

Resource Assessment

The Shotton Project



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THE UNIVERSITY
OF BIRMINGHAM



ENGLISH HERITAGE

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(with a contribution from N.J. Lockett)**

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Part 1:

An introduction to the Midlands Palaeolithic

Introduction

The Lower and Middle Palaeolithic, for a long time a somewhat arcane and neglected subject for many archaeologists, has achieved considerable prominence over the last decade. The discovery of the Lower Palaeolithic site of Boxgrove (Pitts & Roberts 1997; Roberts & Parfitt 1999), with its exceptional preservation and hominid remains, and most recently the Middle Palaeolithic site of Lynford (Boismier *et al* 2003), a Neanderthal mammoth butchery site, have sparked the imagination and received national and international press coverage. Furthermore, the completion of John Wymer's much-praised extensive survey of the Lower and Middle Palaeolithic archaeology of England's river valleys – *The English Rivers Palaeolithic Project* – stimulated renewed discussion of the goals of British Palaeolithic research (Gamble & Lawson 1996). The vast bulk of this archaeology was found in the context of commercial sand and gravel quarrying. The completion of the English Rivers Project ensured that up-to-date information on the Palaeolithic resource was available both to archaeologists and the quarry operators. The follow up (Wymer 1999), aimed at the more general reader, is as good, if not better and is recommended to anybody interested in following up this paper.

However, the Midlands section of the English Rivers Project (Wessex Archaeology 1996), which deals with the Warwickshire-Worcestershire Avon and the Severn, is the shortest and in many ways the least satisfactory of the project. This reflects the general lack of research in the region over the past decade and the shortage of finds. These problems were identified by Simon Buteux, during his talk at the first of the West Midlands Research Seminars held in June 2002. Some of the key issues raised were:

- There is a near absence of research into the Lower and Middle Palaeolithic of the region over the last decade or more.
- There is a comparative dearth of sites and finds in comparison to the south and east of the country.
- The approaches to researching the Lower and Middle Palaeolithic differ substantially from those employed in researching the archaeology of later periods.
- Few archaeologists working in the region have an in-depth knowledge of Palaeolithic archaeology or the wider research culture in which it is situated.
- There is a lack of readily accessible guidance for curatorial archaeologists in dealing with Palaeolithic archaeology in sand and gravel quarries, the context in which most significant finds are made.

- There is a lack of communication between the collectors of Palaeolithic finds, usually operating outside the archaeological establishment, and archaeologists working in the region.

These issues are, of course, interrelated. An important conclusion of the paper was the need to develop a research framework in which the issues could be addressed in an integrated manner. Subsequently, and in many respects in response to the points made in the paper and discussion which flowed from it, a research project was devised to address the problem. This was *The Shotton Project: A Midlands Palaeolithic Network* (Buteux 2003), commissioned by English Heritage and funded by the Aggregates Levy Sustainability Fund (ALSF). The project commenced in April 2003 with a one-year duration.

The timing of Shotton Project was fortunate, as it was both able to build on the work of the *English Rivers Palaeolithic Project* and engage with the AHOB (Ancient Human Occupation of Britain) project. This latter is a major Leverhulme-funded initiative which aims to address some of the most fundamental questions of Palaeolithic research in Britain. These questions include, the date and environmental context of the earliest human occupation of Britain, the nature of the transition from the Lower to the Middle Palaeolithic, and the factors associated with apparent periods of human abandonment of Britain and subsequent recolonisation.

We begin with an overview of Lower and Middle Palaeolithic archaeology in general and the nature of Palaeolithic research. The following section reviews the history and results of research in the West Midlands and includes a discussion of the geological background, which is essential both for an understanding of the evidence and for a consideration of the potential for future research. The paper concludes by providing a set of goals for future research and the practical methods by which this will be achieved. These goals and methods are essentially those pursued by *The Shotton Project: A Midlands Palaeolithic Network*.

The Palaeolithic

The Palaeolithic has a tripartite division of Lower, Middle and Upper. On the international stage, it covers the archaeology of human evolution from the earliest tools around 2.6 million years ago to the end of the last Ice Age about 10 ka (thousand years ago) (Gowlett 1992). In Britain, the earliest records of humans date back over 500 ka with a number of important sites, including Waverley Wood in Warwickshire, dating to this earliest occupation. The division (in this country) between the Lower and Middle periods is identified through a change in lithic technology about 260 – 250 ka. The transition to the Upper Palaeolithic is generally defined by the appearance of evidence for occupation by the first fully modern humans in this country about 40 ka and continues until the end of the last ice age about 10 ka.

The first stone tools in northwestern Europe appear at approximately 500 ka (Gamble 1999) and are identified alongside hominid remains of *Homo heidelbergensis*, the earliest human species currently recognised in this part of Europe. Human fossils of this species have been identified in a number of countries, including the type fossil from near Heidelberg in Germany, from Greece, and a shin-bone and two teeth from

Boxgrove, England (although these finds can only receive a provisional designation – Roberts *et al* 1994). Although the picture is complex, in Europe and the Near East *Homo heidelbergensis* appears to have gradually evolved over millennia into *Homo neanderthalensis*, a species more adapted – especially in its ‘classic’ form – to the Ice Age environment of Europe. Neanderthals had emerged by 230 ka but became extinct around 30 ka. It is generally thought that their extinction is related to the appearance of fully modern humans (*Homo sapiens*) in Europe around 40 ka. Currently the mainstream view is that modern humans evolved in Africa and gradually replaced the Neanderthals of Europe.

The British Lower and Middle Palaeolithic

The study of the Palaeolithic cannot be divorced from the study of geology and environmental change during the Pleistocene geological epoch (Ice Age), and falls under the general aegis of Quaternary studies (see below). The ebb and flow of occupation would have been determined by the fluctuating climate and changing environment of the Pleistocene. The transition from cold (glacial) periods to warm (interglacial) periods was the key catalyst for migration of both beasts and their pursuing hunters.

There are two principal sources of evidence for climatic change during the Pleistocene. These are the terrestrial geological record and the oceanic record, the latter derived from deep-sea cores. Unfortunately, much of the British terrestrial geological record is incomplete due to non-deposition or subsequent erosion and we must therefore rely on another method to date sites and sequences in the Pleistocene and Palaeolithic.

Over the last fifty years the analysis of the oceanic record has become the major marker by which terrestrial sequences are evaluated. Studies of the small planktonic fossils (foraminifera) that have sunk to the sea floor allow identification of the changing global climatic environment. To explain briefly, ocean water has two different types of oxygen isotopes, the lighter δO^{16} , evaporates more quickly from the sea during the water cycle, and during cold or glacial climatic episodes gets trapped in glacial ice. On the other hand the heavier isotope δO^{18} , remains a comparative constant and it is the ratio of these two isotopes in the fossil remains that can be measured, giving us a climate graph stretching back over the whole Pleistocene oscillating between warm (stronger δO^{16} content) and cold (stronger δO^{18} content). Each major cold or warm stage is assigned a Marine Isotope Stage (MIS) going back from the present day, warm episodes have odd numbers (we live in MIS 1 – an interglacial) and cold episodes have even numbers (Fig 1).

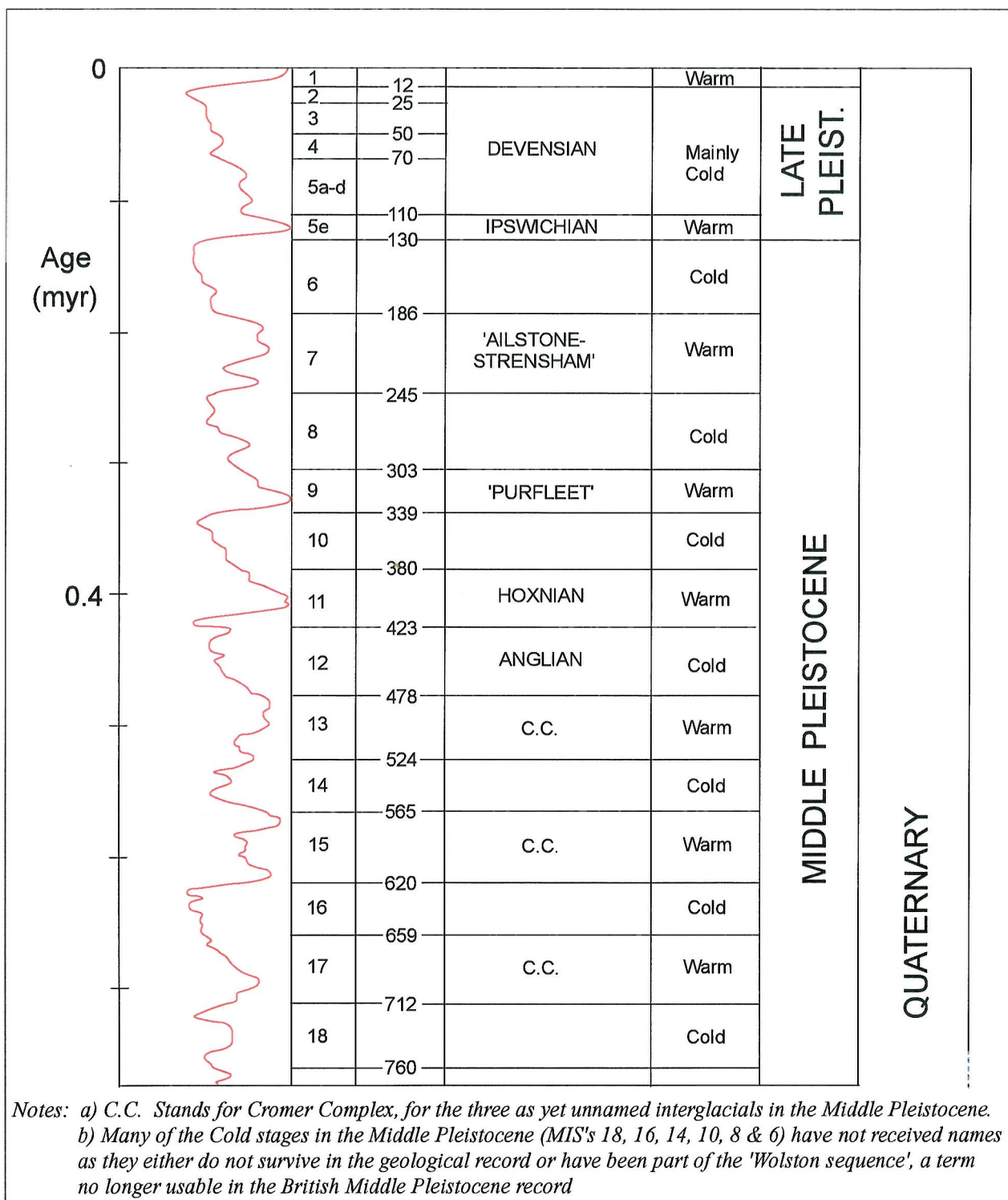


Figure 1: A Middle Pleistocene timeline for the British Isles, showing the Marine Oxygen Isotope curve (left) and the alternating cold and warm glacials and interglacials alongside their respective dates and names (if one has been assigned).

Terms after Schreve et al 2002, De Rouffignac et al 1995; Wymer 1999; Maddy et al 1995.

The most severe glaciation identified in the terrestrial record in Britain, the 'Anglian', is dated to between 478 and 423 ka and attributed to MIS 12 (Bowen *et al* 1986), and the most recent glaciation, the Devensian, between 110 and 12 ka (MIS 4-2), but with the period of most intense cold around 18 ka (Fig 2). Others glacial stages exist both before the Anglian and between the Anglian and Devensian in the continuous oceanic climatic record, but many of these are still the subject of research and are not securely identified in the terrestrial geological succession.

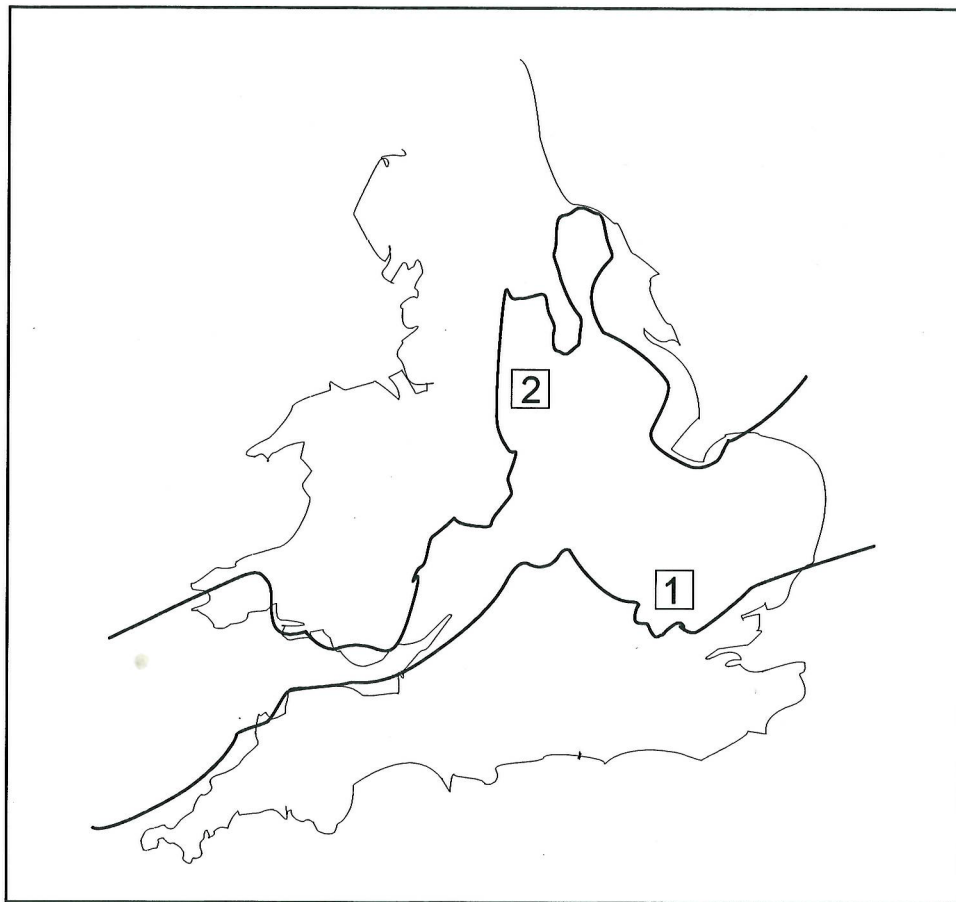


Figure 2: The major Ice extents across terrestrial Britain.

1. The Anglian glaciation, c. 450 ka
2. The maximum limit during the Devensian c. 20-18 ka.

The basic archaeological evidence for the Palaeolithic comprises stone tools. Flint was the main raw material for these tools as it can be easily worked in order to create a razor-sharp edge. Chalk, which contains flint, outcrops over large parts of southern and eastern Britain (although not in the Midlands) and good sources of flint were readily available in these areas. The Lower Palaeolithic material is comparatively basic in its lithic technology, and two principal traditions have been identified. These are the 'Acheulean tradition', principally characterised by the handaxe, and the flake and core tools of the 'Clactonian tradition'. These two traditions are largely contemporary (Ashton *et al* 1994) and are often treated today as a single 'culture', although a degree of significant distinction remains, which has led to continuing discussion of the different associations of the two technologies (*e.g.* White & Schreve 2000). The Middle Palaeolithic material is from the somewhat more developed Mousterian industry. It employs the use of the Levallois 'core and flake' technology which uses a prepared flint core that allows a greater degree of control in the creation of tools.

Palaeolithic Research: perspectives and problems

Palaeolithic research differs in several fundamental respects from research into the archaeology of later periods and has its own perspectives and problems.

- Palaeolithic archaeology is best considered as an aspect of Quaternary Science rather than as a self-contained discipline.

The Quaternary is the most recent geological period dating from approximately 2.2 million years ago to the present. Quaternary Science is a multi-disciplinary study, which combines the disciplines of, for example, geology, archaeology and vertebrate palaeontology as well as the study of pollen (palynology), beetles, snails and caddis flies, to name just a few. A central concern of Quaternary Science is reconstructing the changing climate, landscape and environment of the time. Human occupation, studied principally through archaeology, is set within this broader context of environmental change and the ebb and flow of other animals.

- The Palaeolithic and Quaternary research community has little overlap with practising curatorial and contract archaeologists.

This problem stems in part from the distinctive nature of Palaeolithic research and its close association with Quaternary studies. Only a comparatively few students who go on to work in professional archaeology have studied Palaeolithic archaeology in any depth at undergraduate or postgraduate level. One consequence is that the number of practising Palaeolithic archaeologists is very small in comparison with those working in other periods, and particularly small in the curatorial and contract archaeology sphere.

- The finding of fossils and deposits of the Pleistocene without archaeological content does not fall within the remit of curatorial archaeology.

It follows from the integration of Palaeolithic archaeology within Quaternary Science that 'finds' of a non-archaeological character, *e.g.* mammalian remains (mammoth, horse, reindeer, etc), microfauna and palaeobotanical deposits, are of importance even when there is no association with stone tools. Such finds do not fall within the remit of curatorial archaeologists and will not normally be recorded on Sites and Monuments Records. At a national level, responsibility for such finds falls uncomfortably between English Nature and English Heritage.

- Lower and Middle Palaeolithic sites and finds are often discovered in very different contexts from those of later periods.

The majority of British archaeology is 'surface archaeology', that is the remains are generally – in a rural context – found either in or immediately below the topsoil. They are thus susceptible to prospection by such means as aerial photography, geophysics and surface survey, and can be investigated by means of comparatively shallow excavation. On the other hand, Lower and Middle Palaeolithic discoveries are often made in contexts well below the modern surface level, and frequently in commercial sand and gravel quarries. This commercially extractable sand and gravel (or 'aggregate') represents the remnants of past landscapes and ancient floodplains of the Pleistocene and was laid down by ancient river systems. The alternation of glacial to interglacial periods has led to complex patterns of aggradation and erosion of these deposits, creating the river terrace systems that in many cases survive today along with the rivers that created them. In other cases these ancient river courses have been obliterated by glacial advances. The step-like system of river terraces created by successive glacial/interglacial cycles provides a crude method of dating archaeological and palaeontological remains found within them. The highest terraces represent the oldest land surfaces from which the river has progressively cut-down through to the modern floodplain at the bottom of the valley. Where terraces can be dated, any archaeological remains within them can be given a *terminus ante quem* – they must either be contemporary with the date of the terrace or reworked from earlier deposits.

- Palaeolithic archaeology is not well served by PPG 16 and other development control mechanisms

PPG 16 has ensured that most archaeologically-sensitive development has had some form of assessment, watching brief or excavation. However, in the case of sand and gravel quarries, where the potential for Palaeolithic archaeology is often high, it is frequently overlooked. Considerable resources are devoted to the 'surface archaeology' – generally remains of the Neolithic and later periods – but often no provision is made for the 'deep archaeology', which may be found 3 or 4 metres below surface level. Furthermore, the aggregate companies are not required to report any discoveries made, archaeological or palaeontological. This leads to a vicious circle: the remains are not found because they are not looked for, and they are not looked for because it is believed they are not to be found. The problem is exacerbated by the lack of readily accessible guidance on appropriate procedures to deal with the potential of deeply-buried remains, and by the limited degree of contact and

mutual understanding between the curatorial and contract archaeology community on the one hand and the Palaeolithic archaeology and Quaternary research community on the other hand.

- Many of the people who make discoveries of Palaeolithic material are not professional archaeologists and are often quarry workers or independent collectors.

The majority of Palaeolithic finds in the West Midlands have been made by quarry workers and independent collectors. Very little communication is maintained between the curatorial and contract archaeologists, on the one hand, and the discoverers on the other hand. Although there are opportunities to report finds through museums and the Portable Antiquities Scheme, the effectiveness of such mechanisms is limited.

A History of Research in the West Midlands.

Research into the British Palaeolithic has been closely tied up with the classification and interpretation of flint tools. Unfortunately, there are no outcrops containing flint in the West Midlands and stone tools were made of either poor quality 'drift' flint or local material, generally quartzite (Fig. 3). Although quartzite is not as easily worked as flint and does not produce the same quality of sharp edge, it was extensively used, with examples found in Shropshire, Warwickshire and Worcestershire (as well as other areas outside the West Midlands). A particular problem with quartzite artefacts is their recognition as stone tools. This has meant that the importance of quartzite as a raw material has only been fully appreciated relatively recently (MacRae & Moloney 1988).

The first Lower Palaeolithic discovery reported in the Midlands was a quartzite handaxe from Saltley in Birmingham. It was discovered in 1890 and published in 1897 in John Evans' seminal study on ancient flint tools (Fig. 3e). It led him to make the much-quoted observation "the question now arises whether the assumed absence of Palaeolithic implements over this area may not be due to their not having yet been found, and not to their non-existence" (Evans 1897, 550).

The next published discoveries did not appear until the 1920s, with a number of tools being reported from Warwickshire (Jack 1920; Shotton 1930) and Worcestershire (Smith 1922). Over the next few decades, tools were reported on various occasions (Clifford 1943; Smith 1957; Shotton 1969), but it was not until the 1970s that research in the West Midlands really took off. The growth in the number of finds from the 1970s onwards is quite remarkable and displayed in Table 1. The two sets of figures are taken primarily from two studies of the British Lower and Middle Palaeolithic, Derek Roe's survey of 1968 and John Wymer's survey of 1996.

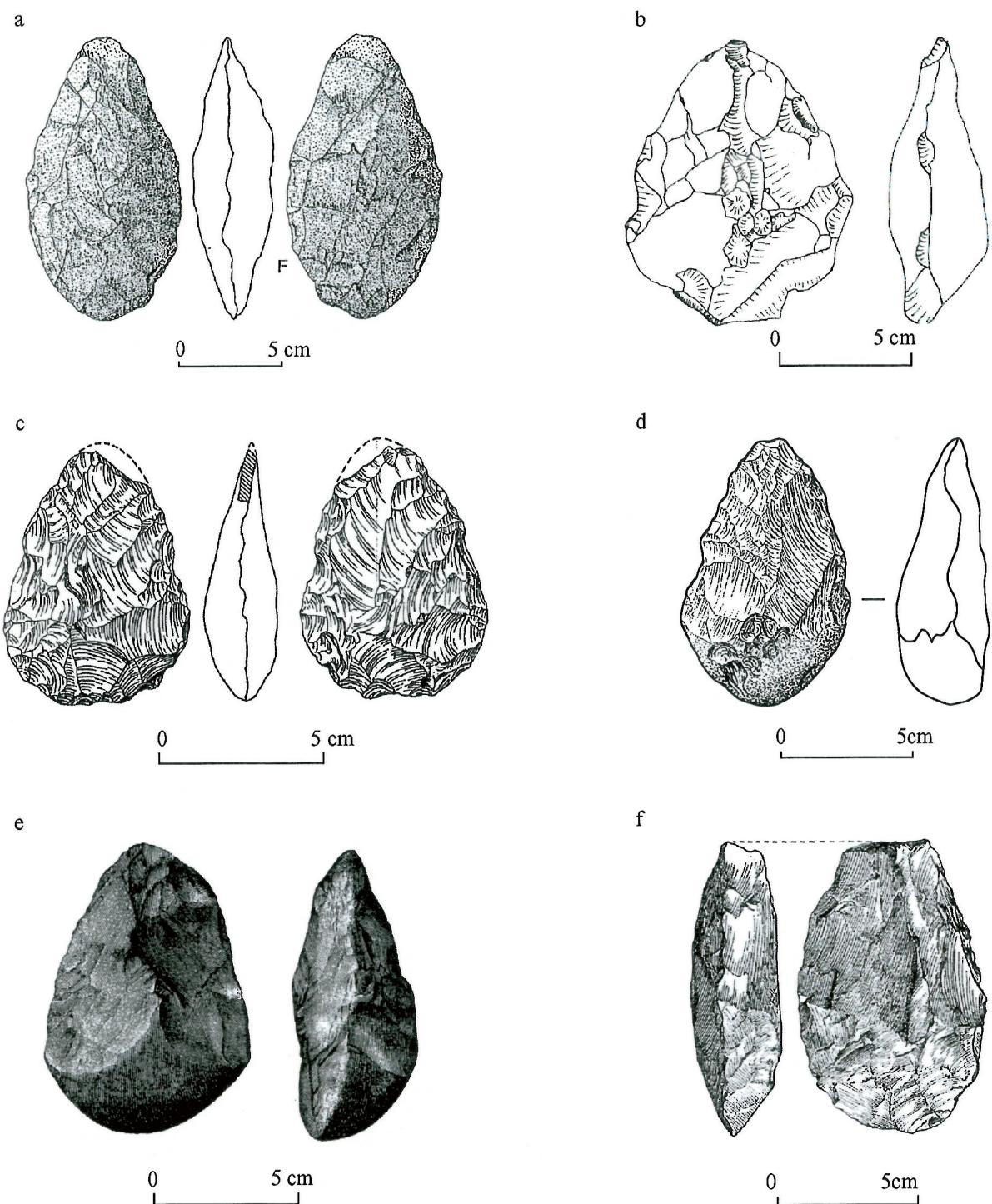


Figure 3: Handaxes of different materials from the Midlands.

a, A handaxe made of Andesitic tuff from Brandon (after Shotton & Wymer 1989, 6, fig. 5).

b, A handaxe of Welded ignimbrite from Bredon's Hardwick (after Whitehead 1980, 4).

c, A flint handaxe from Heathcote, nr. Warwick (after Shotton 1960, 110, fig. 13).

d, A flint handaxe from Radford Semele (after Shotton 1969, 80).

e, A quartzite handaxe from Saltley (after Evans 1897, 579).

f, A quartzite handaxe from Little Alne, Warwickshire (after Clifford 1943, 54, fig. 5).

	Roe (1968)	Present
<i>Herefordshire</i>	None	5
<i>Shropshire</i>	1	2
<i>Staffordshire</i>	None	2
<i>Warwickshire</i>	33	< 261
<i>Worcestershire</i>	9	< 70

Table 1. Lower and Middle Palaeolithic artefacts from the West Midlands, showing the number of finds recorded since 1968, estimates are given for Warwickshire and Worcestershire as lack of access to the collections means they cannot be counted fully.

The main reason for the dramatic increase in the number of finds for Warwickshire and Worcestershire lies in the work of two dedicated independent collectors. Both collections were made over a number of years, one in South Worcestershire and the other in North Warwickshire and Leicestershire. The slight increase in finds from Herefordshire, Shropshire and Staffordshire, on the other hand, reflects the normal operation of chance discovery and reporting.

The research of P.F. Whitehead (1988) took him on many trips to the sand and gravel quarries of the lower Warwickshire-Worcestershire Avon, the Severn and the Carrant Brook. Here he investigated pits at Lower Moor, Beckford, Aston Mill (Kemerton) and Twynning. He single-handedly more than quadrupled the number of finds from Worcestershire – as well as collecting a large quantity of mammal bones – in just a small area close to the confluence of the Avon and Severn Rivers. The collection includes some important finds of both flint and quartzite, from the Lower, Middle and Upper Palaeolithic. This is a crucially important collection and has added a number of important finds, including an Upper Palaeolithic Aurignacian shouldered scraper, one of only five in the country (Jacobi & Pettit 2000), all of which are in the British Museum. The majority of these tools are in fact derived, often from much earlier deposits or land surfaces, as they were picked up from deposits relating to the Devensian glaciation.

The work of R. Waite in the area around Wolvey in north Warwickshire and south Leicestershire has transformed the picture of the Palaeolithic in the West Midlands. Over three decades spent collecting, he has recovered a very large number of palaeoliths – some surface finds and others from quarries – from contexts that appear to be very early (Saville 1988). The geology around Wolvey has been mapped as glacial outwash from the Anglian and this would make some of the handaxes date to over 400 ka, with a few possibly even as old as 500 ka, reworked by glacial processes. The significance of this collection for the understanding of the Midlands Palaeolithic has been recognised by John Wymer (1999, 178) and others.

However, the most important discovery from the West Midlands is also one of the most recent. During the 1980s a number of finds from Waverley Wood Farm Pit, near Bubbenhall, Warwickshire were reported by the quarry workers. Among these finds were teeth and bones of straight-tusked Elephant (*Palaeoloxodon antiquus* – Shotton *et al* 1993) and four handaxes, three of which were made of andesitic tuff (Shotton & Wymer 1989). A salvage excavation followed and the discoveries (including *in situ* archaeology) has led Waverley Wood Farm Pit to be classed as an

extremely important site in both a national and international terms. A crucially important aspect of the site is its date. The mammalian evidence from secure contexts has been used, in conjunction with the stratigraphic sequence, to date the site to a pre-Anglian age. Waverley Wood is therefore dated to over 500 ka and one of the earliest archaeological sites in the country, broadly contemporary with a few other select sites such as Boxgrove, West Sussex and High Lodge, Suffolk. This site therefore forms part of the evidence for the earliest colonisation in Britain by our human ancestors (Roberts *et al* 1995) and is of fundamental importance in the development of a research framework for the Lower Palaeolithic of the West Midlands (Fig 4).

The geological background

An understanding of the geological background is a necessary prerequisite for the study of the Palaeolithic. The site of Waverley Wood Farm Pit was just one in a long line of sites to be investigated in Warwickshire due to the importance of its geology. In a paper of 1953, Shotton discussed a sequence of deposits relating to an earlier river system that underlies the current Warwickshire-Worcestershire Avon valley, which he termed the 'proto-Soar'. He placed this river in a context predating the 'Wolstonian' glaciation, which he believed had obliterated the river. However, the 'Wolstonian' deposits in this region are now recognised to belong to the Anglian glaciation and therefore this early river system can be dated to before 500 ka.

This change of view was a consequence of research in the 1980s which led to the recognition of a much more extensive sequence of deposits throughout the Midlands that related to this river system (Sumbler 1983 & Rose 1989 *a* & *b*). As the sequences became more thoroughly investigated the 'Baginton River' was proposed as the name of the ancient river system, as 'proto-Soar' was now somewhat misleading (Maddy & Lewis 1991). However, a re-analysis of this sequence allowed it to be traced right across the Midlands and into East Anglia and the Baginton River is now known as the Bytham River (after Castle Bytham in Lincolnshire). This 'tracking' of the stratigraphic sequence across the country also led to a re-dating of the river, giving it a pre-Anglian context and placing it over 150 ka earlier than previously thought (Rose 1987).

It is very difficult to determine when the Bytham River first came into existence. However, by the Middle Pleistocene (from about 760 ka) it is likely to have been the largest river in Britain, with a length in excess of 310 km (Rose 1994, 435). It has been sourced to somewhere close to the vales of Evesham and Moreton, and flowed through Worcestershire, Warwickshire, Leicestershire, Lincolnshire, Cambridgeshire, Norfolk and Suffolk. It drained a large part of the Midlands, including the area round what is now Birmingham, and a large tributary originating in the Southern Pennines (Bateman & Rose 1994). Moreover, it is now thought that this river system may have some surviving terraces (a great deal of the sequence was obliterated by the ice of the Anglian), which would trace its history to even earlier periods (Wymer 2001, 177-8).

A further ancient river flowed through what is now eastern Herefordshire, and has been named the Mathon River (Barclay *et al* 1992). This river system has been identified (on palaeoenvironmental grounds) as being broadly contemporary with the Bytham River (Coope *et al* 2002) and drained either into the Bytham or a pre-Severn river that has yet to be identified (Maddy 1997; 1999) (Fig. 5).

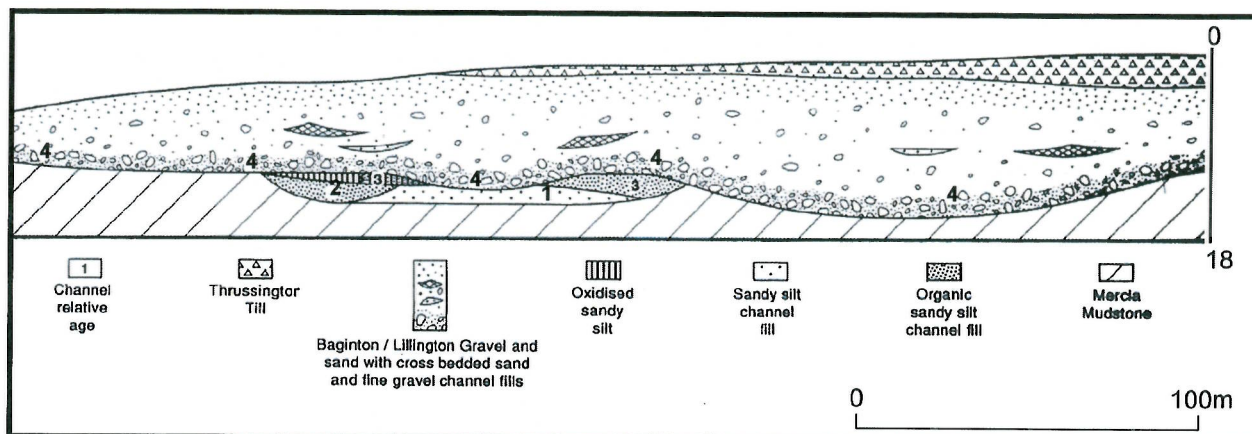
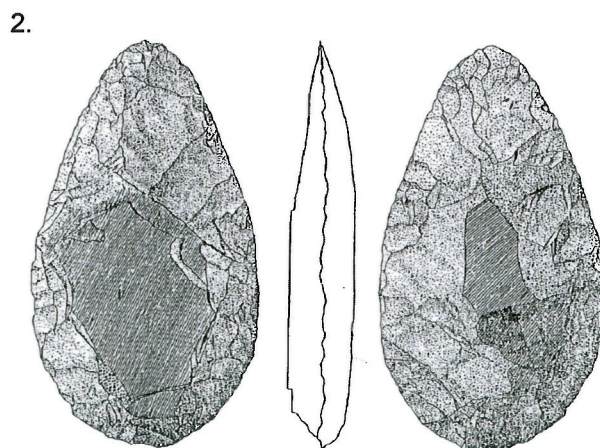
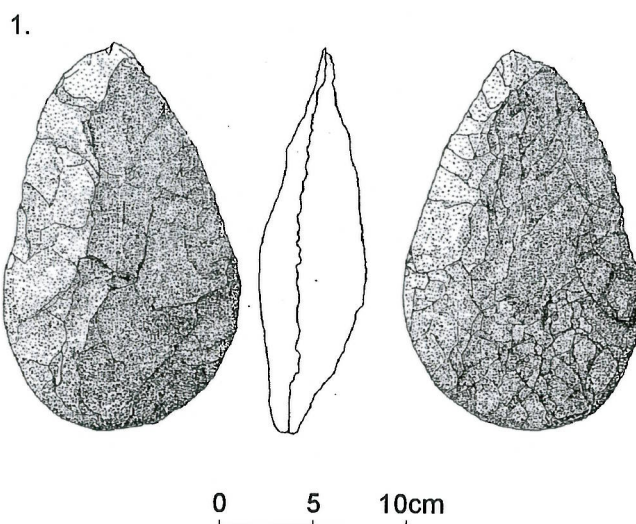


Figure 4: A section from the key site of Waverley Wood, showing the organic channels excavated in the 1980s. (After Shotton et al 1993, 296, fig. 3). Below are two of the handaxes that the quarry workmen found lying on the Mercia Mudstone, close to the organic channels. (Source Shotton & Wymer 1989, 2 & 4, figs. 1 & 3).



The deposits survive relatively well in a palaeovalley underlying what is now the Cradley Brook Valley. Research into these deposits during the 1990s yielded some important finds. This includes the earliest evidence of larch in this country (Field *et al* 1997) and the key Coleoptera that helped draw comparisons with Waverley Wood Farm Pit (Shotton *et al* 1993) and Brandon (Maddy *et al* 1994). Moreover, it has now been traced through northern Herefordshire and into Shropshire (Richards 1998 & 1999) and is therefore recognised as a crucial Midlands' sequence (Maddy *et al* 1999).

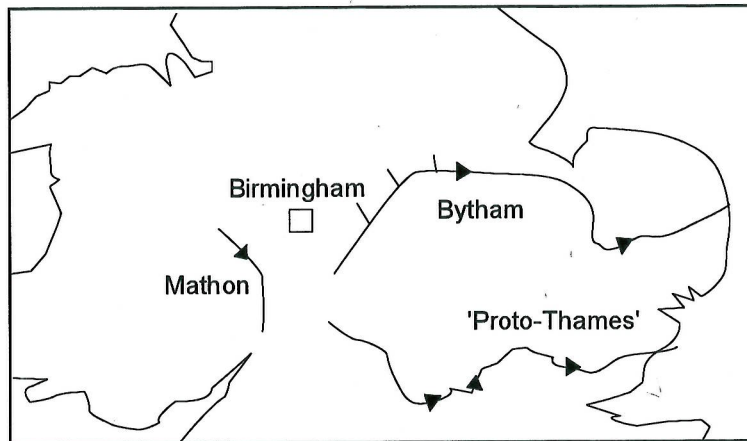


Figure 5: Schematic of the early Middle Pleistocene drainage patterns in Britain (after Barclay *et al* 1992, 86, fig. 9a)

These ancient river systems have the potential to yield important archaeological sites. As far as the Bytham River is concerned, one of these sites is Waverley Wood, with its outstanding handaxes, but this West Midlands site needs to be placed in its wider context. The large number of finds of stone tools from East Anglia that relate to the gravels of the Bytham River suggest that it was one of perhaps only two major entry points into the British area for our human ancestors prior to the Anglian. Evidence from High Lodge (Ashton *et al* 1992), Warren Hill, Feltwell and Shouldham Thorpe (Wymer 2000; 2001) provides clues to this entry route, as early humans followed the river system inland with constant access to water and food. The only other known entry route, the south coast, has produced the globally unique site of Boxgrove (Roberts & Parfitt 1999) as well as the cave sites of Kent's Cavern and, slightly further north, Westbury-sub-Mendip (Wymer 1999).

However, with the onset of glacial conditions in the Anglian, the Bytham and Mathon Rivers were obliterated by the ice sheets that covered the country. Since then the landscape has been developing, over hundreds of thousands of years, into that which we recognise today with its modern river systems and their terraces. Two of the most heavily researched river systems in the West Midlands are the Severn and the Warwickshire-Worcestershire Avon. The majority of archaeological and palaeontological findspots in the West Midlands are on the terraces of these rivers, and this allows us to attach a rough date to them (Fig. 6).

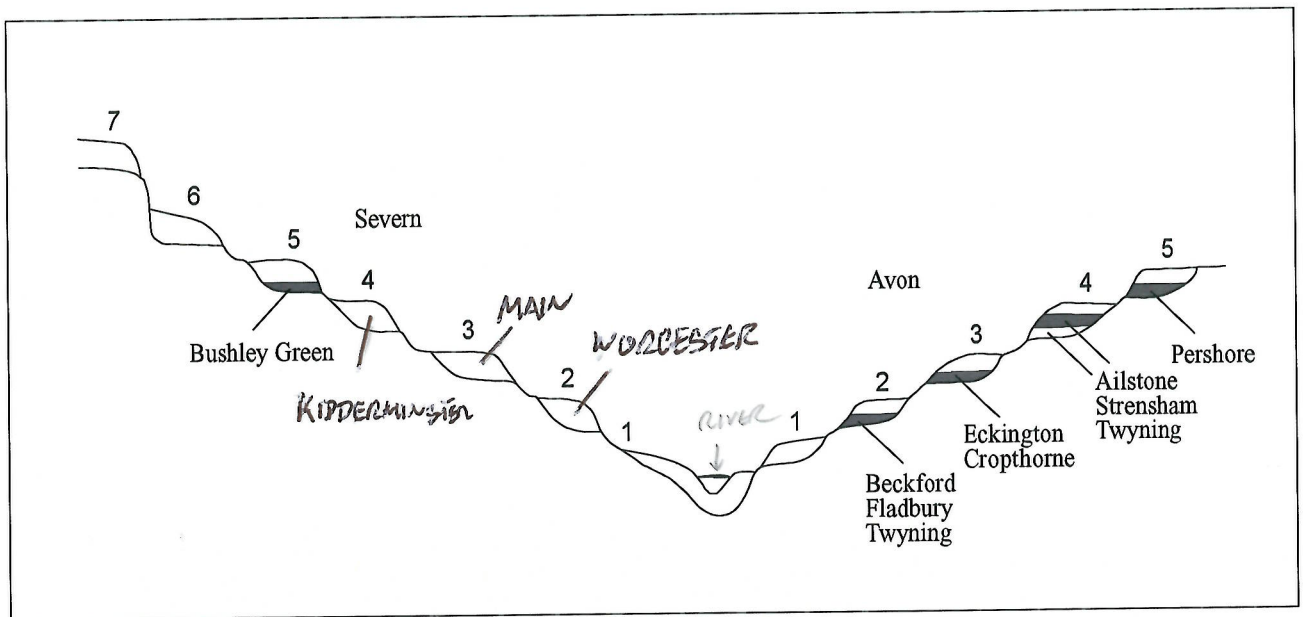
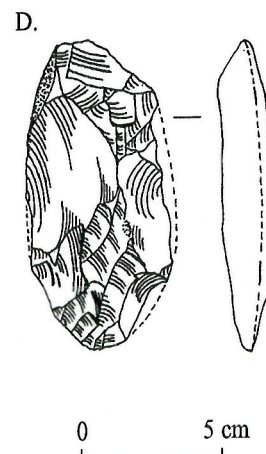
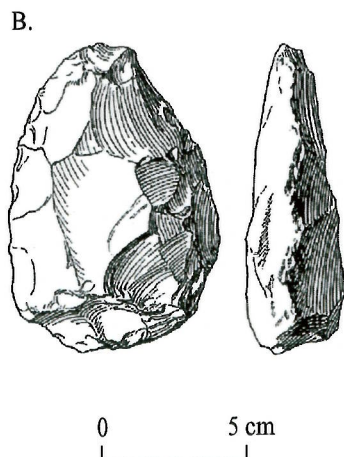
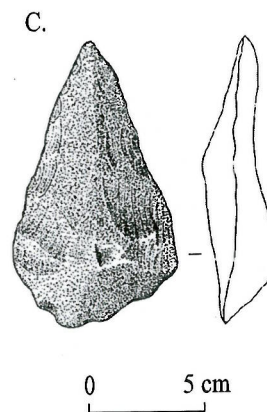
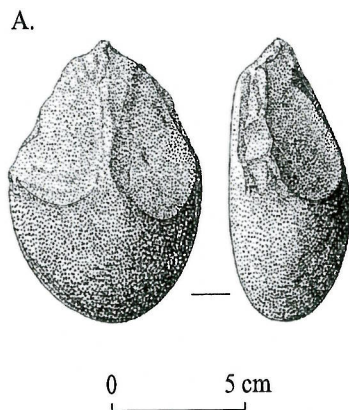


Figure 6: The terrace sequences of the Rivers Severn and the Worcestershire-Warwickshire Avon. The grey layers are organic deposits that have revealed floral and faunal material. (After Wymer 1999, 119, fig. 45 and Maddy et al 1991, 1999b).

Below: four handaxes from gravels of the Severn (a & b) and Avon (c & d) in Worcestershire.
 A. Quartzite Pebble handaxe from Hanley Castle (after Saville & Shotton 1977, 80, fig. 1).
 B. Handaxe from Henwick (after Smith 1922, 26, fig. 2).
 C. Handaxe of andesitic tuff from Beckford (after Whitehead 1988, 108, fig. 2).
 D. Flint handaxe from Aston-on-Carrant (after Whitehead 1988, 114, fig. 11).



Nevertheless, the stone tools that are found in terrace deposits can only be given a *terminus ante quem*. The lack of *in situ* discoveries does not allow a more accurate system of dating. The nature of fluvial erosion and the continuous deposition of material means that the handaxes (or other material) may relate to a much earlier period than the terrace in which they are found. This is often betrayed by their appearance; if a handaxe appears 'rolled', 'worn' or 'ventefacted' (affected by wind erosion) it has probably been secondarily deposited from an earlier primary context.

The secure dating of river terraces requires the survival of remains in primary contexts. From a Quaternary point of view the best examples of primary contexts are organic deposits within the terraces, where preservation is often excellent. Findspots from the Lower Avon are more frequent than are those from the Severn, with notable discoveries from Cropthorne (Strickland 1835, Maddy *et al* 1991), Eckington (Keen & Bridgland 1986) and Strensham (De Rouffignac *et al* 1995). These deposits often give an in-depth environmental picture of local plant and animal life, as well as what the climate was like during deposition. The finds also often allow dates to be assigned to the terraces as, for example, some animals may only be found in certain glacial or interglacial periods. Research has revealed five terraces of the Avon (Maddy *et al* 1991) and seven of the Severn (Maddy *et al* 1995), which can be provisionally dated with the help of organic deposits and discoveries from the sands and gravels.

Professor F.W. Shotton

The name of Prof. F.W. Shotton has cropped up on numerous occasions in our overview of the history of Palaeolithic research in the West Midlands, and it is appropriate to consider his contribution in a little more depth before turning to the development of a research framework. There is much to be learned both from Shotton's research philosophy and his practical approach to the discovery of sites and finds. Fred Shotton was one of several academics based at the University of Birmingham who researched the Quaternary geology of the Midlands and its river valleys. These included Mabel Tomlinson, who worked on the Warwickshire-Worcestershire Avon (Tomlinson 1925), Leonard Wills, who researched on the Severn (Wills 1938), and Shotton himself who worked on the Warwickshire geological sequence (Shotton 1953). However, Professor Shotton was one of the first scholars to integrate archaeology into Quaternary research.

Shotton developed a network of 'informants' – which included members of local societies, archaeologists and quarry workmen – that passed anything of archaeological interest to him and allowed the publication of any finds thought important enough. Moreover, Shotton would often provenance the find within the local and regional geological sequence so that a greater understanding of the age and locality of the find could be gained. Whilst there are flaws in Shotton's geological sequence, *e.g.* we now know his chronology was too short (Keen 1999, 164), his concept of contextualising finds within the local geological sequence was to a considerable extent unprecedented for its time, although this approach now forms the basic model for publishing Palaeolithic material.

Prof. Shotton was therefore a key figure in the development of research into the West Midlands Palaeolithic and his contribution over half a century provides one starting point for the development of a new research framework. Moreover, it was Shotton's identification of the exposures in Waverley Wood Farm Pit that led to its excavation and recognition as the single most important Palaeolithic site in the West Midlands and a site of national significance. Appropriately, the report on Waverley Wood was his last paper, published posthumously in 1993.

The Development of a West Midlands Palaeolithic Research Framework.

With the development of university research centres at Southampton (CAHO – Centre for the Archaeology of Human Origins) and Liverpool (John Gowlett *pers. comm.*), human origins and Palaeolithic research is receiving a great deal of attention from funding bodies. On top of this, the AHOB (Ancient Human Occupation of Britain) project is specifically centring research into the British Palaeolithic within the broader framework of Quaternary research. This project, funded by a grant from the Leverhulme Trust, is carrying out a five-year programme of research addressing a number of key topics concerning the patterns of human occupation in Britain during the Pleistocene. With specialists from two museums (the Natural History Museum and the British Museum) and a number of universities, key research questions are being analysed from a multidisciplinary perspective.

Research topics addressed by the AHOB project include the age of the earliest occupation of Britain and the rich archaeological record from the Hoxnian (the first post-Anglian interglacial). The project is also investigating the transition from the Lower to the Middle Palaeolithic and the introduction of Levallois stone-tool technology, the apparent hiatus in occupation between 180 – 60 ka, and the repopulation towards the end of the Palaeolithic by fully modern humans. All these research goals are in general terms relevant to the West Midlands, and form one obvious starting point for the development of a regional research framework, although the region has its specific problems and idiosyncrasies, which also need to be addressed. The research programme proposed below is, however, confined to the Lower and Middle Palaeolithic.

In order to develop a coherent research framework for the West Midlands we need a clear set of goals to aim for. The goals may be divided into two groups: first, goals which form part of the wider national agenda and which are in many respects coterminous with the goals of the AHOB project; second, goals which are specific to the West Midlands. Having defined our research goals we then need to develop a strategy and methods for attempting to achieve these goals. In the following sections of this paper the question are tackled in this order. The combination of national and regional goals together with the research strategy and methods forms the overall research framework.

General research goals

With regard to the West Midlands in the Lower and Middle Palaeolithic the relevant general research questions, developed from those of the AHOB project (AHOB 2003) are:

For the period 700 ka to 500 ka:

- When did humans first reach the West Midlands and by which routes?
- Which areas of the West Midlands and which river systems were occupied?
- What was the nature of the environment to which they were adapted?
- What is the nature of the lithic record?

The handaxes from Waverley Wood are of national importance, not only for their geographical position in the Midlands and for their pre-Anglian date, but also for the material of which they were made.

The handaxes are made of andesitic tuff – a volcanic material with the nearest British outcrops in the Lake District and North Wales. Did this material arrive by human action or natural processes? The argument currently lies unanswered (but see discussion in Wymer, 1999), but poses a number of crucial questions about the extent of human occupation, their thought and planning processes as well as the terrestrial glacial record.

With the contemporaneity of the Baginton and Mathon deposits – will there be any archaeological evidence from Eastern Herefordshire relating to this period? With proven evidence of migration along the Bytham could occupation have continued further west into the Mathon?

For the period around 400 ka (Hoxnian Interglacial):

- What is the extent and nature of occupation during the Hoxnian Interglacial?

On a national level, in the south and east of the country, this period following the Anglian glaciation contains the richest Palaeolithic record in Britain. However, in the West Midlands there is a distinct lack of Hoxnian (*sensu stricto*) sites. There are very few geological deposits of Hoxnian age that have been reported, with only two sites in the upper reaches of the Midlands Severn (Horton 1989, 74-6). Why is this? Is there any way to investigate the question? It appears that the Lower Severn was created by glacial outwash from the Anglian ice (Maddy *et al* 1995) – does it have any deposits related to the Hoxnian?

For the period 300 ka to 180 ka (Lower-Middle Palaeolithic transition):

- What is the date of the appearance of Levallois technology in the West Midlands?

In the West Midlands, the transition is from the Handaxe tradition (there is no evidence of the Clactonian in the West Midlands) to Levallois technology. Why have handaxes and Levallois artefacts been picked up from the same quarry (Twynning pit – Whitehead 1988, 119) and attributed to the same deposits? Was there a continuation of the two 'traditions' at the same time?

For the period 180 ka to 60 ka (Middle Palaeolithic Population collapse):

- Is there any evidence of human occupation in the West Midlands during this period?
- Can study of the geological and environmental record for the West Midlands shed any light on the possible reasons for Britain's apparent depopulation during this period?

For the period 60 ka to 30 ka (repopulation at the end of the Middle Palaeolithic):

- What is the evidence from the West Midlands for recolonisation by Neanderthal populations in this period?
- How could we identify such recolonisation in the lithic record?

Specific research goals

If we were to compare the general research questions asked above with reference to the West Midlands with those for the country as a whole (AHOB 2003), the most striking observation would be the way in which a severe shortage of data for all but the first of the periods discussed severely limits the scope of the research questions that can be addressed. From this observation flow most of the specific research goals for the West Midlands:

- More data is urgently required.

The most pressing need in the West Midlands is to acquire more basic data. Only if a concerted effort is made to acquire this data can the apparent lack of occupation in the Hoxnian, for example, be attributed to real low levels of occupation rather than an insufficiency of research. In a sense we are still asking the same question as John Evans asked in 1897 – is the absence more apparent than real? Furthermore, without more finds from the West Midlands the research process will stagnate as it did in the years since the Waverley Wood discoveries and Shotton's death in 1990.

- Improve understanding of the context of existing finds

There is a need to create a greater understanding of the date and significance of existing finds by putting them in their geological and environmental context. Working within the broader framework of Quaternary Science is therefore crucial. This should include study of local geological sequences and palaeontological material even in the absence of archaeological remains.

- Better define the Palaeolithic potential of the region's river systems

There is also a need to gain a better understanding of the geological sequences relating to the region's river systems and their potential for Palaeolithic archaeology. These sequences can be divided into the pre-Anglian river systems of the Bytham, the

Mathon and the possible 'pre-Severn' on the one hand, and the development of the post-Anglian riverscapes, including the Severn, Avon, Lugg, Tame and Trent on the other. Whilst there is ongoing research on all of these sequences, and some areas have been studied in detail in the last decade by the British Geological Survey (*e.g.* Barclay *et al* 1997), there are many questions left unanswered. These include the age and furthest extent of the Bytham, as well as the earliest date of the Warwickshire-Worcestershire Avon and the true age of the Anglian glaciation (Sumbler 2000).

A Framework for the future

The Shotton Project (the remit of which includes Leicestershire and Rutland as well as the West Midlands) does not directly address the general research goals for the Lower and Middle Palaeolithic listed above. However, it provides the necessary foundation to make such research possible. Indeed, in collaboration with the Shotton Project the University of Liverpool is proposing intensive survey in the Mathon palaeovalley beginning in 2003.

Maintaining the research initiative stimulated by the Shotton Project is the major issue for the future. Central to this will be the effective incorporation of data related to Palaeolithic archaeology and the Pleistocene palaeoenvironment into the region's SMRs, or rather the more comprehensive and flexible HERs (Historic Environments Record) which are now coming on stream. A pilot project is currently being developed with the Worcestershire HER to this end. This will include the mapping of artefacts on a GIS with the appropriate geological (terrace) deposits and relevant non-archaeological finds, such as mammalian fossils and palaeoenvironmental evidence. In conjunction with the 'Palaeolithic protocol' this will help to ensure that the evidence for this highly important period of human development will take its rightful place alongside the archaeology of later periods in the curation and research of the region's archaeological resource.

One issue that can be approached through the HER database is the potential for 'predictive modelling' of sites and finds. Using the current county 'Minerals Local Plans' the Shotton Project is exploring the potential for future discoveries within quarries using information on existing finds from similar contexts. This predictive modelling can also be used to implement controlled site-monitoring schemes by curatorial archaeologists, where finds can be systematically recorded and potential deposits thoroughly assessed.

Through the combination of current research initiatives at the national level, such as AHOB, and at the regional level, such as The Shotton Project, together with the full incorporation of the Palaeolithic into curatorial mechanisms and policies, the future for Lower and Middle Palaeolithic research in the West Midlands looks bright. It need be neither lost nor forgotten.

Part 2:

Quarries of the West Midlands and Leicestershire: Research and Potential

Introduction

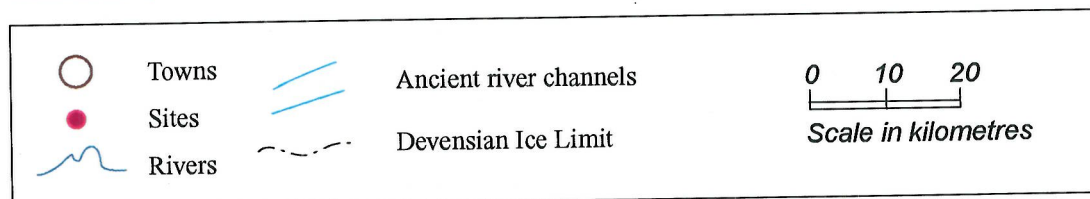
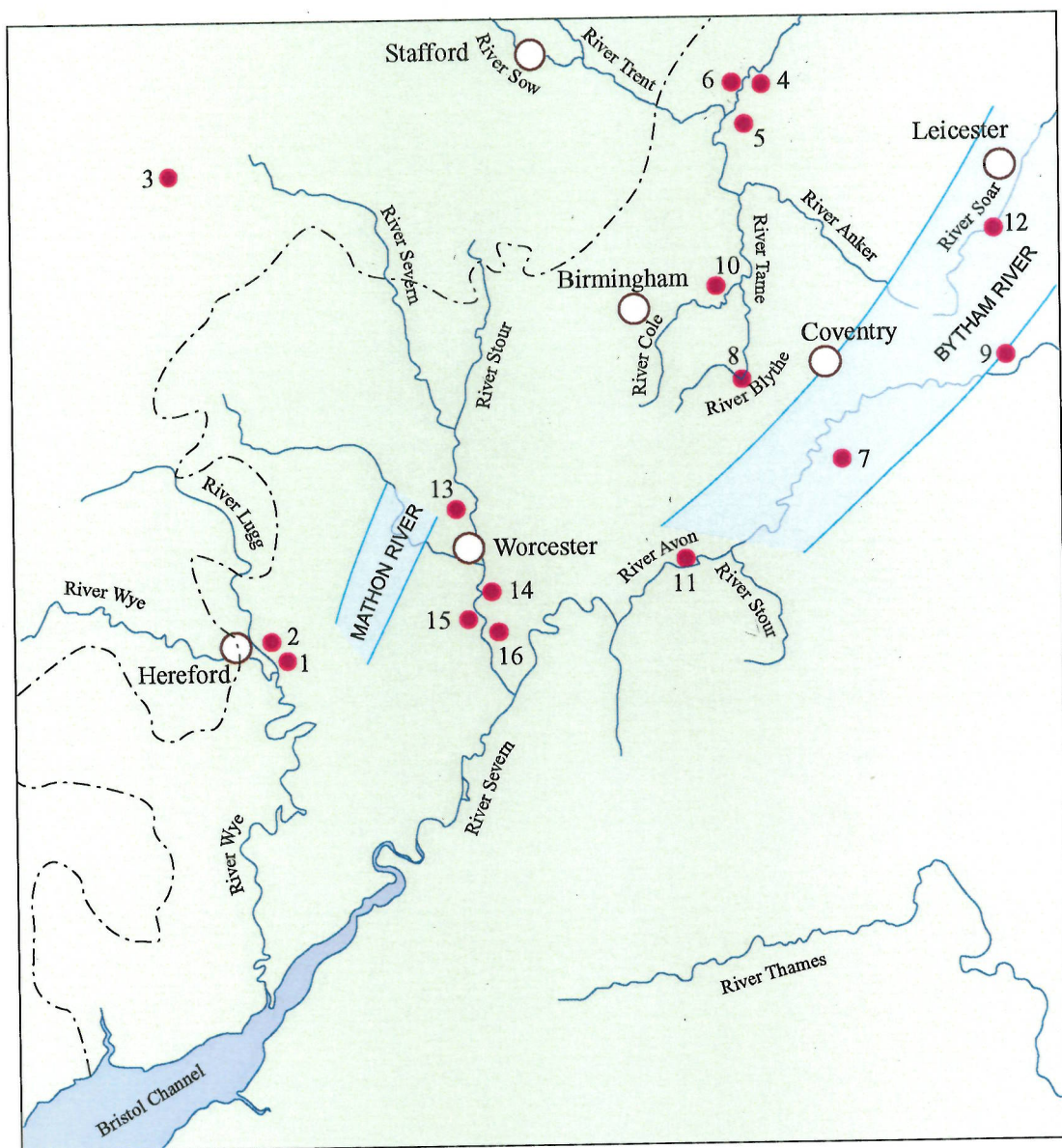
The West Midlands plus Leicestershire, despite being near to the edge of the Palaeolithic world, has produced a considerable amount of evidence of human presence. Coupled with this human-made material has been an abundant record of the environmental changes of the later part of the Pleistocene, which provide a context of time and habitat for the traces of these early humans.

In the region, almost all of the Palaeolithic record has been obtained from river terrace deposits which in this inland area also provide the majority of the sites for Pleistocene environmental reconstruction (Fig. 7). Terrace sediments, because they contain most of the palaeontological record of the area, also provide the basis of the lithostratigraphic succession. Because they can be dated, the terraces allow the determination of the age of the widespread sheets of glacial till which cover much of the area, but which being non-fossiliferous, have no internal means of dating.

Most aggregate extraction in the West Midlands is from river terrace deposits, either as in the majority of cases terraces along the courses of the modern rivers, or buried terraces as is the case for the sites in the former course of the Bytham River. Terrace development in the area follows the Bridgland model (1994; 2000), in which the gravels are thought to be deposited under cold stage conditions under a braided river regime, although temperate channel fills exist below them and provide much of the archaeological and palaeontological interest.

A number of sites currently active are not discussed within this resource assessment. This is for a number of reasons, but most notably perhaps are those sites that were not visited through a lack of access agreements between the aggregates company and the Shotton Project.

The following assessment takes place on a County basis, although the discussion at the end provide a more regional approach from which a regional research framework for the West Midlands region and Leicestershire can be built for the Palaeolithic.



1 Lugg Bridge	5 Whitemoor Haye	9 Coleshill	13 Holt Heath
2 Wellington	6 Barton-under-Needwood	10 Ling Hall	14 Clifton
3 Tern Hill	7 Waverley Wood	11 Salford Priors	15 Ripple
4 Middleton Hall	8 Berkswell	12 Huncote	16 Ryall

Figure 7: Location map of quarries discussed in part 2.

Sites, their record and potential

Herefordshire

Current workings in Herefordshire are centred on the valley of the Lugg north of Hereford. These pits take gravel from the low terrace of the river at Wellington and Lugg Bridge. Both sites produce aggregate which is reworked from recent glacial deposits as the whole area is within the ice limits of the Devensian (Richards 1999). As such, they are composed largely of Old Red Sandstone lithologies from the local area, but also contain moderately far-travelled material from the Lower Palaeozoic outcrop in Central Wales.

Wellington (SO 508 479)

The pit at Wellington is in a large terrace flat deposited at the confluence of the Lugg and the Wellington Brook. It is close to current river level and aggregate is extracted by dredging so sections are difficult to examine. The gravel is primarily of Old Red Sandstone and mudstone, and Silurian limestone, which because of the well-bedded nature of the bedrock outcrop produces tabular slabs of rock up to 1.5 m in length at the base of the terrace. The majority of the gravel is, however, much finer with most clasts below 10 mm. Much of the content of the gravel is reworked from glacial deposits and the coarse nature of the base of the gravel suggests an origin in the Late Devensian, the Marden Member of Brandon (in Maddy *et al* 1999). Overlying the gravel is 1.5 m of marly silt with abundant wood fragments and Mollusca indicative of deposition in a floodplain pool. The marly silt has interbedded layers of charcoal perhaps suggesting Neolithic woodland clearance. This upper unit is channelled to the basal gravel surface by further infills of muds with Roman and Mediaeval material.

Because central Herefordshire is all within the limit of the Devensian ice, river terraces are young and date only to the ice retreat. Although the deposits at Wellington preserve an excellent Holocene record, their Palaeolithic potential is very low.

Quaternary and Palaeolithic potential: Very low

Lugg Bridge (SO 530 417)

This quarry is also at floodplain level and worked by dredging so has difficult access to the faces. The sections visible at present are mostly in red/brown alluvial muds which are up to 2-3 m thick and rest on fine gravel of Old Red Sandstone shale and sandstone, Lower Palaeozoic greywacke and fine-grained basic igneous rocks. This sequence probably follows that at Wellington, with the gravel being of Lateglacial age and the overlying muds being deposited in the Holocene. Although there is potential for Holocene environmental data from the alluvial sequence, the young age of the deposits rules out any Palaeolithic interest.

Quaternary and Palaeolithic potential: Very low

Shropshire

Because Shropshire is entirely within the limit of the Devensian ice the terrain is largely built on outwash and till. All aggregate resources are derived from outwash sands and gravels. The county has revealed some important Quaternary finds in the past, most notably the Condover mammoths, excavated in the 1980s (Lister 1991). However these have been dated to the Devensian Lateglacial and were not associated with any Palaeolithic archaeology. With the whole county being within the ice limit of the last glaciation, potential for recovery of Quaternary or Palaeolithic material across the region is low.

Tern Hill (SJ 653 305)

The pit at Tern Hill is highly representative of the facies to be seen in outwash complexes associated with the retreat of the Last Glaciation ice. Faces up to 5 m high exhibit current bedded, well-sorted sand in units with an amplitude up to about 30 cm. The erosional base of each unit is picked out by fine gravel largely of quartzite, but clasts of coal and carbonaceous shale from Carboniferous sources, flint, and white granite also occur. These latter lithologies are derived from the Irish Sea basin via the Irish Sea ice which deposited the Shrewsbury Formation glacial suite (Worsley 1991). The sands were deposited as an outwash fan which makes a prominent terrace feature above the Tern Valley which has incised into it in Holocene times.

The glacial origin of the deposits allows very little Palaeolithic interest.

Quaternary and Palaeolithic potential: Very low

Staffordshire

Although the Devensian ice limit lay across north Staffordshire, the south and east of the county remained ice free. In particular the valleys of the Tame and Trent were not overrun by ice and at their confluence, between Tamworth and Burton-on-Trent, considerable quantities of gravel were deposited. The petrology of these gravels is dominated by Triassic quartzites derived from the outcrops of the Kidderminster Formation (Barclay *et al* 1997) which form the uplands of Cannock Chase to the NW of the Tame and the Weeford escarpment to the south. As is usual for the Midlands, predominantly quartzite gravels are, in general, a hostile geochemical environment for the preservation of calcareous fossils, although some spectacular finds have been made where the basal levels of the gravel rest on mildly calcium carbonate rich patches of Mercia Mudstone as at Whitemoor Haye.

Middleton Hall (SP 195 975)

The pit at Middleton Hall is the last working site in an area along the floor of the Tame Valley which has been very heavily quarried. The gravel forms the base of a low terrace (probably equivalent of the Hemington Member of the Trent, Brandon in Maddy *et al* 1999) *circa* 1 m above the present floodplain. The gravels are almost entirely of quartz and quartzite from Triassic sources, although flint reworked from early glacial deposits also occurs (Fig. 8). The basal levels of the gravel contain cobbles and small boulders of quartz up to 30 cm long axis indicating very high river flow rates and perhaps ice-rafting. The gravel reaches a maximum thickness of 2.5 m and rests on a planar surface of Mercia Mudstone bedrock. Overlying the gravels are large scale channels up to 100 m wide filled with peat and wood, probably of early Holocene age, which have been sampled by Dr T.M. Mighall (Coventry University) for palaeobotanical analysis.

Quaternary and Palaeolithic potential: Low

Figure 8: Middleton Quarry, Staffordshire



Above: A general view of the workings, September 2003.

Below: A view of a working section with DHK and the quarry manager as scales.



Whitemoor Haye (SK 173 127)

The very wide gravel spread at Whitemoor Haye was deposited by the three-way confluence of the Rivers Tame, Trent and Mease. The resulting terrace flat is around 2 km wide and has been extensively quarried. The gravel is of the typical Trent/Tame lithology of quartz and quartzite resting on a planar surface of Mercia Mudstone (Fig. 9). Unlike at Middleton Hall or Barton-under-Needwood the gravel at Whitemoor Haye is relatively fine-grained throughout the full thickness of the terrace and there is considerably more sand in the sequence than either upstream or downstream. This fine grained facies is probably due to the wide expanse of terrace deposition caused by the three-way confluence which would have prompted slower water flow rates than in the narrower valley to the North or South and shallower channels in the braided system.

Shallow channel fills in the base of the gravel have produced a varied mammalian fauna and organic layers with abundant insects and plant macro fossils indicative of fully arctic conditions. The age of the deposits from the biostratigraphic evidence lies within MIS 3 (60-30 ka) although probably at the latter end of that age range. The deposits at the site allow a detailed reconstruction of the environment of a phase within the last glaciation when the Neanderthal inhabitants of Britain were replaced by early modern humans. Although no archaeological material has been found at Whitemoor Haye, the site is one of high importance for the evidence of the environment under which the last vestiges of the Middle Palaeolithic was replaced by Upper Palaeolithic cultures.

Quaternary and Palaeolithic potential: High

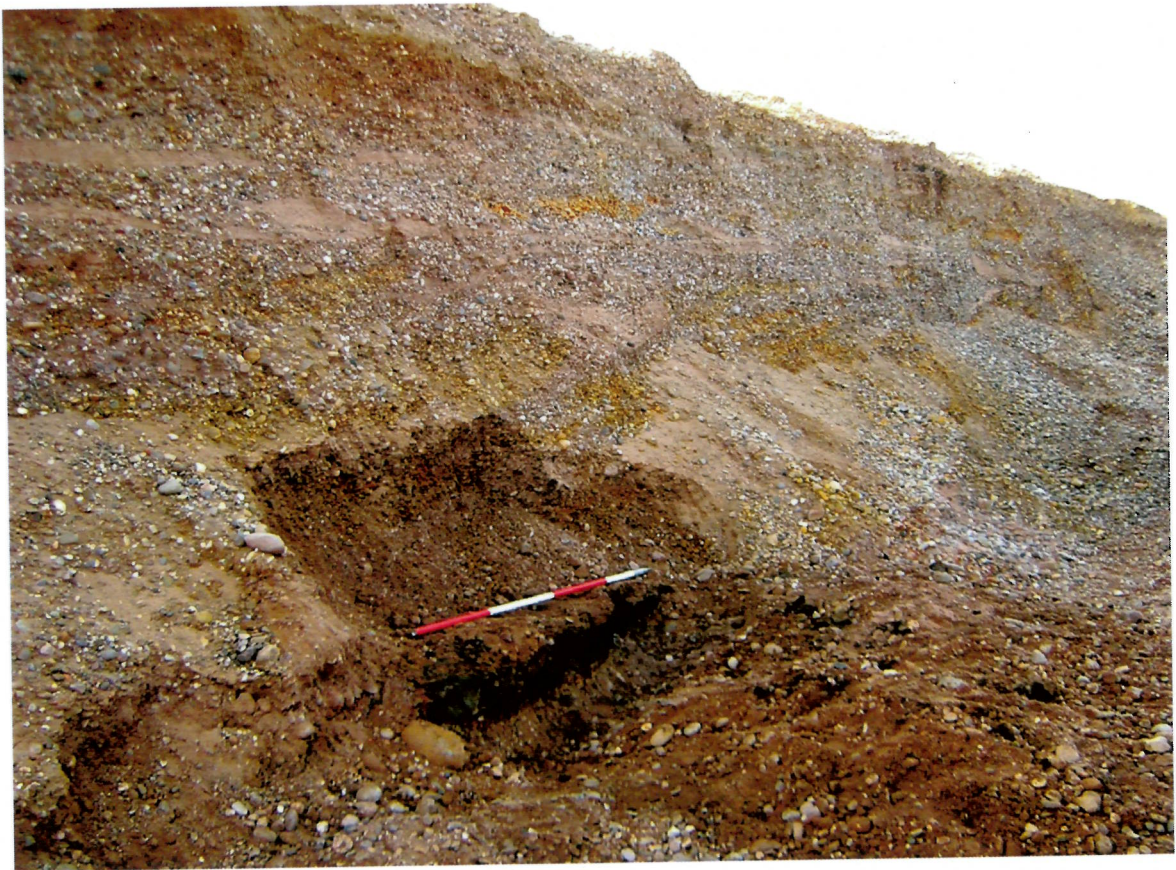


Figure 9: General extraction workings at Whitemoor Haye, Staffordshire, October 2003.

Barton-under-Needwood (SK 205 165)

Barton-under-Needwood quarry is 3 km to the NE of Whitemoor Haye in the same terrace of the Tame. A similar sequence of quartz and quartzite gravel up to 4 m thick and resting on a planar, eroded surface of Mercia Mudstone can be seen. Sandy channel fills, some with visible plant debris, have been sampled for palaeobotanical and palaeoentomological study by Dr T.M. Mighall (Coventry University) and Dr S. Elias (Royal Holloway, University of London) respectively (Fig. 10). The age of the deposits is probably similar to those at Whitemoor Haye although Barton-under-Needwood has yet to yield the spectacular mammalian remains of the former site.

Quaternary and Palaeolithic potential: High



*Figure 10: An organic lens sampled and recorded at Barton-under-Needwood quarry, Staffordshire, October 2003.
Scale 2m.*

Warwickshire

Gravel extraction in Warwickshire is greatly reduced from former times with major workings being found only at Waverley Wood, Bubbenhall, Ling Hall, Rugby, Berkswell, Coleshill and Salford Priors. These five pits are in contrasting sedimentary situations. Waverley Wood is one of only two pits now working the sands and gravels of the Baginton Formation which were laid down by the Bytham River (Rose 1987; Keen 1999) before its course was destroyed by the ice of the Anglian glaciation. Berkswell Quarry also works Baginton-type sands although their association with the Bytham River is difficult to determine. Ling Hall is cut in the outwash gravels of the Anglian (the Dunsmore Gravel) (Shotton 1953), and the Coleshill deposits form a low terrace of the Tame. The single Avon site currently being worked is at Salford Priors, on Terrace 2 of the river (Tomlinson, 1925; Maddy, Lewis & Keen, 1999) in deposits which as Tomlinson suggested contains deposits from both the Avon and the Arrow below a single terrace surface.

The petrology of the gravels in Warwickshire is largely determined by the abundance of reworked Triassic quartzites from the Kidderminster Formation, although the sediments of the lower Warwickshire Avon are a combination of reworked flint and Triassic quartzite from Anglian glacial sources and limestone brought from the Cotswolds by left-bank tributaries. The predominance of quartzite clasts up to cobble size, imparts a general acidity to the gravels of the area as does the widespread Mercia Mudstone which forms the bedrock over much of the county. These lithologies do not provide a good environment for the preservation of fossils such as Mollusca or mammalian bones with their high calcium carbonate content. Only in places where fine-grained sediments in channel fills inhibit ground water flow, or in places with water flowing from the Lias outcrop in the south and east of the county are such fossils preserved. The acid habitat does not cause problems for plant or insect fossils.

In the lower Avon near its confluence with the Severn, the river flows on Jurassic limestone bedrock which provides very good conditions for fossil preservation (See Keen & Bridgland 1986; De Rouffignac *et al* 1995).

Quarries not covered in this section include Brinklow and High Cross, the latter is a quarry that is known to have produced Palaeolithic finds in the past, thought to date either prior to, or after, the Anglian glaciation. The majority of finds have been made by Mr Ron Waite, who is in current communication with Anne Graf, a former planning archaeologist to Leicestershire. The project was unable to gain access to the quarry despite requests, due to a lack of communication from the site manager and Aggregates company.

Waverley Wood Farm (SP 365 715)

This site, with its famous Acheulean handaxes and detailed palaeoenvironmental data was fully published in the late 1980s and 1990s (Shotton & Wymer 1989; Shotton *et al* 1993). Although sited on Mercia Mudstone bedrock the infill of the channels containing the Mollusca, insects and plant fossils used to reconstruct the environment remained calcareous enough for good preservation of the fossils. The biostratigraphy of the molluscs and insects suggested an age late in the "Cromer Complex" thus probably in Marine Isotope Stage (MIS) 13 or 15 *circa* 500 ka before present. Because of its overlying Anglian Till, Waverley Wood is one of the few sites which unambiguously demonstrate a pre-Anglian age for the human population of Britain (Roberts *et al* 1995).

The sections described in the 1993 paper were destroyed during the preparation of the site for landfill. Current workings are centred around Paget's Lane (SP 373 271) (Fig. 11) around 600 m to the NE of the original pit. The deposits being worked are still the sands and gravels of the Baginton Formation as at the early site, but there are no channels cut into the Mercia Mudstone in the new workings. The channel complex of the previous pit was the source of all of the archaeology and fossils, so in their absence no new finds have occurred since the early 1990s. The site is still one of considerable potential for Quaternary work if new channel fills below the basal levels of the Baginton Formation can be found. Together with Huncote, Waverley Wood represents the only current exposure of the Bytham River deposits in the West Midlands and the only places where significant discoveries of the environment and technology of the earliest inhabitants of the area could potentially be made.

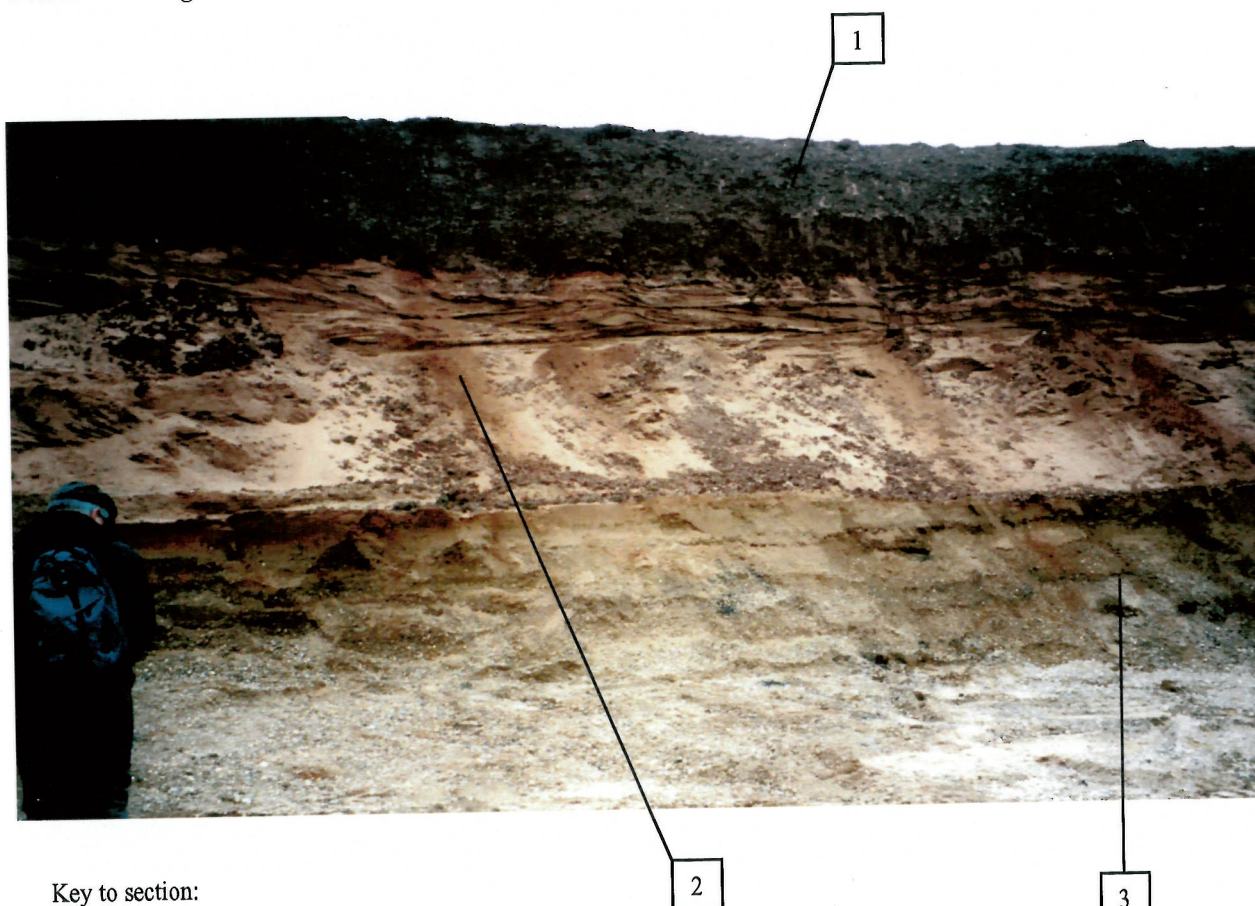
Quaternary and Palaeolithic potential: High

Figure 11: Waverley Wood Farm Pit, Warwickshire.



Above: Shot of the extraction area, November 2003.

Below: A working section at Waverley Wood.



Key to section:

1. Oadby till, remnant of the Anglian glaciation.
2. Baginton sands of the main pre-Anglian River system.
3. Baginton gravels of the main pre-Anglian River system.

Berkswell Quarry (SP 227 808)

The small workings at Berkswell are the last remnant of far larger pits in the general area which worked both the Baginton Formation and the terrace gravels of the Blythe. The current workings are in the Baginton Formation which consists of up to 7 m of gravel and sand resting on a planar surface eroded into the Mercia Mudstone bedrock. The occurrence of cobbles of quartzite up to 15 cm along their longest axis strongly suggests deposition under a cold climate typical of the later stages of the deposition of the Baginton Formation throughout its outcrop (Shotton 1953). The abundance of fragments of coal and blocks of poorly indurated Carboniferous Sandstone suggests that the sediment was largely derived from an area of outcrop of these sediments close to the site of deposition. A likely source would be the area of Carboniferous rocks outcropping on the Nuneaton Ridge 10-15 km to the NE of Berkswell. Because of the cold climate origin of the sediments, fossil and artefact content are likely to be low and there are no records of either from the area. However, the Baginton Formation at Waverley Wood contained channels in its base from which the Palaeolithic artefacts and Pleistocene fossil material was obtained. If such channels appeared at Berkswell, the potential for archaeological and palaeontological content could be high.

Quaternary and Palaeolithic potential: Low to Medium

Ling Hall (SP 449 729)

The large excavations at Ling Hall are situated high on the plateau surface of Dunsmore Heath and above the modern Avon valley and its terraces. However Maddy (*et al* 1999) regards these deposits as related to the Avon system and notes that they are the first deposit laid down by the new drainage developed on the deglaciated landscape left by the retreating Anglian ice. The gravels are up to 4 m thick although their base is on highly channelled Mercia Mudstone, so the gravels are much thinner in parts of the pit. Their nature as post-(Anglian)glacial sediments is indicated by their high flint component derived from the flinty Oadby Till. Although the gravels are related to the Avon they were deposited as glacial outwash (Ling Hall is the stratotype of the Dunsmore Member of the Baginton Formation, Maddy *et al* 1999) and as such will have formed under such a severe climate that they will never have had either fossil or archaeological content.

Quaternary and Palaeolithic potential: Very low

Coleshill (SP 202 905)

The gravels at Coleshill underlie a terrace flat 2 m above river level between the Rivers Cole and Blythe. The gravels are largely of quartzite from Triassic sources, although perhaps also reworked from outcrops of Baginton Formation upstream. Work in the 1960s (Coope & Sands 1966) suggests a sub-arctic climate for the deposition of the gravels from the insect fauna that they contain, and an age in the Upton Warren Interstadial around 32 ka from ^{14}C dates. In view of the doubt now cast over radiocarbon dates of this sort of range (Bowen *et al* 1989) it is possible that the Coleshill deposits may have been deposited at any time during the Devensian Cold Stage. The section at Coleshill preserved a number of lenses of sandy organic mud in

its lower parts (see Fig. 12 and also the section figured by Coope & Sands, 1966 from the terrace deposits at Whiteacre Heath, about 2.5 km to the NNE of Coleshill) which are undergoing palaeobotanical investigation by Dr T.M. Mighall of Coventry University. The nature of the setting of the Coleshill deposits strongly suggests deposition under a cold climate within the Devensian Cold Stage as proposed by Coope & Sands (1966). Although archaeological finds from open sites during this period are not common, the recent description of the site of Lynford, Norfolk (Boismier *et al* 2003) in a very similar situation to that of Coleshill in a low terrace of the River Wissey and yielding fossils of a similar sub-arctic character alongside an abundant Middle Palaeolithic industry shows that deposits of this age do have some chance of significant finds of both archaeological and palaeontological material.

Quaternary and Palaeolithic potential: Low to Medium



*Figure 12: Organic lens at Coleshill quarry, Warwickshire, September 2003.
Scale 2m.*

Salford Priors (SO 073 523)

The pit at Marsh Farm is in a gravel spread at the confluence of the Avon and Arrow and contains sediments from both rivers deposited during the shift of the position of their junction during the latter part of MIS 5 and the early part of MIS 4 (Maddy, Lewis & Keen 1999). The lower gravels (unit 1 of Maddy, Lewis & Keen 1999) have a distinct yellow colour and high limestone content derived from the Avon. The upper gravels (unit 2) have no limestone and a low but clear occurrence of igneous and metamorphic clasts in a red or red/grey matrix. Unit 1 was deposited by the Avon, unit 2 by the Arrow after alteration of the course of the two rivers (Fig. 13). The limestone content of unit 1 provides a good environment for the preservation of Mollusca and bone, and Maddy, Lewis & Keen report a molluscan assemblage of 10 taxa indicative of sub-arctic conditions. During the present survey a molar and tusk fragments of woolly mammoth (*Mammuthus primigenius*) were found on the floor of the pit (Fig. 13). The form of the molar is typical of mammoths from early in the last glaciation (D.C. Schreve, pers comm., 2003). Although no Palaeolithic material was found, an age for the sediments at Salford Priors in the Early Devensian would be similar to that of the Lynford finds in Norfolk (Boismier *et al* 2003) and thus provide potential for the occurrence of Middle Palaeolithic finds.

The site of Salford Priors is *circa* 15 km down stream of Little Alne from where a significant group of quartzite handaxes were reported by Clifford (1943). The context of the finds is not clear from Clifford's short note, but it seems likely that it was from a higher terrace of the Alne than that of the equivalent of the Avon represented at Salford Priors. However, the occurrence of quartzite hand axes in the deposits of the Carrant Brook 20 km SW of Salford Priors (Whitehead 1988) in a low terrace of that left bank tributary of the Avon at a similar level to that of Salford Priors indicates that the potential for finds of Palaeolithic archaeology in the Avon terraces is quite high.

Quaternary and Palaeolithic potential: Medium to high

Figure 13: Salford Priors, Warwickshire, August 2003



Working face of the Salford Priors quarry with DHK as scale

Key to section:

1. Unit 1 of Maddy, Lewis & Keen; Terrace 2 gravels of the River Avon.
2. Unit 2 of Maddy, Lewis & Keen; Gravels of the Arrow during mid-Devensian times.



Molar of *Mammuthus primigenius* (Blumenbach) found on the quarry floor during a field visit. Scale 0.4m

Leicestershire

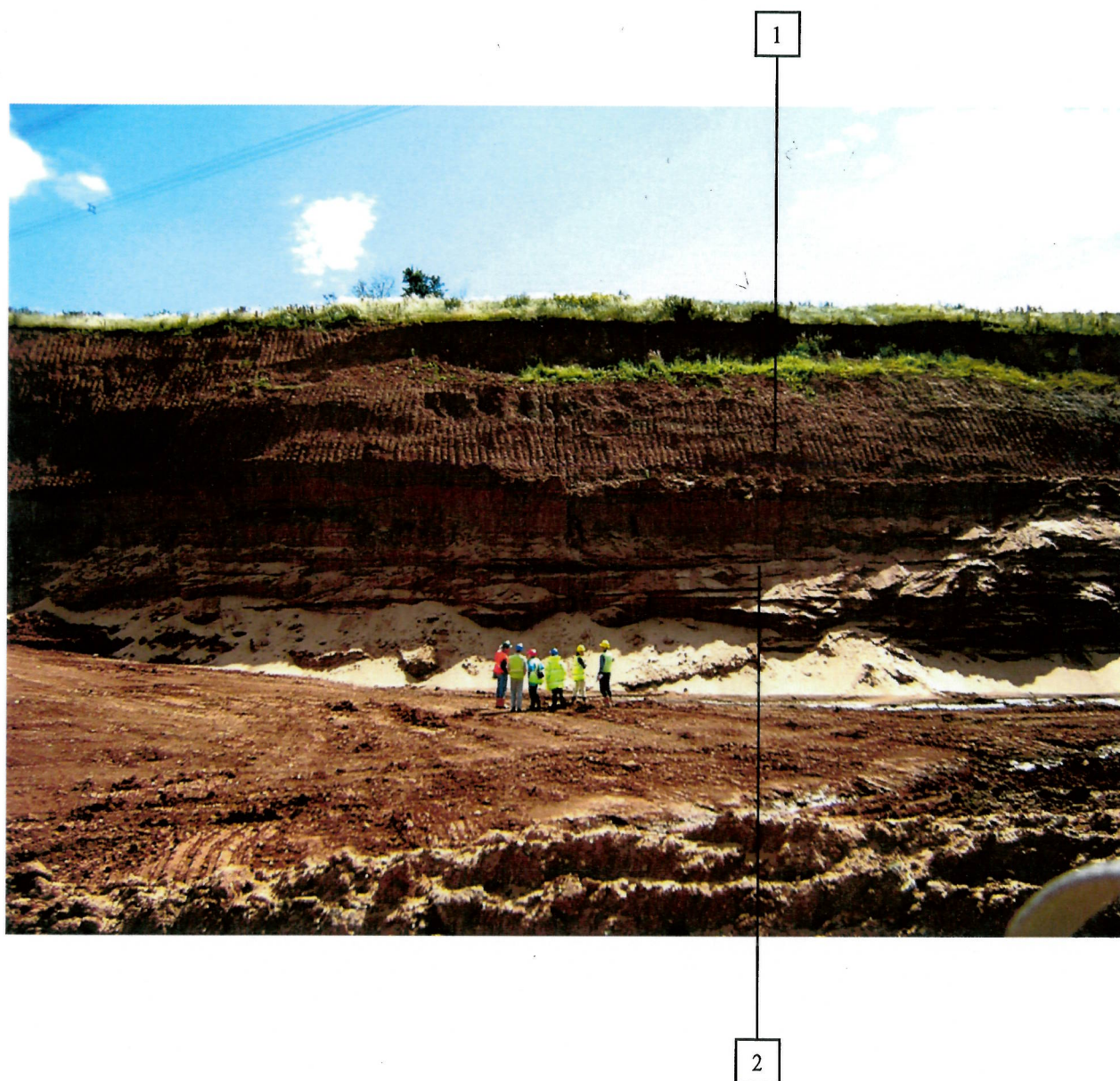
Only one working pit in Leicestershire is a significant source of aggregate. This site, Huncote Quarry, is in the course of the Bytham River (Rose 1987; Keen 1999) (Fig. 14) and works Baginton Formation sands and gravels. As at Waverley Wood these sediments are quartz and quartzite rich, but their acid nature is somewhat modified by ground water percolating through the overlying Oadby Till which is strongly calcareous from its high Chalk content.

Huncote (SP 520 990)

Huncote Quarry is the second (with Waverley Wood) of the quarries in the area which work the Baginton Formation sands and gravels deposited by the Bytham River. Extensive faces in the sands up to 5m high exhibit low amplitude cross bedding indicative of deposition in a sand bed river probably under a braiding regime. The basal gravels recorded at the site by Rice (1981) are currently hidden by an infill of Mercia Mudstone preparing the bottom of the quarry for landfill, but fine pebbles of quartz and quartzite, and angular fragments of carbonaceous shale and coal occur in the basal layers of the sand units. The top of the section has up to 6 m of glacial till, predominantly composed of red/brown Mercia Mudstone fragments but also with pockets of chalky and flinty Oadby Till facies. No archaeology has so far been found in the Baginton Formation at Huncote despite the clear indication that it is the downstream equivalent of the exposures at Waverley Wood, although the occurrence of tusk and tooth fragments of straight-tusked elephant (*Palaeoloxodon antiquus*) recovered from Huncote in the 1980s also serve to make a correlation with the abundant elephant fossils found at the latter site.

Quaternary and Palaeolithic potential: High (but site shortly to be used for landfill)

Figure 14: The extensive working face of Huncote Quarry, Leicestershire.



Key to section:

1. Oadby till of the Anglian glaciation.
2. Baginton sands of the pre-Anglian River system.

Worcestershire

The focus of gravel extraction in Worcestershire is wholly along the valley of the Severn. Four working pits currently lie along the Severn, at Clifton, Holt Heath, Ripple and Ryall, all close to Worcester. The Severn terraces are heavily influenced by outwash from the Irish Sea ice channelled through the Ironbridge Gorge (Maddy *et al* 1995). The most northerly of the four pits, Holt Heath, has abundant evidence of the sediments' origin in the form of far-travelled erratics from Scottish sources, the more southerly sites at Ryall and Clifton although having much non-local material also have the geometry and local lithological content of true river terraces. The Severn deposits have a high quartzite content and little limestone, so are a hostile habitat for fossil preservation.

Holt Heath (SO 829 260)

The large pits around Holt Heath are situated at the downstream end of the Ironbridge Gorge (Dawson 1989). This feature is a product of the glacial diversion of the Severn, probably during Devensian (MIS 2) times, although some evidence exists (Maddy *et al* 1995) for a glaciation in MIS 6 in the area which may also have excavated the valley. Prior to the glacial excavation of the gorge, the Lower Severn was part of a "Greater Avon" system developed from Late Anglian times (Keen 1999). The deposits at Holt Heath are wholly atypical of river terrace sediments in the area being up to 7 m thick and consisting of coarse gravels with occasional boulders within them indicative of very high water flow rates probably with ice rafting. Maddy (*et al* 1995) record an igneous pebble content for the gravels of 14.33 % strongly suggesting a derivation from Irish Sea ice sources via the Ironbridge Gorge. The lithologies of these igneous pebbles include granites from Southern Uplands sources confirming an Irish Sea origin. The outwash origin of the Holt Heath gravels precludes any fossil or archaeological content, although the Holt Heath Formation can also be traced into the tributary valleys of the Severn below Holt Heath and here organic deposits indicative of interglacial and cold stage conditions sometimes occur (Maddy *et al* 1995).

Quaternary and Palaeolithic potential: Very low

Clifton (SO 841 466)

The pit complex at Clifton is also in the Holt Heath Member (Maddy *et al* 1995), and although 24 km down stream of the type-locality, exhibits the same suite of pebble types indicative of an origin as outwash from the Irish Sea ice. The igneous content is down to 5.20% (Maddy *et al* 1995) but Scottish granites are still clearly present. The gravels are also thinner, about 4 m thick, and much more typical of the sort of thickness found in river terrace deposits of the Avon. The basal levels at Clifton contain sub-angular blocks of Carboniferous Sandstone as well as occasional cobbles of igneous rocks, but the sedimentary structures in the sections are indicative of gravel bar development under a slower flowing regime than that of Holt Heath. Individual fining-up sequences of bar gravels and bar top sands can be seen in the sections and the top of the sequence is capped by channels *circa* 150 m wide filled with muddy sand probably of Holocene age. The gravel units are still of cold climate origin and

deposited under braided stream conditions, but far down stream of the constraining walls of the Severn Gorge at Holt Heath.

Quaternary and Palaeolithic potential: Very low

Ripple (SO 871 370)

A quarry that remains as yet unopened, although preliminary excavations close to the River Severn show something of the nature of the sediments. The deposits seen consist of approximately 2 – 3 metres of Holocene alluvial sands and muds underlain by the gravels of the Power House Terrace (Terrace 1). Because of the water level in the excavation, only the top of these gravels could be seen giving little indication of their character or content.

Quaternary and Palaeolithic potential: Very low

Ryall (SO 866 392)

The sections at Ryall are small and degraded. The exposures that remain are of fine gravel and sand possibly filling a channel feature, although its geometry is uncertain due to poor exposure. The fine gravel and lack of large scale bar bed-forms indicates that the deposits were deposited by moderate water flow and are not the product of a braided periglacial system, but could be of Holocene age.

Quaternary and Palaeolithic potential: Very low

Summary and other areas of potential

Because of the partial coverage of the Midlands by working gravel pits the chance of significant finds in any one year is not high. However, areas of potential for Palaeolithic and evidence for Quaternary environment discoveries are clearly indicated by the present survey. The areas to the north and west of the region under study (most of Herefordshire, Shropshire and the NW part of Staffordshire) are those of the lowest potential. These areas are within the limits of the ice of the Devensian glaciation thus any deposits of earlier stages are likely to have been destroyed or masked during this ice advance and with them any Palaeolithic or Quaternary fossil material they may have contained. The outwash from the Irish Sea ice down the Ironbridge Gorge and its deposition at the southern end of the gorge as the Holt Heath Member (formerly the Severn Main Terrace of Wills 1938) has had a similar effect of destroying any pre-existing Quaternary or Palaeolithic sites older than that of the Dimlington Stadial glaciation in MIS 2. Some Quaternary environmental data has come from the Power House Member which is younger than the Holt Heath Member, and dated to the Lateglacial with radiocarbon ages *circa* 12,570 (Shotton & Coope 1983). In tributary valleys sheltered from the direct action of the flood of Irish Sea outwash, fossil-bearing sites of MIS 3 age have been recorded (Coope *et al* 1961; Maddy *et al* 1995) that give both evidence for the environment of this period and the potential of Middle and Upper Palaeolithic finds.

The areas which have a greater potential for discoveries of Palaeolithic material and associated Quaternary environmental data are those outside the limits of the Devensian ice. Accounts of Palaeolithic finds in these areas (see below) have been complicated by the use until recently of the stratigraphic scheme devised by Tomlinson (1925) and Shotton (1953) for the Avon Valley and later widely applied across the area. As has been pointed out from a number of lines of evidence over the last 20 years (Rose 1987; Maddy *et al* 1991; Keen 1999) this paradigm of the Quaternary formation of the West Midlands landscape applied a timescale too short for the number of events recognised. Thus finds of Palaeolithic material were often associated with a timescale and Quaternary events which would not now be recognised as realistic.

With this need to review Quaternary events in the light of modern views of the succession, the major potential for continuing work on the Palaeolithic and Quaternary of the area lies in the Bytham River corridor between Stratford-upon-Avon and the Soar Valley N of Leicester as far as Brooksby, the Colwall/ Mathon valley immediately W of the Malverns, the valleys of the Avon and its tributaries (especially the Carrant Brook, Arrow, Alne and Stour), and the Tame and Trent valleys. All of these area have been or are significant areas of aggregate extraction and systematic monitoring any new pits over their development stands a very good chance of finding sites of the importance of Waverley Wood.

Bytham River Corridor

Because this former river course (Fig 7) was destroyed by the Anglian glaciation and covered by a range of sediments of glacial age and also by the terraces of the Avon deposited in the new SW flowing drainage formed after the retreat of the ice, sections

are rare. The high quality aggregate from sites such as Waverley Wood and Huncote have made the deep excavations necessary to expose the sediments worthwhile commercially and also allowed the examination of some of the oldest Quaternary sediments in our region with their contained Palaeolithic tools. The clear dating of these tools to a pre-Anglian Interglacial because they come from the Baginton Formation which underlies the earliest Anglian Till, makes sites in the Bytham corridor of international importance because of their early date and the clarity of the dating. The monitoring of any excavations in the Baginton Formation is thus very important. The planned quarry at Brooksby in the Baginton Formation north of Leicester has already produced environmental data from its initial test boreholes and an unprovenanced handaxe from the valley side (Graf 2002). If this quarry is opened as planned the potential for further Palaeolithic and Quaternary discoveries is high. Deposits attributed to the Baginton formation at Baginton (the typesite – Shotton 1953) revealed a number of quartzite and flint handaxes (Shotton 1930; 1937) from interglacial deposits. Reanalysis of these finds (Lang 2004) indicates that these tools are also likely to derive from pre-Anglian deposits of the Baginton River corridor.

Colwall/Mathon Valley

This palaeovalley (Fig 7) follows the west side of the Malverns in Eastern Herefordshire. Although there is currently no aggregate extraction in the area former pits produced fossil evidence of sediments with an age in the Middle Pleistocene which may be similar to those of Waverley Wood (Barclay *et al.*, 1992; Coope *et al* 2002). If this age can be confirmed further discoveries of Palaeolithic material from the same early date as that at Waverley Wood cannot be ruled out. More environmental data would also help to confirm the age attribution by Barclay *et al.* (see also discussion in Maddy, 1999). Further evidence of the Mathon valley fluvial system has been traced into Northeast Herefordshire outside the limit of the last glaciation (Richards 1998) although there is little chance of gravel extraction taking place in this region.

Avon Valley

Notable clusters of Palaeolithic material has come from the tributaries of the Avon system rather than the main valley, although sites providing Quaternary fossil material have mostly been in the terraces of the main river (Maddy *et al* 1991, De Rouffignac *et al* 1995). The greatest potential for Lower Palaeolithic finds in the Avon system lies in the higher terraces, particularly in the former Terrace 5 (Pershore Member of Maddy, 1999) and Terrace 4 (Cropthorne Member) dated to the interglacials in MIS 9 and 7 (Maddy *et al* 1991). Terrace 3 (New Inn Member), dated to MIS 5e should not contain any Palaeolithic material if the postulated gap in the Palaeolithic settlement of Britain between MIS 7 and early in MIS 4 (White & Schreve 2000; Aston & Lewis 2002) is correct. Handaxes reworked from earlier terraces could possibly be found in MIS 5e deposits, a possible source also for the quartzite handaxes found in association with the low terraces of the Carrant Brook. Around the headwaters of the Avon reworking of Palaeolithic tools from the deposits of the Bytham River is also not impossible as significant thicknesses of the Baginton Formation exist below terrace flats and deposits formed by the post-Anglian development of the landscape. Such a juxtaposition occurs around Brandon, E of Coventry (Maddy *et al* 1994) where the sediments of the Cropthorne Member rest directly on the sands and gravels of the

Baginton Formation. The terrace deposits have produced at least one handaxe closely similar in form and material (andesitic ash) to those found below the Baginton Formation at Waverley Wood only 8 km to the SW (Fennell & Shotton 1977). The cluster of handaxes of fine grained igneous material from the area around Wolvey on the NE side of Coventry found by Mr R. Waite may also be ultimately derived from the Baginton Formation as Avon Terraces also directly overlie the earlier formation in this area.

Tame and Trent Valleys

The extensive spreads of gravel with their large pit complexes which floor the Tame and Trent Valleys were laid down under cold climate conditions during the last glacial stage. Arctic landscapes are not highly productive of fossil material or capable of providing the resources for extensive exploitation by Palaeolithic humans. However, the lack of a direct contribution of glacial outwash to these two valleys has provided a more productive source of Quaternary fossil material than the Severn Valley or the areas in Shropshire and Herefordshire within the ice limits of the last glaciation. The finds of woolly rhinoceros (*Coelodonta antiquitatis*) at Whitemoor Haye and the radiocarbon dated insect sequences from Coleshill (Coope & Sands. 1966) suggest deposition of the Tame/Trent gravels over a long period of the middle of the Devensian Glaciation during the crucial time when Neanderthal cultures were being replaced by those of early modern humans. Although no finds have so far been made in the area of tools associated with either group the extensive quarrying and recent finds of fossil material gives considerable promise of significant archaeological finds if workings are regularly monitored.

This survey of the West Midlands has clearly demonstrated the area of potentially for further work on the Palaeolithic of the area and highlighted the potential for new studies on the Quaternary geology which can give valuable data on the environment of early humans in the area. The new framework for the stratigraphy of the Quaternary of the West Midlands worked out since 1987 now allows a reappraisal of the Palaeolithic record and the placing of new discoveries in a robust time sequence for the first time for half a century.

Part 3:

Mapping and Analysis of Palaeolithic deposits in Worcestershire. A GIS model for developing a Palaeolithic HER.

A.T.O. Lang (Birmingham University)
&

N. J. Lockett (Worcestershire County Council)

The collaboration between Worcestershire County Council Historic Environment and Archaeology Service and the Shotton Project has demonstrated how disparate data sources, of varying quality, can be developed using GIS, to create a flexible and sophisticated management, research and education resource.

The data from Worcestershire has been collected over more than 25 years, with little thought to database structure, or standards for data presentation. What is now the Historic Environment Record started as a card index in 1974 and, in common with most other English SMRs, developed as a planning control, not a research tool. Because of this it focused on site specific data with no acknowledgement of landscape and little or no interpretative elements.

Worcestershire covers 172,000 hectares. The 15,500 records and 6000 sources document a great variety of information types including statutory archaeological constraints, monuments, archaeological interventions, historic buildings and other data sets. This information has been gathered by large numbers of archaeologists, antiquarians and others. There is, therefore, no consistency of data capture.

In addition to this the record is skewed, with areas that attracted antiquarian interest or modern development having a high density of records and other parts of the county being almost blank. All the data is currently mapped on one layer.

It has been said that you cannot protect what you don't understand. Worcestershire HER is in the process of developing a new system to maximise the knowledge we have and create a platform upon which new understanding can develop.

Any new system must:

1. enable us to more effectively promote and protect the Historic Environment
2. provide a wide range of users with easy access to high quality data
3. promote partnership projects.

The new HER provides a framework which will interact with other County wide information resources. These include information held centrally on the natural environment, library resources, details of collections and archives held by museums and documentary resources held within the County Record Office.

The Historic Environment record system will be based on a modular concept. This fundamentally alters our perception of large-scale record management systems.

The Shotton project, focussing on the Quaternary and Palaeolithic record of the West Midlands region offered an opportunity for Worcestershire HER to develop a further aspect of the new HER: that of interpretative models of historic landscapes. These are flexible spatial and temporal models which, by their nature are:

1. subjective and are based on a point of time interpretation
2. The models are not didactic and a number of interpretations can exist at the same time.
3. Coverages can be created where there is little or no data through predictive modelling.

The purpose of these themes is to provide models which can be tested and changed as fieldwork and synthesis is instigated and completed.

A collaborative project, The Shotton Project and Worcestershire HER

The development of a partnership between the two protagonists has taken place due to the need for a development of an integrated record for the Quaternary and Palaeolithic which does not currently exist in Britain. The results of the joint project are mutually beneficial to both sides. The Shotton Project has a long lasting influence on decisions concerning the Palaeolithic in Worcestershire, whilst the HER has the use of specialists who can provide specialist input into the record and thus help to make the Quaternary and Palaeolithic more accessible.

For the Shotton Project two main sets of data were determined as best suited for the enhancement of extant records and the creation of a Lower Palaeolithic interpretative theme within the GIS. These were

- Traditional heritage data sets
- Non-heritage data

The first is the information supplied by the SMR/HER Office. From a Palaeolithic perspective this included all finds between a certain date range (500,000 – 10,001 BC), defined as the Palaeolithic on the HER. All records of this type will be of sites or finds reported to the County record office.

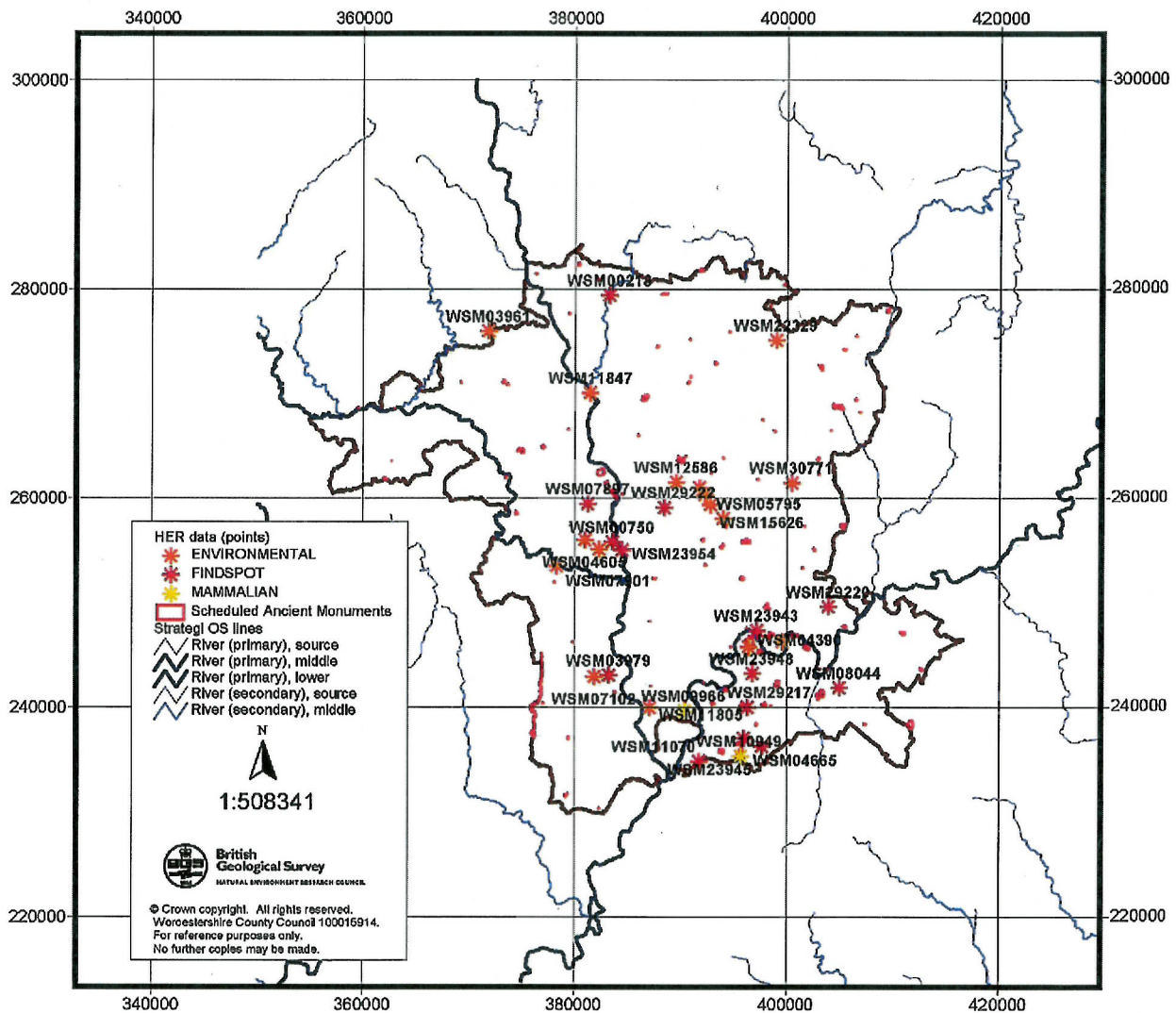


Figure 15: The HER data recorded by the County record office for the Palaeolithic.

The second 'non-heritage data' constituted geological mapping purchased under license from the BGS (British Geological Survey) which provided the key data from which a Quaternary record could be developed. These maps are the digital version of the 1:50,000 sheet geological maps, for which the county has complete coverage (although it must be pointed out this is an exception and most County SMRs and HERs do not have access to such information and simply cannot afford the licences).

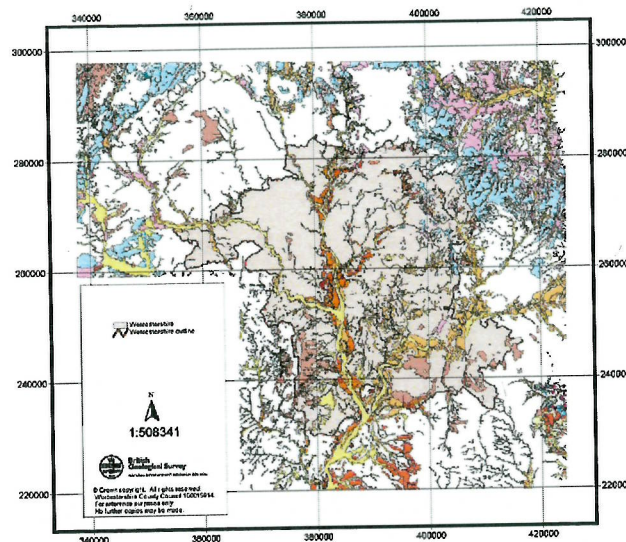


Figure 16: The Quaternary geology of Worcestershire

Methodology: Creating a Palaeolithic and Quaternary HER in Worcestershire.

There are ten 1:50,000 digital maps covering Worcestershire. The first task therefore was to merge the drift geology from the different maps into a single County-wide GIS theme. The resultant theme contained 5189 individual features assigned by the BGS for Worcestershire. These features were reprocessed into 77 class groups based on the BGS lexicon description field.

This process was facilitated through the use of a number of literary sources and identifying similarities within the various map sheets. The first logical step was to identify the same BGS lexicon terms and match them.

Example. Each sheet would have terrace records for the River systems that run through Worcestershire, therefore all terrace records and rivers systems could be matched throughout the County. This process meant all terraces of the Severn and Midland Avon rivers were processed to cover all the sheets as each individual terrace feature. This was narrowed down as much as possible, however some features remain undefined or cover more than one feature (for example terrace deposits that remain undated due to a lack of identifiable features within the deposits when studied by BGS).

At this stage a project-specific GIS theme was created.

Whilst this process was being undertaken, a literature study provided a background to current geological interpretation of the Midlands. This research was covered by two sources, firstly the BGS Memoirs: books written to go with the drift geological sheets alongside interpretative discussions on the geology. These range in publication date from 1962 – 2003 (see geological memoirs at the end of this assessment). Furthermore, geological correlations for the Quaternary have been recently produced by the Geological Society and were used as the mainstay (and the second source) for correlations, formations and terrace sequences for the County (Bowen 1999).

From the various literature sources stated above, the process was started in classifying all the individual features in various groups that were identified in the literature search. The main classificatory markers were:

- Lexicon name.
- Formation name.

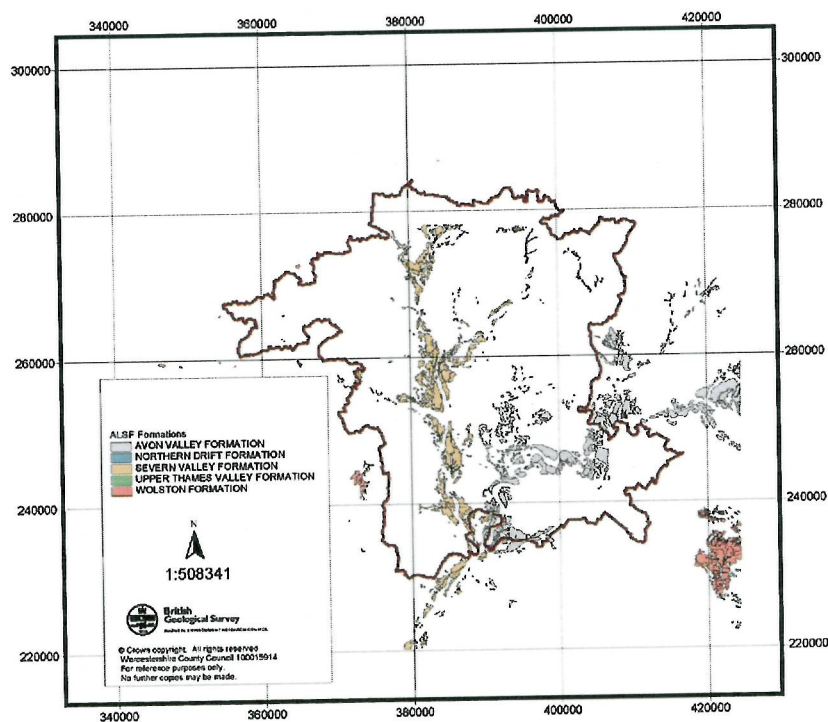


Figure 18: Formations attributed to the Quaternary geology of Worcestershire

-

-
- ALP Members**
- ▲LESTON MEMBER
 - ▲WILLOW MEMBER
 - ▲BURNLEY GREEN MEMBER
 - ▲COARSE MEMBER
 - ▲DAY LEECH MEMBER
 - ▲FRIELAND MEMBER
 - ▲HOLT HEATH MEMBER
 - ▲KIDDERMINSTER STATION MEMBER
 - ▲NORTHTON MEMBER
 - ▲NEWBY MEMBER
 - ▲PIN FINE GRIND MEMBER
 - ▲POULSHORE MEMBER
 - ▲PORTER HOUSE MEMBER
 - ▲SPINNEY HILL MEMBER
 - ▲UNIVERSITY MEMBER
 - ▲WOLFORD HEATH MEMBER
 - ▲WOOD ROUSE MEMBER
 - ▲WORCESTER MEMBER
- N
1:508341
- British Geological Survey**
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- Date range.
- Minimum Date.
- Maximum Date.
- Marine Oxygen Isotope Stage.
- Period.

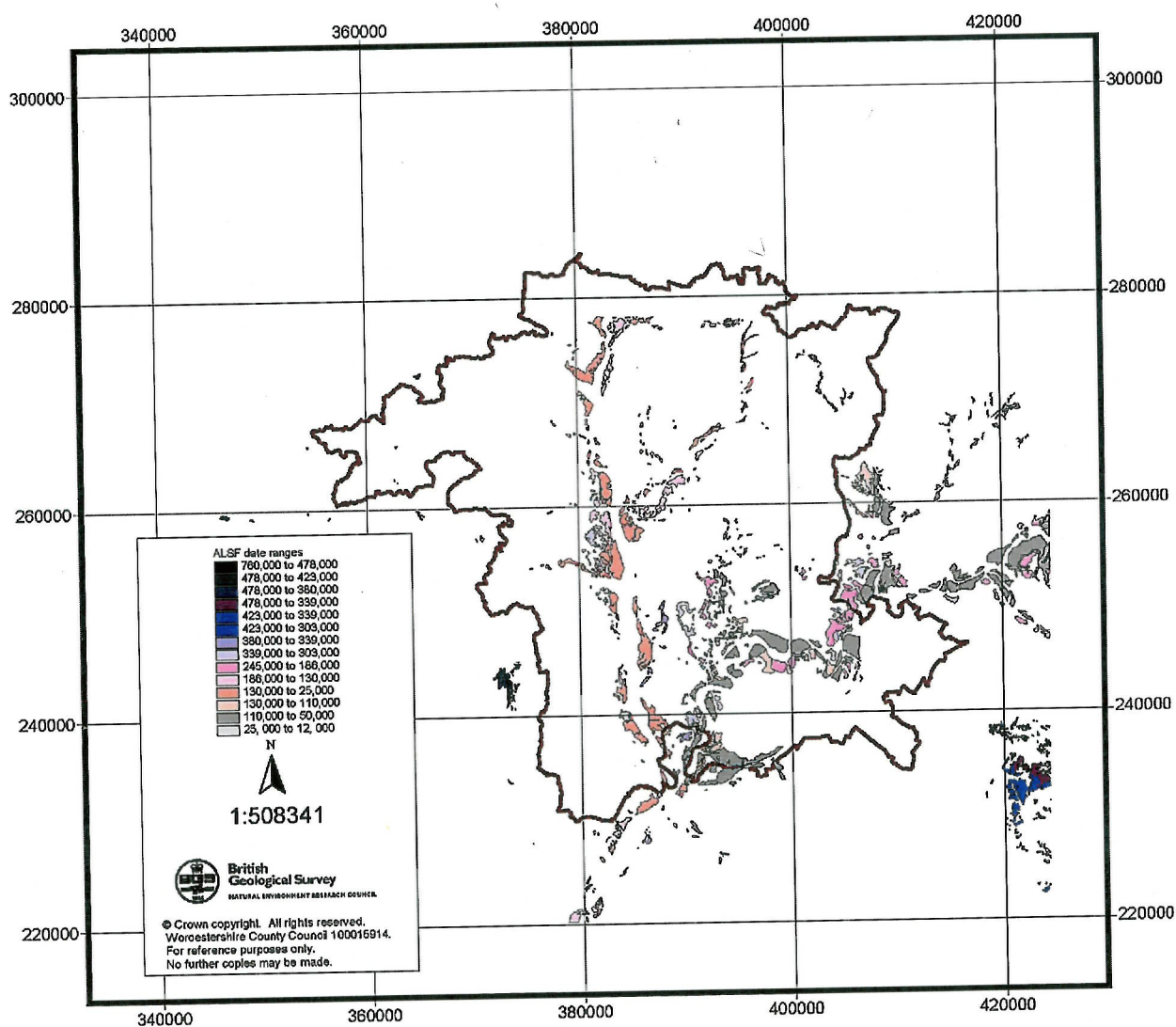


Figure 20: Date ranges of the Worcestershire Quaternary geology.

The information for each pertinent drift geological deposit was added to the GIS theme so that each individual formation could be identified either on its own or as part of one of a number of groupings, depending on the information required when submitting a query.

Once all of these terms had been established, it was possible to set up a query based system within GIS where different queries could be put forward depending on what was being asked of the digital maps.

To clarify the importance of the Quaternary aspects of this HER record, it was decided that type sites would be included for the different members put forward by the geological correlations. These were taken from the Maddy (*et al* 1999) paper within the edited Bowen volume. It is of suitable interest to point out that these type sites provide important information on date ranges and evidence of vertebrates and invertebrates through organic deposits (defined here as beds, often below related members). Only one of the type sites used here had archaeological material within associated contexts. By definition therefore, this case has proved the importance of using non-heritage data sets to make a more complete Palaeolithic and Quaternary HER, by its use of the digital BGS maps and Geological correlations to give a far greater, more well rounded history of drift geology in Worcestershire.

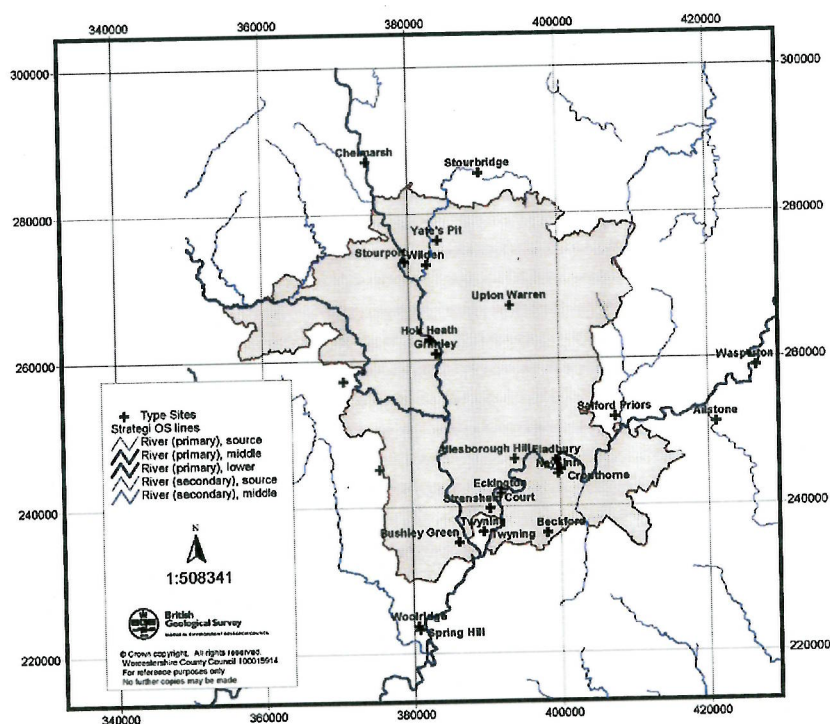


Figure 21: Type sites selected for the Worcestershire Palaeolithic HER.

Once the background had been established, it was possible to combine the work created above with the current Palaeolithic knowledge available through the current HER. Information from the enhanced drift geology coverage was linked to the HER data using a spatial join. This provided refined date ranges for many sites contained within the HER and also gave the specific terrace deposit and formation information which could be used to enhance the core HER data.

In addition, the creation of a single, county-wide coverage containing period and date-range information enabled this data-set to form the basis of a Palaeolithic interpretative model which can be incorporated into future planning advice. The layer can additionally form the basis of a testable model for the survival of deposits of this period within the county.

The partnership of the Shotton Project and Worcestershire Historic Environment and Archaeology Service has demonstrated a cost-effective method of producing a model of Palaeolithic survival within the county. Furthermore the results of the analysis have provided a framework for producing predictive models for inclusion within the Historic Environment Record.

Overall, the project has shown that this type of analysis of the Historic Environment requires a detailed understanding of all data sources, both strength and weaknesses together with a knowledgeable multidisciplinary team.

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