Title: Prehistory of the British Isles: A tale of coming and going

Titre: La préhistoire des îles britanniques: Une histoire de va-et-vient

Authors: Isabelle De Groote[1], Mark Lewis[2] & Chris Stringer[2]

[1] Research Centre in Evolutionary Anthropology and Palaeoecology, School of Natural Sciences and Psychology, John Moores University, Liverpool, United Kingdom

[2] Earth Sciences Department, Natural History Museum, London, United Kingdom

Keywords: Pleistocene, Palaeolithic, migration, *Homo sapiens, Homo neanderthalensis, Homo heidelbergensis, Homo antecessor*

Abstract:

It is now recognized that Britain has not always been geographically isolated from Europe and, for most of the last one million years, formed an extension of the northwest European landmass. During most of this time, Britain was accessible to migrating humans and animals, although climatic conditions varied greatly from Mediterranean-like through to glaciations and extreme cold, making Britain a difficult place to settle for any length of time. The oldest evidence for humans in Britain dates to between about 850,000 and 1 million years ago. Recovered lithic artefacts suggest that hominin species occupied and deserted the British Isles at least nine times. In this article, we review the prehistory of the British Isles and present the main sites and time periods.

Il est bien connu que les îles britanniques n'ont pas toujours été des îles et que pendant la plus grande partie du dernier million d'années, elles faisaient partie d'une péninsule s'étendant à partir du (ou à l'extrémité) nord-ouest de l'Europe. Cette région était alors accessible aux humains et aux animaux venant du continent. Les conditions climatiques ont varié entre celles trouvées aujourd'hui en Méditerranée et les conditions désertiques des régions polaires, rendant la Grande-Bretagne un endroit difficile à habiter. La plus ancienne preuve de présence humaine en Grande-Bretagne date entre 850000 et 1 million d'années. Les industries lithiques suggèrent que les espèces d'hominines se sont depuis installées puis ont déserté les îles britanniques au moins neuf fois. Dans cet article, nous proposons une revue des connaissances sur la préhistoire des îles britanniques, à partir des principaux sites et périodes correspondantes.

Introduction

When did the first humans arrive in what is now known as the British Isles? It is well known that the British Isles were not always islands and for most of the last one million years, they formed part of a peninsula extending from northwest Europe, potentially accessible by migrating humans and animals. Britain was not a straightforward place to settle, however, with the local climate oscillating between temperatures similar to those found in the modern Mediterranean through to polar desert conditions. Humans were able to migrate into the territory temporarily but were repeatedly pushed out by successive ice ages. The process of colonisation was repeated at least 9 times, but when the last British ice sheets began to melt around 12,000 years ago, a new wave of migrants was able to settle more permanently. Lithic artefacts of varying industries and ages have been found across most of Britain for its 1-million-year-long human history, but human fossil remains are few. In this paper, we provide an overview of the presence of humans in the British Isles and present their tale of coming and going.

The first explorers (1 million to 450,000 years ago)

Layers dating back to the late early Pleistocene (between 1 and 0.78My ago) from Happisburgh (pronounced 'Hays-bruh') have yielded flint artefacts, butchered animal bones and even human footprints [1, 2]. The lithic artefacts of a Lower Palaeolithic industry were found in river deposits, and are the oldest known stone tools in northwest Europe.

Connected lands

From the early Pleistocene, Britain was connected to mainland Europe by a land-bridge that enabled humans and fauna to migrate in and out (Figure 1A). Until about 130,000 years ago, this narrow chalk isthmus, separating the north (North Sea) and southwest (English Channel)

marine embayments, kept Britain connected to varying extents even when sea-levels were high during the warm interglacial periods [3]; the eventual complete breaching of this chalk barrier was crucial in forming the island and the Dover Strait. During glacial periods much of the earth's water would have been trapped in the ice caps and when, during the later Pleistocene, the bed of the North Sea was exposed, a large land area known as Doggerland, created by geological uplift and sedimentation from rivers, also provided a route into the British Isles and fauna, including hominins, would have entered this way. The flooding of the shallow shelf areas of the English Channel and the North Sea are the consequence of the current high interglacial sea levels.

The main sites and their evidence

The site with the oldest evidence for humans in the British Isles is at **Happisburgh**, Norfolk, now located on the eastern English coast (Figures 2 and 3) [1]. During the Early Pleistocene Happisburgh formed part of a large river estuary, close to the confluence of the now extinct Bytham and the palaeo-Thames (currently flowing further south through London) [4]. The Happisburgh sites, now numbering more than five localities, are situated on and near the present-day beach. The cliffs there are composed of till deposited by glaciers with laminae of undisturbed bedding surfaces beneath. The sediments at the base of the cliffs (Happisburgh site 3) were excavated between 2005 and 2010, and around 80 lithic artefacts were discovered dating broadly to between 850,000 and 950,000 years ago [5]; a borehole through the cliffs to the underlying estuarine sediments was taken in May 2013. Results show that these sediments are predominantly estuarine sands and silts forming the infill of channels with intermittent gravel deposits. The gravel deposits, up to 20cm in thickness, within these sands and silts have yielded flint flakes and cores. In addition, a rich assemblage of flora and

fauna has allowed their attribution to the latter part of an interglacial during the late Early Pleistocene, perhaps Marine Isotope Stage (MIS) 21 or 25.

In May 2013, a footprint surface was discovered near Happisburgh site 3 and found to be in the same complex of channel fills as the archaeological layers. The exposure of the laminated silts through coastal erosion is frequent at Happisburgh and usually takes the form of flat or gently undulating surfaces. The exposed surface, approximately 12m^2, showed very different characteristics with a series of hollows from circular to elongate, and the visual similarity to other coastal footprint surfaces in Britain (e.g. Formby, Sefton Coast) prompted analyses of these hollows [6]. The surface was located in the intertidal zone and subsequently eroded by tidal action over a period of two weeks, until the footprints were completely destroyed. The footprints may well have been left by *Homo antecessor*, the only hominin species so far known in Europe at that time [1]

Although no human fossils have been found at **Pakefield** (Suffolk), flint artefacts dating back approximately 700,000 years were, until the more recent Happisburgh discoveries, the earliest evidence for human presence in Britain (Figure 4) [7]. The presence of hippopotamus, elephant, lion, and deer remains, as well as analyses of sediments and pollen, suggest the climate of the British Isles was warmer than at the earlier Happisburgh 3 site, with summers as warm as those in the Mediterranean today [8, 9]. At **West Runton,** on the North Norfolk coast, an almost complete skeleton of a mammoth was found in 1990, the largest and oldest steppe mammoth skeleton found in Britain, dating to about 700,000 years ago, but no evidence of human occupation was found at the site [10]. Climatic conditions at West Runton were similar to those today. However, from soon after this time climatic oscillations became more extreme and Britain was regularly plunged into severe ‘Ice Ages’,

experiencing the effects of the ice caps reaching the lower latitudes and the chilling of the North Atlantic.

Archaeological excavations at **Boxgrove, in Sussex, England,** uncovered a land surface with freshwater pools where animals gathered, dating from about 500,000 years ago (Figure 5). Besides the butchered bones of a range of herbivores such as rhinoceros, horse and deer, large numbers of Acheulian handaxes were discovered [11, 12]. These tools are more sophisticated than those found at Happisburgh and Pakefield, and the earliest British human fossils, a tibia and two teeth, were uncovered here alongside the butchered animal bones and the handaxes [13]. Around 475,000 years ago we see the onset of the most severe cold stage of the Middle and Late Pleistocene, known as the Anglian (or Elsterian), with ice sheets extending far into southern Britain, making it uninhabitable.

Hominins

There are no *Homo antecessor* fossils currently known from Britain, but the footprint surface associated with Happisburgh 3, with a range of juvenile to adult hominin foot sizes, may be evidence of that species. Using foot length to stature ratios, the hominins who left the prints were estimated to have been between 0.93m and 1.73m in height, which suggests that the group consisted of individuals of different ages. The estimated adult statures of the hominins from Happisburgh fall within the range derived from the fossil evidence of *Homo antecessor*, the only known species in western Europe of a similar age and known only from fossils found at the site of Gran Dolina, Atapuerca, Spain and dated to about 860,000-780,000 years ago. The species is believed to have evolved from *Homo erectus* but had unique features that distinguish it from other *Homo* species [14-17]. A number of lithic artefacts similar in typology to those found at Happisburgh were found at Happisburgh.

Animal remains at these early Pleistocene sites suggest that the climate was largely warm but this changed after about 650,000 years ago. At times, conditions throughout Europe became harsh and cold and Britain became uninhabitable. It is unclear whether *Homo antecessor* gave rise to *Homo heidelbergensis*, and subsequently to Neanderthals, or whether they were an evolutionary dead-end.

Homo heidelbergensis is the earliest human species for which we have fossil evidence in Britain, from around 500,000 years ago at Boxgrove. Two lower incisors were found close to one another and probably belong to the same adult individual. The morphology of the teeth is similar to that of other middle Pleistocene hominins making their assignment to *Homo heidelbergensis* possible. The tibia most likely originated from a different individual because it was discovered in a different stratigraphic context from the two teeth [18]. The tibia reveals a mosaic morphology relative to other archaic *Homo* tibiae. The external diaphyseal robusticity and mediolaterally thickened cortical bone distribution are characteristic of Late Pliocene to Late Pleistocene archaic *Homo*. The estimated cold-adapted body proportions would have promoted body heat conservation in a hominin practicing minimal cultural buffering during the late interglacial cool temperate climate [19]. From the Boxgrove tibia it has been shown that *Homo heidelbergensis* was taller than the later, cold-adapted, Neanderthals [20]. Although no other British sites have yielded *Homo heidelbergensis* fossils, some have yielded similar lithic artefacts to those found at Boxgrove, Brandon and Waverley Wood for example [11, 21]. The tools associated with *Homo heidelbergensis* were more varied than those of *Homo antecessor* and included bifacial handaxes, cleavers and scrapers; they were probably skilled hunters of large animals, such as rhinoceros, bear, horse

and deer [11].

The colonisers (450,000 – 40,000 years ago)

Connected or disconnected?

Britain's history of connectivity to mainland Europe is complex. However, in broad terms around 450,000 years ago (MIS 12), ice stretched right across the North Sea, from Britain to Scandinavia, and at the end of this glacial stage there was an initial breaching of the chalk ridge (Figure 1B). This initial erosion of the land bridge was probably characterised by waterfalls and channels that would have emptied proglacial lakes in the southern North Sea basin [3]. During the following glacial periods Britain would have been too cold to inhabit and Neanderthals would have been pushed out of the British Isles to return during the interglacials. From around 180,000 years ago there was a steady decline in global temperature which must have forced the Neanderthals out of Britain, and at about 160,000 years ago (MIS 6) it is unlikely that any humans were still present; however, the climate then recovered rapidly at around 130,000 years ago. This led to sea levels rising and the submerging of the land surface between Britain and the continent, making Britain an island. Some mammals, depending on the distances of their glacial refugia, were fast to migrate and managed to reach Britain before it became an island. Others, such as elephants and hippopotamus, may have swum across, but Neanderthals (without boats) are not thought to have returned until around 60,000 years ago [22].

Coming and going: Ice ages and deserted lands

Just over 400,000 years ago a rapid improvement of the climate after the Anglian glaciation made Britain habitable again. **Swanscombe** is the only British site, to date, where a very

178 early Neanderthal fossil [23] has been discovered and it is possible that Neanderthals evolved
179 from *Homo heidelbergensis* around this time (Figure 6). The climate worsened again by
180 about 375,000 years ago, driving these early Neanderthals out again. Neanderthals returned to
181 Britain after the ice had retreated around 330,000 years ago, bringing with them new
182 technologies. The Neanderthals are mostly known from sites across Britain with Mousterian
183 artefacts, an industry which incorporates Levallois technique[1]. **Baker's Hole** (Ebbsfleet,
184 Kent) is one of the foremost sites that shows the Levallois industry [24].
185
186 The oldest human fossils in Wales found so far come from **Pontnewydd Cave,** which has
187 been dated to about 225,000 years ago [25, 26], and comprise teeth of early Neanderthal
188 adults and children (Figure 7). The Mousterian industry was also found at **Crayford**, Kent
189 [27, 28]. Additionally, more than 250,000 lithic artefacts were found on the other side of the
190 Channel at the site of **La Cotte** and although this site is now on the island of Jersey, the
191 island was connected to mainland France during periods of Neanderthal occupation.
192 Generations of Neanderthals most likely returned to the site over a period totalling more than
193 150,000 years [29-32]. Although for a long time it was believed Neanderthals did not return
194 to Britain until about 60,000 years ago, a recent discovery from Dartford (Kent), dated at
195 about 100,000 years ago, may hint that small Neanderthal groups possibly made rare visits
196 into Britain from their more permanent camps in France or Belgium [33, 34]. It is possible
197 they followed herds of mammoths, rhinoceros, horse and deer into Britain, but further
198 analyses and evidence are needed to support this claim.
199

[1] A method of stone reduction, involving the striking of flakes from a prepared core which provided much greater control over the size and shape of the final flakes which would then be employed as scrapers, knives and points.

Neanderthals were back in full force around 60,000 years ago. The site of **Lynford Quarry**, Norfolk has extensive evidence for classic Neanderthal Mousterian tools associated with the remains of at least eleven woolly mammoths [35, 36]. Although no butchery marks were found on the recovered mammal bones, none of the large meat-bearing bones were found, indicating they may have been transported away from the kill site.

Hominins

The oldest fossil evidence for Neanderthals in the British Isles is the partial skull from Swanscombe. The three cranial bones were discovered between 1935 and 1955; the articulated bones form the back of the skull of what is believed to be an early Neanderthal female and were found alongside a number of flint handaxes [37]. Despite its chronological association with the Middle Pleistocene, the occipital bone carries Neanderthal features: a weak occipital torus with bilateral projection, a central suprainiac depression and a strongly convex occipital plane. This makes the Swanscombe hominin one of the earliest primitive Neanderthals and supports an ancient root for the Neanderthal clade. The early emergence of these Neanderthal features in Swanscombe, while other roughly contemporary fossil hominins from Italy, Hungary and Germany display less derived Neanderthal morphology, suggests a more complex pattern of human evolution than has generally been assumed [20, 37]. Neanderthals fossils were also found in **Pontnewydd Cave,** North Wales. The nineteen hominin teeth were associated with bifacial and Levallois artefacts and belonged to both juveniles and adults. The teeth are taurodont and the overall dental morphology shows clear affinities with Neanderthals and the pre-Neanderthal Middle Pleistocene teeth from the Sima de los Huesos, Atapuerca, Spain.

The founding people (40,000 – 10,000 years ago)

An island established

Neanderthals had returned to the British Isles by about 60,000 years ago, and although MIS 3 climate was variable and complex, conditions did not improve permanently until the end of the glacial period (MIS 2), which reached its cold peak around 20,000 years ago, the Last Glacial Maximum (Figure 1C). During the early part of the current interglacial, the Holocene, Doggerland, the exposed land area in the present-day North Sea region, gradually disappeared as the ice melted and sea levels slowly rose to those of today (Figure 1D). Well before this time (around 40,000 years ago) we see the demise of the Neanderthals and the arrival of *Homo sapiens* in Europe [38]. The role of modern humans in the physical extinction of the Neanderthals is the subject of much debate [38], but genetic data show that Neanderthal DNA entered the modern human gene pool through interbreeding events. At present, no evidence of overlap exists for the occupation of Britain by Neanderthals and modern humans; any interbreeding probably happened more centrally within the Neanderthal range rather than at its geographical limits.

Still coming and going

The oldest modern human fossil in Britain, a fragment of maxilla, was found at **Kent's Cavern** (Figure 9) and dates back to at least 40,000 years [39]. The "Red Lady of **Paviland**" (actually the skeleton of a young man initially wrongly identified as a female) was discovered at **Goat's Hole**, South Wales, in 1823. The skeleton was coated in red ochre and the body had been buried wearing jewellery made from mammoth tusks; recent dating to about 33,000 years makes this discovery the oldest ceremonial burial in western Europe [40]. During the

Last Glacial Maximum much of Scotland and upland Wales would have been under an ice sheet that was up to one kilometre thick in places, and cold winds and dry air would have prevailed across Britain. This severe environment seems to have been too difficult to deal with, even for the resourceful first modern humans, and Britain was deserted once more, probably by around 28,000 years ago [41].

Around 15,000 years ago the climate started to improve and the ice gradually retreated making Britain, once again, a welcome place for large game and the hunters who followed them [42]. **Gough's Cave** in Cheddar Gorge was one of the first settlements for Magdalenian modern humans after the peak of the last glacial stage [43]. Not only did these humans bring with them finely decorated bone tools, such as batons and needles, they also made cups out of human skulls [44, 45]. For a long time, it was believed that one of the main differences between early British and mainland European modern human sites was the absence of figurative art such as figurines and cave paintings or engravings. In 2004 however, an engraving at least 13,000 years old of a bison, similar in style to those found in European caves, was found at **Church Hole** in the English midlands [46]. Shortly after 13,000 years ago another brief cold period hit Europe, but by about 11,700 years ago the current interglacial had started and temperatures soon returned to essentially what they are today [47, 48]. Prehistoric hunter-gatherers coming from Europe had to deal with new challenges. The animals they were used to hunting on the European Steppe, such as reindeer and horse, were replaced by forest dwelling taxa such as deer and wild boar. Around 6,000 years ago new ideas of agriculture and animal husbandry arrived from Europe leading to the decline of the hunter-gathering way of life and the beginning of the Neolithic [49, 50]. As well as the adoption of agriculture, technological advances, and a more sedentary way of life, these

farming communities also implemented the construction of the first monuments in the landscape, such as Stonehenge 4,600 years ago [49].

Conclusion

This review has laid out how human occupation of the British Isles during the last one million years is a story of repeated migration. The changing environment, with temperatures decreasing and recovering during the glacials and interglacials, would have posed challenges to the humans and fauna that they would not have encountered in more southerly parts of Europe. Not only would the English Channel land area have been submerged or dissected by large rivers at times, making accessing Britain difficult or impossible, but also when the ice sheets were at their thickest the extreme cold would have made the area uninhabitable for long periods of time. The first hominins to venture into the British Isles, probably *Homo antecessor* and *Homo heidelbergensis*, would have been unable to survive these long cold periods. Even Neanderthals, a human species well adapted to living in the cold northwest European plains, seem to have been unable to survive in Britain during MIS 6. Modern humans, despite their controlled use of fire, building of shelters and advanced lithic technology, still needed several attempts before being able to settle because life at the western edge of the Old World was not easy. The prehistory of the British Isles is a tale of coming and going, of deserted lands and recurring migrations.

Acknowledgements

We would like to thank: Simon Parfitt and also the Photography Unit at the Natural History Museum, London, for some of the images used; John Sibbick for the Happisburgh and Boxgrove reconstructions; Elizabeth Walker and Kay Kays from the National Museum of

295 Wales for the Pontnewydd lithics image. CBS and ML's research work was supported
296 through the AHOB Project, funded by the Leverhulme Trust, and Pathways to Britain, funded
297 by the Calleva Foundation.
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Figure 1: Generalised reconstruction of the land surface and the extent of ice sheets of the British Isles. A: ~900,000 years BP; B: ~450,000 BP (MIS 12 – Elsterian Glaciation); C: ~20,000-30,000 years BP (MIS 2 - Last Glacial Maximum); D: ~10,000 years BP (MIS 1 – Early Holocene) (after [51]).

Figure 2: Current distribution of the main Palaeolithic archaeological sites of the British Isles.

Figure 3: Happisburgh, Norfolk. A: Site 3 excavation (courtesy of NHM, London). B: Artist's reconstruction of the environment at Happisburgh ~900,000 years BP (courtesy of John Sibbick and the AHOB Project).

Figure 4: Pakefield, Norfolk. A: Excavation at Pakefield with the Cromer Forest-bed deposits clearly visible at base of cliff. B: Flint artefacts recovered from the site (courtesy of NHM, London).

Figure 5: Boxgrove, West Sussex. A: Reconstruction of butchering of a rhinoceros at the Boxgrove site (courtesy of John Sibbick). B: Excavations at Boxgrove. C: A rich assemblage of handaxes being excavated.

Figure 6: Swanscombe, Kent. The partial cranium belonging to an early Neanderthal, probably female, and a selection of handaxes recovered at Swanscombe (courtesy of NHM, London).

Figure 7: Pontnewydd Cave, North Wales. A: Handaxes discovered at Pontnewydd Cave (courtesy of the National Museum of Wales). B: The cave entrance during excavations. C: A juvenile Neanderthal maxilla is part of the assemblage of 19 teeth discovered at the site (courtesy of the NHM, London).

Figure 8: The maxilla from Kent's Cavern, Devon, including three teeth of the earliest known modern human in Britain, discovered during excavations in 1927.

Table 1: Simplified table of the main Pleistocene sites in the text; dates given in most cases are approximate; at many sites, only the relevant horizons and dates mentioned in the text are provided. BP = before present; AAR = amino acid racemization; OSL = optically stimulated luminescence; TL = thermoluminescence; U-series = Uranium series; 14C = Ultra filtered radiocarbon; MIS = Marine Isotope Stage.

Site	Industry	Age	Dating method
Happisburgh 3	Lower Palaeolithic	950,000 – 850,000 BP Early Pleistocene; MIS 25 or 21	Palaeomagnetism, biostratigraphy
Pakefield	Lower Palaeolithic	750,000 – 680,000 BP; MIS 19 or 17	Lithostratigraphy, biostratigraphy, AAR, palaeomagnetism
West Runton	None	~700,000 BP; MIS 17	AAR, biostratigraphy
Boxgrove	Lower Palaeolithic	~500,000 BP; MIS 13	Lithostratigraphy, biostratigraphy
Swanscombe	Lower Palaeolithic	~400,000 BP; MIS 11	Lithostratigraphy, biostratigraphy AAR
Baker's Hole	Levallois	MIS 8/7	AAR, biostratigraphy
Pontnewydd Cave	Levallois	~225,000 BP; MIS 7a	U-series, ESR, TL, biostratigraphy
Crayford	Levallois	MIS 7a	AAR, biostratigraphy
La Cotte	Levallois	MIS 7 to 2	OSL, 14C, TL, biostratigraphy
Lynford Quarry	Middle Palaeolithic	~60,000BP; MIS 4/3	OSL (+14C)
Kent's Cavern	Middle & Upper Palaeolithic	Maxilla ~40,000 BP; MIS 3	14C, biostratigraphy
Paviland	Upper Palaeolithic	Burial ~ 34,000 BP; MIS 3	14C
Church Hole	Middle & Upper Palaeolithic	MIS 3 to 1	U-series, 14C
Gough's Cave	Late Upper Palaeolithic	14,700 BP; MIS 2	14C

References: HSB 3 [2]; Pakefield [7, 52]; West Runton [10, 52]; Boxgrove [11] ; Swanscombe [23, 52]; Baker's Hole [24, 52]; Pontnewydd [53]; La Cotte [31, 32]; Lynford [36]; Kent's Cavern [39]; Paviland [40]; Church Hole [46, 54]; Gough's Cave [43].