed for the temporal pattern of their absence in the record.

The loss of handaxes has been explained as a product of hominins moving into new areas and no longer being able to support the use of, or need for, 'costly' handaxes (Mithen 1994;1996; Kohn and Mithen, 1999; Kohn, 1999; McNabb, 2007:353). The evidence from MIS 9 cannot be used to support the specific ideas of Mithen (1994;1996), but what is becoming clearer is the importance of culture, social factors and going beyond functional explanations.

Previously, McNabb (2007:161) contested the Clactonian as a genuine cultural tradition as it was confined to the Thames in MIS 11, but this is no longer true. The work of Ashton *et al.* (2016) has demonstrated that the Clactonian is found outside the Thames in MIS 11 at Barnham, and this study has shown that there is good reason to accept a second non-handaxe signature in MIS 9. Together with the evidence from Europe (Table 6.2), this demonstrates compelling evidence for a non-handaxe tradition (or traditions) during the Middle Pleistocene. McNabb (2007:142) admitted that it is likely that the previous focus on handaxes has meant that non-handaxe sites have been missed or ignored, meaning that our understanding of these groups would be sporadic at best.

The two scenarios put forward by White and Schreve (2000:22) still adequately describe the chronological pattern seen in the records of MIS 11 and MIS 9 through different pulses of occupation:

1. Pioneering populations: The lack of handaxes in pioneering populations at the beginning of an interglacial period due to social pressures.
2. Different founder populations: The original occupation of Britain after a glacial period by hominins from non-handaxe areas of Europe followed by a later Acheulean group.

No complete explanation is offered, but after eliminating more functionalist explanations it is hard to argue against some cultural underpinning to non-handaxe assemblages. Based on the European evidence as a whole, it appears that different cultural groups were operating across the continent, and Ashton *et al.* (2016:841) suggested that within a stable environment only small cultural drift would have occurred. Larger scale movements of groups could have been triggered by climatic change during transitions between glacials and interglacials (Ashton *et al.,* 2016: 841). This view leaves some major questions around the cause of the movement of the Acheulean population and the possibility of this happening in both MIS 11 and MIS 9 (Ashton *et al.,* 2016:842).

Caution has been advocated by Davis and Ashton (2019) who avoided the terms Clactonian and Acheulean when discussing the patterns in MIS 11. The Acheulean is often tied solely to handaxes, but the term could be used more broadly to include behaviour rarely seen in the Palaeolithic record such as fire, hunting practices and landscape use. Davis and Ashton (2019) therefore argued that the Acheulean techno-complex represents a Lower Palaeolithic culture with or without handaxes but united through other behaviour and social structures. In this way, the Clactonian and the Acheulean can be seen as two cultural expressions of a wider techno-complex (Davis and Ashton, 2019). In fact, the difference between the Clactonian and Acheulean may be a misunderstanding. The difference may be cultural, but this does not presuppose major cultural differences or distinct lineages; rather a phenomenon linked to culture. While the term Clactonian may be misleading, the importance lies in a form of Lower Palaeolithic technology without handaxe manufacture.

6.6 Moving forward

The evidence currently indicates that in Britain there have been two periods of non-handaxe production during the Middle Pleistocene that were underpinned, in some way, by culture and can be related to the mosaic of hominin groups across Europe. From this model we can predict that further non-handaxe assemblages will be found within the MIS 12/11 and MIS 10/9 transitions and that they will not be found further into the interglacials, as current evidence suggests the *in situ* development of handaxes or replacement by Acheulean populations (White and Schreve, 2000). More work is needed to understand how this relates to mainland Europe.

Focusing on Britain there are a number of ways to strengthen or falsify this theory. Further work at the MIS 9 non-handaxe sites will either provide more evidence for their status as non-handaxe sites or may recover evidence of handaxe manufacture. Handaxes, or convincing handaxe thinning flakes, within these contexts would change our interpretations of these sites as it did with the fresh material from the cobble band at Barnham (Ashton, 1998b; Pettitt and White, 2012). Large-scale excavation work, similar to Ebbsfleet (Wenban-Smith, 2013), would be useful as the numbers of artefacts needed to satisfy critics of the MIS 9 non-handaxe signature (McNabb, 2007; Wenban-Smith, 2013) are likely to only be achieved in this way. Obvious targets for future research are the sites of Purfleet and Cuxton to expand on known assemblages. Alternatively, re-examinations of sites such as Grovelands Pit may be productive due to previous potential that has not been fully explored. Any work that would test the presence of non-handaxe assemblages outside of the Thames, such as Biddenham, Kempston or any site in the Solent, would deepen our understanding of non-handaxe assemblages. It is probable that these sites were previously labelled as containing Clactonian elements due to the influence of typology and culture history, but in most cases the details of these excavations are too sparse to entirely dismiss the possibility of a non-handaxe layer, especially when considering the recent changes in our understanding of Barnham (Ashton *et al.,* 2016).

It is important not to be too quick in dismissing the non-handaxe signature in MIS 9, and it should remain an important research question. Any sites that can be correlated to this period should examine the question of non-handaxe populations. Whilst the discovery of hundreds of cores and flakes is, to most Palaeolithic archaeologists, not as exciting as finely made handaxes, evidence that confirms or denies the MIS 9 non-handaxe signature would be a significant contribution to our understanding of the Lower Palaeolithic.

The identification of new sites in either MIS 12/MIS 11 or MIS 10/MIS 9 would strengthen the position of these industries, or non-handaxe assemblages from later stages of these interglacials would challenge current perceptions. The most significant addition would be one (or multiple sites) chronologically restrained to the MIS 10/9 boundary with a large non-handaxe assemblage. As White (2000:22) lamented, establishing a non-handaxe site is difficult without undisturbed unmixed archaeological sites which are the exception not the rule in the Lower Palaeolithic.

Further work is needed for a better understanding of non-handaxe assemblages, but the works and debates of McNabb (1992;2007) and White (2000; White and Schreve, 2000) have been helpful at stripping away the misconceptions and baggage of the Clactonian, including beliefs that Acheulean assemblages did not contain cores and flakes or that there were diagnostic flakes, flake tools and cores. Subsuming the MIS 9 non-handaxe signature under the term Clactonian would add too much emphasis on the similarity between the two industries. The term 'MIS 9 non-handaxe signature' is perhaps the most appropriate (although slightly unwieldy) as with no positive identifiers it would be difficult to link sites to the same culture. If a term was coined it should relate to Globe Pit, Little Thurrock as the first, and most established, site. However, a unique name would erroneously separate the British sites from their wider European context which has previously been done to the detriment of the study of the non-handaxe phenomenon.

6.7 Summary

It has not been possible to add new sites to the corpus of MIS 9 non-handaxe sites, but it is possible that some sites may obscure more complex situations due to their excavation history. While a number of additional MIS 9 sites have previously been characterised as containing evidence of the Clactonian, this study has demonstrated the lack of any tangible evidence. What we are left with, unfortunately, is the same view as before, three sites which represent the end of MIS 10/beginning of MIS 9. These represent a chronologically significant reappearance of non-handaxe manufacture in Britain that can parsimoniously be explained as being cultural, rather than functional. Interestingly, of the five sites labelled 'flagships' by White and Bridgland (2018), three of them contain non-handaxe signatures. Although the nascent nature of the MIS 9 non-handaxe signature raises doubts, this study has shown the need for it to continue to be evaluated seriously. There is scope for future work on this topic, but more well excavated sites are needed to fully address this essential research area.

Chapter Seven: Flake Tools in MIS 9, Change or Continuity?

The chronological position of MIS 9 offers the opportunity to examine how technology changes between the Lower and Middle Palaeolithic. Chapter Eight will address the beginnings of PCT, but another marker of the Middle Palaeolithic is the increased importance of flake tools (de Mortillet and de Mortillet 1881; Coulson, 1990). The assemblages analysed in this study were previously used by White and Bridgland (2018) to suggest that the increase in flake tool usage could be interpreted as early signs of Middle Palaeolithic behaviour towards the end of the interglacial. The findings of this study challenge this view and show a number of different trends during MIS 9. This evidence will be compared to the preceding Lower Palaeolithic (MIS 13 and MIS 11) and the succeeding EMP (MIS 7) to evaluate if there is evidence of a Middle Palaeolithic character to the MIS 9 assemblages, or if they align more with the Lower Palaeolithic. This will be placed within a wider European context, allowing for a discussion of flake tool technology in the European Lower-Middle Palaeolithic (Figure 7.1).

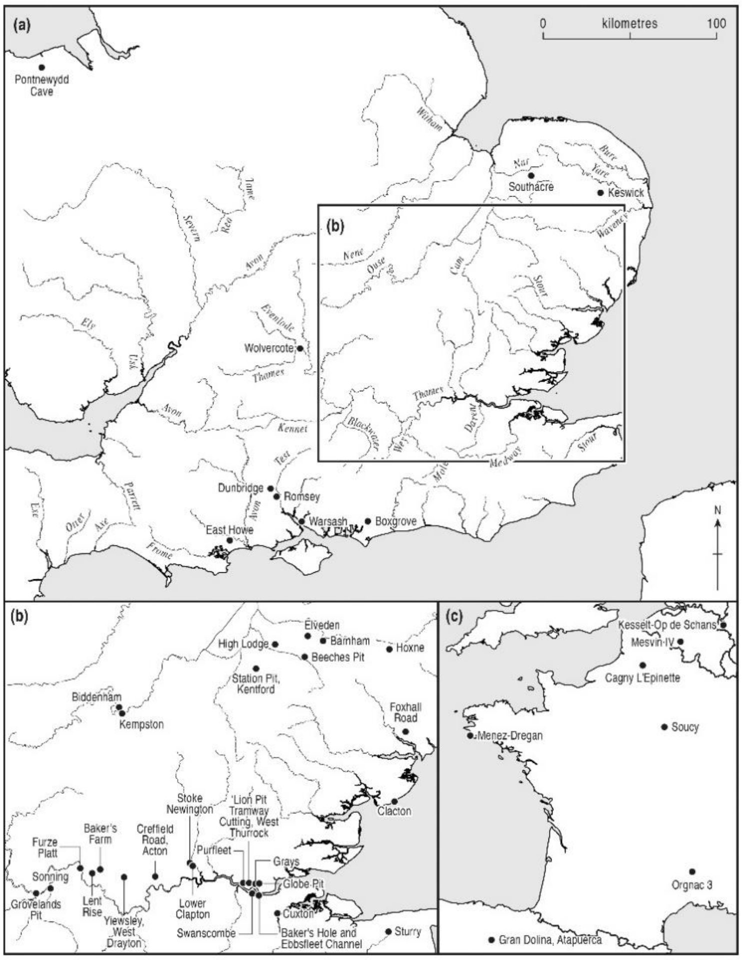

Figure 7.1 Location map of sites in Chapter Seven (after Rawlinson *et al.,* submitted).

7.1 Flake tools in MIS 9

The study of the MIS 9 assemblages has shown that Roe's (1968a) totals, and the totals of Wymer's English Rivers Project (1993; 1996;1997) (the tool counts for which were primarily based on Roe's), are overestimates (Table 7.1). While it has not always been possible to study all of the collections from these sites, it is clear from the collections and information available that many artefacts have been falsely labelled as flake tools. Misunderstandings over the terms 'flake tool' and 'retouched flake' in the older literature, combined with over-optimistic identifications, has caused naturally damaged unmodified flakes to be classed as flake tools. As a result, even half of the 100 flake tools recommended by Bordes (1961) for a statistically viable sample were not examined except from at the sites of Botany Pit, Stoke Newington and Grovelands Pit. Despite the lack of previous study and lower totals than previously thought, the flake tools from MIS 9 show interesting patterns.

The flake tools of MIS 9 are dominated by scrapers (Table 7.2) usually between 75-95%, and while the majority were side scrapers, other forms including end scrapers and convergent scrapers were also found across various sites. Notches and denticulates made up the majority of the rest of the flake tool technology. No type of flake tool was considered diagnostic of non-handaxe or handaxe sites, but variations are discussed below. Few differences can be observed in the size of the flake tools, with Grovelands, Warsash, Sturry and Station Pit, Kentford showing larger flake tools and Grays Thurrock showing smaller examples (Table 7.3). This is probably due to raw material and only the sites of Sturry and Station Pit show higher degrees of elongation. Larger flake size at a number of sites has naturally led to longer retouched edges.

Difference between sites can be noted in the degree of invasive retouching (Table 7.4). When compared with factors such as form, regularity, distribution and position, flake tools in MIS 9 demonstrate clear variations in quality. Flake tools are on average characterised by semi-invasive, continuous, regular retouch with convex edges, but more 'elegant' forms of retouch can be noted at a number of sites.

Collection bias may have played a role in some variation, and it is notable that sites with larger proportions of flake tools, and especially invasively retouched flake tools, are from collected assemblages. Nevertheless, the presence of these well-made flake tools can still be observed across a number of sites. Trends in the flake tools of MIS 9 are discussed in more detail below by geographical region.

Table 7.1 Technology of flake tool sites in Britain (after Rawlinson *et al.,* submitted).

Site	Roe (1968) flake tools	Flake tools identified	Total flakes + flake tools	% of Flake tools to flakes	% of flake tools with invasive retouch	Roe (1968) handaxes	Roe Group (Dale, Pers. Comm. 2021)	PCT (minimal numbers)
Thames								
Baker's Farm	101	47	307	15.3	28	387	I	3 cores, 1 flake
Botany Pit, Purfleet	1005	114	3455	3.3	6	12	?	134 cores, 5 flakes
Cuxton (Cruse, layers 1-6)	N/A	10	120	8.3	10	None	N/A	None
Cuxton (Tester)	70	32	461	7.2	16	212	I	4 Cores
Furze Platt	100+	39	363	10.7	26	1663	I	None
Grays Thurrock	56	13	137	9.5	8	12	?	None
Grovelands Pit	101	59	181	32.6	41	95	? (Roe (1981) attributed to Group VII)	None
Globe Pit	3	4	555	0.7	0	None	N/A	None
Lent Rise	54	18	140	13	22	120	I	1 core, 2 flakes
Lower Clapton	69	14*	33	42.4	43	159	I	None
Purfleet	N/A	5*	77	9.1	0	15	?	Beds 6/8- 5 cores, several flakes
Sonning Railway Cutting	7 (different pits)	6	33	18.2	17	13	?	2 cores, 4 flakes
Stoke Newington (Common, Geldeston Rd, Abney Park)	320	50 (all sites)	531	9.4	34	230 (Common) 63 (Geldeston Rd) 26 (Abney Park)	I	None
Sturry	71	26*	60	43.3	23	514	?	None
Wolvercote	10	2	15	13.3	50	75	III	None
Eastern England								
Barnham Heath	Numerous	16	327	4.9	25	230	I	17 cores, 3 flakes
Biddenham	50+	47	578	8.1	28	304	I	13 cores, 14 flakes
Kempston	54	27	157	17.2	37	445	I	3 cores, 5 flakes
Keswick	49	1*	1	n/a	n/a	175	I	?
Southacre	37	1	8	12.5	100	31	?	?
Station Pit Kennett/ Kentford	55	28	196	14.3	18	144	?	None
Solent								
Dunbridge	16	15	132	11.4	20	953	Mixed; fresh material Group I	4 cores
East Howe	7	2	37	5.4	50	73	?	3 cores, 3 flakes
Romsey	5	2	17	11.8	50	169	Pointed tradition, no clear Group attribution (Roe 1981)	None
Warsash	30	28	122	23	54	366	I	3 cores, 7 flakes

*Partially studied sites due to Museum access.

Table 7.2 Percentage of flake tool types in British MIS 9 assemblages with ≥ 10 flake tools (after Rawlinson *et al.,* submitted).

Site by predominant technology	n	Sidescraper	Endscraper	Converg. scraper	Double scraper	Converg/ Unifacial scraper	Notch	Denticulate	Bifacially worked flake	Misc
Core and flake assemblage										
Cuxton (Cruse 1-6)	10	60	10	10	-	-	-	20	-	-
Handaxe assemblages										
Baker's Farm	47	40.4	25.5	14.9	4.3	2.1	6.4	2.1	-	4.2
Barnham Heath	16	68.8	12.5	-	12.5	-	-	-	-	12.5
Biddenham	47	50	8.6	10.8	4.3	10.7	6.5	2.1	-	6.4
Cuxton (Tester)	32	53.1	12.5	3.1	6.3	-	12.5	9.4	-	3.1
Dunbridge	15	60	6.7	13.3	20	-	-	-	-	-
Furze Platt	39	46.2	17.9	12.8	7.7	2.6	10.3	2.6	-	-
Grays Thurrock	14	30.8	30.8	-	7.7	-	15.3	7.7	7.7	-
Grovelands Pit	59	40.7	22	5.1	8.5	6.8	6.8	6.8	1.7	1.7
Kempston	27	44.4	22.2	7.4	-	18.5	-	-	3.7	3.7
Lent Rise	18	55.6	11.1	11.1	5.6	11.1	-	5.6	-	-
Lower Clapton	14	21.4	28.6	21.4	14.3	7.1	-	7.1	-	-
Station Pit Kennett/Kentford	28	75	3.6	-	-	7.1	3.6	10.7	-	-
Stoke Newington	50	54	22	14	6	2	-	-	2	-
Sturry	26	65.4	-	23.1	3.8	-	7.7	-	-	-
Warsash	28	57.1	10.7	17.9	7.1	3.6	-	-	-	3.6
PCT assemblage										
Botany Pit	114	57	10.6	-	6.1	-	7	9.6		9.7

Table 7.3 Metrics of flake tools in British MIS 9 assemblages with ≥ 10 flake tools (after Rawlinson *et al.,* submitted).

Site by predominant technology	n	Length (mm)		Width (mm)		Thickness (mm)		Elongation (W/L)		Retouch length (mm)	
		Mean SD	Range	Mean SD	Range	Mean SD	Range	Mean SD	Range	Mean SD	Range
Core and flake assemblage											
Cuxton (Cruse)	10	68.4 ± 21.1	41-106	60.2 ± 16.8	40-100	21.3 ± 10.7	9-43	0.91 ± 0.2	0.63-1.26	56.5 ± 21.5	29-94
Handaxe assemblages											
Baker's Farm	47	84.3 ± 16.8	57-141	76.1 ± 14.7	45-105	24.7 ± 7.7	8-38	0.93 ± 0.24	0.5-1.43	70.8 ± 35.5	16-163
Barnham Heath	16	88.6 ± 22.8	65-155	81.8 ± 24.3	49-127	32.5 ± 8.4	19-47	0.96 ± 0.32	0.41-1.59	84.3 ± 23.3	43-124
Biddenham	46	77.2 ± 18.2	37-119	66.4 ± 25.1	22-143	21.7 ± 8.5	7-46	0.88 ± 0.37	0.51-1.87	85.7 ± 47.4	24-202
Cuxton (Tester)	32	69.1 ± 22	31-143	67.8 ± 22.3	32-112	23.1 ± 10.6	9-54	1.05 ± 0.45	0.49-2.25	57.0 ± 31.4	14-146
Dunbridge	15	88.6 ± 25.7	46-153	70.1 ± 17	55-114	26.2 ± 9.8	16-53	0.85 ± 0.35	0.4-1.92	93.6 ± 39.3	50-187
Furze Platt	39	80.4 ± 17.2	50-114	74.1 ± 19.6	41-121	23.2 ± 6.3	8-34	0.98 ± 0.4	0.36-1.88	78.4 ± 36	35-170
Grays Thurrock	13	52.8 ± 13	30-73	54.4 ± 14	36-85	18.5 ± 4.8	11-28	1.07 ± 0.28	0.59-1.64	48.1 ± 16.4	22-79
Grovelands Pit	59	90.2 ± 24.4	47-202	86.5 ± 24.3	45-189	27.8 ± 9.7	14-71	1.00 ± 0.33	0.49-2.24	85.6 ± 45.1	30-251
Kempston	27	71.3 ± 23.9	34-122	65.7 ± 16.4	22-96	21.4 ± 5	14-33	1.03 ± 0.44	0.21-2.03	83.9 ± 46.6	36-219
Lent Rise	18	76.9 ± 21.4	38-120	60.1 ± 24	23-115	19.2 ± 8.4	5-38	0.83 ± 0.36	0.36-1.54	61.0 ± 31.2	22-136
Lower Clapton	14	80.9 ± 17.9	52-120	76.8 ± 18.5	58-120	25.3 ± 6.4	17-37	1.00 ± 0.43	0.55-1.82	82.2 ± 35.9	26-181
Station Pit Kennet/Kentford	28	90.6 ± 27.6	39-158	60.5 ± 15.9	34-95	23.2 ± 9.3	10-47	0.70 ± 0.29	0.36-1.44	82.0 ± 39.9	20-185
Stoke Newington	50	70.4 ± 18.9	37-122	67.4 ± 17.7	35-106	22.3 ± 5.5	11-35	1.03 ± 0.42	0.42-2.33	77.2 ± 28.5	28-153
Sturry	26	91.1 ± 23.2	50-146	61.9 ± 15.1	39-94	25.7 ± 20.9	9-41	0.70 ± 0.21	0.44-1.35	105.5 ± 50.4	16-249
Warsash	28	90.2 ± 29.8	39-148	78.2 ± 29.8	22-139	25.5 ± 11	7-57	0.90 ± 0.33	0.3-1.62	102.3 ± 61.1	31-300
PCT assemblage											
Botany Pit	114	76.5 ± 17.8	44-129	69.1 ± 17.3	37-134	24.3 ± 67.1	12-47	0.94 ± 0.29	0.41-1.89	60.4 ± 21.3	24-183

Table 7.4 Retouch attributes of flake tools in British MIS 9 assemblages, given as percentages (after Rawlinson *et al.,* submitted).

Site by predominant technology	n	Extent of Retouch			Distribution		Position			Form						Regularity	
		Min.	Sem.	Inv.	Cont.	Disc.	Dir.	Inv.	Bi.	Cx.	Cv.	Rl.	Nc.	Dt.	Mu.	Reg.	Irr.
Core and flake assemblage																	
Cuxton (Cruse)	10	-	90	10	100	-	90	10	-	50	20	-	-	20	10	70	30
Handaxe assemblages																	
Baker's Farm	47	38.8	34	27.7	89.4	10.6	93.6	6.4	-	66	10.6	8.6	6.4	2.1	6.3	34	66
Barnham Heath	16	6.3	68.8	25	87.5	12.5	87.5	12.5	-	81.3	6.3	-	-	-	12.5	68.8	31.3
Biddenham	47	28.2	28.2	43.3	91.4	8.6	80.4	13	6.5	71.7	17.4	2.2	2.2	-	6.5	63	37
Cuxton (Tester)	32	15.6	68.8	15.6	84.4	15.6	84.4	12.5	3.1	68.8	15.6	12.5	-	-	3.1	75	25
Dunbridge	15	13.3	66.7	20	80	20	100	-	-	80	-	6.7	-	-	13.3	53.3	46.7
Furze Platt	39	17.9	56.4	25.6	94.9	5.1	92.3	5.1	2.6	76.9	12.8	5.1	-	-	5.1	84.6	15.4
Grays Thurrock	14	15.4	76.9	7.7	76.9	23.1	69.2	23.1	7.7	53.8	7.7	7.7	15.4	7.7	7.7	76.9	23.1
Grovelands Pit	59	18.6	40.7	40.7	74.6	25.4	89.9	5	5	61	18.6	5.1	6.8	3.4	5.1	52.5	47.5
Kempston	27	11.1	51.9	37	96.3	3.7	96.2	-	7.4	77.8	-	18.5	-	-	3.7	81.5	18.5
Lent Rise	18	27.8	50	22.2	88.9	11.1	94.4	5.6	-	77.8	5.6	11.1	-	5.6	-	83.3	16.7
Lower Clapton	14	7.1	50	42.9	85.7	14.3	85.7	14.3	-	92.9	7.1	-	-	-	-	92.9	7.1
Station Pit Kennett/Kentford	28	21.4	60.7	17.9	85.7	14.3	85.7	14.3	-	67.9	17.9	7.1	-	3.6	3.6	67.9	32.1
Stoke Newington	50	6	60	34	86	14	98	-	2	82	2	12	-	-	4	70	30
Sturry	26	-	76.9	23.1	92.3	7.7	96.2	3.8	-	88.5	3.8	-	7.7	-	-	76.9	23.1
Warsash	28	17.9	28.6	53.6	82.1	17.9	100	-	-	75	10.7	10.7	-	-	3.6	71.4.	28.6
PCT assemblage																	
Botany Pit	114	42.1	51.8	6.1	87.7	12.3	88	12	-	57.8	13.2	8.8	6.1	9.6	3.9	51.8	48.2

Thames

Although there is a genuine non-handaxe signature during MIS 10/9 in the Thames, as discussed in Chapter Six, these sites do not show anything distinct in their flake tools. At Globe Pit only four flake tools were examined, mainly semi-invasive scrapers along with one notch. While all the flake tools from Cruse's excavation at Cuxton come from the non-handaxe layer, they do not differ in technology from Tester's. Just five flake tools, including side scrapers and an *ad hoc* tool, could be identified from Purfleet (Greenlands) showing minimal to semi-invasive retouch. Palmer's (1975:5-7) report also indicates that flake tools were low in number at the site and not remarkable in their character which was further corroborated by Bridgland *et al.* (2013). Therefore, in line with McNabb's (1992; 2007) work there appears to be no distinct tools in non-handaxe assemblages, showing *ad hoc* retouch typical of expedient technology which make up between 1-8% of the flake assemblage (Table 7.1). However, they do seem to lack more invasively retouched scrapers (Table 7.4).

Many other sites in the Thames area during MIS 9 also show a typical Lower Palaeolithic character in their flake tools with similar *ad hoc* expedient technology to earlier non-handaxe sites, but now found alongside handaxes (Table 7.2+7.4). While many of the sites represent a higher proportion of flake tools (Table 7.1) this could be due to collection bias as, in contrast to the non-handaxe assemblages, most MIS 9 Acheulean assemblages have not been formally excavated.

Taking the large assemblage at Furze Platt as an example, the majority of the flake tools are simple scrapers, notches and denticulates. However, a quarter of the assemblage shows more elaborate retouch with a proportion of these representing unifacial handaxes and convergent scrapers (Figure 7.2; Table 7.4). This can also be seen at two of the sites with over 50 flake tools. Grovelands Pit (Figure 7.3) contains a much higher proportion of invasively retouched flake tools (>40%). These flake tools grade from side scrapers to convergent scrapers to flake handaxes with some bifacial working on flakes. Despite these more sophisticated tools, irregular and discontinuous tools including notches and denticulates are still found at the site. While these tools were previously labelled as Mousterian, the site yielded no PCT. Stoke Newington yielded 50 flake tools across all sections of the site, and no difference could be found between the technology of the Common and Geldeston Road. The flake tools were on a spectrum between well-made scrapers and flake handaxes with no Levallois traits, similar to those at Grovelands Pit (Figure 7.4d). Fewer examples from the site contain the irregular and discontinuous work seen at Grovelands, although it is still present. With just under 50 flake tools, Baker's Farm shows a similar, but not as pronounced, trend with around a quarter of the tools showing invasive retouch linked to scrapers including convergent scrapers. Minimally invasive scrapers were still the most predominate flake tool type at Baker's Farm (Figure 7.3).

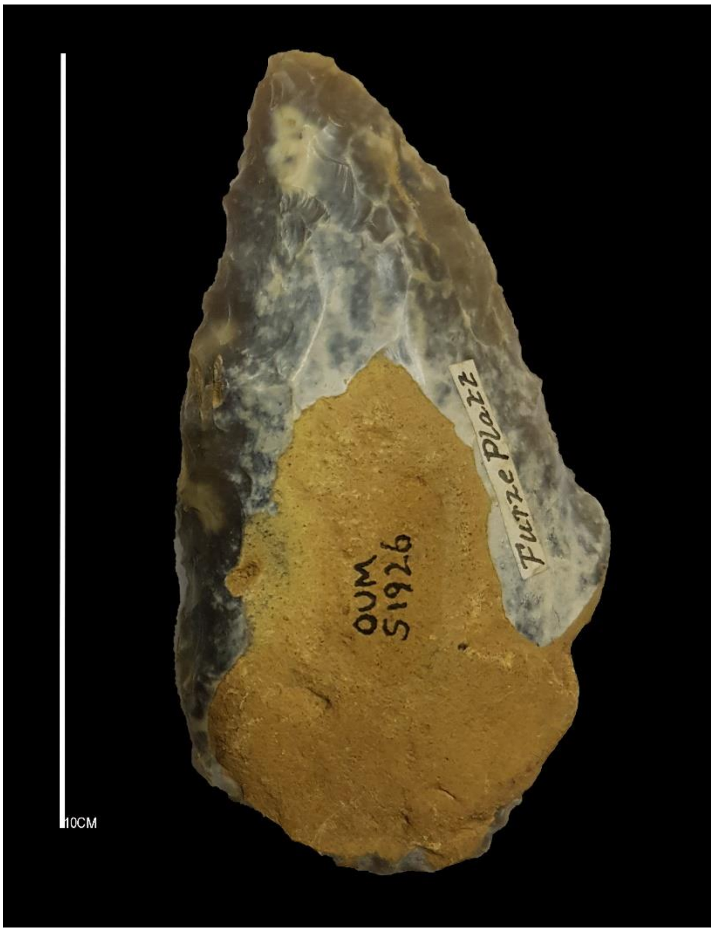

Figure 7.2 Convergent scraper from Furze Platt.

A number of sites while containing fewer examples also show similar technology. These include Lower Clapton where collections at Luton could not be accessed, but the museums database shows around 50 further scrapers (although it is likely some of these would not show evidence of retouch). The flakes analysed show 14 flake tools out of a total of 33 flakes, possibly showing a degree of collection bias. The majority of flakes are semi-invasive or invasive with examples of convergent scrapers and unifacial handaxes similar to the above sites (Figure 7.4b). Wolvercote, one of the most prominent MIS 9 sites, suffered from collection bias with a collection which focused on handaxes. Two flake tools were analysed: a side scraper and a point. Grays Thurrock (for issues of provenance see Chapter Four) yielded only 13 flake tools (scrapers, notches and denticulates), but one flake is bifacially retouched, perhaps showing an attempt at creating a flake handaxe. This can also be seen at the site of Lent Rise where unifacial handaxe attempts and convergent scrapers represent around a fifth of the flake tools. The rest of the assemblage shows less invasive working to create simple scrapers.

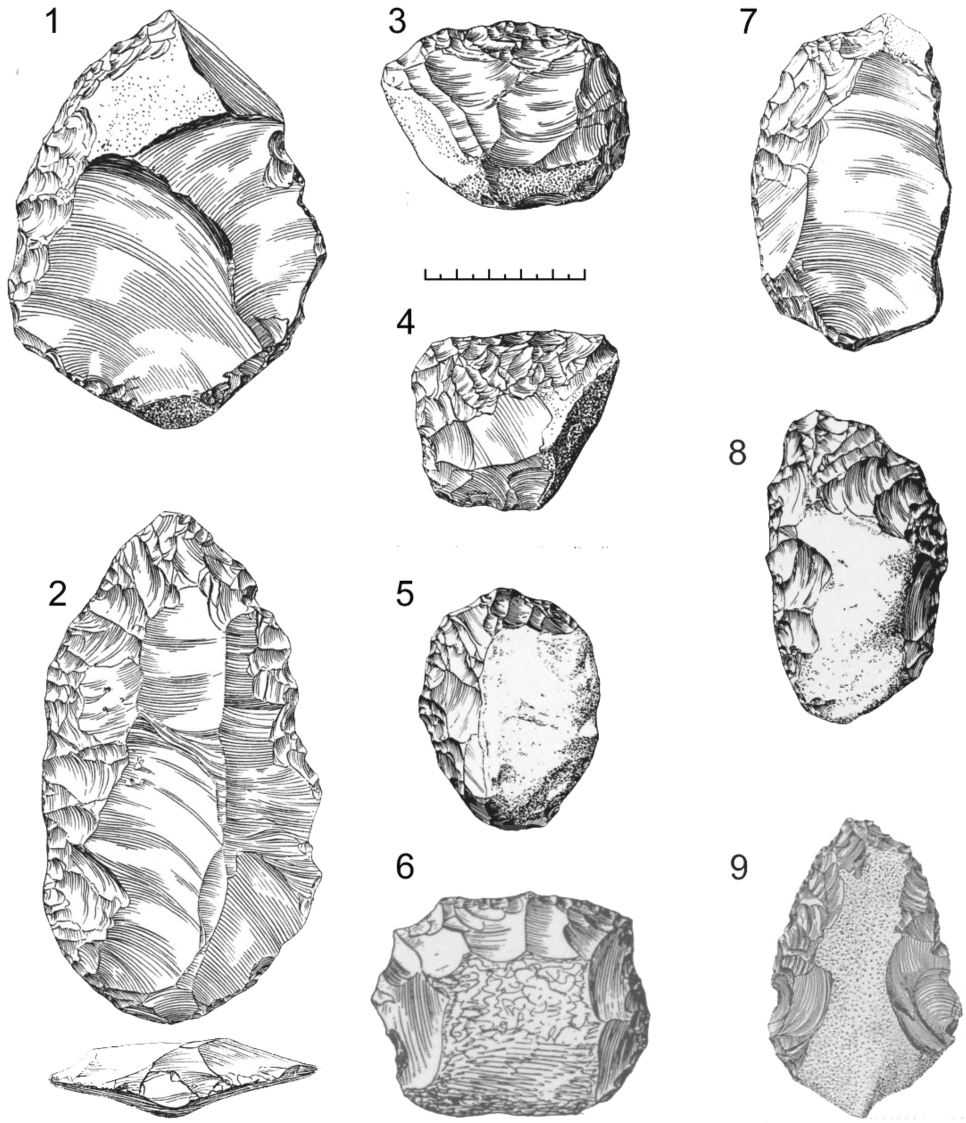

Figure 7.3 Scrapers from British MIS 9 sites: 1, 3, 4 & 7: Grovelands Pit, Berkshire; 2. Sonning Railway Cutting, Oxfordshire; 5 & 8: Kentford, Suffolk; 6. Baker's Farm, Buckinghamshire; 9. Cannoncourt Pit, Furze Platt, Berkshire. (1-4 & 7 after Wymer, 1968; 5 & 8 after Wymer, 1985. 4 & 9 after Lacaille, 1940) (Rawlinson *et al.,* Submitted).

The largest collection of flake tools comes from the site of Botany Pit, Purfleet, (n=114) although this is well below the 1000+ recorded by Roe (1968a). Despite the PCT from Botany Pit, none of the flake tools were made on Levallois flakes. A small proportion (~6%) represent invasive retouch with over 40% containing minimal retouch (Table 7.4). Over half of the flake tools are retouched irregularly, and the most common form of tools are simple side and end scrapers, with notches and denticulates also present. One flake handaxe is present in the assemblage, but the majority of other flake tools represent simple retouch. The flake tools from Cuxton also show no connection to Levallois technology despite the presence of PCT at the site. Tester's assemblage is similar to Botany Pit with only 15% showing invasive retouch and side scrapers being the most common type.

While some of the sites above including Grovelands Pit and Stoke Newington show no evidence of PCT, Baker's Farm and Lent Rise do contain PCT, but do not show any connection between the flake tools and the PCT. None of these sites suggest that an increase in flake tools can be linked to PCT. This can also be observed in the small amount of material studied from Iver which shows evidence for Levallois but no well-made flake tools with Levallois traits.

The site of Sonning Railway Cutting offers a contrast, but the 36 artefacts examined offer only a small sample size. The assemblage shows an undistinguished mixture of handaxes and PCT with six scrapers with semi-invasive to invasive retouch. The invasive convergent scraper from the site shows evidence of being made on a Levallois flake connecting the production of flake tools to the PCT (Figure 7.3).

The Thames sites show a general background of expedient flake tool manufacture with more invasive tools grading into flake handaxes associated with Acheulean assemblages. There are few links between flake tools and PCT.

Eastern England

Although lacking the contextual evidence of the tripartite structure at Purfleet, it has been suggested that the three industries can be seen at the Bedfordshire sites, Biddenham and Kempston (Knowles, 1953). Both sites were listed by Roe (1968a) as having a large flake tool component, but many can be dismissed as naturally edge-damaged. In addition, no non-handaxe signatures can be verified at these sites. Nevertheless, the flake tools from both sites demonstrate interesting parallels to what is seen in the Thames.

The higher number (47) of flake tools that come from Biddenham might be the result of assemblage size, with more than 500 flakes being studied from the site. Nevertheless, the majority are scrapers showing semi-invasive to invasive retouch, with a small proportion of notches and denticulates. Some flake tools are bifacially worked and could be described as flake handaxes, in addition to well worked convergent scrapers. Kempston has a smaller flake assemblage (n=152) with 27 being flake tools. No notches and denticulates are associated with the site, only scrapers, some of which contain bifacial working to create flake handaxes. The invasiveness of the retouch on these tools makes the flake tools at this site important even if they are not as high in number as previously thought. Both sites still contain more minimally worked and/or irregular flake tools.

While not as pronounced as the Bedfordshire sites, Station Pit, Kennet/Kentford (see Chapter Four for issues of provenance) shows similar examples of invasive scrapers including convergent scrapers and unifacial handaxes. Although, flake tools were scarcer than previously recorded and the majority of the assemblage shows less elaborate scrapers, as well as notches and denticulates (Figure 7.3).

In East Anglia, the site of Barnham Heath contained a much smaller proportion of flake tools all of which were scrapers. These were predominantly semi-invasively retouched side scrapers, although a quarter showed invasive working. No convergent scrapers or unifacial handaxes were present at the site.

Despite issues accessing the assemblages from Southacre and Keswick, some examples of flake tools were available for study. The flake tool from Southacre is an elongated invasive convergent scraper similar to examples from Biddenham and Kempston. Southacre has been compared to High Lodge by McNabb (2007:203) and is thought to contain both *ad hoc* flake tools and more controlled invasive retouch (Sainty and Watson, 1944:186). At Keswick there is an example of an invasive double scraper which is again similar to sites above (Figure 7.4c). The associated site of Whitlingham has also had its flake tools compared to those at High Lodge (Sainty, 1927:197). A full analysis is needed of the material from these three sites, but it is likely that results would show, similar to other sites in MIS 9, that numbers have previously been inflated but that high-quality flake tools are present.

Similar to the Thames area, links between flake tools and PCT are minimal across all these sites. The Levallois flakes from Biddenham and Kempston show no signs of retouch, but there is no distinction between handaxe related material and PCT. The only site where this is possible in eastern England is Barnham Heath. At Barnham Heath the PCT is less abraded than the Acheulean material, but the flake tools lie between these groups. With the relatively small sample size it is difficult to be certain where the flake tools fit, and whether abrasion is obscuring other examples of genuine retouch. There are no signs of a technological connection between the PCT and flake tools at the site, and the flake tools are not remarkable.

Figure 7.4: Scrapers from British MIS 9 sites: a) Warsash; b) Lower Clapton; c) Keswick; d) Stoke Newington (Rawlinson *et al.,* submitted).

The Solent

As with the study of non-handaxe assemblages (Chapter Six) and PCT (Chapter Eight) the lack of core and flake collecting in the Solent, as well as the issues surrounding dating (Westaway *et al.,* Davis *et al.,* 2016; Hatch *et al*, 2017), has affected the collections from these sites. No Solent sites were listed by Pettitt and White (2012) and White and Bridgland (2018) due to these factors, but the flake tools at these sites show interesting parallels with the other regions. As with eastern England there were no non-handaxe assemblages related to MIS 10/9 in the Solent area. The Solent sites examined all contain examples of PCT.

The 55 flakes examined from Harvey's Lane showed no signs of retouch. The abraded nature of the finds could have obscured retouch, but no convincing flake tools could be identified. The site formation processes show signs of collection bias or winnowing typical of the region. A small sample from Romsey showed no links between flake tools and PCT, with the only flake tools from the site being semi-invasive side scrapers with no PCT traits.

A small assemblage from East Howe (n=37) contained two flake tools both made on large flakes. The site formation and condition are similar to that found at Harvey's Lane. It is not possible to say anything conclusive based on such a small sample, but the presence of flake tools in the assemblage can be verified. Neither flake tools show signs of being made on a Levallois flake, one is a semi-invasive convex side scraper typical of more elaborate flake tools during the Acheulean, and the second tool was labelled 'Le Moustier' and in the museum database as a handaxe made on a flake. This tool is mainly unifacial with invasive convergent retouch on the distal end giving it a handaxe like appearance, but it is not a true biface. It is likely that these flake tools were collected for their more invasive retouch which does not represent the assemblage as a whole.

The site of Dunbridge permitted a larger assemblage to be studied, with 15 flakes showing signs of retouch. All tools were scrapers and most showed signs of semi-invasive to invasive retouch. Some flakes marked as flake tools were dismissed as being edge damaged. The convergent scrapers and some of the more invasive side scrapers could be attempts at working a flake into a handaxe. Other irregular flake tools show signs of a more expedient technology. The flake tools demonstrated no links to the PCT at the site.

Finally, 28 flake tools from Warsash were examined where over half showed invasive retouch, which suggests that more elegant flake tools may have been collected. Nonetheless, it equally demonstrates that highly worked flake tools were present (Figure 7.4a). Other than one notch the rest of the flake tools are scrapers, grading from minimally invasive irregular side and end scrapers to a unifacial handaxe. Multiple flakes could be classed as flake handaxes and show minimal working on the ventral side. Levallois flakes from the site show no signs of retouch, and based on condition it is possible that the flake tools show a mixture of those relating to the handaxe material and those related to the later PCT. However, the sample size makes this difficult to assess.

Overall, the Solent sites show a small group of sites with similarities to the other regions. It is clear that more elegant working of flakes took place alongside handaxe manufacture and PCT, but the extent of this has been lost due to collection bias. Irregular *ad hoc* retouch is also common at these sites which is considered more typical of the Lower Palaeolithic. Connections with PCT cannot be established at most sites.

7.2 Flake tools in the British Lower and Middle Palaeolithic

Studies of flake tools in the British Lower Palaeolithic are rare. Both Kelley (1937) and Lev (1973) were restricted by their contemporary chronologies and interpretive frameworks, relying on culture history and typologies respectively. Advances in the understanding of Palaeolithic chronology now allows for a much more nuanced examination of changes throughout the Palaeolithic. In order to place MIS 9 within its wider context, it is vital to compare the sites to selected sites from MIS 13, MIS 11 and MIS 7 (Table 7.5). These have been selected on the secureness of their dating and extent of publication. Comparisons between these sites and MIS 9 will produce an updated study of flake tools within the Lower and Middle Palaeolithic.

MIS 13

The idea of an evolutionary trend in the Acheulean from crude to advanced is clearly refuted by the Boxgrove handaxes attributed to MIS 13 (Bergman and Roberts, 1988:105; Roberts,1990; Roberts *et al.* 1997:303; Pope *et al.,* 2020). Despite this, an evolutionary trend still seems to influence ideas around flake tools becoming more significant closer to the Middle Palaeolithic (White and Bridgland, 2018), but this may be an oversight. The main Boxgrove monograph (Roberts and Parfitt, 1999) offers limited details of flake tool finds. The rare examples of scrapers tended to be atypical end scrapers (Roberts *et al.,* 1986:241) with Austin *et al.* (1999:345) describing a handful of flakes tools: a retouched piece, a notch and a transverse scraper. This gives the flake tools at the site a restricted character, but information can be gleaned from other sources including Pope's (2002) work which has shown that flake tools may be more important at Boxgrove than commonly thought.

Table 7.5 Summary of flake tools at British sites MIS 13-MIS 7 (after Rawlinson *et al.,* submitted).

Site	Flake tools (n)	Retouched flakes/flakes (%)	Handaxes	Flake tools on Levallois flakes	Method	Reference
MIS 13						
Boxgrove Q1/B	262	1.8	Y		Excavated	Pope, 2002
High Lodge Bed C	67	7.0			Excavated	Ashton, 1992
High Lodge Bed E	15	3.9	Y		Excavated	Ashton, 1992
MIS 11c						
Clacton (Golf Course)	87	7.5			Excavated	Singer *et al.,* 1973
Barnham Area I (unit 5)	46	4.3			Excavated	Ashton *et al.,* 1998
Barnham Area IV (unit 5/6)	7	1.2	Y		Excavated	Ashton *et al.,* 1998
Swanscombe Lower Gravels (Waechter)	70	7.0			Excavated	Ashton and McNabb, 1996a+b
Swanscombe Lower Loam (Waechter)	17	7.2			Excavated	Ashton and McNabb, 1996a+b
Swanscombe Lower Middle Gravels (Waechter)	7	5.4	Y		Excavated	Ashton and McNabb, 1996a+b
Swanscombe Middle Gravels (Wymer)	199	2.4	Y		Excavated	Wymer, 1964
Beeches Pit	~40	<1	Y		Excavated	Gowlett *et al.,* 2005
Elveden (all areas)	15	0.8	Y		Excavated	Ashton *et al.,* 2005
Southfleet Road elephant site (Elephant Butchery)	5*	11.9*			Excavated	Wenban-Smith, 2013
Southfleet Road elephant site (Phase 6)	110*	12.3*			Excavated	Wenban-Smith, 2013
Southfleet Road elephant site (Phase 8)	11*	10.5*	Y		Excavated	Wenban-Smith, 2013
MIS 11c?						
Foxhall Road (Layard)	14	8.9	Y		Excavated	White and Plunkett, 2004
Foxhall Road (Moir)	20	8.1	Y		Excavated	White and Plunkett, 2004
MIS 11a						
Hoxne Lower Industry	17	2.3	Y		Excavated	Wymer, 1993
Hoxne Upper Industry	95	11.9	Y		Excavated	Wymer, 1993
MIS 8-7						
Creffield Road, St. Bernard's	7	3.4		Y	Collected	Scott, 2011
Creffield Road, School site	8	6.8		Y	Collected	Scott, 2011
Yiewsley, Eastwood Pit, Garroway Rice	2	2.1	(Y)	?	Collected	Scott, 2011
Bakers Hole	19	12.4	(Y)	Y	Collected	Scott, 2011
Ebbsfleet	9	3.8		?	Collected	Scott, 2011
Ebbsfleet (site B)	4	2.7		?	Collected	Scott, 2011
Lion Pit Tramway Cutting	2	0.9			Both	Scott, 2011
Pontnewydd Cave (Main)	70	13.7	Y	Y	Excavated	Aldhouse-Green *et al.,* 2012
Pontnewydd Cave (New entrance)	17	18.8	Y	Y	Excavated	Aldhouse-Green *et al.,* 2012

* includes utilised flakes and flake handaxes; (Y) distinct condition

The horse butchery area (GTP17) yielded some bifacial flake tools (Figure 7.5), one (1039) shows irregular minimally invasive retouch while the other (1086) shows evidence of more invasive retouch (Pope, 2002:128). Handaxes from GTP17 were mostly made on the spot and then removed (Roberts, 1990), and it is possible that retouched flakes were subject to similar transport behaviour. Most areas of Boxgrove were locales for meat processing with other activities happening elsewhere (McNabb, 2000). In contrast to this, area Q1/B was more regularly visited and intriguingly Pope (2002:218) described this area as containing higher quantities of flake tools. While at other areas of Boxgrove flake tools represent 0.3% of the assemblage (only 20 across all areas), they represent 1.8% of Q1/B with 262 flake tools across all units (Pope, 2002:181). Pope (2002:218) questioned whether some of the retouch was natural, indicating its minimally invasive nature, but concluded that given the lack of other abrasion and localised nature these were anthropogenic. Little is written about their character, but these could show both the production of handaxes on flakes and the simple expedient retouch of flakes.

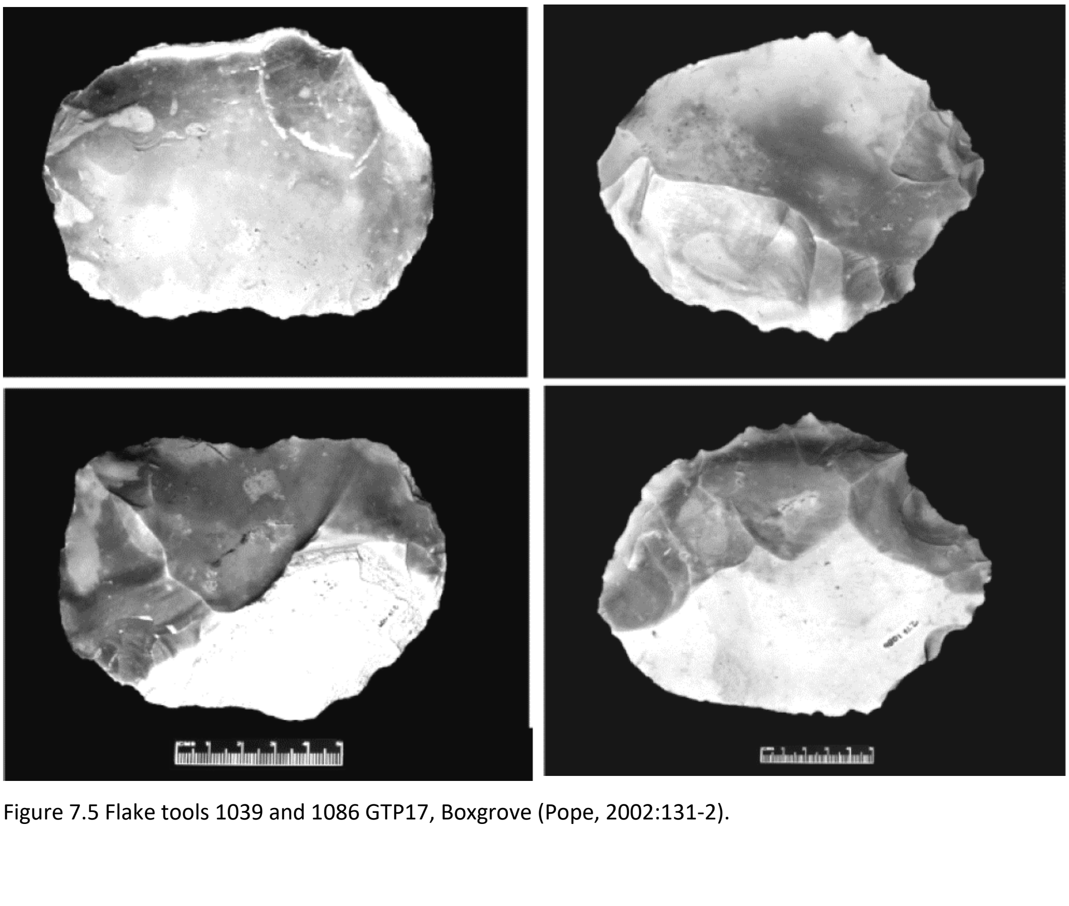

Figure 7.5 Flake tools 1039 and 1086 GTP17, Boxgrove (Pope, 2002:131-2).

The idea that MIS 13 contains crude archaeology is also contradicted by High Lodge, known for its elegantly made flake tools variously linked to the Clactonian, Acheulean and Mousterian (Breuil, 1932; King and Oakley, 1936; Oakley and Leaky, 1937; Paterson and Fagg, 1940;

Oakley, 1949; Collins, 1969; Bordes, 1984; Coulson, 1990). The flake tools (Figure 7.6) come from different contexts to the handaxes with a clear distinction in condition, and while it has previously been argued that post-depositional movement of the handaxes suggested the archaeology could be contemporary (Ashton, 1992:124), Lewis *et al.* (2019:53) have recently argued that they are separate assemblages. Later excavations by the British Museum recovered 100 flake tools between 1962-1968 and five from the 1988 cleaning. Scrapers, notches and denticulates were found in all three beds (Ashton, 1992:129). The 28 new scrapers uncovered included both 'classic High Lodge scrapers' and scrapers with minimum edge modification, and these were compared with the 167 from old collections (Ashton, 1992:150). The invasiveness cannot be dismissed but it may have been over-emphasised, and the recent excavations show many scrapers are less invasive than the classic examples (Ashton and McNabb, 1992:166). Ashton and McNabb (1992:166) argued that the flake tools at High Lodge are not completely unique during the Lower Palaeolithic and are found at other sites, such as Warren Hill and Maidscross Farm.

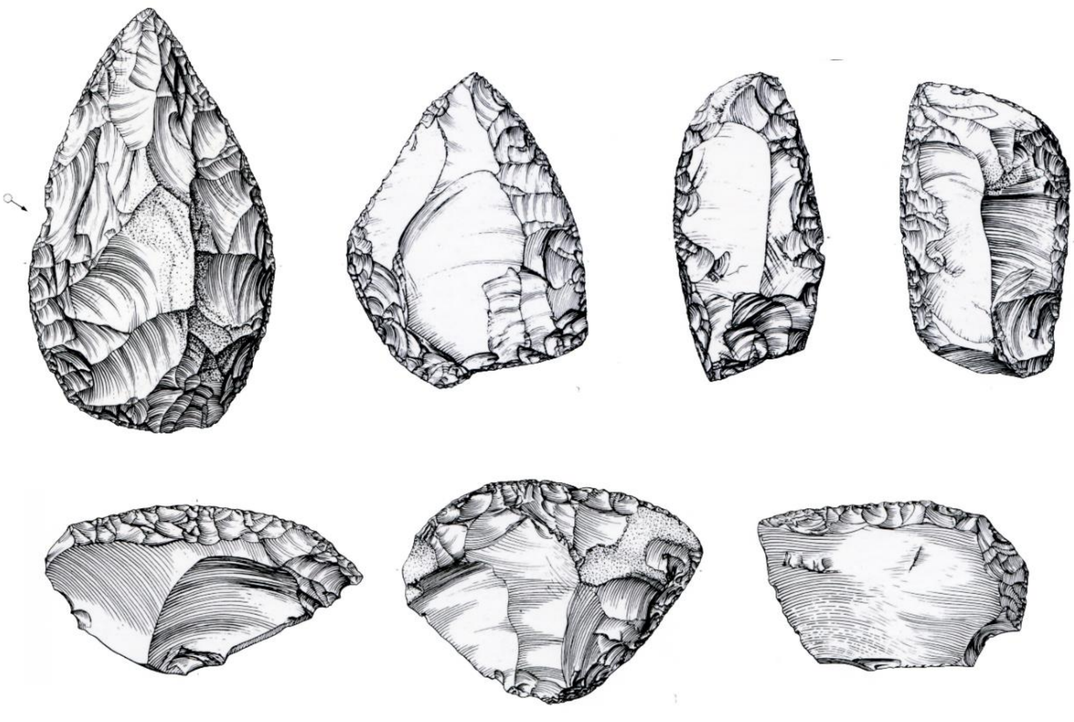

Figure 7.6 Scrapers from the clayey-silts (Bed C) High Lodge, Suffolk (after Ashton et al., 1992a; Rawlinson *et al.,* submitted).

The evidence from MIS 13 shows that flake tools were present at all sites, and there is little evidence that technology was cruder than later periods of the Lower Palaeolithic. Flake tools during MIS 13 are part of a general Acheulean technology and there are examples of elegant invasive scrapers, minimally retouched flakes, notches and denticulates. Expedient technology is common at all of the sites and the more invasive examples, 1086 GTP17 from Boxgrove and the High Lodge scrapers, show similar occurrences to MIS 9.

MIS 11

Clactonian sites during MIS 11 contain numerous flake tools, but these are conservative in nature. At Clacton, Warren (1951:133) stated that flake tools represented 5% of the assemblage, mainly made up of side scrapers, end scrapers and bill hook forms (Figure 7.7). Roe (1968a) lists 450 from Lion Point alone and another 117 from a general provenance. While flake tools were important at Clacton, Wymer (1985:277) argued that the flake tools lacked standardisation. Singer (1973:42-55) mentioned that some of the flake tools were elegant despite the Clactonian context and linked some of them to High Lodge. The figures of these elegant flakes seem to show only semi-invasive retouch similar to other non-handaxe contexts from MIS 11 and MIS 9 (Figure 7.8).

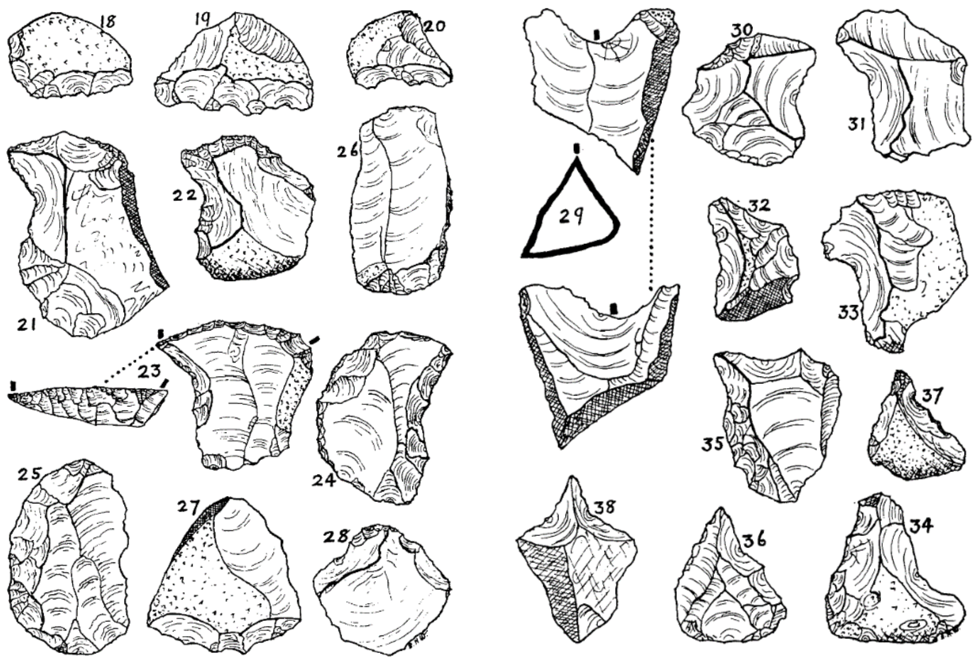

Figure 7.7 Flake tools from Clacton (Warren, 1951:119-121).

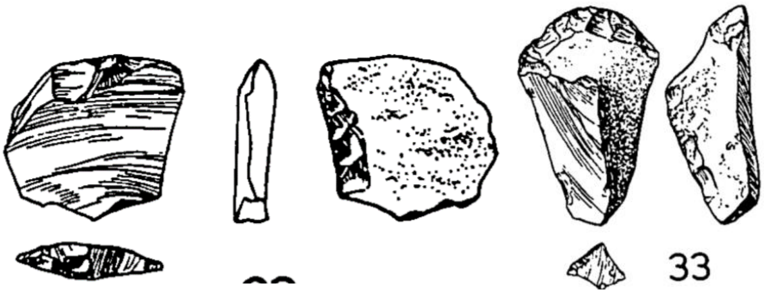

Figure 7.8 Flake tools from Clacton referred to as elegant by Singer (1973:52-54).

At Barnham, despite distinct Clactonian and Acheulean layers showing potential cultural differences (Ashton *et al*., 2016), variations in flake tools are minimal (Ashton *et al.,* 1998a:219). Proportions do differ as flake tools are not as common in Area IV (Acheulean) as Area I (Clactonian), and this could show either flake tools being taken away or the lack of their production (Ashton, 1998c:252). Scrapers mainly show semi-invasive retouch on the most convenient edge and a length of retouch rarely above 50mm (41mm average) (Ashton, 1998a:219). Other tools include two denticulates and one notch with the rest of the flake tools being flaked flakes (Ashton, 1998b:219). Despite a higher proportion of flake tools in Area I, few are invasively retouched (Ashton, 1998c:251) similar to the non-handaxe sites of MIS 9.

Similarly, at Swanscombe Ashton and McNabb (1996b:213) argued that there were minimal differences between the flake tools from Clactonian and Acheulean layers, and that the majority of the genuine flake tools were flaked flakes, with only seven scrapers, three notches and four denticulates from all three layers. The flake tools were characterised as short-term *ad hoc* behaviour to fit immediate needs (Ashton and McNabb, 1996b:217).

The same can be seen in the material from Wymer's (1964) work on the Acheulean layers associated with the Swanscombe Skull. Wymer (1964:36) described these flake tools as "tools of the moment" and argued that they were not easily classified. Most only show evidence of minimal retouch and only one has more invasive working (Wymer, 1964:36).

The Elephant Butchery site in Ebbsfleet Valley shows simple flake tools and notches both at the butchery site and the larger Clactonian area (Phase Six) (Wenban-Smith, 2013). While the proportion of flake tools is high, Wenban-Smith (2013) included all flakes with signs of utilisation. The Clactonian assemblages show basic flake tools in line with other Clactonian sites. The overlaying Acheulean (Phase 8) demonstrates a decrease in the proportion of flake tools, but included more advanced forms such as flake handaxes and 'Quina-like' scrapers (Wenban-Smith, 2013c). However, there are only a low number of flake tools and many include similar flake tools to the Clactonian layers including notches, utilised flakes and simple flake tools. Wenban-Smith (2013) argued that the Acheulean flake tools showed the use of mental templates in flake tools due to the presence of two almost identical ‘Quina-like’ scrapers. While only low in number, the site does show the production of more invasively worked flake tools during MIS 11.

Overall, MIS 11 sites show a restricted nature in flake tools. Beeches Pit contained a largely *in situ* archaeological assemblage with evidence for refitting (Preece *et al.,*1991;2000;2006). Flake tools were considered important, making up around 2% of all artefacts (Gowlett *et al.,* 1998:94;2005:17). Only three scrapers are recorded with the majority being notches and denticulates, showing a paucity of more intense retouch (Gowlett *et al.,* 1998:93-4; 2005:20). Gowlett *et al.* (2005:17) argued that core and flake working at the site was separate from handaxe manufacture, but two handaxes have been made on large flake blanks suggesting possible links. In all other cases bifacial retouch is rare, with the flake retouched either minimally or semi-invasively preferentially on the longest edge (Gowlett, 2005:20). The use of large flake blanks (>100mm) suggests the selection of large blanks for flake tools (Gowlett *et al.,*2005:20). As none of the flake tools relate to the refitting studies it is possible flake tools were transported around the landscape, and more could have been moved away (Gowlett *et al.,* 2005:25).

Elveden also fits with this use of expedient flake tool technology. Paterson and Fagg (1940:6) reported four handaxes and seven partial handaxes alongside ~600 cores and flakes. Paterson and Fagg (1940:8) argued 45% of the flakes showed some signs of retouch or utilisation, but admitted that differentiating from natural edge damage was difficult with definite retouch only on 15%. Flake tools were mainly small and convex, with minimal to semi-invasive touch, but some notches and handaxes made on flakes were also present (Paterson and Fagg, 1940:20). The 1995-1999 excavations recovered a collection of handaxes, cores, flakes and flake tools (Ashton *et al.,* 2005:1). Only 13 flake tools were identified from all areas including both minimally and invasively retouched scrapers along with notches (Ashton *et al.,* 2005;44). These flake tools were characterised by *ad hoc* working with no evidence of blank selection (Ashton *et al.,* 2005;45). Ashton *et al.* (2005:58) interpreted the site as showing handaxe manufacture with the rare use of scrapers and other flake tools.

The importance of flake tools at Foxhall Road may have previously been overstated. The site was excavated by Nina Layard (1903; 1904; 1906a; 1906b) between 1902-1905, and her surviving notebooks detail the recovery of all worked artefacts including small scrapers comparable to eoliths (White and Plunket, 2004:54). White and Plunkett (2004:77-8) split the archaeology into eight assemblages with 306 formally labelled artefacts, noting a bias towards handaxes and tools with most flakes having been lost or not collected. The red gravel contained small handaxes which were minimally worked from pebbles and flakes (Pettitt and White, 2012:111). While Layard (1904:233) described 46 irregular scrapers, from the 20 illustrated in Layard (1906a) only one was verified by White and Plunkett (2004:125). The genuine flake tools from Layard's excavations are generally semi-invasively retouched side-scrapers, but one may be a handaxe attempt (White and Plunkett, 2004:128). While Reginald Smith's excavations did not recover any flake tools, Boswell and Moir (1923:249) excavated 544 artefacts and amongst all levels found flake tools that were usually referred to as racloirs. Some of these racloirs were compared to handaxes while others were linked to the Mousterian (Boswell and Moir, 1923:255-6). From the Moir collection White and Plunkett (2004:145) noted a denticulate and a 'tayac' point amongst simple flaked flakes.

At Hoxne there is evidence of higher quality flake tools. The Lower Industry contains few formal flake tools, but it has been argued they were suitable for tasks without further modification (Wymer and Singer, 1993:91). Some flakes show working, but this tends to be only minimal to semi-invasive working to make side scrapers (Wymer and Singer, 1993). However, the Upper Industry yielded 95 flake tools showing a difference between the two layers (Wymer and Singer, 1993:106). Convex scrapers are common with rectilinear and concave forms scarcer (Wymer and Singer, 1993:106). Some of the convex scrapers are finely made (Figure 7.9) and Roe (1981:275) compared the site to High Lodge and Stoke Newington. This is an important contrast to the other MIS 11 sites and is comparable to the more elegant flake tools at sites such as Grovelands, Biddenham and Kempston in MIS 9. Ashton *et al.* (2008) reassigned the site to MIS 11a, which could be significant considering its separation from the other MIS 11 sites typically dated to MIS 11c.

Overall, during MIS 11 flake tools do not show any distinct Clactonian characteristics. There also appears to be a lack of more elaborate flake tools in Acheulean contexts, although the Upper Series at Hoxne shows examples of more invasively retouched flake tools, and a number of other sites show that the more invasive flake tools are known in lower numbers. This includes a number of sites that show the use of large flake blanks for handaxe manufacture and more elaborate tools, including Foxhall Road, Beeches Pit, Southfleet and Elveden. Nevertheless, the majority seem to show *ad hoc* minimally invasive working also typical of MIS 9.

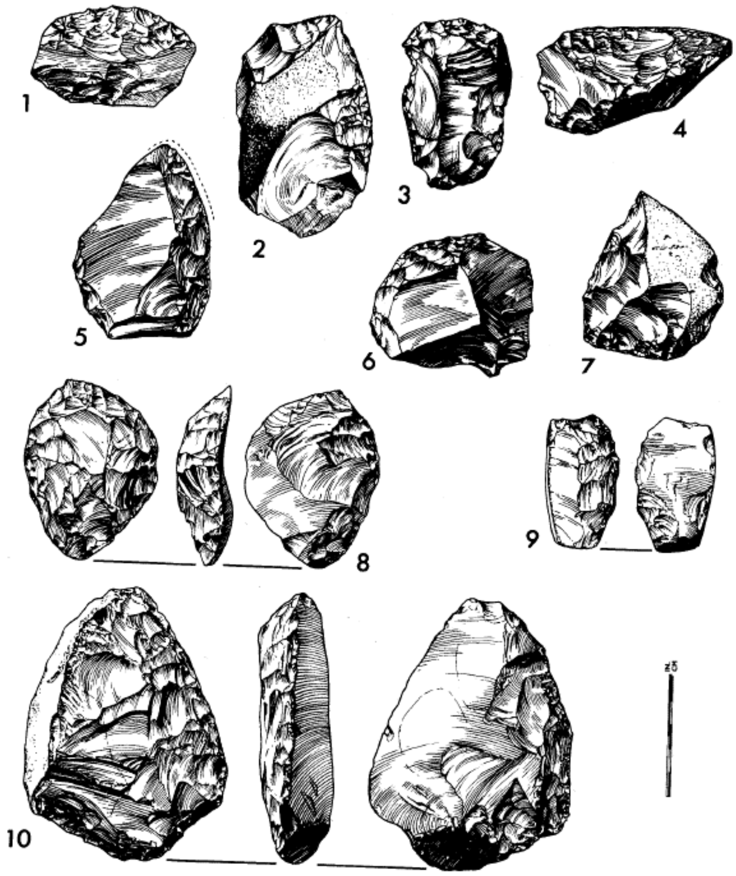

Figure 7.9 Flake tools from the Upper Series at Hoxne (Wymer,1985:168).

Early MIS 8/7 (Lynch Hill/Corbets tey)

The sites examined for MIS 8/7 are largely based on the work of Scott (2011). They represent old collections that can be correlated to the time periods comprising the EMP. Due to distinct differences these have been split into early sites correlated with the Lynch Hill/Corbet's Tey terraces and later sites correlated with the Taplow/Mucking terraces and equivalent deposits in line with Scott (2011).

Creffield Road, Acton and Yiewsley can be correlated to the earliest part of the EMP, and these sites show little evidence for the importance of flake tools in either numbers or the invasiveness of retouch. Due to the lack of contextual evidence, Scott (2011:71) only examined the Levallois artefacts from Yiewsley where just two retouched Levallois flakes were examined. With such a small presence it could be argued that flake tools were not that important at the site. Collins (1978:29) compared a small number of retouched Levallois flakes to the ones at Baker's Hole. Judging from the illustrations of both Levallois and non-Levallois examples, this working is not extensive and could be natural edge damage or minimal working (Figure 7.10).

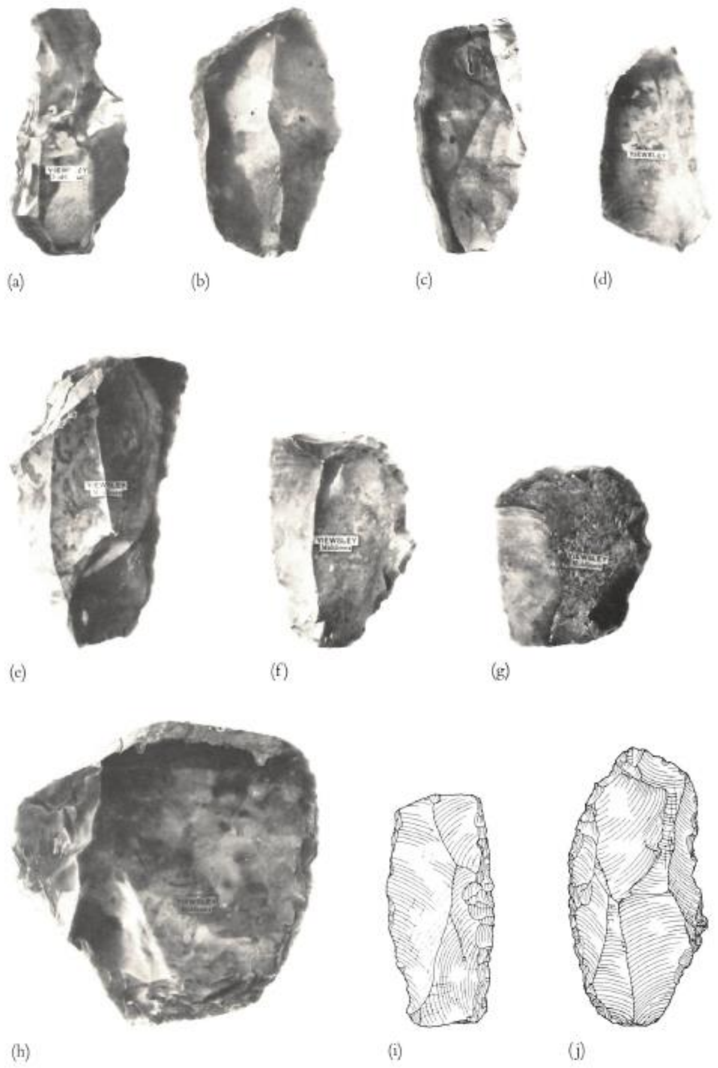

Figure 7.10 Examples of retouched flakes from Yiewsley (Collins, 1978:30).

At Creffield Road, Brown (1886,197;1887) described flakes that had been both roughly and symmetrically retouched alongside less refined flake tools. Wymer (1968:267) recorded only 25 flakes with secondary working, with a further sixteen “used as knives” out of over 400 flakes. Roe (1968a) recorded around 50 flake tools from the site. After separating the site into discrete areas, Scott (2011:39) recorded only seven flake tools (3.2% of assemblage), five on Levallois flakes, from St. Barnard’s area. Both Levallois and non-Levallois flakes show proximal thinning that can be described as “truncated-faceting” (Scott, 2011:55). Scott (2011:56) suggested this work could be due to hafting the flakes. Only two of the flakes show more invasive retouch (Scott, 2011:56). At the school site the eight flake tools were made on Levallois flakes with five of them demonstrating thinned butts, similar to the St Barnard’s site (Scott, 2011:58). Further modification through scaly retouch was also noted, but was rarely invasive (Scott, 2011:58). Breuil and Koslowski (1931) argued that Levallois flakes were often left unretouched, being tools in themselves. This shows a change in technology from MIS 9 through the establishment of full Levallois, but surprisingly not an increase in the importance of modified flakes. This may be due to the fact that little retouch was needed to use a Levallois flake as a tool similar to a handaxe (Roe, 1981:275).

MIS 8-7

Flake tool technology from later MIS 8/7 sites show a degree of diversity. Some sites such as Lion Pit Tramway Cutting show little evidence for flake tools with only two flake tools known out of 229 artefacts, one a side scraper, the other bifacially worked, both on non-Levallois flakes (Figure 7.11; Scott 2011:130-131). These two flake tools came from the 1984 excavations, with none found in 1995 or in the older Warren Collections (Schreve *et al.,* 2006:36). It has been suggested that one of the flake tools could be a handaxe roughout (Schreve *et al.,* 2006:42).

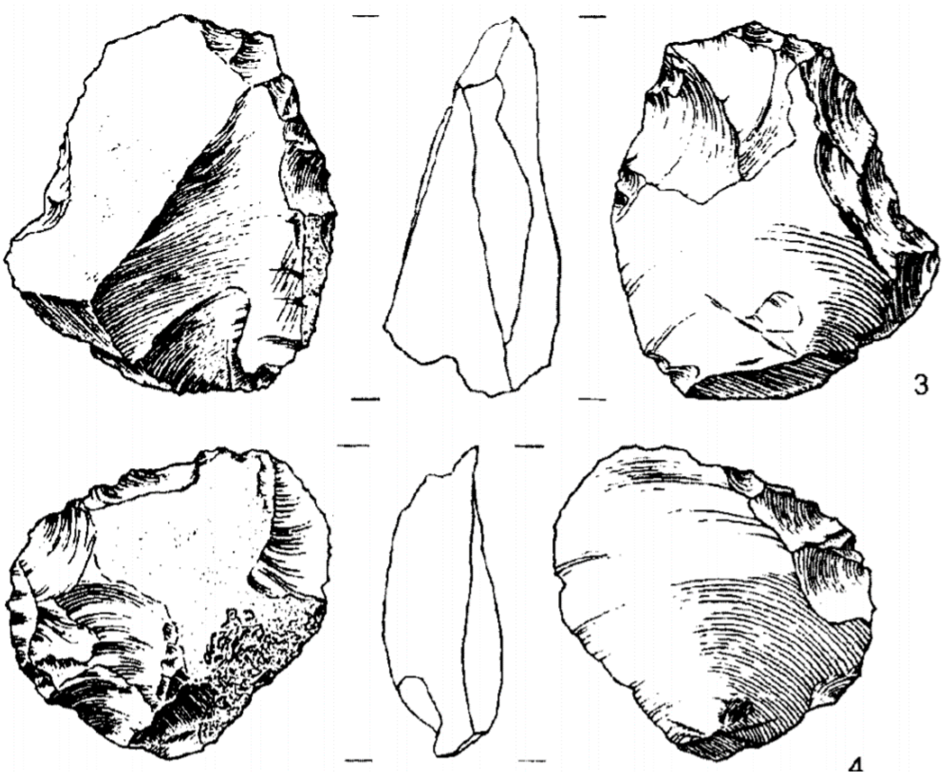

Figure 7.11 The two flake tools from Lion Pit Tramway Cutting (Schreve *et al.,* 2006:41).

The sites of Stoke Tunnel, Ipswich and Brundon, Suffolk have smaller assemblages making analysis difficult. At Stoke Tunnel only one side scraper can be identified out of seven artefacts (Scott, 2011:159). Layard (1920:219) noted the scarce nature of flint, but mentioned one 'double racloir' scraper from the site. Scott (2011:163) reported no flake tools at Brundon, but Moir and Hopwood (1939:10) and Wymer (1985:201) mentioned examples of elegant scrapers from the site. These sites hint at the potential importance of flake tools but without more artefacts this cannot be examined.

Other sites show retouch being used to modify both Levallois and non-Levallois flakes. At Bakers Hole Wenban-Smith (1992:5) concluded that 6% of the assemblage were flake tools, mostly showing unifacial working on the distal end but with some bifacial examples (Figure 7.12). Scott (2011:95) studied 17 flake tools from the site, identifying three notches and denticulates among an assemblage dominated by convex side scrapers with either semi-invasive (47.1%) or invasive (11.8%) retouch. Double scrapers and bifacially worked scrapers are also represented, often resembling handaxes (n=5) (Scott, 2011:95). Some of these are similar to what is seen in MIS 9. Scott (2011:97) noted that the large Levallois flakes are functional analogues for handaxes.

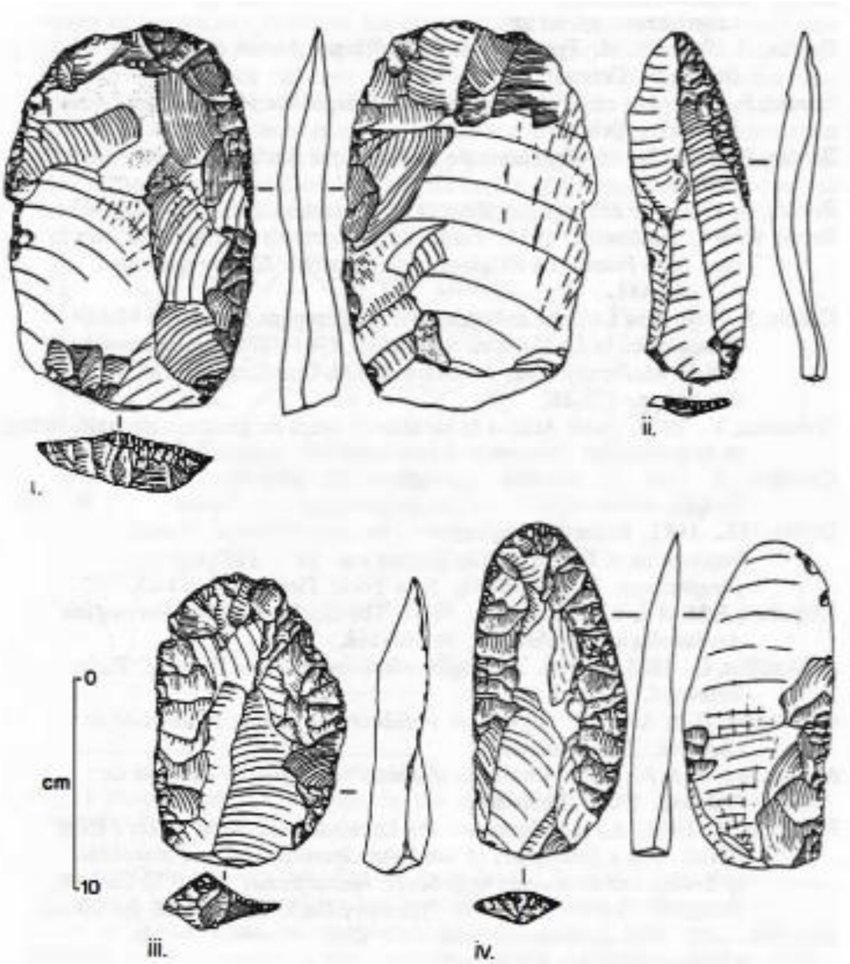

Figure 7.12 Flake tools from Baker's Hole (Wenban-Smith, 1992:9).

Evidence for flakes being retouched to resemble handaxes, by working two edges and sometimes being worked bifacially, is also present at Ebbsfleet Channel, Kent. Scott (2011:113) examined 13 retouched flakes (five minimally invasive, five semi-invasive and three invasive), of which five were made on Levallois flakes. Examples of both Levallois and non-Levallois flakes show evidence of bifacial working, with one Levallois flake resembling a cleaver (Scott, 2011:114). The non-Levallois flake tools show more *ad hoc* retouch with semi-invasive working on various edges (Scott, 2011:114). One Levallois flake shows thinning of the butt possibly related to hafting (Scott, 2011:114). Scott (2011:114) argued that the site showed a varied approach, and this can be linked to a baseline of simple retouched flakes and the use of flakes as handaxe analogues.

Outside of the Thames and eastern England, Pontnewydd Cave in North Wales yielded over 600 artefacts (Aldhouse-Green, 2012). Flake tools are an important part of the technology of the site, along with both handaxes and Levallois made on local volcanic raw material (Green, 1981; 1984; Aldhouse-Green, 1998). There seems to be no chronological separation between handaxes and Levallois, although handaxes are slightly more dominant in the 'main cave' (~225 kya) compared to the 'new entrance' (~175kya), and flake tools show a slight increase in proportion in the new entrance (Aldhouse-Green, 2012:333). Irregular retouch is common, but at times this can be more invasive (Aldhouse-Green *et al.,*2012:266). The relation with Levallois is unclear, with some flake tools made on regular flakes and others showing Levallois traits with different levels of regularity and invasiveness (Aldhouse-Green *et al.,*2012:266). While raw material could have affected the use of flake tools, they fit in with the diversity of the period.

Summary

Scott (2011:179) described EMP Levallois flakes being retouched in a number of ways to both rejuvenate and create tools. While this was also the case in the Lower Palaeolithic, Scott (2011:179) argued that the Middle Palaeolithic showed flake tool use increasing. While flakes do replace handaxes during this period, the elaboration of retouch does not seem to increase, especially at the early sites. Work by Scott (2011) and White *et al.* (2006) has shown a dichotomy between sites from the early EMP sites and later ones. Flakes at earlier sites such as Creffield Road seem to have been retouched to accentuate the cutting edge rather than create it, unlike Ebbsfleet Valley where retouching has been used to modify the edges (White *et al.,* 2006). This appears to change chronologically, with earlier flakes being tools within themselves and examples from later in the EMP requiring modification. However, some sites such as Lion Pit Tramway Cutting and Brundon contain too few flake tools to accurately relate to the pattern (White *et al.,* 2006).

A lack of retouched tools could be due to the utility of unretouched Levallois flakes. Differences could be due to site function, with flake tools being moved away from manufacture sites but present at mixed strategy sites (Scott, 2011:182). Comparisons with Pontnewydd Cave are difficult due to it being the only cave site in the sample.

Within the context of the rest of the British Lower-Middle Palaeolithic, it can be observed that MIS 9 is similar to other Lower Palaeolithic periods, although collection bias may have led to more elaborate flake tools being attributed to MIS 9. The two trends that are clear throughout the Lower Palaeolithic are a background of expedient *ad hoc* flake tool technology, and more elaborate flake tools possibly related to phases of handaxe manufacture. Comparisons to the EMP show a continuation of this and despite the change from handaxe manufacture to Levallois working that takes place between MIS 9/8 and MIS 8/7, there is no notable increase in elaborate flake tools.

7.3 Flake tools in Europe during MIS 9

Although Britain has a rich archaeological record for MIS 9, the secondary context of most of the archaeology, and the absence of long detailed sequences that overlap with MIS 7 (Scott, 2011), makes it difficult to contextualise the Lower to Middle Palaeolithic transition. In order to place the work within its wider context, select sites from continental Europe (Table 7.6) have been selected for comparison. These sites offer a more detailed record of this period (Hérisson *et al.,* 2016a), and one which can help interpret the trends seen in Britain including the relation of flake tools to non-handaxe assemblages, handaxe assemblages and the EMP.

France

Menez-Dregan in Brittany has occupation layers dating from MIS 12-MIS 8 and is one of a number of sites that has previously been given the label ‘Colombanian’ (Ashton and Davis, 2019). Ravon *et al.* (2016a;2016b) described the ‘Colombanian’ as a local facies of the Acheulean, where handaxes are absent, or very rare, with few scrapers and assemblages dominated by cobble tools, notches and denticulates. These sites have often been compared to the Clactonian in Britain and other non-handaxe sites in France, Italy and Spain (Ravon, 2019). Menez-Dregan preserves a long sequence where change can be observed over time (Ravon *et al.,* 2016a;2016b; Ravon, 2019). The Colombanian layers are comparable to the non-handaxe layers in MIS 9 Britain, but no culturally significant tools forms can be identified to link these two occurrences, as most flake tools are examples of expedient working with only low proportions of scrapers (Ravon *et al.,* 2016a;2016b; Ravon, 2019).

Table 7.6 Summary of comparative sites from mainland Europe MIS 12-8 (after Rawlinson *et al.,* submitted).

Site	Dating	Artefacts (n)	Flake tools (%)	Handaxes	PCT	Comments	References
France							
Cagny L'Epinette	MIS 10/9	3000	3.3	Yes	No	Open-air site with handaxes. Flake tools predominantly notches, denticulates and rare scrapers.	Moigne *et al*., 2016; Lamotte and Tuffreau, 2016
Menez-Dregan Layers 9-7	MIS 12-10	26,361	1.7 - 6.2	Rare	No	Multi-level cave site with rare handaxes in some levels. Flake tools vary between levels dependent on-site function. Denticulates and notches more dominant than scrapers. Discoidal cores evident at top in layer 4ab.	Ravon *et al.,* 2016a; 2016b submitted; Ravon, 2018; 2019
Menez-Dregan Layers 5-6	MIS 9	112,060	0.8 - 2.8	Rare	No		
Menez-Dregan Layers 4c-4ab	MIS 8	14,856	1.6 - 2.6	Rare	No		
Orgnac, layers 7-5a	MIS 9	13,065	8.9 -24	Yes	No	Multi-level cave site showing early development of PCT as handaxes decrease. Scrapers dominate over other flake tools, some with invasive retouch in lower levels. Layers 1-2 have fewer flakes tools and marginal retouch.	Moncel *et al.,* 2011; 2012; 2020
Orgnac, layers 4b-3	MIS 9/8	9,510	10.3 - 17.4	Yes	Yes		
Orgnac, layers 2-1	MIS 9/8	60,798	6.2 - 8	Rare	Yes		
Soucy 6	MIS 9	182	14.2	No	No	Nine occupation sites within alluvial deposits of the Yonne. Although stratigraphically separate, the sites reflect different activity areas with variation in tool production and use. All sites have denticulates, notches and scrapers, with convergent forms at Soucy 3.	Lhomme, 2007
Soucy 5, Level II	MIS 9	1433	1.8	Yes	No		
Soucy 5, Level I	MIS 9	1595	$	Yes	No		
Soucy 3, P	MIS 9	6066	14.6	Yes	No		
Soucy 2	MIS 9	156	$	No	No		
Spain							
Gran Dolina Lower TD 10.1	MIS 9?	21,522	3.4	Yes	Yes	Highest levels in Gran Dolina cave with intense occupation in TD10.1. Handaxes decline through sequence and first PCT. Mainly ad *hoc* flake tools, but also convergent scrapers with Quina retouch in TD10.1.	Rodríguez-Hidalgo *et al.,* 2015; García-Medrano *et al.,* 2015; Lombera-Hermida *et al.* 2020
Gran Dolina Upper TD10.1-A and B	MIS 9?	967	5.7 - 6.9	Yes	Yes		
Belgium							
Kesselt-Op de Schans	MIS 9/8	2683	0.7	No	Yes	Terrace deposits with early PCT and Levallois. Simple scrapers and other flake tools.	Van Baelen *et al.* 2007; 2008; 2011*;* Van Baelen, 2014; 2017
Mesvin IV	Early MIS 8	4970*	2.3	Rare	Yes	PCT and Levallois associated with rare handaxes. Scrapers with marginal retouch and other simple flake tools. Levallois flakes minimally retouched	Ryssaert, 2004; 2005; 2006a; 2006b

*sample; $ figures not given.

The low number of handaxes has been attributed to the difficult raw materials, mainly consisting of flint, quartz, microgranite and sandstone beach pebbles, but also to variable use of the cave (Ravon *et al.,* submitted). Handaxes are completely absent in some layers (9, 9a, 8c, 5d, 5c', 5c, 5b), but importantly present in the intervening layers (8b, 7, 6', 5e, 5d', 5b', 5a', 4c, 4ab). The flake tools generally consist of *ad hoc* modifications to flake edges and are dominated by denticulates with lower quantities of notches and scrapers (Ravon, 2019). While layers 9 to 7 (MIS 12-10) have relatively high proportions of flake tools, there is a significant drop in the proportion in layers 6 to 5a, which date to MIS 9. The relative number of scrapers varies in the MIS 9 levels, with somewhat higher proportions in layers 5c', 5c and 5b' (Ravon, 2019). Layers 4c and 4ab have been attributed to MIS 8 with the first signs of the Middle Palaeolithic based primarily on evidence of several discoidal cores, although Levallois is absent. However, the proportion of flake tools remains low with no marked difference to the preceding levels. Ravon (2019) suggested the decrease in flake tools as a slight change in site function with a move towards flake production rather than a focus on retouching blanks. Menez-Dregan offers clear parallels to the British sites, showing that there is no evidence for an increase in flake tool numbers or elaboration, either during MIS 9 or as part of the shift towards EMP technologies.

Soucy, France has been dated to MIS 9, with nine distinct horizons (Lhomme, 2007). These show clear similarities to what can be observed in Britain, but with higher levels of preservation. The oldest area (Soucy 6) is characterised by its crude flake tools including notches, denticulates and *ad hoc* retouching of flakes (Figure 7.13), while also lacking handaxes (Lhomme, 2007). This background technology is seen across the other horizons. However, where there is evidence of handaxe manufacture there is an increase in scrapers and the quality of the retouch (Lhomme, 2007). Soucy 5, Level 1 shows evidence of flakes from handaxe manufacture being used as flake tool blanks. In Soucy 3, Level P, flake tools included evidence of convergent scrapers and more invasive and regular retouch (Lhomme, 2007). At Soucy 1 a separation between flake tools and handaxes can be observed, possibly indicating different uses of the landscape with simple *ad* hoc flake tools being quickly made to suit the task at hand (Lhomme, 2007; Malinksy-Buller, 2016a). The site mirrors the British record, and the spatial data and environmental information could help explain some of the variation in the British sites.

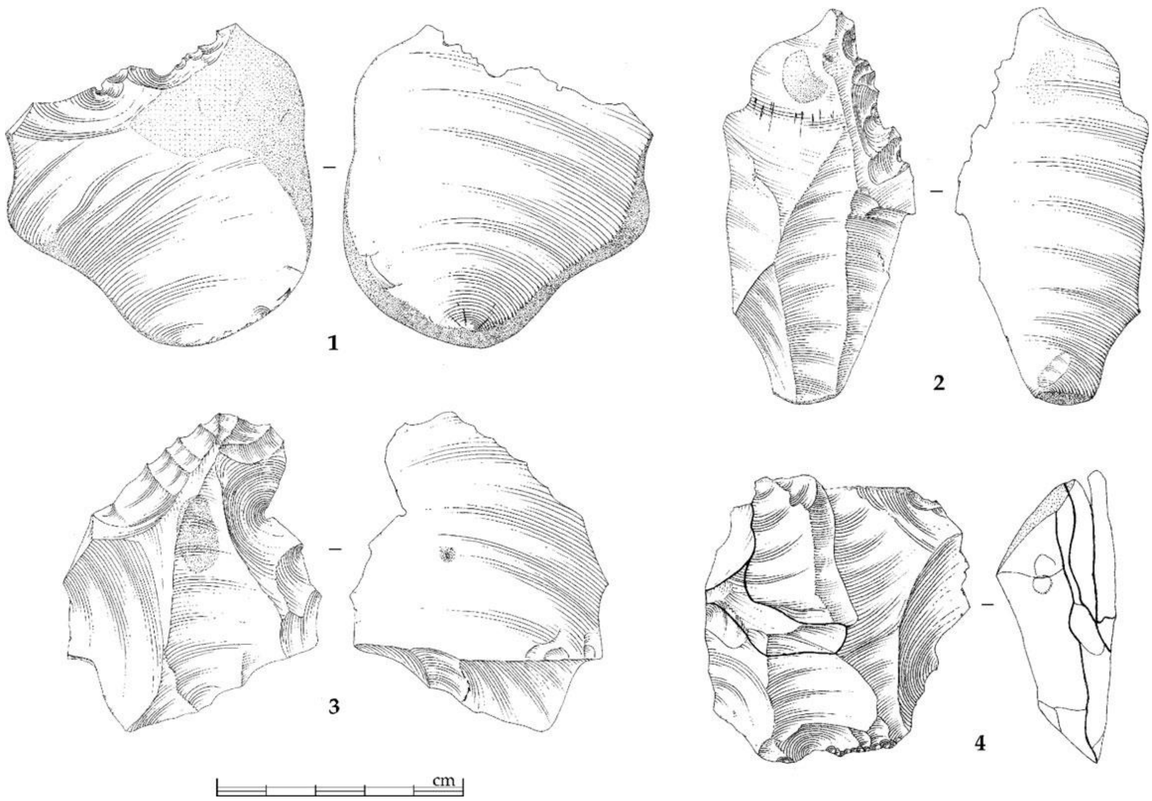

Figure 7.13 Artefacts from Soucy 6, 1-3) denticulates 4) Refitting core (Lhomme, 2007:541).

Lamotte and Tuffreau (2016) used the sites around Amiens, Somme Valley dating between MIS 12-9 including Cagny-la-Garenne I, Cagny-la-Garenne II, Cagny-la-Ferme de l'Epinette, Cagny-l'Epinette, Revelles and Gentelles to argue that retouched tools show little change between MIS 12-9, being dominated by notches and denticulates. Nevertheless, they argue that single scrapers appear around MIS 10 and that only during MIS 9 do convergent scrapers become part of the technology. This is a strong contrast to what is seen in Britain. Differences between proportions of flake tools are considered to centre on site function rather than chronology (Lamotte and Tuffreau, 2016). PCT is considered rare during MIS 10-9-8, and no links between flake tools and Levallois are suggested (Lamotte and Tuffeau, 2016).

The presence of refined 'Mousterian' flake tools has long been a hallmark of the Middle Palaeolithic, but as in Britain the EMP of Europe does not clearly demonstrate the importance of these tools. Orgnac 3, France preserves a detailed record of the transition from MIS 9/8 and corroborates evidence from Britain that early Levallois is not linked to an increase in elaborate flake tools (Moncel *et al.,* 2012). At Orgnac 3 flake tools are more common in the lower handaxe levels (8-5) prior to the appearance of PCT in the middle layers (4b-4a) (Moncel *et al.,* 2012). The upper layers (2-1) represent a period where handaxes have become rare (<1%), Levallois is the main core working method and there are lower numbers of flake tools (Moncel *et al.,* 2012). There is a decrease in diversity and the invasiveness of retouch that begins higher up in the sequence but becomes more prominent once handaxes become scarce (Moncel *et al.,* 2012).

Spain

In Spain, the evidence concurs that the EMP does not represent a clear proliferation of flake tools, but a more complex transition from the Lower to Middle Palaeolithic. The upper section of the Gran Dolina (Atapuerca) sequence preserves archaeology dated to MIS 11-8, with TD 10.1 correlating to ~MIS 9 (Lombera-Hermida *et al.,* 2020). Early signs of PCT are known from Lower TD 10.1 and Upper TD 10.1A, where it is considered the major change in technology (Lombera-Hermida *et al.,* 2020). Despite this, the site shows continuity with previous periods with the manufacture of handaxes, although there is a marked drop off later in the sequence (Lombera-Hermida *et al.,* 2020). Lower TD 10.1 demonstrates higher levels of intensity of retouch to create convergent scrapers (Figure 7.14) and side scrapers alongside Acheulean handaxes (Lombera-Hermida *et al.,* 2020). Upper 10.1 1A-B, shows more expedient signs of retouch with a higher proportion of denticulates, and this is accompanied by a decrease in the importance of handaxes, especially refined handaxes (Lombera-Hermida *et al.,* 2020). They argued that the site showed a local *in situ* transition rather than outside influence, showing cultural continuity. Changes in raw material usage and different approaches to flake tools have been attributed to different uses of the site, influenced by the length of occupation (Lombera-Hermida *et al.,* 2020).

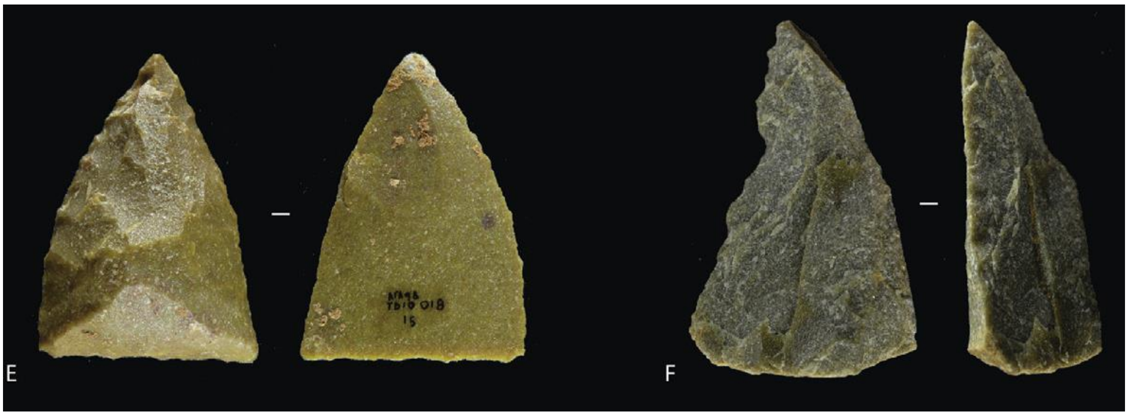

Figure 7.14 Examples of convergent flake tools (Lombera-Hermida *et al.,* 2020:18).

Belgium and the Netherlands

Kesselt-Op de Schans, Belgium, is a MIS 9/8 site which contains handaxes, early PCT and full Levallois (Van Baelen, 2017). After refitting, only 19 'tools' could be identified including three scrapers (two with only minimally invasive retouch and one with semi-invasive retouch) and six Levallois flakes, classed by Van Baelen (2017: 89) as tools. The rest of the assemblages are made up of more *ad hoc* retouched flakes (Van Baelen, 2017). This evidence fits the results of this study showing no increase in flake tools, especially in invasiveness, during the EMP. This is also true of Mesvin IV, Belgium (early MIS 8) where flake tools make up a low proportion (3%) of an assemblage containing PCT and handaxes, which Ryssaert (2006) argued is typical of the period. Of the flake tools, 42% are scrapers but most are simply retouched, with Levallois flakes containing only marginal retouch (Ryssaert, 2006).

Conversely, in the Netherlands Maastricht-Belvédère represents a site with fully developed Levallois and no handaxes dated to MIS 7. Although parts of the site may date to MIS 9, and early PCT has been found alongside Levallois, as well as by itself at sites D, F and H (De Loecker, 2006; De Warrimont, and Stassenstraat, 2007; De Loecker and Roebroeks, 2012; Verpoorte *et al.,* 2016). Site K does show the importance of flake tools, especially scrapers (including convergent scrapers) alongside Levallois, but De Loecker (2006) argued that these represent a transported toolkit. Similar ideas have been suggested by Scott (2011), but the British record often lacks the level of detail to explore this further. Examples figured in De Loecker (2006:506), while showing convergent scrapers on Levallois flakes, only show minimal retouch but do demonstrate a clear connection between flake tools and Levallois. This fits with the observation that Levallois products only needed minor retouch compared to more typical Acheulean flake tools.

Summary

The sites discussed above show clear parallels to what can be seen in Britain during both MIS 9 and the Lower-Middle Palaeolithic transition. The lack of an increase in flake tool use and elaboration is seen at numerous well-preserved sites from across north-western Europe. It is also noticeable that more elaborate flake tools from these sites seem to come from handaxe contexts in the region as well.

7.4 Patterns in flake tools during the Lower-Middle Palaeolithic

A number of common trends can be seen in the flake tools of MIS 9 when compared to the preceding Lower Palaeolithic and the succeeding Middle Palaeolithic detailed above. These have ramifications for the character of MIS 9 and the broader Lower-Middle Palaeolithic, and there are equivalents in the record of continental Europe.

How common are flake tools in MIS 9?

The analysis of the flake tools from MIS 9 has shown that the hypothesis that there was an increase in flake tools during MIS 9 cannot be verified. As previously shown in Table 7.2, the numbers detailed in Roe (1968a) do not accurately reflect the collections. Large quantities of flakes were labelled or listed as flake tools, but many have been dismissed as being naturally edge damaged by this study. It is crucial not to over inflate the importance of flake tools by reporting larger numbers, and previous confusion may stem from the term 'retouched and flake implements' by Roe (1968a). This ambiguous term has led to over counts of flake tools by including 'naturally retouched' flakes and utilised flakes.

At only three sites (Botany Pit, Grovelands Pit and all areas of Stoke Newington) were over 50 flake tools examined, although at both Biddenham and Baker's Farm 47 flake tools were examined. Some sites such as Keswick and Lower Clapton could not be fully examined due to the lack of access to collections. While the same is true of Southacre and the Palmer collection from Purfleet, these were not included in Pettitt and White's (2012) list of 15 sites. The emphasis on total number of flake tools is perhaps misleading. For example, Stoke Newington (all areas) yielded 50 flake tools, but this only represents 9.4% of the flake assemblage. While Kempston only has 27 flake tools these represent 17.2% of the flake assemblage. This difference is crucial as otherwise sites with large collections of flakes, such as Furze Platt, Stoke Newington and Botany Pit, can give a false impression of the increase in flake tools.

Taking excavated sites as a baseline, the Cruse Collection from Cuxton (Cruse, 1-6), Globe Pit and Purfleet (Greenlands) show modest proportions of flake tools (c. 1-9%), as well as low proportions of invasive flake tools. However, all three sites represent non-handaxe assemblages so may not be typical as handaxe sites show more evidence of elaborate flake tools. The increase in the proportion of flake tools in handaxe assemblages should be treated with caution due to collection bias, as while seven sites show a comparable proportion (<10%), ten show a higher proportion (10-20%) and the remainder even higher which may be as a result of collection bias or sampling. Further excavations to recover representative samples are needed to evaluate if this is a genuine trend.

Other than Purfleet (Schreve *et al.,* 2002; Bridgland *et al,* 2013) and Cuxton (Cruse, 1987; Wenban-Smith, 2006), there has been a lack of critical re-evaluation of MIS 9 sites when compared to MIS 11 (Conway *et al.,* 1996; Ashton *et al.,* 2008; Ashton *et al.,* 2016) and the EMP sites (Scott, 2011). This has allowed outdated perceptions to remain unchallenged as Roe

(1968a;1981) and Wymer (1968;1985;1999) both offer the most complete and relevant summaries of many MIS 9 sites.

Much of the collection at MIS 9 sites was overseen by certain archaeologists and collectors including Treacher and Lacaille (Baker's Farm, Furze Platt, Groveland's Pit, Lent Rise) and WG Smith (Stoke Newington, Lower Clapton, Grays, Kempston, Biddenham). The high quality of the work of these archaeologists has been noted especially compared to contemporaries, leading to a more representative collection of all artefacts, including flakes and flake tools (Roe, 2009; Hosfield, 2009; Harris *et al.,* 2019:17). Their work also focused on certain urbanising areas on MIS 9 terraces around Maidenhead and Bedford. Lacaille's labelling of artefacts is often misleading and many of the counts of flake tools appear to be inflated through the counting of naturally edge damaged flakes.

The absolute number of flake tools can be a deceptive metric, and many sites outside of MIS 9 have significant numbers of flake tools. Over 50 flake tools are known from the MIS 13 sites of Boxgrove and High Lodge. For MIS 11, Roe (1968a) is vague on the numbers of flake tools from Barnham East Farm and Hoxne, but seems to suggest they are a significant part of the assemblages. The sites of Swanscombe and Clacton are both listed as containing numerous flake tools (Roe, 1968a), and this does not seem to be restricted to Clactonian layers at Swanscombe. In addition, the EMP sites discussed above do not show the predicted increase in the number of flake tools, with only Yiewsley having above 50. This is because the number of flake tools is arbitrary, being controlled by assemblage size. The proportion of flake tools in well excavated sites is a much better metric to measure this by. Nevertheless, it is apparent that it should be the quality and character of the flake tools that should be examined and not their quantity.

Non-handaxe

While describing higher number of flake tools in Clactonian contexts, McNabb (2007:341) suggested that this was a product of larger assemblages and the collection of flakes, and therefore does not reflect a higher proportion. The flake tools from the sites of Globe Pitt, Little Thurrock and the non-handaxe layers of Purfleet and Cuxton were found in low number and are undistinguishable from Acheulean flake tools, apart from a potential lack of more invasive working similar to Clactonian sites. Flake tools have little bearing on the identification of non-handaxe sites, and these examples form a part of the basic flake tool use in the Lower Palaeolithic.

Middle Palaeolithic

Despite the proximity to the EMP, and evidence of PCT (Chapter Eight), only a flake tool from Sonning Railway Cutting demonstrates convincing evidence of the retouching of Levallois products during MIS 9. References to 'Mousterian' flake tools stem from elegant flake tools without any connection to Levallois technology or the Middle Palaeolithic. The high-quality flake tools from High Lodge and Hoxne demonstrate that these are not unknown in the Lower Palaeolithic. Due to this, it is unnecessary to link the flake tools of MIS 9 to an emerging Middle Palaeolithic.

The changes in flake tool use in the EMP could also explain this pattern without contradicting the emerging Middle Palaeolithic character of late MIS 9. MIS 8 sites show that Levallois flakes are mainly unmodified, and only later MIS 7 sites show more extensive modification of the flakes to transform them into tools (Scott, 2011). The lack of increase in flake tool numbers and elaboration can be seen across Europe during this period, including the sites of Organc 3, Gran Dolina, Menez-Dregan, Kesselt-Op de Schans, Mesvin IV and Maastricht-Belvédère. Levallois flakes are often considered as tools in themselves not requiring retouch which led to a decrease in the amounts of retouched flakes (Douze and Delagnes, 2016; Eren and Lycett, 2016). Evidence of this could be seen with the lack of connection between PCT and flake tools at sites including Botany Pit, Barnham Heath, Biddenham and Kempston.

It is also likely that the simpler PCT created fewer diagnostic flakes, and so any flake tools would be harder to distinguish as related to the cores. At Middle Palaeolithic sites it is common for Levallois flakes and flake tools to be carried away from the site which could also explain their absence (Geneste, 1985; 1989; Scott, 2011). It is unlikely that the perceived increase in flake tools is due to the beginning of Middle Palaeolithic behaviour, but this does not contradict the clear signs of PCT in MIS 9 discussed in Chapter Eight.

Invasiveness

Roe (1981:13) observed that Lower Palaeolithic contexts often included well-made scrapers, but they were not the most prevalent artefacts. This study has shown that at a number of sites invasive scrapers are present and make up a significant proportion of assemblages including Baker's Farm, Grovelands Pit, Stoke Newington, Biddenham and Kempston. What these sites have in common is a handaxe component, in the cases above assigned to Roe's (1968b) Group I (Dale, Pers. Comm. 2021). It seems that alongside handaxe manufacture, hominins were retouching flakes into tools that go beyond mere *ad hoc* modification. Many of the finest flake tools could be seen as grading into flake handaxes. The similarity between handaxes and retouched Levallois flake tools has been noted by White *et al.* (2006) and Scott (2011). This could be extended to the Lower Palaeolithic as many flake tools appear to be attempts to create, or at least mimic, handaxes.

García-Medrano *et al.* (2019) recently examined the idea of mental templates for the manufacture of handaxes using data from Boxgrove. This could extend to retouching flakes as part of a wider Acheulean technology, and White (2012:257) has previously questioned whether true handaxes, partial bifaces and bifacial scrapers could represent the application of a single *chaîne opératoire,* which was flexible and expediently used on the available material. Similar ideas were also explored by Wenban-Smith (2013). Flake handaxes are known from many of the sites discussed above, both MIS 9 and the comparisons. Tester (1951:126) discussed the connection between handaxes and flake tools at the MIS 11 site of Bowman's Lodge due to numerous flake handaxes and more invasive flake tools. Many of the flake tools figured in Kelly (Figure 7.15) show flake tools on a spectrum with flake handaxes, and Wymer's (1968:61) figures could also show a similar trend.

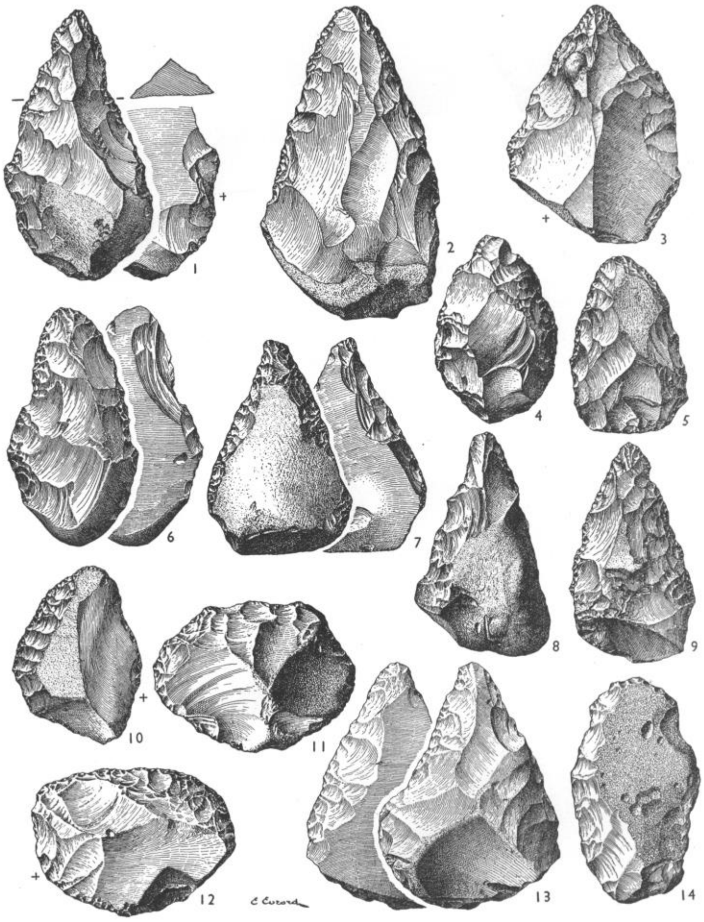

Figure 7.15 Selection of flake tools resembling handaxes (Kelly, 1937:26).

There is no evidence that this is unique to MIS 9. As discussed above, invasively retouched flake tools often approaching flake handaxes are present at sites including High Lodge (MIS 13) and Hoxne (MIS 11a). Ashton and Davis (submitted) suggested that the well-made High Lodge scrapers took on some of the 'social resonance' associated with handaxes. In addition, the more elaborate flake tools of MIS 9 are associated with Group I handaxes, noted for ficron handaxes which are thought to demonstrate wider meaning beyond the merely functional (Gamble, 1999; Kohn and Mithen, 1999; Wenban-Smith, 2006; Westaway et al., 2006; Spikins, 2012; Bridgland and White, 2014; 2015; Davis *et al.,* 2016; Hosfield *et al.,* 2018; White and Foulds, 2018; White *et al.* 2018; 2019; Rawlinson *et al.,* submitted). Elaborate flake tools during MIS 9 could therefore be part of a wider Acheulean technology rather than signs of the EMP. This can also be seen in the absence of invasive flake tools in both Clactonian sites and MIS 9 non-handaxe contexts. However, while elegant flake tools seem to be a part of the Acheulean repertoire, they are not present at all sites and there is no evidence of an evolutionary trend.

Ad hoc expedient technology

Not all sites in the Lower Palaeolithic contain well-made scrapers, and even at sites known for elegant flake tools like High Lodge the assemblages are still dominated by more simple flake tools (Ashton, 1992). The same is true for the sites of MIS 9. Indeed, these simple minimally retouched flake tools appear to represent just as much of a base line technology throughout the Palaeolithic, as do flakes and cores. Hallos (2005:165) argued that flake tools were often manufactured and discarded in the same area showing expedient technology. Simple *ad hoc* retouch on flakes is found throughout the Lower and the Middle Palaeolithic, and Kelley (1937:17) described points, side scrapers and crude end scrapers as the most common with notches and denticulates also found alongside these. A focus on 'type fossils' such as handaxes and Levallois technology has meant that little attention has been paid to undiagnostic elements of the Lower Palaeolithic, and as a result fewer were collected (Dennell, 1990:550). These flake tools still reflect the wider background of flake tool use during the Lower Palaeolithic, and it was only during the EMP that handaxes declined and flakes became the predominant tool type (Scott, 2011). As stated above, this *ad hoc* expedient technology is not unique to, or more prevalent in, MIS 9 but instead a variable constant in Lower Palaeolithic technology.

Resharpening

How much re-sharpening affected the character of flake tools during MIS 9 is hard to measure. Results from MIS 9 do not fit the idea that flake tool variation is a by-product of reduction

(Dibble, 1986; 1987;1995; Rolland and Dibble, 1990; Dibble and Rolland, 1992) as there are a variety of invasively retouched side scrapers, double scrapers and convergent scrapers amongst other tools, showing discrete tool types. Therefore, there is no way of linking minimally retouched flake tools to an earlier stage of retouch (Brumm and McLaren, 2011:193). While most unifaces and convergent scrapers by their nature have more invasive retouch, many side scrapers from sites such as Grovelands Pit and Stoke Newington also demonstrated invasive retouch. The record from MIS 9 fits with Hiscock and Clarkson's (2008) idea of multiple approaches to flake tool production. The variation during the Lower and Middle Palaeolithic cannot be explained by reduction alone.

Reduction has been associated with the highly mobile toolkits often linked to the Middle Palaeolithic, but highly worked tools do not always mean they have been highly curated (Kuhn, 2014:33). For example, handaxes can be elegantly made in a short space of time (Pitts and Roberts, 1997:XCVIII). As it has been noted above there is no clear link between the emerging Middle Palaeolithic and an increase in invasive flake tools during MIS 9. The continuum of flake tools at certain sites could be explained by abandoned handaxe attempts, but this does not explain the predominance of minimally retouched flakes as well as notches and denticulates. It is more likely that different flake tools were reduced for various purposes, and while resharpening was part of the history of some of the flake tools, it does not explain the variation or occurrence of various types.

Function

The suggestion by Pettitt and White (2012:169) that an increase in flake tools during MIS 9 could be the result of changes in activities such as hide working or the production of more complex clothing cannot be sustained as this study has demonstrated that there was no discernible increase in the importance of flake tools during MIS 9. No new forms can be seen to represent changes in activity, and continuity rather than change seems to characterise the flake tools of MIS 9 Britain. Flake tools in the Lower Palaeolithic are not one homogenous occurrence but a variety of forms with diversity both within and between sites. This is likely to reflect numerous functions which can be linked to the use-wear work of Keeley (1980;1993) and Mitchell (1996;1997).

7.5 Future work

Collection bias in old collections has led to a patchy record where the flake tools from a site have been affected by the collection practices of collectors and excavators. Caution is needed before taking any trends in flake tools at face value. We cannot dismiss the possibility of temporal trends in flake tools especially after recent work has shown the temporal significance of handaxe form (White *et al.,* 2018; 2019). What is apparent is, similar to handaxes, there is no temporal trend from crude to refined. A more in-depth analysis of flake tool form in relation to their periods may be able to tease apart if these flake tools change in character. An Acheulean assemblage that comes from a Roe group I site may differ from the flake tools at Boxgrove (MIS 13 group VIII) or Swanscombe (MIS 11 group II). It is likely that this is not possible based on old collections, but this should be considered in future work. In addition, as White and Plunkett (2004:140) argued flake tools are variable within the Acheulean and are often context dependant, and wider details about the sites could be crucial. From the wider European record this appears to be true, and future well-excavated primary contexts sites are needed. The lack of studies of flake tools apart from Kelley (1937) and Lev (1973) has hindered work on flake tools, but these artefacts should not be dismissed or treated as epiphenomena. Instead, they should be treated as a crucial part of Lower Palaeolithic technology.

7.6 Summary

This study has refuted the idea of an increase in the importance of flake tools during MIS 9. In both quantity and quality, flake tools seem variable during the Lower Palaeolithic. Flake tools do not have any significant links to the beginnings of PCT. In fact, more elegant flake tools could be linked to handaxe production at Grovelands Pit than the PCT at Botany Pit. The wider comparison with both the Lower and Middle Palaeolithic of Britain, and the wider European context, has shown continuity rather than change to characterise flake tools during this period, and major changes in flake tool technology occurred prior to the Lower-Middle Palaeolithic transition. A base line technology of expedient flake tools is found at most sites. Examples of more invasive flake tools are found within handaxe contexts. The function of these tools and the role of resharpening in their manufacture remain elusive as the pristine conditions needed to examine these factors, such as at Boxgrove (Mitchell, 1996;1997), are not present in any current MIS 9 collections. With changes in the way we examine and discuss flake tools, more information could be obtained from their study.

Chapter Eight: The Beginning of the Middle Palaeolithic?

The beginning of the Middle Palaeolithic is linked to the emergence of Levallois and decline in handaxe manufacture (White *et al.,* 2006; Scott, 2011). For such a significant change, this period is still enigmatic and understudied due to the previous lack of chronological understanding (Ronen, 1982). Scott (2011) examined the EMP during the MIS 8/7 boundary, showing the establishment of full Levallois and the decline of handaxe use. This review did not dismiss the idea of an earlier form of PCT at Botany Pit (Wymer, 1968; White and Ashton, 2003). In addition, Bolton (2015) analysed a number of sites during the Lower Palaeolithic that contained similar technology. This chapter reviews the hypothesis that this early PCT coincides primarily with MIS 9 (Figure 8.1).

Figure 8.1 Map of the main British sites discussed in Chapter Eight.

Despite White and Ashton's (2003) study being published over 17 years ago, it is still uncertain whether Botany Pit is an isolated example of novel technology or a wider spread trend during MIS 9. Ashton (2018:153) has argued that whilst early PCT is known from the Thames, it is relatively unknown in other areas and the primary aim of this chapter is to explore whether

Botany Pit is unique during MIS 9. To understand this phenomenon it is important to scrutinise any evidence for PCT before MIS 9, as well as to compare it to the succeeding Levallois of the EMP. The British record will then be situated within both its European and global context. After assessing these factors, an evaluation of the role of earlier PCT technology during the Lower-Middle Palaeolithic transition can then be reviewed.

8.1 Prepared core technology in MIS 9 Britain

While the older works of Roe (1968a;1981) and Wymer (1968; 1985) previously accepted Levallois as a part of general Lower-Middle Palaeolithic technology, our increased knowledge of Palaeolithic chronology and the re-evaluation of the EMP by Scott (2011) has made Levallois almost synonymous with the Middle Palaeolithic (Pettitt and White, 2012:244). Nevertheless, as detailed in Chapter Two, this technology has much older roots. A number of sites (Table 8.1) extend the role of early PCT beyond the site of Botany Pit and, despite lower numbers, represent a significant *in-situ* development of PCT during MIS 9. These sites are primarily Acheulean with many conforming to Roe's Group I. While some sites such as Warsash and Barnham Heath show evidence of distinction in condition, many of the sites show evidence of PCT within the main assemblage. Fully developed Levallois is rarer, and usually associated with a distinction in condition as at Warsash. The PCT from this period shows a number of similar traits, but with some variation (Tables 8.2 + 8.3). Due to the low numbers of Levallois products and uncertainty around their identification the focus here is on cores, with some observation from the flakes.

Thames

Unlike the other sites discussed below, Botany Pit has a substantial number of prepared cores (n=134). This is probably due to the work of Snelling and the higher recognition of flakes and cores compared to most of the older collections. The striking platforms of these cores were usually prepared proximally (41.8%), or proximally and distally (32.2%) with an average of 4.1 removals, although more extensive examples are present. Preparation on the flaking surfaces tended to be centripetal or unipolar, with on average 3.7 removals. The cores were often exploited lineally (Figure 8.2), but a smaller proportion showed recurrent removals and around 8% were left unexploited. One example shows evidence of a point being removed through convergent preparation. Some cores demonstrate more advanced control of the lateral and distal convexities showing more developed Levallois working (Figure 8.3).

Table 8.1 Summary of sites with PCT in MIS 9.

Site	Size of core and flake assemblage examined	Number of Levallois artefacts examined		Context	Distinct condition	Developed Levallois
		Cores	Flakes			
Thames						
Baker's Farm	313	3	1	Group I Acheulean assemblage	No	?Yes
Botany Pit	878*	134	5	Evidence of Acheulean assemblage, but mainly PCT	No	Yes
Cuxton (Tester)	488	4	0	Group I Acheulean assemblage	No	No
Lent Rise	142	?1	2	Group I Acheulean assemblage	No	No
Purfleet Greenlands Beds 6/8	109	1 (5 known from Bridgland *et al.,* 2013)	0	Unclear relationship between Acheulean assemblage and Bed 8	Unclear	
Ruscombe	13	0	6	Acheulean assemblage, PCT distinct condition	Yes	?
Sonning Railway Cutting	36	2	4	Acheulean assemblage	No	?
Eastern England						
Barnham Heath	376*	17	3	Group I Acheulean assemblage, PCT distinct condition	Yes	Yes
Biddenham	604	13	14	Group I Acheulean assemblage	No	Yes
Kempston	165	3	5	Group I Acheulean assemblage	No	No
The Solent						
Dunbridge	150	4	0	Mixed Acheulean assemblage; element of Group I	No	No
East Howe	45	3	3	Acheulean assemblage	No	No
Harvey's Lane	62	5	1	Acheulean assemblage	No	No
Warsash	133	3	7	Group I Acheulean assemblage, PCT distinct condition	Yes	Yes

*Larger assemblage checked for PCT traits, see Chapter Three.

Table 8.2 Technological information of prepared cores from MIS 9 assemblages.

Site	**n**	**Method of Preparation**				**Method of exploitation**			**# removals**				**Product**			**Striking surface**							**Average # removals flaking Platform**	**Average # removals striking Platform**
		Uni	Bi	Cent	Con	Lin	Rec	Unex	0	1	2	3	Flake	Point	Un	Prox	Prox+Dist	One edge	Two sides	Three sides	All	None		
Thames																								
Botany Pit	134	43.3	11.2	44.8	0.7	78.4	13.4	8.2	8.2	79.1	11.9	0.7	91	0.7	8.2	41.8	32.1	0	14.9	2.2	8.2	0.7	4.1	3.7
Baker's Farm	3	0	33.3	66.6	0	66.6	0	33.3	33.3	66.6	0	0	66.6	0	33.3	0	0	0	0	33.3	66.6	0	7	7.6
Cuxton (Tester)	4	0	25	75	0	50	25	25	25	50	25	0	75	0	25	0	75	0	0	25	0	0	4	4
Sonning Railway Cutting	2	0	0	100	0	100	0	0	0	100	0	0	100	0	0	0	0	0	0	0	100	0	7	7
Eastern England																								
Barnham Heath	17	11.8	35.3	47.1	5.9	70.6	0	29.4	29.4	70.6	0	0	64.7	5.9	29.4	11.8	11.8	0	11.8	17.6	47.1	0	5.7	6.2
Biddenham	13	0	38.5	61.5	0	84.6	7.7	7.7	7.7	84.6	7.7	0	92.3	0	7.7	7.7	30.8	7.7	7.7	23.1	23.1	0	5.9	5.7
Kempston	3	0	0	100	0	66.6	0	33.3	0	66.6	33.3	0	100	0	0	0	0	0	0	0	100	0	7	6
Solent																								
Dunbridge	4	25	75	0	0	50	0	50	50	50	0	0	50	0	50	25	75	0	0	0	0	0	5.75	5
East Howe	3	33.3	33.3	33.3	0	66.6	0	33.3	33.3	66.6	0	0	66.6	0	33.3	0	100	0	0	0	0	0	5.7	5
Harvey's Lane	5	20	60	20	0	40	40	20	20	40	40	0	80	0	20	0	100	0	0	0	0	0	4.6	3.2
Warsash	3	0	0	100	0	33.3	33.3	33.3	33.3	33.3	33.3	0	66.6	0	33.3	0	33.3	0	0	0	66.6	0	6	8.3

Table 8.3 Metrics of prepared cores from MIS 9 assemblages.

Site	n	Cores										Preferential removals					
		Length (mm)		**Width (mm)**		**Thickness (mm)**		**Elongation (W/L)**		**Flattening (Th/W)**		**Length (mm)**		**Width (mm)**		**Elongation (W/L)**	
		Mean SD	Range	Mean SD	Range	Mean SD	Range	Mean SD	Range	Mean SD	Range	Mean SD	Range	Mean SD	Range	Mean SD	Range
Thames																	
Botany Pit	134	93.8±17.8	53-145.9	90.5±18.9	58.7-151.4	44.8±14.2	18.7-86	0.991±0.248	0.495-1.742	0.5±0.153	0.275-1.309	67.9±19.1	26.6-111.3	55.6±16.2	23-96.2	0.882±0.351	0.237-2.041
Baker's Farm	3	171.8±15.2	155.2-185.0	123.1±40	90.2-167.6	44.9±11.8	36.0-58.3	0.713±0.2	0.581-0.956	0.373±0.065	0.323-0.447	77..3±8.627	71.2-83.4	59.9±17.607	47.4-72.3	0.776±0.142	0.666-0.867
Cuxton (Tester)	4	128.2±17.7	105.9-149.2	107.3±10.1	95.6-120	49.1±6.9	42-58.4	0.847±0.12	0.735-1.027	0.459±0.066	0.401-0.537	70.4±16.4	43.4-87.2	67.7±7.5	60.1-80.2	1.066±0.5	0.689-1.848
Sonning Railway Cutting	2	100.7±29.3	79.9-121.4	92±23	75.7-108.2	36.9±7.4	31.6-42.1	0.919±0.04	0.891-0.947	0.403±0.02	0.389-0.417	65.3±3.9	62.5-68	55±10.4	47.6-62.3	0.848±0.21	0.7-1
Eastern England																	
Barnham Heath	17	98±23.9	69.3-147.5	98.4±21.5	65.7-129.4	44±14.8	16.8-75.7	1.02±0.18	0.597-1.315	0.446±0.178	0.597-1.315	66.1±18.4	36.9-92.9	57.6±16.4	39.1-81.8	0.890±0.179	0.563-1.212
Biddenham	13	83.1±20.5	54-135.9	81±23.5	17.4-54.8	31.4±12.7	17.4-54.8	0.984±0.21	0.703-1.507	0.39±0.12	0.198-0.691	54.5±13.3	22.9-77.4	43.2±16.4	25.8-72.7	0.818±0.288	0.425-1.164
Kempston	3	94.2±18.1	77.1-113.2	96.4±17.6	83.5-116.5	38.3±11	28-49.9	1.026±0.058	0.966-1.083	0.395±0.058	0.966-1.083	73.4±2.8	70.2-75.4	60.6±10.68	48.3-67.8	0.827±0.157	0.647-0.934
Solent																	
Dunbridge	4	106.9±15.7	84.7-119.7	74.3±10.7	20-41.1	30.9±8.7	20-41.1	0.695±0.012	0.683-0.709	0.421±0.130	0.271-0.554	61.3±6.4	56.8-65.8	49.5±2.4	47.8-51.2	0.814±0.124	0.726-0.901
East Howe	3	131.3±20.4	108.4-147.7	111.5±27	95.7-142.7	43.7±5.6	37.6-48.5	0.887±0.373	0.263-0.507	0.413±0.131	0.263-0.507	88.3±2.26	86.7-89.3	75.7±10.041	68.6-82.8	0.859±0.136	0.763-0.955
Harvey's Lane	5	102.7±33.5	68.7-143.5	105.4±25	75.1-138.6	42.6±13.125	32.1-62.5	1.113±0.453	0.746-1.802	0.41±0.104	0.263-0.513	52.7±19.6	31.5-78.6	63.2±11	48.5-81.4	1.349±0.517	0.617-2.041
Warsash	3	78.3±8	71.7-87.2	86.5±9	76.1-92	35.8±17.6	20.1-54.9	1.105±0.082	1.055-1.2	0.405±0.172	0.264-0.597	66.6±10.9	51.7-77.4	50.2±16.6	27.1-65.4	0.811±0.374	0.350-1.265

Figure 8.2 Proto-Levallois core from Botany Pit.

Figure 8.3 More developed Levallois cores from Botany Pit.

Whilst not distinct in size or elongation, the prepared cores are on average flatter than regular cores. Five possible Levallois products have been examined, including one point, which display similar features to the cores. This is a small proportion of the artefacts in the assemblage, but this could be due to difficulties in recognising simpler Levallois products or the removal of products from the site. Preferential removals show slightly elongated products. It is clear from this study and the past work of White and Ashton (2003), Scott (2011) and Bolton (2015) that this site represents a Proto-Levallois site from MIS 9/8. What is less clear is if this technology is unique to the site. Therefore, Botany Pit is a useful comparison point to other potential PCT sites.

Botany Pit is correlated to other locales in the Purfleet area, principally in Greenlands and Bluelands Pits (Schreve *et al.*, 1998). Small amounts of Levallois were reported by Palmer (1975) and this was considered a separate industry by Wymer (1985). At these locations Proto-Levallois and Levallois finds have been found stratified above the Clactonian and Acheulean layers, although the separation of the Levallois and Acheulean is blurred (Bridgland *et al.,* 2013:456). A single Proto-Levallois core was examined in this study from Bed 6/8, showing similar traits to the Botany Pit material. The core shows simple preparation of the striking platform before centripetal preparation of the flaking platform which was left unexploited. While this is only one example, it is part of a larger number reported by Bridgland *et al.* (2013). These were not available for analysis as detailed in Chapter Three, but two Proto-Levallois cores, reminiscent of the Botany Pit cores, were described by Schreve *et al.* (2002:1452).

Additional Proto-Levallois has been attributed to the base of Beds 6/8 as the separation is not clear in all sections during the HS1 excavations (Bridgland *et al.,* 2013:457). These six cores have also been described as similar to the Botany Pit material (Bridgland *et al.,* 2013:457). Unlike at Botany Pit where White and Ashton (2003) suggested that the PCT came after the evidence for handaxes, the evidence from the HS1 work at Bluelands and Greenlands seems to suggest that Proto-Levallois and handaxes co-existed, based on the evidence from the HS1 work. However, the reports of classic Levallois flakes from the 1998 Armour Road excavations in Bed 8, distinct from Bed 6, may suggest a later fully developed Levallois period (Bridgland, 2013:459; Schreve *et al.,* 2019:117).

The second location discussed in relation to Proto-Levallois during MIS 9 is Cuxton, Kent. Despite being considered as comparable to Purfleet (Pettitt and White, 2012; White and Bridgland, 2018), the assemblage is much smaller. Chapter Six already detailed how the Proto-Levallois core in the non-handaxe layer described by Bolton (2015) shows little evidence of preparation. This leaves four Proto-Levallois cores amongst Tester's material which are reminiscent of the Botany Pit cores, particularly in regards to their levels and methods of preparation and exploitation (Table 8.2). Many cores show the preparation of two opposing sides of the striking surface to exploit the flaking surface (Figure 8.4). The cores from Cuxton are larger than those at Botany Pit and show increased signs of elongation and flattening. This may have made them easier to recognise during the Tester excavation and given the low sample size is probably not a significant variation in technology. No Levallois flakes were identified alongside the cores despite the large number of flakes from the Tester excavations. The material is not distinct in condition and seems to relate to the wider Acheulean assemblage.

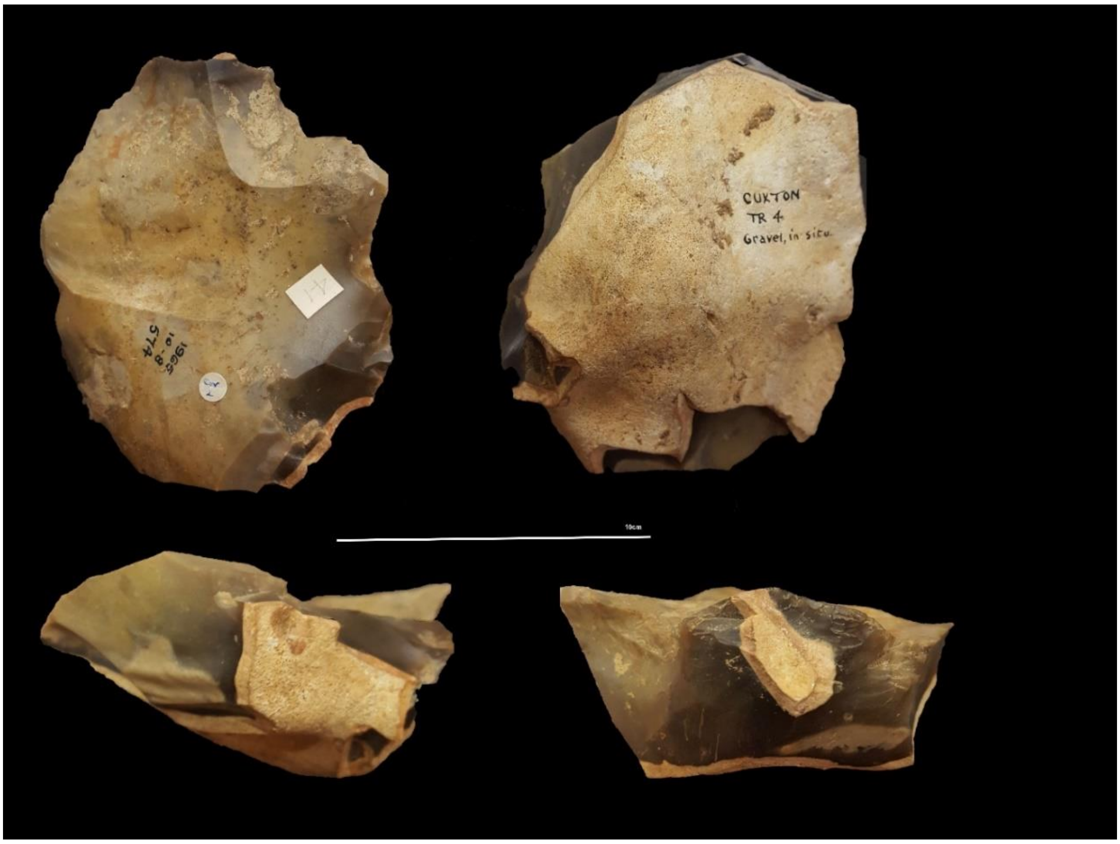

Figure 8.4 Example of Proto-Levallois core from Cuxton.

Baker's Farm shows similar technology to both Botany Pit and Cuxton. Three cores and a flake were recorded within an Acheulean assemblage with no distinction in condition. The cores showed more extensive preparation of the striking platforms, either on three sides or all around the edge. On average 7-8 removals were used to prepare both the striking and flaking platforms. The flaking platforms show evidence of both centripetal and bipolar preparation, with examples of both lineal exploitation and unexploited cores (Table 8.2). Despite this, there were still little signs of accentuated convexities and the cores show clear parallels to the other PCT in MIS 9, although one core does show traits of more advanced working and is similar to examples from Botany Pit and other sites (Figure 8.5). The cores are larger, more elongated and flatter than those at Botany Pit and Cuxton, including evidence of more elongated removals. The more advanced traits from these cores are likely to be due to collection bias, with more remarkable examples being collected. Still the evidence shows remarkable similarities to Purfleet and Cuxton.

Figure 8.5 Prepared core from Baker’s Farm.

Lent Rise contains one core which is reminiscent of cores from the other three sites, although this core is obscured by later damage. The core shows the simple preparation of the striking platform followed by centripetal preparation of the flaking surface which is left unexploited. Later damage has obscured much of the flaking surface making analysis difficult. More convincingly two possible Levallois products, a flake and a point, have been identified at the site. These products are faceted and show bipolar preparation. The three PCT artefacts are in a fresher condition and while low in number, this could show a distinction compared to the main Acheulean assemblage.

Some smaller sites are significant, despite being difficult to analyse, due to the lack of material recovered. At Sonning Railway Cutting 36 cores and flakes were analysed and compared to the condition of the handaxes from the site, but showed no distinction in condition. Two cores are examples of PCT, with some signs of fully developed Levallois working including semi-invasive distal and lateral convexities. Both cores had evidence of preparation all around the striking platform and showed preparation of the flaking surface through centripetal preparation, before being lineally exploited. The numbers of removals are similar to cores from Baker's Farm (Table 8.2), but the cores are not as large with size attributes more similar to Purfleet and Cuxton. Alongside these cores were four flakes with evidence of faceting or dihedral butts with bipolar or centripetal preparation.

Ruscombe is a site dominated by handaxes, but six out of the 13 flakes examined showed Levallois characteristics and were fresher than the handaxes and other flakes. The Levallois flakes showed either faceting or dihedral butts and evidence for centripetal or bipolar preparation. While the lack of cores makes it difficult to discuss further, there appears to be a separation between handaxes and Levallois. Similarly, flakes from Iver show signs of being Levallois, but recent work by Shaw (2019) has suggested that this assemblage could be from MIS 8/7.

Eastern England

Looking beyond the Thames it is important to examine whether PCT can be found in eastern England. As noted in the previous chapters, the sites near Bedford, Biddenham and Kempston are similar in both technology and condition, and both sites contain PCT. Biddenham contains 13 prepared cores, one of which is a full Levallois core with lateral and distal convexities being controlled semi-invasively (Figure 8.6). This core is one of the less abraded cores, but the condition of the other prepared cores falls on a spectrum and the PCT is not convincingly distinct from the handaxes and Acheulean assemblage. Centripetal preparation of the flaking surface is the most common with bipolar preparation also used. The average number of removals on both platforms are higher than the cores from Botany Pit but lower than Baker's Farm (Table 8.2). The majority were exploited linearly but there are examples of unexploited cores and recurrent working. The cores are smaller than the examples in Thames with more evidence of flattening which could show more heavily exploited cores (Table 8.3). This site represents a much more significant PCT assemblage than any of the Thames sites outside of Purfleet.

Figure 8.6 Prepared cores from Biddenham Top: Simple and more rolled. Bottom: More advanced and less abraded.

Kempston is similar representing PCT which is undistinguishable in condition to the wider Acheulean context. Three cores from the site are Proto-Levallois (Figure 8.7), although one shows very minimal evidence of additional accentuated convexities. The striking platforms have been prepared all the way around leading to centripetal preparation of the flaking surface, with slightly higher numbers of removals than at Biddenham (Table 8.2) that have been exploited either linearly or recurrently. While showing similar levels of flattening, the cores from Kempston are larger than those at Biddenham. Both sites contain a range of possible Levallois products (Biddenham 14 and Kempston five) of different levels of confidence. The flakes show evidence of complex dorsal scar patterns and faceting. Both sites have examples of points not seen in the core technology.

Figure 8.7 Proto-Levallois core from Kempston.

In East Anglia, the site of Barnham Heath represents a different situation. Here the PCT is in a less abraded condition compared to the handaxes, associated cores and flakes. At Barnham Heath 17 prepared cores were analysed (Figure 8.8). The majority represented Proto-Levallois similar to Biddenham and Botany Pit, but the site also contained fully developed Levallois examples with control of the convexities. The cores showed various ways of preparing the striking platform, from cores with one edge prepared to all around preparation. The average number of preparation removals are similar to Biddenham and Kempston (Table 8.2).

A Levallois core showed the production of a point which is rare in the Proto-Levallois material. Almost a third of the cores were left unexploited, much higher than at other sites. The cores were similar in size to the Bedford sites and Botany Pit, and while there was no evidence of elongation in the cores, the preferential removals scars showed elongation (Table 8.3). Three flakes showed Levallois traits and were similar to the prepared cores. Whilst Barnham Heath has parallels with many other sites such as Biddenham, Kempston and Botany Pit, the relationship between the PCT and the handaxes needs to be resolved as the PCT could be later, similar to Iver and Ruscombe.

Analysis of a number of sites in East Anglia has not been possible due to a lack of museum access as discussed in Chapter Three. The most significant of these sites is Southacre where MacRae (1999) reported three Proto-Levallois cores and nine flakes, and Wymer (1985:387) had previously compared this site to Botany Pit. From the literature the Proto-Levallois seems reminiscent of other MIS 9 sites (Wymer, 1985:387; MacRae, 1999). Elsewhere in East Anglia, Wymer (1999:133) noted the absence of Levallois at Whitlingham, and Callow (1976:42) argued that there was none at Keswick. In contrast, Roe (1981:171) stated that Keswick showed clear examples of Levallois, although none are illustrated, and no descriptions are offered including whether they are flakes or cores. These three sites remain a possible source of additional information on early PCT and should be prioritised for future study.

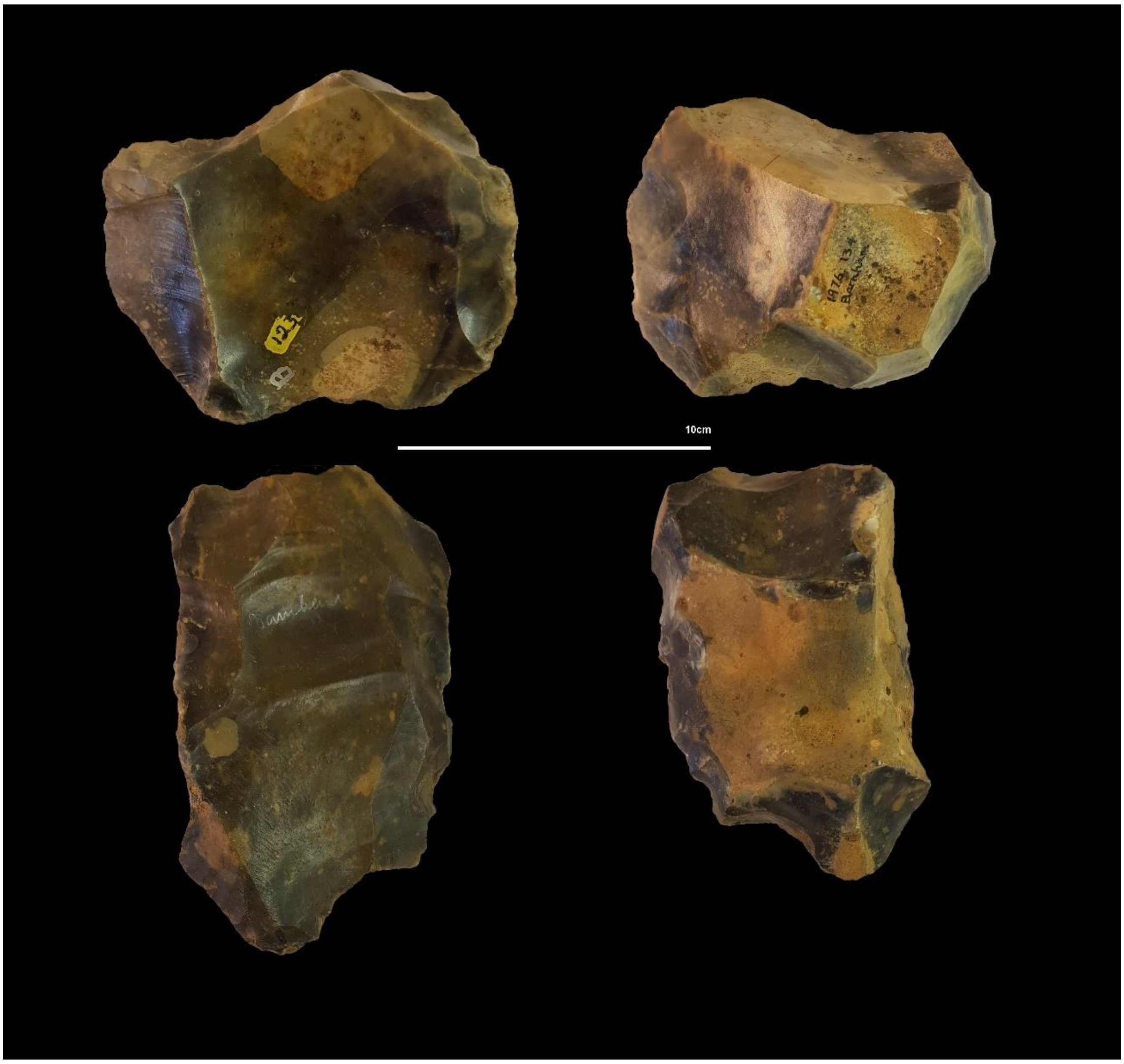

Figure 8.8 Examples of PCT from Barnham Heath Top-Developed Levallois core. Bottom-Proto-Levallois core.

Solent

The evidence from the Solent is difficult to contextualise, but many parallels can be made to the evidence above. Warsash is the most discussed site containing a mixture of handaxes and Levallois technology (Davis *et al.,* 2016; Hatch *et al.,* 2017; Hatch *et al.,* 2019). The Levallois that can provenanced comes from the lower terrace, and Davis *et al.* (2016) previously noted a distinction in condition between the handaxes and Levallois. As a result, Hatch *et al.* (2019:40) correlated the PCT at the site to MIS 8/7 which is more in line with Scott's (2011) EMP sites than the MIS 9 sites in the Thames and eastern England. This difference in condition holds up, but some of the cores from the site are basic and more similar to the Proto-Levallois of MIS 9 (Figure 8.9). The technology of the cores is similar to sites in the Thames and eastern England, although on average there are higher numbers of removals on both platforms (Table 8.2). This may have led to the smaller size of the cores from Warsash (Table 8.3). Levallois flakes from the site show a high degree of faceting and dorsal preparation.

Figure 8.9 Prepared core from Warsash.

The three Levallois cores reported by Harding *et al.* (2012) from Dunbridge show little control of the lateral or distal convexities and are more akin to the Proto-Levallois of MIS 9. Simple working can be seen on the proximal and distal striking platforms before being bipolarly prepared (Figure 8.10), with similar numbers of removals to the sites discussed previously (Table 8.2). These have been left unexploited apart from core 671 which shows evidence of a lineal removal. 'Core 653' shows a simple unipolar example which Harding *et al.* (2012) characterised as Proto-Levallois. While other cores from the site show potential preparation, possible hierarchical treatment of the platform and some working across a flat surface indicative of Proto-Levallois, these are less certain. The cores display similarities in size to other PCT but show increased elongation (Table 8.3). 'Flake 500' was considered undiagnostic but could relate to the PCT from the site and would fit based on condition. Current work by Dale (Pers. Comm. 2021) has classified the handaxes from the Belbin terrace as rolled examples of Group II handaxes and argues that they are derived from MIS 11 contexts. A smaller sample of handaxes fit with the less abraded condition of the PCT, indicative of occupation in MIS 9. Dunbridge therefore could show evidence from two periods, but the fresher material fits well with evidence from MIS 9.

Figure 8.10 Prepared core from Dunbridge.

The other two Solent sites noted for early PCT are Harvey's Lane and East Howe where PCT occur within Acheulean assemblages. At Harvey's Lane the condition of the material does not separate the Proto-Levallois from handaxes unlike at Warsash. Five possible Proto-Levallois cores were identified, three certain and two, like some examples at Dunbridge, showed traits of preparation that are less developed. Overall, the cores are similar to others from MIS 9 showing simple preparation of the striking surface and scars, indicating removals from the proximal and distal ends for both lineal and recurrent removals (Figure 8. 11). The number of prepartion scars are low, although similar to Botany Pit and Cuxton (Table 8.2). The cores are similar in size to other sites but lack any signs of elongation (Table 8.3). A Levallois flake, with a complex dorsal scar pattern and faceting, was also found alongside the cores.

Figure 8.11 Prepared core from Harvey's Lane.

East Howe is similar to Harvey's Lane with the condition of the PCT not differing from handaxes at the site. Three cores show the simple preparation of the striking platform at both the distal and proximal ends, prior to the use of differing methods of preparing the flaking platform, with a higher number of removals than Harvey's Lane, more in line with other PCT sites. The cores were then abandoned or exploited linearly (Figure 8.12). On average, the cores were larger than those at other sites except for Baker's Farm (Table 8.3). Three Levallois flakes were also found but did not refit to the cores. Overall, these two sites show PCT with similarities to sites in the Thames, eastern England, and Dunbridge. What is harder to discern is whether the small sample size, lack of contextual information and condition of the artefacts obscure different layers at the sites. This could be the difference between MIS 9/8 and MIS 8/7 which consequently has major ramifications for the timing of early PCT.

Figure 8.12 Prepared Cores from East Howe.

Red Barns, the large assemblage (>6000) on the outskirts of Portsmouth, yielded at least two examples of PCT. Bolton (2015) analysed two Proto-Levallois cores from the site, both in fresh condition with centripetal preparation and lineal exploitation, which she correlated to MIS 11-9. Current work has verified one of these cores and concurs with Bolton's (2015) observations. There have been suggestions that the plano-convex handaxes from Red Barns could link the site to MIS 9 due to similarities to Wolvercote (Roe, 2001). Red Barns is unusual as despite having a large core and flake component, the site shows only two examples of PCT and these are not distinguished by condition (Bolton, 2015).

No evidence of PCT could be found from Romsey on Terrace Four of the Test. PCT from Terraces 9 and 10 of the Stour, mentioned in Chapter Four, were isolated finds related to Lower Palaeolithic assemblages which lacked contextual evidence and consequentially can add little to the overall interpretation of the Solent. In addition, these artefacts show a mixture of full Levallois (although often lacking MIS 8/7 levels of preparation) and simpler PCT, further complicating the sequence.

Summary

The examination of PCT in Britain has shown that sites from the Thames such as Cuxton, Baker's Farm and Sonning Railway Cutting show similarities to Botany Pit, but in smaller quantities. In eastern England, the Bedford sites offer a strong parallel to the Thames sites showing Acheulean assemblages with PCT. Barnham Heath is less straight forward and could indicate a later Proto-Levallois signature succeeding the Acheulean assemblage. This would link to the record from Warsash and other Solent sites, as well as the sites of Iver and Ruscombe. However, dating and correlation in the Solent is not resolved and some sites do show the co-occurrence of early PCT with Acheulean handaxes like in the Thames and eastern England. What seems clear is that there appears to be a basic Proto-Levallois stage in the archaeology of the Solent, but the record is sparse and dating is unclear.

Some sites with claims of PCT such as Furze Platt and Stoke Newington (see below) have been dismissed and this is likely due to changes in how PCT is perceived. For example, Oakley and Leakey (1937:228) observed that the knapping of some cores was sometimes confined to one side and these were possibly used as tools. It is possible that these resembled prepared cores, but with further examination show no signs of preparation. Levallois products are rare in the assemblages, possibly due to the difficulty in identifying them. It is difficult to examine whether the MIS 9 sites show evidence of multiple independent occurrences of PCT or a connected tradition. The technology is not restricted to one area but is known from sites around Purfleet, Reading, Bedford and Dunbridge, so a single localised tradition can be ruled out. It is currently unclear where in the interglacial the PCT dates to, with the most common suggestions being the end of a substage such as MIS 9e or the MIS 9/8 (Bridgland *et al.,* 2013; White and Bridgland, 2018).

8.2 Prepared core technology prior to MIS 9

Wenban-Smith (2013:19) has claimed that PCT was present throughout the Lower Palaeolithic and was common during MIS 11. This would mean that what we observe in MIS 9 is not a significant change from preceding interglacials. Bolton (2015:248) listed sites where there have been claims of PCT during the Lower Palaeolithic (Table 8.4), and while most of these relate to MIS 9 some do lie outside this period. In order to assess if the change during MIS 9 was distinct enough to be significant, these need to be considered.

Site	Dating	Status
Tabor's Pit, Bocking, Essex	Unknown	Little evidence for PCT-no longer extant
Morton on the Hill, Norfolk	Unknown	Little evidence for PCT- no longer extant
Frindsbury, Kent	Undated	Left out of sample due to dating issues- Analysed by White and Ashton (2003)
Caddington, Bedfordshire	Undated	Left out of sample due to dating issues; None found by Bolton; PCT stored at Luton museum (M. White Pers. Comms. 2021).
Feltwell, Norfolk	?MIS 14-12	One core
High Lodge, Suffolk	MIS 13	None- Referred to as handaxe related
Elveden, Suffolk	MIS 11	None
Highland's Farm Pit, Oxfordshire	MIS 11	Little evidence for PCT
Bowman's Lodge	MIS 11	One core
Swanscombe, Rickson's Pit, Kent	MIS 11	One core
Swanscombe, Barnfield Pit, Kent	MIS 11	None
Stoke Newington, London	MIS 9	Rejected by this study
Furze Platt, Berkshire	MIS 9	Rejected by this study
Barnham Heath Pit, Suffolk	?MIS 9	Verified by this study
Biddenham, Bedfordshire	MIS 9	Verified by this study
Cuxton, Kent	MIS 9	Verified by this study
Dunbridge, Hampshire	MIS 9	Verified by this study
Purfleet, Essex	MIS 9	Verified by this study
Red Barns, Hampshire	?MIS 9	One core verified
Ruscombe, Berkshire	?MIS 9	Verified by this study; possibly MIS 8/7
Southacre, Norfolk	MIS 9	No access available

Table 8.4 PCT sites prior to the EMP.

Field (2005:38) argued that claims of PCT at Stoke Newington, Elveden and High Lodge within Acheulean contexts could show isolated accidental convergence, but there is little evidence of PCT at these sites. The work of Ashton *et al.* (1992a;2005) does not show PCT at High Lodge or Elveden and this study has found no evidence of PCT at Stoke Newington.

Wymer (1985:55,249) mentioned that Morton on the Hill and Tabor's Pit, Bocking both contained a single Proto-Levallois core, but both are untraceable. Another site, Highland's Farm Pit, Rotherfield is mentioned by Wymer (1968:193) as having five 'Proto-tortoise cores', but this is not discussed further. The figure from this site (Figure 8.13) shows a possible unipolarly prepared core, but the preparation of the striking platform is not clear and Wymer did not explicitly label the core as Levallois. Wymer (1961;1968) did not classify Highland's Farm Pit as having a Levallois assemblage and accepted these as part of a wider Acheulean in contrast to other sites. The site is rarely linked to Levallois in later syntheses and when it is included (McNabb, 2007:136), this is only to relay the artefact totals given in Wymer (1968). As with non-handaxe assemblages and flake tools, it is possible that older frameworks and syntheses are now outdated. For example, Levallois is reported from Barnfield Pit by Wymer (1968;1999) and Roe (1968a), however current syntheses do not concur with this (McNabb, 2007; Pettitt and White, 2012; Bridgland *et al.,* 2014).

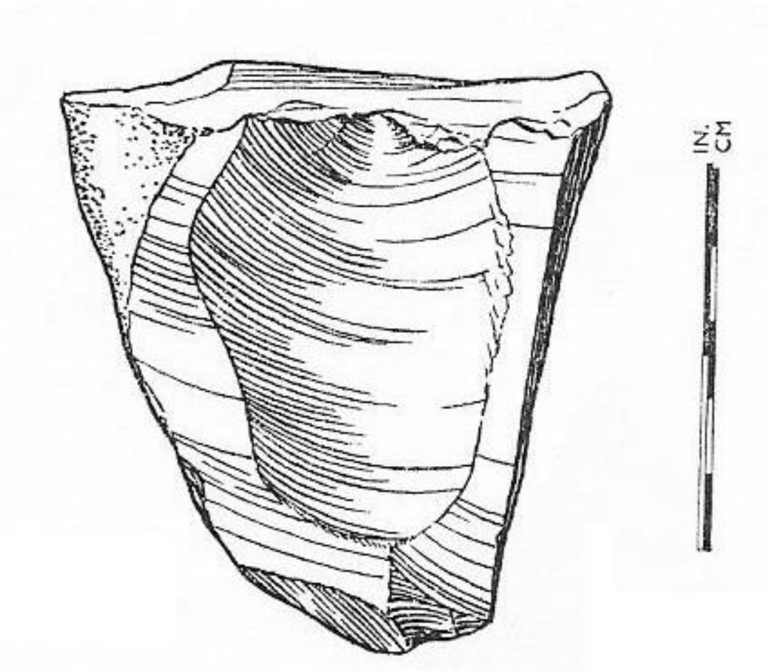

Figure 8.13 Possible PCT from Highland's Farm Pit (Wymer, 1968:195).

Other suggestions require more attention. Roe (1981:78) indicated that Bowman's Lodge and, to a lesser extent, Rickson's Pit both contained evidence of PCT dated to MIS 11 (McNabb, 2007; Scott, 2011). In his gazetteer, Roe (1968a) recorded five cores and six flakes classified as Levallois from Bowman's Lodge and examples of a core and a flake from both the brickearth and upper gravels at Rickson's Pit, Swanscombe. Scott (2011:171) considered both Bowman's Lodge and Rickson's Pit to only contain single examples of PCT within wider Acheulean assemblages. Scott (2011:176) emphasised that while these sites could represent individual innovations, they do not show the widespread adoption of the technology as seen around MIS 9.

Dewey (1930; 1932:46) reported cores that resembled tortoise cores from Rickson's Pit, Swanscombe with the main example remaining unstruck, but this was linked to the Clactonian at the site. Burchell (1932:256) observed unabraded Levallois artefacts that were contemporary with handaxes. Contrary to this, Tester (1965) rejected the claims of Levallois at the site and classified the site as containing Clactonian artefacts. From Burchell's figures (Figure 8.14), the core shows potential PCT traits and warrants further examination. This artefact could not be verified by the current research.

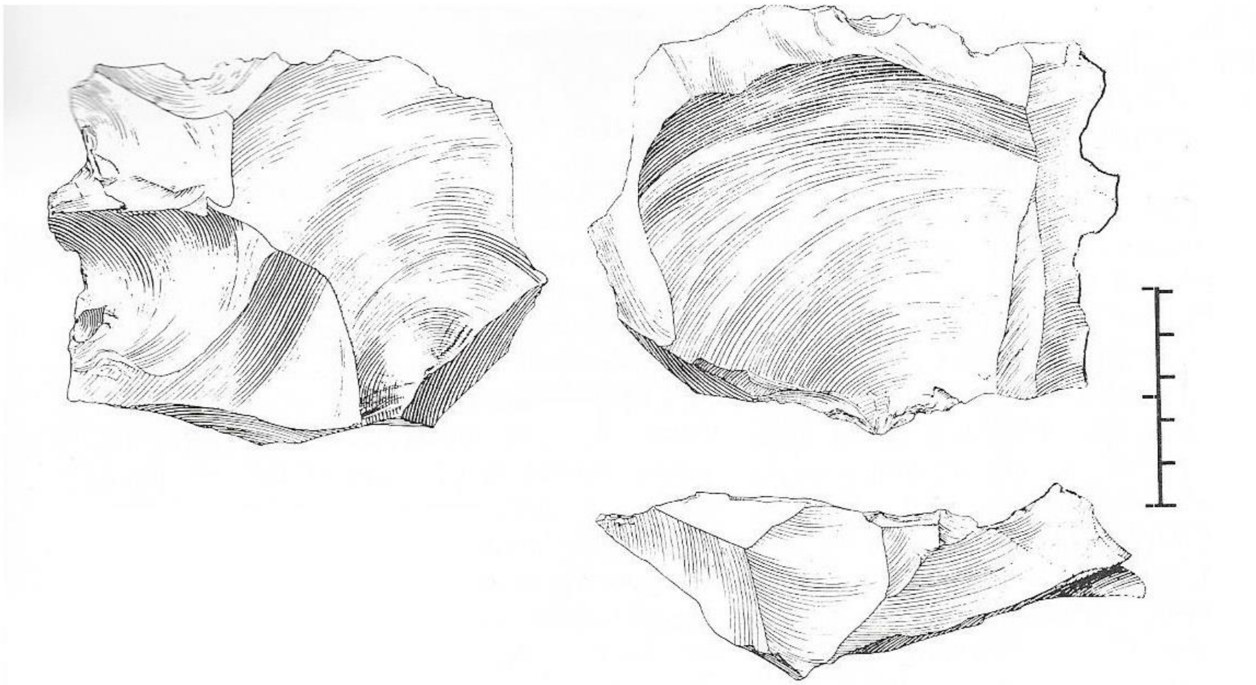

Figure 8.14 Possible example of PCT from Rickson's Pit, Swanscombe (Roe, 1981:79).

Tester's (1951:126) report on Bowman's Lodge noted a small sample of faceted flakes (6) and tortoise shaped cores (5) showing the earliest use of the Levallois technique. The figures from Tester (1951:129) illustrated a handful of artefacts, although more angles are needed to verify the core, and this appears to be where the idea of Bowman's Lodge containing PCT stems from (Figure 8.15). The flakes classed as Levallois from Bowman's Lodge were examined and showed no convincing evidence of being Levallois flakes, with many being related to handaxe manufacture. Most of the cores showed little evidence of preparation and some show separate periods of working. Some of the cores are evidence of irregular handaxes and only one example shows some PCT traits. While this core would not look out of place within one of the MIS 9 assemblages, it is less convincing in isolation. The idea of PCT at Bowman's Lodge was also a result of Tester (1951:128) linking the development of the Levallois technique to the Clactonian. This was noted by Wymer (1961;1968) and the claims of Clactonian and Levalloisian industries at sites often came from having larger numbers of cores and flakes within Acheulean contexts.

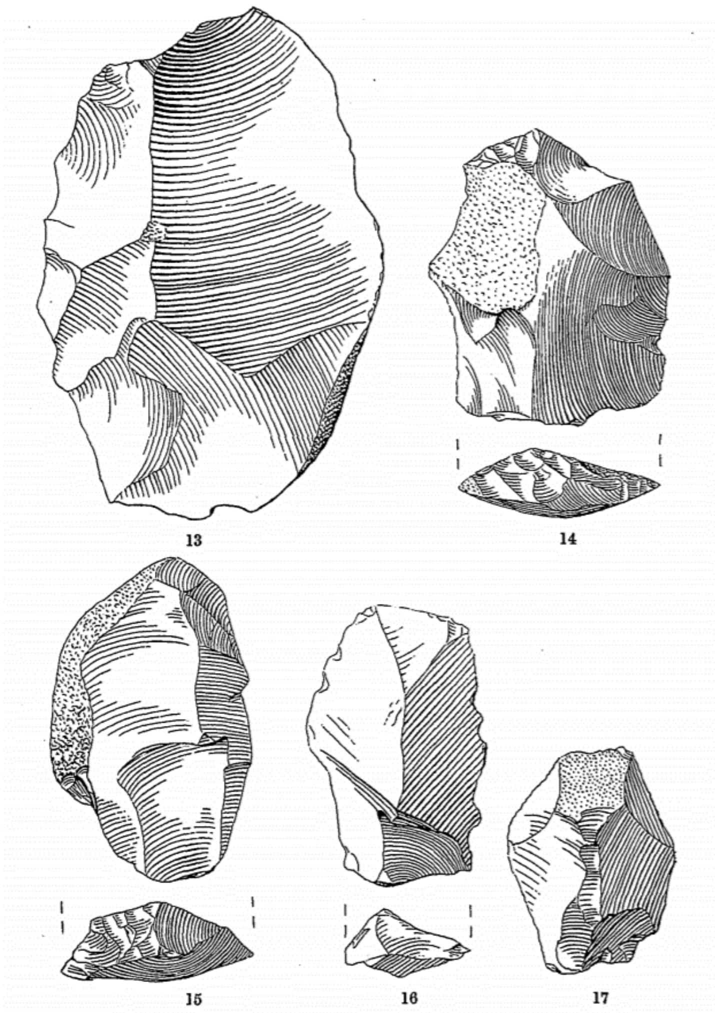

Figure 8.15 ‘Levallois’ artefacts from Bowman’s Lodge (Tester, 1951:129).

Lastly, Bolton (2015) argued that Feltwell contained an example of PCT, with similarities to Frindsbury, dating back to MIS 14. Although no controlled excavations have taken place, more than 350 artefacts were collected from Frimestone’s Pit by MacRae and Hardaker (2000), not to be confused with the more famous Shrub Hill Pit. Previous discussion of Feltwell relates to the site of Shrub Hill Pit and while Roe (1968a) notes Levallois at the site (as well as at Warren Hill), these are not mentioned by Roe (1981:115) or Wymer (1985:79; 1999:130). This leaves one Proto-Levallois core described by MacRae (1999:5), Bolton (2015:91) and Hardaker and Rose (2020), with one large preferential removal and minimal centripetal preparation. From drawings and photos this seems an accurate assessment of the core (Figure 8.16).

MacRae (1999:5) dismissed the core as not having enough evidence for preparation to be significant, and in their later paper Hardaker and MacRae (2000) made no mention of PCT among the 14 handaxes and ~100 flakes and cores collected. The material from the site is in mixed condition and came from reject heaps at the quarry (Hardaker and MacRae 2000:53). The site is pre-Anglian, most likely MIS 13-12 (Westaway, 2009; Hosfield, 2011b:1496; Candy *et al.,* 2015; Davis *et al.,* 2017), but the secureness of a single example of PCT within the assemblage is suspect given the condition of the artefacts and the nature of collection (Hardaker and Rose, 2020).

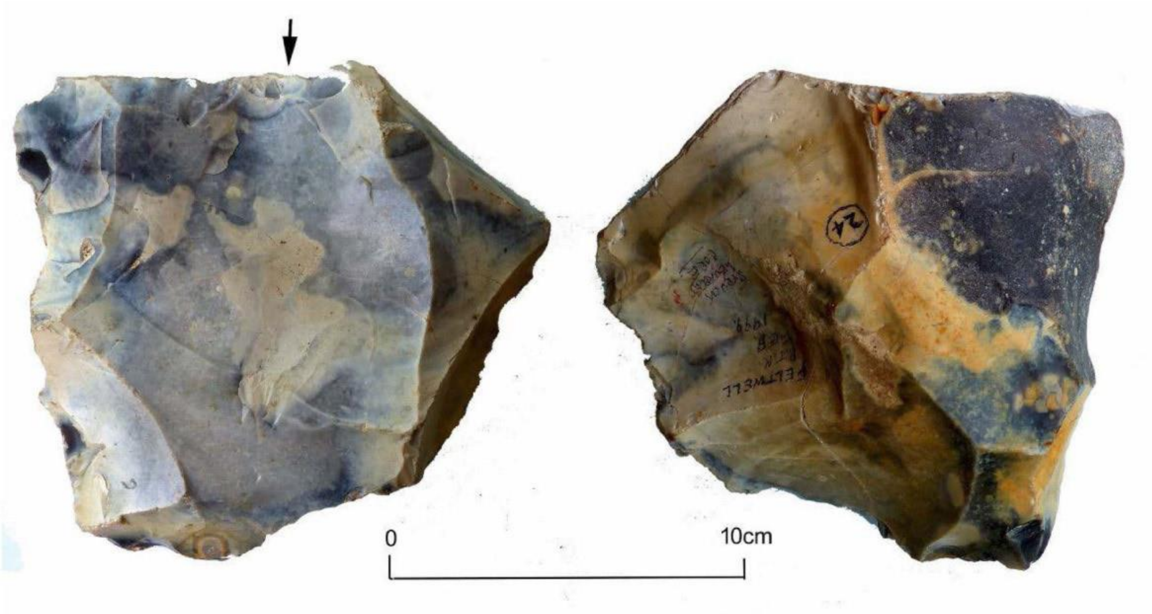

Figure 8.16 'Proto-Levallois' core from Feltwell (Hardaker and Rose, 2020:51).

As well as the above examples there are a number of sites which, while containing more convincing evidence of Proto-Levallois, cannot be dated with any certainty. Over 4000 artefacts including handaxes, cores, flakes and flake tools are known from Cook and Killick's (1924:140) work at Frindsbury, located 4km downstream from Cuxton (Wymer, 1999:170). A core figured by Cook and Killick (1924:145) clearly shows unipolar preparation reminiscent of cores from MIS 9 sites (Figure 8.17). Unfortunately a large majority of this material has been lost, with McNabb (1992) only being able to study 13.2% of the assemblage. White and Ashton (2003:601) reported that 14 of the 16 cores showed simple preparation and working across a flat surface similar to Botany Pit.

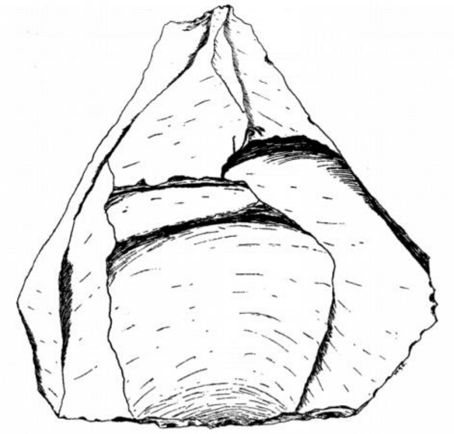

Figure 8.17 A Proto-Levallois core from Frindsbury (Cook and Killick, 1924:145).

The fresh condition, context and refitting at Frindsbury indicate that the assemblage represents a short period of time unlike other sites (White and Ashton, 2003:601). Bolton (2015:157) also analysed the assemblage and argued that there was a variation in the size and extent of working on the cores; six cores showed centripetal preparation while seven showed unipolar preparation. The majority were exploited lineally but there is one example of recurrent exploitation (Bolton, 2015:157). White and Ashton (2003:601) argued that the cores and flakes showed a relative increase in elongation. Due to the informal excavations by Cook and Killick, there is little evidence for dating (Roe, 1981:279; White and Ashton, 2003:601; Bolton, 2015:93; Pettitt and White, 2012:251). Regrettably only two handaxes have been recorded (White and Ashton,2003:601; Bolton, 2015), making it impossible to tie the site into the current work by Dale (Pers. Comm. 2021) which could suggest connections to MIS 9. With the lack of dating and extant exposures, plus much of the assemblage unaccounted for, Frindsbury is likely to remain enigmatic.

The sites around Caddington were worked by WG Smith (1894) between 1887-1914 producing thousands of artefacts with refitting material (Pettitt and White, 2012:135). Due to the geology of Caddington, it clearly post-dates the Anglian glaciation, but attempts to date the site have not been precise enough (Sampson, 1978; Avery *et al.,* 1982; White, 1997). Roe (1981:230) noted the presence of a reduced Levallois at the site similar to that at Botany Pit. McNabb (2007:207) described the issues with dating these finds and whether they related to the small Levallois 'South Site', thought to date to MIS 8/7 or supposedly older Acheulean artefacts correlated with either MIS 11 or MIS 9 (Sampson, 1978; Avery *et al.,* 1982; White, 1997; Pettitt and White, 2012:137). Bolton (2015:220-3) found no convincing evidence of Proto-Levallois at the site but did not examine the material held by Luton Museum which holds the Proto-

Levallois figured in Roe (1981:194-5; Figure 8.18). These look reminiscent of PCT in MIS 9. The ambiguity of both the artefacts and dating makes Caddington of little use to this study.

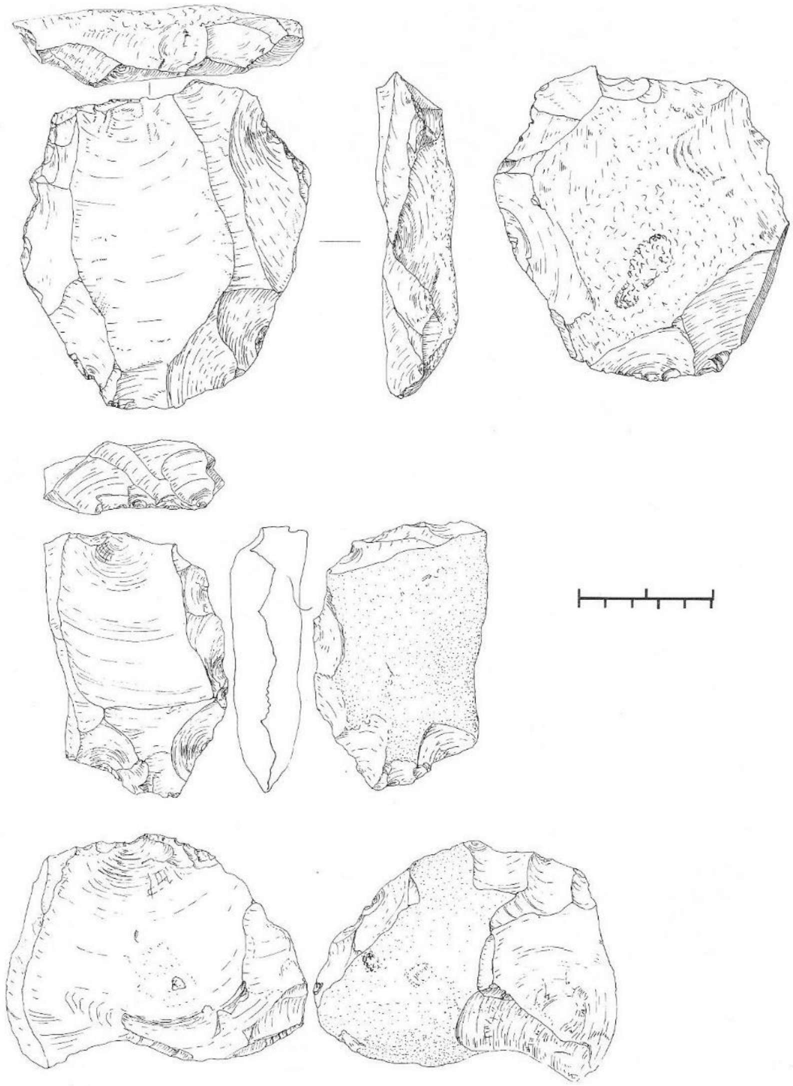

Figure 8.18 PCT from Caddington (Roe, 1981:194).

Summary

Wenban-Smith's (2013:19) claims that Proto-Levallois is common within Britain during MIS 11 cannot be supported, despite possible isolated examples from Bowman's Lodge and Rickson's Pit. Evidence of PCT prior to MIS 9 is tenuous, with a lack of PCT at the well-excavated and dated MIS 11 sites. While there are a small number of potential examples of earlier PCT prior to MIS 9, these are rare and the idea of multiple origins and the immanence of PCT within the Acheulean make it meaningless to find an origin point for PCT (Scott, 2011:171). There is a crucial distinction between previously short-lived examples of PCT and a larger persistent occurrence that begins around MIS 9/8, prior to the proliferation of Levallois in the following interglacial.

The more convincing examples, accurately dated outside MIS 9, are single cores from Feltwell, Rickson's Pit and Bowman's Lodge. Within larger PCT assemblages these would be more convincing, but these cores could easily be accidents of convergence or might serendipitously resemble PCT. The re-evaluation of Caddington and Frindsbury would be needed to in order to fully understand the archaeology at the sites. While the cores at Frindsbury, and those at Caddington (Luton Museum) are reminiscent of MIS 9 PCT, they cannot be accurately attributed to MIS 9. The current conception of PCT does not exclude earlier manifestations (as discussed in Chapter Two), but it is notable that apart from undated sites there are only isolated examples prior to MIS 9. Only during MIS 9/8 does a more stable and widespread phenomenon occur. Future work may expand on this, but currently there is no reason to assert that PCT was common prior to MIS 9 in Britain.

8.3 The Early Middle Palaeolithic

The EMP in Britain is often seen as peripheral to Europe, with fewer sites and artefacts often seen as an indication that the region was less intensely occupied (Ashton and Lewis, 2002; Scott, 2011:167). The sites used by White *et al.* (2006) and Scott (2011) to examine the EMP are well age-constrained, despite a mixture of primary and secondary fluvial contexts. The differentiation between MIS 9 and MIS 7 was crucial for Scott's (2011) work, and is also vital for this thesis as previous confusion has restricted our knowledge of the Middle Palaeolithic in Britain.

At the top of the Lynch Hill terrace, Levallois in a fresher condition lying on the top of the gravels was previously conflated with older more abraded Acheulean assemblages within the main gravel (Scott, 2011:177). The separation of this Levallois technology from the preceding Acheulean has given a distinct character to the EMP. These EMP sites (Table 8.5) offer a crucial comparison to earlier PCT found alongside the final Acheulean populations of MIS 9, represented by the sites in this thesis. It is important to demonstrate that the PCT in MIS 9 is not actually part of the succeeding interglacial. It is clear that there are key differences in the technology, landscape use and preservation between these two interglacials.

Table 8.5 British EMP sites (MIS 8-6) based on the work of Scott (2011).

Site	Dating	Levallois Assemblage size	Other archaeology	Technology	End products	State of cores at discard	Interpretation	Additional references
Creffield Road, Acton	MIS 8/MIS 7	186 (171 flakes, 15 cores)	1 handaxe at school site, distinct condition	Nodule selection; varied preparation bi-polar with some convergent preparation; recurrent exploitation but mainly liner or unexploited; import of exhausted cores and end products; missing stages of reduction at the site; hafting	Elongated flakes; point dominated	Exhausted	Exhausted cores abandoned after use elsewhere, used throughout landscape	
Yiewsley/West Drayton	MIS 8/MIS 7	290 (264 flakes, 26 cores)	Handaxes in distinct condition	Core preparation mainly centripetal examples of unipolar, some evidence of recurrent exploitation and cores left unexploited but mainly lineal exploitation	Elongated flakes; point dominated	Exhausted	Similar to Creffield Road but more varied Neanderthals abandoned cores where they could replenish	
Lion Pit Tramway Cutting, West Thurrock	Late MIS 8	>227 (20 flakes, 12 cores)	Proto-Levallois traits on other cores	Nodule selection; variety of methods of preparation and exploited in a variety of ways; centripetally prepared (6) unipolar convergent cores (2). Lack of intense working, thick cores. Little evidence for repreparation	Large broad flakes	Exploitable	Large cores used to create a variety of Levallois products; Little evidence of prolonged working Movement of products off site	
Baker's Hole, Northfleet, Kent	MIS 8/7	156 (137 flakes, 19 cores)	Handaxes in disctinct condition	Nodule selection; variety of preparation and exploitation; flaking surfaces are highly prepared but the striking platforms were less prepared; limited rejuvenation	Very Large broad flakes	Exploitable	Production of large flakes from large nodules no exhausted cores due to nearby raw material and preference for large flakes	
Ebbsfleet, Northfleet, Kent	Earlier MIS 7	90 (80 flakes, 18 cores)	2 handaxes, possibly contemporary 5 cores with Proto-Levallois traits	Nodule selection; Centripetal preparation (61.1%) but 3 bi-polar cores and 1 unipolar convergent; some evidence of recurrent removals (five cores); limited rejuvenation	Large flakes; Some elongated; points known	Potentially exploitable	Use of large pebbles	
Selsey, West Sussex	Early MIS 7	5 Levallois artefacts including a core	N/A	Discard away from raw material source	Flakes	Exhausted	Episodic Levallois away from a raw material source indicative or curated technology	
Aveley, Essex	Early MIS 7	5 Levallois flakes (Lower Ponds Farm MAZ) 3 Levallois flakes and a Levallois cores (Upper Sandy Lane MAZ)	N/A	Discard away from raw material source	Flakes	Exhausted	Two separate small-scale occupations Small exhausted core similar to Stoke Tunnel	Pettitt and White, 2012

Brundon, Suffolk	Later MIS 7	24 (21 flakes, 3 cores)	Levallois and handaxes in distinct condition	Nodule selection; centripetal and unipolar preparation; some recurrent exploitation; limited rejuvenation	Medium-large, broad flakes	Exploitable and exhausted	Extraction site used by Neanderthal to provision themselves with the local raw material leaving behind cores that had ceased to be efficient.	
Crayford, Kent	Later MIS 7	>120 (>113 flakes, >7 cores)	N/A	Nodule selection; convergent and bipolar working; both liner and recurrent exploitation; removal of cores	Larger, broader flakes	Mainly missing	Nodules selected nearby with on-site decortication Occasional further prepartion on site but often removed for further preparation Products often removed.	Cook, 1986; Révillian, 1995
Stanton Harcourt Channel, Oxfordshire	Later MIS 7	1 core ~5 flakes	Abraded handaxes, Levallois fresher	Simple preparation to make a small core		Exhausted	Core made on flake with simple preparation- opportunistic exploitation of raw material Flexible behaviour due to poor availability of raw material Neanderthals use of a curated tool kit and maintained it at the site	Briggs *et al.,* 1985; Buckingham *et al.,* 1996; Schreve, 2001b; Scott and Buckingham, 2001; White *et al.,* 2006
Stoke Tunnel, Ipswich, Suffolk	Later MIS 7	1 Core	N/A	Raw material brough in; Lineal exploitation relatively flat with centripetal preparation	Small-medium broad flake	Exhausted	Location where artefacts were rarely discarded in contrast to Baker's Hole and West Thurrock	
Holbrook Bay, Suffolk	Later MIS 7	1 Levallois core ~5 points	Various conditions, rolled handaxes	~100 artefacts including Levallois core and points	Points	?	Small assemblage linked to production of points	White *et al.,* 2006
Pontnewydd Cave, Wales	MIS 7 (~225-175kya)	Main Entrance (47 flakes, 13 cores, 3 blades, 3 points) New entrance (24 flakes, 1 core, 2 blades)	754 artefacts. Mixed with handaxes no distinction in condition- higher proportion in main entrance	Use of local material being volcanic; crude or inept simple preparation; persistent use of Levallois despite the raw material	Flakes, points and blades	Exhausted	Main entrance and New entrance could be contemporary or Main entrance older. Possibly showing increase in Levallois and decrease in handaxes. The main entrance shows 23.6% handaxes and 17.8% Levallois products while the new entrance contained 5.5% handaxes and 35.6% Levallois products)	Green, 1981; Aldhouse-Green, 1995;1998;

The initial EMP

The amelioration of the MIS 8 glaciation brought with it the lasting adoption of Levallois technology in Britain represented by the fresh material from the top of the Lynch Hill gravels at Creffield Road and Yiewsley (Scott, 2011:38; Figure 8.19). The change is characterised by fully developed Levallois and the lack of Acheulean technology (any handaxes at the sites are distinct in condition) which is used as the starting point of the EMP (Scott, 2011:169). These initial sites show a contrast to MIS 9/8, as while some sites such as Botany Pit, Biddenham and Barnham Heath have some examples of fully developed Levallois, the majority of the PCT is Proto-Levallois. Despite the link to the Lynch Hill terrace, both Creffield Road and Yiewsley show fully developed Levallois with additional accentuated convexities, more evidence of convergent preparation to produce points and the use of recurrent exploitation.

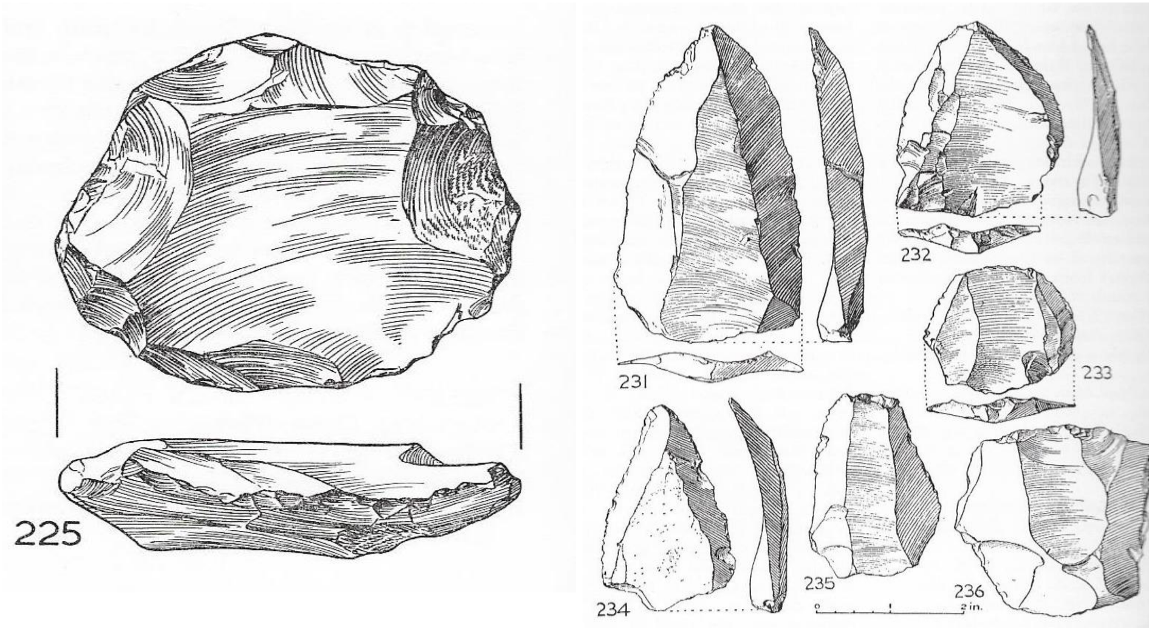

Figure 8.19 EMP artefacts: Left- Prepared core from Yiewsley (Wymer, 1968:256). Right-Levallois flakes from Creffield Road (Wymer, 1968:264).

The PCT analysed in this research closely resembles that of Botany Pit rather than these later, fully developed Levallois sites. The Solent sites are less clear; whilst Harvey's Lane, East Howe and Dunbridge conform with Proto-Levallois from the Thames and eastern England, Warsash is a more complex site containing fully developed Levallois. The work of Davis *et al.* (2016) has shown that there is a separation between the handaxes and most of the Levallois at Warsash, similar to MIS 8/7 sites. It is likely that this Levallois, distinct from handaxe manufacture, dates to MIS 8/7. Further work in the Solent needs to focus on this as without firmer dating the appearance of PCT is poorly understood in the region. The sites of Iver, Ruscombe and

Barnham Heath are also unclear, and could be related to MIS 8/7. However, the majority of early PCT is more securely correlated to MIS 9/8 alongside handaxe manufacture, demonstrating a change in technology and behaviour between MIS 9/8 and MIS 8/7.

The Aveley interglacial

During MIS 7, handaxes are absent from most sites, and while handaxes were found alongside Levallois at some sites such as Baker's Hole and Brundon, their condition is distinct (Scott, 2011:85). The period is defined by similar technology to the MIS 8/7 sites with fully developed Levallois technology (Scott, 2011). Sites demonstrate a variety of methods in both preparation, exploitation and the role they played in the *Chaîne opératoire* at different sites. This includes highly prepared cores at Baker's Hole (Figure 8.20) and less intense preparation at Lion Pit Tramway Cutting with bolder removals (Scott, 2011:177). Some cores at Ebbsfleet and West Thurrock show a reduced Levallois similar to the Proto-Levallois from MIS 9 Britain (Scott, 2011). Their position at the beginning of the interglacial could show an early establishment of PCT, or a continuum of working that includes more simply prepared cores. Both explanations would fit the patterns seen both within Britain and Europe during MIS 9-7.

Figure 8.20 Baker's Hole Levallois Core (Ashton and Scott, 2016:65).

Despite the absence of handaxes after MIS 9, the Levallois technique was often used to create and maintain large handaxe like blanks (Scott, 2011:178). The preference for large flakes explains why some cores at Baker's Hole and Lion Pit Tramway Cutting were abandoned before they were exhausted. This can be seen in two distinct schemas: one at Baker's Hole where cores were abandoned when large blanks were no longer feasible, and the second at Crayford (Figure 8.21) where despite a more fragmented polarised *Chaîne opératoire* the focus is still on large blanks (Scott, 2010; 2011:178). The use of recurrent removals to increase the productivity of these cores, and flakes from Ebbsfleet being retouched in a number of ways, demonstrates the importance of these large handaxe-like blanks (Scott, 2011:179). The decline of the handaxe after such a long period of dominance needs an explanation just as much as the appearance of Levallois technology. It is possible that the two are linked and that the Levallois blank usurped the place of the handaxe in the technological sphere (White *et al.,* 2011). The recently recognised cultural importance of handaxe shape and types (White *et al.,* 2018; 2019) raises questions about similar importance and therefore patterns in Levallois technology, yet this has received little attention.

Figure 8.21 Refitting core from Crayford (Ashton and Scott, 2016:65).

The EMP sites show variability in preparation and exploitation, as do the sites of MIS 9. Scott (2011:179) noted the use of bipolar preparation to produce large flake blanks, and this can be seen dominating many of the MIS 9 sites including Harvey's Lane and Dunbridge, with significant proportions at Botany Pit, Baker's Farm, Biddenham and Barnham Heath. In addition, McNabb (2007:186) has argued that the appearance of points is a crucial distinction as they are absent during MIS 9. Despite this, there are rare examples at Biddenham, Kempston, Botany Pit and Lent Rise with some evidence of convergent preparation at Barnham Heath. This is not as developed as the clear intention of producing points at Creffield Road, probably linked to hafting (Scott, 2011:62), and still represents a major difference between Proto-Levallois and full Levallois. From the variety in both MIS 9 and MIS 7, including the use of bipolar preparation to produce large blanks and convergent preparation to produce points, it is clear that many of the characteristics of the EMP were embryonic within MIS 9.

What MIS 9 lacks in comparison to MIS 7 is large assemblages at multiple sites from which to build a landscape framework. Using the concepts outlined by Turq (1988;1989), Scott (2011:182) assigned the British open air EMP sites into categories. The majority, including Baker' Hole, Ebbsfleet, Lion Pit Tramway Cutting and Brundon, were classed as extraction and exploitation sites, located near raw materials with large amounts of debitage and little evidence of end products (Scott, 2011:182). At these sites Neanderthals were previsioning themselves for various tasks which took place elsewhere (Scott, 2011:185). Crayford represents a variation due to the removal of cores from the site meaning that slightly different activities took place than at the other sites (Scott, 2011:185).

Mixed strategy sites as defined by Turq (1988;1989) show all stages of production as well as end products, similar to cave sites. This is seen at Creffield Road where, alongside extraction and exploitation, end products were also maintained and sometimes abandoned (Scott, 2011:185). Lastly small sites, usually single exhausted cores in the landscape, are often signs of episodic occupations representing small specialised tasks exemplified by the sites of Stoke Tunnel, Aveley, Selsey and Stanton Harcourt (Scott, 2011:182-6). These sites are less archaeologically visible due to their small size and location away from typical capture points, representing snapshots of curated technology moving through the landscape (Scott, 2011:185-6).

Pontnewydd is difficult to fit in with the rest of MIS 7 due to its nature as a cave site, large geographical distance from other sites and the unique nature of its technology. What the site does show is the expanse of hominins during MIS 7 across a large part of Britain and the use of

Levallois despite poor volcanic raw material leading to 'crude or inept' Levallois (Green, 1984; Aldhouse-Green, 1995;1998; White *et al.*, 2012:534). The technology shows Neanderthals exhausting small flint cores, sometimes using unsuitable material, and evidence of a heavily curated technology (Aldhouse-Green, 2012:335).

These key insights into the MIS 7 sites, typical of the European EMP, are lacking in MIS 9. The MIS 9 PCT is found within Acheulean contexts and cannot be treated in a comparable way. Botany Pit is probably an extraction and exploitation site (Scott, 2011:182), but the other sites are harder to define as they could be conflated with Acheulean contexts from either a small episodic site or a long term PCT tradition. The sites could also be a distinct form of PCT associated with late Acheulean contexts. Current evidence points to the latter but without a well-preserved primary context site, other explanations cannot be dismissed. Most of the MIS 9 sites are near sources of raw material which would suggest they could be similar to Scott's (2011:185) extraction and production sites, but due to the major differences between MIS 9 and MIS 7 technology they are unlikely to map onto Turq's (1988;1989) site types.

It is much harder to interpret the assemblages in relation to hunting or landscape use than the sites examined by Scott (2011:189). Scott's (2011:199) work demonstrated a wide array of end products, preparation sequences and the effect of raw material sources on lithic production. However, despite MIS 7 having a better-preserved archaeological record, more detailed landscape usage including exploitation of fauna is still elusive (Scott, 2011:186).

Summary

The sites of MIS 7 represent a clear proliferation of PCT, the establishment of full Levallois and the decline of handaxe production. The presence of simpler PCT alongside more developed Levallois at Ebbsfleet and West Thurrock show the technologies nature as a simple base line, or first step towards fully developed Levallois. The archaeological record appears to show the indigenous development of PCT during both MIS 9 and MIS 8/7 (Scott, 2011:199), but the two are distinct. While there are more primary context sites with better preservation and excavation histories in MIS 8/7, this does not explain the difference. Therefore, the transition represents a major shift in technology. This reserves the start of the Middle Palaeolithic for the more substantial and permanent adoption of Levallois in the succeeding interglacial, often accompanied by the decline in handaxe manufacture. The earlier forms of PCT during MIS 9/8 could have acted as one option of a flexible Acheulean which fits in with the idea of a technology of convergence (White and Pettitt, 1995).

8.4 Handaxes within MIS 7

While the majority of evidence in Britain fits the concept that the rise of Levallois meant the decline of the handaxe during MIS 7, Pontnewydd Cave, Wales is an exception. It is uncertain whether the two different assemblages are contemporary but according to Aldhouse-Green (2012:334), if the two assemblages are separate then the later one shows an increase in the proportion of Levallois products in comparison to handaxes (the Main Entrance shows 23.6% handaxes and 17.8% Levallois products while the New Entrance contained 5.5% handaxes and 35.6% Levallois products). It has been suggested that different groups could have made the varying technologies (Ashton, 2017:181), or that they were at least made at different times due to the secondary context of the finds (Pettitt and White, 2012:260). Nevertheless, due to the lack of separation either by context or by condition it is possible that the technology is contemporary. If the handaxes and Levallois are contemporary, as suggested by McNabb (2007:212), then the survival of handaxes alongside Levallois into MIS 7 requires an explanation due to the inverse relationship often observed between handaxes and Levallois.

The co-occurrence of Levallois and handaxes at Pontnewydd is anomalous when compared to other MIS 7 sites and the LMP, where Levallois declines in favour of MTA handaxes (White and Pettitt, 2011). What the archaeology of Pontnewydd Cave resembles most is the early PCT found alongside handaxes during MIS 9 (Figure 8.22), and this is not without precedent in European sites, especially in France (Hérisson *et al.,* 2016a). Pontnewydd could therefore show an emerging Levallois alongside handaxes, possibly still within MIS 7. This could be related to the potential later occurrence of handaxes in the West during MIS 8, such as Harnham and Broom (Hosfield *et al.,* 2013a; 2013b; Bates *et al.,* 2014:173).

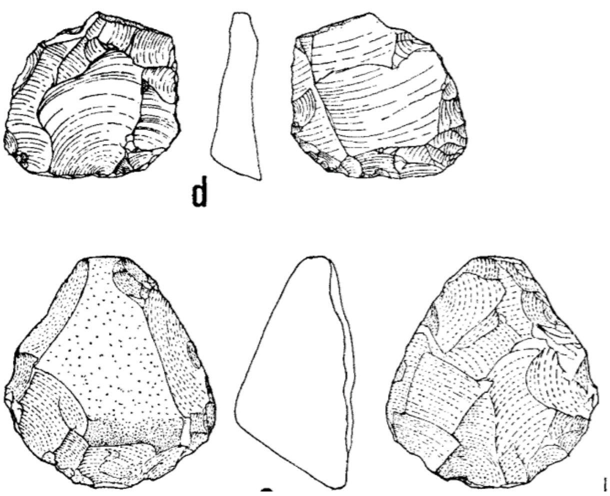

Figure 8.22 Levallois cores from Pontnewydd Cave (Green, 1981:193).

Evidence of Levallois at Harnham and Broom is limited and could be handaxe by-products (Hosfield *et al.,* 2013a; 2013b; Bates *et al.,* 2014:173). Most examples lack provenance or can no longer be verified (Ashton and Hosfield, 2010). The presence of handaxes at Broom and Harnham has been used to suggest a west-east technological divide (Ashton and Hosfield, 2010; Ashton *et al.* 2011). The persistence of handaxe-making populations in the West could be due to different routes bringing different populations into Britain, possibly from western France where handaxes are dominant with the occasional use of Levallois such as Gouzeaucourt, Gentelles, Ranville and La Cotte de St Brelade (Scott and Ashton, 2011:107; Ashton *et al.,* 2018:206).

White and Bridgland (2018) have questioned the MIS 8 status of both Broom and Harnham. The dates of Broom overlap with MIS 9, and handaxes from the site have a similar character to MIS 9 sites with the co-occurrence of ficrons and cleavers (White and Bridgland, 2018). Dale (Pers. Comm. 2021) has since argued that the handaxes show a different character to Group I sites with a larger amount of ovates. In addition, White and Bridgland (2018) expressed scepticism of Harnham being *in situ;* the 36 handaxes from Harnham show similarities to MIS 9 sites and the conditions and geology of the site could show a mass displacement. These sites either show a late surviving Acheulean in the west without the adoption of Levallois, or are erroneously dated and fit in with the MIS 9 Acheulean. The first offers a potential explanation for Pontnewydd Cave, but the second does not dismiss more complex explanations of Pontnewydd. More data is needed to fully understand the period but in Europe it is clear that the transition was complex, with handaxes continuing in some regions and Levallois replacing the Acheulean in others (Van Baelen, 2017:189-190).

These handaxe sites have been used by Wenban-Smith in Bates *et al.* (2014:173) to question the Levallois at Purfleet due to it being "anomalously early". However, there is a clear differentiation between full Levallois from Proto-Levallois, as Wenban-Smith (2013) previously argued that Proto-Levallois was common throughout the Lower Palaeolithic. This research has shown that Proto-Levallois was a significant part of late MIS 9/8 technology, but that full Levallois is rare, although examples exist from the sites of Purfleet, Biddenham and Barnham Heath. Under a diffusionist single (or limited) origin model, this would be improbable in MIS 9. However, accepting local innovations and multiple origins immanent within the Acheulean it is clear that Levallois could have developed like it did elsewhere in Europe and around the world. If Proto-Levallois technology occurring during the Lower Palaeolithic is accepted, then elaboration of this technology *in situ* is not implausible*.* The re-evaluation of the 'late handaxe sites' of Broom and Harnham is beyond the scope of this research but given the discontinuity between the PCT of MIS 9, and the more fully developed and widespread Levallois of MIS 7, the sites have little direct bearing on the PCT of MIS 9.

8.5 A European phenomenon

Despite challenges correlating the British data to that of mainland Europe, it is important to place the British record within this context and examine whether evidence of Proto-Levallois and other PCT can be seen around MIS 9. A wider European tradition of PCT (Figure 8.23; Table 8.6) is the parsimonious inference from the evidence in MIS 9 Britain as there is no reason to expect Britain to be exceptional, or an origin point for PCT. While the evidence from Britain is not extensive, similar technologies during this period in mainland Europe support the PCT examined in this thesis.

Figure 8.23 Location of early PCT sites in mainland Europe.

Table 8.6 Key European sites relating to early PCT around MIS 9.

Site	Dating	Condition	Assemblage size	Handaxes	Proto-Levallois	Levallois	References
North-east France							
Etricourt-Manancourt	MIS 9/8	Primary context-refitting	HUZ-175 HUD-2161	Present	Unipolar cores Proto-Levallois within Acheulean	Not until MIS 7	Hérisson et al., 2016b
Revelles Les Terres-Sellier	MIS 9/8	Secondary	5116	Present	Four cores (unipolar) show evidence of PCT with some others showing traits along with fourteen Levallois products	None	Guerlin *et al.,*2008; Lamotte *et al.,* 2019
Achenheim	MIS 9/8	Secondary	1015	Present in lower layers	Proto-Levallois slowly transitioning into full Levallois in successive layers	Present in higher layers	Heim *et al.,* 1982; Junkmanns, 1991;1995
North-west France							
Carrefour Boudet, Barneville	?MIS 9	?	10	Absent	Simple PCT	Present	Cliquet, 2008
South-western France							
Petit-Bost	Late MIS 9	Secondary	3,046	Present	Absent	Full Levallois intensifying in MIS 7	Bourguignon *et al.* 2008
Les Bosses	Late MIS 9	Secondary	Quartz 2174 flint 406	Present	Absent	Present	Jarry *et al.,*2004;2007; Jarry, 2010
South-eastern France							
Orgnac 3 layers 8-5a	Late MIS 9	Primary	13,055	Present	Centripetal discoidal cores signs of prepared striking platforms	None	Moncel *et al.,* 2011, 2012; Michel *et al.,* 2011; 2013; Mathias, 2016
Orgnac 3 Layers 4b-4a	Late MIS 9	Primary	5,418	Present	Persistence of discoidal cores and thick cores with only minimal management of the striking platforms	First evidence of fully developed Levallois, many uni-polar	Moncel *et al.,* 2011; 2012; Michel *et al.,* 2011;2013; Mathias, 2016
Orgnac 3Layers 3-1	Late MIS 9-Early MIS 8	Primary	64,890	Present but decline over time	Decline of non-Levallois overtime	Full Levallois	Moncel *et al.,* 20112012; Michel *et al.,* 2011; 2013; Mathias, 2016
Netherlands							
Maastricht-Belvédère (Site C, K, N)	MIS 7 (potentially MIS 9)	Primary-detailed refitting landscape	10,912 at site K alone	Absent one stray Micoquian example	Present found alongside Levallois and by itself at D, F and H	Full Levallois	Van Kolfschoten and Roebroeks 1985; Roebroeks, 1988; Roebroeks et al., 1992; Vandenberghe et al., 1993; De Loecker, 2006; De Warrimont, and Stassenstraat, 2007; De Loecker and Roebroeks, 2012; Verpoorte *et al.,* 2016

Belgium							
Kesselt-Op de Schans	MIS 9/8	Primary-refitting	~3000 7 cores 1-Proto-Levallois, 1 Levallois, four discoidal and on MPC	Present	1 Centripetal example, similar to full Levallois Discoidal cores show clear signs of preparation and control	1 full Levallois	Van Baelen, 2007;2008;2011;2014; Bolton, 2015
Mesvin IV, Haine Basin	Early MIS 8	Secondary	7889	Present	'Reduced Levallois' at least 13 varying degrees but mainly centripetal of preparation, one recurrent	At least 15 Levallois cores mainly centripetal but others present 120 Levallois products	Roche, 1981; Cahen *et al.,* 1984; Van Neer, 1986; Ryssaert, 2004; 2005; 2006a; 2006b; Van Asperen, 2008; Pirson *et al.,*2009; Van Baelen and Ryssaert 2011; Bolton, 2015
Germany							
Schöningen	MIS 9 (~320-300kya)	Primary	>1500	None	Present- potential landscape use with artefacts brought in location and sharpened	None	Thieme, 1997; 2005; 2007; Voormolen, 2008; Serangeli and Conard, 2015; Serangeli *et al.,*2018; Peters and van Kolfschoten, 2020
Markkleeberg	Early MIS 8 some argument the site is MIS 6	Primary	>4500	Present	Present-unidirectional flaking exploiting natural convexities	Present	Grahmann and Movius, 1955; Picin, 2018
Zwochau	MIS 9/8	Primary	1221 (eleven Levallois cores, examples of Proto-Levallois cores)	None	8 unidirectional with some examples of bidirectional cores	Present	Picin, 2018
Wallendorf	MIS 9/8	Secondary	~100	Some flakes tools resemble handaxes	Unclear	Present	Mania, 1995
Ariendorf I	MIS 8 (c. 250 kya)	Primary	126	None	None	Present	Bosinski *et al.,*1983; Turner, 1997; Richter 2011
Spain							
Atapuerca (TD10)	MIS 9/8	Primary	9800	Present	Centripetal core working strategies, signs of hierarchal treatment of surfaces, increased preparation and predetermination	Scarce, not full Levallois	Ollé et al., 2013; Mosquera et al., 2013; Rodríguez-Hidalgo *et al.,* 2015; García-Medrano *et al.,* 2015; Lombera-*Hermida et al*. 2020
Cuesta de la Bajada	MIS 9/8	Primary or very well preserved secondary	282	None	Debitage scheme to produce retouched flakes	None	Santonja *et al.* 2014; 2016

Ambrona	~350kya	Secondary	1,985	Reduced presence	Based around discoidal schemes	None	Santonja and Villa, 1990; Santonja *et al.,* 2016
Aridos I	MIS 9/8	Primary	331	Present	‘Limited Levallois’	‘Limited Levallois’	Santonja and Villa, 1990; Santonja *et al.,* 2016
Portugal							
Cobrinhos	200-160kya	Secondary	15,779	None	None	Present	Cunha *et al.,* 2012; Pereira *et al.,* 2019
Italy							
Guado San Nicola	MIS 11-10	Primary	4,168	Present	Present- centripetally prepared lineal and recurrent cores	None	Picin, 2013; Moncel *et al.*, 2020
Cave dall'Oli	MIS 9	Secondary	494	15 handaxes	Mixture- unipolar prepartion with recurrent removals with bipolar and centripetal being rarer	Mixture	Picin, 2013; Moncel *et al.*, 2020
Monte delle Gioie and Sedia del diavolo	MIS 9-8	Secondary	128	Unclear some older forms of lithic production	Unclear some older forms of lithic production	Full Levallois present but not dominant. Three cores recurrent and centripetal. Retouch common.	Soriano and Villa, 2017
Rosaneto	MIS 7/6	Secondary	~1000	Present	Unclear perhaps some overlap with full Levallois	Present	Mussi, 1999; Picin, 2013; Moncel *et al.*, 2020
Armenia							
Nor Geghi	MIS 12-7	Primary- well stratified	2979	Contemporary with early Levallois	Contemporary with handaxes	Possible	Adler *et al.,* 2014

European PCT prior to MIS 9

Similar to Britain, claims of PCT prior to MIS 9/8 in Europe are scarce and usually more problematic (Moncel *et al.,* 2005; 2020). Tuffreau (1982:146; 1995:417) described Levallois as being present at Rue Marcellin Berthelot, St Acheul, Fréville Terrace level (MIS 14) with two preferential flake cores, and more abundant evidence coming from the Garenne Terrace level (MIS 12), although these are isolated examples which fell out of use. Breuil and Kelley (1956) noted preferential flake cores but denied the use of the term 'Proto-Levallois' (Tuffreau, 1995:417). The re-use of handaxes as Levallois cores at Cagny la Garenne is an example of possible technological convergence linking early Levallois and handaxes (Tuffreau, 1995:418). However, Field (2005:38) argued that Cagny La Garenne should not be considered PCT as it is a variation of handaxe production. In contrast, Moncel *et al.* (2020) has since claimed the prepared artefacts from Cagny La Garenne appear over time and are constrained to the lower levels of the site. These artefacts show multiple methods (unipolar, bipolar and centripetal) were used and the intention to produce Levallois products can be observed (Moncel *et al.*, 2020). Similar to the evidence from Britain, it is possible that PCT appears as a vague idea in Europe prior to MIS 9, but more clearly in MIS 9 (Gowlett *et al.*, 2018:258).

The European transition

Moncel *et al.,* (2020) argued that after more accidental and ephemeral occurrences the period of MIS 11-9 represented a period of innovation relating to PCT. The north-east of France offers a clear parallel to Britain with the co-existence of Proto-Levallois and handaxes present at both Etricourt-Manancourt (Figure 8.24) and Revelles Les Terres-Sellier (Figure 8.25), but with no signs of fully developed Levallois until after a period of abandonment in MIS 8 (Guerlin *et al.,*2008; Hérisson *et al.,* 2016a:80; Hérisson *et al.,* 2016b:90; Locht *et al.,* 2018:217; Lamotte *et al.,* 2019:700-1). In detail beyond what is seen in Britain, Achenheim demonstrates the gradual emergence of Levallois technology over sequential layers indicative of Levallois emerging from local circumstance (Heim *et al.,* 1982; Junkmanns, 1991;1995; Scott, 2011:173). Other sites in the region during MIS 9 only show Acheulean technology such as Soucy (Hérisson *et al.,* 2016a:249). The site of Cagny L'Epinette has been noted for both the presence and absence of PCT, and it is not clear if these are different interpretations or confusion with other sites and layers (Fontana *et al.*, 2013; Lamotte and Tuffreau, 2016; Hérisson *et al.,* 2016a).

In north-west France, a small assemblage from Carrefour Boudet, Barneville has been tentatively dated to MIS 9 and demonstrated evidence of Levallois technology and simple PCT (Cliquet, 2008; Hérisson *et al.,* 2016a:253). The only other site dated to MIS 9 is an Acheulean site, Catterville, with no evidence of PCT (Coutard and Cliquet, 2005; Hérisson *et al.,* 2016a).

The traditional beginning of the EMP is well represented in this region by Ranville (c.230kya) and Tourville (c.220kya), but with the continued use of handaxes (Hérisson *et al.,* 2016a:253).

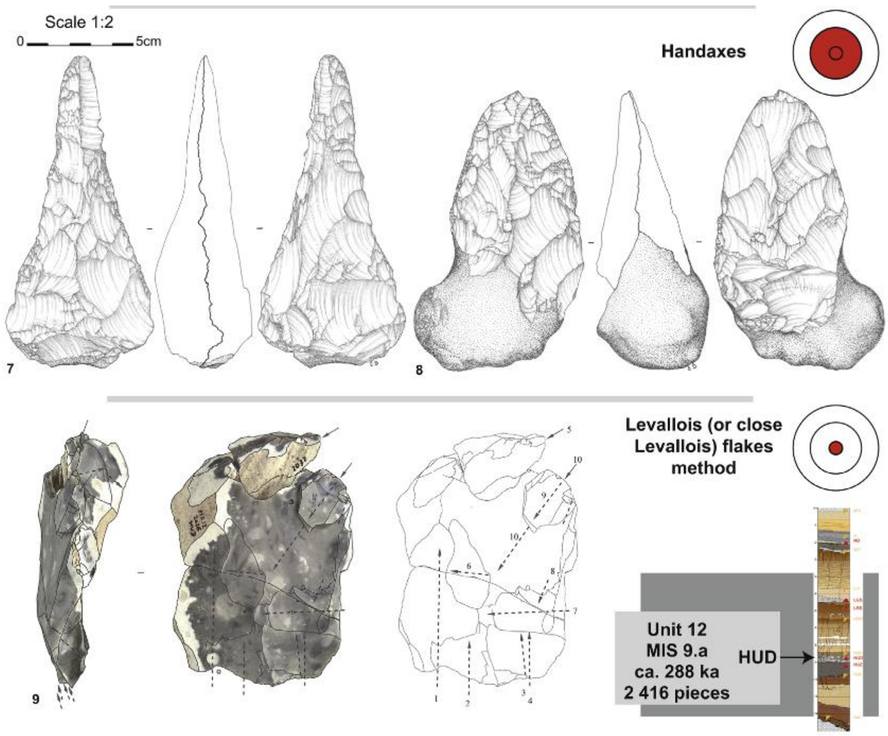

Figure 8.24 Handaxes and Levallois refitting from layer HUD at Etricourt- Manancourt (Hérisson *et al.,* 2016b:86).

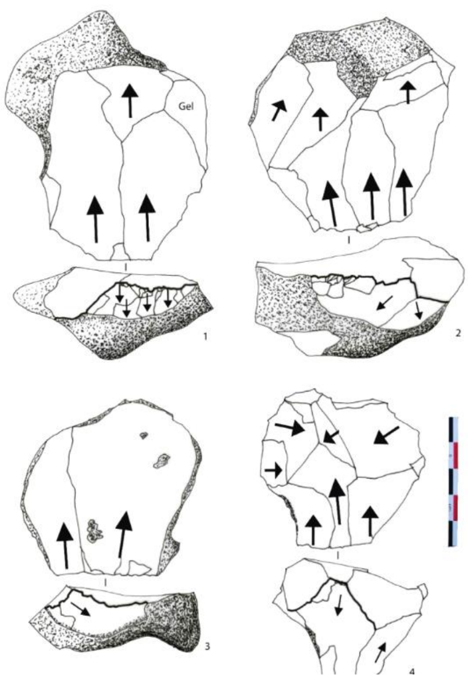

Figure 8.25 Cores from Revelles Les Terres-Sellier with similarities to those found in MIS 9 Britain (Lamotte *et al.,* 2019:704).

The south-west of France differs from the north of France and Britain, having no Proto-Levallois. The sites of Petit-Bost and Les Bosses yielded fully developed Levallois within Acheulean contexts, although this expanded in the succeeding interglacial (Jarry *et al.,* 2004; 2007; Bourguignon *et al.,*2008:51-2; Jarry, 2010; Hérisson *et al.,* 2016a). In contrast, the nearby Acheulean MIS 9 site of La Micoque has no PCT (Hérisson *et al.,* 2016a:267).

In the south-east, Orgnac 3 offers a more complex view. Orgnac 3 contains a sequence (Figure 8.26) which points to an *in situ* development of Levallois technology from a local Acheulean industry (Moncel *et al.,* 2011; Moncel *et al.,* 2012:653). The increase in the evidence of both the numbers of PCT and the extent of preparation suggests that this was a gradual or punctuated development of Levallois (Moncel *et al.,* 2012:658). There are glimpses of earlier Levallois traits in the sequence, with basic management of opposing striking platforms as seen at many MIS 9 Britain sites (Moncel *et al.,* 2012:662). In contrast, long detailed sequences covering this period are missing in Britain. Moncel *et al.* (2011:36; 2012:663) interpreted this evidence as showing the gradual development of Levallois in stages and part of the Neanderthalisation process, arguing that older sites such as Cagny la Garrene (MIS 12) could show the roots of this behaviour.

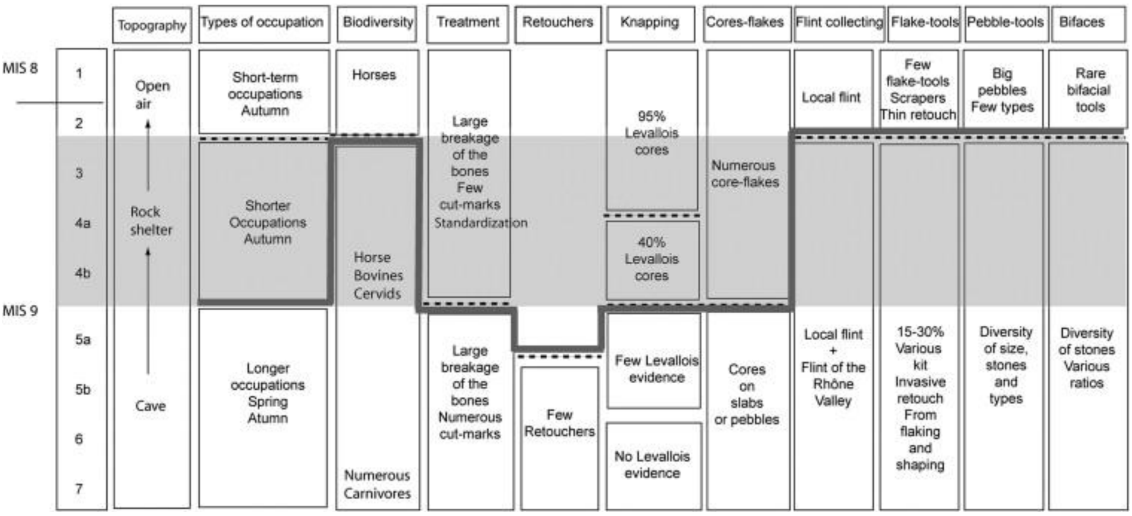

Figure 8.26 Summary of Orgnac 3 during MIS 9/8 (Moncel *et al.,* 2012:662).

The appearance of PCT is varied across the rest of Europe. The earliest PCT from the Netherlands, Maastricht- Belvédère (Sites C, K, N) containing Levallois technology, discoidal cores and scrapers (Verpoorte *et al.,* 2016:152) is commonly dated to MIS 7 on the basis of TL, ESR and paleoenvironmental dating (Van Kolfschoten and Roebroeks 1985; Roebroeks, 1988; Roebroeks *et al.,* 1992; Vandenberghe *et al.,* 1993; De Loecker, 2006; De Loecker and Roebroeks *et al*, 2012). Contrary to this, AAR of *Corbicula* shells and the associated molluscan fauna points to a MIS 9 date (Meijer and Cleveringa*,* 2009). This distinction is vital to current work and although not clear from other sources, there appears to be a form of PCT (not full Levallois) recorded at various areas of Maastricht- Belvédère. This technology is found alongside full Levallois at C, G, K, N (which possibly shows a link between Proto-Levallois and full Levallois) and by itself at B, D, F and H (Meijs *et al.*, 2012:154; Hérisson *et al.,* 2016a:241).

Di Modica and Pirson (2016) suggested an MIS 9 correlation for a period at Maastricht-Belvédère that contains simple PCT and Levallois (Meijer and Cleveringa, 2009; Roebroeks *et al*., 2012). This represents the difficulties in comparing areas as it is hard to assess whether this form of PCT is comparable to that found in Britain during MIS 9/8. MIS 7 appears to be a minimum age for the archaeology, but the quantity, lack of handaxes and well-prepared nature of many of the cores and products indicates similarities with MIS 7 sites rather than earlier occurrences. The presence of simple PCT and doubts around dating still need to be resolved (De Warrimont and Stassenstraat, 2007; De Loecker and Roebroeks, 2012:351).

There is little to compare to within the Netherlands due to the poor quality of data elsewhere (Hérisson *et al.,* 2016a:260), but the nearby the site of Kesselt-Op de Schans, Belgium contained a number of refitting lithic scatters dating to MIS 9/8 (Van Baelen *et al.*, 2007; 2008; 2011; Van Baelen, 2014; 2017). Kesselt-Op de Schans yielded an assemblage containing handaxes, Proto-Levallois and full Levallois dated to MIS 9/8, with clear parallels to both Britain and France (Hérisson *et al.,* 2016a). Bolton (2015) dismissed some of the early PCT as discoidal cores, but Van Baelen (2008:7-8), White *et al.* (2011:61) and Scott (2011:173-174) have all argued that the discoidal cores demonstrate a very particular and controlled form of this technology linked to PCT (Figure 8.27). Evidence of preparation came from refitting studies at the site (Van Baelen, 2008; 2014). White *et al.* (2011:61) and Scott (2011:173-4) emphasised that the variety of novel approaches to core use at the time foreshadowed fully developed Levallois. The knapping scatters at Kesselt-Op de Schans represent snapshots of core working that has many similarities with the transitional industries around MIS 9/8 (Van Baelen, 2007; 2008).

Another Belgian site, Mesvin IV, has been characterised by 'reduced Levallois' (Roche, 1981; Cahen *et al.,* 1984; Cahen and Michel, 1986; Van Neer, 1986; Van Asperen, 2008; Pirson *et al.,* 2009; Van Baelen and Ryssaert, 2011). The early prepared cores (Figure 8.28) are similar to British examples but show some signs of more advanced preparation of the striking platform than those at Purfleet (Ryssaert, 2004; 2005; Van Baelen and Ryssaert 2011). Additionally, the Acheulean component of the Mesvin IV assemblage is more substantiated than at Botany Pit, showing a large Acheulean assemblage with early Middle Palaeolithic elements possibly reminiscent of Biddenham, Kempston and other MIS 9 sites (Ryssaert, 2006a:98; Ryssaert, 2006b). It was suggested by Ryssaert (2006a:95) that the 'reduced Levallois' could present an earlier stage of Levallois working as the cores were larger than the full Levallois cores with less evidence of flattening. While this could work for Mesvin IV, many of the sites in MIS 9 do not contain the more developed Levallois cores. Similarly, Proto-Levallois cores are not present at all Levallois sites.

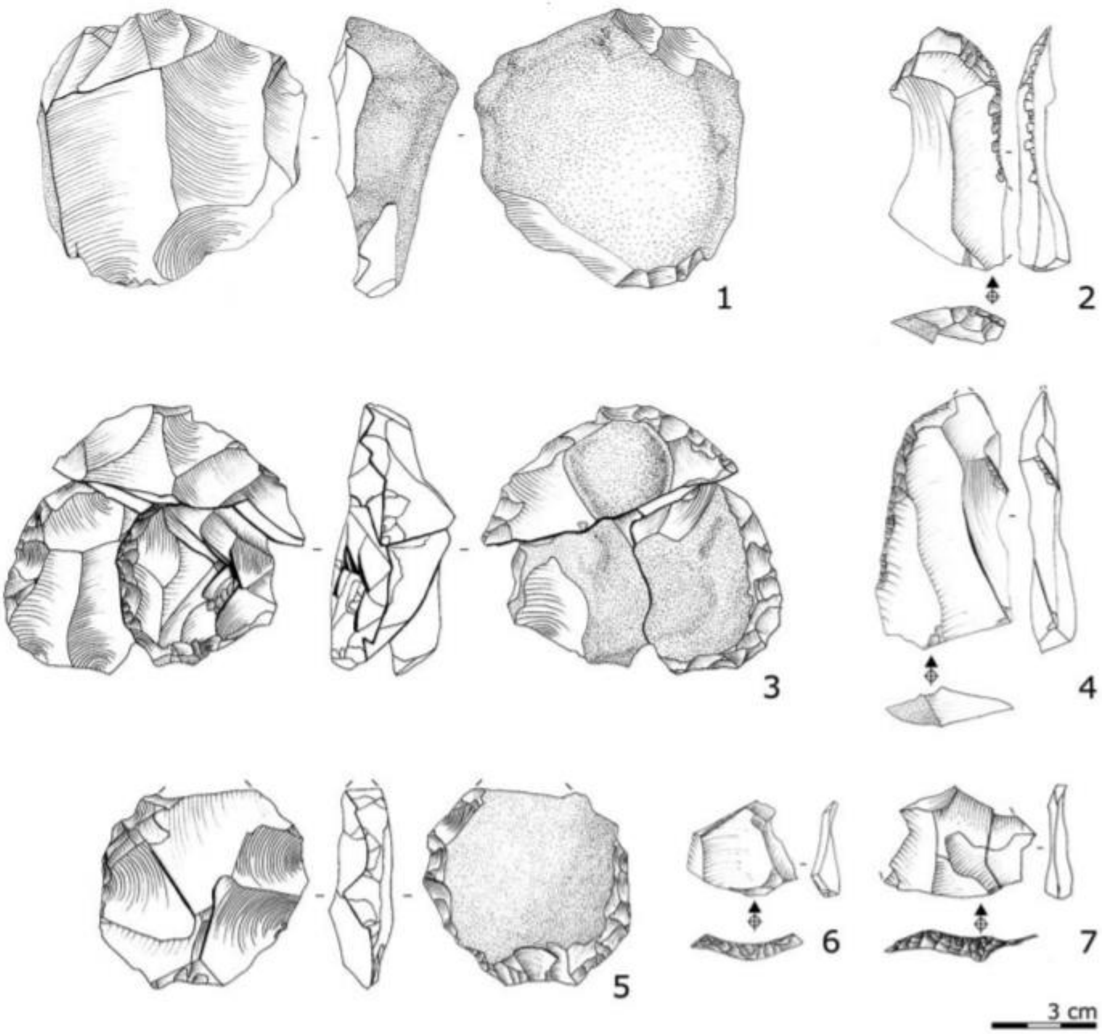

Figure 8.27 Proto-Levallois and Levallois finds from Kesselt-Op de Schans (Van Baelen *et al.,* 2008:8).

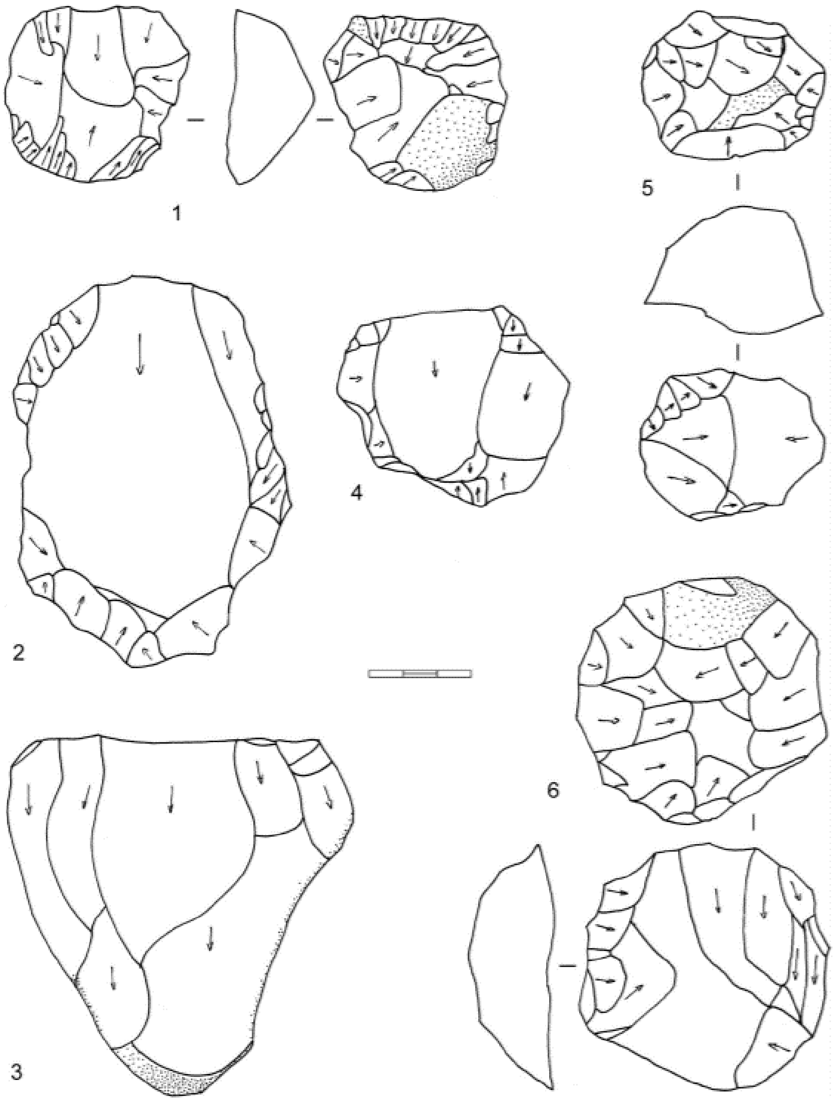

Figure 8.28 Examples of Levallois, Proto-Levallois and discoidal cores at Mesvin IV (Ryssaert, 2004a:96).

Claims of ‘unsophisticated Levallois’ alongside handaxes have been made at older findspots in Belgium related to the Petit-Spiennes and Pa d'la l'iau terraces (Cahen *et al.,* 1985; Watteyne, 1985; Di Modica and Pirson, 2016). While this could show older traditions, both the dating and contexts are uncertain with the artefacts needing to be revaluated (Di Modica and Pirson, 2016). The contrast between the Belgium and Dutch findings is noticeable and could be due to deficits in the local archaeological records or different academic perspectives.

Sites in Spain including Atapercua (TD10), Cuesta de la Bajada, Aridos and Ambrona show transitional industries containing Proto-Levallois around the MIS 9/8 transition (Ollé *et al.,* 2013; Santonja *et al.,* 2016). Full Levallois appears to be absent apart from potentially at Aridos where the term ‘limited Levallois’ is used (Ollé *et al.,* 2013; Santonja *et al.,* 2016), and Atapercua (TD10) where some more prepared examples are present (Lombera-Hermida et al.

2020). There is a decrease in the importance of handaxes during this period, with no handaxes found at Cuesta de la Bajada (Ollé *et al.,* 2013; Santonja *et al.,* 2016). The sites show an increase in centripetal and discoidal core working strategies, with signs of hierarchal treatment of surfaces, increased preparation and predetermination aimed at producing retouched flakes leading to Levallois (Ollé *et al.,* 2013).

Current work at Cova Negra, Spain, is attempting to date a sequence (tentatively MIS 9/8) that represents an early presence of Levallois technology alongside handaxes and shows little difference between the final Acheulean and earliest Middle Palaeolithic in the area (Eixea *et al.,* 2020). In contrast, evidence from the Tagus Valley, Portugal, including the Cobrinhos site, shows a much later transition to the Middle Palaeolithic, between 200-160kya, with little evidence of transitional industries (Cunha *et al.,* 2012; Pereira *et al.,* 2019). This could be the result of dating issues, a lack of sites or the raw material in the area. While the local conditions for *in situ* development may not have occurred, explaining the lack of cultural drift from Spain is difficult. Similar to Belgium and the Netherlands a difference in academic perspective or local preservation is likely to be the reason for this.

Dating is also problematic in Italy. Picin *et al.* (2013) claimed that there is no convincing evidence of PCT until the end of MIS 7/6 at Rossanetto (Mussi, 1995), where there is a mixture of handaxes and Levallois technology (possibly some Proto-Levallois). This delayed introduction of Levallois could be due to belated Neanderthal development in the area (Picin *et al.,* 2013), but while this thesis concurs that the introduction of Levallois was likely asynchronous, this later date (after the traditional start of the EMP) for Italy seems dubious with no evidence for isolation from the rest of Europe. Recently Moncel *et al.* (2020) correlated Cave dall'Oli, which contained handaxes and a mixture of PCT (ranging from Proto-Levallois to some examples of Levallois), with MIS 9 in line with evidence across Europe. According to Moncel *et al.* (2020), nearby surface finds while undated show similar technology.

Around Rome the sites of Monte delle Gioie and Sedia del Diavolo demonstrate the presence (but not dominance) of full Levallois within Lower Palaeolithic contexts (Soriano and Villa, 2017). This limited, but evident, presence backs up the idea of varying *Chaîne opératoires,* leading to local appearance of Levallois (Soriano and Villa, 2017). In southern central Italy the site Guado san Nicola, systematically excavated between 2008-2015, yielded early PCT alongside handaxes but with no developed Levallois, and is correlated to MIS 11-10 (Moncel *et al.*, 2020). These sites could either show dating issues or local development of PCT at various points.

Outside of the traditional Acheulean area, sites in Germany are also varied. Schöningen 13-II-4 has been re-dated to MIS 9 (~320-300kya), fitting in with some of the earliest signs of the EMP (Peters and van Kolfschoten, 2020). Traditionally the lack of Levallois at Schöningen was given as a reason for placing the site within the late Lower Palaeolithic rather than the earliest EMP (Serangeli and Conard, 2015:291). Despite the lack of Levallois, the use of technology in the landscape is reminiscent of many Middle Palaeolithic sites with artefacts being brought into the location and only sharpened at the site. Serangeli *et al.* (2018:148) argued that despite the lack of Levallois, some tools and cores were reminiscent of the Middle Palaeolithic. Similar to Maastricht-Belvédère, Hérisson *et al.* (2016a) noted PCT at the site but with no further details.

Three German sites, Markkleeberg, Wallendorf, and Zwochau, show evidence of Levallois within MIS 9/8, although dating at Markkleeberg is disputed (Herrison *et al.,*2016a:262; Picin, 2018:302). Despite the lack of handaxes in the preceding German Lower Palaeolithic, Markkleeberg contains handaxes and Wallendorf contains flake tools that highly resemble handaxes (Mania, 1995; Picin, 2018). The sites of Markkleeberg and Zwochau both contain clear evidence of Proto-Levallois which Picin (2018:307) argued demonstrates the gradual emergence of PCT in eastern Germany. The site of Zwochau represents an increase in the amount of fully developed Levallois and lacks handaxes, but more simple versions are still present, possibly demonstrating the elaboration of this technique over time representing a local development different to that seen at other sites (Picin, 2018:308).

The site of Wallendorf shows evidence for Levallois technology and potentially early Proto-Levallois but this is unclear, and it could either relate to the same time as Markkleeberg and Zwochau or the later Ariendorf I (Mania, 1995; Picin, 2018). Ariendorf I is dated to the beginning of the EMP (MIS 8, c. 250 kya) and is a full Levallois site, more closely related to Scott's (2011) EMP sites in Britain, with well-prepared cores demonstrated by *in-situ* refitting knapping scatters (Bosinski *et al.,* 1983; Turner, 1997; Richter, 2011; Hérisson *et al.,*2016a:262).

Other regions in central and eastern Europe that are characterised as being outside the traditional Acheulean show signs of the adoption of handaxes after MIS 8, along with Levallois technology (Hopkinson, 2007:296-8; Scott, 2011:178). One example of this is the site of Korolevo, Ukraine which shows signs of early PCT (Haesaerts and Koulakovskaya, 2006), although this has been disputed by Koulakovskaya *et al.* (2010). Wiśniewski (2014) noted a number of sites including Kulna Cave, Czech Republic, Bisnik, Poland and Hôrka ondrej, Slovakia all dating to MIS 8-6. Wiśniewski (2014) argued that these early signs of Levallois were diverse, possibly pointing to different sources or distinct appearances, although there is a lack of the local convergence or gradual adoption seen at other sites. Similarities exist in small, more incidental PCT happening prior to the proliferation and rapid spread of developed Levallois, and this was possibly due to unstable populations and/or varying environmental evidence close to the glaciation (Wiśniewski, 2014; Moncel *et al.,* 2020). Wiśniewski (2014) linked the beginning of Levallois with incoming Acheulean populations which could explain a delayed arrival compared to western Europe.

While many sites in the southern Caucasus remain poorly dated and understudied (Adler *et al,* 2014:1609), at Nor Geghi, Armenia a well stratified site dating between MIS 12-7 shows the contemporary usage of handaxes and early Levallois made on obsidian (including 17 Levallois cores) with no evidence of mixing (Adler *et al,* 2014:1611). This could again be explained through the local emergence of PCT.

Summary

Despite the difficulties of correlating between the different areas, there is a common pattern across most of Europe. Despite some possibly earlier occurrences, PCT appears more regularly during MIS 9-8 within traditionally Lower Palaeolithic assemblages (Hérisson *et al.,* 2016a:269), concurring with current research into MIS 9 Britain. It is unlikely that occupation would have been present during full glacial conditions during MIS 8 (Hublin and Roebroeks, 2009; Hérisson *et al*., 2016a; Locht *et al*., 2016), so along with the traditional EMP this represents at least two separate appearances of PCT in Europe. Hérisson *et al.* (2016a:273) argued that our knowledge of how PCT originated and spread is limited due to the scarcity of MIS 9 sites and the lack of sites in MIS 8. There is still some resistance to the idea of early proto stages in Europe and Richter (2011:10-13) has questioned the dating of many early PCT sites including Markkleeberg, Achenheim and Korolevo. Despite this, the evidence overwhelmingly supports a mosaic of changes during MIS 9/8 across Europe, of which the Proto-Levallois found at British sites is another example.

8.6 Rest of the world

While a comprehensive review of all PCT is outside the scope of this thesis, Africa and Asia provide interesting insights into the British and European evidence. Schick and Toth (1993:237) observed that it was common in many areas outside of north-west Europe to create handaxes from large flake blanks especially when raw material is difficult to work (Wallace and Shea, 2006; Barham and Mitchell, 2008). Variations of PCT within Africa point towards a relationship to Acheulean technology. The Kombewa technique, named after a site in Western Kenya (Owen, 1938), creates a flake with the profile of a handaxe by splitting a cobble and removing the positive bulb with a further flake. This blank could then be further modified in numerous ways (Schick and Clark 2003). Key examples of this are found in the Awash Valley 1.1 mya (Schick and Clark, 2003) and Gesher Benot Ya'aqov in the Levant (Goren-Inbar, 2000).

The Victoria West technique first discovered in South Africa (Goodwin and van Riet Lowe, 1929) shows the shaping of elongated cores which are then side struck to produce cleavers (McNabb, 2001; Sharan and Beaumont, 2006). A similar technique from the north-western Sahara is called the Tachengit technique (Barham and Mitchell, 2008:194; Shipton, 2019). These occurrences show the link between the Acheulean and PCT, with many techniques originating from the need to produce handaxe blanks. Van Baelen (2017:21) argued that early African examples such as Victoria West remain poorly dated.

The Kapthurin formation, west of Lake Baringo in the Kenyan Rift Valley, is a well dated sequence between 509-235kya that could clarify these dating issues (Tryon, 2006; Tryon and McBrearty 2006). The Acheulean layers contain elements of PCT, but the manufacture of handaxes is later abandoned around 250-200kya (Barham and Mitchell, 2008:225). This represents continuation and adaption, rather than the abrupt change with which the Acheulean-Levallois divide is often portrayed (Foley and Lahr, 1997).

This can also be observed at the site Kudu Koppie, South Africa (Figure 8.29) where late Early Stone Age (ESA) and early Middle Stone Age (MSA) can be studied (Wilkins *et al.*, 2010). Both periods at the site show Levallois often exploiting natural convexities with simple preparation, similar to Proto-Levallois at Purfleet and other sites, alongside handaxes (Wilkins *et al.*, 2010). Through time handaxes decrease, raw material use changes and there is an increased diversity in the Levallois technology including more formal preparation (Wilkins *et al.*, 2010). This reflects what is seen at multiple European sites such as Orgnac 3 with early manifestations of PCT before later proliferation.

The link between the Acheulean and PCT seems to be supported by the lack of PCT east of the Movius line in China, central Asia and southeast Asia (Schick 1998; Dennell, 2009:435). The Indian sub-continent has limited dating evidence, but there is a distinct early Acheulean with a lack of Levallois followed by sites with a higher proportion of cleavers to handaxes, flake tools, soft hammer working, discoidal cores and Levallois cores such as the sites in the Raisen Basin and Bhimbekka (Misra, 1989; Misra *et al.,* 2010; Dennell, 2009:340). The EMP appears to have developed indigenously from the local Acheulean without a strict cut off (Dennell, 2009:344).

At Attirampakken, India, a transitional site is seen with the end of the Acheulean and beginning of Levallois dated to 385±64kya, much earlier than previously assumed for southern Asia (Akkilesh *et al.,* 2018). Dating in this area of the world had previously been poor with the assumption being that the Middle Palaeolithic started with intrusion from Africa around MIS 5 (Akkilesh *et al.,* 2018). The beginnings of simple PCT and the development of Levallois preceding the decrease in handaxes shows the local transition similar to Europe.

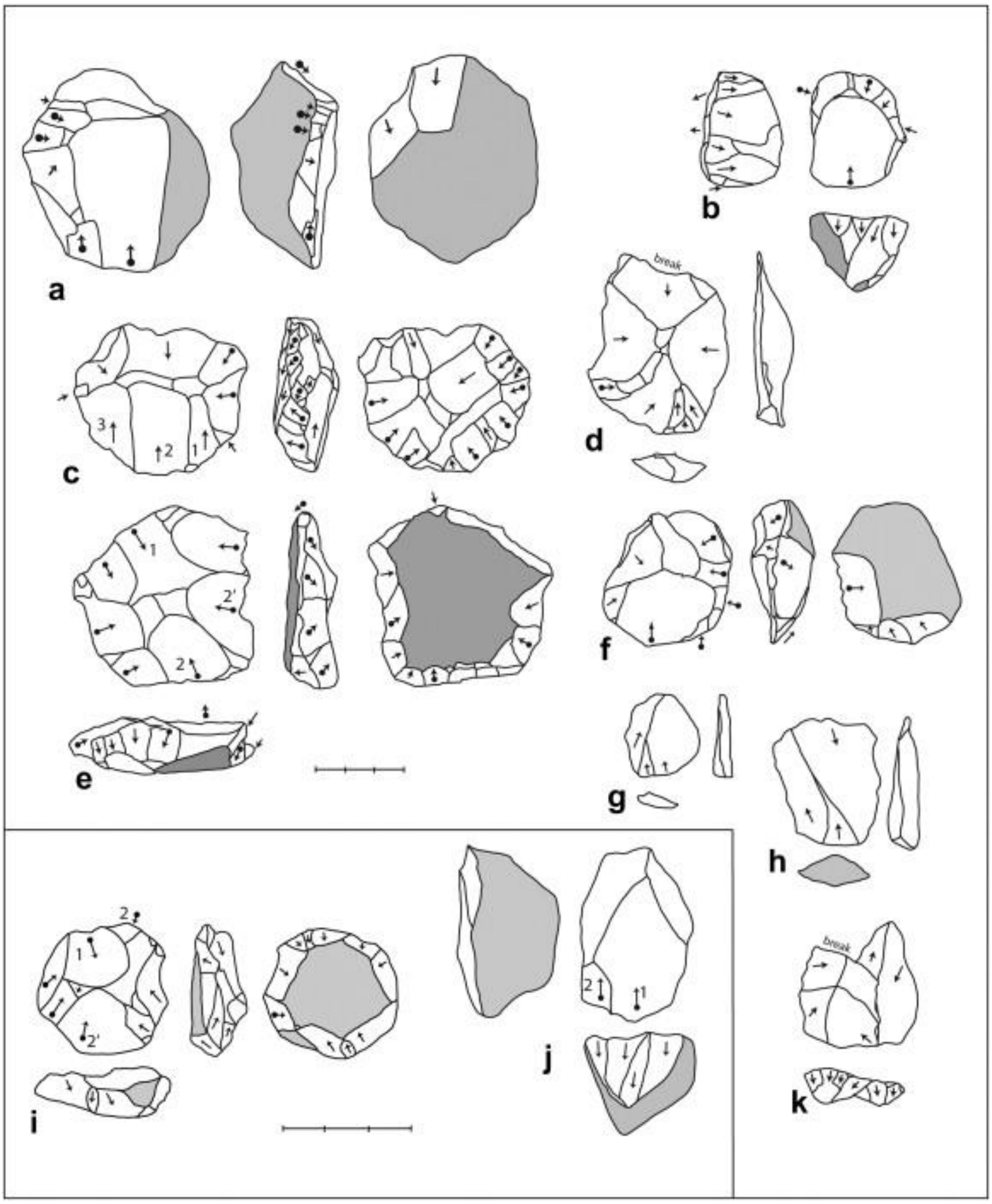

Figure 8.29 Examples of early PCT from Kudu Koppie (Wilkins *et al.,* 2011:1284).

While the Levant acted as a bridge between Africa and Eurasia (Malinsky-Buller, 2016b), dating is an issue due to homogenous biostratigraphy and a lack of accuracy (Bar-Yosef, 1982:31; 1992; Malinsky-Buller, 2016b). Dennell (2009:264) argued that Gesher Benot Ya'aqov showed an African influence in the use of the Kombewa technique that is not seen afterwards, although it is not clear why this had to be influenced by Africa and could not be another example of convergence technology like other PCT. Shimelmitz *et al.* (2016:25) argued that the diversification of Levallois defines the Middle Palaeolithic in the region rather than the earliest appearance. In the Levant the Acheulean, which is thought to include some PCT, is succeeded by the Acheulo-Yarbrudian (including the facies of Yarbrudian and Pre-Aurignacian/Amudian), where handaxes continue and PCT disappears, before the Levantine-Mousterian (Dennell, 2009:289). Although the dating still not clear, industries in the region overlap with the Acheulean persisting until 200kya at sites such as Berekhat Ram, Holon and Revadim, the Acheulo-Yarbrudian beginning between 400-300kya at the site of Qesem, and the Levantine-Mousterian beginning between 250-200kya.

Examples of the EMP include Tabun and Hayonim dating to early MIS 7 (Zaidner and Weinstein-Evron, 2016). At Tabun and Ma'ayan Barukh, Levallois within the Acheulean has been noted since the 1950's but prior attempts to separate the two industries (Rolland, 1995:333; Copeland, 1995:171) have ignored this connection. At these sites, despite the samples being small, the archaeology shows handaxes being transformed into cores in a way which has led to comparisons to Cagny La Garenne (DeBono and Goren-Inbar, 2001:10-1). According to DeBono and Goren-Inbar (2001:21-2), this phenomenon is more widely observed but rarely described in detail and shows a clear conceptual link. While the removal of these flakes from handaxes could be accidental, it shows potential convergence and innovation and the handaxes/cores at Tabun and Ma'ayan Barukh appear to have been modified before removal of the final flake (DeBono and Goren-Inbar, 2001:21-2).

The chronology of the Levant needs to be assessed, but it does appear to show a unique development of PCT and points again to multiple origins of PCT linked to the Acheulean, possibly with some outside influence (Zaidner and Weinstein-Evron, 2016). The differences between late Acheulean, Acheulo-Yarbrudian and EMP may obscure wider diversity and similarities, and differences may be due to other factors such as location and site types (Malinsky-Buller, 2016b). Malinsky-Buller (2016b) argued that the EMP is likely to represent an arrival from outside (c. MIS 8-7) rather than local innovation due to discontinuity, evidenced by the introduction of pointed blanks and a lack of continuity with previous technology. However, while Malinsky-Buller and Hovers (2019) argued that there was a clear break prior to the EMP, Shimelmitz *et al.* (2016) have argued that the record shows some continuity between industries. Regardless, Malinsky-Buller (2016b) avoided linking any outside influence to Foley and Lahr's (1997) climate-based global diffusion and argued for the importance of local conditions and multiple origins of Levallois.

Other areas in Asia (Middle-East, Jordan and the Arabian peninsula) are harder to examine due to a lack of evidence and dating with most sites showing only Acheulean evidence, although in the Arabian peninsula small proportions of PCT are common within later Acheulean sites (Dennell, 2009). While some claims of increasingly ancient PCT are disputed, it is clear that PCT is part of the later Acheulean across the Lower-Middle Palaeolithic (as well as ESA-MSA) transition, with PCT emerging slowly out of local circumstance multiple times across the globe (Kuhn, 2013). Overall, the British MIS 9 sites are concordant with evidence from Africa, Asia and Europe, showing evidence for a global process of transition.

8.7 The role of prepared core technology during the Lower-Middle Palaeolithic

In Britain, Levallois is recognized as characterising the EMP, but earlier PCT is considered more problematic (Moncel *et al.*, 2020). Davis *et al.* (2016:571) argued that a handful of Proto-Levallois material does not indicate a separate technological tradition or bare any relation to later Levallois. This study, while advocating the importance of early PCT, does not disagree with either of these points. Early PCT, from the evidence in Britain in both its European and global context, appears to be part of a flexible late Acheulean technology that is distinct from EMP populations. While caution is appropriate, there is now enough evidence to show that early PCT represents an important stage in Britain and Europe. This leads to a number of implications regarding our understanding of the Lower-Middle Palaeolithic periods.

Nature of Proto-Levallois

Early PCT is often found within Acheulean contexts demonstrating a clear link between the Acheulean and PCT (Schick and Toth, 1993:263). This conceptual link, shown through the merging of *façonnage* and *debitage*, demonstrates the immanence of this technology within the Lower Palaeolithic (White and Pettitt, 1995; Gamble, 1999; Moncel *et al.,* 2020). This is indicated by the similarity between early forms of PCT and the existing technology at a number of sites, including Orgnac 3, Guado San Nicola and Cave dall'Oli, showing evolution out of local traditions (Moncel *et al.*, 2020). Across the globe, sites show a wide variation in predetermined core technology that reflects behavioural response to local circumstance (Shimelmitz and Kuhn, 2018). The difference between earlier PCT and Levallois is unclear at times and this could show that approaches lie on a continuum. It is noted by both Scott (2011:199) and Moncel *et al.* (2020) that simpler forms of PCT can be found after MIS 8 alongside developed

Levallois. However, Moncel *et al.* (2020) still links simpler PCT, especially when full Levallois is absent, to MIS 11-9.

Bolton (2015:243) argued that the absence of the control of lateral and distal convexities showed a lack of predetermination in early PCT. In contrast, the early PCT technology examined in this thesis and described in the comparisons do show a level of predetermination that is key to the technology. While not as controlled as full Levallois, the MIS 9/8 sites show the repeated use of a *Chaîne opératoire* to produce certain types of flakes. Moncel *et al.* (2020) argued that early Levallois showed signs of control but were not fully standardised. This is why the technology, despite not being linked directly to full Levallois, can be referred to as Proto-Levallois. Using Victoria West as an example, Lycett (2009:187) argued that there was little evidence that the technology was Proto-Levallois as there is no evidence of an ancestral connection, preferring to view them as an independently invented form of 'para-Levallois'. Lycett *et al.* (2010:1115) further argued that after analysis of the shape of Victoria West cores, they were distinctly Acheulean in contrast to Levallois cores. This is consistent with the work above on early PCT, but this distinction does not seem useful. What is important is the level of predetermination, and use of core preparation prior to the traditional EMP. The evidence points to a larger trend across the globe of early PCT preceding developed Levallois.

Some sites with early PCT such as Holon, Israel, have been classed as Levallois cores due to increased centripetal working, but Malinsky-Buller (2016b) argued that these still lack rejuvenation stages and Levallois products. Additionally, the hierarchical reduction sequences occur in late Acheulean layers in the Levant with a high degree of variety (especially in degree of preparation and links to other core types) but are primarily unipolar with some centripetal cores (Malinsky-Buller, 2016b). This is reminiscent of the situation in MIS 9 Britain and the connections to other core working, both Levallois and non-Levallois, is seen in the European comparisons. For Malinsky-Buller (2016b), these cores show a low investment by using the original form of the nodule linked to White and Ashton (2003) and Scott's (2011) ideas of using natural convexities. More advanced Levallois could emerge as an optimum solution which could explain the multiple origins of the technology either from hierarchical core working developing into Levallois or some incipient Levallois traits developing overtime (Malinsky-Buller, 2016b).

Local innovations or African export?

For some, the complexity of Levallois requires biological separation from the Lower Palaeolithic and this is epitomized in the Mode 3 hypothesis by Foley and Lahr (1997). The hypothesis argued that *Homo helmei,* based on the Florisbad cranium (~260kya) detailed in Grün *et al.* (1996), were responsible for the spread of Mode 3 technology due to climatic changes (Figure 8.30). *Homo helmei* were supposedly ancestral to both AMH and Neanderthals (Lahr and Foley, 2001:26-7) but there remains no evidence of *Homo helmei* being an intrusive species in Europe, leading to Stringer (2016) rejecting the species usage as part of the Mode 3 hypothesis.

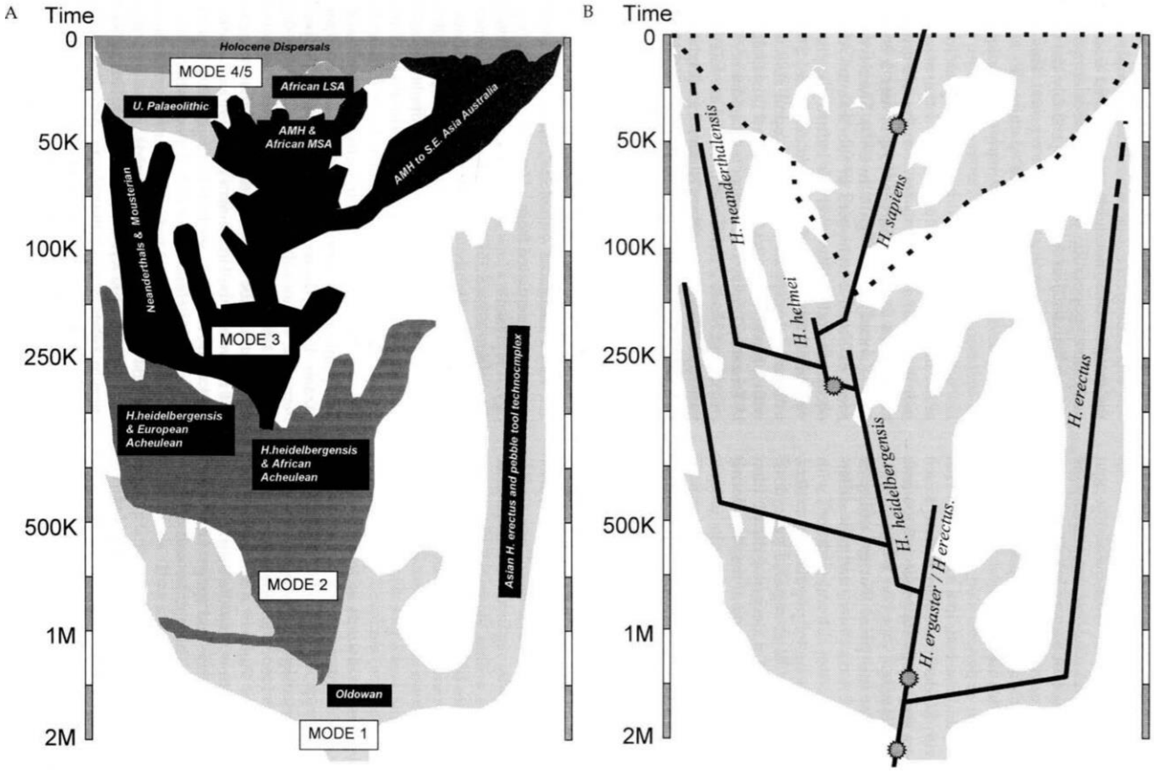

Figure 8.30 The Mode 3 hypothesis attempt to map technology on to hominin species (Foley and Lahr, 1997:21).

Current evidence, including the Neanderthal features in earlier hominins such as at Swanscombe and Sima de los Huseos from 600-450kya, supports a longer period of *in situ* 'Neanderthalisation' in Europe with Hublin (2009), Endicott *et al.* (2010), Fontana (2013) and Moncel *et al.* (2020) all questioning the timing of this divergence. The Mode 3 hypothesis was an attempt to solve the paradox of AMH and Neanderthals using the same technology whilst being on separate evolutionary trajectories (Lahr and Foley, 2001). The use of Clark's (1969) Mode 3 may have concealed the diversity during this time (White *et al.,* 2011:53). While Lahr and Foley (2001:32) argued that without *Homo helmei* the contemporary convergence of technology in different conditions seems highly unlikely, this neglects the immanence of PCT within the Acheulean. It is possible, therefore, that the Mode 3 hypothesis was an attempt to solve a problem that did not exist.

The existence of Proto-Levallois industries was acknowledged by Foley and Lahr (1997:19), but the extent of these industries is not accounted for. Whilst acknowledging the different methods and products of PCT, Lahr and Foley (2001:26) argued that these were a united tradition. Foley and Lahr (1997) claimed that proto stages appear in Africa around MIS 9/8 and spread out to the Levant and Europe where PCT had been absent, supporting the late arrival of Levallois in these regions contrary to the evidence above. The mixture of the late Acheulean and early PCT is explained by possible admixture of populations (Foley and Lahr, 1997:23) but this again does not satisfactorily explain the current evidence. This view is built on a more simplistic view of 'out of Africa' which, as discussed in Chapter Two, has become increasingly complicated. The idea, also argued by Roebroeks (2001:444), that PCT diffused around the world does not fit the evidence of multiple local origins, some with prolonged proto stages. While diffusion and dispersals played a role at this time, mapping on the technology to populations is not possible due to the convergence of PCT at numerous times and places (Eren *et al.,* 2018).

Rolland (1995) argued for a middle ground where the transition occurred once in Africa and once in Europe, but there is growing evidence of a more complex situation (Hérisson *et al.,* 2016a; Picin, 2018; Moncel *et al.,* 2020). Additionally, if technology converged twice it is not much of a leap to argue it could have converged multiple times. Brantingham and Kuhn (2001:747) postulated that Levallois should show more diversity over a large area and concluded that rather than being linked to a group, the use of the technique is the result of economic and mechanical factors affecting the production of predetermined flakes. Brantingham and Kuhn (2001:760) used this idea to explain evolutionary convergence, as PCT suited particular roles that were created by the pressures and conditions experienced by many different groups. The widespread adoption of Levallois after MIS 8 could be the result of the technology being a highly beneficial and efficient adaption (Adler *et al.,* 2014:1610).

Malinsky-Buller (2016a) argued for a cultural break before the introduction of full Levallois due to the fundamental changes seen around MIS 8/7, with the rise of Levallois and decline in handaxes. The difficulty in pinpointing a beginning hinders the work and Malinsky-Buller (2016a) argued that given the source and sink relationship between the Mediterranean and Biotidal zone respectively, then diffusion is likely to have played a role. However, while part of a global process, local dynamics seem to have had more of an influence than Foley and Lahr (1997) leave room for (Malinsky-Buller, 2016a).

Malinsky-Buller (2016a) identified four modes of cultural transmission:

1. Preferential adoption through time
2. Modification and refinement of existing technology
3. Stochastic culling (akin to mutation and drift)
4. Outside introduction

While Malinsky-Buller's (2016b) work in the Levant favoured an outside introduction, other sites demonstrate evidence of other modes. The sites of Botany Pit, Gouzeaucourt and Mesvin IV all show evidence for the modification and refinement of previous technology (Malinsky-Buller, 2016a). Orgnac 3 shows the use of selective innovation akin to number one, while the Mediterranean region shows evidence for random mutation and drift (Malinsky-Buller, 2016a). This indicates that as well as there not being one origin for Levallois, there is also no one type of origin.

This study concurs with Picin (2018:300) that the beginning of PCT was not a single uniform phenomenon but a result of different adaptive strategies. It is possible a false equivalence has been purported between these technologies. Differences exist in their roots, with unidirectional and bidirectional core working in northern Europe showing a route to Levallois technology, whilst southern Europe shows evidence of development from centripetal and discoidal technologies (Picin, 2018:309). Differences also exist in the desired ends from points to large elongated blanks (Picin, 2018:309). Examining these technologies on a regional scale could further demonstrate these differences (Picin, 2018:309). Fontana (2013) posited that PCT developed out of handaxes (Cagny la Garenne and African sites) or core working (Botany Pit). It is unclear why these could not both have played a role given the multiple origins with different routes leading to similar technologies.

The idea of multiple origins occurring from local traditions is not new and can even be seen in the work of Leakey (1936:85) on the Victoria West technique. Here the presence of handaxes and cleavers made on flakes from prepared cores resembling Levallois was seen as a parallel phenomenon. Continuity between proto stages within Africa seems unlikely due to both temporal and geographical separation between sites, showing that even within Africa PCT is likely to have evolved multiple times (Sharon, 2007). Bordes (1971) argued that Levallois was likely to have developed more than once, and both Otte (1995) and Villa (2001) characterise Levallois as a technology of convergence. This fits with White *et al.'s* (2011:59) characterisation of the transition taking the form of multiple *in situ* independent origins based on previous technologies.

Some specialists such as Van Baelen (2017:26) have questioned the appearance of full Levallois preceding some Proto-Levallois sites, but under a model that accepts multiple origins this is not an issue as there is no reason for the development of PCT to be linear (Rolland, 1995:351). White *et al.* (2011:61) highlighted the example of Gentelles, France where the Levallois is only found in lower levels correlated with MIS 9, disappearing before MIS 7 (Tuffreau *et al.,* 2008:61). From this it is clear that the overlap of the Acheulean and Middle Palaeolithic is not a linear change but one with false starts (Fontana, 2013).

The nature of the Lower-Middle Palaeolithic transition

The arrival of PCT/Levallois is arguably the only major innovation of the Middle Pleistocene (White and Pettitt, 1995) but this does not necessarily mean it is a complete break from what came before. Levallois is often thought to break the monotony of the Lower Palaeolithic, but the idea of the Lower Palaeolithic being a period of homeostasis is unsustainable (Bar-Yosef, 1982:30). Chapters Six and Seven of this thesis, the current work by Dale (Pers. Comm. 2021), Davis and Ashton (2019) and White *et al.,* (2018;2019) all demonstrate that this indictment of tedium against the British Lower Palaeolithic is not justified, and technology during this period was more dynamic than previously thought. A period of gradual change taking place on a continuum cumulatively, rather than a rapid takeover as previously suggested by Tuffreau (1982:140), Roe (1981:233) and Gamble (2018:3), is supported by the current evidence.

New lithic technologies are just one element of change from 400kya including changes in hafting, fire use, hunting, landscape use, use of pigments and the Neanderthalisation of hominins which represent a transitional stage towards the Middle Palaeolithic (Kuhn, 2013; Moncel *et al.*, 2020). Levallois became persistent in Europe between MIS 8-6, and it has been suggested that the changing landscapes of MIS 8, shifting towards the mammoth steppe, or a changing form of social organisation, caused the shift in technology (Scott and Ashton, 2011:92).

The adoption of hafting has been highlighted as a key change which led to the proliferation of Levallois during the Middle Palaeolithic, due to the lack of evidence for hafting during the Acheulean (Boëda *et al.,* 2013; Hérisson and Soriano, 2020). Shipton (2019b:158) described this as a key difference between the hierarchical complexity of Lower and Middle Palaeolithic behaviours, and linked hafting to changes in hunting between the periods (Shipton, 2019b). Shipton (2019b) suggested that one knapping sequence could provide the scraper to make the haft and provide the hafted flake. These changes in technology and behaviour can be linked to occupying up-land regions and traveling further distances (Shipton, 2019b). Evidence for these behaviours is scarce in the British record, and the wider evidence casts doubt on there being one function or reason for the adoption of Levallois (Moncel *et al.,* 2020).

Moncel *et al.* (2020) dismissed changes in climate playing a major role due to the widespread of Levallois over different regions. Varying climates make it unlikely that local environmental changes influenced the transition (Fontana, 2013). Scott (2011:176) used the work of Hosfield (2005) to suggest that an increase in population densities could explain innovations, but this is contradicted by Ashton and Lewis (2002) who argued there was a decrease in population. Studies of demography based on artefact numbers are debatable, especially between Acheulean and Levallois sites with little to quantify the difference.

The link between a large increase in cognition and Levallois has been described by Schlanger (1996:231) as a well-worn cliché which often goes unchallenged and unscrutinised. Between 400-200kya there were a number of technical, behavioural and anatomical changes in hominins corresponding with the evolution of AHM in Africa and Neanderthals in Europe (Adler *et al.,* 2014:1669). The idea of a major leap forward lies in the concept of older hominins being denied higher levels of intelligence. Early hominins are often discussed as passive responders to outside influences rather than active agents (Otte, 2010:273). Moncel *et al's.* (2020) argument that the increased role of mental templates and desired end products could be a reason for the adoption of Levallois seems to ignore these elements in the Acheulean as noted by White *et al.* (2018; 2019) and García-Medrano *et al.* (2019). The evidence from the Lower Palaeolithic shows hominins selecting raw material and using it, not in an automatic or passive way, but acting with agency and making decisions based on requirements and culture.

Despite the older roots of PCT, the Middle Palaeolithic is still a major shift albeit a gradual one. It is thought that PCT evolved slowly with short bursts of innovation and frequent failures (White and Ashton, 2003:605; Hérisson and Soriano, 2020). The beginnings of PCT seems to be a disjointed progression that stemmed from the Acheulean (White and Ashton, 2003:598). Field (2005:41) argued that the lasting adoption of PCT was the result of increased social connection, and the change could only come about through social reasons. Picin *et al.* (2013) detailed that the earliest PCT often overlapped with handaxes and showed a reorganization of local traditions as seen in the different forms of early PCT. Due to this, an overly simplified dichotomy should be avoided as there is a clear trend of independent trajectories from handaxe making populations to those with PCT (Otte, 2010:273).

Richter (2011:8) emphasised that the predominance of Levallois is key rather than the earliest signs of the technology and argued that prior to the Middle Palaeolithic occurrences were scarce. While this critique and the timing of the Middle Palaeolithic with MIS 7 holds up, dismissing earlier examples as unique coincidences ignores their prevalence. While evidence is scarcer, Richter's (2011:8) insistence that early PCT is an Acheulean tradition may draw a false divide. Despite developing from Acheulean populations, these instances still foreshadow the adoption seen in the following interglacial.

Timing of PCT and its use in dating

The use of Levallois as a *Fossile directeur* is controversial even after the increased clarity in dating. Westaway *et al.* (2006) argued that the beginnings of Levallois could be revised to MIS 9b rather than MIS 9/8 through modelling in the Solent, which is based on the idea of an incoming population with Levallois technology from Europe. Furthermore, this was used as a way to date sites to the period. The modelling and use of Levallois as a *Fossile directeur* by Westaway *et al.* (2006) have been criticised by a number of sources (Ashton and Hosfield, 2010; Ashton and Scott, 2016; Davis *et al.,* 2016; Hatch *et al.,* 2017). While the PCT is described by Westaway *et al.* (2006) as fully developed Levallois, a number of the sites discussed including Dunbridge, Harvey's Lane and East Howe have been studied in this research and only show evidence of simpler PCT. This would fit in with the Proto-Levallois of MIS 9 and not the distinct EMP sites (Scott, 2011). The early PCT seen in the Solent sites can also be observed earlier in some European sites (Hérisson *et al.,* 2016a; Moncel *et al.,* 2020; Lombera-Hermida *et al.* 2020), and is seen as being immanent within the Acheulean (White and Ashton, 2003). PCT from Warsash is more developed but is likely to date to MIS 8/7 in line with other EMP sites (Davis *et al.,* 2016).

Given the unknown, and likely multiple, origins of Levallois it is difficult to use Levallois for dating (McNabb, 2007:16). What can be seen by studying the British record is that MIS 8/7 has clear characteristics (fully developed Levallois and a lack of handaxes), whereas some sites studied in this research from MIS 9 show the co-existence of Proto-Levallois (often with rare examples of more developed Levallois) with Roe Group I handaxes. While this pattern still needs further work, it is strong enough to act as an indicator but not a definite proof of age. It is important to avoid circular reasoning where dating is concerned.

Lastly, an important issue as mentioned by McNabb (2007:130) is that single examples of flakes with Levallois traits (for example at Corfe Mullen) cannot be seen as indicative of an entire culture or used to tie sites to MIS 9 or MIS 7. This can be extended to the suggestions of single examples of cores at Feltwell, Bowman's Lodge and Rickson's Pit with PCT traits which may be examples of accidental convergence that were short-lived.

8.8 Moving forward

The major barriers to our knowledge of PCT during MIS 9/8 remain the lack of well-excavated sites, accurate dating and extent of publication (Hérrison *et al.,*2016a:262). While this is an issue within Europe, it is particularly pertinent in Britain as the sites containing early PCT are mainly secondary context with little documentation, thus making it difficult to assess many details including *Chaîne opératoires*. Work at sites such as Biddenham, Kempston and Barnham Heath could help clarify this with modern excavation techniques. The excavation of a British MIS 9/8 locale with conditions seen at Organc 3, Kesselt-Op de Schans or Maastricht-Belvédère would help further our understanding of the technology during this transitional period and better establish this period in the British record.

On a European scale it can also be added that a lack of collaboration and establishment of a clear framework also hinders progress. The sites of Kesselt-Op de Schans and Maastricht-Belvédère are nearby with similar technologies but are dated and treated differently by the excavating teams due to different academic paradigms (Van Baelen, 2017; Verpoorte *et al.,* 2016). Issues with identification remain and sites with conflicting accounts such as Cagny L'Epinette demonstrate a need to remedy this (Fontana *et al.*, 2013; Lamotte and Tuffreau, 2016; Hérisson *et al.,* 2016a). The terms Proto-Levallois, SPC and PCT are used and conceived differently by many of the references cited in Herrison *et al.* (2016a), although many use White and Ashton (2003) as a basis. The only British sites with PCT dated to MIS 9/8 in Herrison *et al.* (2016a:239) are Botany Pit and Cuxton (although the dating of this site is questioned). If Britain is representative, there may well be a larger corpus of sites which show early PCT working during MIS 9/8. This would radically change our understanding of the Lower-Middle Palaeolithic transition. Whilst our knowledge of this technology and transition is still in its infancy, the chronology and character of Proto-Levallois technology is becoming clearer and establishing itself as worthy of further study. The main issues outstanding are chronological resolution and a need for a global approach.

8.9 Summary

Roe (1981:233), with understandable pessimism at the time, argued that Britain had little to say on the transition from the Lower to the Middle Palaeolithic due to sporadic occupation.

However, with recent advances in chronology we are in a much better place to tackle this problem. This study has shown that early PCT is not unique to the Purfleet sites with its presence seen in smaller amounts at the sites of Cuxton, Baker’s Farm and a number of isolated find spots correlated with MIS 9 in the Thames. In eastern England, larger quantities of PCT are seen at the sites of Biddenham and Kempston. The Solent, despite issues with dating, also appears to have sites similar to those in the Thames and eastern England including Dunbridge, East Howe and Harvey’s Lane. These sites show the presence of Proto-Levallois cores, similar to those at Botany Pit, within Acheulean assemblages with little distinguishing them in condition or provenance. At some sites there are some more advanced cores which approach full Levallois. Levallois flakes are much rarer and may be hard to distinguish due to more minimal preparation.

This situation is reflected across the rest of Europe with sites such as Orgnac 3, Kesselt-Op de Schans and Mesvin IV showing a similar early form of PCT. Forms of PCT before this MIS 9 transition are suggested but are either much smaller in number (such as at Feltwell, Rickson’s and Bowman’s Lodge) or could be accidental flaking of a handaxe (such as at Cagny La Garenne). This suggests that MIS 9/8 shows an increase in PCT that precedes, but does not relate directly to, the proliferation of Levallois and abandonment of handaxes in MIS 7. The British record within its European context demonstrates a mosaic of local innovations of early PCT, signifying the immanence of Levallois within the Acheulean as a technology of convergence.

Chapter Nine: Conclusions

This thesis has helped characterise the archaeology of the hitherto under-researched Purfleet Interglacial. The results fit with other recent advances which have indicated that the technology of the Lower-Middle Palaeolithic has complexity to rival the increasingly complicated hominin record, refuting the idea that the Lower Palaeolithic was a period of stasis or lacked culture. Davis and Ashton (2019) recently highlighted this issue in relation to the different groups in MIS 11 Britain, the Clactonian and at least two distinct handaxe signatures (White *et al.,* 2019) which they argued fits within the mosaic of cultures observable across Europe. However, on the continent these signatures appear to be muted and more difficult to detect. It is therefore likely that the geographical position of Britain, as an island on the periphery of Europe, led to these signatures being more pronounced and work on MIS 9 has expanded on this. Below are the key findings of this study including the impacts on the chronology of MIS 9, the ramifications for the nature of the Lower-Middle Palaeolithic transition and suggestions for how to proceed with future research.

9.1 MIS 9 core and flake technology: the characteristics

Cores and flakes are predominantly found alongside handaxe manufacture and are typical of the Lower Palaeolithic. Nevertheless, the examination of the research questions laid out in Chapter One has highlighted three important elements beyond the traditional Acheulean:

Non-handaxe signatures

- Three non-handaxe sites dated to MIS 10/9 can be verified within the Thames and Kent.
- Further sites, previously claimed to contain ‘Clactonian elements’, can either be rejected or cannot be substantiated from current evidence.
- Although similar in nature, there is no need for a direct connection to the Clactonian of MIS 11.
- Whilst often seen as a British occurrence, non-handaxe assemblages (not related to the earliest occupation or the Middle Palaeolithic) form a wider trend across Europe.

- Whilst unknown, the explanation for non-handaxe assemblages is more likely to be cultural than defined by raw material or other functional explanations, in part due to their chronological patterning.

Flake tools

- The increase in flake tool numbers during MIS 9 compared to previous interglacials (Pettitt and White, 2012; White and Bridgland, 2018) cannot be verified and is based on over estimations of flake tool numbers due to the prior lack of re-evaluation of MIS 9 sites.
- Two main types of retouched flakes are evident:
    1. A background *ad hoc* technology of simple retouched flakes.
    2. More invasive flake tools that grade into handaxes which are possibly related to handaxes via similar *Chaîne opératoires.*
- Flake tools in MIS 9 are not overtly related to non-handaxe assemblages, or an emerging Middle Palaeolithic connected to PCT.
- Within their wider context (MIS 13-MIS 7) there is no evolutionary trend and any temporally or geographically distinct groups are not observable at present.
- The trends seen in the British record are observable in their wider European context. A number of these sites offer better resolution to study these changes over one or more interglacials.

Prepared Core Technologies

- PCT can be observed across all three areas under study, although no sites rival Botany Pit in size.
- The majority of PCT during MIS 9/8 is found alongside Acheulean technology, but dating in the Solent remains problematic and good quality sites are lacking.
- PCT prior to MIS 9 is either absent or rare and isolated, with MIS 9 showing a more widespread occurrence.
- MIS 8/7 represents a separate phenomenon leading to a proliferation with fully developed Levallois and a lack of handaxes. This could also be seen from some sites in this thesis such as Warsash and Barnham Heath.
- This pattern reflects what is seen across Europe.
- This is part of a wider global transitional process with a mosaic of changing technology.

- The evidence points to PCT having multiple origins based on an immanence within the Acheulean.

9.2 Chronology of MIS 9

The lack of new fieldwork has meant that no new environmental, dating or geological data can help clarify uncertainties surrounding the chronology of MIS 9. However, this work can both reinforce and add detail to the chronology put forward by White and Bridgland (2018).

Work on the non-handaxe assemblages indicates that hominins that did not produce handaxes were present in Britain during MIS 10/9. The outstanding question is whether these groups extended beyond the Thames area. There is currently no evidence, similar to MIS 11, that these groups persisted further into the interglacial alongside handaxe-making populations.

These non-handaxe populations were replaced by traditional Acheulean groups during the main interglacial, either with a new wave (or waves) of colonisation or *in situ* development. This period is represented by handaxe manufacture alongside core and flake working. The Acheulean assemblages of MIS 9 included the production of flake tools, some of which were more elaborate than those in the non-handaxe assemblages. However, these do not represent a major shift in technology from previous interglacials. Handaxes from this period are characterised by Roe's (1968b) Group I (Dale, Pers. Comm. 2021), alongside generic core and flake working.

At some point during MIS 9-8, PCT was produced by hominins alongside the manufacture of handaxes. Despite being low in number, evidence of handaxes and their manufacture are contemporary with the large PCT site at Botany Pit (Bridgland *et al.,* 2013). Other sites dating to MIS 9, which have yielded PCT alongside handaxe manufacture such as Biddenham, Kempston, Baker's Farm and Dunbridge, display a trend across Britain. Botany Pit and its equivalents in the Botany gravels are related to cooling conditions and have typically been used to tie PCT to the end of MIS 9/8 (White and Ashton, 2003). More recently, Bridgland *et al.* (2013; White and Bridgland, 2018) questioned whether this represented MIS 9e/d rather than MIS 9/8. Westaway *et al's.* (2006) suggestion of MIS 9b as a starting point for PCT lacks supporting evidence and appears less likely than the suggestions of White and Bridgland (2018), but given the lack of current data on dating the assemblages to sub-stages, any cooling period cannot be disregarded. While the exact timings are unclear, all scenarios show the emergence of PCT overlapping with, and possibly succeeding, handaxe populations of MIS 9.

With the immanence of PCT within the Acheulean, this potentially shows *in situ* development as seen across Europe during this period.

At other sites such as Warsash, Iver, Ruscombe and Barnham Heath, this is less clear. The distinction between the condition of handaxes and PCT could mean that the PCT represents a later part of the interglacial or later MIS 8/7 populations. These sites are similar to Creffield Road and Yiewsley where, as discussed by Scott (2011), there is a clear separation between handaxes and later Levallois technology.

This difference is important as the distinction between new populations bringing PCT to Britain and the *in situ* development of PCT out of the Acheulean is key to understanding the origins and spread of this new technology. Given the cruder nature, low proportions and the wider European framework, it seems most likely that Acheulean groups developed PCT at least once, but probably multiple times, during MIS 9/8. Whether this was during the end of MIS 9/8, or at the end of a cold substage needs further clarification. However, this would not change the overall interpretation of PCT being immanent within the Acheulean, allowing for multiple origins. It should be made clear that the PCT of MIS 9/8 does not show a direct relation to the record of MIS 8/7 which is likely to have involved new populations from the continent after a period of abandonment.

Further potential chronologies and outstanding questions

While the secondary context of the majority of MIS 9 sites makes precise dating difficult, there are some indications of chronology within the handaxe sites. Stoke Newington is considered to belong to an early part of MIS 9 based on geology and biostratigraphy (Green *et al.*, 2004, Simon Lewis Pers. Comm. 2019), suggestive of being contemporary with the middle gravels at Purfleet. A number of sites studied, including Furze Platt, are similar to Stoke Newington showing a strong Acheulean signature related to Roe's (1968b) Group I, but contain no PCT. It is possible that handaxe sites containing PCT could date to later in the interglacial in relation to the material from the Botany gravels at Purfleet. However, most of the sites where handaxes and PCT appear to be contemporary are also characterised by Roe's Group I handaxes. Clarification about the dating of these sites, whether collections can be considered representative and any additional information on site function is needed to resolve these issues.

The presence of Roe (1968b) Group III handaxes from Wolvercote could potentially show a different group to the other MIS 9 sites. Due to the cooling conditions seen in the environmental evidence at the site, it has been suggested to be placed towards the end of MIS 9 or a substage. The site also lacks any evidence of PCT which, while interesting, is likely due to lack of core and flake collection across the site. Without further excavation to recover a more representative sample, any analysis for this thesis is difficult.

Summary

The two scenarios put forward by White and Bridgland (2018) of Purfleet representing the whole of MIS 9, or just MIS 9e, has little impact on many of these conclusions. Preliminarily, current research shows that handaxe populations were making simple PCT alongside handaxes, and these sites are not distinct from other MIS 9 sites in regard to handaxe shape. Therefore, it is likely that this was an *in situ* development unlike the beginning of the EMP in MIS 8/7. This perhaps lends itself to the interpretation that the archaeology of the period fits in MIS 9e as there is little variation in the Acheulean of the period other than the presence or absence of PCT. However, further information from future work is needed to clarify this.

9.3 Relation of MIS 9 to Lower-Middle Palaeolithic transition

Late MIS 9/8 is often considered the beginning of the EMP due to the appearance of Levallois (Roebroeks and Tuffreau, 1999; McNabb, 2007; Pettitt and White, 2012:209), but while both Levallois and Neanderthals have traditionally been used to define the Middle Palaeolithic it is becoming increasingly clear that the EMP saw their proliferation, not origins. There is a division between the MIS 9 sites (mainly Acheulean, with simple PCT) and the sites belonging to Scott's (2011; Scott *et al.* 2019) EMP (no contemporary handaxes, fully developed Levallois) which shows a clean break between the two periods.

The PCT of MIS 9 is found within what Pettitt and White (2012:209) dubbed "a typically Lower Palaeolithic suite of behaviours", therefore they do not represent the start of the Middle Palaeolithic but demonstrate diversity within the Lower Palaeolithic. Roe (1982) described the transition as the handaxe 'losing ground' to flake tools, based on what he considered transitional assemblages (Stoke Newington, High Lodge, Hoxne, Grovelands Pit, Wolvercote). In a wider context, Bar-Yosef (1982) used this pattern to argue there was no cultural break. Re-evaluation of these sites and better chronology has weakened this position. The evidence does not point towards the handaxe losing ground to flake tools during MIS 9, but being made alongside early PCT at the end of MIS 9 with a clear break prior to the arrival of the EMP in MIS 8/7. This could be a result of the intermittent insularity of Britain as discussed by White and Schreve (2000) which would explain the more muddled record in the rest of Europe.

With the recognition of a more diverse Lower Palaeolithic, Davis and Ashton (2019) suggested a larger techno-complex subsuming various 'cultures'. Other factors which are rarer in the Lower Palaeolithic record, including evidence for hunting, hide processing, clothing, shelter and fire, also feed into these wider techno-complexes. The Middle Palaeolithic did not appear suddenly with the first prepared core, but was a more protracted change affecting a suite of behaviours which have commonly been used to define the Middle Palaeolithic. Many approaches to the Lower-Middle Palaeolithic transition have been preoccupied with lithics. This is entirely understandable, but if the ideas above are accepted then there is a need to take a more holistic approach to the period. To do this we need to overcome current problems with reconstructing 'human' environments at a finer timescale in relation to periods of occupation and abandonment (Roebroeks and Tuffreau, 1999). Turq (1999), Gaudzinski (1999), Gunthrie (1984; 1990) and Mussi (1999) all advocated for this approach due to the difficulty of examining the boundary between the Lower and Middle Palaeolithic, but with more of a focus on lifestyle. This included shelter, hunting, use of landscape and the expansion of the Mammoth steppe. More in-depth analysis of this change between MIS 9-7 would help contextualise the transition. The ebb and flow of Neanderthals within Europe related to this biotope is of vital importance to understanding their technology as Neanderthals would have changed and responded to the landscape in which they were situated (Gamble and Roebroeks, 1999).

9.4 Moving forward

Firstly, future work is needed to fill some of the gaps in the current study by examining the collections that could not be accessed, namely Southacre and Keswick. From what is currently known, they are likely to fit the rest of the evidence. For real progress new fieldwork on a number of sites discussed in this thesis should be undertaken which would enable modern techniques either to confirm, refute or alter current interpretations. Focus should be given to East Anglia and the Solent, as understudied areas. While work on the Solent is on-going, advances in chronology as well as new excavations are needed to fully integrate the Solent with the rest of the British record. The Solent is especially important as it would help evaluate whether the non-handaxe signatures in both MIS 11 and MIS 9, or appearances of PCT, are regional occurrences or representative of Britain as a whole. In addition, the excavation of new sites is essential to making sure that current debates can move forward, and new sites are needed to further interrogate the non-handaxe signature and PCT. However, opportunities for such breakthroughs are limited (Bates and Pope, 2016).

This thesis has shown the importance of placing the British record within its wider European context, as factors which may seem peripheral take on a wider significance when compared to sites from Europe and beyond. The main example is early PCT, as while Bates *et al.'s.* (2014:173) assessment of the Levallois from Purfleet being "anomalously early" is understandable within the context of the British record, it is ill-fitting within the wider European context.

Multi-disciplinary work is needed to go beyond the lithic assemblages and reconstruct a more holistic picture of MIS 9 which may help explain the complexity of the archaeological record. Better contextualised and excavated sites will enrich our understanding of environments and hopefully evidence for hunting practices, landscape use and other areas of uncertainty.

Central to future work is the place for detailed analysis and synthesis of Lower Palaeolithic core and flake assemblages alongside the analysis of handaxes. While handaxes will always remain fundamental to the Lower Palaeolithic, previous work has under-played the importance of core working and flake tools. Modern excavations are much less biased, but studies undertaken to interpret the Lower Palaeolithic need to take into consideration the role of all artefact types.

This study has established a number of working hypotheses which should be challenged by future work. Along with other recent studies (White *et al.,* 2018; Davis and Ashton, 2019) this work allows for some of the historical baggage to be stripped away. Non-handaxe signatures should only be considered where there is a clear separation from handaxe manufacture and the use of 'Clactonian traits' as identifiers should be abandoned as previously argued by McNabb (1992; 2007; 2020). Consensuses need to be reached on how to deal with flake tools and early PCT. As this study has shown, a focus on the quality and attributes of flake tools is more important than numbers and attempts should be made to analyse these in full. Early PCT is part of a wider debate around the Lower-Middle Palaeolithic but it is one that is needed to move forward. Without a proper framework to analyse and discuss these cores, they are likely to be ignored or misunderstood due to the confusing proliferation of terms and interpretations of this technology.

9.5 Final remarks

As well as answering key questions about the Lower-Middle Palaeolithic, one aim of this thesis was to provide a fuller characterisation of an under-researched interglacial, and test if the patterns noted at Purfleet can be observed across Britain during MIS 9. Whilst future work needs to be conducted, this thesis and work by Dale (Pers. Comm. 2021) has confirmed a number of defining characteristics for MIS 9 including non-handaxe assemblages, handaxe assemblages linked to Roe's Group I and early PCT. When situated in its British and European context, MIS 9 now has a more clearly defined position within the British Middle Pleistocene.

Appendix A- Location and collection information of main assemblages analysed in this thesis

Site	Museum	Main Collections
Thames		
Baker's Farm	British Museum; Oxford Natural History Museum; Pitt Rivers Museum	Lacaille; Treacher; Underhill
Botany Pit, Purfleet	British Museum	Snelling
Cuxton	British Museum	Cruse; Tester
Furze Platt	British Museum; Oxford Natural History Museum; Reading Museum; Cambridge MAA	Lacaille; Wescott; WG Smith; Treacher; INQUA 1977
Grays Thurrock	British Museum	Institute of Archaeology
Grovelands Pit	Reading Museum; Oxford Natural History Museum	Stevens; Treacher
Globe Pit	British Museum	Institute of Archaeology; Bridgland and Harding
Lent Rise	British Museum; Oxford Natural History Museum	Lacaille; Wellcome; Underhill
Lower Clapton	British Museum; Pitt Rivers Museum	Sturge
Purfleet (Greenlands)	Royal Holloway	Schreve; Wymer
Sonning Railway Cutting	Oxford Natural History Museum; Reading Museum	Treacher
Stoke Newington (Common, Geldeston Rd, Abney Park)	British Museum; Pitt Rivers Museum	Greenhills; Warren; Wellcome; Campbell; WG Smith
Sturry	British Museum; Cambridge MAA	Ince; Bowes
Wolvercote	Oxford Natural History Museum	Arkell
Eastern England		
Barnham Heath	Pitt Rivers Museum; Ipswich Museum	Lawrence
Biddenham	British Museum; Pitt Rivers Museums Higgins Bedford, Cambridge MAA	WG Smith; Knowles; Sturge; Turner; Wyatt; BMS; MacDonald; Elliot; Purch
Kempston	British Museum; Pitt Rivers Museum; Higgins Bedford, Cambridge MAA; Oxford Natural History Museum	WG Smith; Lark; BMS; Langdon; Lack; MacDonald; Elliot;
Station Pit Kennett/ Kentford	British Museum; Sedgewick; Cambridge MAA; Pitt Rivers Museum	Sturge; Stephenson; Wright
Solent		
Dunbridge	Hampshire Cultural Trust; Cambridge MAA	Harding
East Howe	British Museum	Calkin
Harveys Lane	British Museum	Calkin
Warsash	Hampshire Cultural Trust; Portsmouth; Cambridge MAA	Mogridge

Appendix B- Analysis of unprepared cores from Botany Pit

Field Artefacts #	Type	#episodes	#removal	Episode 1	Episode 2	Episode 3	Episode 4	Episode 5
1963 4-5 1	Chopper Core	1	5	5C				
1963 4-5 30	Discoidal core	2	12	6C	6C			
1963 4 5 28	Discoidal core	2	13	7C	6C			
Box 22 2	MPC	3	7	3C	3B	1A		
Box 22 4	MPC	3	6	3C	2C	1D		
Box 226	MPC	4	7	2C	3B	1D	1D	
Box 23 2	MPC	2	5	2C	3C			
Box 23 4	MPC	3	6	3C	2B	1D		
Box 23 5	MPC	1	5	5C				
Box 23 6	MPC	2	5	4C	1D			
Box 23 8	MPC	3	5	2C	2C	1d		
Box 24 2	MPC	3	10	8C	1D	1D		
Box 24 4	MPC	2	5	2B	3B			
Box 25 1	MPC	2	7	6B	1D			
Box 25 2	MPC	2	11	6C	5C			
Box 25 3	MPC	2	8	5C	3B			
Box 25 4	MPC	4	9	6C	1D	1D	1D	
Box 25 5	MPC	3	7	2B	4C	1D		
Box 26 1	MPC	2	9	7C	2B			
Box 26 2	MPC	4	7	3C	2B	1D	1D	
Box 27 1	MPC	2	13	7C	6C			
Box 27 2	MPC	3	10	7C	2B	1D		
Box 27 5	MPC	2	7	4C	3C			
Box 28 2	MPC	2	6	4C	2B			
Box 28 4	MPC	3	8	2C	4B	2B		
Box 29 3	Discoidal core	2	9	4C	5C			
Box 29 6	Chopper Core	1	11	11C				
Box 29 7	MPC	3	13	6C	5C	2C		
Box 30 2	MPC	2	6	4C	2B			
Box 30 3	MPC	3	9	6C	2C	1D		
Box 30 4	MPC	3	8	5C	2C	1D		
Box 30 6	MPC	1	4	4C				
Box 31 6	MPC	3	8	6C	1D	1D		
Box 32 8	MPC	3	8	6C	1D	1D		
Box 32 9	MPC	2	8	6C	2C			
Box 33 3	MPC	3	10	5C	4C	1D		
Box 33 4	MPC	1	4	4C				
Box 34 1	MPC	3	9	5C	3c	1D		
Box 34 3	MPC	2	8	7B	1D			
Box 35 5	MPC	3	9	4C	2C	3C		
Box 36 1	MPC	3	6	1A	2B	3B		
Box 36 3	MPC	3	5	2C	2B	1A		

Box 36 4	MPC	2	5	2B	3B			
Box 36 5	MPC	2	4	3C	1A			
Box 36 6	MPC	1	2	2B				
Box 36 7	MPC	1	5	5C				
Box 37 1	Roughout/MPC	2	7	6C	1D			
Box 37 2	MPC	2	8	7C	1D			
Box 37 3	MPC	2	7	3C	4C			
Box 37 6	MPC	1	5	5C				
Box 37 7	MPC	1	3	3B				
Box 38 5	Roughout/MPC	2	9	5C	4C			
Box 38 6	MPC	2	5	3B	2C			
B0x 38 8	MPC	2	5	2B	3B			
Box 39 1	MPC	3	5	3B	1D	1D		
Box 39 3	MPC	2	4	3C	1D			
Box 39 4	MPC	2	7	6C	1D			
Box 39 5	MPC	2	3	2B	1D			
Box 39 6	Chopper Core	1	6	6C				
Box 40 2	MPC	3	10	5C	4C	1D		
Box 41 1	MPC	4	6	3C	1D	1D	1D	
Box 41 4	MPC	2	5	4C	1A			
Box 42 3	MPC	1	4	4C				
Box 42 4	MPC	2	5	4C	1D			
Box 43 2	MPC	3	6	3C	2C	1D		
Box 43 3	MPC	2	5	2C	3C			
Box 43 4	MPC	2	7	6C	1D			
Box 43 5	MPC	3	8	5C	2C	1D		
Box 44 1	MPC	4	8	4C	2B	1D	1D	
Box 44 2	MPC	1	1	3C				
Box 44 4	MPC	3	6	4C	1D	1D		
Box 44 5	MPC	3	8	5C	2B	1D		
Box 45 2	MPC	2	5	4C	1A			
Box 45 3	MPC	2	5	3C	2C			
Box 45 5	MPC	3	8	4C	2C	2B		
Box 45 6	MPC	3	10	7C	2B	1D		
Box 46 2	MPC	3	6	4C	1D	1D		
Box 46 5	MPC	3	7	4C	2C	1D		
Box 46 6	MPC	4	6	2C	2C	1D	1D	
Box 46 7	MPC	1	1	1A				
Box 46 8	MPC	3	9	7C	1A	1A		
Box 47 2	MPC	1	3	3B				
Box 48 1	MPC	2	9	8C	1A			
Box 48 2	MPC	1	1	1A				
Box 48 5	MPC	4	10	6C	2C	1D	1D	
Box 48 6	MPC	3	4	2B	1D	1D		
Box 49 1	MPC	1	2	2C				
Box 49 2	MPC	3	8	5C	2C	1D		

Box 49 3	MPC	2	5	4C	1D			
Box 49 5	MPC	2	4	2C	2C			
Box 49 6	MPC	3	6	1A	3B	2B		
Box 50 3	Fragment	1	5	5C				
Box 50 5	MPC	1	3	3C				
Box 50 6	Fragment	1	1	1A				
Box 50 8	MPC	2	5	3C	2B			
Box 50 9	MPC	2	5	4C	1D			
Box 51 2	Fragment	2	4	2B	2B			
Box 51 3	MPC	2	6	6C	1D			
Box 51 4	MPC	4	8	4C	2C	1A	1D	
Box 51 5	MPC	2	5	4B	1D			
Box 51 6	MPC	3	9	6C	2B	1A		
Box 51 7	MPC	2	7	5C	2B			
Box 52 1	MPC	2	8	5C	3B			
Box 52 2	MPC	2	2	1D	1D			
Box 52 4	MPC	3	6	4C	1D	1D		
Box 52 5	MPC	2	3	2B	1D			
Box 52 6	MPC	2	2	1D	1D			
Box 52 7	MPC	1	4	4C				
Box 53 7	MPC	3	11	4C	3C	4C		
Box 54 3	MPC	3	8	5C	2B	1A		
Box 54 4	MPC	3	5	3C	1D	1D		
Box 54 5	MPC	3	8	4C	2B	2B		
Box 54 7	MPC	2	10	5C	5C			
Box 55 1	MPC	4	9	5C	2B	1D	1D	
Box 55 3	MPC	2	2	1D	1D			
Box 55 4	MPC	3	8	2B	3B	5C		
Box 55 6	MPC	3	9	5C	3C	1D		
Box 56 1	MPC	3	10	7C	2B	1A		
Box 56 3	MPC	3	6	4C	1D	1D		
Box 56 4	MPC	1	4	4C				
Box 56 6	MPC	3	9	6C	2B	1D		
Box 57 4	MPC	3	7	5C	1A	1D		
Box 57 5	MPC	2	5	3C	2C			
Box 57 7	MPC	1	3	3C				
Box 57 10	MPC	1	3	2B	1D			
Box 58 1	MPC	2	7	4C	3C			
Box 58 2	MPC	2	8	2C	6C			
Box 58 3	MPC	4	7	3C	2B	1D	1D	
Box 58 5	MPC	2	7	6C	1D			
Box 58 6	MPC	3	7	5C	1D	1D		
Box 58 7	MPC	2	7	6C	1D			
Box 59 1	MPC	2	5	2C	4C			
Box 59 3	MPC	3	4	2B	1D	1D		
Box 59 5	MPC	3	6	2C	2C	2B		

Box 59 7	MPC	4	7	4C	1D	1D	1D	
Box 59 8	MPC	4	11	4C	2B	4C	1D	
Box 60 1	MPC	1	4	4C				
Box 60 3	MPC	1	4	4C				
Box 60 4	MPC	1	6	6C				
Box 60 5	MPC	2	7	5C	2C			
Box 60 6	MPC	3	10	7C	2B	1D		
Box 61 1	MPC	2	3	2B	1D			
Box 61 2	MPC	2	6	4C	2B			
Box 61 4	MPC	1	4	4C				
Box 61 5	MPC	1	4	4C				
Box 61 6	MPC	2	6	5C	1A			
Box 62 1	MPC	3	8	6C	1D	1D		
Box 62 2	MPC	4	10	5C	3C	1D	1D	
Box 62 3	MPC	4	8	4C	2C	2B		
Box 62 4	MPC	5	10	4C	2B	1D	1D	2C
Box 62 5	MPC	3	6	3C	1A	2B		
Box 62 6	MPC	3	8	5C	2B	1A		
Box 62 8	MPC	3	7	4C	2B	1D		
Box 63 1	MPC	3	9	3B	5B	1A		
Box 63 2	MPC	1	5	5c				
Box 63 4	MPC	3	5	2B	2B	1D		
Box 63 5	MPC	2	6	5C	1A			
Box 63 6	MPC	2	6	4C	2B			
Box 63 7	MPC	3	9	3B	5C	1D		
Box 64 1	MPC	1	5	5C				
Box 64 4	MPC	2	5	3C	2C			
Box 64 5	MPC	3	5	3C	1A	1A		
Box 55 1	MPC	3	5	3B	1A	1A		
Box 55 5	MPC	3	7	4C	2B	1A		
Box 55 7	MPC	3	10	3B	4C	3B		
Box 55 8	MPC	2	2	1D	1D			
334	MPC	1	3	3C				

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