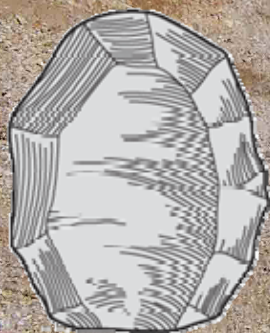


# THE LOWER AND MIDDLE PALAEOLITHIC OF CAMBRIDGESHIRE



An introduction to the work of  
**THE FENLAND RIVERS OF CAMBRIDGESHIRE  
PALAEOLITHIC PROJECT**



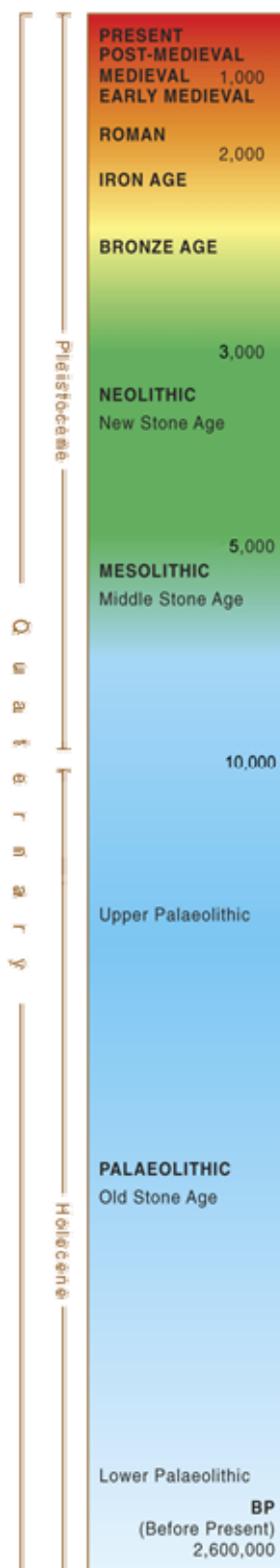
# INTRODUCTION

The **Palaeolithic** or ‘old stone age’ (from the Greek *palaeos* – old + *lithos* – stone) is the earliest archaeological period. In Britain, the Palaeolithic spans the time from the earliest human occupation, at present thought to be *c.*750,000 years ago, until the end of the last ice age *c.*10,000 years ago. Unlike later archaeological periods, evidence from Palaeolithic sites often only consists of concentrations of stone tools preserved within ancient silts, sands and gravels. The skeletal remains of ancient humans are very rarely preserved, with only small fragments of bone and teeth recovered from a handful of British Palaeolithic sites. In order to understand more about the human populations that lived in Britain and produced these artefacts, Palaeolithic archaeologists combine many strands of evidence to reconstruct the landscape, climate and ecology of the past.

Palaeolithic archaeology is an aspect of **Quaternary science**, the interdisciplinary study of the Quaternary geological period (often referred to as ‘the Ice Age’) which spans the last 2.6 million years. Quaternary scientists include geologists, archaeologists, soil scientists, palaeontologists and climatologists, as well as specialists in scientific dating techniques. All of these sources of evidence can be combined in various ways to reconstruct past environments and the climatic changes that have occurred at regular intervals during the Quaternary. The Quaternary period is subdivided into two **epochs**; the **Pleistocene** (2.6 million – *c.*10,000 years ago) and the **Holocene** (*c.*10,000 years ago – present).



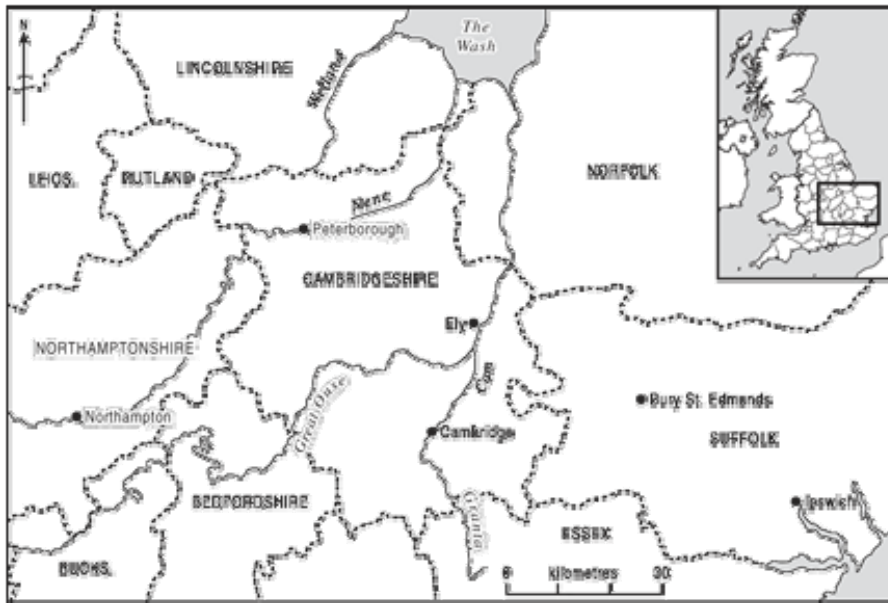
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# THE FENLAND RIVERS OF CAMBRIDGESHIRE PALAEOLITHIC PROJECT

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The modern county of Cambridgeshire falls between two areas with strikingly different records of early human occupation. To the north and west are the East Midlands, where Palaeolithic archaeology is relatively rare and poorly understood; to the south and east lies East Anglia, one of the richest Palaeolithic landscapes in Europe, which includes the site of Pakefield where the oldest known human evidence anywhere in Northern Europe was recently discovered. Cambridgeshire itself has produced a diverse Palaeolithic record dating back *c.*500,000 years and is an important area for researchers interested in linking the archaeological and geological records in the Midlands and East Anglia.



Compared to its neighbouring counties of Suffolk and Norfolk, however, Cambridgeshire has received little attention from researchers in recent years. The **Fenland Rivers of Cambridgeshire Palaeolithic Project (FRCPP)** was therefore initiated in 2007 as a short research project to examine the Palaeolithic and Quaternary evidence from the county. The FRCPP was funded by the Aggregates Levy Sustainability Fund (ALSF) as a collaborative project between the University of Durham, Cambridgeshire County Council and the University of Cambridge.

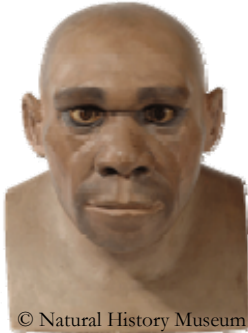
The FRCPP had two main interests:

- the collections of Lower and Middle Palaeolithic stone tools held by various museums and private collectors
- the ancient deposits of the major rivers flowing across the Cambridgeshire Fenland towards the Wash (the Great Ouse and Nene, as well as important tributaries such as the Cam) from which most of these artefacts were recovered.

The sands and gravels deposited by rivers are an important economic resource and are intensively quarried throughout Cambridgeshire. They are also the source of most of the evidence for Palaeolithic settlement and Quaternary climate. An important aspect of the project was therefore to provide as much information as possible about the potential for Palaeolithic and Quaternary material to be preserved with gravel deposits, so that planners can advise quarrying companies.

The Palaeolithic falls entirely within the Pleistocene epoch and in Britain is also divided, on the basis of changes in the technology and form of stone tools, into three smaller sub-periods:

The **Upper Palaeolithic**, c.35,000 – 10,000 years ago (generally associated with modern humans, *Homo sapiens*, right)

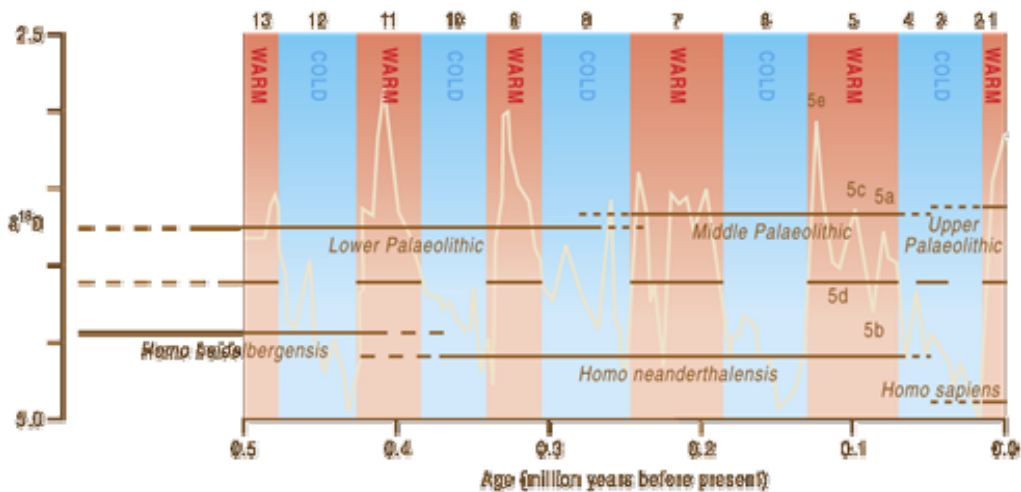


The **Middle Palaeolithic**, c.300,000 – 35,000 years ago (generally associated with the Neanderthals, *Homo neanderthalensis*, left)

The **Lower Palaeolithic**, c.750,000 – 300,000 years ago (generally associated with the archaic human species *Homo heidelbergensis*, right)



There is evidence of human occupation in Britain during all three periods, but the populations were small and occupation was not continuous. The climate has fluctuated throughout the Quaternary between warm temperate periods similar to the present and extremely cold periods when ice sheets covered the land. Humans abandoned Britain for warmer parts of mainland Europe during the cold extremes, returning as the climate returned to more favourable warm conditions.



# PALAEOLITHIC RESEARCH IN CAMBRIDGESHIRE: A BRIEF HISTORY

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During the nineteenth century, the disciplines of archaeology and geology were very new and knowledge about the history of the Earth that is now taken for granted was unavailable to early researchers. The evolutionary ideas of Charles Darwin had also not long taken root, meaning that many scholars tried to include a theological aspect in their geological and archaeological theories. For example, the Great Flood of the Old Testament was often thought to be responsible for washing the bones of exotic animals (such as hyena, lion and hippo) that now live only in warmer countries into British deposits.

In the late nineteenth century, suggestions that a flood was responsible for Quaternary deposits were abandoned by most scholars in favour of an Ice Age. This coincided with a widespread acceptance that Palaeolithic stone tools were indeed extremely old (another difficult adjustment to make for a society used to Creationism) and were connected with the Ice Age sediments. The study of the Palaeolithic has therefore been closely linked to the study of

Quaternary geological systems.

The original geological survey of the Cambridge district was made in 1881 and identified glacial deposits, ancient river gravels, modern river gravels and peat deposits among others. The first artefact to be found in the county was discovered on a gravel heap by the geologist William Whitaker in 1862 and given to the great archaeologist Sir John Evans. Another early find was made by Mr. A. F. Griffith in 1878 at Barnwell, where the remains of elephant, rhinoceros and hippopotamus had been found a few years earlier.

Because Palaeolithic sites are relatively rare, Quaternary scientists and Palaeolithic archaeologists still make considerable use of collections of stone tools and animal bones made many decades ago. The work of early researchers is therefore invaluable. There have been a number of influential scholars and antiquarian researchers, many from the University of Cambridge, who have contributed significantly to Palaeolithic research in Cambridgeshire and who are briefly mentioned here:

## **Professor Thomas McKenny Hughes and Mary Caroline McKenny Hughes**

Thomas McKenny Hughes worked for the Geological Survey between 1861-73 before succeeding Adam Sedgwick as Woodwardian Professor of Geology at Cambridge in 1873, an office he held until 1917. He wrote more than fifty research publications, many relating to glacial and post-glacial phenomena and deposits. His most important research was done while he was working for the Geological Survey and in the few years following his appointment at Cambridge, after which his professorial duties absorbed most of his time. Hughes stimulated a lot of interest in geology as he was an excellent lecturer and was very popular with both students and senior members of the university.



His wife, Mary Caroline (her Christian names were usually omitted from her publications, which identify her as simply 'Mrs. McKenny Hughes'), was also interested in Quaternary deposits and archaeology, and published several papers on sites in Cambridgeshire in the late 19th and early 20th centuries. The most important site studied by Prof. and Mrs. McKenny Hughes was Grantchester, where an extremely rich assemblage of Pleistocene molluscs was discovered in an interglacial deposit revealed by coprolite digging.



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## Professor John Edward Marr



John Edward Marr (1857-1933) was another highly respected geologist from Cambridge who worked on the local Quaternary deposits. He succeeded Thomas McKenny Hughes as Woodwardian Professor in 1917, a position he held until 1930. He was particularly interested in the effects of earth movements and glaciation on topography and scenery, considering their roles in the formation of lakes and drainage patterns. In his later years, Marr turned his attention towards prehistoric archaeology, studying the Pleistocene deposits in the neighbourhood of Cambridge, and examining the claims for the existence of flint implements of Pliocene age.

## Miles C. Burkitt

Miles Crawford Burkitt (1890-1971) was a student of the famous French Palaeolithic archaeologist, the Abbé Henri Breuil, and explored prehistoric sites in France and Spain with both Breuil and Dr Hugo Obermaier, another eminent early prehistorian. Burkitt lectured in Cambridge on prehistoric archaeology, at first on a voluntarily basis, then officially with a salary of £10 a year, and finally as a university lecturer in the Faculty of Archaeology and Anthropology. He also conducted fieldwork around Cambridgeshire, notably at the famous Traveller's Rest Pit site and at Babraham Park. Burkitt travelled widely and published a number books and articles on the Stone Age and prehistoric art around the world.



## G. Wyman Abbott

Wyman Abbott was a Peterborough solicitor with an interest in many aspects of prehistory and was an active collector of Palaeolithic artefacts during the 1920s. He conducted fieldwork at gravel pits and brick pits in Fletton, Woodston and Whittlesey and collected a large number of Lower and Middle Palaeolithic stone tools. The material collected from the pits around Woodston is particularly interesting as it contains a number of Levallois cores and flakes. Abbott's interests lay mainly with later prehistoric periods, however, and few of his notebooks and letters refer to the Palaeolithic finds. This has meant that much of the material held by museums is difficult to interpret, as there is no contextual data to accompany them and the precise pits and levels from which they were recovered are unknown.

Despite the problems with interpretation, the Wyman Abbott collections from the Peterborough district remain the most comprehensive Palaeolithic record for the river Nene deposits in Cambridgeshire.

Left: Levallois flake collected by G. Wyman Abbott from a gravel pit in Woodston, Peterborough (Peterborough Museum Collection).

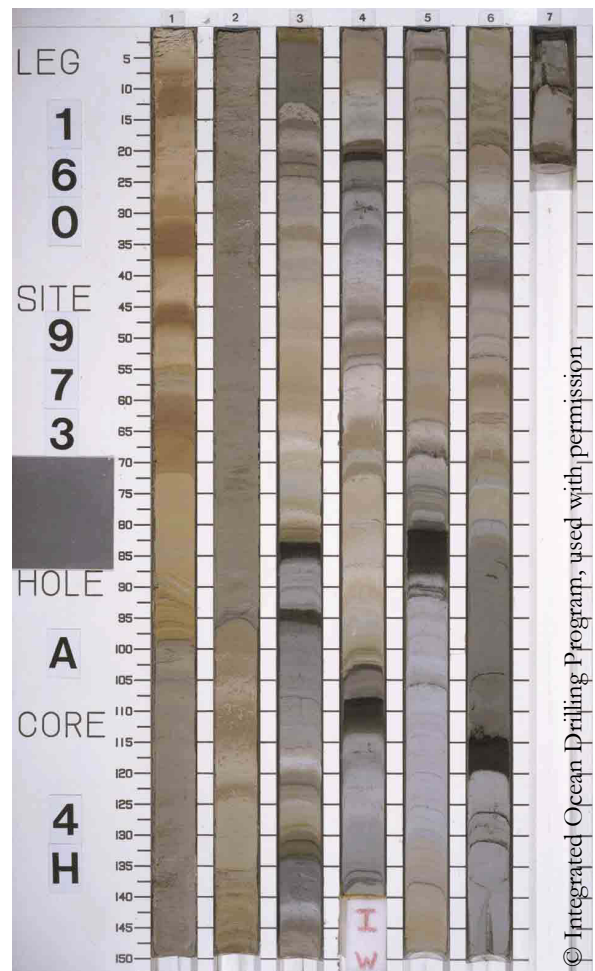
## THE QUATERNARY PERIOD

Although often referred to as simply ‘the Ice Age’, the Pleistocene was not a continuous period of extreme cold. There have in fact been many ‘ice ages’, known as **glacials**, separated by periods of warm climate called **interglacials**. The Holocene, in which we are living at present, is in fact the most recent interglacial. The alternating glacial-interglacial cycle is controlled by variations in the Earth’s orbit around the sun and the tilt of its axis. If the global warming caused by human activities does not permanently alter the natural chemical balance of the atmosphere, the world should begin to enter another glacial period a few thousand years in the future.

Unravelling the geological record has been likened to doing a jigsaw puzzle with most of the pieces missing. This is particularly true for the Quaternary, as every time an ice sheet advanced across the landscape during the intense cold of a glacial, earlier records were mostly destroyed. Piecing together the information on the past climates of the Quaternary is far from straightforward, as the evidence that survives on land is now very fragmentary.

Since the 1950s, scientists have been able to reconstruct a more complex history of Quaternary climate change by examining the information contained within sediments drilled from the ocean floors (right). These sediments have accumulated continuously and can fill gaps in the fragmentary records on land. This is possible because the proportion of different **isotopes** of oxygen in seawater varies according to climate or, more precisely, according to the amount of ice that exists on the planet. Water evaporating from the oceans contains more of the lighter oxygen isotope (O16), which means that the same is true of ice (the snow and rain that go to make up ice sheets come from the evaporation of sea water); the oceans therefore

contain a higher proportion of the heavier isotope (O18) during glacials when large ice sheets exist.



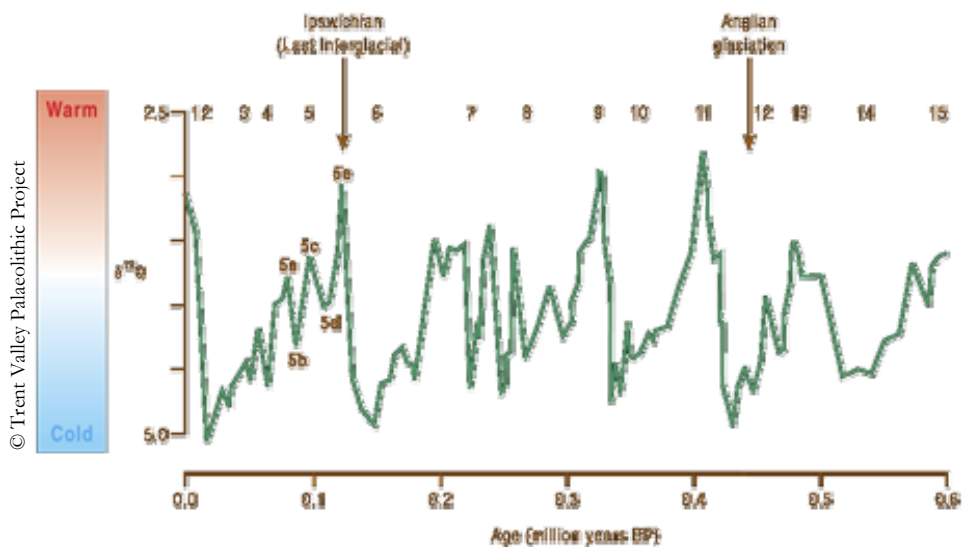
These variations are recorded in the shells of tiny single-celled animals called **foraminifera**, which take oxygen into their shells from the sea-water in which they live. By analysing the ratios of the isotopes in these shells within different layers of ocean sediments, the amount of global ice can be calculated for different periods of the Quaternary. From these types of record, around five glacial-interglacial climatic cycles have been recognized within the last half million years, each cycle lasting about 100,000 years. The warm interglacial part of each cycle only accounts for about 10 – 20,000 years of this time.

Recently these ocean records have been supplemented by evidence from the ice sheets of Greenland and Antarctica, which have accumulated in layers just like sediments. The lowest and oldest ice layers, sampled by drilling and retrieving ice cores, provide a history that extends back over half a million years. Like ocean sediments, ice cores also show oxygen isotope variations, as well as containing air bubbles that represent tiny samples of the atmosphere at the time of ice formation. From these we know that the carbon dioxide content of the air has varied naturally in the past before modern human actions caused it to increase alarmingly.

The result of this research has been the **oxygen isotope curve**. This illustrates the record of cold and warm climate conditions throughout the Quaternary, and provides a way of comparing the age of sediments on a global scale. The curve is divided into a series of stages, each of which is numbered; each glacial period is assigned an even number, and each interglacial an odd number. On land, the various glacial and interglacial periods are often referred to by a series of names, reflecting important local sites and sequences. One of the key developments of recent years has been the correlation of land and

ocean sequences. For example, the last interglacial, known in Britain as the **Ipswichian**, has been identified as equivalent to the early warm part of Oxygen Isotope Stage 5, sub-stage 5e (approximately 125,000 years ago). Ipswichian deposits can thus be compared to other MIS5e deposits throughout the world.

The build-up of huge ice-sheets during the most severe periods of glaciation also lowers sea level. Ice-sheets have covered northern Britain several times, even reaching as far south as the Thames Valley on one occasion (known as the **Anglian glaciation**) about half a million years ago. Global sea level would have been around 150 metres lower than present at the height of the Anglian glaciation, and Britain would not have been an island, as the shallow basins that are today the North Sea and the English Channel would have been dry land connecting it to mainland Europe. These 'land-bridges', as they are often referred to, were important routes for the migration of both humans and animals. Indeed, this was very much the normal Quaternary situation. Sea level was only high enough to separate Britain from the continental mainland during the very warmest periods, i.e. for less than 20% of Quaternary time.





## THE FORMATION OF SAND AND GRAVEL DEPOSITS

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Deposits of material formed by rivers are known as **fluvial** sediments. Some deposits are coarse sands and gravels, formed during colder periods when the rivers were more powerful; other deposits are fine sands and silts that were laid down when the climate was warmer and rivers sluggish. The dramatic changes in the characters rivers and the types of sediments they deposit are also controlled by climatic cycles.

As the climate began to warm after a glacial maximum, the huge quantities of water released from melting snow and ice (including **permafrost**) gave the river the ability to erode and transport vast quantities of material. Rivers flowing under these glacial conditions are known as **braided rivers**, and have many channels separated by islands of eroded gravels. Although the climate was warming, the temperatures were still very cold, and only a limited range of vegetation could survive. The landscape was therefore very bleak, consisting of wide expanses of gravel colonized by occasional mosses and hardy tundra plants. Braided river systems can be seen today in the glacial and **periglacial** landscapes of Iceland, Greenland, Alaska and the Canadian Arctic, which give an impression of how Cambridgeshire might have looked as recently as 13,000 years ago.



Above: fluvial sands and gravels at Needingworth Pit, Cambridgeshire.



Left: a typical braided river: the Tasman River (New Zealand) with Aoraki / Mount Cook in the background.



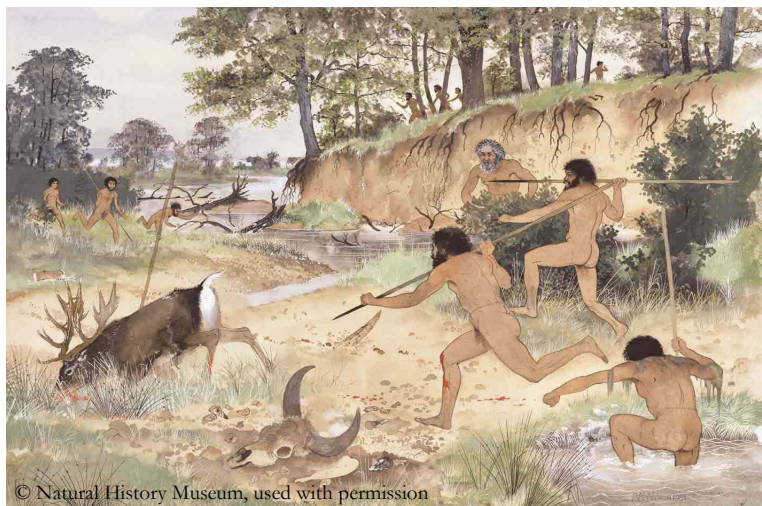
During interglacial periods, rivers were less powerful, usually flowing in single meandering channels. The valley-sides were stabilized by plant growth, and so coarser sediments were not as easily eroded and transported. Instead, interglacial rivers carried a combination of fine sands and silts, which were usually laid down in abandoned channel sections (cut-off **meanders**, known as **oxbow lakes**), or on the wider floodplain during times of flood. If preserved, these fine-grained interglacial elements of the Quaternary record often contain organic remains and fossils and can provide very detailed environmental information about the local environment. Records of this sort were often destroyed, however, by subsequent ice-sheet advances and erosion by the river in its higher-energy glacial form.



Above: a fine-grained organic deposit preserved in a Cambridgeshire gravel pit.

Patches of ancient fluvial sand and gravel deposits can be found scattered across Cambridgeshire. Their tops often form relatively flat surfaces known as **terraces**, which represent fragments of former valley floors. Rivers usually form terraces once in a 100,000 year cycle, although it is possible for two terraces to be formed. Changing climatic and geological conditions cause the river to erode into its valley floor (a process known as downcutting) and deposit large amounts of coarse fluvial sediment (a process known as aggradation). The older river deposits are therefore left 'high and dry' when the river deepens its valley. Repeated downcutting and aggradation events have created a 'staircase' of river terraces, fragments of the oldest being preserved at the top with each terrace becoming progressively younger until the present course of the river is reached. It is possible to group terrace fragments together by comparing features such as height above the current valley bottom, and the distinctive types of rocks contained within the gravels. Even if two patches of sediment are many miles apart, they can be matched to the same continuous river terrace. If sufficient fragments survive, the former floodplain can be mapped. The evolution of the river systems during the Quaternary, with minor and sometimes major course changes, can thus be pieced together.

The rich natural resources of interglacial river valleys made them extremely attractive to early human communities like the hunting group pictured to the right. However, although life may have been easier during interglacials, early humans were able to adapt to a variety of warm and cold conditions, probably only leaving Britain altogether when the climate was at its coldest.



© Natural History Museum, used with permission

## THE RIVERS OF CAMBRIDGESHIRE

All of the river valleys of Cambridgeshire have been cut into glacial sediments deposited by the Anglian glaciation and so all the river terraces are therefore younger than this event (i.e. less than 500,000 years old). The two major rivers, the Great Ouse and the Nene, rise on the Jurassic hills to the west of the county and flow roughly parallel to each other to the Wash. They have wide low-lying terraces and floodplains where they cross the Oxford Clay into the Fens. Here, the terraces become wide, delta-like fans. The lowest terrace deposits are covered with Fen clay or peat, but where they outcrop as 'gravel islands' they have been a major influence on the location of towns and villages. Large areas of Cambridgeshire are extremely low-lying and include Holme Fen, the UK's lowest physical point at 2.75 m (9 ft)

below sea-level. The Anglian glaciation is thought to have been responsible for cutting the huge estuary known as the Wash and excavating the lowland Fen Basin. At times of high sea level during the Quaternary the Fen Basin has therefore been a large embayment of the sea. Evidence of marine environments has been found far inland of the present coastline, such as the marine molluscs that are preserved in the gravel deposits around March. The highest point in the county is in the village of Great Chishill at 146 m/480 ft above sea level. Other prominent hills, such as the Gog Magog Downs, Rivey Hill and the Madingley Hills are capped with gravel deposited by older river systems, which has acted as armour against erosion. These hilltop gravel deposits are the oldest Pleistocene sediments in the county.

### MAJOR RIVERS OF CAMBRIDGESHIRE

#### Great Ouse

The Great Ouse is the largest river in Cambridgeshire and the 5th longest in England. The course of the river has been significantly modified since the 17th century, when the construction of the Old and New Bedford Rivers was undertaken in order to drain the Bedford Levels.

#### Cam

The River Cam is tributary of the Great Ouse and is about 40 miles (64km) long.

The two rivers join to the south of Ely at Pope's Corner. In earlier times the Cam was named the Granta, but after the name of the Anglo-Saxon town of Grantebrygge had been modified to Cambridge, the river was renamed to match. The two principal tributaries of the Cam are the Granta and the Rhee, though both are also officially (and confusingly) known as the Cam. Another minor tributary is the Bourn Brook, which has its source near the village of Eltisley 10 miles west of Cambridge, and flows east to join the Cam.

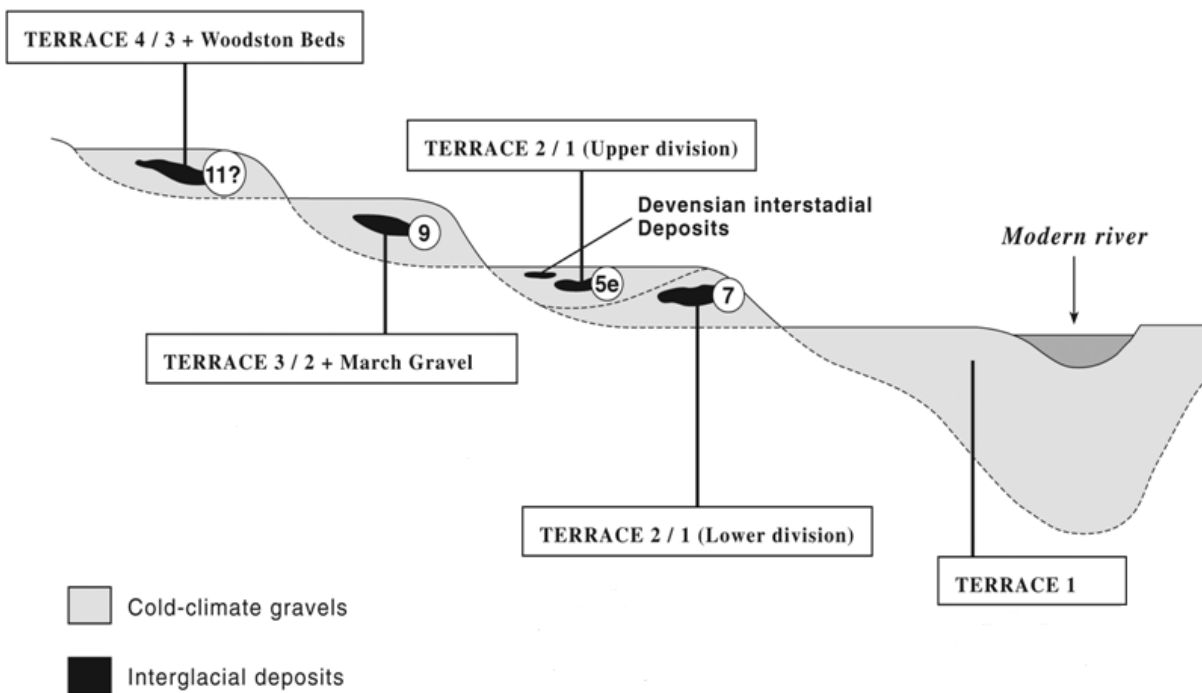
#### Nene

The River Nene flows for 91 miles (147 km) through Northamptonshire, Cambridgeshire and Lincolnshire. The Nene forms the border between Cambridgeshire and Norfolk for about six kilometres





The rivers of Cambridgeshire and the Fenland region present unique problems for Quaternary scientists. In contrast to the Thames and Severn-Avon, which have generally formed one terrace during each climatic cycle, the valleys of the rivers draining across Cambridgeshire into the Wash have a relatively low number of terraces. This is partly because their formation began only after the Anglian glaciation, but even allowing for their short history these rivers have condensed sequences. One explanation is that single terraces in the Wash rivers can sometimes span more than a single glacial-interglacial cycle. This is seen in the case of Terrace 1 of the River Welland and Terrace 2 of the River Cam, which are thought to correlate with one another, both spanning the last two glacial-interglacial cycles. The difference in numbering between the Welland and Cam has come about because different Geological Survey mappers have been responsible for each area, the Survey maps being the primary source of basic information on the extent and identity of terrace deposits. Thus the Nene and Welland sequences comprise three terraces, whereas the Cam-Ouse system has four. It is often not possible to distinguish higher (and therefore older) deposits, making interpretation of the sediments very difficult.



Above: suggested interpretation of the Cambridgeshire river terrace deposits, seen in idealized section (after Bridgland and Schreve, 2001)

## QUARRYING, BRICK-MAKING AND COPROLITES

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Knowledge of the Palaeolithic period is derived almost entirely from artefacts, animal bones, pollen, insects and other fossilized remains preserved within deposits exposed by extractive aggregates and minerals industries. Sand and gravel, clay and ‘coprolites’ have all been quarried extensively across Cambridgeshire and have formed a major part of the county’s economy.

### The Aggregates Industry

As recently as the inter-war years, gravel pits were still largely dug and sieved by hand, providing a golden opportunity for collectors to obtain archaeological and faunal material. Gravel pit workmen would often gather Palaeolithic artefacts and animal bones to sell to collectors, and some very large and significant artefact collections were amassed in this way. Some less honest workmen were tempted to produce forgeries, however.



Above: Mr George ‘Deffy’ Carter sieving gravel by hand in 1913. Mr Carter, who worked at Maidenhead in the Thames Valley, gained his nickname from his love of gramophone records, which he bought with the money he made by selling stone tools to collectors (Photo: L. Treacher, reproduced by courtesy of J.J. Wymer).



Above: a mechanical excavator at work in a gravel quarry.

In recent years, the mechanization of the sand and gravel extraction process means that it is now much more difficult to find Palaeolithic stone tools and other evidence from the Quaternary. Research now relies heavily upon the goodwill of numerous aggregates companies to access the deeply-buried deposits, which can be many metres below the present ground surface. Without the information yielded by these dwindling resources, most of the evidence for archaic humans and their activities would have remained undiscovered. The central irony of the Palaeolithic, then, is that the industry responsible for revealing the evidence of ancient human occupation may also be responsible for its destruction, and it is only through projects like the FRCPP that this evidence can be recovered and preserved for the benefit of future generations.

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## The Brick Industry

During the late 19th and 20th centuries, the Fletton and Woodston districts of Peterborough were the centre of the British brick-making industry, producing bricks that were to become known as 'flettons'. The clay dug for brick making was excavated by hand until 1902, when the first mechanical excavators were brought in so that work could continue during a strike. Although the clay being excavated from these sites pre-dates the Quaternary, post-Anglian gravel deposits and interglacial sediments have been discovered in the upper portions of the pits, most famously at Woodston. Here, estuarine deposits dating to the Hoxnian interglacial (MIS 11) were discovered, in which were preserved pollen, molluscs, insect remains and the bones of small mammals.

Archaeological material recovered from brick pits in Woodston and Fletton includes Levallois cores and flakes, suggesting that deposits dating to the interglacials in MIS 9 and MIS 7 are also present. There are very few records of the precise locations for the archaeological finds, however, and so the whereabouts of sediments of this age remains a mystery. Continued quarrying of clay in the area may lead to their discovery in the future.

## Coprolite Digging – an odd business

Between 1850 and 1890, an industry unique to Cambridgeshire flourished and declined. It was discovered that the natural phosphatized nodules, or coprolites, that occurred in the Lower Greensand deposits between Soham and Barrington, could be used to manufacture a powerful fertilizer. The term coprolite usually refers to the fossilized droppings of animals, often found in Quaternary cave deposits where bone-eating carnivores such as hyenas were once active. In this case, however, the term has been applied to the mineral nodules because of their resemblance to true coprolites.

Phosphate was the cheapest form of fertiliser (with the exception of animal manure) and so the industry boomed. It could be spread on the fields by hand in the traditional way or could be diluted with water and placed in a fertiliser drill, a method often used for the cultivation of root vegetables such as turnips, swedes and sugar beet. The bridge across the River Cam at Clayhithe was built in 1872 specifically to allow coprolite to be transported more easily. A wharf was also built, from where the mineral was taken in barges to Cambridge, Ely or Kings Lynn for subsequent distribution by sea. By 1900 there were virtually no coprolite workings left, due to the exhaustion of the Cambridgeshire deposits and the import of cheaper phosphate from America. Several important Quaternary sites were discovered in coprolite pits, including the interglacial deposits near Grantchester.

The following resources are a more detailed overview of this intriguing Cambridgeshire industry and include further references:

'Coprolite Mining in England' by Trevor Ford and Bernard O'Connor, feature in *Geology Today* Vol.18, No.5, September-October 2002.

[www.cambridgeshirehistory.com/People/coprolitehistory](http://www.cambridgeshirehistory.com/People/coprolitehistory)



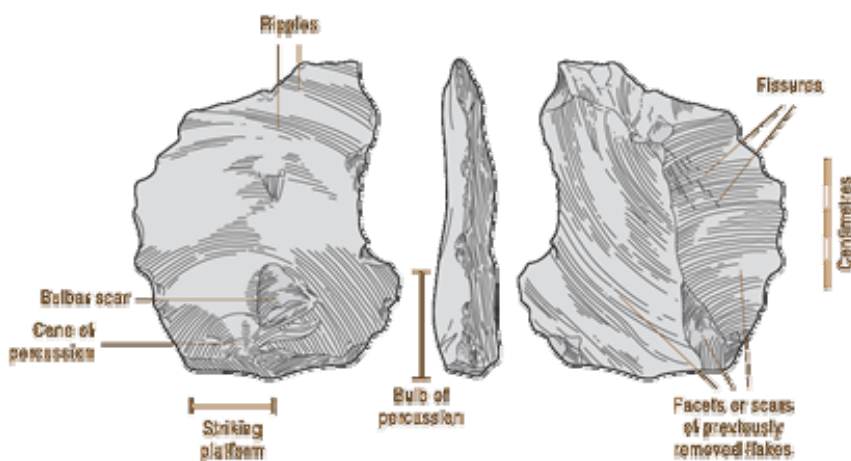
## LOWER AND MIDDLE PALAEOOLITHIC STONE TOOLS

The working of stone to make tools is referred to as **knapping**, and this process has been the basis of tool manufacture for most of human history. Even after the use of metals became widespread during the Bronze Age, stone continued to be an important raw material. Knapping is based on the principle of **conchoidal fracture**, or the way in which certain types of brittle stone break very cleanly to form an extremely sharp edge. In Cambridgeshire, as in most of the rest of Britain, the stone most often used by Palaeolithic knappers was **flint**. Nodules and more extensive beds of flint occur in the chalk bedrock that stretches across the South-East

and East Anglia. In areas where flint was not available, however, other types of local stone were substituted, such as **quartzite, andesite** and **chert**. These rocks are not as easy to work as flint, but can produce equally effective stone tools in the hands of a practiced knapper. In Cambridgeshire very few non-flint Palaeolithic artefacts are known. Lower and Middle Palaeolithic stone tools are dominated by four distinctive types of artefact: **cores, flakes, handaxes, and flake tools**. Two types of hammer or **percussor** were used by Palaeolithic knappers: hard-hammers, usually another piece of stone; and soft-hammers, usually antler or bone, and perhaps wood.

### Cores and flakes

When a piece of flint is struck, flakes of stone are removed leaving a central core. Because this type of knapping often consisted of heavy blows from a hard-hammer, the knapping features on such objects are very pronounced. The scars left by the flakes on the core are very distinctive. Simple cores and flakes are highly variable in both size and shape. Sharp edged flakes suitable for cutting are generally assumed to have been the end goal of this technology, the cores being the waste by-product. However, some, referred to as choppers or chopper-cores, have a sharp zig-zag edge opposite an unworked area and it is unclear whether these were specially created to be used in heavy-duty chopping activities or whether their shape is just coincidental.



Above: a typical Palaeolithic flake with the important diagnostic features noted

### Flake diagnostics

*Bulb of percussion:* When a flake is struck from a core, the force of the blow produces a conical swelling or bulb next to the striking platform. The bulb of percussion is one of the first things to look for when determining whether a flake is a genuinely of human workmanship, as it is rarely present on naturally broken stone.

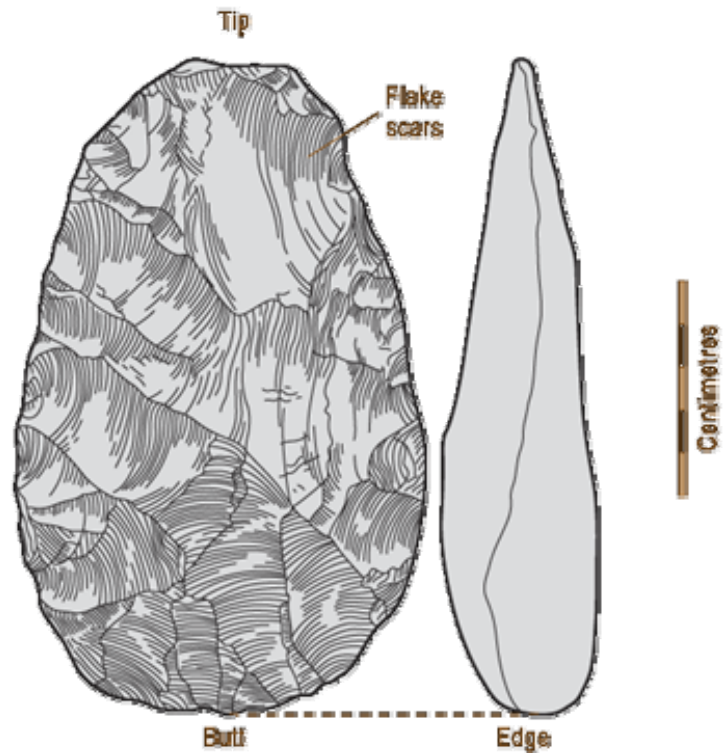
*Striking platform:* The flat surface from which a flake is struck from a core.

*Bulbar scar:* A small secondary flake detached as the bulb of percussion forms.

*Ripples:* These radiate out from the bulb of percussion, indicating the direction of the blow that detached the flake.

## The handaxe

Handaxes are perhaps the most distinctive of all Lower and Middle Palaeolithic tools. They are symmetrical, pear-shaped implements possessing a sharp **bifacially-worked** edge around all or part of the circumference. Unlike simple cores, handaxes are deliberately shaped objects. Many are delicately flaked using a soft hammer to thin their profile, leaving a complex pattern of **scars** on both surfaces. Handaxes were made on nodules, pebbles or large flakes of different stone types and can take a number of different forms around the basic blueprint. These implements are often found in large numbers and have been described as a Palaeolithic ‘Swiss Army knife’ because they have a wide variety of potential uses. Microscopic studies of their edges have shown that they were most often used in butchery.

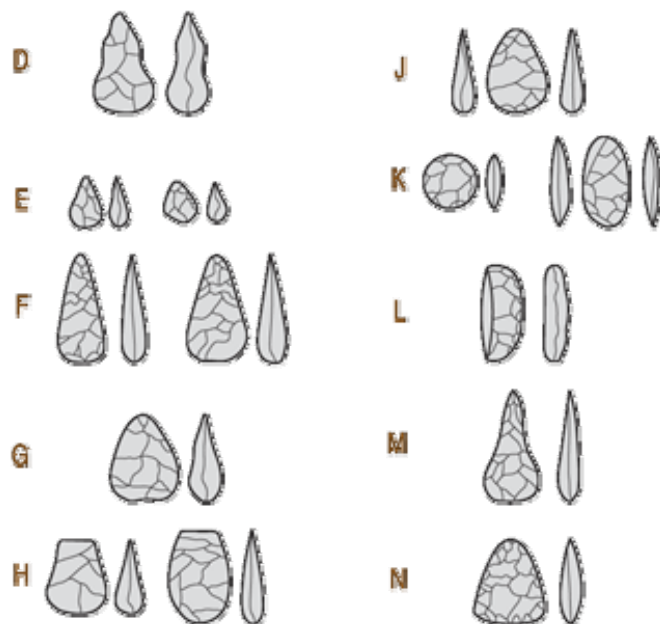


## Handaxe types and diagnostics

Handaxes come in many shapes and sizes, ranging from small ovate forms to very large pointed examples. The great Palaeolithic archaeologist, John Wymer, developed a typology of handaxes which demonstrates the variation in shape.

### John Wymer's handaxe typology:

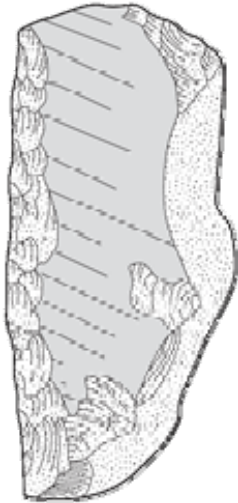
- D: Stone-struck, crude handaxe
- E: Small (<10cm) irregular handaxes
- F: Pointed handaxe
- G: Sub-cordate handaxe
- H: Cleaver
- J: Cordate (heart-shaped) handaxe
- K: Ovate handaxe
- L: Segmental 'chopping tool'
- M: Ficron
- N: Flat-butted cordate handaxe or *bout coupé*



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### Flake tools

Flake tools are modified flakes with additional flaking or **retouch** on one or more edges. Several different types are recognised, depending on the nature of the edge produced: scrapers, notches, denticulates and flaked flakes. Flake tools are not particularly rare, although it is sometimes difficult to differentiate between man-made and naturally altered edges in sand and gravel deposits. They were probably used in a variety of wood and hide working activities.



Scraper



Notch



Denticulate

### The handaxe: to have or have not?

Different combinations of these tool forms are used by archaeologists to define different stone tool **industries**. In Britain, two Lower Palaeolithic industries are recognised: the **Clactonian** (named after the type site at Clacton-on-Sea) and the **Acheulian** (named after the French village of St. Achuel in the Somme Valley). The Clactonian is a simple core and flake industry, which may also contain a variety of flake tools and chopper cores but by definition lacks handaxes. The Acheulean is defined by the presence of handaxes, but may equally contain a number of flake-tools and cores identical to those found in the Clactonian. The significance of the presence and absence of handaxes within these two industries, whether the result of different populations each with their own distinctive tool kit, different toolkits used by the same groups of people for different purposes, or a response to local raw material suitability, is the subject of heated debate.

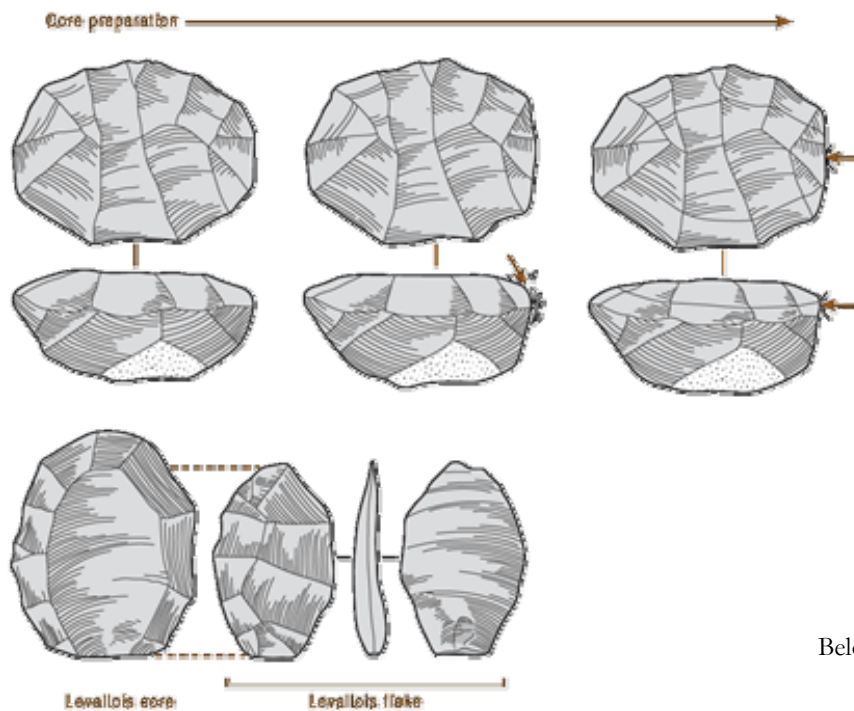


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## Middle Palaeolithic technology and Levallois technique

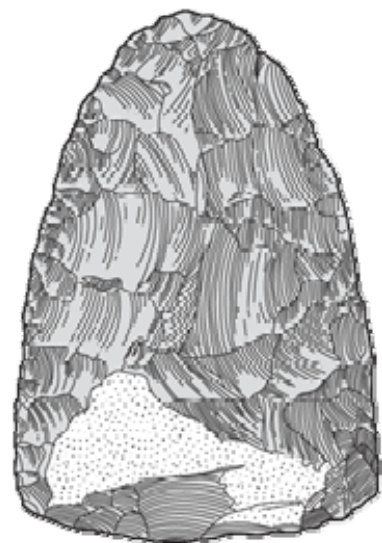
The Middle Palaeolithic tool kit shows a number of technological advances over the Lower Palaeolithic. Most notable is the introduction of a new form of core working referred to as the **Levallois technique**, which appears in Britain around 300,000 years ago. Levallois is a form of 'prepared core technology', in which the core is carefully shaped by removing a series of preparatory flakes to enable the production of a final flake or series of flakes of predetermined shape and size. In its classic form Levallois cores are often referred to as 'tortoise cores' due to their resemblance to a tortoise shell, but a number of other variations exist. The Middle Palaeolithic also shows a much wider range of more sophisticated flake tools, including a large number of different forms of scrapers with elaborately retouched edges.



Left: stages in the preparation of a Levallois 'tortoise core' and the resulting Levallois core and flake.

Below: a *bout coupé* handaxe

With the introduction of Levallois in Britain the number of handaxes dwindled, Levallois flakes perhaps taking their place as the main cutting implement. However, the handaxe reappears some 200,000 years later at the very end of the Middle Palaeolithic. These later examples are frequently small and cordiform (heart-shaped). One peculiar form of late Middle Palaeolithic handaxe, believed to be unique to this period in Britain, deserves special mention – the *'bout coupé'*. This is an elongated D-shaped handaxe with a markedly flat butt and a broad tongue-shaped tip. *Bout coupé* handaxes often occur as individual finds on or just beneath the surface.



## RECONSTRUCTING ENVIRONMENT AND LANDSCAPE

When sediments are laid down in any geological environment, be it a desert, a lake, a river valley or beneath an ice sheet, the sediment and associated features provide a distinctive record of that environment. Experienced geologists can read the features of exposed sediments and identify the processes that created them, reconstructing the physical appearance of the landscape. Sediments can also be sampled for organic and inorganic remains, which can be used in a variety of ways. Some are analysed by laboratory specialists to determine what species of plants and animals were living in a

given environment at various times during the Quaternary. Others can be dated, allowing the development of chronologies and the comparison of sites of similar date. Some of the methods used for reconstructing the environment and landscape are outlined here. Individually, these analyses can only tell us about the particular site at which the samples were collected, a snapshot of a specific place at a particular time. By combining the information from a wide range of different samples collected from several sites, however, we can begin to reconstruct a continuous history of an area.

### Stone Counting and Gravel Analysis

By studying the different stones that make up gravel deposits, a technique known as ‘clast analysis’, it is possible to identify where the component rock types originated. Changes in the course of the river can be mapped by matching distinctive stones in river gravel deposits to the sources from which they were eroded. Events such as glaciations can also transport ‘exotic’ rocks from far afield and introduce them into river systems, each event leading to the introduction of new rock types into the sand and gravel deposits.

The gravels of the Cambridgeshire are rich in flint pebbles derived locally within the river catchments. Occasionally, more exotic rock types are encountered, such as **quartzite** from the Midlands. There are also much less durable Jurassic **limestone** pebbles from the escarpment to the west, although these can be regarded as very local components that would not survive long-distance transport in the rivers.



Left: examples of gravel clasts likely to occur in Cambridgeshire gravels. The most common component is flint (7). Quartz, quartzite and chert are derived from the East Midlands and were transported to Cambridgeshire by both fluvial and glacial processes during the Quaternary.

- 1: Conglomerate pebble
- 2: Well-cemented orthoquartzite
- 3: Poorly-cemented orthoquartzite
- 4: Metaquartzite
- 5: Vein quartz
- 6: Schorl
- 7: Flint
- 8: Carboniferous chert
- 9: *Rhaxella* chert

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## Reconstructing Palaeoclimate

Palaeoclimate means ‘ancient climate’. A number of features and structures found in sand and gravel deposits are records of the nature of the climate both during and after sediment deposition.

During periods of cold climate, the freezing and contraction of the ground causes the formation of vertical bodies of ice (ice wedges) within the deposits, their thickness tapering downwards in a distinctive V-shape. These structures often penetrate through the entire sequence of sediments. When the ice melts, the gap is filled by material that tumbles in from above, creating features known as called ice wedge casts. Research on ice wedges forming today in the Canadian Arctic suggests that annual air temperatures of around  $-6\text{ C}$  are needed for them to form. Ice wedge casts recorded in the Cambridgeshire therefore illustrate the severity of the climate during the glacial periods.



Above: an exposed ice wedge in a modern arctic region. The wedge is approximately 3m long.



© P. Allen

Although at times climate was harsh, the upper levels of some of the sand and gravel deposits show signs of warm-climate soil development. This type of deposit is known as a **palaeosol** (ancient soil), and indicates that the climate was comparable with that of the present day.

Finding distinctive features such as these in a sand and gravel deposit enables geologists to quickly determine whether the sediments were deposited during a period of cold or warm climate

Left: gravel pit section in Essex showing warm-climate soil formed at the top of a river gravel buried beneath glacial till. The warm climate soil is indicated by the dark red coloured areas. It has been disrupted by frost activity including the formation of an ice-wedge cast (fossil ice-wedge) seen in the centre. Compare with the photograph of a modern ice-wedge above.



# ENVIRONMENTAL EVIDENCE FROM TERRESTRIAL DEPOSITS

Fine-grained sands and silts rich in organic material have been discovered within Quaternary sequences throughout Cambridgeshire. The remains of plants and animals, both large and small, preserved within these (usually waterlogged) sediments can help us reconstruct the environments and habitats of the past.

## Plant remains

Pollen grains are the microscopic reproductive material of flowering plants. Often produced in vast quantities by wind-pollinated species, which are therefore the best represented in sediments, pollen can be transported over considerable distances. It is highly resistant to destruction and can survive under the right conditions for millions of years.

Pollen specialists can identify plant types from preserved pollen, as different groups of flora produce characteristic forms of pollen grains. It is therefore possible to determine the types of trees, shrubs and grasses that grew in a particular environment during a specific part of the Quaternary. Furthermore, because pollen is widely distributed in the air (as anyone with hay-fever will tell you), it can provide a regional picture of the vegetation growing on the landscape.

As well as pollen, large fragments of plant material (macrofossils), including tree trunks, twigs, leaves and seeds, can be preserved and their species identified. In contrast to pollen, these remains tend to be deposited relatively locally and therefore provide an idea of the plants growing at a specific site, such as the edges of river channels, lakes and ponds.



Above: pollen grains, magnified several thousand times (1 mm = one millionth of a metre)



Left: examples of plant macrofossils (from left to right): *carex* seed, birch fruit and a blackberry pip (*rubus*)

## Animal remains

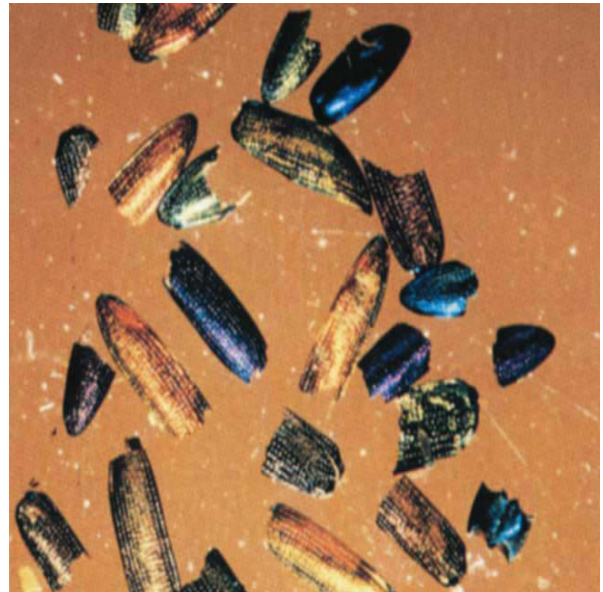
Remains of animals from Quaternary deposits consist mainly of bones and shells, the soft parts of the body only surviving in exceptional cases, such as the mammoth carcasses frozen in Siberia. In Britain, animal bones and teeth are often found in river gravels, and can be used to determine the prevailing climate when the deposit was formed. Remains of smaller animals can also be found, predominantly in the fine-grained organic sediments of interglacials. They can be used to determine how warm or cold an interglacial period was, as well as giving an indication of the types of habitats that would have existed, such as woodland, grassland, and tundra.

Fragments of insect **exoskeleton** are often found in organic sediments. Wing cases are very common, although other remains are more useful for identifying species, especially the reproductive parts. By identifying the different species of fossil insects preserved in a deposit, it is possible to reconstruct their environment by looking at the habitats of their modern descendents. Most insects live in very specific habitats, and many are very intolerant to change in climate and environment. One advantage insects have over environmental indicators, such as vegetation, is that they respond very rapidly to changes in their environment and are therefore very sensitive indicators of climate change. Combinations of insect species of known environmental distribution can reveal very precise temperature ranges for past climate.



Above: tooth of the extinct straight-tusked elephant, *Palaeoloxodon antiquus*, recovered from interglacial sediments dating to MIS 7.

Below: iridescent beetle wing cases washed from Quaternary sediment



Under specific conditions, the shells of snails and other molluscs, living on land and in water, may be preserved. As with other environmental indicators, individual species have particular ecological preferences, and can be identified and used to reconstruct the local environment.

Left: snail shells preserved in Quaternary sediments:

- 1) *Planorbis corneus*
- 2) *Bithynia tentaculata*
- 3) *Discus rotundatus*
- 4) *Theodoxus fluviatilis*
- 5) *Aneulus fluviatilis*



## DATING THE SEDIMENTS

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There are two types of dating commonly used by Quaternary scientists; **relative** and **absolute dating**.

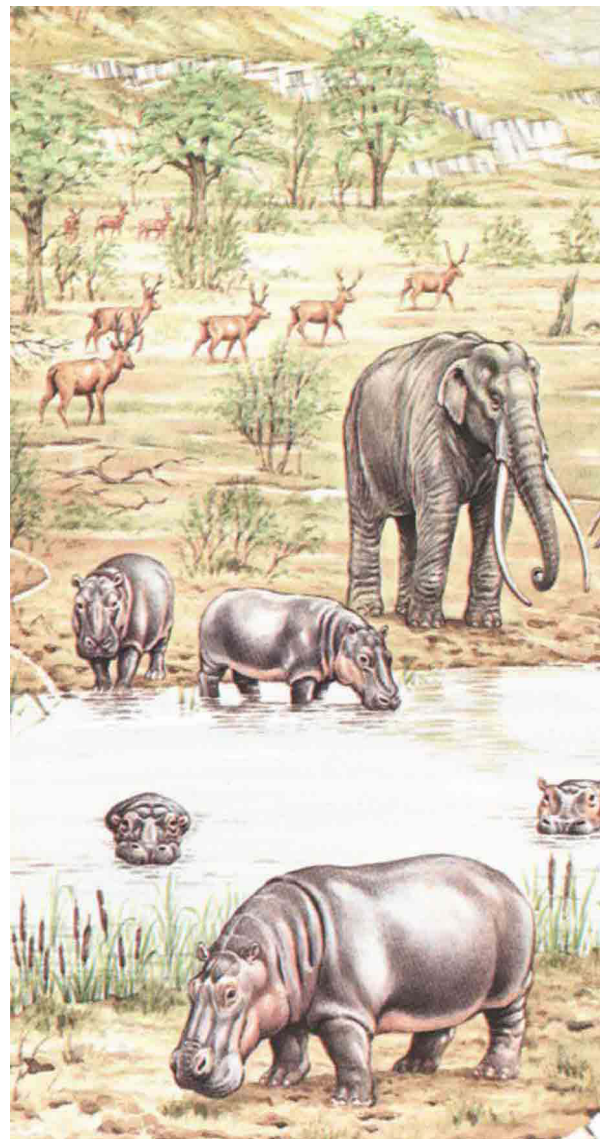
Relative dating does not involve any numerical dates. It is often based on the relationships observed between deposits. When examining a geological section, it can usually be assumed that the oldest deposits are at the bottom of the sequence, with progressively younger ones stacked above. Deposits within individual river terraces conform to this principle, but the terraces themselves show the opposite, in

that the higher terraces are older than those further down the 'staircase'.

In recent years, however, advances have been made in correlating some of the relative dating sequences to the oxygen isotope curve, thereby providing a means of locating these sequences within Quaternary timescales. One way in which this has been done is through the different terrace formations of British rivers (principally the Thames), where a model of terrace formation based on climate and uplift has suggested that during each climatic cycle a new terrace is produced.

### BIOSTRATIGRAPHY

As well as helping to reconstruct a picture of climate and environment, faunal assemblages can also be used to identify and characterize the various interglacial episodes. The remains of many different mollusc and mammal species can be used to obtain relative dates for geological sediments, especially where these can be anchored to a well-known series of terrace deposits. Deposits may contain fossils which have clearly evolved from an earlier form found in other deposits, contain groups of mammals or molluscs that only existed together in the British Isles during certain periods, or contain individual species unique to a certain deposit. The last decade has seen significant advances in tying these specific mollusc and mammalian groups to the MIS curve, along with the terrace deposits in which they are found, a method referred to as biostratigraphy (building up a chronological sequence based on biological remains). Some animals, like the straight-tusked elephant (*Palaeoloxodon antiquus*), now extinct, were present in Britain during each of the last five interglacials and so are of little use for biostratigraphy. Others occurred only during some these episodes and so are of greater value. Taking the last interglacial as an example, this uniquely contains hippopotamus, but not horse, humans or the mollusc species *Corbicula fluminalis*. Finding hippopotamus within a deposit can be sufficient to assign it to the Ipswichian, even if an absolute date is not available.





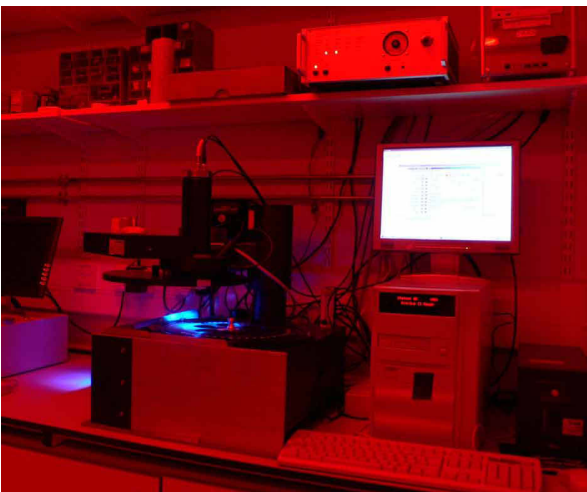
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## GEOCHRONOLOGY

Since the 1950s a number of scientific dating techniques have been developed which allow precise age estimates to be calculated. This type of dating is known as absolute dating, and methods have been developed to date a variety of mineral and fossil remains found in sediments.

**Radiocarbon dating** is one of the best-known techniques, but can only be confidently used for materials which are less than 30,000 years old. Because the FRCPP is dealing with deposits that are sometimes almost 20 times older than this, two comparatively new absolute dating techniques, both developed in the last few years, have been used to date the sands and gravels.

**Optically Stimulated Luminescence Dating (OSL)** measures the natural radiation that builds up in geological deposits over time. All sediments contain tiny amounts of natural radioactive isotopes, and the radiation from these elements is absorbed by quartz or feldspar grains in the surrounding sediment. Exposure to sunlight resets the radioactive signal stored in grains to zero, and so samples are collected in light-proof tubes. In a laboratory darkroom (below), grains taken



from the centre of the sample can be made to emit their stored radiation in the form of light (luminescence), which can be measured and used to estimate the amount of time that has

elapsed since they were buried. An OSL date therefore represents the date at which the deposit was laid down, not the age of the grain itself.

OSL has been most successfully used to date aeolian (wind-blown) sediments, which have generally been zeroed by exposure to light before burial. In the last few years, however, scientists have attempted to use OSL to date both glacial and fluvial sediments, in which the grains are less likely to have always been zeroed.

**Amino Acid Racemization Dating (AAR)** works by analyzing the **amino acids** that form proteins. Protein is an essential part of life: every cell of every organism contains proteins in different amounts. However, proteins decompose very rapidly when an organism dies, and so the AAR technique relies on protein preserved within single crystals of the calcium carbonate shells of snails, which has been preserved from the moment the snail died.

The amino acids can exist in two forms, that are chemically the same, but mirror images of each other, just like left and right hands. Amino acids in living organisms are all left-handed (L), but when the organism dies, gradually a reaction occurs until there are an equal number of left-handed and right-handed (D) amino acids. The ratio of right-handed to left-handed, or D to L, therefore increases with time and the measurement of this ratio of amino acids (the DL ratio) is used to date the shell.

AAR can be used to provide age estimates for individual mollusc shells preserved in organic sediments within sand and gravel deposits. It cannot be used to date all sites, of course, as mollusc shells are

often not preserved and some are unsuitable for this type of dating. The opercula of *Bithynia tentaculata* (right) have been most successfully used for AAR dating.



## COMBINING THE EVIDENCE: CREATING A PORTRAIT OF PALAEOLITHIC LIFE

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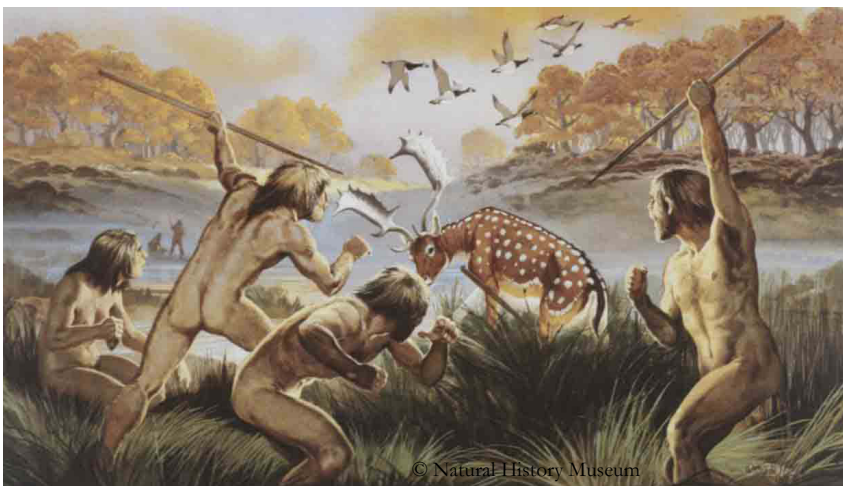
As we have seen, the archaeology and landscape of the Palaeolithic can only be reconstructed by connecting many lines of inquiry. Every new strand of evidence adds to the picture of Britain during the Palaeolithic, and as new sites are discovered and scientific techniques are improved our understanding of prehistoric life continues to expand.

In some respects Lower and Middle Palaeolithic archaeology has more in common with **palaeontology** than with later archaeological periods. We have remarkably little from which to reconstruct the lives of ancient humans, often no more than stone tools and the bones of wild animals preserved in sands and gravels. These early people left no monuments, recognisable architecture or complex settlements, and their effects on the natural landscape were minimal. On extremely rare occasions wooden artefacts have been preserved, such as the famous Clacton Spear, discovered in 1911 at Clacton-on-Sea and dating to approximately 450,000 years ago, making it the oldest wooden object from the British Isles.

The evidence we have suggests that they lived as simple hunter-gatherers who adapted their lifestyles to meet the challenges of surviving in the harsh natural environments around them. Their lifestyle was probably highly mobile but at the same time very local.

Archaeologists believe that they moved between a number of well known places in search of food and other raw materials, foraging for vegetable foodstuffs and hunting and butchering the animals that roamed the landscape. They had no true homes as such, but many temporary camps; they rarely moved resources further than an hour or two's walk and made most of their tools where suitable raw materials naturally occurred.

Their stone tool kits tell us much about their level of technological sophistication, the decisions they took in making them and the skill and intelligence that this required. The shape and edges of the tools also allow us to infer the range of materials on which they were used, including meat, hides, wood and other plants. Many tools were involved in butchery, but others were probably used to make other vital equipment such as animal skin clothing and wooden implements. Amazingly, 400,000 year-old examples of wooden spears have been found at Clacton-on-Sea in Essex and at the German site of Schöningen, preserved under exceptional circumstances. These just hint at the potential range of tools, manufactured on perishable materials such as wood and bone, that are now lost to the Palaeolithic archaeologist. Hunting was probably based around frequent visits to places where animals were known to congregate, such as riverbanks, or where they could be easily ambushed, such as the gorge at Creswell Crags.



Above:  
the  
Clacton  
Spear,  
discovered

## Glossary

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**Acheulian** – a Lower Palaeolithic stone tool industry characterized by handaxes, named after the site at St. Acheul, France.

**alluvium** – sand, silt and gravel deposited by rivers, sometimes spread over quite large areas during flooding.

**amino acid** – an organic compound, the main component of proteins. There are over 100 amino acids, but only 20 are commonly found in living organisms.

**andesite** – volcanic, igneous rock named after the Andes mountains of South America where it is commonly formed.

**Anglian glaciation** – a period when much of Britain was covered in ice, extending from about 480,000 until about 300,000 years ago.

**biface** – a stone artefact, commonly a handaxe, that has been flaked on both faces.

**braided river** – a river overloaded with sediment and forced to divide into many channels separated by shifting bars or islands.

**chert** – a very hard sedimentary rock commonly found as nodules in limestone as well as in beds as a primary deposit. It is closely related to flint, the main difference being that the latter is found in chalk.

**Clactonian** – Lower Palaeolithic stone tool industry made distinct from the Acheulean by the complete absence of handaxes (probably).

**conchoidal fracture** – (literally, shell-like) - the manner in which materials such as flint or glass fracture with a smooth curved surface.

**Devensian glaciation** – a period when much of Britain was covered in ice, extending from about 70,000 until about 10,000 years ago.

**epoch** – the smallest unit of geological time, being a subdivision of a geological period (e.g. the Pleistocene is an epoch of the Quaternary period).

**exoskeleton** – the hard outer covering of invertebrate organisms such as insects.

**flint** – a very hard sedimentary silica-based rock that occurs mainly as nodules or thin beds in chalk. It breaks to form thin, sharp splinters when struck with another object, making it a perfect raw material for stone tool manufacture.

**flintknapping** – see **knapping**

**fluvial sediments** – material deposited by the action of a stream or river, often sands and gravels.

**foraminifera** – tiny, single-celled marine animals with a hard shell composed of calcium carbonates that can be analysed to determine the oxygen isotope ratio in sea water.

**glacial period, glaciation** – a period of intense cold, lasting centuries or millennia, during which ice-sheets and glaciers form.

**glaciofluvial sediments** – material deposited by the action of a stream or river fed by a glacier or ice sheet.

**Holocene** - the warm period in which we now live, which began about 10,000 years ago. It is now thought of as an ongoing interglacial of the Pleistocene.

***Homo heidelbergensis*** – the Latin name given to a human species which may have been ancestral to both modern humans and Neanderthals. *H. Heidelbergensis* appears to have flourished from about 750,000 years ago; in Britain remains have been found at Boxgrove in Sussex dating from around 500,000 years ago.



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***Homo Neanderthalensis*** – the Latin name for a species closely related to, but distinct from, modern humans; popularly known as ‘Neanderthal Man’, they seem to have co-existed with our own species for about 170,000 years, before becoming extinct about 30,000 years ago.

***Homo sapiens sapiens*** – the Latin species-name for modern humans (*Homo* = man, *sapiens* = wise); we appear to have been around for about 200,000 years.

**Industry** – a group of archaeological assemblages found over a specific region or corresponding to a certain period of time containing similar artefacts, e.g. the **Clactonian** industry.

**interglacial period** – a warm episode between two glacial periods or ‘Ice Ages’.

**isotope** – one of two or more forms of an element, chemically identical but with different atomic weights.

**knapping** – a technique for making stone tools by striking flakes from a core of stone with various types of **percussor**.

**Levallois technique** – knapping technique in which a core is carefully prepared in order to produce flakes of a predetermined size and shape.

**meander** – a loop-like bend in a stream or river channel.

**megafauna** – large animals, often – as in the cases of the mammoth and woolly rhinoceros – more massive equivalents of species which survive today, which roamed the landscapes of the Lower and Middle Palaeolithic and were hunted by their human inhabitants.

**Neanderthal** – see *homo Neanderthalensis*.

**outwash** – gravels, sands, silts and clays deposited by meltwater flowing outwards from a glacier.

**oxbow lake** - a lake formed in the abandoned channel of a river meander.

**palaeo-** - from the Greek *palaios* meaning ancient, of ancient times. For example, Palaeoclimate = ancient climate.

**Palaeolithic period** – ‘The Old Stone Age’ (Greek *palaios* = ‘old’, *lithos* = ‘stone’); covers the period from when the earliest ancestral human species began to manufacture tools (about 2.5 million years ago, but what is now Europe effectively begins, as far as we know at present, about 800,000 years ago), extending until about 10,000 years ago. The period is usually subdivided into ‘**Lower**’ (before 300,000 BP), ‘**Middle**’ (300,000 – 35,000 BP) and ‘**Upper**’ (35,000 – 10,000 BP).

**palaeontology** – the study of the fossil remains of plants and animals.

**percussor** – a hammer or striking object used in flint knapping, which can be made of stone (for ‘hard-hammer’ techniques) or antler or bone (for ‘soft-hammer’ techniques).

**periglacial** – conditions prevailing close to an ice sheet, but not covered in ice. The ground is often permanently frozen save the **active layer**, resulting in waterlogging of the surface during summer as drainage is impossible. Such areas support only tundra vegetation.

**permafrost** – a layer of soil that has remained permanently frozen from a few to several thousand years.

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**Pleistocene** – the most recent major geological epoch (dating from c. 2.6 million – 10,000 years ago), colloquially known as the ‘Ice Age’ due to cyclical expansion and contraction of glaciers.

**quartzite** – usually a metamorphic form of pure quartz sandstone altered due to heat and pressure. Some quartzites are sedimentary in origin, however.

**Quaternary** – the geological period which extends from about 2,000,000 years BP until the present, subdivided into two epochs, the Pleistocene (2 million – 10,000 years ago) and the Holocene (10,000 years ago – present).

**retouch** – further intentional modification of the sharp edge of a stone tool to suit certain jobs or to re-sharpen the implement.

**river terrace** – fragments of ancient river floodplain surfaces preserved as distinctive flat steps in the valley side as the river channel cuts downwards.

**scar** – distinctive concave feature on the surface of stone tool where a flake has been removed.

**terrace** – see **river terrace**.

**till** – material deposited by the movement of glaciers typically stiff clay containing boulders and therefore sometimes referred to as ‘boulder clay’.

**uplift** – elevation of land surface due in part to the removal of the great weight of an ice sheet, and a contributing factor to downcutting of river channels

## Further Reading

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## Weblinks

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Ancient Human Occupation of Britain Project (AHOB) - [www.nhm.ac.uk/hosted\\_sites/ahob](http://www.nhm.ac.uk/hosted_sites/ahob)

Cresswell Crags - [www.cresswell-crags.org.uk](http://www.cresswell-crags.org.uk)

National Ice Age Network - [www.iceage.bham.ac.uk](http://www.iceage.bham.ac.uk)

Quarry Products Association (QPA) - [www.qpa.org](http://www.qpa.org)

Quaternary Research Association (QRA) - [www.qra.org.uk](http://www.qra.org.uk)

Trent Valley Palaeolithic Project - [www.tvpp.org](http://www.tvpp.org)

Trent Valley Geoarchaeology - [www.tvg.org](http://www.tvg.org)

Young Archaeologists Club (YAC) - [www.britarch.ac.uk/yac](http://www.britarch.ac.uk/yac)

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## Acknowledgments

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The Fenland Rivers of Cambridgeshire Palaeolithic Project and this publication were funded with a grant from the Aggregates Levy Sustainability Fund (ALSF) through DEFRA and administered by English Heritage (Project Number 5266 MAIN). Our thanks go to Jim Leary and Kath Buxton of English Heritage for project management and support.

We would like to offer our sincere thanks to the curators of the museums visited during the project to record Palaeolithic artefacts from Cambridgeshire, and the HER officers at Cambridge and Peterborough for their help with local records. Their time and patience in accommodating our work is greatly appreciated:

Rebecca Casa Hatton (Peterborough HER)  
Bob Burn-Murdoch (St. Ives Museum)  
Sarah Poppy (Cambridgeshire HER)  
Matt Riley (Sedgwick Museum of Geology, Cambridge)  
Ben Robinson (Peterborough HER)  
Anne Taylor (Museum of Archaeology and Anthropology, Cambridge)  
Glenys Wass (Peterborough Museum)

We would also like to offer our thanks to the following companies and individuals:

Hanson Aggregates  
Mr. Alan Holloway

Lastly, thanks to Chris Orton and David Hume of the Durham Digital Design and Imaging Unit for their care and patience in the production of the illustrations in this publication.

## Bibliographic details of this booklet:

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White, T. S., Boreham, S., Bridgland, D. R., Gdaniec, K. and White, M. J. (2008) The Lower and Middle Palaeolithic of Cambridgeshire.