McDONALD INSTITUTE MONOGRAPHS

Hunter-gatherers in the landscape

Surveys and excavations in the eastern Vale of Pickering, 1976–2000

Edited by Paul J. Lane, Tim Schadla-Hall & Barry Taylor

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On the front cover: *Area excavations at Site K, Seamer Carr, 1984. Photo: Simon Evanston.*

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Contents

Contributors

Ian Bailiff
Department of Archaeology, University of Durham, Science Site, South Road, Durham DH1 3LE.

Peter Cardwell
Richmond, North Yorkshire.

Juliet Clutton-Brock†

Chantal Conneller
School of History, Classics and Archaeology, Faculty of Humanities and Social Sciences, Newcastle University, Newcastle-upon-Tyne NE1 7RU.

Gaynor Cummins
Durham, County Durham.

Andrew David
Fishbourne, West Sussex.

Stephen East
School of Geosciences, University of Edinburgh, Grant Institute, King's Building, West Mains Road, Edinburgh EH9 3JW.

Albert Franks†

Rowena Gale
Andover, Hampshire.

Charlotte Haddon
School of Geosciences, University of Edinburgh, Grant Institute, King's Building, West Mains Road, Edinburgh EH9 3JW.

Rupert A. Housley
Royal Holloway, University of London, Egham Hill, Egham TW20 0EX.

James B. Innes
Department of Geography, Durham University, Lower Mountjoy, South Road, Durham DH1 3LE.

Paul Lane
Department of Archaeology, University of Cambridge, Downing Street, Cambridge CB2 3DZ.

Tony Legge†

Eva Panagiotakopulu
School of Geosciences, University of Edinburgh, Grant Institute, King's Building, West Mains Road, Edinburgh EH9 3JW.

Peter Rowley-Conwy
Department of Archaeology, University of Durham, Science Site, South Road, Durham DH1 3LE.

Tim Schadla-Hall†

Ian G. Simmons
Department of Geography, Durham University, Lower Mountjoy, South Road, Durham DH1 3LE.

Roger Simpson
Scarborough, North Yorkshire.

Geoff Smith
Department of Archaeology, University of Reading, Whiteknights Box 227, Reading RG6 6AB.

Sue Stallibrass
Department of Archaeology, Classics and Egyptology, University of Liverpool, 12–14 Abercromby Square, Liverpool L69 7WZ.

Ken Thomas
Institute of Archaeology, University College London, 31–34 Gordon Square, Bloomsbury, London WC1H 0PY.

Barry Taylor
Department of History and Archaeology, University of Chester, Parkgate Road, Chester CH1 4AR.

Junzo Uchiyama
Sainsbury Institute for the Study of Japanese Arts and Cultures, University of East Anglia, 64 The Close, Norwich NR1 4DH.

Francis Wenban-Smith
Department of Archaeology, University of Southampton, University Road, Southampton SO17 1BJ.

Figures

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The Toasts and
Annual Awards

'The Patron, Trustees, Farmers,
Landowners, and Diggers'
~
Response

'The Catering Manager'
~
Response

MENU
~
Shrimp Mayonnaise
~
Roast Beef
Roast Potatoes
Yorkshire Pudding
Carrots Julienne
Courgettes Marriott
~
Raspberry Mousse
Cundall
~
Chocolate Gateau
~

Figure 0.1. *The 1996 Annual VPRT Dinner Menu, courtesy of Mrs Helen Patterson.*

Wenban-Smith, and Dave Wicks on the Seamer Carr excavations; and, Angus Easie, Amy Gray-Jones, Adrian Green, Martin Griffiths, David Kenyon, Nicky Milner, Biddy Simpson, Andrew Morrison, Angela Russell, Twigs Way and Jenny Young on the VPRT excavations. Many thanks too to the finds' supervisors on the two projects, Steve Cracknell, Joanna Davinson and Tania Simpson, and to Simon Evanson for serving as the Seamer Carr on-site photographer for several years. An enormous vote of thanks and appreciation is due to Mrs Helen Patterson, our cook-extraordinaire throughout the Seamer Carr and VPRT projects, who kept everyone supplied with lunchtime sandwiches, hearty evening meals and fabulous last night dinners (see the menu for the 1996 dinner as an example), all prepared either on-site in a portacabin or in a disused stable at the dig campsite in Sherburn during the VPRT project.

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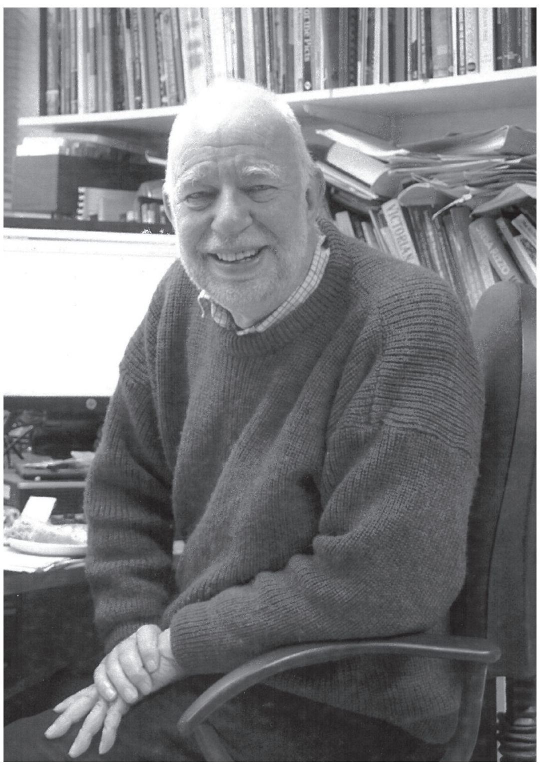
Note

1. 'Celluloid Heroes', The Kinks, 1972.



This volume is dedicated to the memory of

Tim Schadla-Hall FSA

and

Richard Marriott CVO, TD, FSA

Chapter 1

Introduction, aims and objectives and history of research on the Late Upper Palaeolithic and Mesolithic in the Vale of Pickering

Paul Lane & Tim Schadla-Hall†

This monograph represents the results of over twenty years of fieldwork and research on the Late Glacial (Late Upper Palaeolithic) and Early Holocene (Mesolithic) landscape around palaeo-Lake Flixton (hereafter Lake Flixton), in the Vale of Pickering, North Yorkshire. The area of focus of this research was on the eastern end of the Vale of Pickering, demarcated by the line of the A64 trunk road in the west, and running east as far as the village of Muston (Figs. 1.1–1.2). This encompasses the basin of Lake Flixton, as originally described by John Moore (1951), and its immediate surroundings, which at its maximum extent measured roughly 5.5 km east–west, up to 2.5 km north–south, and covered approximately 12.5 km^2 *in toto*. The work was initially undertaken between 1976 and 1985 as part of the Seamer Carr Project, and then from 1985 to 2000 by the Vale of Pickering Research Trust (VPRT). Research by the VPRT continued after 2000, with elements being later subsumed within new projects at Star Carr (Milner et al. 2018a, 2018b), Flixton Island (Milner et al. 2017) and Flixton School House Farm (Taylor 2012, 2019; Taylor & Gray Jones 2009), and on the Early Holocene palaeoecology (Taylor 2019) and in a recently published summary of the VPRT-sponsored palaeoecological research (Innes et al. 2022).

It is worth emphasizing at the outset that the work described in these volumes began as a development-led rescue archaeology project at Seamer Carr, and was subsequently developed into a research-driven landscape project, aimed at examining areas of known Early Mesolithic activity, in the hope that it would not only place the well-known site at Star Carr (Clark 1954; Mellars & Dark 1998; Milner et al. 2018a), in a wider context, but also provide a methodology for analysing Mesolithic activity on a landscape scale. The research was also intended to provide insights into the future directions for Mesolithic studies, and challenge misconceptions about the Early Mesolithic that were current at the start of the Seamer Carr Project. The easternmost part of the Vale, the former Lake Flixton and its environs, was ideal for this work because it represented a palaeo-landscape that could be clearly delineated as a relatively finite area for investigation. One point to emerge from this study is the environmental variability, both in the immediate area of the lake and in the wider landscape of North Yorkshire, during the Late Glacial and Early Holocene (see below, Chapter 5). Documenting the subsequent spatial and temporal characteristics of this mosaic of different environments, its transformation over time, and significance for understanding human strategies of exploitation following the Mesolithic, must remain a priority for future research.

The aim of this chapter is to provide a brief background to the Seamer Carr Project and the VPRT, highlighting the main activities and accomplishments of different phases of work, and some of the wider developments and changing intellectual context of the surveys and excavations as the projects unfolded. The following four chapters (Chapters 2–5) provide additional background material concerning the excavation and post-excavation methods, a critical analysis of the radiocarbon dates generated by the two projects, and the setting and the environmental history of Lake Flixton. Chapters 6–13 describe the results of the surveys and excavations at individual localities in more detail, and discussions of the character and scale of human activity recorded through this work. In places, these are supplemented by the results of palaeoenvironmental studies aimed at reconstructing the local environment, and identifying possible anthropogenic modifications to vegetation.

Diverse assemblages of worked flint and animal bones, some of it modified by human activities, were virtually the only categories of finds recovered during the two projects, despite the extreme care taken during

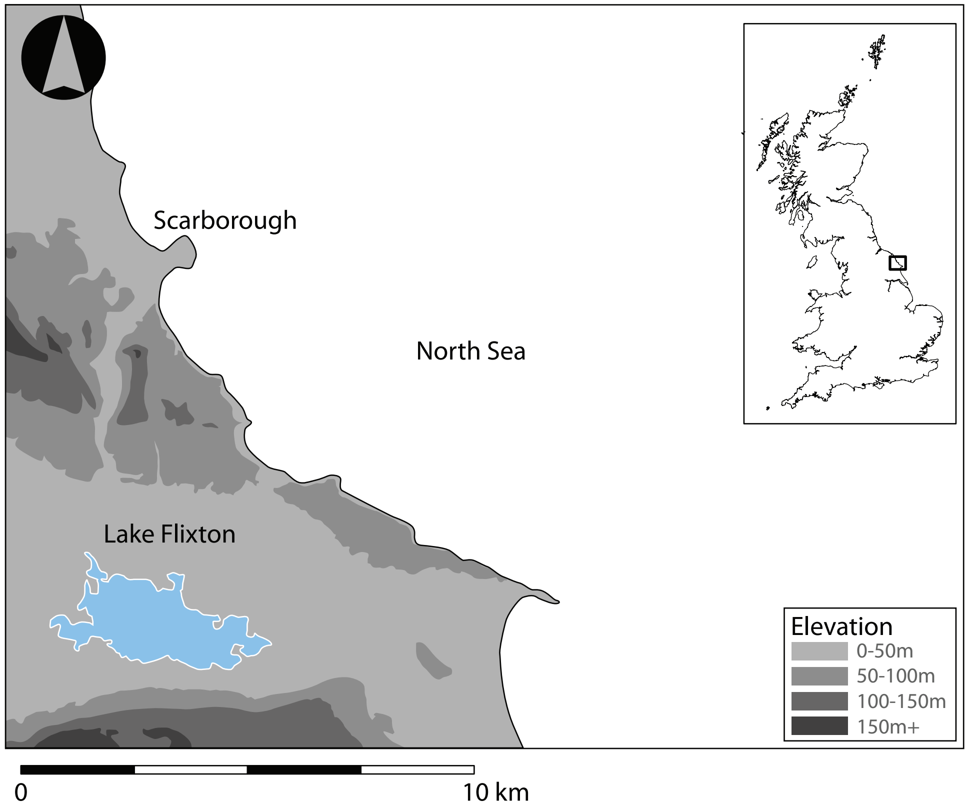


Figure 1.1. *The eastern Vale of Pickering, showing the maximum extent of Lake Flixton.*

excavation to look for the wider range of artefacts made from organic and inorganic materials known to have been recovered from the site of Star Carr (Clark 1957; Milner et al. 2018b). The lithic assemblages are described in detail in Chapters 14 and 15, the faunal assemblages are reviewed in Chapters 16 and 17, and a summary of the insect analysis is discussed in chapter 18. Chapter 19 provides an overall summary and interpretation of the results, and Chapter 20 presents the main conclusions drawn from the two projects and offers some pointers for future research.

At the outset, readers should be aware that the post-excavation research on which these volumes are based has been undertaken in a series of phases, interrupted by long years of inactivity (and exceptional patience on the part of the individuals involved). Inevitably, as a consequence of these delays, the analysis of the Seamer Carr and VPRT data sets has been overtaken by the results of new analyses of materials recovered at different times from the site of Star Carr (Mellars & Dark 1998; Milner et al. 2018a, 2018b). Aspects of the work at Seamer Carr, and elsewhere around Lake Flixton, certainly informed some of this later work, at least in its initial iterations, and elements of this intellectual history, and some of the results have been outlined elsewhere (Conneller & Schadla-Hall 2003; Lane & Schadla-Hall 2004; Milner et al. 2011). At the risk of repeating some of this information, and mindful that Mesolithic studies in Britain and mainland Europe have advanced on several methodological, analytical, and theoretical fronts since the first sod of turf was cut at Seamer Carr, the following sections endeavour to explain how the two projects unfolded over the course of twenty-five years of engagement with the material, the landscape settings, and shifting contexts of practice.

Background to the Seamer Carr Project

The initial fieldwork that resulted in the development of the project took place in 1976, and was prompted by the requirement for a rescue excavation at Seamer Carr on an area of some 40 ha threatened by the construction of a waste disposal plant for North Yorkshire County Council (NYCC). Although it was rather late in the planning process, the then County Archaeologist, Mike Griffiths, was brought in to address the need to record the archaeology of the area to be developed. One of the primary reasons for initiating excavations in the area was the potential for recovering evidence of

Early Mesolithic activity, as the world-famous site of Star Carr lay only 1.5 km to the south of the threatened area. As such, the overall aim of the investigations at Seamer Carr was to recover any evidence of past activity, irrespective of period, within the area of development, but with a primary goal of seeking evidence of Early Mesolithic activities that might help to place Star Carr into a wider context, both within the area of lake Flixton, and the broader region of northeast England (Schadla-Hall 1987a, 1989). It was also hoped that the work at Seamer Carr might provide a better insight into the nature of this hitherto unique site, which had long been regarded as the 'type' site for the Early Mesolithic in northwest Europe and yet, despite the quality of the initial excavation and publication, was constantly being re-interpreted in isolation from its surrounding landscape (for a summary of these changing views, see Legge & Rowley Conwy 1988, Mellars 1998a, 1998b; Lane & Schadla-Hall 2004; Milner et al. 2018a).

Prior to the work at Seamer Carr, there had been no fieldwork focusing specifically on the Early Mesolithic of this part of the Vale of Pickering since the late Sir Grahame Clark had published the results of excavations at Star Carr (Clark 1954). This gap seems remarkable in retrospect, given the pre-eminence accorded to the results of the work at Star Carr, and the pivotal position of the site in the interpretation of Mesolithic hunter-gatherers in northwest Europe (Lane & Schadla-Hall 2004; Rowley-Conwy 2010). Given that the original publication by Clark (1954), as well as the work of John Moore (1950, 1954), indicated that there were other sites of the period known around the former lake, plus the subsequent advent of palaeoenvironmental and dating techniques not available in the early 1950s, the hiatus in fieldwork activity in the area is difficult to explain. One practical and important consequence of this dearth of work, was that many of the assumptions that guided the initial research design of the Seamer Carr Project

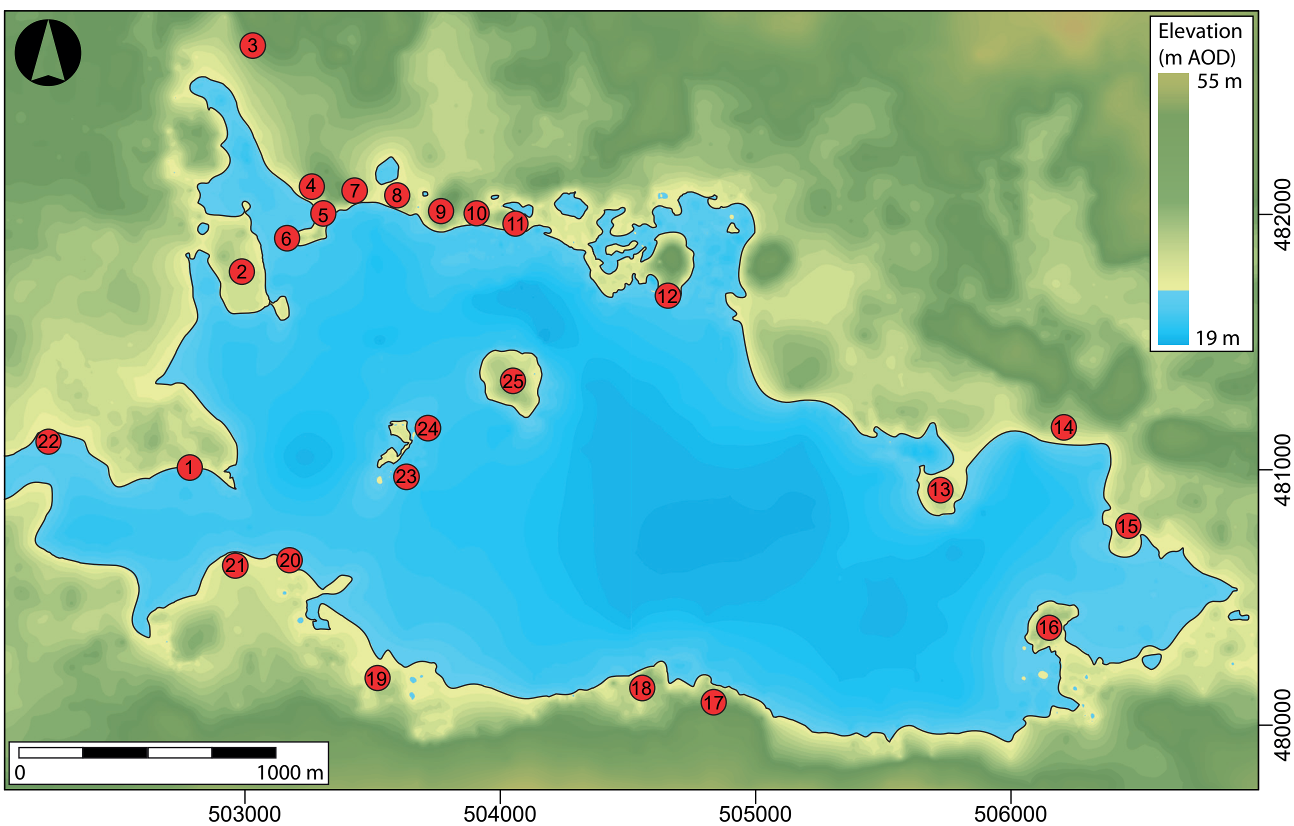


Figure 1.2. *Location of Palaeolithic and Mesolithic sites around Lake Flixton: 1: Star Carr; 2: Ling Lane; 3: Seamer Carr Site F; 4: Seamer Carr Sites L & N; 5: Seamer Carr Site K; 6: Seamer Carr Site D; 7: Seamer Carr Site B; 8: Seamer Carr Site C; 9: Manham Hill (Moore's site 6); 10: Cayton Carr (Moore's site 7); 11: Cayton Carr (Moore's Site 8); 12: Cayton Carr VPRT; 13: Lingholm Farm Site B; 14: Lingholm Farm Site C (Moore's Site 5); 15: Lingholm Farm Site A; 16: Barry's Island; 17: Flixton School Field; 18: Flixton School House Farm; 19: Woodhouse Farm; 20: VP Site E; 21: VP Site D; 22: Flixton 9 (Moore's Site 9); 23: Flixton Island South (Moore's Site 1); 24: Flixton Island North (Moore's Site 2); 25: No Name Hill (Moore's Site 3).*

had to be amended or even discarded as the field and analytical research progressed.

The work at Seamer Carr took place over ten years (1976–85),[1] and as a result of the generosity and far-sightedness of the sponsors resulted in an area covering nearly 2 km of former lake shoreline being investigated in detail, and the discovery of several Late Upper Palaeolithic and Mesolithic artefact concentrations. However, the initial work made those directly involved in the fieldwork also recognize that there was much more to do if some of the questions being asked about the nature of Early Mesolithic activity in the area, as well as the nature of Star Carr itself, were to be better understood. Furthermore, it was clear that the environmental history of Lake Flixton was poorly understood in terms of the nature and shape of the lake, its hydrological regime, and the character of the environments that formed within it. More disconcerting was the recognition that increased drainage in the eastern Vale of Pickering since the original excavations at Star Carr, was also threatening the lake-edge deposits. Visually, this was best demonstrated by photographs taken in the 1940s and 1950s, which exhibited much more water in drainage ditches than was the case in the mid-1980s. However, it was also clear that progressive drainage was resulting in damage to the fragile archaeological deposits sealed beneath the peat, as well as damage to the palaeoenvironmental and faunal record contained in what were rapidly ceasing to be wet, anaerobic deposits. Drawing on a variety of records, it was possible to estimate that the water table had, in some areas, declined by at least a metre and probably more since the excavations in the 1940s/50s. It was at this point that it was decided to examine the wider landscape around both Star and Seamer Carrs, and place the discoveries made there into a wider, and potentially more meaningful context, by attempting to locate all evidence of Early Mesolithic (and any surviving Late Upper Palaeolithic) activity around the former Lake Flixton.

As an initial step toward this goal, Edward Cloutman and Alan Smith carried out a survey of the western end of the former Lake Flixton. This demonstrated the complexity of the lake-edge topography (Cloutman 1988a), and for the first time made it possible to show exactly how Star Carr sat within its wider landscape setting. From 1985 to 2000, under the overall direction of Tim Schadla-Hall, the VPRT carried out an annual field season aimed at mapping the edges of the lake basin through a programme of hand augering, limited excavation and field survey, and locating traces of Early Mesolithic activity along the line of the lake shore. This fieldwork was accompanied by a programme of palaeoenvironmental investigation aimed at understanding the lake environments and identifying evidence for human impacts on the vegetation. By 2000, roughly two-thirds of the lake shore had been mapped, along with both of the islands within the lake, and several new sites of Early Mesolithic date had been located. The work of completing the mapping of the lake continued over the following decade, again mostly under the auspices of the VPRT supplemented by work undertaken by Barry Taylor for his PhD (Taylor 2012); those results have been incorporated into the published reconstructions of the changing size and shape of the lake presented here.

The fieldwork undertaken around Lake Flixton between 1985 and 2000 resulted in the location of several new areas of Early Mesolithic activity, most of which occupied a zone from the former lake shore onto the adjacent dry land. At the same time, work at Star Carr between 1985 and 1992 confirmed what had already been suspected, namely that the area excavated by Clark had been merely a part of a much larger site, (if 'site' is the appropriate word), and that there was considerably more evidence to be extracted from the site both environmentally and archaeologically, as was subsequently demonstrated by more sustained archaeological investigations in the late 1990s and again in the early 2000s (Mellars & Dark 1998; Milner et al. 2018a, b). Together, this work has demonstrated that there is no such thing as a typical 'Early Mesolithic site' within the Lake Flixton landscape, and that Star Carr remains, in almost every sense, exceptional (see also Chapter 19). It is also clear that activity during the Early Mesolithic was focused on the lake shore area and the islands, but not, as far as one could discern from fieldwalking evidence, in the surrounding landscape. In other words, the lake itself seems to have been the focus for occupation (see Conneller & Schadla-Hall 2003).

A note on the use of the term 'site'

As the foregoing suggests, and as developed further in this publication, the use of the term 'site' can be problematic as it conjures up notions of habitation as opposed to simply activity, and, in the context of hunter-gatherer studies, differences between such phenomena as base camps, hunting stands, and extractive locations (Binford 1978a, 1980, 1982). In previous publications concerning the Seamer Carr and VPRT projects (Schadla-Hall 1987a, 1987b, 1988, 1989; Schadla-Hall & Cloutman 1985), the term site was used to refer to the archaeology recovered from both large, excavated areas, such as Seamer Sites C and K, and that from smaller excavation units. This nomenclature is retained here simply out of convenience. However, it should be understood from the outset that the use of the term simply refers to scatters of artefactual and/or faunal remains, sometimes associated with archaeological features such as hearths and possible stake-holes, which can vary in spatial extent, density, and even stratigraphic characteristics. In other words, we use the term to refer to all such archaeological entities that have been located and investigated as part of the Seamer Carr and VPRT projects, without implying that these represent either a discrete habitation area or single activity event. Instead, we suggest it is more appropriate to consider the assemblage of archaeological remains and environmental traces recorded from around the lake as representing the debris of various acts of manufacture, use, curation, and deposition, that accumulated over many centuries, both sequentially and consecutively, some of which may have derived from broadly contemporary, related acts while others did not.

Origins of the project

The field investigations on which this monograph is based were conducted between 1976 and 2000 under the auspices of two separate bodies, funded by different organizations, and co-ordinated by different steering committees. However, both projects had certain objectives in common, most especially those concerned with elucidation of the pattern of settlement and landscape utilization in the vicinity of Lake Flixton during the Late Upper Palaeolithic and the Mesolithic (*c*. 12,600–4000 cal BC). Both the archaeological and the environmental investigations also accumulated data concerning later periods of human occupation and activity within the eastern end of the Vale of Pickering, and associated details of changing environmental conditions. These include evidence of Neolithic, Bronze Age, and Iron Age settlement activities around the margins of the carrland deposits that overlie the Early Mesolithic horizons. Detailed description and interpretation of these data, however, falls outside the remit of this monograph, and the principal results will be published elsewhere.

Background to the Seamer Carr excavations

The initial field investigations formed part of the Seamer Carr Project. This was established jointly by North Yorkshire County Council and what was then the Archaeology Division of the Department of the Environment (subsequently a division of English Heritage, and now part of Historic England), in 1976. The primary objective of the Seamer Carr Project was to mitigate the potential effects of construction work and the dumping of waste on any archaeological resources in a 40-hectare area of farmland on the northern edge of the Vale of Pickering (Fig. 1.3). Known as Seamer Carr Farm, North Yorkshire County Council had acquired this area for use as the site for a waste disposal and processing plant that was intended to serve the nearby town of Scarborough and the surrounding villages. Although there was extensive evidence in the existing Sites and Monuments Record (SMR) of prehistoric and Anglo-Saxon sites in the general vicinity, there were virtually no archaeological records at all for this particular parcel of land.

A programme of systematic sampling and area excavations was duly initiated, under the guidance of a Steering Committee comprised of representatives from the Ancient Monuments Inspectorate, the Ancient Monuments Laboratory, North Yorkshire County Council, the British Museum and Sheffield and Cardiff Universities, as well as the Field Director, R.T. Schadla-Hall (See Appendix 1). For its duration, the project was managed by North Yorkshire County Council in terms of all supporting administration. The first season of fieldwork took place in 1976, with the final season being completed in 1985. Between 1976 and 1979, efforts were divided between sampling the entire area to determine the overall distribution and levels of preservation of archaeological remains, and more large-scale excavation of selected sites ranging in date from the Late Upper Palaeolithic to the Iron Age. From 1980, following completion of the excavation of later sites, further work was directed at determining the distribution, extent, composition, function, and temporal resolution of Early and Late Mesolithic activities within the threatened area, and reconstruction of their associated environmental settings through a coordinated programme of test-pitting, large scale excavation, and environmental sampling.

By the end of the Seamer Carr Project, extensive excavations had been conducted at two localities (Site C and Site K). Three more spatially restricted concentrations of lithic and faunal material (Sites B, D and L) representing traces of 'off-site' activities, had also been excavated, and nearly 2 km of the former Lake Flixton shoreline had been sampled for traces of human activity. More limited investigations, using machine-excavated trenches, had also been undertaken in areas of deeper peat deposits thought to mark the locations of areas of former open water during the Early Mesolithic. Although these demonstrated the existence of traces of faunal remains ('U' and 'M' trenches), no detailed examination of these was undertaken due to the physical difficulties of investigation (most likely requiring the use of a cofferdam), and the likely costs that would have been involved.

Origins of the Vale of Pickering Research Trust

As discussed above, even before the end of the Seamer Carr Project it was apparent that a broader, landscape-oriented approach to documenting the Early Mesolithic

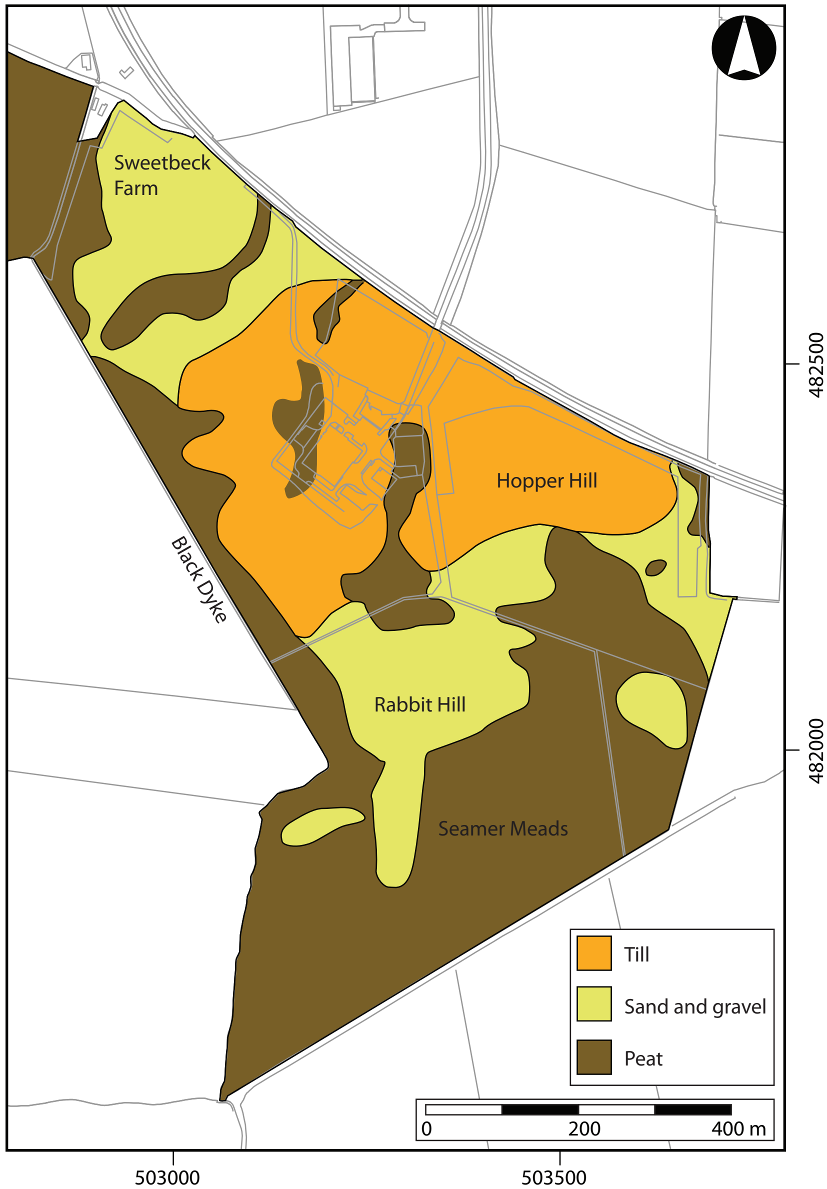


Figure 1.3. *Area investigated during the Seamer Carr Project, 1976–1985, showing superficial geology.*

presence around Lake Flixton was needed. It was also apparent that any attempt to resolve the debates regarding the character of activity at Star Carr, which had been published while the Seamer Carr Project was ongoing (Caulfield 1978; Wheeler 1978; Pitts 1979; Andresen et al. 1981; Price 1982; Coles & Orme 1983), along with understanding the divergent evidence from Seamer Carr, would be contingent on a more comprehensive understanding of the diversity of the Early Mesolithic landscape than was then available. A further stimulus to conducting additional survey was the growing evidence for accelerating deterioration of the waterlogged deposits covering the Early Mesolithic horizons, and the consequences this would have on the long-term potential of the archaeological and environmental resource.

As a result, the VPRT was established in 1985 to carry out further investigative work in the eastern end of the Vale. The Trust is a registered charity, administered by a board of Trustees, and comprised of members of the local business and farming communities, as well as professional archaeologists (See Appendix 1). Each year from 1985 to 2000, the Trust supported a programme of archaeological survey and excavation around Lake Flixton, with a particular focus on the previously uninvestigated southern shore and islands. Over this same period, the Trust also commissioned several palaeoenvironmental and other specialist analyses, as well as more general post-excavation work.

This work led to the survey of approximately 4 km of the former shoreline of Lake Flixton, the complete topographical survey of Flixton Island, No Name Hill and Barry's Island, and the excavation of almost 250 2 × 2 m test-pits. This resulted in the accurate delineation of four sites first located by John Moore (1950, 1951, 1954), and the discovery and delineation of a further four previously unrecorded concentrations of lithic and faunal remains of Early Mesolithic date. At all but two of these, larger excavations took place to document their internal spatial organization and collect larger samples of cultural and palaeoenvironmental material. Additional environmental sampling was also carried out in areas of deeper peat, as part of a strategy aimed at reconstructing the natural vegetation during different climatic stages, against which evidence for human manipulation and impact could be assessed.

Principal research objectives

Over the twenty-five years of research with which this monograph is concerned, the specific aims of certain aspects of the work inevitably changed and developed. This was partly in response to new discoveries and better understandings of the complexities of the archaeological and palaeoenvironmental records, but also in response to the development of new methodologies and analytical approaches, and broader shifts in theoretical approaches to the study of hunter-gatherer societies over this period (e.g. Clark 1972a; Binford 1978; Price & Brown 1985; Bettinger 1991; Winterhalder & Smith 1991; Kelly 1995). From the 1970s, various critiques of Clark's model of Mesolithic activity around Lake Flixton, and its relationship to the wider region, had begun to emerge (see Lane & Schadla-Hall 2004; Milner et al. 2018c for summaries). In addition, since at least the 1990s, alternative interpretative models of seasonal mobility, logistical organization, lithic technologies and standardization, settlement dynamics, and human-environment relations during the Mesolithic in Northern Britain have been proposed (e.g. Myers 1989; Eerkens 1998; Spikins 1999; Chatterton 2003; Conneller 2005, 2007; Reynier 2005; Donahue & Lovis 2006, Waddington 2007; Evans et al. 2010; Preston & Kador 2018), alongside calls for alternative analytical frameworks (e.g. Bevan & Moore 2003; Conneller & Warren 2006), and greater attention to the diversity evident in the archaeological signatures of hunter-gatherer societies more generally (Cummings et al. 2014; Finlayson & Warren 2017).

Notwithstanding these shifting intellectual currents, which have certainly shaped how the data presented here have been interpreted, in broad terms, all the archaeological and palaeoenvironmental field research conducted between 1976 and 2000 on the Early Mesolithic of the eastern end of the Vale of Pickering, adhered to the same general objectives (see Schadla-Hall & Cloutman 1985 for an early statement of these research goals). It has been in conjunction with, rather than in opposition to, these primary objectives that supplementary and subsidiary ones subsequently developed.

Archaeological objectives

A1 To reconstruct, through the use of systematic auger surveys, the surface topography and superficial geology around the shores of Lake Flixton, and any former islands within it, for the Late Upper Palaeolithic and Early Mesolithic periods.

A2 To systematically examine a 5% sample of these palaeo-shorelines for traces of human activity, through the excavation of a sequence of regularly spaced test-pits, with the aim to reconstruct the distribution of settlements, off-site activities, and resource zones around Lake Flixton during the time period under consideration.

A3 To investigate in greater detail any significant concentration of buried artefactual or faunal remains located by means of test-excavation or fieldwalking, to determine their chronological associations, spatial extent, assemblage diversity and composition, depositional sequences, and internal structure.

A4 To collect supplementary information concerning the distribution of terminal Upper Palaeolithic and Early Mesolithic activities around Lake Flixton via systematic fieldwalking in areas affected by peat shrinkage and recent ploughing.

A5 To record any evidence of later human activity encountered during fieldwork, and to assess the possible effects of this on the integrity of the buried Upper Palaeolithic and Early Mesolithic deposits.

A6 To integrate the available archaeological data from around Lake Flixton for the Late Upper Palaeolithic and Mesolithic with appropriate paleoenvironmental data for the same period from locations within the Vale of Pickering (including those investigated by other researchers) and adjacent areas, so as to reconstruct patterns of resource distribution and land use; diet and subsistence practices; seasonality and frequency of site occupation; settlement logistics; locational preferences; human impact on the environment; temporal and spatial variations in activities.

Palaeoenvironmental objectives

P1 Reconstruction of the environment and palaeogeography of Lake Flixton, through stratigraphic, depositional and palynological analytical investigations, with particular reference to the Late Glacial and early Holocene.

P2 To provide information regarding landscape changes and vegetation history within the eastern end of the Vale of Pickering, in order to establish an environmental context of the early prehistoric human occupation of the area.

P3 To collect, analyse and document information regarding the distribution of habitats and plant resources within and around Lake Flixton, and assess their relative potential for utilization by prehistoric human and animal populations.

P4 To collect, analyse and interpret any evidence for human interference with, and impact on the natural vegetation within and around Lake Flixton, with particular reference to evidence for deliberate or accidental burning.

P5 To provide information concerning the phases, duration and seasons of occupation or utilization of archaeological sites, through the examination of charred and waterlogged plant macros, and faunal, insect and molluscan remains and soil chemistry.

History of research

Initial field investigations

Early fieldwork at the eastern end of the Vale of Pickering was carried out by a local archaeologist John W. Moore during the 1940s (Fig. 1.4). By examining sections of freshly cleaned drainage ditches, Moore located ten sites containing pieces of worked flint, bone, and other material, with the earliest dating from the Early Mesolithic (at one of these sites (Site 6), on Manham Hill, Moore also found Bronze Age pottery) (Moore 1950, 1951). Moore also correctly identified the sequences of peat as the remains of a palaeolake, which he named Lake Flixton to distinguish it from the Glacial Lake Pickering. In 1948–9, Moore undertook archaeological excavations at two of these sites (Flixton 1 and Flixton 2). At Flixton 1, Moore encountered a dense scatter of Early Mesolithic flints, which he took to represent the remains of a 'short-term camp'

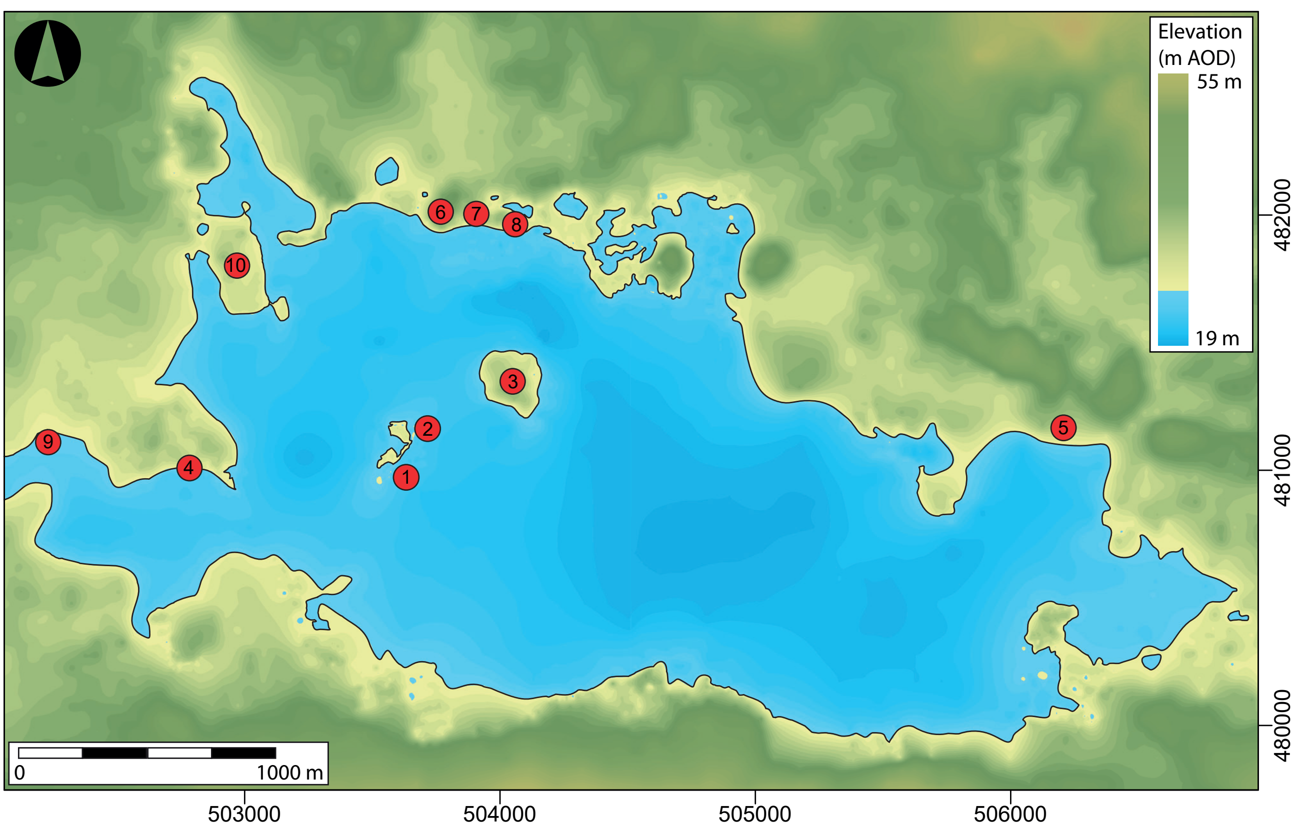


Figure 1.4. *Location of John Moore's sites 1–10 (n.b. locations of Sites 7 & 8 are approximate).*

(Moore 1950, 102). At Flixton 2, however, he uncovered a backed flint blade in association with the bones of several horses in a deposit of lake-bed muds (Moore 1954). The sediments were dated on the basis of pollen data to the Late Glacial (Windermere) Interstadial, leading Moore to interpret the site as a Late Palaeolithic horse kill site, though this chronology now seems unlikely (see Chapters 4 and 10).

Moore drew his discoveries to the attention of Dr (later Professor) Harry Godwin, Director of the Sub-Department of Quaternary Research at Cambridge University. In 1948, Godwin, and his colleague Professor A.P. Clapham, visited Moore's excavations at the Flixton sites, and obtained a pollen core from the vicinity, details of which were subsequently published (Godwin 1949). Following advice from Godwin (Moore, pers. comm. 20/1/1985),[2] and from the Curator of Scarborough Museum at the time, Mr Gwatkin, Moore sent a sample of the flints he had recovered to Grahame Clark at the Department of Archaeology, University of Cambridge (Clark 1954, xviii). Clark later wrote of his excitement on receiving the 'parcel of flints' Moore had sent to him, which he initially assigned to the Maglemosian:

> 'The possibility was there of recovering this industry in early postglacial deposits. The vital clue would be animal bone. Mr Moore responded by systematically exploring ditches on the northern margin of the alluvium. Sure enough, he was able to lead me on my first visit to a site where decayed bone and antler were visible in a dike profile at the same level as the flints. This site was Star Carr [i.e. Moore's Site 4]' (Clark 1972b, 4).

Clark duly directed excavations at the Star Carr site over three seasons (Fig. 1.5), each approximately three weeks long, between 1949 and 1951. At Star Carr, Clark found what he took to represent the remains of a residential base camp for a small band of mobile hunter-gatherers or foragers (*sensu* Binford 1980), who had occupied the site during the winter and spring months (Clark 1954; Fraser & King 1954). During the same period, Moore continued to work at Flixton, and some of his preliminary results were included in the final Star Carr publication (Moore 1954).

Rise in importance of Star Carr

Following Clark's excavations at Star Carr, the site rapidly came to be considered as a 'type-site' for the Maglemosian in Northern England, not least because it was the only site of its kind to have been investigated.

Figure 1.5. *Excavations at Star Carr, 1952 © Cambridge University Museum of Archaeology and Anthropology, reproduced with permission.*

Another reason for this rise in prominence was the quality of preservation of faunal remains and organic artefacts. The latter included a large assemblage of barbed projectile points, mostly made from red deer antler, plus associated manufacturing debris, as well as elk antler mattock-heads, bone bodkins and scrapers, rolls of birch bark, a wooden club and possible paddle, and a 'birchwood platform' on which much of the settlement activity was believed to have taken place (Clark 1949, 1950, 1954; Clark & Thompson 1953). This wealth of information, not normally encountered on dryland Early Mesolithic sites, plus the prompt publication of the results of the excavation, gave further significance to Star Carr and the research potential of waterlogged sites in general.

The integration of data from specialist analyses of the faunal assemblage (Fraser & King 1954), and the palaeoenvironmental remains and peat deposits (Walker & Godwin 1954), was a further contributory factor. In particular, by providing information about the diet of the site's occupants, its environmental setting and possible seasons of occupation, Clark's monograph underscored the great potential of scientific analyses within archaeology. As a consequence, the Star Carr approach to 'economic prehistory' (Clark 1952, 1953a, 1953b) came to be regarded as a model for others to follow, and was widely cited in archaeological textbooks (see Lane & Schadla-Hall 2004). Another contributory factor was the discovery and investigation of Early Mesolithic sites with parallel Maglemosian-type assemblages on the Pennines in West Yorkshire, which were interpreted as representing the summer counterparts of the site at Star Carr (Radley & Mellars 1964; Radley 1969).

The view that Star Carr was a fairly typical, if exceptionally well preserved, example of an Early Mesolithic winter and spring-time base camp became further entrenched in the mid-1970s, following the publication of a re-appraisal by Clark (1972a) of the evidence from the site and those in the Pennines. In this, he proposed a model of upland-lowland migration, where the inhabitants of Star Carr moved seasonally onto the surrounding upland areas as they followed herds of migrating red deer. Among other issues, this incorporated some of the fresh insights into hunter-gatherer territoriality and subsistence behaviour provided by recent anthropological studies (e.g. Lee & DeVore 1968) and Site Catchment Analysis (e.g. Vita-Finzi & Higgs 1970). This underscored his interpretation of Star Carr as the remains of a winter base camp, utilized by a small band of mobile foragers. Roger Jacobi's interpretation of Early Mesolithic flint scatters on the North York Moors, such as Pointed Stone sites 2 and 3, as representing the remains of short-term summer hunting camps (Jacobi 1978), lent some support to this interpretation.

Over the following decades as work at Seamer Carr progressed, a number of alternative interpretations of the function of Star Carr, its season of occupation and place within a larger settlement system were put forward. These included suggestions that it was (i) a winter to early summer hunting and processing site (Jacobi 1978); (ii) a butchering station and possible kill site (Caulfield 1978); (iii) a specialized locality for summertime processing of antler and animal skins within a larger, uninvestigated settlement complex (Pitts 1979); (iv) a hunting and butchering station used episodically throughout the seasons (Andresen et al. 1981) or principally in the summer months (Legge & Rowley-Conwy 1988); and (v) a base camp occupied repeatedly during more than one season (Price 1982) (see also Grigson 1981 for a reassessment from this era of the season of occupation).

In addition, commentators raised doubts about the overall importance of red deer within the subsistence economy of the site. Caulfield, for example, argued that in terms of meat weight, aurochs would have provided a greater contribution to the diet than red deer, particularly if the minimum numbers of individuals for the different species were re-calculated without the inclusion of shed antlers (1978). Following this theme, Lister (1981) noted that the behaviour of red deer in forested environments, such as would have existed in the vicinity of Star Carr, is different from that observed for the same species in more open landscapes. In particular, herds tend to be much smaller and there is far less tendency toward seasonal migration.

The merits of these different interpretations have been discussed elsewhere (e.g. Legge & Rowley-Conwy 1988; Mellars & Dark 1998; Dincauze 2000: 489–93, Milner et al. 2018a), and need not be elaborated here. Instead, in this context it is more important to note that, whereas these re-interpretations of the site all tended to undermine the original model of hunters following red deer on their annual migration between upland and lowland areas, for the most part they were advanced purely on the basis of the information presented by Clark, without either any re-examination of the material collected by Clark or further fieldwork in the area.

Until the mid-1990s, the main exceptions to this were (a) microwear analyses of some of the lithics (Dumont 1983, 1986, 1988, 1989), and (b) extensive re-analyses of elements of the faunal assemblage (Degerbøl 1961; Klein et al. 1983; Noe-Nygaard 1975, 1977, 1988; Rowley-Conwy 1987; Legge & Rowley-Conwy 1988, 1989; Clutton-Brock & Noe-Nygaard 1991). This latter work, as well as studies of aspects of the depositional context of the assemblage (Wheeler 1978; Coles & Orme 1983), and some of the bone and antler artefacts (Smith 1989; Bonsall & Smith 1990; Smith & Bonsall 1991), all added to the debates about the function and seasons of occupation of Star Carr, as well contributing new information about the site. Most importantly, while it became clear from the work by Legge and Rowley-Conwy that Star Carr was definitely occupied in the summer, this did not rule out use of the site in the winter months as well, opening the possibility of multiple phases of occupancy and differential utilization of the site over time.

Seamer Carr surveys and excavations

Despite the proven archaeological and palaeoenvironmental potential of the area, no further fieldwork was conducted on the Early Mesolithic around Lake Flixton for the next 25 years. This situation changed in 1976, following the designation by North Yorkshire County Council of a 40 ha area on Seamer Carr, less than 1.5 km to the north of Star Carr, as the location for a waste disposal plant to serve Scarborough's growing population (Fig. 1.3). In view of its proximity to Star Carr, and the likely presence of waterlogged deposits, there was initial expectation of finding another site of 'Star Carr' type, with a rich assemblage of faunal remains and organic artefacts. Moreover, compared with other parts of the Vale, the area of the proposed waste disposal plant had not been heavily drained or cultivated, and preliminary investigations of the peat deposits quickly established their palaeoenvironmental potential (Schadla-Hall & Cloutman 1985; Cloutman 1988a, 1988b).

In the first four seasons of fieldwork (1976–79), efforts were divided between investigating the margins of the waterlogged peat deposits for traces of Early Mesolithic activity, and sampling other surface deposits and topographic zones, which were under more immediate threat from development, for later archaeological materials. During this phase, the main achievements were as follows:

- Discovery and investigation (1977–9) of a general spread of Early Mesolithic flint and associated faunal remains at the eastern end of the development area, around the 25.5–24.5 m AOD contour – East Island or Site C;
- Discovery and recording (1978) of over 200 pieces of struck flint in an area of *c*. 4 m^2, in association with a cache of flint pebbles on a ridge of ground at the southwest side of the development area – West Island or Site D;
- Investigation of over 100 m^2 (1977–8) on the summit of East Island/Site C, which failed to locate any significant flint scatters above the 25.5 m AOD contour;
- Trial investigation of the margins of West Island/Site D between the 25.50 m and 24.50 m AOD contour (1977–8), leading to the discovery of low-density scatters of Early Mesolithic flint;
- Discovery of limited evidence for Late Mesolithic activity on gravel areas to the north of the main peat deposits near Sweetbeck Pig Farm – Site F;
- Determination through environmental sampling (1978–9), and corroborated by the archaeological data collected, that the ~24.5m AOD contour marked the approximate location of the shoreline of Lake Flixton during the Early Mesolithic.

By 1980, as a result of the information accumulated during the previous seasons, it was clear that the areas lying between the 25.5 m and 24.5 m AOD contour offered the greatest potential for the discovery of Early Mesolithic material (Schadla-Hall & Cloutman 1985; Cloutman 1988a, 1988b). As these were obscured by peat deposits of variable depth, a sampling strategy allowing systematic inspection of the Early Mesolithic ground-surface had to be devised. The method developed entailed four elements:

(i) initial surface contour surveys of the peat margins on a 10 m grid;
(ii) systematic augering of the peat at each 10 m grid intersection, to determine the depth of peat and characteristics of the subsurface deposits;
(iii) interpolation of the surface contour readings and peat depths to reconstruct the subsurface topography; and
(iv) excavation by hand of 2 × 2 m test-pits placed at approximately 15 m along the approximate line of the Early Mesolithic lake shore

The 15 m interval was chosen on the basis of evidence from the earlier phases of work at Site C and other Mesolithic sites, which suggested that this was the average diameter of major concentrations of worked flint. A greater interval, therefore, would reduce the chances of detecting such a cluster, while a lesser interval would increase time and labour costs without significantly increasing the probability of detecting new areas of occupation. This sampling strategy was first implemented during the 1980 season, leading to the survey of over half of the total length of shoreline available for investigation through the excavation of a total of 31 test-pits. The sampling programme was completed during the following season, with the excavation of a further 23 test-pits. During the 1980 and 1981 seasons, area excavations were continued at Site C, with some trenches being extended into deeper, and hence wetter, peat deposits. In addition, one of the 1980 test-pits (Z7), which had exposed parts of a semi-articulated *Bos primigenius* skeleton, was enlarged for further excavation in 1981 (Site B). The major results of the 1980–81 sampling programme were as follows:

- Discovery of a major concentration of struck flint plus associated faunal remains and other artefacts on the edge of a low promontory, *c*. 300 m to the west of Site C – designated Site K;
- Discovery and investigation of the semi-articulated skeleton of a *Bos primigenius* lying on the surface of basal lake-bed muds, which also contained a lithic assemblage that included a number of blades – Site B;
- Discovery of a localized scatter of flint and associated faunal remains to the north of Site K – Site L;
- Discovery of traces of Late Mesolithic and later prehistoric activity on the higher ground above Site B – Rabbit Hill site;
- Investigation by means of systematic sampling at 15 m intervals of approximately 1600 m of the Early Mesolithic shoreline.

With the completion of the auger survey and test-pit sampling programme in 1981, the focus of fieldwork in the years up to 1985 was on investigating the composition and spatial organization of the larger artefact concentrations. This was achieved through the use of large-scale, open-area excavations that entailed the hand-excavation by trowelling of all of the exposed Early Mesolithic land surface to the underlying subsurface, the hand-removal of the immediately overlying peat deposits, and the three-dimensional recording of all cultural material and possible features.

The two main concentrations to be investigated in this manner were Site C, where excavations covered approximately 1400 m^2, and Site K, where the area examined amounted to slightly over 2300 m^2. In 1984–85, area excavations were also conducted at another, spatially less extensive concentration of cultural material *c*. 75 m to the northwest of Site K. This was designated Site L. In addition, areas of deeper peat to the southwest of Site C were sampled using machine-excavated trenches for traces of cultural activity. Edward Cloutman's palaeoenvironmental work had suggested that these areas would have formed the boundary between reed swamp and open water during the Early Holocene, and that of all the areas under investigation they most resembled the topographic and environmental setting of the Star Carr site. Trenching in one of these areas (Site 'U'), brought to light a small sample of faunal remains, but because of funding constraints, this could not be investigated further. By the end of the project, the following had been achieved:

- Approximately 2 km of the northern shoreline of Lake Flixton had been mapped and sampled by means of augering and test-pitting;
- Two extensive Early Mesolithic sites (Sites C and K) had been located and fully excavated;
- Two localized scatters of Mesolithic flints, and in one case associated faunal remains, had been located around the margins of Lake Flixton, and extensively investigated by area excavations (Sites D and L);
- One localized scatter of flints and associated animal bone of Final Palaeolithic date stratified beneath Early Mesolithic deposits, had been defined and fully excavated (Site K);
- Three scatters of Late Mesolithic flints and associated animal bone (one of which also contained material of Neolithic date) had been located in proximity to the former Lake Flixton, and partially excavated (Sites B, F and Rabbit Hill);
- One deposit of faunal material of presumed Early Mesolithic date had been located in an area of deep peat, approximately 75 m from the former shoreline, and sampled (M and U trenches opposite Site C);
- Traces of later prehistoric settlement activity had been located and investigated by sample excavations in three separate locations – Hopper Hill (Site A), East Island (Site C) and to the southeast of Sweetbeck Pig Farm (Site F);
- The extent, topography and characteristics of the buried topography around Seamer Carr had been mapped through a programme of augering;
- The depositional contexts and vegetation history of the areas around the archaeological deposits located on Seamer Carr had been systematically investigated through pollen analysis, and dated.

Vale of Pickering Research Trust surveys and excavations

As discussed above, the VPRT was established in 1985 to continue the archaeological and palaeoenvironmental surveys of the Early Mesolithic landscape around Lake Flixton. The decision to establish the Trust was taken partially in response to new research questions raised by the work at Seamer Carr, and partly in response to the steadily increasing threat from drainage to the buried archaeological and environmental deposits. More recent geochemical analyses at the site of Star Carr (Boreham et al. 2011), hydrological assessments (Brown et al. 2011), and investigation of the preservation at the site of pollen and other microfossils (Albert et al. 2016), bone (High et al. 2015), and other organic material (Milner et al. 2011; High et al. 2016), have provided empirical demonstration of the impacts of this threat, and the continuing deterioration of deposits.

The basic research strategy pursued by the Trust was to examine:

(i) the entire shoreline of Lake Flixton and its associated islands at *c*. 15 m intervals for traces of Early Mesolithic, and perhaps Late Glacial, activity;
(ii) any similar topographic locations to those already identified by excavation at Seamer Carr;
(iii) the known sites identified by J.W. Moore in the 1940s;
(iv) potential new locations as suggested by earlier and on-going palaeoenvironmental work and fieldwalking.

The methodology used to implement this strategy was broadly similar to that used at Seamer Carr, entailing the following elements:

- Systematic augering of appropriate areas so as to reconstruct the subsurface topography;
- Systematic fieldwalking of areas of higher ground bordering the former Lake Flixton after ploughing;
- Excavation by hand of 2 × 2 m test-pits at approximately 15 m intervals along the approximate line of the 24.5–25.0 m AOD subsurface contour;
- Expansion of initial sample units where necessary so as to recover larger faunal and artefactual assemblages and additional spatial, dating, and contextual data;
- Targeted sampling of deposits for palaeoenvironmental information.

For the most part, these different elements were undertaken simultaneously, so that even in those seasons when more spatially extensive excavations were undertaken (i.e. 1987, 1988, 1993, 1995, 1996 and 1999), sampling and augering surveys were also undertaken elsewhere around the lake.

The first field season was in 1985, when a narrow trench (designated VP85A) was excavated at Star Carr, close to the area excavated by Grahame Clark, details of which have been published elsewhere (Mellars et al. 1998a, 1998b). From 1986 and 1989, however, most of the survey and sampling work was concentrated at the western end of Lake Flixton. By the end of this period, the following results had been achieved:

- Approximately 2 km of the southern lake shore, from Moore's Site 9 to a point to the west of Flixton village, and due south of the Flixton Island sites, had been augered and sampled;
- Two, previously unrecorded concentrations of lithics and faunal remains (VP86 D and VP86 E), had been located and delineated on the southern shore, south of Star Carr;
- Several, low-density scatters of material, probably representing traces of 'off-site' activity had been located;
- A 4 × 4 m trench had been excavated at the VP D site, from which lithic and faunal assemblages, as well as palaeoenvironmental data were recovered;
- Demonstration of the growing threats to the archaeological and environmental resources as a result of ongoing drainage of the peat, as attested by reduced pollen preservation, deteriorating condition of the faunal remains, and extensive lowering of the water-table.

Between 1989–93, additional augering and sampling was undertaken on Flixton Island, Manham Hill, No Name Hill and in the vicinity of both Sweetbeck Pig Farm (Seamer Carr Site F) and Lingholm Farm. The sampling on Manham Hill and No Name Hill demonstrated the presence of buried Early Mesolithic deposits, but was not sufficiently extensive to determine either their exact nature or spatial distribution. At Sweetbeck Pig Farm, pollen-sampling, surveys and excavated extensions to the 1977 trenches were carried out in 1989 at the request of North Yorkshire County Council, so as to further delineate the extent of Site F in advance of a proposed extension to the Seamer Carr landfill complex. This work tended to confirm the impression gained in 1977, that the site contained a stratified, sealed, Neolithic occupation site with traces of both Late and Early Mesolithic activity. The full extent of these deposits, however, was not completely determined. At Flixton Island, the subsurface topography was mapped and sampled through augering and test-pitting, Moore's original trenches were located, and additional excavations delimited the extents of the lithic scatter he had originally identified at Site 1 and confirmed the stratigraphy of Site 2.

In 1990, limited test-pitting and fieldwalking was carried out on Lingholm Farm as part of an archaeological assessment commissioned in response to a planning application for the creation of an 18-hole golf course in the area. No traces of Early Mesolithic activity were located in this area, and, overall, very little in the way of archaeological material was encountered. The 1991 season concentrated on further delineating the area around site VP E first located in 1986, and continuing the survey and investigation of the southern palaeo-shoreline eastwards. In 1992, work began at a new site at the western end of the lake, named Barry's Island after Barry Kitchen who owned and farmed the land where the site was situated. The 1992 season concentrated on mapping the subsurface topography of the area, and sampling the former shoreline. This led to the identification of two main concentrations of faunal and artefactual material, one on the southwest side of the island, and one on the northern side. Particularly important was the discovery of a stream deposit containing large quantities of worked flint and animal bone, stratified between two layers of peat which also contained archaeological material. Subsequent work at Barry's Island, between 1993 and 1996, concentrated on resolving the origins of this stream deposit, while establishing whether any undisturbed deposits of Early Mesolithic age survived elsewhere on the site.

In 1994, concurrently with the work at Barry's Island, a more comprehensive programme of survey and sampling was carried out at No Name Hill, and new surveys were started along the southern side of the lake, to the north of Flixton village. These investigations ran from 1994–6, and resulted in the mapping of *c*. 1500 m of the southern lake shore, the excavation of 52 2 × 2 m test-pits plus eight additional larger units, the identification of two discrete lithic scatters on No Name Hill, and extensive sampling of deposits for pollen and other palaeoenvironmental remains. In addition, fieldwalking surveys were carried out on land to the south of Flixton village. This area was then subject to more extensive surveys from 1997–2000, with the excavation of a series of test-pits and larger trenches, resulting in the identification of two previously unrecorded sites, designated Flixton School Field and Flixton School House Farm. Work at both sites has continued since 2000, and only limited information, principally concerning the subsurface topography, from this locality is included here.

In addition to the fieldwork listed above, more limited surveys and fieldwalking were undertaken by the VPRT at two other localities. These were:

(a) West Flotmanby, at the eastern end of Lake Flixton, where the shoreline was examined by means of augering, fieldwalking and test-pitting over a number of seasons; and
(b) Seamer Mere, where two 2 × 2 m units were excavated in 1994 as part of an archaeological assessment in connection with a planning application for a Nature Reserve in the locality.

The test-pits and fieldwalking results from West Flotmanby suggest the presence of two Early Mesolithic sites, although these have yet to be fully defined. No archaeological traces of any age were encountered at Seamer Mere. However, the deposits were extensively sampled for environmental remains.

Vale of Pickering Research Trust's investigations at Star Carr

Since active field research on the Early Mesolithic of the Vale of Pickering recommenced in the late 1970s, there has been renewed fieldwork at the Star Carr site and in its immediate proximity, most recently as part of a large programme of excavation and analyses directed by Nicky Milner, Chantal Conneller and Barry Taylor (Milner et al. 2018a, 2018b). This recent work grew out of far more modest work initiated by VPRT in 1985, and subsequent work conducted by researchers from the McDonald Institute for Archaeological Research and the Department of Archaeology, University of Cambridge, under the overall supervision of Paul Mellars (Mellars & Dark 1998).

Field activities at Star Carr under the auspices of the VPRT entailed a combination of fieldwalking, trial excavations, remote sensing, coring and stratigraphic survey, linked with palaeoenvironmental sampling. The first phase of activity took place in August 1985, when a narrow trench (VP85A) between 2.0 and 2.5 m wide and 18 m long[3] was excavated approximately 30 m to the east of Clark's excavations (Fig. 1.6) (see also Cloutman & Smith 1985, Mellars & Dark 1998). Two additional 2 × 2 m sample units were excavated by hand in the same general area, one *c*. 15 m south of VP85 A (designated VP85 B) and one *c*. 17.5 m to the west of the area excavated by Clark (VP85 C). This was carried out by a small team of experienced archaeologists all of whom had worked previously at Seamer Carr, and all archaeological material and stratigraphic deposits encountered were recorded following procedures adopted for the Seamer Carr Project. Small assemblages of faunal and lithic material, plus a single barbed point were recovered from Trench A (see Rowley-Conwy 1998, and Mellars & Conneller 1998, for relevant reports). In addition, a zone of substantial worked timbers, associated with this material, was identified close to the base of the organic deposits. This was provisionally interpreted as part of a deliberately laid platform, which subsequent excavations at Star Carr have shown to be part of an extensive wooden structure running into the lake (Milner et al. 2018a)

The main objective of the 1985 excavation, however, was to obtain fresh samples and stratigraphic data from the Star Carr environs. Analysing these data formed part of a study of the microhabitats, lithology and depositional context of the Star Carr site, undertaken by Edward Cloutman and Alan Smith (Department of Plant Sciences, University College, Cardiff), and funded by what was then the Science and Environmental Research Council (SERC). As a result of this work three pollen diagrams from the VP 85A trench, and one from VP 85B were produced, allowing more detailed reconstruction of the local vegetation than was achieved at the time of Clark's excavation (Cloutman & Smith 1985). Cloutman and Smith suggested that, at the time of occupation the Star Carr site was adjacent to an area of sedge-dominated fen that was fringed by a narrow band of reed swamp, beyond which lay open water some 26 m from the dry land (Cloutman & Smith 1988). A discrete charcoal horizon immediately below the timber layer was also identified. Their analyses, however, provided no indication of the possible effects of human occupation in the area on the local vegetation.

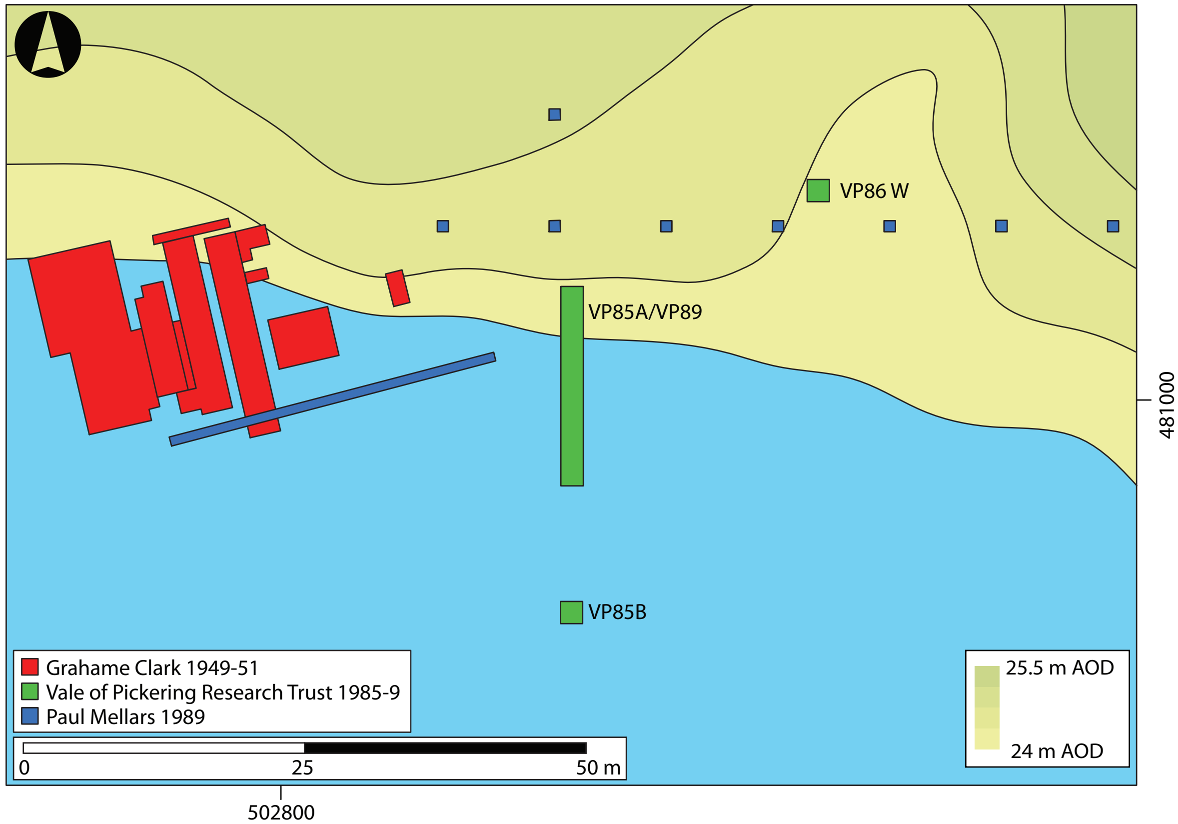


Figure 1.6. *Location of excavation units at Star Carr 1949–1989.*

In 1986, two further 2 × 2 m test-pits were excavated in the vicinity of the Star Carr site. One of these, VP 86W, was situated 17.5 m to the east of VP 85A, on the edge of a slight rise in the modern ground surface, from which only seven stratified finds were recovered. A second test-pit (VP 86X), located *c.* 140 m north of VP 86W, on the north side of the Hertford Cut, did not produce any archaeological materials.

In 1989, the VP 85A trench was re-opened by a team from Cambridge University under the direction of Paul Mellars, with assistance from the VPRT. The main objectives were to recover samples for a new programme of palaeoenvironmental research, and a block of the archaeological deposits adjacent to the 1985 wooden platform for controlled micro-excavation under laboratory conditions (for a discussion of this see Mellars 1998c; for the results of more recent block lifting and assessment of its returns, see Hadley et al. 2010). In addition, a series of seven 2 × 2 m test-units, aligned roughly east–west, were excavated to the north of the main trench to test for the preservation and spatial distribution of any archaeological materials (Mellars & Dark 1988). A narrow, machine-cut trench was also excavated through the topsoil to the west of VP 85A, in order to relocate Clark's original excavations. As a result of this work it became clear that the extent of archaeological deposits at Star Carr was far greater than Clark had assumed (for earlier suggestions that this was the case see Spratt 1982, 105, and Schadla-Hall 1989, 224), and that there were possibly three separate concentrations of activity. Exactly how contemporaneous these were remained a matter of debate, partly because of the problems of dating the deposits and the organic artefacts, caused by the existence of a *c.* 400 year 'radiocarbon plateau' around 9600 BP (Mellars 1990; Day & Mellars 1994; Dark 2000).

The palaeoenvironmental research by the Cambridge team focused principally on the effects of human occupation on the vegetation around Star Carr, utilizing high resolution pollen, charcoal and sediment analyses in conjunction with radiocarbon dating by Accelerator Mass Spectrometry (AMS) (Day 1993; Day & Mellars 1994; Mellars & Dark 1998). This work was followed up in 1991 by the removal of a sediment core from the former open-water area (Day 1996a, 1996b; Mellars & Dark 1998). Analyses of the samples identified a number of distinct peaks in the micro-charcoal profile, which correlated with declines in the frequency of Poaceae pollen. This was interpreted as resulting from the deliberate, repeated burning of the reed beds at around the time the timber platform was constructed (Day 1993; Dark 1998a; Dark et al. 2006).

After 1989, limited investigation of the environs of the Star Carr site were carried out by both the University of Cambridge and the VPRT. Overall, this work sought to define more precisely the exact extent and nature of the archaeological deposits in this area, and the circumstances behind their deposition and post-depositional transformations. This fieldwork comprised two elements, fieldwalking of the area after ploughing (in 1989, 1992, and 2000) with gridded surface collection of material (see Chapter 13), and mapping of the peat deposits and areas of disturbance, through a combination of augering and ground-penetrating radar.

Ling Lane evaluation

In 1996, Northern Archaeological Associates (NAA) was commissioned to undertake a pre-development archaeological evaluation of an area proposed for use as a landfill extension to the existing Seamer Carr Waste Disposal Unit (Fig. 1.7). Situated immediately to the west of the existing landfill site, the stratigraphy of this area had been investigated previously by coring as part of the Seamer Carr Project (see Cloutman 1988a). John Moore had also identified evidence of Early Mesolithic activity in the area during the 1940s. Designated 'Site 10' by Moore, this was situated at the southern end of a small gravel hillock in the vicinity of Ling Lane, near the southern limit of the proposed landfill extension.

Following a desk-based assessment, a programme of field survey and trial trenching was conducted over the area between July and October 1996, to determine the nature and extent of cultural deposits and the subsurface topography. The methodologies and recording procedures used for the subsurface and stratigraphic surveys, intensive fieldwalking programme, and trial trenching, were essentially the same as those developed during the Seamer Carr Project (Northern Archaeological Associates 1996a, 1996b, 1996c), as many of the NAA team had worked on the Seamer Carr Project and also with the VPRT during the 1980s, and so were familiar with the sampling strategies used on those projects.

The results of the NAA evaluation, therefore, are broadly comparable with those of the Seamer Carr Project and VPRT surveys and excavations, and by kind permission of NAA and Edward Cloutman details relating to the position of the Early Mesolithic

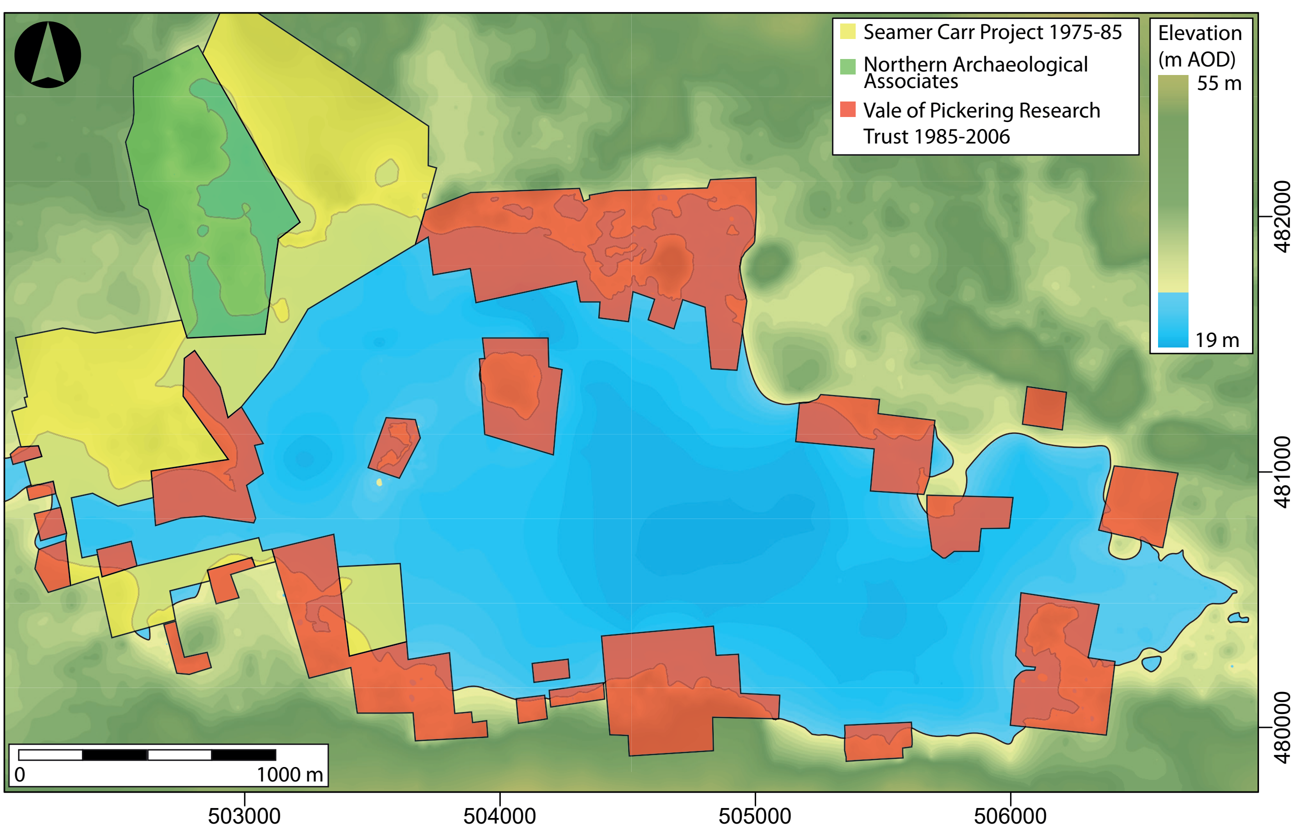


Figure 1.7. *Location of all investigated areas around Lake Flixton 1949–2006.*

shoreline, peat depths and test-pit and trench locations in the vicinity of Ling Lane have been incorporated in the reconstructions of Lake Flixton presented in subsequent chapters. Their work also helped improved the delineation of the subsurface topography of the area immediately to the west of the Seamer Carr sites, most notably around the topographic features known as 'Ling Lane Island' and the 'West Embayment', and helped to refine understanding of the nature of Early Mesolithic traces at Moore's Site 10, as well as providing new information about various signs of 'off-site' activity along the western shoreline of the West Embayment.

Discussion

This chapter has provided the background to the archaeological research on the early prehistory of the eastern end of the Vale of Pickering, North Yorkshire undertaken over nearly a quarter of a century between 1976 and 2000. Having begun as a potentially limited, pre-development archaeological assessment, the Seamer Carr Project expanded into a ten-year programme of rescue excavations and surveys, excavating some of the largest areas of Early Mesolithic activity in the United Kingdom at the time, while also endeavouring to record traces of off-site activity, and to place these materials in their immediate topographical and environmental settings. The excavations were funded from a combination of central and regional government sources, and were run entirely with the help of volunteers, who included a handful of professional archaeologists and several dozen archaeology students, many of whom returned year-on-year to provide assistance. From 1985 onward, the focus of activities shifted more to an emphasis on survey and site location that, given the archaeological horizons of interest typically lay beneath later deposits, required the excavation by hand of a large number of 2 × 2 m test-pits and the hand-augering of many hectares of farmland. Annual field seasons took place, with a few exceptions, during July and August, and were supported by funds raised by the VPRT, from other charitable bodies, and generous donations (some of it in kind) from several members of the Trust and the local business and farming communities. As with the Seamer Carr Project, the fieldwork was undertaken by volunteers drawn from different walks of life but always including archaeology students and some professional archaeologists. As at Seamer Carr, on-site recording relied on conventional notebooks, finds registers, hand-filled context forms, and scale plans and sections drawn on drafting film. Many hours were spent in the evenings updating the previous day's records, collating master lists, and cataloguing the day's finds, often from half-a-dozen or more individual test-pits. Only toward the end of the programme of work reported here were records computerized and electronic total stations available for on-site logging of finds and topographic survey work. There was also remarkable continuity in the composition of the field crews from one year to the next, with many of the 'old hands' having also worked at Seamer Carr. 'New blood' was welcomed, though at times rather unfairly overly scrutinized by those who had worked for the project for longer, and several have continued to work in the Vale including during the recent (2010–2015) phase of major investigations at Star Carr (Milner et al. 2018a; 2018b), as well as renewed excavations at Flixton Island (Milner et al. 2017; Taylor 2018) and Flixton School House Farm and Flixton School Field (Taylor 2012, 2019; Taylor & Gray Jones 2009). An equally critical component of this phase of the field research was the generosity and good will (normally) of the numerous landowners allowing access to volunteers and their vehicles to auger, undertake topographical surveys, and excavate variously sized holes at what was probably their busiest time in the farming calendar.

Although the field components of both projects stand scrutiny, in retrospect, it is evident that more attention should have been devoted on an annual basis to post-excavation processing of the year's data and checking for gaps or inconsistencies in the site records. As many will be aware, this volume has had a long and interrupted history. Work on synthesizing the material was undertaken in the late 1980s, and again, for a smaller data set, in the early 1990s. Through the generous support of English Heritage/Historic England, a major programme of post-excavation analysis and synthesis spanning roughly 18 months began in mid-1997, under the overall supervision of one of us (PL) and hosted by the McDonald Institute for Archaeological Research, Cambridge University. Unfortunately, this stalled in late 1998 when PL moved to Kenya, and while additional work was undertaken periodically over the intervening years, including re-cataloguing of the paper archive prior to deposition with the Rotunda Museum in Scarborough, the final phase of writing up was delayed until early 2018 and ultimately only completed in 2020. Much of this latter work was undertaken by Barry Taylor, University of Chester, once again with generous support from Historic England. The following chapters are the culmination of this collective effort. As with, perhaps, any large and long-running project where several years have elapsed since trowels were lifted in anger, so to speak, gaps and contradictions in the site records have been noted for several of the sites reported here. Unfortunately, some finds also have been misplaced and it has not been possible (despite extensive searches) to relocate them for analysis. All of these shortcomings are noted in the following chapters, and more detailed observations have sometimes been added to the archive. It is hoped, nonetheless, that these do not overly detract from the value of the rest of the work.

Notes

1. Although the Seamer Carr Project formally began in 1976, heavy rain early in the first season of excavations led to the fieldwork being abandoned and the field team ended up undertaking a small field project at Scorton, North Yorkshire.
2. Letter from J.W. Moore to R.T. Schadla-Hall 20/1/1985.
3. Not 13 m, as erroneously reported in Cloutman and Smith 1988.

Chapter 2

The Vale of Pickering

Paul Lane & Tim Schadla-Hall†,
with a contribution by Albert Franks†

The Vale of Pickering is a broad, flat-bottomed valley running east–west from Cayton Bay on the Yorkshire coast to Byland on the edge of the Vale of York, some 65 km to the west. It is bounded to the east by the North Sea, in the west by the Howardian Hills, to the north by the Corallian limestone of the Tabular Hills (and to the north of these, the Lower and Middle Jurassic shales, limestone and sandstones of the North York Moors), and to the south by the scarp of the Cretaceous chalk of the Yorkshire Wolds (see Fig. 1.1). It is important to note that, conventionally, the geographical area described as the Vale of Pickering includes not only the low-lying and peat covered parts of the valley and the slightly higher glacial and postglacial sand, gravel and till deposits, but also the lower portions of the limestone dip slope to the north and the chalk scarp and part of the Wold top to the south. This wider area embraces a diverse range of topography and geology.

The form of the Vale is the result of past glacial activity, and while this volume is only concerned with the eastern Vale, the whole area (including the adjacent Vale of York), is highly complex in terms of surface geology and topography as well as drainage, hydrology, and landscape history (Foley 2006; Bateman et al. 2015; Palmer et al. 2015; Powell et al. 2016). The underlying geology of the eastern Vale, at considerable depth, is a deposit of Kimmeridge clay, but the current land surface is littered with glacial and periglacial features, including kames and eskers, the result of a highly dynamic Late Glacial and Early Holocene environment, as well as clayey till deposits. Often described as flat and low-lying, the edges of the Vale display a considerable variation in local topography (Fig. 2.1 a–d), and although the area of the former Lake Flixton is basically peat covered and level, there are a number of small hills (e.g. Flixton Island, No Name Hill), rising between two and six metres above the modern ground level. Further east and north, especially from the line of the present A165 road, the ground surface is more undulating and rises steadily to a height of almost 90 m AOD above the chalk cliffs at Cayton Bay.

Physical setting and Quaternary geology

The soils, hydrology, and subsurface geology of the Vale of Pickering, to a greater or lesser extent, have all been influenced by the two upland masses which form its northern and southern boundaries. The most prominent feature to the south is the scarp slope of the northern section of the Yorkshire Wolds, which rises to over 170 m above Staxton and between 130 m and 145 m between Flixton and West Flotmanby. The Wolds form a large crescent of Cretaceous material that rises from the Humber to the south and terminates at Flamborough Head. Most of the Wolds are composed of 'fine-grained, fairly hard, pure white limestone containing more than 98% calcium carbonate' (Catt 1990, 16). However, beds of grey or greenish clay occur throughout, and the middle section of the sequence contains bands of flint nodules. Soils on the Wolds tops are relatively thin and, for the most part, overlie a reddish clay subsoil. Two types predominate, with lithomorphic soils, mostly brown silty rendzinas of variable depth, typically occurring on the higher and steeper parts, and deep, brown calcareous soils with clearly developed topsoil and subsoil horizons on the gentler eastern side of the Wolds. Pockets of clay-with-flints occur along the northern escarpment, while the valleys are typically floored with thick deposits of gravel overlain by hillwash material. At the foot of the northern scarp there is a raised bench of fertile chalky-gravel soils, which have been the focus of settlement at least since Anglo-Saxon times (Powlesland et al. 1986).

To the north of the Vale, an almost continuous outcrop of Corallian limestone, interbedded between

Figure 2.1. *Views over the eastern Vale of Pickering from the top of the Wolds: a) Looking north across the Vale from Flixton Top, 1980 (Photo Tim Schadla-Hall); b) Looking northwest from No Name Hill toward Seamer Waste Disposal area, 1985 (Photo Paul Lane); c) Looking south toward the scarp slope of the Wolds from Flixton School Field, 1998 (Photo Paul Lane); d) Looking north across the Vale toward Cayton and Eastfield villages from above Folkton, 2000 (Photo Tim Schadla-Hall).*

Lower, Middle and Upper Calcareous Grits extends for *c*. 60 km from the coast at Scarborough to the Hambleton Hills, forming a series of flat-topped hills (Hemingway 1982). At its eastern end, these are known as the Hackness Hills, further west the outcrop is known as the Tabular Hills. Chert is found throughout the Corallian in both tabular and nodular form (*ibid.*). The soils of this area are relatively deep, well-drained, loamy brown earths. Watercourses drain southwards to the River Derwent through deep narrow valleys cut into the limestone, the most prominent of which is Forge Valley through which the River Derwent enters the flat lowlands of the Vale from its source on Fylingdales Moor to the north.

Lying between these uplands, the Vale tapers gradually toward the outlet of its drainage to the west, but is sealed from the sea (to the east) by a low ridge of Quaternary material. A complex sequence of Kimmeridge, Oxfordian, and Speeton Clays of Upper Jurassic origin lies beneath the Vale (Kent 1980; Bateman et al. 2015). These were modified extensively by glacial action during the last Ice Age, and consequently the Quaternary geology at the eastern end is complex. The main superficial deposits around the margin of the former Lake Flixton comprise predominantly glacial till and glaciofluvial moraine, deposited during the Dimlington Stadial of the Late Devensian (Moore 1951; Franks 1996). Named after the type-site near Spurn Point in Holderness (Rose 1985), the Dimlington Stadial (31–16 ka BP) represents the last major cold phase of the Quaternary, and period of maximum glacial advance prior to the Windermere Interstadial. During this phase, the North Sea Ice Lobe advanced inland twice between 20.9–15.1 ka BP, creating several large proglacial lakes (Bateman et al. 2015) (Fig. 2.2).

The resultant deposits laid down by the ice moving across the region and from associated periglacial meltwaters are diverse. On the north side of the Vale, to the east of Seamer village, are thick deposits of heavy boulder clay or till. Known now as the Lower Till

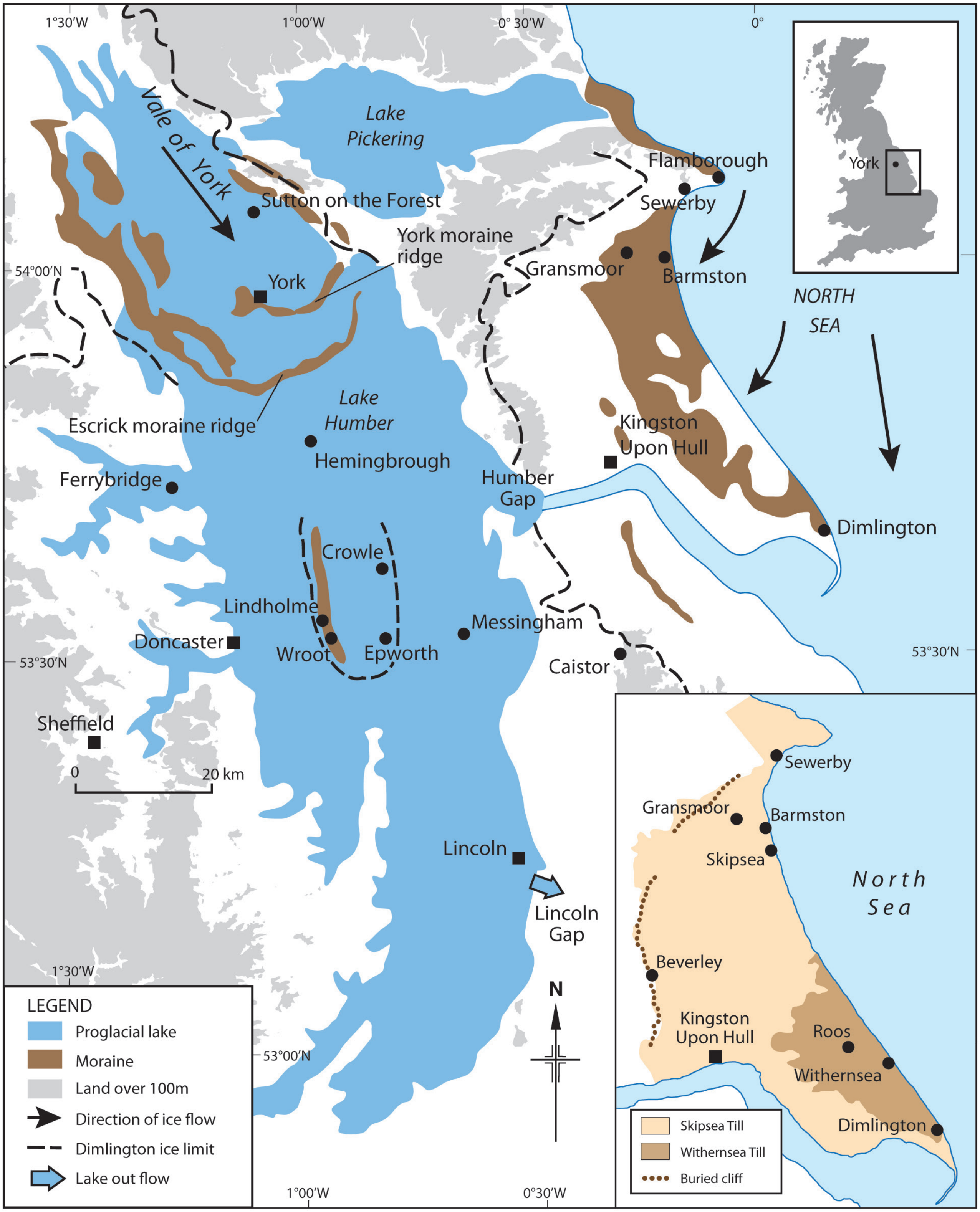


Figure 2.2. *Reconstructed direction of ice flow leading to the formation of Lake Pickering during the last Ice Age (Bateman et al. 2005, Fig. 1, reproduced with permission).*

Series (Franks 1996), and formerly as Skipsea Till (or Drab Clay), this was deposited during the westward advance of the ice sheets from the direction of the North Sea during the Dimlington Stadial. The boulder clay extends as far as the coast and across the most easterly end of the Vale. To the northwest of this deposit of Till, on the north side of the Vale, is a band of ocherous, sandy gravels known as the Seamer Gravels, which are overlain in places by coarse silty sands and sandy clays. These are most probably of fluvioglacial origin (Franks 1996).

The Seamer Gravels are bounded to their west by another set of sand and gravel deposits, known as the Supraglacial Sedimentation Complex (SSC). This extends westwards for some distance beyond the line of the present A64 road, and south across the Vale to the mixed sandy gravel and colluvial deposits that fringe the foot of the Wolds escarpment in the vicinity of Staxton. This effectively forms the western geological boundary of the study area, and these deposits are believed to have formed as a result of *in situ* melting of ice during a retreat stage from the Late Devensian ice-maximum near Wykeham, some 8 km west of Seamer Carr (Franks 1987).

The boulder clay deposit on the northern side of the Vale is also bordered along its southern edge by another band of sands and gravels, known as the Seamer Carr Sands and Gravels (SCSG). This area is characterized by a number of geomorphologically distinct kames and eskers (i.e. concentrations and linear deposits of sands and gravels formed by retreating glaciers), which are presumed to have been formed beneath and along the margins of the retreating ice sheets during the final stages of the Last Glacial Maximum (LGM). The deposition of the Seamer Carr Sands and Gravels was thus chronologically earlier than that of the SSC, although they are superficially similar deposits. In turn, the SCSG deposits are fringed along their southern edge by an extensive series of peat deposits, formed as a result of hydroseral infilling of Lake Flixton, along with contemporary wetland systems to the east and west, during the early Holocene.

This lake, sometimes erroneously known as Lake Pickering (e.g. Cloutman & Smith 1988; Day 1996a), should be termed Lake Flixton as Moore (1951) proposed over seventy years ago. This is so as to distinguish it from the much more extensive body of water which was centred in the Pickering area during the height of the last glaciation (Clarke et al. 2004). The latter, i.e. Lake Pickering, was formed as a result of the advance from the northeast of a lobe of ice along the line of the Vale (Fig. 2.2). At the same time, ice sheets also advanced from the northwest across the Vale of York (Bateman et al. 2015). Once ice from the North Sea ice sheet had blocked the eastern end of the Vale, water was impounded in the low-lying areas between it and the Vale of York glacier and several metres of laminated clay accumulated over the lake floor (Catt 1987, 1990; Ellis 1995).

Origins of Lake Flixton

The advance of the ice sheets up the Vale had the effect of scouring and deepening the eastern end relative to the areas covered by Lake Pickering, while the outflow from Newtondale built an outwash delta at Pickering (Evans et al. 2017). On the retreat of the ice sheets, as discussed below, an extensive section of trapped ice may have been left behind resulting in the eventual formation of a large kettle-hole across the eastern end of the Vale, which was subsequently infilled by streams draining off the North York Moors. Prior to the last glacial episode, the eastern part of the Vale was drained from the west to the coast by a fairly direct route. However, the retreating ice sheet left a large moraine deposit along the coast, which cut off the possibility of drainage in this direction, allowing the waters of Lake Pickering to rise to about the 75 m AOD mark, before overflowing at a point near Kirkham Abbey (Fig. 2.2). As a result, ever since the start of the Holocene, drainage of the eastern part of the Vale has been westwards through the Kirkham Gorge and thus eventually joining the River Ouse with its outflow into the Humber estuary some 100 km to the south of its originating point (Kendall 1902; Kent 1980; Catt 1987). It is also generally accepted that the main impetus for the current drainage pattern of the Vale was provided by the River Derwent, which flowed south from the North York Moors cutting a steep sided valley at Forge Valley into the Vale before flowing west toward Malton and the Kirkham Gorge, through which it passed into the Vale of York. Thus, the eastern part of the Vale was to the east of the main drainage channel in the Vale, which explains in turn why, initially at least, this area developed into Lake Flixton, with an outflow channel to the west of Star Carr leading to the Derwent (Fig. 1.2). The existence of a small moraine running north–south just to the east of the putative early Holocene course of the River Derwent presumably acted as an inhibitor to drainage from this area, which was at the extreme easterly limit of the whole of the Vale's drainage system. Whilst the Derwent's catchment, even the point where it entered the Vale, was a large part of the North York Moors, the catchment for the area subsequently represented by Lake Flixton was limited, and the main source of inflow was derived by the spring-fed streams from the chalklands of the Yorkshire Wolds on the southern edge of the Lake (this aspect of the lake's hydrology is discussed below).

In brief, a combination of limited water inflow and morainic blocking ensured the development of Lake Flixton, the outflow from which joined the much larger Derwent as it flowed to the west. In the rest of the eastern Vale, the existence of the Derwent, at least after the breaching of the Kirkham Gorge, ensured that there was a better water flow. However, although the uneven and dislocated topography clearly resulted in the formation of peat deposits and boggy areas, it is not clear whether there were any extensive permanent open water areas comparable to Lake Flixton to the west during the Early Mesolithic. Indeed, given the likely considerable impact of the Derwent, in view of its sizeable catchment area, it seems more likely that seasonal variations would have resulted in highly variable water levels across this western section of the Vale, making Lake Flixton with its comparative hydrological stability especially attractive for human settlement.

Lake Flixton was in existence by the start of the Windermere Interstadial, and at its maximum extent was probably slightly over 5 km in length from west to east, and in places almost 2 km wide. Areas of higher ground composed of glacial and periglacial deposits in the centre of this area would thus have been transformed into islands. The earliest lacustrine deposits, as illustrated in cores taken from the centre of the lake, consist of calcareous muds forming throughout the Interstadial (Day 1996a; Dark 1998b). The climatic downturn during the Late Loch Lomond Stadial then led to the deposition of mixed sands and gravels into the basin through a combination of hillwash and solifluction (Walker & Godwin 1954). As the climate improved with the onset of the Holocene, a sequence of calcareous and detrital muds accumulated in the basin as plants recolonized the lake. As these deposits built up, the depth of the lake became gradually shallower, and a succession of wetland environments expanded into the lake whilst peat-forming environments expanded over the surrounding landscape (Walker & Godwin 1954; Cloutman 1988a, 1988b; Innes et al. 2011; Taylor 2019). By around 4000 cal BC the lake was largely infilled, and a complex mosaic of wetland environments covered much of the basin (Taylor 2019).

The reduction in open water area over this period was accompanied by the development of the 'old' River Hertford, or its precursor. The course of the river presumably changed through time before it arrived at its course as mapped by the drainage proposals in AD 1800. However, as it appears to have been mainly fed from the chalk springline, it must have flowed on the southern side of the Vale, where vestigial elements of its old course survive today.

Quaternary landforms and sediments

Albert Franks†

The eastern Vale of Pickering forms part of a broader region that experienced glaciation during the Dimlington Stadial of the Late Devenisan sub-stage. The area between Mere Valley and Staxton, which encompasses the Seamer, Flixton, and Star Carrs, contains large deposits of sand and gravel resulting from that event (Fig. 2.3). It is thus important not only for its archaeological remains, but also geologically for it contains many previously unrecorded ice contact features. This section aims to describe the form and composition of the ice contact features observed in the area between the Mere Valley and Staxton, with particular reference to the area of Seamer Carr. In addition, the sediments and landforms are considered within the glacial history of the area.

Mere Valley, to the north of the Vale, is widely considered to have carried glacial meltwater during the Late Devensian. Sands and gravel in the northern part of the Vale were previously considered to have been transported through the Mere Valley, fanning out into the Vale of Pickering near Seamer Carr (Penny & Rawson 1969; Edwards 1978), although little detailed attention has been directed to this area. South of the Mere Valley, the gravels at Seamer Carr extend to form a band of low rounded hills, some 2 km wide, which crosses the Vale of Pickering towards Staxton. These hills have a relief of only 8 m and effectively divide the eastern and coastal sections of the Vale. West of this line, a narrow belt of gravels dotted with kettle holes is present along the northern edge of the Vale and links with sands and gravel at Hutton Buscel. Till is absent at the surface, and apart from shallow peats the surface is composed of sand and gravel. East of the line, tills and associated outwash gravels outcrop, but are replaced along the low-lying central axis of the Vale by an extensive area of thick peats and marls. East of Seamer Carr, the coastal plain is covered predominantly by till, and a landform interpreted as a morainic ridge has been identified between Cayton and Speeton. Straw (1979, and pers. comm. 1982) considered this 'fresh morainic complex' between Speeton and Cayton to represent a genuine re-advance and not merely a temporary stabilization of the ice front during recession, as others had done (Penny & Rawson 1969).

To better define the nature of the area lying south of the Mere Valley, a survey of the superficial geology was carried out. Seismic investigation for oil and gas structures along a line from Flixton to immediately east of Seamer Carr waste disposal plant also allowed observation of the sub-surface deposits revealed in 'hot holes' drilled by Horizon Explorations Ltd. In addition

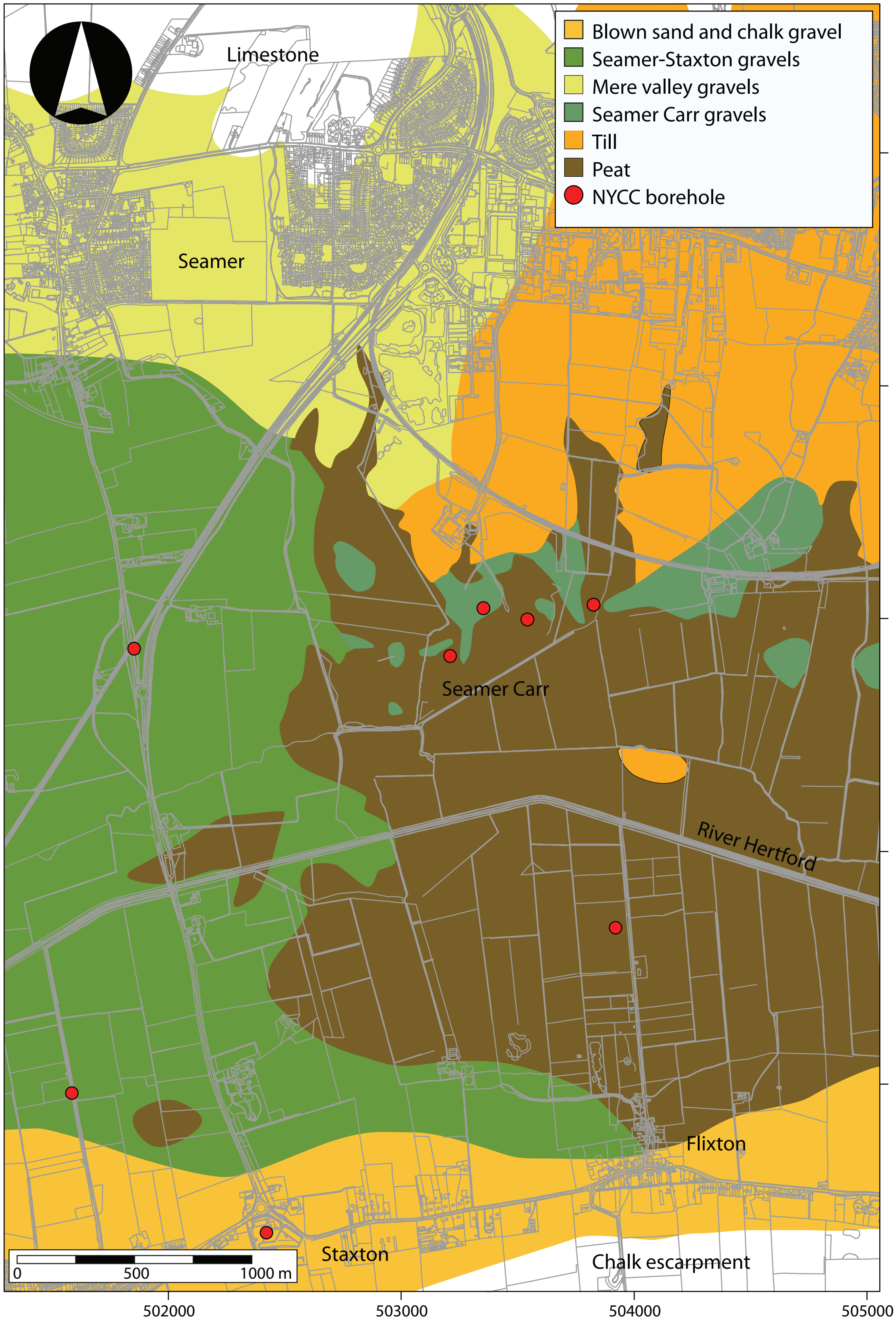


Figure 2.3. *Superficial geology of the Star Carr and Seamer Carr areas as reconstructed by Albert Franks (1987).*

to this survey, sections were dug and holes augered to supplement other available borehole data (Franks 1987). Particular attention was devoted to the areas at and around Seamer Carr. On the basis of this work, deposits within this part of the Vale were subdivided geographically into four groups:

(i) The gravels in the Vale between Seamer and Staxton
(ii) The gravels along the northern edge of Seamer Carr
(iii) The peat and marl between Seamer Carr and Flixton
(iv) The gravels at the southern end of the Mere Valley

Observations and findings for each of these areas are summarized below. Additional information is provided in the relevant chapters on the archaeological surveys and excavations at Seamer Carr.

Gravels in the Seamer-Staxton area

At the surface, coarse sands and gravels are exposed with some cobble-sized material, predominantly 'local' Middle Jurassic Ravenscar Group sandstones. Between the low hills, deposits of peat blanket the hollows and subdue the original relief. The canalized River Hertford flows east to west across this gravel belt near the site of Star Carr, but apart from a thin veneer of surface gravel, the main body of sands and gravels appears to be unrelated to the contemporary river. A line of NYCC boreholes put down across the Vale from Seamer Junction (Fig. 2.3), south of the Mere Valley, toward Staxton, shows sandy gravel predominating in the top 6 m of deposit. Where boreholes have penetrated below 6 m, the gravels give way to sands and silts, with clays being recorded in the deepest hole. The clays and silts occurring beneath the gravels below approximately 9 m AOD may represent an eastward, lateral expansion of the Yedingham clays (Franks 1987), deposited as proglacial lake sediments in the central Vale of Pickering.

At the southwest corner of the line of gravel hills, little evidence of the subsurface deposits is available. However, at the southern end of the gravel spread, adjacent to the chalk scarp in Staxton Quarry (NGR 50230 47930), coarse angular gravels underlie approximately 3 m of sand. The lithology of a sample from these gravels, in the range 8–23 mm, showed a high proportion of sandstone and basic igneous material, together with a high percentage (27.65%) of chalk. Overall, the gravels are relatively angular, but high proportions of angular clasts are chalk, perhaps indicating a limited fluvial transportation for the material as a whole, but particularly for the chalk component. For purposes of communication these gravels are referred to informally as the *Staxton gravels*.

To overcome the paucity of sub-surface information immediately north of Staxton, two holes (nos. 271 and 272, Franks 1987) were augered to a depth of 10.9 m, using a 'Minuteman' power auger. Both holes show a series of coarse sandy gravels which become finer with depth. A sample of the gravel collected from a depth of approximately 8 m (Borehole 271, 23 m AOD, sample 213) was found to contain a high proportion of sandstone, limestone, and basic igneous material, typical of the lithological frequency of other sites along the northern edge of the Vale. Whilst similar in lithological content, the gravels from this borehole sample exhibit a higher degree of roundedness than gravels from other sites between the Mere Valley and Staxton, perhaps reflecting a greater distance transported by outwash streams.

Till is not in evidence at the surface, but a NYCC borehole (no. 232, Franks 1987) records a thin band of very dark greyish brown till (10YR 3/2), a sample of which was made available for analysis. The till has a particle size distribution peaking at 90 microns which compares closely with the particle size distribution for the Lower Till Series of Edwards (1978), found along the coast of Filey Bay. If this correlation is correct, the occurrence in Borehole no. 232 would be the most westerly example of this unit to be found in the Vale of Pickering to date, being some 10 km inland from the coastal exposures. A sample of gravel extracted from the till, in the range 8–32 mm, was analysed and found to have a much greater igneous (17.08%) and quartzite (25.3%) fraction than any other site in the area. There is a similarity in lithological composition to gravels found at Seamer Carr (see below), however.

Toward the north of this area, west of Seamer Carr, the landform is typical of the 'kame and kettle moraine' described by Charlesworth (1926), which has long been shown by Sissons (1958) and others (e.g. Boulton & Deynoux 1981) to have no ice marginal significance. Instead, this terrain reflects a zone of supraglacial sedimentation associated with a sub-polar glacial land system (Eyles 1983). However, whilst the presence of till within the gravels is not in itself justification for any assumption as to their origin, the disposition of the drift hills across the eastern end of the Vale of Pickering, and association of these features with the Seamer Carr kames and esker which exhibit ice contact structural features (see below), suggest that this sediment complex may represent an ice stagnation accumulation formed by an ice sheet which extended into the eastern part of the Vale of Pickering.

Gravels along the northern edge of Seamer Carr

The area allocated at Seamer Carr in 1976 for waste disposal was the subject of a brief subsurface investigation by NYCC to safeguard against waste leachate contaminating water supplies in the eastern Vale. The results of this survey showed the area to be underlain by a predominantly sandy gravel with bands of fine silt and sand. These are referred to informally here as the Seamer Carr sands and gravels. This deposit, which lies along the northern edge of an extensive area of peat and marl deposits referred to here as the Flixton Basin, forms a series of low, flat-topped hills which stand up above the peats to a maximum height of *c.* 29 m AOD. On top of the hills, four excavations to a depth of 1.2 m revealed a poorly sorted sandy gravel (see Chapter 6, for a detailed description of lithology; for geological sampling locations on Seamer Carr, see Fig. 2.4).

Peat and marl deposits between the Seamer Carrs and Flixton

In this area, marls overlain by peat lie in the Flixton Basin. These deposits have been shown to be Late Glacial and Early Holocene in age (Clark 1954; Cloutman 1988a, 1988b; Mellars & Dark 1998; Taylor 2019, and Chapter 5, this volume). Seismic shot-holes drilled across the Vale north of Flixton, by Horizon Exploration, indicated the presence of peat up to 5.5 m thick, overlying up to 5.2 m of pale grey marl, beneath which lies a chalky gravel. A sample of this gravel was found to contain a high proportion (39%) of angular chalk with only 3% of limestone. This would suggest transportation into the area from an eastern or southern site devoid of limestone. The presence of chalk, when compared to the Seamer Carr gravels, strongly suggests the chalk escarpment lying along the southern margin of the basin to be the source of this material. For purposes of communication, this chalky gravel lying in the Flixton Basin will be referred to informally as the Flixton chalky gravel. At its most northerly observed occurrence, between East Island and Manham Hill (NGR 50365 48200), a sample of gravel brought to the surface from 17 m AOD (Seismic Hole No. 219), was found to contain 11.29% of angular chalk and flint. This represents part of a steady reduction in the proportion of chalk northward across the basin, supporting the northward movement into the Vale from the chalk escarpment.

Toward the centre of the basin, overlying the Flixton chalky gravels, the marls contain little inorganic non-carbonate material, but this increases gradually

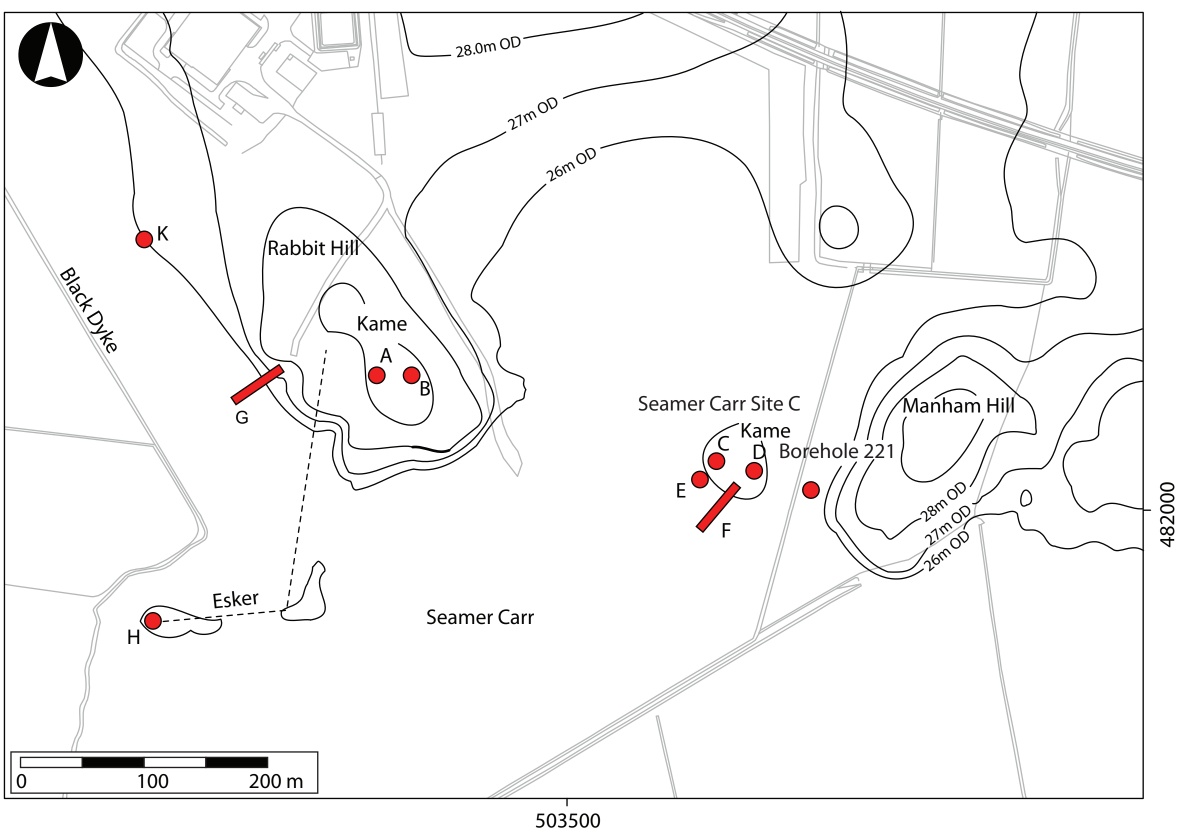


Figure 2.4. *Location of main geological sampling points and trenches on Seamer Carr (after Franks 1987).*

toward the edge of the basin. Thus, immediately south of Rabbit Hill (NGR 50340 48190), the minerogenic non-carbonate content rises to 57% and is composed predominantly of quartz grains showing a full range of shapes from round frosted, to very angular. Some angular quartz grains have a carbonate coating giving the grains a spherical appearance. This affects approximately 5% of the quartz content and appears to represent some degree of rolling during the deposition of the carbonate. The carbonate content varies in size from fine silt to individual grains. Many of the larger particles are in the form of tubular structures, whilst others exhibit an uneven pattern of concentric rings typical of associated algal growth. Small fragments of Characeae (multicellular algae that live in fresh and sometimes brackish water) were found to be present in the marls. The marls rapidly thin away from the centre of the basin and become patchy in distribution around the margins of the hills, leaving the overlying peat resting directly on sandy gravel. Regardless of whether the marl is present or not, along the northern margins of the peat, the sand and gravels form a narrow bench, and it is on this that most traces of Mesolithic activity have been found.

The fact that this large basin is found within an area surrounded by outwash gravels suggests that it was formed by the melting of buried ice during deglaciation. Thus, it is suggested that this basin represents a large kettle hole in which ice stagnated and decayed after the deposition of the Seamer-Staxton sediment assemblage.

Gravels at the southern end of the Mere Valley

The Mere Valley forms a breach in the Falsgrave Moor watershed connecting the Scarborough embayment with the Vale of Pickering (Kendall 1902). A deep channel, infilled with till, exists at the northern end of the valley where it opens out to Scarborough. At its southern end, at Seamer Junction, observations from NYCC boreholes showed that a deep valley form infilled here with gravel.

Evidence has long been available from borehole records to suggest that the shape of the bedrock floor of the Vale of Pickering, south of the Mere Valley, east of Seamer, has been dissected and represents a north–south trending valley form cut into the Kimmeridge Clay (Franks 1987). This valley is not, however, linked directly to the Mere Valley, as borehole records indicate that the main channel running southward out of the Mere Valley swings southwest of a limestone spur. Such a spur would have caused any stream draining south through the Mere Valley to be diverted southwest to a point past the location of Seamer village. Separated from the Mere Valley by the rock spur, the lower gravels around Seamer Carr are unlikely to be directly related to any movement of material southward through the Mere Valley.

The Flixton basin

The Flixton chalky gravels lying across the floor of the basin are lithologically distinct from the Seamer Carr gravels in their chalk content. The presence of chalk in these gravels is a consistent feature of the material brought to the surface in seismic survey boreholes. The frequency of chalk and flint decreases northward from 43.63% near the centre of the basin to 11.29% in gravel collected from south of East Island (Seamer Carr, Site C). This spread of chalky gravel in the Flixton basin appears to be the most northerly in the Vale. The chalk could have been transported into the area from the North Sea Basin, but its localized distribution and increasing frequency to the south of the area argues against this. The obvious source of the chalk is hence the Cretaceous outcrop along the southern margin of the area. From the escarpment, the gravel could have been transported northward by streams flowing from near the foot of the scarp. However, the angular nature of the gravel and lack of abrasion on the chalk clasts, together with the fact that they are not found between the surface and 16 m AOD in any of the NYCC boreholes drilled between Staxton and Seamer, suggest that this is not the case. It seems more likely that the deposit represents a gelifluctate which lies stratigraphically above the Seamer Carr gravels. It is suggested that the Flixton chalky gravels are the product of cold climate mass movement of chalk and flint from the chalk scarp northwards across the surface of an ice-covered lake at Flixton, and subsequently dumped on the basin floor as the ice cover melted.

Deposits at Seamer Carr

The landforms and sediments in the area of Seamer Carr are interpreted as kames (Site C, Rabbit Hill, Site D, Far Island) and an esker (Site K), testifying to the presence and stagnation of ice in the eastern Vale (Figs. 2.4, 2.5).

Depositional palaeo-current structures within the gravels suggest a flow direction to the southwest, supporting evidence from elsewhere in the Vale of a general westerly transport of material. This, in turn, supports the idea that the bedrock spur at the southern end of the Mere Valley would have prevented the southward movement of much of the Mere Valley gravel into this area. It is suggested, therefore, that the Seamer Carr gravels are related directly to a western meltwater flow and are unrelated to movement through the Mere Valley. In turn, they are distinct from and predate the gravels that form the floor of the Flixton

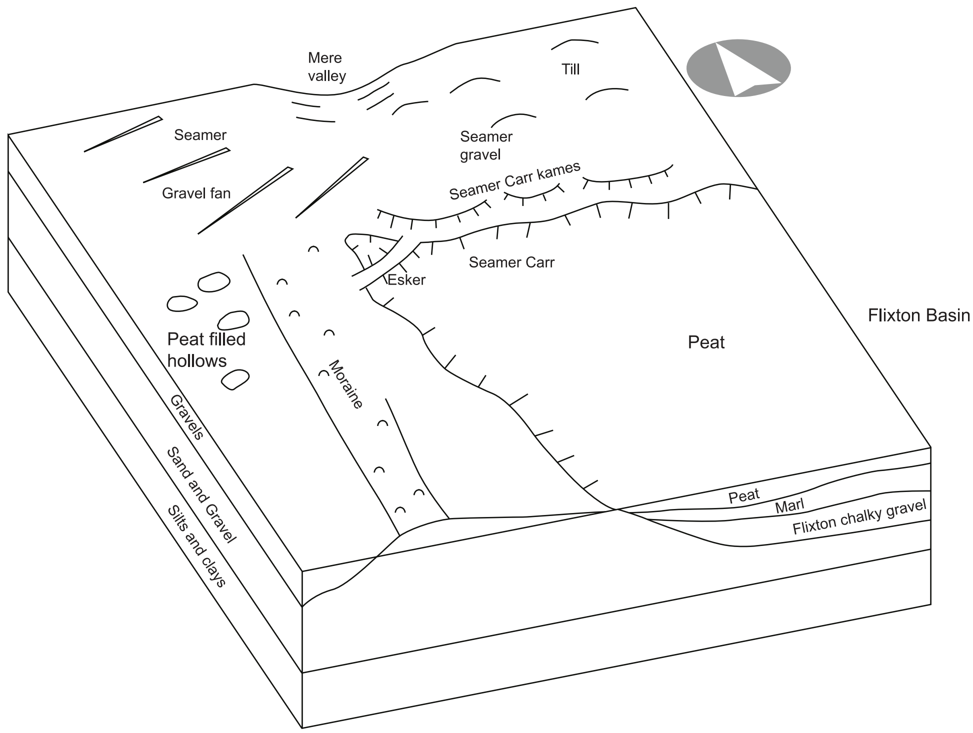


Figure 2.5. *The main glacial/periglacial features at Seamer Carr (after Franks 1987).*

Basin. Lying stratigraphically above deposits of Late Devensian till and below evidence of Late Palaeolithic activity at Site K, these gravels can be ascribed to the later part of the Dimlington Stadial.

Deposits between Seamer and Staxton

Geomorphologically and lithologically it is considered that this sediment assemblage forms a supraglacial landsystem complex, associated with Late Devensian ice present in the Flixton basin. The feature is not directly related to the gravel fan at Seamer village. If it were associated with meltwater discharging southward from the Mere Valley, it would need some constraint to produce such a linear feature. An eastern constraint could have been provided by ice present in the Flixton basin. However, no similar constraint can be accounted for on the western side.

At the southeast corner of this sediment assemblage, the Staxton gravels found beneath sand in Staxton quarry contain chalk and flint and may be associated with the gravels in the Flixton basin, although their proximity to the chalk scarp makes their precise association unclear. It is suggested, on the basis of content and position, that the Staxton gravels are in part glaciofluvial in origin, incorporating angular chalk clasts which are the product of mass movement from the chalk escarpment. West of these deposits, one borehole contained chalk clasts. These can be traced southward to the surface and appear to overlie the Staxton sands and constitute the eastern extension of the West Heslerton upper angular chalky gravel (Franks 1987).

With the exception of the high percentage of quartzite in the A64 till, the lithology of gravel obtained from the Staxton boreholes bears close resemblance to that in the till and shows a very similar particle size distribution to the Lower Till Series of Edwards (1978). The deposits in the top 10 m fine westward, and the Staxton Borehole gravels are less angular than those at other sites farther east. It is suggested that this finer material, being better sorted to form the 'running sands', represents an outwash from the Lower Till Series ice (Edwards 1978) in the Flixton Basin.

Discussion

The complex of gravels at Seamer Carr, together with those stretching across the Vale of Pickering toward Staxton, had not been evaluated in previous work. The area lies at the junction of the eastern and coastal sections of the Vale of Pickering, in which ice marginal and supra-glacial landforms and sediment associations are present, with overlying deposits of Late Glacial and Early Holocene peats and marls (see Chapter 5). Whilst the Mere Valley gravels appear to be a significant contributor to the deposits west of the Seamer Carr area and along the northern edge of the Vale toward Ayton, they are not considered significant to the Seamer Carr area owing to the valley direction. However, run-off from the dip slope adjacent to the Mere Valley may have transported some of the local sandstones and limestone south into the area. Otherwise, the deposits appear to be composed of material generally transported from the east of the area, along the coast or from the south.

The lithology of gravels sampled at eight sites in and around Seamer Carr was found to be relatively uniform, with broad differences in content and frequency being explained by the relationship of an individual site to the Jurassic dip slope or chalk escarpment. Thus, the Seamer Carr kames, lying along the southern edge of the dip slope, contain a high frequency of sandstone and limestone, with gravels in the Lake Flixton basin and Staxton quarry containing much chalk and flint. This suggests a common source for the material composing the Seamer Carr kames and the Seamer-Staxton sediment assemblage, transported from the north or east by ice, with local modification of the deposit by Jurassic material transported from the Corallian dip slope and by Cretaceous material from the south into the Flixton Basin. The lithological frequency of clasts found in this area is similar to that found in the Hutton Buscel sands and gravel (Franks 1987) when allowance is made for chalk and flint content, and for the incorporation of Corallian limestone from Irton Moor into the Hutton Buscel deposits.

The model postulated to account for the pattern of features observed south of the Mere Valley is an ice marginal and supraglacial landform system of Dimlington Stadial age as shown on Fig. 2.5, which also illustrates the suggested lithostratigraphy for the area. The area of the Seamer-Staxton supraglacial land system represents a retreat stage of ice from the Late Devensian ice-maximum Wykeham stage. It is suggested the deposition of the Seamer Carr kames coincided with ice wastage in the eastern Vale on the site of the Flixton basin. The deposition of the Cayton-Speeton moraine must have been at least contemporary with the presence of ice in the Flixton basin, otherwise it seems likely that outwash gravels from that event would have filled this geographically adjacent basin.

Hydrology and history of drainage

The modern drainage of the Vale is characterized by natural streams and numerous drainage ditches and canalized watercourses. Two major aquifers, one to the north and one to the south, feed the Vale (Harrison 1973; Foley 2006, 55 Fig. 2.13). Consequently, streams flow generally either north–south off the Tabular and Hackness Hills, eventually feeding into the River Derwent, or south–north into the canalized Hertford River from spring-lines along the foot of the Wolds escarpment at the *c*. 50 m AOD contour. Streams coming off the Corallian deposits fall steeply as they cross the outcrop but thereafter falls are slight over the flatter, central portions of the Vale. Summer flows in these streams are maintained 'by a substantial baseflow component from the Corallian and other minor aquifers', and response to rainfall is rapid due to the large extent of impermeable catchment in the adjacent areas to the north (Reeves et al. 1978, 256). By contrast, because of the more permeable nature of the chalk, streams on the southern side of the Vale are less deeply incised, and frequently flow only during the winter months. Both sets of streams feed into the River Derwent, which flows westwards at a fairly gentle gradient as far as Malton, where it turns south and joins the River Ouse at Barmby on the Marsh.

The value of the wetland areas of the Vale of Pickering was clearly recognized throughout prehistory, and from at least the Early Mesolithic onward they have been a focus of human activity and settlement. As already discussed, by the Late Mesolithic/Early Neolithic (i.e. fourth millennium cal BC), there was probably no permanent lake and only a boggy carrland, a putative 'old' River Hertford, and a series of water inflows into the central areas of the Vale from chalk-fed streams. By the Late Neolithic/Bronze Age, the carrland is likely to have become a component of the land division system based on the use of different land types and ecological niches evident in the linear pattern of later parishes. Although the fieldwork in the eastern Vale has not targeted the patterns of activity demonstrated in the Heslerton area to the west (Powlesland et al. 1986), it is highly possible that a similar pattern of ladder settlements (linear enclosure systems with associated buildings, resembling a ladder), existed during the Romano-British and Anglo-Saxon periods along the edges of this part of the Vale as well.

By the thirteenth century, a string of settlements numbering 135 in all, from Coxwold at the western end of the Gilling Gap to Gristhorpe on the North Sea Coast, were established along the southern and northern margins of the Vale (Wightman 1968, 128), most of which were already in existence by Domesday (AD 1086). The fertile soils along the margins of the Vale, mostly glacial sands and gravels, were a considerable focus of settlement and a substantial proportion was probably under cultivation. The Yorkshire Domesday, for instance, describes Flixton village as having 'land for 5 ploughs', Folkton as having 'land for 4 ploughs' and Seamer as having an area of land where a total of twelve ploughs could be worked:

> 'In Seamer Karli had 6 carucates of land
> taxable, where 3 ploughs are possible.
> Now William had there 5 ploughs; and

> 15 villagers with 4 ploughs. There a church and a priest. Woodland pasture, 3 furlongs long and 2 wide. The whole, 1 league long and 1 wide. Value before 1066, 20s; now £4' (Williams & Martin 2003).

Most parishes, especially along the southern margins and in common with parishes elsewhere in the Vale to the west (Allerston 1970) have a distinctly linear outline, extending up onto higher, dryer land more suitable for crop cultivation and grazing sheep, as well as out into the marshier carrland in the centre of the Vale (Tucker 1972). These latter areas were largely utilized as hay meadows and a source of wildfowl, and probably game and fish. Some hand cutting of peat for fuel probably took place. The available Medieval records include '220 references to woodland and 120 to unwooded conditions' across the entire Vale, although not all of these references can be tied to specific locations (Wightman 1968, 128–9). Based on an analysis of the distribution of those references to vegetation and land-use conditions, Wightman (1968) has argued that the wooded areas were mostly confined to valleys and steep slopes of the Jurassic uplands on the north side of the Vale and similar locations along the scarp slope of the Wolds. The lowland valley floor, by contrast, was basically unwooded, characterized by numerous references to carrs and ings, with a few mentions of the existence of marshes in the centre of the Vale. The latter occupied the wetter sections of the Vale, while the carrs were peripheral to these. Thorn, gorse, bracken, rushes, and sedges are the most frequently mentioned vegetation types in these unwooded areas, with the latter two most characteristic of the poorly drained areas, where alder is also recorded. Pastoral grants were made to numerous villages, including one for Folkton, where these were 'for meadow and summer pasture in an unidentified wetland called Sterks Ings' (Wightman, 1968, 131). The carrs seem to have been used for pasture and a source of moorland products, including peat. In Flixton Carr, for example, Bridlington Priory was allowed to extract at least fifty carts of turves, and a dispute between Folkton, Cayton, Gristhorphe and Osgodby is mentioned in the early fourteenth century lay subsidy rolls over the surcharging of certain carrs with cattle and the burning of stacked turves and rushes (*ibid.*).

From the early twelfth century until the late fifteenth century, various intensive efforts were made to drain and manage these wetland areas, largely due to the activities of the various monastic houses (Waites 1967; Miller 1976; Hallam 1988). Rievaulx Abbey, established in 1131, had the highest ownership of lands within the Vale, with multiple granges, and was especially active in bringing portions of the central Vale into cultivation to support its sheep farming enterprises (Jamroziak 2005). However, there were several other monastic houses with holdings in the Vale, and most of these took an active interest in reclaiming areas of wetland for arable cultivation, especially in the central and western parts of the Vale (for a summary, see Atherden 1999).

In contrast to these areas, for much of the Medieval period, much of the eastern part of the Vale (also known as Little Maeris, i.e. 'marsh'), which was mostly controlled by Yedingham Abbey, remained poorly drained, covered by marsh, mere, and in places forest (Waites 1967). The largest of the open bodies of water at the time was Muston Mere. This most probably represents the residual part of Lake Flixton, which had steadily contracted in size from the Late Mesolithic onward as a result of natural vegetation succession. However, other small lakes and boggy marshes existed. The Calendar of Patent Rolls for 1447, for example, observed that travellers crossing this part of the Vale in winter 'would be in danger of water, marshes and swamps' (cited in Waites 1967, 25). While John Leland, writing around 1508, described Seamer as 'having a greate lake on the south west of it, whereof the toun takithe name' (Smith 1964, 59). This still survives as a small boggy area, known as Seamer Mere, immediately to the southwest of the church and former Medieval manor house.

There is no doubt that in the twelfth–fourteenth centuries (and presumably earlier), parts of the Vale were exploited for peat as a fuel – apart from anything else the Medieval pottery kilns between Staxton and Potter Brompton were heavy consumers of peat (Brewster & Hayfield 1992), and the various communities around the edge of the Vale had rights for peat cutting and drying which were jealously guarded. It is difficult to be sure of the scale of turf removal during this period, but it seems likely that peat cutting was a seasonal activity which affected only the upper deposits of peat stratigraphy. A number of ditches and small undated earthworks visible around Seamer Carr and elsewhere in the Vale might well represent attempts at bog-edge drainage, although none of those so far observed are longer than a few metres. The ditch across Seamer Carr at Site C (see Fig. 6.1) was initially suggested as a Medieval drainage ditch, or alternatively as a rabbit warren, but there is no real archaeological evidence to prove either of these hypotheses.

Following the dissolution of the monasteries in 1536 by Henry VIII, the pace of drainage seems to have slackened (Waites 1967). However, understanding of the scale, nature, and location of attempts at drainage is hampered by the paucity of documentary sources for this period (Atherden 1999). Nevertheless, by the sixteenth century, settlement in the Vale had clearly assumed its present pattern at least in terms of overall population distribution, with a series of nucleated villages spread out along the east–west roads running along the higher ground well clear of the wet carrlands. On the southern edge of the Vale, the villages had parishes that ran from the high Wolds and the steep chalk scarp (often at heights of nearly 100 m AOD), down onto the edges of the Vale (35–40 m AOD) where the best agricultural land lay, comprising areas of chalky material derived from late and postglacial mass movement mixed with the deposits of Late Glacial tills, eskers, and kames, and early Holocene sands. Below this was a narrow band of 'ings' (the local dialect term for swampy meadows beside watercourses), below which was the area known as carrland that was almost entirely formed of peat derived from infilling of the former Lake Flixton. Prior to enclosure, the higher, marginal slopes were mostly used as common sheepwalks, while arable fields occupied the lower slopes, and 'common cattle and hay meadows the central vale' (Ward 1914, 389–90).

Enclosure began in the Vale in the late seventeenth and early eighteenth centuries and was a drawn-out process conducted on a parish-by-parish basis. The Enclosure Award for Seamer was made in 1810 (although the Act appears to have been passed in 1768); that for Flotmanby East and West in 1807; for Flixton in 1806; for Folkton in 1807; Staxton in 1801; and Gristhorpe to the east in 1806. The main impact on the Vale as a whole, was to create larger and more manageable field units. A commission of Sewers was appointed for the North Riding in 1615 and one for Pickering Lythe in 1637 (Sheppard 1956), although these appear to have been largely inactive. In contrast, the new owners of the former monastic lands in the Marishes, the central part of the Vale, continued drainage activities initiated in the previous centuries. Throughout the seventeenth century, the Carrs at the eastern end of the Vale continued to be used for pasture, after the retreat of floodwaters, except between May and July when the Ings were closed so the hay crop could grow (Musto 1962). By the earlier part of the eighteenth century and the period of the agricultural improvers, the drainage of the Vale was becoming more of a priority. Some abortive attempts to drain parts of the Vale were made in 1702 and again in 1772, for instance.

Later in the century, Arthur Young (1771, cited in Atherden 1991, 12) wrote at some length about drainage techniques and equipment, although he does not specifically refer to the eastern end of the Vale. However, a large range of interests were at work, and these early efforts had limited success. Additionally, there were conflicting reasons for trying to develop drainage in the Vale. The eastern end, where the main drainage was provided by the 'old' River Hertford, was certainly prone to flooding, and it was felt that drainage here would increase agricultural land values and rents. In 1788, for instance, Marshall noted that the eastern end of the Vale, with its extensive carrland, was much wetter than the west (Marshall 1788), as did John Tuke (1800) a few years later. In the west, there was more concern with the navigation of the Derwent at least as far as Malton, as well as other interests such as the maintenance of mills at Malton. There was no doubt a clear need to control the flow of water down the River Derwent (something which was still causing problems in January 1999, for example, when the town of Malton was cut off).

At the turn of the nineteenth century, more concerted efforts were directed toward drainage and improvement, especially following the enactment by parliament of the Muston and Yeddingham Drainage Act in 1800, which helped establish a directorate with powers over the draining of an area covering 10,000 acres at the eastern end of the Vale (Loughborough 1965). As a direct consequence, the Derwent and Hertford rivers were straightened and their gradients changed to improve water flow, and from the 1800s onwards, catchwater drains were constructed to improve surrounding drainage. This work was carried out in conjunction with the movement toward enclosure, particularly between 1801, the date of the Staxton award, and 1810 when Seamer was eventually enclosed. The latter awards involved the excavation of Black Dike, which roughly follows the line of the eastern shoreline of the 'West Embayment' of Lake Flixton at Seamer Carr. This fed into the Hertford River, which at the time still followed its original course. By 1854, however, the New Hertford Cut had been made and New Dike had been cut to create a link with the former river (Northern Archaeological Associates 1996a). Many of the smaller field dikes and drains were also dug during this period as part of the process of enclosure, and it is perhaps more than coincidental that as land holdings were consolidated most of the Vale experienced a decline in population during the last two decades of the nineteenth century (Ward 1915, 33). As Ward noted, while falling wool prices might well account for the temporary depopulation of the sheep-rearing districts of the Tabular Hills, the steep decline experienced by the low-lying wetter areas, 'noted for cattle pastures and dairying', is less easily explained solely by economic factors.

Even as late as the early twentieth century, commentators observed that the eastern end of the Vale

Figure 2.6. *Detail of land use in the eastern end of the Vale of Pickering in the mid-1930s/early 1940s, from The Land Utilisation Survey of Great Britain, 1933–49, Sheet 23 – Scarborough. Green areas indicate pasture/grazing land, brown indicates arable. This work is based on data provided through www.VisionofBritain.org.uk and uses historical Land Utilisation Survey map material which is copyright of The Land Utilisation Survey of Great Britain, 1933–49, copyright Audrey N. Clark. Reproduced with permission.*

was largely 'deficient in drainage' (Ward 1914, 384), and drains were still being maintained by hand up to the Second World War. In the immediate post-war era this began to change, with hundreds of acres being drained and, following increased mechanization, brought into arable cultivation. From the later 1950s onward, the removal and burning of bog oak from the peat deposits intensified as drainage was improved, peat deposits shrank, and increased ploughing took place. In 1976, the Hertford River was lowered, and a new period of machine laid drainage took place. This in turn saw further expansion of arable activity and increased ploughing and improvement of areas of permanent pasture. This phase of drainage (1970s–1990s) was piecemeal and on a farm-by-farm basis and has continued into the twenty-first century. The effects are also increasingly apparent within the landscape, and many of the drains laid in the 1960s at a depth of 3 feet (*c.* 0.9 m), were effectively on the surface (i.e. at a depth of 0.3 m or less) by the late 1990s.

Drainage from the nineteenth century onwards has also encouraged a progressive change in land use. As late as the Second World War, grassland was permanent and unimproved (except for liming), or ploughed and re-seeded very rarely. This is evident on the vertical aerial photographs taken immediately after the end of World War II, which show that much of the carrland was still under permanent grass, and on land use maps from that era (Fig. 2.6). In the 1950s and 1960s, the need to improve pasture and switch from hay to silage saw grassland being re-seeded and ploughed far more frequently, which explains the push to improving drainage, not least so as to allow tractor access. By the late 1960s and into the 1970s, the move to increase agricultural productivity had stimulated a steady shift toward grain and root crops and more intensive drainage. The consolidation of fields into increasingly larger blocks for mixed farming also led to a decline in permanent pasture.

As well as changing the pattern of agriculture and land use, the continuing process of drainage has had a significant impact on the biodiversity of the Vale and has contributed to the loss of a number of important wildlife habitats. In this regard and with the benefit of hindsight, it is especially ironic that the purchase of Seamer Carr Farm by NYCC in 1976 for use as a waste disposal area, and which provided the initial stimulus for the new phase of archaeological research in the area reported here, also led to the irrevocable destruction of what was probably the single most important area of unimproved, species-rich carrland to have survived anywhere in the eastern part of the Vale.

Chapter 3

Fieldwork and post-excavation programmes and methodologies

Paul Lane, Tim Schadla-Hall† & Barry Taylor, with contributions by Ian Bailiff, Chantal Conneller, Rowena Gale, Jim Innes & Ken Thomas

This Chapter outlines the nature of archaeological fieldwork conducted in the eastern end of the Vale of Pickering under the auspices of the Seamer Carr Project and the Vale of Pickering Research Trust between 1976 and 2000. It also summarizes the various methodologies employed for the fieldwork and the post-excavation analyses of the accumulated data.

Fieldwork programmes and methodologies: Seamer Carr Project

Ten seasons of fieldwork were conducted at Seamer Carr between 1976 and 1985 (Fig. 3.1). The 1976 season focused entirely on the boulder clay areas of Hopper Hill, and lasted only a couple of weeks before being abandoned because of adverse weather conditions. Thereafter, each field season lasted between 6–8 weeks, running through the months of July and August. For most years, the size of the field crew averaged around 15–25 individuals. However, during the 1984 and 1985 seasons the numbers were rather higher, ranging between 35–50 people working on site at any one time. A significant proportion of the field personnel were either archaeology students from British (and occasionally European or North American) universities, or full-time professionals on the national excavation circuit. However, since the project was advertised in the Council for British Archaeology (CBA) excavation calendar, and given the context of the time, it attracted a sizeable number of volunteers from other walks of life, with a wide range of experience, interests, and skills, who at times were also joined by young offenders on day release from local remand centres.

Field investigations at Seamer Carr comprised a combination of area and trench excavations in conjunction with a programme of sampling by means of the excavation of 2 × 2 m test-pits. Details of the specific objectives and chronology of field investigations at individual excavation sites are given in the appropriate chapters (Chapters 6–8) that follow. The purpose of this section is to outline the main procedures and principles adhered to throughout the duration of the project.

Test-pit sampling strategy – 1979–84

The primary objective of the sampling exercise was to locate any large/substantial artefacts scatters, or 'sites', that survived beneath the peat that had formed over the Late Glacial/Early Holocene land surface around the margins of the former Lake Flixton within the threatened area. The location of the test-pits was determined on the basis of a programme of augering carried out by Edward Cloutman carried out during 1979–80 (Cloutman 1988a). A total of 70 auger transects, 15 m apart were recorded, mainly using a Hiller peat borer (Fig. 3.2). Borings were taken at *c*. 10 m intervals, in the case of the shorter transects oriented at right angles to the former shoreline/peat margins, and at *c*. 30 m intervals for the four longer transects that sampled the deeper parts of the basin (Cloutman 1988a). Information from this series of borings allowed a reconstruction of the buried topography, and in particular the location of the 25 m AOD contour, which previous work had shown to correspond roughly with the main zone of activity during the Early Mesolithic (Schadla-Hall and Cloutman 1985). The borings also provided an indication of the condition and survival of the peat and the nature of the sub-peat deposits.

To investigate this buried land surface, a sequence of 2 × 2 m test-pits were excavated at 15 m intervals, placed so as to straddle the 25 m AOD contour, along the entire length of the former lake margins, between East Island (Site C) and Sweetbeck Pig Farm (Site F). A smaller number of trial test-pits were also excavated on Far Island, situated *c*. 270 m to the south of West

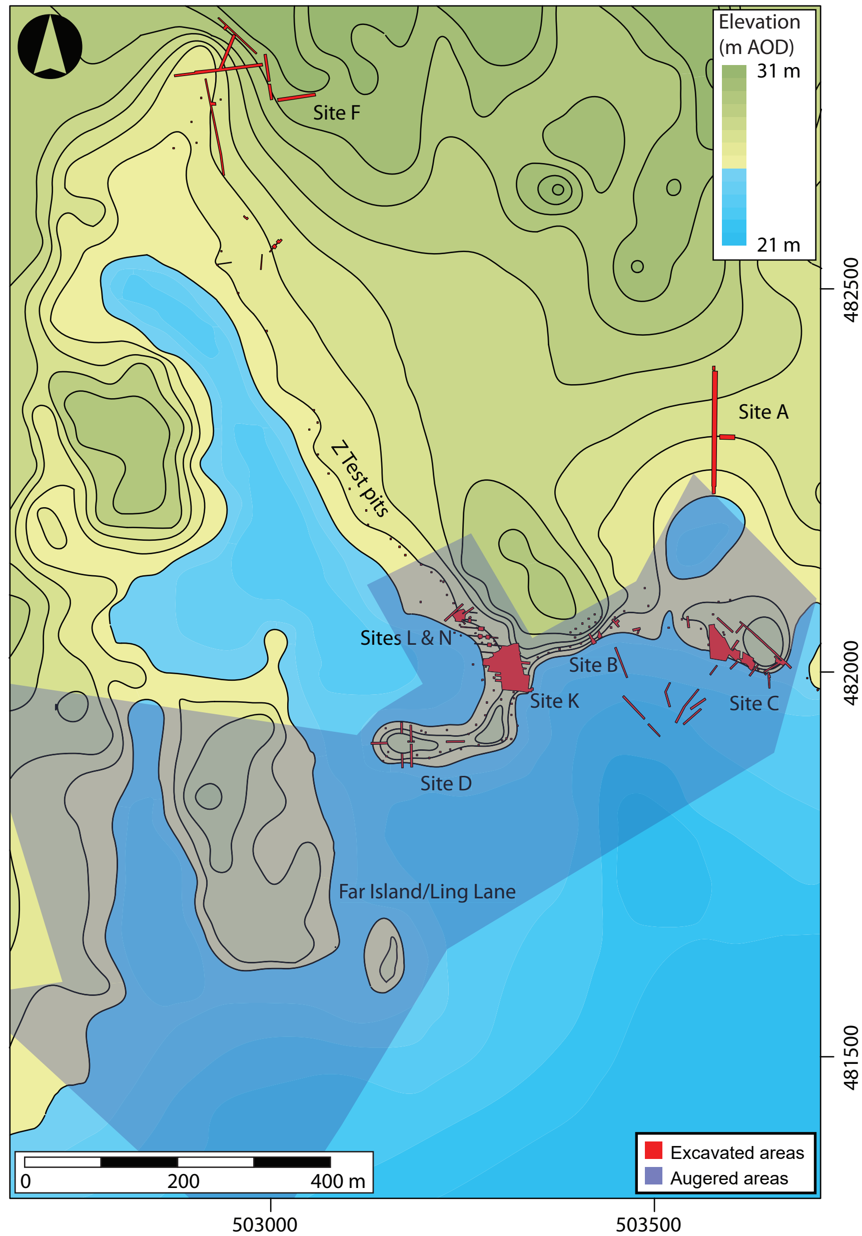


Figure 3.1. *Investigated areas at Seamer Carr, 1976–1985, in relation to Mesolithic land surface, (level of the lake shown at 24 m AOD).*

Island (Site D). The decision to space the test-pits at 15 m intervals was based on the assumption that this would detect any large activity areas, a rationale that was based on the information available at the time about the relative sizes of the Star Carr and Flixton 1 artefact distributions, combined with a re-reading of Clark (1954) which indicated that Early Mesolithic activities were commonly concentrated on the edge of the *Phragmites* zone fringing the lake (Schadla-Hall and Cloutman 1985, 82). As discussed by Schadla-Hall and Cloutman (1985, 82), it was hoped that this method of sampling would provide comparative information for at least one topographic and ecological zone of the Early Mesolithic landscape, while the size of the test-pits would be sufficient to allow easy excavation, and the use of a pump if necessary when waterlogged conditions were encountered.

All 2 × 2 m test-pits were hand excavated from the surface (Fig. 3.3). Typically, after de-turfing, the topsoil and upper horizon of oxidized peat were removed by shovel, after which excavation was carried out by trowelling, or with the use of wooden spatulas and/or fingers where appropriate (such as around pieces of bone and possible wooden artefacts). Where features of either natural or human origin were exposed, these were planned and sectioned, and in some cases the 2

× 2 m test-pit was enlarged to reveal the full extent of the feature. All finds below the upper, oxidized peat horizon were three dimensionally recorded, and plotted by context on a 1:10 scale plan of the test-pit. At least one section was photographed (in both black and white and colour) and drawn at 1:10 scale, with accompanying written context descriptions. Where there were significant differences in the visible stratigraphy and/or angle of slope of the subsurface between different faces of a test-pit, additional sections were recorded in a similar fashion. Between 1979 and 1984, 118 test-pits were excavated in this fashion, and the data from them was used to determine areas warranting more intensive investigation by either trench or area excavation.

While the test-pitting strategy was a reasonably effective means of sampling the drier area along the approximate position of the shoreline of Lake Flixton, where peat deposits were rarely greater than 1.5 m in depth, the same strategy could not be used for investigating the areas of former lake margins lying immediately to the south. This was due to the depth of covering deposits, and the degree of waterlogging, which would have made the excavation of a 2 × 2 m test-pit both impractical and extremely hazardous. To investigate these areas, two strategies were adopted, both involving the excavation of machine-cut trenches. In the areas immediately adjacent to the former shoreline, where the subsurface topography formed a gently sloping shelf, it was possible to cut a

Figure 3.2 *(above). Using a Hiller peat borer on Seamer Carr (Photo Tim Schadla-Hall).*

Figure 3.3 *(right). Sampling for beetle remains from a 2 × 2 m test-pit, Seamer Carr.*

Figure 3.4. *Searching upcast from machine-excavated slot trenches in the East Embayment, Seamer Carr, known affectionately as 'peat squeezing' (July 1983, Photo Simon Evanston).*

broad trench through a transect of several metres of deeper deposits by using an untracked (typically a JCB) or tracked (Hymac) mechanical excavator to remove the upper peat deposits, thereby exposing the lower, and potentially archaeological, horizons, for standard excavation (see below). The other strategy, which was only used to sample the area of the East Embayment south of Site C (Fig. 3.1), entailed the use of a Hymac to excavate narrow slot-trenches through the complete sequence of wetland deposits. In this approach, the machine-excavated peat overburden was placed to one side of the trench, while the spoil removed from the interface between the basal muds and the underlying glacial sands and gravels was placed on the other side and then searched systematically by hand (a technique that became known affectionately by those involved as 'peat squeezing') (Fig. 3.4). Whenever archaeological material (i.e. flint or bone) was found, its approximate horizontal position along the transect was noted along with a description of the matrix from which it was derived. This approach was necessary due to the depth of the peat deposits in this area, and the extremely waterlogged nature of the peat, conditions that would have required the use of a cofferdam and multiple pumps (which were beyond the financial resources available) to excavate by hand. As such, the slot trench sampling provided a suitably expedient alternative (and even this nearly resulted in the loss of the Hymac in the peat), especially as the dumping of household waste was scheduled for this area in the following year. Although far from ideal, this method of grab-sampling did produce results, and indicated the approximate position of at least one possible bone-dump.

Trench and area excavations – 1976–85

In the initial phases of the Seamer Carr project, areas thought to be of archaeological potential were investigated by means of a series of 2.0–2.5 m wide trenches, generally aligned at right angles to the former 'shoreline' so as to provide a longitudinal section through the fringing peat deposits (e.g. Site C Trenches I, III, IV, VI & VIII; Site D Trenches I–VI). After initial excavation by hand to determine the likely depth of deposits, the topsoil and upper horizons of oxidized and humified peat (typically post-dating the Mesolithic), were removed mechanically by a skilled operator using either a Hymac or JCB excavator under archaeological supervision (Fig. 3.5). The deposits below this were then hand excavated by 'shovel-skimming' to remove the next horizon of peat, and thereafter trowels, wooden spatulas, and fingers where appropriate, with all finds being three-dimensionally recorded following the same procedures as for the test-pits. Excavation ceased once the natural glacial sands and gravels had been reached, although experience showed that it was often necessary to trowel off the top 50–100 mm of these deposits to establish whether archaeological material had been worked down into it.

In the first few field seasons, considerable time was spent exposing, planning, and photographing concentrations of wood and bark whenever these were encountered as a distinct layer within the peat (Figs. 3.6, 3.7). This was done principally because of the reported discovery of a 'birch wood platform' during Clark's excavations at Star Carr (Clark 1954), and the presumption that all Early Mesolithic sites likely to be found elsewhere in the area would be of 'Star Carr' type. Subsequently, however, as familiarity with the deposits progressed and understanding of the post-Early Mesolithic depositional history evolved, it became apparent that these wood horizons were of natural origin. Some probably represented natural accumulations of tree-litter following the expansion of fen and carr environments into the lake (see Cloutman 1988a), whereas other accumulations observed lower down in the stratigraphic sequence are more likely to have been the result of later root penetration.

Figure 3.5. *Use of mechanical excavators to strip topsoil and peat horizons, Site K (July 1983, Photo Simon Evanston).*

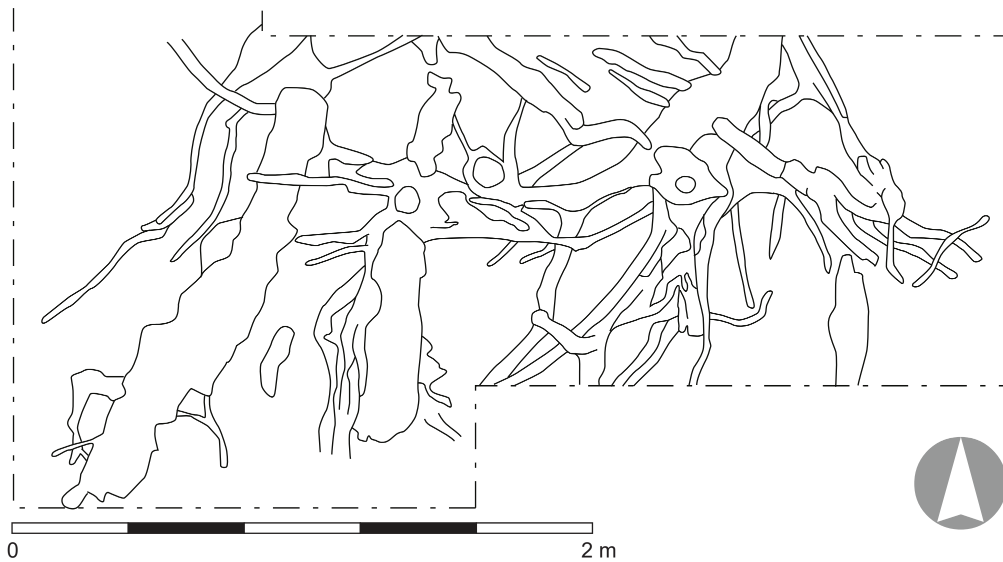


Figure 3.6. *Plan of a 'natural' accumulation of wood, Seamer Carr, Site C.*

While it is possible that some concentrations were due to the activities of beavers, as has been suggested at Star Carr (Coles and Orme 1983), there is no strong evidence for this.

In addition, as more areas were excavated, it became apparent that most of the archaeological material lay below the main wood horizons. The only major exceptions to this were at Site 'B' (see Chapter 8), and in some of the deeper sections around Site C. While it is possible that there had been some downward vertical movement of artefacts since their original deposition, it seems highly unlikely that all finds would have migrated in such a systematic fashion at all the sites around Seamer Carr. In view of this, in later seasons (and also during the VPRT excavations), less effort was expended on detailed recording of such wood horizons. Nevertheless, where present they were always documented, and care was taken to examine larger pieces for traces of tool marks or working. Parenthetically, it was precisely because excavators were familiar with 'natural' wood accumulations from having worked on the Seamer Carr sites, that when a humanly made wooden platform was exposed in the VP 85A trench at Star Carr (Mellars et al. 1998a), it was recognized as being something unusual (Fig. 3.7b).

In later seasons (i.e. post-1979), greater emphasis was placed on area excavation (Fig. 3.8a, b) (although smaller trenches were used to investigate both Site L in 1984, and Site N in 1985, see Chapter 7). On Site C, this entailed excavating areas of undisturbed deposits lying between previously excavated trenches, in order to expose most of the gently sloping sandy gravel shelf on the south side of the site (see Fig. 6.2). At Site K, an area *c*. 850 m^2 was initially cleared in 1983, and subsequently extended in 1984 and 1985 to cover an extra 1400 m^2, so as to trace the extent of the main flint distributions (see Fig. 7.1). As with the trench excavations, a JCB or Hymac mechanical excavator driven by a skilled operator under archaeological supervision was used to remove the upper deposits before hand-excavation commenced.

Recording strategies

In 1976, a localized conventional metric grid, oriented in relation to magnetic north, was established by a professional surveyor using a standard theodolite across the area of Hopper Hill that was under investigation. This was extended in 1977 to cover the entire *c*. 40 ha Seamer Carr project area, and permanent markers set in concrete were established at various points to permit recreation of the grid and/or its extension during subsequent field seasons. These concrete markers also doubled as permanent benchmarks for the duration of the project, and their height and position were checked on a regular basis at the start of each field season. The locations of these permanent markers were also tied in, again by theodolite survey, to the National Grid.

All subsequent test-pits, trenches and excavated areas were located with reference to these permanent markers, as were the various sampling transects and pollen boreholes utilized by Cloutman (1988a). Where they were required, additional grid-points were established for each trench or excavated area, and occasionally for some of the test-pits. For narrower trenches,

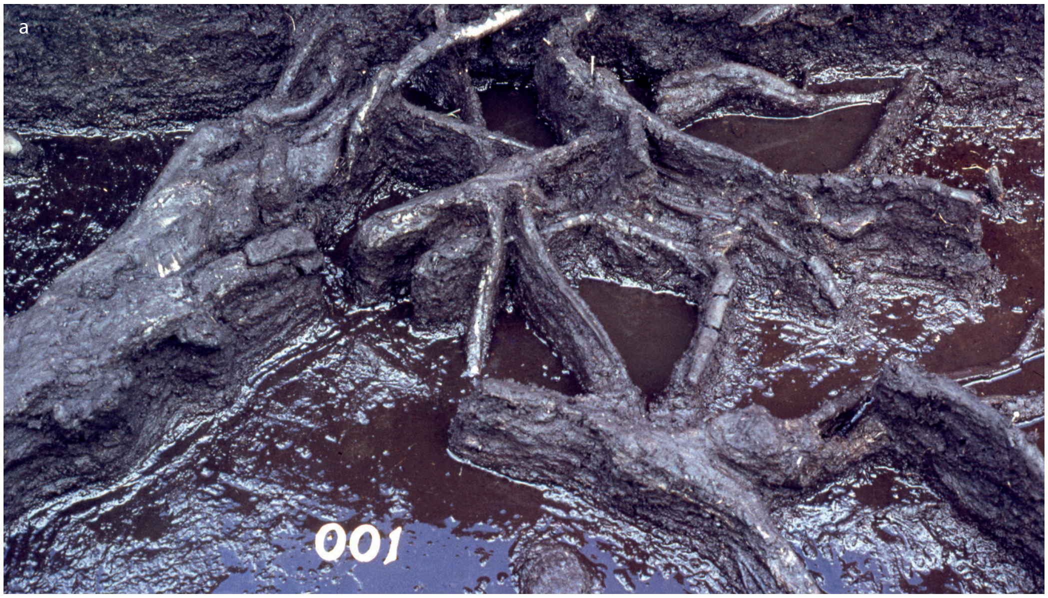


Figure 3.7. *(a) Example of a typical 'natural accumulation' of wood at Seamer Carr, Site C, 1980 (Photo Roger Simpson); (b) The wooden 'platform' exposed in Trench VP85A at Star Carr (August 1985, Photo Paul Lane).*

Figure 3.8 *(above and opposite). Area excavations at (a) Site C, and (b, c) Site K, Seamer Carr (July and August 1984, Photos Simon Evanston).*


b


c

Figure 3.9. *Excavated surface at Seamer Carr Site K with finds marked by white tags and being plotted using a 1 × 1 m planning frame (in the background).*

these comprised a simple horizontal grid divided into 10 m squares such that the X- and Y-coordinates of individual finds within these trenches could be easily measured by taped offsets from adjacent grid-pegs no more than 10 m apart. For the larger areas, i.e. Sites C, K and L, this 10 m grid was further subdivided into 1 m squares, with grid intersections marked by 6-inch nails, from which horizontal coordinates of individual finds were determined by taped offsets or the use of a 1 × 1 m planning frame. The positions of these 1 m grid points were checked regularly and repeatedly during the course of excavation, so as to maintain the accuracy of the grid. At the end of each field season, the grid-pegs marking the 10 m grid were left in place for use the following year, although their position was always checked relative to the permanent markers at the start of each new season before recording work began in case any had been displaced during the intervening months.

As far as possible, deposits were excavated stratigraphically to the basal, natural layers. Each individual find that was recorded below the topsoil and oxidized peat horizons was given a unique finds number, a context number appropriate to the trench stratigraphy, and three-dimensionally recorded and bagged (Fig. 3.9). As indicated above, horizontal coordinates were measured by taped offset from fixed grid points to the nearest 5 mm, while heights (also to the nearest 5 mm) were taken using conventional planar Dumpy levels and Sopwith levelling staff with reference to site specific Temporary Bench Marks (TBMs) of known height above Ordnance Datum (AOD). Levels and coordinates for individual finds were logged in field notebooks and subsequently transferred to the master finds register for the appropriate excavation area and details entered onto standardized computer-coded record forms. Artefact distribution plots (by context), for each excavated surface were also prepared manually in the field on Permatrace drafting film at the scale of 1:10.

All features were planned at either 1:10 or a larger scale prior to sectioning, and then re-drawn after excavation. Small, sub-circular features were generally half-sectioned while larger features, such as hearths and 'sandy-gravel lumps', were usually quarter sectioned. Where linear features were encountered (mostly on the summit of East Island), these were systematically sectioned along their length. All such sections were drawn following standard conventions.

In each trench, excavation area, and 2 × 2 m test-pit, all stratigraphic units were described following the Central Excavation Unit system that was then current (Jefferies 1977) and the details entered on standardized context record forms. Trench and test-pit sections and plans were typically drawn at 1:10 scale, except where more detail was required in which case drawings were made at either 1:5, or even 1:2 scales. Oblique black and white print and colour slide photographs, with accompanying scales, were taken of all drawn sections, features, and 'special finds', as well as shots of working conditions and sampling procedures. Details of these were recorded in a photographic log, according to site and excavation area.

Wet sieving

Wet sieving was employed during the area excavation of Sites C and K as a means of monitoring artefact recovery levels by hand-trowelling. During the initial investigation of Site C, an attempt was made to wet sieve all hand-excavated deposits from below the basal peat/coarse detritus mud horizons, using three stacked sieves measuring 1.0 × 1.3 m, with mesh sizes of 10, 5 and 2.5 mm. However, it became clear that within the time scale available, and given the volume of deposits being excavated, total wet sieving of this material would not be possible. The initial results from the wet sieving exercise had also shown that *c*. 95% of all material over 10 mm in length, and 85% of flint over 2.5 mm in length was being recovered during trowelling (Schadla-Hall 1987a, 52). Accordingly, the strategy was changed so that roughly one five-litre bucket of spoil per 100 was sieved, to provide a general control and check on recovery. Care was taken to ensure that all the sieved spoil within a particular bucket was derived from the same 1 × 1 m square (rather than adjacent ones), so that the general location of any recovered finds would be known. This strategy was also used during the first two seasons of area excavation at Site K (1983–4), but later abandoned mostly because of the consistently high level of recovery by trowelling, but also because of time and labour constraints.

Fieldwork programmes and methodologies: Vale of Pickering Research Trust

The first season of fieldwork supported by the VPRT was carried out in 1985, with the excavation of a *c*. 18 × 2 m trench (VP85A) and two 2 × 2 m test-pits in the vicinity of Star Carr. These excavations ran concurrently with the final season of excavations at Seamer Carr, and have been reported elsewhere (Mellars et al. 1998a, 1998b; see also Cloutman and Smith 1988 for a report on the environmental analysis). Subsequently, between 1986 and 2000, the VPRT supported annual seasons of fieldwork, each lasting between 4 and 5 weeks during the months of July and August. The size of field teams over this period varied considerably, ranging from as few as ten (1990) up to as many as 40 individuals (1994) in the field at any time. As with the Seamer Carr project, the field personnel typically involved a mix of full-time professional archaeologists, graduate and undergraduate archaeologists, and volunteers from other disciplines and walks of life – many of whom had also participated on the Seamer Carr excavations. In addition to this work, the VPRT supported environmental work and post-excavation analyses, as well as a limited programme of fieldwalking.

Details of the specific strategies employed at different sites are given in the relevant chapters that follow (Chapters 9–13). The purpose of this section is to summarize the general approaches used during fieldwalking, auger survey and excavation.

Fieldwalking strategies – 1989–2000

Fieldwalking was carried out at several locations around the peat margins on an occasional basis as opportunities arose. Except for the surveys at Lingholm Farm in 1990, Star Carr in 1992, Flixton School Field in 1993, and West Flotmanby in 1999, this work was carried out during the autumn or winter months. Fieldwalking team sizes varied from just two individuals to around ten, depending on circumstances, and this was a primary factor influencing the size of the collection unit employed at different locations. In all cases the main objectives were to determine the extent of surface flint scatters, and document the degree of spatial variation and patterning in artefact densities. Accordingly, all fieldwalked areas were gridded into collection squares (ranging from 30 m^2 to 5 m^2), with finds from different collection units being bagged separately. In addition, general notes on the fieldwalking conditions were made, and a plan recording the position of the collection squares in relation to modern field boundaries was prepared. Additional information concerning variations in soil type, and the distribution of individual walkers across the collection grid was also recorded (see relevant chapters for details relating to individual surveys).

Auger survey – 1987–2000

As part of the strategy for mapping the Early Mesolithic topography around Lake Flixton, a key feature of the work of the VPRT was to undertake a programme of augering around the presumed margins of the former lake and its associated islands. Rather than relying on transect sampling, as had been employed at Seamer Carr, the strategy instead was to take systematic auger readings of peat depths in conjunction with surface levels, on a 10 m grid over large areas.

Since the size and location of the areas augered each field season were dependent on access to particular fields, their current land use, and the availability of sufficient labour, local survey grids were established for each newly augered area, rather than trying to work from a single grid. In establishing each grid, a baseline aligned north–south by magnetic compass was normally established as close as possible to the westernmost field boundary (although sometimes it was set further into the field to maximize the line of sight). A second baseline aligned east–west was then offset from this. Next, the 10 m grid for the area to the east and north of these lines was established by means of taped offsets from both baselines using 30 m tapes, occasionally using a crosshead set up on one of the baselines to check the overall alignment of the grid. Each grid intersection was marked with either a garden cane or small wooden grid-peg.

Once established, the position of the major corners of the grid in relation to the modern field boundaries was measured by either taped offset or optical tacheometry, and a plan of the field showing the grid and field boundaries was prepared at 1:500 scale. Next, surface levels for the gridded area were taken at 10 m intervals, relative to a local TBM of known height established at the start of the survey by level survey to fixed Bench Marks of known height. A 4.0 m long, narrow, cylindrical auger, with a 1 m long sampling tube with a 30 mm diameter, was then used to measure the depth of peat at each 10 m grid point. The depth thus penetrated was noted, along with the general characteristics of the subsurface material, i.e. whether it was sand, gravel, clay, calcareous mud, or some combination of these. Where the upper few centimetres of overburden were hard or compacted, it was sometimes necessary to dig a shallow hole until softer material that could be penetrated by the auger was reached. The absolute height above Ordnance Datum for this subsurface horizon was then derived by subtracting the overall auger depth from the reduced surface level at the auger point, and two contour maps (one for the surface and one for the subsurface) were generated manually at 1:500 scale by interpolating the individual readings. The subsurface contour map could then be used to determine the approximate location of the 25.0 m, 24.5 m, and 24.0 m

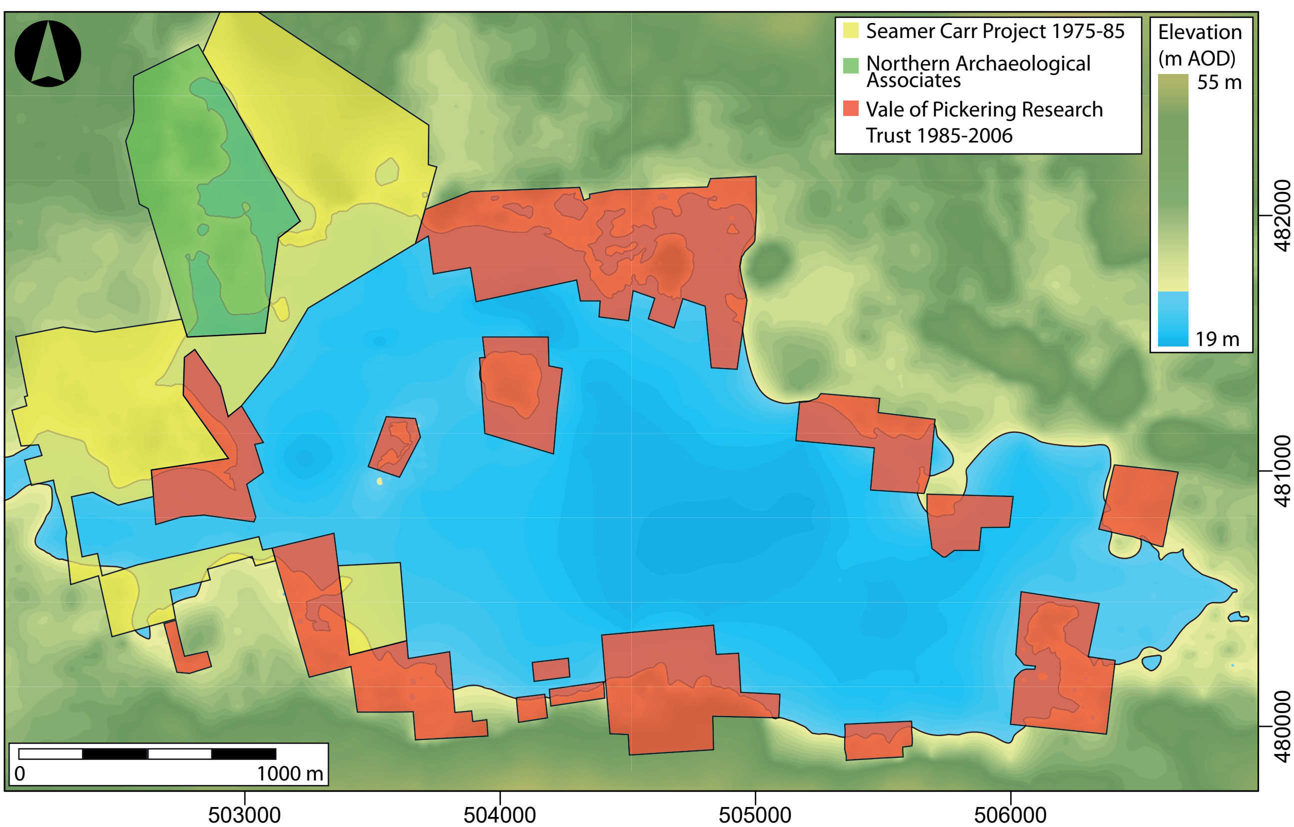


Figure 3.10. *Extents of auger surveys around Lake Flixton.*

contours, and from this the optimum position for the location of 2 × 2 m test-pits.

While the method for establishing the survey grid was not the most accurate possible, the system was reasonably easy and quick to employ, and the margin of error was generally low. Two teams, each of two people, one laying out the grid and taking the surface level, the other augering each point, would average 50–60 auger points in a day once they were familiar with the system (Kenyon 1994). In this way, some 146 hectares of the buried Early Mesolithic land surface along the edge of the former lake basin was mapped by the VPRT (Fig. 3.10). The final parts of the survey, to fully circumnavigate the shores of the former lake and fill in any remaining gaps in the VPRT survey (see Fig. 3.10), were completed in 2008 during doctoral research undertaken by Barry Taylor (Taylor 2012).

Test-pit survey

With the exception of the large-scale area excavations at Star Carr, Seamer Carr, and the smaller trench excavations at Flixton Island, Barry's Island, VP D and Flixton School House Farm, 2 × 2 m test-pits provide the main source of information about the nature of the deposits and the distribution of archaeological material at particular locations around the lake. Clearly, there are limitations with this approach. The understanding of the stratigraphy in any 2 × 2 m excavation will be partial, and there is no guarantee that the area sampled by the test-pit will be entirely representative of the local stratigraphy, or that the finds densities will be indicative of the more general patterning of material. Indeed, in some cases (most notably at the Barry's Island site, Chapter 12), initial interpretation of the stratigraphy (as revealed by test-pitting) was misleading, such that had a larger area been exposed at first then it is likely that a rather different excavation strategy would have been adopted for subsequent seasons. Yet, overall, the results have shown that a broadly similar stratigraphy exists at most of the investigated areas, making both context concordance and correlation with the main stages of wetland succession relatively straightforward. It has also been possible to derive a broad date range for the different stratigraphic levels, from a combination of stratified finds and sequences of radiocarbon dated organic remains (for assessment of the radiocarbon dates, see Chapter 4). As such, certain broad conclusions can be drawn regarding the depositional sequence at each locality, and the spatial extent and diversity of the archaeological assemblages from the test-pit records alone. In addition, where larger excavations were carried out subsequently, the results obtained tended to substantiate the impressions gained from the test-pit data. Where uncertainties about the true nature of particular deposits or artefact spatial patterning remain, these are referred to in the individual chapters.

Excavation and recording methods – 1985–98

Essentially the same excavation and recording methods used during the Seamer Carr project were employed on the VPRT field investigations, particularly with respect to the excavation of 2 × 2 m test-pits, which was a major focus of fieldwork after 1985. As no large areas were excavated, there was little call for the use of heavy machinery, and with the exception of the VP85 A trench at Star Carr and trench LAK on Barry's Island, for which mechanical excavators were used to remove the upper peat deposits, all other trenches were excavated by hand from the topsoil (Fig. 3.11). In all cases, excavation followed the stratigraphic sequence of deposits until the basal glacial deposits were reached. Typically, the top 50–100 mm of this 'natural' horizon was also trowelled to establish whether any archaeological material had worked down into the substrate. In cases where the excavation of a test-pit or larger trench was not completed during a field season, the base of

Figure 3.11. *Test-pit excavation underway on Barry's Island in 1994 (Photo Paul Lane).*

Figure 3.12. *Excavations at (a) Flixton Island 1997, and (b) at Trench LYY, Barry's Island 1993 (Photos Paul Lane).*

the unit was covered with heavy plastic sheeting and the trench/test-pit backfilled and re-opened the following season to allow excavation of the archaeological horizons to be completed.

As on the Seamer Carr excavations, all archaeological finds below the upper oxidized peat horizon were individually, three-dimensionally recorded. In the case of 2 × 2 m test-pits, x/y coordinates were calculated using the southwest corner of the test-pit as the grid origin, with the height (z coordinate) established using a dumpy level. Where larger areas were excavated (VP88 D, AH & AJ on Flixton Island, and LYY on Barry's Island; Fig. 3.12) a local, site-based grid with its origin to the southwest of the excavated areas was used. A major task of the post-excavation analysis (see below) was to convert these local grids to a single, common unified system – i.e. the national Ordnance Survey grid. As on the Seamer Carr project, sections, plans, and finds distribution plots for all excavated surfaces were prepared following standard procedures, with accompanying black and white and colour photographs. Standardized context record forms, closely based on those developed by the Central Excavation Unit, were used throughout to maintain compatibility with the Seamer Carr records, although it is recognized that these are not particularly suited to describing different types of peat and coarse detritus mud.

Remote sensing – Seamer Carr and VPRT Projects

Remote sensing techniques were rarely used in either the Seamer Carr project or the work carried out by the VPRT. This was principally because of the unsuitability of most of the available techniques, at least until recent years. Conventional aerial photographs of the eastern end of the Vale held by Cambridge University, the RCHM and in other collections were nonetheless examined. These were of limited value as a means of site location given the nature of Mesolithic sites, the depth of covering peat deposits, and the dominance of semi-permanent pasture as the major land use during the years of the two field projects. Certain geomorphological features, such as fossil stream channels and drumlin- and kame-like glacial features are occasionally visible in vertical photographs of ploughed areas (especially in more recent years following peat shrinkage). Mapping of these features has yet to be carried out, although their future investigation may be warranted in the light of the work carried out at and around the Barry's Island site (see Chapter 12).

Limited geophysical surveys were carried out by the Ancient Monuments Laboratory at Seamer Carr at the start of the project between 1976 and 1978 on areas of East Island/Manham Hill (Site C), West Island (Site D), Sweetbeck Pig Farm (Site F) and Hopper Hill (Site A). The results from all surveys were mostly inconclusive, partly due to the number of anomalies caused by recent peat burning and possible mineral enrichment due to localized waterlogging (Haddon-Reece et al. 1977). The main exception to this was on the summit of East Island, where the extent of a ditch exposed by excavation was traced as far as the adjacent peat deposits (David and Bartlett 1978) (Fig. 3.13). Soil test-pitting in 1977 also led to the discovery of a corroded Iron Age sword in the vicinity of Site F. (Keeley 1977).

During the VPRT investigations, limited geophysical surveys were conducted at two other locations: (a) just upslope from the 'shoreline' at the northeast end of the former Lake Flixton, on Lingholm Farm in 1990, and (b) on the summit of No Name Hill in 1994. In neither case, however, were the results particularly conclusive. This was possibly as a result of the number of natural anomalies induced by the quantity of metamorphic sandstone fragments in the soil but could also be attributable to breadth of the sampling interval. Brief details of the location and results of these geophysical surveys are given in the relevant chapters (Chapter 11, 13) below, and copies of the field reports have been deposited with the site archives.

Post-excavation methodologies

Stratigraphic and contextual analysis

Preliminary analysis of the contexts, and phasing of the Seamer Carr sites was conducted by Peter Cardwell and Roger Simpson during initial post-excavation work in the late 1980s. Albert Franks provided additional observations concerning the glacial and periglacial features and deposits. Geoff Smith developed the context concordance and Harris matrices in the early 2000s in consultation with Paul Lane & Tim Schadla-Hall. Analysis and phasing of the sites investigated by the VPRT was undertaken by Paul Lane in the 1990s.

Figure 3.13. *Geophysical survey by Ancient Monuments Laboratory staff on the edge of East Island, Seamer Car, July 1977 (Photo Tim Schadla-Hall).*

Digitization of the archive

As already noted, all of the spatial data from the excavations and surveys carried out by the Seamer Carr Project and VPRT (such as trench locations, finds locations, and auger survey points) was recorded in relation to site specific grids, or in some cases trench specific coordinate systems. Over the duration of the Seamer Carr project, the three-dimensional coordinates of all recorded pieces of flint, animal bone, radiocarbon samples and environmental samples were entered with brief descriptions onto pro-forma record forms formatted for easy computer coding by the on-site artefact specialists (Stephen Cracknell 1977–8, and Tania Simpson 1979–95). These data were subsequently entered by Roger Simpson and Peter Cardwell as part of their post-excavation work into a master digital database at the North Yorkshire Sites and Monuments offices that was maintained on the NYCC mainframe computer at County Hall, Northallerton. The GIMMS software package was used to generate spatial distribution plots and initial spatial analyses of artefact distributions. Concurrent with this pioneering digitization work, Andrew David and Francis Wenban-Smith undertook extensive analyses of the lithic assemblages (see below and Chapter 14), and preliminary on-site identifications of individual lithics were updated on the relevant pro-forma finds records as required. Copies of all the pro-forma finds registers and the various GIMMS plots are lodged with the paper archive for both projects (see below). The GIMMS data were migrated to Microsoft Excel in the late 1990s, and copies of these databases have been lodged with the Archaeology Data Service.

During the VPRT project, the coordinates of each individual find were entered into a field notebook on site each day; these details were transferred to a master paper-based catalogue in the evenings. Between 1986 and 1989, the same pro-forma forms as used during the Seamer Carr project were used, and the entire finds register was maintained and updated by Tania Simpson. From 1990 onward, these master catalogues were entered into a finds' register book, and from 1992 onward were also entered at the end of each day into a Microsoft Excel spreadsheet for each of the investigated areas. Digitization of the spatial data from previous VPRT seasons (i.e. 1986–91) was undertaken by Barry Taylor during the next phase of post-excavation work in 1998. The original field notebooks and registers are lodged with the rest of the VPRT paper and photographic archive, and copies of the databases have been lodged with the Archaeology Data Service.

In order to integrate the records from each site, the spatial data for each artefact had to be moved onto a common coordinate system. To achieve this, all site plans and survey grids were digitized and then georeferenced onto the Ordnance Survey national grid, initially using a bespoke Geographic Information System (G-Sys) developed by Dominic Powlesland for analysing archaeological data from the late-Roman and Anglian settlement at West Heslerton (Powlesland 1997). Data relating to individual trenches (such as trench name and date of excavation) were added to the individual polygons using the functions in G-Sys, and Ordnance Survey coordinates for individual survey points and finds were calculated using the georeferenced site plans and added to the relevant finds/survey spreadsheets. The georeferenced results of the auger surveys were then used to create a contour plan and Digital Elevation Model of the lake basin, using the Surfer™ software package and G-Sys. In the early 2000s these data were migrated into ArcGIS (version 10.3), and data are currently held in a combination of Esri shapefiles and MS Access databases at the University of Chester and have been archived with the Archaeology Data Service.

Palaeoenvironmental investigations

Jim Innes

Palaeoenvironmental analysis (notably pollen analysis, but also the examination of plant macrofossils, peat stratigraphy, and molluscs) was undertaken between 1987 and 1997 by Jim Innes, mostly in connection with excavations at Flixton Island and smaller sites along the southwest of the lake, and by Gaynor Cummins at No Name Hill and Barry's Island, as part of her doctoral research funded by the Leverhulme Trust (Cummins 2003) (see Fig. 5.1). In addition, a single profile (Profile D) was recorded through the Late Glacial and Early Holocene deposits near to the centre of the lake (see Chapter 5).

The objective of this research was to establish a record of the environments close to, and potentially contemporary with areas of human occupation, and assess the potential impact that human activity may have had upon the local vegetation. To assess possible anthropogenic impacts, the regional 'natural' environment was reconstructed in some detail (Profile D). This acted as a form of control site against which local, near site vegetation changes identified in the pollen profiles recorded from areas of human activity could be measured. The microcharcoal record in some profiles was also assessed for indications of human or naturally induced fires throughout the period. As demonstrated by work at Star Carr in the 1990s (Day 1993; Dark 1998a), charcoal particle analyses are particularly important for determining possible human influence on the vegetation during the Early Mesolithic, as this was also a period characterized by rapid climate and vegetation fluctuations. Without such analyses periods of human induced changes can be overlooked or misinterpreted due to equifinality. Lack of such analyses may account for the dearth of human impact found during previous work around Star Carr (Walker and Godwin 1954; Cloutman and Smith 1988).

When interpreting or correlating a pollen diagram from a specific site or between sites, various taphonomic issues need to be considered. The regional or background component of the pollen rain needs to be established before the local pollen input can be identified. This is because a sedimentary pollen assemblage consists of pollen derived from a variety of sources, ranging from within a few metres to hundreds of kilometres away from a sedimentary basin (e.g. Tauber 1965; Jacobson and Bradshaw 1981). Pollen variation and deposition around a particular site is considered to be reasonably uniform, so that a single core is sufficient to reproduce the vegetation history of the surrounding area (e.g. Turner et al. 1989). By taking pollen cores from close to various archaeological sites, the analysis will not only reveal aspects of the local vegetation but also any intrasite variability. This is particularly important in the elucidation of more localized, spatial variation in human impact on the vegetation. Once the regional pollen rain has been established in detail, it is then possible to investigate the local presence of plant taxa at specific archaeological sites.

The source area of the pollen, and therefore relative influx of local pollen, will depend on the local conditions of the site, and will vary according to vegetation changes, sediment composition and relative distance of the site from the lake shore. The latter is particularly important as vegetation changes will be registered at different times and intensities depending on the location of the site in relation to the lake shore or areas of disturbance. The preservation status of the deposits can also affect the pollen signal due to differential rates of corrosion and degradation. Finally, the amount of both macroscopic and microcharcoal, or intensity of a fire signal, will also vary with distance from the combustion source, character of the fire and type of vegetation that is burnt (see reviews by Patterson et al. 1987; Blackford 2000; Scott 2010; also Dark 1998a).

In palaeolimnological studies the dynamic nature of the lake sediments also causes problems with potential sediment mixing, re-suspension and re-deposition. It is assumed that the zone of vegetation at the margins of Lake Flixton (Cloutman 1988a, 1988b; Cloutman and Smith 1988; Day 1993; Mellars and Dark 1998) acted as a sediment trap and minimized any reworking or slumping of the deposits, with sediment remaining *in situ* once deposited. This assumption is verified by the apparent lack of hiatuses in the profiles investigated. However, the application of fine resolution sampling techniques to these sediments still requires justification as 'the fineness of the temporal scale does call into question some of the basic assumptions of the technique' (see Simmons et al. 1989, 209). The internal resolution of a sample at the scale of the sample thickness is assured when the pollen diagram shows evidence of both gradual and abrupt changes in pollen frequency in a sediment that has accumulated continuously (Simmons et al. 1989). If there was any post-deposition mixing or bioturbation this would set a limit to the resolution that can be achieved. Post-deposition mixing can be identified by the nature of the pollen diagram and interpretations limited accordingly (e.g. Green 1983; Turner and Peglar 1988).

Pollen analysis

Samples of 0.2–0.5 cm^3 taken at various intervals according to the profile in question were prepared for pollen analysis following standard procedures. A known concentration of *Lycopodium* spores was added, and the sample was suspended in silicon oil (Berglund and Ralska-Jasiewiczowa 1986) allowing the calculation of pollen concentrations and microcharcoal area concentrations. Pollen was counted on a Nikon microscope at X400 magnification using X600 or X1000 for detailed identifications. Pollen and Spores types follow Moore et al. (1991). A minimum of 500 identifiable fossil land pollen (including Cyperaceae) were counted, except during very low concentration periods, e.g. 'stadial' phases of the Late Glacial, where a minimum of 300 grains were counted due to time constraints. *Betula* pollen was not assigned to species due to the difficulty in determining morphological differences in subspecies under light microscopy. However, using the measurements of Birks (1968), we were unable to recognize any notable quantities of *B. nana* (dwarf birch) pollen.

Percentage calculations are based on a sum of total land pollen (TLP) but excluding Cyperaceae and spores, except when otherwise specified. Percentages for aquatics are expressed as a percentage of TLP. Percentages for cryptogams and percentages for Cyperaceae are also expressed as a percentage of TLP. The data sets were zoned, and diagrams produced using Tilia (Grimm 1991). Local pollen assemblage zones were determined from the results of constrained incremental sum-of-squares cluster analysis (CONISS, see Grimm 1986), using a square root transformation and chord distance dissimilarity measure for the pollen taxa that occured at greater than 5% abundance. The lithology of the sediments from which the samples were taken is shown on the pollen diagrams, the lithology symbols follow Troels-Smith (1955).

Microscopic charcoal analyses of the samples (where undertaken) were estimated using size class particle analyses. Estimates of charcoal area per slide were calculated using a standardized eyepiece graticule with grid squares. Charcoal sizes were recorded using factors and multiples of grid squares (after Waddington 1969). The results were grouped into four size classes: <410 mm^2, >410<1750 mm^2, >1750<8800 mm^2, >8800 mm^2 (after Clark et al. 1989). The minimum number of fields of view used to determine the charcoal area was a factor of the same number required to achieve the total pollen count. An absolute minimum of 100 *Lycopodium* or 100% of the total *Lycopodium* count, whichever was the smaller, was used to determine the sample area. The charcoal area could then be expressed as a percentage of the Total Land Pollen or as a concentration. Both pollen and charcoal concentrations relate to volume of sediment.

Loss on ignition and metal concentrations

Samples of approximately 1 cm^3 from selected horizons were analysed for mineral and organic content according to the method of Bengtsson and Enell (1986). Selected samples were also analysed for the total available concentrations of the metals Sodium (Na), Magnesium (Mg), Potassium (K), Calcium (Ca), Iron III (Fe) and Manganese (Mn) according to the solution preparation method 1 of Bengtsson and Enell (1986). Samples were only taken at a few selected horizons due to time and monetary constraints. Unfortunately, this limits the amount of information that can be derived due to the uncertain basal (background levels) and sediment trends through time. The results were interpreted in light of the research by Mackereth (1965, 1966).

Particle size analysis

Samples of approximately 1 cm^3 from selected horizons within minerogenic deposits were analysed for their Particle Size Distributions. A known dry weight of the sample was sieved through a 2 mm mesh and the dry weights of the > 2 mm and < 2 mm components were measured again. The < 2 mm component was made up to a known volume using distilled water and analysed using a Coulter Counter Machine (McCave and Jarvis 1973).

Mollusc analysis

Ken Thomas

Samples of molluscs were analysed by Ken Thomas as part of the palaeoenvironmental investigations at No Name Hill (Profile NM, see Chapter 11). The samples were received in the laboratory as blocks of wet sediment (each sample bag contained either 2 or 3 blocks per stratigraphic unit). The samples were air dried before processing. Each block after drying measured *c.* 120 × 100 × 70 mm, giving a sample volume per block of around 840,000 mm^3. Blocks were processed by immersing in water and gently teasing the plant fibres apart. Floating material – mostly plant debris with some mollusc shells was decanted off. For three samples (NM 9142, NM 9143 and 9148) two blocks of sample were processed; for others only one block was processed. Organic material was broken down using 100 vol. hydrogen peroxide to aid the release of contained mollusc shells. After 2–3 days soaking, the material was washed through a nest of 4.0, 1.0 and 0.5 mm mesh sieves. The residues were dried in an oven at 50 °C for three days. The dried residues were then sorted under a low-power binocular microscope. This was very time consuming because of the large amounts of fibrous plant remains, which had to be teased apart with needles to release the mollusc shells. In many samples large numbers of shells were present in quite large volumes of residue, therefore not all of the residue on each mesh was sorted.

Wood and nut samples

Rowena Gale

Samples of water-logged nuts, wood, bark, and charcoal, recovered from basal peat and coarse detritus mud deposits at No Name Hill, were examined and identified to genus by Rowena Gale. Most samples were waterlogged, although two had dried out in storage. The surface of one sample was especially soft, and had been imprinted with creases from plastic wrapping during storage. Standard methods were employed. Thin sections of the wood samples were taken to show the transverse, tangential and radial surfaces of the wood samples were prepared using a double-sided razor blade. The sections were mounted in 70% glycerol on microscope slides and protected with glass cover slips. These were examined using a Nikon Labphoto microscope at magnifications of up to X400. The anatomical structure of each sample was matched to authenticated reference material. Where possible, the number of growth rings and growth patterns were recorded. Samples likely associated with human activity were only recovered from No Name Hill, and further details of these are provided in Chapter 11.

Luminescence dating of sediments from Barry's Island and Flixton Island

Ian Bailiff

Sample collection

Samples of sand obtained from two locations, Barry's Island (VP 93 LYY9112) and Flixton Island (VP93MG), were tested by measuring the OSL signal stimulated by visible blue/green light (~ 470–550 nm). Aluminium alloy monoliths (0.5 m long) were pressed into a cleaned, vertical section through the deposit in trenches VP93LYY and VP93MG and immediately wrapped in opaque polythene. In both cases a layer of sand of thickness ~ 150 mm was enclosed by overlying and underlying peat beds. The gamma-ray activity was measured at the base via a hole bored horizontally into the face of the trench wall of VP93 LYY using a portable gamma-ray spectrometer.

Sample dating

Sub-samples were extracted from each monolith in the laboratory under subdued red lighting conditions; their laboratory reference numbers, given in Table 3.1, are 178-1 (VP93LYY9112) and 178-2 (VP93MG). Samples 178-1 and 178-2 were taken between 50 and 80 mm and between 55 and 75 mm, respectively, below the contact surface between the sand body and upper peat. The sands were substantially minerogenic with occasional root fragments. The subsamples of sand were split to allow the extraction of luminescence samples and the preparation of samples for annual dose assessment; samples of peat were also taken for radioactivity measurements.

Determination of luminescence age (Table 3.1)

The event dated by luminescence is the last exposure of the sampled sediment to sunlight, which is presumed to occur only prior to burial. The luminescence age of the samples is the quotient of the palaeodose, P, and the total annual dose-rate, Dtot, corrected for moisture content. The uncertainty associated with the age was calculated using a system of analysis similar to that described by Aitken (1985); the error given is the overall error (68% level of confidence). The components of the annual dose due to beta, gamma and cosmic radiation are given in cols 5–7 in Table 3.1. The average moisture content during burial, Wh, expressed as a percentage by weight of the dry sediment is given in col. 8 in Table 3.1.

Palaeodose

Luminescence samples were prepared by sieving dried sediment and retaining the 90–150 μm fraction; the quartz within this fraction was isolated by immersion in 40% HF for 45 minutes followed by removal of precipitates in 15% HCl. The HF etching treatment removes the outer skin of the quartz grains in which alpha particles are absorbed. The absence of residual feldspars was confirmed by measurement of infra-red stimulated luminescence (IRSL) which was found to be negligible. A single aliquot regenerative procedure based on that developed by Murray et al. (1997) was applied to evaluate the palaeodose; corrections for sensitivity changes were made by monitoring at set intervals in the measurement sequence the OSL response to a 'monitor' radiation dose.

Annual dose

The total dose-rate and the percentage contributions due to beta, gamma and cosmic radiation are given in Table 3.1. The beta dose-rate within the sediment was evaluated by ß-TLD measurements (Bailiff and Aitken, 1980); given the expected heterogeneity of the radiation field within the sands, 10 different subsamples taken from the dried sediment were measured; the mean value has been used in the calculations. The radioactivity of subsamples of the clastic inorganic and organic (peat) samples was also determined using thick-source alpha counting (TSAC). The contribution from alpha radiation was assumed to be negligible. The gamma dose-rate was assessed on the basis of measurement of the *in situ* gamma-ray activity and laboratory determinations of radioactivity of sediment and peat samples; the gamma dose rate at the sampled location was calculated taking into account the relatively thin (approx. 150 mm thick) inorganic clastic sediment layer sandwiched between two organic layers using a simple multiple layer model that employs calculated geometry coefficients calculated by Løvborg and reproduced by Aitken (1985). The gamma dose-rate was subject to an uncertainty of at least ±20%. On the basis of the dose-rate calculations, the gamma dose rate accounts for less than 20% of the total dose-rate and the dominant contributor is that due to beta particles. An allowance was made for the likely disequilibrium in the uranium decay series in the peats (Lian et al. 1995).

Luminescence ages

The luminescence ages for 178-1 and 178-2 of 6.7±0.9 ka and 40±5 ka, respectively, have been calculated assuming that the sediments were exposed to sunlight prior to burial for a period sufficient to reduce the trapped charge to negligible levels. This appears to

Table 3.1. *OSL Dates from Barry's Island and Flixton Island.*

Lab. ref	Wh %	Sample ref	Age (ka)	P (Gy)	Dtot (mGy/a)	ß %	Γ %	cos. %
Dur98OSL178-1qi	30	VP93LYY9112	6.7±0.9	6.0±0.6	0.9±0.1	68	12	20
Dur98OSL178-2qi	30	VP93MG	40±5	47±5	1.1±0.1	69	16	15

be a reasonable assumption only in the case of 178-1 since the luminescence age falls within the calibrated age ranges for the under and overlying organic deposits (see Chapter 12). As radiocarbon determinations for the enclosing peats are also of Holocene age (see Chapter 4), this suggests that the sediments had limited exposure to light before burial.

Radiocarbon dating

Details of the radiocarbon sampling strategies, sample pre-treatment and analysis is given in Chapter 4. Measurements have been calibrated using the IntCal13 terrestrial atmospheric calibration curve of Reimer et al. (2013) and the OxCal v4.3.2 computer program of Bronk Ramsey (2008; 2009). Unless otherwise stated, the calibrated age determinations are shown at 94.5% probability range and expressed in years cal BC.

Lithic analysis
Chantal Conneller

Lithic analysis was undertaken on the assemblages recorded by the Seamer Carr Project and the VPRT. Each lithic artefact was categorized in accordance to its typology (see Appendix 2), raw material, and cortical extent. The exact location and context of each item were combined in a database with additional information including completeness of pieces; length of complete blades; macroscopic evidence for wear traces; colour of artefact; whether patinated or stained; refit information; and additional information.

Refitting
In addition to the above methodologies, refitting was employed, where appropriate. The objectives of this exercise were:

1. to elucidate technological sequences
2. to address specific problems of site interpretation.
3. to explore the intra- and inter-site dynamics of reduction and tool manufacture sequences.

Pieces that displayed evidence of utilization were not included in the refitting programme and were preserved for potential future analysis.

Functional analysis
Although a sample of over 500 flints from Site K at Seamer Carr was examined microscopically for traces of wear in 1983–4, as a pilot study, no conclusions were drawn up, and no such analysis has subsequently been undertaken on any of the Vale collections. Despite problems at certain locations of post-depositional modification (see below), the potential for further analysis of the better preserved and contextually relevant material deserves to be assessed, potentially building on the pioneering work by Dumont (1983, 1988, 1989) on material from Star Carr, and more recent geochemical detection of micro-residues (Croft et al. 2016, 2018a, 2018b).

Raw materials
Each lithic artefact was identified to raw material type, on the basis of visual comparison with the categories outlined by Henson (1982, see below) reinforced by collection of further reference material as part of this project. Cortical condition, to understand whether lithic material came from a primary or derived source, was also recorded. Two major flint types were employed in the Vale of Pickering assemblages – Till flint (derived from regional till deposits) and Wolds flint (from the chalk formations of the Yorkshire Wolds). These two types vary greatly in their appearance, knapping properties, and frequency of use in Early Mesolithic contexts. Chert is also present in very small frequencies in most assemblages.

Till flint, which is the type most frequently employed in the Vale of Pickering assemblages, is found in the glacial deposits that extend along the east coast and into the northeast part of the Vale of Pickering. These consist of the Basement Till of pre-Devensian age, and the overlying Devensian Skipsea and Withernsea Tills (Madgett and Catt 1978; Kent 1980). All three tills contain erratics from the North of England and Scandinavia (Bisat 1939; Catt and Madgett 1981), though most of the flint nodules in the till appear to derive from the chalk formation underlying the North Sea. All three tills also appear to contain flints of similar colours and qualities.

As might be expected for a secondary source, the till contains a heterogeneous mix of flint types, which vary in colour, size, shape, and quality. Henson (1982) has categorized several different types of till flints (see Table 3.2). However, while Henson's types can broadly be distinguished, especially in nodule form, in practice the variability within individual nodules, the staining that occurs on many sites, and more particularly the degree of overlap that exists between the different groups, often makes it difficult to attribute an individual flake to a particular group. Thus, the till flint varies in colour and quality from high quality translucent black or brown flint through poorer quality grey, brown, red, or grey/red mottled, often speckled flints. Nodule size also varies irrespective of flint colour and quality, from small pebbles *c*. 40 mm in diameter to large, often tabular nodules up to 184 mm in length.

Table 3.2 *Nodule types present in the glacial till (after Henson 1982).*

Type	Easington	North Landing	Dimlington	Out Newton	Mottled
Properties	Translucent, white specks, few inclusions, grey	Highly translucent few inclusions, black	Poorly translucent, inclusions red brown	Translucent, white speckling, red brown	Translucent, few inclusions grey + red brown
Munsell colour	10YR5/1-3/1 or N7/0-4/0; brownish grey or grey	10YR2/1-1.7/1; black	2.5Y3/2-3/3; dark reddish brown	5YR2/4; very dark reddish brown	10R3/3+ N3/0; dark reddish brown+grey
Variablity	-----	------	------	-------	Mottled
Translucency	Medium	Good	Poor	Medium	Medium
Inclusions	20 mm sepp. + speckled	20 mm sepp, little speckled	10 mm sepp + speckled	Speckled	10 mm sepp + speckled
Cortex	Thin, sharp	Thin, sharp	+10/20 mm diffuse	?	
Occurrence	Tabular mixed	Tabular mixed	------	Mixed	Nodular
Size	40 mm	40 mm	------	------	100 mm
Quality	2	1	4	3	2

Despite these slight caveats, Henson's survey remains the most detailed to date, and knowledge of his range of types is vital for understanding the rather confusing descriptions which exist of till flint. One of the earliest writers on this topic, John Moore, described the flint at Fixton 1 as a 'fine-quality, foreign black and lustrous flint (in fine section a colourless or horn-coloured flint)' (Moore 1950, 107). Subsequently Clark (1954, 97) described the till flint as 'grey to black…often mottled', Radley and Mellars (1964, 21) as 'translucent...ranging in colour from mottled yellow to brown or black'. and Jacobi (1978, 305) as 'semi-translucent speckled grey flint and transparent honey-coloured flint'.

Wolds flint was less frequently employed, despite the fact that exposures are present on the Wolds escarpment, which forms the southern boundary of the Vale. The chalk plateau of the Wolds is made up of four different formations – the Flamborough, Burnham, Welton and Ferriby formations. While only 35% of the chalk contains flint, most of the flint-less Flamborough formation remains unexposed, while the Ferriby formation, which contains minimal amounts of flint, is the thinnest of the four. Both the Burnham and Welton formations, however, contain a number of siliciferous horizons (Henson 1982). Because these horizons occur throughout the Wolds, exact sourcing is not possible. Exposures of these horizons are likely to have existed through erosion of the Wolds edge. However, Wolds raw material in the present day – whether occurring as isolated examples eroded from the chalk or as a number of flint horizons exposed through quarrying – is rarely of knappable quality, being brittle and frequently subject to frost fracturing. Mining for unaffected flint was not an option, even in the Neolithic, because Wolds chalk, unlike the chalk of southern England, is very hard. One mechanism for obtaining undamaged Wolds material may have been through the erosional action of the numerous springs and streams which originated in the Wolds and drained into Lake Flixton. Here nodules would have been less subject to the extremes of temperature that results in frost fracturing. Large cobbles have been recovered from ancient stream beds elsewhere in the Vale (Zylawyj 1986).

Wolds flint occurs both in nodular and tabular forms, the nodular form being of higher knapping quality, while the tabular form has a tendency to fracture along its natural planes. Durden (1995) suggests that, although tabular chalk flint is too brittle for knapping, the nodular type is rather more suitable and was used in Mesolithic industries and for small and simple tools in later periods. While this appears true of some Mesolithic industries – certain Pennine assemblages, for example, appear to be manufactured entirely on nodular Wolds flint – during both the Late Glacial and Early Mesolithic periods in the Vale of Pickering tabular material appears to have been utilized.

Henson (1982, 1985) has also examined the different flint horizons of the Wolds; while some of these nodular types from different horizons can be recognized in archaeological contexts, the tendency for Wolds flint to patinate very quickly from its original opaque grey/blue colour, to opaque white, usually makes identification tricky. Moreover, since the different types are distributed horizontally throughout the Wolds, precise geological identification is unnecessary since it will not provide information on the specific places where people obtained flint.

Wolds material varies very little in colour, from opaque bluish grey or grey to white. It is coarser and of much poorer quality than till flint and contains numerous flaws, pin holes and fossils. It is thus more difficult to work and is generally much less abundant in archaeological assemblages in the Vale of Pickering. In general, there are fewer cortical pieces of Wolds material amongst the Vale assemblages. This is likely to be the result of two different factors. First, the use of chunks of tabular flint, which are only cortical on the top and base, would mean that many pieces of Wolds material were less cortical than till pebbles to begin with; also, on occasions these flat cortical surfaces were used as platforms. Second, the lower quality of Wolds flint and its tendency to frost fracture would have necessitated a more rigorous testing of Wolds material at source.

Cherts are present in very small quantities in the lithic assemblages. Chert, in British archaeology, is defined as material which derives from limestone, rather than chalk (Luedtke 1992). They are generally of coarser and more opaque appearance than flint, though in practice some flint types have a more chert-like appearance than some cherts – Wolds flint for example is relatively coarse and opaque.

The most common chert type recovered is a rough opaque grey chert of uncertain origin, though a battered cortex indicates it was probably recovered either from a fluvial source or as a beach pebble (in which case it is likely to derive from till deposits). Thus, whether it is a chert in the true sense, or is simply a cherty flint is open to question. Isolated examples of black and brown Pennine cherts are present, though whether these were also recovered from till or fluvial deposits or were manually transported from the more distant source is uncertain.

Condition

Whatever the type of raw material, a disconcerting feature of the artefacts recovered from many locations around Lake Flixton is a post-depositional staining and patination of artefacts from a number of sites. Though the material from Star Carr, VP D and VP E is fresh and unstained, certain artefacts from the remainder of the sites have suffered from staining and/or patination. This varies from the minimal staining of a very few artefacts at Site C to the severe staining or patination of almost the entire assemblage from Flixton School Field. The staining – the result of a high concentration of mineral salts in the ambient groundwater – generally takes one of two forms. The most common gives brown flint and Wolds material an ocherous red/brown staining, while grey flint becomes green/brown. This staining appears to occur particularly on flint recovered from higher/drier ground. A rarer staining gives all flint a grey/black hue. This occurs on flint recovered from extremely waterlogged deposits, mostly at Flixton School Field – a site where patination is also a problem in identifying raw material types. Lithic artefacts from waterlogged areas at the Seamer sites are often encrusted with pyritous deposits and mineral-replaced organic remains such as rootlets.

In this regard, the results of an experiment to explore post-depositional effects of sediments and weathering on flints, carried out at Seamer Carr in the 1980s by Emily Moss, in collaboration with Tim Schadla-Hall and Andrew David, are suggestive. As part of this study, several nodules of beach flint from Flamborough Head were knapped by Emily Moss and Andrew David onto the excavated surface of part of Seamer Carr Site C in August 1983. The sandy gravels in this area tend to be quite acidic, with pH values ranging from 1.5 to around 6. Soil samples taken from the area of knapping had a pH of 4. The resulting scatter of material was left on the surface, and re-examined the following year, and again in 1985. After one year, some of the flints were partially buried, although none were totally covered. On microscopic examination, Moss found that the 'surfaces which were facing down were unaltered but some ridges and high points on the upward facing surfaces had developed a "generic weak polish"' (Moss 1988, 401). However, not all pieces had been affected. By August 1985, several of the flints were completely covered, and the 'generic weak polish' was observable on all of the pieces selected for examination. Although this was no more intense than that observed on samples examined in 1984, the distribution of this polish on individual pieces was clearly patterned. Specifically, Moss found that it occurred 'on some ridges, and edges, with abrupt termination' and was 'diffuse over some surfaces'. Moss noted that rather similar patterning of 'generic weak polish' can also be produced experimentally, by a range of one-off tool uses, such as cutting fresh hides and plant matter, meat, and fish, and drew attention to similar patterns on worked flints from the Late Hamburgian site of Oldeholtwolde in The Netherlands.

Archiving

The physical archive from both the Seamer Carr Project and the work of the VPRT (finds, paper context sheets, and all hand-drawn plans and section drawings) have been deposited with Scarborough Museums and Gardens. The digital version of this archive will be deposited with the Archaeology Data Service.

Discussion

Over the course of roughly twenty-five years, the Seamer Carr and VPRT projects undertook a combination of systematic auger and test-pit surveys aimed at inspecting the buried Early Mesolithic landscape proximal to the shoreline of a large palaeolake, Lake Flixton, and locating physical traces of Early Mesolithic (and other) activity in these areas. Larger area excavations were undertaken selectively, especially at Seamer Carr where they were conducted within the context of a nine-year rescue archaeology campaign. From 1985 onwards, a sample of previously known sites and newly discovered ones was also investigated by small-scale trenching. The excavation and recording methods were essentially the same on both projects, with modest changes and improvements over time.

Post-excavation analyses were conducted over many years, commencing while the Seamer Carr project was still running when they were led by Roger Simpson, Peter Cardwell and Tania Simpson, and after 1992 by Andrew Morrison (archaeology). Concurrent with this early phase of post-excavation analysis, Juliet Clutton-Brock (British Museum) undertook identification and analyses of the faunal remains, and Andrew David (Ancient Monuments Lab/English Heritage) and Francis Wenban-Smith (University of Southampton) began work on identifying and classifying the large assemblage of lithics. Palaeoenvironmental analyses were undertaken on samples from Seamer Carr, Star Carr and the wider Vale by Edward Cloutman and Alan Smith (both University of Cardiff) more-or-less concurrently with this phase of post-excavation work. Some preliminary processing and analysis of samples for beetles and snails was also undertaken during this phase by Alan Osbourne and Maureen Girling, and Penny Spencer, respectively. The latter studies were rather inconclusive, however, and are not reported in detail here (see Chapter 18); copies of the interim reports have been deposited with the rest of the paper and photographic archive at the Scarborough Museum.

An additional phase of post-excavation work, following an assessment of potential by Paul Lane (PL), funded by English Heritage (now Historic England) and coordinated by PL ran from September 1997 to October 1998. This included completion of the lithics analysis by Chantal Conneller with some of this work forming part of her doctoral dissertation (Conneller 2000), and preparation of illustrations of lithic material from the VPRT excavations by Joanna Richards (independent archaeological illustrator); completion of the faunal analyses, led by Peter Rowley-Conwy (University of Durham) and assisted by Junzo Uchiyama for his MA dissertation (Uchiyama 1986, 2016); assessment of the radiocarbon dates by Rupert Housley; cataloguing and archiving of the Seamer Carr and VPRT paper records by Laura Basell and Charlotte Bower, respectively; digitization of all the site drawings from both projects, and creation of the project GIS by Barry Taylor; and sundry analyses of the non-flint stone recovered during the Seamer Carr project (Chris Collins, University of Cambridge), wood and hazelnut samples from No Name Hill (Rowena Gale, independent wood anatomist), and snail samples from No Name Hill (Ken Thomas, Institute of Archaeology, UCL). Commencing slightly earlier, palaeoenvironmental analyses of samples collected under the auspices of the VPRT-supported work were undertaken by Gaynor Cummins for her doctoral dissertation in the Department of Geography, University of Durham (Cummins 2003), supervised by Ian Simmons and Jim Innes. Additional, brief phases of work on different elements (especially context concordance, Harris matrices and site descriptions by Geoff Smith (while at UCL) and Paul Lane and, preparation of the line drawings) occurred in the autumn of 2003–4 (when a first draft of the report was produced for English Heritage), 2009 (with editorial assistance from Edward Blinkhorn, University of York) and 2013. A final phase of post-excavation work, funded by Historic England, coordinated by Paul Lane ran between March 2018 and May 2020, during which Barry Taylor, assisted by Chantal Conneller, drafted the chapter summaries and most of chapters 19 and 20, and cross-checked and edited the site descriptions, and Alex Wilshaw (University of Cambridge) and Ellie Winter prepared the remaining line illustrations and GIS-generated artefact distribution plots. Final editing was by Paul Lane, Barry Taylor and Tim Schadla-Hall between early 2021 and early 2025.

Chapter 4

The radiocarbon chronology associated with the investigations of the Seamer Carr and Vale of Pickering Research Trust Projects

Rupert A. Housley

In many ways the radiocarbon dataset from the area around Lake Flixton encapsulates and reflects the history of radiocarbon. In the 1950s Graham Clark used the newly developed technique of carbon dating to measure the age of the timbers from the wooden 'platform' at Star Carr, obtaining dates (Q-14 and C-353) from two freshly established radiocarbon laboratories, Cambridge and Chicago (Clark 1954). Of significance to future investigations, he also used the method of pollen zonation to place the site into context within the vegetation history of the region, locating it at the end of Godwin's zone IV, the Preboreal, in the Early Holocene. Thus, was pioneered a combination of approaches that have strongly influenced chronological investigations in the area ever since.

The present study focuses on a subset of the radiocarbon dataset on archaeological and palaeoenvironmental deposits from Lake Flixton. Bayliss et al. (2018) discussed a dataset of 223 radiocarbon determinations from Star Carr: 76 from earlier researchers undertaken before 2006 and a further 147 samples made in the context of investigations at the site from 2004 reported in Milner, Conneller and Taylor (2018a, 2018b). This present study includes 95 radiocarbon age determinations, which are on samples taken in the context of the investigations initiated by the Seamer Carr Project and the VPRT. For location of the sampled archaeological deposits see Fig. 1.2, and Fig. 5.1 for the environmental sampling sites. If these determinations are added to the 223 previously reported in Bayliss et al. (2018), the total number of measurements from the Star Carr embayment and Lake Flixton comes to 318. To this total need to be added those reported by Conneller and Higham (2015, tables 1 and 2: five determinations) by Marom et al. (2013, table 3: six determinations), and Taylor (2019, table 1: 19 determinations).

Developments within radiocarbon dating have a significant bearing on any discussion of the chronology of both the environmental and human history of Lake Flixton. Since the late 1970s, the development of accelerator mass spectrometry (AMS) has allowed measurement of samples significantly smaller in size to those required by radiometric dating (Bennett et al. 1977, Nelson et al. 1977). This has enabled the dating of short-lived single entities (e.g. seeds, leaves, fruits) permitting greater sample selectivity. The arrival and development of high precision calibration curves (Kromer and Becker 1993; Reimer et al. 2004; 2009; 2013; Stuiver et al. 1998) has placed past events in an absolute calendar time frame. The implementation of enhanced laboratory quality control procedures within the radiocarbon community (Otlet et al. 1980; Scott 2003; Scott et al. 2007; Scott et al. 2010a; 2010b) has given increased confidence to the resulting laboratory age measurements.

Methods of chemical pre-treatment have also changed significantly, as can be illustrated, for example, by taking just one laboratory (Oxford) and similar materials (bone and antler) from Star Carr. Two samples of bone and antler (OxA-1154 and -1176) were pre-treated in 1986 as ion-exchanged gelatine, graphitized and dated by AMS (Hedges et al. 1989). Four samples of unconsolidated bone and antler (OxA-4450-1 and OxA-4577) from T C Lord's collection were pre-treated in 1995 as ion-exchanged gelatine, but combusted to CO_2 and dated by AMS (Hedges et al. 1992). The samples producing OxA-1154 and -1176 were re-dated in 2001 using the first ultrafiltration protocol at Oxford (Bronk Ramsey et al. 2000) giving dates OxA-10808-9. When this protocol was found to give ages slightly too old, the four bone and antler specimens from Lord's collection were re-dated in 2009 using the revised ultrafiltration protocol (Bronk Ramsey et al. 2004). Thus, six samples have undergone repeated measurement with different treatments at the same laboratory in the space of almost twenty-five years. This illustrates the complexity of assessing the quality and validity of such data. If only the most recently produced determinations are viewed as being reliable then most of the dates from Lake Flixton would have to be questioned. But this is not the view taken in this study – a less absolutist, more pragmatic, approach has been adopted assessing the dates based on several strands of evidence.

In terms of sampling and interpretation, the increasing implementation of Bayesian chronological modelling (Buck et al. 1996) to suites of radiocarbon determinations has, over the last two decades, significantly altered the way archaeological sites are investigated and chronologies interpreted (Bayliss 1998; 2009). The Seamer Carr and VPRT's investigations happened at a time before English Heritage / Historic England had protocols for radiocarbon sampling within a Bayesian framework. The chronological data produced are therefore variable in quality, and of mixed utility. Chronological studies at one stage in the project fall short of standards later established. It is probably true to say that the dataset is a reflection of its time, and this chapter attempts to bring out the strengths and weaknesses of the measurements made between 1976 and 2000. However, a degree of forward and backward looking is necessary for context, and so a few measurements produced outside this time window are discussed.

Nine radiocarbon laboratories have been responsible for the measurements in this study, six are from the UK (the British Museum, Harwell, Cardiff, Swansea, Oxford and Cambridge), two are in the United States (Chicago and Beta Analytic) and one is in Germany (Hannover). The Chicago laboratory was the first radiocarbon laboratory set up by Willard Libby, but no longer makes radiocarbon measurements. The laboratories at the British Museum, Harwell, Cardiff and Cambridge have either been decommissioned or have relocated. The other listed laboratories continue to produce ever larger numbers of ^{14}C determinations.

All the measurements have been calibrated using the IntCal13 terrestrial atmospheric calibration curve of Reimer et al. (2013) and the OxCal v4.3.2 computer program of Bronk Ramsey (2008; 2009).[1] The corrected age determinations are shown at *68.2% and 94.5% probability* range intervals and expressed in years *cal BC*.

Archaeological samples

Introduction

The validity of a radiocarbon determination on an archaeological sample not only has to address the question of whether, in a technical sense, the measurement produced by a laboratory accurately reflects the true age of the dated material. It must also consider the relationship between the cessation of carbon exchange between the sample and the biosphere, and the archaeological event with which it is believed to be associated. Whilst an age on an animal bone may be technically valid, if the death of the animal cannot be confidently tied to the human action being investigated the utility of the measurement for charting *human activity* is diminished. Determinations which cannot do this are not necessarily of no value. Deposition of any organic material in the ground obviously post-dates the formation of that material and its cessation of carbon exchange with the biosphere (Bowman 1990). Provided the material is not intrusive, measurements on such samples will always provide a *terminus post quem*. The time interval need not, however, be small.

The issues that influence the reliability of an archaeological radiocarbon date and its validity to the human action that it purports to relate to include:

- Whether the sample dated was a single entity (i.e. a single individual item, piece or fragment);
- Whether it is from short-lived or long-lived material. A hazelnut is short-lived in that it results from a single growing season. Wood charcoal *may* be either be short- or long-lived depending on whether it is from small roundwood / outer rings, or from inner heartwood.
- Whether the sample has significant time-width (Bowman 1990). For example, wood charcoal may have a number of annual rings – a single piece of wood with 25 annual rings is said to have a 25-year time-width. A sample of wood charcoal in the form of many fragments may have an overall-time width that is variable and unquantifiable.
- Whether a clear causal connection can be made between the presence of the dated sample and the archaeological event being addressed.
- Whether there is any question over the appropriateness of the laboratory procedures applied to produce the determination. Excluding machine measurement errors – detectable where adequate regular laboratory monitoring with secondary standards is adopted – the main potential problem is physical or chemical contamination from the burial environment. Intrusion of rootlets would be an example of physical contamination, presence of humic and fulvic acids is a form of chemical contamination. Chemical pre-treatment protocols are designed to remove the latter. Sample selection and individual 'picking' of contaminating fragments will mitigate the former. The measured $\delta^{13}C$ ratio provides a level

of information on the purity of the pre-treated, dated fraction, but as δ^{13}C is itself influenced by many factors (including ^{14}C-depleted reservoirs, Philippsen 2013), the result is not an infallible guide to age bias by contamination.

- Whether carbon exchange may have included sources with a significant reservoir component, be it marine or a freshwater offset. The age of such samples will be systematically offset from the atmospheric calibration data by having been in exchange with one or more differing ^{14}C-depleted reservoirs.

All of these issues are factored into the following discussion of the ^{14}C samples from Lake Flixton, although in specific cases only certain ones are given attention because the particular circumstances preclude others.

Seamer Carr Site C (Tables 4.1, 4.2)

The first three determinations (CAR-195, -196 & -197) were taken by Ed Cloutman in 1979 as part of his environmental sampling programme. However, because of the nature of the dated sample material and their association with archaeological remains, the three measurements are discussed in relation to the archaeology.

CAR-195 is a radiometric determination on a single entity. The branch is likely to have had a number of annual rings and so the sample can be said to have time-width. However, in relation to the measurement error this is unlikely to be a serious cause of bias. CAR-195 almost certainly derives from an Early Holocene deposit in which tree birch was becoming more widespread, and is probably a good estimate of the age of the wood. This would certainly fit with the likely stratigraphic context and the pollen data (Cloutman 1988b). However, in terms of the overlying archaeology, it is not clear how much time elapsed before deposition of animal bone above it. CAR-195 merely provides a *terminus post quem* for the bones.

CAR-196 is a radiometric determination on bones of two species. It is therefore not on a single entity and the validity of the measurement depends on the extent the deaths of the two animals coincided in time. In addition, the δ^{13}C value may be indicating the dated fraction has suffered contamination by exogenous carbon, the chemical pre-treatment not having successfully removed all contaminants. Whether CAR-196 has a direct relationship with human activity is unclear in that the examined records give no indication the bones were the result of human predation. In terms of its stratigraphic relationship with CAR-195 a younger age is possibly acceptable, but overall the validity of this measurement is questionable. The recent analyses of 3 single entity faunal specimens from Seamer C reported by Conneller and Higham (2015, table 1) highlight the low collagen content of the fauna from this site. The one successful determination (OxA-26542: 9340±45 BP [*8740–8470 cal BC*] on an elk/aurochs sized shaft fragment) would appear to indicate that CAR-196 is similarly affected and is giving a too recent age determination.

CAR-197 is a radiometric determination on charcoal from a mineral layer associated with a flint scatter on a shelf at the edge of the lake. It is unlikely to be a single entity determination, and the resulting mean age will be an average of the ages of the constituent fragments of charred wood. The sample is also likely to have an unknown time-width. Lack of knowledge of the species, and if it is from round or heartwood, further lessens its value. Nor can any functional relationship or causal connection be demonstrated between the charcoal and the flint unless one attributes the burning of the vegetation to the same human event. The determination may only provide an approximate *terminus post quem* for the lithic layer.

Two further determinations (HAR-5237 and -5790) were obtained on peat deposits forming in the lake margins adjacent to the site, and containing small quantities of struck flint and animal bone. HAR-5237 has been described at different times as peat or soil (the latter may be an amorphous, very humified/oxidized peat). The deposit is a coarse woody detritus mud that formed during the Early Holocene. It is not possible to demonstrate an unambiguous connection between the archaeological event that produced the struck flint and the cessation of carbon exchange in the sample. Furthermore, potential peat wastage/decay and mixing by soil organisms makes use of this determination hazardous.

Although the type of peat is unrecorded, given a marginal lake locality the sample dated by HAR-5790 is unlikely to be affected by a hard water error. This determination may therefore be an accurate, albeit imprecise, estimate of the age of the peat. But, given that a causal or functional relationship to the associated archaeology cannot be demonstrated (i.e. the bone is not butchered), the archaeological value of this determination depends on the elapsed time between death of the animal, deposition of the bone in the deposit and peat formation around it. From an archaeological point of view, the value of this determination is hard to judge as too many unknown factors are in play.

The remaining dated samples were from contexts associated with the Early Mesolithic land surface. HAR-5236 is a radiometric determination on a sample that has, at different times, been described as peat or semi-charred wood (the δ^{13}C would fit either). It is almost certainly not a single entity. If the sample is peat, a hard water error is unlikely given it is from the

Table 4.1. *Radiocarbon measurements from Site C.*

Lab Code	Radiocarbon years BP	δ13C (‰)	Material	Context
CAR-195	9480±110	-30.0	Wood – *Betula* sp	From peat [2132], directly below animal bone. Trench C IX
CAR-196	9100±100	-24.2	Bone collagen – elk and aurochs	From peat [2132] at 24.60 m AOD. Trench C IX
CAR-197	9260±90	-26.0	Charcoal	Associated with flint scatter (Scatter F), context [2133] at 25.13 m AOD. Trench C IX
CAR-896	6470±90		Peat	Base of black humified peat in Profile E77
CAR-895	5550±80		Peat	Top of black humified peat in Profile E77
HAR-5236	9470±100	-28.6	Peat/wood	From context [5012], the Early Mesolithic occupation surface. Trench C XIII
HAR-5237	9800±80	-29.3	Peat	From context [2506], peat which contained worked flint. Trench C VIII
HAR-5238	9300±110	-28.2	Wood charcoal	From [2018], the Early Mesolithic occupation surface, associated with worked flint, adjacent to Scatter H. Trench C XVIII
HAR-5547	8910±200		Charcoal	Sample taken from immediately below dense flint concentration (Scatter K) in [5012] (Early Mesolithic occupation surface). Trench C XI
HAR-5790	9520±90	-29.3	Peat	Sample from alongside and below animal bone in deep peat close to pollen monolith C VIII. Trench C VIII
HAR-5791	9340±160	-27.8	Charcoal	From a charcoal lens in sand layer [2018] (the Early Mesolithic occupation surface) adjacent to Scatter H. Trench C XVIII
HAR-5792	9900±140	-29.2	Charcoal	From within a large pit. Trench C XIII
HAR-5793	9320±150	-28.2	Charcoal	From the same pit as HAR-5792, but taken from a greater depth
OxA-26542	9340±45	-22.4	Bone – elk/ aurochs size	From peat [2132]. Trench C IX

Table 4.2. *Calibrated ages from Site C.*

Lab No. & 14C age (BP)	68.2% probability (cal BC)	95.4% probability (cal BC)
CAR-195: 9480±110	*9120–8630*	*9220–8545*
CAR-196: 9100±90	*8450–8235*	*8570–7985*
CAR-197: 9260±90	*8605–8345*	*8715–8290*
CAR-896: 6470±90	*5515–5350*	*5605–5255*
CAR-895: 5550±80	*4475–4335*	*4570–4245*
HAR-5236: 9470±100	*9120–8625*	*9195–8545*
HAR-5237: 9800±80	*9360–9195*	*9650–8860*
HAR-5238: 9300±110	*8705–8345*	*9095–8275*
HAR-5547: 8910±200	*8280–7750*	*8550–7585*
HAR-5790: 9520±90	*9130–8730*	*9200–8630*
HAR-5791: 9340±160	*8790–8330*	*9145–8275*
HAR-5792: 9900±140	*9740–9245*	*10,035–8920*
HAR-5793: 9320±150	*8750–8335*	*9135–8270*
OxA-26542: 9340±45	*8705–8550*	*8740–8470*

lake-edge margin, although contamination by rootlets is possible. If wood, then the age may have an unknown time-width. Context 5012 contained over 2000 pieces of struck flint and animal bone, interpreted as the Early Mesolithic occupation layer that was sealed by peat deposits. Although it is likely that the sample came from immediately adjacent to archaeological material, a direct causal relationship cannot be demonstrated. The large age difference between this determination and HAR-5547 (8910±200) from an equivalent horizon in trench C XI is potentially informative. Given this sample may be of mixed material of potentially differing age, it is probably safer to see HAR-5547 as the better, if less precise, estimate for the age of context 5012.

HAR-5547 is an unidentified charcoal sample from immediately below a dense flint concentration (flint scatter K). There is no record of a measured δ^{13}C value. An equivalent horizon to 5012 in trench C XIII in 1982 produced an age of 9470±100 (HAR-5236). Unfortunately, HAR-5547 has an unknown time-width, and may derive from fragments of differing aged wood as it is doubtful a single entity was dated, although given the large error on the determination such concerns may not be of significance. Although a direct causal association with the immediately overlying archaeology cannot be demonstrated, there is a good likelihood that HAR-5547 is providing a tolerably good, albeit imprecise, *terminus post quem* for the overlying lithic concentration.

Context 2018 was the most productive horizon archaeologically at Seamer Carr site C, producing over 4500 individual finds. Both radiometric determinations from this horizon (HAR-5238 and -5791) are on *Salix* and/or *Populus* wood charcoal. HAR-5238 is from a sand layer that contained struck flint and *c*. 1% macroscopic charcoal within a 2 × 2 m test-pit (C XVIII) that was later incorporated into a larger excavation area C XXI. The dated sample is probably not a single entity. Time-width is probable but, given the error term, is unlikely to be significant. It is doubtful if a causal relationship with the flint can be shown. However, provided the charcoal is not a mixed assemblage of differing age, HAR-5238 probably provides a reasonable *terminus post quem* for the associated flint.

The same comment applies to HAR-5791 as HAR-5238, except by coming from a discrete charcoal lens the level of confidence in the measurement is higher. The good agreement between the two determinations argues for minimal mixing of significantly different-aged *Salix*/*Populus* charcoal, suggesting both are good *termini post quem* for context 2018.

HAR-5792 and HAR-5793 are from the same large pit feature and should, therefore, be interrelated. However, the significant difference in their ages, and the fact that the measurement from the lower elevation sample (HAR-5793) is later than the one above it one suggests there may be problems with one, or both, of these measurements. The δ^{13}C values are as would be expected for wood charcoal. The weights of carbon used in the counting process (2.822 and 2.684 g, respectively, for HAR-5792 and -5793) are slightly smaller than with the majority of HAR radiometric dates for the site but cannot explain this discrepancy. If one excludes laboratory measurement error, for which there is no evidence, one is left considering archaeological explanations such as the mixing of charred wood of differing ages at the time the pit was dug and its incorporation into the fill. All in all, these two measurements are best viewed as problematic.

Finally, three bone samples from Seamer C were analysed as part of *The Early Mesolithic Colonisation of Britain* project (Conneller & Higham 2015). Two specimens (ARC83.5004 and ARC81.5581) produced an insufficient collagen yield. Only ARC79.5428 (OxA-26542) was successful giving an age determination that centres on 8500 BC. This date is based on ultra-filtration of bone and has an acceptable δ^{13}C value. It is probably a reliable age estimate for one event on a repeatedly re-occupied multi-period site.

Seamer Carr Site K

A total of ten radiometric determinations derive from Seamer Carr site K on the eastern side of the West Embayment (Tables 4.3, 4.4). Cloutman collected CAR-841 and -842 as part of his environmental sampling programme, and because the samples were internal submissions to the Cardiff ^{14}C laboratory, only incomplete sample records now exist (Q. Dresser, pers. comm.). Six samples were obtained by the VPRT, and two further samples were recently dated as part of the *Early Mesolithic Colonisation of Britain* project (Conneller & Higham 2015).

Context 5085 is described as a thin, undulating horizon of fine, black, homogenous organic detritus with *Phragmites* reed, infilling small natural hollows in the sandy gravel subsurface. It becomes discontinuous upslope, and is restricted to the lower slopes of the former shoreline on the western side of the glacial esker on which Site K is situated. Within it were pockets of fine grey sand (context [5088]) and sealing it was a relatively sterile horizon of medium-coarse carbonate-rich white sand (context [5084]). Context [5069] in test-pit Z 306A is equivalent to [5085].

CAR-842 appears to date the onset of organic detritus sedimentation during the Late Glacial or Windermere Interstadial, whilst CAR-841 dates the cessation of this organic sediment accumulation at the interface between the interstadial and the subsequent Loch Lomond Stadial. This interpretation is supported by the pollen evidence (Cloutman 1988b, 28–9). The presence of emergent *Phragmites* plants indicates the deposit formed within the lake margin and a hard water error is unlikely. The δ^{13}C is in agreement with such an interference and so it is probably safe to put full confidence in the reliability of these two determinations.

HAR-5787 is from an equivalent context to CAR-841. The date is assumed to be on peat below an organically enriched sand. The sample's position beneath context 5084, a medium coarse carbonate-rich white sand, suggests that it is providing a *terminus post quem* for this deposit. In comparison to CAR-841 this determination is significantly young. Either this reflects non-conformities in the sedimentary record or is highlighting possible measurement errors in the determinations.

Table 4.3. *Radiocarbon measurements from Site K.*

Lab Code	Radiocarbon years BP	δ^{13}C (‰)	Material	Comment
CAR-841	10,960±110	-27.87	Organic detritus	Top of organic detritus [5085] Trench K (Profile K2)
CAR-842	12,010±130	-27.35	Organic detritus	Base of organic detritus [5085] Trench K (Profile K2)
CAR-878	9000±100		Organic material	Base of peat [5005] lying over the mineral substrate south of Site K at 25.0 m AOD
CAR-879	9700±90		Organic material	Base of peat lying over the mineral substrate south of Site K at 24.0 m AOD
CAR-880	11,000±110		Organic material	Base of peat lying over the mineral substrate south of Site K at 23.0 m AOD
CAR-881	9490±110		Organic material	Base of peat [5005] lying over the mineral substrate west of Site K at 25.0 m AOD
CAR-882	9860±110		Organic material	Base of peat lying over the mineral substrate west of Site K at 24.0 m AOD
CAR-883	10,930±90		Organic material	Base of peat lying over the mineral substrate west of Site K at 23.0 m AOD
HAR-5241	9560±120	-30.3	Peat	From [5067] containing Mesolithic material, lies above the main Mesolithic occupation surface [5098] (same as [5012]) in Z306A
HAR-5242	11,000±130	-22.8	Organic detritus	Top of organic detritus [5069] (same as [5085]) Trench Z306A.
HAR-5787	10,040±130	-29.7	Organic detritus	Organic detritus [5085] directly beneath [5084], and above basal gravels
HAR-5789	8020±90	-28.9	Peat	From [5005], taken adjacent to a group of hafted microliths.
HAR-5794	9590±120	-26.3	Charcoal	From [5012,] Mesolithic occupation surface
HAR-6498	8210±150	-30.8	Wood – *Salix/ Poplus sp.*	Part of the haft of a Late Mesolithic arrow shaft from [5005] (see HAR-5789)
OxA-26543	10,015±50	-21.83	ARC85.5134	*Cervus elaphus* L, marrow fracture, PVA contamination
OxA-26544	9990±55	-22.57	ARC84.5021	*Cervus elaphus*, L tibia, marrow fracture, PVA contamination

Table 4.4. *Calibrated ages from Site K.*

Lab No. & ^{14}C age (BP)	68.2% probability (cal BC)	95.4% probability (cal BC)
CAR-841: 10,960±110	*10,995–10,780*	*11,105–10,750*
CAR-842: 12,010±130	*12,100–11,780*	*12,240–11,600*
CAR-878: 9000±100	*8285–7990*	*8450–7815*
CAR-879: 9700±90	*9240–8915*	*9305–8810*
CAR-880: 11,000±110	*11,050–10,825*	*11,130–10,770*
CAR-881: 9490±110	*9090–8675*	*9200–8510*
CAR-882: 9860±110	*9610–9255*	*9805–8955*
CAR-883: 10,930±90	*10,990–10,795*	*11,080–10,750*
HAR-5241: 9560±120	*9150–8775*	*9255–8625*
HAR-5242: 11,000±130	*11,040–10,800*	*11,145–10,745*
HAR-5787: 10,040±130	*9850–9360*	*10,095–9275*
HAR-5789: 8020±90	*7070–6775*	*7180–6650*
HAR-5794: 9590±120	*9175–8810*	*9270–8635*
HAR-6498: 8210±150	*7455–7055*	*7570–6775*
OxA-26543: 10,015±50	9670–9405	9800–9335
OxA-26544: 9990±55	9655–9370	9765–9305

As already stated, overlying the peat horizon (context [5085[/ [5069]) is a sterile sand unit (context [5084]), interpreted by Cloutman (1988b, 28) as a hillwash or solifluction horizon dating from the Loch Lomond Stadial. HAR-5241 and -5242 bracket this sand unit. HAR-5242 is therefore equivalent to CAR-841, and in age there is good agreement, however the reported δ^{13}C for this measurement is slightly less depleted in ^{13}C than would normally be expected for a peat. Although worrying, a value of -22.8‰ is within the range of variation for C3 plants (-22‰ to -33‰, Fritz and Fontes, 1980). By its position HAR-5241 post-dates this hillwash/solifluction event and an Early Holocene age would be acceptable. Although a slightly older age might have been expected, comparison with Day's (1993, 1996a) work shows that some lake margins did not experience the onset of organic sedimentation until several hundred years into the Early Holocene, and so the age obtained is acceptable.

HAR-5794 is a radiometric determination on specifically identified charcoal from context 5012. Whether a single entity was dated is unknown. Time-width is unknown but unlikely to be significant. Doubts must remain whether charcoal fragments from successive visits have been amalgamated given that we cannot rule out that the exposed surface of 5012 may have seen repeated Early Mesolithic human activity. If this has not happened, and the charcoal all derives from a single human activity, then HAR-5794 may provide a reasonable *terminus post quem* for an occupation event.

HAR-6498 relates to a single piece of wood (*Salix* or *Populus* sp.) associated with a discrete scatter of Late Mesolithic microliths, and is thought to have been the haft for a composite tool. As a direct single entity measurement on an identified relatively short-lived sample, HAR-6498 is almost certainly a good age estimate for the particular dated item.

HAR-5789 is an age determination by association as it was made on a peat sample that was removed, in the laboratory, from adjacent to and at the same level as, the possible composite tool dated by HAR-6498 (David 1998). Since a direct causal or functional relationship cannot be demonstrated between the microliths and the dated peat carbon, the elapsed time interval between lithic placement and peat growth will depend on the peat accumulation rate. Provided the rate of growth was not excessively slow, then there would be a reasonable case for arguing that the age of the sample coincides relatively well with the time of deposition of the lithic armature, in which case HAR-5789 may be viewed as a good unbiased age estimate. However, should rootlets from later plant growth have penetrated to the level of the microliths then this conclusion would be wrong and HAR-5789 would need to be rejected. For a discussion of the pollen from this context, see Cloutman (1988b, 28–30).

In addition to the samples obtained by the VPRT, two further bone samples from Seamer K were analysed as part of *The Early Mesolithic Colonisation of Britain project* (Conneller & Higham 2015). Although these specimens have good links to archaeological events the presence of PVA appears to have biased the age measurements to being too old. It is probable that the ultra-filtration chemical pre-treatment has not fully removed the contamination. These new analyses of Conneller and Higham (2015) therefore do not help the assessment of the determinations produced under the auspices of the VPRT.

Seamer Carr Site L

One radiocarbon date associated with archaeological material is available from Site L (Tables 4.5, 4.6). This is a direct radiometric date on a single entity horse right mandibular ramus. The measurement is of significant importance in discussions on the presence of horse in the Last Glacial to Early Holocene transition in Britain (Clutton-Brock and Burleigh 1991; Kaagan 2000). Other documented examples of horse of similar age include specimens from Three Ways Wharf in Uxbridge (Lewis and Rackham 2011) and Flixton site 2 (see below). In the context of this sample the term 'collagen' means the acid insoluble organic fraction after treatment with cold dilute acid. Due to the method used in the pre-treatment, exogenous carbon of a different age is very likely to be contaminating this sample. The $\delta^{13}C$ of -24.1‰ is more negative (more depleted in ^{13}C) than would normally be expected. For this reason, confidence cannot be placed in this measurement. The magnitude of the bias is difficult to quantify, but if the exogenous carbon derives from the overlying peat deposits, then an age too young would be expected. In all likelihood BM-2350 is not an accurate age determination, and re-measurement using modern chemical pre-treatment methods is needed.

Table 4.5. *Radiocarbon measurements from Site L.*

Lab Code	Radiocarbon years BP	$\delta^{13}C$ (‰)	Material	Comment
BM-2350	9790±180	-24.1	Collagen *Equus ferus*	From horse bone associated with Long Blade and Early Mesolithic flint
OxA-19511	10,025±40	-20.7	Bone, *Equus ferus*	From horse bone associated with Long Blade and Early Mesolithic flint

Table 4.6. *Calibrated ages from Site L.*

Lab No. & ^{14}C age (BP)	68.2% probability (cal BC)	95.4% probability (cal BC)
BM-2350: 9790±180	*9650–8835*	*9990–8710*
OxA-19511	*9800–9370*	*9800–9370*

More recent analysis reported by Conneller and Higham (2015: table 2) from Seamer L would appear to confirm this assessment. A cluster of horse bones in a layer of peaty sand associated with a Long Blade knapping scatter (Conneller 2007) has given an additional age estimate of 10,025±45 BP (OxA-19511) (9805–9370 cal BC). The large error term on determination BM-2350 is responsible for the overlap in the calibrated age ranges between the two measurements.

Seamer Carr Site N

There are two determinations from Site N (Tables 4.7, 4.8).

OxA-1030 is a determination on a dog vertebra retrieved from near the base of context 5005 in 1985. The bones represented the remains of a single animal, a canid, and based on size criteria attributed to a domestic dog. Context [5005] was the upper wood peat that sealed the main Early Mesolithic horizon and so an age after the time of this occupation was anticipated. Due to the archaeological and faunal importance of this find a direct AMS determination was made on vertebrae fragments (the complete vertebrae were not used in the dating as these had been preserved by immersion in an emulsion of PVA, polyvinyl acetate). The dating, however, turned out to be far from straightforward.

The first issue concerned the chemical pre-treatment used by Oxford (Batten et al. 1986, Gillespie, Hedges and Wand 1984). This has subsequently been shown to have problems where specimens have low collagen levels and come from waterlogged (or semi-waterlogged) deposits (Hedges and Law 1989; Hedges and van Klinken 1992; Brock et al. 2010). Such contamination would normally manifest itself in terms of a further depleted $\delta^{13}C$ value (i.e. more negative than the typical -19 to -23‰ range). Although the $\delta^{13}C$ was not measured at the time the sample was dated, subsequent stable isotope analysis on the same specimen (below) indicate other factors are in play.

For reasons given below, the assumed (not measured) $\delta^{13}C$ used in the isotopic fractionation correction for this date (i.e. -21) is incorrect. However, in relation to other potential biases this factor is small. For example, when measuring an age using the $^{14}C/^{13}C$ ratio, a 1‰ difference represents 8 radiocarbon years; hence using a $\delta^{13}C$ value of -15.8 (the average for the Seamer Carr dog bones) against -21 would affect the result by *c*. 40 years.

Using stable isotope analysis, Clutton-Brock and Noe-Nygaard (1990) obtained $\delta^{13}C$ values of -14.67±0.5‰ and -16.97±0.5‰, which led them to conclude that the dog had eaten marine resources, probably fish. This conclusion was subsequently disputed (Dark 2003; Day 1996a) but upheld by Schulting and Richards (2002, 2009). In the context of the validity of the dating, whether the enrichment of ^{13}C is due to consumption of local vegetation that had obtained carbon from the carbonate-rich waters of the lake, or from seasonal use of marine resources, is immaterial. Both explanations have serious implications for OxA-1030. If the dog had a significant marine or freshwater component to its diet (or consumed something, which in turn had a significant marine or freshwater dietary component) then some degree of ^{14}C dilution could be expected regardless of which carbon reservoir was used. This would make the age older than would be the case if the bone collagen purely came from materials in equilibrium with the atmosphere. Although a bias is certain (the $\delta^{13}C$ clearly show input of non-terrestrial food sources) it is important to keep in mind the magnitude of such an effect. If the dog had a 100% marine diet (unlikely) the age offset would be the same for marine organisms which take all their carbon from the surface waters. In a modern-day context, the marine offset in British waters is 405±40 ^{14}C years (Harkness 1983) although conditions in the Early Mesolithic may have been different. In practice this degree of marine resource use is unlikely and so the bias is almost certainly less. All in all, OxA-1030 is almost certainly too old, although probably only by a few hundred

Table 4.7. *Radiocarbon measurements from Site N.*

Lab Code	Radiocarbon years BP	$\delta^{13}C$ (‰)	Material	Comment
HAR-5243	10,190±110 10,220±120	-28.3	Peat	From organic detritus [5091]
OxA-1030	9940±100		Collagen- dog	Context [5012]/ [5005]

Table 4.8. *Calibrated ages from Site N.*

Lab No. & ^{14}C age (BP)	68.2% probability (cal BC)	95.4% probability (cal BC)
HAR-5243: 10,190±110	*10,145–9665*	*10,435–9440*
HAR-5243: 10,220±120	*10,275–9675*	*10,450–9450*
OxA-1030: 9940±100	*9655–9290*	*9860–9240*

Table 4.9. *Radiocarbon measurements from Site B.*

Lab Code	Radiocarbon years BP	$\delta^{13}C$ (‰)	Material	Comment
BM-1841R	8740±120	-23.2	collagen from *Bos primigenius* rib	Context [5007]. Trench B I

Table 4.10. *Calibrated ages from Site B.*

Lab No. & ^{14}C age (BP)	68.2% probability (cal BC)	95.4% probability (cal BC)
BM-1841R: 8740±120	*7960–7600*	*8210–7585*

years. This determination would benefit from repeat measurement using modern pre-treatment methods.

HAR-5243 is an age determination on a peat sample from Seamer Carr site N, test-pit Z313A that is thought to have originated during the Late Glacial Interstadial. Records from the Harwell laboratory give two differing ages for this sample, although the difference in age is not significant. The $\delta^{13}C$ value is consistent with the type of material although lack of information as to exactly what type of peat was dated makes further discussion difficult. In terms of its supposed context and association HAR-5243 would appear to be too young, however in the absence of further details it is not clear whether the measurement is the problem or whether the inferred age is at fault.

Seamer Carr Site B

There is a single radiocarbon determination from Site B (BM-1841R) (Tables 4.9, 4.10). This is a radiometric age on a short-lived single entity rib bone of *Bos primigenius* from context 5007, described as a blackish brown woody detritus peat with *Phragmites* and hazelnuts, in trench B I of Seamer Carr site B. The $\delta^{13}C$ give no indication of a marine or freshwater aquatic component to the diet. Although affected by the British Museum laboratory problem (Bowman et al. 1990), this is a revised measurement. Relationship to the associated archaeology would be increased should examination of the fauna reveal butchery marks on the surfaces of the bones. The biggest potential worry is in the chemical pre-treatment, in that collagen in this context probably means the acid insoluble organic fraction. The $\delta^{13}C$ value shows that if there has been any contamination of exogenous carbon it is only relatively minor. A tolerable degree of confidence can probably be placed on this measurement.

Seamer Carr Site F

There are two radiometric determinations from test-pits at Site F (Tables 4.11, 4.12). Almost certainly neither sample was a single entity date. HAR-5239 is probably on a sample of decayed humified peat with a large humic component, as shown by the negative $\delta^{13}C$ value. Given the solubility of humic acids in water and their mobility in the ground (Cook et al. 1998), the likelihood that the dated sample could have been affected by peat wastage and mixing by soil organisms, considerable care is advisable in using this measurement. To what extent it can be linked with an archaeological event is unclear. HAR-5240 appears to be a sample of mixed composition (the $\delta^{13}C$ would be appropriate for either material) and thus the validity of the age will depend on how coincident the ages were for the peat and the wood. The timber may have a time-width to it and the precise relationship between the cessation of carbon exchange with the atmosphere of the sample and the archaeological event(s) recorded by the bone and flint scatter is hard to define. For these reasons HAR-5240 has only limited archaeological value.

Ling Lane 'Moore's Site 10'

Six radiometric determinations are available for Ling Lane (Moore's Site 10) at the edge of the basin (Tables 4.13, 4.14). The first three were taken by Cloutman

Table 4.11. *Radiocarbon measurements from Site F.*

Lab Code	Radiocarbon years BP	$\delta^{13}C$ (‰)	Material	Comment
HAR-5239	8730±90	-30.1	soil (?peat)	Context [5005], 27.057 m AOD, Z435
HAR-5240	9100±90	-25.9	wood and peat	Interface between [5005] and [5067], Z441

Table 4.12. *Calibrated ages from Site F.*

Lab No. & ^{14}C age (BP)	68.2% probability (cal BC)	95.4% probability (cal BC)
HAR-5239: 8730±90	*7940–7605*	*8200–7585*
HAR-5240: 9100±90	*8450–8235*	*8570–7985*

Table 4.13. *Radiocarbon measurements from Ling Lane.*

Lab Code	Radiocarbon years BP	δ13C (‰)	Material	Note
CAR-875	7270±80	-27.76	Oxidized coarse detritus mud with reeds	Taken from the base of the organic sequence at 25 m AOD
CAR-876	9390±110	-27.78	Coarse detritus mud with reeds	Taken from the base of the organic sequence at 24 m AOD
CAR-877	9800±110	-28.56	Coarse detritus mud with much *Phragmites*	Taken from the base of the organic sequence at 23 m AOD
SWAN-251	9210±110	-27.02	Amorphous organic sediment with a little herbaceous detritus	Contained 13 flint artefacts, and sealed the basal mineral deposit [130] with a further 106 flints. Height 24.47 m AOD
SWAN-252	9440±110	-28.86	Moist dark grey soft fibrous organic sediment – appeared 'jumbled' with abundant herbaceous detritus & some sand	Below flint core 853 at 23.83 m AOD. To date discarded flint core to see if contemporary with flint scatter in trench 80
SWAN-253	9840±120	-28.01	Moist mid to grey fibrous sandy silty amorphous organic sediment	From base of context [183] at 23.46 m AOD, below artefact layer. To date onset of peat development

Table 4.14. *Calibrated and modelled ages from Ling Lane.*

	Before Bayesian analysis		After Bayesian analysis		Agreement index
	68% probability	95% probability	68% probability	95% probability	
Start boundary			*9660–9230*	*9820–9130*	
CAR-877 : 9800±110	*9450–8940*	*9670–8820*	*9660–9230*	*9820–9130*	76.2
SWAN-253 : 9840±120	*9650–9170*	*9810–8840*	*9370–8930*	*9470–8820*	96.5
SWAN-252 : 9440±110	*9120–8560*	*9190–8450*	*8850–8610*	*9130–8550*	117.2
CAR-876 : 9390±110	*8830–8460*	*9130–8320*	*8770–8550*	*9050–8410*	122.7
SWAN-251 : 9210±110	*8550–8300*	*8720–8240*	*8500–8280*	*8640–8240*	106.0
CAR-875 : 7270±80	*6220–6060*	*6360–5990*	*6230–6070*	*6370–6000*	97.9
End boundary			*6230–6070*	*6370–6000*	

(1988a) using a Hiller peat corer and were primarily taken to establish the rate of hydroseral transition and sedimentation. These dates came from the base of the stratigraphically earliest organic deposit, and thus dates the onset of organic sedimentation. The second three were taken about a decade later by Northern Archaeological Associates in connection with an archaeological watching brief and test-pitting.

The height above Ordnance Datum data for these six measurements can be combined with the calibrated age ranges to produce a time-depth profile (Fig. 4.1). However, it is also possible to use the fact that they form a stratigraphic sequence to constrain the calibrated age ranges, which would otherwise be quite large. This is done using OxCal v4.3.2 computer program of Bronk Ramsey (2008; 2009) and the IntCal13 atmospheric calibration curve (Reimer et al. 2013). All age ranges are expressed in cal BC.

Given the proximity to the margins of the lake it is unlikely that any of the determinations have been affected by a hard water error. All the δ13C values are acceptable for the material concerned, raising confidence in the age determinations. The sediment description from SWAN-252 suggests a degree of mixing with sand eroding from the margins of the lake contaminating the organic horizons. However, based on a Bayesian analysis of the calibrated time-depth profile this does not appear to have affected the overall age profile of this locality. It is possible to suggest two explanations that would account for this. If the minerogenic input had very little organic content, any age bias would be minimal. Secondly, if the organic content of the allochthonous sand had a similar age to that of the autochthonous material, no bias would result.

Based on the dates obtained it would appear, at least at the start of the Holocene, that there was a good deal of consistency in the age-depth profile for this marginal locality. This is despite the fact that the dating samples were taken at separate times by different

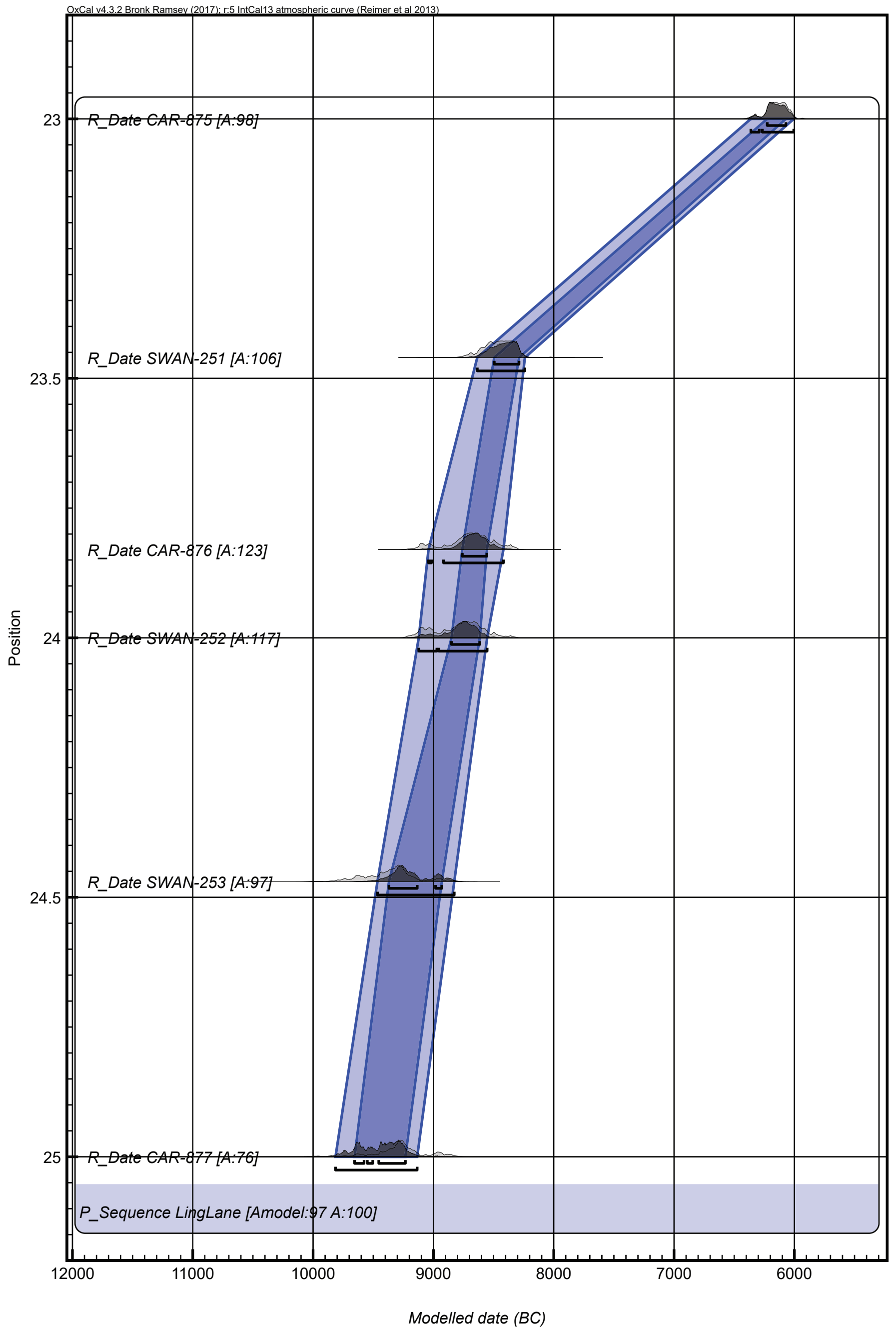


Figure 4.1. *Ling Lane Bayesian age model.*

people and measured with a long intervening period by admittedly the same laboratory (Swansea being essentially the Cardiff laboratory relocated). Such consistency is reassuring, allowing us to place a good level of confidence in the validity of these measurements. On the basis of the ages obtained, it would appear that the rate of sedimentation slowed as the basin infilled.

The archaeological relevance is fairly straightforward, in that SWAN-253 provides a *terminus post quem* for the overlying artefact layer; SWAN-252 similarly provides a *terminus post quem* for the flint core at 23.83 m AOD, while SWAN-251 provides a *terminus ante quem* for the buried mineral layer with 106 flints. The three Cardiff results have no direct archaeological relevance, but because all six measurements form a continuous age-depth profile they together provide a good degree of chronological control to the archaeology.

Flixton 1

Three radiometric determinations on, probably, bulked samples of peat from Flixton 1 test-pit AB, excavated in 1986 (Tables 4.15, 4.16). The $\delta^{13}C$ values are acceptable

Table 4.15. *Radiocarbon measurements from Flixton Site 1.*

Lab Code	Radiocarbon years BP	δ^{13}C (‰)	Material	Context
CAR-1013	8040±90	-27.44	Peat	Context [1010], above a clay/silt layer at 24.529 m AOD
CAR-1014	9130±110	-27.72	Peat	Context [1011], below a clay/silt layer at 24.389 m AOD
CAR-1015	9740±110	-26.11	Peat	Sample from above the basal gravel (context [1008]) at 24.239 m AOD, which contained struck flint

Table 4.16. *Calibrated ages from Flixton Site 1.*

Lab No. & ^{14}C age (BP)	68.2% probability (cal BC)	95.4% probability (cal BC)
CAR-1013 : 8040±90	7120–6775	7295–6675
CAR-1014 : 9130±110	8535–8250	8640–7980
CAR-1015 : 9740±110	9315–8860	9450–8765

for the dated material and the determinations are in the correct stratigraphic order. Whilst there is no direct functional relationship with the associated lithic material, and there are no exact details on the nature of the organic material being dated, the determinations do provide a series of stratigraphic-related *termini post quem* for archaeology in this test-pit.

Flixton 2

The dated samples come from an assemblage of horse bones and teeth in a layer of fine detritus mud, which were originally recorded by Moore during his excavations at Flixton 2. Only one of these (Q-66) was obtained at the time of Moore's excavations, the remainder came from work undertaken by the VPRT (CAR-1016), and subsequent attempts to directly date the horse bone (Kaagan 2000) (Tables 4.17, 4.18).

CAR-1016 is a sample of the fine detritus mud, originally recorded by Moore, and then identified in test-pit AE during excavations by the VPRT. The δ^{13}C value is acceptable for the material being analysed and on superficial examination the determination appears to provide an estimate of the likely age of the associated faunal specimens (however, see below).

Q-66 was measured relative to 1957 rather than 1950 and was originally expressed in uncalibrated radiocarbon years BC. Furthermore, no fractionation correction has been applied and so Q-66 is not a

Table 4.17. *Radiocarbon measurements from Flixton Site 2.*

Lab Code	Radiocarbon years BP	δ^{13}C (‰)	Material	Comment
Q-66	10,413±210	not measured	Nekron mud	Date obtained on the nekron mud by Walker and Godwin (1954), and Godwin and Willis (1959)
CAR-1016	9850±80	-27.18	Fine detrital mud	Context [1016], test-pit AE
OxA-6318	10,090±90	-20.8	*Equus ferus*,1st phalange	Date obtained by Laura Kaagan
OxA-6319	10,150±80	-20.8	*Equus ferus*, 1st phalange	Date obtained by Laura Kaagan
OxA-6328	10,150±90	-20.2	*Equus ferus* astragalus	Dates on bone sample from Moore's excavations, commissioned by Peter Rowley-Conwy
OxA-6329	9160±80	-20.3	*Equus ferus* astragalus	Dates on bone sample from Moore's excavations, commissioned by Peter Rowley-Conwy

Table 4.18. *Calibrated ages from Flixton Site 2.*

Lab No. & ^{14}C age (BP)	68.2% probability (cal BC)	95.4% probability (cal BC)
Q-66 : 10,420±210 (correction for 1957 vs. 1950)	*10,670–10,030*	*10,780–9460*
CAR-1016 : 9850±80	*9435–9240*	*9660–9175*
OxA-6318 : 10,090±90	*9875–9450*	*10,075–9360*
OxA-6319 : 10,150±80	*10,045–9670*	*10,140–9450*
OxA-6328 : 10,150±90	*10,060–9665*	*10,175–9400*
OxA-6329 : 9160±80	*8465–8280*	*8595–8245*

Table 4.19. *Radiocarbon measurements from No Name Hill.*

Lab Code	Radiocarbon years BP	δ13C (‰)	Material	Context
Beta-104484	9510±60	-26.4	'Collagen' extracted with alkali from antler	Context [9420] at the base of NAZ

Table 4.20. *Calibrated ages from No Name Hill.*

Lab No. & 14C age (BP)	68.2% probability (cal BC)	95.4% probability (cal BC)
Beta-104484: 9510±60	*9120–8735*	*9140–8640*

conventional radiocarbon date in the sense of Stuiver and Polach (1977). The main comment must be that Q-66 does represent a measurement made in the very early days of radiocarbon when much was to be learnt. Problems may have gone unrecognized and the large counting error and doubts on the pre-treatment makes the determination of very limited value.

OxA-6318, -6319, -6328 and -6329 are all AMS determinations on short-lived single entity faunal samples. The δ13C values suggest that there has been little exogenous carbon contamination of the collagen and so the determinations may be good estimates of the time of death. But the significant age discrepancy of OxA-6329 vs. OxA-6318, -6319 and -6328 suggest there are important biases to the pre-treatment. Subsequent investigations by Marom et al. (2015) have shown this to be the case. The hydroxyprolene fraction (X-2395-14: 10,155±55 BP) is believed to be the most reliable age for this faunal assemblage of horse, whilst interestingly the ion exchange gelatine (AI, +/- a solvent wash) have on the whole given less biased ages (OxA-6329 excepted) than ages produced more recently with ultrafiltration protocols. For a while the Early Holocene age for horse from Flixton 2 was held to be interesting for it hinted at the survival of the species for several hundred years longer than had previously been known (cf. BM-2350: Clutton-Brock and Burleigh 1991; Kaagan 2000). This is probably no longer the case for the re-measurement by Marom et al. (2015) has clarified the situation. To summarize, CAR-1016 is probably mildly contaminated by younger humic acids; OxA-6318, -6319 and -6328 show little bias; OxA-6329 has been much more affected and is significantly biased to a younger age.

No Name Hill

This is a single entity AMS determination on collagen from a worked antler of red deer recovered from the base of trench NAZ (Tables 4.19, 4.20). The main worry is the δ13C of -26.4‰ that clearly shows the collagen has been contaminated by exogenous carbon. Given that the form of chemical pre-treatment is unlikely to have removed such contaminants, the problem was always going to be a possibility in such organic-rich sediments. The determination is unlikely to be an accurate indication of the age of the antler.

Flixton School Field

This is another single entity AMS determination on collagen extracted by alkali from the skull of a large mammal, in this case recovered at the base of trench OG at Flixton School Field (Tables 4.21, 4.22). The association with such lithic material would suggest the age is much too young, and the δ13C confirms this in that the pre-treated extract appears to have been contaminated by exogenous carbon of a younger age. The chemical pre-treatment is failing to remove the contaminants, and the resulting age bias makes this determination of little value.

Barry's Island

These are AMS determinations on single entity bone and tooth dentine samples from a range of faunal species from two trenches, LYY and LW, at Barry's

Table 4.21. *Radiocarbon measurements from Flixton School Field.*

Lab Code	Radiocarbon years BP	δ13C (‰)	Material	Context
Beta-104487	5490±40	-26.6	Collagen extracted by alkali from skull of large mammal	Large mammal skull, from the base of trench OG, associated with Early Mesolithic worked flint

Table 4.22. *Calibrated ages from Flixton School Field.*

Lab No. & 14C age (BP)	68.2% probability (cal BC)	95.4% probability (cal BC)
Beta-104487: 5490±40	*4370–4265*	*4450–4255*

Table 4.23. *Radiocarbon measurements from Barry's Island.*

Lab Code	Radiocarbon years BP	δ^{13}C (‰)	Material	Context
OxA-6330	10,160±90	-19.6	Premolar, Horse	Context [9113], Trench LYY
OxA-8045	5730±60	-22.1	Elk Find No. 50632	Context [9113], Trench LYY
OxA-8098	6255±50	-23.1	Red Deer Find No. 50892	Context [9114], Trench LYY
OxA-8099	5855±50	-23.0	Roe Deer Find No. 50561	Context [9104], Test-pit LW
OxA-8100	9690±60	-20.5	Aurochs Find No. 51504	Context [9117], Trench LYY

Table 4.24. *Calibrated ages from Barry's Island.*

Lab No. & ^{14}C age (BP)	68.2% probability (cal BC)	95.4% probability (cal BC)
OxA-6330: 10,160±90	*10,070–9670*	*10,195–9405*
OxA-8045: 5730±60	*4680–4495*	*4715–4450*
OxA-8098: 6255±50	*5315–5080*	*5325–5055*
OxA-8099: 5855±50	*4795–4620*	*4840–4580*
OxA-8100: 9690±60	*9255–8925*	*9285–8835*

Island (Tables 4.23, 4.24). OxA-6330 and -8045 are AMS determinations on faunal remains from a sand horizon (context [9113]) intercalated between two peat layers. The lower peat/sand contact has been dated to 8850±50 BP (Beta-99937) whilst the upper sand/peat contact has a date of 6190±60 BP (Beta-94438). The context of the finds, a high-energy minerogenic inwash layer on the west side of the island, and the large age difference strongly suggests a deposit of mixed age. Both faunal dates may be accurate indicators of the age of the tooth dentine / bone collagen respectively in that the chemical fraction used was the ion-exchanged gelatine and the δ^{13}Cs are acceptable. The calibrated age range for OxA-8045 (*68% probability: 4680–4495 cal BC, 95% probability: 4715–4450 cal BC*) is in agreement with the OSL date (Dur178-1) for the deposition of the sand (6745±890 calendar years before 1998). However, OxA-8045 is younger than overlying peat, which was dated to 5290–4905 cal BC (Beta-94438, see below). It is probably best to be cautious with OxA-8045 for it may not be an accurate reflection of its age.

The next two AMS determinations – OxA-8098 and -8099 – are again on short-lived single entity specimens using ion-exchanged gelatine as the dating fraction. The δ^{13}Cs are acceptable and so there is no suggestion that the ages are biased. Again, the contexts are indicative of having undergone some reworking or mixing, hence their dating value is mostly confined to providing direct age measurements on red and roe deer occurrence in the area in the mid-Holocene. OxA-8099 (from trench LW) is younger than the date for the formation of peat over the sand layer in trench LYY (Beta-94438), and either peat formation was later in LW or the age of the bone is erroneous.

The fifth measurement, OxA-8100 is on a bone of an aurochs. The context of this find would suggest this was *in situ*. Unless it has signs of butchery one cannot demonstrate a direct link with the associated lithic material although it is valuable as a *terminus post quem* for the context and as a direct age determination for an Early Holocene aurochs.

Palaeoenvironmental samples

Introduction

As far as the environmental samples from Lake Flixton are concerned the most important issue is the question of whether or not they have been affected by a hard water error. A hard water error occurs when growing plants take their carbon from carbonate-rich freshwater rather than taking carbon from the atmosphere (Deevey et al. 1954). The hard water error is sometimes also known as the freshwater reservoir effect (Philippsen 2013). This leads to the incorporation of ^{14}C-depleted carbon into the plant cell structure such that they have an apparent age at death which is greater than zero. The depletion can be carried up the food chain if animals consume ^{14}C-depleted plants. Hence ^{14}C dates on the remains of such plants, whether in the form of peat, coarse detritus mud or fine detritus mud (gyttja), will give ages older than would normally be the case were all the carbon to have come by way of photosynthesis from atmospheric carbon dioxide.

Only certain plants obtain their carbon from sources other than the atmosphere. In the case of Lake Flixton the most relevant set of plants are the floating-leaved aquatic species, such as taxon like the *Potamogetonaceae*. Plants, which have their roots in water but substantial parts usually above water, generally take their carbon from the atmosphere. What this means is that deposits made up of emergent plants – reeds, rushes, sedges – would generally not suffer from a hard water effect whereas lake muds that consist of the remains of aquatics would. Aquatic plants which are incapable of assimilating carbonates, and rely on CO_2, such as aquatic mosses, can also show a substantial hard water reservoir effect. Samples from the centre of the lake rather than from the lake margins would be most at risk of being biased in this way. Whether or not the sediment is calcareous today is not the issue (this is normally removed by the acid pre-treatment, which all such samples undergo in the laboratory). It is the conditions in the past when the plants were living and exchanging carbon that determines whether hard water is an issue.

Hard water also influences the δ^{13}C ratio. Normally, terrestrial C_3 plants have average δ^{13}C values of -26‰ (but with a range from -22 to -40‰). Aquatic plants can have a large scatter of δ^{13}C values, in part to be attributed to the large variation in the δ^{13}C content of the carbon source itself: in this case the 'Dissolved Inorganic Carbon' (DIC) of the water. Dark (1998b) demonstrated that deposits of marl in the Lake Flixton give δ^{13}C values of -0.5 and -0.7‰; samples composed mostly of *Potamogeton* (pondweed) macrofossils gave values of -14.2 and -16.4‰; whereas samples of terrestrial plants fell in the range from -25 to -30‰. By examining the δ^{13}C of the dated samples some indication of this freshwater reservoir effect may be observed. Unfortunately, as will be seen, this does not always seem to be the case. Phillipsen (2013) accounts for Dark's (1998b) values by observing 'this is caused by the fact that most of the CO_2 for mineral weathering will be derived from the atmosphere in these cases, and not from decomposition of organic matter in the soil, as would be the case for mature vegetation and more developed soils'. Over time, vegetation change in the lake will have affected soil maturity thus influencing the resultant δ^{13}C values of soil carbon. More recent samples, in particular, will deviate from the pattern Dark (1998b) reported. Furthermore, if the composition of the sample is mixed, the situation becomes more complicated and the δ^{13}C values of the dated fraction may not be sufficiently different to identify a clear freshwater reservoir effect.

Issues other than the hard water effect are discussed in the main text of this chapter as they relate only to a small number of individual samples.

Flixton 1

Two sets of determinations were obtained to support palynological analysis at Flixton Site 1. The first is a series of seven radiometric determinations taken from a pollen sequence at Flixton 1 (AK87) to date specific pollen zone boundaries (Tables 4.25, 4.26). Material consisted of organic lake mud gyttja, reed-swamp peat or oxidized organic matter. As with Ling Lane it is possible to use the fact that the dates form a stratigraphic sequence to constrain the calibrated age ranges, which would otherwise be large. A Bayesian analysis using OxCal v4.3.2 computer program of Bronk Ramsey (2008; 2009) and the IntCal13 atmospheric calibration curve (Reimer et al. 2013) gives the following outcome (Fig. 4.2).

The δ^{13}C values are perfectly normal for the type of organic sediments that were dated, and the position of the sampling site close to the margins of the lake argues against the presence of a hard water error. The fact there are rootlets in some of the samples is definitely a concern, however the large error term on many of the determinations possibly reduces the impact of any bias. Superficially there appears to be a problem in that two pairs of measurements (Hv-17824 and -17825; Hv-17822 and -17823), which are effectively indistinguishable in age despite, in the case of the latter pair, being vertically separated by 24 cm of sediment. However, the errors on the measurements are large, and as the Bayesian analysis demonstrates, the sequence of measurements is not out of place if the large error terms and the calibration curve are taken into account.

Based on comparison with other environmental profiles from the area, Hv-17824 may be several centuries too old, though this may be due to both the large error term and the thickness of the sample in relation to the horizon in the pollen stratigraphy that it dates (see Chapter 10). However, based on the consistency of the age-depth curve, the Bayesian model and the remaining palynological correlations the conclusion must be that the remaining measurements represent relatively good, albeit poorly resolved, age estimates for the material and the depositional event.

The second set consists of three measurements (two radiometric and one AMS radiocarbon determination) on organic material from pollen sequence F-1035, which was recorded from the section of trench AH, which contained dense concentrations of worked flint (Tables 4.27, 4.28).

Given that the samples were taken some distance from the edge of the lake, and the δ^{13}C values obtained are normal for the material sampled, it does not seem likely that a hard water error is a problem with any of these three measurements. There is also good agreement with common horizons in the dated pollen stratigraphy from AK87. All in all, in the absence of any

Table 4.25. *Radiocarbon measurements from pollen profile AK87, Flixton Site 1.*

Lab Code	Depth (cm)	Radiocarbon years BP	δ^{13}C (‰)	Material
Hv-17821	2–4	5300±85	-28.1	Peat
Hv-18296	13–15	5990±90	-27.2	Peat
Hv-17822	74–76	8710±215	-28.2	Peat
Hv-17823	98–100	8745±380	-28.8	Peat
Hv-17824	114–116	9395±215	-28.6	Gyttja
Hv-17825	118–120	9255±135	-28.5	Gyttja
Hv-17826	124–126	10,275±175	-27.1	Gyttja

Table 4.26. *Calibrated and modelled ages from pollen profile AK87, Flixton Site 1.*

	Before Bayesian analysis		After Bayesian analysis		
	68% probability	95% probability	68% probability	95% probability	Agreement index
Start boundary			*9940–9290*	*10,430–9260*	
Hv-17826 : 10,275±175	*10,460–9770*	*10,620–9400*	*9940–9290*	*10,430–9260*	71.4
Hv-17825 : 9255±135	*8630–8300*	*9120–8220*	*9140–8490*	*9230–8340*	60.8
Hv-17824 : 9395±215	*9120–8350*	*9290–8230*	*9040–8410*	*9100–8310*	109.2
Hv-17823 : 8745±380	*8350–7360*	*9130–6840*	*8470–8010*	*8660–7730*	105.2
Hv-17822 : 8710±215	*8190–7570*	*8350–7310*	*7890–7340*	*8120–7170*	89.6
Hv-17296 : 5990±90	*5000–4760*	*5210–4680*	*4950–4720*	*5200–4600*	99.3
Hv-17821 : 5300±85	*4240–4000*	*4330–3960*	*4320–4060*	*4340–3980*	96.8
End boundary			*4320–4060*	*4340–3980*	

information to the contrary, these three measurements may be accepted as reliable age estimates.

Flixton 9
These represent two radiometric determinations with quite large error terms from a pollen profile at the eastern end of the lake (VPCG) (Tables 4.29, 4.30).

The δ^{13}C values are acceptable for the dated material. Given the marginal position no hard water error is likely. Note the sample dated by Hv-17829 may represent mixed material with a potential time-width if the charcoal includes wood rather than purely coming from the remains of burnt reeds. Correlation with other, dated pollen profiles suggests that HV-17830 is too young, while Hv-17829 compares well with similar horizons recorded at other locations around the lake (see Chapter 9). Methodologically, there is little to choose between determinations Hv-17829 and -17830. However, the supporting environmental evidence is clear, with date Hv-17829 to be favoured over Hv-17830.

Deep Section – Profile D
Two AMS determinations on blocks of detritus mud (7 and 9 cm in thickness) from an area of deep organic sedimentation mid-way between Barry's Island and

Table 4.27. *Radiocarbon measurements from pollen profile F1035, Flixton Site 1.*

Lab Code	Depth (cm)	Radiocarbon years BP	δ^{13}C (‰)	Material
Hv-17827	15–17	6815±110	-27.8	Peat
Hv-17828	28–30	8340±105	-29.0	Peat
OxA-3734	49–51	8930±85	-27.7	Organic mud

Table 4.28. *Calibrated ages from pollen profile F1035, Flixton Site 1.*

Lab No. & ^{14}C age (BP)	68.2% probability (cal BC)	95.4% probability (cal BC)
Hv-17827: 6815±110	*5835–5620*	*5975–5530*
Hv-17828: 8340±105	*7530–7190*	*7580–7080*
OxA-3734: 8930±85	*8245–7965*	*8285–7790*

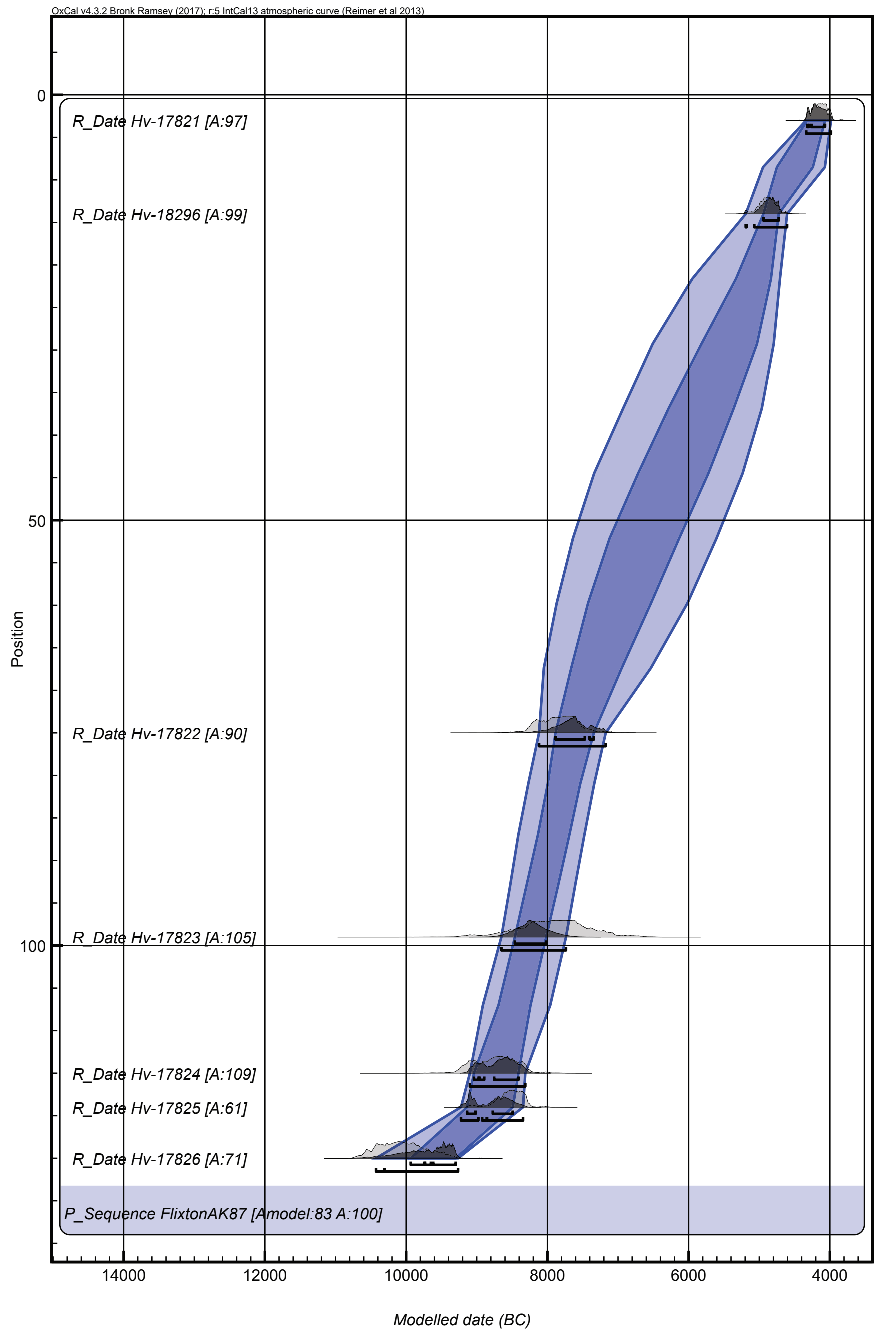


Figure 4.2. *Flixton AK87 Bayesian age model.*

Table 4.29. *Radiocarbon measurements from pollen profile VPCG, Flixton 9.*

Lab Code	Depth (cm)	Date BP	δ^{13}C (‰)	Material
Hv-17829	35–37	8755±210	-29.5	Humified, charcoal-rich peat
Hv-17830	40–42	8435±195	-28.6	Slightly clayey humified herbaceous peat

Table 4.30. *Calibrated ages from pollen profile F1035, Flixton 9.*

Lab No. & ^{14}C age (BP)	68.2% probability (cal BC)	95.4% probability (cal BC)
Hv-17829: 8755±210	*8190–7595*	*8435–7370*
Hv-17830: 8435±195	*7655–7175*	*8185–7030*

Table 4.31. *Radiocarbon measurements from pollen profile D.*

Lab Code	Depth (cm)	Radiocarbon years BP	$\delta^{13}C$ (‰)	Material
Beta-104479	202–209	5740±50	-30.1	Dark brown detritus mud with abundant remains of aquatic plants, monocotyledons, seeds including *Potamogeton* and insect remains
Beta-104478	321–330	8370±60	-29.7	Light brown detritus mud/marl with vegetative remains, molluscs and insect remains

Table 4.32. *Calibrated ages from pollen profile D.*

Lab No. & ^{14}C age (BP)	68.2% probability (cal BC)	95.4% probability (cal BC)
Beta-104479: 5740±50	*4680–4530*	*4710–4460*
Beta-104478: 8370±60	*7520–7355*	*7575–7195*

No Name Hill away from any archaeological activity (Tables 4.31, 4.32).

Correlation with other pollen profiles suggests that Beta-104478 is too old for the horizon it dates (Chapter 5). Given the distance from the margins of the lake, a potential hard water bias is to be anticipated unless careful sample selection focused on only vegetative remains that use carbon from the atmosphere and not the aquatic environment. In this case, as far as the records show, no such procedures were adopted. The presence of aquatic plants including *Potamogeton* (pondweed) in the samples, and the fact thick slices of organic mud matrix were included, means that the ^{14}C-depleted Dissolved Inorganic Carbon (DIC) of the lake is very likely to have had an effect on these samples. The type of chemical pre-treatment used in preparing the samples in the laboratory – in this case acid washes only – is unimportant. If a high proportion of the sample's vegetative matter took carbon from the lake when alive then an offset in the $\delta^{13}C$ values might be expected, but the reported $\delta^{13}C$ would seem to indicate this was small. This contrasts with Dark (née Day's) (1996a, 10–11) findings. She noted $\delta^{13}C$ values for marl of -0.5 and -0.7‰ whilst samples of mainly *Potamogeton* remains had values of -14.2 and -16.4‰. The ^{14}C age offsets which Day obtained were of the order of >1500 and 2000 years too old. In the case of profile D, no large $\delta^{13}C$ shifts to less negative values have occurred. The bias here is most likely due to the samples being of a mixed nature with some of the organic matter coming from sources that use atmospheric carbon whilst other organic matter has been using the DIC in the lake.

The second determination from this profile, Beta-104479, comes from the beginning of pollen zone 9. Again, comparison with other profiles suggests that this may be too old, though in this case the discrepancy may also be due to preferential preservation of the pollen of different taxa (see Chapter 5). Given the sample sediment description a hard water error is likely. But the magnitude of the bias is hard to quantify and may be relatively minor. The status of this measurement is best seen as inconclusive, it may be a valid age estimate but the associated environmental evidence to assess this is inconclusive.

No Name Hill

Two AMS determinations on single entities from test-pit NAZ on the north side of No Name Hill, less than five metres from the edge of the Early Mesolithic shoreline (Tables 4.33, 4.34). The type of material means there is no danger of a hard water effect. Chemical pre-treatment in the laboratory was by acid/alkali/acid, i.e. normal for these types of material. The $\delta^{13}C$ values are perfectly acceptable.

Table 4.33. *Radiocarbon measurements from pollen profile NAZ, No Name Hill.*

Lab Code	Depth (cm)	Date BP	$\delta^{13}C$ (‰)	Material
Beta-104486	9–10	8850±50	-25.8	*Corylus* nut
Beta-104485	33.5–36.5	9250±60	-28.7	*Betula* wood

Table 4.34. *Calibrated ages from pollen profile NAZ, No Name Hill.*

Lab No. & ^{14}C age (BP)	68.2% probability (cal BC)	95.4% probability (cal BC)
Beta-104486: 8850±50	*8200–7840*	*8220–7755*
Beta-104485: 9250±60	*8560–8345*	*8620–8305*

Table 4.35. *Radiocarbon measurements from pollen profile NAQ, No Name Hill.*

Lab Code	Depth (cm)	Date BP	δ^{13}C (‰)	Material
Beta-104483	154–6	9810±160	-29.7	peat
Beta-104482	164–6	9570±130	-28.1	peat

Table 4.36. *Calibrated ages from pollen profile NAQ, No Name Hill.*

Lab No. & ^{14}C age (BP)	68.2% probability (cal BC)	95.4% probability (cal BC)
Beta-104483: 9810±160	*9655–8915*	*9870–8760*
Beta-104482: 9570±130	*9175–8780*	*9275–8615*

There are also no grounds for doubting the validity of either of these measurements on the basis of the pollen stratigraphy, which agrees well with other dated profiles in the immediate area (see Chapter 11). Beta-104485 may have a degree of time-width depending on what specific part of a birch tree (roundwood, heartwood, outer-rings of the trunk) it came from but with birch such offsets are likely to be small. For discussion of a third age determination (Beta-104484), from a lower elevation position in this profile see discussion above.

Two further radiometric determinations were obtained from profile NAQ on the north side of No Name Hill, approximately 20 m from the edge of the Early Mesolithic lake shore (Tables 4.35, 4.36).

Both samples were given an extended counting time after undergoing an acid/alkali/acid pre-treatment suggesting carbon content was less than optimal. The δ^{13}C values are acceptable for peat samples.

In terms of the environmental context, both determinations appear too old for their position in the pollen stratigraphy. Beta-104483 is older than the measurements from a comparable horizon in profile NAZ (Beta-104485), just to the south. Whilst this may be due to the large error range and the thickness of the sample, it is also possible that the date is erroneously old, and therefore the question of whether there may be a hard water error affecting this sample needs considering. Emergent vegetation like reeds would not normally take their carbon from the DIC in the lake and so if the sample description is accurate a hard water bias seems highly unlikely. If, however, the fine organic matrix of the sample did include quantities of in-washed aquatic plant fragments then a bias may be present. Possibly the low carbon content implied by the longer counting times are influencing the result. There is a significant difference between Beta-104482 and Beta-104485 (X2-test: df=1 T=5.0 [5% T=3.8], Ward and Wilson 1978), but otherwise there is little reason to question this determination.

Beta-104482, has also produced a significantly older age in terms of the pollen stratigraphy. The larger error term perhaps points to measurement problems associated with small samples needing longer counting times.

Five AMS radiocarbon determinations from profile NM, approximately 50 m south of No Name

Table 4.37. *Radiocarbon measurements from pollen profile NM, No Name Hill.*

Lab Code	Depth (cm)	Date BP	δ^{13}C (‰)	Material
Beta-86147	12–13	6160±50	-27.9	peat
Beta-86146	70.1–71.2	8250±50	-28.5	peat
Beta-86145	109–110	8610±60	-28.1	peat
Beta-86144	156–156.6	11400±60	-15.1	wood
Beta-86143	155.5–157.1	11410±60	-11.7	*Potamogeton* seeds

Table 4.38. *Calibrated ages from pollen profile NM, No Name Hill.*

Lab No. & ^{14}C age (BP)	68.2% probability (cal BC)	95.4% probability (cal BC)
Beta-86147: 6160±50	*5210–5050*	*5285–4955*
Beta-86146: 8250±50	*7420–7175*	*7460–7080*
Beta-86145: 8610±60	*7705–7575*	*7785–7535*
Beta-86144: 11,400±60	*11,350–11,210*	*11,430–11,150*
Beta-86143: 11,410±60	*11,360–11,215*	*11,445–11,165*

Hill (Tables 4.37, 4.38). Beta-86144 may have been a single entity measurement. Precise details of the pre-treatment method have been lost (the measuring laboratory, Beta Analytic, have stated that all the old records were destroyed in hurricane Andrew in 1992), but the most likely treatment would have been either acid/alkali/acid washes (perfectly appropriate for the materials concerned) or acid only wash. Given the distance from the lake shore, were the samples to come from open water sediment layers then a hard water problem would be expected but once the hydroseral process reached reed swamp and emergent vegetation such errors would disappear.

There is clearly a problem with the basal two determinations (Beta-86143 and -86144). The δ^{13}C value for Beta-86143 indicates the seeds selected for dating came from living plants that, at least in part, got their carbon from the DIC in the lake. The effect is analogous to Day's (1996b, 10–11) findings from her deep core and the ^{14}C age is old. This determination can therefore be rejected as being biased by the hard water effect. Beta-86144 should, in theory, be immune from a hard water bias in that all trees are believed to use the terrestrial C_3 photosynthetic carbon pathway. However, the δ^{13}C value obtained (-15.1‰) suggests either (a) the sample was not wood; or (b) the sample is of a very mixed nature with some of the carbon coming from matter that takes up DIC from the lake. The δ^{13}C value is clearly demonstrating that this sample is not purely wood and has been biased by a hard water error and so Beta-86144 is not a reliable estimate for the age of the horizon.

The three upper samples have δ^{13}C values that indicate the material is as described in the sediment description, in which case there should not be a hard water problem. This is supported by the good agreement between the dated samples and the pollen stratigraphy. On this basis there would appear to be little grounds for doubting the validity of these measurements.

Flixton School Field (30 m from shoreline)

Six AMS determinations on bulk samples from a pollen profile FS96, recorded from Flixton School Field (trench OE) (Tables 4.39, 4.40). The trench was located approximately 30 m from the southern shore of the lake.

Given the distance from the lake margins, a hard water error is certainly a possibility in contexts that were deposited prior to the hydroseral infilling of the basin. Beta-94431 and -94432 are both too old in relation to their position relative to the pollen stratigraphy (see Chapter 13). Although the hard water bias appears to be affecting the ^{14}C age, like Beta-104478 from the Deep Section profile D, there is not a corresponding effect on the δ^{13}C values. This implies samples of a mixed composition where some of the organic matter is coming from sources that use atmospheric

Table 4.39. *Radiocarbon measurements from pollen profile F95, Flixton School Field.*

Lab Code	Depth (cm)	Date BP	δ^{13}C (‰)	Material
Beta-104481	262–264	9020±60	-28.4	Dark brown organic mud with extensive reed macrofossils and vegetative remains
Beta-104480	265–267	9030±60	-27.1	Dark brown organic mud with extensive reed macrofossils and vegetative remains
Beta-94434	268–269	9220±100	-29.2	Dark brown organic mud with extensive reed macrofossils and vegetative remains
Beta-94433	282.5–283.5	9900±100	-33.2	Dark brown organic mud with extensive reed macrofossils and vegetative remains
Beta-94432	297.5–299	10,230±100	-29.7	Dark brown organic mud with fewer reed macrofossils and vegetative remains
Beta-94431	303–305	11,430±100	-27.1	Brown organic silt

Table 4.40. *Calibrated ages from pollen profile F95, Flixton School Field.*

Lab No. & ^{14}C age (BP)	68.2% probability (cal BC)	95.4% probability (cal BC)
Beta-104481: 9020±60	*8300–8020*	*8325–7965*
Beta-104480: 9030±60	*8300–8210*	*8415–7965*
Beta-94434: 9220±100	*8550–8310*	*8710–8265*
Beta-94433: 9900±100	*9650–9255*	*9815–9210*
Beta-94432: 10,230±100	*10,200–9765*	*10,450–9455*
Beta-94431: 11,430±100	*11,425–11,210*	*11,505–11,140*

Table 4.41. *Radiocarbon measurements from pollen profile LAP, Barry's Island.*

Lab Code	Depth (cm)	Date BP	$\delta^{13}C$ (‰)	Material
Beta-94438	164–167	6140±60	-28.2	peat
Beta-94437	182.5–185	8850±50	-28.0	peat

Table 4.42. *Calibrated ages from pollen profile LAP, Barry's Island.*

Lab No. & ^{14}C age (BP)	68.2% probability (cal BC)	95.4% probability (cal BC)
Beta-94438: 6140±60	*5205–5000*	*5290–4905*
Beta-94437: 8850±50	*8200–7840*	*8220–7755*

carbon whilst others gain carbon from the DIC in the lake. The same may be true of Beta-94433, which also seems old in relation to the existing chronology for vegetation change in this area. Based on the high component of reeds in the sample, one might initially conclude that there was little chance of a hard water error being present. However, Beta-94433 was taken close to the boundary where open water deposits were replaced by emergent vegetation (at 285 cm) and so a mixing of aquatic and emergent vegetation cannot be ruled out. Like Beta-94431 and -94432, we are again seeing, perhaps, an older bias due to the mixing of atmospheric and DIC synthesized vegetative matter.

The upper three-radiocarbon measurements are probably valid age estimates. The high reed content of the sediment would negate any hard water effect and the chemical pre-treatment used, acid/alkali/acid, would be appropriate for the dated material.

Barry's Island

Two radiometric determinations from profile LAP at Barry's Island, a peninsula at the southeast end of the lake with evidence for both Early and Late Mesolithic activity (Tables 4.41, 4.42). The profile was recorded from deposits forming above a layer of sand within the peat, which is thought to have been deposited by a stream during the Mesolithic. The two dates bracket this sand layer.

The chemical pre-treatment was the appropriate one for peat; namely acid/alkali/acid. The $\delta^{13}C$ values are as expected for this sample material. A hard water error should not be a problem in that the overlying and underlying deposits which bracket the sand were made up of reed peat with sedge and reed vegetative remains (see Chapter 12). There is therefore little reason to doubt the validity of these two measurements which dates a phase of sand deposition.

Assessment summary

Archaeological samples

There are three basic questions when assessing the validity of archaeological samples:

1. Is the measurement a valid age estimate for the material being dated (i.e. did the laboratory apply the appropriate methods and get the correct age)?
2. Does the material relate to a particular event (e.g. death of plants which make up a peat horizon, growth rings of a single tree) rather than being of mixed origin and hence of potentially mixed age?
3. Is the dated event linked to human action and thus be archaeologically relevant?

This complicates any classificatory system, as a proliferation of options may result. The best dates would be valid age estimates with strong links to an archaeological event; the worst would be poor age estimates of no archaeological significance. Table 4.43 lists the different categories.

Table 4.43. *Categories of radiocarbon dates generated during the Seamer Carr and VPRT projects.*

Group 1: valid age estimate; good link to archaeological event	**Group 2**: valid age estimate; uncertain link to an archaeological event	**Group 3**: valid age estimate; poor link to an archaeological event
Group 4: uncertain age estimate; good link to archaeological event	**Group 5**: uncertain age estimate; uncertain link to an archaeological event	**Group 6**: uncertain age estimate; poor link to an archaeological event
Group 7: poor age estimate; good link to archaeological event	**Group 8**: poor age estimate; uncertain link to an archaeological event	**Group 9**: poor age estimate; poor link to an archaeological event

Table 4.44. *Categorization of the quality of the different radiocarbon dated samples for the Seamer Carr and VPRT projects associated with archaeological materials and events. (*These six determinations are classified here not because of their direct archaeological link but the fact that together they tightly constrain the age of the cultural material).*

Group 1: BM-1841R, HAR-6498, [CAR-875, CAR-876, CAR-877, SWAN-251, 252, -253]*	**Group 2**: CAR-195, CAR-1013, CAR-1014, CAR-1015, HAR-5241, HAR-5242, HAR-5789, HAR-5790, OxA-6318, OxA-6319, OxA-6328, OxA-8100	**Group 3**: CAR-841, OxA-6330, OxA-8045, OxA-8098, OxA-8099
Group 4: BM-2350	**Group 5**: CAR-196, CAR-197, CAR-928, CAR-1016, HAR-5238, HAR-5791, HAR-5794	**Group 6**: HAR-5243a&b, CAR-842, HAR-5787
Group 7: OxA-1030	**Group 8**: Beta-104484, Beta-104487, HAR-5236, HAR-5237, HAR-5240, HAR-5547, HAR-5792, HAR-5793, OxA-6329	**Group 9**: Q-66, HAR-5239

Using this set of nine categories the dated archaeological samples can be grouped as shown in Table 4.44.

Environmental samples

The environmental samples do not need to be linked to a human event. Hence there are three simple categories: (1) valid age estimates, (2) incorrect age estimates, and (3) determinations of questionable or debatable status.

Valid Age Estimates

Flixton 1 (AK87):	Hv-17821, -17822, -17823, -17825, -17826, -18296
Flixton 9 (VPCG):	Hv-17829
Flixton 2 (F1035):	Hv-17827, -17828, OxA-3734
No Name Hill (NAZ):	Beta-104485, -104486
No Name Hill (NM):	Beta-86145, -86146, -86147
Flixton School (FS):	Beta-94434, -104480, -104481
Barry's Island (LAP):	Beta-94437, -94438

Incorrect Age Estimates

Flixton 1 (AK87):	Hv-17824
Flixton 9 (VPCG):	Hv-17830
Profile D:	Beta-104478
No Name Hill (NAQ):	Beta-104483
No Name Hill (NM):	Beta-86143, -86144
Flixton School (FS):	Beta-94431, -94432, -94433

Determinations of Questionable or Debatable Status

Deep Section – profile D:	Beta-104479
No Name Hill (NAQ):	Beta-104482

Discussion

It is probably fair to conclude that the Seamer Car Project and VPRT's radiocarbon dataset from 1976–1997 is typical of the chronological approach adopted by archaeological projects of this time period (Bayliss 1998; 2009). Some aspects have been well dated, in some instances particularly well, but others are not so well dated. Looking at the archaeological dating aspects first, the paucity of short-lived samples (which had not been chemically consolidated), which can be tied directly to human activity meant a reliance on contextual associations that have not always turned out to be secure. The near absence of unconsolidated humanly-worked organics placed a heavy reliance on natural samples (peats and wood charcoal) that do not in themselves reflect human events. It is only their *association* with lithic scatters that give them relevance. For this reason, considerable attention was given to dating proxy measures, such as clearance events in the pollen record and microscopic reed charcoal peaks, that indirectly mark the actions of the past inhabitants of the area. To a point this is valid, but the problem of not being able to tie specific vegetation-impact events to particular activity horizons on individual archaeological sites limit the significance of such dating. A generalized chronology for the archaeology and the changing environments is established (Cloutman and Smith 1988; Dark 2000; Dark et al. 2006; Mellars 2009) but this is different to a Bayesian-derived absolute chronology that is precise within a scale of human lifetimes and generations (Bayliss 2009; Bayliss et al. 2018). The Seamer Car Project and VPRT's dating programme significantly adds to the general chronology by bringing in evidence from many new sites like Flixton, Seamer Carr (sites C, K, N), Barry's Island and No Name Hill, but it does not greatly enhance the Bayesian chronological framework.

In terms of the environmental aspects, some of the dating undertaken by the Vale of Pickering Research Trust was of the highest standard, signposting what could be achieved. Whilst the lake margin localities can have localized problems, there are numerous sites where continuous organic sedimentation provide high quality dating sequences. The lake centre is more problematic due to hard water (freshwater reservoir) effects, and there has been much less subsequent focus on these environments.

All in all, the ^{14}C determinations made by the Seamer Carr Project and the Vale of Pickering Research Trust were a necessary step in the process of better understanding the chronology of the Star Carr embayment. The strategy of sample selection was typical of the approaches of the time. Subsequent methodological improvements have cast some results in a poor light, however others produced by the two projects can now be seen as having been of ground-breaking significance, representing markers to future research. The overall impression is a dataset that was of its day, some parts stand up very well to modern scrutiny while others merely highlight localities that would benefit from fresh investigations should an opportunity arise.

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Addendum

An extra eight ^{14}C determinations have been included in this chapter but are not discussed herewith in. Two dates from Seamer Carr Site C (Tables 4.1, 4.2: CAR-896 and CAR-895), and six dates from Seamer Carr Site K (Tables 4.3, 4.4: CAR-878 to CAR-883). These age determinations were comprehensively reported by Cloutman (1988a, 1988b) in connection with his pollen analytical and palaeoenvironmental studies. But the fact they closely relate to two of the excavated archaeological sites in this monograph (Seamer Carr Sites C and K) means inclusion here is worthwhile. Specifically, the calibrated age ranges in this chapter help in better understanding peat formation rates on the two sites.

Note

1. This chapter was finalised in 2018. Newer versions of the OxCal programme have since need issued, but owing to editorial oversights it was not possible for the author to update this chapter using the latest iteration in time to meet the publication deadline.

Chapter 5

The environmental setting

Gaynor Cummins, Jim Innes, Ian Simmons & Barry Taylor

This chapter describes palaeoenvironmental investigations that were undertaken by the VPRT to establish the environmental setting of Lake Flixton, and to provide context for the site-specific studies that are documented in the following chapters. Though further work has since been undertaken around the lake, this will not be discussed here, but will be integrated in the final discussion chapter.

The Lake Flixton basin had been the focus of extensive programmes of palaeoenvironmental investigation prior to the work of the VPRT. Following the initial identification of the lake by Moore (1951), and publication of an early pollen profile for Flixton Island (Godwin 1949), large-scale surveys of the lake basin were conducted by Donald Walker and Harry Godwin as part of Grahame Clark's work at Star Carr (Walker and Godwin 1954). Auger transects were taken through parts of the basin, recording the sequence of calcareous and organic deposits that had formed within the lake, and pollen and plant macrofossil analysis was used to reconstruct the local vegetation. This work showed that the lake had formed at the start of the Windermere Interstadial, with the environmental sequence spanning the Interstadial, the subsequent Loch Lomond Stadial, and the early part of the Holocene (Walker and Godwin 1954). The Interstadial deposits consisted of calcareous muds, with pollen and macrofossils indicating the presence of aquatic and emergent vegetation within the lake, whilst the surrounding landscape was gradually colonized by areas of woodland (Walker and Godwin 1954, 64–65). The formation of the calcareous muds was interrupted by the deposition of a layer of sand and gravel, which was thought to have derived through solifluction during the subsequent Loch Lomond Stadial (Walker and Godwin 1954, 36). The start of the Holocene was marked by a resumption in the formation of calcareous deposits within the basin as the warming climate allowed wetland plants to colonize the lake (Walker and Godwin 1954, 66). The growth of wetland vegetation then led to the accumulation of organic sediments (detrital muds and peats), and the lake began to shallow. This in turn allowed a sequence of swamp, fen and carr environments to expand into the basin, gradually reducing the areas of open water (Walker and Godwin 1954, 68).

A more detailed survey of the palaeogeography and palaeoecology of the lake was undertaken by Edward Cloutman as part of the Seamer Carr Project (Cloutman 1988a, 1988b). Close interval auger surveys were carried out around the Seamer Carr area, creating a high-resolution plan of the buried Late Glacial and Early Holocene land surface, whilst the topography and stratigraphy of the western end of the lake, and some of the deeper parts of the basin, were recorded through a series of more widely spaced auger transects (Cloutman 1988a). A chronology for the formation of these deposits within the lake margins and over the adjacent areas of higher ground was also established by radiocarbon dating the basal calcareous and organic deposits where they formed above the basal geology (Cloutman 1988a). Finally, pollen profiles were recorded from the deposits adjacent to several of the archaeological sites (Fig. 5.1), which were brought together with the peat stratigraphy to produce a record of the changing character of the environments in the Seamer area (Cloutman 1988b).

The topographic surveys revealed a complex and undulating landscape along the northern edge of the lake consisting of low hills, peninsulas, and several shallow embayments (see Cloutman 1988a). The palaeoenvironmental sequence began at the latter stages of the Windermere Interstadial, with a pollen profile from a layer of organic sediment at Site K (Profile K2), indicating a relatively open environment with grasses and herbs present amongst populations of shrubs (Cloutman 1988b, 34) (Fig. 5.2a). Organic sediments began

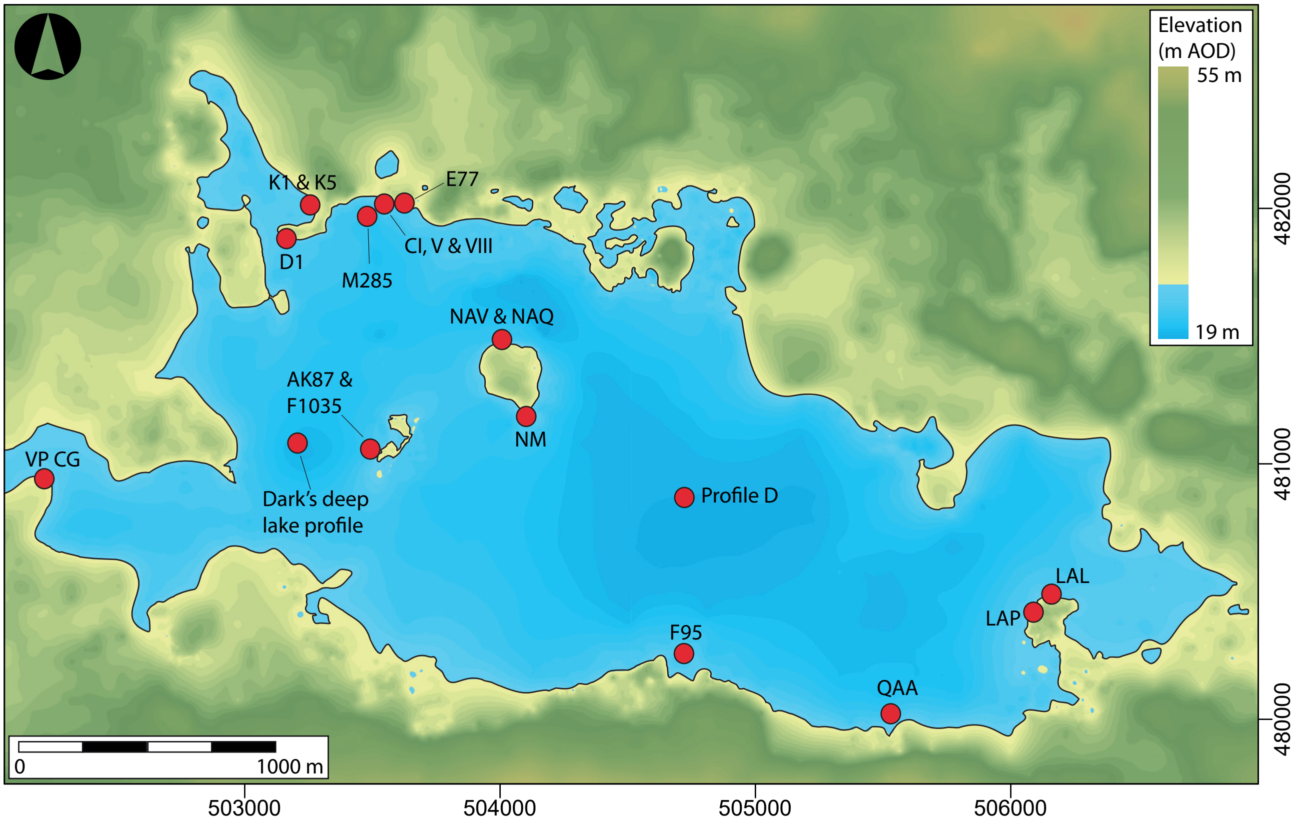

Figure 5.1 *(above). Location of pollen profiles recorded around Lake Flixton as part of the Seamer Carr Project and the VPRT, and Dark's Deep Lake Profile (level of the lake shown at 24 m AOD).*

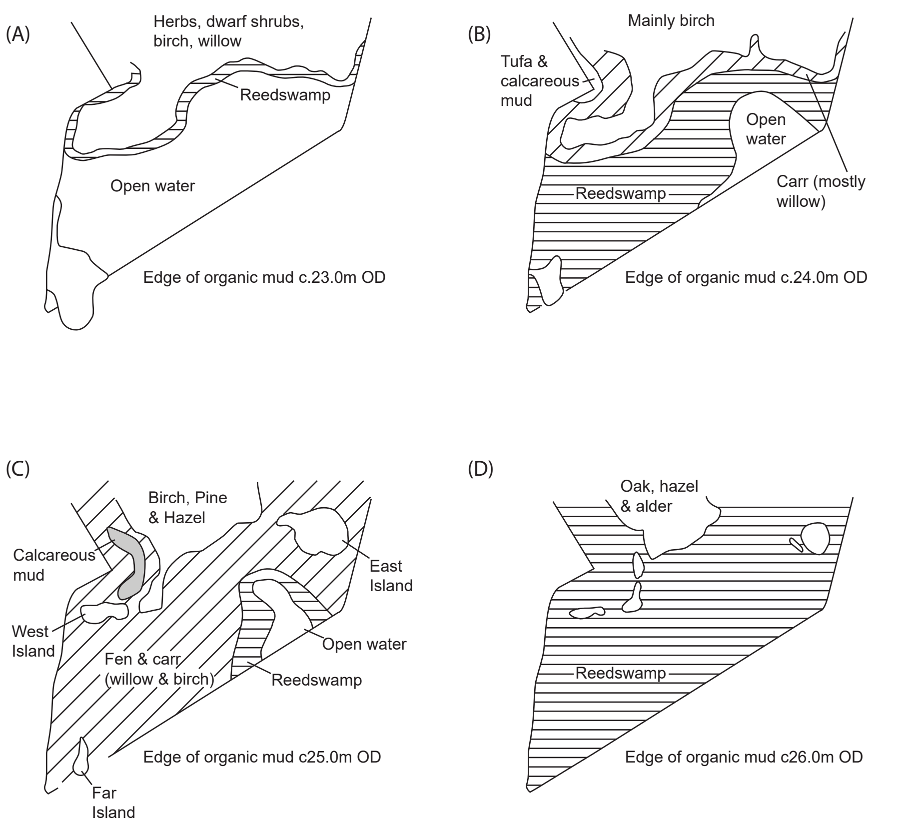

Figure 5.2 *(left). The changing environments at Seamer Carr (after Cloutman 1988b, fig. 7).*

to accumulate at the edge of the lake at the Holocene transition as a thin band of reedswamp formed along the shore, and calcareous muds (marl) accumulated in open water to the south (Cloutman 1988b, 34), while a largely open environment was present on the dry ground (Cloutman 1988b, 24). Reedswamp quickly became more established, forming extensive beds of vegetation to the south of the Seamer Carr sites, before gradually being succeeded by fen and carr (Fig. 5.2b-c). At the same time, a suite of tree species became established on the dry ground, leading ultimately to the development of broadleaf deciduous woodland (Cloutman 1988b, 35). Throughout this period organic sediments were encroaching onto previously dry ground, a process that gradually isolated several of the low hills and peninsulas from the mainland. This was initially thought to have been driven by a gradual rise in lake level (Cloutman 1988a, 15), though subsequent research has shown that it resulted from water-logging of the mineral sediments above the shore (Taylor 2019, 570).

A significant rise in the level of the lake during the Late Mesolithic caused a slight reversal in the hydrosere, with reedswamp replacing the areas of fen and carr that had formed in the lake margins (Cloutman 1988b, 35, though see Taylor 2019) (Fig. 5.2d). These environments persisted till around the middle of the sixth millennium cal BC (5735–5475 cal BC, 6680±90 CAR-894), when a subsequent fall in lake level caused the organic deposits to dry out (Cloutman 1988b, 35). A corresponding increase in levels of macro-charcoal and pollen of plants characteristic of open and broken ground, suggested that areas of woodland and marginal vegetation at Seamer Carr were being disturbed, possibly through deliberate burning, during this period (Cloutman 1988b, 27–28).

Whilst Cloutman's work provided a far more detailed record of the environmental history of the area, there were a number of limitations. First, very few of the pollen profiles at Seamer Carr were dated, making it difficult to relate the changing character of the local environments to the phases of human activity recorded in the area. Second, although episodes of vegetation disturbance were noted, many of the profiles were analysed at relatively low resolution and were unlikely to detect evidence for the impacts of human activity on either the woodland or wetland environments. This latter point was particularly significant, as work on upland environments had suggested that Mesolithic groups were deliberately modifying their local environments (Jacobi et al. 1976; Simmons and Innes 1987, 1996; Bush 1988; Innes et al. 2010).

From 1986 to 2000 palaeoenvironmental work carried out by the VPRT aimed to establish both the environmental context of human activity around the lake, and the potential impact that this activity may have had upon the local vegetation, by recording pollen profiles close to several of the main archaeological sites (Fig. 5.1). The results of this work are given in the relevant chapters which follow. In order to properly interpret these site-specific studies, it was also necessary to establish a regional record of vegetation history by recording an additional pollen profile (Profile D) from the deepest part of the lake basin, as far away from the lake shore, and the known areas of human activity, as possible (Fig. 5.1). The pollen from this profile would not be affected by the localized wetland vegetation successions that occurred closer to the edge of the lake, and would be more representative of the wider landscape. Coring took place in mid-August 1995, and the results are presented in this chapter.

Profile D – The regional pollen profile

The sediments were retrieved using a Russian Corer in 0.5 m segments, taken from proximal holes, and with 5 cm overlap at each end. Though the entire sequence of deposits was retrieved, the first (upper) 2.0 m were not sampled for pollen as it consisted of dry, highly decomposed peat. Depths were measured from the ground surface, which was levelled to a datum of 24.89 m AOD. The lithostratigraphy of the profile is shown in Table 5.1.

Pollen analysis

Subsamples for pollen analysis were taken at intervals of 1–8 cm throughout the profile (see Chapter 3 for processing and analytical methods). The sampling interval was based on pollen concentrations and periods of archaeological interest. The pollen diagram (Fig. 5.3) has been divided into nine local assemblage zones (prefixed D), as follows:

LPAZ D-1 620–660 cm
Poaceae-*Betula*-Cyperaceae-*Artemisia*

Clay deposits give way to silty marls containing low concentrations of pollen. The dominant pollen taxa are Poaceae (grasses), *Betula* (birch) and Cyperaceae (sedge family) along with a range of other shrubs and herbs, of which *Salix* (willow) and *Artemisia*-type (mugworts) are the most abundant. *Juniperus* (juniper) appears toward the end of the zone. Poaceae dominates the assemblage at between 40% and 50% of total land pollen (TLP), and total herbaceous pollen consistently contributes about 60%. A suite of herb/ruderal taxa peak in this zone, its most prominent members being *Artemisia*-type, *Helianthemum* (rockrose), *Rumex* (dock/sorrel), *Thalictrum* (meadow rue) and *Plantago maritima* (sea plantain). Microcharcoal frequencies are high.

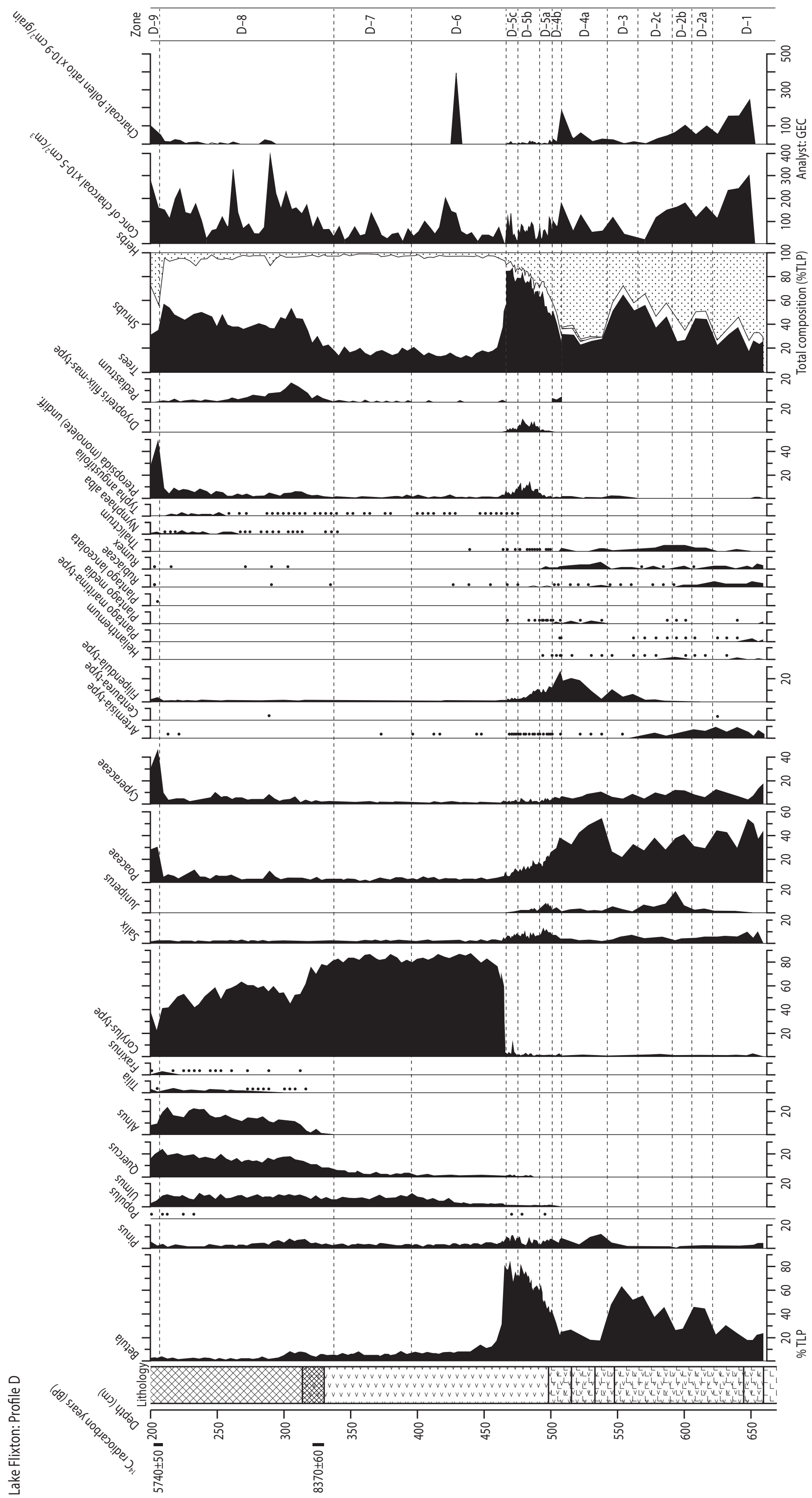

Figure 5.3. *Pollen Profile D, Pollen Diagram.*

Table 5.1. *Lithostratigraphy of Profile D*

Depth (cm)	Description
195–314	Dark brown detritus mud with abundant remains of aquatic plants, monocotyledons, fruit including *Potamogeton* (pondweed) and insect remains.
314–330	Light brown detritus mud/marl with vegetative remains, molluscs and insect remains.
330–468	Brown/olive to dark olive marl with vegetative remains, molluscs and insect remains.
468–499	Pale olive marl with dense vegetative remains including Poaceae/Cyperaceae fragments and insect remains.
499–516	Pale olive to olive silty marl with some vegetative and insect remains.
516–534	Grey-olive clayey marl.
534–538	Grey-olive silty/clayey marl with occasional gravel.
538–545	Grey-olive silty clay with gravel.
545–548	Olive silty/clayey marl with occasional gravel.
548–645	Pale olive silty marl.
645–660	Olive silty/clayey marl.
660–670	Grey-olive silty/clay.

LPAZ D-2 564–620 cm
Betula-Poaceae-Cyperaceae
Three different subzones are identifiable.

D-2a 604–620 cm
Betula-Poaceae-*Artemisia* Subzone
Betula frequencies rise to almost 50%, mainly replacing Poaceae. *Salix*, Cyperaceae and *Artemisia*-type remain unchanged, while *Juniperus* values increase. Ruderal weed pollen frequencies are reduced, and microcharcoal values also fall.

D-2b 590–604 cm
Juniperus-*Thalictrum* Subzone
Betula frequencies fall to about 30%, while *Juniperus* values rise sharply to 18%. *Salix*, Cyperaceae and *Artemisia*-type percentages are unchanged. Poaceae rises and there is a peak of *Thalictrum*. There is an increase in ruderal weed taxa, primarily *Helianthemum*. Microcharcoal frequencies recover slightly.

D-2c 564–590 cm
Betula-*Juniperus*-*Filipendula* Subzone
Betula frequencies rise steadily through the subzone, peaking at about 50%, while *Juniperus* declines but is still important. Poaceae remains in high values. *Salix* and Cyperaceae are unchanged, but *Artemisia*-type declines. *Filipendula* (meadowsweet) becomes recorded, while microcharcoal percentages fall gradually to low values. Open ground ruderal weeds occur only sporadically.

LPAZ D-3 542–564 cm
Betula-Poaceae-*Filipendula*
Betula dominates the assemblage, rising to 60% of TLP. *Salix* is unchanged but *Juniperus* falls to low values. Poaceae and Cyperaceae contribute most of the non-arboreal pollen, but *Filipendula* increases to 10% of TLP. Few other herb types are present, with *Artemisia*-type almost ceasing to be recorded. Microcharcoal percentages are low.

LPAZ D-4 500–542 cm
Poaceae-*Filipendula*
This zone has been divided into two subzones

D-4a 507.5–542 cm
Poaceae-*Filipendula*-*Rumex* Subzone
Betula frequencies fall to about 25% of TLP, and there is a rise in *Pinus* (pine) values to almost 20%. Poaceae rises to over 50% of TLP and there is a sharp increase in *Filipendula* and a rise in *Rumex*. All other taxa are present in low values, although *Plantago media* (hoary plantain) is prominent. Microcharcoal values remain low.

D-4b 500–507.5 cm
Poaceae-*Filipendula* Subzone
Poaceae still dominates the assemblage at 40% of TLP, but *Filipendula* rises to peak values of almost 30%. Arboreal pollen frequencies remain low, with *Betula* still the major contributor. Sporadic records of open ground weeds occur, with a small peak of *Pediastrum* (green algae). Although still low, microcharcoal values show small peaks.

LPAZ D-5 465.5–500 cm
Betula-*Dryopteris filix-mas*
The zone can be further subdivided into three subzones D-5a to 5c.

D-5a 490.5–500 cm
Betula-*Filipendula* Subzone.
Betula rises to over 50% of total land pollen, and small increases occur in *Salix* and *Juniperus* as total arboreal pollen reaches over 60%. The start of a continuous *Ulmus* (elm) curve is recorded. Poaceae and *Filipendula* both decline sharply in value but still contribute most of the non-arboreal pollen. Sporadic records of open ground herbs occur, and microcharcoal values are very low.

D-5b 474.5–490.5 cm
Betula-*Dryopteris filix-mas* Subzone
Betula continues to increase, reaching 80% of TLP. *Salix* values remain unchanged, although *Juniperus* falls to very low percentages. Continuous curves for *Ulmus*

and *Quercus* (oak) are recorded. Non-arboreal pollen values are very low, mainly contributed by Poaceae and *Filipendula*. Occasional records of open ground herbs still occur. Peaks of Pteropsida (undifferentiated ferns) and *Dryopteris filix-mas* (male fern) are recorded, while microcharcoal frequencies remain very low.

D-5c 465.5–474.5 cm
Betula Subzone

The assemblage is dominated by *Betula*, at 85% of TLP. *Pinus* rises slightly, *Salix* is unchanged, and *Corylus*-type (hazel) joins *Ulmus* and *Quercus* in being consistently present in very low frequencies. *Juniperus* ceases to be recorded. Microcharcoal values remain very low.

LPAZ D-6 394–465.5 cm
Corylus-Ulmus

Corylus-type pollen frequencies rise very sharply to dominate the assemblage at 85% of TLP, with *Betula* and *Ulmus* contributing most of the rest of the arboreal pollen. *Ulmus* rises in the upper half of the zone. *Salix* falls to very low frequencies. Herb pollen values are very low indeed. Microcharcoal percentages are very low except for a sharp peak in mid-zone.

LPAZ D-7 336–394 cm
Corylus-Ulmus-Quercus

Corylus-type continues to dominate the assemblage at about 85% of TLP. *Ulmus* and *Quercus* percentages increase. Herb pollen types are almost absent, and microcharcoal representation is very low.

LPAZ D-8 206–336 cm
Corylus-Quercus-Alnus-Ulmus

The assemblage is dominated by pollen of deciduous trees and shrubs, with *Corylus*-type still most abundant at 60% of TLP. *Quercus* and *Alnus* (alder) rise to high values and *Ulmus* remains unchanged. A continuous *Tilia* (lime) curve occurs later in the zone, and *Fraxinus* (ash) increases towards the top. Poaceae and Cyperaceae percentages rise slightly, while Pteropsida also increases. *Nymphaea alba* (white water-lily) occurs, and increases at the top of the zone along with *Typha angustifolia* (lesser bulrush). A peak of *Pediastrum* algae occurs early in the zone. Microcharcoal values remain very low.

LPAZ D-9 200–206 cm
Cyperaceae-Poaceae-Pteropsida

Tree and shrub frequencies fall sharply in this zone, although they still contribute about 60% of TLP. There are sharp increases in Poaceae and Cyperaceae values, but few other herb pollen types occur. A sharp peak in Pteropsida occurs, and there is a small rise in microcharcoal frequencies.

Dating

Two samples were submitted for radiocarbon dating with the following results (Table 5.2). Full details of calibration methods can be found in Chapter 4.

The first radiocarbon date obtained for this profile, 7575–7195 cal BC (8370±60 BP, Beta-104478) occurs just after the initial rise in *Alnus* pollen. However, this seems very early compared with dates from comparable horizons in profiles recorded by Dark (1998b; Day 1996b), which placed it at 6590–6430 cal BC (7640±45 BP, OxA-4042), and by the present authors at other sites around the lake. As noted in Chapter 4, this is probably due to the effects of hard water error.

The second determination from this profile, Beta-104479, comes from the beginning of pollen Zone D-9 and may document the first evidence for the elm decline from the region (though this requires further research for clarification). The decline has been dated here to 4710–4460 cal BC (5740±50 BP, Beta-104479), a date which is potentially too old, though the decrease in *Ulmus* pollen could also be attributable to preferential deterioration of its grains. It is worth noting that a high Pteropsida peak (as seen at this point in the profile) is often indicative of poor preservation of pollen grains. As with Beta-104478, this sample may have been affected by hard water error (for additional comments, on these issues, see Housley, Chapter 4).

Interpretation

This section offers an interpretation of Pollen Profile D, with particular reference to its implications for understanding regional vegetation changes.

Table 5.2. *Radiocarbon dates for Pollen Profile D.*

Lab No.	Depth (cm)	Radiocarbon years BP	$\delta^{13}C$ (‰)	Calibrated age (cal BC)	Material
Beta-104479	202–209	5740±50	-30.1	4710–4460	Dark brown detritus mud with abundant remains of aquatic plants, monocotyledons, seeds including *Potamogeton* and insect remains
Beta-104478	321–330	8370±60	-29.7	7575–7195	Light brown detritus mud/marl with vegetative remains, molluscs and insect remains

D1-D3 Late Windermere Interstadial

Deposition in this profile commenced as the climate ameliorated during the Windermere Interstadial. Birch scrub with scattered willow started to spread gradually over the landscape, although there were still large tracts of open land and areas with pioneer herb vegetation. Pollen concentrations are extremely low reflecting the low productivity of the lake and high erosion rates. Gradually, as the climate became increasingly warm and soils started to stabilize, a closed grassland/scrub community was able to develop in some areas.

By Zone D-2 birch scrub had developed into open woodland with willow and juniper, although the herb values suggest that more open environments with areas of disturbed ground persisted within the landscape. Juniper scrub replaced willow and birch woodland in D-2b, after which there was an increase in areas of open ground allowing space for species such as meadow-rue and rock-rose to expand, before birch became re-established in D-2c. This pattern of a short-lived expansion in juniper followed by increases in open and disturbed ground is a feature noted from several Late Glacial sites in Britain (Walker 1995), and in North Yorkshire examples of this feature occur at Gransmoor in Holderness (Walker et al. 1993) and at Mill House in the Vale of Mowbray (Innes et al. 2009), as well as being recorded by work undertaken by Dark in Lake Flixton (Dark 1998b). The decline in juniper is generally thought to relate to climatic changes in the early stages of the Interstadial (e.g. Walker and Harkness 1990), probably corresponding with GI1-d in the NGRIP ice-core record (Tweddle 2001; Innes 2002a; Innes et al. 2009), which dates to *c*. 12,000 cal BC (Rasmussen et al. 2014)

Birch woodland became re-established in Zone D2-c and was present across much of the landscape throughout much of D3. Though areas of open ground persisted, these were probably much reduced, and there is little evidence for disturbed ground. The sharp increase in tree pollen and corresponding decline of herb communities in the middle of the zone is possibly the result of a warmer episode at the close of the Interstadial (Walker 1995; Tweddle 2001). This was then followed by a decline in birch woodland coinciding with an increase in mineral inputs (gravel) into the sediment. Similar records have been identified regionally (e.g. Tweddle 2001; Innes 2002a; Innes et al. 2009), and correspond to a cooling event at the end of the Interstadial (GI-1b) dated to *c*. 11,300 cal BC (Rasmussen et al. 2014).

Throughout the whole of the Interstadial, microcharcoal concentrations are very high with peaks occurring during periods of more open environments, a feature that has also been noted in other records for this period (Edwards et al. 2000; Innes et al. 2009). Bos and Janssen (1996) have attributed similar Late Glacial microcharcoal peaks at Milheeze in the Netherlands to the activities of hunter-gatherer communities. Adopting such an interpretation here would imply that the human presence around the lake in the Late Glacial was much more intense or significant than throughout many periods of the Holocene, which is not borne out by the archaeology (Conneller 2007; Conneller et al. 2015). Alternatively, the microcharcoal deposition may be linked to natural fires within the landscape. High microcharcoal concentrations before the Holocene are a feature of many pollen diagrams (e.g. Behre 1988; Van Geel et al. 1989; Maenza-Gmelch 1997), and could be interpreted as natural in origin, caused by complicated weather conditions during a phase of rapidly changing climate (Whitlock et al. 2010; Williams et al. 2016). During the Windermere Interstadial, the Vale of Pickering would have had a much more continental climate as sea levels were much lower, and fires would be a possibility, as they would also be during the arid Loch Lomond Stadial (Edwards and Whittington 2000; Innes et al. 2009). Given that humans were present in the landscape during the Interstadial (see Chapters 6 and 7) it remains possible that some of the fires were of anthropogenic origin, but they were unlikely to have caused the significant levels of microcharcoal observed in this record.

D4: The Holocene transition

The climatic deterioration into the Loch Lomond Stadial at the start of D4-a is shown by increased minerogenic sediment and decreased tree concentrations. The pollen record shows that vegetation had reverted back to an open, disturbed grassland lacking in thermophilous species. Dwarf birch may be the source of some of the *Betula* pollen, as macrofossils of this species were found in Early Holocene deposits at Star Carr (Dark 1998c), although some tree species of birch might have survived in favoured locations.

The increasing levels of *Betula* pollen in Zone D4-b, along with the peak in *Filipendula*, mark the subsequent amelioration of the climate, suggesting the onset of the Holocene. This has been dated locally to 10,055–9325 cal BC (Blockley et al. 2018, table S6; Taylor et al. 2018a). Ruderal taxa were still present, indicating areas of disturbed ground, but these were being colonized by grasses and herbs while areas of birch, willow and juniper scrub were probably becoming established. Small peaks in microcharcoal could reflect the presence of human groups in this landscape.

D5-9: The Early Holocene

Birch woodland expanded across the landscape, largely replacing areas of willow and juniper scrub by the top of D-5a, with male fern becoming the dominant component of the understorey in D5-b. However, a suite of ruderal and herb taxa was also present during the whole of Zone D-5, indicative of a mosaic of communities in the open woodland understorey. By Zone D-5c hazel was present in the landscape, an event dated locally to 9135–8315 cal BC (9385±115, OxA-4376) (Dark 1998c, 132). Microcharcoal concentration levels suggest several periods of fire activity within the catchment throughout this zone.

Hazel began to rapidly replace birch from the start of Zone D-6 (its pollen attaining values of 75–80% of the TLP), with birch probably persisting in the wetter parts of the landscape where it was able to grow alongside willow. Elm also began to spread into the area, with more sporadic occurrences of oak, though the latter became more abundant in Zone D-7. The development of the denser canopy in both zones was to the detriment of the diverse understorey, with male-fern, grasses and sedges all declining as the woodland became more closed.

Alder rapidly became established in Zone D-8, probably reflecting the formation of carr environments on the increasingly terrestrial wetlands around the edges of the basin. The date of the alder rise in this profile is thought to be erroneously old, and should probably be closer to the ages established by Dark of 6655–6270 cal BC (7640±85, OxA-4042) (Dark 1988b, 170; Day 1996b, 17) or from No Name Hill (5295–4945 cal BC, 6160±50, Beta-86147) (see Chapters 11 and 19 for further discussion). Woodland diversity increased slightly with the presence of lime and ash, possibly due to episodes of canopy disturbance. Wetland vegetation, (white water-lily and lesser bulrush) became more established in the immediate area of the pollen profile, coinciding with the shift to organic sedimentation.

By Zone D-9 wetland plant communities were probably established in all but the very deepest parts of the lake. It is unlikely that the environment was as open as suggested by the pollen diagram and the high percentages of Poaceae and Cyperaceae may be attributed to the influx of pollen from the local hydrosere succession. The beginning of the zone may document the first evidence for the elm decline from the region, though this requires further research as the decrease in this species could also be attributable to preferential deterioration of its pollen grains, or a pre-elm decline phase of local woodland disturbance. Furthermore, the date obtained for the top of the profile, 4710–4460 cal BC (5740±50 BP, Beta-104479) is potentially too old if the pollen actually does register the elm decline.

Discussion

The purpose of locating Profile D in the centre of the lake basin, as far from the edges of the lake as possible, was to provide a vegetation history that was regional rather than local in nature (Jacobsen and Bradshaw 1981), its pollen record being derived from the area around Lake Flixton as a whole and not dominated by the localized wetland vegetation successions that occurred at individual sites near the edge of the lake. With a much greater pollen source area it would, therefore, be more representative of the vegetation history of the wider landscape and would provide a template against which to compare and evaluate pollen data from the other sites recorded in this volume. Other, previously published, pollen cores from areas of the lake away from its margin can be used to validate and qualify the data from Profile D, and together provide a secure understanding of vegetation history in the eastern Vale of Pickering. These include the cores of Dark (1998b; Day 1996b) and of Walker and Godwin (1954), both of which were from deep sediments, well away from the lake shore, Dark's between Star Carr and Flixton Island, and Walker and Godwin's between Star Carr and the southern edge of the lake. Both are close to the western end of the lake, sited to be near to Star Carr, whereas Profile D in the lake centre to the east of Flixton Island provides information from the previously neglected eastern part of the lake basin.

Though not confirmed by radiocarbon dating, the deepest and oldest parts of Profile D clearly cover much of the Late Glacial, and should provide a regional vegetation history for that period around Lake Flixton. The Loch Lomond Stadial is recognized in Profile D, as it is in Dark's (1998b) profile. Before the Stadial, both cores are similar in recording fluctuations in temperature-sensitive taxa such as mugworts, juniper and species of meadowsweet that must reflect low-amplitude climatic changes, including significant periods of climatic deterioration. These fluctuations correspond to the event stratigraphy for the Late Glacial recognized in the Greenland ice-core data (Rasmussen et al. 2014). Interpretation of the Late Glacial sequence at Profile D is not straightforward, as the lithology and pollen stratigraphy are difficult to correlate in terms of cold and warm phases. Nevertheless, the similarities between Profile D and Dark's data suggest that the Late Glacial vegetation history of the Lake Flixton area as a whole (Profile D) was similar to that of the Star Carr area of the lake. These two cores can therefore be used as templates with which to compare the local pollen records from sites located around the margins of the lake. An interesting difference between Profile D and Dark's is the greater presence of microcharcoal in the former, during both the Late Glacial and the Holocene. Perhaps the more regional source area of Profile D in the centre of Lake Flixton accounts for this, with burning occurring in the central and eastern areas around the lake when it was not in the area around Star Carr.

The transition from the Late Glacial to the Holocene, and the development of the vegetation in the Early Holocene at Profile D, follows the usual pattern of succession to birch woodland, followed by the immigration of thermophilous trees, until a mixed oak forest was achieved by the Middle of the Holocene (Innes 2002b). The composition of the forest, with elm, oak and alder replacing hazel, is very similar at both Profile D and Dark's core, suggesting that the woodland was very similar across this landscape. Although Profile D extends almost a millennium further into the Holocene, it almost certainly falls short of the mid-Holocene elm decline, but provides a good template for the other pollen stratigraphies in the Vale. It also differs from Dark's core in that very little microcharcoal occurs at Profile D in the latter part of the Mesolithic, while Dark (1998b, 171) recorded a massive macro- and microcharcoal presence after *c*. 6300 cal BC in the area near Star Carr (see Dark 1998b, figs. 14.1b and 14.2). Differences in fire history must have occurred in different parts of the area around the lake. In conclusion, Profile D fulfilled its aim of providing a regional, long pollen record that records vegetation history from the whole of the area around Lake Flixton, rather than only from the western end, and provides a template with which records from sites in the central and eastern areas of the lake margin can be compared.

Chapter 6

Seamer Carr, Site C – East Island

Paul Lane, Barry Taylor, Chantal Conneller, Peter Cardwell, Albert Franks†, Roger Simpson, Geoff Smith & Tim Schadla-Hall†

Site C (also known as East Island) consisted of a low, roughly oval area of raised ground between Manham Hill and Rabbit Hill, on the northwest edge of the lake basin (NGR 50360 48230) (Figs. 1.2, 3.1). The hill measured approximately 145 × 80 m, and was aligned northwest to southeast, with gently sloping sides and a maximum height of *c*. 26.8 m AOD. At the time of the excavations, the area was under unimproved grassland fringed by rough pasture. The site was investigated between 1977 and 1984 through a programme of trial trenching and open-area excavations.

The main concentration of archaeological material came from a gently sloping shelf of sandy gravels sealed beneath later peat deposits on the southern side of the hill. In total 14,275 pieces of worked flint, and 129 fragments of animal bone were recorded, along with several hearths and a possible structure. Based on diagnostic material within the lithic assemblages, and a small number of radiocarbon dates, the site was occupied intermittently during the Terminal Palaeolithic (Long Blade) and the Early Mesolithic, with some evidence for earlier activity during the Final Palaeolithic.

Geology

Albert Franks†

A geological section 9.0 m long and 2.6 m deep was cut into the southwest end of the hill. This showed a varied pattern of extensively faulted sands and gravels of fluvioglacial origin (Fig. 6.1). At the point of maximum exposure, the section comprised topsoil *c*. 0.30 m thick, overlying *c*. 1.10 m of coarse, unsorted ochreous sandy gravel with discrete, thin gravel bands towards the base. This deposit overlay *c*. 0.70 m of dark brown silty sand with sporadic gravel bands and some silt lenses. In the bottom 0.30 m of this deposit, the silty sand gave way to a light brown, bedded sand with some fine gravel. The sand dipped at approximately 16° on a bearing of 175°. Faint, small scale, cross-stratification was observed within the bed, dipping at between 15° and 20° on bearings ranging from 190° to 275°. This bed merged northwards into the overlying silty sand. It was underlain by a deposit of coarse unsorted sand and gravel at least 0.70 m thick.

The angle of dip and orientation of the sand unit is indicative of a general southwesterly transport current flow through the area. The coarse, unsorted gravel at the base of the section extended southwards to form a bench at around 25 m AOD, which skirted around the southern edge of the hill. A sample of this, predominantly angular gravel in the range of 8–23 mm, was collected from a depth of 2.5 m and, with the exception of a flint component, proved to be lithologically similar to the majority of material found elsewhere along the northern edge of the Vale (see Chapter 2). The presence of flint within this matrix, without the chalk clasts normally associated with its occurrence, suggests a glacially derived source from the North Sea basin, the non-durable chalk having been eliminated by solution and abrasion during transport into the area.

A second geological section cut into the southern side of East Island, *c*. 75 m west of the initial section (see Fig. 2.4), showed a similar pattern of sedimentation and faulting. The faulting seen in the sand and gravel was of the normal type, reflecting relaxation structures, which would suggest that the sand and gravel island was deposited in contact with ice that subsequently melted slowly. The irregularity of the structures, and variability of bed thickness, suggest that the ice wall supporting the gravels was in decay during the period of deposition. In all probability the flat-topped feature known as East Island, and the other morphologically similar features situated along the northern shoreline of Lake Flixton to the west of this site, represent the remains of glacial kames.

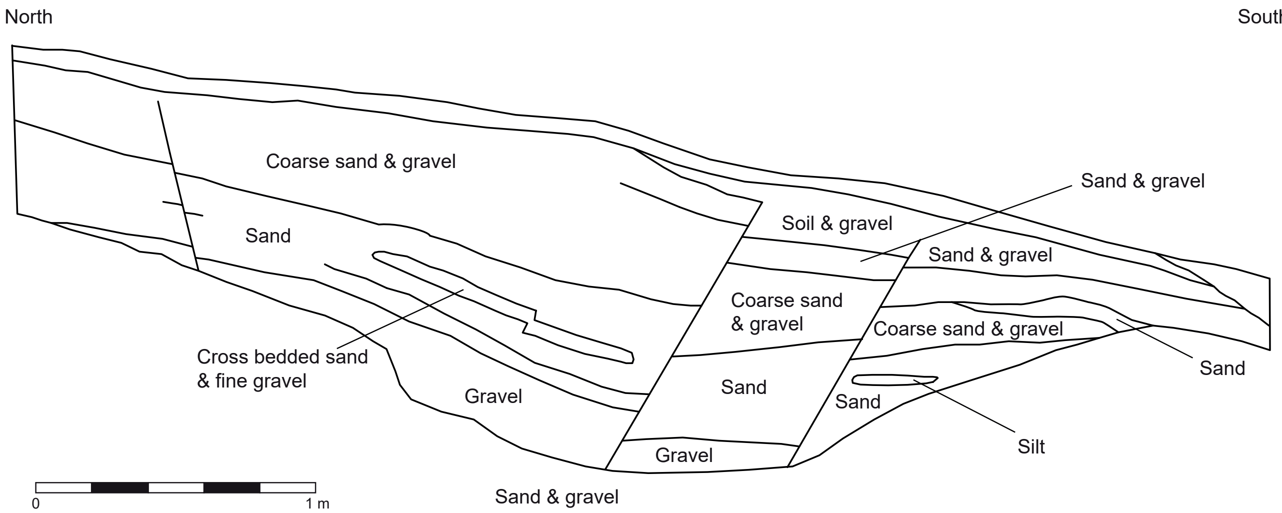

Figure 6.1. *Geological section through southern end of Site C, Seamer Carr.*

Palaeoenvironmental investigations

Three pollen monoliths were taken from trenches C V, VII and VIII on the southern side of Site C, and a fourth (Profile E77), was taken from an auger transect further to the east (Fig. 6.2). The analysis of these profiles has been reported by Cloutman (1988b). Profile C VIII lay on the lower slope of the southern side of the site, and sampled the deposits that had formed in the shallow lake margins, whilst C V and VII were recorded from peat that had formed on slightly higher ground above the former shore. Together these provide a record of the local wetland and terrestrial environments that were forming throughout much of the Mesolithic. Profile E77 was taken through the later Mesolithic peat deposits, and provides a record of the terrestrial environment during the latter part of the period.

Based on the data from profile C VIII, sedimentation began in the lake margins at the start of the Holocene, with emergent vegetation growing at the lake-edge and a largely open environment on the dry ground (Cloutman 1988b, 24). Reedswamp environments became more established in the Early Mesolithic, while willow carr began to form at the shore and birch woodland developed on the higher ground (Cloutman 1988b, 24 and 34). Carr environments then became more extensive, replacing the reedswamp that had formed in the lake margins, a process that was probably driven by the gradual accumulation of organic sediments around the edges of the basin (see Taylor 2019). This process is undated at Site C, but data from other sites around the lake, notably Star Carr (Taylor and Enid 2018), No Name Hill (Taylor 2011) and Flixton School House Farm (Taylor 2019) indicates that the transition to a more terrestrial wetland was occurring in the ninth millennium cal BC. On the dry ground, hazel began to form a significant part of the local terrestrial woodland (Cloutman 1988, 24).

By the Late Mesolithic much of Site C was wooded, with hazel, oak, elm and willow growing locally (Cloutman 1988b, 24 and 27). At around the same time, the wetland stratigraphy shows a change in lithology from wood peat to coarse detritus muds with *Phragmites* reeds (Cloutman 1988a). Cloutman interpreted this as reflecting a rise in the lake water level, which led to the replacement of carr by reedswamp (Cloutman 1988b, 35). However, subsequent work has shown that there is no evidence for a sustained rise in the level of the lake, and that the sedimentary change probably reflects a transition to a fen environment of reeds and other herbaceous plants (Taylor 2019). This event is undated at Seamer Carr, though it post-dates the main expansion of hazel, placing it in the earlier part of the Late Mesolithic.

The top of the environmental sequences was marked by a lithological transition to a humified peat containing high levels of charcoal. In Profile E77 this coincided with an increase in non-arboreal pollen, including species characteristic of disturbed ground, vegetation disturbance, and burning (Cloutman 1988b, 28). This, and increased diversity in the wetland flora, suggest a period of vegetation disturbance coinciding with a slightly drier phase in the local wetland (Cloutman 1988b, 28). Dates on the base and top of the humified peat place the start of this event at 5620–5290 cal BC (6470±90 BP, CAR-896), with the end occurring at 4560–4230 cal BC (5550±80 BP, CAR-895) (Cloutman 1988b, 28).

Insect analysis was also undertaken at the site, though largely from samples taken from the basal

Figure 6.2. *Excavated areas at Site C (level of the lake shown at 24 m AOD). Black dots mark the location of Cloutman's sample points.*

deposits of trenches located at the edge of the lake (see Chapter 18). As such, the material is indicative of local environmental conditions at the very start of the Mesolithic. The insects from these deposits indicate the presence of slow-moving, vegetated water, as well as the local growth of trees (particularly species of willow and birch), and areas of open ground on the more terrestrial parts of the site. Areas of standing water were also indicated, possibly reflecting the presence of pools of water within the lake-edge swamp, as was the accumulation of litter from both wetland and arboreal plants.

Archaeological investigations

Site C was investigated by a combination of trial trenching and open-area excavations between 1977 and 1984 (Fig. 6.2). In the first two seasons, a series of 2.0–2.5 m wide trenches of varying lengths were excavated across the top of Site C and along the more southerly slopes (Fig. 6.3a-d). One of these trenches (C VII) was subsequently expanded eastwards by *c.* 8 m. The main objectives of this early work were to locate the Early Mesolithic horizon, determine its extent, and establish the basic stratigraphic sequence for the overlying peat deposits.

In 1979, a larger area (C IX) was excavated from the eastern edge of trench C V to just short of C IV. Two more small areas were excavated (C X and C XI) in 1981, which linked trench C V/IX with trench C VII, and expanded the area of excavated shoreline slightly westwards. A 30 m long trench, *c.* 2 m wide was also excavated perpendicular to the former shoreline further to the west (C XII).

During 1982, investigations shifted to the western part of Site C, with the excavation of a large open-area (trench C XIII) and a series of 2 × 2 m test-pits (C XIV-XX). Excavation of C XIII was continued during the 1983 season whilst the area previously investigated by the test-pits was opened up through the excavation of trench C XXI. This work was completed in the 1984 season.

Six machine cut trenches were also excavated to the southwest of Site C, in an area that would have been marginal reedswamp during the Early Mesolithic (trenches M1-3, U1-3). The depth of the deposits in these areas meant that excavation by hand was not possible due to the logistical issues and associated cost implications. Instead, a Hymac mechanical excavator was used to cut slots of variable length, approximately one metre wide extending away from the shoreline.

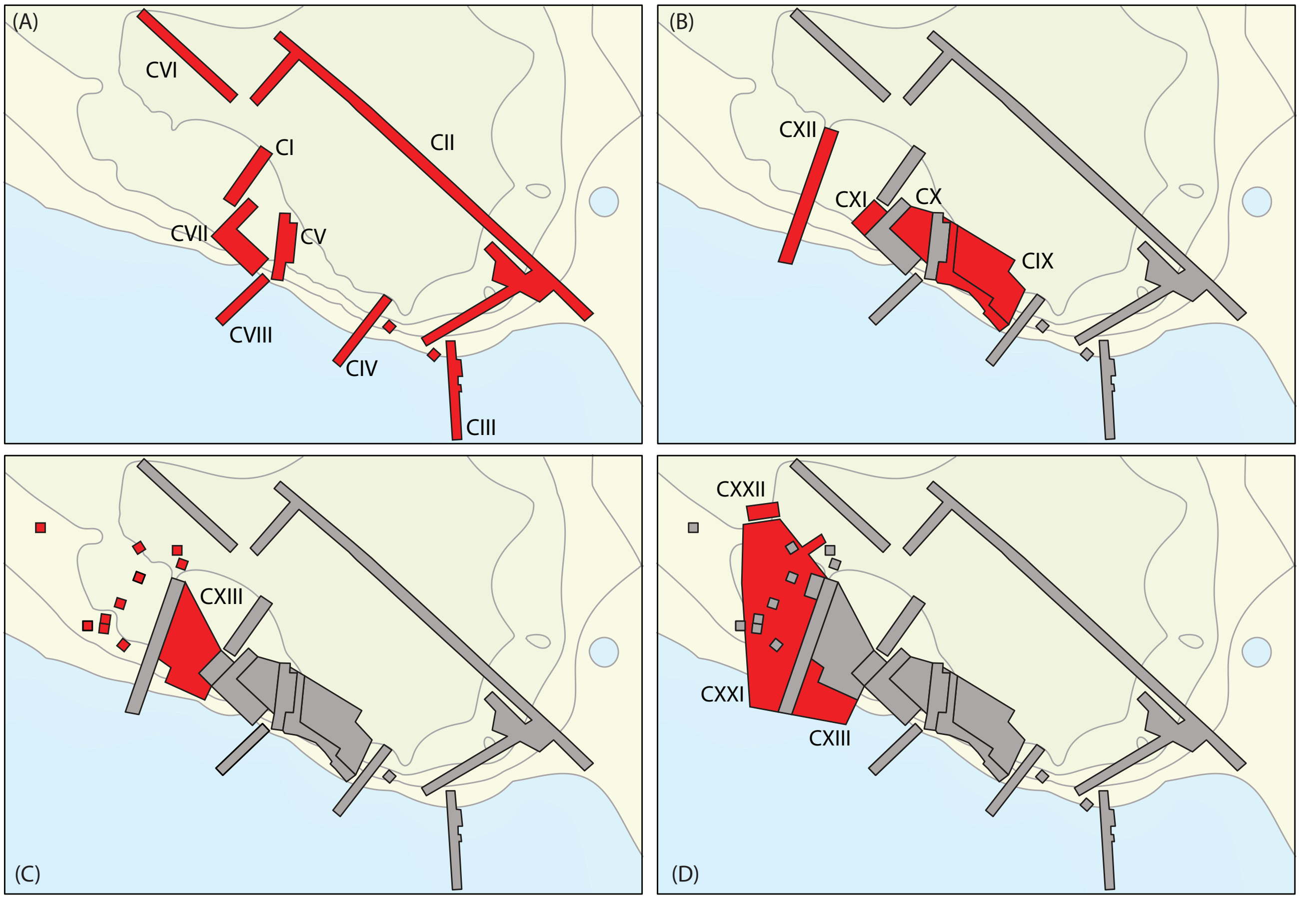

Figure 6.3. *Sequence of excavation of trenches and test-pits at Site C; (A) 1977–8, (B) 1979–81, (C) 1982, (D) 1983–4.*

Most of the overburden was dumped to one side of the trench, with the lower deposits dumped on the opposite side. This was hand searched and the approximate location along the slot trench of any finds was recorded (see Chapter 3). Although the nature of these investigations limited the potential for artefact recovery, a small assemblage of faunal material (six specimens) was recovered. These comprised two roe deer scapulae, a fragment of a red deer calcaneum and the base of a naturally shed antler, and the phalanx and an atlas vertebra of an aurochs. There is no indication of the contexts from which these were recorded, but given the absence of any later activity at Site C these probably date to the Early Mesolithic and are related to the activity taking place on the main area of the site.

Stratigraphy

Paul Lane, Peter Cardwell, Roger Simpson & Geoff Smith

The stratigraphic sequence across East Island varied depending on trench location and the depth of the covering deposits. On the summit of the island, where the depth of the overlying deposits was thin, the basal kame material was sealed by a layer of sand that lay beneath a mineralized peaty topsoil and root mat horizon. On the southern side of the island, the basal deposits became gravellier and more clayey closer to the position of the former lake edge, and were sealed by a layer of organically enriched sand. This constituted the main archaeological horizon and has been interpreted as the Terminal Palaeolithic and Early Mesolithic land surface. Sealing this at the southern end of the site, below the *c*. 24.5 m contour, was a sequence of coarse detritus muds and reed peats. The latter extended slightly further up slope, and was overlain by deposits of wood peat and peaty topsoil that extended across the entire area of the site. This sequence is summarized in Table 6.1.

There was considerable horizontal and vertical variation in the site stratigraphy, due in part to the differential growth of peat and different rates of subsequent peat shrinkage. Partly because of this, but also for ease of presentation, the excavated portions of Site C are divided into four broad areas. These are

Table 6.1. *Phasing of deposits at Site C.*

Phase	Sub-Phase	Description
I		Basal, glacial deposits of sandy gravel, clay and sand
II	*a*	Deposit of sand, with a high organic content, and inclusions of gravels and clay, containing archaeological material (worked flint, bone and charcoal)
	b	Natural and anthropogenic features that cut into this deposit
	c	Deposits of coarse detritus mud overlying the sub-phase *a* deposit below the 24 m AOD contour
III	*a*	Marl and *Phragmites* reed peat sealing the basal deposits below *c.* 24 m AOD
	b	Deposits of coarse, herbaceous detrital mud, *Phragmites* reed peat, and mixed reed/sedge peat
IV		Wood peat sealing the *Phragmites* reed peat (on the lower-lying ground), and the basal, mineral deposits on the higher ground
V		Black, hummified, charcoal rich peat
VI	*a*	Dark brown oxidized, friable peat
	b	Peaty topsoil

the 'western', 'central' and 'eastern' sections of the southern shoreline of the site, and the northern part of the site on the crest of the hill (Fig. 6.4). The contexts associated with the main deposition phases in each of these areas are related to one another on the composite Harris Matrix for East Island (Fig. 6.5). The following description is a synthesis of this detail.

The basal geology consisted of sandy gravels, sands, and clays, the character and extent of which varied across the excavated area. There was little spatial patterning in the distribution of these deposits, except that the sands and gravels gave way to clay towards the lower parts of the slope (around *c.* 24 m AOD). The variable nature of these deposits is consistent with their glacial origin, and they should be considered contemporary. A total of 19 context numbers were assigned to this horizon (Table 6.2).

Overlying the basal, glacial geology were a series of minerogenic deposits that probably formed during the latter part of the Late Glacial or the very Early Holocene, and which represent the Upper Palaeolithic and Mesolithic surfaces. These mostly comprised loams, sands and gravels, some with a high organic content, and may have formed through weathering and/or erosion of the underlying geology, though the organic

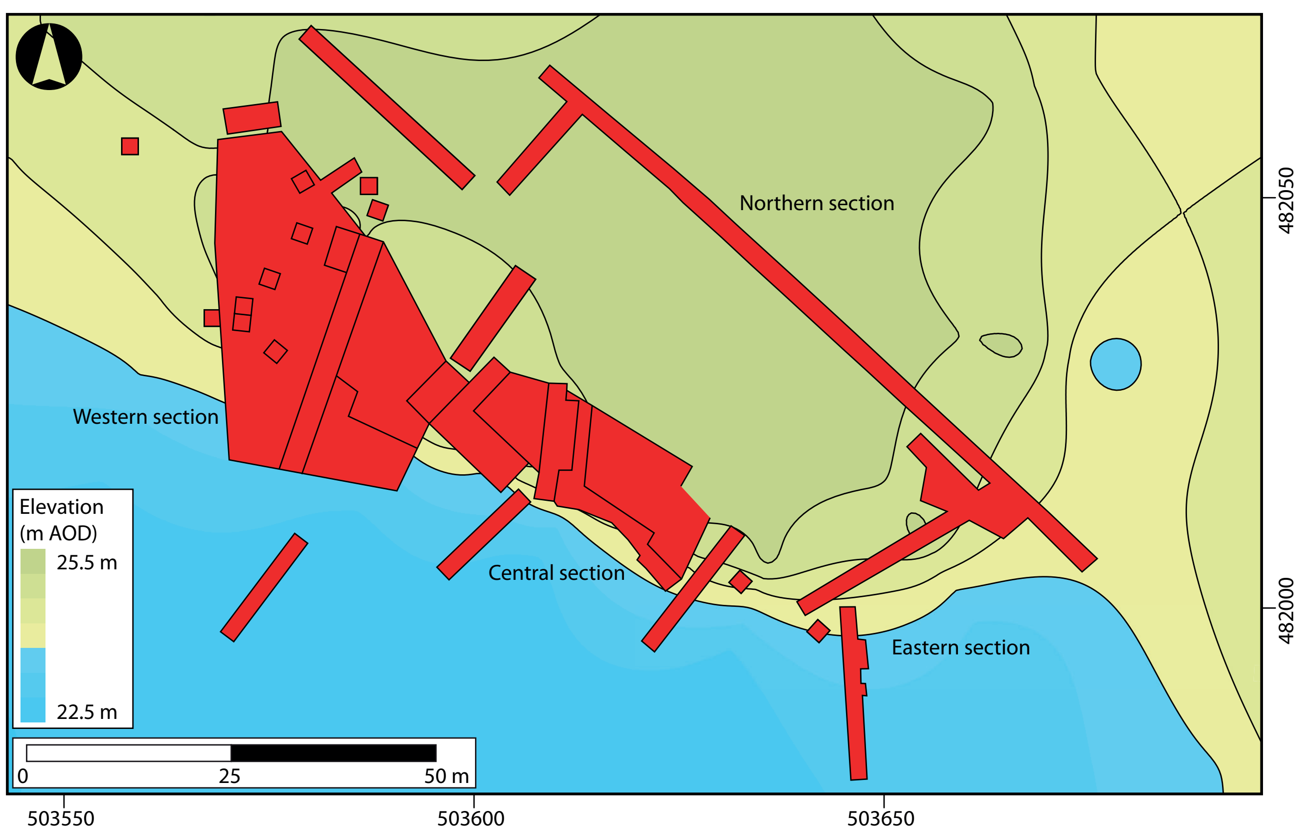

Figure 6.4. *Analytical divisions of excavated areas at Site C, as used for stratigraphic analysis.*

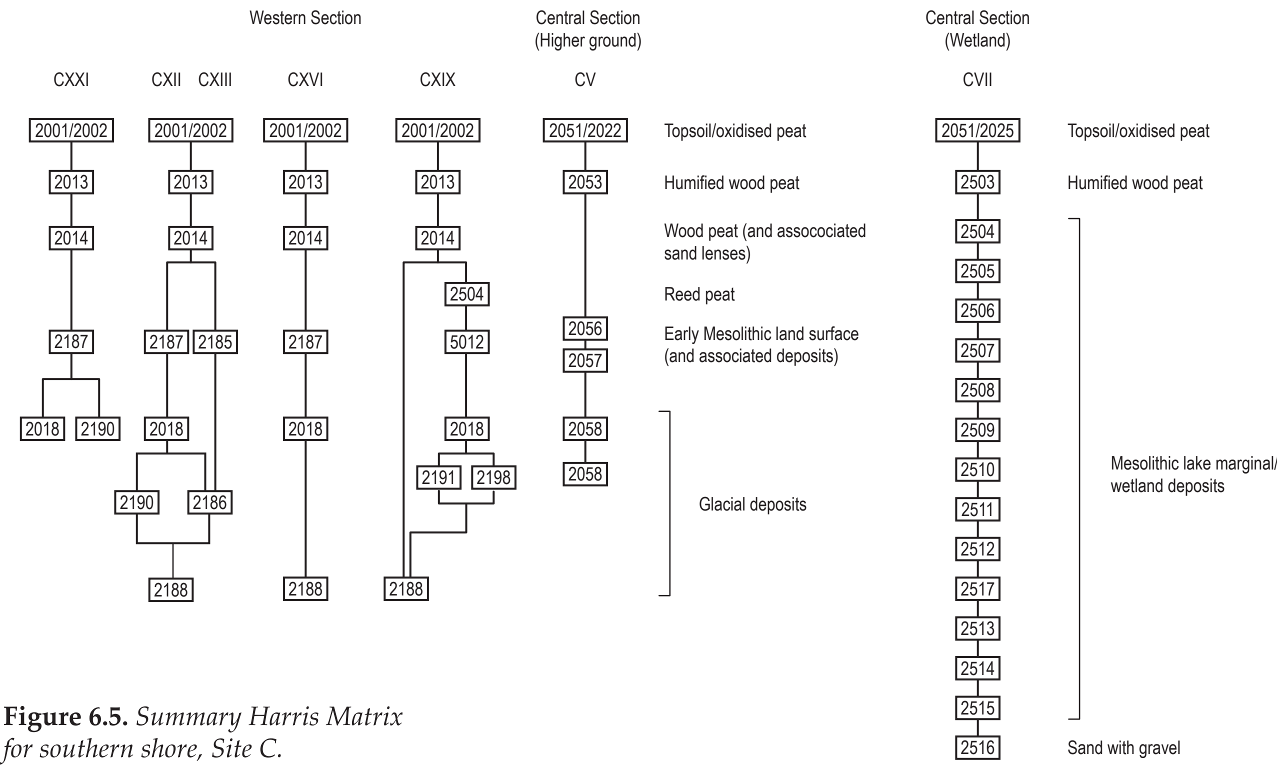

Figure 6.5. *Summary Harris Matrix for southern shore, Site C.*

content may also reflect relict soil horizons. Twelve contexts are associated with this horizon (Table 6.3)

In places the Palaeolithic/Mesolithic land surface was sealed by deposits that were forming during the occupation of the site. As with the underlying deposits, these sediments have probably formed through erosion and other taphonomic processes, though again the organic content could be the remains of relict soil horizons. Twelve contexts were assigned to this horizon (Table 6.4).

The minerogenic deposits were sealed by a sequence of lacustrine and wetland sediments, the character of which varies in relation to the basal topography. On the lower lying areas of the site (notably trench C VIII), the basal geology was overlain by a sequence of calcareous marl [2515], *Phragmites* reed peat [2514], and coarse wood peats [2508/2509/2510] (Table 6.5, Fig. 6.6). These reflect the gradual infilling of the lake edge, and were probably forming during the Early Mesolithic occupation of the site. As the marl and reed peat are indicative of submerged and seasonally flooded environments, this part of the site must have been underwater during this time. At the very southerly, low-lying part of the site a series of distinct bands of woody detritus [2511/2512/2132/2517/2513] were identified between the *Phragmites* reed peat and the overlying coarse wood peat. These may reflect minor fluctuations in the lake water level and/or differences in the quantities of tree branches and other woody material being transported into the lake margins from the shore.

Above this was a sequence of peats and detrital muds that probably formed during the Late Mesolithic. These began with a sequence of coarse detrital muds containing herbaceous material and woody fragments

Table 6.2. *Contexts assigned to the basal geology, Site C.*

Context	Description
916, 917, 965, 2018, 2058, 2133, 5015	Clayey sand with gravel
2078, 2061	Clayey sand, with less gravel
2156, 2068	Clay
2186	Coarse silty sand with gavel
2188, 2190	Coarse sand
2191, 2198	Coarse sand overlying 2190 and 2188
5013, 5014	Sandy clays overlying 5015

Table 6.3. *Contexts assigned to the Late Glacial/Early Holocene land surface, Site C.*

Context	Description
912, 922, 960	Silty sand with organic content
966, 2017, 2057, 2072, 2130	Sandy loam
2073	Clayey sand
2092	Sand lenses within 2187
2185, 2516	Medium-coarse sand with gravel

Table 6.4. *Contexts assigned to the mineral deposits overlying the Late Glacial/Early Holocene land surface.*

Context	Description
911	Sandy silt
921	Peaty silt
962	Silty sand with organic material
2015	Lenses of fine grey sand in 2016
2016	Fine sandy loam
2018a	Medium-coarse sand, overlying 5012 and 2187. Likely redeposited basal material [2018]
2055	Lenses of fine grey sand in 2016
2056, 2071, 2129	Fine sandy loam with lenses of fine grey sand
2187	Organically enriched medium-coarse sand
5012	Organically enriched medium-coarse sand

Table 6.5. *Contexts assigned to the wetland deposits in the deeper parts of Site C.*

Context	Description
5201	Topsoil
2502	Oxidized, friable peat
2503	Humified peat with a high charcoal content
2504	Mixed *Phragmites* reed and sedge peat
2505	*Phragmites* reed peat with woody detritus
2506	Coarse herbaceous detritus with woody fragments
2507	Mixed woody, moss-rich detritus
2508	Coarse herbaceous detritus with woody fragments
2509	Coarse wood peat with an increased content of fine detrital mud
2510	Coarse wood peat
2511	Mixed woody and moss-rich detritus with a high charcoal content
2512	Woody detritus within a matrix of fine detrital mud
2132, 2517	Coarse wood peat
2513	Woody detritus within a matrix of fine detrital mud
2514	*Phragmites* reed peat
2515	Marl

[2506], overlain by layers of *Phragmites* reed peat and mixed reed/sedge peats 2505/2504]. This lithological change from coarse wood peats to a more herbaceous detritus and reed peat was also identified at other sites at Seamer Carr and in the surrounding landscape, and probably reflects a shift to a slightly wetter fen environment (Taylor 2019). In some places the detrital muds were interrupted by a thin layer of woody, moss rich detritus

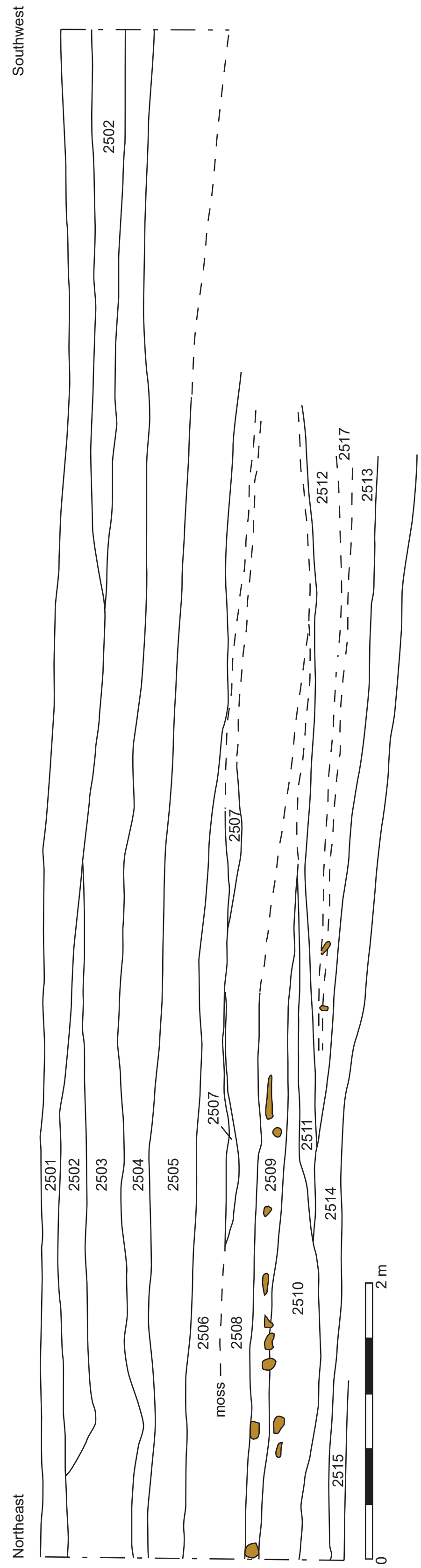

Figure 6.6. *Trench C VIII, northwest-facing section showing the sequence of wetland deposits forming at the edge of the basin.*

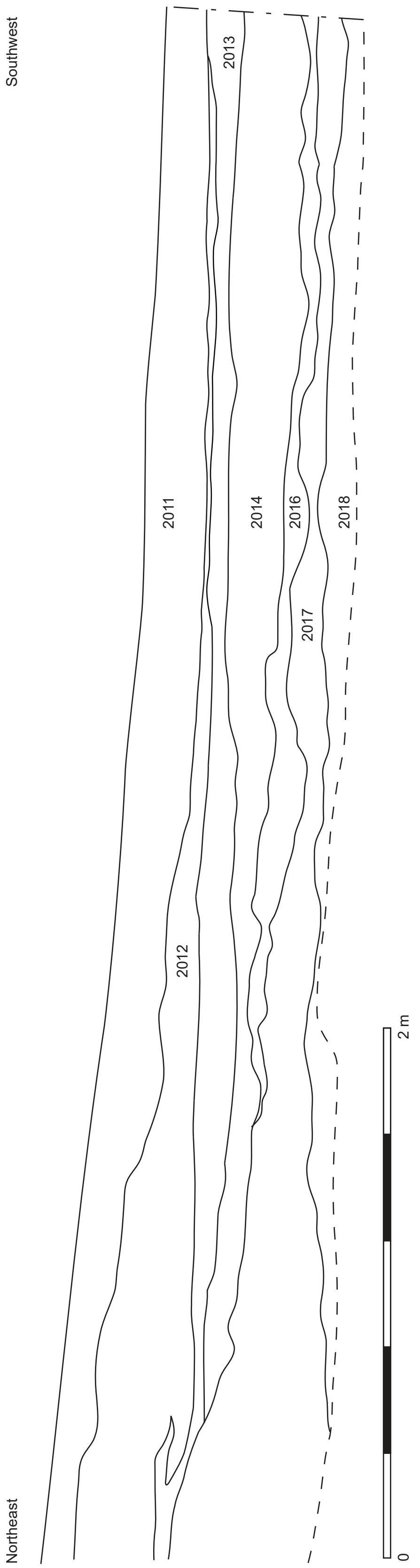

Figure 6.7. *Trench C I, northwest-facing section showing the sequence of deposits on the upper slope of Site C.*

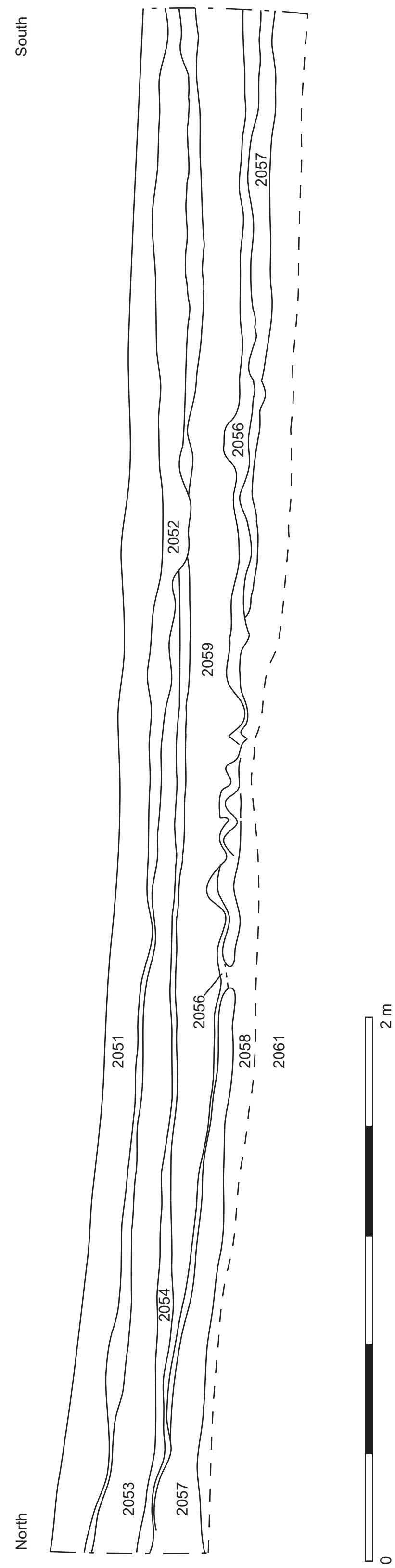

Figure 6.8. *Trench C V, west-facing section showing the sequence of deposits on the upper slope of Site C.*

Table 6.6. *Contexts assigned to the wood peat and overlying deposits above* c. *24 m AOD.*

Context	Description
2001, 2011, 2051, 2077, 2126, 2002	Topsoil
2012, 2127, 2003, 2052	Oxidized, friable peat
2053	Highly humified, friable peat
1004, 2054, 2013, 2075	Humified wood peat with a high charcoal content
967, 2014, 2059, 2074, 2079, 2132	Coarse wood peat

Table 6.7. *Contexts assigned to the organic deposits on the most elevated parts of the site.*

Context	Description
2004	Gritty peat underlying topsoil
5004	Charcoal rich humified peat overlying 5005
5005	Peaty silt
919, 956	Charcoal rich humified peat overlying 920 and 957
920, 957	Peaty silt

[2507], possibly resulting from minor fluctuations in the local water table. The sequence was then sealed by a layer of highly humified peat, often containing wood, and with a high charcoal content [2503], that relates to the layer of humified peat recorded by Cloutman in pollen profile E77. Dates from the top and base of this deposit (CAR-895 and 896 respectively) place its formation towards the end of the Mesolithic. Overlying this were deposits of highly oxidized, friable peat [2502] and topsoil. The sequence of deposits, and corresponding context numbers is shown in Table 6.5, and Fig. 6.6.

Further upslope, above the *c*. 24 m AOD contour, the mineral deposits were sealed by a deposit of wood peat, often containing lenses of sand. This deposit gradually encroached over the site and does not represent a contemporaneous stratigraphic horizon. A date of 9220–8545 cal BC (9480±110 BP, CAR-195), from the base of the wood peat in trench C IX, shows that this process was underway during the Early Mesolithic. As with the deposits in the deeper parts of the site, the wood peat was sealed by a layer of highly humified, charcoal rich wood peat, one or more layers of humified, oxidized peats, and topsoil (Table 6.6, Figs. 6.7, 6.8).

On the very highest parts of the site (the northern and eastern areas) the peat preservation was much poorer, and the basal mineral deposits were sealed by a sequence of humified peats, often mixed with mineral sediment, which lay below the topsoil (Table 6.7). These probably relate to the sequence of wood peat and humified peat described above.

Natural features

A series of amorphous features, filled with redeposited natural sediment [2188, 2189, 2190] were identified at the northern end of trench C XIII (Fig. 6.9a). Given the character of the fills, and the amorphous character

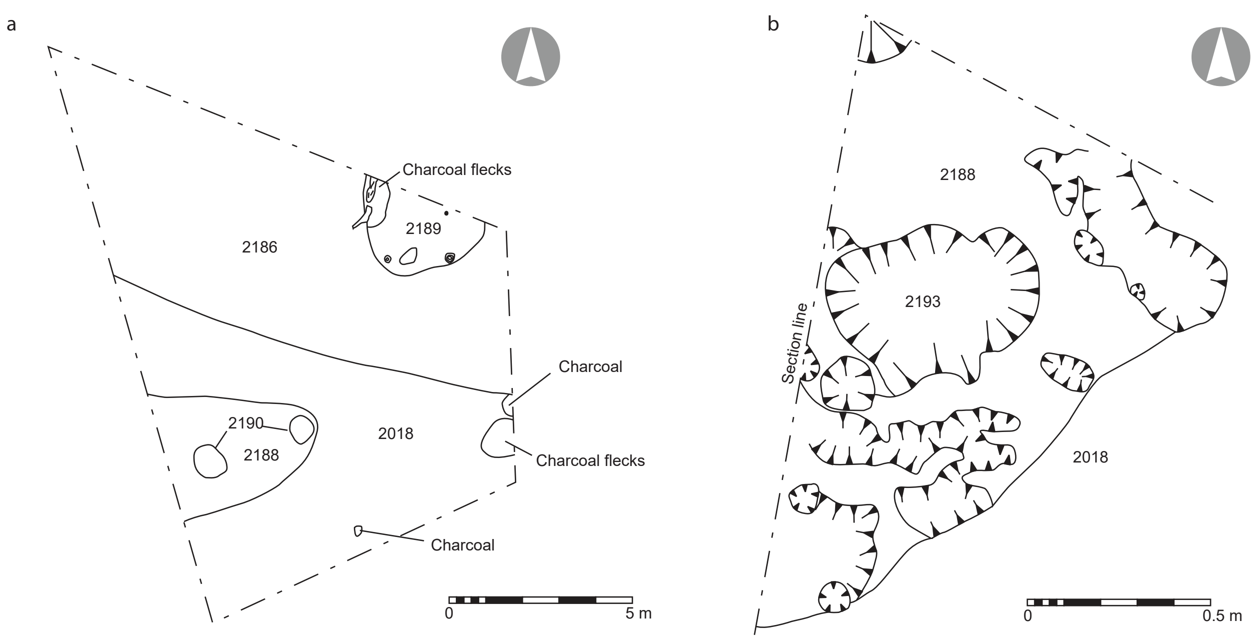

Figure 6.9. *Plan showing a) natural features cutting into the basal geology at the northern end of trench C XIII prior to excavation and b) the series of irregular hollows and depressions underlying them.*

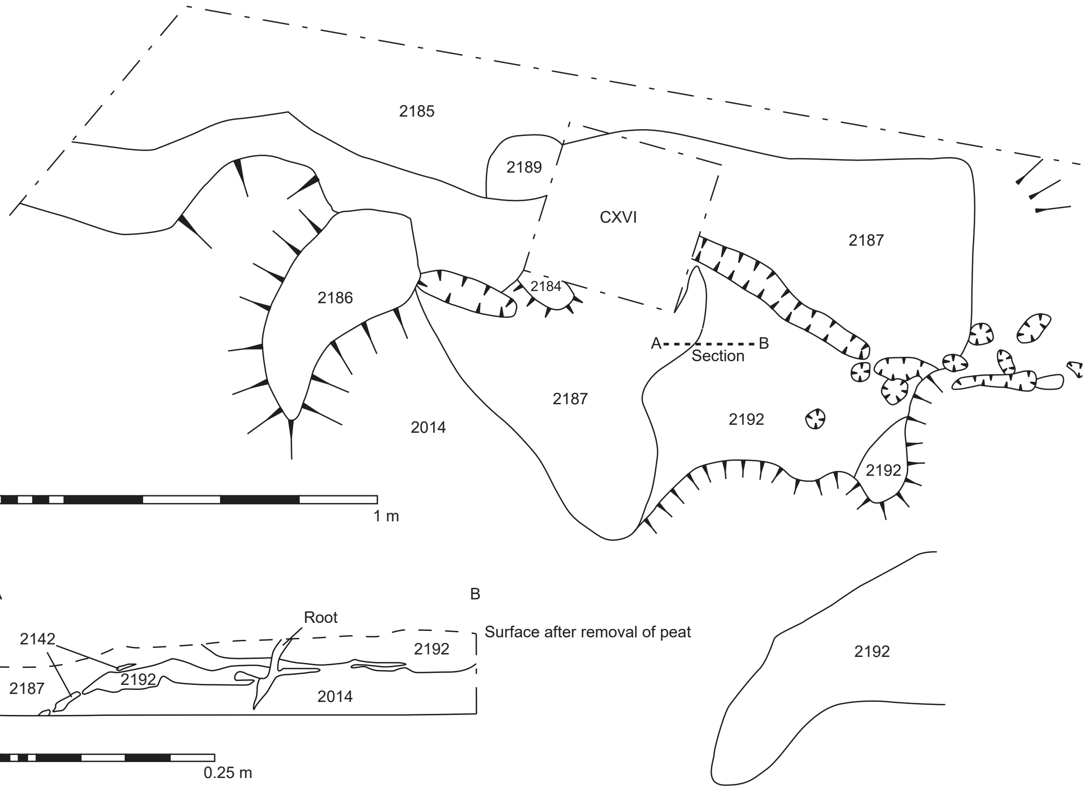

Figure 6.10. *Plan of the northern end of trench C XXI showing areas of disturbance, and section through contexts 2014 and 2192.*

of the hollows, these are thought to be the results of natural processes. Below these features, and the deposits they were cut into, a further series of hollows and depressions filled with the same light grey or white sand [2189] were recorded (Fig. 6.9b). Again, given the nature of these features, and their position within what has been interpreted as the sequence of basal, geological deposits, these have been interpreted as the results of natural processes.

Another second hollow associated with this horizon was also exposed along the northern edge of trench C XIV. This had a low mound of up-cast sandy gravel [2018] along its eastern side, and was filled by a grey clayey silt with charcoal fragments [2192] and a layer of grey sand [2189]. From the shape of the feature it is probable that this is a tree throw.

A further area of disturbance, probably also caused by bioturbation, was recorded at the northern end of trench C XXI. Again, this consisted of a series of irregular hollows and raised areas, and included patches of redeposited natural material (Fig. 6.10). During the excavation of this area, an irregular, shallow

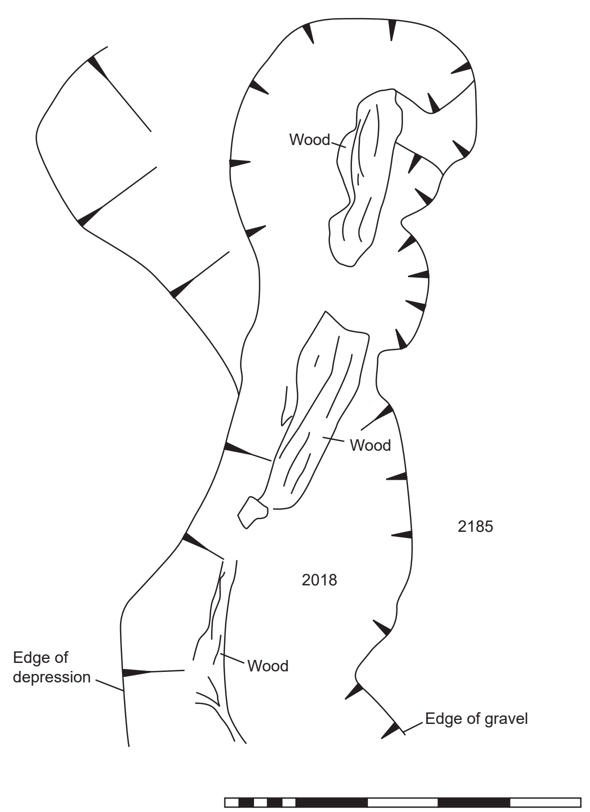

Figure 6.11 *(right). Plan of feature 2202, after excavation.*

depression [2022], some 2.6+ m long, between 0.4–0.8 m wide, and aligned roughly north–south, was recorded cutting into the Mesolithic land surface [2185]. This was filled with interleaved deposits of reed peat [2504] and humified wood peat [2014], which contained a number of large wood fragments near the surface and probably represents the remains of a large root (Fig. 6.11). A series of postholes were also recorded in this area (see below).

Anthropogenic features

A number of features of possible anthropogenic origin were also identified at Site C (Fig. 6.12). As noted above, a scatter of 24 stakeholes were recorded at the north of C XXI, one of which contained the base of a wooden stake (Fig. 6.13a). Concentrations of worked flint and a small quantity of animal bone were recorded from this area (Scatter B). However, there was no discernible pattern to the arrangement of the stakeholes, as might be expected if they had formed part of a structure, and their function remains unclear.

A possible hearth was recorded in test-pit C XV, a few metres to the north of the stakeholes. The feature was formed by a shallow depression containing a dark grey peaty sand and a concentration of charcoal [2196], possibly representing some localized burning [2196]. It is uncertain, however, whether this was related to human activity at the site or was the result of a natural fire.

A second possible hearth was recorded in the southwest of trench C XXI, close to flint Scatter H. This consisted of a roughly oval area of burnt sand and flint with rather amorphous edges, around which were over 20 large pebbles [2023], possibly representing a stone lining.

A third possible hearth was recorded further to the east in trench C XI. This consisted of a roughly circular concentration of charcoal, *c*. 60 mm in diameter, in a larger, roughly oval (*c*. 130 × 60 mm) spread of charcoal enriched sand with large charcoal fragments. This lay at the northeast edge of a dense scatter of worked flint (Scatter K). Three smaller, circular patches of charcoal lay nearby. These were planned but not assigned separate context numbers (Fig. 6.13b).

A small, oval hollow (Hollow I) (0.28 m wide and 0.18 m deep), filled with a peaty, charcoal-rich

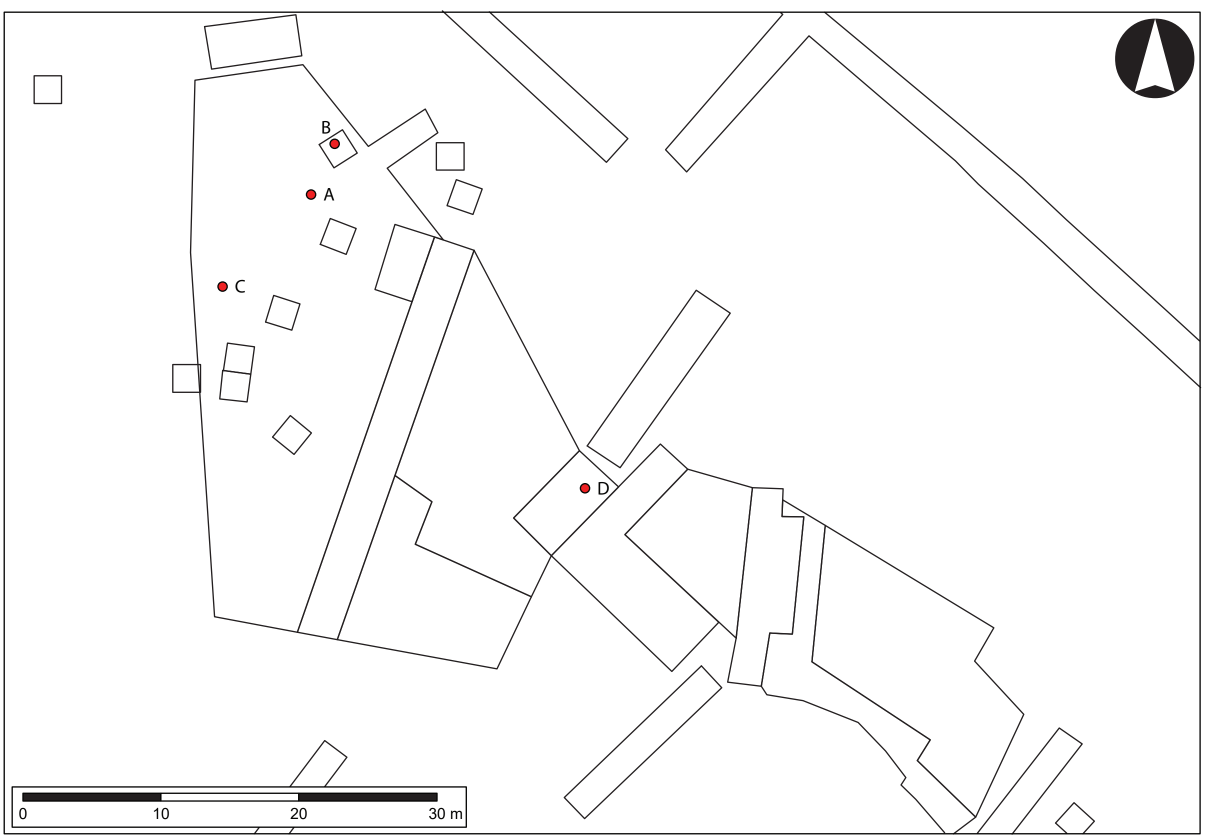

Figure 6.12. *Location of probable anthropogenic features recorded at Site C. (A) scatter of possible stakeholes, (B) possible hearth in C XV, (C) possible hearth in C XXI, (D) possible hearths in C XI.*

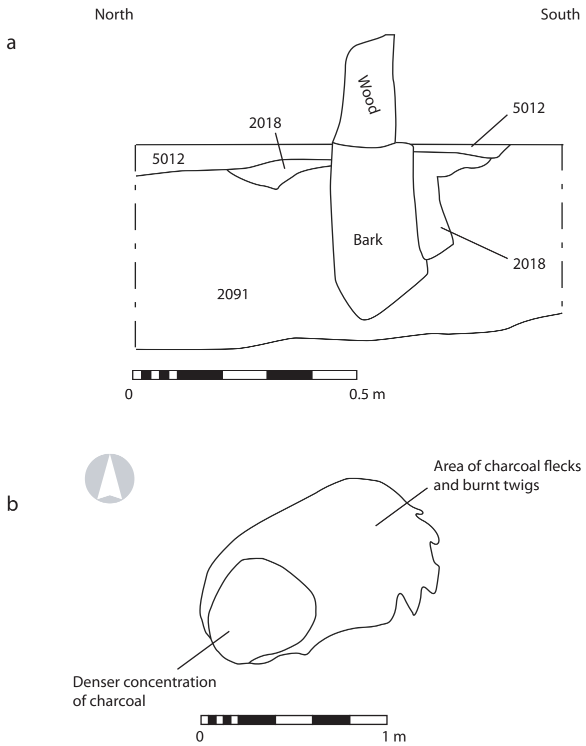

Figure 6.13. *(a) Section through stakehole in C XXI. (b) Plan of possible hearth and associated patches of charcoal in C XI.*

sand, was recorded close to the spread of charcoal. It is possible that this may have been a small pit (or even another hearth), though there were no finds within its fill, and no clear indication of its function.

Summary of the archaeology

A total of 14,275 pieces of worked flint, and a much smaller assemblage of 129 fragments of animal bone were recovered during the excavation of Site C (see Chapters 14 and 16 respectively). The flint assemblage represents two principal periods of activity, Long Blade or Terminal Palaeolithic, and Early Mesolithic. Final Palaeolithic activity may also be represented by a small number of backed blades, though no associated knapping debris could be discerned. Direct dates on the animal bone, and the wetlands contexts from which bone was recovered are all Early Mesolithic, though some of the undated bone from the minerogenic sediments may relate to the Terminal Palaeolithic occupation (see below). There is no evidence for Late Mesolithic activity at Site C.

Almost all the flint, and the majority of the animal bone, was recovered from the basal minerogenic sediments, constituting either the basal geology or the overlying Late Glacial/Early Holocene land surface. Unfortunately, no clear stratigraphic separation between the Terminal Palaeolithic and Early Mesolithic material could be discerned, and refitting sequences of flint run through the stratigraphy, suggesting that post-depositional processes have resulted in a significant degree of vertical movement. A very small proportion of the flint assemblage (24 pieces) and several specimens of animal bone (less than five fragments) were recovered from the wood peat [2132] and may represent material deposited or discarded into the wetlands that were forming at the edge of the lake, or into the peat-forming environments that subsequently encroached across the higher ground.

Spatially, the lithic assemblage forms a series of scatters across the excavated area (Fig. 6.14). Of these, Scatters B1, C, and F can be dated to the Terminal Palaeolithic on typological grounds. Attempts to directly date these scatters have been largely unsuccessful; a sample of charcoal spatially associated with Scatter F was dated to 8715–8290 cal BC (CAR-197), which is too young for a long blade assemblage and is either erroneous or relates to a period of Mesolithic activity. A large number of refits were identified between Scatters B1 and Scatter C, suggesting they were contemporary, while a lack of refits with Scatter F suggests that this was a separate phase of occupation.

Scatter C was made up of two knapping areas, and in both cases was generated through the reduction/working of imported till flint to produce quantities of large blades, flakes and more occasionally tools. A concentration of burnt flint was also identified within the scatter, and probably represents the remains of a hearth or open fire. Tools, including scrapers, burins, and projectile points, as well as some of the blades cluster around this, suggesting that the hearth was the primary area of tool use. Some of the cores and blades produced at Scatter C are missing from the refitting sequences and were probably removed from the site.

Scatter B1 (see Fig. 14.4) lay 10 m to the north-west of Scatter C, and probably represents an area of contemporary activity. Here, knapping focused on the reduction of a nodule of grey till flint that was used to manufacture a series of large blades, several of which were subsequently segmented, and in one case was used to produce a beak burin. Some of this material was then taken to other parts of the site, including Scatter C.

Scatter F lay further to the southeast of B and C, and may represent a separate episode of activity. At this scatter, partially prepared raw material and a quantity of blades were brought onto the site. The raw material was used to produce a further stock of blades, some of which were deposited (along with the imported blades) around a concentration of burnt flint, probably representing a hearth. A small assemblage

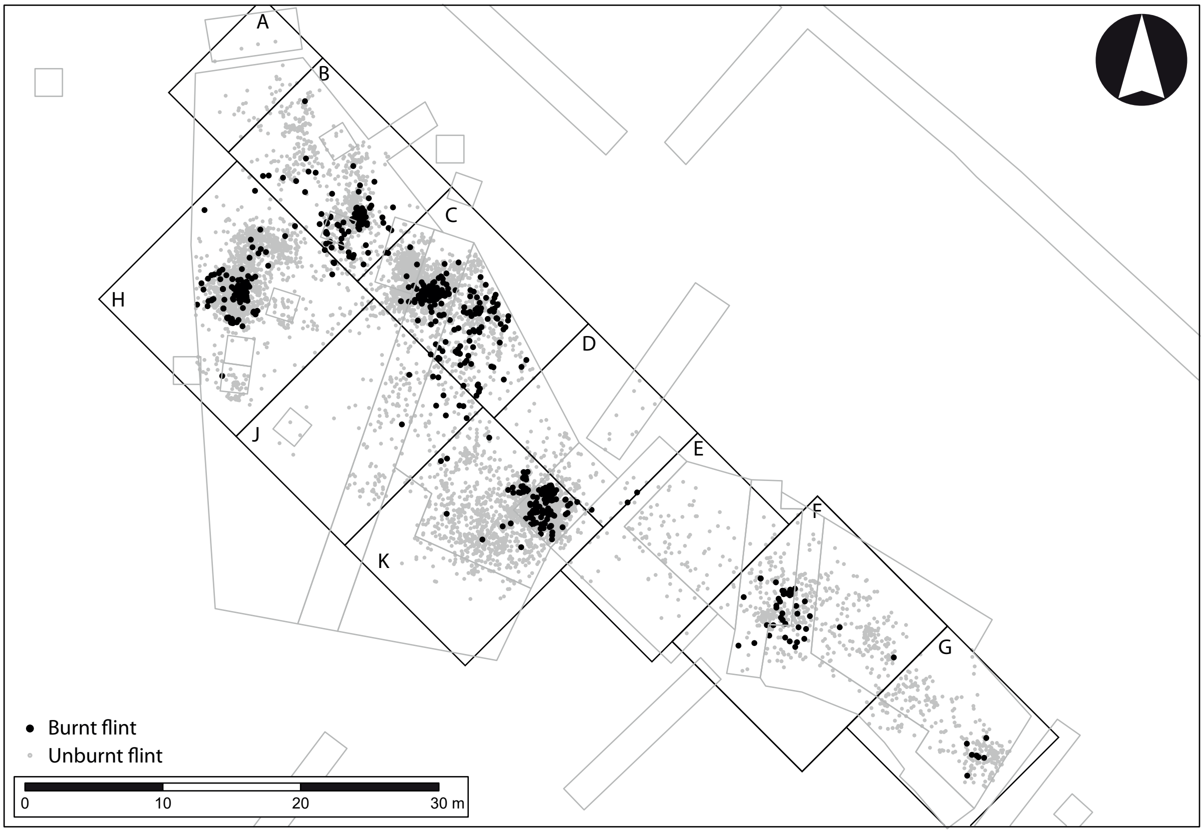

Figure 6.14. *Distribution of flint scatters at Site C.*

of tools (a backed bladelet fragment and two refitting fragments of a thicker backed piece, three burins and a scraper) were also present, along with burin spalls, indicating the use and sharpening of the burins on site.

Scatters B, H, and K are typologically Early Mesolithic. Again, attempts to refine the age of these scatters through radiocarbon dating have been of limited value; determinations on a sample of charcoal from Scatter K (HAR-5547) provides a *terminus post quem* of 8550–7585 cal BC for the deposition of the lithics, while two samples from Scatter H (HAR-5238 and HAR-5791) provides a *terminus post quem* of 9095–8275 cal BC and 9145–8275 respectively (see Table 6.8 and associated discussion of the radiocarbon dates below and in Chapter 4). Refits were identified between Scatters H and K. While this may indicate contemporary episodes of activity, the movement of material is exclusively from Scatter K to H, which could suggest that H is younger and utilized material deposited at K during an earlier visit to the site.

Scatters H and K lie approximately 20 m apart and were both generated through the working of Wolds and till flint, much of which was brought onto the site in the form of beach pebbles. In both cases the tool assemblages were dominated by scrapers (89 in Scatter H, 48 in Scatter K), many of which were produced from flakes and blades that were manufactured on the site, and subsequently used and discarded. Microliths were also recorded at both scatters, as were burins and burin spalls.

Scatter H has been divided spatially into two smaller scatters. The most southerly of these forms a relatively discrete, circular spread of material, *c*. 4.5 m in diameter, with a well-defined edge that probably reflects the presence of a tent or other structure (see Chapter 14). The majority of the scrapers and microliths were found within this area (and in the case of the scrapers had also been produced there). A concentration of burnt flint was also identified within this area, and indicates a probable hearth, while a stone-lined hearth [2023] was also recorded close to the possible tent structure. A second spread of burnt flint was also identified at Scatter K, probably reflecting the presence of a hearth, and was potentially associated with an oval spread of charcoal lying along the northeast edge of the scatter.

Scatter B is much smaller (only 210 pieces) and lies to the north of Scatter H. In contrast to H and K

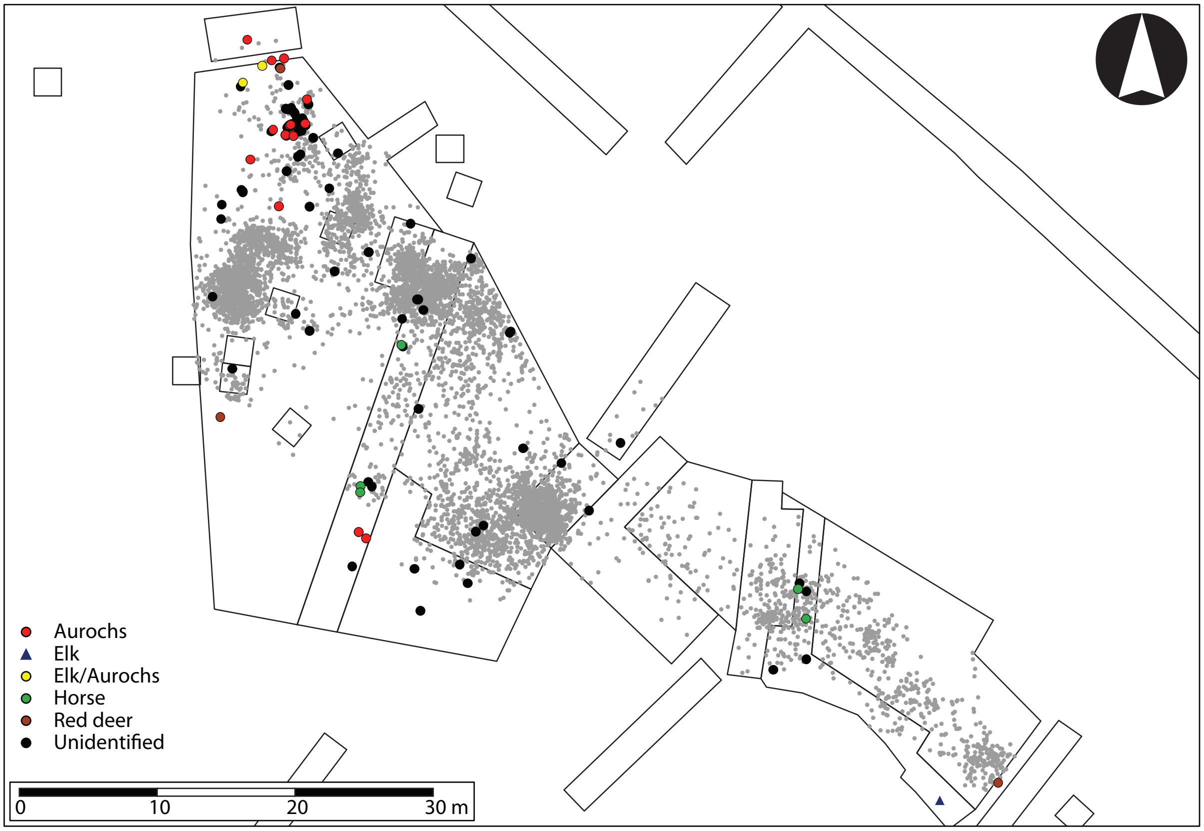

Figure 6.15. *Distribution of worked flint and animal bone at Site C.*

it contains a higher proportion of blades, and much smaller quantities of tools, notably burins (one) scrapers (one) and microliths (four). Burin spalls were also present in the assemblage, as were microburins, reflecting the manufacture and use of tools on site. A series of stakeholes were also recorded around Scatter B and could potentially relate to the activities being undertaken there.

The faunal assemblage was small, comprising only 129 fragments, of which only 51 specimens (*c.* 40%) were identifiable to species (aurochs, horse, red and roe deer and elk, see Chapter 16). Of these, aurochs is the most common (22 of the identifiable specimens), with most fragments deriving from the crania and the limb extremities, though scapula, ribs and limb bones (femur, tibia and ulna) are also represented. Horse remains are the next most common, but are dominated by teeth (16 out of 17 specimens), while red deer are represented by only eight fragments deriving from the mandible, limbs and pelvis. Roe deer and elk are both represented by just two specimens.

Spatially, most of the faunal remains lie in the northernmost part of the site around the Early Mesolithic flint Scatter B, and may relate to activities undertaken in this area (Fig. 6.15). This assemblage is dominated by aurochs, though most of the unidentified specimens were also found in this part of the site. Horse remains, however, were generally found in the area of the long blade scatters (C and F), tentatively suggesting differences in the hunting patterns between the Terminal Palaeolithic and Early Mesolithic.

Dating

A total of fourteen radiocarbon dates are available, 13 of which were obtained as part of the Seamer Carr Project, while one (OxA-26542) was obtained more recently (Conneller and Higham 2015) (Table 6.8). The dated samples derive from different archaeological and palaeoenvironmental materials relating to both the initial occupation of this area of the Lake Flixton shoreline and later parts of the environmental sequence. The archaeological samples come from both the occupation surface (CAR-197, HAR-5236, HAR-5238, HAR-5547 and HAR-5791-93), and the adjacent wetland deposits (CAR-195-6, HAR-5237, HAR-5790 and OxA-26542). As discussed in Chapter 4, HAR-5236, and HAR-5792-3 on the dryland, and HAR-5237 in the wetland are problematic and should not necessarily be

Table 6.8. *Radiocarbon dates for Site C.*

Lab No.	Radiocarbon years BP	$\delta^{13}C$ (‰)	Calibrated date (cal BC)	Material	Context
CAR-195	9480±110	-30.0	9220–8545	Wood – *Betula* sp	From peat [2132], directly below animal bone. Trench C IX
CAR-196	9100±100	-24.2	8570–7985	Bone collagen – elk and aurochs	From peat [2132] at 24.60 m AOD. Trench C IX
CAR-197	9260±90	-26.0	8715–8290	Charcoal	Associated with flint scatter (Scatter F), context [2133] at 25.13 m AOD. Trench C IX
CAR-896	6470±90		5620–5290	Peat	Base of black humified peat in Profile E77
CAR-895	5550±80		4560–4230	Peat	Top of black humified peat in Profile E77
HAR-5236	9470±100	-28.6	9195–8545	Peat/wood	From context [5012], the Early Mesolithic occupation surface. Trench C XIII
HAR-5237	9800±80	-29.3	9650–8860	Peat	From context [2506], peat which contained worked flint. Trench C VIII
HAR-5238	9300±110	-28.2	9095–8275	Wood charcoal	From [2018], the Early Mesolithic occupation surface, associated with worked flint, adjacent to Scatter H. Trench C XVIII
HAR-5547	8910±200		8550–7585	Charcoal	Sample taken from immediately below dense flint concentration (Scatter K) in [5012] (Early Mesolithic occupation surface). Trench C XI
HAR-5790	9520±90	-29.3	9200–8630	Peat	Sample from alongside and below animal bone in deep peat close to pollen monolith C VIII. Trench C VIII
HAR-5791	9340±160	-27.8	9145–8275	Charcoal	From a charcoal lens in sand layer [2018] (the Early Mesolithic occupation surface) adjacent to Scatter H. Trench C XVIII
HAR-5792	9900±140	-29.2	10,035–8920	Charcoal	From within a large pit. Trench C XIII
HAR-5793	9320±150	-28.2	9135–8270	Charcoal	From the same pit as HAR-5792, but taken from a greater depth
OxA-26542	9340±45	-22.4	8740–8470	Bone – elk/ aurochs size	From peat [2132]. Trench C IX

taken as reliable indicators for the date of occupation. Two further dates were obtained on the top and base of the layer of black, humified peat in pollen profile E77, recorded as contexts [2013/2054/2075/2503] during the excavations. These have been previously reported by Cloutman (1988b, 28) and provide ages for the formation of this deposit.

Discussion

Seamer Carr Site C was investigated over a seven-year period by the Seamer Carr Project. The site was discovered through an initial programme of trenching in 1977, and investigated further through a combination of 2 × 2 m test-pits and larger, open-area excavation, ultimately covering an area of 1400 m^2. This work recorded a large assemblage of 14,275 pieces of worked flint, dating typologically to the Terminal Palaeolithic (Long Blade) and Early Mesolithic (though it is possible that some of the lithics date to the Final Palaeolithic/ Federmesser). A much smaller assemblage of animal bone was also recorded, much of which was spatially associated with the lithics. Much of the Terminal Palaeolithic and Early Mesolithic flint occurred in spatially discrete scatters that were generated by distinct episodes of activity. Although these scatters are mostly undated (except on typological grounds), the lack of refits between some of them, and the variations in the character of activity they represent, suggests that these represent separate visits to the site.

At the time it was occupied, Site C lay on a small, low-lying hill, immediately adjacent to the lake shore to the south, and separated from the high ground of Manham Hill to the east by a small inlet or channel. Though none of the environmental sequences from the site document the environments prior to the start of the Holocene, the regional pollen profile suggests that the local landscape would have been open grassland during the first half of the Windermere Interstadial, that was subsequently colonized by juniper scrub and birch woodland (see Chapter 5). Conditions would have become more open during the Loch Lomond Stadial, after which birch and willow woodland developed on the dry ground, and beds of reeds and aquatic vegetation became established within the lake margins in the early centuries of the Holocene. As organic sediments accumulated around the edges of the basin during the Early Mesolithic, the lake margins became shallower, and fen and carr environments became more extensive, while above the shoreline hazel began to grow on the site and in the surrounding landscape.

Peat-forming environments began to extend above the shoreline during the Early Mesolithic, a process that would have gradually buried the lower-lying parts of the site. The radiocarbon date from the base of the peat in trench C IX shows that these environments were already becoming established by 9220–8545 cal BC (9480±110 BP, CAR-195) on the lower ground, though a date on charcoal associated with one of the lithic scatters recorded further up slope shows that the higher ground was still clear of wetland deposits by 8715–8290 cal BC (9260±90 BP, CAR-197). By the end of the Early Mesolithic, however, these environments are likely to have sealed much of the earlier land surface, leaving Site C as a small, tree-covered mound within the expanding wetlands.

The earliest human activity at the site may be represented by the small assemblage of Final Palaeolithic curve-backed points, which date (typologically) to the latter half of the Windermere Interstadial. None of this material could be refitted to knapping debris, making it difficult to infer the character of activity taking place. However, Final Palaeolithic material was also recorded from Site K, *c*. 270 m to the west, and the material from Site C may be related to this phase of activity (see Chapter 7).

Terminal Palaeolithic activity was more extensive, consisting of three scatters of lithic material (Scatters B1, C and F) and small quantities of horse bone. Activity at Scatters B1 and F was relatively small in scale, but Scatter C was more substantial, with several blocks of material reduced by at least two different knappers, and a broader range of tools manufactured, repaired and used. The range of tools found at Scatter C is rare for Long Blade assemblages, and may represent a residential site, though given the size of the assemblage one only of relatively short duration.

While attempts to date the Terminal Palaeolithic activity failed (the only radiocarbon date that is spatially associated with this activity is CAR-197, and the calibrated age is far too young), refitting shows that the assemblages were probably generated through at least two separate visits to the site. On these visits, human groups arrived already provisioned with raw materials that they had accessed from non-local sources, which recent work suggests was South Lincolnshire or North Norfolk (Conneller et al. 2019). Some of this material was used to manufacture tools, including burins and scrapers, which were used and subsequently discarded, while the remainder was worked to produce a series of blades that were then taken away. As Conneller (2007, 232) has argued, this emphasis on provisioning suggests a flexible mobility strategy that allowed people to respond to differing situations within the wider landscape.

The Early Mesolithic activity was slightly more extensive, and of a different character to that of the Terminal Palaeolithic. A wider range of raw materials was utilized, and the range of tools-types reflects a wide variety of tasks, including hunting and butchering (e.g. microliths, blades), manufacture and/or maintenance of composite tools (microburins) making and repairing wooden, antler and/or leather objects (e.g. burins, scrapers). In addition, parts of the carcasses of animals, particularly aurochs, were being brought to this locality having been hunted and killed in the surrounding area, and were presumably processed for meat and raw materials. However, while varied activities are represented on a small scale, the main lithic assemblages (Scatters H and K) are strongly focused on scraper production and use, thus the Mesolithic component of Seamer C is a rare example of one of Mellars' type C sites, a type that he suggested may have had particular seasonal and gender associations (Mellars 1976). Scrapers can have varied uses, but microwear studies on scrapers from Star Carr suggest they were mostly used for scraping hide (Dumont 1988; Conneller et al. 2018). Such intense focus on hide-working may well have had a seasonal component, given that animal skins attain their optimum condition in the autumn (Mellars 1976; Jacobi 1978, 315). Clark's (1954) equation of scrapers with the presence of women, based on analogy with Inuit groups, was followed by Mellars in his interpretation of scraper dominated sites. While such direct analogies are undoubtedly problematic (Lane 2014), it is certainly worth considering that such a specialized site may have been occupied by a task group of particular age or gender.

Establishing an absolute chronology for the Early Mesolithic activity is problematic. Although several radiocarbon determinations were obtained (Table 6.8), there are potential problems with a number of these (see Chapter 4), while the large error ranges of the remainder make it difficult to establish a precise timescale for human activity. Those radiocarbon dates from Site C that are deemed reliable could suggest activity starting in the centuries around *c*. 9000 cal BC and spanning much of the millennium, though not necessarily continuously (see also Conneller et al. 2016). However, as many of the dates have poor associations with the archaeology, it is safer to suggest that the site was visited on several occasions during the early part of the period. The limited seasonal evidence that can be derived from the faunal assemblage suggests that at least some activity took place here during the warmer months of the year, but there is nothing that would rule out activity at other times, and indeed the composition of the lithic assemblage may suggest occupation during the autumn.

There is no evidence for activity during the Late Mesolithic, and gradual encroachment of wetland environments over the site may have meant that it was no longer regarded as a place suitable for certain forms of activity. However, it is possible that human communities continued to visit the location for tasks such as hunting or harvesting plants within and around the edges of the wetlands.

Chapter 7

Seamer Carr Sites K, L and N

Paul Lane, Barry Taylor, Chantal Conneller, Peter Cardwell, Roger Simpson, Geoff Smith & Tim Schadla-Hall†

This chapter summarizes the results of the excavations at Site K conducted between 1981 and 1986, as well as the excavations of two areas to the north, designated Sites L and N respectively. The excavations in these two additional areas were more limited in scope, due to both the nature and extent of the archaeological deposits, and constraints on the available time and resources for their investigation. Although the three areas are in proximity to one another, and hence why they are treated together here, this does not imply that any of the activities represented at sites K, L and N were necessarily coeval with one another.

Seamer Carr Site K

Site K lies on the southwest slope of a small hill, in the northwest corner of the lake basin (NGR 50330 48199), roughly 250 m west of Site C. It was first identified during the 1981 programme of 2 × 2 m sampling (test-pits Z13 & Z14), and delineated by further sampling in 1982 (test-pits EZ13A-F, EZ14A-C, EZ15 and 15A, EZ16 & EZ306). Open-area excavations were carried out from 1983, with work continuing until the summer of 1986, by which time an area of *c*. 2300 m^2 had been investigated. Stratigraphic and palynological analyses indicate that Site K lay on the southern side of a narrow kame formation, close to the edge of a small lagoon (known as the West Embayment). The earliest activity is associated with an organic deposit, sealed beneath an almost sterile layer of sand, located toward the western part of the site. This contained a relatively discrete scatter of 2298 Final Palaeolithic worked flints in association with a few fragments of poorly preserved bone. Radiocarbon dating of the deposit places its formation in the latter stages of the Windermere Interstadial.

The bulk of the finds, totalling 12,137 struck pieces of flint and 79 pieces of bone and antler, were recovered from the Early Mesolithic horizon and were associated with a number of anthropogenic features. Two radiocarbon dates on material from the Early Mesolithic occupation horizon indicate that activity took place sometime during the late tenth or early to mid-ninth millennium cal BC.

Two groups of microlithic bladelets of Late Mesolithic type were also recovered from the upper peat horizons. One group, which contained a total of 17 pieces, was associated with a straight section of wood that probably represents the remains of an arrow shaft. Two radiocarbon dates for this complex place this phase of activity in the earlier part of the Late Mesolithic (the mid-eighth to mid-seventh millennium cal BC). These finds have been fully reported elsewhere (David 1998).

Palaeoenvironmental investigations at Site K

The topographic survey of the area indicates that Site K lay on an area of gently sloping ground on the southwest corner of a small hill (Rabbit Hill). The southeast part of the site lies just above the lake shore, whilst to the west was a large, shallow lagoon or embayment (the West Embayment).

The palaeoenvironmental investigations at Site K and its environs included sampling for pollen, and systematic peat-boring along transects (see Cloutman 1988a, 2–6), as well as more localized sampling during excavation for beetles, molluscs and plant macrofossils. Two pollen profiles were recorded from the site and have been published (Cloutman 1988b). The first (Profile K2) sampled the Late Glacial organic deposit that had been sealed beneath a layer of sand on the western side of Site K (Fig. 7.1). Although preservation was poor, the pollen indicated a relatively open habitat, with shrub species such as dwarf birch and rockrose growing in the general vicinity as the deposit was forming (Cloutman 1988b, 28). Based on radiocarbon dating, Cloutman argued that the deposit formed

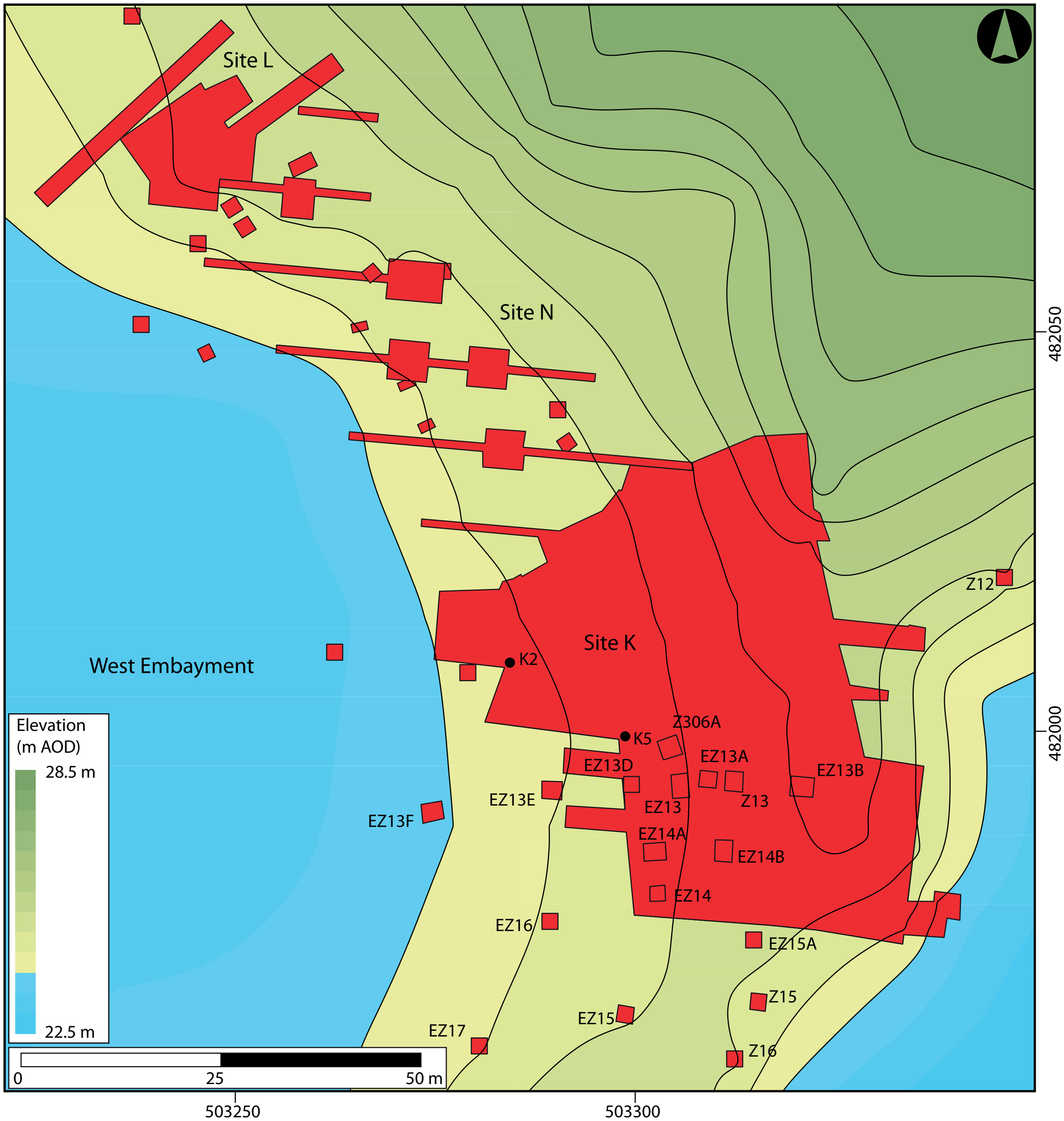

Figure 7.1. *Excavated areas at Sites K, L and N, and location of Cloutman's palaeoenvironmental sampling points (black dots) at Site K (level of the lake shown at 24 m AOD).*

during the Windermere Interstadial, and possibly into the subsequent Loch Lomond Stadial (Cloutman 1988b, 28 and see below). Organic sedimentation was then interrupted by the deposition of a layer of calcareous sand that was laid down across the lower part of the site, possibly as a result of either hillwash or solifluxion during the Loch Lomond Stadial (Cloutman 1988b, 28).

There is no pollen record for the Early Mesolithic from Site K, but the local stratigraphy suggests a comparable environmental sequence to that recorded at Sites C and D, with reedswamp, followed by fen and carr forming in the shallower parts of the lake to the south of the site, and the embayment to the west (see Cloutman 1988b, 33: Fig. 7). Based on the

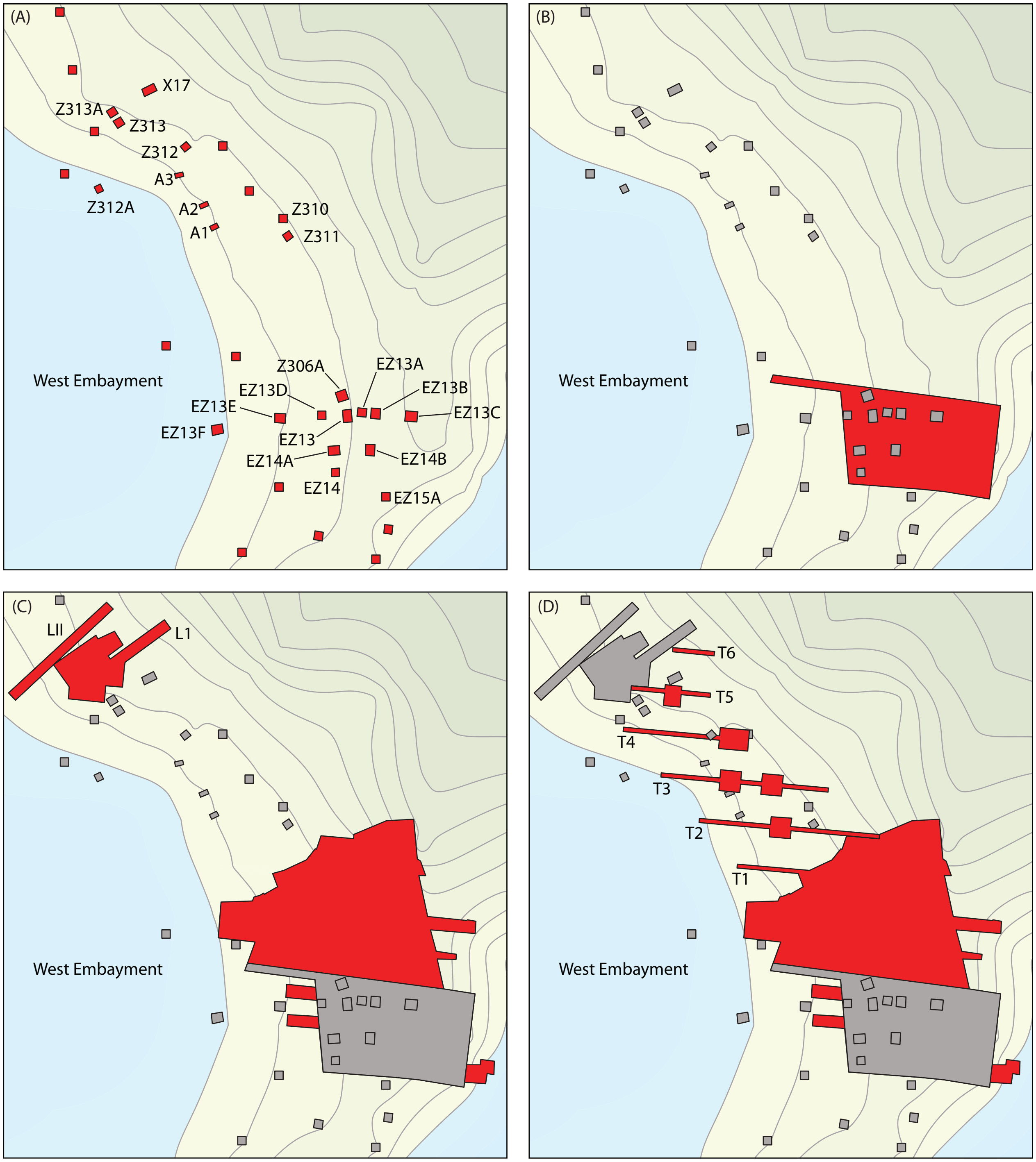

Figure 7.2. *Test-pits and area excavations, Sites K, L and N, 1981–5; A) the 1982 test-pits; B) 1983 area excavations at Site K; C) extension of area excavations at Site K, and Site L excavation areas; D) final excavations at Site K and additional exploration at Site N (T1-T6).*

pollen profiles from Sites C and D, birch woodland was probably forming over some of the drier areas of the site in the early centuries of the period, with hazel becoming established later. Dates on the base of the organic deposits where they overlay the basal geology show that peat-forming environments began to expand over previously dry ground at the western side of Sites K and L during the Early Mesolithic, reaching 25 m

Figure 7.3. *Excavations in the 'deep peat' extension, Site K, July 1983.*

AOD from 9225–8555 cal BC (9490±110 BP, CAR-881), and had reached a similar elevation on the south of the site by 8455–7820 cal BC (9000±100 BP, CAR-878) (Cloutman 1998a, 15).

The second pollen profile, K5, was recorded from a sequence of peat that had formed over the Early Mesolithic land surface at the western side of Site K, adjacent to where the two scatters of Late Mesolithic microliths were recovered (Fig. 7.1). Here, the pollen record showed that a relatively open fen environment was forming in the area, with hazel and oak growing on drier ground nearby (Cloutman 1988b, 28–9). The area became drier at around 7190–6650 cal BC (8020±90 BP, HAR-5789), corresponding stratigraphically with the deposition of the microliths, while the pollen indicates episodes of ground or vegetation disturbance, probably resulting from either animal or human action (Cloutman 1988b, 30). The upper half of the profile is undated, but the pollen shows that the area became wetter again, with pine and oak growing in the surrounding landscape before alder became established toward the end of the Mesolithic (Cloutman 1988, 30).

Archaeological investigations at Site K

Archaeological material was first identified in the area in 1981, during the 2 × 2 m test-pit sampling programme, when worked flints were recovered from two test-pits (Z13 and 14) that had been excavated to the north of the narrow gravel isthmus linking Rabbit Hill with West Island (Site D). The relatively large size of the assemblage from Z13 (312 pieces) and the lack of material to the east (Z12) and south (Z15) suggested that this may have been a discrete area of activity. In 1982, a series of further test-pits were excavated to the west of Z13–Z15 (Fig. 7.2a). These eleven test-pits, (EZ13 and 13A-F; EZ14 and 14A-C) all produced relatively high concentrations of worked flint and in a few cases pieces of animal bone, mostly from a layer of peaty sand immediately below the covering peat deposits. As these densities suggested the presence of an Early Mesolithic occupation horizon, open-area excavation was subsequently undertaken. In 1983 an area measuring 865 m^2 was opened, and a 2 × 15 m trench, the 'deep peat' extension, was excavated into the deeper deposits towards the edge of the West

Embayment (Figs. 7.2b, 7.3). During the 1984 season, the main area was extended some 35 m northwards (Fig. 3.9), and excavated to the basal geology, but there was a marked drop off in the density of finds in this area (Fig. 7.2c). Accordingly, in 1985, these parts of the site were sampled by excavating a series of two-metre wide 'trowelling lanes' aligned diagonally southeast to northwest (Fig. 7.2d), so as to complete the sampling of the site. In 1986, a brief return visit was made to complete excavation of a few small areas.

Stratigraphy

Paul Lane, Peter Cardwell, Roger Simpson, Geoff Smith & Barry Taylor

A broadly similar stratigraphy was recorded across the main areas of Site K. The main exception was across the part of the site bordering the West Embayment. The deposits here were deeper and more complex, largely due to the combined effects of geomorphological processes active during the Late Glacial, and the encroachment of organic deposits across this portion of the site at the start of the Holocene (Fig. 7.4).

The basal deposit consisted of a sandy gravel containing thin bands of sand and boulder clay, and constitutes the surface of the glacially derived kame deposit [5015] (Table 7.1). Overlying this was a layer of fine yellow gravelly sand [5014 and 5023], which became siltier and less gravelly on the more elevated parts of the site (to the east of the excavated area). This deposit probably represents the land surface at the start of the Windermere Interstadial.

Table 7.1. *Contexts assigned to the basal minerogenic deposits, Site K.*

Context	Description
5015	Sandy gravel – basal geology
5014	Yellow gravely sand overlying 5015
5023	Siltier sand, otherwise the same as 5014

Table 7.2. *Contexts assigned to the Windermere Interstadial and Loch Lomond Stadial deposits, Site K.*

Context	Description	Site area
5069	Fine organic detritus, same as 5085	Trench Z306A
5085	Fine organic detritus, same as 5069	Site K, west
5091, 5114	More humified organic detritus	Site K, east
5084	Carbonate rich sand	Site K, west
5103	Carbonate rich sand	Site K, east

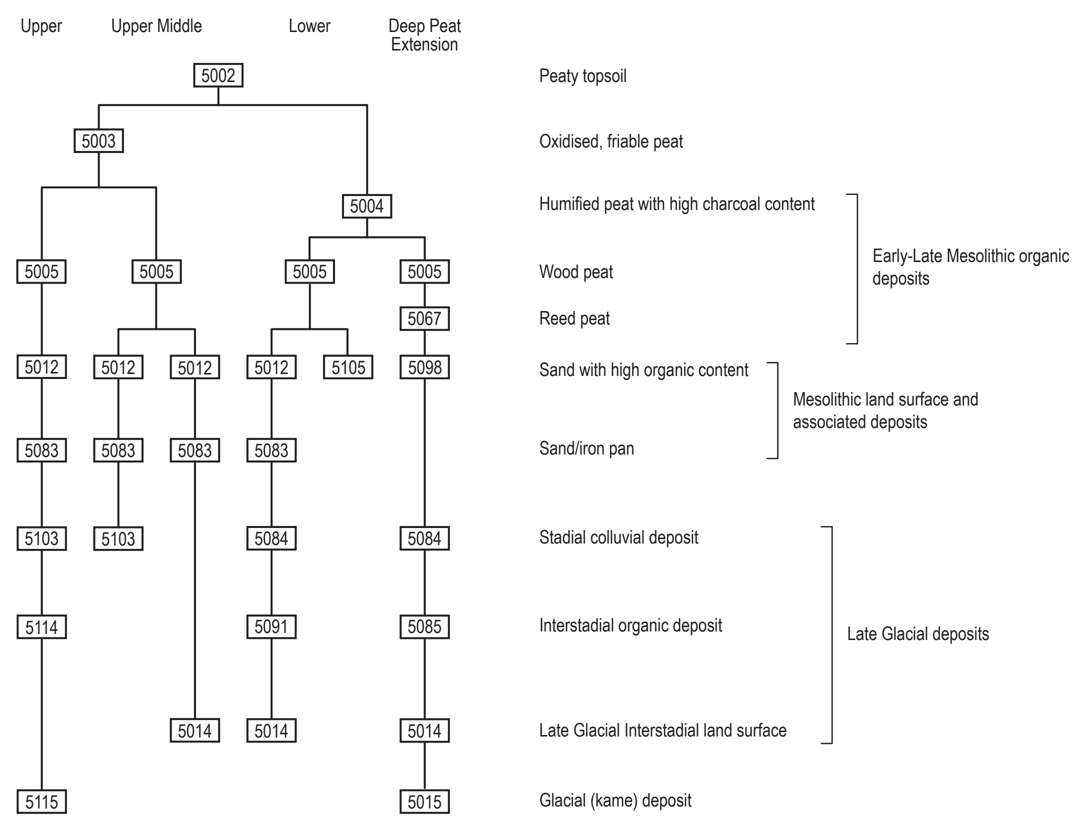

Figure 7.4. *Summary Harris Matrix, Site K.*

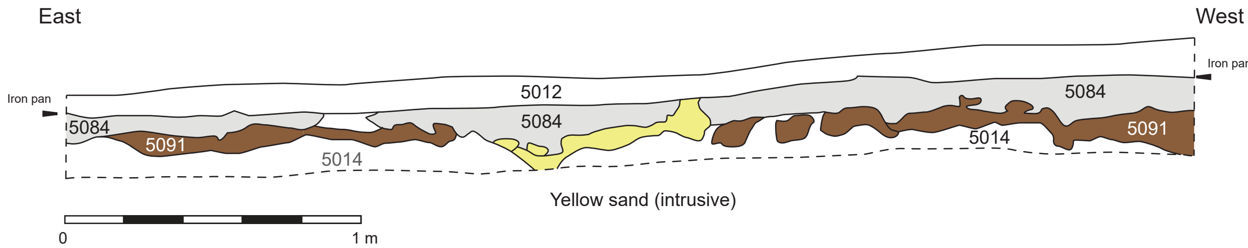

Figure 7.5. *Section through the sequence of Late Glacial deposits [5014, 5091, 5084] and the overlying Early Holocene sediments [5012].*

Overlying the minerogenic deposits on the lower-lying parts of the site was a fine organic detritus [5069/5085], which became more humified further upslope [5091/5114] (Table 7.2). This deposit was not always continuous, and the more humified detritus became increasingly patchy (or was absent) on the more elevated parts of the site (Figs. 7.4, 7.5). A date obtained by Cloutman (1988b, 28) on the base of the deposit places its initial formation within the Windermere Interstadial (12,240–11,600 cal BC (12,010±130 BP, CAR-842)), while two dates on the top of the deposit suggest that the cessation of organic sedimentation occurred either at the end of the Interstadial or in the early centuries of the Loch Lomond Stadial (11,105–10,750 cal BC (10,960±110 BP, CAR-841), 11,145–10,745 cal BC (11,000±130 BP, HAR-5242)). A fourth date obtained on the organic detritus is significantly younger (10,095–9275 (10,040±130 BP HAR-5787)), and (if correct) suggests that the deposit continued to form in the Loch Lomond Stadial, and (potentially) the Early Holocene. This will be discussed further at the end of this chapter.

The organic detritus was sealed across parts of the site by a layer of carbonate rich sand [5084/5103], up to 0.2 m thick, interpreted by Cloutman (1988a) as a colluvial deposit formed during the climatic deterioration of the Loch Lomond Stadial. This deposit was best defined in the lower-lying areas to the west and east, but only survived as localized patches on the higher ground toward the centre and north of Site K. However, the presence of these patches suggests that the sand originally covered the entirety of Site K, and had been disturbed and reworked, either during the later part of the Loch Lomond Stadial or in the early part of the Holocene.

The sequence of Late Glacial deposits was sealed across much of the site by a medium-coarse grey sand [5012] (Tables 7.3, 7.4). This had a greater organic content across the lower lying parts of the site (especially to the west), becoming increasingly peaty and with inclusion of *Phragmites* reed fragments (Fig. 7.6). This deposit probably constituted the Early Holocene land surface, though in parts of the site the underlying deposits would still have been exposed during this period. On the eastern side of the site a thin, but compacted and iron rich sand [5083] lay beneath this deposit, and probably represents an area of increased mineralization caused by the percolation of groundwater through the overlying deposits, and associated leaching of iron and other minerals.

These minerogenic deposits were then sealed by a sequence of organic sediments that were forming at the edge of the lake or in the West Embayment, and which subsequently encroached upslope across the more elevated parts of the site. These began with the formation of a thin layer of *Phragmites* reed peat [5067], which accumulated over the peaty sand on the lower-lying areas along the west of Site K, where it bordered the West Embayment. A single radiocarbon date on

Table 7.3. *Contexts assigned to the minerogenic deposits representing the Early Holocene land surface, Site K.*

Context	Description	Site area
5012	Medium-coarse grey sand	Site K
5098	Brown peaty sand with *Phragmites* reed fragments forming a continuation of 5012 on the lower-lying parts of the site.	Site K, west
5083	Compacted, iron rich sand/iron pan	Site K, east

Table 7.4. *Contexts assigned to the organic deposits, Site K.*

Context	Description	Site area
5080	Layer of flint cobbles	Site K, south
5003	Friable peaty deposit	Site K
5004	Black, highly humified peat with high charcoal content	Site K
5005, 5006	Humified wood peat	Site K
5081	Calcareous sand with shells, forming lenses in the base of 5005	Site K, west
5067	*Phragmites* reed peat	Site K, west

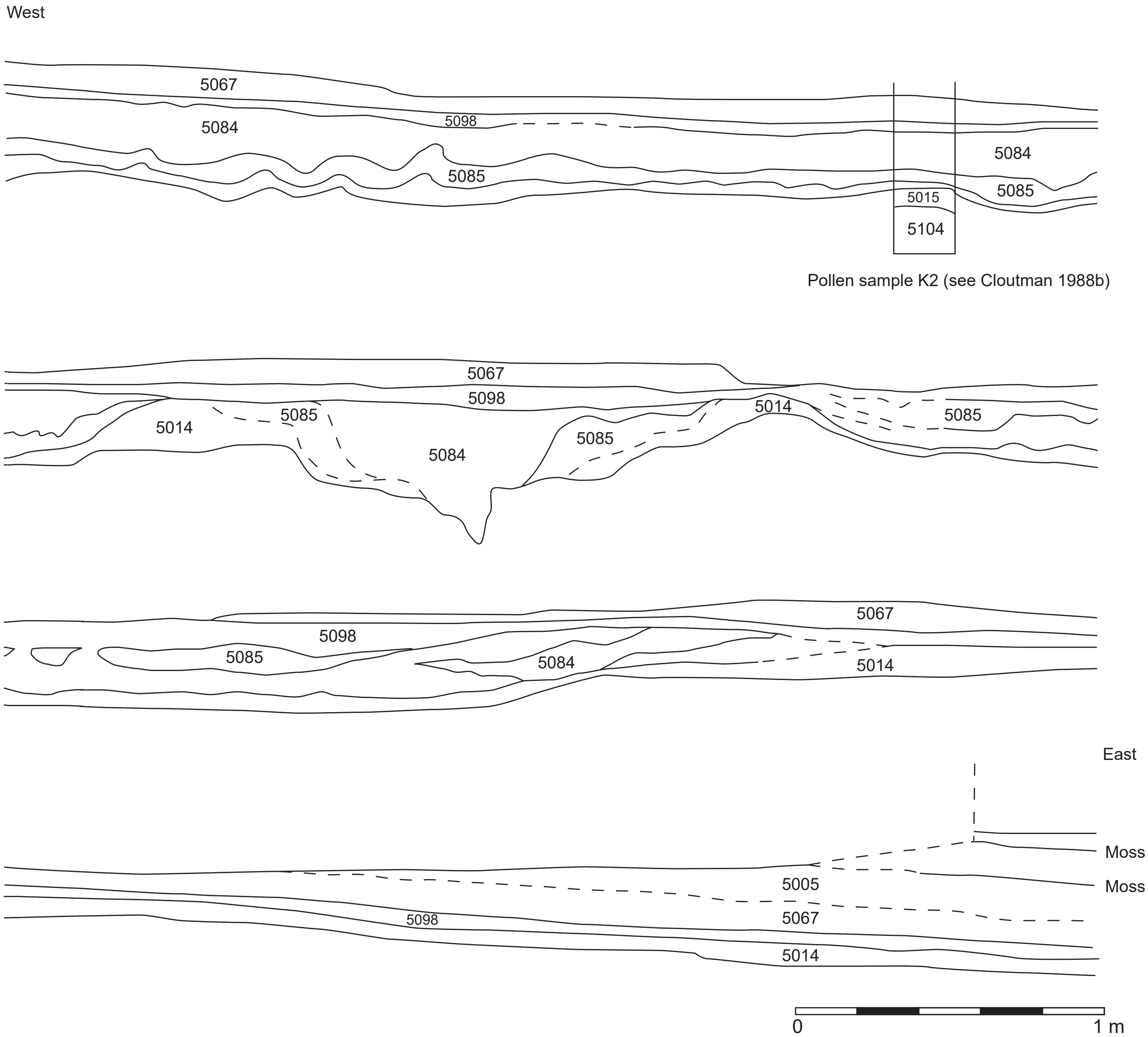

Figure 7.6. *North-facing section through the sequence of Late Glacial deposits [5015, 5014, 5085 and 5084] and the overlying Early Holocene minerogenic [5098] and wetland deposits [5067, 5005] on the western side of Site K following removal of the upper peat deposits.*

a fragment of charcoal from this deposit indicates that it was forming by 9255–8625 cal BC (9560±120 BP, HAR-5241). This deposit, or where it was absent, the Early Holocene land surface, was then sealed by a thick layer of humified wood peat [5005/5006] that extended across the entire site, and represents the progressive encroachment of fen and carr environments.

On the lower-lying areas to the west the wood peat was relatively thick (up to 0.9 m thick) and contained thin layers of calcareous mud (marl) and moss (Fig. 7.7), probably related to a calcium-laden water source, such as a stream flowing into the embayment from the north, or springs emerging from beneath the glacial till, resulting in localized ponding in the West Embayment (see Cloutman 1988b, 34–5). Elsewhere along the western edge of the site intermittent lenses of light grey calcareous sand with small shell fragments [5081] were recorded near the base of the wood peat, and may have formed through similarly related processes. On the more elevated parts of the site towards the east and north, the wood peat became much thinner (*c.* 0.2 m thick) and more humified.

Dates obtained by Cloutman (1988a) on the base of the wood peat show that it began to form over the Early

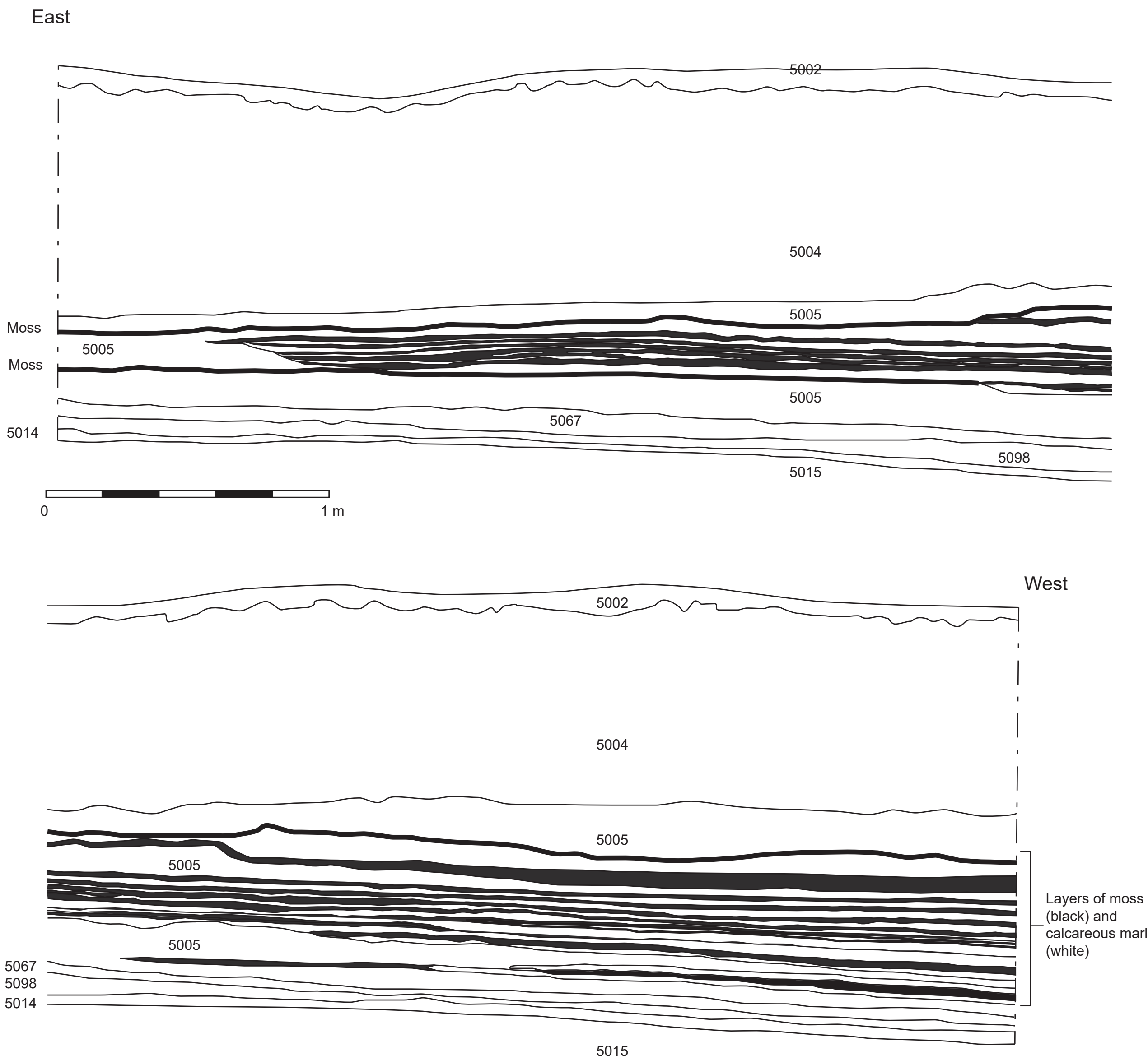

Figure 7.7. *Section through the sequence of Early Holocene wetland deposits recorded at the edge of the West Embayment showing the alternating layers of calcareous marl and moss within the wood peat [5005].*

Holocene land surface during the Early Mesolithic, and continued to form into the latter part of the period. Two samples taken from the base of the wood peat at 24 m AOD date to 9300–8810 cal BC and 9815–8920 cal BC (9700±90 BP, CAR-879 and 9860±110, CAR-882 respectively), and two further samples taken from the base of the peat at the 25 m AOD contour date to 8455–7820 cal BC and 9225–8555 cal BC (9000±100, CAR-878 and 9490±110, CAR-881 respectively). Towards the top of the deposit a radiocarbon assay on a sample of peat that lay adjacent to a cluster of Late Mesolithic microliths was dated to 7180–6650 cal BC (8020±90 BP, HAR-5789) (for details, see David 1998, and Cloutman 1988b). Pollen analysis on samples from this deposit show that it was forming in an herbaceous, fern rich fen (Cloutman 1988b, 28–30).

The wood peat was succeeded by a band of black, highly humified peat with a high charcoal content [5004]. This was also identified at Site C, where it was dated to the Late Mesolithic (see Chapter 6). Above this was a friable, peaty deposit [5003] that was succeeded by the modern topsoil. At the eastern edge of the site along the line of the gravel isthmus linking Site K with Site D (West Island) traces of a causeway made from flint cobbles [5080], presumed to be of medieval origin, lay between the topsoil [5002] and the friable peat.

Natural features

A series of very shallow, irregularly shaped hollows, infilled with a sandy peat and sometimes associated with low mounds of gravel, truncated the basal geology across Site K (Table 7.5). Seven of these were investigated through excavation. Given their shape and the character of their fills they have been interpreted as natural features, probably tree throws (Fig. 7.8). Analogous features have been recorded in a number of similar contexts, including the Early Mesolithic site at Thatcham, Berkshire (Healey et al. 1992, 46; see also Macphail and Goldberg 1990). Several mounds of gravel were also noted overlying the basal gravel, of which several were excavated and again interpreted as natural features.

Two shallow, irregularly sided gullies filled with a sequence of sand or sandy gravels, and then by the overlying Early Holocene land surface [5012], were also recorded cutting into the basal geology. The largest [5083] was a linear feature with a V-shaped profile extended for *c*. 12 m on a north–south alignment, the other was a narrow, curved gully [5123]. Both have been interpreted as having formed as the result of frost action.

Table 7.5. *Contexts assigned to natural features truncating the basal geology [5015] and the Early Holocene land surface [5012], Site K.*

Context	Description
5094, 5095, 5096, 5097, 5099, 5110, 5117	Irregular hollows filled with sandy peat
5108, 5116	Isolated mounds of gravel
5083	Shallow, linear gully with V-shaped profile
5014	Yellow-grey sand, primary fill of 5083
5013	Silty sand, secondary fill of 5083
5123	Curved, shallow gully (filled by 5012)

Anthropogenic features

Several features were associated with the Early Holocene land surface (Fig. 7.9). Two small, oval hollows or pits [5109 and 5110] were recorded in the middle of the site, within the main concentrations of worked flint (between Scatters 2 and 23) (Fig. 7.10). Feature [5110] had a thin primary fill of grey sand, and both were filled with a blackish brown sandy peat. Neither contained any finds, but given their size and morphology could have acted as small pits.

A third possible pit [5134] was recorded cutting into the Early Holocene land surface towards the western edge of the main scatter of flint. A small, discrete mound of sand, gravel, and large stones lay adjacent to the feature and may have been associated with its use. Finally, a possible hearth [5121] was recorded to the north of these features, on top of a small mound of gravel, just to the south of a dense scatter of worked flint (Scatter 1) (Fig. 7.11).

Summary of the archaeology at Site K

An assemblage of 12,137 pieces of worked flint, and a much smaller assemblage of faunal material (79 fragments), were recorded during the excavation of Site K. The majority of the lithic assemblage can be dated on typological grounds to the Final Palaeolithic (Federmesser) and the Early Mesolithic, though two clusters of Late Mesolithic microliths, probably representing the remains of composite tools, were also recorded.

The majority of the flint and faunal remains were recorded from the basal mineral sediments, predominantly context [5014] and the Early Holocene land surface [5012 and equivalents], and from the Late Glacial detrital muds [context 5091 and equivalents] that lay between them. However, there was a significant degree of post-depositional movement, resulting in typologically Late Glacial material occurring within the Early Holocene deposits and (to a lesser degree) Early Mesolithic microliths present within the Late Glacial deposits. As such, the stratigraphic position of the worked flint cannot be taken as a reliable indicator of its depositional context or age.

A small assemblage of worked flint (137 pieces) and faunal material was recorded from the thin layer of *Phragmites* reed peat [5067] that formed across the western side of the site during the Early Mesolithic. Most of this material forms a spatially discrete scatter (Scatter 21A) and could reflect a phase of activity undertaken in damp, boggy conditions at the edge of the West Embayment, especially given the very fresh nature of the material and the quantity of fine debitage recovered during excavation. A second, discrete assemblage of worked flint, consisting of two clusters of Late Mesolithic microliths, was recorded from the top of the wood peat at the eastern end of the site. This material is also considered to be *in situ*, and probably represents the remains of composite tools that were lost or discarded in the area. Very small quantities of flint and animal bone were also recorded from the sequence of wood peat [5005], humified peat [5004] and the friable peat [5003] directly below the topsoil in other areas of the site. Whilst some of this material may represent *in situ* activity, most probably derives from post-depositional movement.

The lithic assemblages form a series of localized concentrations or scatters across the excavated area (Fig. 7.12). However, these generally lack the coherence of the scatters recorded at Site C and exhibit a greater degree of mixing between adjacent areas as well as the vertical movement of material from stratigraphically

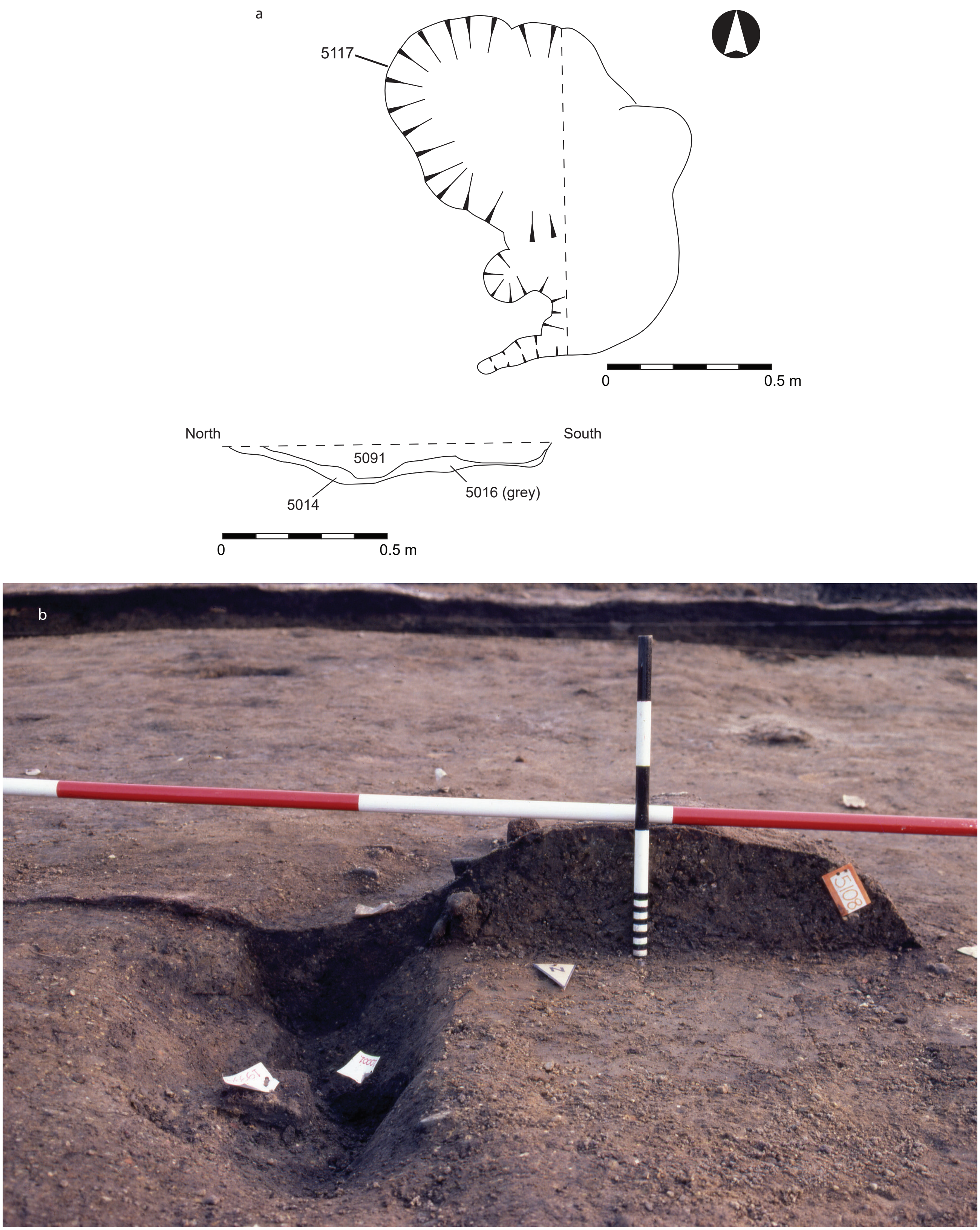

Figure 7.8. *(a) Plan and section of Feature [5117], a probable tree-throw hollow; (b) Section through isolated gravel mound [5108].*

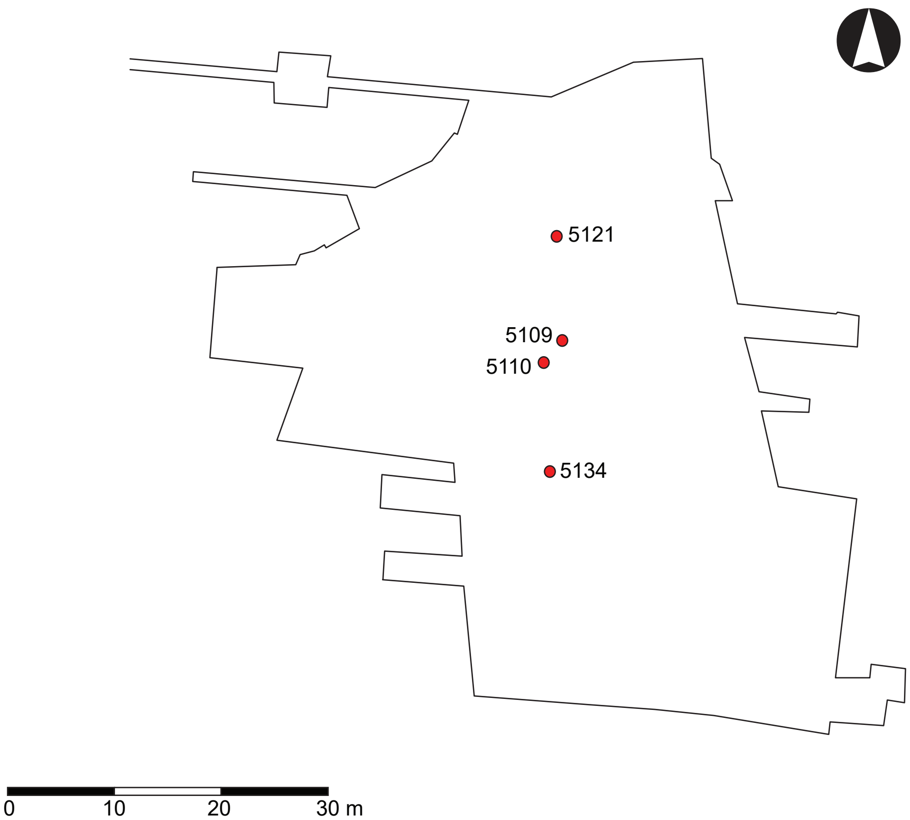

Figure 7.9. *Location of anthropogenic features at Site K.*

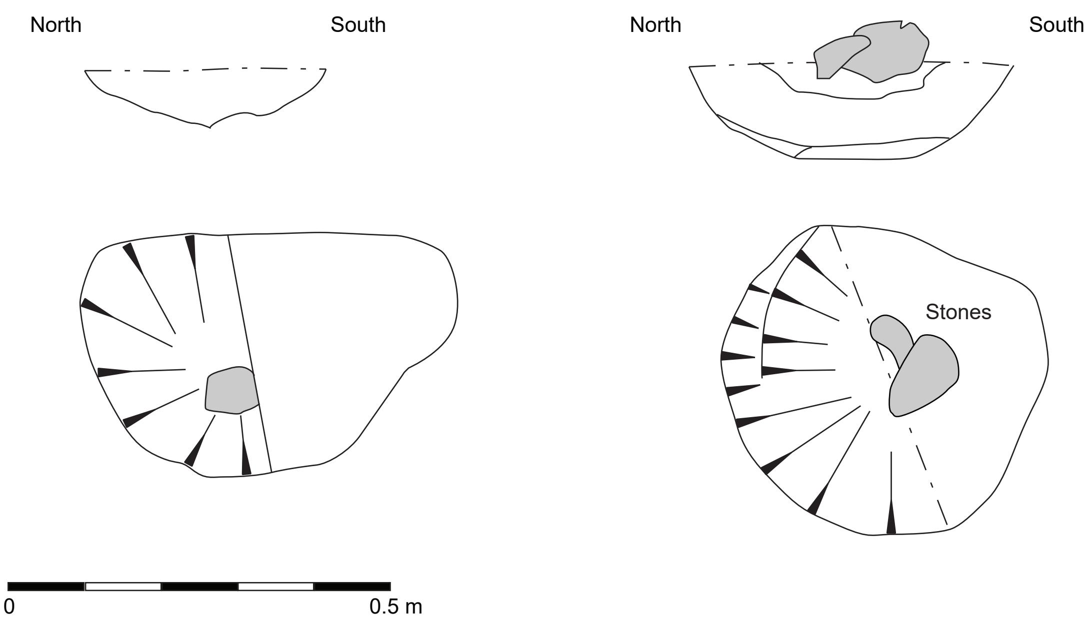

Figure 7.10. *Possible pits, Site K [left – 5109 and right – 5110].*

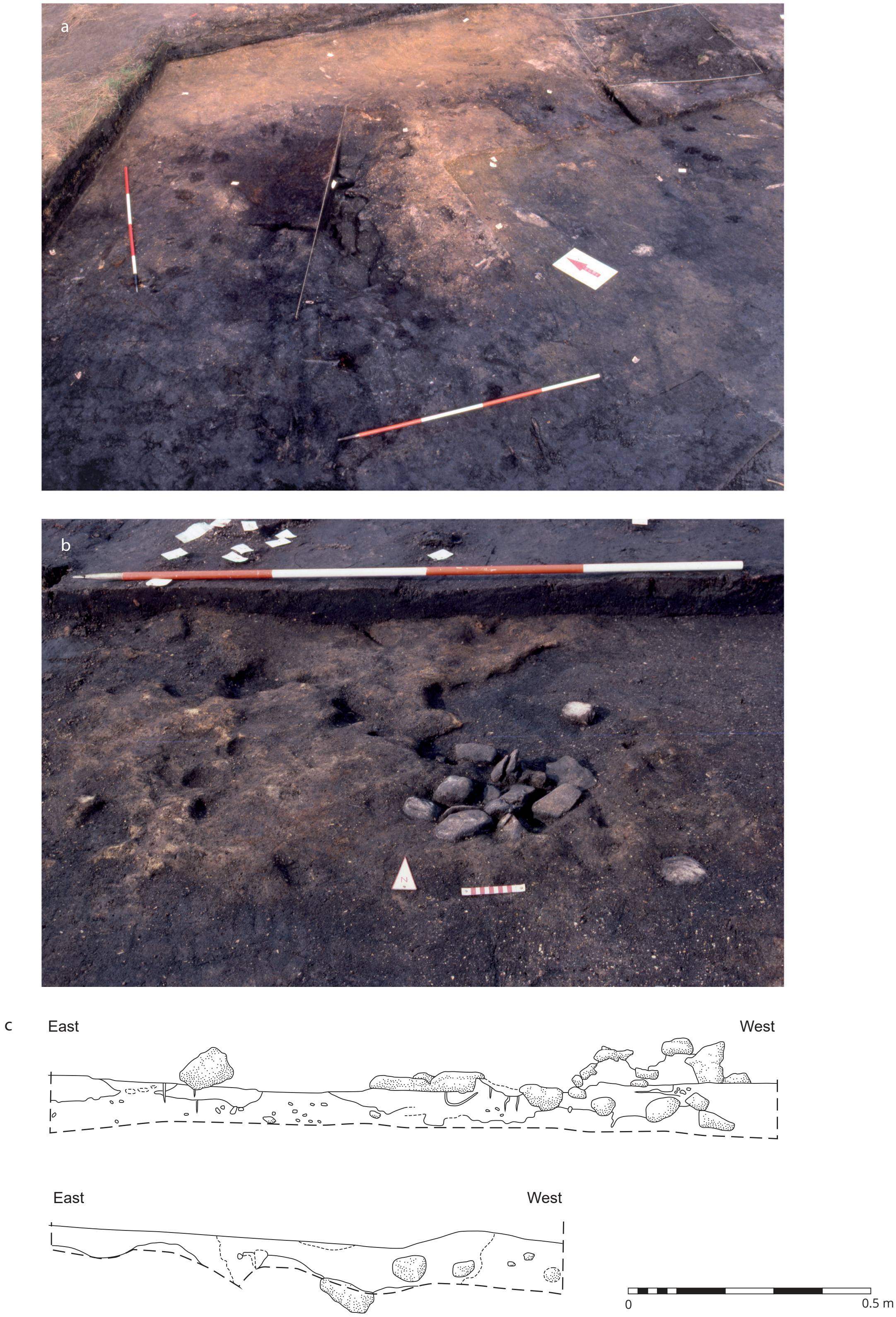

Figure 7.11. *(a) Area of blackened sand [5012] centred on possible hearth [Feature 5121]; (b) Feature 5121 under excavation; (c) Section through possible hearth [5121] on Site K (Photos Simon Evanston, 1983; section drawing prepared by Chloe Watson).*

Figure 7.12. *Distribution of the main lithic scatters at Site K. For other scatters refer to Figure 14.22b.*

earlier contexts. As a result, some spatially defined scatters contain diagnostically Final Palaeolithic and Early Mesolithic material as well as material generated at other parts of the site, making it difficult to assign them to a particular period. Additionally, in some instances material appears to have been brought onto the site and deposited or dumped in discrete middens, creating scatters that are the result of multiple episodes of activity undertaken at other locations in the surrounding landscape. This is best demonstrated by Scatter 2, where refitting shows that part of the assemblage was generated by the almost complete reduction of two beach pebbles, reflecting activity taking place *in situ*. However, the scatter also included large pieces of debitage from a variety of raw material units, and 16 cores (half of which had been worked to exhaustion), only one of which could be refitted to the debitage. This part of the assemblage appears to reflect material that has been brought to Site K and deposited there.

Despite these limitations, the assemblages represented by these scatters still reflect discrete sets of actions, albeit intermixed with material generated during different visits to the site and in some cases deriving from other locations in the landscape. In contrast to Site C, where Early Mesolithic activity appears to have been relatively specialized, activity at Site K was more varied with the lithic scatters reflecting a wide range of tasks undertaken during both the Final Palaeolithic and Mesolithic.

Scatters 3 and 4, for example, are predominantly Final Palaeolithic (though Early Mesolithic is also present), and are both dominated by scrapers (at least one of which was repaired on site), though burins and burin spalls were also recorded (the latter occurring in higher quantities), indicating their use and maintenance, as well as microliths and microburins. A similar pattern can be seen just to the north at Scatter 5, which is also of mixed age with both backed pieces and microliths present in the assemblage. The scatter is again dominated by scrapers, and contains burins and higher numbers of burin spalls, but both microliths and microburins were present in significant numbers, suggesting a greater focus on retooling activities (which refitting shows were carried out at the site).

Retooling also took place at Scatter 30, where the assemblage included 40 microburins and 21 microliths. Refitting shows that several pieces of raw material were brought to the site and reduced to produce blanks from which many of the microburins were produced. This activity was particularly intensive, with eleven microburins produced from a single core. Similarly, at Scatter 7 (Early Mesolithic) microliths and microbrins were present in the assemblage, though in this case the former occurred in higher numbers (15/6) suggesting that pre-prepared microliths were being utilized. Again, other tools were present (including a burin and an awl) suggesting that different tasks were also being carried out here.

In some cases, it has been possible to distinguish between the different periods of activity. Scatter 21A was recorded at the western edge of the site. It is more spatially distinct from the other scatters, and much of the assemblage came from the thin layer of reed peat [5067] radiocarbon dated to the Early Mesolithic. In this scatter, a core was brought to the site, worked, and then discarded; two more cores were also partially worked here and then taken away along with several blanks and microliths that were also manufactured at this location. At Scatter 25, both refitting and differences in the condition of the flint has made it possible to distinguish between Final Palaeolithic and Early Mesolithic activity. During the former, burins and blanks of till flint and nodules of Wolds flint were brought onto the site, the nodules were worked to produce cores from which at least one backed point was manufactured whilst burins were used and sharpened. In the Early Mesolithic, till flint was imported to the site and worked to produce microliths. In other cases, the scatters belong predominantly to a single period. Scatters 13 and 14, for example, whilst containing some Early Mesolithic material, were largely the product of Final Palaeolithic activity. Here, a preformed nodule of Wolds flint was brought onto the site, worked *in situ* and the resulting core abandoned, whilst a second nodule (again of Wolds flint) was worked to produce a partially prepared core, which was then taken away.

While many of the scatters were generated through manufacturing activities, some primarily reflect the use of tools or the utilization of unmodified flakes and blades with little or no evidence for knapping. Scatter 11, for example, included a hammerstone, burin and three blades (two with macroscopic traces of use) out of an assemblage of ten pieces, and Scatter 12 contained a high proportion of large blades.

In addition, two discrete concentrations of typologically Late Mesolithic microliths, one associated with a possible haft, were recorded in the wood peat [5005] (see David 1998 for a full discussion). Based on their relative positions these are thought to represent two composite tools, either lost or discarded in the wetland environments that formed over the site during the Late Mesolithic. The possible haft was radiocarbon dated to 7570–6775 cal BC (8210±150 BP, HAR-6498) and a sample of peat from the same horizon was dated to 7180–6650 cal BC (8020±90 BP, HAR-5789) (see Table 7.6). Pollen analysis carried out by Cloutman on samples adjacent to the microliths show that they were deposited in a terrestrial fen environment, rich in ferns and grassess (Cloutman 1988b, 28–30)

The faunal assemblage (see Chapter 16) was made up of small quantities of fragmented bone, predominantly from large mammals. Fifteen fragments were recorded from the Late Glacial detrital mud and are tentatively interpreted as being contemporary with the sediments. These consisted of single fragments of limb elements from horse, red deer, elk, and aurochs as well as eleven unidentified fragments. There was no clear spatial relationship between this material and the demonstrably Final Palaeolithic scatters of worked flint.

The Early Mesolithic assemblage was slightly larger (46 fragments of bone and a shed red deer antler), the majority of which were recorded from the Early Holocene land surface [5012] and the reed peat [5067]. Only nine fragments could be identified to species (red and roe deer, and horse) and derived from elements of the limbs and torso, as well as teeth and antler. The assemblage also included an unidentified fragment of bird bone. Cut marks were identified on a fragment of red deer tibia shaft. The only area where the faunal material occurred within a spatially defined lithic scatter was in Scatter 21A, where the assemblage included the red deer antler, which may have been collected and retained for use as raw material (see Fig. 16.4).

The possible Late Mesolithic material was recovered from the wood peat [5005] that sealed the site, and consisted of sixteen fragments, of which only six could be identified. These derived from the limb elements of red and roe deer and the mandible of an otter.

Dating

A total of 14 radiocarbon dates are available for Site K (Table 7.6; see also Chapter 4). Four dates were obtained on the layer of Late Glacial organic detritus [5085/5069]; CAR-842 from the base of the deposit, and CAR-841, HAR-5242, and HAR-5787) from the top. If the formation of the organic detritus was limited to the Windermere Interstadial, and the overlying sand formed during the subsequent Stadial, then HAR-5787 appears to be too young. However, if the date is correct then it indicates that sedimentation continued into the Loch Lomond Stadial and/or the early part of the Holocene. This will be discussed further at the end of this chapter.

Two dates were obtained on Early Mesolithic horizons; HAR-5794, from the main Mesolithic occupation surface [5012], and HAR-5241 from a layer of reed peat [5067], which contained Early Mesolithic material.

Table 7.6. *Radiocarbon dates for Site K and immediate environs.*

Lab No.	Radiocarbon years BP	δ13C (‰)	Calibrated age (cal BC)	Material	Comment
CAR-841	10,960±110	-27.87	11,105–10,750	Organic detritus	Top of organic detritus [5085] Site K (Profile K2)
CAR-842	12,010±130	-27.35	12,240–11,600	Organic detritus	Base of organic detritus [5085] Site K (Profile K2)
CAR-878	9000±100		8455–7820	Organic material	Base of peat [5005] lying over the mineral substrate south of Site K at 25.0 m AOD
CAR-879	9700±90		9300–8810	Organic material	Base of peat lying over the mineral substrate south of Site K at 24.0 m AOD
CAR-880	11,000±110		11,120–10,765	Organic material	Base of peat lying over the mineral substrate south of Site K at 23.0 m AOD
CAR-881	9490±110		9225–8555	Organic material	Base of peat [5005] lying over the mineral substrate west of Site K at 25.0 m AOD
CAR-882	9860±110		9815–8920	Organic material	Base of peat lying over the mineral substrate west of Site K at 24.0 m AOD
CAR-883	10,930±90		11,070–10,745	Organic material	Base of peat lying over the mineral substrate west of Site K at 23.0 m AOD
HAR-5241	9560±120	-30.3	9255–8625	Peat	From [5067] containing Mesolithic material, lying above the main Mesolithic occupation surface [5098] (same as [5012]) in test-pit Z306A
HAR-5242	11,000±130	-22.8	11,145–10,745	Organic detritus	Top of organic detritus [5069] (same as [5085]) test-pit Z306A
HAR-5787	10,040±130	-29.7	10,095–9275	Organic detritus	Organic detritus [5085] directly beneath [5084], and above basal gravels
HAR-5789	8020±90	-28.9	7180–6650	Peat	From [5005], taken adjacent to a group of hafted microliths
HAR-5794	9590±120	-26.3	9270–8635	Charcoal	From [5012,] Mesolithic occupation surface
HAR-6498	8210±150	-30.8	7570–6775	Wood – *Salix/ Poplus sp.*	Part of the haft of a Late Mesolithic arrow shaft from [5005] (see HAR-5789)

These are statistically indistinguishable and suggest that activity was taking place in the centuries around 9000 cal BC (see also Conneller et al. 2016). A further two dates establish the age of the Late Mesolithic composite tool (HAR-6498) and the matrix in which it was found (HAR-5789). Of these, the former provides a direct date of 7570–6775 cal BC for the use of the tool. Finally, CAR-878, -879, and -880 date the formation of organic deposits over the basal mineral sediments to the south of Site K at 23 m, 24 m, and 25 m AOD, and CAR-881, -882 and -883 date the same process to the west of the site. These have previously been reported by Cloutman (1988a).

Seamer Carr Site L

Site L was situated some 70 m to the northwest of Site K on the eastern edge of the West Embayment (NGR 50323 48207). It was first identified following test-pitting in the area in 1982, and investigated in more detail in 1984 when two parallel trenches (Li and LII), covering a total area of about 250 m^2, were machine stripped to the top of the lower peat horizon, and then hand excavated to the natural subsoil. Terminal Palaeolithic and Early Mesolithic worked flint was recorded along with a small assemblage of horse bone.

Stratigraphy

The stratigraphic sequence at Site L (Fig. 7.13) was essentially the same as that recorded at Site K, with only some minor differences in the composition of the sediments. The basal mineral sediment was a coarse sandy gravel [5015] that formed the surface of the kame. In places, this was covered by a discontinuous layer of fine detrital mud [5111] that was overlain by a fine sand [5101]. These have been interpreted as continuations of the Interstadial and Stadial deposits that were present at Site K. In the southwest areas of the site, closest to

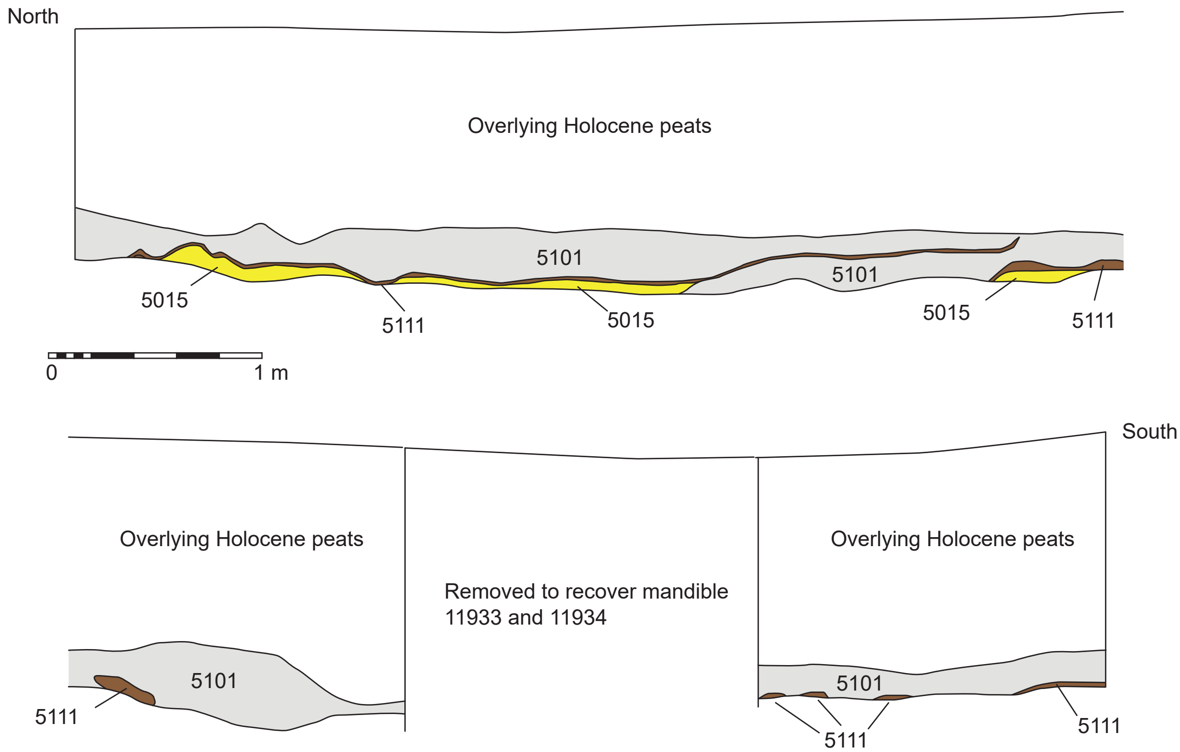

Figure 7.13. *Section through the Late Glacial detrital mud [5111] and the overlying fine sand [5101] in trench L I, showing the detrital mud within the sand.*

the West Embayment, the detrital mud appeared to be within, rather than beneath the fine sand, suggesting a more complex depositional history.

Overlying these deposits was a layer of peaty sand [5012], representing the Early Holocene land surface, which was then sealed by a sequence of wood peat [5005], humified peat with a high charcoal content [5004], a friable peat [5003], and a mixed peaty sandy soil that formed the modern topsoil [5002].

Table 7.7. *Context concordance between Sites K and L.*

Site L Context	Site K Context	Description
5002	5002	Topsoil
5003	5003	Oxidized, friable peat
5004	5004	Humified peat with a high charcoal content
5005	5005	Wood peat
5012	5012	Early Holocene land surface
5101	5084, 5103	Stadial colluvial deposit
5111	5085, 5069, 5091, 5114	Interstadial detrital mud
5015	5015	Basal geology

The concordance of the context numbers with Site K is shown in Table 7.7.

Summary of the archaeology

An assemblage of 410 pieces of worked flint (See Chapter 14) and a small faunal assemblage (28 identifiable fragments, see Chapter 16) were recorded from Site L (Fig. 7.14). Of these, the worked flint and most of the bone derived from the Early Holocene land surface [5012], with a much smaller quantity of faunal material (six specimens) recovered from the overlying wood peat [5005].

The lithic assemblage can be assigned on typological grounds to two periods, the Terminal Palaeolithic (Long Blade) and the Early Mesolithic. In contrast to Sites C and K, there were no spatially distinct scatters or concentrations that could be assigned to particular periods, or that may reflect separate visits to this locality. The Terminal Palaeolithic assemblage was manufactured exclusively from Wolds flint, and consisted of knapping debris, a blade core, and a series of large flakes and long blades. Parts of the assemblage were generated through the primary stages of knapping and blade production and core maintenance. In contrast, the Early Mesolithic material was generated

Figure 7.14. *Red deer mandible from trench L I (Photo Simon Evanston, August 1984).*

through the working of till flint. The composition of the assemblage, which includes a relatively large proportion of primary flakes, suggests that some initial testing and shaping of this material occurred on site. Both microliths and microburins were also present, which may reflect an episode of retooling, while burin spalls and an axe flake suggest these tools were also being used and/or maintained.

As with the other Seamer Carr locations, the faunal assemblage was very small, and was mostly represented by specimens from large mammals (predominantly red deer, with horse and roe deer). The horse remains consisted of the left side of the mandible and several teeth and were spatially associated with typologically Terminal Palaeolithic material. Two radiocarbon dates have been obtained on the horse bone (Table 7.8). Of these, the most precise places the killing of the horse at 9800–9370 cal BC (10,025±40 BP, OxA-19511), either at the very end of the Loch Lomond Stadial or in the opening centuries of the Holocene. The remaining material was made up of red deer (left mandible and teeth, fragments of two vertebrae and the sacrum) and roe deer (two teeth), but had no clear association with either the Terminal Palaeolithic or Early Mesolithic flint. A smaller assemblage (five possible fox teeth and a red deer phalanx) were recorded from the overlying wood peat [5005]. Whilst these could potentially belong to a later episode of activity, the lack of any Late Mesolithic material on the site suggests that this material has moved from an earlier context through post-depositional processes.

Dating

Two radiocarbon dates are available for Site L, one of which came from the horse mandible (Clutton-Brock and Burleigh 1991), the other from a horse bone from the same scatter (Table 7.8). The latter was obtained by Jacobi and Higham (2009) and reported in more detail by Conneller and Higham (2015). As noted in

Table 7.8. *Radiocarbon dates for Site L.*

Lab. No.	Radiocarbon Years BP	δ13C (‰)	Calibrated age (cal BC)	Material	Comment
BM-2350	9790±180	-24.1	9990–8710	Collagen *Equus ferus*	From horse bone associated with Long Blade and Early Mesolithic flint
OxA-19511	10,025±40	-20.7	9800–9370	Bone, *Equus ferus*	From horse bone associated with Long Blade and Early Mesolithic flint

Table 7.9. *Radiocarbon dates for Site N.*

Lab No.	Radiocarbon years BP	δ13C (‰)	Calibrated age (cal BC)	Material	Comment
HAR-5243	10,190±110 10,220±120	-28.3	10,435–9440 10,450–9450	Peat	From organic detritus [5091]
OxA-1030	9940±100	-14.7	9860–9240	Collagen – dog	Context [5012]/[5005]

Chapter 4, the first date (BM-2350) is considered to be unreliable due to the methods of pre-treatment, with OxA-19511 providing a more accurate age for the killing of the horse.

Seamer Carr Site N

Site N was situated between Sites K and L on the eastern shoreline of the West Embayment (NGR 50327 48205). This area was first investigated during the 1982 test-pitting (Z310-12), and investigated in more detail in 1985, by a series of six parallel, two-metre wide trenches, running roughly east–west from higher ground into the deeper deposits of the West Embayment (see Fig. 7.1). Each trench was machine stripped to the top of the lower peat horizon, and then hand excavated to the natural subsoil. The total area investigated was approximately 275 m^2. The stratigraphic sequence was very similar to that recorded on Sites K and L, with only minor variations in sediment composition (Fig. 7.15).

Summary of the archaeology

Six articulated cervical vertebrae from a domestic dog were recorded from the interface between the Early Holocene land surface [5012] and the overlying wood peat [5005]. No worked flint was present and a radiocarbon date on a sample of the bone (OxA-1030) is likely to be erroneous (see below and Chapter 4). However, given that the vertebrae were found in an articulated state it is unlikely that they have moved from the original depositional context, and are therefore likely of Early Mesolithic age.

Dating

Two dates are available for Site N. The first (HAR-5243) was obtained from a sample of [5091], the organic detritus sealed by a layer of sand [5084] recovered from Z313A, and thought to be a continuation of the Late Glacial deposit [5085] recorded at Site K (Table 7.9). The date of this sample is younger than the deposit in Site K, and is either erroneous or shows that the formation of these organic deposits continued into

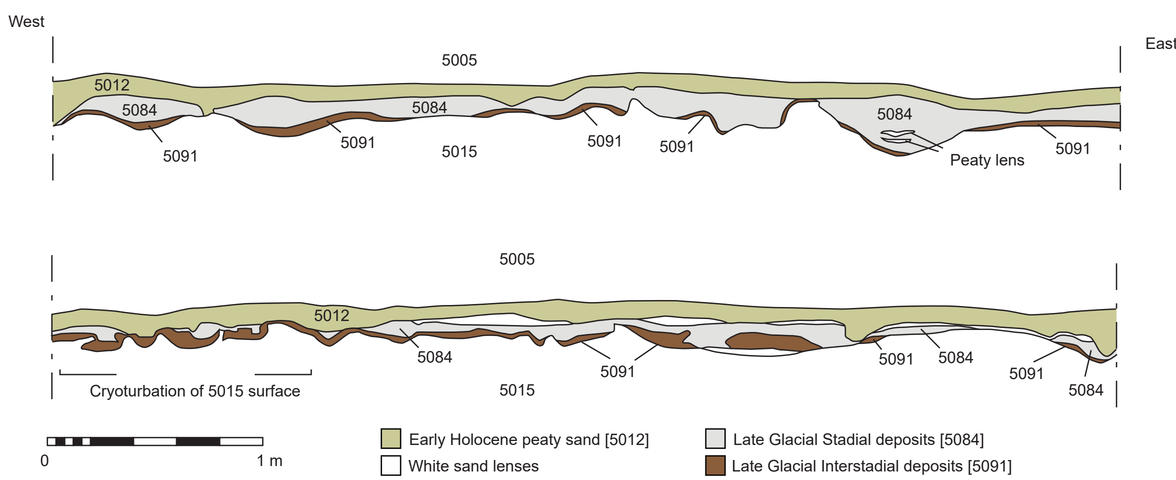

Figure 7.15. *Section through the sequence of Late Glacial and Early Holocene deposits in Transects 2–3, Site N.*

the Loch Lomond Stadial, and (potentially) the early centuries of the Holocene. The second sample (OxA-1030) was obtained from one of the dog vertebrae, but as discussed in Chapter 4, there are several possible problems associated with this date that derive from both the method of pre-treatment used by the Oxford Laboratory and the possibility of ^{13}C enrichment of the sample.

Discussion

Sites K, L, and N were investigated between 1981 and 1986 as part of the Seamer Carr Project. The sites were first identified during test-pitting surveys of the area in 1981 and 1982, and were investigated in more detail through large scale open-area excavation at Site K, between 1983 and 1985, and more limited excavations at L and N in 1983 and 1984 respectively. This work recorded a large assemblage of worked flint dating to the Final Palaeolithic (Federmesser), Terminal Palaeolithic (Long Blade), and the Early and Late Mesolithic, and a much smaller assemblage of faunal material.

The three excavated areas run along the eastern side of the West Embayment, downslope of the higher ground of Rabbit Hill. Based on the pollen profile K2, taken to the west of Site K, the environment was relatively open during the Final Palaeolithic, and peat-forming wetlands were present along the edge of the embayment. Although none of the pollen profiles cover the Early Mesolithic, the environment was probably comparable to Site C, with birch woodland becoming established on the higher, drier ground, and beds of reeds and other aquatic species forming in the shallow lake margins to the east of Site K and within the shallow water of the West Embayment. The embayment itself may have become infilled with sediments relatively early in the period, though a stream continued to flow in from the north (Cloutman 1988b, 34), potentially feeding small pools of water.

As at Site C, peat-forming environments were becoming established over areas of previously dry ground during the Early Mesolithic, forming along the west of Site K by 9225–8555 cal BC (9490±110 BP, CAR-881), and to the south of the site by 8455–7820 cal BC (9000±100 BP, CAR-878). By the start of the Late Mesolithic an open fen environment had become established across the area, and a forest of hazel and oak was present on the surrounding higher ground (Cloutman 1988b, 28–9). Fluctuations in the local water table occurred at around 7190–6650 cal BC (8020±90 BP, HAR-5789) leading to the fen becoming drier, and coinciding with episodes of disturbance to the local vegetation (Cloutman 1988b, 28–9). As wetter conditions returned, peat continued to form across Site K, gradually extending onto the higher ground, and probably causing the terrestrial woodland to recede.

Final Palaeolithic activity is represented by a relatively large assemblage of worked flint and a much smaller assemblage of animal bone, all of which was recovered from Site K. Although typologically contemporary material was also found at Site C, the assemblage from Site K provides the clearest evidence for the character of human settlement in this period, and tells us much about the groups coming into Britain during the latter half of the Interstadial. The lithic assemblage forms a series of relatively discrete scatters, probably representing distinct episodes of activity. These varied considerably in terms of the tasks that were taking place, which included the knapping of flint nodules (some of which had been brought onto the site in a pre-prepared state), the manufacture, use and repair of tools, and episodes of retooling. Raw material sources varied in relation to these tasks, with the local Wolds flint being preferentially used for knapping, while pre-prepared tools brought onto the site tended to have been manufactured from grey speckled flint. LA-ICP-MS analysis suggests that this material may have originated as far away as East Anglia (Conneller et al. 2019), though as the chemical signature of flint deposits beneath the North Sea is currently unknown, these are also possible sources. As Conneller (2007) argues, the nature of the assemblages probably reflects the provisioning strategies of a highly mobile group, 'travelling light' with tools manufactured from flint sourced some distance away, and visiting Lake Flixton to resupply from local resources. Though the faunal assemblage is very small, it suggests that these Final Palaeolithic groups were also hunting in the area, and that at least some of the worked flint may have derived from the subsequent processing of animal carcasses.

Terminal Palaeolithic activity was more limited in scale, and was only documented at Site L, where a small assemblage of worked flint and an associated scatter of bone were recorded. Given the small size of the assemblage, and the close spatial association between the lithics and the faunal assemblage, this may represent a discrete episode of hunting, followed by the subsequent butchery of the carcass, and is potentially related to the more extensive occupation at Site C.

In contrast to the Terminal Palaeolithic, the Early Mesolithic activity was both more extensive and varied, with the lithic assemblages reflecting a broad range of tasks, including primary knapping and core maintenance, the manufacture and/or repair of composite tools, along with the production and use of scrapers and burins, and the utilization of unmodified flakes and blades. Although the faunal assemblage was relatively small, it shows that people were also hunting in the landscape, and that animal carcasses were being brought to the site in at least a partial state, where they were being processed for food and raw material. Most of the activity was focused at Site K, where a large assemblage of lithics, and smaller quantities of animal bones were recorded. As has been discussed, the lithics formed spatially discrete scatters, which were generated on separate visits to the site. Radiocarbon determinations on a charcoal fragment from the occupation surface (HAR-5794) and from the overlying peat (HAR-2541), which contained Early Mesolithic material, date activity to 9270–8640 cal BC and 9260–8620 cal BC respectively, but there is no reason to assume that activity was constrained to a particular phase within this period, or that some of the activity represented by the lithic assemblages may not predate this. Sites L and N were more limited in scale, and may reflect more discrete episodes of activity, possibly undertaken on different occasions to those at Site K.

The character of activity changed in the Late Mesolithic, probably in response to the expansion of peat-forming environments over the dry ground. While diagnostically Late Mesolithic material is absent from the flint scatters recorded at Site K, two sets of microliths were recorded from the overlying wood peat, and may reflect the remains of composite tools lost or discarded in the wetlands (David 1998). Stratigraphically, the microliths are contemporary with the fen environments described above, and a date on a possible haft places their deposition at 7570–6775 cal BC (8210±150 BP, HAR-6498; see David 1998, 197). From the spatial arrangement of the microliths it is difficult to tell if they acted as projectiles, and therefore reflect an episode of hunting, or if they were used as knives for the harvesting of plants either for food or raw materials. However, at the very least they indicate the changing use of this part of the landscape by Late Mesolithic groups, perhaps associated with the area of occupation on nearby Rabbit Hill (see Chapter 8).

Chapter 8

The smaller Seamer Carr sites and associated test-pit data

Paul Lane, Barry Taylor, Chantal Conneller, Peter Cardwell, Roger Simpson, Geoff Smith & Tim Schadla-Hall†

This chapter describes the results of smaller scale excavations and test-pitting at Site B and Rabbit Hill, Site D (West Island) and Site F on Seamer Carr, as well as the results of the test-pit surveys that have not already been discussed in the earlier chapters. These data provide a useful counterpoint to the evidence from the larger, open-area excavations at Sites C and K, illustrating the range of activities performed around the edge of the lake during the Early and Late Mesolithic.

Rabbit Hill and Seamer Carr Site B

Rabbit Hill (NGR 50341 48206) is the name given to a small, low hill of poorly sorted glacial sands and gravels that lay between Sites C and K. It was so named because of the existence of an extensive rabbit warren covering much of the area at the time of the Seamer Carr excavations. At the time that fieldwork took place the hill formed a low, flat-topped area, with a maximum elevation of *c.* 29.0 m AOD, flanked by peat deposits. The area was under unimproved rough pasture, dominated by mixed grasses with occasional clumps of gorse scrub, and had not been ploughed at least since the 1940s.

Both Rabbit Hill and Site B were investigated through a programme of trial-trenching, mostly consisting of 2 × 2 m test-pits but with some slightly larger trenches in areas where denser concentrations of archaeological material were identified (Fig. 8.1). As a result, a small assemblage of worked flint and animal bone, including partially articulated elements from a butchered aurochs' carcass, was recorded from the peat deposits on the southeast slope of the hill (designated Site B). Based on the dating of a single element from this carcass, this material represents a phase of activity that took place at the chronological boundary between the Early and Late Mesolithic. A larger assemblage of worked flint (including diagnostically Early and Late Mesolithic material), and several small pits and hearths, was recorded on the higher ground toward the top of the hill (designated Rabbit Hill). A small assemblage of pottery of likely Iron Age date was also recovered during the archaeological work, with more exposed when the top was bulldozed during expansion of the landfill site. This has yet to be analysed in detail and is not reported here.

Palaeoenvironmental investigations at Site B

The auger surveys carried out by Edward Cloutman show that the Mesolithic topography consisted of a relatively large, steep sided, flat-topped hill, *c.* 80 m wide (east to west), and almost 180 m long, overlooking the western side of the lake basin. The hill dropped sharply to a level of *c.* 23 m AOD to the southeast, creating a steep slope from dry ground into the lake, and to the west where it formed the eastern side of the West Embayment. To the east, the hill fell away more gradually to the low-lying areas near Site C.

No palaeoenvironmental samples were taken from the vicinity of this area. However, stratigraphic studies by Cloutman (1988b) recorded a sequence of detrital muds and peats comparable to the other Seamer Carr localities, indicating a similar pattern of Early Holocene wetland succession, while the pollen profiles from Sites C and K suggest that Rabbit Hill would have supported dense stands of woodland during both the Early and Late Mesolithic. As at Sites C and D, a black peat horizon was detected at around 26 m AOD. This probably reflects the drier period in the wetlands' history recorded in Profile E77 (Site C), which dates to the latter part of the Mesolithic (see Chapter 6).

Archaeological investigations at Site B

Evidence of Mesolithic activity was located on the southeast side of Rabbit Hill during the initial sampling exercise in 1979, when a concentration of aurochs

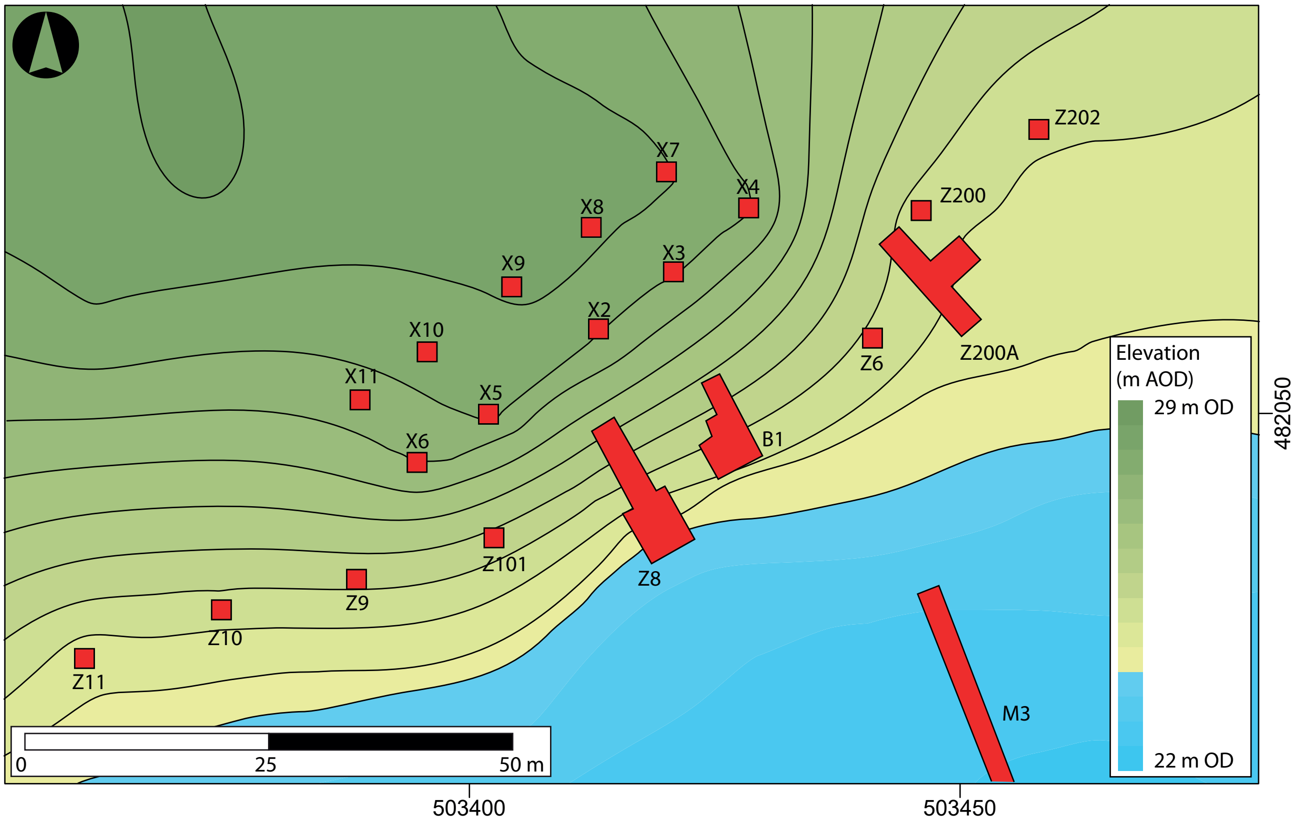

Figure 8.1. *Excavated areas at Rabbit Hill and Site B (level of the lake shown at 24 m AOD).*

Figure 8.2. *Excavated test-pits on Rabbit Hill (X6 and X11 in foreground), looking northeast (Photo Roger Simpson, 1980).*

bones was recorded within the lower wood peat/coarse detritus mud horizons of test-pit Z7 (Site B). This was subsequently enlarged by 4 × 2 m and re-designated as trench B I. In 1980, a further sequence of 2 × 2 m test-pits was excavated to sample the deposits along the south-east margin of Rabbit Hill. Of these, three (Z6, Z200 and Z202) were situated to the northeast of B I, while six (Z8-Z12 and Z101) lay to the southwest (Figs. 8.1, 8.2). Trench B I was also extended by a further 2 × 4 m to the northwest, to examine the shoreward deposits. At the same time, three 2 × 2 m test-pits (X2–X4) and one 3 × 2 m unit (X5) were excavated on the higher ground, along the edge of the bluff overlooking Site B.

From 1980–82, further trenches (Z200A and Z8 extension) and 2 × 2 m test-pits (Z101A and X6-X11) were hand excavated in the vicinity of Site B and on adjacent parts of Rabbit Hill. In addition, a single machine-cut trench (M 3, see Chapter 6), *c*. 1 m wide and 40 m long was excavated at right angles to the former shoreline to sample deeper deposits of peat and detrital muds within the former lake (Fig. 8.1). As discussed in Chapter 3, both the depth and degree of saturation of these deposits prevented close examination. Nevertheless, grab samples taken from the base of these deposits did suggest the presence of some archaeological material in this area. By the end of the Seamer Carr Project, a total area of 355 m^2 had been investigated in the general vicinity of Site B and Rabbit Hill.

Stratigraphy

Paul Lane, Peter Cardwell, Roger Simpson, Geoff Smith & Barry Taylor

The stratigraphy from the top of the eastern side of Rabbit Hill extending downslope into the main lake basin (Site B) was relatively straightforward, and broadly similar to that encountered elsewhere on Seamer Carr (Figs. 8.3, 8.4).

The basal mineral sediments consisted of a poorly sorted sandy gravel [5013/5015/5026] that constituted the surface of the glacially derived landform upon which Site B and Rabbit Hill were located. On the higher ground this deposit had been disturbed by animal burrowing and other recent taphonomic processes.

The character of the overlying deposits varied in relation to the basal topography. Across Site B, the basal, glacial deposit was sealed by a layer of coarse, organically enriched sand [5014] that extended upslope at least as far as the 26.0 m AOD contour. In some areas this was then sealed by a thin layer of sand with a high clay content [5012], possibly resulting from the downslope movement of the mineral sediments on the top of the hill. On the lower-lying parts of the site, the sands were succeeded by a coarse detrital mud,

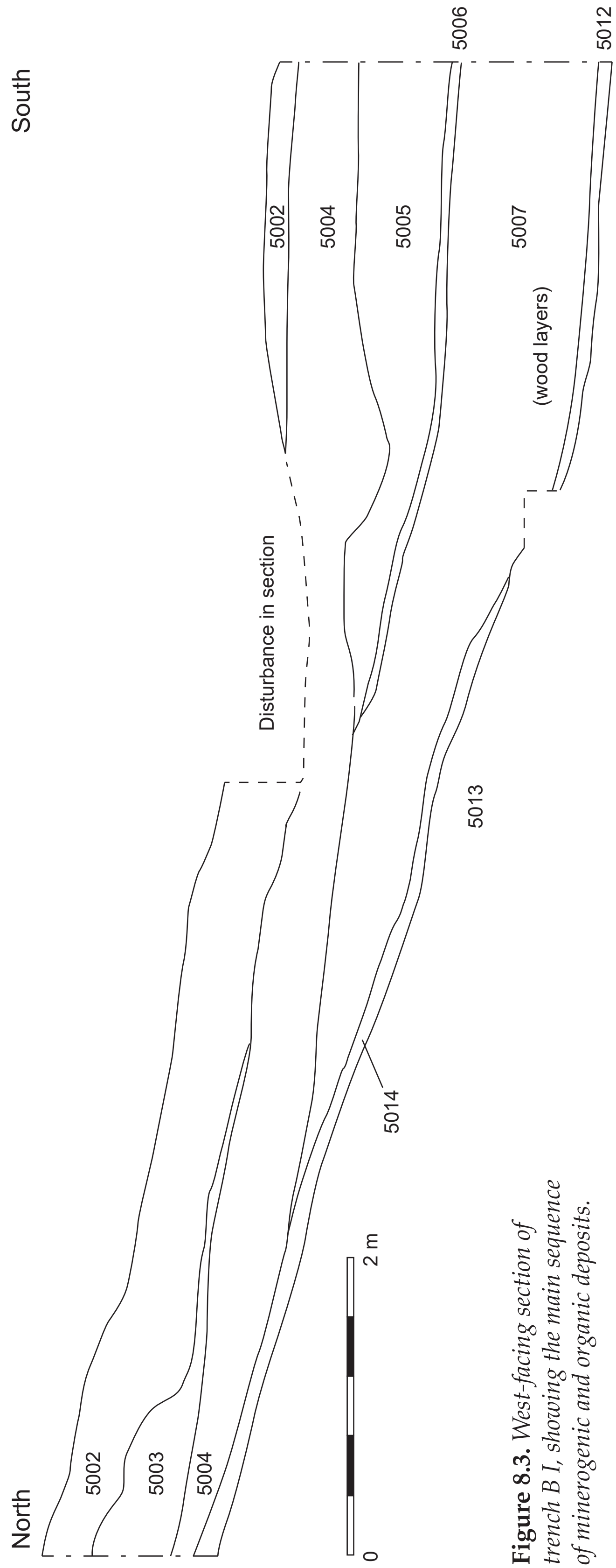

Figure 8.3. *West-facing section of trench B I, showing the main sequence of minerogenic and organic deposits.*

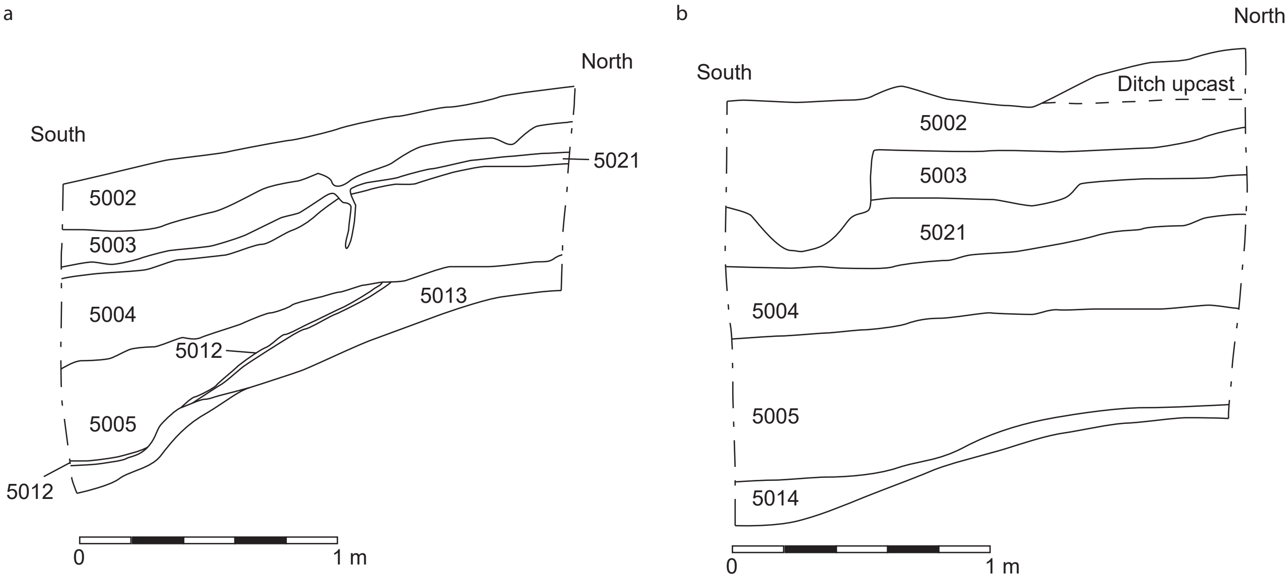

Figure 8.4. *East-facing sections through the wetland deposits in (a) Z101 and (b) Z200.*

made up of pieces of wood and *Phragmites* reeds, and containing small quantities of hazelnuts [2167/5007]. In the deeper parts of trench B I this deposit contained three distinct bands of woody material, which were assigned separate context numbers (see Table 8.1). Above this was a fine, silty organic detritus made up of sphagnum moss [2166/5006].

Table 8.1. *Contexts assigned to the stratigraphic sequence at Site B.*

Context	Description
2161, 5002	Topsoil
2161, 5003, 5021	Humified friable peat
2143, 2164	Sand and clay lenses within the humified peat
2162, 5004	Humified peat with high charcoal content
5005	Coarse detritus of reed and sedge
2166, 5006	Sphagnum rich detrital mud
5045, 5046, 5048	Bands of denser wood
2167, 5007	Coarse woody and reedy detritus
5012	Sandy clay
5014	Coarse sand
5013, 5015, 5026	Sandy gravel

Table 8.2. *Contexts assigned to Rabbit Hill.*

Context	Description
5022	Topsoil
5053	Stony horizon
5030, 5052	Coarse sand
5051	Sandy gravel

Overlying the organic sequence along the lower slopes, and directly overlying the mineral sediments on the more elevated parts of Site B, was a thick layer of coarse detritus mud made up of reed and sedge [5005]. In trench B I this contained lenses of clay with charcoal fragments. Above this was a darker, more humified peat, with a high charcoal content [2162/5004] and thin layers of sand and clay. This corresponds to the 'black layer' identified by Cloutman (1988a, 1988b), and which was also recorded at Sites C and K. This was sealed by a friable, humified peat [2161/5003/5021], and a peaty, sandy topsoil. In some parts of the site the upper peat deposits had been truncated by modern drainage ditches.

On the top of Rabbit Hill, the basal geology [5051] was sealed by a coarse sand [5030 and 5052], which constituted the Mesolithic land surface. This had been disturbed by recent taphonomic processes. In some areas this deposit was then overlain by a stony horizon [5053] with charcoal flecking (Table 8.2). Peat was absent from this area, and the mineral sediments were sealed by topsoil (Fig. 8.5).

Anthropogenic features

Three archaeological features were identified on the high ground at Rabbit Hill. Two of these lay within test-pit X5, towards the western end of the investigated area (Fig. 8.6).

The first (X5i) consisted of a shallow, oval hollow with a rectangular, straight sided pit (1.02 × 0.70 m, and 0.34 m deep) cut into its fill in the centre of the feature. This smaller pit was filled with a layer of

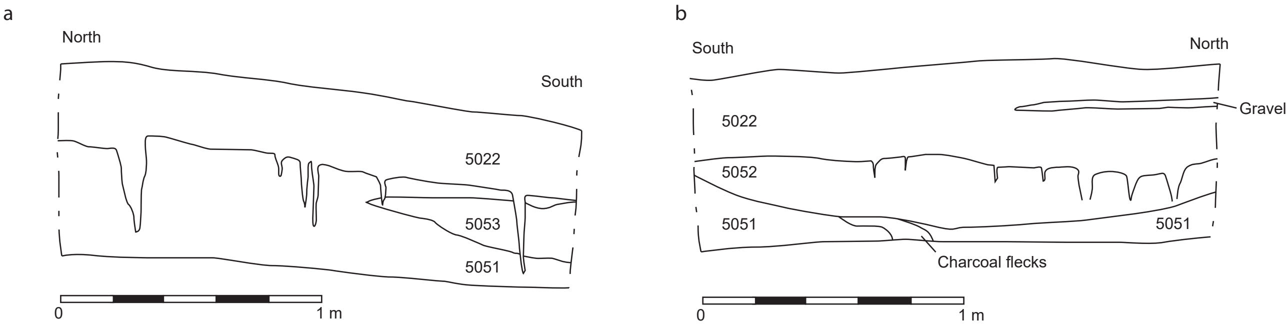

Figure 8.5. *Sections through the stratigraphic sequence at Rabbit Hill recorded in test-pits (a) X6 and (b) X7.*

charcoal-rich silt [5061] sealed by a silt with smaller quantities of charcoal and a stony surface [5059]. At the top of the fill was an oval concentration of charcoal and burnt sandstone. The function of the larger hollow is difficult to discern, though the rectangular pit was probably a hearth.

The hollow was cut along its northern edge by a second feature (X5ii), a narrow oval scoop, (0.77 × 0.44 × 0.05 m), filled by a charcoal-rich silt with patches of bright red, burnt sediment. This feature has been interpreted as a hearth.

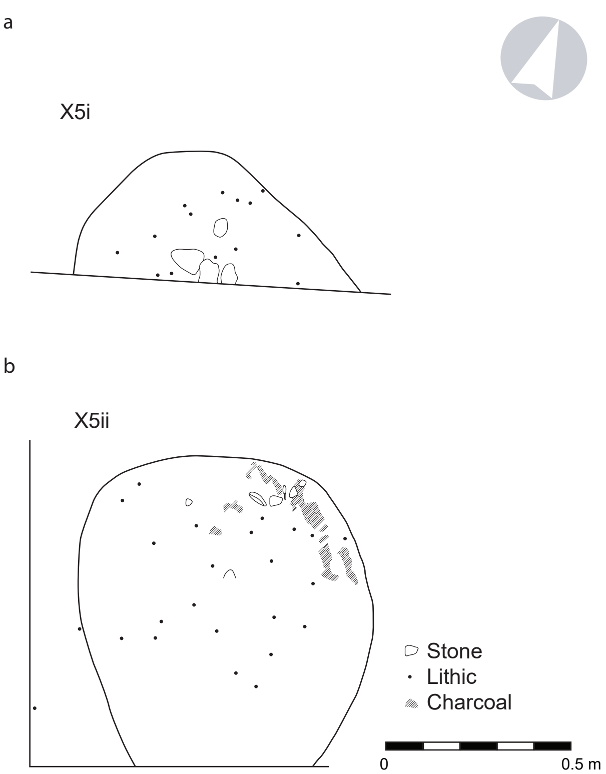

Figure 8.6. *Mesolithic features on Rabbit Hill, (a) Feature X5i, (b) Feature X5ii.*

The third feature (X8i) recorded was situated in the southwest corner of test-pit X8, *c*. 17 m to the northeast of X5 (Fig. 8.7). It comprised a shallow, oval hollow (0.90 × 0.95 × 0.24 m). This was filled by a sandy loam containing dense patches of charcoal and several pieces of sandstone, which were concentrated along the northeast edge of the feature. Pieces of Mesolithic flint were recorded from this deposit and from the overlying topsoil. The function of the feature is difficult to determine, though its fills could represent material that had been cleaned out from one or more hearths.

Summary of the archaeology

An assemblage of 1190 pieces of worked flint was recorded from Rabbit Hill. The assemblage is of mixed date; diagnostically Late Mesolithic pieces are most common, but Early Mesolithic, and later prehistoric material is also present. Some of the assemblage derives from the mineral sediments [5030 and 5032] but the majority was recovered from the overlying topsoil [5022] and had been displaced through taphonomic processes (notably the actions of rabbits).

There is some spatial variation in the composition of the assemblage and the forms of activity taking place. The highest concentration of material was in test-pit X8 (365 pieces). This material is diagnostically Late Mesolithic and was generated (at least in part) through the manufacture of microliths. The assemblages from X2–X4 were generated through core reduction (though the presence of a microburin in X3 shows that microliths were being manufactured), whereas X7, X8 and X11 included both knapping debris and tools. The assemblage from X5 indicates the widest range of activity, and included scrapers, microliths and a burin (though these were not necessarily contemporary).

A further small assemblage of worked flint (223 pieces) and faunal remains (96 specimens, of which 53 could be identified) was recorded from Site B. Most of this came from trench B I (almost half of the flint and a third of the faunal material), although a large

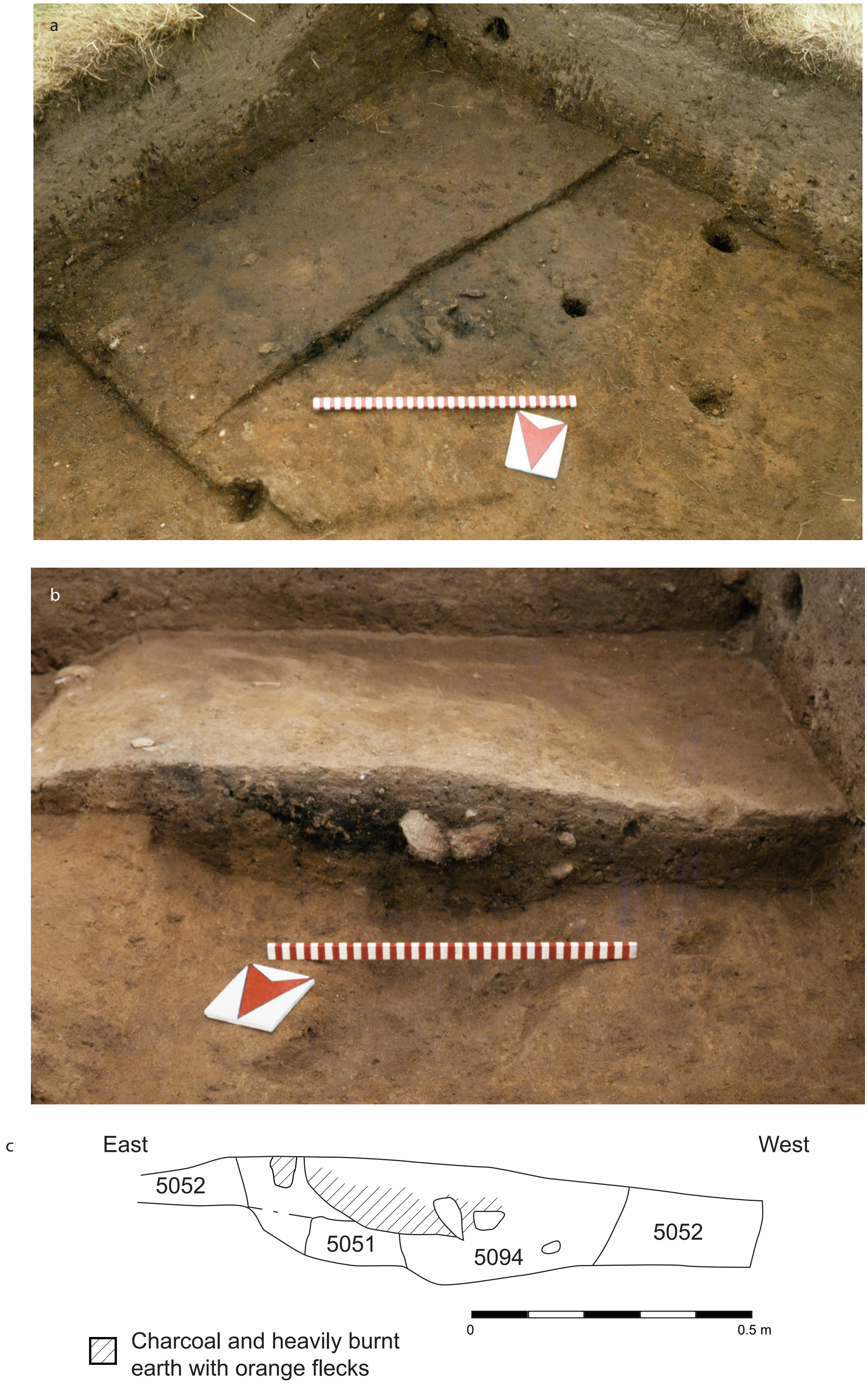

Figure 8.7. *Mesolithic features on Rabbit Hill, (a) X8i under excavation (note the rabbit burrows), (b-c) section through feature (Photos Roger Simpson, 1981).*

assemblage of flint and a small quantity of bone was also recorded from Z8, less than 10 m to the west. Smaller quantities of flint were present in Z6, Z101 and Z101A, and flint and bone were recorded from Z200 and Z202.

The flint assemblage consists of knapping debris, as well as five cores and a range of formal tools including three microliths, a knife, an arrowhead and three scrapers. As with the material from Rabbit Hill, the assemblage is of mixed date, with diagnostically Late Mesolithic, Late Neolithic and Late Neolithic/Early Bronze Age material present, while some of the debitage is probably Early Mesolithic. Some of the flint was found in association with a scatter of aurochs bones in trench B I (see below) and may be related to the butchery of this animal. However, much of the assemblage, both in B I and the other test-pits, derived from the upper peat deposits (notably context [5002]). This, together with the presence of large quantities of knapping debris and burnt flint (which are generally absent from assemblages recovered from the wetland areas at other locations around the lake), and the mixed age of the assemblage suggests that it has derived from Rabbit Hill, immediately to the north.

The faunal assemblage can be divided into two parts. Almost a third of the assemblage derived from context [5007] in trench B I. Of this, all but two fragments (a red deer vertebra and a roe deer radius) came from a scatter of aurochs bones, some of which were found in a semi-articulated state (Fig. 8.8). The elements derived mostly from the torso (five thoracic and six lumbar vertebrae, the pelvis and

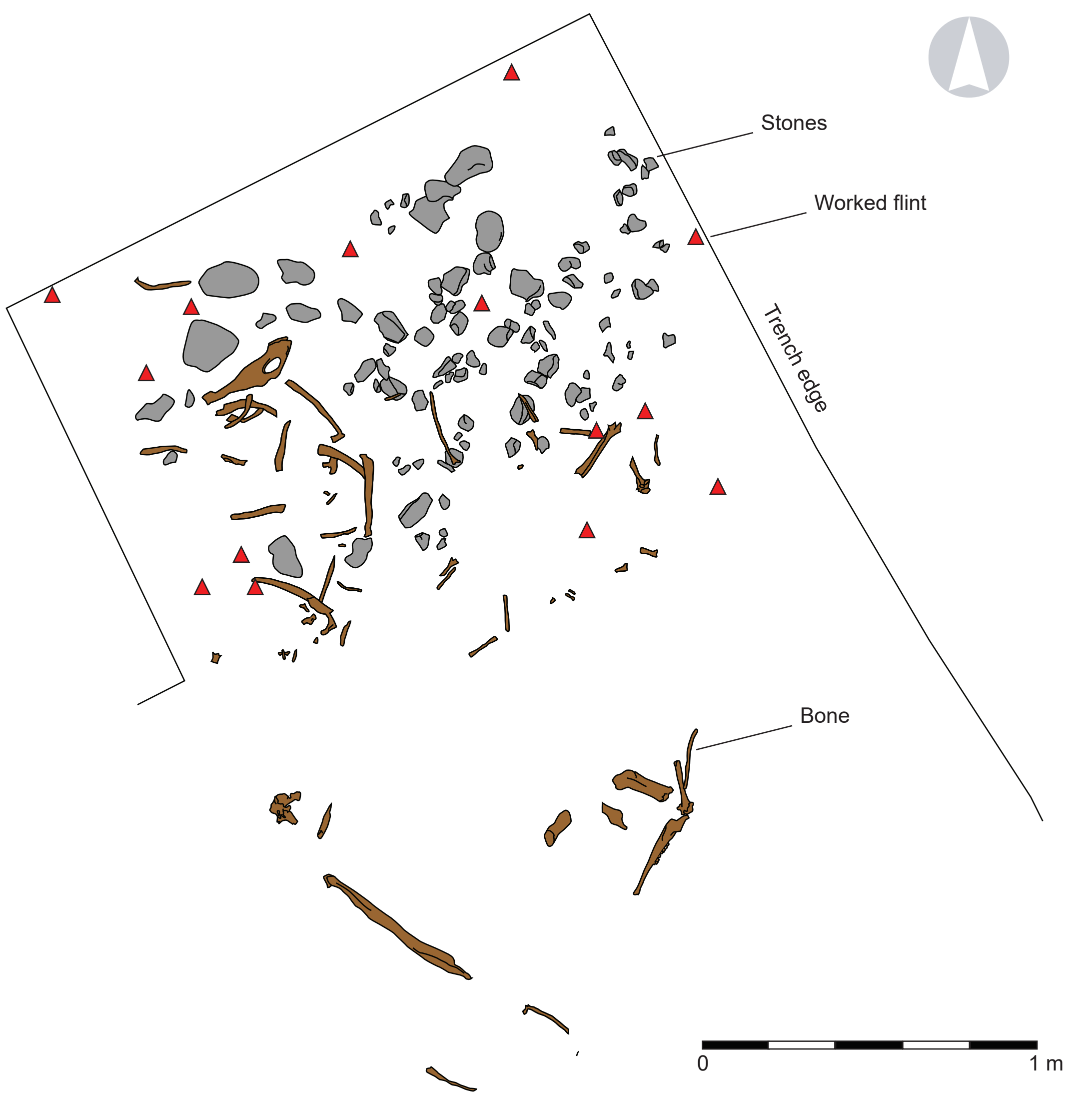

Figure 8.8. *Plan of the partial aurochs' carcass in trench B I.*

Figure 8.9. *Disturbance in the deposits around the aurochs' carcass in trench B I, probably deriving from trampling (Photo Roger Simpson, July 1979).*

15 fragments of rib), as well as the right side of the mandible and maxilla, and the distal end of a right radius. As discussed in Chapter 16, the lack of repeating elements, and the fact that some of the material was in a partially articulated state suggests that the assemblage reflects the killing and butchery of a single individual. The deposit immediately around these remains was heavily pitted with what appeared to be hoof prints (Fig. 8.9) and it is possible the animal was killed (and subsequently butchered) at or close to this location, after which the limb elements were removed. Radiocarbon dating places the death of the aurochs at 8210–7585 cal BC (8740±120 BP, BM-1841R) (see below and Chapter 4).

The remainder of the assemblage consisted of a small quantity of fragmented bone from a range of medium and large mammals (notably red deer but also horse, elk, roe deer and pig) and a bird of indeterminate

Table 8.3. *Radiocarbon dates for Site B.*

Lab. No.	Radiocarbon Years BP	δ¹³C (‰)	Calibrated age (cal BC)	Material	Comment
BM-1841R	8740±120	-23.2	8210–7585	Collagen from *Bos primigenius* rib	Context [5007] Trench B I

species. Of these only one specimen (a vertebra of a red deer) came from a secure context [5014], with the remaining material deriving from the possible layer of hillwash [5012] and the upper peat deposits [5004-5002], and may have derived from an activity area on the higher ground of Rabbit Hill.

Dating

A radiocarbon date of 7940–7525 cal BC (8620±80 BP, BM-1841) was initially obtained on a collagen sample from one of the aurochs' bones from trench B I (Table 8.3). This was subsequently revised to 8210–7585 cal BC (8740±120 BP, BM-1841R), following detection of a systematic error in the dates produced by the British Museum laboratory between 1980–84 (Bowman et al. 1990). This would place the probable aurochs kill and butchering area at Site B to the beginning of the Late Mesolithic.

Seamer Carr Site D – West Island

Site D (West Island) was situated at the western edge of the area investigated during the Seamer Carr Project (NGR 50317 48190). At the time of excavation, the area was under unimproved rough pasture, with a species-rich flora typical of fen carr habitats, dominated by gorse, rushes and sedges. Though described as an island, Site D was an angular ridge of raised ground, approximately 100 long from west to east, and *c.* 40 m wide north–south, connected to the higher ground of Site K to the northeast (Fig. 8.10). The site was investigated between 1978 and 1982 through a combination of 2 × 2 m test-pits and six long, narrow trenches (totalling an area of 504 m²). A very small assemblage of Early Mesolithic worked flint was recovered from the area of high ground on the top of the ridge.

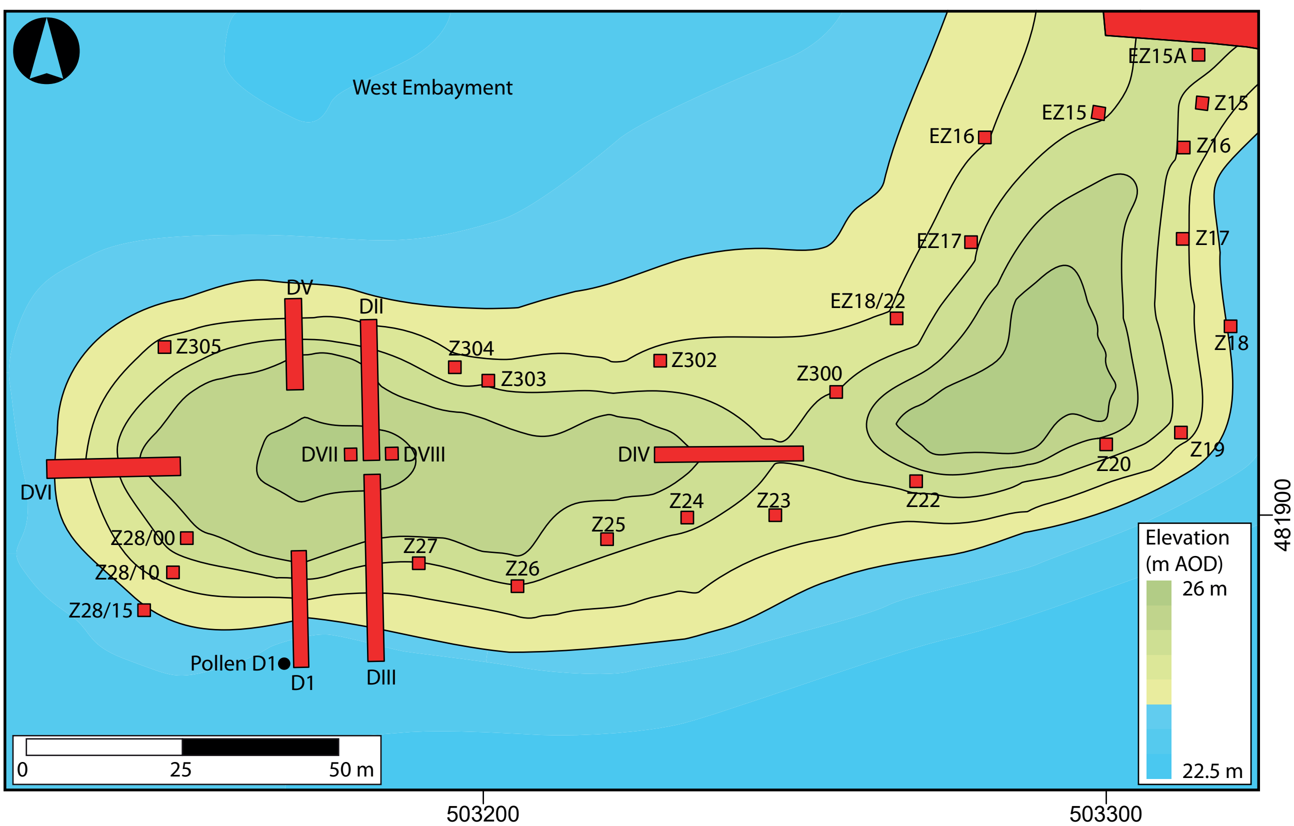

Figure 8.10. *Excavated areas at Site D (level of the lake shown at 24 m AOD). Black dot indicates location of pollen sampling point.*

Geology at Site D

Based on its morphology, West Island resembles the remains of a glacial esker. This was confirmed by subsequent geological analysis of the basal deposits over West Island by Albert Franks during the Seamer Carr Project (Franks 1987; see also Chapter 2). A 2.0 m long section dug into the crest of the ridge at the southern end of trench D II revealed gravels downfaulted against coarse gravels and cobbles. The mainly angular cobbles were predominantly of Jurassic sandstone, and were scattered along the length of the ridge, particularly near the junction with Rabbit Hill. At this point, the esker was found to continue beneath the overlying sandy gravel of the kame deposits at Site K, indicating its earlier formation. Immediately south of this contact, the coarse gravel and cobbles from the top of the esker were found to have been eroded, probably by water draining south from Sweetbeck, and redistributed as a small gravel fan.

Palaeoenvironmental investigations

A single pollen profile (D1) was recorded from the southern (lakeward) end of trench D I (Cloutman 1988b, 24–7). Both the pollen and the local peat stratigraphy are very similar to that recorded at Site C, and reflect a comparable sequence of wetland and terrestrial environmental succession during the early part of the Holocene. As at Site C (profile VIII), the base of the profile probably dates to the very start of the Holocene, with a largely open environment on the dry ground and reeds growing at the water's edge (Cloutman 1988b, 24 and 34). From this date, Site D would have been at the western end of low-lying peninsula, *c*. 130 m long and 50 m wide, extending into the lake from the higher ground at Site K, and across the entrance to the West Embayment. During the Early Mesolithic, *Phragmites* reedswamp became established around the peninsula, extending into the shallow areas of the lake to the south, as willow carr began to develop along the shore and birch began to grow on the higher ground (Cloutman 1988b, 24 and 34).

Dates obtained by Cloutman show that peat was forming over previously dry ground just north of Site D in the latter half of the Early Mesolithic, reaching a basal elevation of 25 m AOD by 8455–7820 cal BC (9000±100 BP, CAR-878) (see Chapter 7). Fen and carr environments were now well established along the former lake edge, and expanded southwards replacing the areas of reedswamp in what had previously been the shallow lake margins, whilst hazel began to form a significant component of the terrestrial environment (Cloutman 1988b, 34).

As at Site C, a change in the peat stratigraphy from woody to reedy detritus was recorded at Site D after the local expansion of hazel. This probably reflects a change from carr to a largely open fen environment resulting from a slight rise in the local water table (Taylor 2019). Toward the end of the period the local water table fell, causing the upper organic sediments to dry out, and resulting in a band of black, humified peat toward the top of the stratigraphic sequence. The base and top of this deposit were dated at Site D to 5735–5475 cal BC (6680±90 BP, CAR-894) and 5290–4805 cal BC (6110±80 BP, CAR-893) (Cloutman 1988b, 35). This is broadly comparable with the dates on the same deposit at Site C, and strongly suggests that this was a lake-wide event. Alder became established in the area during this period, probably forming carr woodlands on the wetland deposits around the site. High levels of charcoal were present in the humified peat, possibly resulting from the deliberate burning of the local vegetation (Cloutman 1988b, 36).

Archaeological investigations

Site D (West Island) was first investigated in 1978, with the excavation of six narrow trenches (trenches D I-VI), that extended from the higher ground on the top of the 'island' into the surrounding peat deposits (Fig. 8.10). Between 1980 and 1982 a further 27 2 × 2 m test-pits (Z15–Z27; Z28/00, Z28/10 and Z28/15; EZ15–EZ17; EZ15A; EZ18/22; EZ19; Z300; Z302–Z305; and D VII and VIII) were excavated around Site D, and along the edges of a ridge of ground that linked the site to the main lake basin. By the end of this work a total area of 604 m^2 had been investigated.

Stratigraphy

The stratigraphic sequence was broadly comparable to that recorded at other sites around Seamer Carr, with a series of organic deposits sealing the basal geology in the deeper (lakeward) parts of the trenches, and more desiccated peats overlying the geological deposits in the shallower, more elevated areas. The basal deposits consisted of glacially derived sands and gravels that formed the surface of the esker. This was overlain by a series of minerogenic deposits (ranging from silts to sandy gravels) that probably formed in the Early Holocene, and which formed the Early Mesolithic land surface (Fig. 8.11). Due to localized variability in the composition of these sediments, several different context numbers were assigned to what are probably contemporary deposits (Table 8.4).

The basal, mineral sediments were overlain by a sequence of organic deposits (peats and detrital

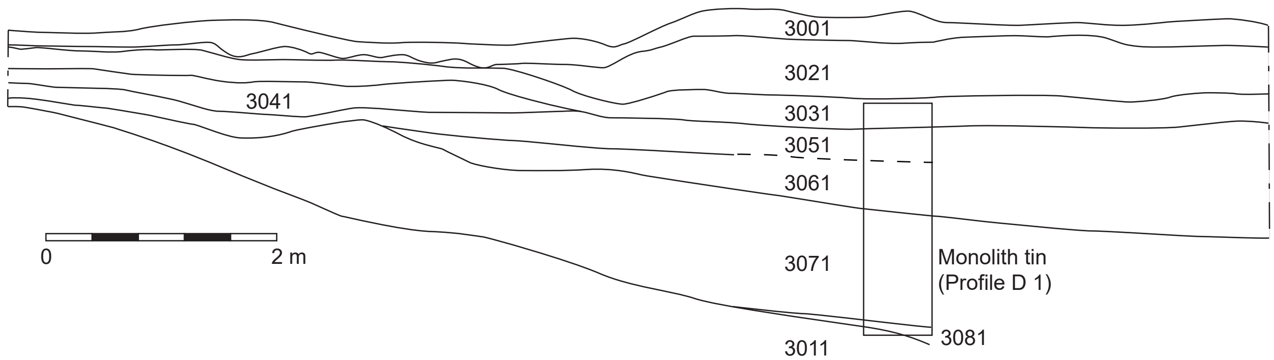

Figure 8.11. *West-facing section through the sequence of wetland deposits recorded at the southern (lakeward) end of trench D I (showing the location of Cloutman's pollen monolith D I).*

muds) that represent the formation and development of the local wetland environments. The character of these deposits varied across the site in relation to the basal topography. In the lower lying areas, the basal sands and gravels were sealed by a fine detrital mud (or gyttja) with fragments of *Phragmites* reeds. This was succeeded by a coarse woody detrital mud or wood peat, that was overlain by one or more layers of *Phragmites* reed peat containing varying proportions of coarse herbaceous and woody detritus. In those trenches that extended farthest into the lake basin, these layers were then succeeded by a deposit of wood peat representing the re-establishment of carr environments at the site. The entire sequence was then sealed by a layer of very dark, humified peat with a high charcoal content. This equates to the layer of black peat recorded by Cloutman, which represents a period of lower water level and burning of the local vegetation. As noted above, radiocarbon dates on the base and top of this deposit at Site D place this event in the later stages of the Mesolithic. Overlying this deposit was a layer of highly humified, friable peat that was sealed by the modern topsoil, or in some places a loose sandy gravel. The context numbers assigned to this sequence are summarized in Table 8.5.

On the more elevated areas of the site the sequence of organic deposits was much less substantial, with just the lower wood peat and the humified peats overlying the Early Holocene minerogenic deposits.

Table 8.4. *Contexts assigned to the basal geology and Early Holocene minerogenic deposits, Site D.*

Context	Description
3091, 3092, 3095, 3096	Sandy gravel with areas of coarse sand
5030	Coarse sand overlying 5014 in DVII and DVIII
3011, 3012, 3013, 3015, 3016, 5014	Compacted sandy clay
5012	Silt with high organic content
5013	Lenses of gravel within 5014
5048, 5069, 5079	Coarse sand with high organic content

Summary of the archaeology

A small assemblage of 216 pieces of worked flint was recorded from Site D. This material lay within the minerogenic deposits that represent the Early Holocene land surface [3012], and was concentrated on the high ground, at the southern end of trench D II and the adjacent test-pits D VII and (to a lesser extent) D VIII. The scatter was spatially discrete and did not extend into trench D III, which lay 2.2 m to the south and clearly ended within trench D VIII to the west.

Table 8.5. *Context numbers assigned to the sequence of organic deposits, Site D.*

Context	Description
5002, 5022, 3014, 3016	Loose sandy gravel
5003, 3021, 3022, 3023, 3024, 3025, 3026	Humified, friable peat
3031, 3032, 3033, 3034, 3035, 3036, 5004	Humified peat with a high charcoal content
3041, 3045	Upper layer of wood peat
3051, 3056	*Phragmites* reed peat without the woody detritus
3061, 3102, 3105, 3106	*Phragmites* reed peat with coarse herbaceous and woody detritus
3071, 3075, 3076, 5005	Coarse woody detritus mud
3081, 3112, 3115, 3116	Fine detrital mud/gyttja

Table 8.6. *Radiocarbon dates for Site D.*

Lab. No.	Radiocarbon Years BP	$\delta^{13}C$ (‰)	Calibrated age (cal BC)	Material	Comment
CAR-893	6110±80	-	5290–4805	Peat	Top of [5004]
CAR-894	6680±90	-	5735–5475	Peat	Base of [5004]

Dating

Two radiocarbon dates were obtained as part of the work undertaken by Cloutman (Table 8.6). CAR-894 and CAR-893 which provide a *terminus ante quem* and *terminus post quem* for the formation of the black, humified, charcoal-rich peat context [5004] in the upper part of the stratigraphic sequence (Cloutman 1988b, 33). No dates are available for the Early Mesolithic horizons.

Seamer Carr Site F

Site F was situated on the northwest part of the threatened area of Seamer Carr a short distance to the southeast of Sweetbeck Farm (NGR 50295 48276). During initial geophysical surveys and associated soil survey test-pitting, carried out by the Ancient Monuments Laboratory in 1976, a corroded Iron Age sword was recovered from this area at *c*. 0.25 m below ground surface (Haddon-Reece et al. 1977). The main phase of archaeological fieldwork took place between 1977 and 1982 when a series of long trenches, and smaller test-pits were excavated across the area, with an additional season of fieldwork in 1989. Together, this work recovered a relatively small assemblage of Late Mesolithic and Neolithic worked flint and stone (1263 pieces). No evidence of Iron Age occupation was encountered.

Palaeoenvironmental investigations at Site F

The site lies outside of the area surveyed by Cloutman, though environmental conditions are likely to have been broadly comparable with those recorded at the other Seamer carr sites. Palaeoenvironmental work was undertaken by Jim Innes on samples collected during the 1989 excavations. However, while preliminary work suggested that a reliable pollen record would be obtained for the site, this proved not to be the case, as a detailed analysis showed few levels with enough preserved pollen to warrant counting.

Samples were also taken for insect analysis from trench F I (see Chapter 18). These provide some evidence for the local environmental conditions contemporary with the initial formation of peat deposits over the basal substrate. These indicate the local presence of wetland habitats, that included heavily vegetated standing and moving water, as well as peat-forming environments and areas of wet woodland.

Archaeological investigations at Site F

Some six trenches (F I-VI) were excavated across the site in 1977, and further test-pitting (Z435, Z437, Z439, Z441 and Z443) was conducted in the general vicinity in 1982 (Fig. 8.12). In 1989, an additional trench (F VII) was excavated by the Vale of Pickering Research Trust at the request of North Yorkshire County Council ahead of construction works associated with the Waste Disposal Plant.

Stratigraphy

Given the elevated position of Site F, well above the lake shore, the sequence of deposits observed in most of the trenches was much simpler than in other parts of Seamer Carr. On the more elevated parts of the site, the basal mineral deposits consisted of clayey and sandy loams [06 and 012], overlain (in parts of the site) by a sequence of sandy loam [08] and peaty loam [04]. These deposits were sealed by a mixed sandy humified peat [07], and more humified, friable peats [03 and 09], that lay beneath the modern topsoil (see Fig. 8.13 and Table 8.7).

Table 8.7. *Contexts assigned to the deposits on the higher ground at Site F.*

Context	Description
01	Topsoil
03, 09	Humified, friable peat
07	Sandy, humified peat
04	Peaty loam
08	Upper sandy loam
012	Basal sandy loam
06	Clayey loam

Table 8.8. *Contexts assigned to the deposits on the eastern side of the West Embayment at Site F.*

Context	Description
5002	Topsoil
5003	Humified, friable peat
5005	Wood peat
5076	*Phragmites* reed peat
5067	Fine detritus mud with *Phragmites* reeds
5012	Coarse sand with a high organic content
5014	Coarse sand
5015	Sandy gravel

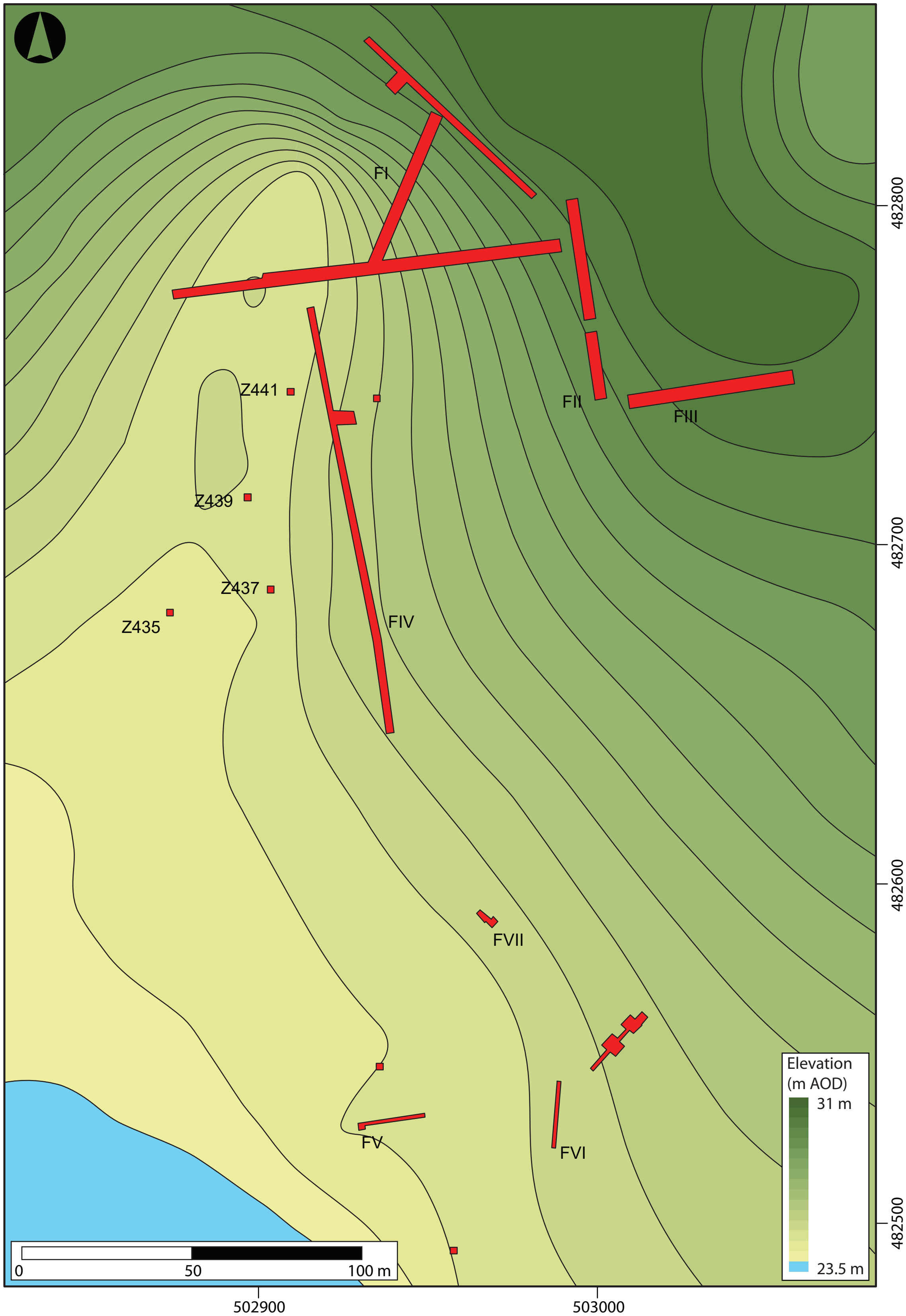

Figure 8.12. *Excavated areas at Site F (level of the lake shown at 24 m AOD).*

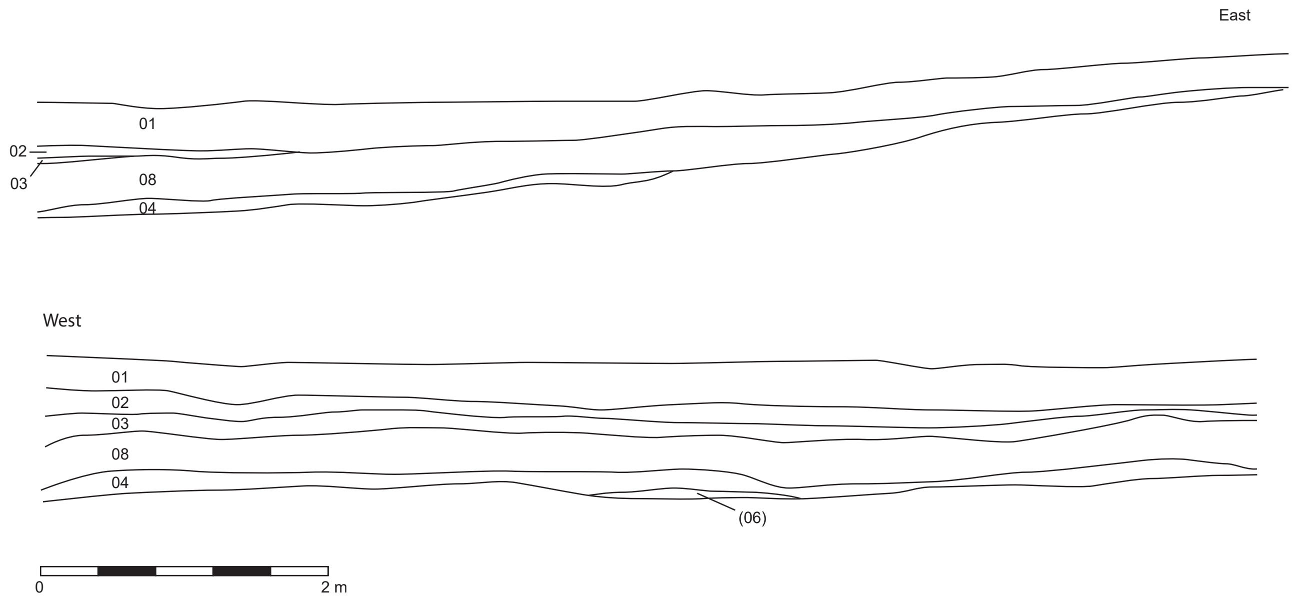

Figure 8.13. *Southeast-facing section through the stratigraphy on the higher ground at Site F (trench F IV).*

In contrast, the deposits along the eastern margins of the West Embayment were both deeper, and more comparable to those found at the other Seamer Carr sites. Here, the basal geology consisted of a sandy gravel [5015], overlain by deposits of coarse sand [5012/5014], the uppermost of which [5012], had a high organic content. This was succeeded by a sequence of fine detritus mud with *Phragmites* reeds [5067], and wood peat [5005]. These deposits occurred twice in each trench but were given the same context numbers. In parts of the site, a coarse *Phragmites* reed peat [5076] was also present below the lower wood peat. The uppermost wood peat was sealed by a friable, highly humified peat [5003] that lay immediately below the topsoil (see Table 8.8 and Fig. 8.14).

Anthropogenic features

A series of 18 possible stakeholes, forming two linear arrangements at right angles to each other, were observed in a 4 m-wide extension in trench F VI (Figure

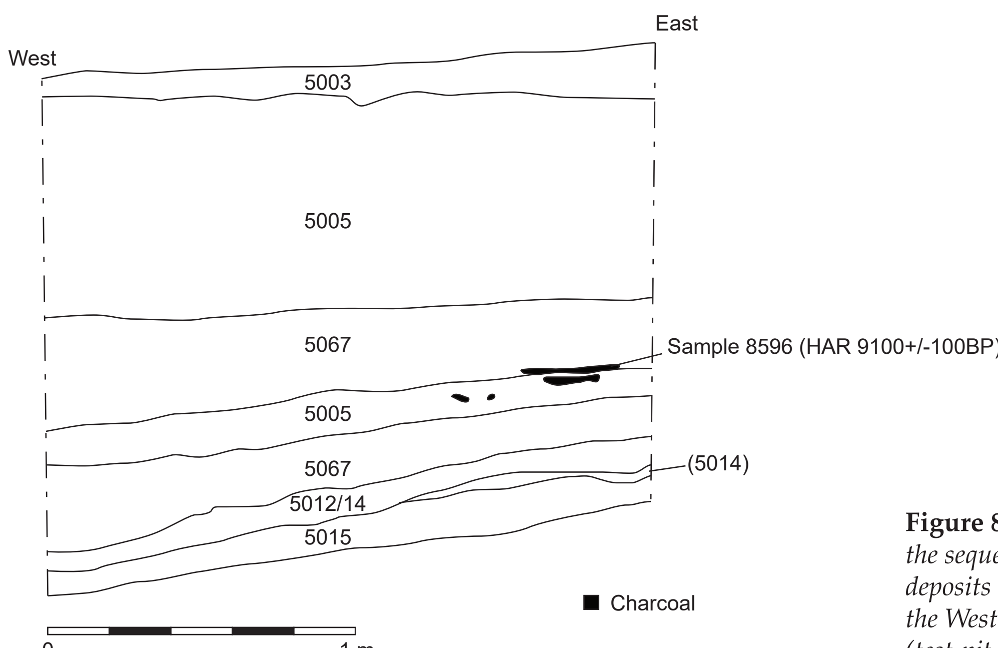

Figure 8.14. *Section through the sequence of wetland deposits on the eastern side of the West Embayment at Site F (test-pit Z441).*

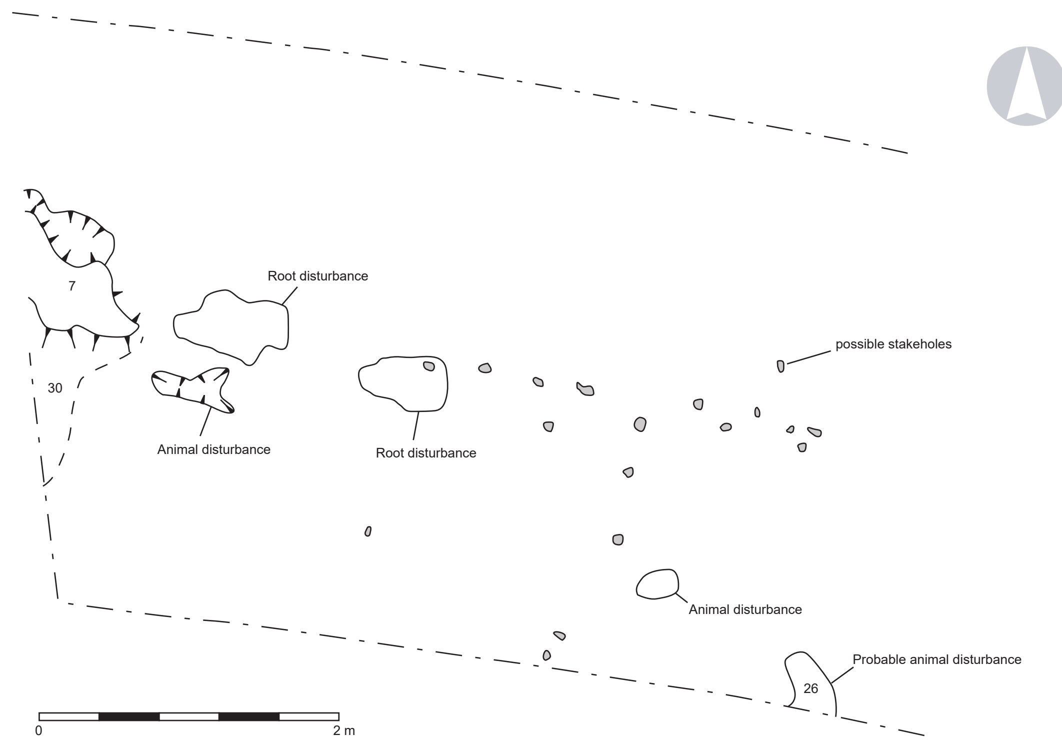

Figure 8.15. *Possible stakeholes in trench F VI.*

8.15), and which may represent the remains of a light structure. No material culture was associated with these features.

Summary of the archaeology

A small assemblage of 1263 pieces of worked flint was recorded from Site F. Most of the material came from the minerogenic deposits, notably [06 and 04] and the layer of humified peat above them [07]. The assemblage is of mixed date, with diagnostically Late Mesolithic microliths, Early Neolithic leaf arrowheads, and a fragment of a Neolithic polished stone axe and an axe flake. There is no stratigraphic separation between the diagnostic material of different dates, though the assemblage from trench F IV was predominantly Early Neolithic.

Overall, the assemblage consisted of tools, notably scrapers and micro-denticulates, with smaller numbers of other tools types (including awls, two knives, a burin, microliths and arrowheads), utilized flakes and blades, and knapping debris. In contrast to the predominately Early Mesolithic assemblages recorded at other sites, most of the material was worked from till flint. There was a high proportion of secondary flakes, suggesting that much of this material was arriving on the site as pre-prepared cores.

Dating

Two dates are available on the sedimentary sequence from Site F (Table 8.9). HAR-5239 dates the base of context 5005 in test-pit Z435, though as discussed in Chapter 4 the date may not provide a reliable age for this deposit. HAR 5240 was obtained on charcoal taken from the interface between the lower deposit of wood peat [5005] and the upper deposit of reed peat [5067] in test-pit Z441.

The X, Z and EZ 2 × 2 m test-pits

A total of 104 2 × 2 m test-pits were hand-excavated between 1980 and 1982. These were numbered sequentially and given the prefix X, Z or EZ according to the area and year of excavation. Where the test-pits recorded concentrations of archaeological material they were generally incorporated into the larger open-area excavations (as at Sites C and K), or the area was

Table 8.9. *Radiocarbon dates for Site F.*

Lab. No.	Radiocarbon Years BP	$\delta^{13}C$ (‰)	Calibrated age (cal BC)	Material	Comment
HAR-5239	8730±90	-30.1	8200–7590	Soil (?peat)	Context [5005], 27.057 m AOD, Z435
HAR-5240	9100±90	-25.9	8570–7985	Wood and peat	Interface between [5005] and [5067], Z441

subjected to further investigation (as at Rabbit Hill and Site B). In these cases, the data from the test-pits has been included in the description and discussion of the main Seamer Carr sites in this, and in the preceding chapters.

The remaining 62 test-pits provide some information on the areas between the main sites. Of these, 17 produced pieces of worked flint (a total of 36 pieces), and no anthropogenic features were recorded.

Stratigraphy

The stratigraphic sequence was the same as that identified at the main Seamer Carr sites. A basal geology of mixed sands and gravels [5016, 5026] was overlain by a coarse sand [5013, 5014], and in some areas by a second layer of sand [5012]. These were succeeded by a sequence of organic deposits: a coarse wood peat [5005], a highly humified peat with a high concentration of charcoal [5004], a highly friable, desiccated peat [5003] and a peaty topsoil [5002].

Summary of the archaeology

Worked flint was recorded from 17 test-pits, though the overall quantity of material was very low (36 pieces). Unsurprisingly, given the small quantity of material, the density of finds was very low (no more than five pieces in a test-pit, with some only producing single finds). Only one diagnostic piece (an Early Mesolithic obliquely blunted point) was recovered, but the assemblage as a whole was consistent with an Early Mesolithic age.

Spatially, these test-pits fall into five areas:

a) a single test-pit (Z33) mid-way between Site C and Site B
b) a single test-pit (Z10) between Site B/Rabbit Hill and Site K
c) a group of test-pits on either side of the causeway between Site D and Site K (Z14, Z16, Z17, Z19–22, EZ17–18)
d) a group stretching from the northern end of Site K to just north of Site L (Z308, Z310, Z316 and Z316A).
e) two test-pits (Z419 and Z427) along the eastern shoreline of the West Embayment between Site L and Site F.

Eleven of the test-pits contained small quantities of knapping debris. The remainder, however, were dominated by formal tools and utilized flakes and blades (making up 29% of the total assemblage) and probably reflect discrete tasks carried out away from the main areas of activity. In several cases the assemblages were made up of utilized flakes and blades, and probably reflect tasks involving the cutting of materials, possibly the harvesting of wetland plants.

Discussion

This chapter describes the evidence from several small artefact concentrations (Sites B, D, and Rabbit Hill) that were recorded as part of the Seamer Carr Project. Much of the work was carried out between 1977 and 1982, and focused on the area close to the line of the former lake shore as well as the adjacent higher ground. Evidence for both Early and Late Mesolithic occupation and later prehistoric activity was recorded during this work, with the later material generally deriving from disturbed contexts on the more elevated parts of the investigated areas.

The investigated areas extend along approximately 1.5 km of the basin's edge, and incorporate a range of topographical contexts. Sites B and D lay on the edge of the main lake basin; the former on the southern slope and scarp of a low hill (Rabbit Hill) facing into the main body of the lake, while the latter occupied a long narrow peninsula that extended across the entrance to the West Embayment. Most of the Z and EZ test-pits ran along the eastern side of this embayment, with Site F lying at its northern end. The environments forming across these parts of Seamer Carr during the Mesolithic would have been comparable to those present at Sites C and K, as a largely open landscape was colonized by a succession of woodland species, while beds of emergent plants became established in the lake margins and the shallow water of the embayment, before being succeeded by willow carr and fen. As at other locations around Seamer Carr, the wetlands would have gradually encroached upslope onto areas that had been dry ground during the course of the Early Mesolithic, with dates on samples just to the north of Site D showing that these environments reached a level of 25.0 m AOD by 8455–7820 cal BC (9000±100 BP, CAR-878) (Cloutman 1998a, 15. See Chapter 7). This would have gradually covered the narrow ridge of ground that connected Site D to the higher ground to the north, leaving it as a small island within the wetlands.

Small assemblages of Mesolithic worked flint and animal bone were recorded from the wetland deposits at Site B, and flint was also present on the dry ground at Site D and, to a lesser extent, Rabbit Hill. Due to the effects of modern disturbance on the higher ground, and the fact that none of these sites were the subject of open-area excavation, the assemblages are somewhat fragmentary and difficult to interpret. However, the evidence recovered provides some important information on the character of Early Mesolithic activity away from the more intensive areas of activity and occupation.

Broadly speaking, the material reflects a series of spatially discrete episodes of activity that took place at locations on both the dry ground and in the adjacent wetland areas. The character of these activities varied considerably, as does their potential relationships to the more extensively excavated areas of occupation at Sites C and K. At Site D, much of the lithic assemblage reflects a potentially short episode of activity that involved the production of microliths, and the use of tools (notably scrapers) that had been brought onto the site. A cache of flint nodules was also brought onto the site, possibly on a separate occasion, and left. Similar caches have been recorded at Flixton School Field (see Chapters 13 and 15) and Star Carr (see Conneller et al. 2018, 208–9). Conneller and Schadla-Hall (2003, 98) have argued that these reflect a lithic provisioning strategy where sources of raw material were deposited for collection and use at a later date. Discrete episodes of activity are also reflected in the small assemblages of worked flint recorded from some of the test-pits, which involved the use of flakes and blades, and more occasionally formal tools. This may have included tasks such as the harvesting and/or processing of plants growing at the edge of the wetlands, as well as activities such as bone or antler working. In contrast, much of the Late Mesolithic material from Site B was generated from the processing of an aurochs carcass following a successful hunt. As discussed in Chapter 16, the assemblage probably represents the butchery of a single animal, after which some of the elements were likely taken to an occupation site in the surrounding area. The date from one of the ribs places this activity at 8210–7580 cal BC (8740±120 BP, BM-1841R).

How these different tasks related to the activities recorded at Sites C and K is difficult to determine. The date from the aurochs' rib could be contemporary with the later phases of activity at Site C, and the animal may have been hunted, killed and butchered at the same time, and potentially by the same groups of people responsible for some of the activity at this site. The same could also be true of the discrete episodes of activity represented at Site D and in the material recorded from the test-pits, which may also represent tasks undertaken away from the main areas of activity at Sites C and K.

The later Mesolithic and later prehistoric activity has a slightly different distribution to the earlier phases of occupation. The Late Mesolithic material was recorded at Site F on what would have been higher ground at the northern end of the West Embayment, and on the high ground at Rabbit Hill, as well as the adjacent wetland deposits at Site B, and later prehistoric material was found at similar locations, albeit in differing quantities. This is probably the result of the expansion of peat-forming wetlands over the lower-lying ground that had been occupied during the Early Mesolithic, a process that was well underway during the Early Mesolithic, and which probably also explains the lack of later material at Site D.

Rabbit Hill provides the most extensive evidence for Late Mesolithic activity in this landscape, albeit one of unknown age and duration. It is also the only site with archaeological features of Late Mesolithic date, including the two possible hearths in test-pit X5, and the shallow scoop in X8. The function of the scoop is unclear, though it must have acted as a significant focus for activity, as over a third of the lithic assemblage from Rabbit Hill was recovered from this trench. The worked flint from Rabbit Hill represents a range of different activities. Tasks undertaken in or around the hollow focused largely on microlith production, while the assemblages from around the hearths in X5 included core reduction and the manufacture of a range of different tools. Late Mesolithic material was also found in the adjacent wetland deposits further downslope, though as with the earlier material this is likely to have been redeposited rather than reflecting *in situ* activity.

Late Mesolithic worked flint was also recorded at Site F, at the northern end of the West Embayment, though here the assemblage was mixed with Early Neolithic material making it difficult to determine the character of activity taking place. However, the assemblage does show a preference for non-Wolds flint, a pattern also present at Rabbit Hill, indicating a change in lithic sourcing from the Early Mesolithic.

Following the end of the Mesolithic people continued to visit the Seamer Carr area, though the nature of activity is harder to determine. Early Neolithic activity was recorded at Site F, and includes knapping debris, a fragment of a polished stone axe, and several tools including leaf arrowheads. Late Neolithic and/or Early Bronze Age material was also recovered from Rabbit Hill/Site B, though again this provides little indication of the forms of activity taking place. What is clear is that these areas around Seamer Carr continued to be visited, and perhaps occupied, on at least an intermittent basis well after the latest Mesolithic hunter-gatherers had left.

Chapter 9

Sites VP D, VP E and Flixton 9

Paul Lane, Barry Taylor, Chantal Conneller, Peter Cardwell, Jim Innes, Roger Simpson, Geoff Smith & Tim Schadla-Hall†

This chapter describes the results of the archaeological and palaeoenvironmental work at three sites situated at the western end of the former Lake Flixton. Flixton 9, which lay at the very western end of Lake Flixton, beside what appears to have been the only outflow from the lake, was first located by John Moore during his pioneering fieldwork in the 1940s. Sites VP D and VP E were subsequently identified during test-pitting surveys carried out by the VPRT (Fig. 1.2). The artefact scatters at both VP E and Flixton 9 were relatively small, and both localities were probably utilized only for short periods of time, whereas VP D was the focus of more intensive episodes of activity.

Site VP D

VP D is situated approximately 400 m to the south of Star Carr, on the opposite side of a large embayment (NGR 50294 48072). It lies in a field of ley pasture, which at the time of excavation had been ploughed every four to six years on a rotational basis over several decades. In the 1970s, field drains had been laid across this area, disturbing the archaeological horizons (see below). The site was identified in 1986 through the programme of test-pitting undertaken by the VPRT, with further excavations carried out in 1988. A total of 2600 pieces of worked flint and 48 fragments of animal bone were recorded, most of which were concentrated in a single area of the site.

Auger surveys at VP D

An area of approximately 15,500 m^2 was augered, recording the subsurface topography around this part of the lake basin (Cloutman 1988b). The results indicate that VP D lay on the northern edge of a relatively flat, low-lying terrace, overlooking the entrance to a large embayment at the western end of the lake (Fig. 9.1). The topography sloped away gently to the north, where it formed the lake shore, and to the east before levelling out again to create an area of level ground where VP E is situated.

Palaeoenvironmental investigations at VP D

J.B. Innes

Profile: VP88D

Pollen analysis was undertaken on samples from VP88 D. However, the preservation of the pollen grains was too poor, and the concentration levels too low, to produce a statistically viable diagram. Samples were also taken for particle size and metals analysis across a thick deposit of sand that overlay the archaeological horizon (see Fig. 9.2). The lithostratigraphy of the profile is shown in Table 9.1.

Particle Size Analysis

Samples from the following depths (cm) were analysed: 20–21, 22–23, 24–25, 26–27, 28–29, and 30–31. The results are shown in Fig. 9.3.

Table 9.1. *Lithostratigraphy of profile VP88 D.*

Depth (cm)	Description
0–8	Blackish green saturated *Phragmites* peat
8–9	An incursion of grey/yellow sand and silt
9–19.5	Blackish green saturated *Phragmites* peat
19.5–32	Coarse grey/yellow sand lens
32–45	Black/dark brown peat with woody fragments and large pieces of bone and flint
45–50	Dark grey, organically enriched coarse clayey sand with traces of degraded chalk

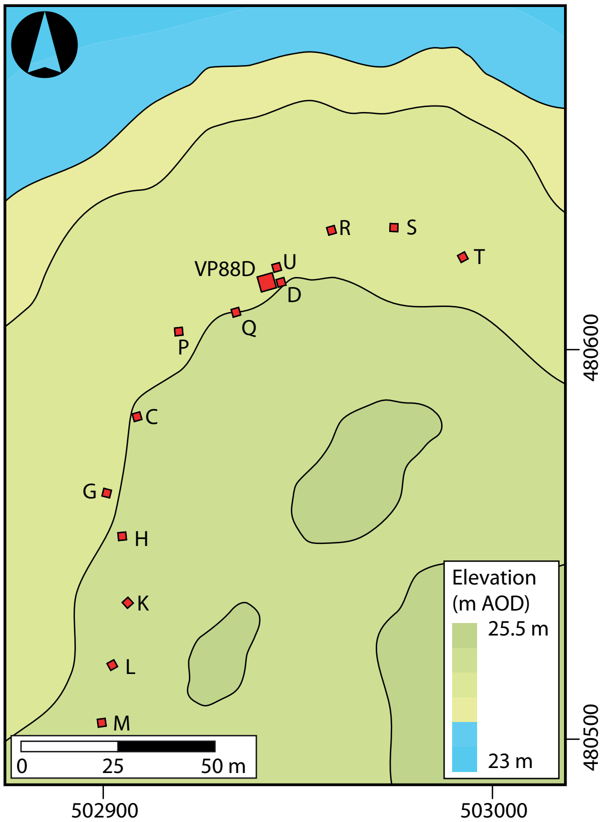

Figure 9.1. *Topography and excavated areas at VP D (level of the lake shown at 24 m AOD).*

The samples were composed of very coarse sands through to medium silts. The deposition of the sand lens appears to have taken place over a period of time, with various processes occurring at different times. The sand layer as an overall unit is poorly sorted, suggesting a waterborne environment. However, one sample (Sample 4) was particularly well sorted, suggesting selective deposition in a different type of event to those preceding and following it. Through the profile, the data goes through several trends from positively skewed progressing to negatively skewed. This suggests reworking and redeposition of sediments probably from different sources. There is no clay component suggesting some selective deposition.

Metals

Erosion is high and increases throughout the sand lens. There appears to be preferential mobility of manganese, indicated by high levels compared to iron, suggesting reducing conditions in the sediments.

Interpretation

Taken together, the data suggests that the sand layer ([0045] in Fig. 9.2) occurred episodically with higher transport velocities at the start becoming slower at the top. This, and the stratigraphic position of the sand, which cuts through contexts, suggest that the deposit has formed through the actions of a subterranean spring sometime after the formation of the peat.

Archaeological investigations at VP D

The site was investigated in 1986 by the excavation of a series of 2 × 2 m test-pits that sampled the area above the approximate line of the Mesolithic lake shore (see Fig. 9.1). In all, 13 test-pits were excavated (VP86 C, D, G, H, K-M, and P-U) that year, with the bulk of the finds coming from units D, Q and U. In 1988, a 4 × 4 m

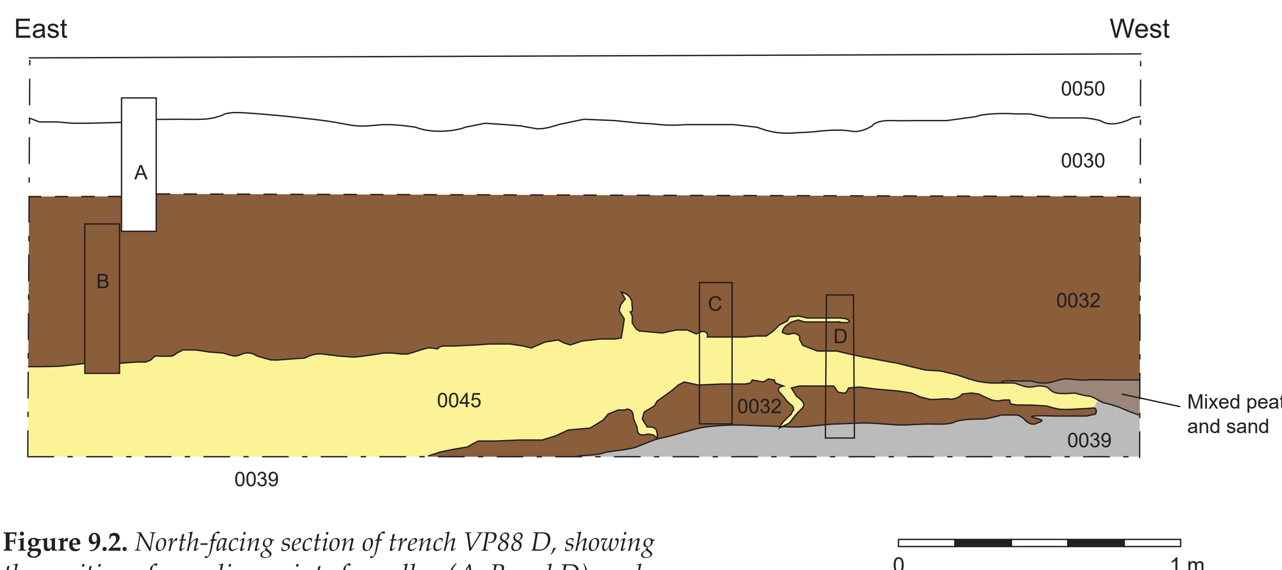

Figure 9.2. *North-facing section of trench VP88 D, showing the position of sampling points for pollen (A, B and D), and particle size analysis and OSL dating (C).*

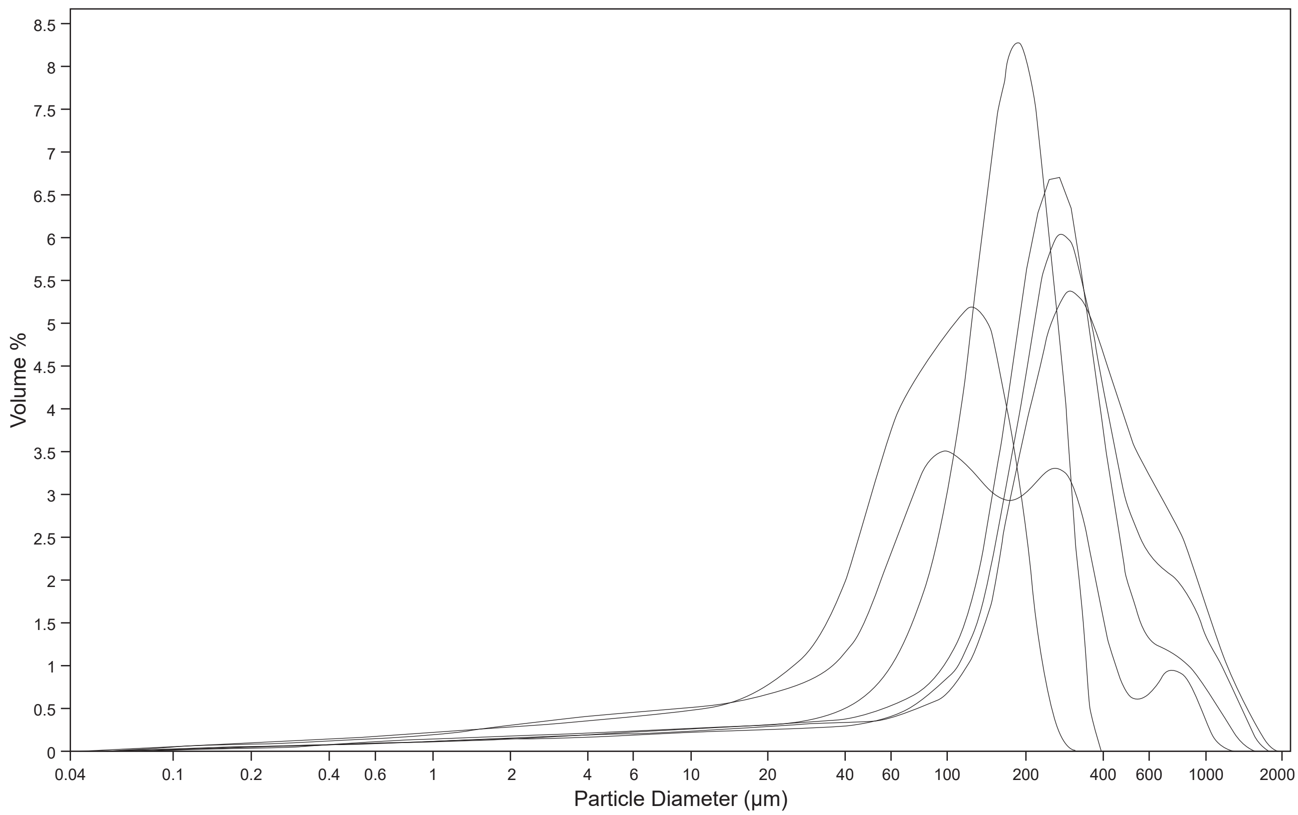

Figure 9.3. *Results of Particle Size Analysis of sediments from VP88 D.*

area, some 0.5 m west of VP86 D and U was excavated. This trench was designated VP88 D, from which the site name is derived.

Stratigraphy

The basal mineral deposits consisted of a poorly sorted sandy gravel [0036] or boulder clay [0040], representing the surface of the glacially derived deposits. These were sealed by a coarse sand with a high organic content [0039], or where the boulder clay was present by a highly organic silt [0035]. In parts of the site, these deposits were succeeded by a layer of highly organic sand containing fragments of woody detritus and charcoal [0033], or an organic-rich sandy clay [0041], both of which probably represent the Late Glacial/ Early Holocene land surface, and/or relict soil horizons. These deposits were overlain by a sequence of organic sediments that formed as wetland environments expanded over the site. These consisted of a layer of *Phragmites* reed peat [0032], which was only present in the northerly test-pits, and a friable, humified peat [0031] that lay beneath the modern topsoil. In VP88 D, and the neighbouring test-pit VP86 D, a lens of coarse sand [0037/0045] lay between the organic sand and the overlying reed peat, in some cases intruding into the peat. As discussed above, particle size analysis suggests that this formed as a result of underground spring action following the formation of the peat (Table 9.2; Figs. 9.4a-c, 9.5).

Natural features

Two irregularly shaped features [0043 and 0044] were recorded in trench VP88 D cutting through context [0039] (Fig. 9.6). These were filled by an organic-rich sand, containing fragments of woody detritus and charcoal, that was indistinguishable from the overlying context [0033]. Although archaeological material was found within these features they have been interpreted (on the basis of their shape and fills) as the result of natural processes (probably tree throws).

A concentration of natural stone lying on top of the Late Glacial/Early Holocene land surface was also recorded in test-pit VP86 P, although no material culture was found in association.

Summary of the archaeology

An assemblage of 2600 pieces of flint and 48 fragments of animal bone were recorded during the excavation of Site VP D. The lithic assemblage can be dated on typological grounds to the Early Mesolithic. There are no radiocarbon dates on the faunal material, but these derived from the same contexts as the flint and are assumed to be contemporary. Most of the assemblage came from the minerogenic deposits forming the Early Mesolithic land surface [0033/0041] with a smaller quantity deriving from the base of the overlying peat [0032]. Refitting lithic sequences run between these two contexts, and it is probable that the material in the overlying peat is the result of a small degree of post-depositional vertical movement.

The main concentration of worked flint was recorded from the southern half of VP88 D and the adjacent test-pit VP86 D (to the east), and in VP86 Q and to a lesser extent VP86 P (to the west). Based on the excavated sample, activity extended for at least

Table 9.2. *Contexts assigned to the sedimentary sequence at VP D.*

Context	Description
0030	Topsoil
0031	Friable humified peat
0032	*Phragmites* reed peat
0037, 0045	Coarse sand
0041	Sandy clay with a high organic content
0033	Sand with a high organic content and fragments of wood and charcoal
0035	Silt with a high organic content
0039	Coarse sand with a high organic content
0040	Boulder clay
0036	Sandy gravel

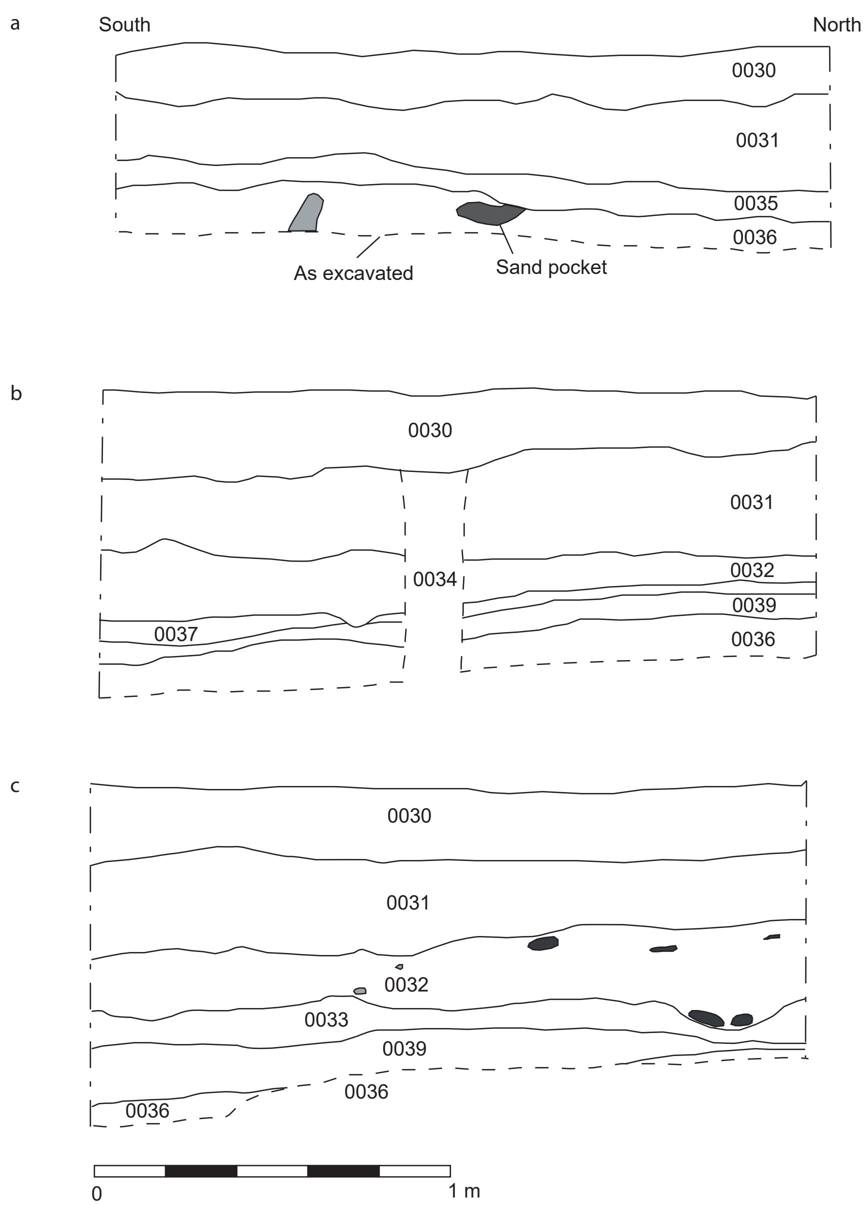

Figure 9.4. *East-facing sections through the sequence of deposits at VP D as recorded in a) VP86 C, b) VP86 D, and c) VP86 Q.*

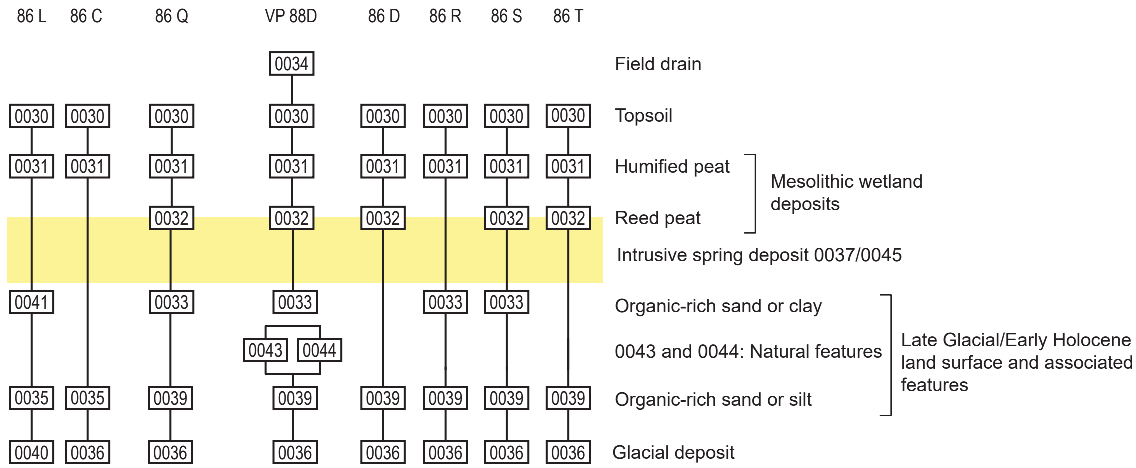

Figure 9.5. *Harris Matrix for Site VP D.*

32 m (east–west) and an unknown distance to the south. The assemblage was generated through core reduction, and the manufacture, use and maintenance of tools. Wolds and till raw material were utilized and brought to the site as tested and untested pebbles, and possibly also as pre-prepared blanks. A wide range of tool types were present, including microliths (which dominate the assemblage), scrapers, burins and a *meche de forêt*, as well as utilized flakes and blades. Microlith manufacture is attested by the presence of microburins (the latter slightly outnumbering the former). However, none of the recovered microliths refit to the microburins, and two-thirds exhibited some sort of damage, and were probably brought onto the site on composite tools and then discarded. Burin spalls were also present, indicating the use and repair of these tools. Overall, similarities in the material that was used, and a high number of refits, suggest that the assemblage was generated over a relatively short period of time. A concentration of burnt flint was also present in VP88 D, suggesting that some of these activities took place around a fire. There was some spatial variability between the assemblages in the different test-pits, with a more limited range of tool making/using activities represented at VP86 Q than in the denser concentrations of material at VP88 D and the adjacent test-pit VP86 D.

The faunal assemblage consisted of 48 specimens, of which 32 could be identified to species. The majority of these came from limb elements of red and roe deer, elk, aurochs, and pig, with other elements (teeth and vertebra) occurring more occasionally. The

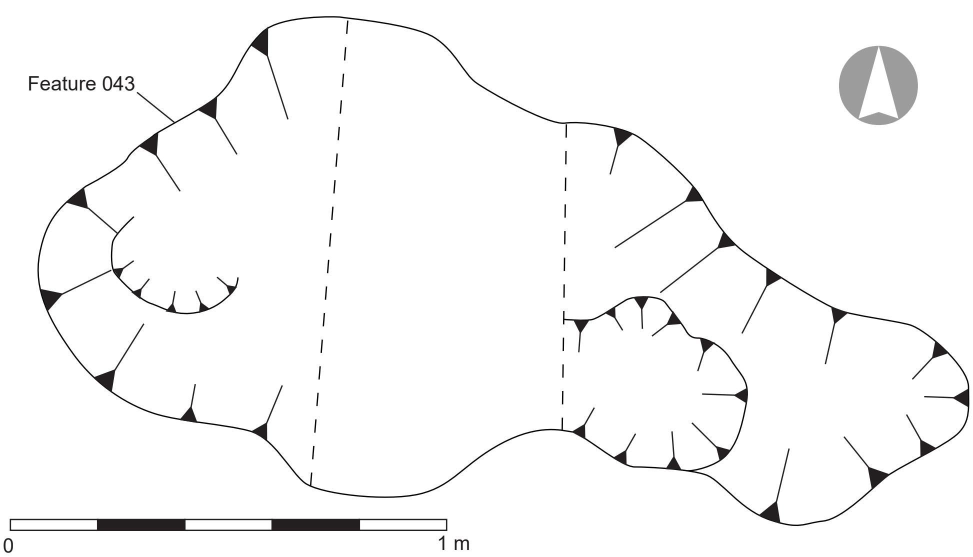

Figure 9.6. *Plan of a natural feature (probably a tree throw) recorded in VP88 D.*

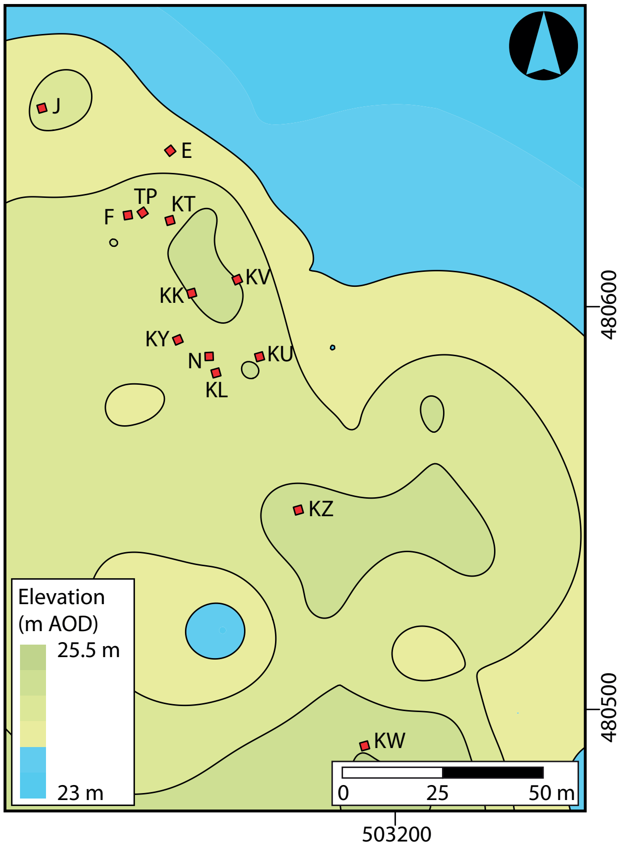

Figure 9.7. *Location of test-pits at Site VP E (level of the lake shown at 24 m AOD).*

unidentifiable elements show the same pattern, with most deriving from the limb elements of medium and large mammals.

Dating

No radiocarbon dates are available for the site. Samples were taken from the sand deposit [0045] in VP88 D by Ian Bailiff (Department of Archaeology, University of Durham) for OSL dating. However, because of inadequate bleaching, no date could be obtained.

Site VP E

Site VP E was situated some 200 m to the east of VP D on the southwest side of the lake basin (NGR 503155 480600). The area was investigated by the VPRT in 1986, with additional surveys carried out in 1991. In all, an area of 1000 m^2 was systematically augered and 12 test-pits (i.e. 48 m^2) were excavated. A small assemblage of flint (252 pieces) was recorded during this work. The material formed two concentrations, the first in trench VP86 J at the north end of the investigated area, the other *c*. 65 m to the south in VP91 KY, while small quantities of material were recovered from several other test-pits. From the test-pitting results, it appears that activity in this part of the landscape was restricted in size and scale.

Auger surveys at VP E

The area around VP E was augered as part of an extensive survey of the western part of the lake basin, undertaken between 1989 and 1992 (see Chapter 13). This work showed that VP E lay on an area of relatively low-lying ground that formed the western side of the lake basin. There was a very gentle slope from the lake shore up to around 24.5 m AOD, after which the topography was generally flat, with some low hillocks, no more than *c*. 60 m across and with a maximum elevation of just over 26.5 m AOD (Fig. 9.7) . Most of the test-pits were located on a small, raised area, with a maximum elevation of 25.2 m AOD.

Archaeological investigations at VP E

In 1986, five 2 × 2 m text-pits were excavated at the site (VP86 E, F, J and N), resulting in the discovery of small quantities of archaeological material (Fig. 9.7). A further eight test-pits were excavated in 1991 (VP91 KK, KL, KT, KU-W, KZ and TP) to establish the extent of Early Mesolithic activity at the site.

Stratigraphy

The stratigraphy was relatively uniform across the area, though as at VP D there were slight variations between trenches, usually within the composition of the basal deposits and overlying organic sediments (Table 9.3 and Fig. 9.8a-b).

The basal geology consisted of a poorly sorted sandy gravel [0036/9016], which was overlain by a sandy clay or an organic-rich sand [0033] representing the Early Holocene land surface. These deposits were sealed by a fine-grained organic detritus [0037/9014], which was succeeded by a layer of *Phragmites* reed peat and then by a wood peat, which were assigned the

Table 9.3. *Contexts assigned to the sedimentary sequence at VP E.*

Context	Description
0030, 9000	Topsoil
0031, 9013	*Phragmites* reed peat and overlying wood peat
0037, 9014	Fine grained organic detritus
0033	Sand with a high organic content
0039, 0041, 9015, 9019	Sandy clay
0036, 9016	Sandy gravel

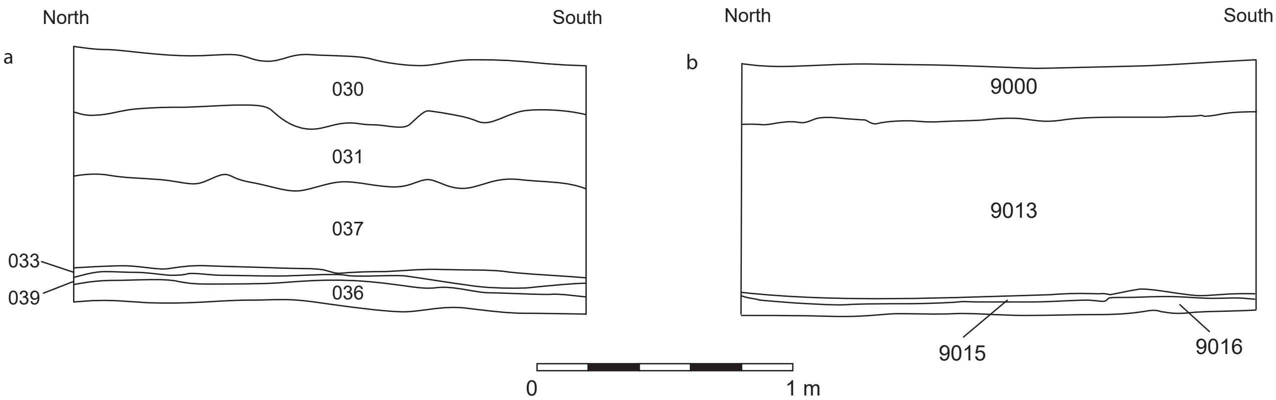

Figure 9.8. *Sections through the sequence of deposits at VP E as recorded in test-pits a) VP86 J, and b) VP91 KT.*

same context number [0031/9013] due to the difficulties of differentiating them during excavation. These organic deposits reflect the expansion of peat-forming environments over areas of previously dry ground. The sequence was sealed by a mixed sandy, peaty topsoil. Dates obtained by Cloutman (1988a, Table 1) show that the organic deposits were starting to form over the mineral sediments along the 25 m AOD contour by 8555–7955 cal BC (9060±100 BP, CAR-887). In some of the more northerly test-pits, the lower deposit of fine organic detritus was absent, and the basal mineral sediments were overlain by the reed and wood peats (see Fig. 9.8b).

Summary of the archaeology

A very small assemblage of 252 pieces of worked flint was recorded during the test-pitting of Site E. The assemblage is Early Mesolithic, based both on the presence of early type microliths and from its stratigraphic position, with the exception of a single, Late Glacial burin in test-pit VP91 KY. Most of this material was recorded from the mineral deposits that represent the Early Holocene land surface, with much smaller quantities from the basal geology and overlying peat (and which are probably the result of post-depositional movement). Almost all of the lithics (235 pieces) came from two test-pits, VP86 J (167 pieces) and VP91 KY (68 pieces), with very small quantities from test-pits VP91 KK, KU and KV.

The two main artefact-bearing test-pits (VP86 J and VP91 KY) lie *c.* 65 m apart and reflect separate areas of activity, possibly undertaken on different occasions. There was some variation between these assemblages. In VP86 J, the material consisted of knapping debris and a small quantity of tools (notably microliths and burins, as well as a scraper and several utilized flakes and blades). The knapping debris utilized till flint, and reflected early stages in the reduction sequences, though the products of this work were absent and had either been taken to another part of the site or transported to a different location in the landscape. There is no evidence for debris associated with tool manufacturing or maintenance, and several pieces had been manufactured from Wolds flint, suggesting that most (if not all) of the tools, as well as several blades, were brought onto the site, used, and then discarded. The assemblage from VP91 KY was generated through the reduction of one or two nodules of a high-quality black flint, though again the products of this work were not present in the assemblage, having either been moved to a different part of this activity area or to another location entirely. In contrast to VP86 J, there were no tools in the assemblage, and activity seems to have focused on core maintenance.

Table 9.4. *Radiocarbon dates for VP E.*

Lab No.	Radiocarbon years BP	$\delta^{13}C$ (‰)	Calibrated date (cal BC)	Material	Context
CAR-887	9060±100	-	8555–7955	Coarse detritus mud with reeds	From the base of the organic deposits at the 25 m AOD contour
CAR-888	9760±100	-	9455–8795	Coarse detritus mud with reeds	From the base of the organic deposits at the 24 m AOD contour
CAR-889	9700±100	-	9320–8785	Coarse detritus mud with reeds and moss	From the base of the organic deposits at the 23 m AOD contour

Dating

No dating was undertaken as part of the work carried out by the VPRT. However, three radiocarbon dates were obtained by Cloutman at the base of the organic sediments on the 23 m, 24 m, and 25 m AOD subsurface contours to model the expansion of peat-forming environments over the Mesolithic land surface (Table 9.4, and see Cloutman 1988a, Table 1). These show that the wetlands encroached from the lake margins (23 m AOD), onto the former lake shore-line (24 m AOD), and across the areas of higher, previously dry ground (25 m AOD), during the Early Mesolithic.

Flixton 9

Flixton 9 lies at the far western end of the basin (NGR 502145 481010), on or close to the outflow channel for Lake Flixton and was first recorded by John Moore in the 1940s (Moore 1950). Most of the evidence he collected came from the edge of the River Hertford, and it was unclear whether the site had been destroyed during the canalization of this section of the river in the nineteenth century. In an effort to establish the location of the site, and assess its extent and the levels of preservation, a limited programme of test-pitting was carried out in 1987. Test-pits on both sides of the river produced a small quantity of Early Mesolithic material, with the densest concentrations closest to the canalized section of the river (test-pits VP87 CF, south of the Hertford, and VP87 CT on the north side) (Fig. 9.9). This suggests that the centre of the site was destroyed when the river was canalized, but that activity had extended over some 60 m or more of the former shoreline. Unfortunately, the lithics were subsequently lost before analysis could take place.

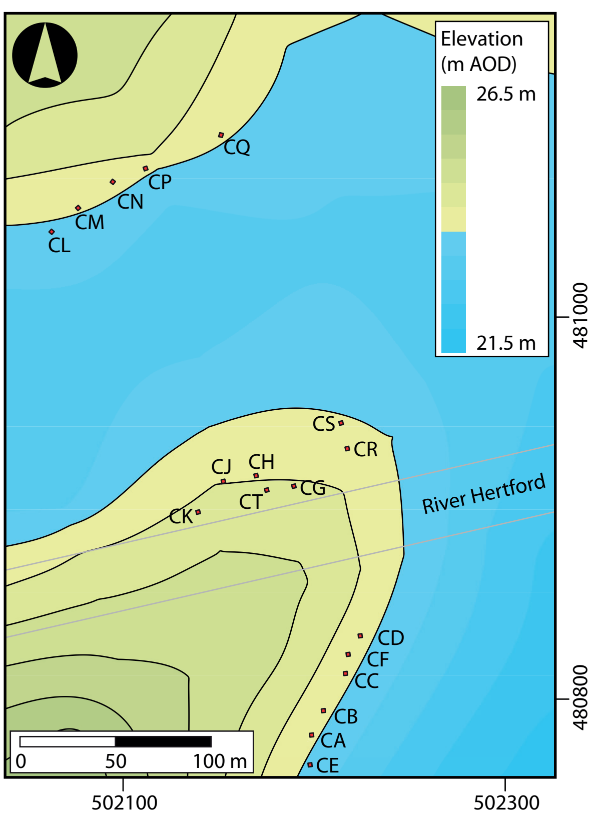

Figure 9.9. *Location of test-pits at Flixton 9 (level of the lake shown at 24 m AOD).*

Table 9.5. *Lithology of pollen profile VP87 CG.*

Depth (cm)	Description
0–9	Crumbly, completely oxidized material with modern rootlets
9–18	Carbonized peat
18–36	Very crumbly, light coloured humified peat with herbaceous rootlets, slightly oxidized
36–38	Very well humified, charcoal-rich peat
38–51	Mid brown, slightly clayey humified herbaceous peat
51–54	Organic sand
54–57	Coarse sand with small gravel

Palaeoenvironmental investigations at Flixton 9

J.B. Innes

Profile VP87 CG

Two overlapping monolith tins were taken from the lower deposits in the west face of test-pit VP87 CG to provide samples for pollen analysis. The sampled horizons included a shallow deposit of humified peat containing a thick charcoal layer with flints stratified in the peat below it. The detailed lithology of the profile is presented in Table 9.5.

Pollen analysis

Subsamples for pollen analysis were taken at two-centimetre intervals through the lower part of the stratigraphic sequence. The pollen diagram (Fig. 9.10) has been divided into four local pollen assemblage zones (prefixed CG).

LPAZ **CG-1** 44–49 cm
Betula-Pinus-Salix-Juniperus-Cyperaceae-Poaceae-Equisetum

Betula and *Pinus* both represent 50% of tree pollen and almost 20% of total pollen, and *Salix* dominates the non-tree pollen sum with lesser but important percentages of Cyperaceae and Poaceae. *Juniperus* is consistently present in low frequencies. Rosaceae and *Filipendula* are

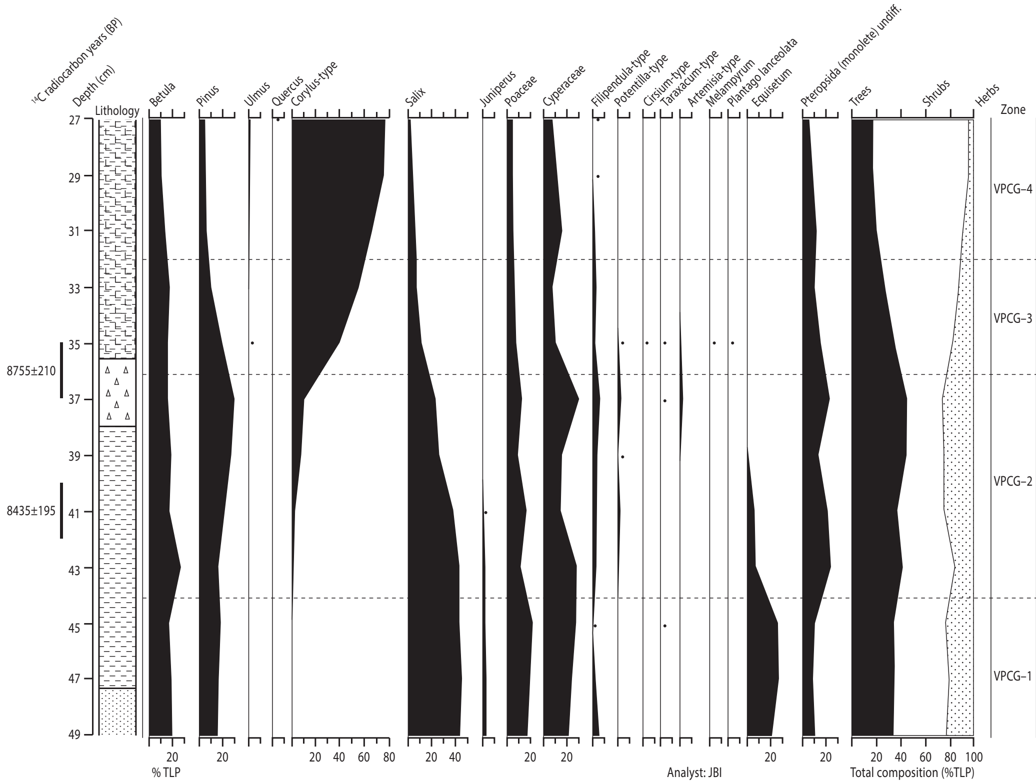

Figure 9.10. *Pollen diagram for profile VP87 CG.*

the most significant of the other herb types. *Equisetum* (horsetails) is present throughout in high frequencies.

LPAZ CG-2 36–44 cm
Betula-Pinus-Salix-Corylus-Cyperaceae-*Sphagnum*

Betula and *Pinus* remain the only tree types recorded, with the latter slightly more abundant. *Salix* declines gradually while *Corylus*-type appears and increases throughout the zone, remaining in low frequencies. *Juniperus* becomes absent by mid-zone, as does *Equisetum*. A curve for *Senecio*-type is important in the later part of the zone, and herbaceous weed taxa *Taraxacum*-type and *Artemisia* occur at the end.

LPAZ CG-3 32–36 cm
Betula-Pinus-Corylus

Betula and *Pinus* still dominate the tree pollen sum, but *Ulmus* is recorded for the first time. *Corylus*-type rises to very high frequencies, and *Salix* percentages show a sharp fall to low values. Most other taxa are unchanged, although Cyperaceae frequencies do fall slightly. *Melampyrum* (cow-wheat) and *Plantago lanceolata* (ribwort plantain) join the ruderal weed group at the start of the zone.

LPAZ CG-4 27–32 cm
Betula-Pinus-Corylus-Ulmus-Cyperaceae

Pinus frequencies are reduced and *Betula* dominates the tree pollen assemblage, although *Ulmus* values become important and *Quercus* and *Alnus* are present. *Corylus*-type is abundant. Cyperaceae values increase and several other herbaceous pollen types occur in low frequencies.

Dating

Two samples were submitted for radiocarbon dating (Table 9.6). Of these, HV-17830 is considered to be

Table 9.6. *Radiocarbon dates from Profile VP87 CG.*

Code	Depth (cm)	Date (BP)	$\delta^{13}C$ (‰)	Calibrated age (cal BC)	Material
Hv-17829	35–37	8755±210	-29.5	8435–7370	Humified, charcoal-rich peat
Hv-17830	40–42	8435±195	-28.6	8185–7030	Slightly clayey humified herbaceous peat

erroneously young in relation to its position relative to the pollen stratigraphy and has been discarded (see Chapter 4).

Interpretation

Peat initiation began at a relatively early stage of the Holocene, before the immigration of hazel and while juniper was still able to find habitats within an increasingly dense tree and shrub canopy. There may even be some indications of open conditions given the high *Filipendula* values, although this could also be a member of the local wetland community. In contrast to the birch domination at Flixton Island AK87 (see Chapter 10) the woodland around VP87 CG contained much more pine and willow. The high Poaceae and Cyperaceae values probably reflect the presence of reed and sedge beds, with horsetails, and possibly some willow, growing at the shore.

There is a gradual decline in willow populations in CG-2, which was accompanied by a slow increase in hazel and the demise of juniper. Little change seems to have taken place in the relative proportions of birch and pine, which presumably formed the local forest. The appearance of hazel is radiocarbon dated here to 8185–7030 cal BC (Hv-17830). This seems to be much too young in comparison to the dates from AK87 on Flixton Island (Hv-17825), (see Chapter 10), NAZ on No Name Hill (Beta-104485) (see Chapter 11), and the comparable horizon dated by Dark (1988c) at Star Carr. Thus, this date from VP87 CG should be discarded (see also Chapter 4).

The start of zone CG-3 is dated to 8435–7370 cal BC (8755±210 BP, Hv-17829), and coincides with both the charcoal layer and the start of the expansion of hazel within the landscape. The two features are probably related, with the charcoal deriving from a period of burning that disturbed the woodland and/or wetland edge vegetation, and allowed the rapid expansion of hazel in its place. A slight diminution of pine occurred but willow was the main casualty of this event, and the removal of an ecotonal willow belt between the developing marsh and the birch-pine woodland seems likely. The fire created areas of open ground, initially allowing ruderal weeds including mugworts, cow-wheat, and ribwort plantain to expand. The change in forest composition may have helped the spread of other taxa as an isolated elm pollen grain was observed at this level. The presence of flints in the peat below the charcoal band makes human agency here quite probable. The upper part of the profile records a return to woodland stability, with elm having found a minor but established place within the birch, hazel and pine forest.

Archaeological investigations at Flixton 9

A total of eighteen 2 × 2 m trenches were excavated, six to the south of the River Hertford (VP87 CA-F), seven immediately north of the river to sample the southern side of the lake outflow (VP87 CG-H, CJ-K, and CR-T) (see Fig. 9.9), and a further five (VP87 CL-N and CP-Q) on the northern side of the outflow channel.

Stratigraphy

The basal geology was varied, consisting of a coarse sandy gravel or boulder clay, in some cases interleaved with lenses of clay or coarse sand, and overlain in places by a layer of silt with a high organic content [115]. These minerogenic deposits were succeeded by a sequence of organic sediments that represent the expansion of peat-forming environments across the site. These consisted of a layer of fine-grained organic detritus [114], which in some places contained, or was partly sealed by, lenses of sand [105], which was overlain by a compact, oxidized peat [104/106]. This was succeeded by a layer of compressed wood

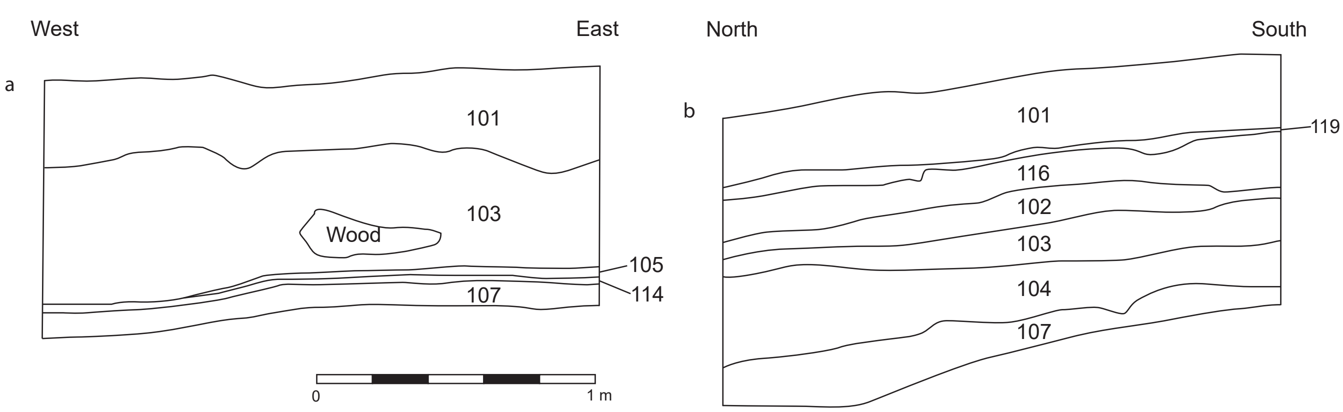

Figure 9.11. *Sections through the sequence of deposits at Flixton 9 as recorded in a) VP87 CD, and b) VP87 CG.*

Table 9.7. *Contexts assigned to the sedimentary sequence at Flixton 9.*

Context No	Description	Interpretation
101	Topsoil	Modern land surface
119	Oxidized peaty soil	Upcast from Hertford Cut
116	Sandy, gravelly soil	Upcast from Hertford Cut
102	Friable, homogenous peat	Oxidized wetland deposit
103	Wood peat with charcoal lenses	Wetland deposit
104, 106	Compact, oxidized peat	Oxidized wetland deposit
105	Lenses of sand within 114	Possible intrusive spring action
114	Fine organic detritus	Wetland deposit
115	Sand with a high organic content	Early Holocene land surface
113	Lenses of sand within 108	Possible intrusive spring action
110	Lenses of clay within 108	Possible intrusive spring action
108	Boulder clay	Basal superficial geology
107, 112, 117, 119	Coarse sandy gravel	Basal superficial geology

peat [103], which contained distinct charcoal lenses and larger pieces of burnt wood (test-pits VP87 CL and CN), and probably corresponds with the burning horizon recorded in pollen profile VP87 CG. Overlying this was a friable peat [102] that lay beneath the modern topsoil. This sequence varied across the site in relation to the basal topography, with some test-pits containing a more limited range of deposits (Fig. 9.11). In several test-pits, a sandy, gravelly soil and an oxidized peaty soil was present directly below the topsoil. This probably represents up-cast from the canalization of the river. The full sequence of deposits is summarized in Table 9.7.

Summary of the archaeology

An assemblage of worked flint was recovered during the test-pitting of Flixton 9 but was lost before analysis could take place. No faunal remains were recovered.

Discussion

This chapter has presented the results of work on three areas of Early Mesolithic activity at the western end of Lake Flixton by the VPRT between 1986 and 1991. Each locality was investigated through the excavation of 2 × 2 m test-pits excavated close to the line of the former lake shore, with slightly larger excavations carried out at Site VP D. It is likely that the main area of Mesolithic activity at Flixton Site 9 was destroyed by the excavation of the canalized section of the River Hertford in the nineteenth century, while modern agricultural practices also led to some localized disturbance of the Early Mesolithic horizons at Site D during the latter part of the twentieth century. However, much of the evidence from Sites D and E, and the surviving areas of Flixton 9 derives from relatively undisturbed contexts and reflects *in situ* activity. The majority of the material recovered from these sites dates to the Early Mesolithic, though a Final Palaeolithic burin was recovered from VP E. A pollen profile from trench VP87 CG at Flixton Site 9 documents the local development of the wetland and terrestrial environments throughout the Early Mesolithic and into the start of the later part of the period and shows evidence for the clearance of areas of woodland.

The three sites were all in areas of very low-lying ground close to the lakeshore, but were situated in very different locations; Flixton Site 9 lay on the north side of a narrow outflow channel at the far western end of the lake, VP D lay *c*. 800 m to the west on the southern side of a large embayment facing Star Carr, and VP E was situated on the southwest side of the main lake basin. The pollen records from Flixton 9 describes a landscape of birch, willow and pine woodland, with some juniper, that was probably developing in the early centuries of the Mesolithic, while reed and sedge beds formed in the lake margins. Episodes of woodland disturbance, possibly caused by intentional burning, altered the composition of these environments at around 8435–7370 cal BC (8755±210 BP, Hv-17829), which was followed by a post-disturbance landscape of birch, hazel and pine woodland. Away from Flixton 9, the environmental sequence probably followed the same broad pattern, with the initial development of birch woodland followed by the immigration of hazel, and then broadleaf deciduous species, while the wetlands developed from shallow-water reed beds to an increasingly terrestrial carr and fen. As at other sites, peat-forming environments gradually encroached over the Mesolithic land surface, and had reached the 25 m AOD contour at VP E by 8555–7955 cal BC (9060±100 BP, CAR-887). Given the low-lying topography at all three sites, this would have buried the areas of Early Mesolithic occupation, and probably caused the terrestrial woodland to recede to the surrounding higher ground.

The first human activity in the area potentially dates to the Late Glacial, based on the morphology of a single burin from VP E. This represents the only evidence for Palaeolithic occupation in this part of the landscape, though the lack of contemporary material from other trenches makes it difficult to determine the nature of activity that was taking place. Evidence for Early Mesolithic activity is more extensive, and while relatively small in scale, provides important information on the range of different ways in which locations around the lake were used during this period. At Site VP D, the assemblage from around trench VP88 D probably reflects the actions of a group of people who spent time repairing composite tools they had used at other places, as well as manufacturing, using and maintaining a variety of tools to work materials either collected locally or that they brought with them from other parts of the landscape. This included animal materials, as the small faunal assemblage shows that parts of animal carcasses were being brought onto the site, and aspects of the lithic assemblage probably reflect the processing of these for food and/or materials. The range of species represented suggests a relatively broad hunting strategy that targeted a range of larger mammals such as red and roe deer. The lithic assemblages appear to have been generated over a fairly short period of time, and may reflect a relatively short-lived, though intensive phase of activity

In contrast, the assemblages from other trenches at VP D, and those at VP E suggest the actions of individuals or much smaller groups of people undertaking *ad hoc* repairs or using tools for discrete tasks. At VP86 J, some 170 m to the east of VP88 D, a nodule was reduced and the core and some of the blades from it were taken away. Other blades were brought onto the site and subsequently discarded (presumably after use), along with a number of tools (including three microliths). Roughly 65 m to the south, in test-pit VP91 KY, a core was reduced, with some of the resulting blades used and then discarded on site. None of these tasks were necessarily contemporary with each other, or the activity in VP88 D, and may reflect separate visits to these parts of the lake shore. Taken together, the material from these sites reflects a dynamic pattern of activity, where people were visiting locations to undertake a variety of different technical practices at a range of differing scales (see also Conneller and Schadla-Hall 2003; Conneller 2005).

In addition to these activities, the pollen record from Flixton 9 provides strong evidence for the intentional management of vegetation in this landscape during the Early Mesolithic. Here, an area of willow that was growing between the terrestrial woodlands and the lake-edge wetlands appears to have been cleared, creating open ground that was colonized by ruderal plants before hazel trees became established. It seems unlikely that burning was responsible for the removal of tree cover, and instead the trees may have been felled after which fire was used to suppress regrowth and keep the area open. The increase in hazel pollen suggests that these trees colonized the area as the episodes of burning came to an end, and it is possible that the initial clearance and subsequent firing of the area was used to encourage its growth. Alternatively, the intention may have been to create a more open area between the wetlands and the terrestrial woodland, with hazel only exploiting this as management practices came to an end. Whatever the reasons, the data from Flixton 9 adds to the evidence for plant management in this landscape, and the Early Mesolithic more broadly.

The lack of Late Mesolithic material at the sites may reflect the position of the test-pits on the low-lying ground close to the shore, an area that would have been sealed by peat-forming environments toward the end of the Early Mesolithic. Evidence for periodic flooding is also recorded in an environmental profile further to the south (profile VP91 KN, see Chapter 13), after the formation of peat over the dry ground, suggesting a dynamic, but very wet environment. Together, these processes would have made the area unsuitable for habitation (resulting in the very low levels of material culture), though it may have continued to be used for hunting or the collection of particular species of wetland plants.

Chapter 10

Flixton Island

Paul Lane, Ian Bailiff, Jim Innes, Barry Taylor & Tim Schadla-Hall†

Flixton Island is situated in the western half of the former lake basin (NGR 503580 481120), *c.* 1.4 km to the north of Flixton village, and immediately south of the River Hertford (see Fig. 1.2). The modern topography consists of several low rises and ridges, separated by a pronounced hollow of sufficient depth that, when viewed from the east, the site appears to comprise two flat topped hummocks rising above the surrounding terrain. These raised areas would have been above the level of the lake during both the Windermere Interstadial and the early part of the Holocene, creating a small island.

From the late 1980s to the early 2000s, the area was under improved pasture, and according to a previous landowner, Mr. Arthur Simpson, had been down to grass since at least the 1940s. The two fields in which the island falls were ploughed only intermittently over this period, mainly for re-seeding. As elsewhere in the Vale of Pickering, drainage has had a profound effect, causing a general lowering of the water-table, shrinkage of the peat deposits and acute oxidization and humification of the upper part of the sedimentary sequence. Currently, the highest parts of the fields lie at around 25.40 m AOD, with the land dipping away to *c.* 24.20 m. In the late 1940s this difference in height was far less pronounced, and records suggest that the level of the lower-lying ground was a metre or so higher than it is today. However, the peat covering some of the higher parts of the island was already thin enough for the archaeological horizon to have suffered damage from ploughing by the 1940s (Moore 1950, 101).

Flixton Island was first investigated archaeologically by John Moore between 1947–9 as part of his investigations around Lake Flixton. Moore located two sites on the island; one towards the southerly extent of the raised ground (Site 1), the other (Site 2) some 140 m north (Moore 1950, 1954). Excavations by Moore at Site 1 revealed a dense concentration of Early Mesolithic flints associated with a number of possible hearths and a small quantity of animal bones (Moore 1950). At Site 2, Moore recorded an assemblage of horse bones in an organic sediment sealed by a layer of sands and gravels and overlain by peats. On stratigraphic and palynological grounds, this lower organic deposit was thought to be of Late Glacial origin (Moore 1954; Walker and Godwin 1954). Walker and Godwin, in association with Moore, conducted a stratigraphic survey of the peat and underlying deposits in the general vicinity of the island, and recorded a number of pollen profiles from which they established the first palaeoenvironmental record of the site and its environs.

Between 1987 and 1993 archaeological and palaeoenvironmental investigations were carried out at Flixton Island by the VPRT (Fig. 10.1). Twenty-five test-pits and trenches were excavated around the approximate position of the island's shore, and on the areas of higher ground, including the area previously investigated by Moore, whilst auger surveys were undertaken to map the buried land surface. The results of this work have established the approximate extents of Moore's Site 1, and confirmed his stratigraphic record of Site 2, including the potentially Late Glacial deposits, samples from which have been dated. In addition, palaeoenvironmental investigations have established a record of the local environment throughout the Mesolithic.

Previous archaeological and palaeoenvironmental work

Prior to the work undertaken by the VPRT, surveys and excavations at Flixton Island were undertaken by John Moore. Moore first discovered Mesolithic material at Flixton Site 1 in the summer of 1947,

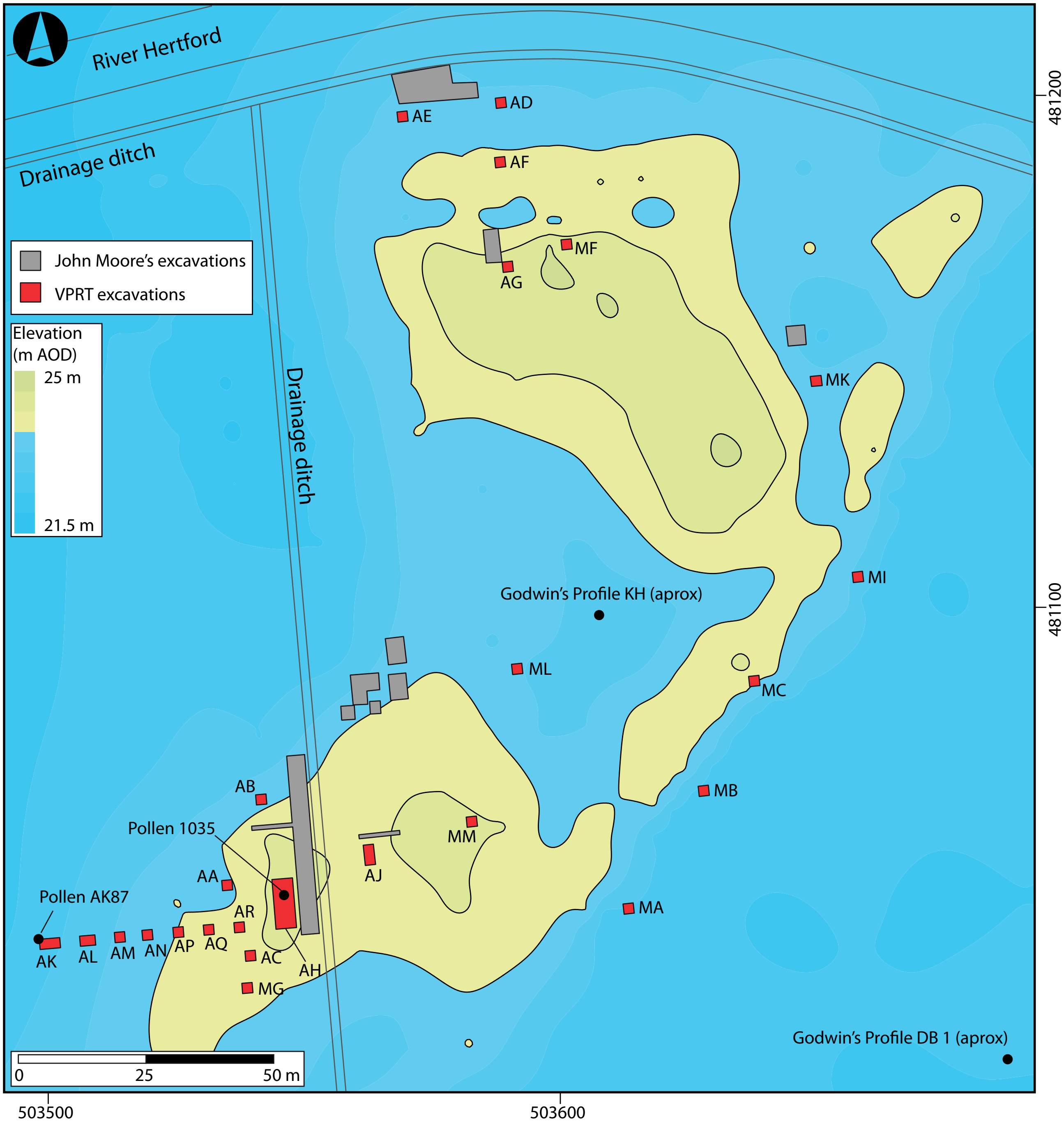

Figure 10.1. *Location of test-pits and trenches at Flixton Island Sites 1 and 2, including Moore's trenches (level of the lake shown at 24 m AOD).*

whilst investigating the peat profiles that had been left exposed by a freshly cleaned drainage ditch that cut through a gravel ridge on the western side of the island (Moore 1954, 101). He returned to the site later that year, excavating a long, narrow trench across the gravel ridge, parallel with the drainage ditch from which the flint had been recovered, and a second trench at right angles to it (Fig. 10.1). Five smaller sondages were also excavated to the north and slightly east of his principal trench, but details concerning the stratigraphy and any finds are lacking.

Within the main trench, Moore recorded a dense scatter of 7728 pieces of struck flint of Early Mesolithic type, in association with four possible hearths and a light scatter of faunal remains, some of which were burnt (Moore 1950, 102). The hearths consisted of shallow hollows, with a fill of what Moore (1950, 102) described as a 'slightly darkened soil', outlined by an iron-pan deposit. Based on more recent work, the iron-pan probably formed after peat had begun to accumulate over the island (see below). Moore interpreted the site as a short-term occupation camp, which on the basis of differences in the microlithic component may have been occupied on at least two occasions (Moore 1950, 102).

Moore then undertook excavations at the northern end of Flixton Island, which he had designated Site 2, starting in the spring of 1949, and returning to the site again in the summer of 1951 (Moore 1954, 192). The main focus of this work was the excavation of a single trench at the very northern end of the island, where it was truncated by the canalized section of the River Hertford (see Fig. 10.1). These excavations recorded a sequence of peats overlying a thick layer of gravel and sand, with a scatter of worked Mesolithic flint and a small assemblage of animal bone at the interface between the organic and mineral deposits (Moore 1954, 192). Underlying the sand and gravel was an organic sediment (described as a 'nekron mud'), at the base of which Moore discovered an assemblage of horse bone. On the basis of pollen and sedimentary stratigraphy, this deposit was thought to be of Late Glacial age (see below).

The faunal assemblage from this potentially Late Glacial deposit consisted of 38 mostly incomplete horse bones and four teeth (Table 10.1), many of which were found in an articulated state (Moore 1954, 192). Fraser and King argued that these represented the remains of at least three animals which, in terms of the size and shape of the recovered samples, did not differ significantly from modern horses (1954, 194). The only other associated finds were 'a small fragment of bird-bone, a small blade of flint without secondary working, and a shouldered point of microlithic size with steep, almost vertical secondary working' (Moore 1954, 192).

At the same time as Moore was conducting his archaeological work at Flixton Island, Harry Godwin led a series of palaeoenvironmental investigations at the site, taking samples for pollen and plant macrofossils from sediments adjacent to Sites 1 and 2, and recording the local stratigraphy through a programme of coring (Godwin 1949; Walker and Godwin 1954). Godwin also recorded the sedimentary and pollen stratigraphy, and the plant macrofossils, from two off-site locations, the first from a possible kettle hole between the two sites (Flixton KH), and the second from an area of deeper peat to the east of the island (Profile DB1) (Walker and Godwin 1954) (Fig. 10.1).

Table 10.1. *List of identifiable horse bones recovered from Site 2, Flixton in 1949 (after Fraser and King 1954, 194).*

Element	Total	Measured
Atlas	3	
Axis	3	
Cervical vertebra	9	
Thoracic vertebra	3	
Radius and ulna	1	
Cuneiform	1	
Pelvis	3	
Femur	2	
Tibia	2	Y
Astragalus	1	Y
Calcaneum	1	Y
3rd Metacarpal	1	Y
2nd Metatarsal	1	
3rd Metatarsal	2	Y
4th Metatarsal	1	
1st Phalange	1	Y
2nd Phalange	1	Y
3rd Phalange	1	Y
Molar (lower)	4	

The sedimentary, pollen and plant macrofossil records from Profile BD1 matched those from other locations around the lake, with the Late Glacial environments characterized by an open landscape gradually colonized by birch woodland, whilst the Holocene sequence reflected an initially open landscape rapidly colonized by a succession of tree species (Walker and Godwin 1954). Similar sequences were recorded in the profile from the kettle hole (Flixton KH) and those recovered closer to the archaeological sites, though with a more limited temporal range.

Archaeologically, the most important profile was that recorded from Site 2, which could be related to the sedimentary sequences recorded by Moore. Here, the pollen stratigraphy suggested that the layer of mixed sands and gravels overlying the basal organic sediments had been deposited in the Loch Lomond Stadial, whilst the overlying peat formed at the start of the Holocene. As such, the horse bone recorded by Moore dated to either the latter stages of the Windermere Interstadial or the start of the subsequent Stadial (Walker and Godwin 1954, 51). This was refined through subsequent radiocarbon dating on a sample of the nekron mud, which produced a date of 10,780–9460 cal BC (10,413±210 BP, Q-66) (Godwin and Willis 1959, 206), suggesting that the sediments (and by implication the horse bone) dated to the Loch Lomond Stadial.

Auger surveys

Auger surveys were carried out across Flixton Island in 1987 and 1993. From the results of this work, the island consisted of a raised area of sand and gravel, on a roughly northwest to southeast alignment, with two low lying hillocks (reaching an elevation of 25.0–25.15 m AOD), connected by a narrow ridge (Fig. 10.1). Between the two areas of higher ground was a roughly circular depression, interpreted by Godwin (1949) as the remains of a kettle hole. During the Early Holocene, the two hillocks would have been separate areas of dry ground with the narrow ridge forming a natural causeway between them.

Palaeoenvironmental research

Jim Innes

Two pollen profiles were recorded from the site, the first from a trench excavated through the shallow lake-edge deposits at the western side of the site (Profile Flixton AK87), the second from the fill of a pit cut into the basal gravel in trench VP87 AH (Profile Flixton 1035). Particle size analysis was also undertaken on samples from a layer of sand in test-pit VP93 MG. The results of the analyses are described below.

Profile Flixton AK87

Profile AK87 was recorded from samples taken from the section of test-pit VP87 AK, excavated through the sequence of lacustrine and wetland deposits that had formed at the western edge of Site 1. The lithostratigraphy of the sediments is shown in Table 10.2.

Pollen analysis

Sediment samples were collected in monolith tins, and subsamples for pollen analysis were taken at two-centimetre intervals throughout the profile. The pollen diagram (Fig. 10.2) has been divided into eight local pollen assemblage zones (prefixed AK).

LPAZ AK-1 119–126 cm
Betula-Salix-Juniperus-Poaceae-*Filipendula-Potamogeton*

Betula contributes over 90% of total tree pollen and over 50% of total pollen, *Pinus* being the only other tree recorded. Major shrub taxa are *Salix* and *Juniperus*, the latter declining through the zone, with an isolated *Sorbus* (rowan) peak. Herbaceous pollen are characterized by Poaceae and Cyperaceae, but there are high frequencies for *Filipendula* in the early part of the zone. Open ground weed taxa occur, with *Artemisia*, and *Rumex* prominent. The aquatic herb *Typha angustifolia* is high. *Pediastrum* colonies are common.

LPAZ AK-2 119–115 cm
Betula-Corylus-Salix-Poaceae

Betula continues to dominate the assemblage, with *Pinus* in low but steady frequencies. Very low *Quercus* and *Ulmus* counts are recorded, and *Corylus*-type appears and increases through the zone. *Salix* declines and *Juniperus* is not recorded. Herb pollen frequencies are much reduced, with low Poaceae and Cyperaceae values the only significant taxa. Occasional ruderal taxa still occur. Very low *T. angustifolia* and *Pediastrum* are the only aquatic types present.

LPAZ AK-3 111–115 cm
Betula-Corylus

Betula continues to dominate the tree pollen assemblage, though *Ulmus* is now present in significant values. *Corylus*-type is abundant and dominates the non-tree pollen count, *Salix* declining to low frequencies. *Poaceae* and *Cyperaceae* are low, and herbaceous taxa are poorly represented, though *Filipendula* and *Potentilla* (cinquefoils) show small peaks. *T. angustifolia* increases.

Table 10.2. *Lithostratigraphy of Flixton AK87 Profile.*

Depth (cm)	Description
0–10	Crumbly completely humified organic material with modern rootlets
10–27	Black, very well humified *Phragmites* reed peat with herbaceous roots
27–62	Brown, dry, very well humified herbaceous peat with *Phragmites* rhizomes
62–73	Dark brown, humified wet herbaceous peat with *Phragmites* rhizomes
73–88	Fresh, poorly humified reed peat with wood fragments and some humified herbaceous peat
88–92	Well humified herbaceous peat with *Phragmites* rhizomes
92–98	Fresh reed peat with *Phragmites* rhizomes and *Carex* remains
98–102	Poorly humified reed peat and organic gyttja with *Phragmites* and *Carex* remains and seeds of *Menyanthes* (bogbean)
102–114	Poorly humified reed peat with *Phragmites* and *Carex* remains, and seeds of *Menyanthes* and *Potamogeton*. Some organic gyttja and occasional fine sand grains
114–127	Olive green to brown organic gyttja with herbaceous roots, *Phragmites* rhizomes and fine sand
127–128	Organic coarse sand with *Phragmites* rhizomes
128–132	Coarse sand with *Phragmites* rhizomes
132+	Coarse sand with medium gravel

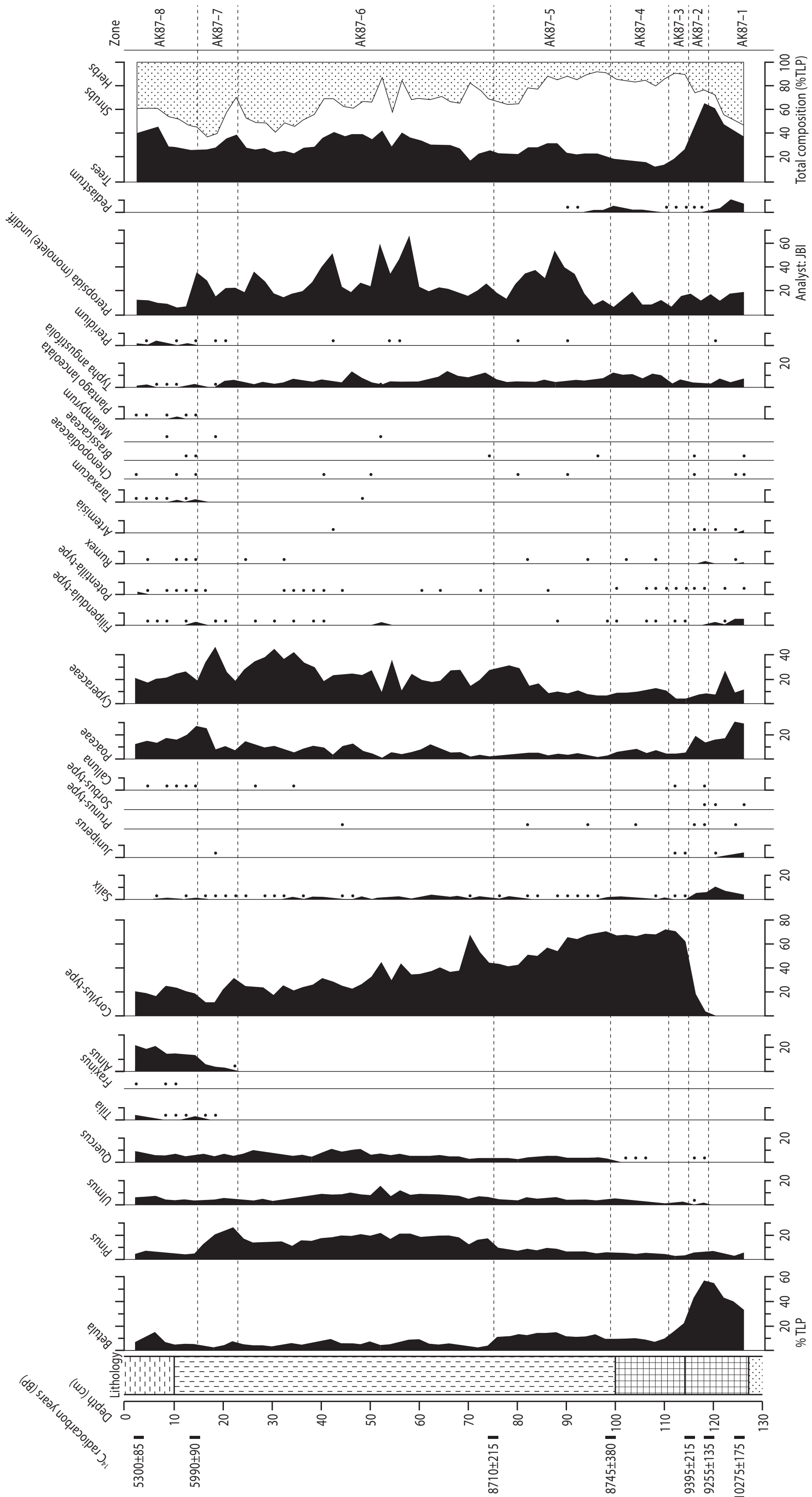

Figure 10.2. *Pollen diagram for Profile Flixton AK87.*

LPAZ AK-4 99–111 cm
Betula-Pinus-Ulmus-Corylus-Cyperaceae-*Typha angustifolia*
Betula is still the most abundant tree, but rises in *Pinus* and *Ulmus* have greatly reduced its dominance. *Quercus* forms a low, but continuous pollen curve. *Corylus*-type frequencies are consistently very high. Herbaceous pollen values are low, although Cyperaceae shows a marked rise. Poaceae is significant and *T. angustifolia* increases; *Pediastrum* also rises.

LPAZ AK-5 75–99 cm
Betula-Pinus-Ulmus-Quercus-Corylus-Cyperaceae
Betula values remain steady, and is the most abundant tree pollen contributor. *Quercus* increases to match *Ulmus* pollen frequencies, and *Pinus* remains high. *Corylus*-type declines slightly but remains abundant. Poaceae frequencies fall but Cyperaceae rises towards a peak late in the zone. Few herb taxa are recorded, *T. angustifolia* declines and *Pediastrum* ceases to be recorded after a sharp decline early in the zone.

LPAZ AK-6 23–75 cm
Pinus-Ulmus-Quercus-Corylus-Cyperaceae
Pinus is the most dominant tree at 60% of total tree pollen and up to 25% of total pollen, *Betula* having fallen very sharply to low frequencies. *Ulmus* remains unchanged but *Quercus* rises gradually throughout the zone to become more abundant than *Ulmus* towards the end. *Corylus*-type remains important but declines steadily through the zone. Cyperaceae is the most abundant herb pollen type, Poaceae being consistently low. *Typha angustifolia* fluctuates throughout but is generally low.

LPAZ AK-7 15–23 cm
Pinus-Ulmus-Quercus-Corylus-Alnus-Cyperaceae
Pinus, *Ulmus* and *Quercus* frequencies are largely unchanged, though a slight increase in *Pinus* and decline of *Quercus* may be seen. *Corylus*-type values fall steadily and are mirrored by the appearance and gradual rise of *Alnus*. *Tilia* appears for the first time late in the zone. All other taxa remain unchanged, with Cyperaceae still the most common herb pollen type.

LPAZ AK-8 2–15 cm
Alnus-Corylus-Ulmus-Quercus-Tilia-Cyperaceae
Alnus rises to dominance at over 40% of total tree pollen and up to 25% of total pollen. *Quercus* and *Ulmus* are unchanged but *Pinus* falls sharply to low frequencies. *Corylus*-type recovers slightly, *Tilia* becomes consistently recorded in higher values and *Fraxinus* appears sporadically. Cyperaceae values decline and those for Poaceae increase. Low curves appear for ruderal-type herb taxa, including *Taraxacum*-type, *Plantago lanceolata*, *Chenopodiaceae* (goosefoot) and *Rumex*. *Pteridium* also occurs consistently, and spores of *Sphagnum* are recorded.

Dating
Six samples were submitted for radiocarbon dating (Table 10.3). The calibrated ages have been constrained through Bayesian modelling using the functions in the OxCal calibration software (Table 10.4) (see Chapter 4 for details).

Interpretation
This profile records vegetation changes throughout much of the Mesolithic, in particular the establishment of the postglacial forest, and the succession of wetland environments within the lake margins. Zone AK-1 begins at 10,430–9260 cal BC (10,275±175 BP, Hv-17826), and contains elements of the Late Glacial/Holocene transition from open ground herbaceous and low shrub communities to denser shrub and birch woodland cover. This transition was well underway by the time the sediments formed, with birch woodland becoming established, while areas of juniper scrub and open ground communities were still present. The presence of limnic gyttja at this part of the sequence shows the area around the pollen profile to have been below the level of the lake during this period, with emergent vegetation (lesser bulrush/cattail) becoming established. The demise of juniper and open ground weeds through the shading effects of birch and willow was followed rapidly in zone AK-2 by the establishment and spread of hazel, which was present in the landscape by 9230–8340 cal BC (9255±135 BP, Hv-17825). This had replaced willow and achieved co-dominance with birch during zone AK-3, which also saw the immigration and establishment of elm populations and the first development of mature, mixed deciduous woodland. The date of 9100–8310 cal BC (9395±215 BP, Hv-17824) for the start of this zone appears to be some centuries too old in comparison with dates from the similar horizon at other sites round the lake, though this may be due to both the large error range and the thickness of the sample in relation to the horizon it dates.

Oak became a minor forest component in zone AK-4, and areas of birch woodland may have declined further, possibly being replaced by pine and elm. Lesser bulrush may have become more abundant in the local area, and the depth of water around the sampling point probably declined, resulting in increased herbaceous material and rhizomes in the sediment. By the end of the zone, at 8660–7730 cal BC (8745±380 BP, Hv-17823),

Table 10.3. *Radiocarbon dates from pollen profile, Flixton AK87.*

Lab. Code	Depth (cm)	Radiocarbon years BP	δ^{13}C (‰)	Calibrated date (cal BC)	Material
Hv-17821	2–4	5300±85	-28.1	4330–3960	Peat
Hv-18296	13–15	5990±90	-27.2	5210–4680	Peat
Hv-17822	74–76	8710±215	-28.2	8350–7310	Peat
Hv-17823	98–100	8745±380	-28.8	9130–6840	Peat
Hv-17824	114–116	9395±215	-28.6	9290–8230	Gyttja
Hv-17825	118–120	9255±135	-28.5	9120–8220	Gyttja
Hv-17826	124–126	10,275±175	-27.1	10,620–9400	Gyttja

Table 10.4. *Radiocarbon dates from AK87 after Bayesian analysis.*

	Before Bayesian analysis		After Bayesian analysis		Agreement index
Lab Number & Date	68% probability	95% probability	68% probability	95% probability	
End boundary			4320–4060	4340–3980	
Hv-17821 : 5300±85	4240–4000	4330–3960	4320–4060	4340–3980	96.8
Hv-17296 : 5990±90	5000–4760	5210–4680	4950–4720	5200–4600	99.3
Hv-17822 : 8710±215	8190–7570	8350–7310	7890–7340	8120–7170	89.6
Hv-17823 : 8745±380	8350–7360	9130–6840	8470–8010	8660–7730	105.2
Hv-17824 : 9395±215	9120–8350	9290–8230	9040–8410	9100–8310	109.2
Hv-17825 : 9255±135	8630–8300	9120–8220	9140–8490	9230–8340	60.8
Hv-17826 : 10 275±175	10,460–9770	10,620–9400	9940–9290	10,430–9260	71.4
Start boundary			9940–9290	10,430–9260	

oak had become a significant, but still lesser member, of the mixed deciduous forest. There are very few heliophyte shrub or herb taxa to indicate open conditions, so the forest at this stage must have been closed and dense. However, some slight indications of open ground do occur throughout the profile, so some low stature communities must have persisted, probably around the wetland edge.

The terrestrial environment remained largely unchanged until the end of zone AK-5/start of zone 6 (8120–7170 cal BC, 8710±215 BP, Hv-17822), when pine replaced birch (probably directly as the other tree curves are almost unaffected), and oak gradually became more abundant. Alder was probably growing in the surrounding area by the start of zone AK-7. The immigration of alder in this profile is undated, but the date of 5975–5530 cal BC (6815±110 BP, Hv-17827) from profile Flixton 1035 is probably acceptable (see below). During this zone, the advance of alder into the forest seems to have been slow, and it may have been restricted to favourable habitats within the wider environment. At 5200–4600 cal BC (10,275±175 BP, Hv-17296), however, a rapid expansion of this tree occurred, which was almost completely at the expense of pine. Alder must have been directly replacing pine in its preferred locations, perhaps due to climatic change, or the paludification of formerly dry ground around the lake shore which led to the establishment of carr. It is possible that some disturbance of soils, perhaps anthropogenic in origin, assisted this expansion as the pollen of ruderal taxa also increases. Lime and ash may also have been encouraged by any such disturbance of the forest, as well as natural, successional immigration. The date of the alder rise in this profile seems slightly late, but this feature could be time-transgressive in lowlands such as the Vale of Pickering. The radiocarbon date for the top of the studied profile of 4340–3980 cal BC (Hv-1782) fits well with this date and the pre-elm decline nature of the pollen data.

Profile Flixton 1035

Samples were taken from the section of a small, shallow pit [1035] associated with Early Mesolithic worked flint in trench AH, and from a layer of peat sealing this feature and the adjacent archaeological horizon. The lithostratigraphy of the sediments is shown in Table 10.5.

Table 10.5. *Lithostratigraphy of Profile Flixton 1035.*

Depth (cm)	Description
0–30	Well humified amorphous peat
30–49	Medium fine sand
49–51	Very fine organic mud
51+	Stiff clay

Pollen analysis

Sediment samples were collected in monolith tins, and subsamples for pollen analysis were taken at two-centimetre intervals throughout the profile. The pollen diagram (Fig. 10.3) has been divided into five local pollen assemblage zones (prefixed F1035).

LPAZ F1035-a 50 cm
Betula-Pinus-Ulmus-Corylus-Cyperaceae

Betula and *Pinus* characterize the tree pollen assemblage, with lesser values of *Ulmus*, and *Quercus* absent. *Corylus*-type frequencies are very high, and Cyperaceae and Poaceae contribute the only other significant, non-tree pollen. Aquatic taxa are represented only by *Typha angustifolia*.

LPAZ F1035-b 25–31 cm
Betula-Ulmus-Corylus-Cyperaceae

Betula is abundant, comprising almost 80% of total tree pollen and up to 40% of total pollen. *Pinus* is reduced to low frequencies, but *Ulmus* increases steadily. *Corylus*-type is reduced but remains important and a low *Quercus* curve is recorded. Cyperaceae and Poaceae remain the major herb taxa, but a wide range of herbs occur. Wetland types like *Filipendula* and *T. angustifolia* are most important, but several ruderal weeds including *Taraxacum*-type, *Rumex* and *Plantago lanceolata* also occur.

LPAZ F1035-c 21–25 cm
Ulmus-Quercus-Pinus-Betula-Corylus-Cyperaceae

Betula declines from its previous abundance and *Betula*, *Ulmus*, *Quercus* and *Pinus* all contribute about 25% of tree pollen. *Corylus*-type maintains its high values. Cyperaceae increases while Poaceae and other herb taxa remain unchanged in abundance, although fewer herb taxa are recorded and dryland weeds are reduced.

LPAZ F1035-d 17–21 cm
Pinus-Quercus-Ulmus-Betula-Corylus-Cyperaceae

Tree pollen curves change little, but *Pinus* increases slightly and *Ulmus* frequencies are reduced. Non-tree pollen frequencies are steady except that Cyperaceae increases slightly. Dryland herb taxa are no longer recorded.

LPAZ F1035-e 12–17 cm
Pinus-Ulmus-Quercus-Alnus-Corylus-Cyperaceae

Betula frequencies fall sharply. *Alnus* is recorded in values similar to *Pinus*, *Ulmus* and *Quercus*, which are unchanged. *Tilia* is recorded in low values. *Corylus*-type frequencies decline slightly. Few other changes occur except that *Filipendula* shows a small peak and *T. angustifolia* is discontinuously recorded.

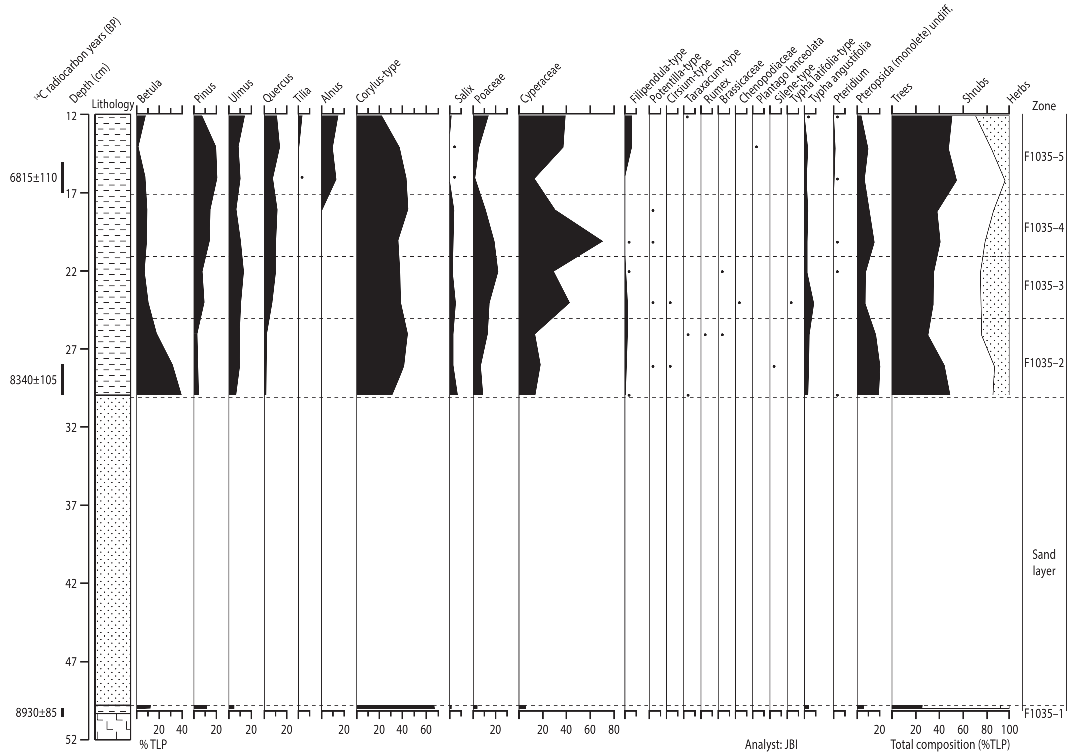

Figure 10.3. *Pollen diagram for Profile Flixton 1035.*

Table 10.6. *Radiocarbon dates from pollen Profile Flixton 1035.*

Lab. Code	Depth (cm)	Radiocarbon years BP	δ13C (‰)	Calibrated date (cal BC)	Material
Hv-17827	15–17	6815±110	-27.8	5975–5530	Peat
Hv-17828	28–30	8340±105	-29.0	7580–7080	Peat
OxA-3734	49–51	8930±85	-27.7	8285–7790	Organic mud

Dating

Three samples were submitted for radiocarbon dating (Table 10.6).

Interpretation

The pollen content of the thin mud layer at the base of the profile (F1035-a), correlates with the early part of zone AK-4, with hazel, and to a lesser extent elm well established on the dryland, along with birch. The radiocarbon date of 8290–7790 cal BC (8930±85 BP, OxA-3734) also fits reasonably well with this position on the AK87 profile (given the large error terms of the measurements from AK-87), and so the correlation of the two data sets at this point seems acceptable.

From 7580–7080 cal BC (8340±105 BP, Hv-17828), after the deposition of the sand layer, the forest was composed of birch, hazel, elm and oak, but site conditions seem to have been open and disturbed, with a range of ruderal weeds present. The presence of wetland herbs reflects a fen environment existing near the site at this time. Oak became more established in the following zone (F1035-c), and the woodland may have become more closed, resulting in a decline in ruderal taxa, while sedges expanded over the increasingly terrestrial wetland. The introduction and establishment of alder at 5975–5530 cal BC (6815±110 BP, Hv-17827), at the start of zone F1035-e, may be the result of local wetland succession to carr habitats, as birch seems to be the tree most disadvantaged by its immigration. This phase, with *Alnus* at only about 20% of tree pollen or 10% of total pollen, correlates with the latter stages of zone AK-7, before the major expansion of alder. The introduction of lime but not of ash supports this correlation. Alder seems to have been established locally, perhaps restricted to carr habitats, for several centuries before ecological changes allowed its expansion and replacement of pine.

Profile VP93 MG

Samples were taken from the section of test-pit VP93 MG (Fig. 10.4) for particle size analysis in order to establish the character of a layer of sand recorded within the peat sequence in parts of the southern side of Site 1. The lithostratigraphy of the sediments is shown in Table 10.7.

Particle size analysis

Samples were extracted from a monolith tin taken from the west-facing section of the test-pit. Samples were taken at the following depths (in cm) from the

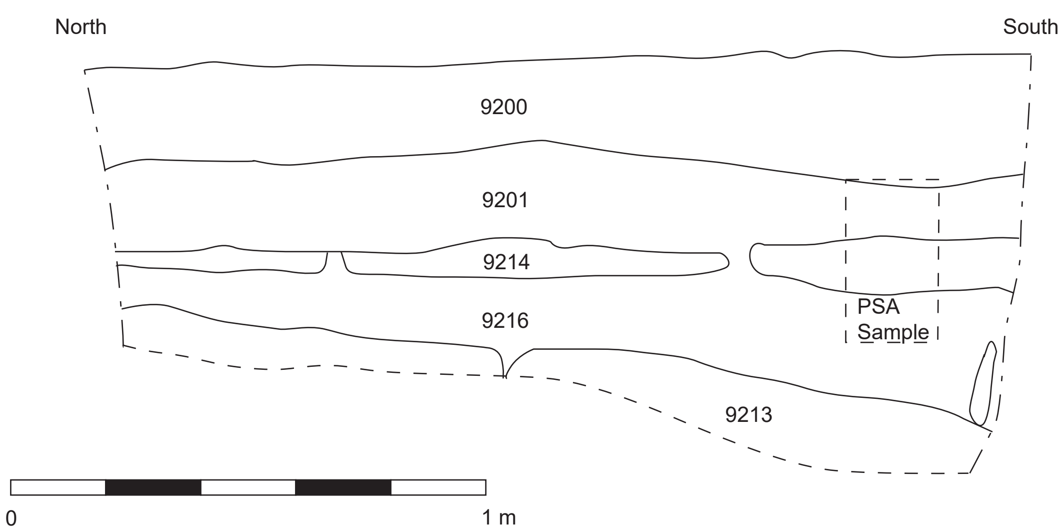

Figure 10.4. *West-facing section of test-pit MG, 1993, Flixton Island, showing stratigraphic position of the sand horizon [9214] and location of column sample for particle size analysis.*

Table 10.7. *Lithostratigraphy of Profile Flixton MG.*

Depth (cm)	Description
0–7	Very dark brown, dry, slightly compacted, oxidized wood peat with extensive rooting
7–17.5	Yellow-grey, fine silty sand, compacted and flecked with orange iron-staining
17.5–25	Dark brown, compacted, friable peat with traces of gravel and occasional lenses of grey sand

top of the profile: 7–8, 9.5–10.5, 11.5–12.5, 14–15, and 16.5–17.5. The results are shown in Figure 10.5.

This deposit is very well sorted and shows selective grain deposition. Samples contain only coarse to fine silts with some element of coarse sand. They are slightly negatively skewed, and were transported at very specific velocities. The samples through the sand layer appear to have either been derived and deposited in very similar environments or are all contemporary. This is suggestive of a windblown deposit, or an extremely well sorted water deposit. The former is more likely.

Metals

Eroded material increases gradually through to the top of the sand layer. Low iron levels through to the top suggest an oxidized environment in keeping with aeolian transport, but the deposits started to become waterlogged at the top of the profile, as indicated by a peak in iron and the iron/manganese ratio.

Archaeological investigations

In 1986, three 2 × 2 m test-pits (AA-AC) were excavated at approximately 15–20 m intervals along the crest of the southern end of the sand and gravel ridge (Fig. 10.1), in the proximity of Moore's Site 1. In this way, it was hoped to locate the main scatter of material recorded by Moore, and possibly also to relocate Moore's original trench. The highest densities of finds were recovered from test-pit AC (*c.* 580), with much lower quantities of material in AA (*c.* 40) and AB (*c.* 30), suggesting that this was the westward limit of Moore's Site 1. Four more 2 × 2 m test-pits (AD-AG) were excavated at the northern end of the Flixton Island, in the area of Moore's Site 2, though worked flint was only recorded from AG. One of these test-pits (AE) showed the same sequence of deposits that had been identified by Moore.

Fieldwork continued in 1987 with the excavation of a further seven test-pits (AJ-AM and AP-AR) and trench AH at Site 1. Trench AH, measured 10 × 5 m and was positioned a few metres west of Moore's

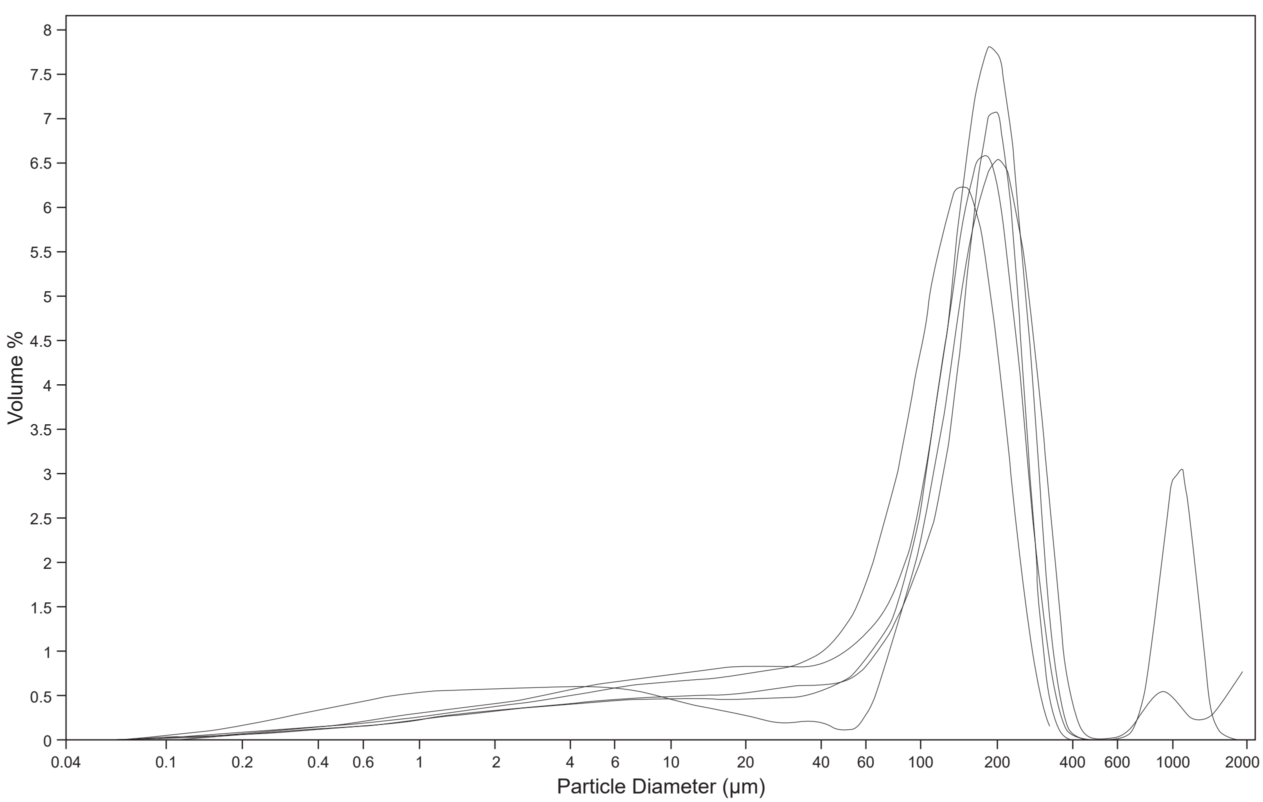

Figure 10.5. *Particle Size Analysis results for Profile Flixton MG.*

main trench so as to document the continuation of the lithic assemblage that had been recorded during the 1940s excavations (Fig. 10.1). A dense concentration of worked flint was recovered from this trench. Six of the test-pits (AK-AM and AP-AR) were excavated in a line running approximately east–west from the southern end of trench AH, so as to sample the deposits around the margins of the island, and record the stratigraphy towards areas of deeper water. Initially, these were all 2 × 2 m test-pits. However, during the course of excavation it was necessary to extend AL by 0.50 m west–east and AK by 1.0 m in the same direction, so as to accommodate the use of pumps. Small quantities of material (up to *c*. 30 pieces of flint) were recorded from these trenches. In addition, test-pit AJ was excavated some 8 m to the east of AH, on the eastern side of the drainage ditch. This location was chosen partly so as to locate Moore's second trench, and also to sample this side of the ridge for Early Mesolithic material. Concentrations of worked flint were lower in this trench (*c*. 350 pieces) than in those to the west.

In 1993, an additional nine 2 × 2 m test-pits (MA-MC, MG, MI-MM) were excavated on the site. The bulk of these test-pits were placed so as to sample the eastern and northern sides of Flixton Island, and included one (MJ) in the general vicinity of the Flixton 2 site. In addition, one test-pit (MG) was positioned a few metres to the southwest of AH, mainly for the purposes of collecting samples from a deposit of wind-blown sand covering this end of the island. Very low concentrations of material were recovered from MG (*c*. 25 pieces of flint), providing some indication of the southerly extent of Site 1, and a very small quantity of material was recovered from MC, suggesting some activity on the causeway between Sites 1 and 2. With the exception of MJ, these trenches are included here as being part of the Flixton 1 site for the purposes of the stratigraphic summary.

Stratigraphy: Flixton Site 1

The basal mineral deposits consisted of layers of coarse sandy gravel, probably of glacial origin, overlain by a sandy silt with a high organic content, and patches of a more organic deposit with fragments of reed [1031/1032]. These upper mineral deposits contained the majority of the archaeological material, and represent the Early Mesolithic land surface. In trench AH this was sealed by a thick layer of medium-coarse sand [1029], which is thought to have accumulated after the Early Mesolithic occupation of the site (Fig. 10.6a). These mineral deposits were succeeded by a sequence of detrital muds and peats forming either within the lake margins or through the subsequent expansion of peat-forming environments across the site. As at other sites, the character of these deposits varied in relation to the basal topography.

In the deepest trenches, which sampled the lake-margins (such as AK), the basal sediments were succeeded by a fine detrital mud or gyttja [1039], which was overlain by a *Phragmites* reed peat [1042] and a thick layer of reed peat with woody detritus [1038] (Fig. 10.6b). Over these was a layer of humified peat [1027/1037] and then topsoil (Table 10.8).

As the ground surface rose towards the top of the island, the basal deposits were sealed by a mixed peaty sand [1024] that was succeeded by a wood peat [9216] and a humified peat [1022/1027/9201]. Towards the east and south of the site, a layer of fine sand [9214] lay between the wood peat and the humified peat. As noted above, this is probably a wind-blown deposit accumulating during the formation of the peat. Overlying the humified peat was a mixed sandy, organic-rich deposit [1024] that underlay the topsoil. In some places a layer of sand and gravel [1021], up-cast from the digging of the drainage ditch that bisects the site, lay directly beneath the modern topsoil (Table 10.9).

Table 10.8. *Contexts assigned to the lake-edge deposits at Flixton Site 1.*

Context	Description
1020, 1026, 9200	Topsoil
1027, 1037	Humified peat
1038	Reed peat with woody detritus
1042	*Phragmites* reed peat
1039	Fine detrital mud
1031, 1032	Sandy silt with a high organic content
1044, 1046, 1047, 1069	Sandy gravels

Table 10.9. *Contexts assigned to the deposits on the more elevated areas at Flixton Site 1.*

Context	Description
1020, 1026, 9200	Topsoil
1021	Sandy and gravel upcast
1024	Sandy, organic soil
1022, 1027, 9201	Humified peat
9214	Sand layer recorded in the southern part of Site 1
9216	Wood peat
1024	Mixed peaty sand
1029	Medium-coarse sand sealing the basal deposits in AH
1033	Sand with a very high organic content and fragments of reed
1031, 1032	Sandy silt with a high organic content
1044, 1046, 1047, 1069, 9213	Sandy gravels

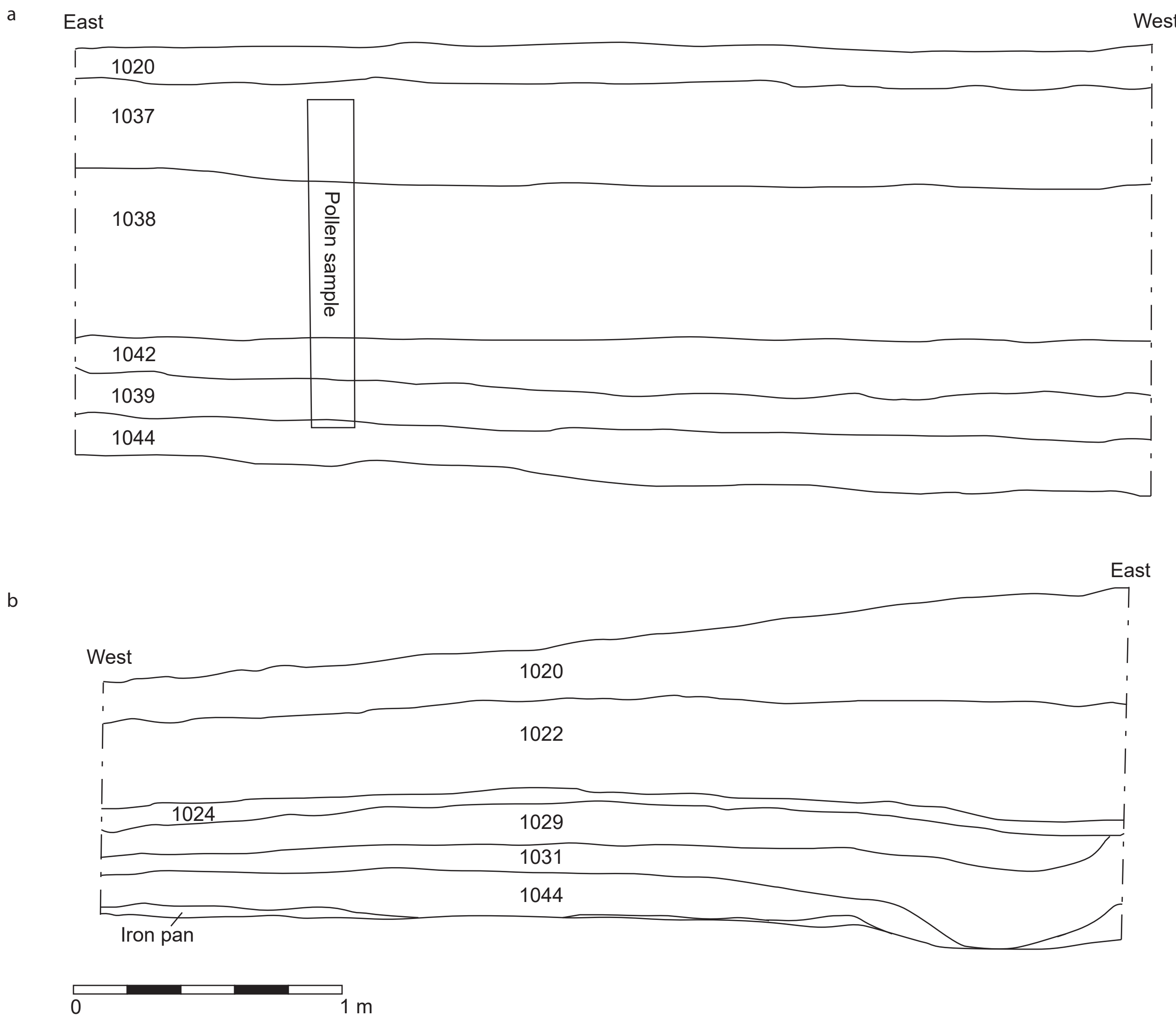

Figure 10.6. *The stratigraphic sequence recorded at Flixton Site 1 in trenches a) AK, b) AH.*

Natural features: Flixton Site 1

A large, sub-rectangular pit [1035], *c.* 1.5 × 1.0 × 0.7 m was recorded towards the southern end of trench AH (Figs. 10.7, 10.8). This contained a series of layers of peat interleaved with sand, which may have been of aeolian origin. A number of bone fragments and worked flints, and several moderately sized stones, were found towards the base of these deposits. The function of the feature is unclear. Two smaller hollows, averaging 0.25 m in diameter and 0.10 m depth, were also noted toward the northern end of this trench but are thought to represent natural features, probably tree hollows.

Summary of the archaeology: Flixton Island Site 1

A large assemblage of worked flint (5954 pieces) and a smaller assemblage of animal bone was recovered during the excavation of the site. Most of the lithics were recorded from trenches AH, AJ, and AC on the top of the island, with the density of material falling sharply in the test-pits excavated into the lake-margins to the west (test-pits AK, AL, and AM). Unfortunately, most of the flint and all of the bone was lost before it could be fully analysed.

Dating: Flixton Island Site 1

No radiocarbon dates have been obtained on any of the archaeological materials.

Stratigraphy: Flixton Island Site 2

The stratigraphic sequence recorded during the work of the VPRT was very similar to that observed by Moore (1951). The basal geology consisted of a coarse sandy gravel [9210] that was overlain in places by a discontinuous deposit of fine detrital mud [1016] (Fig. 10.9).

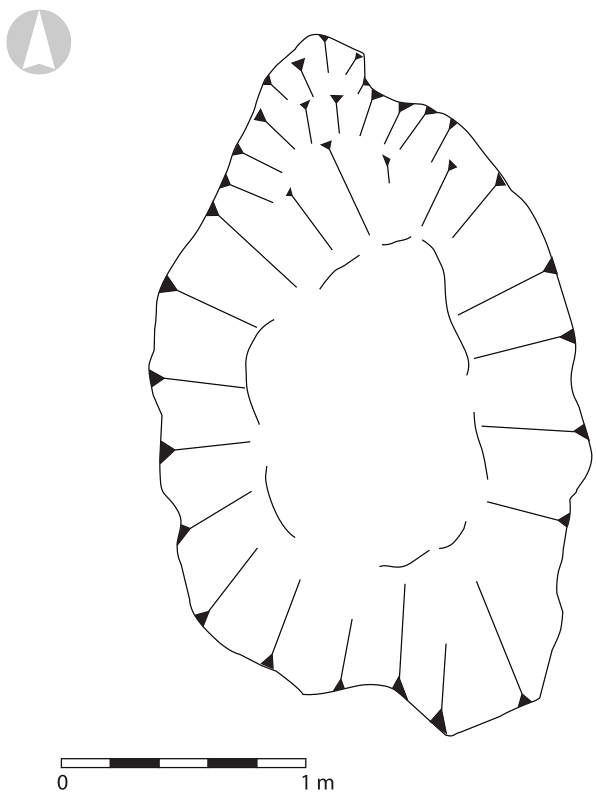

Figure 10.7. *Plan of Feature 1035, trench AH, Flixton 1.*

Figure 10.8. *Pit in trench AH, Flixton 1 under excavation in 1987 (Photo Paul Lane, August 1987).*

The detrital mud coincides stratigraphically with the nekron mud recorded by Moore, from which the horse bones were recovered. A radiocarbon date on a bulk sample of this deposit taken from test-pit VP86 AE yielded a date of 9660–9175 cal BC (9850±80 BP, CAR-1016). The mud, or where it was absent, the basal sandy gravel, was succeeded by a layer of fine sand overlain by a sandy gravel (both assigned to the same context number [1008]). A very thin layer of fine detrital mud (no context number assigned) overlay this upper sandy gravel, which was then sealed by a thin layer of fine sand [1007]. The entire sequence was then succeeded

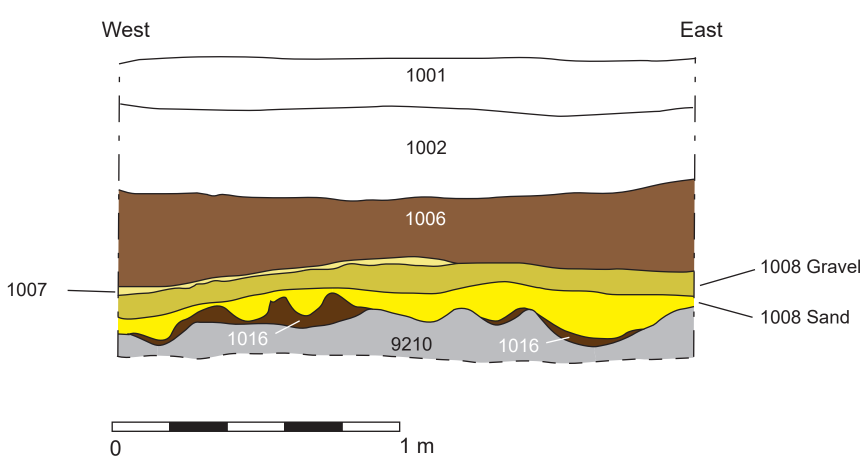

Figure 10.9. *The stratigraphic sequence at Flixton Island Site 2 as recorded in test-pit AE.*

Table 10.10. *Contexts assigned to the sedimentary sequence at Flixton Island Site 2.*

Context	Description
1001, 9200	Topsoil
1002, 9201	Friable peat
1006, 9214	Humified peat
1007	Fine sand
1008	Fine sand overlain by a sandy gravel
1016	Fine detrital mud
9210	Coarse sandy gravel

by a thick layer of humified peat [1006/9214], and a more oxidized, friable peat [1002/9201] that lay directly beneath the modern topsoil (Table 10.10).

Summary of the archaeology: Flixton Island Site 2

No archaeological material was recorded from the test-pits close to Moore's excavations (AD and AE). A small assemblage of worked flint (17 pieces) was recorded from test-pit AG, on the higher ground to the south. Apart from a single obliquely blunted point, the flint consisted of knapping debris (mostly fragments, but more occasionally flakes and a single blade), probably generated through the knapping of several, partially reduced nodules. All but two pieces derived from the topsoil. Given the very limited scale of the investigations, and the small size of the assemblage, it is not possible to infer the character of activity at this location.

Dating: Flixton Island Site 2

Six radiocarbon dates are available for Flixton Island 2. Two were on the detrital mud near the base of the excavated sections, of which one derived from a sample recovered during the VPRT excavations in 1986 (CAR-1016), the other from the same deposit recorded by Moore (Q-66). Of these, the date obtained by Walker and Godwin place the formation of the deposit during the Loch Lomond Stadial, whilst the more recent sample suggests that it formed either at the very end of the Stadial or in the early centuries of the Holocene.

The remaining dates were on collagen extracted from horse bones recovered during Moore's excavations, and were obtained by Peter Rowley-Conwy, and by Laura Kaagan (Kaagan 2000). As discussed in Chapter 4, OxA-6329 has been contaminated by humic acids and is erroneously young, while OxA-6328 and OxA-6319 are more reliable estimates of the age of the bones (see Table 10.11).

Discussion

This chapter describes the archaeological and palaeoenvironmental investigations carried out at Flixton Island between 1986 and 1993 by the VPRT. Evidence for early prehistoric activity at Flixton Island was first recorded in the 1940s by John Moore, who identified two sites (Sites 1 and 2) on the low hills making up the island. Site 1, on the southern part of the island consisted of a dense and spatially extensive scatter of worked flint and small quantities of animal bone, dated (on the basis of lithic typology) to the Early Mesolithic (Moore 1950). Site 2, at the northern end of the island, comprised a large assemblage of horse bone and two pieces of worked flint within an organic deposit that was sealed by sands and gravels, and then peats (Moore 1954). On the basis of the pollen stratigraphy this material was thought to date to the Windermere Interstadial (Walker and Godwin 1954, 51).

Table 10.11. *Radiocarbon dates for Flixton Island Site 2.*

Lab No.	Radiocarbon years BP	$\delta^{13}C$ (‰)	Calibrated date (cal BC)	Material	Comment
Q-66	10,413±210	not measured	10,780–9460	Nekron mud	Date obtained on the nekron mud by Walker and Godwin (1954), and Godwin and Willis (1959)
CAR-1016	9850±80	-27.18	9660–9175	Fine detrital mud	Context [1016], test-pit AE
OxA-6328	10,150±90	-20.2	10,175–9400	*Equus ferus* astragalus	Dates on bone sample from Moore's excavations, commissioned by Peter Rowley-Conwy
OxA-6329	9160±80	-20.3	8595–8245	*Equus ferus* astragalus	Dates on bone sample from Moore's excavations, commissioned by Peter Rowley-Conwy
OxA-6318	10,090±90	-20.8	10,075–9360	*Equus ferus*,1st phalange	Date obtained by Laura Kaagan
OxA-6319	10,150±80	-20.8	10,140–9450	*Equus ferus*, 1st phalange	Date obtained by Laura Kaagan

These sites were subsequently investigated by the Trust between 1987 and 1993. Auger surveys were carried out across the island, mapping the buried early prehistoric land surface and the surrounding parts of the lake basin, and 2 × 2 m test-pits were excavated around the island to determine the extent of the archaeology and provide a new record of the local stratigraphy. Larger trenches were also excavated at Site 1 in an attempt to characterize the nature of Mesolithic activity in that area. This work confirmed the stratigraphy of Moore's excavations at Site 2 but failed to recover any further archaeological material, and demonstrated that dense scatters of worked flint extended across much of Site 1. Unfortunately, most of the lithic assemblage was subsequently lost, limiting what we can say about activity in that area. Two pollen profiles were also recorded from the island (AK87 and F1035), both at Site 1, and provide a dated record of the environment on and around the island throughout much of the Mesolithic.

The earliest phases of activity on the island are represented by the butchered horse remains recovered by Moore from the north of the island (Site 2). Though the chronology remains uncertain, the radiocarbon dates from both the sediment and the bone indicate activity during either the latter part of the Loch Lomond Stadial or the very early centuries of the Holocene. In archaeological terms this would place the assemblage within the Terminal Palaeolithic.

Based on pollen analysis by Walker and Godwin, the contemporary landscape would have been relatively open, with areas of scrub vegetation forming once the climate had begun to warm. The deposit that the bone was recovered from probably formed in a submerged or seasonally flooded environment, as aquatic plant remains were present in samples taken during Moore's excavations (Walker and Godwin 1954, table 1). This would place the level of the lake at a minimum of 23.5 m AOD (based on the basal topography of the area around Moore's trenches). At this level the gravel ridge on which Sites 1 and 2 were located would have formed an island, separated from the edges of the basin to the south and southwest, and from No Name Hill to the northeast. Based on the macrofossils recorded by Walker and Godwin, emergent and aquatic plants were present in the water around the island, and willow was growing on the dry ground, probably close to the shore.

The assemblage itself represents the butchery of at least three horses (Moore 1954) on the northern shore of the island. There is a distinct lack of contemporary material culture on the site, and the island may have been visited solely for the purposes of hunting and killing these animals by humans based at another location around the lake. This may have included Seamer Carr Site C, where several of the lithic scatters relate to Terminal Palaeolithic activity and are associated with horse bone, or Site L, where direct dates on the horse bone are broadly contemporary with those from Flixton Island.

Following the killing and butchering of the horses the organic sediments on the north of the island were sealed by a thick layer of sand and gravel. The cause of this event remains unknown but is likely to relate to an Early Holocene climatic event, possibly one of the two abrupt climatic events recorded in the oxygen isotope records from the lake (see Blockley et al. 2018). There is no indication of either event in pollen profile AK87, suggesting that they preceded the deposition of organic sediments along the island's western shore. By the time these sediments were accumulating, birch was becoming established on the island, and species of reed (notably bulrush) were growing in the shallow waters along the shore.

Early Mesolithic groups were active in the area at a very early date, as worked flint was recorded at the base of the organic deposits in trench AK. The density of material recorded in the VPRT test-pits shows that Moore's Site 1 extended to the west and southwest (towards the island's shore), and towards the higher ground to the east. The material recovered by Moore is broadly comparable with the assemblages from other Early Mesolithic sites around the lake, with a range of tool types and debitage indicative of a suite of different tool using and knapping tasks (Moore 1950). This includes episodes of microlith manufacture, probably associated with the maintenance and repair of composite tools, the maintenance and/or use of an axe, as well as the use of burins and scrapers (Moore 1950). Based on the presence of worked flint in the line of VPRT test-pits at the west of Site 1, people were also undertaking tasks at the shore or in the shallow water just beyond. As with the other sites around the lake, these tasks were not necessarily undertaken on a single visit, and the site was probably the focus for multiple episodes of occupation throughout the earlier part of the period. There is very little evidence for activity on the northern part of the island (Moore's Site 2), though this may be the product of sampling as very few trenches were excavated in that area. Small quantities of worked flint were recorded in test-pit AG, on the edge of an area of raised ground overlooking the northern shore, and it is possible that this area was used more extensively during the Early Mesolithic.

Chapter 11

No Name Hill

Paul Lane, Barry Taylor, Chantal Conneller, Gaynor Cummins, Rowena Gale, Ken Thomas & Tim Schadla-Hall†

No Name Hill is a small, low hillock in the western section of the former lake basin, some 1.6 km north of the modern village of Flixton (NGR 50405 48140). The modern topography consists of a steep-sided area of raised ground, *c*. 130 × 230 m across, that rises *c*. 4.5 m above the surrounding, low-lying ground. During the Early Mesolithic, the hill would have formed a relatively large, prominent island, some 450 m north of Flixton Island and *c*. 700 m southeast of Seamer Carr Site C.

Early Mesolithic worked flint was recorded from the site by John Moore in the 1940s (Moore 1950, 102), who designated the site 'Flixton 3', but did not carry out any extensive investigations. Limited stratigraphic investigations were also conducted to the north of No Name Hill by Walker and Godwin in the late 1940s, who referred to the site as 'an unnamed hillock' (Walker and Godwin 1954 , 32 [Transect D]). These were supplemented in the mid-1980s by further stratigraphic work by Edward Cloutman as part of the Seamer Carr project (Cloutman 1988a: 14).

Between 1986 and 1996, archaeological investigations at No Name Hill were undertaken by the VPRT. These aimed at defining the distribution, extent and character of Early Mesolithic occupation areas on the former island, and establishing a palaeoenvironmental record for the site. Preliminary test-pitting and augering were conducted in 1986, 1987, 1991 and 1992, with the main seasons of investigation between 1994 to 1996 (Fig. 11.1). Most of this work was focused on the lower slopes of the hill, where the surviving peat deposits were more likely to preserve archaeological material, with more limited test-pitting on the higher ground, in conjunction with fieldwalking and geophysical survey. As a result of this work, concentrations of Early Mesolithic material, including worked flint, animal bone, and antler working waste were recorded from the peat deposits that had formed at the lake shore, and on what would have been the drier ground just above the shore. The higher ground had been extensively damaged by recent ploughing and no *in situ* deposits survived, although later prehistoric (Neolithic) material was recovered, and two sub-circular features of unknown date were noted in this area during a geophysical survey in 1994 (Kenyon 1994).

Auger surveys

The first auger surveys of the area were conducted by Cloutman (1988a), who recorded the sequence of wetland deposits on the north shore of the island (Fig. 11.2). More detailed surveys were then carried out by the VPRT in 1991, and again in 1994 (led by David Kenyon), recording a total area of *c*. 100,000 m^2. The results show that the island was formed from an area of raised ground, *c*. 320 × 260 m, orientated northwest to southeast, and with a maximum elevation of *c*. 27.5 m AOD. The top of the hill was relatively flat, with steep slopes on the northern, western, and southern sides (Figure 11.1), and a gentler slope on the eastern side that fell away towards the Mesolithic shoreline.

Palaeoenvironmental research

Gaynor Cummins, with contributions by Rowena Gale & Ken Thomas

Three pollen profiles were recorded from No Name Hill in order to establish the nature of the environment on and around the island, and to identify possible impacts of human activity on the local vegetation (Fig. 11.1). The most extensive was recorded test-pit NM, excavated *c*. 100 m to the south of the island's southern shore (see Fig. 5.1), in an area of deep peat and calcareous mud (Profile NM). Two further profiles

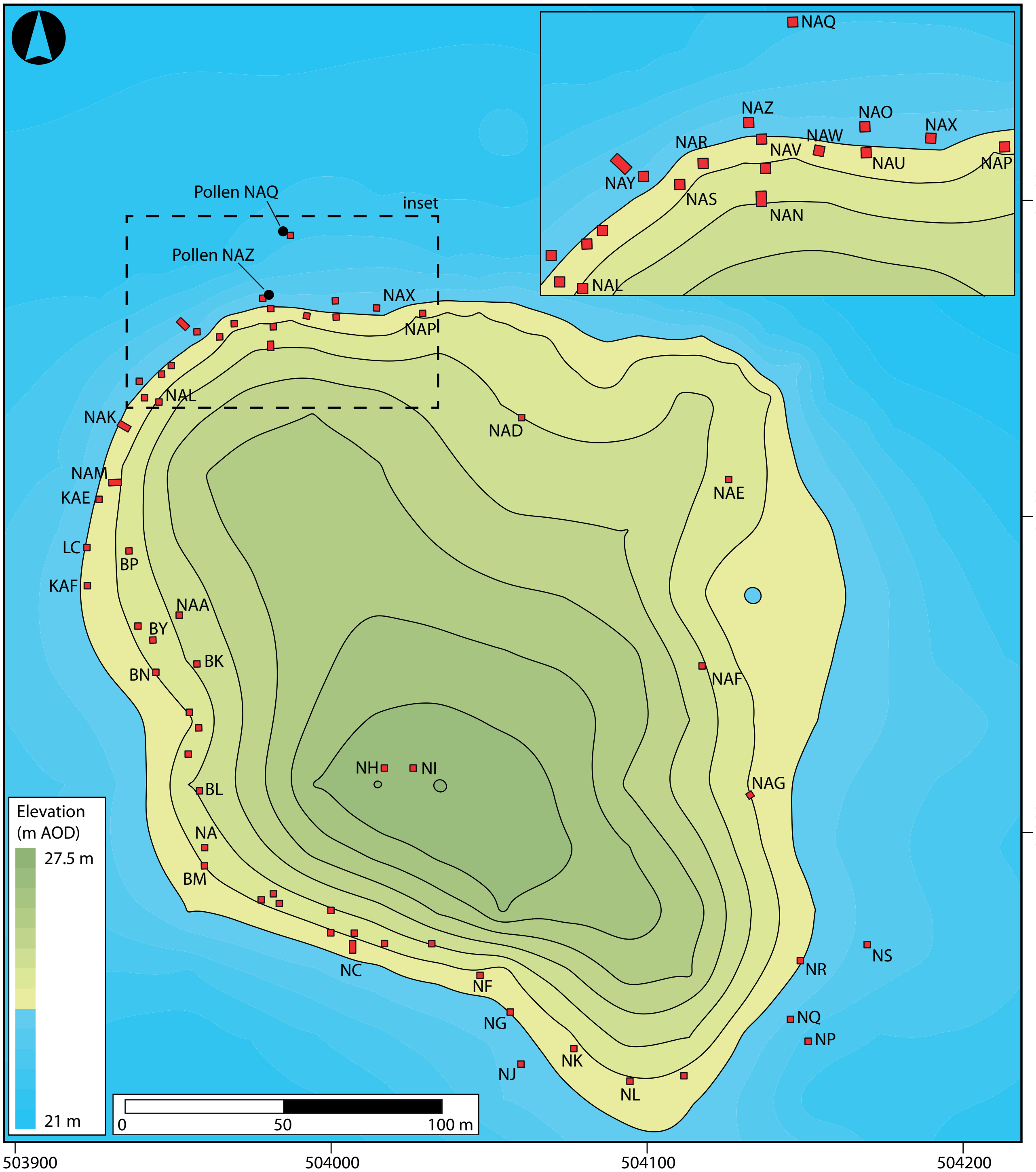

Figure 11.1. *Location of test-pits at No Name Hill (level of the lake shown at 24 m AOD).*

were recorded from samples on the north of the island, NAQ and NAZ, 21.5 m and *c*. 5 m from the former shoreline, respectively. All three profiles recorded inputs of micro- and macrocharcoal, some of which coincided with changes to the local flora, possibly reflecting episodes of human activity and burning of the island's vegetation. In addition, samples of sediment from test-pit NM were analysed for mollusc remains, and samples of wood and hazelnuts were analysed from test-pit NAZ.

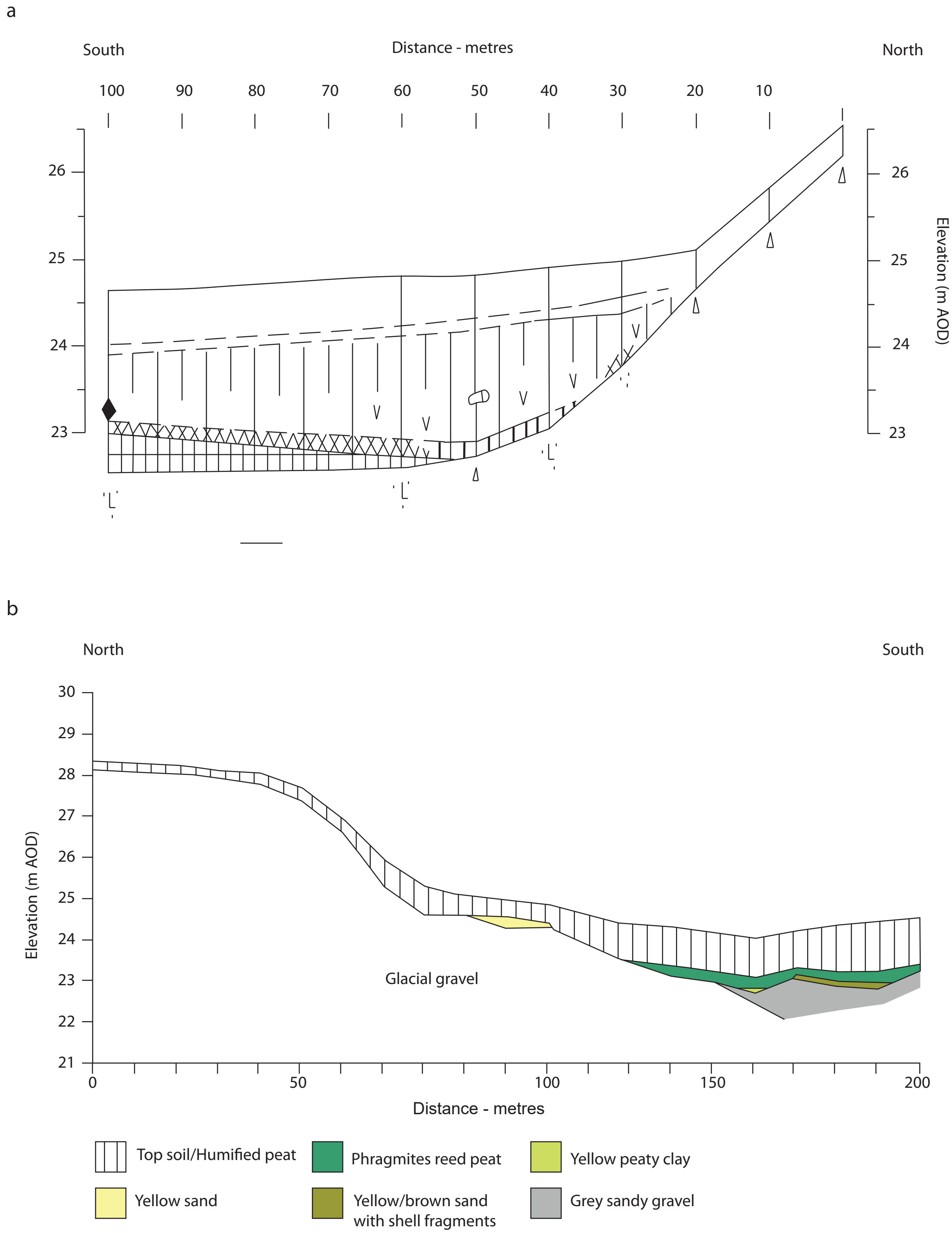

Figure 11.2. *Profile through deposits on (a) western side of No Name Hill (from Cloutman 1988a: 14), and (b) on the eastern side (from Kenyon 1994).*

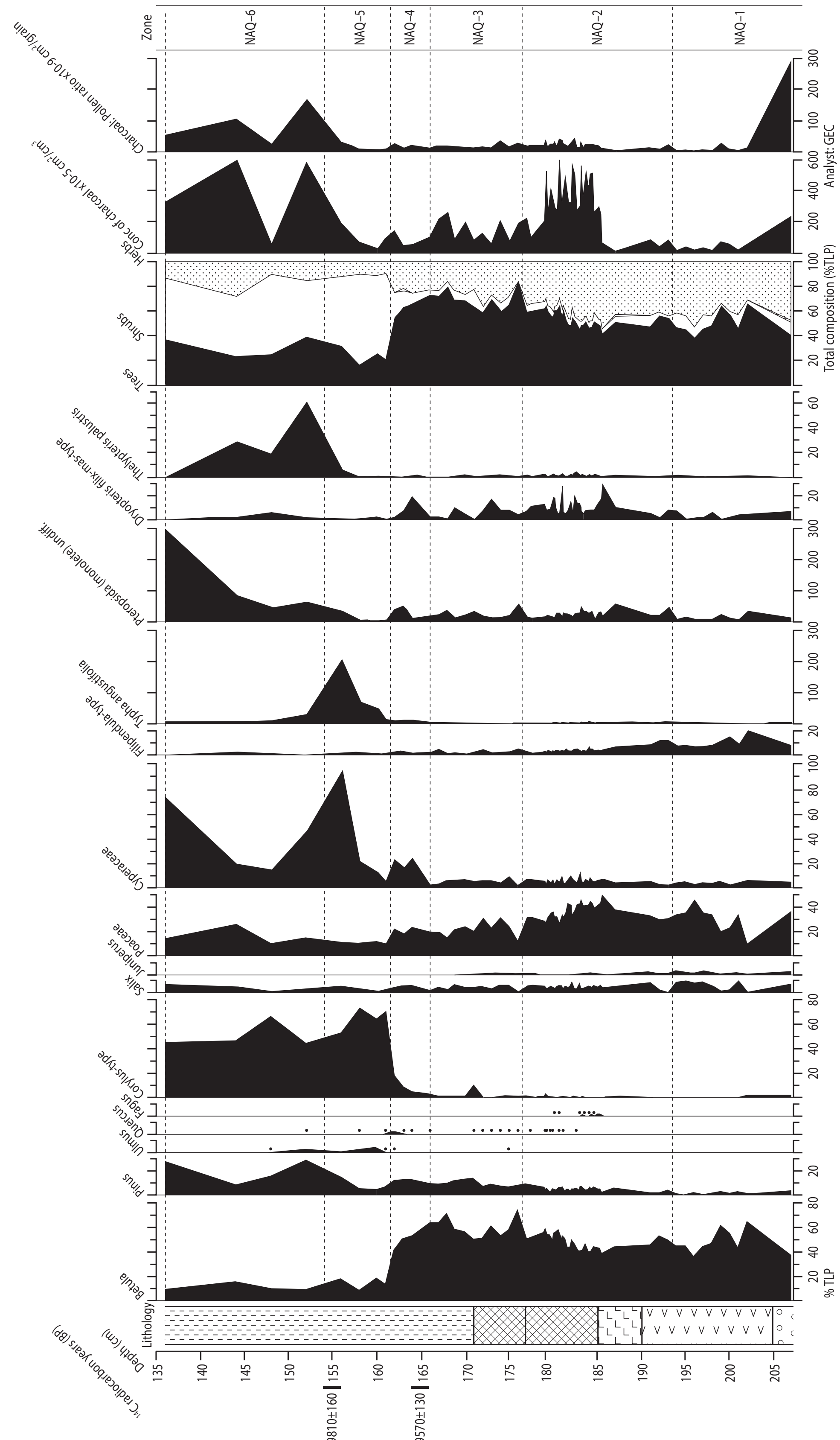

Figure 11.3. *Pollen diagram for Profile NAQ.*

Table 11.1. *Lithostratigraphy of Profile NAQ.*

Depth (cm)	Description
144–172	Very dark brown crumbly reed peat
172–177	Dark brown organic mud with vegetative (reed) material and mollusc remains
177–181	Brown organic marly mud with some mollusc remains
181–184.5	Dark brown organic mud with extensive reed fibres and mollusc remains
184.5–189	Grey sticky clay with abundant fragments of black slate or manganese
189–204	Light olive marl with mollusc remains
204–208	Grey organic sand with small angular gravels

Profile NAQ

Profile NAQ was recorded from a test-pit excavated through a sequence of marl and lake muds on the north side of the island, *c*. 21.5 m from the Early Mesolithic lake shore where concentrations of flint, bone and antler had been recorded. All measurements were taken from a datum of 24.28 m AOD. The lithostratigraphy of the sediments is shown in Table 11.1.

Pollen analysis

Samples were taken from overlapping monolith tins. Subsamples for pollen analysis were taken every 10–40 mm, with finer resolution sampling every 2.5 mm at selected horizons. Only the bottom 0.65 m of the sediment profile was analysed due to poor pollen preservation in the upper sediments. The pollen diagram (Fig. 11.3) has been divided into six local pollen assemblage zones (prefixed NAQ).

LPAZ NAQ-1 193.5–209 cm
Betula-Poaceae-*Filipendula*

Betula is the dominant pollen taxon contributing between 35–60% TLP, though it is notable that all pollen percentages fluctuate markedly. *Juniperus* is also present in low quantities. Poaceae contributes a high percentage of the pollen sum, values ranging between 15–50% TLP and levelling off to 30% by the end of the zone. *Salix* also fluctuates greatly varying from 1–10% TLP. Fern values do not exceed 7% TLP before the end of the zone. *Filipendula* values are relatively high, but fluctuate.

LPAZ NAQ-2 176.5–193.5 cm
Betula-Poaceae-*Dryopteris filix-mas*

All pollen values fluctuate considerably, though *Betula* attains constant levels of between 50–60% TLP and Poacaeae remains high at 30–40%. *Corylus*-type pollen input is consistent but low and there is a brief but consistent peak in *Fagus* (beech) in the middle of the zone. *Juniperus* pollen is negligible by the zone's mid-point. *Filipendula* declines as *Dryopteris filix-mas* increases, with spore values reaching over 25% TLP. Microcharcoal concentrations peak during this zone.

LPAZ NAQ-3 166–176.5 cm
Betula-Pocaeae-*Corylus*

Betula fluctuates, though values remain between 55% and 75% TLP. This zone shows the first substantial increase in *Corylus*-type pollen. Poaceae levels decline slightly through the zone from 30–20%, *Dryopteris* levels decrease slightly (though they remain variable). Charcoal concentrations are reduced from the previous zone, but remain high.

LPAZ NAQ-4 161.5–166 cm
Betula-*Corylus*-Cyperaceae

Betula starts the zone at 60% TLP but drops sharply to 25% as *Corylus*-type increases. Both Cyperaceae and *Typha* achieve high pollen values. *Dyropteris* peaks once again. Microcharcoal falls but then peaks at the top of the zone.

LPAZ NAQ-5 154–161.5 cm
Corylus-Cyperaceae-*Typha angustifolia*

Corylus-type rises sharply from 25–70% TLP, but declines to 45% TLP at the end of the zone, while *Betula* drop sharply to 10–20%. Peak levels of Cyperaceae and *Typha angustifolia* occur. The pollen from *Ulmus* and *Quercus* becomes consistent but very low. *Dryopteris filix-mas* spores become sparse. Microcharcoal levels are low.

LPAZ NAQ-6 136–154 cm
Corylus-Cyperaceae-Pteropsida

Corylus-type is the dominant taxon, but fluctuates around an average of 50% TLP. *Pinus* percentages reach over 25% TLP. *Thelypteris palustris* (marsh fern) increases at the start of the zone before declining, while Cyperaceae increases. At the very top of the profile is a brief peak in *Fraxinus* pollen. There are two peaks in microcharcoal.

Dating

Two samples were submitted for radiocarbon analysis (Table 11.2). However, both are too old for their position relative to the pollen stratigraphy and are assumed to be erroneous (see Chapter 4).

Interpretation

This profile documents the vegetation development during the earlier part of the Mesolithic. Sedimentation probably began sometime after the start of the

Table 11.2. *Radiocarbon dates from pollen Profile NAQ.*

Code	Depth (cm)	Date (BP)	$\delta^{13}C$ (‰)	Calibrated date	Material
Beta-104483	154–6	9810±160	-29.7	9870–8760	peat
Beta-104482	164–6	9570±130	-28.1	9275–8615	peat

Holocene, as open birch woodland and an understorey of male fern were becoming established. Poaceae pollen is particularly high, and was probably derived from *Phragmites* reed growing within the nutrient-rich water in the lake margins. Sedges were probably also present, and some of the willow may have derived from trees growing at the island's shore.

These conditions persisted into zone NAQ-2, until the point where microcharcoal values increase (*c*. 185 cm). Here, the finer resolution sampling shows a somewhat cyclical pattern that is particularly evident in the *Betula*, Poaceae and Pteropsida curves, where *Betula* values are reduced slightly whilst Poaceae and Pteropsida values peak and *Fagus* appears. Fluctuations in Cyperaceae and *Thelypteris* also occur at this time. Microcharcoal concentrations are consistently high throughout this part of the profile, suggesting continuous human activity over a relatively long period. However, it is difficult to tell whether the burning is related to the changes in the local plant communities. Research by Whitlock and Millspaugh (1996) has highlighted several problems to do with the deposition and interpretation of microcharcoal curves and their association with pollen data. They identified a time lag, potentially greater than five years, between a catchment fire and microcharcoal deposition in the middle of a lake. With such a time lag it is difficult to argue for any direct connection between the pollen and charcoal curves. That said, the changes seen in the pollen do suggest openings within the birch woodland, resulting in an increase in habitats suitable for the expansion of grass and ferns and some local growth of beech, and/or disturbance within the local wetlands affecting the growth of reeds, sedges, and marsh fern. Given the evidence for Mesolithic occupation at the site, and the increased levels of microcharcoal at this part of the zone, such changes could be attributed to human activity, though whether this was intentional or not is harder to discern. The clay band at 185–191 cm is likely to be due to a localized erosional event upon the island, as there is no trace of the event further to the north or east (Cloutman 1988a) and could also be attributable to local human activity.

Conditions remained largely unchanged throughout zone 3, though the fluctuations in *Betula*, Poaceae, and *Dryopteris*, and the corresponding peaks in microcharcoal, could reflect episodes of vegetation disturbance. Hazel was present in the landscape and had begun to replace birch within the local woodlands in zone 4. The date of 9275–8615 cal BC (9570±130 BP, Beta-104482) for the very early part of the hazel rise, is older than the measurements from a comparable horizon in profile NAZ (Beta-104485) just to the south, and from other pollen profiles in the area. While this may be due to the large error range and the thickness of the sample, it is also possible that the date is erroneously old due to hard water error, and that the date from NAZ (which was obtained on terrestrial wood) should be considered as a more accurate age (see also profile NAZ below).

Above Zone 4, the pollen reflects the continued transition to hazel dominated woodland, and the progressive infilling of the lake margins, with the increasing levels of marsh fern probably indicating the presence of fen environments along the north of the island. Human action again affected the local vegetation, with the fluctuations in *Corylus*-type pollen occurring in association with peaks in charcoal concentrations in Zones 5 and 6. This implies a fairly significant degree of human activity in the local vicinity. The date of 9870–8760 cal BC (9810±160 BP, Beta-104483) is clearly too old for this point in the profile and has probably been affected by hard water error.

Profile NAZ

Profile NAZ was taken from a test-pit less than five metres to the north of the edge of the former lake (Fig. 11.1). The test-pit contained a relatively large assemblage of worked flint and faunal remains, including a fragment of worked red deer antler (see below).All measurements were taken from a datum of 23.70 m AOD. The lithostratigraphy is shown in Table 11.3.

Pollen analysis

Samples were collected from a monolith tin, subsamples for pollen analysis were taken every 10–40 mm throughout the profile. Due to the low resolution of the sample points, the pollen diagram (Fig. 11.5) has been split into two local pollen assemblage zones (prefixed NAZ).

LPAZ NAZ-1 22–47 cm
Betula-Corylus-Dryopteris filix-mas

Betula starts the zone at 40% just after the clay band which correlates with NAQ. After peaking mid-zone at 55%, *Betula* values decline to 40% once more.

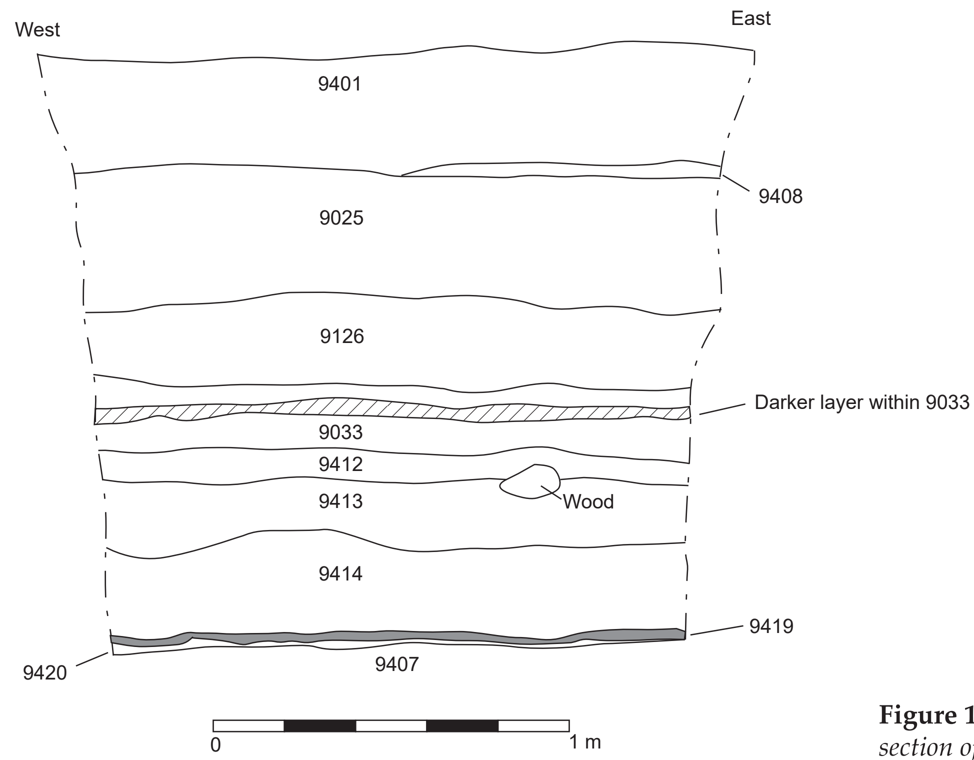

Figure 11.4. *South-facing section of NAZ.*

Corylus-type pollen becomes consistently present at 40 cm at 5% before rising to 45% at the top of the zone. *Salix* is present only in low numbers and gradually declines through the zone from 8–2% TLP. Poaceae fluctuates from 30% at the zone start to a peak of 45% at 41 cm, before declining to 10–15% at the zone end. *Dryopteris filix-mas* peaks mid zone at 20%, before declining to very low levels by the top of the zone. *Rumex* undiff. (c.f. *aquaticus*), *Typha angustifolia* and Cyperaceae (towards the zone end) are the important lake marginal taxa. Microcharcoal concentrations are high, with two peaks (centred on 23 cm and 46 cm), and a third peak in the charcoal/pollen ratio at 39 cm.

LPAZ NAZ-2 10–22 cm
Corylus-Cyperaceae-*Pteropsida*

Corylus-type values continue to rise until they reach 70% at the top of the zone, while *Betula* values decline to *c*. 10% where they remain consistent for the rest of the zone, and *Salix* rises slightly to *c*. 5% TLP. *Dryopteris* values remain negligible, while *Typha angustifolia*, Cyperaceae and Pteropsida undiff. (c.f. *Thelypteris palustris*) show increased (though fluctuating) values, and Poaceae declines. Pollen from *Quercus* and *Ulmus* is sparse. Microcharcoal concentrations remain high, with a peak at the start of the zone and another at 14 cm.

Table 11.3. *Lithostratigraphy of Profile NAZ.*

Depth (cm)	Description
0–23	Very dark brown crumbly reed peat with abundant *Corylus* nuts
23–47	Dark brown lake detritus with macro remains of monocotyledons and *Betula* (wood)
47–48	Sticky grey clay layer with slate/manganese fragments
48–50	Dark grey sand

Dating

Two samples were submitted for radiocarbon dating, the results are presented in Table 11.4. A third date, Beta-104484, on a fragment of worked red deer antler recorded adjacent to the base of the pollen monolith, has also been included as it was thought this would establish an approximate age for the start of the profile. However, it has been contaminated by exogenous carbon and is not considered to be an accurate estimate of the age of the antler or the corresponding point in the pollen profile (see Chapter 4).

Interpretation

Organic sedimentation began on top of a grey clay layer with abundant slate/manganese fragments which is probably a continuation of the clay layer in profile NAQ, though the date of 9140–8640 (Beta-104484, 9510±60 BP) at the base of the profile is thought to be erroneous. Open birch woodland was present, with male fern understorey and small amounts of willow,

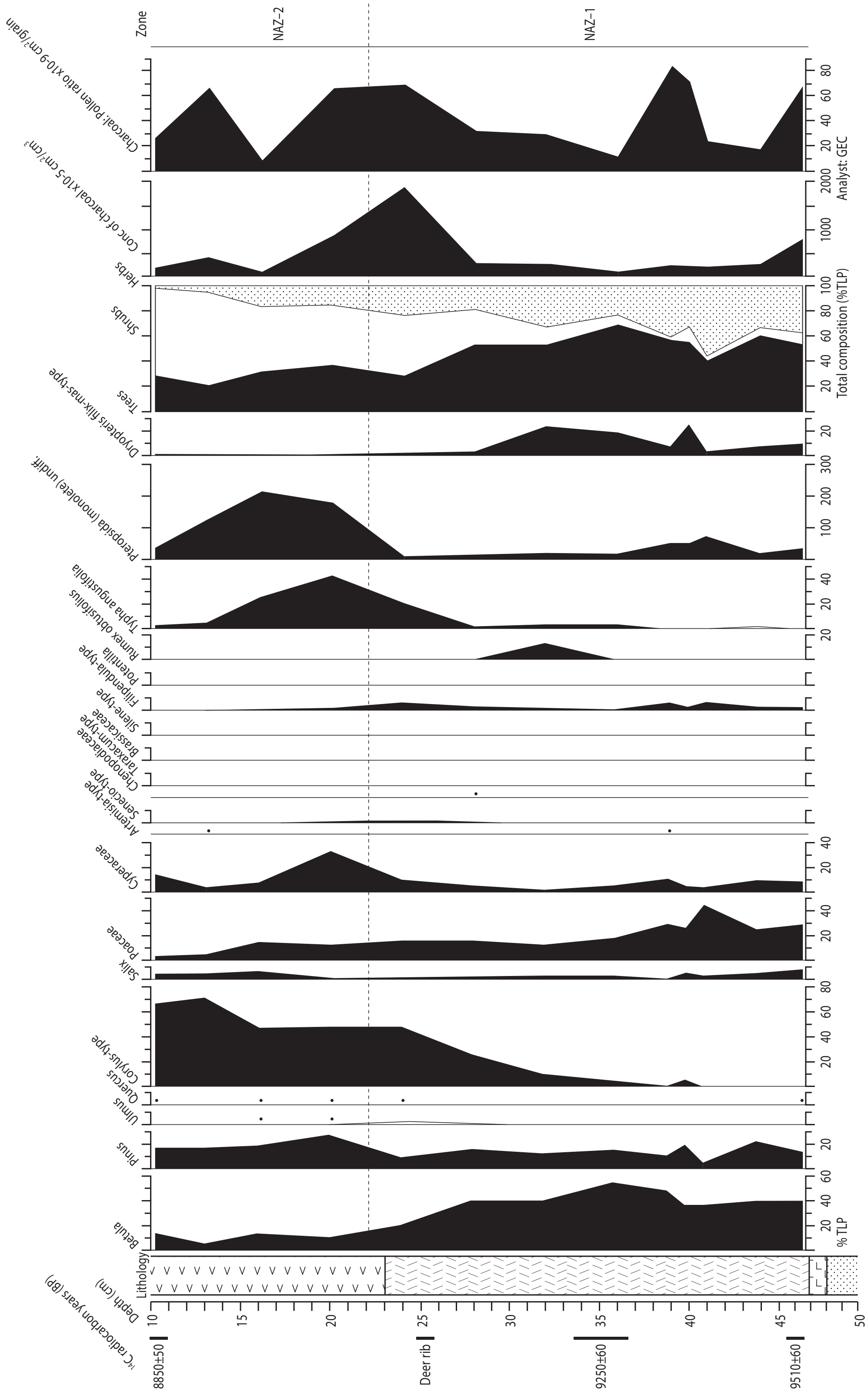

Figure 11.5. *Pollen diagram for Profile NAZ.*

Table 11.4. *Radiocarbon dates from Profile NAZ.*

Code	Depth (cm)	Date (BP)	$\delta^{13}C$ (‰)	Calibrated date	Material
Beta-104486	9–10	8850±50	-25.8	8220–7755	*Corylus* nut
Beta-104485	33.5–36.5	9250±60	-28.7	8620–8305	*Betula* wood
Beta-104484	45.5–46.5	9510±60	-26.4	9140–8640	Red deer antler (worked)

suggesting that sedimentation began after the start of the Mesolithic but probably within the early centuries of the period. Hazel was probably growing in the area by 8620–8305 cal BC (9250±60 BP, Beta-104485), which agrees well with the dates from Star Carr (see Dark 1998c). As woodland became more established, it restricted the amount of light to the understorey so that grasses, ferns and herbs declined, and woodland shrubs were shaded out. The date for the top of the profile, obtained on a *Corylus* nut, is shortly after 8220–7755 cal BC (8850±50 BP, Beta-104486), and there is no reason to doubt this on the basis of the pollen stratigraphy. The absence of large quantities of *Ulmus* and *Quercus* pollen is also attributed to preferential corrosion of the pollen grains.

Microcharcoal concentrations are high throughout the profile, with distinct peaks probably representing three or four periods of localized burning. However, the effects on the local vegetation are difficult to determine due to the low sampling interval, and the charcoal may have derived from hearths/fires associated with human activity areas on the island, rather than deliberate plant management.

Wood and nut samples from NAZ

Rowena Gale

One sample of waterlogged nuts and four samples of wood recovered during excavation of test-pit NAZ were submitted for identification and analysis. The anatomical structure of the samples was consistent with the taxa (or groups of taxa) given below. It is not usually possible to identify to species level, and the anatomical similarity of some related species and/or genera makes it difficult to distinguish between them.

VP 1996 NAZ Context 9420

Find No. 53987: Salicaceae spp. (*Salix*/*Populus*). Three short sections of roundwood, probably all originating from a single piece, with a combined length of 180 mm. The heterocellular rays suggest willow as the more likely, but this feature is doubtfully stable, particularly in juvenile wood. The diameter of each piece was 15 mm; two sections included seven growth rings; one section included only six. The growth patterns of all segments were similar, with the innermost two rings wider than the outer rings. The segments were very straight; the base of a lateral branch occurred on one piece. The morphology and growth pattern of these pieces is comparable to coppice growth.

Find No. 53986: Salicaceae spp. (*Salix*/*Populus*). A single portion of roundwood, possibly *Salix*, with a diameter of 15 mm and a maximum length of 80 mm. The piece included seven growth rings and the growth pattern was similar to Find no. 53987. This piece also appeared rod-like.

Find No. 53988: Salicaceae spp. (*Salix*/*Populus*). A single piece of roundwood, possibly *Salix*, with a diameter of 15 mm and a maximum length of 35 mm. The piece included six growth rings, and the growth pattern and morphology were similar to Find no. 53987.

Find No. 53989: Salicaceae spp. (*Salix*/*Populus*). Two pieces of roundwood, possibly *Salix*. The largest piece had a diameter of 15 mm and maximum length of 50 mm; the smaller piece was 12.5 mm in diameter and 20 mm in length. Both included six growth rings, and the growth patterns and morphology matched that of Find no. 53987.

VP 1996 NAZ Context 9414

Nine *Corylus* nuts with areas of rodent (?) gnawing.

Discussion of the wood and nut samples

Although relatively well-preserved, no tool marks were recorded on any of the wood samples, and the nuts are likely to have been gnawed by rodents rather than humans. The seven pieces of wood from the basal context [9420] were very similar in structure and morphology. The growth patterns were also similar and each piece was straight and uniform in width, suggesting a common origin. The similarity of these to coppice growth was striking although the characteristic coppice 'heel' was not included on any sample.

Profile NM

This profile was recorded from samples taken from trench NM, excavated through deeper peat and marl deposits, *c*. 50 m to the south of the island. All depths were measured from a datum of 23.6 m AOD. The lithostratigraphy is shown in Table 11.5.

Pollen analysis

Samples were taken from overlapping monolith tins, subsamples for pollen analysis were taken every 10–40 mm. The pollen diagram (Fig. 11.7) has been divided into four local pollen assemblage zones (prefixed NM).

LPAZ NM-1 125–161.5 cm
Betula- Dryopteris filix-mas

The zone has been subdivided into four sub-zones NM-1 a-d.

LPAZ NM-1a 151.5–161.5 cm
Filipendula Subzone.

Betula levels rise to 60%. Principle shrub taxa are *Salix* and *Juniperus*. Herbaceous pollen is characterized by Poaceae, Cyperaceae and *Filipendula*, though *Dryopteris filix-mas* rises. Wetland species consist of *Typha angustifolia*.

LPAZ NM-1b 141.5–151.5 cm
Dryopteris filix-mas Subzone.

Betula continues to rise, whilst *Juniperus* declines. Poaceae and *Filipendula* values both fall, and there is an increase in *Dryopteris*.

LPAZ NM-1c 130–141.5 cm
Betula Subzone.

Betula maintains its high levels and *Corylus*-type occurs for the first time but at very low levels. *Juniperus* all but disappears and *Salix* declines. Herbaceous taxa all decline, with *Filipendula* occurring very sporadically toward the top of the zone.

LPAZ NM-1d 125–130 cm
Betula-Corylus Subzone.

Corylus-type values rise gradually in a stepwise manner from *c.* 10 to 25%, and there is a fall in *Betula* from 77% to 57%. Pollen percentages of *Ulmus c.f. glabra* (wych elm) and *Quercus* are sporadic but persistent. There is a slight resurgence in Pteropsida values but *Dryopteris* percentages decline to less than 1% TLP

LPAZ NM-2 109–125 cm
Corylus-Betula

Corylus-type values continue to increase, from 25% to 80% TLP near the top of the zone, in contrast to declining *Betula* values. Pollen percentages of both *Ulmus* and *Quercus* are constant but low throughout, *Ulmus* values rise toward the end of the zone. *Salix* percentages drop to less than 2% at the start of the zone and

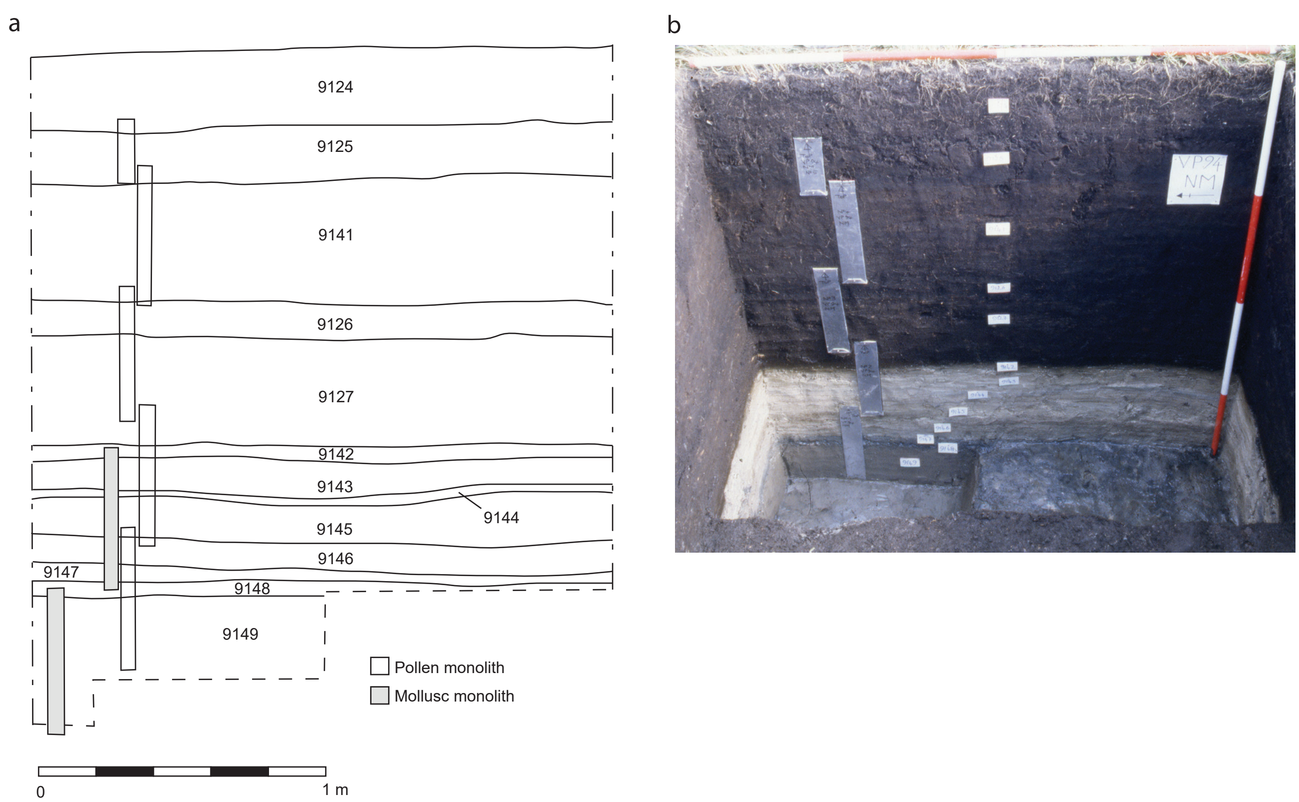

Figure 11.6. *Drawing (a) and photograph (b) of the west-facing section of test-pit NM showing position of pollen sampling tins, and on (a) also mollusc bulk samples.*

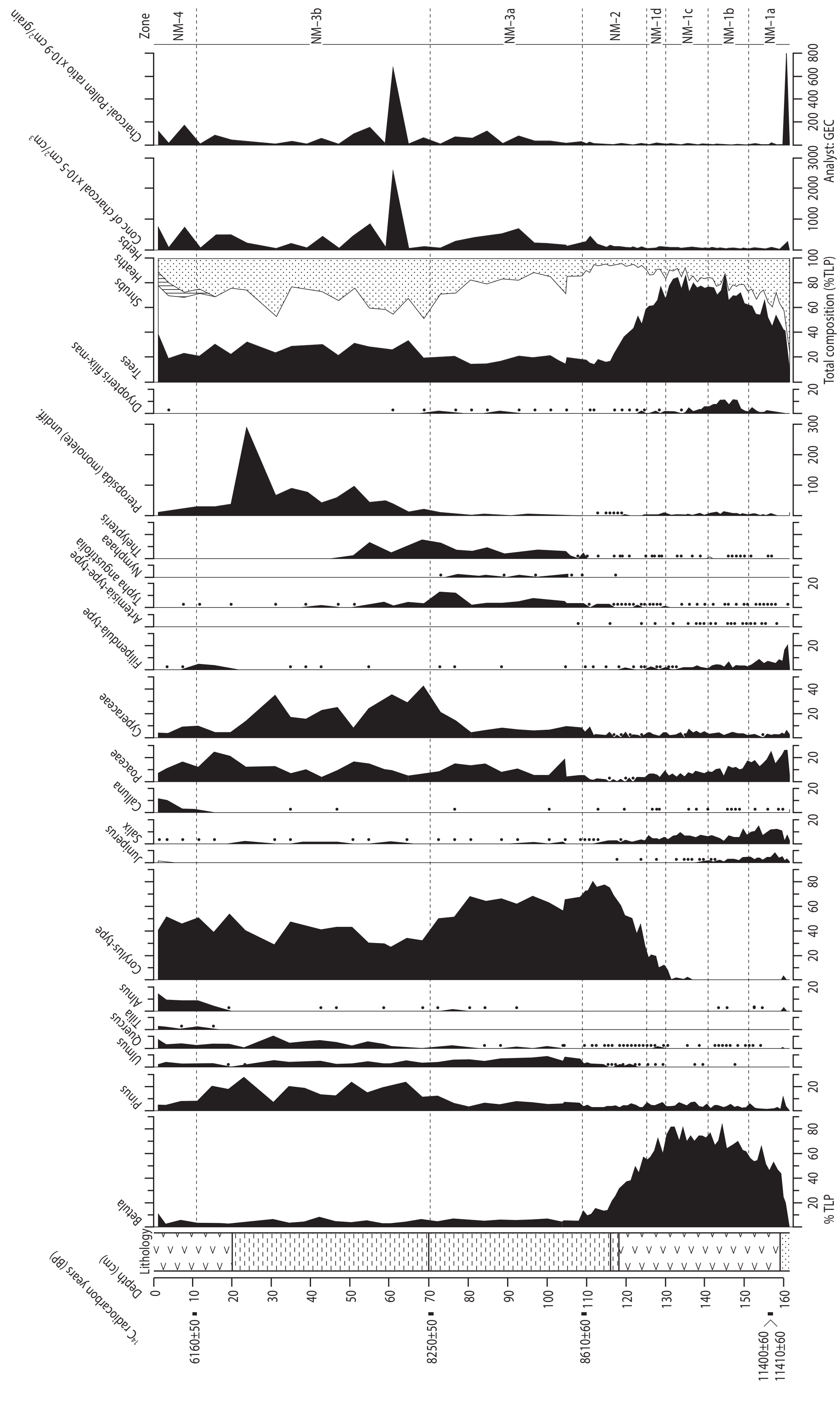

Figure 11.7. *Pollen diagram for Profile NM, No Name Hill.*

Table 11.5. *Lithostratigraphy of Profile NM.*

Depth (cm)	Description
0–70	Dark brown to black crumbly humified herbaceous peat. Wood remains increase through the top 20 cm
70–116	Dark brown unhumified reed peat
116–118	Dark brown reed peat with dense concentration of mollusc and ostracod remains
118–138	Olive marl with reed remains, *Potamogeton* seeds, molluscs and insect remains
138–153	Pale olive marl with less dense plant remains including *Potamogeton* and reed. Contains *Chara* oospores, molluscs and insect remains
153–159	Pale olive slightly sandy marl containing banded aquatic plant remains (e.g. *Potamogeton* and reed), molluscs and woody fragments
159–161	Dark grey sand with gravels towards the base
161–165	Grey clay

never recover. *Typha angustifolia* increases toward the top of the zone. Microcharcoal concentrations peak at the top of the zone.

LPAZ NM-3 11–109 cm
Corylus-Ulmus-Quercus zone

This zone has been subdivided into two further sub-zones.

LPAZ NM-3a 70–109 cm
Corylus-Ulmus

Ulmus values rise, *Corylus*-type fluctuates and declines to *c*. 60% by the end of the zone, *Quercus* percentages increase slightly but are still low. There are slight peaks in *Dryopteris* and an increase in Pteropsida. *Typha angustifolia* percentages remain high while both Poaceae and Cyperaceae increase. Charcoal concentrations are high, with a peak at 92 cm.

LPAZ NM-3b 11–70 cm
Pteropsida-Cyperaceae-*Corylus-Pinus*

Corylus-type continues to decline, *Quercus* increases. Small peaks in *Salix* occur, though values remain low. Pteropsida and Cyperaceae continue to increase and Poaceae levels remain the same. *Alnus* begins to rise at the top of the zone. Charcoal concentrations fluctuate, with distinct peaks at 60 cm and 55 cm.

LPAZ NM-4 11–0 cm
Corylus-Alnus-Calluna

Alnus rises, and *Tilia* appears, whilst *Quercus* values decline slightly. *Caluna* (heather) increases toward the top of the zone, whilst Cyperaceae declines. Charcoal concentrations peak at 8 cm.

Freshwater molluscs from NM
Ken Thomas

Bulk samples of material were taken from basal calcareous (marl) deposits, detrital muds, and peats (archaeological contexts [9142] to [9148]). The lowest [9148] had a relatively low organic content, being a dark grey gravelly sand. Context [9147] is a pale olive sandy marl with a minor gravel component. Context [9146] is a pale olive marl with rather more plant remains than found in the samples below, while from [9145] to [9143] the samples contain abundant fibrous and matted remains of aquatic plants, whilst [9142] was a reed peat (Table 11.6).

Gastropod shells and opercula, as well as bivalve shells were recovered. The gastropod shells and opercula were identified to species. All the bivalve shells were valves of *Pisidium* species. While these were not fully identified to species level, a number of species were recognized, including *P. casertanum* (Poli), *P. milium* Held and *P. nitidum* Jenyns. The numbers of shell elements (whole shells or apices, opercula and bivalve valves) for each taxon identified are given in Table 11.7.

Different volumes of samples were processed, and different volumes of residues sorted, for the various samples. The numbers of individuals of each taxon in each sample have therefore been corrected to a standard sampling volume of 1000 cm^3, as shown in Table 11.8.

Discussion of the mollusc samples

In terms of the sedimentary characteristics of the samples, there is a change from gravelly sands with little organic plant material, to lake marls with increasing amounts of plant material preserved in them. The abundance and diversity of mollusc remains reflects this sequence, with the lowest contexts, [9148] to [9146], having relatively low total numbers of specimens, and the upper contexts having significantly higher numbers. This probably reflects both the increasing shallowness of the lake, and an increase in the amount of vegetation growing in it.

In [9145] there is an increase in the abundance of both gastropods and bivalves (Table 11.8), which might be associated with both shallower water conditions and the development of an abundant and diverse aquatic flora (the deposits become much richer in fibrous plant materials, and Charophyte oospores also appear in the samples). There is a decline in abundance of molluscs in contexts [9144] and [9143], followed by another increase in context [9142]. It is not obvious what might have caused these fluctuations in this part of the sequence, and examination of the patterns of abundance in various taxa show no consistent pattern. Thus, *Pisidium* valves fall off progressively (from a very high abundance in [9145]) throughout this part of the sequence,

Table 11.6 *Volumes of sample residues sorted for analysis of mollusc remains from NM. Depths are given in relation to the pollen profile NM.*

Sample number	Depth (cm)	Volume processed (cm^3)	Volume (cm^3) of residue in each fraction sorted for molluscs/ total volume in that fraction			
			>4.0 mm	>1.0 mm	>0.5 mm	Total
NM 9142	112–116	1680	75//75	225//315	80//190	380//580
NM 9143	116–128	1680	125//125	160//320	215//355	500//800
NM 9144	128–131	840	70//70	75//75	75//75	220//220
NM 9145	131–145	840	130//130	90//175	70//135	290//440
NM 9146	145–154	840	440//440	150//150	105//105	695//695
NM 9147	154–160	840	295//295	90//90	55//55	440//440
NM 9148	160–165	1680	230//230	85//85	30//30	345//345

Table 11.7. *Numbers of shells (apices, opercula, valves) recovered from samples from NM.*

Species	Sample NM:						
	9142	9143	9144	9145	9146	9147	9148
Valvata cristata Müller	986	131	248	489	60	27	3
Valvata piscinalis (Müller)	15	10	8	74	4	6	11
Bithynia tentaculata (Linnaeus)	114	57	71	9	-	-	-
Opercula	210	104	260	1	-	-	-
Radix peregra (Müller)	439	104	15	115	15	5	-
Anisus vortex (Linnaeus)	-	1	-	-	7	-	-
Gyraulus laevis (Alder)	-	-	-	-	1	1	6
Gyraulus crista (Linnaeus)	100	22	16	51	2	5	10
Hippeutis complanatus (Linnaeus)	5	-	-	3	-	-	-
Acroloxus lacustris (Linnaeus)	-	-	-	-	-	1	-
Pisidium spp. (no. of valves)	83	31	150	1172	2	8	2
Charophyte oospores	+	++	++	+	-	-	-

Table 11.8. *Numbers of shells, corrected for variable sample volume (specimens per 1000 cm^3 of sample).*

Species	Sample NM:						
	9142	9143	9144	9145	9146	9147	9148
Valvata cristata Müller	1048	136	295	1101	71	32	2
Valvata piscinalis (Müller)	15	10	10	164	5	7	7
Bithynia tentaculata (Linnaeus)	105	59	84	21	-	-	-
Opercula	198	119	309	2	-	-	-
Radix peregra (Müller)	400	111	18	230	18	6	-
Anisus vortex (Linnaeus)	-	1	-	-	8	-	-
Gyraulus laevis (Alder)	-	-	-	-	1	1	4
Gyraulus crista (Linnaeus)	104	23	19	118	2	6	6
Hippeutis complanatus (Linnaeus)	5	-	-	7	-	-	-
Acroloxus lacustris (Linnaeus)	-	-	-	-	-	1	-
Pisidium spp. (no. of valves)	74	35	178	2674	2	10	1
Charophyte oospores	+	++	++	+	-	-	-
MNI of Gastropods/1000 cm^3	1770	400	651	1641	105	53	19

while *Valvata cristata*, *Radix peregra* and *Gyraulus crista* decline and then rise again. *Bythnia tentaculata* has a rather lagged response compared to these other taxa, with low numbers of shells or opercula in [9145], peaking in abundance in [9144], then declining and rising again through [9143] to [9142]. Possible reasons for the lag in *B. tentaculata* are considered below, but it should be noted that there is often a significant disagreement between the numbers of shells of this species and the numbers of opercula, with the latter outnumbering the former in all contexts except [9145]. This might be the result of differential preservation, favouring calcitic opercula over aragonitic shells, but it is more likely to be the result of post-mortem sorting by localized currents in the lake. This might imply that this part of the lake had become very shallow, with wind-generated currents disturbing the bottom deposits.

In ecological terms, most of the molluscs recovered from the samples have quite broad tolerances (Boycott 1934; Kerney 1999; Oklund 1990), but the occurrence and changing patterns of abundance of certain taxa are potentially informative of broad ecological and biogeographical patterns. For example, the absence of *Bythnia tentaculata* from contexts [9146], [9147] and [9148] could reflect a very Early Holocene age for these deposits. Preece (1998: 174–5) has noted that this species appears to have been absent from a number of lakes in northern England in the very Early Holocene (including his own samples from Lake Flixton near the site of Star Carr). The occurrence of *Gyraulus laevis* in contexts [9146], [9147] and [9148] adds weight to the idea of an Early Holocene date for these deposits. This species appears to have established itself early in Britain after the retreat of the ice (Kerney 1999: 64), being characteristic of Late Glacial and Early Holocene lake marls. Macan (1969: 43) lists it as a soft water species with a northerly distribution in Britain. It prefers clean quiet water, often being found on bare mud or stones.

The changes in the relative abundance of *Valvata piscinalis* and *V. cristata* through the deposits probably reflects the increase of aquatic vegetation and muddy substrates favoured by the latter species, and a relative decline in the siltier substrates favoured by the former. As noted above, the general increase in numbers of species and abundance of different taxa probably also reflects this increasingly eutrophic, plant-rich, shallow water lacustrine ecosystem.

Dating

Five samples were submitted for radiocarbon analysis. The results are presented in Table 11.9.

Samples Beta-86143 and -86144 are considered to be erroneously old, probably due to the effects of hard water error (see Chapter 4). The remaining dates provide accurate estimates of the ages of the sediment from which the samples were taken.

Interpretation of the pollen and molluscs from NM

The start of the profile documents the development of birch woodland within the surrounding landscape, with willow and juniper forming an early component of this environment, and male fern developing as the understorey. Bulrush was an early colonizer of the shallow waters around the island, though some of the Poaceae pollen probably derives from the local growth of reeds. The presence of the freshwater mollusc *Planorbis laevis*, towards the base of the deposits, indicates clear water with a stony substrate and poorly developed aquatic vegetation. The lake marginal environment developed rapidly, however, with the higher abundances of the mollusc *Valvata cristata* and the constant presence of *Bithynia tentaculata* in the overlying sediments suggesting well developed vegetation and a soft, muddy substrate (corresponding with zone NM-1c).

Hazel began growing in the landscape in zone NM-1d probably around 8620–8305 cal BC (9250±60 BP, Beta-104485), based on the dates from profile NAZ. The sharp increase in its pollen, and the corresponding decline in birch in zone NM-2, mark the replacement of birch woodland with hazel, along with the sporadic occurrence of elm and possibly oak on the island. These were well established before a date of 7785–7535 cal BC (8610±60 BP, Beta-86145), shading out the male fern understorey. Bulrush continued to grow at the edge of the lake, probably with reeds and sedges, with the transition from marl to detrital mud indicating the increasing quantities of wetland vegetation present in the local area.

Table 11.9. *Radiocarbon dates from Profile NM.*

Code	Depth (cm)	Date (BP)	$\delta^{13}C$ (‰)	Calibrated date	Material
Beta-86147	12–13	6160±50	-27.9	5285–4955	peat
Beta-86146	70.1–71.2	8250±50	-28.5	7460–7080	peat
Beta-86145	109–110	8610±60	-28.1	7785–7535	peat
Beta-86144	156–156.6	11400±60	-15.1	11,430–11,150	wood
Beta-86143	155.5–157.1	11410±60	-11.7	11,445–11,165	*Potamogeton* seeds

Microcharcoal concentrations throughout much of this period are very low, indicating a lack of burning caused by natural fires or human activity along the south side of the island at this time. It is interesting to note that the fire activity along the north side of No Name Hill (see above) during the Early Mesolithic is undetectable at this site. This implies that microcharcoal deposition was fairly localized, and fire activity or occurrence was limited in scale. There is, however, a peak in charcoal associated with a small decline in *Corylus*-type and *Betula* pollen at the top of zone NM-2, which may imply a period of human activity on this part of the island just prior to 7785–7535 cal BC (8610±60 BP, Beta-86145).

Hazel and elm woodland persisted across the island in the first half of zone NM-3, with oak and possibly pine growing locally from NM-3b, which is dated to 7460–7080 cal BC (8250±50 BP, Beta-86146). The higher concentrations of *Pinus* pollen probably indicate the local growth of the tree but settling out of pollen grains at the lake shore is also a possibility (Walker and Godwin 1954). Elm appears to decline slightly toward the top of the zone, though this may be an artefact of poorer preservation. Microcharcoal concentrations were higher throughout the zone and coincide with fluctuations in *Corylus*-type pollen suggesting some disturbance in the woodland canopy and possible human activity in the local area.

Alnus pollen increases at the start of zone NM-4, probably reflecting the formation of alder carr environments at the site as wetland succession entered its final stages. This is dated to just before 5285–4955 cal BC (6160±50 BP, Beta-86147), which is later than Day's (1996b) date of 6655–6270 cal BC (7640±85 BP, OxA-8042); but, as stated earlier, the transition is probably time transgressive within the landscape, and dependent on local soil conditions. Microcharcoal concentrations increase again, suggesting episodes of localized burning around this time. By the top of the profile, alder carr and wet heath had started to form at the pollen site.

Archaeological investigations

Fieldwalking and geophysical survey

Parts of No Name Hill were fieldwalked on three separate occasions during the course of the VPRT project; in 1986, 1991 and 1994. In all cases, the fields were walked a few weeks after ploughing. The methodologies employed varied between these different surveys.

In 1991 and 1994, an area 80 × 20 m on the western side of the island was gridded into 10 m squares. Each square was then walked for five minutes by two volunteers, with finds from different squares being bagged separately. The density of worked flint recovered from the surface was extremely low, with only two squares yielding material (two flints) on either occasion. Surface walkovers (without a fieldwalking grid) were also conducted in the eastern field in both those years. During these surveys, only formal tools were collected. The density of flint was significantly higher than on the western side of the island, and included diagnostically Neolithic material, as well as material dating to the Early Mesolithic.

In July 1984 an 80 × 80 m area on the crest of the hill was surveyed using an RM4 resistivity meter at a sampling interval of one metre. The results were processed on site using the Geoplot software package on a portable computer, and further enhanced using a more powerful generation of the software at the University of Durham. The results revealed a series of fans of low resistivity running from the top of the hill toward its edges, which probably resulted from the natural pattern of surface drainage (Kenyon 1984). Aside from a faint ring-shaped anomaly, no features of archaeological significance could be observed. This may be due to their absence, the impact of ploughing across the field, and/or the similarity between the fills of any surviving feature and the surface geology into which they were cut.

Excavations

Between 1986 and 1996, a total of 58 test-pits were excavated around the margins of the former island (Fig. 11.1). All were originally 2 × 2 m units, although five (LC, NY, NAK, NAM and NBA) were extended to 4 × 2 m so as to investigate subsurface features exposed during excavation. In addition, two 2 × 2 m units (NH and NI) were excavated on the crest of the hill and two 2 × 2 m more (NM and NAQ) were excavated away from island's edge in order to sample deeper, waterlogged peat and marl deposits for environmental analysis. The primary objectives of this work, as elsewhere in the Vale, were to identify areas of Early Mesolithic activity and to recover samples for dating and environmental analysis. This sampling programme led to the identification of two main areas of Early Mesolithic activity. The most significant of these lay along the former shoreline, at the northwest end of the island (roughly between test-pits NAK to NAP), from which a large sample of flint and a smaller quantity of faunal material, including antler-working waste and several barbed points, were recovered. The second area was a highly localized concentration, centred around test-pit NC, situated on a low spur on the southwest side of the island. Other, smaller and more localized scatters, were encountered elsewhere around the margins of the island.

Table 11.10. *Contexts assigned to the basal geology and the overlying mineral deposits that represent the Early Holocene land surface.*

Context	Description	Interpretation
508, 526, 530, 9027, 9054, 9129, 9130, 9334	Mixed sandy clay with gravel	Basal geology
9135, 9151, 9407	Blue clay	Basal geology
9130, 9136, 9148	Sandy gravel	Basal geology
9136	Sandy grit	Basal geology
9132	Clayey sand	Basal geology
527, 531, 9026, 9029, 9131, 9140, 9332, 9333, 9405	Sandy clay with high organic content	Early Holocene land surface
515	Coarse sand	Early Holocene land surface
504	Organic-rich clayey silt	Early Holocene land surface
9134	Organic-rich clay	Early Holocene land surface
9128, 9332	Sand with a high organic content	Early Holocene land surface

Stratigraphy

The basal geology was highly variable, probably reflecting its glacial origin, and consisted of clays, sandy clays and sandy gravels (see Table 11.10). In some test-pits (particularly those excavated on the more elevated parts of the island), these basal deposits were succeeded by a further mineral deposit, often containing a high organic content. These deposits are thought to represent the Early Holocene land surface (Table 11.10).

In the test-pits that were excavated through the deeper deposits in the former lake margins (Fig. 11.8), the basal geology was sealed by a sequence of wetland sediments (Table 11.11). At the base of this sequence were layers of marl, with a coarse component of aquatic plant material and reed that increased with height. This deposit was only present in the very deepest test-pits (NM, NAQ). Overlying this (or where it was absent, the basal geology) was a *Phragmites* reed peat [529/9204/9414/9420] (in test-pit NAZ this contained a thin layer of blue clay), which in the deeper test-pits was succeeded by further layers of reed peat with an increasing woody content [9412/9413], and ultimately by a wood peat [9033/9127]. In test-pit NAZ a thin band of highly humified peat lay within the wood peat, but was not assigned a separate context number. The wood peat was sealed by a very dark, humified woody detritus with a significant degree of root penetration [503/523/9121/9126/9141]. Overlying this was a friable, oxidized peat [502/506/522/9025/9125] that lay beneath the modern topsoil.

Table 11.11. *Context numbers assigned to organic deposits (and lenses/layers of mineral sediments within them).*

Context No.	Description
501, 521, 9024, 9124, 9401	Topsoil
9401a	Upcast sand and gravel
9408	Buried early modern topsoil
9030, 9137, 9330	Fine sand within the peat
502, 506, 522, 9025, 9125	Friable, oxidized wood peat
9121	Dark, humified fine grained detritus
503, 523, 9126, 9141	Dark, humified woody detritus with roots
507, 524	Reedy, woody detritus with clay and sand lenses
516, 526	Reedy, woody detritus
9033, 9127	Wood peat
9412, 9413	*Phragmites* reed peat containing more frequent wood
529, 9204, 9414, 9420	*Phragmites* reed peat
9142	Thin layer of reed peat overlying the marl
9143, 9144, 9145, 9146, 9147	Layers of marl, with increasing coarse component of aquatic and emergent plant material

Further upslope the sequence was more limited. The lower reed peats were generally absent (or very thin and poorly preserved), and layers of wood peat and humified peats lay directly over the basal mineral sediments (Fig. 11.9). In some places, a layer of fine sand [9030/9137/9330] had accumulated within these deposits. On the north of the site the upper peat deposits were also sealed by a layer of sand and gravel [9401a], upcast from the cleaning of a drainage ditch, and in some places, this sealed a buried, early modern topsoil [9408].

Natural and anthropogenic features

Two natural features were recorded during the excavations at No Name Hill. The first was an irregularly shaped hollow, 1.32 × 1.17 × 0.25 m, recorded in test-pit KAF cutting into the basal sediments. The hollow [9051] was filled by layers of sandy gravel [9034/9032] similar in composition to the Mesolithic ground surface

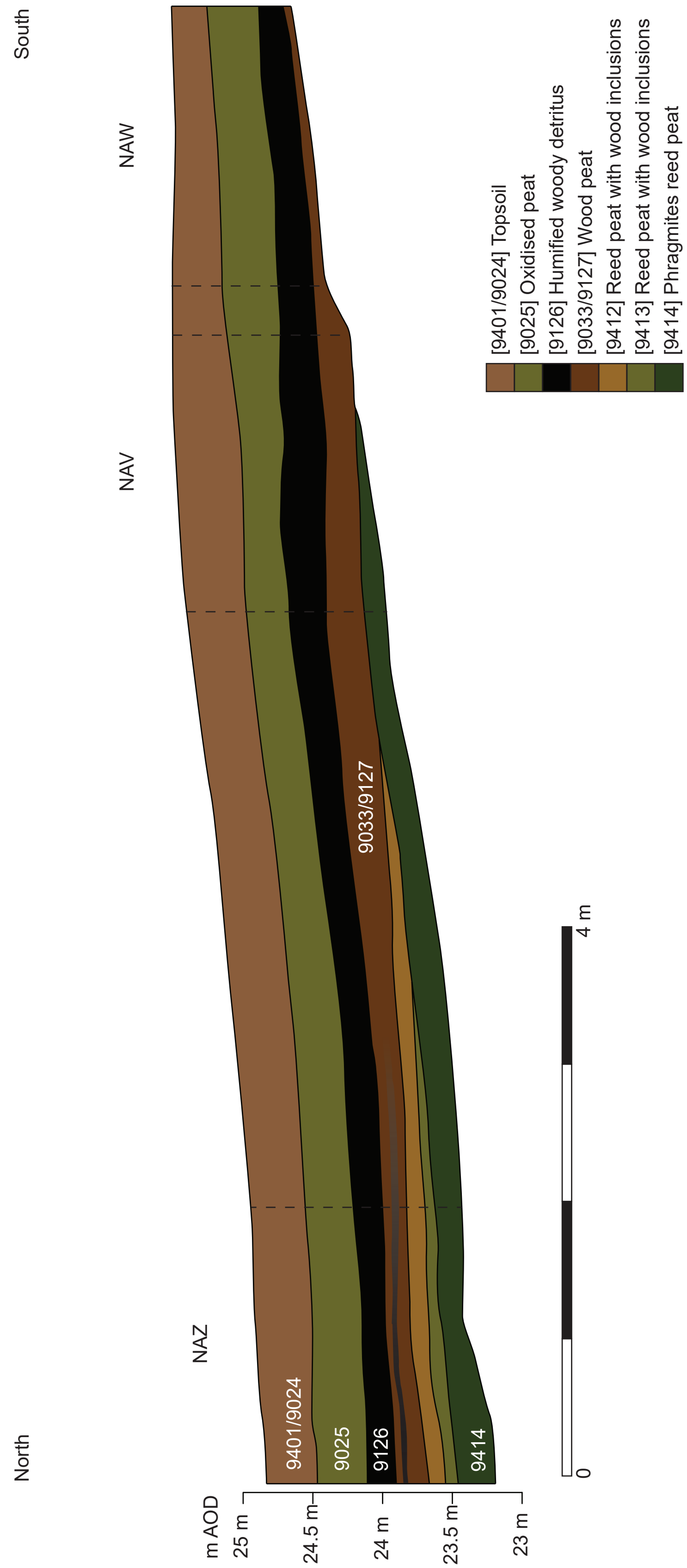

Figure 11.8. *Composite section through the wetland deposits on the north shore of No Name Hill, test-pits NAZ, NAV and NAW.*

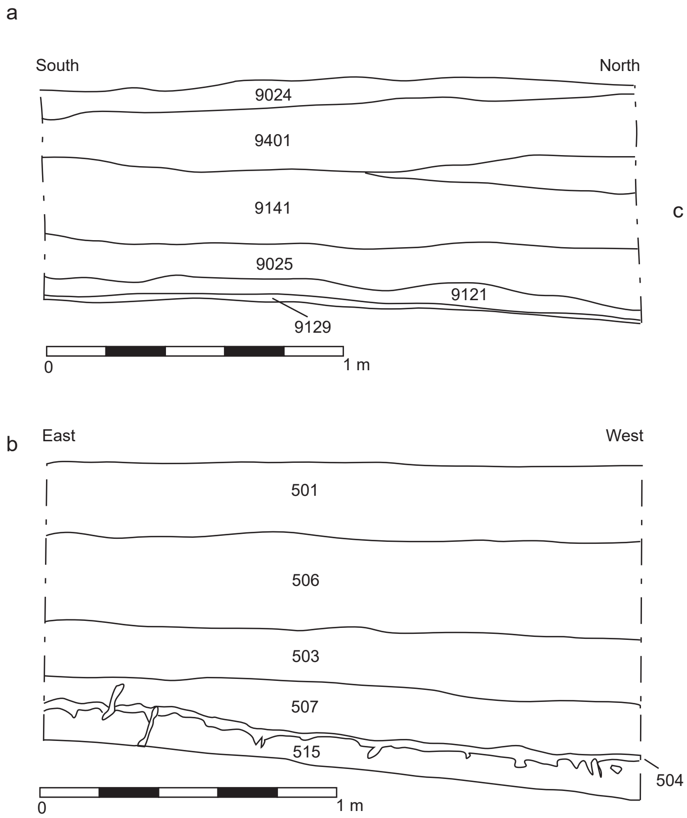

Figure 11.9. *Sections through the deposits on the upper slopes of No Name Hill. a) test-pit NAN, b) test-pit BK, c) test-pit NAC.*

and underlying geology, and probably represents the remains of a tree-throw. A similar (though smaller), irregularly shaped feature was recorded in test-pit NC and is also thought to have formed through natural processes.

Three anthropogenic features were also recorded cutting into the Early Mesolithic land surface. A circular feature, 0.44 × 0.35 × 0.35 m, was recorded in NAW, and had been filled by a clayey sand with a very high organic content and fragments of woody detritus (Fig. 11.10a). The feature lay on low-lying ground on the north shore of the island, very close to the lake shore, and would probably have filled with water after it had been dug. No direct evidence for its function was recovered, but it is conceivable that the feature was used to soak materials, such as antler, prior to working them.

A small, oval feature [9402] *c.* 0.70 × 0.60 × 0.35, with several large cobbles clustered around it, was recorded in NAL, overlooking the northwest shore of the lake (Fig. 11.10b). No direct evidence for the function of this feature was recovered but given its size and shape it may have acted as a pit. Three, small, refitting bladelets were recorded from the fill, and could represent some form of intentional deposition.

A small oval feature [9339], 0.66 × 0.32 × 0.30 m, was recorded in test-pit NAH on the southwest corner of the island (Fig. 11.10c). Flecks of charcoal and several large stones were observed in its fill [9332]. There is no evidence for the function of this feature.

Summary of the archaeology

An assemblage of 1400 pieces of worked flint and 85 fragments of animal bone and antler were recorded during the excavations and surveys at No Name Hill. The flint assemblage includes diagnostically Early Mesolithic, and both Early and Late Neolithic material. The Early Mesolithic material derives largely from the minerogenic deposits forming the Early Holocene land surface, though as at other localities a small degree of post-depositional movement had brought some of the flint into the peat immediately above it, and into the underlying geology. In the test-pits excavated along the island's shore and within the lake margins, Early Mesolithic flint was also recorded from the lower peat deposits, particularly the *Phragmites* reed peat (notably in NAZ) and the overlying wood peat (in NAV). These deposits formed during the Early Mesolithic, and the flint is considered to be *in situ*. On the higher ground, smaller quantities of flint were also present in the topsoil and the shallower peat deposits, and were probably brought into these sediments through ploughing. The later prehistoric material was restricted to the test-pits on the higher ground and was recorded

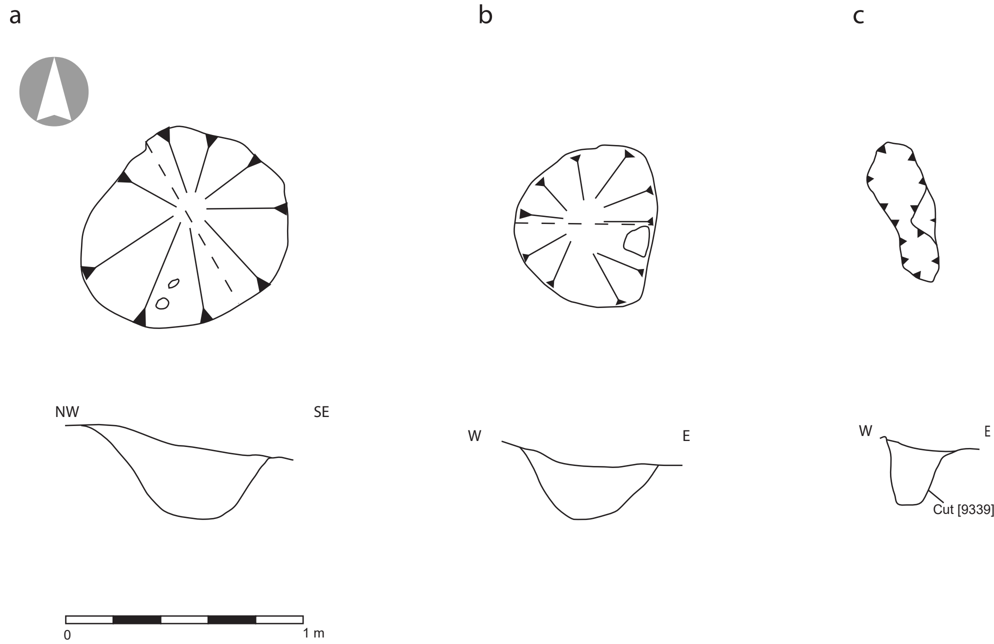

Figure 11.10. *Archaeological features at No Name Hill. a) Plan and section of small pit in NAW, b) Plan and section of small pit in NAL, c) Plan and section of small feature in NAH.*

from the topsoil (including during fieldwalking surveys after the site had been ploughed). The faunal material is undated (a single radiocarbon date, Beta-104484, on a fragment of antler from test-pit NAZ produced an erroneous age due to contamination by humic acid), but was derived from the Early Holocene land surface close to the former lake shore or from the lower reed peat and wood peat. All of this material is considered, therefore, to be Early Mesolithic.

The Early Mesolithic flint assemblages (see Chapter 15) can be broadly divided into two principal groups. The first consists of material from a series of test-pits excavated on the more elevated areas around the edge of the island (notably test-pits BJ, KAF, LC, NAN and NC). Here, the assemblages consisted of knapping debris, tools, and waste from the maintenance and repair of tools, which had been generated through activities carried out *in situ*. Burnt flint was also common, suggesting that these tasks were being carried out around hearths. There is no direct dating of any of these assemblages, and it is unclear whether they reflect contemporary episodes of activity or were produced on successive visits to the island.

The densest concentration of material (test-pit NC) consisted of 385 pieces, and was generated largely through the working of nodules of till flint. The early stages of core production are reflected in the debitage, but most of the cores were absent, having been taken either to another part of the site or elsewhere in the landscape. The remainder of the assemblage included two microliths, scrapers, and an awl, along with retouched flakes and blades, as well as an axe sharpening flake, microburins, and burin spalls, indicating a wide range of tool using and manufacturing activities. At test-pit BJ (149 pieces), knapping also focused on the early stages of core manufacture, after which the cores were removed, whilst at KAF (81 pieces) cores are over-represented in the assemblage. Microburins were present at KAF and NAN, indicating tool manufacture, and small numbers of tools were present (notably scrapers) as well as utilized or retouched flakes, blades, and fragments.

The second group is made up of assemblages from test-pits on the lower slopes of the island, either along the shore, or in some cases (notably NAZ) within the adjacent wetlands. These assemblages are generally smaller than those from the higher ground, are dominated by tools and utilized or retouched flakes and blades, and lack burnt material and evidence for knapping or tool manufacture and maintenance. There is a considerable degree of variability between these assemblages suggesting that they were generated through highly localized, specific task-based activities.

In test-pits NAR, NAS and NAY, these assemblages all derive from the minerogenic deposits forming the Early Holocene land surface at, or very close to the line of the Early Mesolithic shore. Tools are absent from all three test-pits, which consist

Table 11.12. *Radiocarbon dates from No Name Hill – archaeological contexts.*

Lab No.	Radiocarbon years BP	$\delta^{13}C$ (‰)	Calibrated date (cal BC)	Material	Context
Beta-104484	9510±60	-26.4	9140–8640	'Collagen' extracted with alkali from antler	Context [9420] at the base of NAZ

predominantly of flakes and blades (comprising at least two thirds of each assemblage), several of which are either retouched or have macroscopic traces of use. The same pattern can be seen in test-pit NAL, which lies on slightly higher ground above the shore. In these cases, the emphasis appears to have been on activities involving the cutting of material, such as the collecting or processing of plants or the butchering of animals. In contrast, the assemblage from NAW, also from the mineral sediments at the water's edge, included scrapers and a burin, as well as flakes and blades, suggesting a slightly broader range of activities.

In two cases, the assemblages derived from the wetland deposits, and reflect tasks that were being undertaken within the wetlands that formed in shallow water around the island's shore. In test-pit NAZ, the assemblage derived from the reed peat, and included two microliths as well as flakes and blades. This material was distributed through the basal 0.35 m of peat, and had clearly been deposited over a prolonged period of time. In NAV the flint was recovered from the reed peat and the overlying wood peat, and included a burin and and three microliths. Again, the assemblage was distributed vertically through the sediments, and had been generated through multiple episodes of activity. Not all the tools found in these test-pits necessarily reflect tasks carried out *in situ*, however, as an axe was recovered from the reed peat in NAZ. This had presumably been lost, discarded, or perhaps intentionally deposited in the lake-edge wetlands.

The faunal assemblage (see Chapter 17) consisted of 85 specimens, of which 43 could be identified to species, notably elk and red deer, but also roe deer, aurochs, horse, and wild boar. Over half of the identifiable specimens were teeth, though fragments of limb elements were also present, as were red deer antler. The high proportion of teeth is partly a product of preservation, as three wild boar mandibular teeth (in NAZ) were found together in their correct anatomical positions suggesting that part of the mandible itself must have been present as these were deposited. All but one of the unidentifiable fragments derived from limb elements of medium to large mammals.

Four pieces of red deer antler were recorded during the excavations, two from the lower reed peat in test-pit NAZ, and two poorly preserved fragments from the Early Holocene land surface in test-pit NC. One of the pieces from NAZ was the well-preserved base of a left, red deer antler, consisting of the brow tine, part of the beam, and the pedicel. The portion of beam shows evidence for working using the groove and splinter technique and was probably used to produce barbed projectile points. Fragments of three projectile points (two made from antler, the other from bone) were also recorded at the site (see Chapter 17). Two of these (a broken tip of a bone point, and the mid-section of an antler point) were recorded from the base of test-pit NAZ (the same context and level as the worked antler), the third, a larger example broken at both ends, was recorded from the wood peat in test-pit NAO. These finds represent the largest assemblage of barbed projectile points that has been recorded in this landscape other than those from Star Carr (the only other point was recorded at Flixton Island).

Dating

A single radiocarbon date (Beta-104484) was obtained on a piece of shed antler from the base of test-pit NAZ. However, the $\delta^{13}C$ of -26.4‰ clearly shows the collagen had been contaminated by humic and fulvic acids from the encompassing layer, and consequently the determination is unlikely to be an accurate indication of the age of the antler (see Chapter 4, for further discussion). The details of this sample can be found in Table 11.12.

Discussion

This chapter describes the work carried out by the VPRT at No Name Hill between 1986 and 1996. Early Mesolithic archaeological material was first discovered at the site in the 1940s by John Moore, and the area was the locus of some limited palaeoenvironmental investigations in the 1950s and again in the 1980s, by Walker and Godwin (1954) and Cloutman (1988a), respectively. From the mid-1980s, the VPRT undertook new auger surveys of the site and excavated 2 x 2 m test-pits along the approximate position of the Mesolithic lake shore, whilst the top of the island was investigated through fieldwalking and small-scale test-pitting. This work showed that *in situ* Early Mesolithic material culture was present both within and immediately adjacent to the lake-edge deposits, with smaller quantities of Early Mesolithic and Neolithic material on the higher ground, much of which has been disturbed by modern agricultural activity. Three pollen profiles were recorded from around No Name Hill; NAZ and NAQ on the north shore of the island and NM some 50 m or so to the south of the island, and span much of the period

At the start of the Mesolithic, No Name Hill would have formed a small island in the western side of Lake Flixton. An area of relatively deep water separated it from the lake shore at Seamer Carr, some 600 m to the northwest, with much shallower water lying to the southwest toward Flixton Island. Wetland vegetation, including beds of *Phragmites* reeds and cattails, would have been present in the shallow water around the island within the first few centuries of the Mesolithic, while ferns grew amongst birch, willow, juniper and possibly beech on the drier ground above the shore. Hazel was growing on the island from 8620–8305 cal BC (9250±60 BP, Beta-104485), its local growth reflected in the presence of hazel nuts in test-pit NAZ, and probably formed a significant component of the local woodland by the start of the Late Mesolithic, as ash, elm and oak gradually also became established. At the same time, fen environments were forming along the shore, probably with willow at the wetland's edge, while reed swamp expanded further into the basin, replacing areas of previously open water. By the end of the Mesolithic, alder was growing on the island, probably colonizing the areas of fen that were present around the former shoreline, while a mixed woodland of hazel, oak, elm and lime was present over the higher ground.

Early Mesolithic activity was relatively extensive, with lithic scatters recorded along the northern and western shores, and on the adjacent higher ground. Given the depth of water around the island, and the distance from the lake shore, people must have used boats when visiting the site, bringing with them flint nodules, pre-prepared tools, and parts of the carcasses of animals. The lake shore area and the adjacent wetlands were a focus for a range of craft activities, that included the working of antler to produce barbed points, the butchery and processing of animal carcasses, and probably the harvesting and use of wetland plants. Away from the shore, people knapped flint to produce tools that were used and then discarded, or taken away and used elsewhere, while the presence of an axe and sharpening flake, along with the wood recorded from the test-pit NAZ, suggests the harvesting and working of willow coppice.

Not all of the archaeological material from No Name Hill necessarily reflects economic activity. To begin with, there are the broken barbed antler points recorded from the wetland deposits in test-pits NAO and NAZ. These artefacts have a limited distribution in this landscape, and their deposition may be limited to particularly important places around the lake (see Conneller and Schadla-Hall 2003). The tranchet flint axe recovered from the wetland deposits in NAZ is also unlikely to have been a casual loss given its depositional environment, while the lack of a wooden handle suggests that it had also been disassembled prior to deposition. Similar practices of curating and disassembling artefacts prior to deposition have been recorded at Star Carr (Taylor et al. 2017, 2018b). There, complete and partially damaged barbed points were decommissioned through de-hafting before being deposited into the lake along with curated, broken parts of other barbed points. Other artefacts, including antler axes were also de-hafted prior to being deposited into the lake along with antler frontlets and elements of the faunal assemblage (Taylor et al. 2017, 2018b). The material from Star Carr has been interpreted as reflecting appropriate ways of disposing of particular types of material or artefacts (Taylor et al. 2017, 2018b), and the material from No Name Hill may reflect the same tradition.

As with other localities around the lake, No Name Hill was visited on multiple occasions throughout the Early Mesolithic. As noted above, the flint and faunal material from NAZ was distributed through the lower 0.35 m of sediment and must have been deposited over a period of time. Though none of this is dated, the earliest material lies in the basal sediments, which on the basis of the pollen was forming in the early centuries of the period, while the upper limit of the assemblage is stratigraphically above a sample from the adjacent pollen profile, which was radiocarbon dated to 8620–8305 cal BC (9250±60 BP). As such, activity must have occurred at various points over a period of centuries. This is supported by the peaks in microcharcoal recorded in pollen profiles NAZ and NAQ. Of these, two of the peaks in profile NAZ occur within the vertical range of the lithics and faunal material recorded from the same trench, with the third and fourth peaks pre-dating 8220–7755 cal BC (8850±50 BP, Beta-104486), while a major burning event in NAQ occurs prior to the appearance of hazel, and so is also of Early Mesolithic date. While it is not possible to determine how long these periods of burning lasted, the vertical range of the microcharcoal within the pollen profiles suggests durations of decades, or possibly centuries. If the burning is taken as a proxy for human activity this suggests that the island acted as a focus for activity on multiple occasions over decadal or even centennial timescales.

These periods of activity also coincide with short-lived changes to the local vegetation recorded in the pollen profiles. The clearest record from the north of the island, profile NAQ, documents repeated declines in birch pollen, coinciding with increases in ferns and grasses, the appearance of beech pollen, as well as fluctuations in plants of the sedge family and marsh fern. Taken together, this suggests short periods when parts of the island's vegetation cover was more open, creating spaces for grasses and ferns to flourish, and for beech to become established, along with the disturbance of the plant communities growing along the shore. The short duration of these changes suggests that this was not the result of intentional management, but the consequences of other forms of human activity, such the felling of trees or the lighting of fires.

The lack of diagnostically Late Mesolithic material culture is somewhat surprising given the evidence for localized burning in pollen profile NM. As discussed above, there is a peak in charcoal concentration at 7785–7535 cal BC (8610±60 BP, Beta-86145), and increased levels of microcharcoal occurring around 7460–7080 cal BC (8250±50 BP, Beta-86146), and 5285–4955 cal BC (6160±50 BP, Beta-86147). Though the durations of these events are not dated, their vertical range suggests periods of burning that span multiple decades or centuries. One possibility for the lack of archaeological evidence is that flint collectors, who were active in the area during the mid-twentieth century, may have removed much, if not all of the later material on the high ground on top of the island. However, it is also possible the burning relates to activities that left little material trace, such as the management of the local vegetation. What we can say is that, after the Mesolithic, No Name Hill continued to be visited by human groups as reflected in the small quantities of Late Neolithic and Bronze Age material that was recovered during test-pitting and fieldwalking on the top of the island. Interpretation of this material is limited as it lacks its original context, but at the very least it shows the continued importance of this location in later prehistory.

Chapter 12

Barry's Island

Paul Lane, Barry Taylor, Ian Bailiff, Chantal Conneller, Gaynor Cummins, Geoff Smith & Tim Schadla-Hall†

Barry's Island (NGR 50613 48037) is the name given to a low hillock situated towards the eastern end of the former Lake Flixton (Fig. 1.2). The site was selected for augering and sample excavation in 1992. Subsequently, the landowner, Mr Barry Kitchen (after whom the site is named), brought to the Trust's attention an assemblage of worked flint recovered from the top of the hill during the construction of agricultural buildings in the 1970s. This included mostly Late Mesolithic, Neolithic, and Early Bronze Age material, although a few pieces could be Early Mesolithic in date.

Further surveys and excavations were undertaken at the site from 1993–6, aiming to reconstruct the subsurface topography, and sample the former shoreline for evidence of Mesolithic occupation (Fig. 12.1). As a result, 1633 pieces of worked flint (both Early and Late Mesolithic) and a relatively large assemblage of animal bone (591 specimens) were recorded from deposits on the northwest side of the site. Much of this material derived from a layer of sand within the peat sequence, thought to have been deposited through the action of a stream in the Late Mesolithic, probably redeposited from an as-yet unknown location. The assemblage is of mixed age, with diagnostically Early and Late Mesolithic flint, and faunal material radiocarbon dated to the end of the Late Glacial and the Late Mesolithic. *In situ* assemblages of Early Mesolithic flint and animal bone were recorded from below this horizon, and both Early and Late Mesolithic material was recorded from the more elevated areas of the site, reflecting several episodes of human activity in this part of the Lake Flixton basin.

Auger surveys

An area of *c*. 36,700 m^2 at Barry's Island was augered at 20 m intervals over the course of the 1992 and 1993 seasons. This showed that during the Mesolithic the area consisted of a small, low hill, roughly 230 × 120 m and with a maximum elevation of 27.75 m AOD, oriented roughly northeast to southwest (Fig. 12.1). The top of the hill gently dropped away to *c*. 26 m AOD, after which it formed a steep slope toward the former shoreline. The initial augering results suggested that the area of higher ground had been surrounded by open water, leading to the site being designated Barry's Island. However, subsequent surveys demonstrated that, despite its name, the hill was connected to the edge of the basin by a very low-lying neck of land to the southeast. The augering also showed that the sand layer within the peat was restricted to the northwest and northern sides of the hill.

Palaeoenvironmental research

Gaynor Cummins

Two pollen profiles were recorded from Barry's Island, one (LAL) *c*. 22 m to the west of the hill, the other (LAP) to the north (Figure 12.1). Both were obtained from the sequence of organic deposits that had formed over the sand layer.

Profile LAL

Profile LAL was recorded from samples taken *c*. 22 m to the west of the approximate line of the Early Mesolithic shore (Fig. 12.1). The sedimentary sequence comprised grey sands (the top of the stream derived deposit) overlain by detrital muds. All depths were measured from a datum of 25.38 m AOD. The lithostratigraphy is shown in Table 12.1.

Table 12.1. *Lithostratigraphy of Profile LAL.*

Depth (m)	Description
0–1.08	Dry crumbly oxidized peat
1.08–2.33	Orange-light brown coarse, woody detrital mud.
2.33–2.43	Brown herbaceous detrital mud
2.43–2.45	Light grey coarse sand (stream deposit)

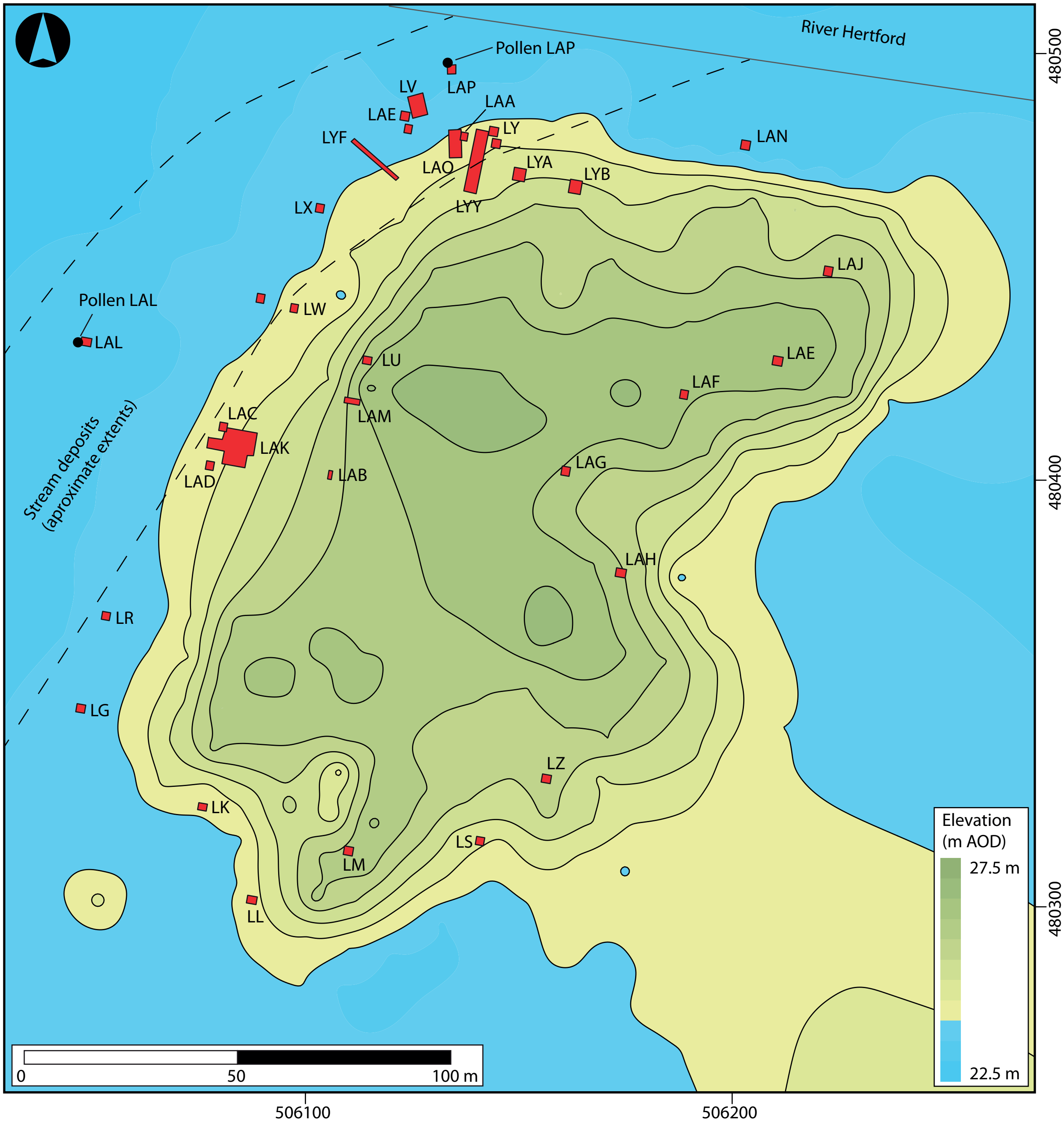

Figure 12.1. *Excavated areas and pollen sampling points at Barry's Island, with the estimated position of stream deposit (level of the lake shown at 24 m AOD).*

Pollen analysis

Samples were retrieved from a monolith tin taken from the east-facing section of test-pit LAL. Subsamples for pollen analysis were taken every 1–4 cm. The pollen diagram consists of one local assemblage zone (prefixed LAL) (Fig. 12.2).

LPAZ LAL-1 200–243 cm

Corylus-Alnus-Quercus-Ulmus

Corylus-type was the dominant woodland tree/shrub at 40% TLP. *Alnus* percentages were already at 15% at the bottom of the profile rising sharply immediately above the with the underlying sands. *Quercus* and

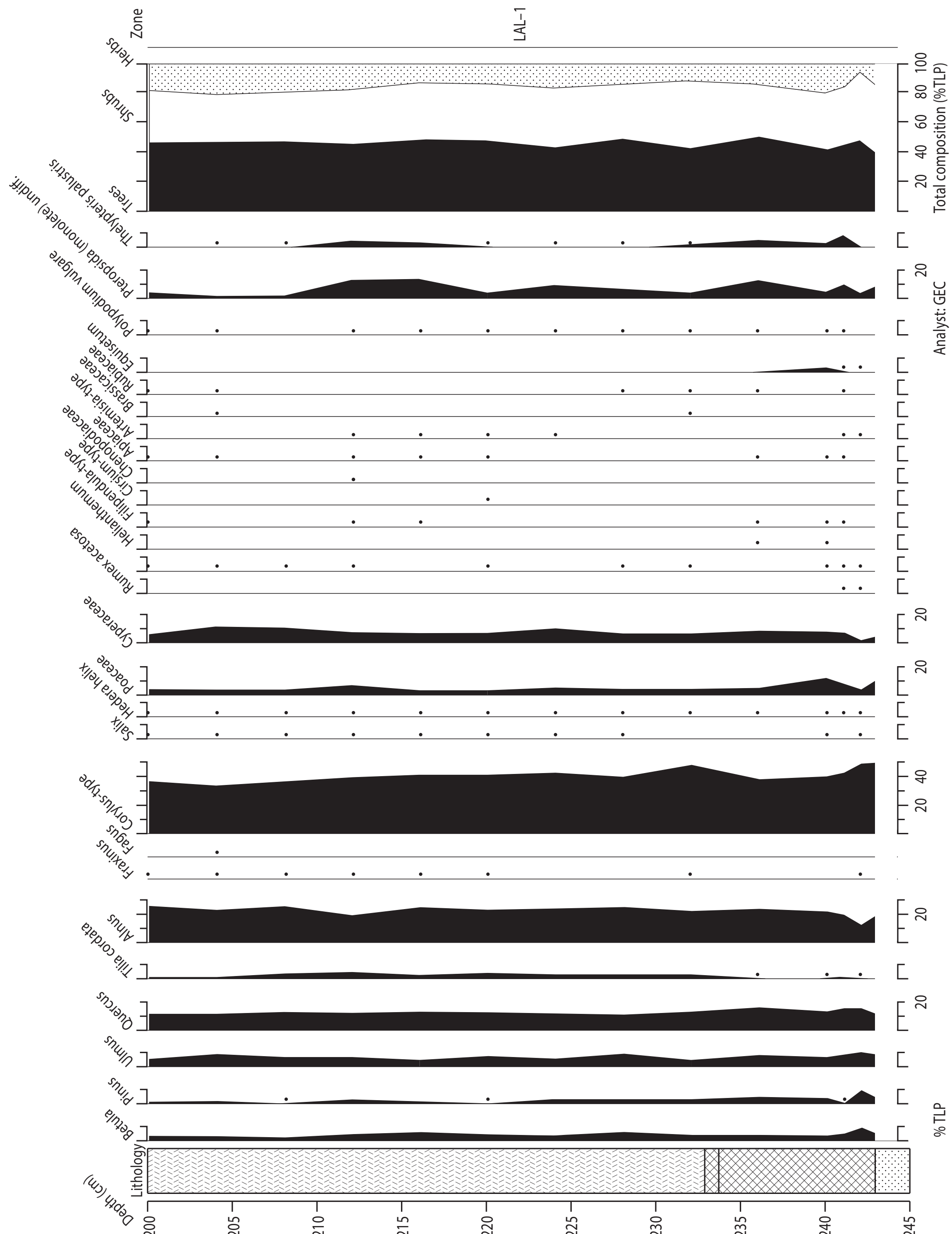

Figure 12.2. *Pollen diagram for Profile LAL.*

Ulmus are also important woodland pollen producers with a smaller but significant contribution from *Tilia* and *Fraxinus* by the top of the profile. Herb and ruderal percentages contribute 15–20% TLP throughout the zone and diversity is high.

Dating
No radiocarbon dates have been obtained for this sequence due to the apparently young age of the sediments.

Interpretation
Alder carr was forming on the wetter parts of the site following the deposition of the sand layer. This probably included the area immediately around LAL, given the presence of woody detritus within the deposit. On the dry land there was mixed woodland of hazel, oak, and elm, with a fairly substantial component of lime on the moist, fertile soils, and ash was just becoming established within areas of secondary woodland. The diversity and proportion of herbaceous taxa within the pollen, which includes a range of ruderals, suggests areas of destabilized soil or disturbance. These may be attributable to disturbances by later Mesolithic activity, wild animals, or natural soil erosion.

Profile LAP
The profile was recorded from samples taken from the sediments overlying the stream deposit *c*. 5 m north of the approximate line of the Early Mesolithic shore (Fig. 12.3). All levels were measured relative to a datum of 25.27 m AOD. The lithostratigraphy is shown in Table 12.2.

Pollen analysis
Samples were retrieved from a monolith tin taken from the south-facing section of test-pit LAP. Only the deposits above the trapped sand layer were sampled (135–167 cm). Subsamples were taken for pollen analysis every 4–8 cm. The pollen diagram (Fig. 12.4) is split into two local pollen assemblage zones (prefixed LAP).

LPAZ LAP-1 167–182 cm
Alnus-Corylus-Quercus
Dominated by deciduous tree and shrub pollen which accounts for up to 90% of TLP. Poaceae is the only herb pollen type recorded in significant values.

LPAZ LAP-2 135–167 cm
Alnus-Corylus-Quercus-Cyperaceae
Corylus-type is dominant, contributing over 40% TLP, though its pollen drops by 10–15% for 25 cm of the zone before recovering its original values. *Alnus* is already established at 20% TLP at the start of the zone but declines briefly in mid-zone. *Betula* is no longer significant but *Tilia* and *Ulmus* pollen are consistently present. Cyperaceae peaks during the *Alnus* decline before dropping to insignificant levels by the top of the profile.

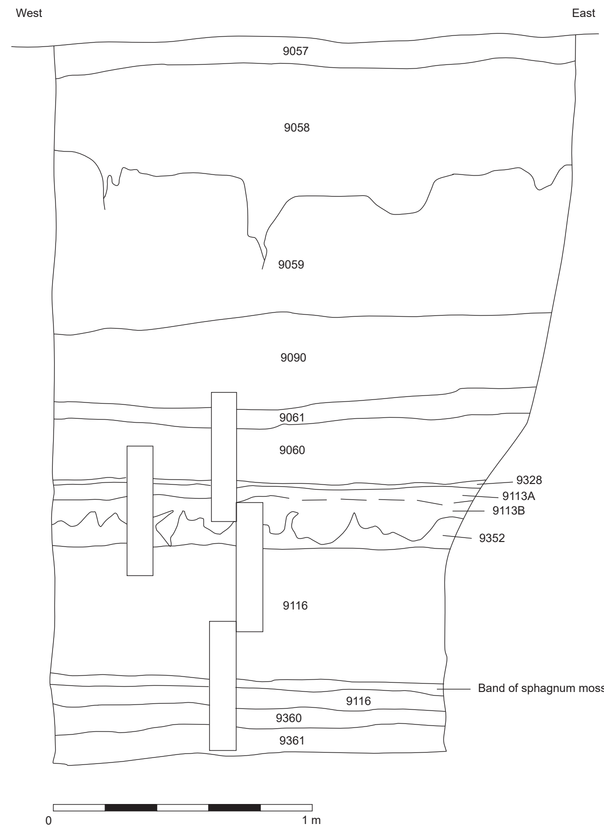

Figure 12.3. *South-facing section of test-pit LAP, showing the position of the monolith tins.*

Dating
Two samples were submitted for radiocarbon analysis, the results are presented in Table 12.3. The dated samples give accurate ages for the deposits on either side of the trapped sand (see Chapter 4).

Table 12.2. *Lithostratigraphy of Profile LAP.*

Depth (m)	Description
0–1.33	Black crumbly oxidized peat
1.33–1.67	Dark brown reed peat with Cyperaceae and other vegetative remains
1.67–1.82	Orange to black coarse oxidized sand (stream deposit)
1.82–1.90	Dark brown reed peat with Cyperaceae and *Phragmites* vegetative remains

Table 12.3. *Radiocarbon dates for Profile LAP.*

Lab Code	Depth (cm)	Date (yrs BP)	$\delta^{13}C$ (‰)	Calibrated age (cal BC)	Material
Beta-94438	164–167	6140±60	-28.2	5290–4905	peat
Beta-94437	182.5–185	8850±50	-28.0	8220–7755	peat

Interpretation
The sand was laid down after 8220–7755 cal BC (8850±50, Beta-94437), with peat formation resuming from 5290–4905 (6140±60, Beta-94438), in an environment of alder and sedge carr, with a mixed woodland of hazel, oak and elm on the surrounding drier ground.

Particle Size Analysis
Samples were taken through the sand layer at the following depths (in cm): 168–169, 170–171, 173–174, 175–176, 177–178, and 179–180. The results are shown in Fig. 12.5.

The sand layer shows a slightly positively skewed, very selective depositional event. Consisting mainly of medium to fine sand, the grain size distribution is bimodal with large flint and bone pieces (not represented in the graph). The deposit is highly sorted, and such selective transport occurs at very specific velocities, suggesting that the sample is either windblown or a very well sorted water event. Due to the large deposits of slightly polished flint and bone the latter scenario is more likely. The particle size data also suggests that the stream current had a high competence, flowing with a bed load of pebbles, bones, and flint in a supporting matrix of quartz sand. Cohesion in the sediment is low due to the low clay content, as the strong river current carried away the fine particles during high velocity discharge events. Deposition was probably contemporary throughout the sand layer as the grain size profiles are all similar. The deposit could have been caused by a high-speed flood. The sediment underwent selective deposition due to the decreasing energy of the transporting process. In order to deposit the larger fraction (>2 mm) as well as the smaller fraction, the transporting process would have had to have undergone an abrupt decrease in velocity.

Metals Analysis
Erosion appears to peak at 175–176 cm when there is a synchronous peak in sodium, potassium and magnesium. Preferential mobility of manganese at this level indicates reducing conditions within the sediments.

OSL Dating trench LYY
Ian Bailiff

A single OSL date (Table 12.4) was obtained from a sample of the sand layer in trench LYY (see Fig. 12.1 for the location of the trench; also Fig. 12.6).

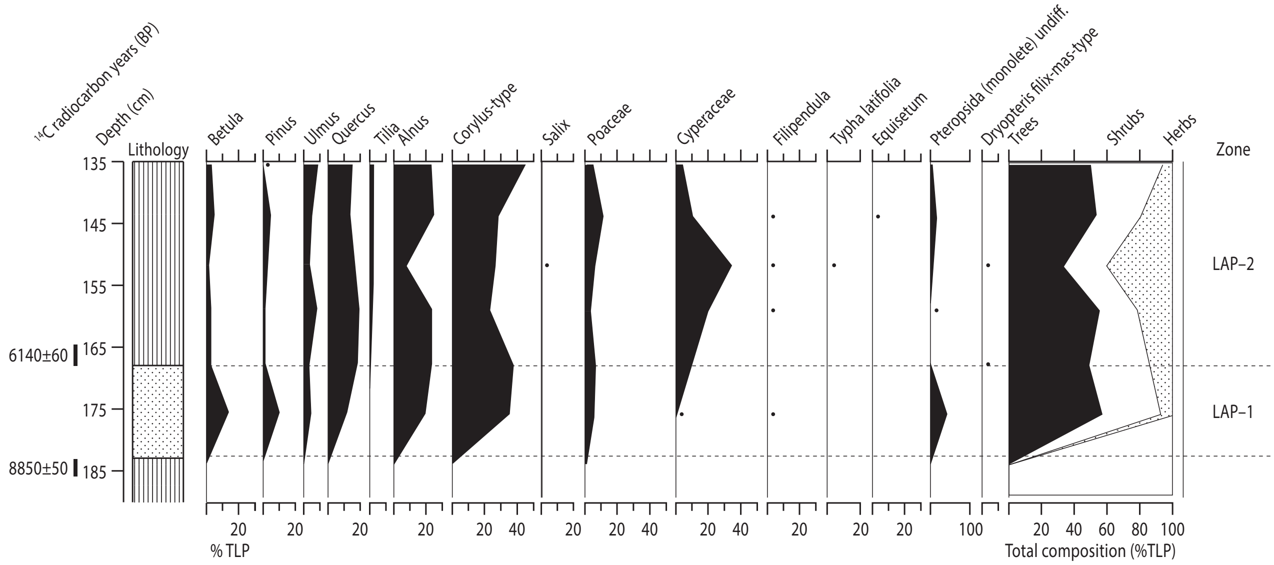

Figure 12.4. *Pollen diagram for Profile LAP.*

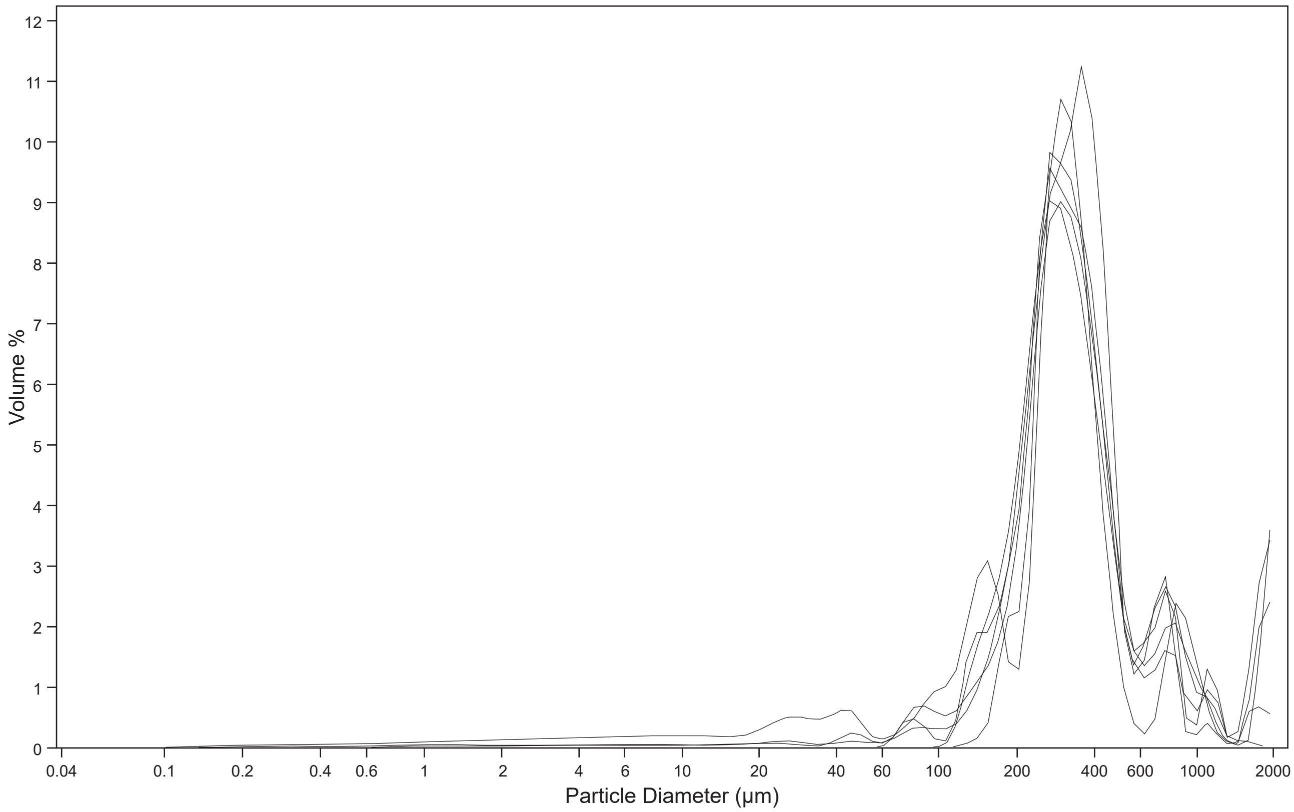

Figure 12.5 *(above). Particle Size Analysis, Profile LAP.*

Table 12.4. *OSL date from the stream deposit in trench LYY.*

Lab Code	OSL Date (1 sigma)	Date measurement taken	Context
Dur178-1 Folkton LYY 9113	6745±890	1998	9113 (upper 50 mm)

Discussion of the palaeoenvironmental research and dating

The sand layer was probably deposited through a high energy fluvial event, most likely a stream that ran across the peat deposits to the west of Barry's Island. The date on peat immediately below the sand in test-pit LAP is significantly older than the OSL date of 6745±890 BP from trench LYY, and the organic deposits may have been truncated by the action of the stream. This is supported by the particle size data, which suggest that the stream current had a high competence, and the traction load, in addition to and as a consequence of the high velocity, probably

Figure 12.6 *(left). Sampling the trapped sand layer, Context 9113, in LYY, August 1993 (Photo Paul Lane).*

caused downward erosion of the peat surface. When the stream met the deeper parts of the basin on the north edge of the site, the stream dropped its bed load as a sand layer over the peat. In order to flow over the peat, the vegetation would have had to have been fairly dry, low-lying, and easily flattened. The date on the peat immediately on top of the sand in LAP indicates that organic sedimentation resumed from *c*. 5290–4905 cal BC (6140±50 BP, Beta-94438), with the pollen from both profiles showing that alder carr had become established over the stream.

The source of the stream may have been the Cowton Beck, which is known to have been a shifting and episodic stream bed in the past, but is now canalized and feeds into the River Derwent. Before canalization, it was one of a series of relict channels that can be traced from the foot of the Wolds *c*. 200 m apart, running northwards toward the centre of the Vale.

Archaeological investigations

A total of 35 trenches were excavated at Barry's Island between 1992 and 1996. These included 2 × 2 m test-pits as well as a few larger, hand-excavated trenches (Fig. 12.1). The initial objective of these excavations was to sample the area along the approximate line of the Early Mesolithic lake shore as well as some of the areas of higher ground on the top of Barry's Island. During this early work, a relatively large assemblage of worked flint and faunal material was recovered from a layer of sand within the peat in test-pit LY, which was subsequently identified as a stream deposit. Consequently, the excavation strategy was modified to investigate this deposit, with the aim of determining its spatial extent and recovering a larger sample of archaeological material. To this end, a single trench (LYY), 15 m long and 3 m wide was excavated across the sand layer immediately west of LY. As well as showing that the sand extended further to both the west and north, this work also confirmed that the underlying horizons of peat and sand contained *in situ* Early Mesolithic material. Subsequent excavation in this section of Barry's Island between 1994 and 1996 provided a better indication of the sand's extent, as well as sampling other parts of the shoreline and the more elevated parts of the peninsula.

Stratigraphy

The basal minerogenic deposits were highly varied across the site, consisting of coarse sandy gravel, sandy clay, and boulder clay. These were overlain by further minerogenic deposits, typically coarse sand, silty sand, or sandy clay, often with a high organic content and traces of woody detritus (Table 12.5).

Table 12.5. *Contexts assigned to the basal geology and overlying mineral deposits representing the Early Holocene land surface.*

Context	Description	Interpretation
9068	Sandy clay with gravel inclusions	Basal geology
9083, 9101, 9107	Boulder clay	Basal geology
9087, 9118, 9312, 9362	Sandy gravel	Basal geology
9066	Coarse sand	Early Holocene land surface
9117, 9104	Silty sand with gravel	Early Holocene land surface
9114	Clayey sand with a high organic content	Early Holocene land surface
9164, 9361	Coarse sand with a high organic content	Early Holocene land surface
9069	Lenses of coarse sand and fine detritus mud within or over 9066 and 9324	Early Holocene land surface
9310	Coarse sand with gravel	Early Holocene land surface
9324	Silty sand	Early Holocene land surface

In the lower-lying areas of the site, these basal deposits were sealed by woody detrital muds [9065/9104] and wood peats [9105/9116/9332] that represent the initial phase of organic sedimentation in the shallow lake margins. In places this was succeeded by a more mixed woody detritus with a high sand content and gravel inclusions [9352].

Across the northwestern side of the site the organic sediments were then sealed by a thick layer of coarse sand [9113/9113a] or gritty sand [9162] interpreted as a stream deposit (Fig. 12.7, 12.8a-c, Table 12.6). Auger surveys showed that this deposit extended at least 50 m further west than the excavated areas but no further than 15 m to the north. In some places, the lower part of the deposit had a higher organic content [9163], or contained woody detritus and gravel [9113b], and was distinct from the purer sand in the upper part of the deposit.

The stream deposit was succeeded by a sequence of organic sediments. In some areas this began with a mixed sandy reed peat [9100] or sandy woody detritus [9161/9328]. This reed peat/woody detritus (or where it was absent the stream deposit itself), was succeeded by a dark humified peat, sometimes containing fragments of wood. A radiocarbon date from pollen profile LAP on the peat sealing the stream deposits shows that this was forming by 5290–4905 cal BC (6140±60 BP, Beta-94438). In some places, this humified peat formed two distinct layers separated by a better preserved *Phragmites* reed peat [9060/9062]. These deposits were

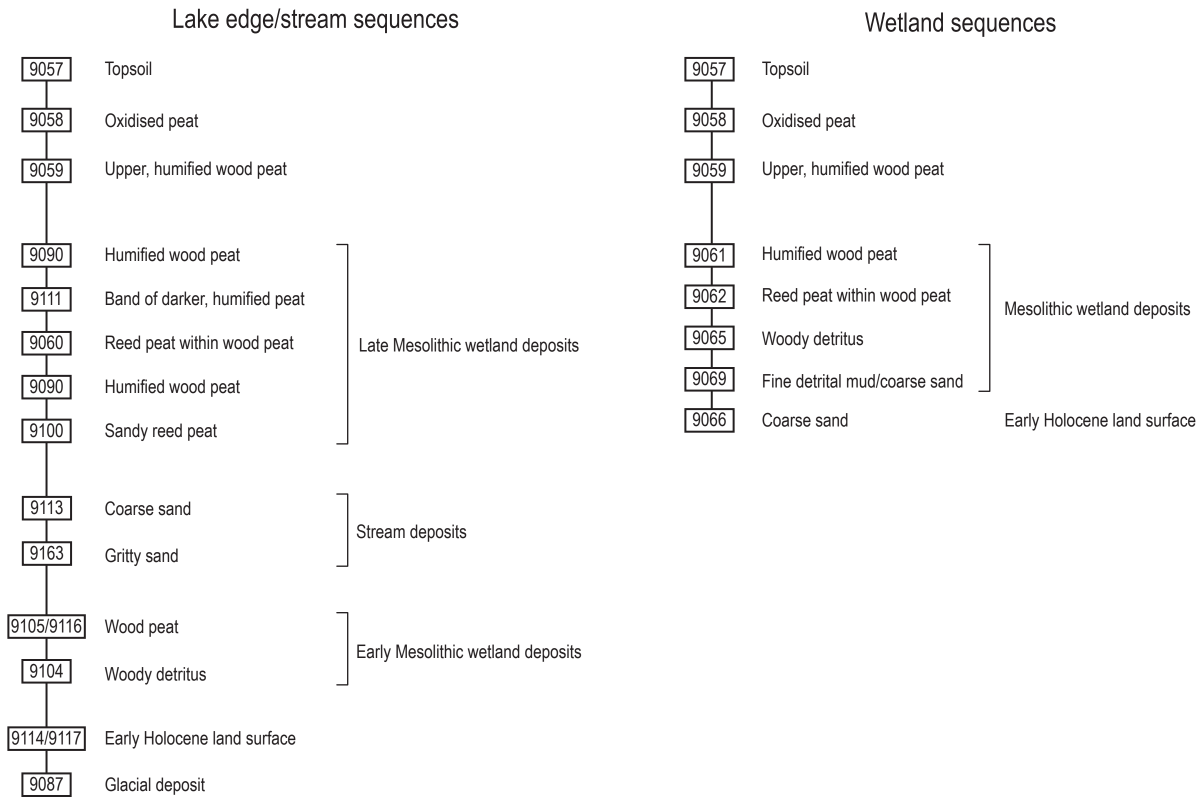

Figure 12.7. *Summary Harris matrices for Barry's Island (prepared by Geoff Smith).*

Table 12.6. *Contexts assigned to the organic sediments and the stream deposits.*

Context No	Description	Phase
9057, 9308	Topsoil	Post-stream organic sediments
9058, 9309	Oxidized, friable peat	
9059	Humified wood peat	
9090	Upper layer of dark humified peat, with some fragments of wood	
9060, 9062	*Phragmites* reed peat	
9111, 9061, 9160	Dark humified peat, with some fragments of wood	
9161, 9328	Sandy woody detritus	
9100	Sandy reed peat	
9115	Lens of pure coarse sand within 9113	Stream deposit
9162	Gritty sand overlying 9163	
9163	Gritty sand with high organic content	
9113a	Coarse sand overlying 9113b	
9113b	Coarse sand with inclusions of gravel and woody detritus	
9101, 9113	Coarse sand	
9352	Mixed woody detritus with sand and gravel inclusions overlying 9105, 9116	Pre-stream organic sediments
9105, 9116	Wood peat	
9332	Slightly humified woody detritus	
9064	Lenses of sand within 9065	
9065, 9104	Woody detritus mud with a high sand content	

Figure 12.8. *The relationship between the stream deposit and the early and later deposits. a) LYY, b) LAO.*

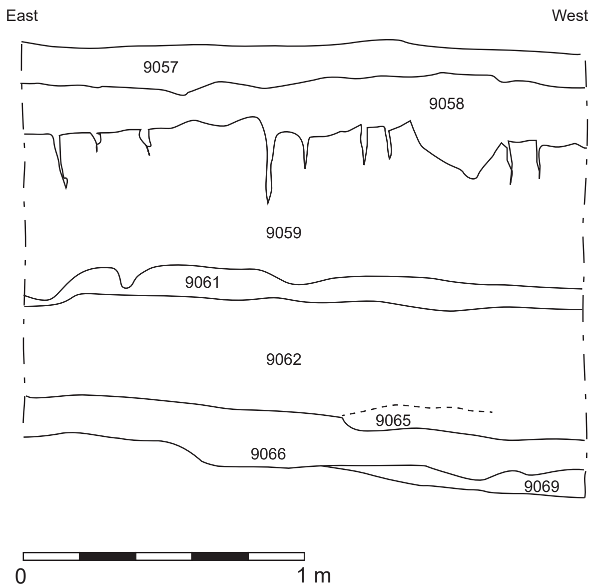

Figure 12.9. *Section through the wetland deposits away from the stream on the west side of Barry's Island in test-pit LG.*

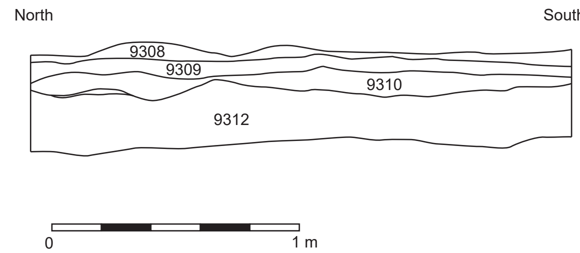

Figure 12.10. *Section through the deposits on the higher ground of Barry's Island in trench LAB.*

then succeeded by a humified wood peat [9059], an oxidized friable peat [9058, 9309], and the modern topsoil (Fig. 12.8 a-b).

Around those parts of the site where the stream deposit was absent (to the south, east, and northeast) the basal mineral deposits were succeeded by a similar sequence of organic sediments to those that had formed over the stream (Fig. 12.9). These became progressively thinner, and less well preserved toward the crest of the hill, with the stratigraphy over the basal geology on the most elevated areas consisting only of friable humified wood peat, friable oxidized peat, and topsoil (Fig. 12.10).

Natural features

Natural hollows were recorded cutting into the Early Holocene land surface in test-pits LM, LYB and LYY. These consisted of oval shaped depressions filled with mixed deposits of peat and the underlying natural geology [9081, 9083] or, in one case, with a coarse sand with a high organic content [9114, 9119]. These have been interpreted as the remains of tree-throws.

Summary of the archaeology

An assemblage of 1633 pieces of worked flint and 591 fragments of animal bone was recorded during the excavations at Barry's Island. An additional 414 pieces of worked flint were also recovered by the landowner during the construction of agricultural buildings on the site prior to the archaeological investigations. A significant proportion of these assemblages had been redeposited by the Late Mesolithic stream, and this material is therefore not indicative of activity taking place on or around Barry's Island. Whilst much of the redeposited material can be identified, because it lies within the stream bed (and hence can be discounted from any reconstructions of Early Mesolithic activity), post-depositional processes have also moved some of it into the overlying and adjacent deposits, potentially mixing redeposited material with some *in situ* pieces.

Where *in situ* lithic and faunal material was recorded, it came from secure Early Mesolithic deposits that were either sealed beneath the stream deposit or that were overlain by demonstrably later organic sediments. This material was recorded in two trenches, LAO and LYY, and several test-pits. The assemblage from LAO was recorded from the mineral deposits making up the Early Holocene land surface [9117] and consisted of a relatively large assemblage of knapping debris, including a high proportion of cortical flakes. Refitting of the assemblage shows that it was generated through an intensive episode of knapping focused on the decortification and roughing out of approximately 16 nodules of flint. Only four of the resulting cores were present, and the remainder had either been moved to a different part of Barry's Island or taken elsewhere. Most of the *in situ* material from LYY was also recorded from the basal minerogenic sediments [9117] that were sealed by Early Mesolithic peat and then by the stream deposit. This assemblage was much smaller than that from LAO, and consisted of small quantities of debitage (from both till and Wolds flint), two Early Mesolithic microliths and a microburin, and was probably generated through an episode of retooling. A very small quantity of worked flint was also recorded from the overlying peat in both LAO and LYY [9116] and probably reflects a small degree of vertical movement from the *in situ* material below.

In some cases, *in situ* material has also been identified on the basis of its fresh, unrolled appearance. In parts of LYY where there was no intervening deposit between the basal sediment [9117] and the overlying stream bed [9113], a small quantity of *in situ* material was identified on this basis. This assemblage consisted of two utilized blades, and debitage from the reduction and working of several nodules. However, a diagnostically Late Mesolithic rod microlith was also recorded from this context, and shows that some redeposited pieces were also being transported into this deposit from the overlying stream bed. Similarly, a small assemblage of material was recorded from the basal deposits [9114] in LYB (a burin and two burin spalls). Based on the fresh, unrolled appearance of the flint, this assemblage was probably *in situ* and may reflect the manufacture or use of burins at this location.

The *in-situ* faunal assemblage consists of 312 specimens, most of which were recorded from the Early Holocene land surface in trench LYY. Of these, 100 could be identified, most of which derived from the limb elements and teeth of red deer (as well as two pieces of antler), with much smaller quantities from roe deer, elk, and aurochs (again predominately limb fragments and teeth). The unidentifiable material derived mostly from large mammals, and included fragments of crania, mandibles, and vertebrae. There is no clear relationship between the faunal and lithic assemblages, though it remains possible that some of the flint was used and then discarded during the processing of animal carcasses.

A larger assemblage of worked flint (358 pieces), and a smaller quantity of faunal remains (279 specimens) was recorded from the stream deposit (mostly context [9113]). This assemblage includes diagnostically Early and Late Mesolithic microliths, and radiocarbon dated samples of animal bone that have returned Late Glacial/very Early Holocene, and Late Mesolithic ages (see Table 12.7). Based on its context, and the mixed ages of the material, at least part (if not all) of the assemblage has been redeposited from another location. The lithic assemblage is made up of knapping debris (some deriving from core reduction and blank production activities) and a wide range of tools including microliths, awls, burins, and scrapers, as well as debitage from tool maintenance and repair (an axe sharpening flake and microburins).

The faunal assemblage was made up of red deer (60 of the 72 identifiable fragments), most of which were teeth or derived from limb elements, with roe deer, aurochs, horse and dog represented by much smaller quantities of material (though again mostly from teeth or limb elements). The unidentifiable specimens were also predominantly from the limb elements of large mammals of red deer size, though fragments of crania, mandible, vertebra and rib were also present. A radiocarbon date on one of the horse teeth produced an age of 10,195–9405 cal BC (10,160±90 BP, OxA-6330), spanning the final stages of the Loch Lomond Stadial or the very Early Holocene. Archaeologically, this would relate to the Terminal Palaeolithic, though no diagnostic lithics of this period were recorded. Of three further dates, one (OxA-8045) is too young for this context and is considered to be erroneous, whilst the others (OxA-8098 and OxA-8099) produced Late Mesolithic dates (see below).

Lithic material deriving from the stream was also recorded from the overlying peat deposits, particularly in trench LYY, and from adjacent deposits, notably in LYY and LAK, where the assemblages included rolled pieces, diagnostic material of differing ages, or Early Mesolithic material in demonstrably Late Mesolithic contexts. For example, diagnostically Early and Late Mesolithic microliths were recovered from the overlying peat deposits in LYY, and an Early Mesolithic microlith was recorded from the overlying peat in LAO (which based on the dating of the stream deposits must be of Late Mesolithic age). This material has probably moved from the stream deposit into overlying and adjacent deposits through post-depositional processes. As discussed, this has mixed potentially redeposited lithics with *in situ* material, as is the case in both LAK and LYY, which contained both rolled and fresh pieces.

Small quantities of worked flint also were recorded from the more elevated areas around the edges, and on top of the peninsula, and reflect activity taking place on the drier ground away from the lake and wetland environments. In trench LAK, a very small assemblage (5 pieces, including a possible Early Mesolithic obliquely blunted point), was recorded from the basal mineral deposits at the break of slope overlooking the lake-edge. More material (including blades, two blade cores, Early Mesolithic microliths and a burnt scraper) was recorded down slope, again within the basal geology. This included patinated and rolled pieces and may have derived from an activity area on the adjacent higher ground. A further very small assemblage was recovered from the oxidized peat overlying the mineral deposits on the high ground in LAK. This included several tools (including a Late Mesolithic rod microlith, a small blade core, and scrapers), knapping debris, and a possible burin spall, and potentially reflects an episode of Late Mesolithic activity within, or at the edges of the wetlands that were encroaching over the peninsula. The material recovered by the landowner (which is predominantly Late Neolithic) also derived from the higher ground on the top of the site.

Dating

A total of seven radiocarbon dates and a single OSL date are available for Barry's Island (Table 12.7). Five of the radiocarbon dates are on archaeological materials (all faunal samples). Two of these (OxA-6330 and OxA-8045) were recovered from the stream deposit [9113] in LYY, a third (OxA-8098) from an underlying deposit [9114], but which is also thought to have been redeposited by the stream, and a fourth (OxA-8099) from a continuation of the stream deposit recorded in trench LW. Of these, OxA-8045 is too young for its stratigraphic position given that the overlying peat is dated to 5290–4905 cal BC (Beta-94438). The remaining samples are potentially Late Glacial or very Early Holocene (OxA-6330) and Late Mesolithic (OxA-8098-99), but have clearly been redeposited by the action of the stream. The fifth sample (OxA-8100) was *in situ*, and sealed in peat below the stream deposit, giving an approximate date for at least some of the Early Mesolithic activity at Barry's Island. The remaining radiocarbon dates, and the single OSL date all relate to environmental and sediment samples. The OSL date on the trapped sand horizon [9113] in LYY of 6745±890 BP, despite the large standard deviation, is consistent with the radiocarbon dates obtained on peat from immediately above and immediately below the trapped sand (Beta-94437 and Beta-94438, respectively).

Discussion

The surveys and excavations at Barry's Island were carried out by the VPRT between 1992 and 1996. Following an auger survey of the area, 2 × 2 m test-pits were excavated around the approximate location of the shore, and several larger trenches were excavated on the north and west sides of the site. Relatively large assemblages of faunal remains and worked flint, dating to both the Early and Late Mesolithic were recorded from deposits around the edge of the site, in what would have been the lake-edge wetlands and the dry ground just above the lake shore. While some of this material is *in situ*, the majority had been redeposited by stream action during the Late Mesolithic. Several test-pits were also excavated on the higher ground further from the former shoreline, one within a barn built prior to the archaeological investigations. A small assemblage of largely undiagnostic material was recovered from the topsoil in one of these test-pits (LU), though the character of the material suggested Mesolithic rather than later activity, and a small assemblage of mostly later prehistoric material was collected by the landowner as the barn was being built. Unfortunately, the construction of the barn truncated any archaeological horizons in that area. Environmental profiles were recorded from two locations, test-pits LAL and LAP, and together provide a record of the environment towards the end of the Late Mesolithic.

At the start of the Holocene, Barry's Island would have been a small peninsula at the eastern end of the lake. Though referred to as an island, the site was connected to the edge of the basin by a wide, but very low-lying area of ground that is likely to have been inundated during periods of higher lake-level. To the east was a large, shallow embayment, while to the west lay the deep water of the main lake basin. The local environment was probably comparable to that documented at other locations around the lake, with a shift from reedswamp to increasingly terrestrial fen and carr around the site, and a succession of woodland species becoming established on the higher, drier ground. Peat deposits probably began to encroach onto areas of previously dry ground during the early part of the Mesolithic, and would have buried the low-lying ground that connected the site to the landscape to the

Table 12.7. *Radiocarbon dates on archaeological and environmental samples, Barry's Island.*

Lab No.	Radiocarbon years BP	$\delta^{13}C$ (‰)	Calibrated date (cal BC)	Material	Context
OxA-6330	10,160±90	-19.6	10,195–9405	premolar, horse	Context [9113], Trench LYY
OxA-8045	5730±60	-22.1	4715–4450	Elk Find No. 50632	Context [9113], Trench LYY
OxA-8098	6255±50	-23.1	5325–5055	Red Deer Find No. 50892	Context [9114], Trench LYY
OxA-8099	5855±50	-23.0	4840–4580	Roe Deer Find No. 50561	Context [9104], Test-pit LW
OxA-8100	9690±60	-20.5	9285–8835	Aurochs Find No. 51504	Context [9117], Trench LYY
Beta-94437	8850±50	-28.0	8220–7755	peat	Immediately above the sand layer in profile LAP
Beta-94438	6140±60	-28.2	5290–4905	peat	Immediately below the sand layer in profile LAP

southeast. During the Late Mesolithic, a stream cut across the fen deposits to the west of Barry's Island, probably truncating the uppermost sediments. Peat formation resumed around 5290–4905 cal BC (6140±50 BP, Beta-94438), by which date alder carr was established around the site, while a mixed woodland of lime, elm, oak, ash and hazel, interspersed with open, and possibly disturbed ground was present on the adjacent, drier areas.

The material record for Early Mesolithic occupation at Barry's Island is somewhat fragmentary, and complicated by the presence of material redeposited by the later stream. However, the lithic assemblages indicate that human groups were certainly present on the site, potentially visiting the location intermittently during the earlier part of the period. The range of activities represented by the archaeology is particularly diverse. On one occasion, a group brought a large number of flint nodules to site, which they then partly prepared before taking much of the material away. A composite tool was repaired, burins were made, used and resharpened, blades were used and discarded, and an axe was resharpened probably reflecting its use on the site. Parts of animal bodies, particularly red deer, but also roe deer, elk, and aurochs were also brought onto the site, and parts of the lithic assemblage may reflect butchery and processing of carcasses for materials.

Establishing the chronology for the occupation of the site is difficult. A radiocarbon date on an aurochs bone from trench LYY dates to the centuries around 9000 cal BC (9690±60 BP, OxA-8100), and parts of the lithic assemblage were recorded from the basal peat deposits, which (on the basis of dating from other sites around the lake) were probably forming during the early centuries of the Mesolithic. However, the absence of any additional dated material makes it impossible to establish the time-span over which human communities were present at the site.

It is also difficult to determine whether the archaeology recovered from Barry's Island represents elements of a more extensive area of occupation, or a series of spatially and chronologically discrete events representing separate, small-scale visits to the area. However, if we draw parallels with other locations around the lake, notably Seamer Carr sites C and K, and No Name Hill, then perhaps the latter is more likely, with groups visiting Barry's Island at different times, probably for different reasons (see Conneller and Schadla-Hall 2003).

Evidence for *in situ* Late Mesolithic activity at Barry's Island is sparser, although the presence of rod and scalene triangle microliths in trench LAK attest to at least intermittent activity during the latter part of the period. People also continued to visit this locality after the end of the Mesolithic, utilizing the remaining area of drier ground on the top of the island, and while the character of activity is difficult to discern it does show the continued use of these areas of high, drier ground within and around the basin in later prehistory.

Chapter 13

Other Vale of Pickering Research Trust field research

Paul Lane, Barry Taylor, Chantal Conneller, Gaynor Cummins, Jim Innes & Tim Schadla-Hall†

The aims of this chapter are to summarize the fieldwork undertaken under the auspices of the VPRT between 1985–2000, not otherwise reported elsewhere in this volume and to provide a synopsis of the main results of this work. The focus is particularly on the results of combined auger surveys and test-pitting around Lake Flixton, which did not lead to the discovery of significant concentrations of archaeological material. In other words, this chapter is primarily concerned with the 'blank areas' between the artefact concentrations designated as 'sites', and the occasional, isolated or very low-density clusters of archaeological material, which following Foley (1981) can be regarded as the 'scatters between the patches'. In addition, this chapter includes a brief and preliminary summary of the results of work at the Flixton School sites, first located in the early 1990s and investigated between 1993 and 2001, full details of which will be published at a later date in the light of more recent excavations by Amy Gray Jones and Barry Taylor. An account of the results of several seasons of fieldwalking at the site of Star Carr, which have only been partially reported elsewhere in connection with other work conducted at the site by the VPRT and a team from Cambridge University led by Professor Paul Mellars (see Mellars 1998: 79–80; Mellars et al.1998a), is also included.

Results of auger surveys and test-pit sampling of other areas

For ease of analysis, the results of the remaining auger surveys and test-pit sampling conducted by the VPRT are presented below as if following the edge of the Early Mesolithic shoreline of Lake Flixton anti-clockwise, starting from a point immediately south of Moore's Flixton 9 site (see Chapter 9). From there, the discussion will follow the southern shoreline in an easterly direction towards Barry's Island (Chapter 12), then around the eastern end of the former lake, and then turning west to cover the northern shoreline up to the edge of Seamer Carr 'Site C' (Fig. 13.1).

From Flixton 9 to VP D/VP E

This area was first investigated in 1989, with subsequent surveys in 1991 and 1992. An area to the south and east of a small channel, detected in the surveys undertaken by Cloutman (1988a) was augered, extending from NGR 502660 480380 to 502840 480230 and covering 9500 m^2. In all, 14 2 × 2 m test-pits were excavated along the section of shoreline recorded by Cloutman; VP89 BA-BE (NGR 502440 480610), and VP92 LA-LB, LD-LE, LH-LJ & LN-LO (NGR 502590 480510) (Fig. 13.2). With the exception of a single flint fragment from VP92 LN, no archaeological material was recovered.

Stratigraphy and topography

The basal geology comprised boulder clay with occasional sandy gravel patches, that was sealed by deposits of peat. The depth of peat deposits above the 24.0 m AOD subsurface contour ranged from 0.5 m to *c.* 1.2 m due to the combined effects of drainage, ploughing, and location of the test-pit in relation to the subsurface topography. Field Nos. 4756, 7500 and 2262, for instance, have been regularly cultivated since the mid-1970s, mostly for growing potatoes or occasionally cereals. The basal topography consisted of small, low hills, with the ground surface sloping gently towards the lake shore.

From VP E to North Street, Flixton

This section was investigated by a combination of augering and test-pitting during 1991 and 1992. At the time of the surveys, the investigated areas lay within

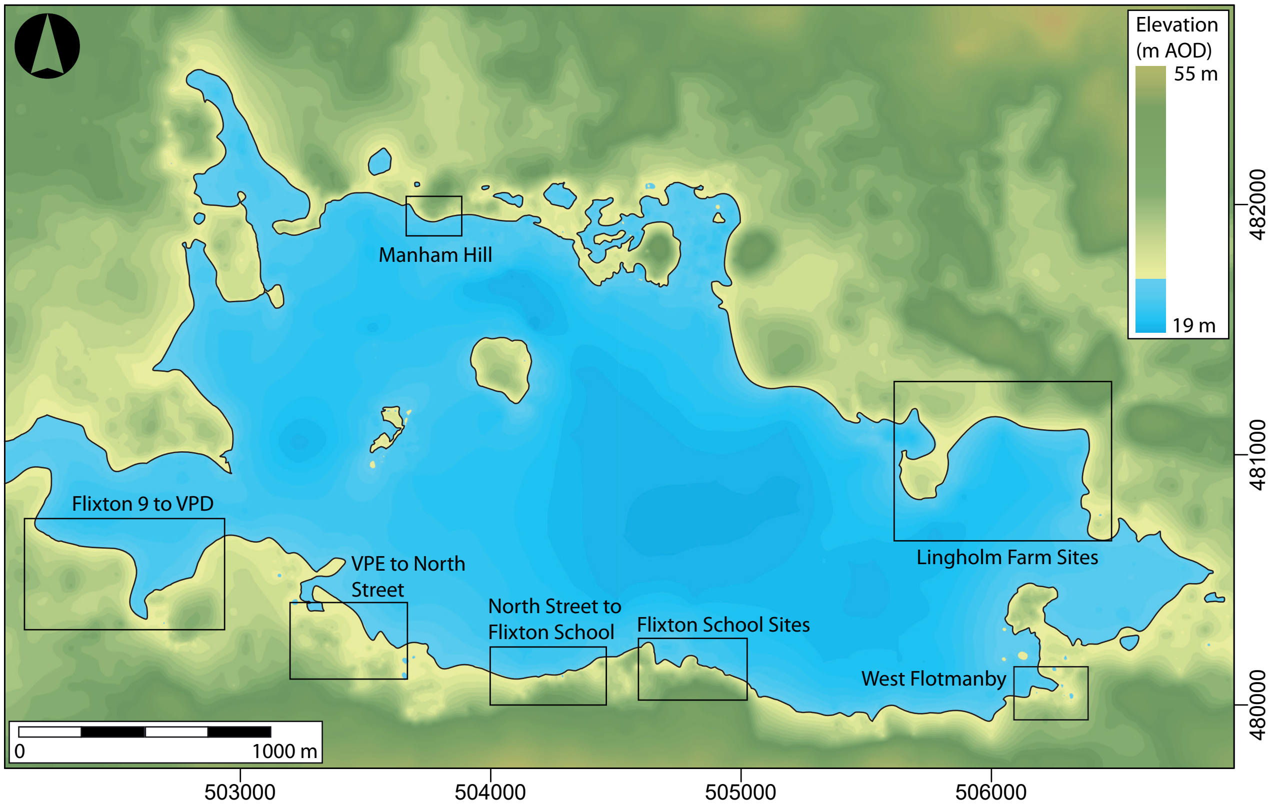

Figure 13.1. *Map of Lake Flixton showing the areas covered by test-pitting and auger surveys that are discussed in this chapter (level of the lake shown at 24 m AOD).*

fields associated with Woodhouse Farm, Manor Farm, and Park House Farm. The total area covered by the auger surveys was *c*. 135,000 m^2, and extended from NGR 503120 480960, to 503790 479950. A total of 20 2 × 2 m test-pits were excavated; VP91 KA-KG, KJ & KM at Woodhouse Farm (centred on NGR 503270 480350), and KN-KS and KAA-KAE on Manor Farm (NGR 503540 480170) (Fig. 13.3). Only 17 pieces of worked flint were recovered during this work, most of which (11 pieces) were recorded from test-pit KAB. A possible Late Mesolithic microlith in test-pit KM was the only formal tool, while the remainder of the lithic material consisted of varying forms of debitage. A pollen profile (profile KN) was also recorded from this site, though poor levels of preservation meant it was not possible to produce a statistically viable diagram. Particle size and metals analyses were also undertaken on two layers of minerogenic sediment within the peat from the same test-pit. The results of this work are summarized at the end of this chapter.

Stratigraphy

The basal geology consisted mostly of sandy clay with gravel that was sealed by a layer of fine sandy silt with a high organic content. In the lower lying areas these deposits were succeeded by a fine detritus mud with a coarse component of *Phragmites* reeds, superseded by a woody detritus that was overlain by a compacted and slightly humified wood peat with fragments of *Phragmites*. This was sealed by a coarse herbaceous peat with *Phragmites* and woody detritus, grading into a heavily oxidized peat and topsoil. In some test-pits (notably KN) thin bands of silt were present within the peat. In test-pits that sampled more elevated areas, the lower deposits of fine detritus were much thinner, compacted and humified, though these were still sealed by a comparable sequence of wood peat and herbaceous peat, and the overlying oxidized peat and topsoil.

The average depth of peat deposits on the areas above the 24 m AOD subsurface contour was variable, ranging from *c*. 0.6 m–1.3 m due to the combined effects of drainage and ploughing, and the position of the test-pits in relation to the subsurface topography.

Topography

Based on the combined auger and test-pit data, the shoreline ran on a southeasterly orientation for some

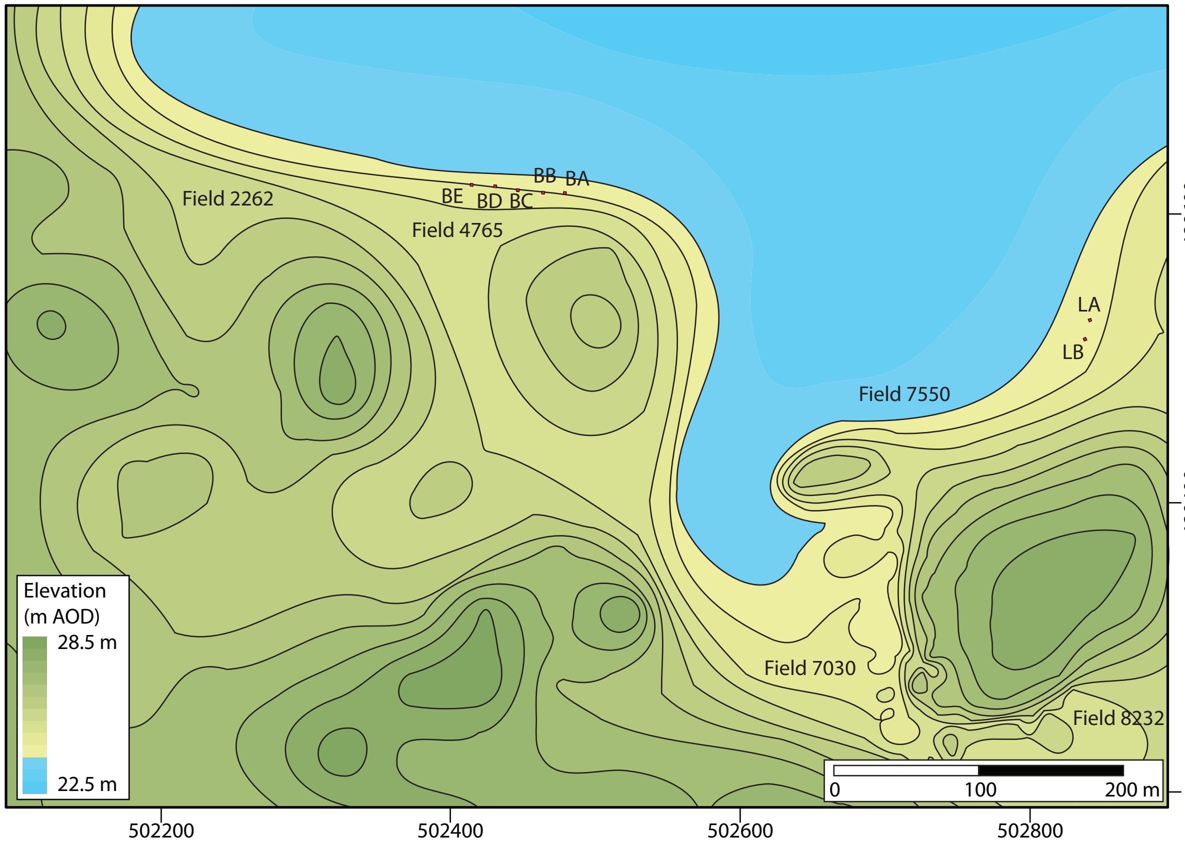

Figure 13.2. *Subsurface topography and excavations between Flixton 9 and VP Site D (level of the lake shown at 24 m AOD).*

650 m from Site VP E, forming the western side of the main lake basin, before turning east, where it formed the southern edge of the lake. The landscape consisted of a series of small, uneven hillocks separated from the lake shore by an area of very low-lying ground. The auger survey detected several relatively shallow hollows that would probably have held standing water during the Early Mesolithic. These may mark the position of former kettle-holes.

Summary of the archaeology

A small assemblage of 17 pieces of worked flint was recorded during the test-pitting of this area (test-pits KM, KP, KAB, KAC & KAD). The individual assemblages were very small, with 11 pieces recovered from KAB and no more than three each from the other test-pits. A possible Late Mesolithic microlith was recorded from KM, though this was too fragmentary for a positive identification; no other tools or diagnostic pieces were present. The assemblage from KAB consisted of a small quantity of debitage from several nodules of Wolds flint. Given the low density of test-pits along this section of the lake-edge (and the fact that parts of the lake-edge remain unsampled), these results may not be representative of the Early Mesolithic archaeology of this general area, and further work may lead to the recovery of more extensive concentrations of material. That said, the paucity of material culture from the two locations where most of the test-pitting was carried out does show that there were areas of the shore that were not used for settlement during the Early Mesolithic and where material traces of activity are also slight.

North Street, Flixton to Flixton School House Farm

Part of this area (centred on NGR 50420 48020) was augered in 1994. However, the depth of peat was consistently over four metres, and it became clear that the former shoreline lay farther to the south. Due to the schedules of agricultural activity, it was not possible to undertake further surveys until 1999, when an area covering 10,600 m^2 was investigated (from NGR 504080 480020 to 504365 480140). No test-pitting was carried out in this area.

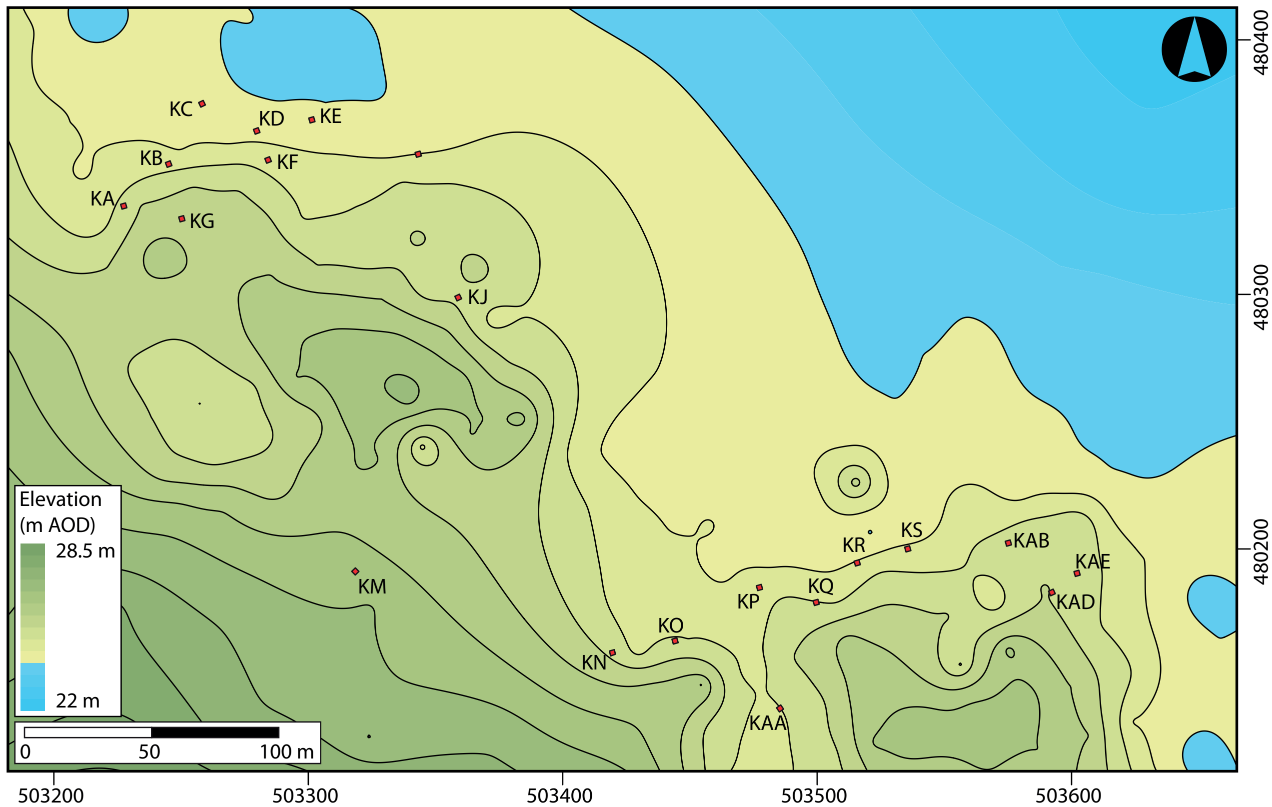

Figure 13.3. *Subsurface topography and excavations between VP Site E and North Street, Flixton (level of the lake shown at 24 m AOD).*

Stratigraphy and topography

Based on the records of the auger surveys the basal topography consisted of sandy clay, giving way to coarse sands in the lower lying areas to the north. These deposits were sealed by a sequence of well-preserved detrital muds and peats, typically grading from a fine detrital mud to a *Phragmites* reed peat and then wood peat, which were then succeeded by a coarse herbaceous detritus and a second layer of wood peat. The depth of peat above what would have been the Early Holocene ground surface was over 2.5 m, and as late as 1999 was well saturated. The relative lack of peat shrinkage here, compared with many other parts of the Vale, may be due to the history of land use since, according to the previous and current landowners, the fields in question had been consistently under pasture since the 1940s and only rarely ploughed for re-seeding during this period. The former shoreline ran roughly east–west, forming part of the southern side of the lake basin (Fig. 13.4).

The Flixton School sites

Two concentrations of material were recovered from this area, one at Flixton School House Farm (NGR 50460 48020), the other at Flixton School Field (NGR 50480 48011) *c.* 140 m to the east (Fig. 13.5). Mesolithic material was first observed at Flixton School Field by a local farmer, Mr Graham Webster (who at the time was also a VPRT trustee), who had collected two long blades from the area while ploughing. Subsequently, a limited fieldwalking survey in the area in 1993 produced some 344 flints, which included Mesolithic and later prehistoric material. The results also suggested that the site had been severely damaged by ploughing. Auger surveys were carried out in 1994 and 1995, covering an area of approximately 28,000 m^2. These showed that the basal topography consisted of two narrow promontories, extending northwards into the basin, separated by a deep embayment *c.* 140 m wide. Between 1994 and 1998, a series of test-pits were excavated around the two promontories, along the line of the intervening embayment, and along the line of the former shore to the east. Most of these were 2 × 2 m, though two (OH and OI at Flixton School Field) were extended during the 1998 excavation season.

The excavations at Flixton School Field were generally productive, with relatively high densities of worked flints, notably in trenches OH and OI. Two

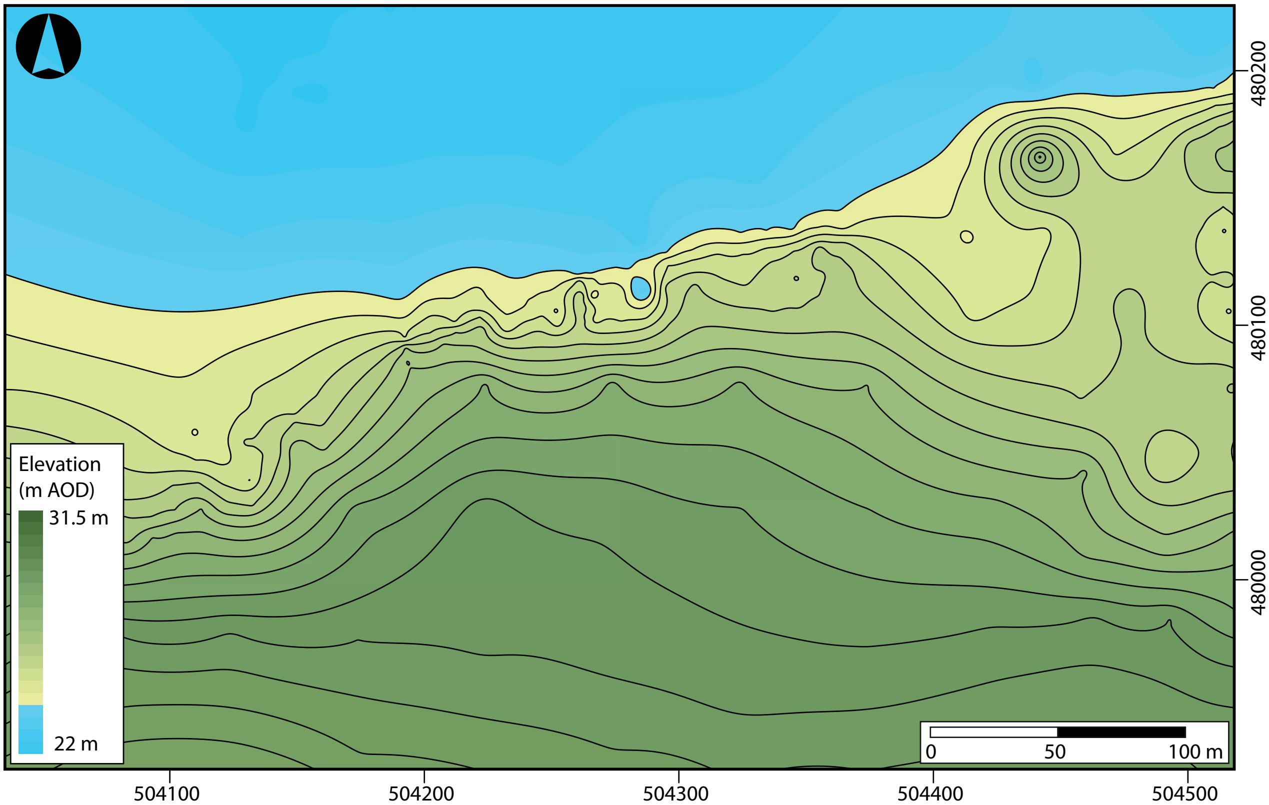

Figure 13.4. *Subsurface topography between North Street, Flixton and Flixton School House Farm (level of the lake shown at 24 m AOD).*

caches of flint nodules were also recorded, one from trench OI, the other from a test-pit to the east (PB) (Fig. 13.6). Small quantities of bone were also present, and were in relatively good condition in comparison to the material recovered from some of the other sites around the lake. Overall, archaeological material was recorded along *c.* 100 m of the former shore, between test-pit PAB in the west and test-pit ON in the east, and extended up slope to the south as far as the *c.* 27 m AOD contour. This represents an area of at least 1500 m^2, making it the most extensive site found by the VPRT. Barry's Island, No Name Hill and Flixton School House Farm would have all been clearly visible from the site, as well as any activity areas that may have existed immediately opposite on the northern shore. The choice of location may also have been influenced by the presence of a freshwater stream running into Lake Flixton some 500 m away to the east.

In contrast, activity in the area designated Flixton School House Farm (test-pits PAP to PAS) was more discrete, with just three test-pits producing archaeological material (PAP, PAS and PAT), none of which produced more than 21 pieces of flint. This may represent the traces of highly localized, short-term activity, similar to the low-density scatters recorded at Seamer Carr Site D (Chapter 7), VP E (Chapter 9), and Ling Lane (NAA 1997a). However, subsequent excavations *c.* 40 m to the southwest have recorded a dense, spatially discrete scatter of Early and Late Mesolithic material, with evidence for several small structures (Taylor and Gray Jones 2009, Taylor 2012). Details of the earlier VPRT excavations will be incorporated in the final report on the site.

A pollen profile (F95) was recorded from Flixton School Field in 1995 and is discussed at the end of this chapter.

Summary of the archaeology – Flixton School Field

A large assemblage of worked flint (4429 pieces) and a smaller quantity of animal bone (162 specimens) were recovered during the various phases of work in the area designated Flixton School Field. Part of the lithic assemblage (334 pieces) was recorded during fieldwalking on the more elevated (southerly) part of the site. This assemblage is of mixed date, and includes later prehistoric material, including a Neolithic leaf-shaped arrowhead and an Early Bronze Age barbed-and-tanged arrowhead. The assemblage recovered during the excavations was largely Early Mesolithic in date,

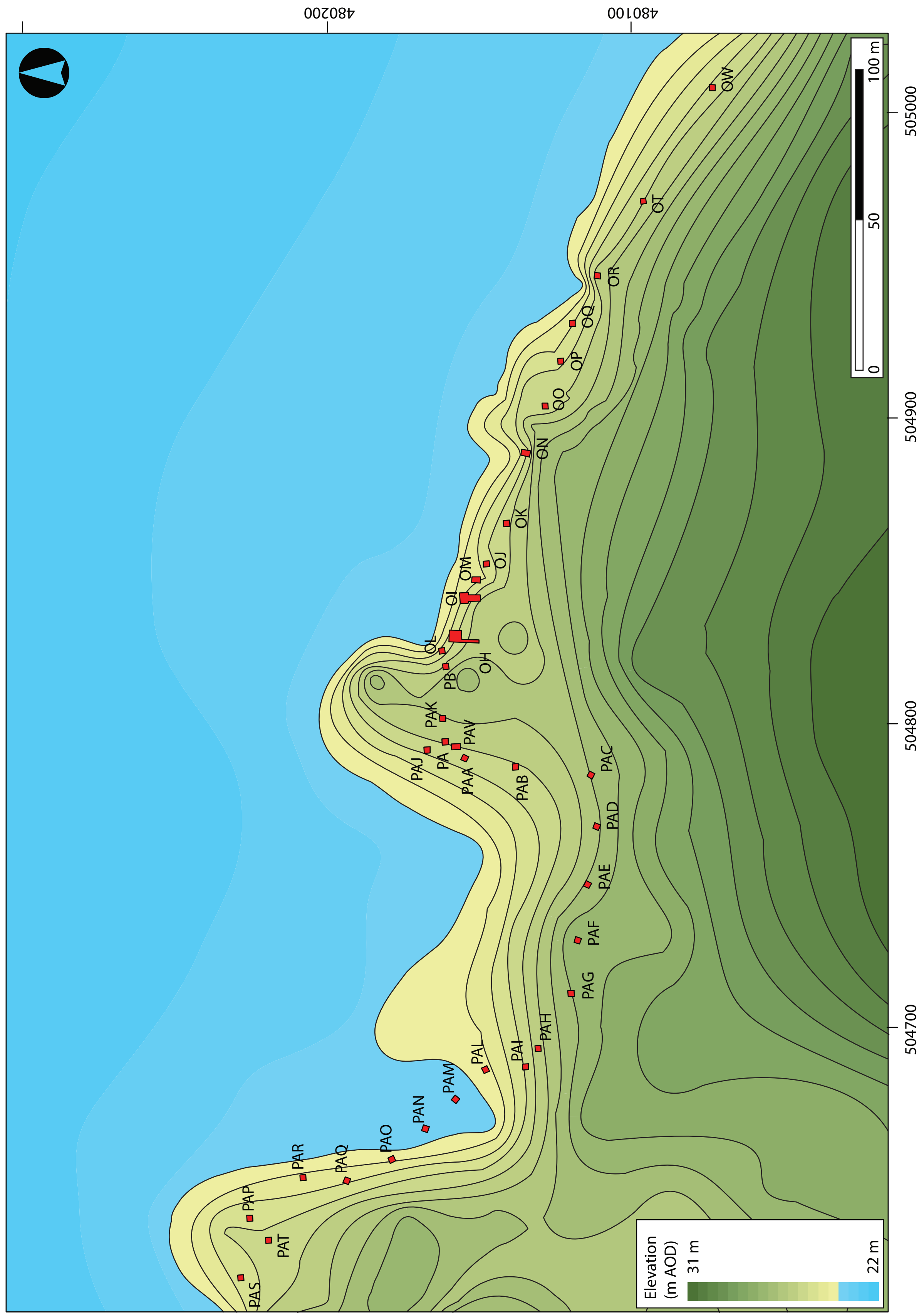

Figure 13.5. *Subsurface topography and location of excavation units at Flixton School House Farm and Flixton School Field (level of the lake shown at 24 m AOD).*

Figure 13.6. *Indication of the stratigraphic location of the flint cache in test-pit PB.*

though some diagnostically later material was recorded from the upper deposits in several trenches. Most of the animal bone was recorded from the same deposits as the Early Mesolithic flint, and is probably of the same age.

Early Mesolithic activity is best represented in trenches OH/OHX and OI, where the largest quantities of worked flint were recovered. The assemblage from OH/OHX consisted of debitage and a range of formal tools, predominantly scrapers, but also microliths, an awl, and several burins. Microburins were also present in the assemblage, suggesting the manufacture of microliths on the site (perhaps reflecting an episode of retooling given that microliths are also present), and an axe sharpening flake was also recorded, indicating the maintenance (and potentially the use) of axes on or near the site. The assemblage from OI was smaller, but also contained a range of formal tools and tool spalls as well as debitage.

Two caches of flint were also recovered from the site. The first, from OI, consisted of five large pieces ranging from a tested nodule to a very large, partially worked core. These were recorded from the same context as diagnostically Early Mesolithic material and are probably of the same date. The second cache was recorded from trench PB, which lay some metres further upslope, and consisted of 12 very large pieces that had been placed in a small pile (Fig. 13.6). This material consisted entirely of till flint, and had probably been collected from the coast.

Late Mesolithic material was also recovered during the excavations. This included a small cluster of nine scalene triangle microliths that were recovered from the upper peat deposits. These may represent the remains of one or more composite tools either lost or discarded in the fen or carr environments that were forming around the lake during the later part of the period, echoing finds recovered from Seamer Carr Site K (David 1998).

The excavated faunal assemblage consisted of 63 identifiable specimens, most of which derived from the elements of the limbs and teeth of red deer and aurochs, with smaller quantities of material from elk, roe deer, and dog (Chapter 17). A further 99 fragments unidentified to species were recovered. These exhibit a similar pattern of element representation with most pieces deriving from the limbs of large mammals.

Flixton School Site to Barry's Island

Due to difficulties accessing land on the stretch of the lake shore, surveys were limited to a small area on Church Farm, to the south of Folkton Village (NGR 50545 47992). The results suggest that the former shoreline ran on a southeasterly orientation for almost 500 m from the east of the Flixton School site, before turning onto an east–west orientation from NGR 50535 47995. The fields around this point today are known to be fairly damp owing to the presence of several underground springs. A pollen profile (QAA – see Fig. 5.1) was recorded from the augered area at Church Farm and is discussed at the end of this chapter.

Eastern end of Lake Flixton

The eastern end of the former Lake Flixton probably lay within the area known today as West Flotmanby (Fig. 13.8). In 1992, an area of approximately 10,800 m^2 was augered to map the subsurface topography to the south (and slightly east) of Barry's Island, and three 2 × 2 m test-pits (VP93 LP, LQ & LT) were excavated. None of these produced any archaeological material. In 1993, further areas to the south and southeast of Barry's Island were augered, and four 2 × 2 m test-pits (ME, MF, MH & MO) were excavated. Although no finds were recovered from any of these test-pits, a complex series of shallow features, possibly of Medieval origin were recorded in test-pit MF (details of these features are provided in the VPRT archive). The very eastern end of the lake was surveyed in 2008 by Barry Taylor as part of his doctoral research.

Topography

Broadly speaking, the surveys show that the edge of the lake ran eastward, before curving toward the north to create a low-lying neck of land connecting Barry's Island with the edge of the basin. From the other side of Barry's Island, the shoreline ran to the east, before curving round to the north and west to create a large, shallow embayment. To the south of Barry's Island, the combined auger and test-pitting data suggest that the Early Holocene shoreline was rather diffuse and indistinct. Instead of an obvious lake-edge defined by a sharp break in slope, much of the area seems to have been composed of hollows, hummocks, small inlets, and perhaps shallow ponds. Beyond the eastern end of

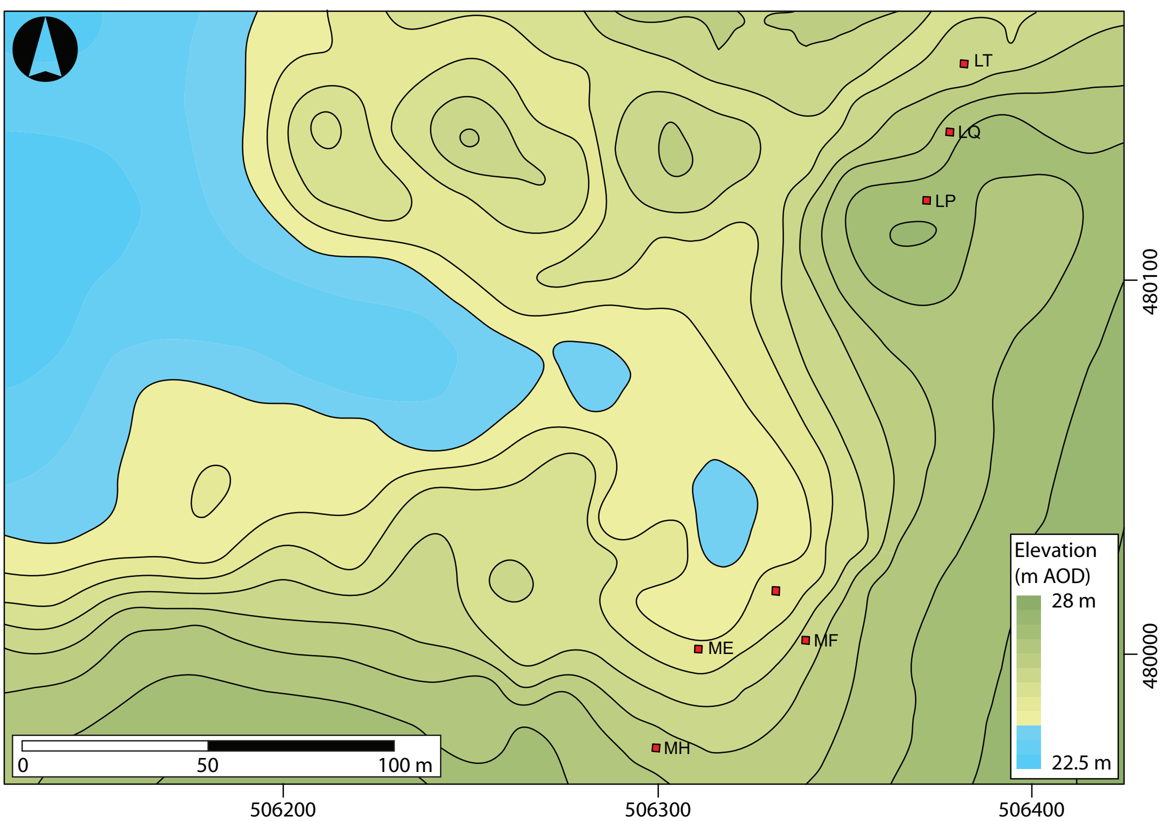

Figure 13.7. *Subsurface topography between Flixton School Field and Barry's Island (level of the lake shown at 24 m AOD).*

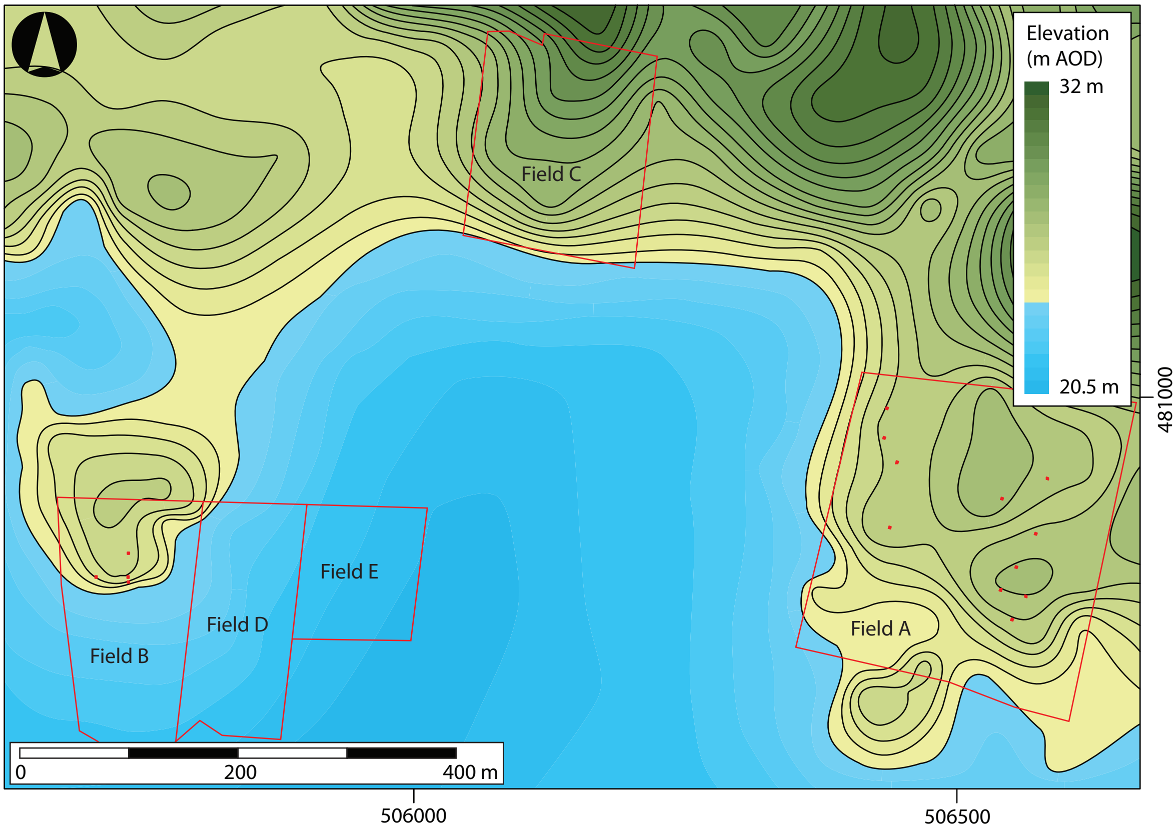

Figure 13.8. *Subsurface topography and survey areas at Lingholm Farm; red squares in Fields A & B show location of 1 × 1 m test-pits (level of the lake shown at 24 m AOD).*

the lake the Mesolithic topography remained very low-lying, and again was punctuated by shallow hollows that would probably have been waterlogged during much of the period.

Lingholm Farm

In 1991, in response to a proposal for development of a golf-course on Lingholm Farm, a stretch of the northern shoreline to the north of Barry's Island was investigated by a combination of augering, test-pitting, fieldwalking and geophysical survey. The augering showed that this stretch of the lake shore consisted of a large embayment, over 600 m wide, between two promontories (Fig. 13.8). Five fields were investigated by fieldwalking (designated A-F), totalling approximately 67,200 m^2. An area covering *c.* 2,500 m^2, centred over the densest surface concentrations of flint, was also surveyed using a Geoscan Research FM18 Fluxgate Gradiometer.

The highest concentration of finds came from the northeast corner of Field B (NGR 505740 480880), on an area of raised ground at the western end of the embayment. The geophysical survey was conducted over this area, but other than the faint traces of a possible ploughed out ditch cutting diagonally across the surveyed area from northeast to southwest, no subsurface anomalies were recorded. Lower density surface scatters were detected in Fields A, C, and E (the scatter in Field C also centred over a low rise). Field D was devoid of surface finds.

Once the surface surveys were completed, a series of 1 × 1 m test-pits were excavated in Fields A (12 test-pits), B and C (four test-pits in each). These were labelled TA 1–12, TB 1–4, and TC 1–4. The depth of deposits in all of these pits was fairly shallow, and without exception the stratigraphy consisted of a fairly thick (*c.* 0.4 m) deposit of sandy, peaty ploughsoil overlying the natural sandy clay with gravel. It was also clear that the deposits across all three fields had been extensively disturbed by prolonged cultivation and deep ploughing, and in several cases plough marks were visible on the surface of the natural sandy clay.

Topography

Lingholm Farm lies on a large embayment, over 600 m wide, on the north shore of the lake (Fig. 13.8). The western side of the embayment (Field B) was formed by a long, narrow ridge of land that extended over

250 m into the lake, with a small, round hill at its northern end. The hill reaches a maximum elevation of 25.9 m AOD, placing it well above the level of the Early Mesolithic lake level, but the ridge of land connecting it to the edge of the basin is much lower (*c*. 24.25 m AOD), and would probably have been boggy and waterlogged throughout much of the period. As this ridge of land met the edge of the lake basin the land rose sharply, and the remainder of the embayment would have been flanked by steep-sided high ground. This dropped away again at the western side of the embayment forming a second, smaller promontory.

Summary of the archaeology

Mixed assemblages of Early and Late Mesolithic and later prehistoric (Neolithic and Bronze Age) worked flint were recovered during the fieldwalking surveys at Lingholm Farm. The largest assemblage was recorded from Field B, which lay on the northern side of the promontory that formed the western side of the embayment (Fig. 13.8). This was dominated by Late Mesolithic material, including three late microlith forms, several scrapers, and knapping debris. Much of the assemblage was burnt, a phenomenon also observed in the Late Mesolithic assemblage from Rabbit Hill at Seamer Carr (Chapter 8). Early Mesolithic material was mostly recorded from Field A, which lay on an area of raised ground at the eastern end of the embayment, overlooking a small promontory. Here, the assemblage included a large micro-burin, a possible burin and two burin spalls, and a possible tranchet axe flake, as well as diagnostically later prehistoric material. Field C lay on an area of high ground along the edge of the embayment and included Late Mesolithic and later prehistoric material.

Manham Hill/Flixton 6

Manham Hill lies 120 m to the east of Seamer Carr Site C, on the slopes of a small rise projecting into the former lake. It was first identified by John Moore, who reported finding Early Mesolithic flints in an area that had also produced a Bronze Age Collared Urn (now in Scarborough Museum) and was designated 'Site 6' (Moore 1950). In 1986, eight 2 × 2 m test-pits (BA-BH) were excavated in this area in an attempt to relocate the flint scatter recorded by Moore. No systematic augering was undertaken, although the area had been sampled by Cloutman (1988a), and the information this provided was used to determine the location of the test-pits (Fig. 13.9).

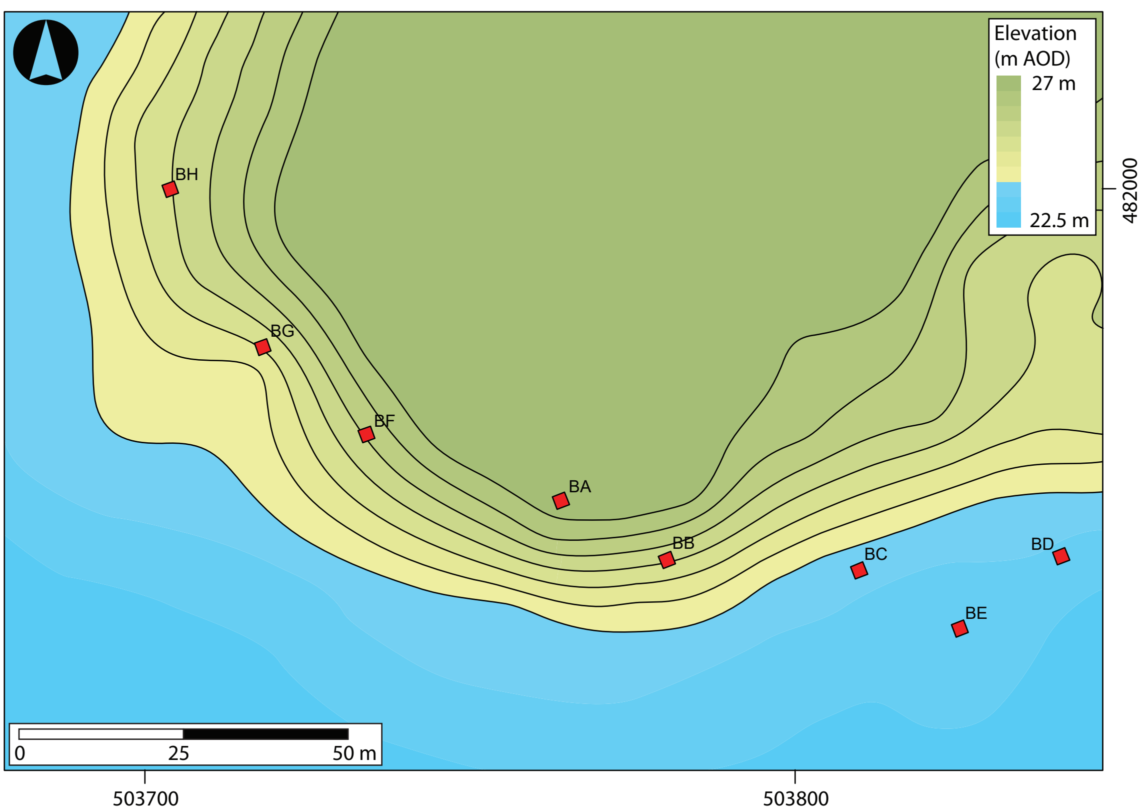

Figure 13.9. *Subsurface topography and excavations at Manham Hill (level of the lake shown at 24 m AOD).*

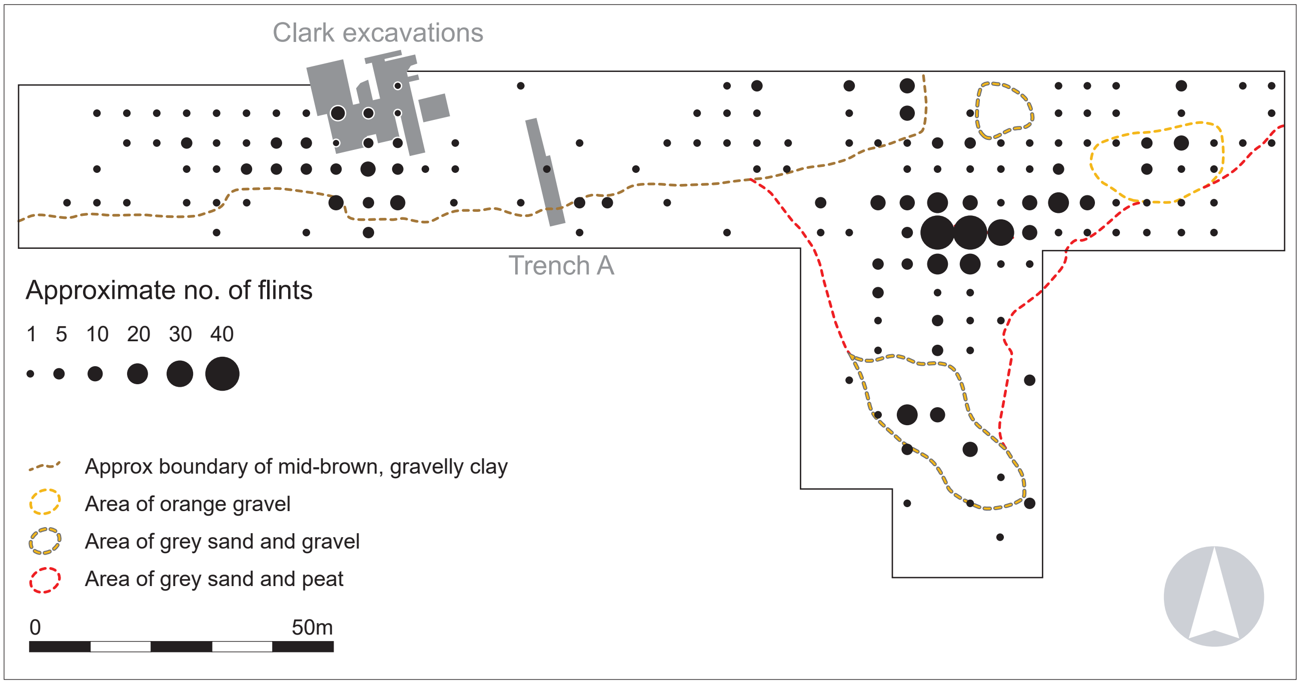

Figure 13.10. *Flint density plot and soil type distributions, Star Carr fieldwalking 1992.*

The results were largely disappointing, and the majority of finds derived from the plough-soil. Although this could imply that Moore's 'Site 6' had been destroyed by ploughing, it is just possible that better preserved deposits await discovery in the vicinity, especially as some test-pits failed to sample the 24.0–24.50 subsurface contour.

Results of fieldwalking at Star Carr in 1989, 1992 and 2000

At the time of Grahame Clark's excavations, and over the following decades, the field in which the site of Star Carr is situated was under ley pasture, and was ploughed only occasionally to allow reseeding. Given the original depth of covering deposits, ploughing was not considered a threat to the integrity of the subsurface remains. By the mid-1980s this regime was changing, partly due to increased drainage across the Vale, and the interval between ploughing had been reduced to every four–five years. During the years of the VPRT project, the field was ploughed three times, in 1989, 1992 and 2000. On each occasion, surface collections of flint from the ploughed area were undertaken. In 1989, collections were made at a fairly coarse scale on a 30 m grid, across the entire field. The number of artefacts recovered was generally low, never exceeding 10 per 30 m^2, and were restricted to the northern quarter of the field, close to the line of the former lake shore. The fieldwalking in 2000 was even less productive, and little further can be said about the results.

The 1992 survey was more productive. During this season, a portion of the field measuring 7850 m^2 was surveyed, with material being collected by 5 x 5 m squares (Fig. 13.10). The results of this latter survey suggested, as had already been intimated by the VPRT excavations in 1985 and the Cambridge University fieldwork in 1989 (Mellars et al. 1998a), that Early Mesolithic activity extended considerably farther east than Clarke had surmised, and that, due to the shrinkage of the peat, this part of the site was now being damaged by the effects of ploughing (see also Emerick 2011). Although these findings have since been reported briefly elsewhere (Mellars 1998d, 79–80, Fig. 6.5), and borne out by more recent area excavations at Star Carr (Milner et al. 2018a) and by studies of changes to the local hydrology over the later part of the twentieth century (Albert et al. 2016; Brown et al. 2011; High et al. 2016), they are still worth summarizing here primarily as a matter of record of the collection methodology and the significance of variations in soil types across the northern part of the Star Carr field.

The 1992 collection methodology

The Star Carr field was ploughed over a three-day period during early August 1992, using a standard mould-board plough to a depth of approximately 10 cm. Immediately after ploughing, an area of 7850 m^2

along the northwest edge of the field was gridded into 5 m squares. Individual fieldwalkers were assigned separate 5 m squares, and these were then searched systematically both along the line of ploughing (east–west) and at right angles to it (north–south). To standardize the intensity with which squares were searched, fieldwalkers spent a total of five minutes in each square, and finds recovered from each square were bagged separately. To minimize any effects on retrieval levels potentially caused by differences in fieldwalking experience and familiarity with lithic artefacts, the allocation of squares to different fieldwalkers was randomized. In all, nine different fieldwalkers participated in the exercise, although at any one time the numbers in the field ranged from three to eight. A total of 314 5 × 5 m squares were searched in this way.

The fieldwalking took the equivalent of two working days to complete, spread over a three-day period. The weather was mostly overcast, and light conditions were good. However, after the first half-day of fieldwalking the exercise was interrupted by a heavy rainstorm. This lasted for over twelve hours. Field-walking commenced the following day, and it was very noticeable that the rain had improved the overall visibility of lithics on the ploughed surface. Several pieces were even observed in some of the squares that had been searched before the storm. Unfortunately, as the field was to be re-seeded immediately after ploughing, it was not possible to re-survey the area that had been fieldwalked before the rainstorm.

After the fieldwalking had been completed, areas of subsoil disturbed by the plough were mapped (Fig. 13.10). These varied in composition from almost pure deposits of medium grained, light-grey sand to more mixed deposits of sand and orange gravel, or a combination of peat, sand, and gravel. As indicated on Fig. 13.10, these deposits of disturbed subsoil were all concentrated toward the southeast end of the gridded area. Their distribution also coincided with a slight break in the slope of the field, which in plan had the appearance of a narrow promontory.

Spatial patterning of artefacts and soils

Overall, there was a general background scatter of flint, averaging between 1–2 pieces per 5 m^2 grid square. However, at least two significant concentrations, with densities ranging between 15–40 flints per square, could be discerned. There was also at least one area of significant size along the northern field boundary, where no flints were recovered. In view of the post-depositional history of the site, including the pattern of previous archaeological activity, this distribution clearly did not provide a uniformly accurate reflection of possible subsurface variations in artefact densities. In particular, the lack of surface finds across much of the northern 10–15 m of the gridded section can be explained by the presence of gravelly clay upcast derived from the nineteenth century re-alignment and deepening of the River Hertford. The excavation in 1985 of a narrow trench (VP 85A) roughly 30 m east of Clark's 1949–51 trenches, indicated that this deposit was at least 11 cm thick (Mellars et al. 1998a, 40, Fig. 3.12), and at the time of the fieldwalking effectively sealed the underlying archaeological horizons protecting them from plough damage. However, there were also signs that more frequent ploughing was starting to erode this protective horizon.

Fresh gravel, which had all the characteristics of the underlying sub-soil, had been brought to the surface by the 1992 ploughing in at least two places, both near the eastern boundary of the survey. It was also noticeable that at least some flint was recovered from most of the collection squares in this area, suggesting that ploughing had already begun to disturb the underlying Early Mesolithic land surface. Additionally, the southerly limit of the gravelly clay upcast appears to have changed over the course of eight years. In 1985, this soil horizon only extended over the northernmost 11 m of the VP 85A trench (Mellars et al. 1998a, 40, Fig. 3.12). On the 1992 soil plot, the gravelly clay/peaty topsoil lay several metres farther south suggesting that, as ploughing had intensified, more of the gravelly clay upcast was being disturbed and redistributed over a larger area.

The major concentration of flints on the surface near the centre of the fieldwalked area can also be attributed to the effects of ploughing. This scatter coincided with the surface distribution of various sandy deposits. Although mixed in places with topsoil, this sand was broadly characteristic of the principal artefact-bearing deposits found at other locations along the former lake shore. Aside from its significance as an indicator of the increased impact of ploughing on the site, the presence of dense surface concentrations of worked flint in this area suggested that the spatial extent of the site was greater than Clark had originally envisaged. This had already been indicated by the results of the VP 1985 excavations, which demonstrated the existence of rich, artefact-bearing deposits at least 30 m beyond the point Clark considered to mark the eastern limits of the site. However, the presence of this dense scatter of lithic material, approximately 70 m farther to the east of VP 85A, showed that the Star Carr site covered an even larger area, as also hinted at by the density of finds recovered from a 2 × 2 m test-unit excavated in the same general area in 1989 (Mellars 1998d, 76, Fig. 6.2). Judging from both the soil-plot and the topography of the area, the surface concentration probably derived from a narrow spit of higher ground on the eastern side of the excavated areas. The outline and extent of this spit of land had already been defined by auguring carried out in conjunction with palaeoenvironmental sampling in 1985 (Cloutman & Smith 1988). This indicated that during the occupation of Star Carr, this spit of land projected into open water, and might have been the locus of a different suite of activities to those performed further to the west in the area investigated by Clark (1954), which lay in a marshier lake-edge environment.

Interpretation of the other surface concentration of lithics is less clear cut. This scatter was situated toward the western edge of the gridded section, in an area of mostly mid-brown gravelly clay (Fig. 13.10). If our assessment of the origin of this deposit is correct, then one would not have expected to find such a discrete concentration of material. Nonetheless, two possible factors might account for the presence of a concentration here. First, the scatter is situated in the same area as Clark's 1949–51 excavations. Since sieving was not used on Clark's excavations, it is possible that at least some of the flint in this scatter derived from the backfill of Clark's trenches. Another possible explanation is that the scatter represents redeposited material derived from the excavation of the cut, that was then dumped to one side (and in this regard, it is worth recalling that it was by examining the freshly cleaned banks of the Hertford Cut that John Moore first discovered the Star Carr site in 1948). If this was the case, then this would imply that the area of human activity at Star Carr originally extended several metres to the north encompassing those sections removed when the Hertford Cut was made.

Environmental records

Gaynor Cummins

Manor Farm/Wood House Farm, VP KN

Palaeoenvironmental samples were taken from test-pit VP91 KN at Woodhouse Farm (*c.* 500 m south of VP Site E) to investigate two layers of minerogenic sediment recorded within the peat stratigraphy. The detailed lithology (recorded from 26.56 m AOD) is presented in Table 13.1.

Pollen analysis

Samples were collected in overlapping 0.5 m monolith tins taken from the section of the test-pit. Twelve subsamples for pollen analysis were taken across the sediment profile concentrating on two episodes of inorganic in-wash at 127–123 cm and 55.5–52.5 cm. Unfortunately, the preservation of the pollen grains was too poor and the concentration levels too low to produce a statistically viable diagram. However, in the absence of radiocarbon dates the main types of pollen grain were noted to try to place the events within the regional chronology. The preferential corrosion of several important pollen taxa, and the absence of specific indicator types, e.g. *Alnus*, proved limiting to age determination.

Table 13.1. *Lithostratigraphy of column sample from west section of VP 91 KN (recorded from the top of the trench).*

Depth (cm)	Description
0–30	Dark brown, oxidized and disturbed peaty topsoil with root matt.
30–45	Dark brown oxidized *Phragmites* peat
45–52.5	Dark brown humidified *Phragmites* and herbaceous peat with some woody fragments.
52.5–55.5	Grey sandy silt mineral in-wash.
55.5–104	Brown woody detrital peat with *Phragmites* and herbaceous remains.
104–110	Light brown compacted wood layer in organic matrix.
110–132	Brown-grey silty gyttja with some pieces of natural, blue-grey flint and fine sand/silt layers occurring between 123 and 127 cm depth
132–161	Dark reddish-brown slightly compacted *Phragmites* peat with woody detritus.
161–168	Dark brown gyttja with *Phragmites* rhizomes
168–174	Grey sand with gravel

VP91 KN 127–123 cm. Three influxes of sand and silt form discrete layers within a matrix of gyttja. Pre-dating the larger sandy/silt in-wash band, this influx occurred during a period of sedge dominated vegetation growth. *Betula*, *Salix* and *Pinus* are the only identifiable tree/shrub types present. The event is tentatively dated to the Early Mesolithic.

VP91 KN 55.5–52.5 cm. This sandy/silt in-wash event occurred sometime after the *Corylus* rise, with *Ulmus* present within the catchment. No *Alnus* pollen grains (easily identified even in poor preservation deposits) were identified so the event is tentatively dated to the Late Mesolithic prior to the *Alnus* rise.

Particle size analysis

Samples were analysed from the following depths (cm): 126–7, 125.5–124.5, 124–123, 55.5–54.5, 54.5–53.5, and 53.5–52. The results are shown in Figs 13.11–13.12.

The three minerogenic layers between 127–123 cm have grains that are poorly sorted, and slightly negatively skewed with an almost bimodal grain distribution. The layers are composed of medium to fine

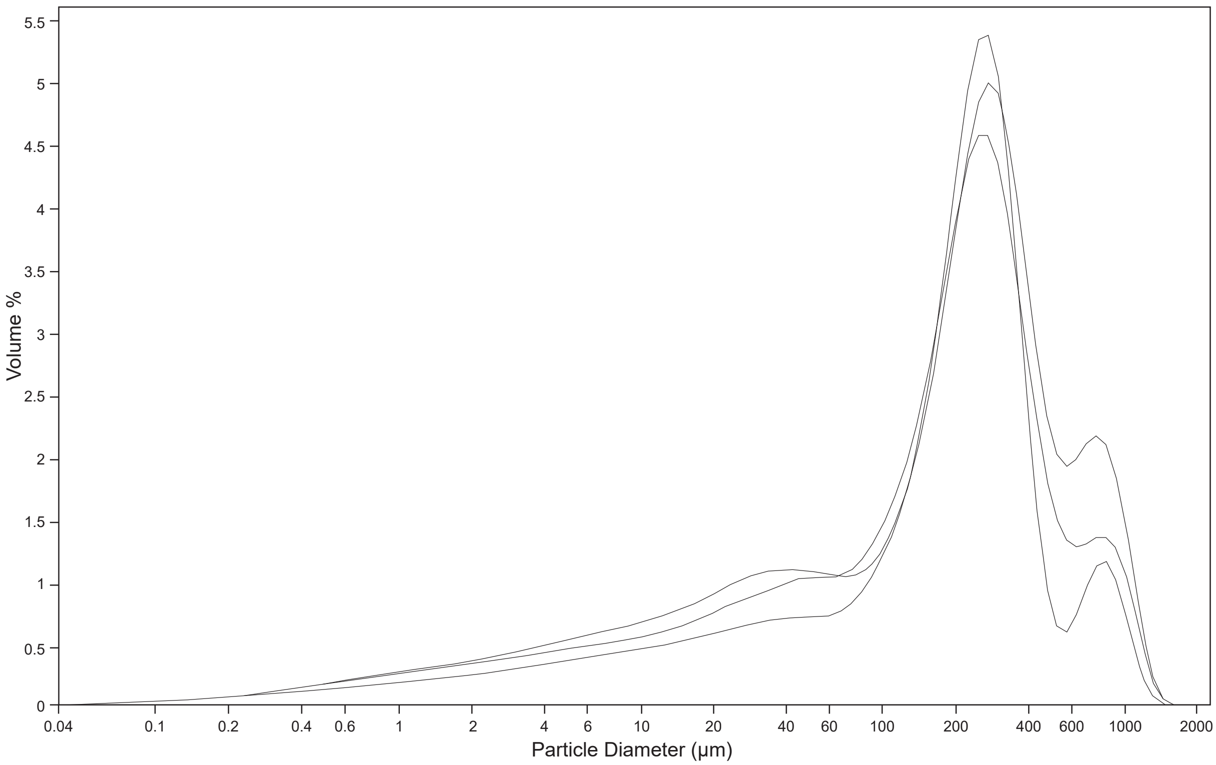

Figure 13.11. *Results of Phase 1 Particle Size Analysis on sediments from VP 91 KN profile.*

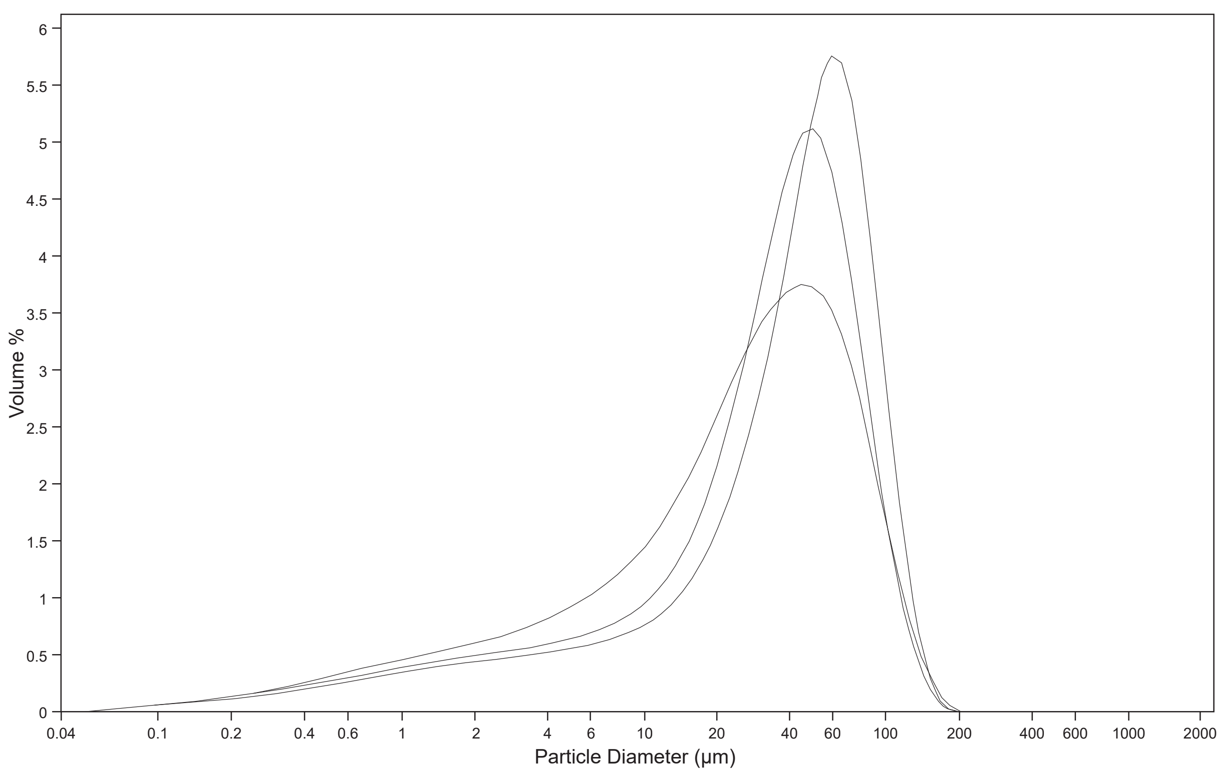

Figure 13.12. *Results of Phase 2 Particle Size Analysis on sediments from VP 91 KN profile*

sand, with some silt and coarse sand and coarse to finer clays. There is little difference between the samples, despite occurring in separate events, suggesting the same processes caused the deposition in each layer. The layers are probably waterborne in origin occurring over a short duration.

The in-wash layer between 52 cm and 55.5 cm is composed mainly of very fine sand to medium silt. The grains are poorly sorted and negatively skewed. The deposit was probably laid down in a very low velocity waterborne environment. All samples contain fairly fine particulate matter (including clays), which would not settle out if there was any movement. None of the samples have sediment greater than 0.2 mm suggesting a cut off in entrainment velocity, or the particle limit of the source material. As the samples progress up the profile the finer fraction increases, suggesting a settling out of the sediment in a decreasing energy environment. Therefore, the in-wash probably occurred in one continuous event but over a period of time. The layer is fairly typical of a Case I deposit (McLaren 1981) suggesting a fairly limited origin, such as flash floods or lake bottom sediments, as the sediments will have had little chance to undergo selective deposition.

Metals

The lowest in-wash horizon shows the highest erosion of mineral matter suggested by high sodium concentrations (Fig. 13.13). Parent rock may have been deposited in the succeeding event as well, as shown by high concentrations of calcium, although this could also be caused by affinity with organics. Waterlogging during the second influx is indicated by the peak in the iron/manganese ratio. The upper sandy/silt layer shows mainly soluble transport of minerals indicated by highs in sodium, magnesium, and potassium. At the start of the in-wash, reducing conditions occur followed by waterlogging.

Flixton School Field, VP96 FS

A 310 cm deep sediment profile was recovered from test-pit OE in 1995, *c*. 30 m from the approximate line of the Early Mesolithic shore. Only the lower 85 cm of the profile proved viable for pollen analysis. The lithology of the recorded section of the profile is given in Table 13.2 (all measurements are from 25.63 m AOD).

Pollen analysis

Samples were taken using overlapping 0.5 m monolith tins. Subsamples for pollen analysis were taken at 1–2 cm intervals, reducing to 1–2 mm at selected horizons. The results are presented in Fig. 13.14. CONISS was used to recognize the following seven assemblage zones.

LPAZ FS-1 299–310
Betula-Filipendula

The zone is dominated by tree and shrub pollen, mainly *Betula* and *Salix*, with the former contributing 50% of TLP. Poaceae and *Filipendula* are the main herb types recorded, at over 10% each, and Cyperaceae is also present in consistent, but low values. Isolated records of open-ground weeds occur, and there is a substantial microcharcoal presence with occasional peaks.

LPAZ FS-2 287–299
Betula-Dryopteris

The assemblage is dominated by *Betula*, at a consistent 70% of TLP, while total tree and shrub pollen accounts for more than 80%. *Filipendula* has fallen to low frequencies but is consistently present. Poaceae and *Salix* remain the other significant contributors. Isolated grains of ruderal weeds are still recorded. *Dryopteris filix-mas* joins the assemblage in the upper part of the zone. Low percentages of Pteropsida occur. Microcharcoal frequencies are reduced.

LPAZ FS-3 281–287
Betula-*Corylus*-type

Betula dominates the assemblage at between 70% and 80% of TLP, while *Corylus*-type becomes consistently present, rising to 20% late in the zone. All other taxa are present in low values only. Total tree and shrub pollen represent 90% of TLP. Microcharcoal frequencies remain low and fluctuate.

LPAZ FS-4 274–281
Betula-Cyperaceae-*Corylus*-type

Betula and *Corylus*-type still characterize the assemblage, but Cyperaceae rises sharply to high values. Isolated peaks occur for other taxa, particularly *Pinus* and *Filipendula*, and *Equisetum*. *Thelypteris palustris* occurs consistently in low values. Microcharcoal frequencies are very low.

Table 13.2. *Lithology of profile VP96 FS.*

Depth (cm)	Description
249–285	Dark brown organic mud with extensive reed macrofossils and vegetative remains
285–299	Dark brown organic mud with few reed macrofossils and vegetative remains
299–303	Light brown to grey silty sand
303–308	Brown organic silt
308–310	Light brown to grey sandy silt
310–312	Unconsolidated grey silty sand
312–335	Grey coarse sand with gravel, pebbles and chalk fragments

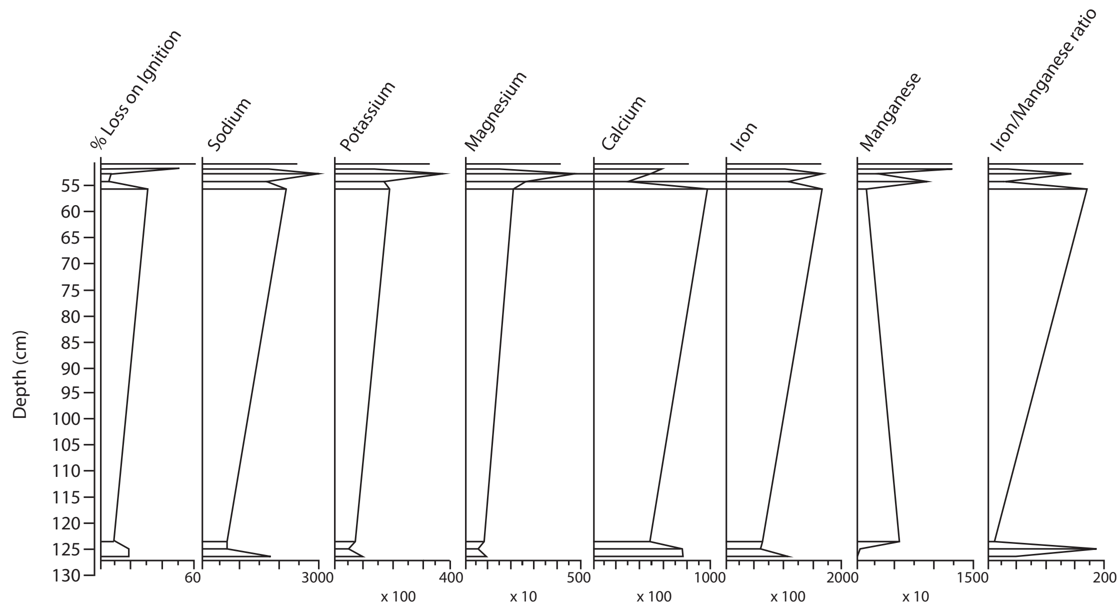

Figure 13.13. *Results of Metals Analysis on sediments from VP 91 KN profile.*

LPAZ FS-5 267–274
Betula-*Corylus*-type-Cyperaceae
Betula is still important but is gradually replaced by *Corylus*-type, its values rising steadily through the zone until it is the dominant taxon. Cyperaceae has fallen to low frequencies, although isolated peak values occur late in the zone, and other herb taxa are scarcely recorded. Low frequencies of *Thelypteris palustris* occur early in the zone. Tree and shrub pollen contribute almost all of the assemblage. Microcharcoal values rise, with a peak at 273 cm.

LPAZ FS-6 261–267
Corylus-type, *Betula*-*Pinus*-Cyperaceae
Corylus-type is by far the most abundant pollen type, with *Betula*, *Pinus* and Cyperaceae all present in moderate frequencies. Other herb types occur inconsistently, and at very low levels. Microcharcoal values are low in the first half of the zone, though there are several distinct peaks, but increase later in the zone.

LPAZ FS-7 252–261
Corylus-type-*Pinus*-*Thelypteris*-Pteropsida
The assemblage is dominated almost entirely by *Corylus*-type pollen with *Pinus* rising to moderate values. *Betula* representation is very low, and herbaceous pollen is almost entirely absent. The ferns Pteropsida and *Thelypteris palustris* show peak values early in the zone before declining. Microcharcoal frequencies are low.

Dating
Six radiocarbon dates were obtained on samples from the profile (Table 13.3). Based on the pollen stratigraphy (which suggests an Early Holocene date for the start of the profile) the lower radiocarbon dates (Beta-94431 and Beta-94432) are erroneous, made too old by hard-water error due to the calcareous nature of the local substrate and soils. The same is probably true of Beta-94443. The remaining dates are considered to be accurate ages for those points on the profile (see Chapter 4).

Interpretation
The pollen data suggest the start of sedimentation during the early stages of the Holocene, with tall herb communities progressively supplanted by shrub and tree cover of willow and birch throughout FS1. Burning appears to have been quite intensive, with several sharp peaks of microcharcoal present in this part of the profile, and this may have created temporary openings in the woodland or at the lake shore, allowing the expansion of ferns, grasses and open-habitat herbs.

Birch woodland with an understorey of male fern was fully established by FS-2 , while marsh fern and horsetails were growing on wet ground and shallow water at, or close to the shore. These stable birch woodland communities remained largely unchanged until F-3, when hazel starts to become established, outcompeting birch on the calcareous, dryland soils. This process was gradual, but eventually led to the

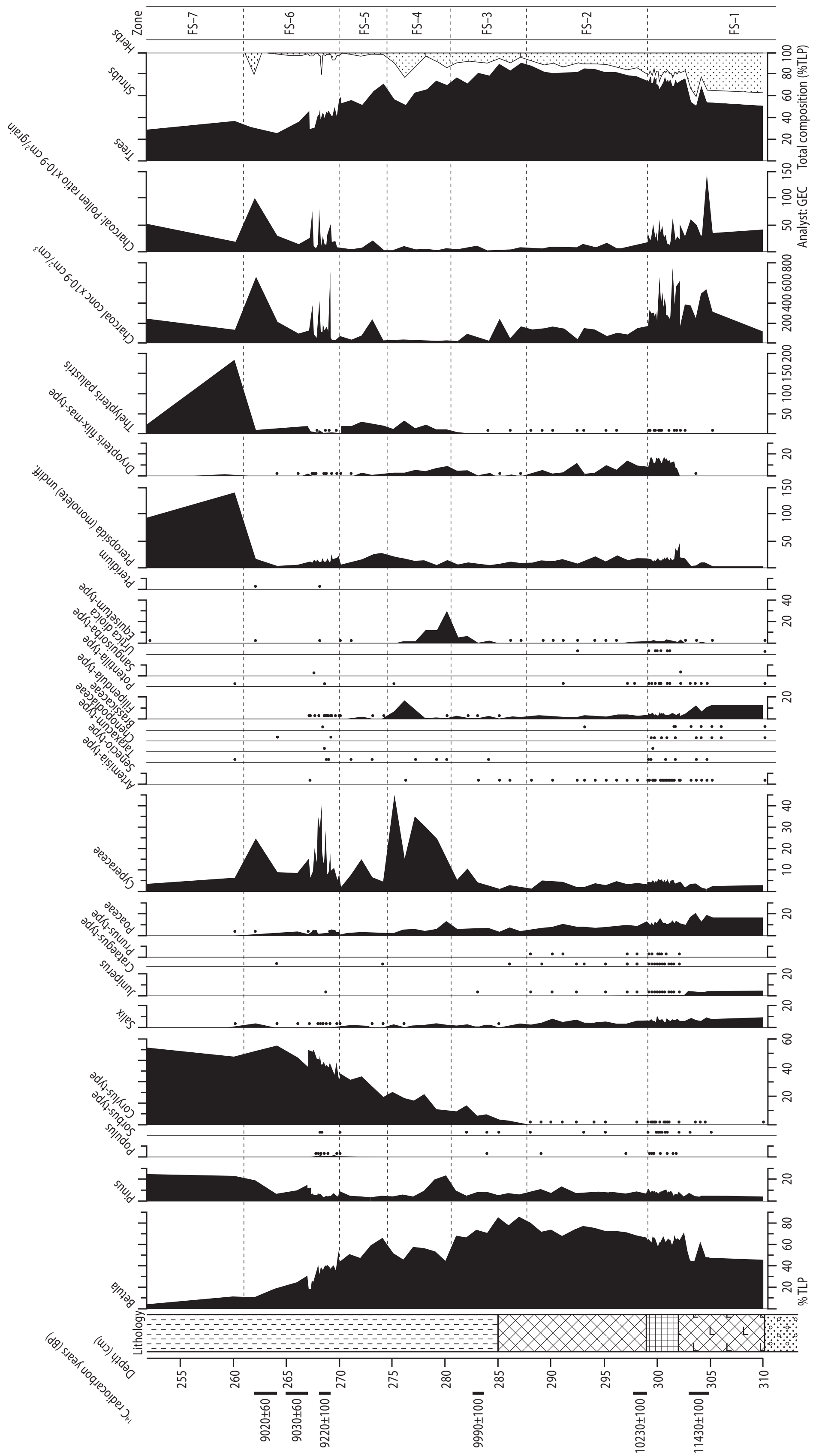

Figure 13.14. *Pollen diagram for profile F95.*

Table 13.3. *Radiocarbon dates from Profile F95.*

Lab Code	Depth (cm)	Radiocarbon years BP	$\delta^{13}C$ (‰)	Calibrated age (cal BC)	Material
Beta-104481	262–264	9020±60	-28.4	8325–7965	Dark brown organic mud with extensive reed macrofossils and vegetative remains
Beta-104480	265–267	9030±60	-27.1	8415–7965	Dark brown organic mud with extensive reed macrofossils and vegetative remains
Beta-94434	268–269	9220±100	-29.2	8710–8265	Dark brown organic mud with extensive reed macrofossils and vegetative remains
Beta-94433	282.5–283.5	9900±100	-33.2	9815–9210	Dark brown organic mud with extensive reed macrofossils and vegetative remains
Beta-94432	297.5–299	10,230±100	-29.7	10,450–9455	Dark brown organic mud with fewer reed macrofossils and vegetative remains
Beta-94431	303–305	11,430±100	-27.1	11,505–11,140	Brown organic silt

dominance of hazel within the woodland. Peaks of *Equisetum* and then *Filipendula*, and an expansion of Cyperaceae in F-4, probably represent instability around the lake edge, with sedge beds advancing into the terrestrializing waterbody, and new marginal habitats being created, then suppressed by woodland shading.

During zone F-5, localized burning may have targeted the sedge beds forming at the edge of the lake, given the apparent correspondence between microcharcoal and Cyperaceae level, and the adjacent areas of birch woodland, which appear to have been replaced by hazel during these periods of burning. The start of this phase of burning dates to 8710–8265 cal BC (9220±100 BP, Beta-94434), slightly later than the start of the second phase of burning recorded by Petra Dark at Star Carr (Dark 1998a; see Milner et al. 2018 for the revised chronology for this event). Further burning occurs at 8325–7965 cal BC (9020±60 BP, Beta-104481), coinciding with a slight expansion of sedge. Ferns (including marsh fern) expand shortly after this event, and their growth may well have been associated with the effects of disturbance in these lake-edge environments. On the dry land around the lake, however, after a long period of expansion hazel-dominated woodland seems to have become fully established with *Pinus* perhaps becoming part of the woodland in favoured locations.

Church Farm

Pollen analysis was undertaken on samples taken from a test-pit (QAA), excavated on an area of farmland to the south of Folkton Church as part of the programme of augering and sample-excavation along the southern shore of the lake between Flixton School Field and Barry's Island (see Fig. 5.1 for sample location). No archaeological material was discovered in the excavation of the test-pit. No radiocarbon dates are available.

Pollen analysis

Samples were taken using overlapping monolith tins. Subsamples were taken at 2–4 cm intervals in the lowest tin, then at 6–16 cm in the upper tins. No samples were taken between 102 and 62 cm where the lithology comprised silty sand overlain by a layer of chalk pebbles. There was a considerable degree of deterioration of pollen grains throughout the profile, with corrosion and crumpling the main effects. The pollen diagram (Fig. 13.15) has been divided into seven local pollen assemblage zones.

LPAZ QAA-1 232–222 cm
Poaceae-Cyperaceae-*Betula*

The zone is dominated by herbaceous pollen, mainly Poaceae and Cyperaceae which together contribute almost 70% of total land pollen. Low frequencies of *Rumex* and *Artemisia* occur, with sporadic occurrences of other open habitat weeds. Aquatic taxa are rarely present. *Betula* and *Salix* are the most important tree and shrub types, with the former above 10% of TLP, while low values for *Pinus* occur. There is a low peak in pre-Quaternary spores and microcharcoal percentages are moderately high.

LPAZ QAA-2 222–204 cm
Betula-Poaceae-Cyperaceae-*Rumex*

Betula frequencies increase to over 20%, the same as those for Poaceae and Cyperaceae, and a low *Salix* curve persists. *Juniperus* is recorded. *Rumex* increases

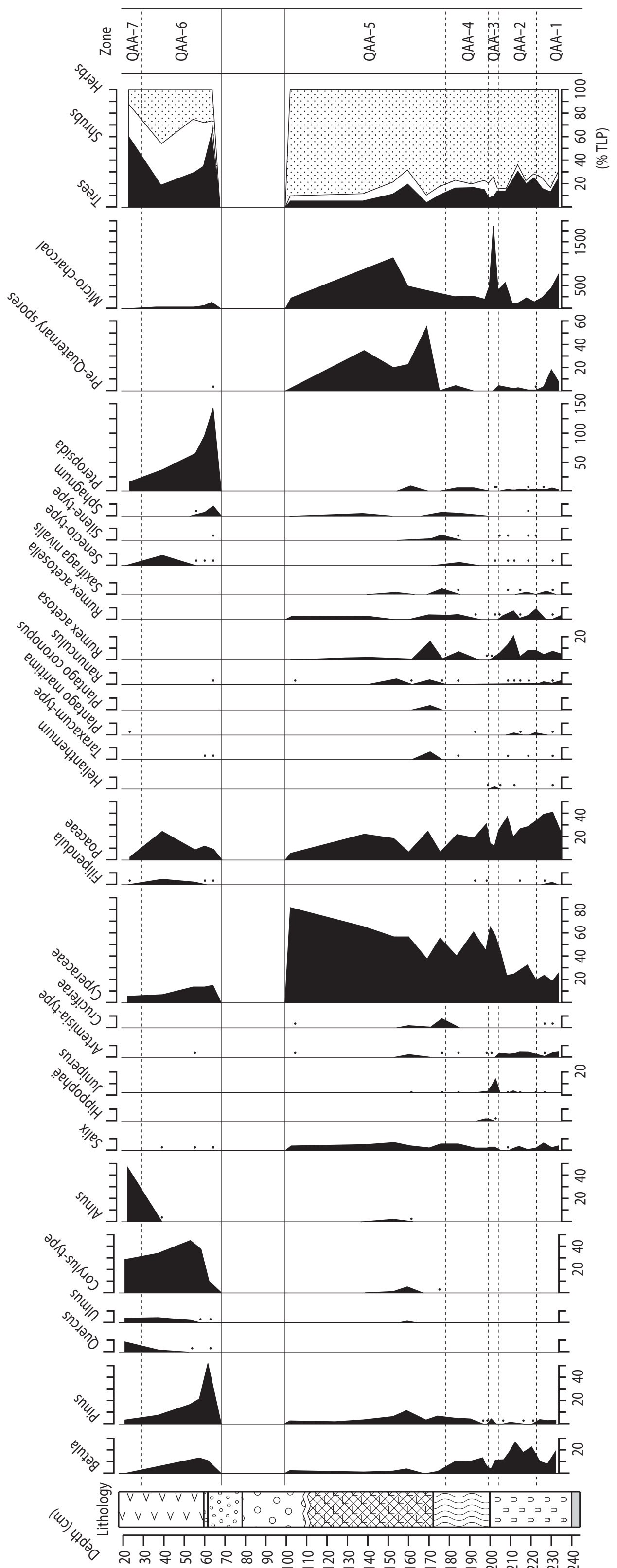

Figure 13.15. *Pollen diagram for Church Farm profile.*

to over 10%, contributed by both *Rumex acetosa* and *Rumex acetosella* (red sorrel) types. *Artemisia* increases but remains at low values. Low peaks of *Plantago maritima* and *Saxifraga nivalis*-type (alpine saxifrage) occur, with isolated records of a range of open ground weeds. Microcharcoal values fall to low levels.

LPAZ QAA-3 204–197 cm
Cyperaceae-*Juniperus*-Poaceae
Betula frequencies fall sharply, replaced by a peak of *Juniperus* of over 10%. Poaceae frequencies fall sharply while Cyperaceae percentages rise to a peak of almost 70% and dominate the assemblage. No other pollen types are significant other than a very small peak of *Helianthemum*. Microcharcoal frequencies rise sharply to a high peak.

LPAZ QAA-4 197–178 cm
Cyperaceae-Poaceae-*Betula*-*Salix*
Betula recovers to values of over 10%, with low curves for *Pinus* and *Salix*. Hippophaë (sea buckthorn) is also briefly recorded. The assemblage is dominated by Cyperaceae, at 60%, and Poaceae, which together contribute 80% of TLP. There is a low curve for Pteropsida, but no other types are significant. Microcharcoal frequencies fall to moderate values.

LPAZ QAA-5 178–102 cm
Cyperaceae-Poaceae-*Salix*-*Pinus*
Betula falls to very low frequencies, and tree and shrub pollen is contributed mainly by low curves for *Salix* and *Pinus*. Cyperaceae percentages rise through the zone to well over 60% and Poaceae is consistently over 20% of TLP. There are isolated low peaks of several pollen types, including *Corylus*-type, *Sambucus*-type (elder), *Taraxacum*-type, *Plantago coronopus* (buck's-horn plantain), *Ranunculus*-type, *Rumex*, *Silene*-type, Cruciferae and *Saxifraga nivalis*-type. High frequencies of pre-Quaternary spores occur. Microcharcoal percentages rise to consistently high values.

LPAZ QAA-6 62–28 cm
Corylus-type-*Pinus*-*Betula*-Pteropsida
Pinus pollen peaks at the start of this zone but is replaced by high frequencies of *Corylus*-type, at over 40%. *Betula* occurs in consistent but low frequencies (below 20%). *Ulmus* and *Quercus* are recorded for the first time. *Filipendula* is consistently recorded in low values, and a *Senecio*-type peak occurs late in the zone. Cyperaceae and Poaceae together contribute only about 20% of TLP. *Sphagnum* occurs for the first time, and peaks of Pteropsida are recorded. Microcharcoal values are very low.

LPAZ QAA-7 28–22 cm
Alnus-*Corylus*-type
Alnus occurs in the assemblage at almost 50%, with *Corylus*-type occurring at 30%, and these taxa dominate the assemblage. There are low frequencies of *Quercus* and *Ulmus*. Herbaceous pollen is at very low frequencies, with only Cyperaceae of any significance. Microcharcoal is absent.

Interpretation
Sedimentation began at the edge of the lake, surrounded by a very open landscape with large areas of bare soil, as shown by records of pioneer weeds and ruderal taxa, primarily docks/sorrels and mugwort, and some areas of birch and willow scrub. Variations in the morphology of the *Betula* pollen grains suggest that some of them might derive from dwarf birch rather than tree birches, which would fit with this vegetation community (Birks 1968). Conditions would have been cold, and the biological productivity of the waterbody would have been low, shown by the almost complete absence of aquatic pollen. The substantial microcharcoal record shows that fires took place in the area—unless the particles were reworked from earlier soils. The presence of a low peak of pre-Quaternary spores, signifying some soil erosion, suggests this may well be the case. Radiocarbon dates are unavailable, but this zone is likely to date to towards the end of the Windermere Interstadial or the start of the Loch Lomond Stadial. Birch woodland started to become established in zone QAA-2, although the vegetation cover was still very open, with extensive areas of weed-rich grassland, and some areas of bare ground encouraging the growth of ruderal taxa. The very sparse aquatic pollen records show that the shallow lake margins remained unvegetated. The falling frequencies of microcharcoal suggest that any local burning was much reduced.

Zone QAA-3 contains only two counted levels but reflects a major, but temporary change in the local vegetation. The very sharp peak in microcharcoal values records a phase of burning that mainly affected birch communities and encouraged the spread of juniper, which would have replaced birch directly as well as colonizing tall herb-grassland areas. Similar brief fire episodes occur during this broad time period at other locations discussed in this volume.

Pre-fire conditions returned in zone QAA-4, as birch became re-established (probably at the expense of juniper), and pine may also have been present (though its pollen may well represent longer-distance transport). Sea-buckthorn (*Hippophaë*) was briefly present in this regeneration community, but sedge-dominated grassland remained the main vegetation community. Although there is very little pollen evidence of aquatic vegetation, the presence of moss peat in the lithology suggests some colonization of the lake margins was occurring.

The pollen record of zone QAA-5 records a significant change in local vegetation, as tree and shrub types decline sharply and the landscape was dominated by herbaceous communities, mainly sedge-grassland, with a range of open-ground weeds and tall herbs. Increases in pre-Quaternary spores and microcharcoal suggest erosion and in-wash of soil material from unstable, bare ground, although fires in local grassland may well have occurred. Only willow persists, and the pollen may well represent dwarf willow here. A major climatic deterioration seems likely and this zone is considered to represent deposition under the severe cold conditions of the Loch Lomond Stadial. The occasional records of thermophilous taxa like *Corylus*-type will originate in reworking of earlier pollen rather than actual presence. Erosion of inorganic sediments under a severe cold climate culminates in the sediment lying above zone QAA-5, comprising coarse grained clastic material including layers of sand and pebbles. This horizon probably represents solifluxion during the later, coldest phase of the Stadial.

Organic sedimentation resumed in zone QAA-6, after the Loch Lomond Stadial, but there seems to have been a hiatus as the rising *Corylus*-type pollen curve at the start of the zone suggests a time almost a millennium into the Holocene. A mixed deciduous woodland dominated by hazel, but also with elm and oak, characterizes this zone, and is similar to the vegetation recorded at the same point in the pollen stratigraphy at several other sites around the lake. Sedges and grasses are much reduced, and were probably restricted to around the wetland edge where the thermophilous *Filipendula* became common. This may also be the source of the Pteropsida, if ferns were also present at the shore. Open ground weeds are almost gone from the assemblage, other than a small peak of *Senecio*–type late in the zone, and the hazel ground cover may have been almost continuous.

Zone QAA-7 is represented by a single pollen level but records a major change in the local vegetation as alder expanded rapidly, probably over the increasingly terrestrialized wetlands around the lake shore. This significant increase in alder must represent the later part of the Mesolithic, but the wide sampling interval at the top of the diagram means that the rate and character of the spread of mid-Holocene woodland is not well defined here.

Discussion

In addition to the intensive sampling of specific sites around the lake, the VPRT project undertook extensive auger surveys of the lake basin, and test-pitting of areas along the approximate line of the lake shore. Though these excavations provide far less detail than the more intensive studies of sites such as VP D and No Name Hill, they nonetheless provide important information on the likely location of other sites and the overall patterning of Mesolithic activity in relation to the topography and palaeoenvironments of the former lake.

Perhaps the most important result of this work is the identification of several additional concentrations of lithic and faunal material around the lake, notably the two Flixton School sites on the southern shore of the lake, and the scatters at Lingholm Farm, on the northeast side of the lake. The test-pitting and fieldwalking at Flixton School Field show that this was a particularly large area of activity, extending at least 100 m along the edge of the lake and covering more than 1500 m^2. Though further work is necessary before we can establish the character and chronology of activity at this location, the results of the test-pitting show the significant spatial scale of Early Mesolithic occupation, and the extent to which the landscape around the lake was occupied.

It is difficult to say if the lack of material culture recorded at Manor Farm, or at the western end of the lake, reflects a lack of activity, or is a product of the small sample size. In both cases, further fieldwork is necessary. The areas around Lingholm Farm, however, clearly were occupied during both the Early and Late Mesolithic, perhaps to make use of the large embayments.

One further issue that arises from the work discussed in this chapter is the variable depth of the peat deposits sealing the Early Mesolithic land surface and the shallower parts of the lake margins. In some areas this is very shallow, as the recent work at Star Carr has demonstrated. In others, there is over twice the depth of peat, particularly along parts of the southern shore. This creates a particular logistical challenge when sampling those areas, but also highlights the potential differences in preservation (both of the archaeological and palaeoenvironmental remains) that exist across this landscape. This is an important issue, and one that should underpin future management plans and fieldwork strategies.

Chapter 14

Seamer Carr lithic assemblages

Chantal Conneller, with contributions from Andrew David & Francis Wenban-Smith

Original lithic illustrations by Hazel Martingell†

This, and the following chapter report on the lithic assemblages recorded by the Seamer Carr Project and the VPRT. The scale and scope of these projects is unique in permitting the opportunity to investigate Early Mesolithic activity at the scale of the wider landscape rather than the individual site. Lithic artefacts remain the most enduring and ubiquitous evidence of these past activities, and as such their study offers an opportunity to better understand the rhythms and scale of working and dwelling in the environs of Lake Flixton. The scale of excavation around Lake Flixton provides a rare opportunity to emphasize the spatial aspects of lithic working – the scheduling in space of economies of procurement, manufacture, use and discard. This emphasis on the landscape-scale aspects of lithic variability complements the focus of fieldwork in the Vale of Pickering – that of understanding these broader patterns of human activity and settlement within their environmental context.

The lithic material also has the potential to address the following, more specific, problems, associated not only with the Early Mesolithic in Northern England, but also with the transition from Late Upper Palaeolithic to Early Mesolithic industries. To begin with, the vast quantity of lithic artefacts collected in the course of the project permits a more detailed consideration of the lowland Mesolithic in Northern England. Lacking additional data, past knowledge and understanding of Mesolithic activities in the lowlands has been dominated by the major sites of Flixton 1, and more especially, Star Carr, which has tended to eclipse the former. Both sites share certain characteristics; they are large, dense and yielded a broad range of tool types – categorized as a 'balanced assemblage' (Mellars 1976). These shared characteristics have thus come to be considered as typical of lowland sites, and have formed the basis for models pairing lowland 'base camps' with microlith dominated 'hunting camps' on the North York Moors (Clark 1972; Jacobi 1978). However, the sheer variability of the lithic material from the Vale of Pickering – encompassing variability in raw materials types and technologies, and in both the scale and type of lithic-based activity patterns – provides an opportunity to clarify and refine earlier ideas about the character of lowland sites and models of hunter-gatherer land use.

The lithic material also has the potential to elucidate the relationship between two facies of the Early Mesolithic – 'Star Carr type' and 'Deepcar type' assemblages. These variants, first noted by Radley and Mellars (1964) in Pennine industries, display differences both in microlith forms and the raw materials employed. Star Carr type industries in Northern England are characterized by the presence of broad obliquely blunted points without further modification, isosceles triangles, and trapezes, and the use of mainly translucent flints. The microlith component of Deepcar type industries consists almost entirely of slender obliquely blunted points, many of which have additional retouch on the leading edge and which were manufactured mainly on Wolds flint (Radley and Mellars 1964; Jacobi 1978; Reynier 2005). These industries have been attributed to different groups with overlapping territories co-existing in Northern England in the Early Mesolithic. Reynier (2005) has identified a chronological component to this variability, suggesting that Star Carr industries first appeared in Britain *c*. 9700 uncal BP with Deepcar assemblages not occurring until after *c*. 9500 uncal BP after which the two assemblage types continued in parallel. More recently, this chronological relationship has been refined, with current evidence suggesting Star Carr-type assemblages first appeared in 9805–9265 cal BC (95% probability; Conneller et al. 2016, Figure 4), probably in 9495–9290 cal BC (68% probability), and disappeared in 8230–7520 cal BC (95% probability; *ibid*. Figure 4), probably in 8165–7835 cal BC (67% probability) or 7830–7815 cal BC (1% probability). Deepcar type assemblages first appeared in 9460–8705 cal BC (95% probability; Conneller et al. 2016, Figure 5), probably in 9090–8775 cal BC (68% probability), and assemblages disappeared in 8200–7240 cal BC (95% probability; *ibid*., Figure 5), probably in 8075–7620 cal BC (68% probability).

The Vale of Pickering collections are composed of material of a variety of different dates, spanning the Late Glacial and Early Holocene. Earliest is Late Glacial Final Palaeolithic or Federmesser material – in the form of Final Palaeolithic occupation debris at Seamer K and possibly more isolated finds of tools at Seamer Site C and site VP E. Late Glacial/Early Holocene Terminal Palaeolithic or 'Long Blade' material is well represented, with reasonably substantial occupation at Seamer C, a small-scale manufacturing area at Seamer L and evidence of horse hunting activities (though lithics are absent) at Flixton II. Late Mesolithic and later visits to the Vale are represented in some areas, particularly on higher ground, where occupation evidence is almost entirely ploughed out. However, the vast majority of the material recovered from the two projects belongs to the Early Mesolithic, with Star Carr type assemblages by far most commonly represented.

A total of 44,840 pieces of worked flint have been recovered over the course of 25 years of fieldwork in the Vale of Pickering. These assemblages represent material derived from 2 × 2 m test-pits, fieldwalking surveys and a number of larger area excavations. The latter include Seamer Sites C and K, Barry's Island, Flixton 1, Flixton School Field, No Name Hill and VP D, all of which have yielded assemblages of more than a thousand pieces. The recovered material varies in density from a single piece per 2 × 2 m test-pit to a density of more than 1000 pieces per 2 × 2 m test-pit at site VP86D. The assemblages thus represent both isolated actions and more repeated or long lasting lithic based activity patterns, and as such reveal the varying rhythms of activity throughout the landscape surrounding Lake Flixton.

Seamer Carr Site C

The lithic collection from Site C, at 14,275 pieces, is the largest so far recovered from the Vale of Pickering. The material is the product of occupations of several different dates: extensive knapping scatters of Long Blade character, dating to the Pleistocene/Holocene boundary (Barton 1989, 1991), while the remainder of the lithic debris belongs to the Early Mesolithic. Eleven backed points may indicate a human presence in the

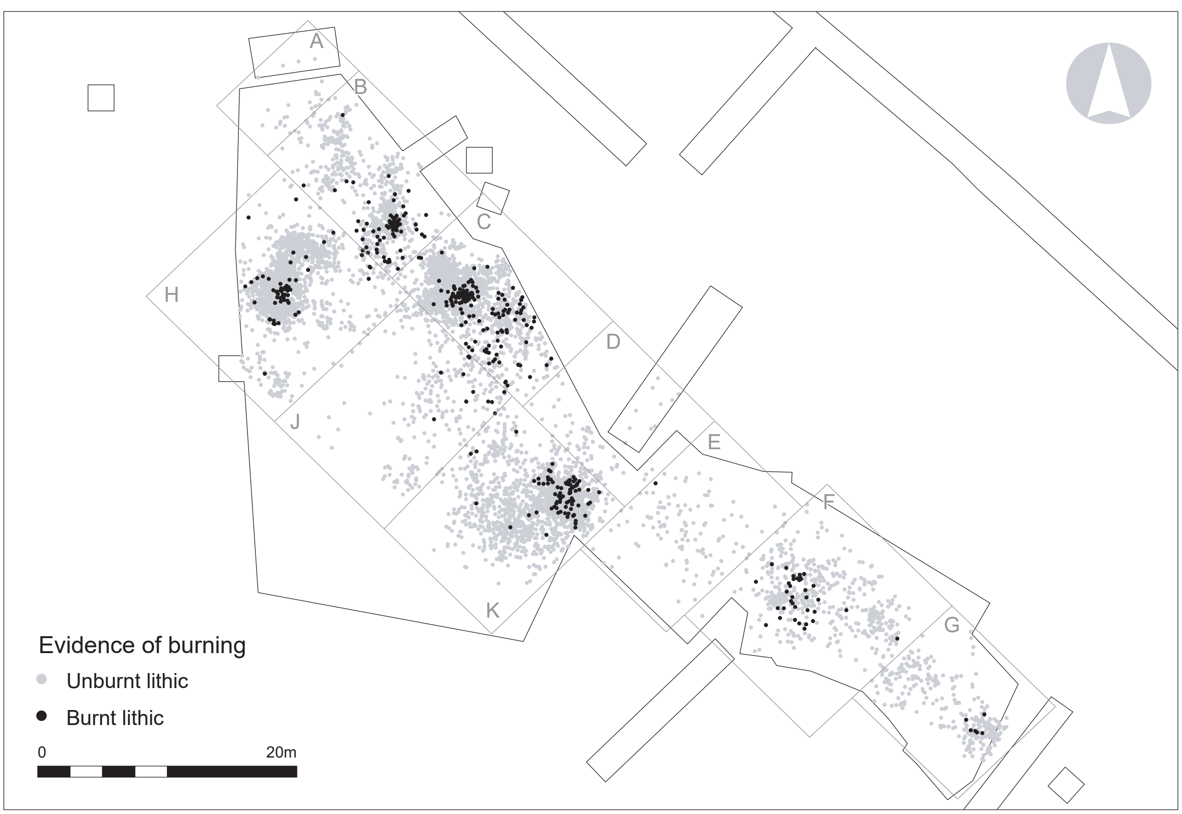

Figure 14.1. *Plot of the lithic scatters and burnt material, Site C.*

vicinity during the second half of the Late Glacial Interstadial, as at Seamer K, however many of these are likely to belong with the Long Blade occupation.

The site is composed of a series of distinct clusters of material (Fig. 14.1) each of which appear to have been generated by the use of a variety of technological systems in the pursuit of a variety of different activities. Occasional refits do occur between a number of these clusters (Fig. 14.2); however, *apart from B1 to C refits*, these are so few that it is difficult to determine whether these indicate contemporaneity or simply the scavenging of usable lithic pieces during later occupations. The contrasting character of several of the scatters suggests that they are the product of a number of different visits to the site. Most broadly, a division can be made between Long Blade occupation(s), which comprises Scatters B1, C and F, and Early Mesolithic occupation, consisting of knapping Scatters B, H, and K and a minor spread of lithic material at Scatter G (Fig. 14.1)

Raw material

Raw material representation is detailed in Table 14.1 and Figure 14.3. The collection is composed nearly entirely of till and Wolds flint, with the latter accounting for just over 50% of the total. Wolds flint is opaque grey or white and obtained in tabular or semi-tabular form from the Yorkshire Wolds, which form the southern boundary of the Vale. As the Wolds chalk is very hard it may have been obtained from head deposits. Till material is grey speckled, brown or red and obtained from the glacial till deposits that blanket the East coast. Examination of the cortex of the Mesolithic material indicates that it was usually procured as beach pebbles. Recent LA-ICP-MS testing of a small number of Long Blade lithics from Site C has suggested that some of the clear brown flint may have a south Lincolnshire source (Conneller et al. 2019). However, it should be noted that such testing has only been very small-scale, and the range of chemical signatures found in till

Table 14.1. *Raw materials at Site C.*

Source	No.	%
Chert	30	0.2
Clear/speckled	5301	37.1
Wolds	7255	50.8
Uncertain	648	4.5
Burnt	1041	7.3
Total	**14275**	**99.9**

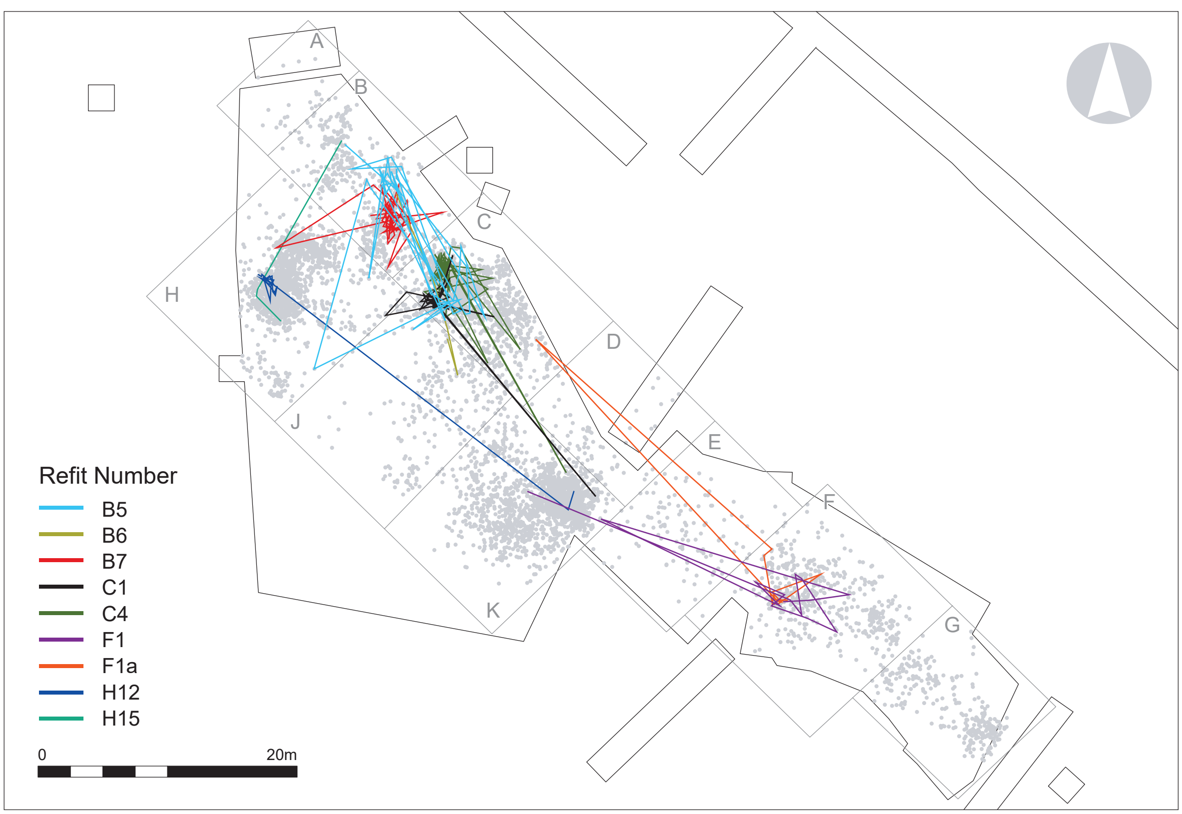

Figure 14.2. *Plot showing refits between scatters, Site C.*

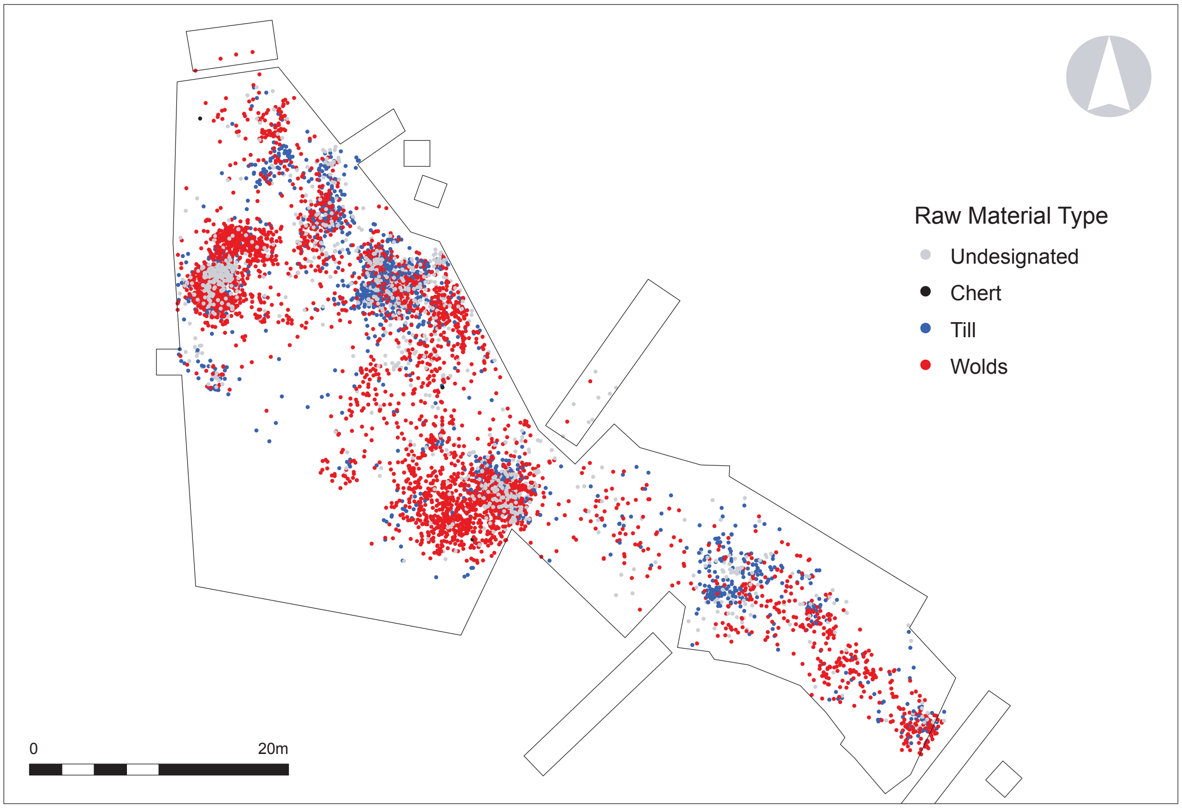

Figure 14.3. *Raw material distribution, Site C.*

material, and offshore sources, is currently unknown. The material used in the Long Blade scatters reveals a number of different cortical conditions. Some may have been obtained direct from a chalk source, other large cobbles appear to have come from head deposits and a fluvial source. Beach pebbles were not used. The appearance of the material identified as having a potential Lincolnshire source overlaps in appearance with the clear flint that can be obtained from the till. These cannot be easily separated so till flint and the large clear brown and grey speckled cobbles used by Long Blade groups have been recorded as a single group.

The size and knapping quality of the original nodules is very variable. Most of the till flints are speckled grey but others vary in colour. Numerous beach pebbles of both till flint and cherty material, with diameters ranging in size from 6–9 cm, were worked. These display an extremely battered cortex and internal fractures as might be expected for beach pebbles. Beach pebble material at Site C is notable for its extremely poor quality. Nodules used during the Long Blade occupation were much larger (refitting suggests up to 20 cm in length), are of much higher quality and a translucent black or speckled grey in colour. The Wolds material consists of medium-sized nodules and tabular pieces, with frequent pin holes and inclusions, ranging from white to bluey-grey in colour. The condition of the flints and cherts is fairly fresh, patination being entirely absent and staining infrequent.

Technology

The knapping debris from Site C consists of Early Mesolithic and Long Blade industries. Though backed points are present, no Federmesser knapping debris could be discerned. In broad terms, the assemblages from Site C are blade-based, and all stages of core reduction are represented, but with significant inter-scatter variation. At one end of the technological spectrum lie the giant blades and large, flat faced blade cores of Scatters C and F, belonging to the Long Blade occupation; at the other are a number of unproductive and crudely worked beach pebbles from Scatter K. Between these two extremes blades were detached from small and medium sized cores with a varying degree of success.

Long-blade technology

Long Blade technology in the Vale of Pickering bears many similarities to that of Southern English sites (Barton 1989, 1998). Large blocks of high-quality material

Figure 14.4. *Long blade cores, Site C.*

were preferentially used at Seamer C (Fig. 14.4), with imported nodules up to 200 mm in length. Tabular and semi-tabular flint was used preferentially, with blade reduction exploiting the full length of the nodule. A soft stone hammer was used for knapping. Anterior cresting was used to initiate blade production, with the angles of tabular pieces used to initiate the crest, before longitudinal blade removal occurred. Cores could be re-crested to maintain and prolong blade production. Some cores have cortical backs, others are crossed by transverse removals from lateral cresting.

Faceting was employed, although not exclusively. Some refit sequences have a high level of faceted and dihedral butts; on others the platforms are plain. Extensive and neat abrasion is a feature of the latter sequences, more so than amongst the Mesolithic assemblages of the area. Platform/core face angles are rather lower than Mesolithic examples, which tend to be nearer 90°. Refitting indicates a true opposed platform technology, with one or two removals from one platform before the core was rotated and a similar number of removals occurred from the opposed platform. This resulted in blades that are generally flat in profile. Blades are also longer than their Mesolithic counterparts, though smaller on average than those of Long Blade assemblages in southern England, where much larger raw material packages were readily available. Fourteen blades from Lake Flixton are >80 mm in length and four are >100 mm. Many of the larger blades are broken, however, and conjoins of snapped blades indicate lengths of up to 140 mm were achieved.

Bruising is less common than on many southern Long Blade sites, but it is present on six pieces at Site C (Fig. 14.5), most notably on a crested piece, where one of the bruising spalls has been refitted (see Fig. 14.13, right). As in Southern England, crested pieces or similarly thick blades were the most common supports for bruising. Rubbed-end pieces are also a feature of the assemblage.

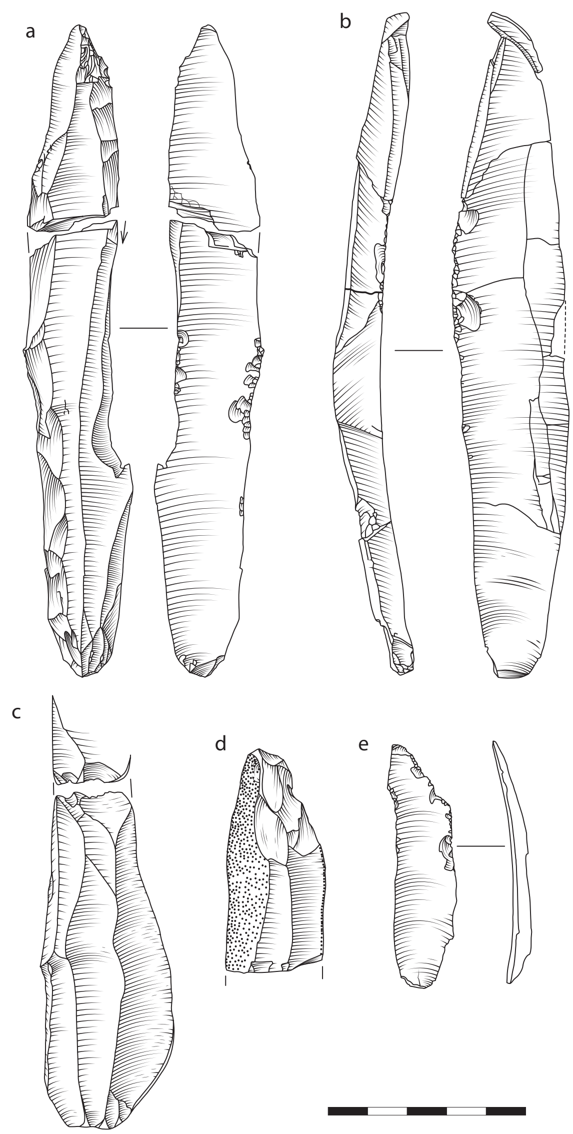

Figure 14.5. *Bruised blades (a-b, e) and rubbed-end pieces (c-d), Site C; scale in cm.*

Figure 14.6. *Early Mesolithic knapped beach pebbles, Site C.*

Early Mesolithic technology

Early Mesolithic cores were smaller, often made on beach pebbles or small Wolds nodules about 5–8 cm in length (Fig. 14.6). This appears a genuine preference; at Star Carr when a large nodule was obtained it was split into smaller parcels. Though cores could be crested, more frequently a natural ridge was used to initiate blade production. Platforms were abraded and overhangs removed to guide blade detachment, while a soft hammer was used at all times, except during cortical removal when a hard stone hammer was often employed. In contrast to the Long Blade assemblage, Mesolithic blades are more curved and though opposed platform cores and a variety of two-platform and multi-platform cores are present, single platform cores are more typical. Refitting suggests one preferential platform on two platform cores, the second used to correct mistakes or generated when the first had to be abandoned due to problems. Techniques designed to anticipate and correct mistakes were employed. These include platform rejuvenation to maintain the requisite platform/core face angle, plunging blades to thin the core face and step fracture removals, where the core was rotated and the step fracture removed from the opposite platform. Cores varied in their productivity; some did not produce any usable pieces at all, while up to 28 blades/tools could be detached from a successful core.

At Scatter K many cores were particularly unproductive. This seems to be due to raw material constraints and a lower level of technological expertise than glimpsed elsewhere on the site. Small, poor quality pebbles were employed and mainly single platform cores, a higher proportion of flakes and shatter fragments and fewer core maintenance flakes were produced. Although many of the nodules shattered on impact, useable flakes and blades were successfully detached from others. Although an anvil is often employed elsewhere in dealing with this type of material, the tell-tale bipolar flakes and cores from such working (Inzan et al. 1992) are absent at Seamer.

Assemblage composition

The overall composition of the lithic material from Site C is shown in Table 14.2 and the main tool categories are discussed below. Following this, the composition and character of each sub-cluster within the Site C complex is described separately.

Backed points (Fig. 14.7)

Nine relatively complete examples were recovered. These are steeply backed, either partially along one edge (n=2) or entirely along one edge (n=7). Six are convex-backed, three have a single angle between the lateral edge and the oblique point. A further four

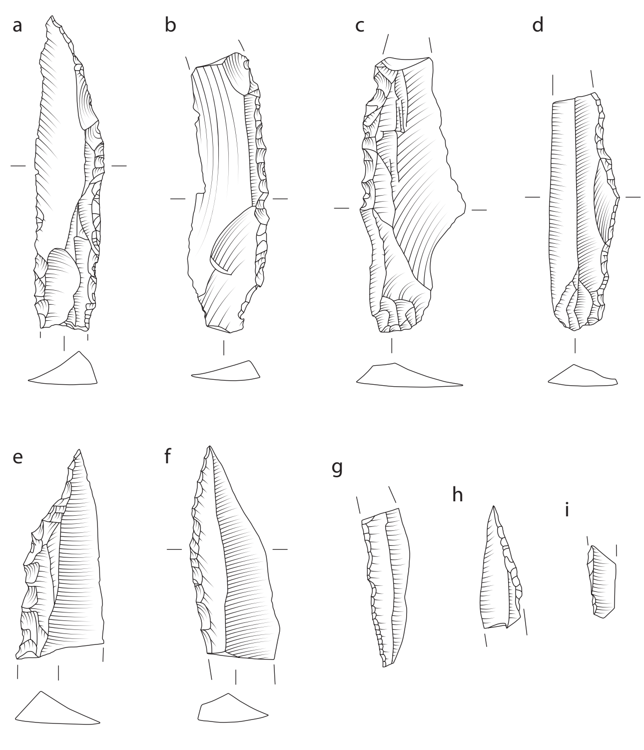

Figure 14.7. *Backed points, Site C; scale in cm.*

Table 14.2. *Composition of the Seamer Carr Site C lithic assemblage; re/ut = retouched or utilized.*

Category	No	%
Tools		
Awl/borer	4	0.03
Backed point	10	0.1
Burin	34	0.2
Core/scraper	4	0.03
Core/scraper/ burin	1	0.01
Core tool	2	0.01
Knife	1	0.01
Microlith	51	0.4
Notch	2	0.01
Scraper	191	1.3
Scraper/awl	6	0.04
Scraper/notch	2	0.01
Tang	1	0.01
Truncation	11	0.1
Blade (re/ut)	64	0.4
Flake (re/ut)	59	0.4
Frag. (re/ut)	103	0.7
Sub-Total	546	3.82
Debitage		
Blade	978	6.9
Flake	2432	17.0
Fragment	4014	28.1
Debitage	5902	41.3
Chunk	68	0.5
Core	97	0.7
Nodule	7	0.05
Sub-Total	13498	94.55
Core preparation		
Crested blade	94	0.7
Plunging blade	12	0.1
Tablet	31	0.2
Other	18	0.1
Sub-Total	155	1.1
Tool spalls		
Axe flake	1	0.01
Burin spall	53	0.4
Micro-burin	16	0.1
Resharpening	6	0.04
Sub-Total	76	0.53
Total	**14275**	**100**

fragmentary pieces may be either backed points or awls. One piece is burnt.

Analogues for such backed points can be found in Late Glacial deposits in English and Welsh caves, and more infrequently as surface finds. In contrast to the trapezoidal bi-truncated blades (Cheddar points) and points with single angles (Creswell points) that belong to the first part of the Late Glacial interstadial, convex-backed points (including penknife points with oblique basal retouch, absent at Site C) seem to appear in the second half of the Late Glacial interstadial (Jacobi 1991).

It should be noted that many backed pieces cluster spatially with the Long Blade material, making it likely that several, at least, belong to this occupation. However, some of these pieces seem more worn than the Long Blade material, which tends to appear quite fresh, while Wolds lithic material, mostly used for these points, is rare or absent among the Long Blade assemblage. These backed pieces appear more similar in raw material choice and condition to the curve-backed points that cluster unambiguously with Final Palaeolithic knapping debris at Seamer K and may represent hunting losses from this occupation. Yet, given the variability of projectile forms found in Long Blade assemblages across Britain, a Long Blade origin cannot be ruled out. One fragment in particular bears similarities to a Blanchere point, found in French assemblages of this date, which are also found in southern England, for example at Avington (Froom 2005).

Burins (Fig. 14.8)

There are 34 burins, 11% of the formal tools (i.e. excluding unclassified retouched and utilized flakes, blades and fragments). There are 15 angle burins on breaks, two angle burins on truncations, 13 dihedral burins, two double burins, a corbiac burin and an unclassified fragment. Six of the burins are unusual in that they were manufactured on large blades, rather than the more typical sturdy medium-sized flakes. Four of these blade-based burins cannot be associated with equivalent raw material debitage and were therefore probably imported onto the site as finished tools or blanks. Other burins were evidently manufactured on the spot.

That some burins were subject to complex use and re-use is illustrated by a group of re-fitted elements originating with an imported blade blank some 16 cm in length (Fig. 14.5a). Initially the blank was transformed into a dihedral burin by the removal of a spall from the distal end on the right hand side, followed by the removal of at least three sharpening spalls on the left. This burin subsequently underwent two episodes of snapping, either deliberately or through use and resharpening, using the snap facets as platforms, before the piece was finally broken and discarded. This resharpening successively altered the morphology of the tool; from the original dihedral burin, it became a

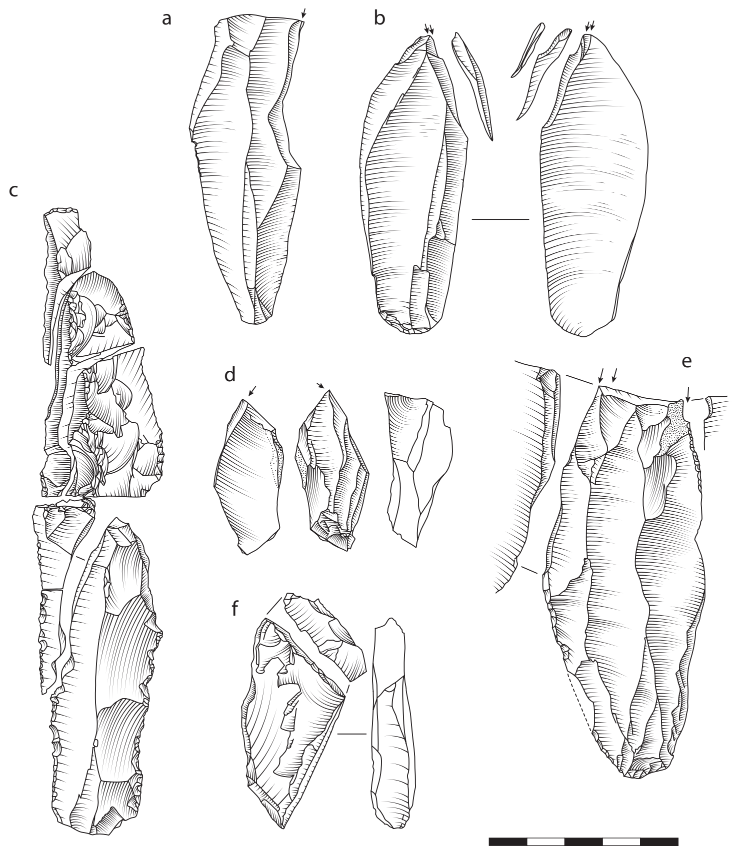

Figure 14.8. *Bruised blades (a and e), bruised burin (b) and rubbed-end pieces (c and d), Site C; scale in cm.*

double burin with the addition of a burin on a break, and finally, following the removal of the dihedral tip, the piece became a double burin, with break burins on either end. A similar complex history can be seen in the successive resharpening episodes of a corbiac burin, that was then transformed into a dihedral burin (Fig. 14.8c). These more elaborate burins belong to the Long Blade occupation of the site.

Most of the burins display little macroscopic wear; however, one dihedral example on a sturdy blade, with two refitting spalls, displays very heavy wear over its entire extent (Fig. 14.8b). The wear is such that almost the entire edge, including the angle between the proximal end and the edges, is worn smooth and rounded. In this case it would seem that it was not simply the burin point which was important, but the entire edge of the tool. No other burin is quite so extensively worn. However, similar wear is also present on a small number of blades and fragments from the same scatter, suggesting a shared function at this particular spot on the site.

Microliths (Fig. 14.9, Table 14.3)

Microliths comprise 16% of formal tools, a lower representation than for other Early Mesolithic assemblages in the Vale. Obliquely blunted points predominate, with other types relatively poorly represented. Notable however are two pieces with basal modification (Fig. 14.9a–b) which might indicate a date fairly late in the Early Mesolithic. While most of the obliquely blunted points cluster with the Mesolithic material, some are found among the Long Blade scatters and are also compatible with an assemblage of this date. Till flint appears to have been slightly favoured for the manufacture of microliths (48%), although an unusually large number (42%) are made on Wolds flint. One example is made on chert, a rarity, the only other such examples being a fragment from Manham Hill and three microliths from Clark's Star Carr excavations. The comparative lack of microburins (n=16), and the

Table 14.3. *Seamer Carr Site C microlith types.*

Type	**No**	**%**
Obliquely blunted point	24	48
Triangle	7	14
Trapeze	2	4
Obliquely blunted with basal truncation	2	4
Other	2	4
Fragment	14	26
Total	**51**	**100**

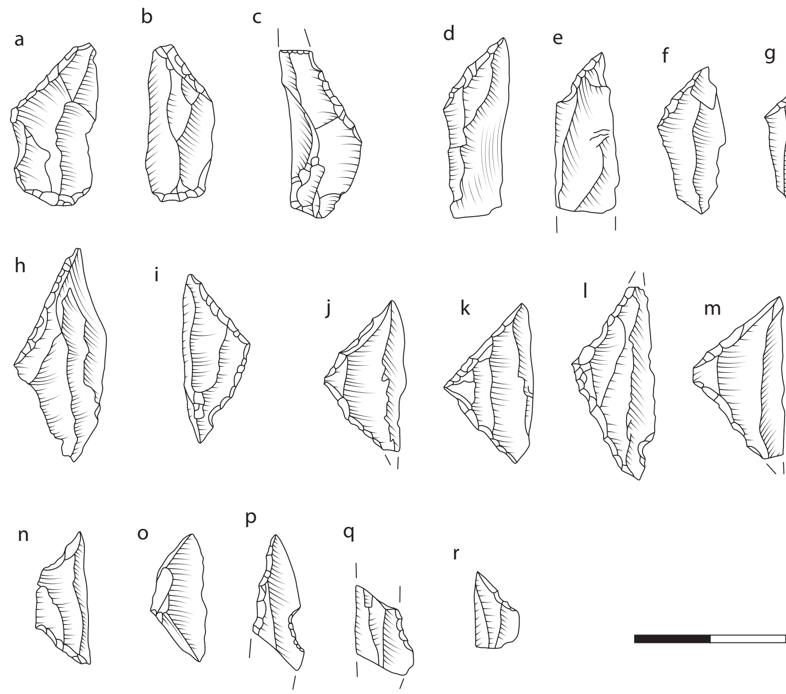

Figure 14.9. *Microliths, Site C; scale in cm.*

fact that the microlith raw materials do not reflect the overall proportions of raw materials represented at the site, might suggest that the majority of microliths were not made on site.

Scrapers (Fig. 14.10)

The tool inventory at Seamer Site C is scraper-dominated, with two of the scatters (H and K) particularly focused on scraper manufacture and use. 191 scrapers were recovered from the site, the majority of the complete examples being short types. A high proportion of fragmentary scrapers (47%) may be a result of breakage during use. Although many of the scrapers bear some form of macroscopic wear, none appear to be very heavily worn.

Several scrapers were manufactured from the same nodules and many are very similar to one another in size and shape. A common feature is a spurred projection on the scraper edge (e.g. Fig. 14.10r). Refitting has also revealed that scraper manufacture sometimes involved the deliberate snapping of a blade and subsequent retouch of the snap facet to form the scraping edge.

Both Wolds and till nodules were used for scraper manufacture: 56% were manufactured on Wolds material and 38% on till flint. Even on one of the few Vale sites where Wolds material dominates overall, this figure still indicates a preference for Wolds flint for scraper manufacture. It may be that, owing to the poor knapping properties of this material, scrapers were one of the few tools that could be manufactured satisfactorily on it. Likewise, scrapers frequently appear to be made on the poorer quality pebble material from the till.

Tanged piece (Fig. 14.11)

This broken item, unique to the Vale of Pickering assemblages under discussion and with no obvious parallel further afield, consists of a thick blade fragment that has two large opposed indentations on either side of its bulbar end.

Spatial variation

Much of the compositional variation at Site C has a spatial basis which can be correlated with the different nucleations of lithic material that make up the site (Scatters A-K, see Fig. 14.1). These scatters are distinctive, the product of occupations of different date, differing lithic procurement strategies, technologies and other activities. There are a large number of refits between Scatter B1 and Scatter C, suggesting they were contemporary. Occasional refits occur between other scatters, however given the issues of recycling and superimposition of activity areas, it is most likely that the different nucleations should be considered to represent temporally discrete activity units. The following discussion will examine first the activities that generated the Long Blade assemblages, followed by the Early Mesolithic material.

Based on techno-typological analysis and refitting, the Long Blade occupation of Site C consists of one large scatter, Scatter C, located in the north-central part of the site, and two smaller scatters B1 and F, the former

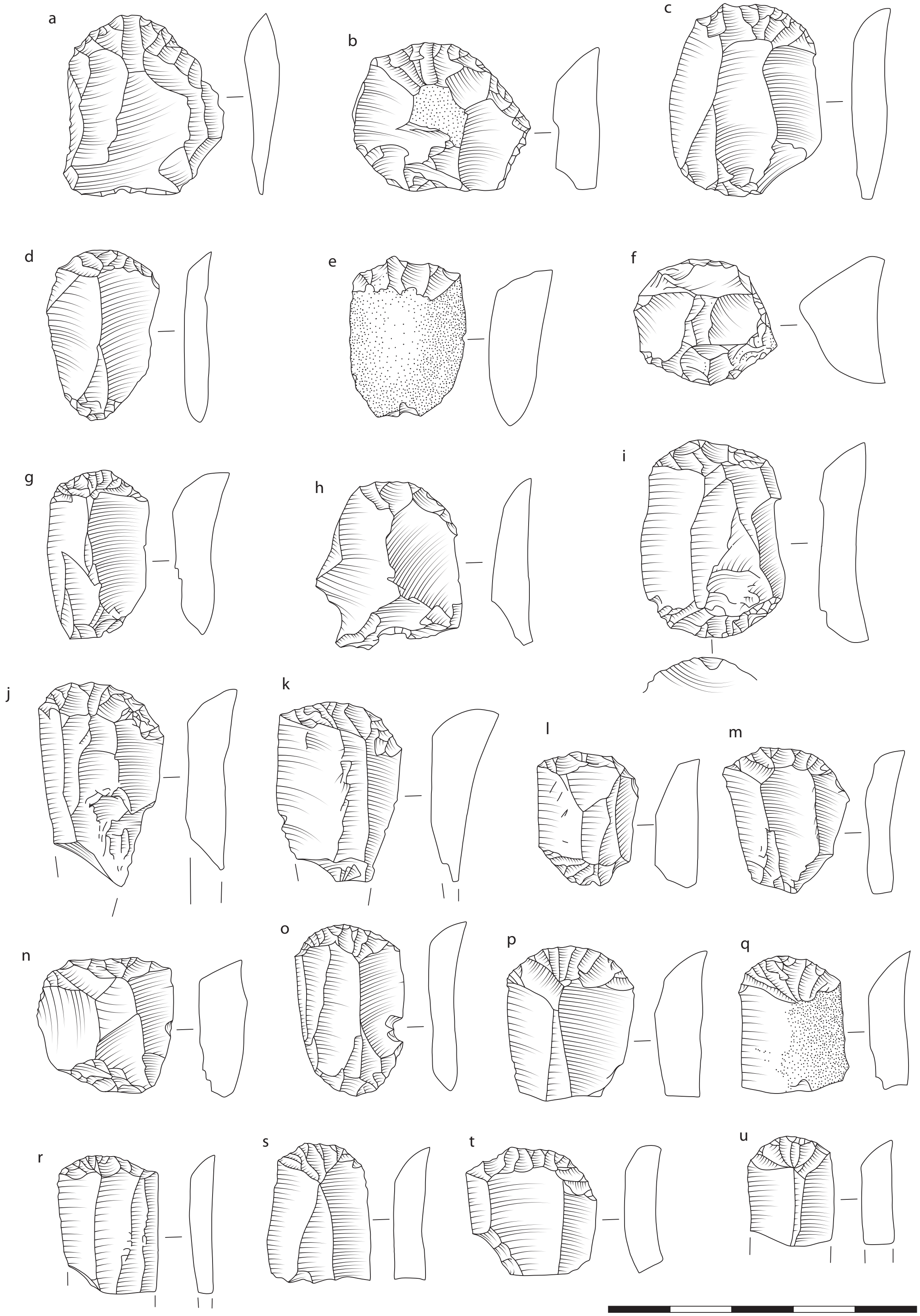

Figure 14.10. *Scrapers, Site C; scale in cm.*

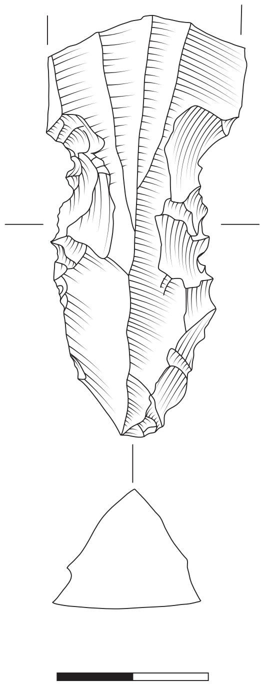

Figure 14.11. *Tanged piece, Site C; scale in cm.*

located to the northwest of Scatter C, and the latter around 25 m to the southeast. Refitting of these scatters has been very successful, with conjoined sequences of up to 51 pieces, offering an insight into lithic-related activities at the site. Six long refit sequences have been conjoined at Scatter C, highlighting different areas of activity.

Scatter C (Table 14.4, Fig. 14.12)
At Scatter C, a cluster of burnt flint represents the location of a hearth, around which much of the knapping activity seems to have taken place. Two distinct knapping areas are visible around the hearth; one to the southwest, the other to the northwest, probably indicating the presence of two different knappers. The knapper in the southwest was focused on initiating the reduction of two large tabular blocks of high quality clear brown flint, each of which only represents the early stage of reduction. Block C1 (Figs. 14.12, 14.13, left), a large tabular piece with a chalky cortex was shaped and crested before ten large blades were removed, six from one platform (one of which is now missing), and four from the opposed platform. The core, which would have been narrow but around 200 mm in length, was not recovered. Products from the core were not circulated widely (Fig. 14.12): three were found in the northeast cluster and one to the southeast of the hearth. A second tabular block, C5 (Figs. 14.12, 14.13, centre), this one with a thin cortex indicative of a derived context, was also knapped by this individual. This block underwent some preliminary shaping, but was not crested; this was

Table 14.4. *Composition of the Scatter C assemblage.*

Category	**No**	**%**
Tools		
Awl/Borer	1	0.1
Burin	12	0.6
Backed point	3	0.2
Microlith	10	0.5
Notch	2	0.1
Scraper	16	0.9
Scraper/awl	2	0.1
Scraper/notch	1	0.1
Truncation	4	0.2
Blade (re/ut)	11	0.6
Flake (re/ut)	12	0.6
Frag. (re/ut)	22	1.2
Tool spalls:		
Burin spall	13	0.7
Micro-burin	2	0.1
Resharpening	1	0.1
Core preparation		
Crested blade	38	2.0
Plunging blade	3	0.2
Tablet	3	0.2
Other	4	0.2
Debitage		
Blade	185	9.9
Flake	345	18.4
Fragment	845	45.2
Chip	319	17.0
Chunk	5	0.3
Core	12	0.6
Total	**1871**	**100**

Material	**No**	**%**
Chert	3	0.2
Till	1184	63.3
Wolds	353	18.9
Uncertain	136	7.3
Burnt	195	10.4
Total	**1871**	**100**

Cortex	**No**	**%**
Primary	49	2.6
Secondary	379	20.3
Tertiary	1443	77.1
Total	**1871**	**100**

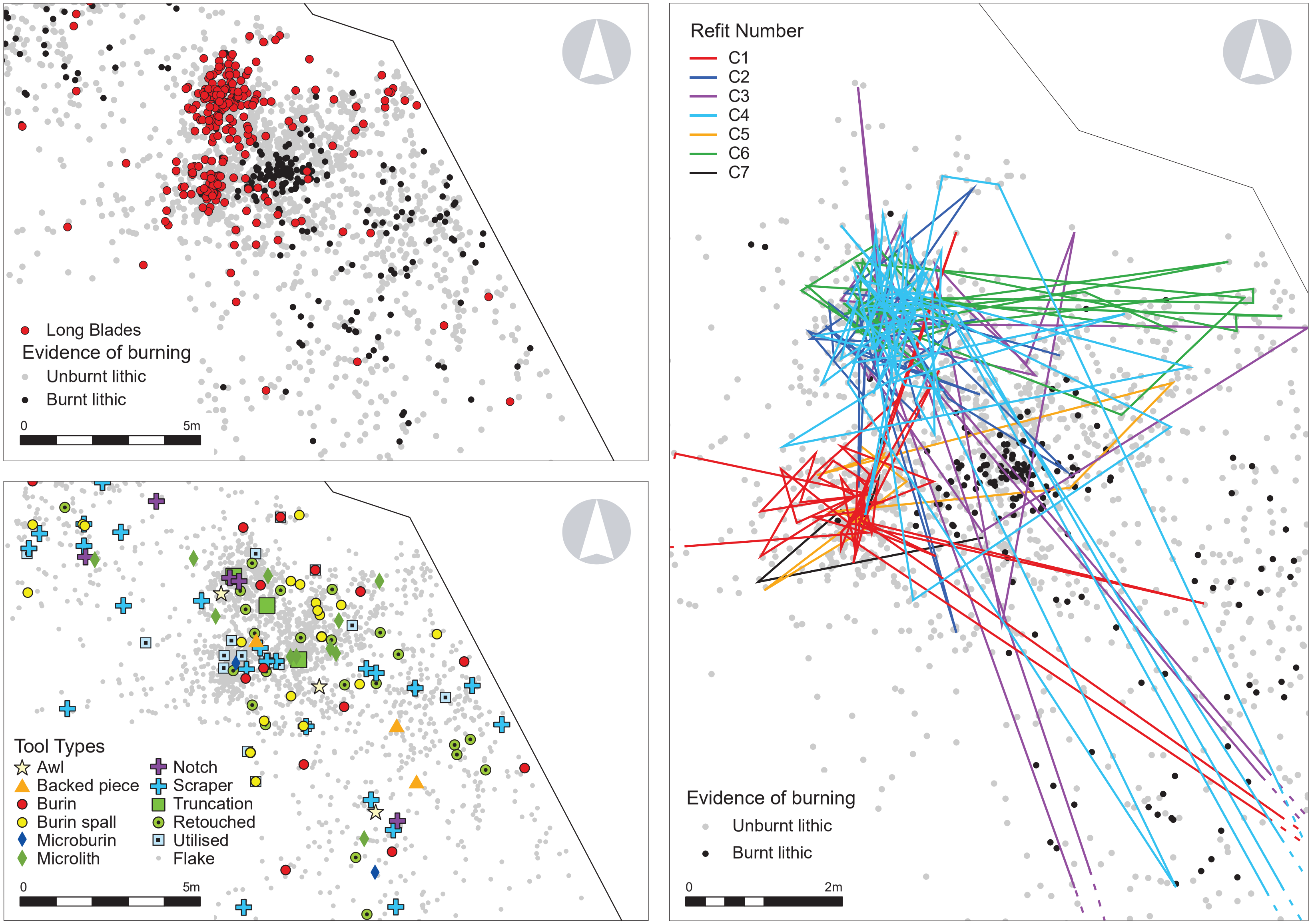

Figure 14.12. *Scatter C Long Blade refit sequences.*

Figure 14.13. *Long Blade refit groups C1 (left), C5 (centre) and C7 (right).*

not necessary given that removals were guided by its tabular ridge. Blades and large flakes were removed from along its long axis as well as the short axis that served as its platform. A third edge of the tabular block was probably also reduced (and one resulting blade used as a *lame mâchurée*) although this sequence (refit group C7, Figs. 14.12, 14.13 right) cannot be refitted to the C5 sequence, and the core itself was not recovered. Products from C5 and C7, as with C1 were not widely circulated (Fig. 14.12). A single blade was found to the east of the hearth. This had been snapped and the two pieces found 1.9 m apart. A second bruised piece was also recovered, probably deriving from this sequence, as was a scraper. Three further scrapers and a couple of burins were associated with this area, as were both a backed piece and a microburin.

In the northeast knapping area, three raw material units (refit groups C2, C3 and C4, Fig. 14.12) (all brown/speckled grey semi-tabular pieces) were reduced. In contrast to the unmodified tabular block in the southwest, all three were imported as preformed cores that had been crested elsewhere. All three underwent the remainder of the reduction sequence on site, from cortical blades and flakes, through blade production to the discard of the core. Discarded cores from the three refit sequences range in size from 80 to 100 mm. In contrast with the sequences from the southwest, faceting was minimally used in this sequence, though platform edges were neatly abraded. Knapping proceeded from two alternate platforms. Associated with this area were a varied set of tools: four burins, three microliths, two notches, an awl, a scraper and several retouched and utilized pieces. Blades from these three refit sequences are more widely dispersed, found to the south, southeast and east of the hearth up to a distance of 20 m away. Also present in this area was a refit sequence based on the preliminary shaping of an opaque grey flint (refit sequence C6). This raw material unit also appears to have been worked to the east of the hearth.

Away from the southwestern and northwestern knapping areas, the hearth served as a focus for tool use. Blades that refit to the sequences recovered from the knapping areas were taken to the northeast of the hearth and used. Burins were also used extensively and resharpened. To the south of the hearth, deliberately segmented blades were brought from Scatter B1, around 10 m to the northeast (see Fig. 14.14). Tools were also used in these areas (Fig. 14.12a): burin spalls are particularly common, indicating both the manufacture and re-sharpening of burins that were presumably made and used in these areas. Scrapers are also common – mainly to the east of the hearth – while microliths cluster immediately adjacent to it.

Scatter B1 (Table 14.5, Fig. 14.14)

Scatter B1 (Fig. 14.14), around 10 m to the west of Scatter C, has a clear association with Scatter C and is likely to be contemporary. A distinctive nodule of grey flint with a white stripe (refit group B5) was knapped in an area seemingly unassociated with any hearth. Though this nodule was mainly worked at Scatter B1, the presence of small debitage from this unit in Scatter C suggests it was also worked here at some point. Blades from this sequence were deliberately segmented and are distributed around the site (Fig. 14.14). One was segmented and made into a break burin. The deliberate segmentation of blades is not a usual feature of British Long Blade sites, although is known from the early Federmesser site of Nea Farm in Hampshire (Barton et al. 2009). Products from this refit sequence are the most widely distributed of any on site and are found up to 25 m to the south, although there is a distinct cluster at Scatter C to the south of the hearth. Refitting indicates that not only were already segmented pieces moved from Scatter B to Scatter C, but also whole blades were brought to Scatter C and segmented there.

Refit group B7 was knapped immediately to the south of B1, adjacent to a small hearth marked by a scatter of burnt flint. This is an idiosyncratic sequence, based on the reduction of a good quality semi-tabular block, but appears to belong with the Long Blade activity due to the use of faceting. Part of this sequence consists of platform preparation flakes, relating to a

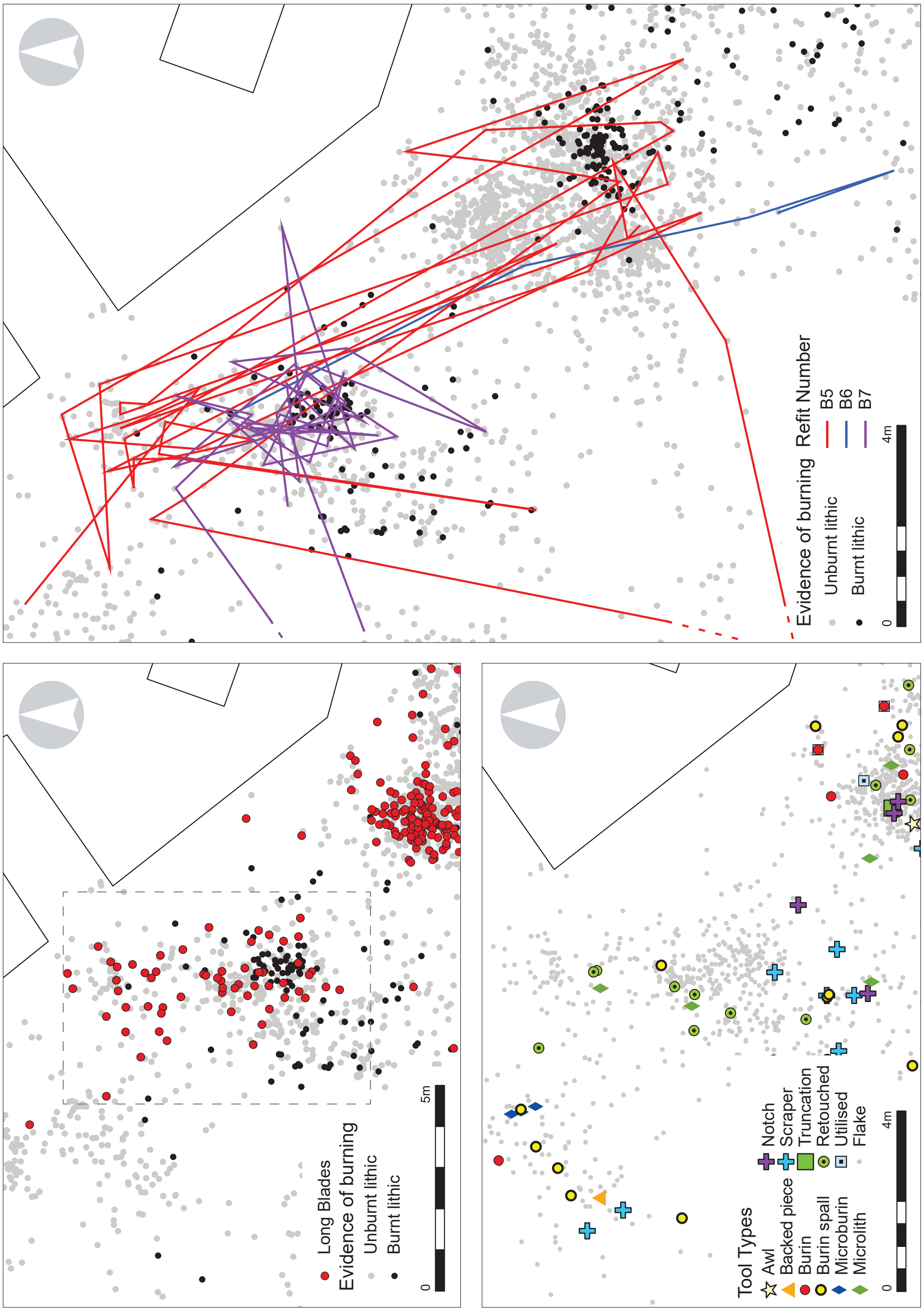

Figure 14.14. *Scatter B 1 Long Blade refit sequences.*

Table 14.5. *Composition of the Scatter B1 assemblage.*

Category	No	%
Tools		
Burin	1	0.2
Backed point	0	0
Core/scraper	1	0.2
Microlith	2	0.4
Scraper	6	1.2
Blade (re/ut)	1	0.2
Flake (re/ut)	2	0.4
Frag. (re/ut)	9	1.8
Tool spalls		
Burin spall	3	0/6
Micro-burin	0	0
Resharpening	3	0.6
Core preparation		
Crested blade	8	1.6
Plunging blade	0	0
Tablet	7	1.4
Debitage		
Blade	74	15.2
Flake	136	27.9
Fragment	186	38.20
Chip	41	8.4
Chunk	5	1.0
Core	0	0
Nodule	2	0.4
Total	**487**	**100**

Material	No	%
Till	218	44.8
Wolds	145	29.8
Uncertain	33	6.85
Burnt	91	18.6
Total	**487**	**100**

Cortex	No	%
Primary	3	0.6
Secondary	116	23.8
Tertiary	368	75.6
Total	**487**	**100**

large core. This could conceivably be early preparation of the core from either refit sequence C3 or C4, as nodule morphology and material type are similar. A large flake was also obtained, which was crested and knapped as a bladelet core. The products of this sequence are not widely distributed, apart from one fragment which was found in Scatter H. This scatter is associated with several utilized pieces, while five scrapers were recovered to the south of the hearth.

Scatter F (Table 14.6, Fig. 14.15)

The final area of Long Blade activity at Site C is Scatter F (Fig. 14.15). This takes the form of a more diffuse scatter, based on the reduction of one raw material

Table 14.6. *Composition of the Scatter F assemblage.*

Category	No	%
Tools		
Burin	3	0.8
Backed point	1	0.3
Microlith	2	0.5
Truncation	1	0.3
Blade (re/ut)	15	4.1
Flake (re/ut)	4	1.1
Frag. (re/ut)	4	1.1
Tool spalls		
Burin spall	5	1.4
Resharpening	1	0.3
Core preparation		
Crested blade	4	1.1
Tablet	2	0.5
Debitage		
Blade	65	17.8
Flake	59	16.1
Fragment	160	43.7
Chip	35	9.6
Chunk	3	0.8
Core	2	0.5
Total	**366**	**100**

Material	No	%
Chert	1	0.3
Till	259	70.4
Wolds	50	13.6
Uncertain	9	2.4
Burnt	49	13.3
Total	**368**	**100**

Cortex	No	%
Primary	1	0.3
Secondary	44	12.0
Tertiary	323	87.8
Total	**368**	**100**

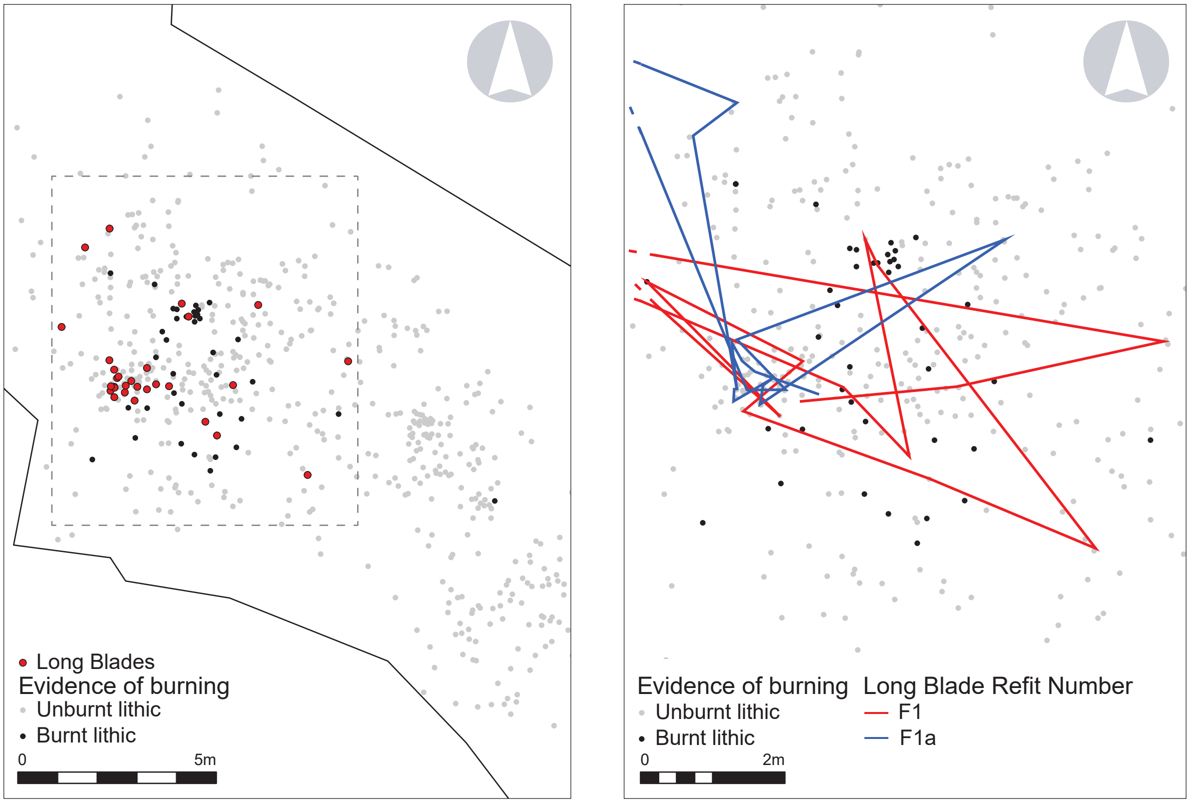

Figure 14.15. *Scatter F Long Blade refit sequences.*

unit – a fine translucent brown flint – that was probably imported in already partly-reduced form (Fig. 14.16). Here, blades were produced in an area to the west of a probable hearth, and products from this sequence were found distributed across an area of *c*. 8 m around the hearth. Several long blades, in a range of different raw material units that were not produced around this hearth, were also recovered, indicating that raw material was imported to the site not just in the form of prepared cores but also as a stock of long, elegant blades (Fig. 14.17). Tools are relatively few: two projectiles (a backed bladelet fragment and two refitting fragments of a thicker backed piece), three burins and a scraper. Three burins were recovered and refitting suggests that at least one further burin, an unstratified piece, also belongs to this group. A number of refitting sharpening spalls suggest that several of the burins were used. The burin with extensive wear (Fig. 14.8b) and a small number of blades and fragments with similar wear patterns (rubbed-end pieces, Fig. 14.5c-d) also derive from this scatter. Horse remains, mainly teeth, reflecting poor preservation, were recovered (see Chapter 16). The potential connection between Scatter F and the other areas of Long Blade activity is unclear. The proximal part of a small obliquely blunted point, found

Figure 14.16. *Refitted sequence from Scatter F.*

Figure 14.17. *Imported blades from Scatter F.*

5 m from the main focus of flint knapping in Scatter F, conjoins to a distal part found in Scatter C, while a utilized flake from refit sequence F1a was found in the same area. This could indicate a functional relationship between the two scatters, or simply that activity areas have been superimposed during different occupations.

Scatter H (Table 14.7, Fig. 14.18)

Scatter H is Early Mesolithic in date. The scatter is dominated by Wolds material, much of this consisted of small to medium material of reasonable quality, though larger, poor quality nodules were also recovered. Small to medium-sized beach pebbles were also employed (see Fig. 14.6). Material appears to have been brought to the site in a variety of states; though some may have been untested, other nodules were already partially reduced. The cores belonging to the Wolds reduction sequences tend to have been recovered from the scatter, however, most of the till cores are missing and thus seem to have been valued as more portable.

Scrapers are the commonest tool type within Scatter H – 89 examples were recovered. Scatter H alone yielded more scrapers than any other site in the Vale. Twenty-one of these have been refitted, demonstrating that many were manufactured from blanks produced on site. The ends of flakes and blades were retouched to produce the scrapers or occasionally a flake or blade blank was snapped and the snap facet retouched to form the scraping edge. Many of the scrapers are broken and it seems likely they snapped during use. Such damage, and the numbers of scrapers involved, suggests an intensive level of use. In comparison to scrapers, other tools are rare; six burins were recovered and eight burin spalls, implying that manufacture and/or resharpening occurred. A cluster of 12 microliths and eight microburins was also found in the eastern part of the scatter.

Scatter H can be divided into two sub-scatters: a northern and a southern one. The southern scatter is 4.5 m in diameter and has a very pronounced edge, suggesting it was enclosed by a boundary, either a tent or built structure (Fig. 14.18). Within this, a tight, central cluster of burnt flint can clearly be discerned that is likely to indicate a hearth. Adjacent to this are two clusters of flint likely to represent knapping scatters. This spatial integrity suggests a relatively short-lived structure. Refits that pass beyond this putative tent wall are few: a flake from H9 was used in the

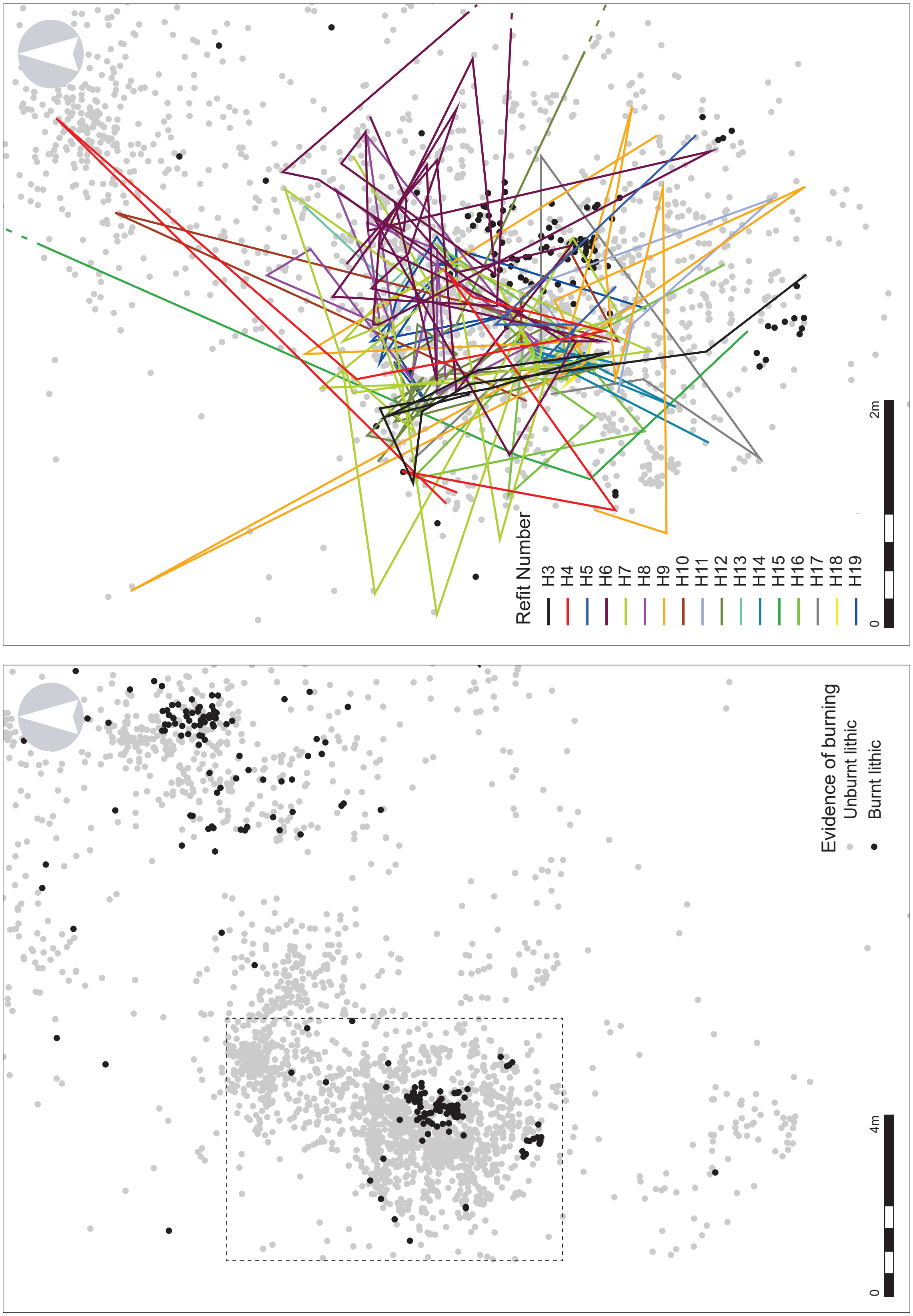

Figure 14.18. *Scatter H refit sequences.*

Table 14.7. *Composition of the Scatter H assemblage.*

Category	No	%
Tools		
Burin	6	0.2
Backed point	1	0.03
Core/scraper	1	0.03
Core/scraper/burin	1	0.03
Core tool	1	0.03
Microlith	12	0.3
Scraper	89	2.3
Scraper/awl	3	0.1
Truncation	2	0.1
Blade (re/ut)	17	0.4
Flake (re/ut)	12	0.3
Frag. (re/ut)	26	0.7
Core preparation		
Burin spall	8	0.2
Micro-burin	8	0.2
Debitage		
Blade	213	5.5
Flake	750	19.4
Fragment	1064	27.5
Chip	1582	40.8
Chunk	13	0.3
Core	31	0.8
Nodule	1	0.03
Total	**3875**	**100**

Material	No	%
Till	870	22.4
Wolds	2513	64.9
Uncertain	217	5.6
Burnt	275	7.1
Total	**3875**	**100**

Cortex	No	%
Primary	78	2
Secondary	537	13.9
Tertiary	3260	84.1
Total	**3875**	**100**

northwest, two pieces recovered from the northern H scatter, a crested blade from Scatter B and two flakes found in Scatter K.

Within this possible structure large quantities of scrapers were recovered: 71 of the 89 scrapers from the scatter, with quantities of other tools low. A total of 11 microliths were recovered along with a microburin, a single burin and two burin spalls. Refitting demonstrates that many of the scrapers were manufactured here. This appears to be an area intensely focused on a specific task. The northern scatter by contrast is almost entirely focused on knapping with only a couple of scrapers and burins associated (Conneller and Schadla-Hall 2003). Fauna is sparse, consisting of a handful of unidentifiable fragments.

Scatter K (Table 14.8, Fig. 14.19)

Scatter K is also Early Mesolithic. Very poor quality small to medium-sized beach pebbles were employed in the manufacture of the debris recovered. The reduction of Wolds material was also undertaken on a significant basis. Till pebbles appear to have been brought to the site untested. Although the subsequent knapping seems to be generally less skilful than seen at the other scatters, the size and quality of the nodules imposed severe restrictions. Many of the nodules have fractured on impact, resulting in the high proportion of chunks/shatter fragments (Fig. 14.6). Knapping was initiated with the creation of a platform by the removal of the top of one of the pebbles, then reduction started first using one of the pebble's natural ridges as a guide, instead of deliberate cresting. Flakes and short bladelets were then removed although sometimes only flakes could be detached. Many pebbles, particularly the poor quality ones, can be reconstructed, with all pieces intact. This raw material and reduction strategy contrasts considerably with those found in Scatters C and F, where both reduction sequences and blank curation were spatially and thus presumably temporally extended.

As at Scatter H, scrapers are also the commonest tool type, with 48 examples recovered – 36 clustering in a 3.3 × 2.0 m area. In comparison to scrapers, other tools are rare; six burins and three burin spalls were recovered. One awl was also present and eight microliths, but no microburins were found. Scatter K incorporated a small, dense cluster of burnt material, suggesting that knapping activities took place around a hearth.

A handful of refits occur between the two Early Mesolithic Scatters, H and K. Three pieces worked in Scatter K were recovered from Scatter H, while the first two removals from a core were found in Scatter K, but the remainder of the core was worked at Scatter H. Pieces seem to have passed between the scatters in one direction only, from Scatter K to Scatter H. This may indicate that Scatter H post-dates Scatter K, and that scavenging of still visible and useable lithic material occurred, though the two scatters could also be contemporary. There are also four refits between Scatter K and Scatter C; these

Table 14.8. *Composition of the Scatter K assemblage.*

Category	No	%
Tools		
Awl/Borer	1	0.04
Burin	6	0.2
Backed piece	2	0.1
Core/scraper	3	0.1
Core tool	1	0.4
Microlith	8	0.3
Scraper	48	1.7
Scraper/awl	1	0.04
Truncation	3	0.1
Blade (re/ut)	3	0.1
Flake (re/ut)	13	0.5
Frag. (re/ut)	27	1.0
Tool spalls		
Burin spall	3	0.1
Core preparation		
Crested blade	18	0.6
Plunging blade	1	0.04
Tablet	6	0.2
Other	4	0.1
Debitage		
Blade	259	9.3
Flake	706	25.2
Fragment	964	34.4
Chip	656	23.4
Chunk	35	1.3
Core	27	1.0
Nodule	2	0.1
Total	**2797**	**100**

Material	No	%
Chert	13	0.5
Till	873	31.2
Wolds	1591	56.9
Uncertain	193	6.9
Burnt	127	4.5
Total	**2797**	**100**

Cortex	No	%
Primary	173	6.2
Secondary	643	23.0
Tertiary	1981	70.8
Total	**2797**	**100**

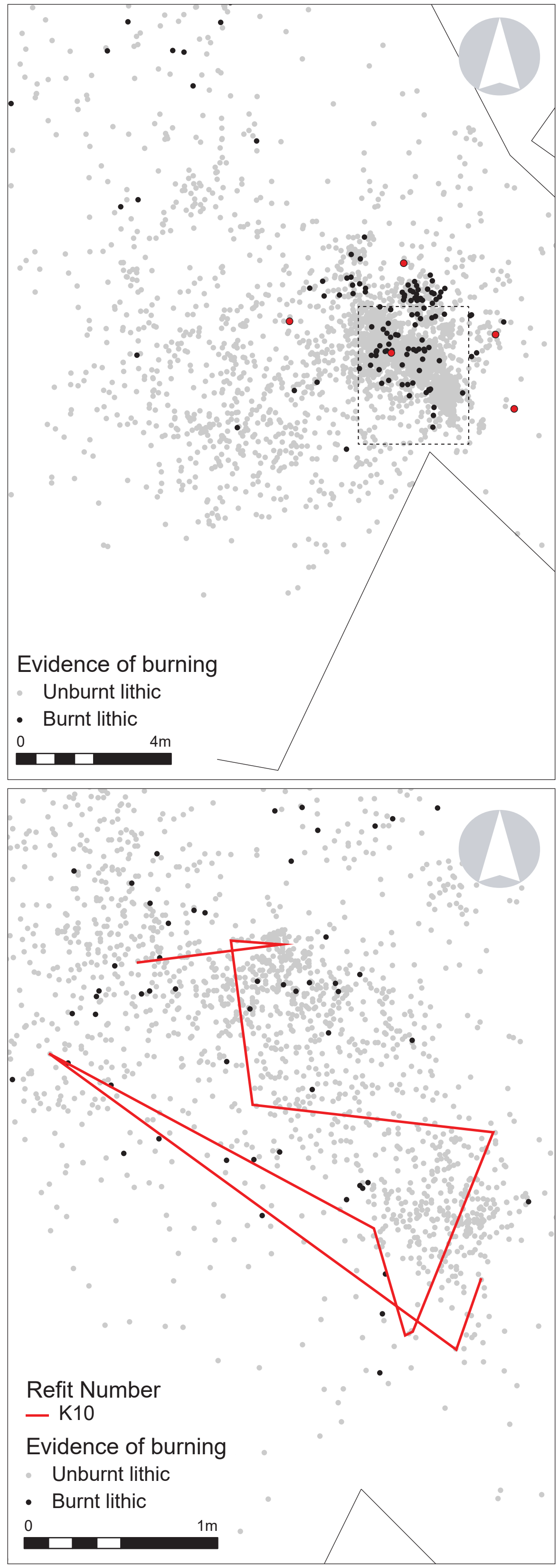

Figure 14.19. *Scatter K refit sequences.*

occurred in both directions. Because these scatters are of different date, these refits may be the results of overlapping activity areas or later scavenging.

Scatter B (Table 14.9, Fig. 14.20)
Scatter B is small, consisting of 213 pieces situated in the northern part of the excavated area. Though some of the Long Blade occupation of Scatter C extends into its eastern half, as a rule it displays none of the technological extremes associated either with the production of very fine blades or the smashing of till pebbles and Wolds flint. The scatter is mainly composed of waste and tools generated in the competent working of a small number of medium-sized beach pebbles. The proportion of blades is high (13.6%) compared to H and K. These are, in the main, small to medium-sized examples that appear to have been manufactured on site, and may be related to the aurochs butchery evidenced in this area.

Scrapers, burins and microliths all appear to have been manufactured and/or maintained at Scatter B. Five times as many burin spalls were recovered as burins and two of the spalls are secondary and indicate re-sharpening. Microlith manufacture appears to be tightly focused, since all three microburins were recovered adjacent to each other.

Discussion
This analysis of Seamer Site C demonstrates how an assemblage that displays certain characteristics at an assemblage level – i.e. scraper-dominated, but with a number of fine blades – can be broken down to reveal a high level of internal variability. Rather than Site C representing a site of a single occupation, that might be read as a base camp or specialized site, it was an area that was intermittently occupied during the very Late Pleistocene/Early Holocene. There appears to have been two Long Blade occupations, one more substantial at Scatters B1 and C and the other much briefer, which generated Scatter F. There were probably several Early Mesolithic visits to the area. Two of these were focused on scraper manufacture; others, represented by Scatters B and G (a low density scatter in the far east of the site associated with animal bone), were more focused on processing animal carcasses. Some of these scatters may have been contemporary, but currently there is no evidence (in contrast to the main Long Blade occupation) to suggest they were.

Seamer Carr Site C was an area that was repeatedly visited by different groups, probably, given raw material variations, coming to the Site C locality from different parts of the landscape. Some of the visits

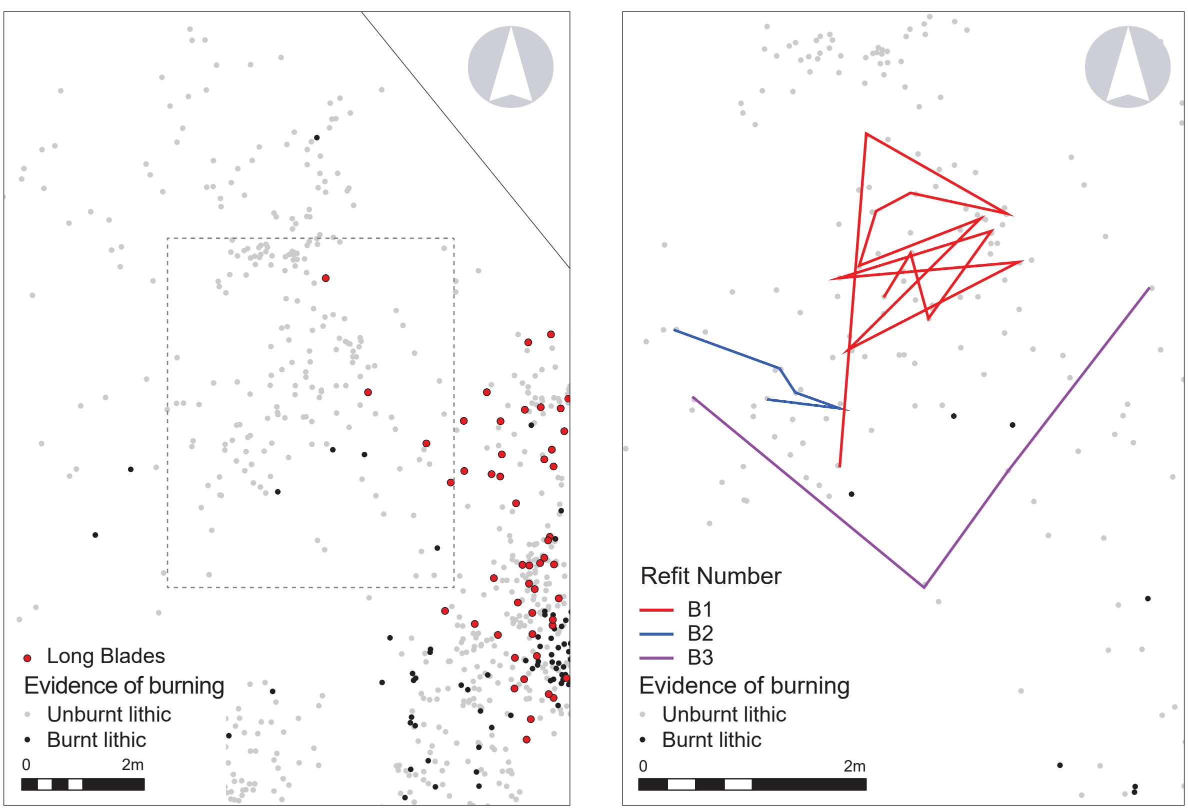

Figure 14.20. *Scatter B Long Blade refit sequences.*

Table 14.9. *Composition of the Scatter B assemblage.*

Category	No	%
Tools		
Burin	1	0.5
Backed point	0	0
Core/scraper	0	0
Microlith	4	1.9
Scraper	2	0.9
Blade (re/ut)	1	0.5
Flake (re/ut)	2	0.9
Frag. (re/ut)	0	0
Tool spalls		
Burin spall	5	2.3
Micro-burin	3	1.4
Resharpening	0	0
Core preparation		
crested blade	3	1.4
plunging blade	1	0.5
tablet	0	0
Debitage		
Blade	29	13.6
Flake	62	29.1
Fragment	69	32.6
Chip	28	13.1
Chunk	0	0
Core	2	0.9
Nodule	1	0.5
Total	**213**	**100**

Material	No	%
Till	81	38
Wolds	104	48.8
Uncertain	14	6.6
Burnt	14	6.6
Total	**213**	**100**

Cortex	No	%
Primary	1	0.5
Secondary	43	20.2
Tertiary	169	79.3
Total	**213**	**100**

were probably for a longer duration than others. Scatter C, for example, represents a longer duration than Scatter F. The presence of a possible tent structure at Scatter H could also suggest a longer stay, although the spatial integrity of the lithics, in comparison to a longer-lived structure such as at Star Carr (Conneller et al. 2012; Taylor et al. 2018b), suggests this was not a very long-term or repeatedly re-occupied structure. Different sets of individuals also seem to have occupied the site at different times. The low-skilled knapping at Scatter K may suggest the presence of apprentices, though the low-quality raw material used may also have been a factor. The intensive focus on scraper production and use particularly at Scatter H, but also Scatter K, suggest that Seamer C at times was occupied for specialist purposes, perhaps on occasions by particular age and gender groups.

Seamer Carr Sites K, L, and N

Seamer K yielded one of the largest lithic assemblages recovered, comprising 12,137 pieces of material of Late Glacial and Early Holocene date. The most recent of these finds were two isolated groups of Late Mesolithic microliths recovered from Late Mesolithic peat and these have been fully reported elsewhere (David 1998). The majority of the remaining flints were recovered from minerogenic sediments below peat. Underlying these was an almost sterile wind-blown sand apparently deposited during the Loch Lomond Stadial. Beneath this, preserved in a deposit of Late Glacial Interstadial peat was a scatter of Final Palaeolithic (Barton and Roberts 1996) or Federmesser material and a few poorly preserved bone fragments. Unfortunately, later root action and tree falls have resulted in a mixing of these deposits over portions of the site, as well as destroying possible stone lined hearths (see Fig. 14.21, which demonstrates the stratigraphic mixing of diagnostic Early Mesolithic microliths and Federmesser backed blades).

The distribution of flints at Site K is shown in Fig. 7.12 and Fig. 14.22a-b, and was composed of a number of nucleations, or scatters, set within a background of more dispersed finds. For the purposes of a more manageable analysis it was decided to sub-divide the total assemblage into contiguous sub-groups centred, as far as possible, over each of the scatters. Each artefact was examined, and its properties recorded on a database (by Andrew David), and a programme of re-fitting was undertaken (by Andrew David and Francis Wenban-Smith). Further refitting, as well as the following tabulation, description and discussion of the Site K assemblage was undertaken later by Chantal Conneller.

Raw material

Wolds material is dominant in the assemblage as a whole (see Table 14.10), with a Wolds/till ratio of 3:2. This is unusual in the Vale, where most assemblages

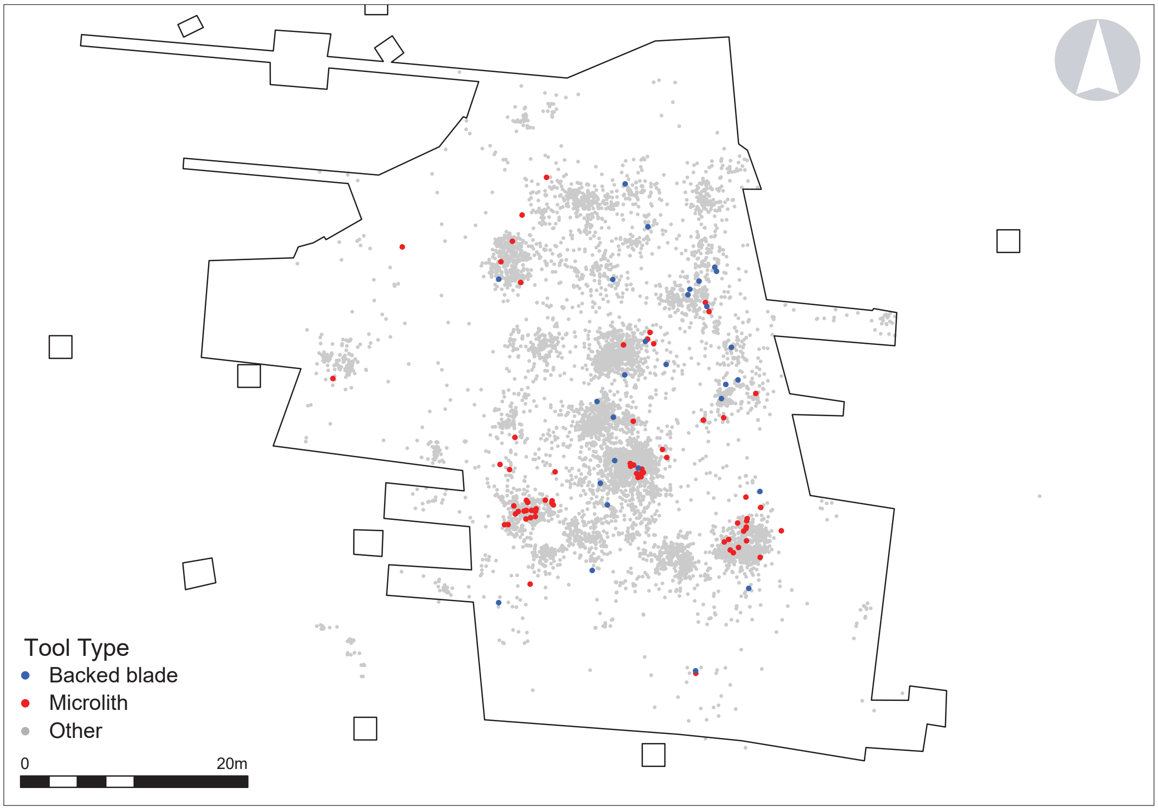

Figure 14.21. *Stratigraphic mixing of Early Mesolithic microliths and Federmesser backed blades at Site K.*

are till-dominated. There is great variability across the individual scatters, with some areas till-dominated, while others have Wolds/till ratios of 45:2. In particular the central scatters are dominated by Wolds material (see Fig. 14.23). The high representation of Wolds material appears due to its preferential use during the Late Glacial occupation, supported by the refitting of a backed point to a knapping sequence of Wolds material (Fig. 14.24). Grey speckled flint, similar to that found today in the glacial till or in East coast beach deposits, was also employed during the Final Palaeolithic occupation, demonstrated by the presence of backed points in this material type. One piece of this material underwent chemical testing using LA-ICP-MS as part of a pilot project (Conneller et al. 2019); this piece clustered with flint sourced from East Anglia, suggesting long distance transport of material. However, it should be noted that this result is based on only a single piece, and the chemical signature of glacial till and flint sources now under the North Sea have yet to be recorded as part of this project.

Wolds material was used in smaller proportions in those scatters attributed mainly to the Early Mesolithic – as at other sites in the Vale. Indeed, several such scatters are almost entirely till-dominated. As several of the latter are dominated by evidence for microlith manufacture, this may be evidence for the preferential manufacture of microliths from till material.

A proportion (18%) of the grey speckled material is slightly patinated. Many of the Late Palaeolithic backed pieces manufactured from such flint have a slight patina, while most microliths appear fresh. It seems likely that much of the patinated speckled flint material is Late Glacial in age. However, this pattern is not an absolute, as exceptions exist, presumably due either to stratigraphic mixing or to variation in local soil environmental conditions.

Table 14.10. *Lithic raw materials at Seamer Carr Site K.*

Material	Total	%
Chert	18	0.1
Till	3642	30.0
Wolds	5680	46.8
Uncertain	1315	10.8
Burnt	1482	12.2
Total	**12137**	**99.9**

Figure 14.22. *Analytical division of Site K into different scatters – (a) Major scatters, (b) Minor scatters.*

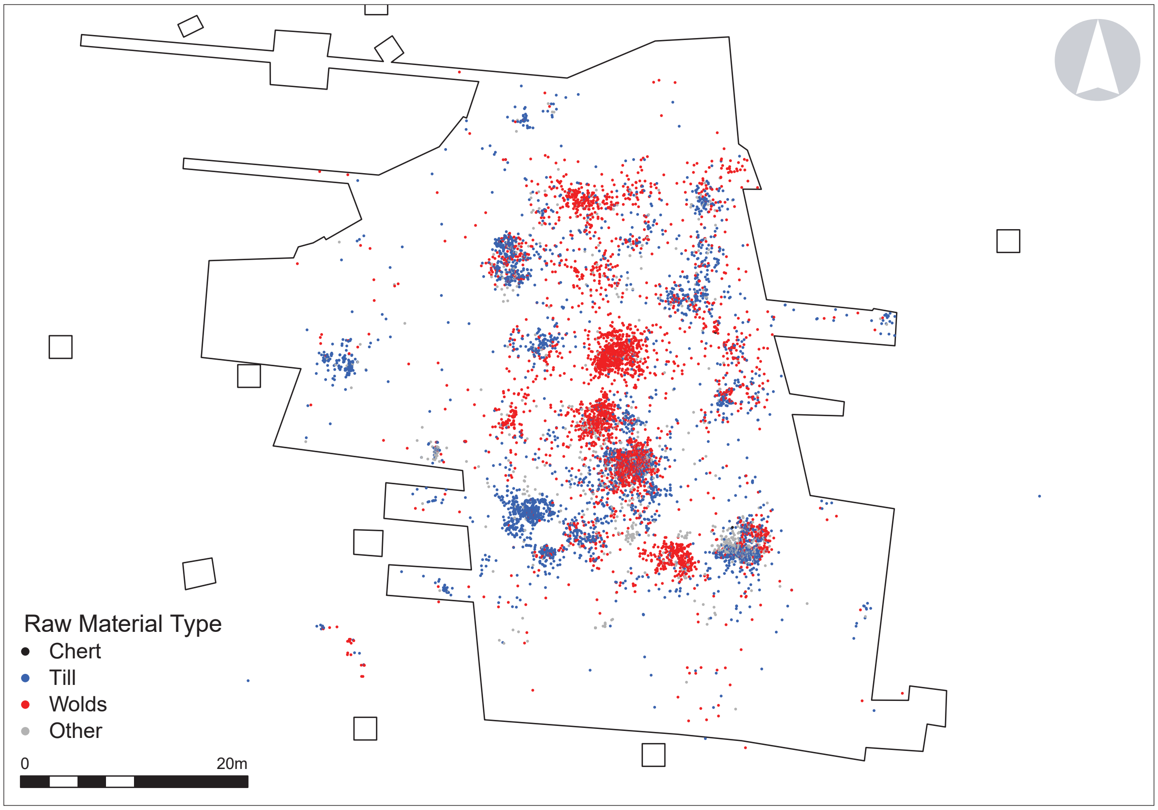

Figure 14.23. *Raw material distribution at Site K.*

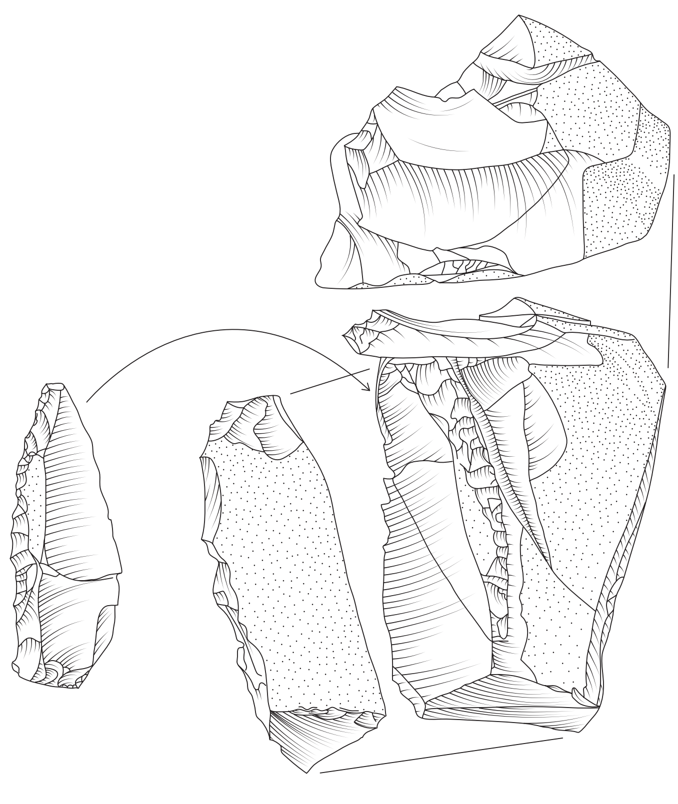

Figure 14.24. *Backed point refitting into Wolds knapping sequence, Site K; scale in cm.*

Table 14.11. *Cortical pieces at Site K.*

Cortex	Total	%
Primary	216	1.8
Secondary	1603	13.2
Tertiary	10318	85.0
Total	**12137**	**100**

Final Palaeolithic technology

Final Palaeolithic technology, as has been frequently noted, is relatively expedient, a strategy that allowed people to usefully employ poorer quality raw material than the preceding Magdalenian (Barton and Roberts 1996, Terberger and Street 2002). This is certainly the case at Site K. Wolds flint was preferentially selected. Tabular material was often knapped with little modification, using the flat, cortical surface as a platform, though on occasion platform rejuvenation occurred. In the Site K collection in general, the representation of cortical pieces is low (Table 14.11), almost certainly as a result of the high representation of Wolds flint and the consequently frequent use of tabular cortical surfaces as platforms. Pieces detached from the Final Palaeolithic cores display thicker butts and frequently less platform-edge abrasion than the Early Mesolithic debitage, where butts are finer and extensively abraded.

Early Mesolithic technology

Till flint was the preferred raw material in the Mesolithic and technology in this case was geared towards exploiting small, ovoid packages of raw material. As at other sites in the Vale, the natural shape of the pebble was often used, with a natural angle being exploited to remove a single flake which then served as a platform, with a second natural angle then being used to remove an initial flake, rather than a crest being used to guide the first removal. However, at Site K refitting has revealed there are also rather more elaborate sequences than at other sites such as Site C and VP D where a single platform was used to reduce a small pebble. At Site K, larger packages of material appear on occasions to have been worked skilfully, with more than one platform exploited, re-cresting and rejuvenation techniques used to correct mistakes and prolong the life of the core.

Assemblage composition

A broad range of tool types of both Final Palaeolithic and Early Mesolithic date were recovered (Table 14.12, Figs. 14.25–14.29). Overall the collection is scraper dominated, although the character of the individual scatters varies considerably (see Fig. 14.25). The central scatters (3, 4 and 5) are scraper-dominated; however, a small number of more isolated scatters are dominated by micro-burins and microliths (Scatters 7 and 30, plus an element of Scatter 5); others are more balanced. The main tool types from the collection will be described below, followed by descriptions of the composition of individual artefact scatters.

Backed pieces (Fig. 14.26)

Twenty-eight backed pieces were recovered. Typologically all are consistent with Late Glacial types: the majority are curve-backed blades, although straight pieces are also present, as are three penknife points

Table 14.12. *Composition of the Site K flint assemblage.*

Category	Total	%
Tools		
Awl	8	0.1
Backed point	28	0.2
Burin	78	0.6
Microlith	68	0.6
Micro-denticulate	1	0.1
Notch	5	0.1
Strike-a-light	1	0.1
Scraper	132	1.1
Scraper/burin	4	0.1
Scraper/borer	3	0.1
Scraper/notch	2	0.1
Truncation	17	0.1
Blade (re/ut)	37	0.3
Flake (re/ut)	31	0.3
Frag (re/ut)	128	1.1
Tool Spalls		
Axe flake	2	0.1
Burin spall	202	1.7
Micro-burin	70	0.6
Resharpening	3	0.1
Debitage		
Blade	608	5.0
Flake	3971	32.7
Fragment	1734	14.3
Chip	4792	39.5
Core	95	0.8
Nodule	20	0.2
Core preparation		
Crested	69	0.6
Plunging	17	0.1
Tablet	9	0.1
Other	2	0.1
Total	**12137**	**100**

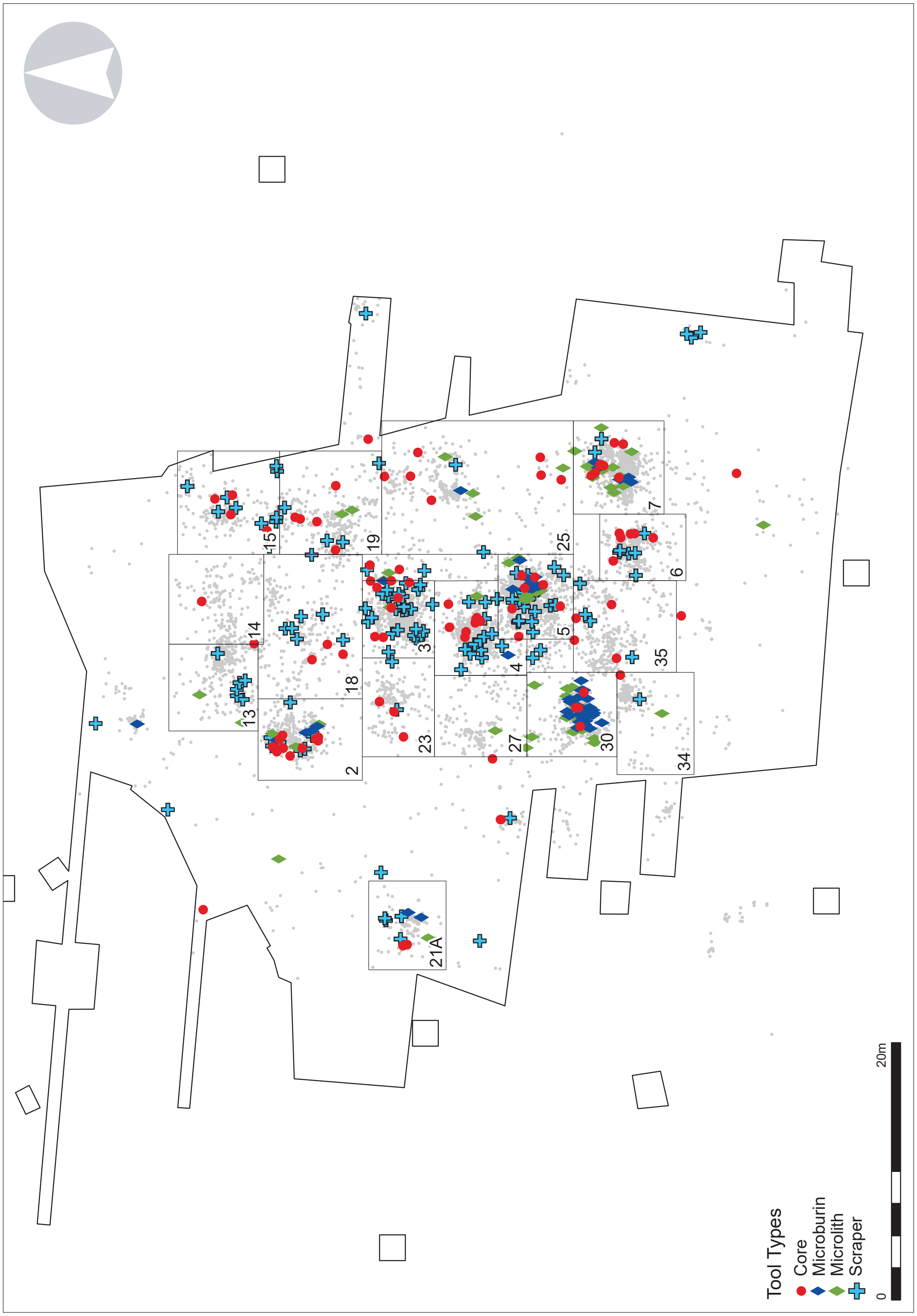

Figure 14.25. *Distribution of tools and cores at Site K.*

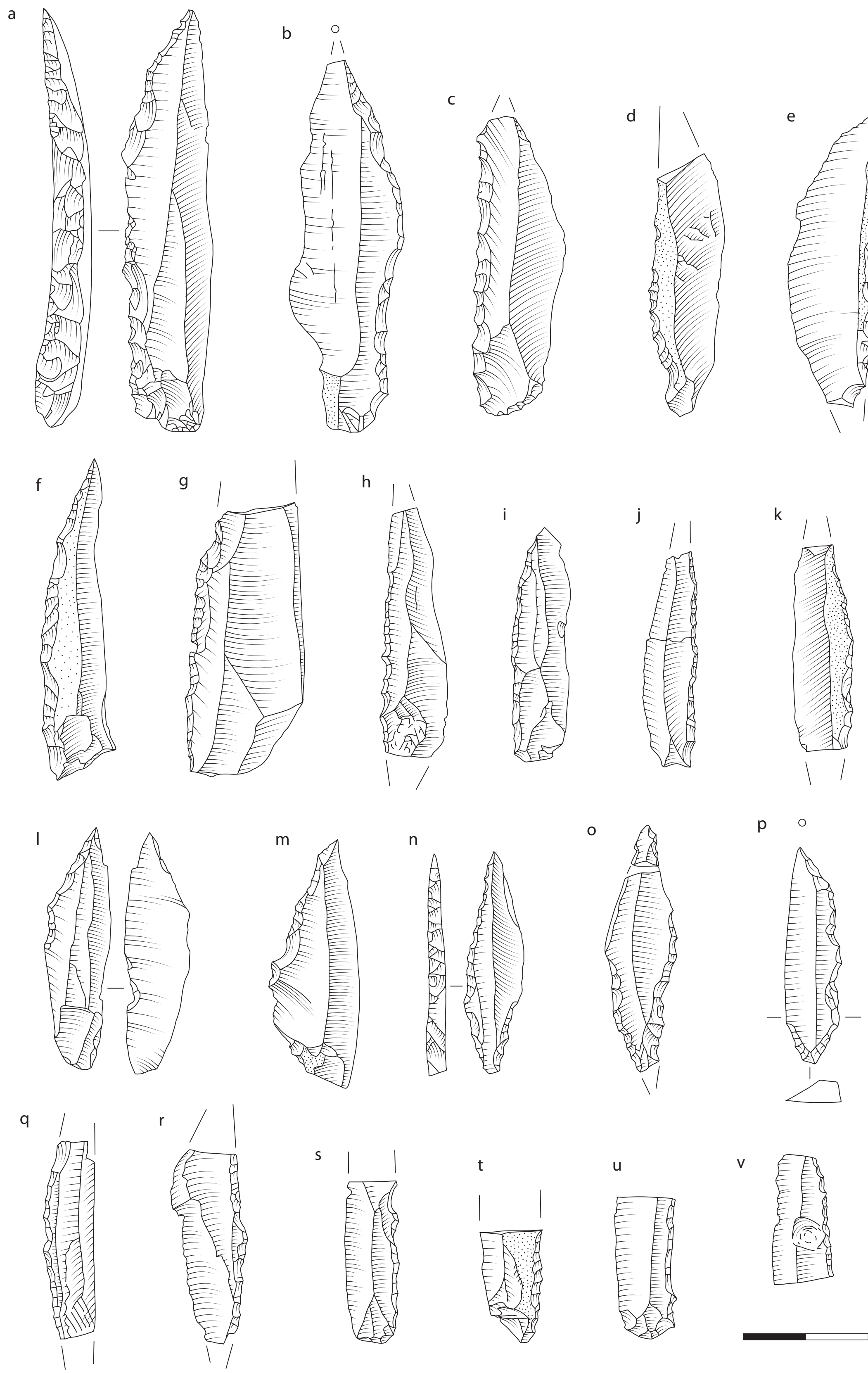

Figure 14.26. *Curved- and straight-backed points (n-p are penknife points), Site K; scale in cm.*

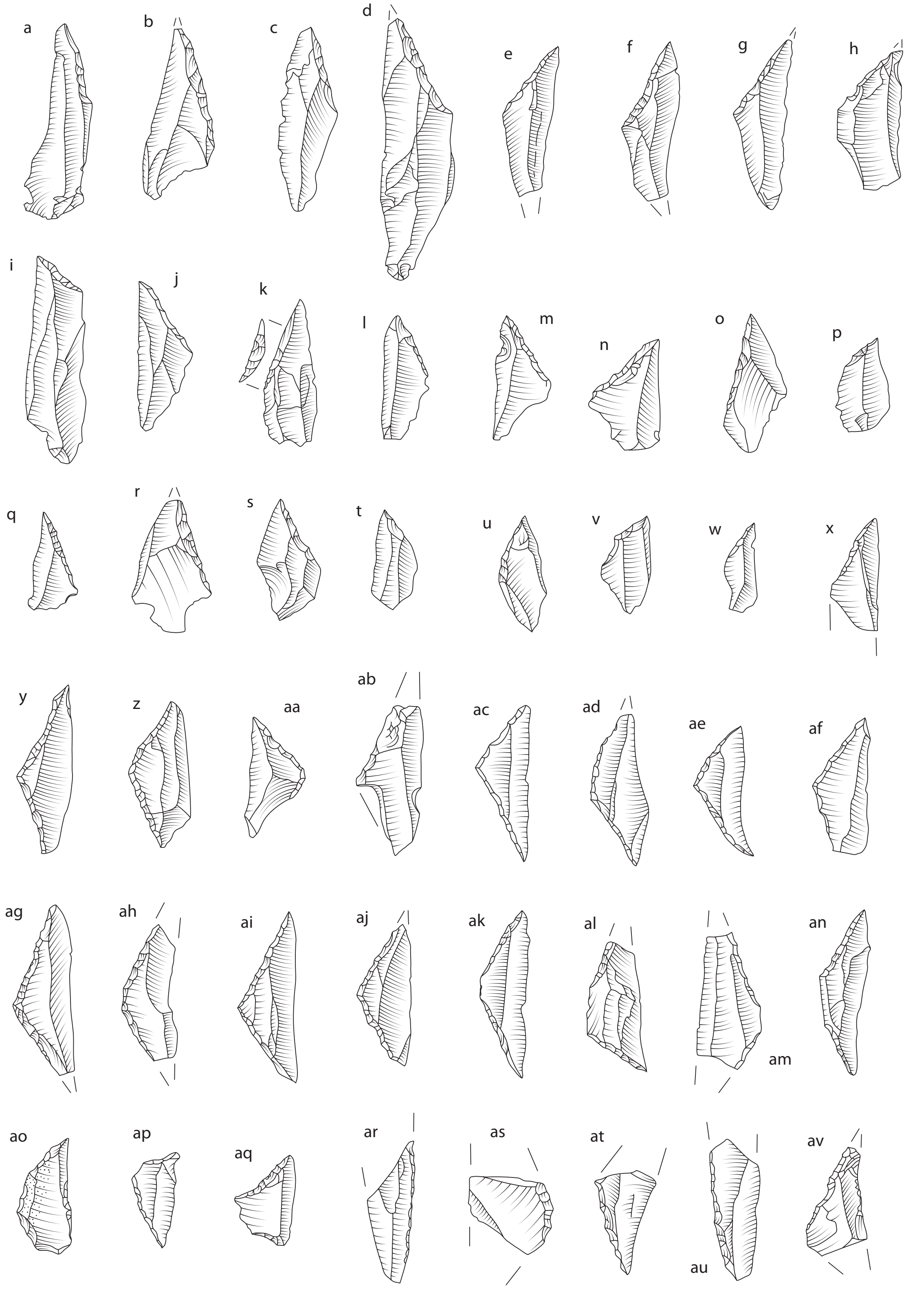

Figure 14.27. *Microliths, Site K; scale in cm.*

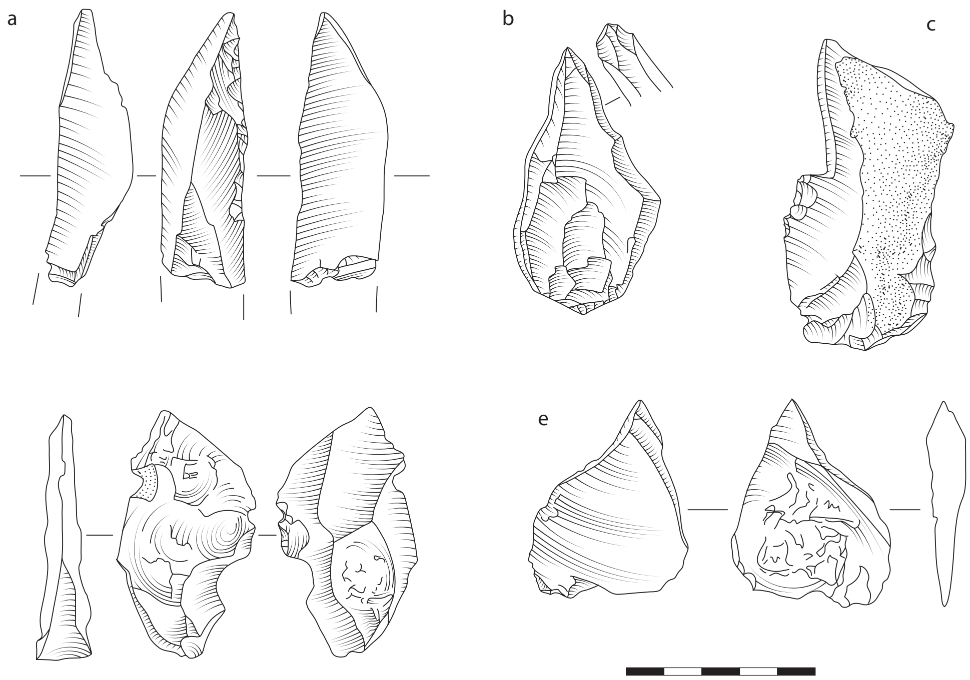

Figure 14.28. *Burins, Site K; scale in cm.*

(Fig. 14.26n-p) and a basally truncated example (Fig. 14.26i). Several of the straight-backed pieces were recovered from a single scatter (Scatter 25) and so may be the product of individual stylistic preferences.

Almost all the backed points are broken or have some degree of tip damage. The majority of backed pieces (19 out of a total of 28) were manufactured from till flint, with only four in Wolds flint, two of which are intact, one refitting within a Wolds knapping sequence. The remainder are burnt or ambiguous. None of the till backed pieces has been refitted. In addition, a further Wolds artefact may represent an unfinished backed piece. Thus, the backed pieces of till may, in the main, represent used and damaged components that were imported to and deposited at Site K, while the Wolds pieces were manufactured at the site.

Microliths (Fig. 14.27)

Although the least common of the essential tools (Mellars 1976) represented at the site, several of the Site K scatters are dominated by microlith manufacture. Obliquely blunted points predominate (Table 14.13), although other Star Carr microlith types are also present. As only two microliths of Wolds material were recovered, it seems probable that there was a definite preference toward till flint for the manufacture of microliths.

Table 14.13. *Microlith types at Site K.*

Microlith type	No.	%
Obliquely blunted point	45	66.2
Triangle	14	20.6
Trapeze	4	5.9
Unident. Fragment	5	7.4
Total	**68**	**100**

Burins (Fig. 14.28)

Burins are relatively common at Site K. In contrast to most Vale of Pickering sites, truncation burins are more common than break burins. This may be because Site K is an assemblage of mixed date. Multiple burins are also very common, perhaps also for this reason and possibly indicating intensive resharpening practices. Burins in till material are twice as common as those manufactured from Wolds flint.

Scrapers (Fig. 14.29)

Seamer Site K is scraper-dominated, with short scrapers the most commonly represented type. Final Palaeolithic scrapers are often round in form. As occurs in several other Vale of Pickering assemblages, scrapers are more common in Wolds material.

Spatial variation

Although the distribution of lithic material at Site K is characterized by localized concentrations (see Figs. 14.22, 14.23), the internal spatial arrangement of material within the site is more complex than at Site C where concentrations are more discrete. At Site K, the different scatters appear to represent debris generated

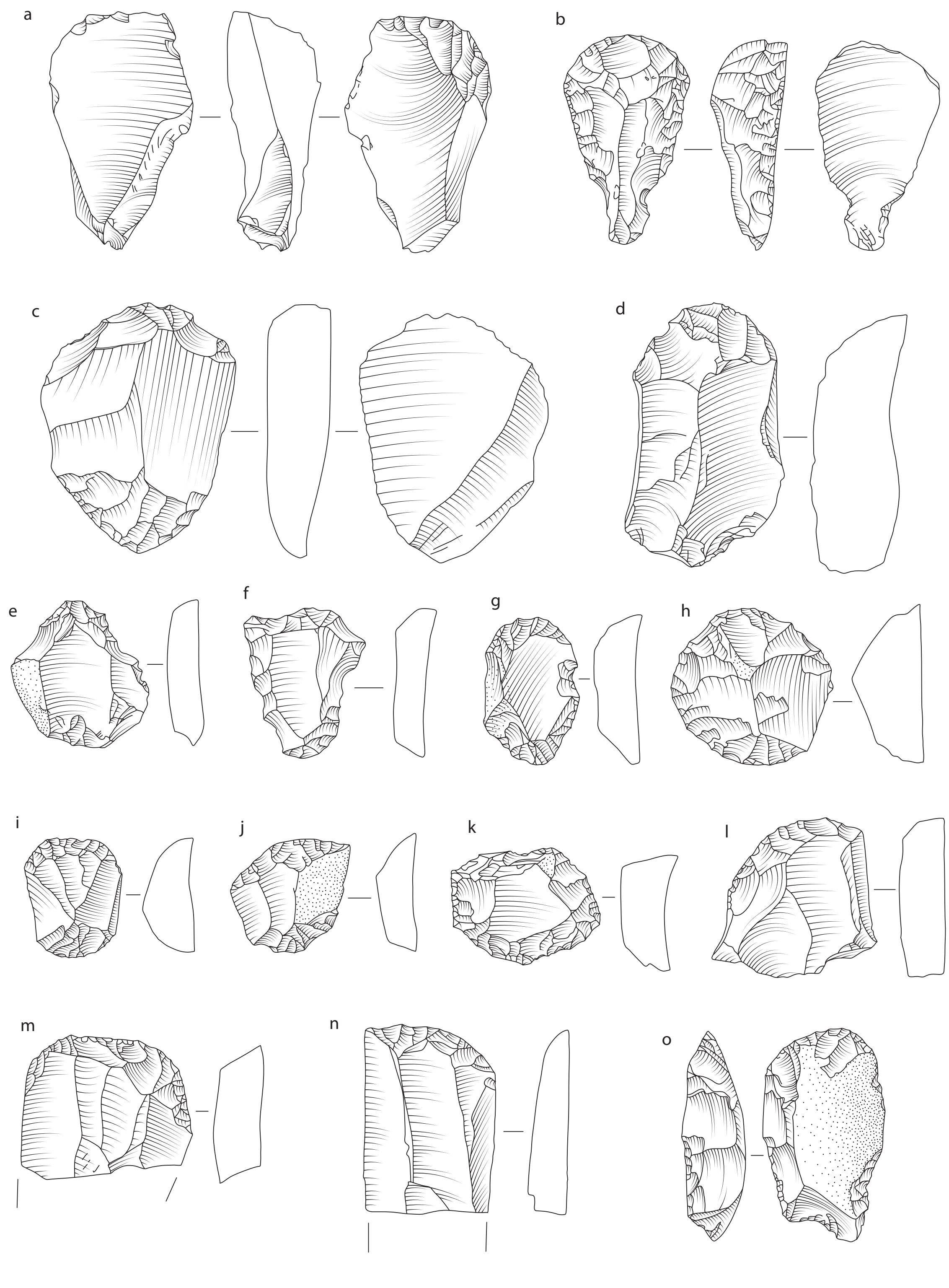

Figure 14.29. *Scrapers, Site K; scale in cm.*

by a number of occupations, site maintenance activities, and post-depositional processes. That tree root action and geomorphological processes have altered at least the vertical distribution of material is demonstrated by the presence of diagnostic Early Mesolithic artefacts in Late Glacial sediments and *vice versa* – as well as refits between horizons dated to different stages of the Late Glacial Interstadial and the Early Holocene.

Although it is difficult to assess to what extent these processes have affected the horizontal distribution of material, many of the scatters seem less coherent than those of Site C, several appearing to represent dispersed extensions of adjacent scatters. This is particularly true of the central scatters, though those on the margins appear more discrete. Further complicating matters, significant gaps seem to exist in certain of the operational sequences represented in many of the different scatters. While some of this can be attributed to the removal of utilizable blanks, tools and cores from site, some site maintenance activities may also have occurred. This is particularly true of Scatter 2, where middening of lithic material – in particular of exhausted and flawed cores and rejected nodules – seems to have taken place.

It is often difficult to demonstrate unequivocally that particular scatters belong either to the Late Glacial or to the Early Mesolithic, as several contain both backed points and microliths. Refitting has elucidated this problem in some instances and further work on these lines has considerable potential. However, in the following paragraphs, activities will be described that cannot be definitely attributed to one particular period.

Scatter 2 (Table 14.14, Fig. 14.30)
Scatter 2 appears to be mainly Early Mesolithic in date, containing microliths, micro-burins and dominated by till material. However, a backed point is also present. The scatter contains two near-complete refit sequences, representing the reduction of medium-sized till beach pebbles. Several partial sequences are also present; however, the majority of the material derives from diverse raw material units which are represented by only one or two pieces each. These are frequently large and cortical, although chips are also represented. Also present are eight completely exhausted cores, another eight cores that were abandoned because of flaws in the raw material and six unmodified, or minimally tested nodules, which appear unknappable. One particularly small and heavily reduced core is of Southern Uplands Chert, a material not elsewhere represented in the Vale of Pickering, apart from within this scatter, where a blade fragment is also present. Debitage can only be refitted to one of these cores. It thus seems that at least part of this scatter represents material that was worked elsewhere and was discarded at this location. Refitting work suggests this material does not derive from elsewhere on Site K. This midden is located on the western side of the scatter (Fig. 14.30) and incorporates scrapers as well as discarded cores.

Table 14.14. *Composition of the Scatter 2 assemblage.*

Category	No	%
Tools		
Awl	1	0.1
Burin	1	0.1
Backed point	1	0.1
Microlith	2	0.3
Micro-denticulate	1	0.1
Scraper	6	0.8
Scraper/borer	2	0.3
Retouched blade	3	0.4
Retouched flake	4	0.5
Retouched frag	5	0.5
Tool spalls		
Axe flake	1	0.1
Burin spall	1	0.1
Microburin	4	0.5
Core preparation:		
Crested	8	1.1
Tablet	1	0.1
Other	1	0.1
Debitage		
Blade	81	11.1
Flake	214	29.3
Fragment	118	16.2
Chip	249	34.1
Core	12	1.6
Nodule	14	1.9
Total	**730**	**99.4**

Material	No	%
Chert	1	0.1
Till	347	47.5
Wolds	105	14.4
Uncertain	253	34.7
Burnt	24	3.3
Total	**730**	**100**

Cortex	No	%
Primary	37	5.1
Secondary	138	18.9
Tertiary	555	76.0
Total	**730**	**100**

Scatters 3 and 4 (Tables 14.15–14.16, Fig. 14.31)
Scatters 3 and 4 display certain similarities and will be discussed together. Though mainly Late Glacial, both also appear to have Early Mesolithic components. Both scatters are Wolds-dominated and have the same proportions of cortical flakes; both are dominated

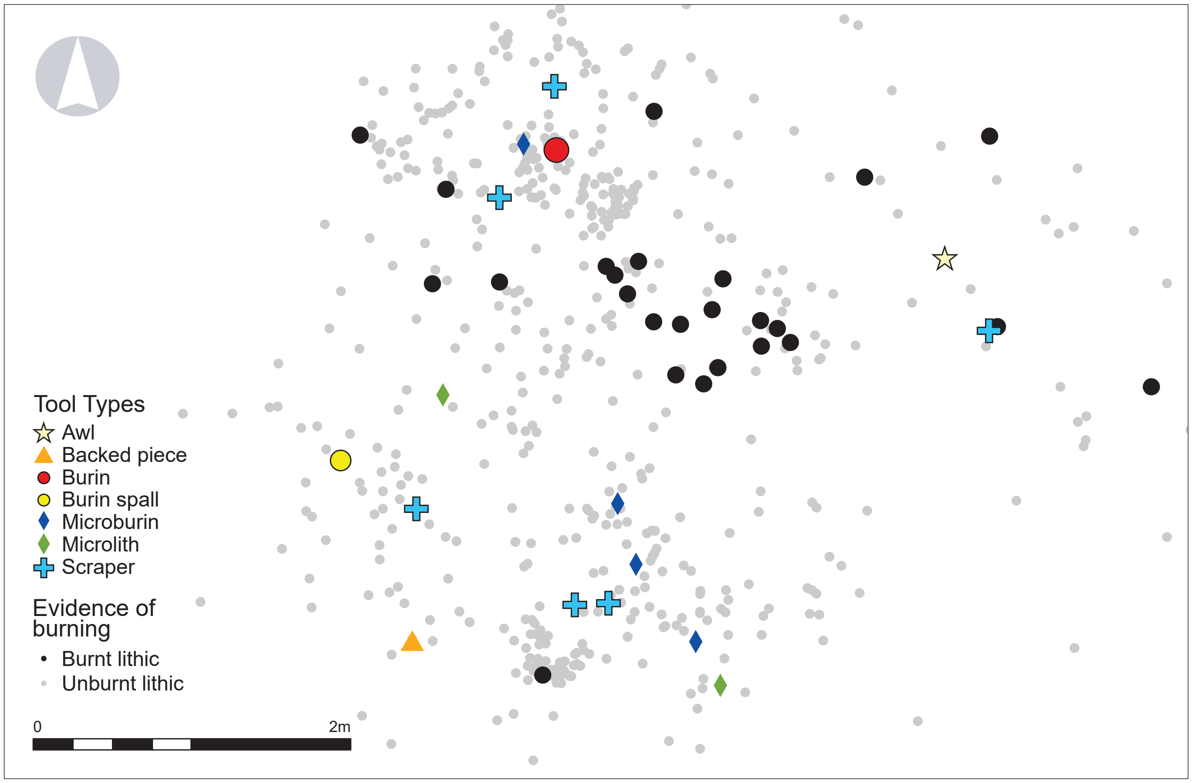

Figure 14.30. *Scatter 2.*

by scrapers, with moderate amounts of burins and frequent burin spalls. They differ in that till material is more common in Scatter 4, which is also a more 'balanced' (Mellars 1976) assemblage. Both contain refit sequences of Wolds material. Activities appear to have included scraper repair/maintenance at Scatter 3, as refitting has demonstrated that a broken scraper was repaired. Although nine burins were recovered from each scatter, 37 and 23 burins spalls derive from each of the two areas respectively, indicating intensive activities involving the use and maintenance of this tool-type. In Scatter 3, burins and burin spalls are concentrated closer to the potential central hearth, while scrapers tend to be more distant. This may relate to the need for the greater spaces needed for hide working. A peripheral patterning of scrapers has also been noted at Star Carr (Conneller et al. 2018). The burnt flint distribution may suggest Scatter 4 is more disturbed. In this scatter, scrapers cluster broadly to the southwest of the scatter, while burins and burin spalls are more evenly distributed.

Scatter 5 (Table 14.17, Fig. 14.32)

Scatter 5 is a balanced assemblage, indicating a range of different tool manufacturing and tool using activities at this locale. Although microlith manufacture is well represented, the presence of three backed points is indicative of earlier, Late Glacial activity. Both Wolds and till material were used, however, a high proportion (22.7%) of the material is burnt, rendering the identification of different raw material units and refit sequences difficult. Large blades and nine scrapers of Wolds material may suggest that the scraper-dominated activities, represented in Scatters 3 and 4, continue to the south. In Scatter 5 more of the scrapers are manufactured on Wolds material, possibly indicative of a preference for this type – as occurs amongst the scraper-dominated scatters of Seamer Site C.

The reverse is true of burins, microliths and microburins, which are predominantly of till material, a preference found elsewhere amongst the Vale sites. Numbers of microliths and microburins are equal – 11 of each are represented, indicating manufacture and retooling. The microburins (and one of the microliths) appear to derive from two or three different raw material units, and can be refitted to debitage represented in the scatter. It seems that several microliths were manufactured per nodule, a situation which contrasts with other sites in the Vale, but occurs elsewhere at Site K. This is further discussed in the analysis of Scatter 30, below. The distribution of microliths and microburins tightly clusters within Scatter 5 (Fig. 14.32). Also, well

Table 14.15. *Composition of the Scatter 3 assemblage.*

Category	No	%
Tools		
Awl	1	0.1
Burin	8	0.5
Backed	2	0.1
Microlith	3	0.2
Notch	1	0.1
Scraper	28	1.8
Scraper/burin	1	0.1
Truncation	1	0.1
Retouched blade	1	0.1
Retouched flake	2	0.1
Retouched frag	7	0.5
Tool spalls		
Burin spall	37	2.4
Microburin	2	0.1
Core preparation:		
Crested	2	0.1
Plunging	1	0.1
Debitage		
Blade	44	2.9
Flake	460	30.0
Fragment	141	9.2
Chip	782	51.0
Core	8	0.5
Total	**1532**	**100**

Material	No	%
Chert	9	0.6
Till	59	3.9
Wolds	1382	90.2
Uncertain	18	1.2
Burnt	64	4.2
Total	**1532**	**100.1**

Cortex	No	%
Primary	11	0.7
Secondary	176	11.5
Tertiary	1345	87.8
Total	**1532**	**100**

Table 14.16. *Composition of the Scatter 4 assemblage.*

Category	No	%
Tools		
Awl	1	0.1
Burin	8	1.1
Backed	2	0.3
Microlith	1	0.1
Scraper	11	1.5
Scraper/borer	1	0.1
Truncation	2	0.3
Retouched blade	1	0.1
Retouched flake	1	0.1
Retouched frag	13	1.8
Tool spalls		
Axe flake	1	0.1
Burin spall	23	3.1
Microburin	1	0.1
Core preparation		
Crested	1	0.1
Plunging	1	0.1
Tablet	1	0.1
Debitage		
Blade	23	3.1
Flake	350	47.4
Fragment	60	8.1
Chip	227	30.8
Core	9	1.2
Total	**738**	**99.7**

Material	No	%
Chert	1	0.1
Till	77	10.4
Wolds	525	71.1
Uncertain	86	11.6
Burnt	49	6.6
Total	**738**	**99.8**

Cortex	No	%
Primary	10	1.4
Secondary	82	11.1
Tertiary	646	87.5
Total	**738**	**100**

represented within the scatter are burins and burin spalls of both Wolds and till material, indicating manufacturing/maintenance. The pattern of burnt flint in this scatter is unusual. It might suggest some disturbance (though there is a clear clustering of microliths and microburins) or some complexity, such as a structure that has burnt down, or an area of microlith production that was subsequently used as a midden.

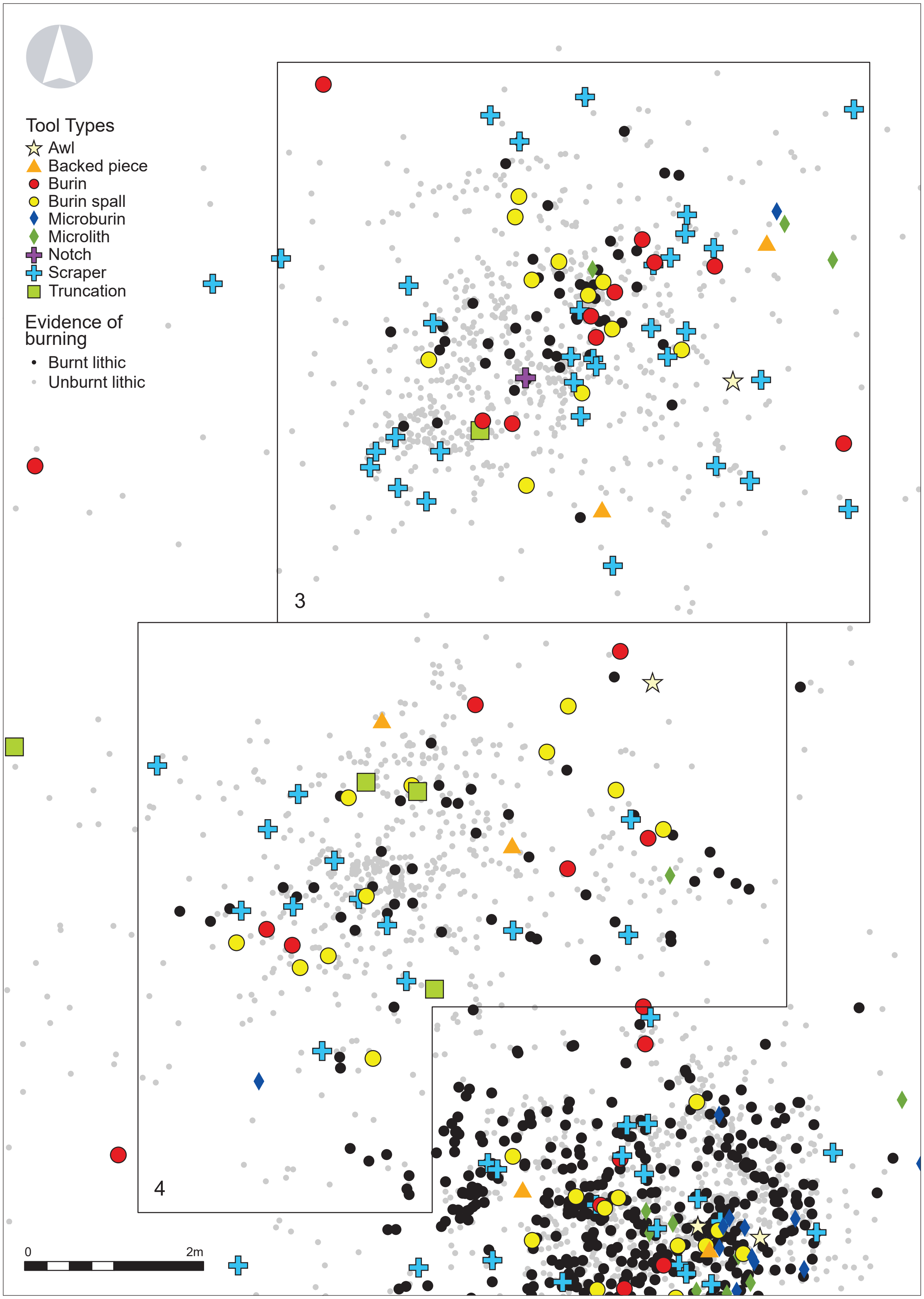

Figure 14.31. *Scatter 3 and 4.*

Table 14.17. *Composition of the Scatter 5 assemblage.*

Category	No	%
Tools		
Awl	2	0.1
Burin	14	0.5
Backed	3	0.1
Microlith	12	0.5
Scraper	24	0.9
Scraper/notch	1	0.1
Truncation	1	0.1
Retouched blade	1	0.1
Retouched flake	3	0.1
Retouched frag	28	1.1
Tool spalls		
Burin spall	36	1.4
Microburin	12	0.5
Resharpening	1	0.1
Core preparation		
Crested	11	0.4
Tablet	1	0.1
Debitage		
Blade	57	2.2
Flake	943	36.6
Fragment	262	10.2
Chip	1158	45.0
Core	6	0.2
Total	**2576**	**100.3**

Material	No	%
Till	398	15.5
Wolds	1155	44.8
Uncertain	438	17.0
Burnt	585	22.7
Total	**2576**	**100**

Cortex	No	%
Primary	31	1.2
Secondary	243	9.4
Tertiary	2302	89.4
Total	**2576**	**100**

Scatter 6 (Table 14.18, Fig. 14.33)

No diagnostic types were recovered from Scatter 6, but raw material and technology suggest a Late Glacial origin. The scatter is dominated by the reduction of Wolds material, from which several scrapers were manufactured. A number of large blades, also in Wolds flint appear to have been imported as blanks. This appears an area of low-scale production and tool use, perhaps in response to a particular task.

Table 14.18. *Composition of the Scatter 6 assemblage.*

Category	No	%
Tools		
Burin	2	0.5
Scraper	6	1.6
Truncation	2	0.5
Retouched blade	4	1.1
Retouched flake	1	0.3
Retouched frag	7	1.9
Tool spalls		
Burin spall	9	2.5
Core preparation		
Crested blade	4	1.1
Plunging	1	0.3
Debitage		
Blade	23	6.3
Flake	162	44.1
Fragment	77	21.0
Chip	63	17.2
Core	6	1.6
Total	**367**	**100**
Material	**No**	**%**
Till	30	8.2
Wolds	259	70.6
Uncertain	57	15.5
Burnt	21	5.7
Total	**367**	**100**
Cortex	**No**	**%**
Primary	10	2.7
Secondary	42	11.4
Tertiary	315	85.8
Total	**367**	**99.9**

Scatter 7 (Table 14.19, Fig. 14.34)

This scatter appears to be of Mesolithic date and dominated by retooling activities. Unlike the similar Scatters 5 and 30, microliths outnumber micro-burins, perhaps suggesting that some pre-manufactured microliths were involved in the retooling episode. Microliths and microburins are concentrated in the north and west of the scatter. Also present are scrapers, burins, truncations, an awl and a notch, suggesting that a

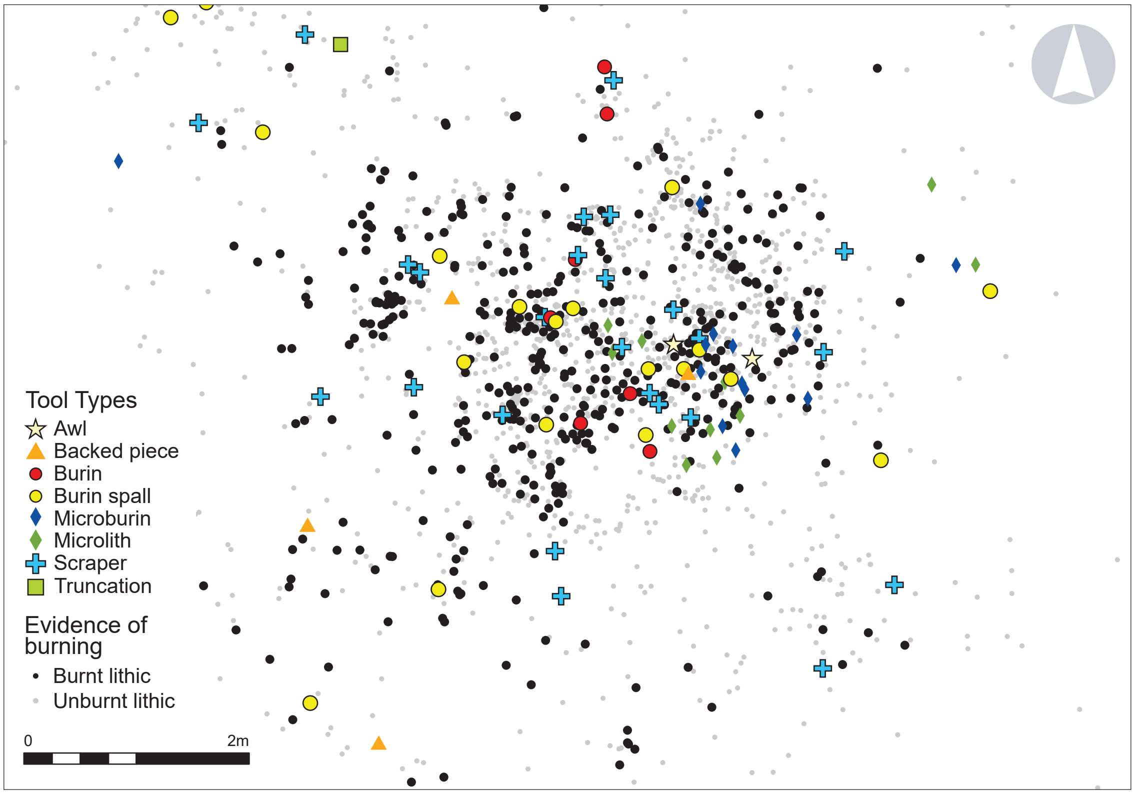

Figure 14.32. *Scatter 5.*

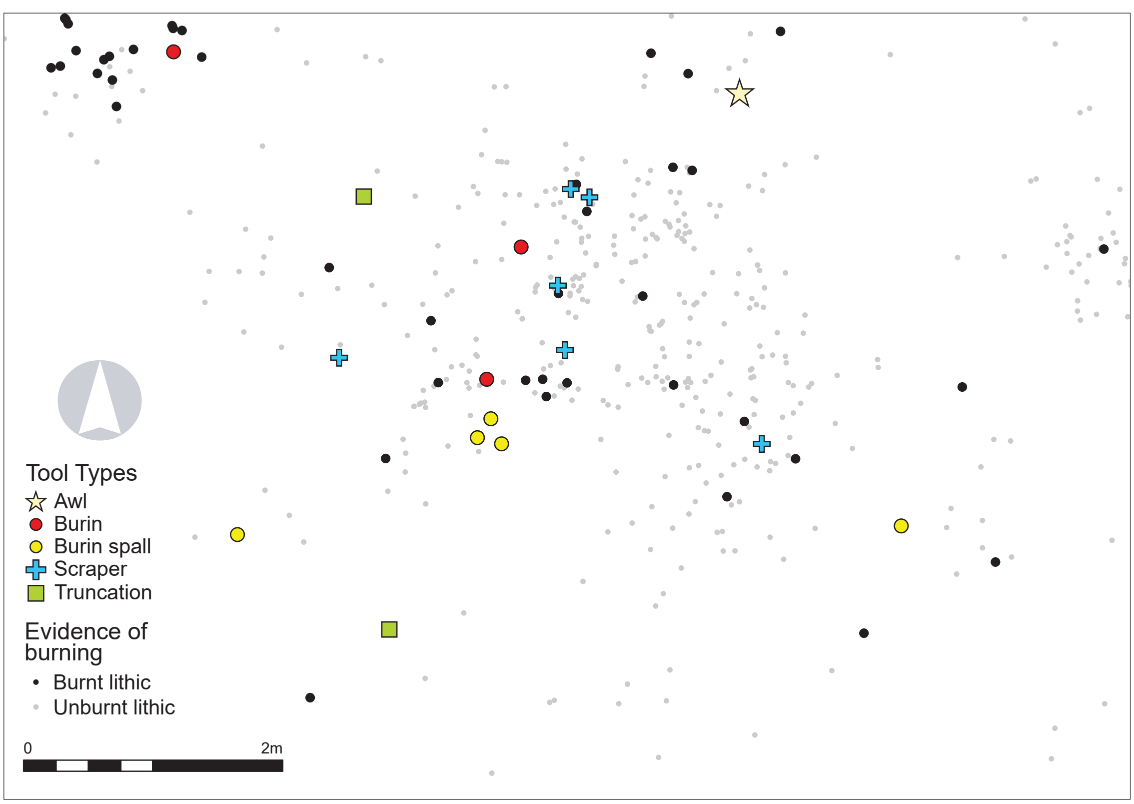

Figure 14.33. *Scatter 6.*

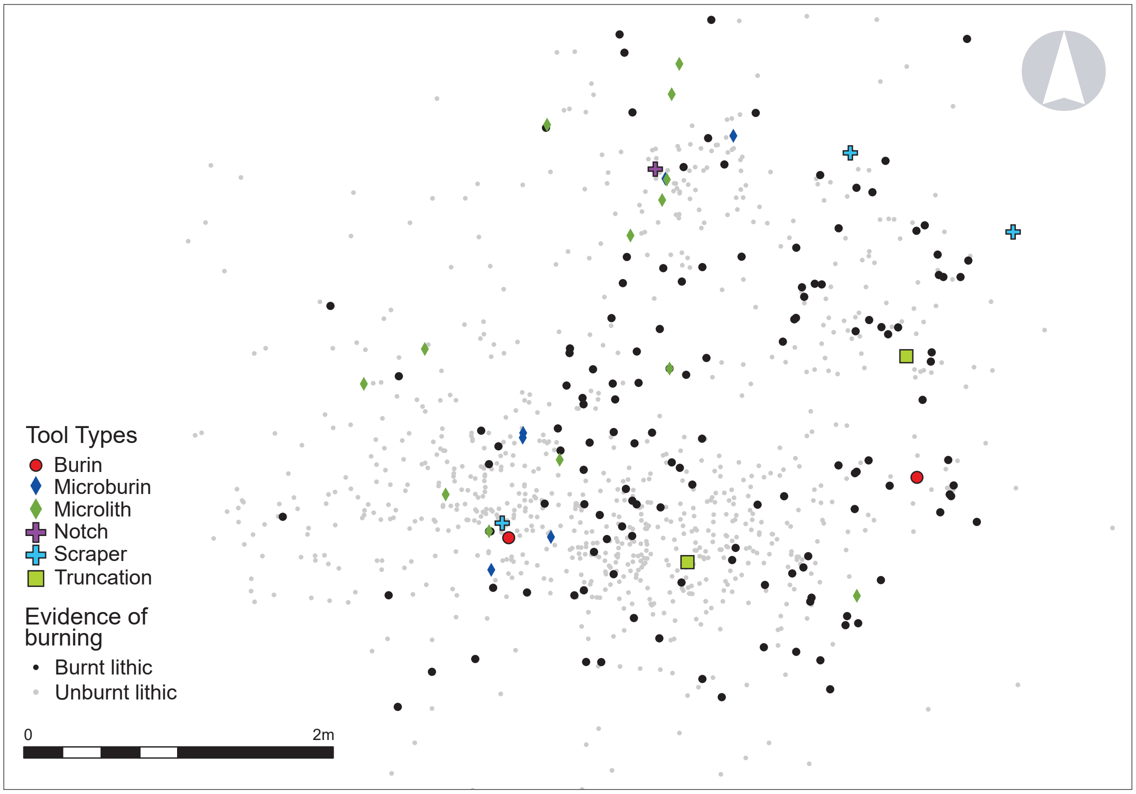

Figure 14.34. *Scatter 7.*

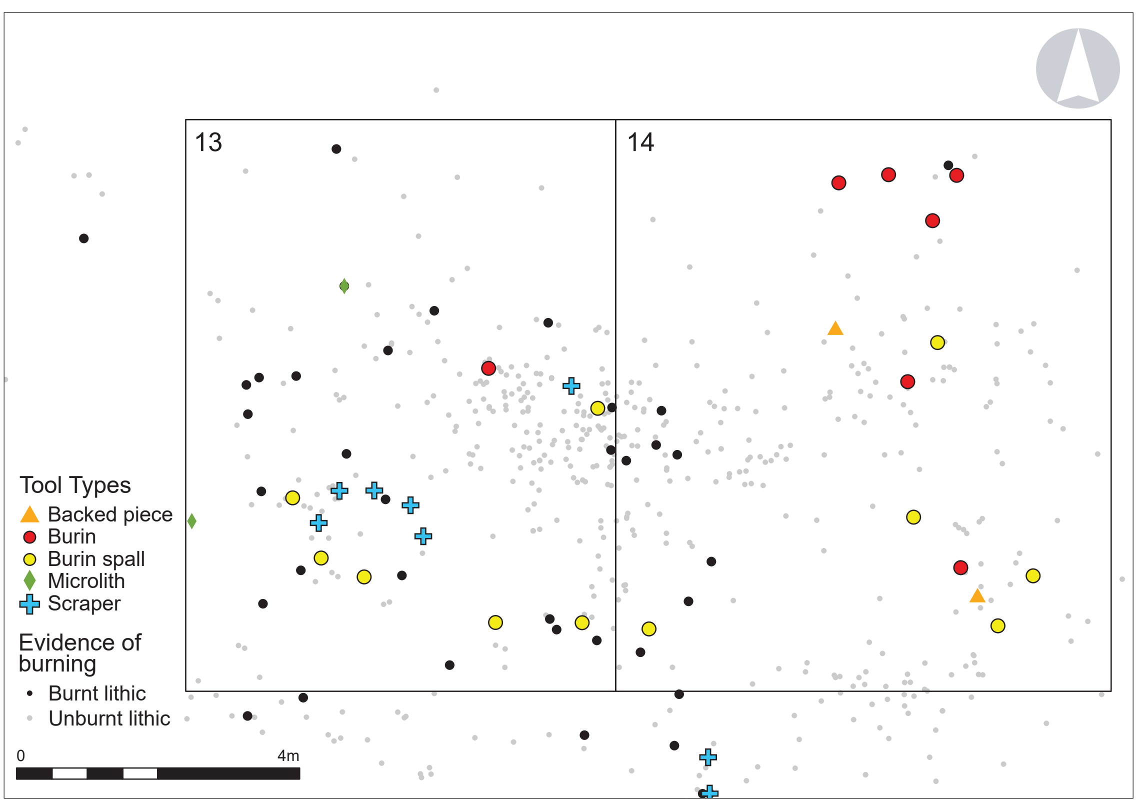

Figure 14.35. *Scatters 13 and 14.*

Table 14.19. *Composition of the Scatter 7 assemblage.*

Category	No	%
Tools		
Awl	1	0.1
Burin	5	0.4
Microlith	15	1.3
Notch	1	0.1
Scraper	3	0.3
Truncation	2	0.2
Retouched blade	1	0.1
Retouched flake	2	0.2
Retouched frag	1	0.1
Tool spalls		
Burin spall	7	0.6
Microburin	6	0.5
Core preparation		
Crested	6	0.5
Tablet	2	0.2
Debitage		
Blade	63	5.6
Flake	366	32.8
Fragment	201	18.0
Chip	426	38.2
Core	8	0.7
Total	**1116**	**100**

Material	No	%
Chert	3	0.3
Till	578	51.8
Wolds	199	17.8
Uncertain	192	17.2
Burnt	144	12.9
Total	**1116**	**100**

Cortex	No	%
Primary	29	2.6
Secondary	135	12.1
Tertiary	952	85.3
Total	**1116**	**100**

Table 14.20. *Composition of the Scatter 13 assemblage.*

Category	No	%
Tools		
Burin	1	0.2
Microlith	2	0.5
Scraper	6	1.4
Retouched blade	2	0.5
Retouched flake	1	0.2
Retouched fragment	2	0.5
Tool spalls		
Burin spall	9	2.1
Core preparation		
Crested	3	0.7
Debitage		
Blade	20	4.7
Flake	75	17.6
Fragment	62	14.6
Chip	243	57.0
Total	**426**	**100**

Material	No	%
Till	53	12.4
Wolds	332	77.9
Uncertain	8	1.9
Burnt	33	7.7
Total	**426**	**99.9**

Cortex	No	%
Primary	2	0.5
Secondary	28	6.6
Tertiary	396	93.0
Total	**426**	**100.1**

wide range of other activities took place. The scatter is till-dominated and at least seven raw material units appear to be represented. Both cortical flakes from these units and the exhausted cores are represented, all of which are heavily reduced. There appear to be significant gaps in the reduction sequences, although recognition is hindered by patination of some of the material. Either the removal of large numbers of blanks from the site may have occurred, the scatter may have a functional relationship with an unexcavated area, or some site maintenance activities may have taken place.

Scatter 13 and 14 (Tables 14.20–14.21, Fig. 14.35)
Scatters 13 and 14 are adjacent low-density scatters in the northern part of the site and both are dominated by Wolds material which are probably part of the same activity episode. Both have a very low proportion of cortical flakes, perhaps resulting from a preference for tabular Wolds material, with the cortical horizontal plane being used as a platform. Scatter 13 yielded 2 microliths, while 2 backed pieces were recovered from Scatter 14. While there is a Mesolithic component to both scatters,

Table 14.21. *Composition of the Scatter 14 assemblage.*

Category	No	%
Tools		
Burin	6	4.0
Backed	2	0.9
Retouched blade	2	0.9
Retouched frag	2	0.9
Tool spalls		
Burin spall	11	5.2
Core preparation		
Plunging	1	0.5
Tablet	1	0.5
Debitage		
Blade	22	10.3
Flake	77	36.2
Fragment	46	21.6
Chip	41	19.2
Core	2	0.9
Total	**213**	**101.1**

Material	No	%
Till	44	20.7
Wolds	146	68.5
Uncertain	13	6.1
Burnt	10	4.7
Total	**213**	**100**

Cortex	No	%
Primary	3	1.4
Secondary	19	8.9
Tertiary	191	89.7
Total	**213**	**100**

Table 14.22. *Composition of the Scatter 15 assemblage.*

Category	No	%
Tools		
Burin	3	1.2
Scraper	9	3.5
Scraper/borer	1	0.4
Scraper/notch	1	0.4
Truncation	1	0.4
Retouched blade	1	0.4
Retouched flake	2	0.8
Retouched frag	6	2.4
Tool spalls		
Burin spall	7	2.7
Core preparation		
Crested blade	1	0.4
Plunging	2	0.8
Debitage		
Blade	9	3.5
Flake	81	31.8
Fragment	42	16.4
Chip	85	33.3
Core	4	1.6
Total	**255**	**100**

Material	No	%
Till	82	32.2
Wolds	98	38.4
Uncertain	13	5.1
Burnt	62	24.3
Total	**255**	**100**

Cortex	No	%
Primary	6	2.4
Secondary	49	19.2
Tertiary	200	78.4
Total	**255**	**100**

the majority of the material appears Final Palaeolithic. The two scatters yielded a long refit sequence on a tabular Wolds nodule, consisting of 50 pieces. Some earlier, outer blades were not recovered, and some smaller blanks from the middle of the sequence are also missing. Although the majority of refitted pieces from this sequence were recovered within Scatters 13 and 14, three pieces were recovered over 20 m away in the southern part of the site. This tabular nodule was probably brought to the area as a pre-form, and all subsequent knapping stages appear to have occurred on site, down to the abandonment of the core. A contrasting refit group was recovered from Scatter 14, where the early stages of reduction of a Wolds nodule are represented, although in this case the partially worked core was removed from the site. The scatters differ in that Scatter 13 is scraper-dominated, with scrapers in a tight cluster in the southwestern part of the scatter, whereas Scatter 14 is burin-dominated. However, a burin and a large number of burin spalls were recovered from Scatter 13, the latter clustering in the same areas as the scrapers. Burin spalls are also present in the southern part of Scatter 14, while burins are mainly found to the north. The southerly distribution of burin spalls in Scatters 13 and 14 may relate to the manufacture/maintenance of burins later used in the northern part of the scatter.

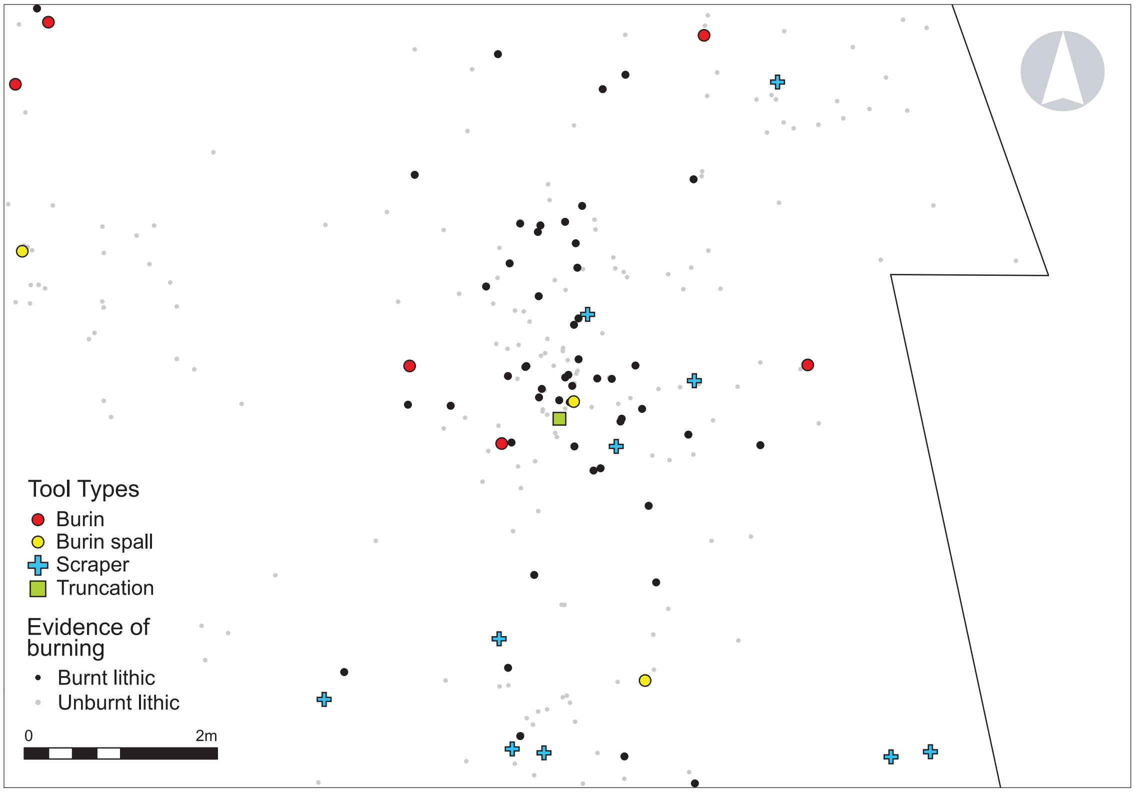

Figure 14.36. *Scatter 15.*

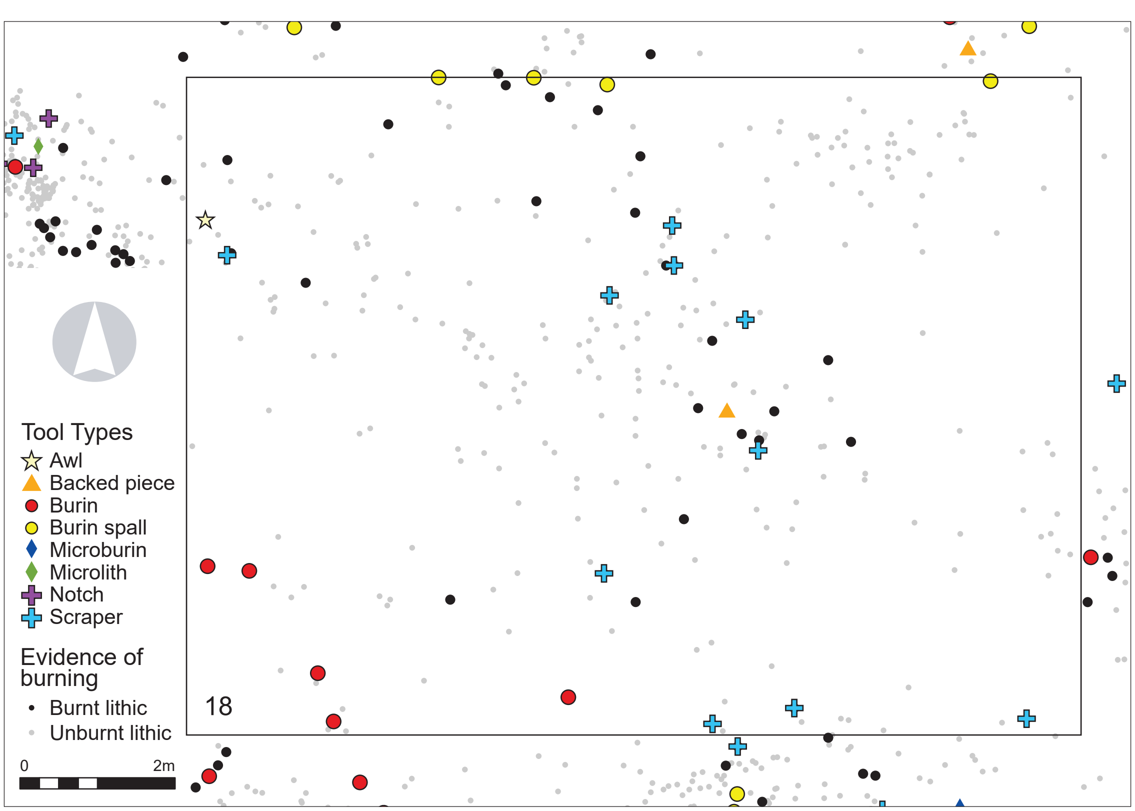

Figure 14.37. *Scatter 18.*

Table 14.23. *Composition of the Scatter 18 assemblage.*

Category	No	%
Tools		
Burin	2	0.6
Backed point	1	0.3
Scraper	7	2.2
Retouched blade	2	0.6
Retouched flake	1	0.3
Retouched frag	4	1.2
Tool spalls		
Burin spall	1	0.3
Core preparation		
Crested blade	3	0.9
Debitage		
Blade	13	4.0
Flake	102	31.6
Fragment	66	20.4
Chip	118	36.5
Core	3	0.9
Total	**323**	**100**

Material	No	%
Till	82	25.4
Wolds	190	58.8
Uncertain	24	7.4
Burnt	27	8.4
Total	**323**	**100**

Cortex	No	%
Primary	3	0.9
Secondary	37	11.5
Tertiary	283	87.6
Total	**323**	**100**

Table 14.24. *Composition of the Scatter 19 assemblage.*

Category	No	%
Tools		
Backed point	6	1.5
Burin	3	0.8
Microlith	2	0.5
Notch	1	0.3
Scraper	4	1.0
Truncation	1	0.3
Retouched flake	2	0.5
Retouched frag	14	3.6
Tool spalls		
Burin spall	15	3.8
Core preparation		
Crested blade	3	0.8
Plunging	3	0.8
Debitage		
Blade	24	6.2
Flake	135	34.6
Fragment	80	20.5
Debitage	92	23.6
Core	5	1.3
Total	**390**	**100.1**

Material	No	%
Chert	1	0.3
Till	141	36.2
Wolds	121	31.0
Uncertain	6	1.5
Burnt	121	31.0
Total	**390**	**100**

Cortex	No	%
Primary	5	1.3
Secondary	60	15.4
Tertiary	325	83.3
Total	**390**	**100**

Scatter 15 (Table 14.22, Fig. 14.36)

This group is dominated by scrapers and composite scraper tools, many of which appear to have been imported. A broader variety of tools have been discarded in the central part of the scatter, but scrapers dominate the margins of the scatter, particularly in the south. Both Wolds and till flint were knapped within Scatter 15. All cores deposited are of till material, although only one appears to have been reduced within the scatter. A very high proportion (24.3%) of material is burnt.

Scatter 18 (Table 14.23, Fig. 14.37)

A backed point is the only diagnostic artefact recovered from this scatter. The assemblage is Wolds-dominated and refitting indicates the reduction of at least one small core of Wolds material. Also present are a number of large flakes and blades of both Wolds and till material which appear to have been imported to the scatter. Scrapers are the dominant tool type and are scattered particularly across the northeastern part, while burins cluster in the southwest. This appears an area predominantly focused on tool use, with small-scale knapping to support these activities.

Table 14.25. *Composition of the Scatter 21a assemblage.*

Category	No	%
Tools		
Microlith	1	0.6
Scraper	4	2.5
Retouched blade	1	0.6
Tool spalls		
Axe flake		
Burin spall	1	0.6
Microburin	2	1.3
Core preparation		
Plunging	3	1.9
Debitage		
Blade	11	7.0
Flake	45	28.5
Fragment	32	20.3
Chip	55	34.8
Core	3	1.9
Total	**158**	**100**

Material	No	%
Till	131	82.9
Wolds	11	7.0
Uncertain	4	2.5
Burnt	12	7.6
Total	**158**	**100**

Cortex	No	%
Primary	1	0.6
Secondary	22	13.9
Tertiary	135	85.4
Total	**158**	**99.9**

Table 14.26. *Composition of the Scatter 23 assemblage.*

Category	No	%
Tools		
Awl	1	0.5
Burin	10	4.8
Scraper	3	1.4
Retouched frag	2	1.0
Tool spalls		
Burin spall	12	5.7
Core preparation		
Plunging	1	0.5
Debitage		
Blade	11	5.2
Flake	89	42.4
Fragment	37	17.6
Chip	41	19.5
Core	3	1.4
Total	**210**	**100**

Material	No	%
Chert	1	0.5
Till	115	54.8
Wolds	69	32.9
Uncertain	2	1.0
Burnt	23	11.0
Total	**210**	**100.2**

Cortex	No	%
Primary	9	4.3
Secondary	74	35.2
Tertiary	127	60.5
Total	**210**	**100**

Scatter 19 (Table 14.24, Fig. 14.38)

Scatter 19 is an assemblage of mixed date, containing both backed pieces and microliths. All the backed pieces display some evidence of fire-cracking, their central position within the scatter perhaps indicating contact with a hearth, although burnt material is broadly distributed across the scatter. Till material, both fresh and patinated, is more common. The fresh till material represents the exploitation of a partially reduced core until it was entirely exhausted. Most of the tools recovered from this scatter are of patinated till material. Minimal debitage of this material is present, suggesting the tools were imported ready-made to this scatter. The imported burins were used and re-sharpened, indicated by the presence of secondary burin spalls. These activities occurred in the southern part of the scatter, while scrapers are more broadly to the north, where they merge with Scatter 15.

Scatter 21a (Table 14.25, Fig. 14.39)

Scatter 21a represents an isolated knapping area in the far western part of the site. An extensive knapping sequence refits to the one core recovered, which appears to have been imported to the site already partially reduced. Two other raw material units are also present, represented by the early stages of core reduction. As the cores belonging to these units were still of workable proportions, they were removed, as were blanks from the refitted sequence and a number of microliths (indicated by the presence of two micro-burins). A discarded

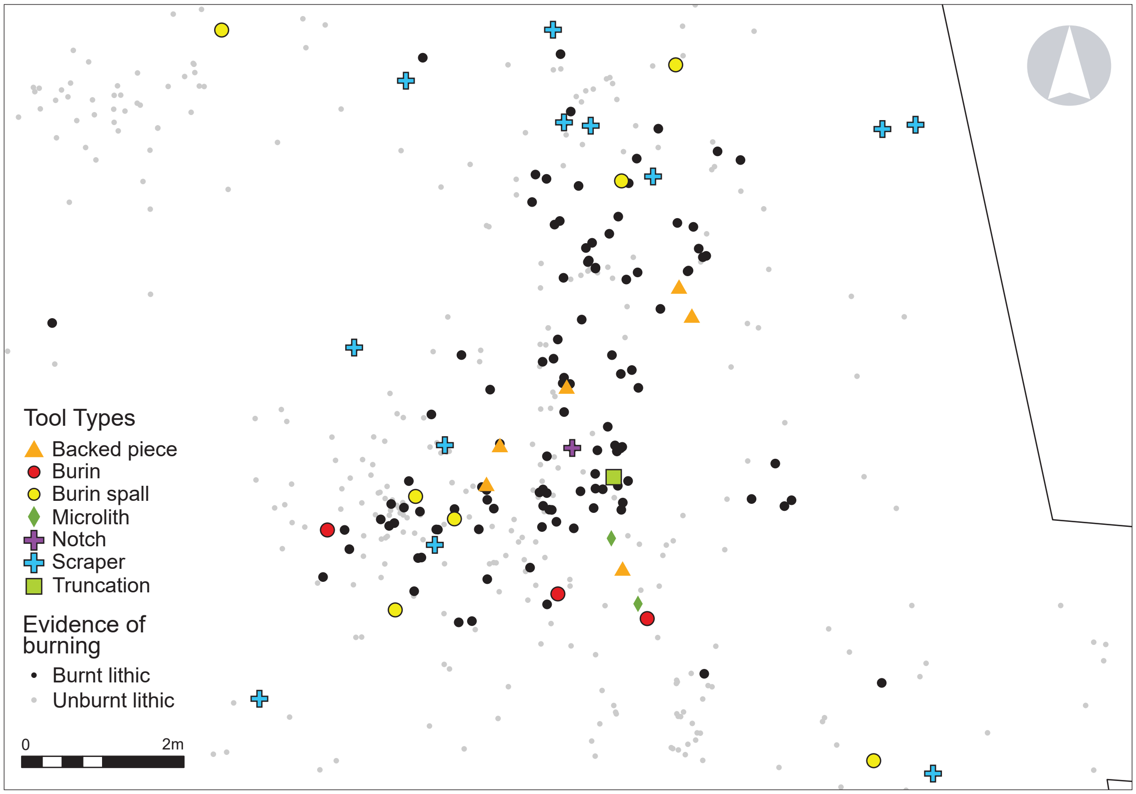

Figure 14.38. *Scatter 19.*

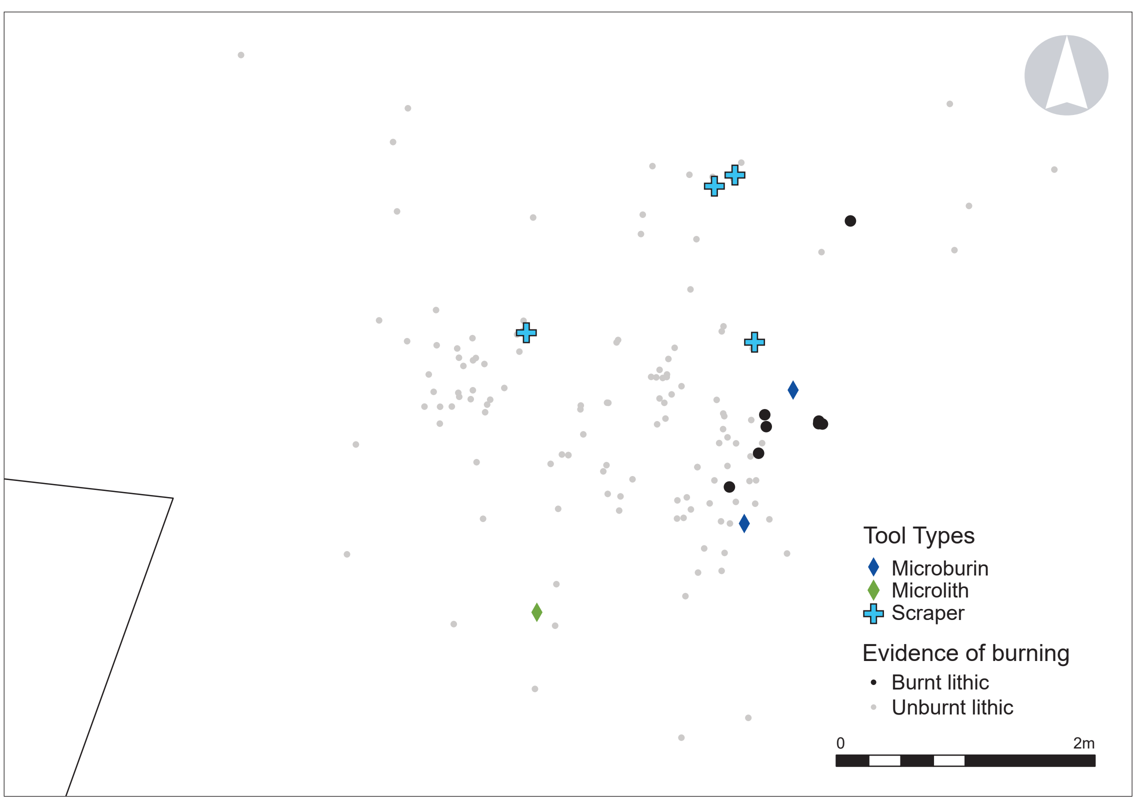

Figure 14.39. *Scatter 21a.*

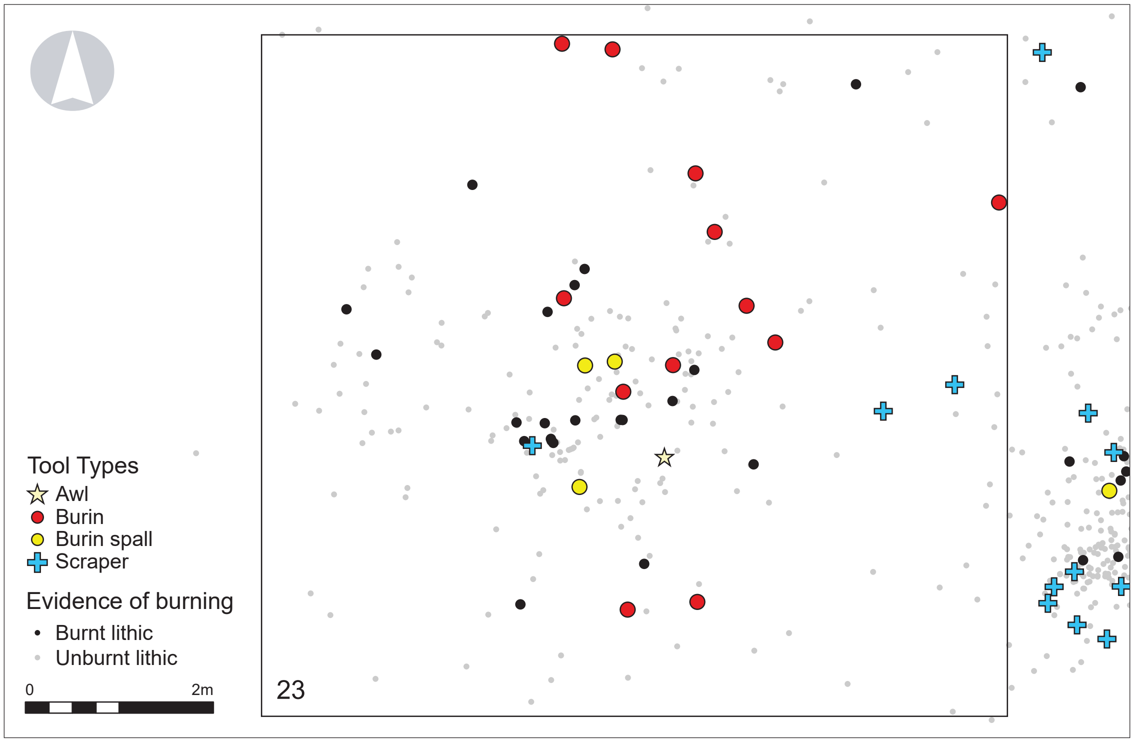

Figure 14.40. *Scatter 23.*

microlith is likely to indicate retooling. Microlith production appears to have taken place round a hearth indicated by a small cluster of burnt flint. To the north of the hearth several scrapers appear to have been used.

Scatter 23 (Table 14.26, Fig. 14.40)
Scatter 23 is till-dominated; much of the material appears to derive from the intensive reduction of a poor quality till pebble. At least two of the burins recovered were manufactured from this nodule. These were used and resharpened within the scatter, near to a small hearth. Burins were distributed broadly to the north of the north of the hearth, suggesting extensive bone and antler working in this area.

Scatter 25 (Table 14.27, Fig. 14.41)
Scatter 25 is of mixed date, containing both backed pieces and microliths. Both types were manufactured within the scatter, indicated by the presence of a microburin and the refitting of a backed piece to a Wolds knapping sequence (Fig. 14.24). Several of the backed pieces from this scatter are straight rather than curved, possibly an indication of idiosyncratic manufacturing techniques.

Three cores of Wolds material were reduced within the scatter, of which one is definitely of Late Glacial date, demonstrated by the refitting of a backed point. The till material is a mixture of patinated and fresh pieces. Knapping debris and microliths are fresh, while a number of large flakes and blades and the remainder of the tools – including the backed points – are slightly patinated. This suggests that the different occupations represented within the scatter can be distinguished, in this case at least, by the condition of the till material. Thus, in the Late Glacial Interstadial, nodules of Wolds material and tools and blanks of till were brought to the scatter. Of these tools, the burins, at least, were worked and re-sharpened on site (indicated by patinated secondary burin spalls) before their deposition. During the Early Mesolithic till material was imported and reduced, microliths manufactured and composite tools repaired in the southern part of the scatter.

Scatter 27 (Table 14.28, Fig. 14.42)
Scatter 27 is dominated by Wolds material and refitting has reconstructed the reduction sequence of a Wolds nodule. Tools are in patinated till material and appear to have been imported to the scatter. Burins were resharpened within the knapping area but used to the east of this area.

Scatter 30 (Table 14.29, Fig. 14.43)
Scatter 30 was generated during the Early Mesolithic and is dominated by microlith manufacture and

Table 14.27. *Composition of the Scatter 25 assemblage.*

Category	No	%
Tools		
Burin	3	0.7
Backed point	5	1.2
Microlith	4	1.0
Scraper	3	3
Retouched blade	2	0.5
Retouched flake	2	0.5
Retouched frag	1	0.2
Tool spalls		
Burin spall	12	2.9
Microburin	1	0.2
Core preparation		
Crested blade	6	1.5
Plunging	1	0.2
Core tablet	1	0.2
Other	1	0.2
Debitage		
Blade	35	8.6
Flake	143	35.1
Fragment	69	17
Chip	111	27.3
Core	7	1.7
Total	**407**	**100**

Material	No	%
Chert	2	0.5
Till	154	37.8
Wolds	207	50.9
Uncertain	14	3.4
Burnt	30	7.4
Total	**407**	**100**

Cortex	No	%
Primary	14	3.4
Secondary	84	20.6
Tertiary	309	75.9
Total	**407**	**99.9**

Table 14.28. *Composition of the Scatter 27 assemblage.*

Category	No	%
Tools		
Burin	3	0.8
Microlith	1	0.3
Scraper	1	0.3
Truncation	1	0.3
Retouched blade	2	0.5
Retouched frag	5	1.4
Tool spalls		
Burin spall	6	1.6
Core preparation		
Plunging	2	0.5
Debitage		
Blade	21	5.7
Flake	78	21.3
Fragment	37	10.1
Chip	208	56.8
Core	1	0.3
Total	**366**	**99.9**

Material	No	%
Till	81	22.1
Wolds	268	73.2
Uncertain	8	2.2
Burnt	9	2.5
Total	**366**	**100**

Cortex	No	%
Primary	6	1.6
Secondary	40	10.9
Tertiary	320	87.4
Total	**366**	**99.9**

retooling activities which took place to the east of a small hearth. Forty microburins and 21 microliths were recovered. The discarded microliths are in general not of the same raw materials as the microburins. Three major raw material units, all of till, are represented. One refit sequence, which is almost complete, reveals that one tested or preformed, medium-sized nodule of till was imported to the site. Core reduction produced blanks – until the core was almost exhausted – from which a large number of microliths were produced, indicated by the presence of eleven re-fitting micro-burins (Figure 14.44). A second refitting core sequence has also produced several microliths. This prolific production well exceeds that so far known at other sites: documented instances of microliths deriving from a single core include only two from material recovered at Pointed Stone, N Yorkshire, the Abri Martin, France and Meer, Belgium (Löhr 1990). A complete refit sequence from Site VP D only produced one microlith, arguing for different rhythms of manufacture and gearing up within the

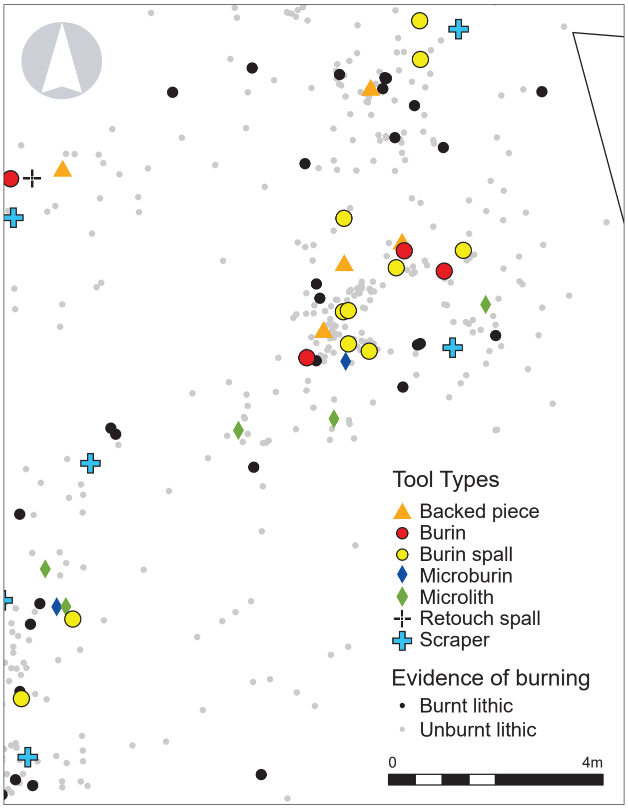

Figure 14.41. *Scatter 25.*

Vale. Only Scatters 5 and 7 at Site K approach similar frequencies of manufacture.

The other two raw material units also pertain to microlith manufacture, although with less intense frequencies – two micro-burins belong to one raw material unit and only one unsnapped, notched blade to the other. One of these units is dominated by cortical flakes, although an exhausted core is also present. Parts of the reduction sequence thus appear to be missing. In contrast the other raw material unit is dominated by tertiary flakes, indicating it was imported part-reduced. The core belonging to this unit is missing, indicating it was carried on with its knappers.

Remaining scatters

A number of scatters appear to have been generated by tool-using, rather than manufacturing activities. These include Scatters 11, 12, 22, 33, 39 and 42. These scatters tend to contain large flakes and blades, some of which display evidence of use, high frequencies of tools and low proportions of chips and burnt flint. Such scatters are discussed in further detail in the context of the No Name Hill site (see Chapter 10). Of the 10 pieces represented in Scatter 11, one is a large flint cobble hammerstone, one a burin and three are blades, two of which show possible evidence of use. Scatter 12 contains a high proportion of large blades and a scraper fragment. Of the six pieces in Scatter 22, one is a truncation, one a retouched fragment and three are large flakes. Although Scatters 33 and 42 do contain some chips they are both small assemblages with high proportions of tools and used pieces. The activity area represented by Scatter 42 appears to have been biased towards the use of burins. One burin and 5 spalls are represented, although the spalls appear to derive from three different tools.

Other scatters appear to represent extensions of the activities represented in adjacent areas. Such

Table 14.29. *Composition of the Scatter 30 assemblage.*

Category	No	%
Tools		
Microlith	21	3.2
Notch	1	0.2
Truncation	2	0.3
Retouched blade	5	0.8
Retouched flake	4	0.6
Retouched frag	6	0.9
Tool spalls		
Microburin	40	6.1
Core preparation		
Crested	14	2.1
Plunging	1	0.2
Debitage		
Blade	53	8.0
Flake	190	28.8
Fragment	135	20.5
Chip	183	27.8
Core	4	0.6
Total	**659**	**100**

Material	No	%
Till	545	82.7
Wolds	27	4.1
Uncertain	8	1.2
Burnt	79	12
Total	**659**	**100**

Cortex	No	%
Primary	7	1.1
Secondary	85	12.9
Tertiary	567	86.0
Total	**659**	**100**

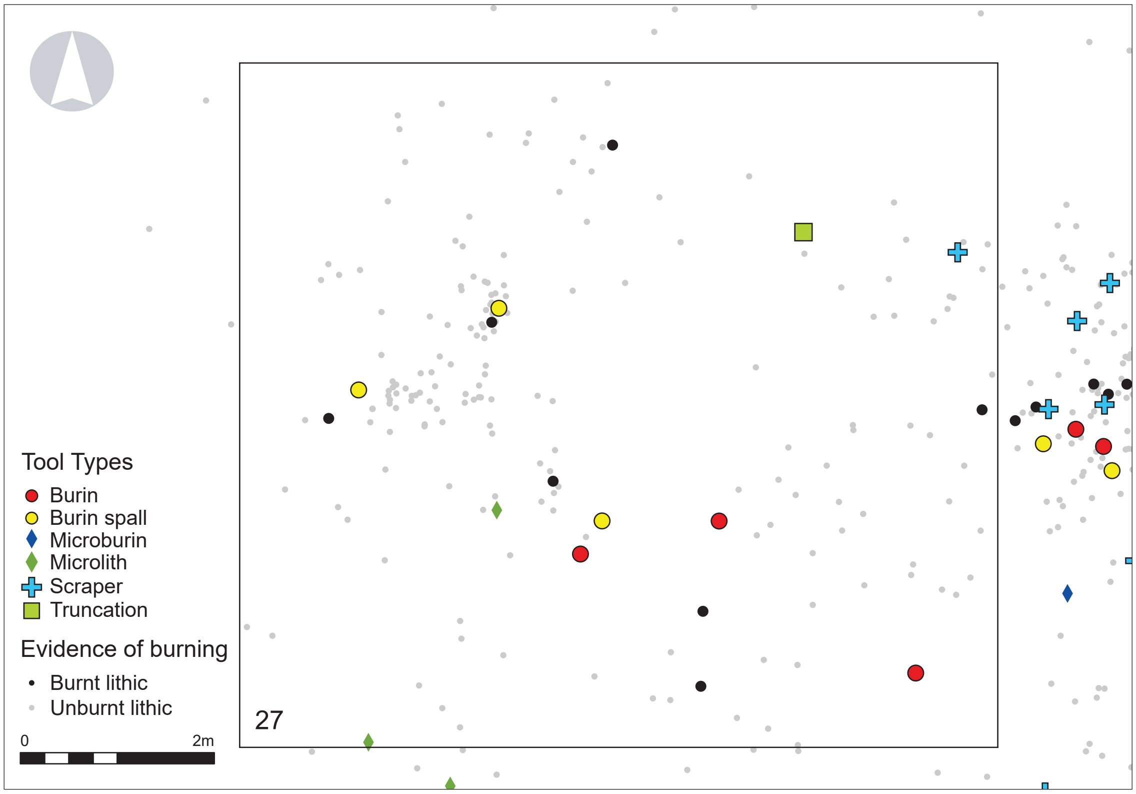

Figure 14.42. *Scatter 27.*

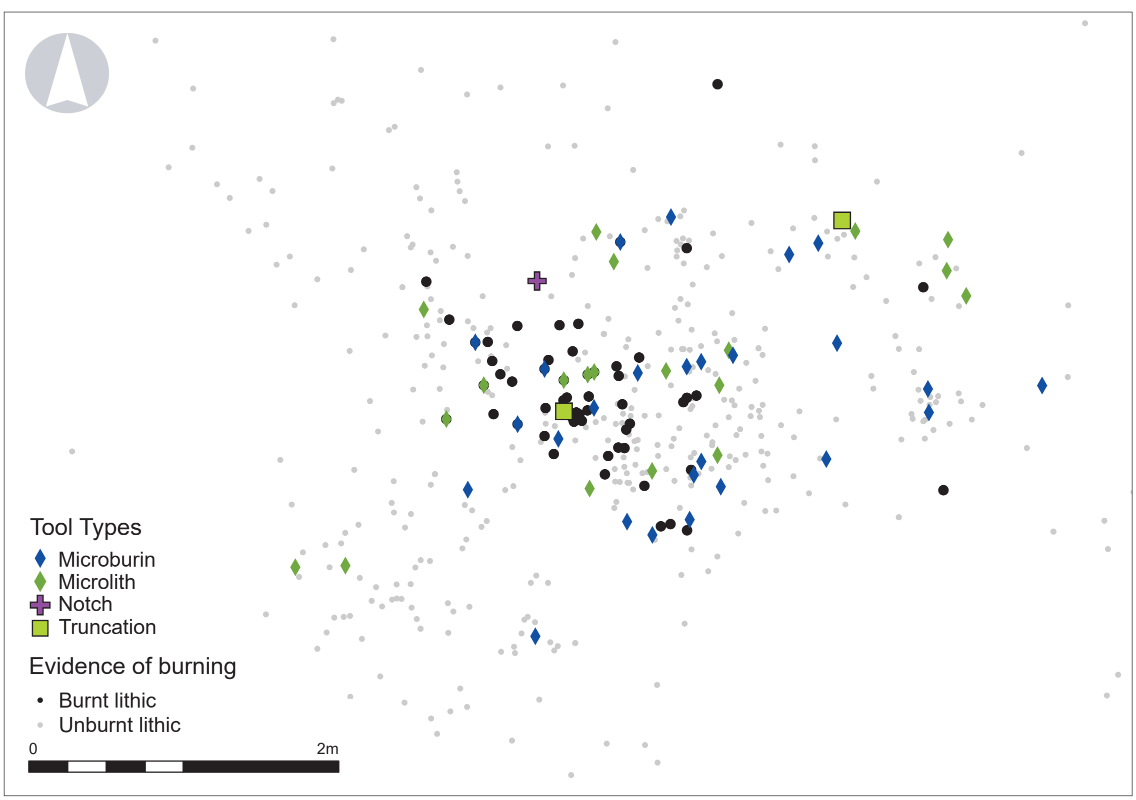

Figure 14.43. *Scatter 30.*

Figure 14.44. *Complete refit sequence including eleven microburins from Scatter 30.*

scatters appear to include 21, 24, 26, 28, 29, 31, 35, 36, 41 and 43. Others, such as scatter 39, which has a proportion of burnt flint of nearly 50%, may represent the cleaning out of a hearth area or the destruction of a hearth by tree roots. Other small scatters appear to have been generated through composite processes.

Seamer Carr Site L

The lithic material collected from Seamer Site L, whilst from one stratigraphic horizon, nevertheless seems to fall into two distinct categories. The earlier of the two is a Long Blade-type industry, the second a larger scatter of Early Mesolithic tools and debris.

Raw materials (Table 14.30)
Till flint dominates and this is a direct reflection of the fact that it was the only material employed in the larger Early Mesolithic scatter. This Early Mesolithic assemblage was manufactured from a relatively small number of nodules, mostly of clear black flint which has suffered some staining, although speckled grey material was also used. The Long Blade-type industry (although it has undergone a degree of patination) appears to have been manufactured solely on very large pieces of Wolds material, some of which were of poor quality, with holes and inclusions.

Long Blade type technology
Perhaps the earliest activity at this site is represented by a small number of large flakes and a series of long blades. Although characteristic bruised blades are absent, this material otherwise resembles the 'Long Blade' type already encountered at Site C (see Chapter 5). A large blade core of Wolds material and also a large flake core, also of Wolds material probably belong to this assemblage. The blade core measures 12.5 cm in length and displays the scars of numerous large blades which were removed mainly from one side of the core and from one direction. No pieces can be refitted to this core and traces of wear down one side suggest it may have been used as a tool. Two long blades, a crested blade and a large flake all appear to have been manufactured from another Wolds nodule, although only two blades refit. The largest piece is 12.8 cm long. All three blades are broken and lack their proximal portions, thus precluding the identification of faceted butts which are common in Long Blade industries (Barton 1989). However, one of the blades plunges at its base, revealing part of an opposing platform with signs of faceting. The debitage shows signs of both core preparation and maintenance: the crested blade appears to belong to the early stages of knapping and represents the initialization of blade production, while the plunging blade probably represents core face thinning, indicating an ability on the part of the knapper to anticipate possible knapping errors.

Table 14.30. *Raw materials at Seamer Site L.*

Material	No	%
Chert	1	0.2
Till	306	74.6
Wolds	44	10.7
Uncertain	50	12.2
Burnt	9	2.2
Total	**410**	**100**

Table 14.31. *Cortical pieces at Seamer Site L.*

Cortex	No	%
Primary	21	5.1
Secondary	90	22.0
Tertiary	299	72.9
Total	**410**	**100**

Table 14.32. *Composition of the Seamer Site L assemblage.*

Category	No	%
Tools		
Microlith	7	1.7
Frag. (re/ut)	1	0.2
Tool spalls		
Axe flake	1	0.2
Burin spall	2	0.5
Micro-burin	6	1.5
Resharpening	1	0.2
Debitage		
Blade	41	10.0
Flake	107	26.1
Fragment	93	22.7
Chip	142	34.6
Chunk	2	0.5
Core	3	0.7
Core preparation		
Crested blade	2	0.5
Tablet	2	0.5
Total	**410**	**100**

Early Mesolithic technology
A range of narrow flakes and fine thin blades were manufactured from till material. The cores from which these pieces were produced were not recovered, although a small number of core preparation and

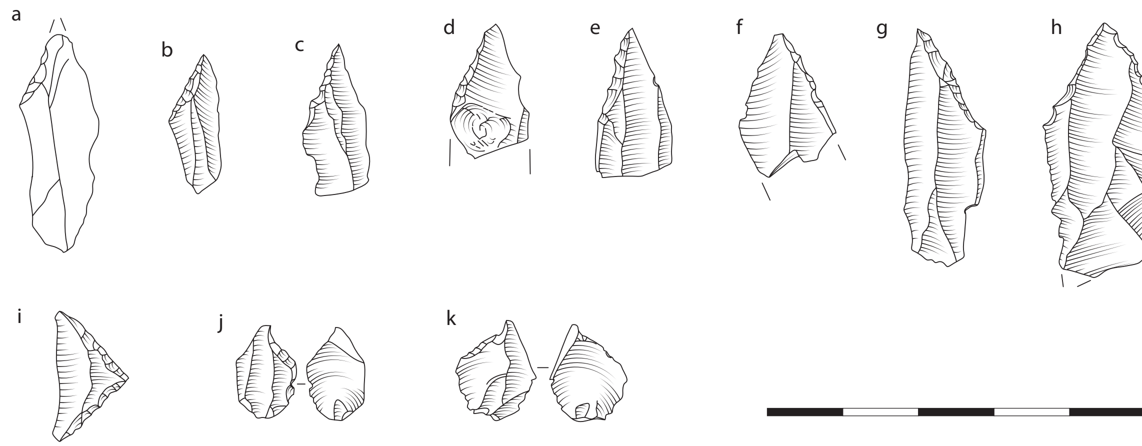

Figure 14.45. *Site L: Microliths (a-i), microburins (j-k); scale in cm.*

maintenance flakes are present. Site L displays a high proportion of primary flakes although the proportion of secondary flakes is fairly average (Table 14.31). This may suggest that some testing of nodules or pre-form shaping occurred on site. Flakes which may represent debris from such activities have been detached using a hard hammer in contrast to the rest of the material which was generated by the use of a soft hammer.

Assemblage composition (Table 14.32)

Microliths are the only tool type recovered at Seamer L. A large number of microburins were also found. Site L is one of only two sites in the Vale where microburins outnumber microliths. Two burin spalls and a possible axe flake indicate that burins and an axe played a role at this site, although these tools were not recovered.

Microliths from Seamer L are all obliquely blunted points (Fig. 14.45), while one has additional retouch on the leading edge. Though obliquely blunted points with retouch on the leading edge are characteristic of 'Deepcarr type' assemblages (Radley and Mellars 1964; Jacobi 1978), the shape of these artefacts is typical of Star Carr types. All pieces have also been manufactured from till flint, which is the favoured material of 'Star Carr type' sites. The association of obliquely blunted points with retouch on the leading edge with Deepcar type assemblages is not absolute – three obliquely blunted points with retouch on the leading edge manufactured on till flint were also recovered from Star Carr itself (Jacobi 1978).

Seamer Carr Site B

Site B generated a small lithic collection of mixed date from eight test pits/small trenches, none of which yielded more than a hundred pieces. Diagnostic artefacts include three Late Mesolithic microliths, a Late Neolithic oblique arrowhead and a Late Neolithic/ Early Bronze Age knife. The character of the debitage is also mixed (with some Early Mesolithic material probably present as well), varying from Mesolithic/ Early Neolithic blade and narrow flake technology, to later prehistoric flakes with broad butts and which lack preparation.

Raw materials (Table 14.33)

The proportion of Wolds material is relatively high considering the presence of diagnostic later prehistoric material. As discussed in more detail below with reference to the Rabbit Hill assemblage, use of Wolds material becomes rarer through the Mesolithic and Neolithic periods (Henson 1992; Durden 1995). This may indicate that a significant component of the undiagnostic knapping debris is of Early Mesolithic date. The collection is also notable for the presence of chert and also a relatively high proportion of burnt material (14.8%).

Technology (Table 14.34)

As a collection of mixed date, a number of different technologies are in evidence. There is a blade and

Table 14.33. *Lithic raw materials at Site B.*

Source	No	%
Chert	3	1.3
Till	115	51.6
Wolds	40	17.9
Uncertain	32	14.3
Burnt	33	14.8
Total	**223**	**100**

Table 14.34. *Cortical pieces at Site B.*

Cortex	No	%
Primary	4	1.8
Secondary	53	23.8
Tertiary	166	74.4
Total	**223**	**100**

Table 14.35. *Composition of the Site B lithic assemblage.*

Category	No	%
Tools		
Arrow	1	0.4
Knife	1	0.4
Microlith	3	1.3
Scraper	4	1.8
Truncation	1	0.4
Flake (re/ut)	3	1.3
Frag. (re/ut)	7	3.1
Tool spalls		
Burin spall	1	0.4
Debitage		
Blade	24	10.8
Flake	67	30.0
Fragment	79	35.4
Chip	18	8.1
Chunk	5	2.2
Core	5	2.2
Nodule	1	0.4
Core preparation		
Crested blade	2	0.9
Plunging blade	1	0.4
Total	**223**	**100**

narrow flake component which demonstrates a more versatile technology including the use of controlled flaking with a soft hammer: butts are thinner and platform-edge abrasion was employed, and core preparation flakes indicate the ability to manipulate raw material efficiently. These techniques are characteristic of Mesolithic and Early Neolithic flint working. In the absence of diagnostic artefacts other than projectile points, (which need not necessarily be associated with knapping or occupation debris), the majority of the material could derive from either of these periods.

Later prehistoric debitage is represented by flakes with thicker butts, sometimes lacking platform abrasion. Many such pieces appear to have been detached by a hard hammer and occasionally bear incipient cones indicative of abortive attempts at flaking. A multiplatform flake core indicates the technological strategy involved. The high proportion of cortical flakes is partly due to the presence of such flake-based technologies where the volume of the core is not as efficiently exploited as in blade technologies. The majority of this material is probably Late Neolithic/ Early Bronze Age in date.

Assemblage composition (Table 14.35)

Three microliths were recovered, all Late Mesolithic in date. Two are scalene triangles with three edges blunted. The other is a small convex backed piece with basal retouch, with all three sides blunted. Two are in till flint, one is burnt. Of the two scrapers recovered, two are short endscrapers and two are fragmentary; one was probably a long scraper. The endscrapers are likely to be of Mesolithic/Early Neolithic date. All were manufactured on till flint.

Later prehistoric tool types are represented by a Late Neolithic oblique arrowhead in translucent brown till flint and a knife. The latter piece consisted of a large flake of till flint with low angle retouch extending along one edge. The flake has a broad platform, lacks platform abrasion and was detached with a hard hammer. It is likely to be Late Neolithic/Bronze Age in date.

Spatial variation

Little significant spatial variation can be detected at Site B. Units Z6, 8, 101, 200 and 202 are either undiagnostic or else of mixed date. In trench BI, although the upper contexts contain material of mixed date, Mesolithic material predominates in the lower contexts and consists of blades and flakes in speckled grey and red till flint, two of which re-fit. The material from Z101A appears to be almost entirely Late Mesolithic, consisting of a scalene triangle microlith, blades and knapping debris of which a high proportion is burnt.

Rabbit Hill

The majority of the diagnostic elements recovered from Rabbit Hill are Late Mesolithic in date. These include small scalene triangle and rod microliths, retouched microblades and microblade cores. Two apparently Early Mesolithic microliths were also recovered. Later prehistoric material is very rare: only a probable Late Neolithic/Early Bronze Age knife indicates any later activity in the vicinity. Although Iron Age pottery was recovered from Rabbit Hill, flintworking of this date is absent. Extensive rabbit disturbance has resulted in a lack of stratigraphic separation between materials of these various periods.

Raw materials (Table 14.36)

The ratio of till material to Wolds material from the chronologically mixed collection at Rabbit Hill is equivalent to that found on Early Mesolithic sites elsewhere in the Vale of Pickering. Given that a significant portion of the diagnostic elements at the site are Late Mesolithic in date, it follows that either Late Mesolithic communities were exploiting lithic sources in similar ways to Early Mesolithic people or that a significant proportion of the undiagnostic debitage is Early Mesolithic in date. An examination of the raw material types selected for Late Mesolithic microliths may elucidate this problem. Only one of the twelve pieces was manufactured in Wolds material (although one piece was burnt and one indeterminate). So, although Wolds material was employed, the proportions used were much lower than the rest of the assemblage and thus much of the undiagnostic debitage may be Early Mesolithic. However certain caveats remain: a preference may have existed for the manufacture of microliths on the higher quality till material; also, as finished tools, microliths are likely to have been carried further either as curated elements or as part of composite tools and thus, if they are the product of embedded procurement strategies, may reflect visits to other raw material sources as part of the seasonal round.

The use of both Wolds and till flint in the Late Mesolithic is interesting because the Vale of Pickering Late Mesolithic industries lie between sites on the Wolds where mainly till material is employed and sites on the North York Moors, where Wolds flint is used (see below, Site F).

Table 14.36. *Raw materials at Rabbit Hill.*

Source	No	%
Chert	3	0.3
Till	653	54.9
Wolds	169	14.2
Uncertain	94	7.9
Burnt	271	22.8
Total	**1190**	**100**

Table 14.37. *Cortical flakes at Rabbit Hill.*

Cortex	No	%
Primary	15	1.3
Secondary	175	14.7
Tertiary	1000	84
Total	**1190**	**100**

Technology (Table 14.37)

The transition from Early to Late Mesolithic technologies has frequently been identified with a shift from the production of elongated regular pieces towards the manufacture of shorter, broader flakes (Pitts and Jacobi 1979). This has been linked to the difficulty in procuring good raw material due to sea level rise as well as to the development of smaller group territories (*ibid.*; Myers 1986). While such an explanation might apply for instance to the Pennine industries, where a range of small nodules of local raw material were exploited to a much greater extent (Conneller 1996), the situation in the Vale of Pickering is different. Here, similar raw material types were exploited in both the Early and the Late Mesolithic, and the effect of sea level rise was actually to bring raw material (beach pebbles) nearer to the site. Thus, the technological constraints identified by Myers need not apply. However, blades are rarer on Rabbit Hill than all but one other Vale of Pickering collection, with a concomitant higher frequency of short flakes, many of which are very small in size. The proportion of debitage is also high.

The Rabbit Hill collection contains the lowest proportion of cortical flakes of any Vale assemblage, indicating that many cores were imported to the site already decorticated and extensively reduced, suggesting the presence of a rather different system of transportation and reduction to that seen elsewhere in the Vale.

Assemblage composition (Table 14.38)

The Rabbit Hill assemblage is dominated by microliths, as are many Late Mesolithic sites (Myers 1987). Although the majority of these are of Late Mesolithic date, two are Early Mesolithic and six are too fragmentary to determine. Of all the possible Late Mesolithic microlith types only scalene triangles were represented. Most pieces were manufactured on till flint, though one was of Wolds material. Of the Early Mesolithic microliths – both obliquely blunted points – one was made from till material, the other from Wolds flint. Scrapers are also relatively frequent. The one knife recovered appears later prehistoric, probably of Late Neolithic/Early Bronze Age date. Microburins are relatively frequent, though these pieces are frequently rare on Late Mesolithic sites in Northern England (Conneller 1996).

Spatial variation

With the exception of X16, which contained only one flake, all Rabbit Hill units yielded moderate to large quantities of lithic material, ranging between 19 and 364 pieces per unit. One notable feature of all units, with the exception of X6, is the large quantity of burnt

Table 14.38. *Composition of the Rabbit Hill lithic assemblage.*

Category	No	%
Tools		
Awl/borer	1	0.1
Knife	1	0.1
Microlith	14	1.2
Scraper	12	1.0
Blade (re/ut)	3	0.3
Flake (re/ut)	8	0.7
Frag. (re/ut)	10	0.8
Tool spalls		
Burin spall	3	0.3
Micro-burin	7	0.6
Resharpening	1	0.1
Debitage		
Blade	50	4.2
Flake	239	20.1
Fragment	522	43.9
Chip	298	25.0
Chunk	2	0.2
Core	7	0.6
Nodule		
Core preparation		
Crested blade	5	0.4
Plunging blade	4	0.3
Tablet	3	0.3
Total	**1190**	**100**

material recovered. The percentage of the assemblage that is burnt ranges from 10.5% in X4 to 30.4% in X11. These figures are sufficiently high and ubiquitous to represent evidence of larger scale burning practices, rather than material burnt by localized hearths, and this burning episode or episodes may equate with those represented by the black peat horizon (context [5004] at Site B) found across the Vale (see Chapter 8; and Cloutman 1988b).

The assemblages from X2, X3 and X4 were generated through routine core reduction. No tools were present and only a microburin in X3 indicates tool production. Units X7, X8 and X11 all yielded knapping debris and a small number of tools. Test-pit X5 revealed a variety of activities including core reduction and the production of a wide range of tools – scrapers, microliths and a burin. Test-pit X8 yielded the largest assemblage of the Rabbit Hill test-pits (364 pieces): Late Mesolithic microlith production appears to have been the predominant activity. Test-pit X9 appears to represent mixed Early and Late Mesolithic activity.

Seamer Site D

The lithic assemblages from Site D at Seamer is associated with a large amount of burnt material, with a restricted range of tool types and manufacturing debris. The Site D assemblage occurs in two small clusters of which the northernmost one incorporates a cache of tested nodules (Figs. 14.46–14.48).

Raw materials (Table 14.39)

Seamer Site D is dominated by till material. As with Site L, this is the result of the use of only a few nodules. All the nodules from the cache are of stained till material with very worn cortex, although one such pebble may be of Wolds material. The non-cache material is similarly stained. A comparatively large proportion of material (28%) is burnt.

Technology (Table 14.40)

The material in the cache is barely reduced; six of the nine pieces have less than three removals, while only one has undergone significant reduction. Testing of the nodules has proceeded using the natural ridges and shape of the pebble to the knappers' advantage. The initial removal often involved the detachment of one of the narrower ends of the pebble which then served as a platform for subsequent removals along the longitudinal axis, using any natural ridge to guide the first detachment. The more fully reduced example appears to have started in this way, only rather more detachments have been made along the longitudinal axis and the initial platform has been developed and rejuvenated by the removal of a core tablet. One pebble has been started slightly differently through the creation of a crest (which has not been detached) using a flat natural surface as a platform.

Table 14.39. *Lithic raw materials at Site D.*

Material	No	%
Chert	0	0
Till	126	58.9
Wolds	15	7.0
Uncertain	13	6.1
Burnt	60	28.0
Total	**214**	**100**

Table 14.40. *Cortical pieces at Site D.*

Cortex	No.	%
Primary	5	2.3
Secondary	67	31.3
Tertiary	142	66.4
Total	**214**	**100**

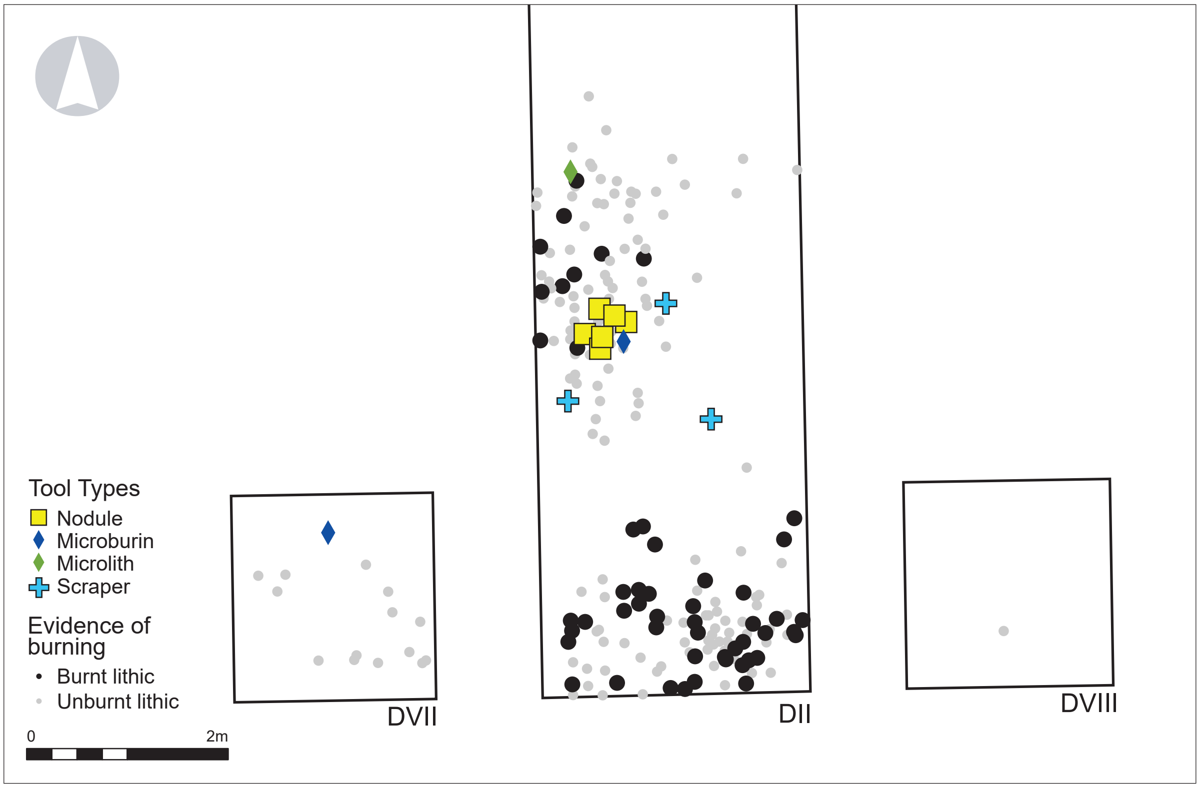

Figure 14.46. *Lithic distribution, Site D.*

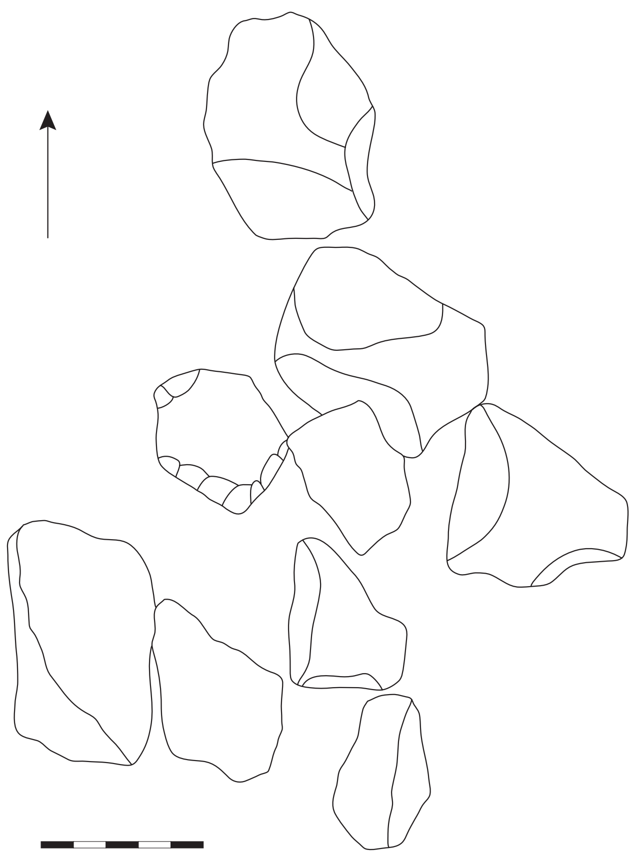

Figure 14.47. *Plan of site D flint cache; scale in cm.*

Figure 14.48. *Cores and tested nodules from the cache.*

Table 14.41. *Composition of the Site D lithic assemblage.*

Category	No	%
Tools		
Core/burin	1	0.5
Strike-a-light	1	0.5
Scraper	4	1.9
Truncation	1	0.5
Blade (re/ut)	2	0.9
Frag. (re/ut)	3	1.4
Tool spall		
Micro-burin	3	1.4
Debitage		
Blade	21	9.8
Flake	53	24.8
Fragment	97	45.3
Chip	15	7.0
Chunk	1	0.5
Core	4	1.9
Nodule	6	2.8
Core preparation		
Crested blade	1	0.5
Tablet	1	0.5
Total	**214**	**100**

The non-cache material is technologically indistinguishable from that seen in Early Mesolithic assemblages from elsewhere in the Vale of Pickering. Techniques to facilitate knapping and anticipate and correct mistakes are all in evidence; crested blades and core tablets are present and platform abrasion was utilized, as was a soft hammer.

Assemblage composition (Table 14.41)

There are few tools: four scrapers (Fig. 14.49), a strike-a-light, (hammerstone), a core-burin and a few retouched fragments. Three microburins demonstrate that microliths were manufactured, although none were recovered. Debitage and core preparation flakes indicate general core reduction also occurred.

Of the four scrapers recovered (Fig. 14.49) – three are fragmentary, while the complete example is a double scraper. Although one example, made on till flint and stained, is of a material type recognizable in the rest of the assemblage, the other three (which have probably been manufactured from the same nodule) are of material distinct from the rest of the assemblage and thus may have been made elsewhere and brought onto site.

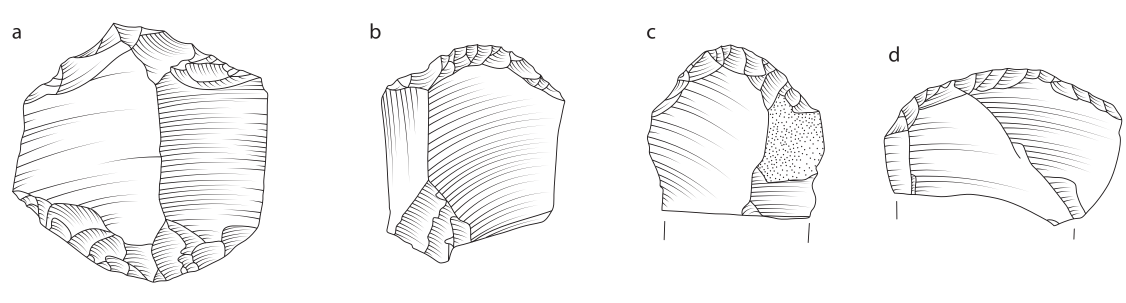

Figure 14.49. *Site D scrapers; scale in cm.*

Table 14.42. *Lithic raw materials at Site F.*

Source	No	%
Chert	0	0
Till	1065	84.3
Wolds	51	4.0
Stone	2	0.2
Uncertain	23	1.8
Burnt	122	9.7
Total	**1263**	**100**

Table 14.43. *Cortical flakes at Site F.*

Cortex	No.	%
Primary	10	0.8
Secondary	326	25.8
Tertiary	927	73.4
Total	**1263**	**100**

Spatial distribution

Activity at the site involved the introduction of three scrapers, and the on-site manufacture of a number of blade and flake blanks and the secondary working of some of these pieces into microliths and a scraper. The microliths appear to have been removed from site, either as curated elements or hafted in composite tools, along with the partially worked cores when the knappers left. In the northernmost scatter, the cache of nodules was deposited, amongst other debris. The cache was recovered as a small cluster approximately 50 cm in diameter (Figs. 14.46, 14.47).

Site F

Site F yielded a lithic collection of mixed date. Both diagnostic Late Mesolithic and Early Neolithic types are present in the form of microliths, leaf shaped arrowheads and a high frequency of micro-denticulated pieces. The focus of the activities which took place in these two periods seems to have differed, as the relative proportions of each type appears to vary across the site.

Raw materials (Table 14.42)

As the assemblage was mostly generated by post-Early Mesolithic activity, a rather different raw material 'signature' is evident at Site F than at many other sites in the Vale. The collection differs from local Early Mesolithic assemblages both in the quantities and types of raw materials present. Proportions of Wolds flint are extremely low. The dependence of post-Mesolithic industries on till flint has been previously noted by a number of authors (e.g. Henson 1982; Durden 1995). The presence of worked stone, in the form of a polished axe fragment and a flake is a component significantly different from the rest of the Vale material, also indicating a Neolithic date, and further underlining the changing relationships between people and certain raw material sources over the Mesolithic and Early Neolithic.

Technology (Table 14.43)

The technology represented at Site F is based on the production of fine flakes and blades, with only cortical

Table 14.44. *Composition of the Site F lithic assemblage.*

Category	No	%
Tools		
Arrow	3	0.2
Awl/borer	7	0.6
Axe fragment	1	0.1
Backed point		
Burin	1	0.1
Core/scraper	2	0.2
Knife	3	0.2
Micro-denticulate	12	1.0
Microlith	2	0.2
Notch	1	0.1
Scraper	28	2.2
Truncation	1	0.1
Blade (re/ut)	6	0.5
Flake (re/ut)	16	1.3
Frag. (re/ut)	20	1.6
Tool spalls		
Axe flake	1	0.1
Burin spall	3	0.2
Micro-burin		
Resharpening		
Debitage		
Blade	137	10.8
Flake	346	27.4
Fragment	584	46.2
Debitage	49	3.9
Chunk	4	0.3
Core	22	1.7
Nodule	1	0.1
Core preparation		
Crested blade	4	0.3
Plunging blade	2	0.2
Tablet	5	0.4
Other	2	0.2
Total	**1263**	**100**

flakes being relatively thick. Core maintenance flakes and platform faceting indicate a high level of technical ability consistent with either a Mesolithic or Early Neolithic date. Although the proportion of primary flakes is low, secondary flakes are abundant, probably indicating cores were introduced as tested nodules.

Assemblage composition (Table 14.44)

The composition of the material recovered from Site F, is presented in Table 14.44.

Two microliths were recovered – both Late Mesolithic in date. One is a scalene triangle, the other an unusual example which, though manufactured using the micro-burin technique, has been backed down one side and tanged at the base. Both were manufactured on brown till flint. The fact that no microburins were recovered from any test pit may mean that these represent accidental losses, rather than being associated with the knapping debitage. A dihedral burin manufactured on stained brown till flint may also be of this date.

Early Neolithic material is represented by three leaf shaped arrowheads, two of which had been manufactured from brown till flint, the other from Wolds material. An axe fragment and an axe flake are probably also of this date. The fragment is an axe butt, manufactured on a pale grey/brown stone. Several flakes had already been removed from this (indicating use as a core), before this piece was detached, since it only retains a small amount of polish. The raw material of both pieces is visually similar to the Group VI Langdale tuff found relatively abundantly amongst Neolithic material in northeast England (Bradley and Edmonds 1993).

Three knives were recovered. Two examples are on flakes with low angle retouch. The other is a fragment with partial bifacial retouch.

Spatial variation

All the excavation units at Site F yielded material of mixed Late Mesolithic/Early Neolithic date. The one exception is unit F IV, which seems to represent mainly Early Neolithic activities. This assemblage contained a polished axe flake, a fine scraper/knife, numerous micro-denticulates and retouched blades, in addition to knapping debris.

Seamer Carr test pits

All the test pits (Table 14.45) which were not grouped with any of the more major sites yielded very little material: five pieces was the most recorded from any one test-pit. Technologically, all pieces are consistent with an Early Mesolithic date but the only diagnostic piece recovered was an Early Mesolithic obliquely blunted point.

If the total for these test pits is combined, they contain a very high frequency of tools (29% if retouched pieces are included). Considering that eleven of the seventeen test pits yielded only small knapping debris, the frequency with which tools and retouched pieces are represented in the other six test pits is remarkable. This apparent frequency of tools may not be a true

Table 14.45. *Material from the miscellaneous Seamer Carr test-pits.*

Group	Unit	No. of pieces	Tools	Debitage
A	**Z33**	4	Scraper, retouched crested blade	
B	**Z10**	3		Core tablet; fragment
C	**Z14**	5	Microlith	Chips × 4
	Z16	1		Flake
	Z17	5		Blade; flake × 3, fragment
	Z19	1		Chunk
	Z20	1		Fragment
	Z21	3	Utilized blade; ut flake; ut frag	
	Z22	3		Fragments × 3
	EZ17	2		Flake; fragment
	EZ18	2		Fragment; chip
C	**Z308**	1		Fragment
	Z310	1		Debitage
	Z316	1	Burin	
	Z316A	1	Strike-a-light	
E	**Z419**	1	Retouched fragment	
	Z427	1		Bladelet; debitage

reflection of habitual activities because of sampling bias, but it nevertheless provides information about activities that occurred away from major knapping areas.

These activities represent tool and blank use rather than core reduction and tool manufacture. Several of the test pits (Z10, Z21, Z33 and Z419) yielded medium- and large-sized flakes, blades and fragments with traces of either retouch or wear on their lateral margins. These tools seem to be indicative of activities which involved cutting, and appear similar to those which generated the debris recovered from some of the No Name Hill units (see Chapter 15). These units also contained low densities of material, occurred nearer to the water's edge than knapping activities and appear relatively isolated. As at No Name Hill, some of the Seamer Carr test pits yielded other tools, either isolated or in association with retouched blanks, as in unit Z33. Examples of isolated single tools are a large dihedral burin from Z316 and a hammerstone of brown chert (Z316A) discarded away from the main knapping area. Such assemblages seem to represent discarded toolkits, or tools dropped during routine activities on the water's edge.

Stone

A total of 103 pieces of possibly either utilized or humanly-introduced stones were recovered from the excavations. These include the stone groups from the excavated hearths. No further analyses of these have been undertaken.

Chapter 15

VPRT lithic assemblages

Chantal Conneller

Original lithic illustrations by Jo Richards

This chapter focuses on the lithic assemblages excavated from 1986, following the formation of the VPRT. Large, open-area excavations on the scale of Seamer C and K were not undertaken during this period, and instead, the Trust focused on sampling the remainder of the lake shore and the islands in the middle of the lake. This work consisted mainly, but not entirely, of 2 × 2 m test-pits, located along and above the approximate line of the 24.5 m contour. As a result, the assemblages, and the techniques used to understand them are rather different from the previous chapter. However, while this means that there is less potential for the types of intra-site analysis carried out at Sites C and K, this is compensated by the spatial extent of the material, which permit insights into the use of the Early Mesolithic landscape on a much broader scale.

Site VP D

The VP D units yielded a lithic assemblage of 2600 pieces, mostly concentrated in test-pits VP86/88 D. Although a post-Early Mesolithic stream deposit (0037/0045) was identified in the upper contexts of trench 88 D, the lithic artefacts recovered are extremely fresh and must represent *in situ* material. The two units 86 D and 88 D yielded a particularly dense cluster of lithic material, which in certain metre squares surpassed both Moore's Flixton 1 and Star Carr in density of concentration. The assemblages from these two units contain a wide variety of tools and tool manufacture debris. Other units incorporated into the VP D site are not only significantly less dense, but also reflect a more restricted range of activities.

Raw materials

Different raw material types are represented in proportions fairly typical of the assemblages from other sites around the lake, though the proportion of Wolds material is slightly higher than the average (Table 15.1). The till component is manufactured on small to medium size beach pebbles of reasonable quality; colour varies from the most frequently represented speckled grey, through translucent brown and speckled red. The Wolds material seems to have been of a larger original size in comparison to the till flint, and also appears to have been of relatively good knapping quality. The assemblage, particularly that from units VP86 D and VP88 D, is startlingly fresh; no staining or discoloration has developed and only three pieces are patinated – only one heavily.

Technology

The small and medium sized pebbles were fairly skilfully managed to produce a number of small to medium sized blades and bladelets. Natural angles of beach pebbles were used to remove a flake to serve as a platform, from which knapping proceeded using a second, perpendicular natural ridge to guide the start of blade production. Cores were mainly single platform examples, bearing numerous blade and narrow flake scars. The intensity of core reduction varies from a completely exhausted example, to cores and nodules with very few removals. Core maintenance flakes associated with competent core working are numerous. Core tablets, rather than crested blades,

Table 15.1. *Lithic raw materials at site VP D.*

Material	No.	%
Chert	3	0.1
Till	1502	57.8
Wolds	579	22.3
Uncertain	180	6.9
Burnt	336	12.9
Total	**2600**	**100**

Table 15.2. *Cortical flakes at site VP D.*

Cortex	No	%
Primary	51	2.0
Secondary	487	18.7
Tertiary	2062	79.3
Total	**2600**	**100**

are the most common core maintenance flake, which is likely to be associated with the predominance of single platform cores – core tablets representing the rejuvenation of a single platform, while crested blades often represent the initial detachment from a second platform. Platform abrasion and crushing, techniques seen throughout the Seamer Carr and VPRT assemblages, were employed and, where discernible, soft hammers appear to have been used.

Although the low proportion of cortical flakes (Table 15.2) indicates that many cores were tested or worked before being brought onto site, at least one example was imported as an untested pebble and all stages of its reduction, including an obliquely blunted point, were recovered. In contrast to this way of working, a number of larger blades appear to have been imported as blanks, also contributing to the relatively high proportion of tertiary flakes. The small size of the excavated area, however, does not preclude the manufacture of these blades in the immediate vicinity.

Assemblage composition

Microliths, in contrast to many of the other assemblages, are the dominant tool form (Table 15.3). VP D is the only assemblage from around Lake Flixton where the number of micro-burins exceeds the number of microliths; it also contains the highest absolute number recovered from any site, indicating significant microlith manufacturing activities. However, VP D is also a reasonably balanced assemblage, displaying significant numbers of a wide range of tool types (Table 15.3). VP D also contains the second highest frequency of tool manufacture spalls of any of the assemblages. Refitting efforts as well as the high percentage of both debitage and resharpening spalls indicate that the activities that generated this assemblage involved core reduction, tool manufacture, use and maintenance.

Tools

Microliths are the dominant tool type in the assemblage. A broad range of 'Star Carr type' microliths are represented (Fig. 15.1a-x). Triangles are common (particularly in certain test-pits) in comparison to the assemblages from other sites. The vast majority (90%) were manufactured on till flint, which in comparison with the composition of the rest of the assemblage represents a noticeable preference for the manufacture of microliths on till material. However, it should be remembered that many of the discarded microliths may have been manufactured at other locations in the landscape, where for a variety of reasons, till nodules may have dominated. Unusually, microburins outnumber microliths overall, indicating that microlith manufacture was being undertaken in a wide range of different areas, and that a number of the microliths were removed from site, either fitted into composite tools or retained for future use. Although none of the microliths refit to the microburins, one of the microliths refits to a core sequence indicating that some of the recovered microliths may have been manufactured on site rather than simply representing components discarded during retooling. However, the fact that two-thirds of microliths are either broken or have tip damage indicates that some retooling took place on site.

Table 15.3. *Composition of the VP D lithic assemblage.*

Category	No	%
Tools		
Awl/borer	2	0.1
Burin	11	0.4
Core/burin	1	0.04
Core/scraper	2	0.1
Microlith	33	1.3
Scraper	16	0.6
Truncation	4	0.2
Blade (re/ut)	30	1.2
Flake (re/ut)	17	0.7
Frag. (re/ut)	47	1.8
Tool spalls		
Burin spall	25	1.0
Micro-burin	34	1.3
Debitage		
Blade	255	9.8
Flake	657	25.3
Fragment	667	25.7
Chip	716	27.5
Chunk	21	0.8
Core	20	0.8
Nodule	2	0.1
Core preparation		
Crested blade	16	0.6
Tablet	19	0.7
Other	5	0.2
Total	**2600**	**100**

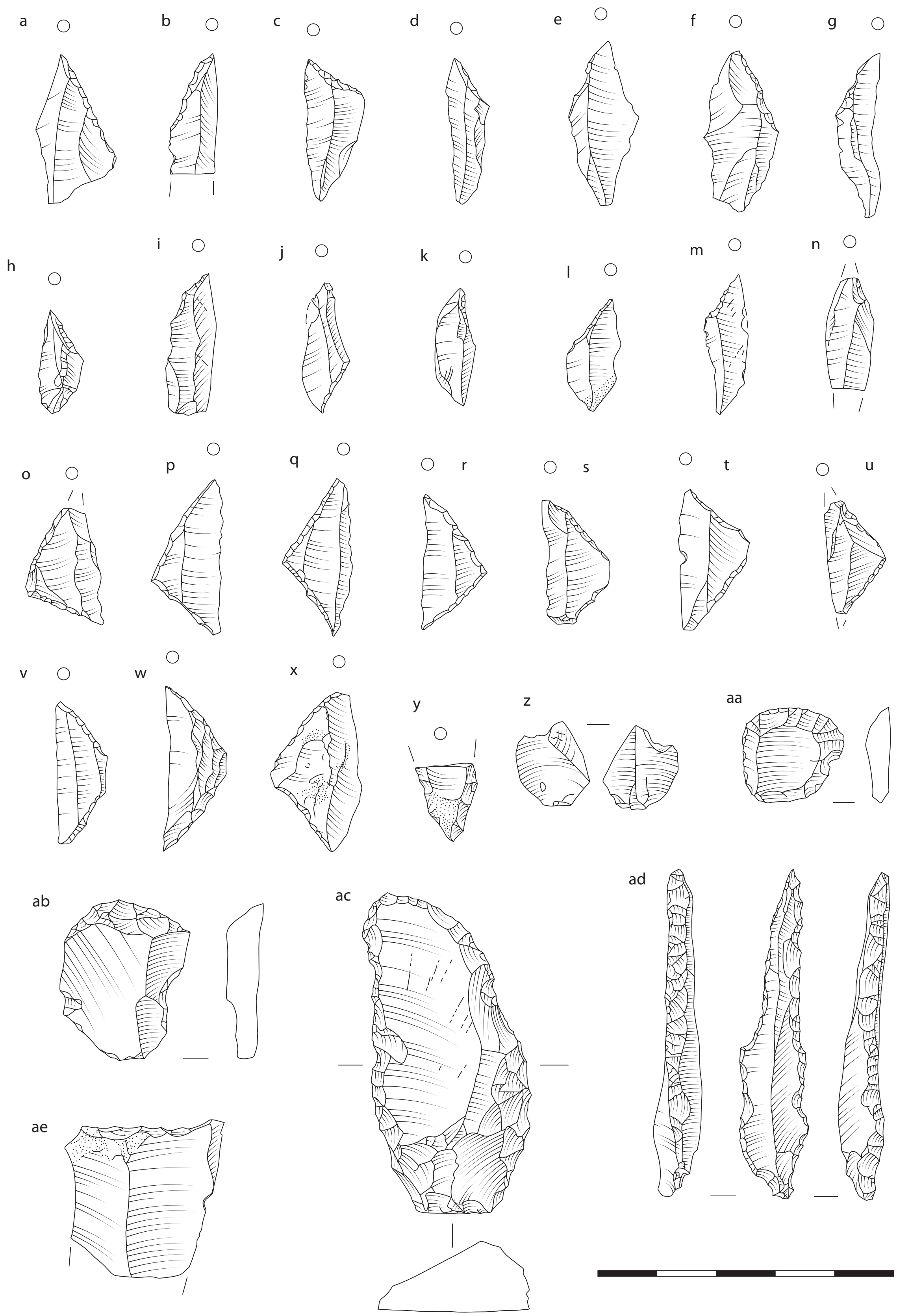

Figure 15.1. *Tools from VP D: Microliths (a-y), microburin (z), scrapers (aa-ab), awl (ac), truncation (ad).*

Burins were manufactured from a variety of different materials. Certain pieces have been sharpened several times, and two burins can be refitted to secondary burin spalls, indicating re-sharpening, probably in response to dulling associated with on-site use. This is supported by the fact that more than twice as many burin spalls as burins were recovered.

A range of scraper types are represented (Fig. 15.1). Two-thirds are manufactured on till flint and one-third on Wolds flint. This is a higher percentage of Wolds flint than is present in the assemblage, and as at other sites where this phenomenon occurs, such as Seamer Site C, the poorer quality Wolds material may have been considered suitable for scraper manufacture because these are the easiest tools to make.

Spatial variation

Site VP D maintains a remarkably similar assemblage profile across different units and contexts. Almost identical proportions of tool types, cortical flakes and raw materials are present at the adjacent units VP86 D and 88 D and throughout the artefact-bearing horizon. Refit data supports this conclusion. One refit sequence, for example, contains pieces from contexts [0032] and [0033] in trench 86 D, and the same sequence of contexts in 88 D. Given the sudden fall off in distribution in VP 86D/88D (Fig. 15.2) this suggests that the assemblage from these two excavation units represents the edge of a super-dense, fairly discrete scatter, which has suffered a certain amount of vertical movement and may have been generated over a fairly short period of time. Super-dense scatters with a sharp fall off on other sites around Lake Flixton have been determined to be (as at Star Carr) or suggested to be (as at Seamer C; see Conneller 2022) dwelling structures. The other major flint bearing unit which makes up site VP D, unit VP 86 Q, is situated to the southwest of trenches VP 86/88D (see Fig. 15.2), and appears to represent a lower density scatter with a rather more restricted suite of activities, focused on microlith production.

VP 86/88 D

At its densest part, this scatter represents the highest concentration of material anywhere around the lake. At a density of 114 pieces per 0.5 m², it surpasses both Moore's excavations at Flixton 1, and Star Carr. However, it differs in a significant way from both these sites in the fact that the VP86D/88 D scatter appears relatively

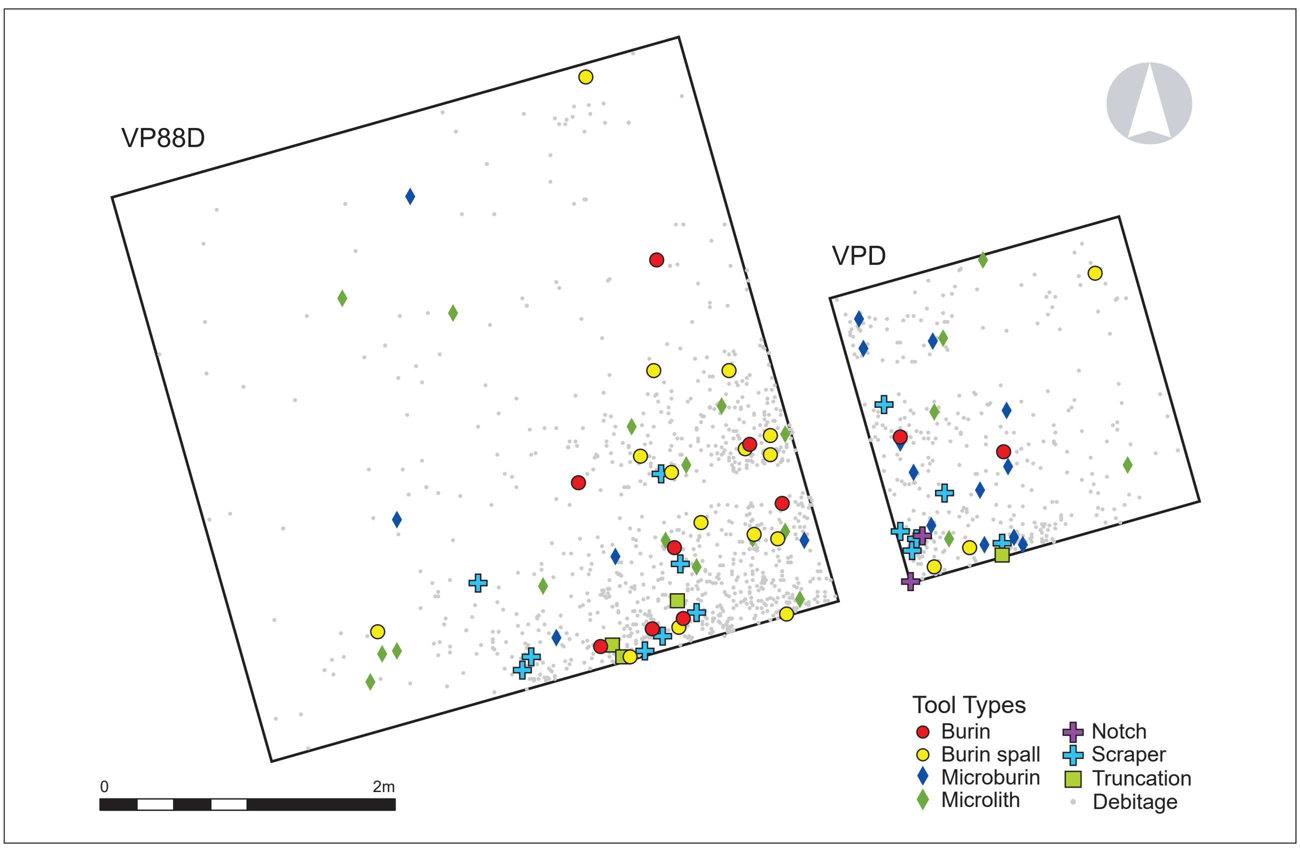

Figure 15.2. *Distribution of lithic material at VP 86 D and VP 88 D.*

localized, whereas at Flixton 1 and more particularly Star Carr the scatters extend over large areas. Exactly how far the VP86/88 D scatter extends to the south does remain to be seen, however the drop off in density to the north of the unit is fairly marked (Fig. 15.2).

As the densest two units, VP86/88 D are responsible for many of the characteristics of the broader assemblage described above. Microliths and evidence for microlith manufacture dominate the tool component of the assemblage (Tables 15.4, 14.5). One microlith has been refitted to a complete knapping sequence. Also present are a wide range of tool types and manufacturing debris. These include piercing implements (including the *meche de forêt*), graving

Table 15.4. *Composition of the VP 86 D lithic assemblage.*

Category	No.	%
Tools		
Awl/borer	1	0.2
Burin	2	0.4
Microlith	7	1.2
Scraper	6	1.1
Truncation	1	0.2
Blade (re/ut)	4	0.7
Flake (re/ut)	2	0.4
Frag. (re/ut)	3	0.5
Tool spalls		
Burin spall	5	0.9
Micro-burin	14	2.5
Core preparation		
Crested blade	1	0.2
Debitage		
Blade	55	9.7
Flake	161	28.3
Fragment	142	25.0
Chip	154	27.1
Chunk	7	1.2
Core	2	0.4
Nodule	1	0.2
Total	**568**	**100**

Material	No.	%
Till	318	56
Wolds	180	31.7
Uncertain	7	1.2
Burnt	63	11.1
Total	**568**	**100**

Cortex	No.	%
Primary	16	2.8
Secondary	106	18.7
Tertiary	446	78.5
Total	**568**	**100**

Table 15.5. *Composition of the VP 88 D lithic assemblage.*

Category	No.	%
Tools		
Awl/borer	1	0.1
Burin	8	0.5
Core/burin	1	0.1
Core/scraper	2	0.1
Microlith	16	0.9
Scraper	8	0.5
Truncation	3	0.2
Blade (re/ut)	23	1.4
Flake (re/ut)	14	0.8
Frag. (re/ut)	42	2.5
Tool spalls		
Burin spall	19	1.1
Micro-burin	9	0.5
Core preparation		
Crested blade	13	0.8
Tablet	18	1.1
Other	5	0.3
Debitage		
Blade	148	8.8
Flake	399	23.6
Fragment	418	24.7
Chip	514	30.4
Chunk	13	0.8
Core	15	0.9
Total	**1689**	**100**

Material	No.	%
Till	939	55.6
Wolds	356	21.1
Uncertain	138	8.2
Burnt	256	15.2
Total	**1689**	**100.1**

Cortex	No.	%
Primary	30	1.8
Secondary	300	17.8
Tertiary	1359	80.5
Total	**1689**	**100.1**

implements, which refitting demonstrates were both manufactured and resharpened on site, scraping implements and cutting implements (retouched blades and flakes), which occur in much higher absolute numbers than any formal tool type. The axe is the only major Mesolithic tool type recovered around Lake Flixton for which there is no evidence for either its manufacture or re-sharpening at the VP86/88 D scatter.

The VP86/88 D scatter also contains a very high proportion of small debitage spalls (<10 mm). This is likely to be the product of the sheer variety of activities taking place at the site. The initial stages of core shaping, probably cresting and the initial preparation of the correct platform/core face angle, seem to generate vast amounts of small debitage (see also, Barry's Island unit LAO), and the early stages of core reduction are present at VP86/88 D as indicated by the refitting of an unmodified pebble. The finishing of such tools as scrapers, a *meche de forêt* (Brinch Petersen 1966; Tixier 1963), and retouched flakes and blades are also likely to have contributed towards generating the debitage. The VP86/88 D scatter also contains a large amount of burnt flint which is concentrated in the southeast corner of unit VP88 D, and which may represent the edge of a hearth or hearth debris. Scrapers and burins are more common in the western part of the scatter, while microlith manufacture was more common in the east.

The extremely dense VP86/88 D scatter, generated through the performance of a broad range of manufacturing and tool using tasks, and with evidence for a heat source is likely to be part of a significant focus of occupation. The similarity in the technology employed and the broad similarity between different contexts (though indicating some vertical post-depositional movement) may suggest that this material was generated over a relatively short period of time.

VP Q

The VP Q scatter differs significantly in several ways from VP86/88 D; it is rather less dense, seems to represent a more restricted range of activities, and there appears to be some differences in assemblage composition between contexts. In common with the VP86/88 D scatter, the VP Q material is also microlith dominated and as in the VP86 D assemblage, microburins outnumber microliths (Table 15.6). It thus seems that this area was dominated by microlith manufacture,

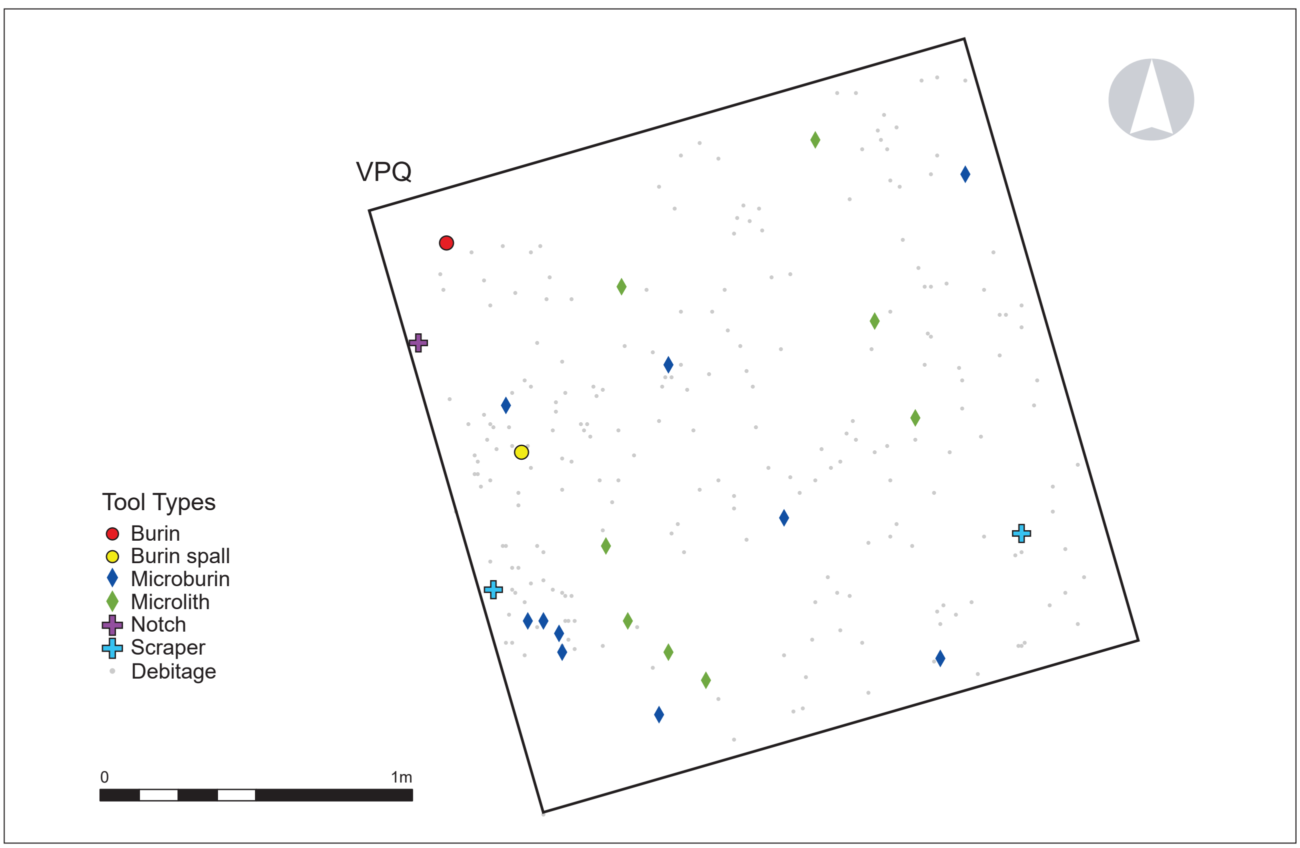

Figure 15.3. *Distribution of lithic material at VP Q.*

Table 15.6. *Composition of the VP 86 Q lithic assemblage.*

Category	No.	%
Tools		
Burin	1	0.4
Microlith	8	2.9
Scraper	2	0.7
Blade (re/ut)	2	0.7
Frag. (re/ut)	2	0.7
Tool spalls		
Burin spall	1	0.4
Micro-burin	10	3.6
Core preparation		
Crested blade	2	0.7
Debitage		
Blade	38	13.9
Flake	73	26.6
Fragment	90	32.8
Chip	42	15.3
Core	2	0.7
Nodule	1	0.4
Total	**274**	**100**

Material	No.	%
Chert	1	0.4
Till	215	78.5
Wolds	12	4.4
Uncertain	32	11.7
Burnt	14	5.1
Total	**274**	**100.1**

Cortex	No.	%
Primary	4	1.5
Secondary	62	22.6
Tertiary	208	75.9
Total	**274**	**100**

which appears to have taken place particularly in the southwest part of the VP Q scatter (Fig. 15.3). Unlike the VP86/88 D scatter, other tool using/making activities seem fairly minimal. Apart from some retouched/utilized flakes and blades only one context [0033] contains any other tools – a burin and burin spall and two scrapers. Quantities of small chips are also significantly lower, indicating less of an emphasis on core/tool shaping activities.

Although context [0033] displays a fairly average profile of cortical pieces, the assemblage from the underlying context [0039] contains a high frequency of both primary and secondary flakes, which taken in conjunction with the presence of a nodule with one flake removed, suggests some testing or preliminary shaping of unmodified nodules may have been undertaken. Both contexts display a much stronger emphasis on the use of till flint than the VP VP86/88 D scatter. Wolds material is rare and confined to the eastern half of the unit.

Site VP E

Six test-pits from the VP E sequence yielded worked flint: J, KK, KM, KU, KV and KY. Most produced minimal amounts of flint, except VP J and VP KY which were more productive, yielding 167 and 68 pieces respectively. All pieces appear consistent with an Early Mesolithic date – with the notable exception of a Late Glacial burin on a large backed blade, and a microlith which may be Late Mesolithic, but is too fragmentary for a definite attribution.

Raw materials

The assemblage is dominated by till material, while Wolds material is at the lowest frequency for any of the VPRT and Seamer Carr Project assemblage (Table 15.7). This is partly a function of the small size of the assemblage, which represents the products of a relatively small range of nodules.

Technology (Table 15.8)

Technologies are similar to those described for site VP D. The proportion of cortical flakes is low at this site (Table 15.8), possibly indicating that many of the nodules utilized had already undergone substantial reduction before being brought to the site.

Table 15.7. *Lithic raw materials at Site VP E.*

Material	No.	%
Chert	0	0
Till	178	70.6
Wolds	9	3.6
Uncertain	56	22.2
Burnt	9	3.6
Total	**252**	**100**

Table 15.8. *Cortical flakes at Site VP E.*

Cortex	No.	%
Primary	5	2.0
Secondary	44	17.5
Tertiary	203	80.6
Total	**252**	**100.1**

Assemblage composition

Burins and microliths are the dominant tool types of this assemblage (Table 15.9, Fig. 15.4), although the small numbers of burins involved and the fact that one represents activities pre-dating the Early Mesolithic occupation suggests this statistic over-emphasizes the part burin use and manufacture/repair played in the activities that generated this assemblage. Scrapers are rarer. Also, although tools are fairly well represented, both tool manufacturing spalls and re-sharpening

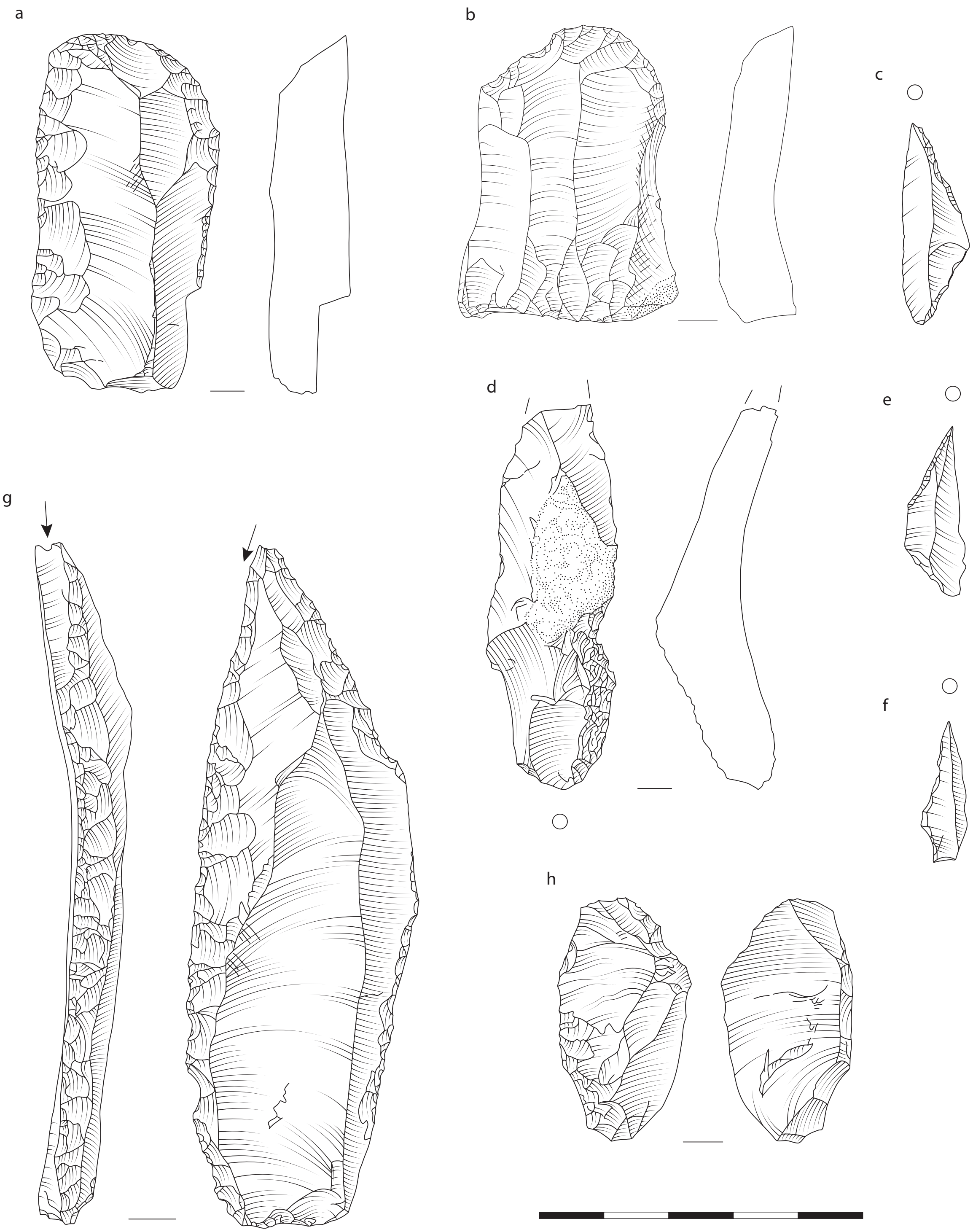

Figure 15.4. *Tools from VP E: Scrapers (a-b), microliths (c, e, f), burins (d, g), tranchet axe sharpening flake (h).*

spalls are rare; in fact, the only tool debris is an axe flake which is unrelated to the manufacture or maintenance of the tools recovered from site.

Tools

All four of the burins recovered were manufactured from till flint in keeping with the majority of the assemblage (Table 15.9). Three are typical Early Mesolithic types, whereas the fourth example is morphologically distinct, not only from the other three, but also from other examples recovered during excavations at sites around the lake. This burin was manufactured on a large blade; after finishing, the piece still measures 107 × 34 × 11 mm. The burin blow occurred on the distal end of the piece, from an oblique truncation. Below the burin spall facet the left lateral is extensively retouched, while traces of use are evident on the right lateral, below the oblique truncation. This piece is similar in morphology to examples from Mother Grundy's Parlour, Derbyshire (Campbell 1977) and is likely to be Late Glacial in date. A range of microlith types were represented. All were manufactured on brown till flint, as were the two scrapers recovered.

Spatial variation

Test-pits VP J, which lay to the north of the 'site', and KY, which was located some 65 m to the south, produced the largest assemblages (166 and 68 pieces respectively). Test-pits KK, KM, KU, KV all produced minimal amounts of flint. KU is notable in that almost half of the Wolds material recovered derives from this unit, and thus this assemblage appears to reflect rather different raw material preferences or availability in comparison with the remainder of the VP E units. Test-pit KM, to the south of the main VP E 'site' (see Chapter 13) may represent Late Mesolithic activities – of the four pieces recovered from this unit, one may be a Late Mesolithic microlith, while the others are all very small pieces of debitage.

VP J

One distinctive nodule group, manufactured from semi-opaque grey till flint, dominates this assemblage, and several pieces refit, demonstrating this unit's integrity. Some of the early stages in the reduction of this nodule are present, typically primary and secondary flakes that have been detached with a hard hammer, and also a large amount of small debitage. No blades in this material were recovered and the core was also absent. This core may have been removed for further reduction elsewhere, or both the core and some of its products were taken from the area. This raw material scatter clusters in the southwest part of the test-pit (Fig. 15.5).

Table 15.9. *Composition of the site VP E assemblage.*

Category	No.	%
Tools		
Burin	4	1.6
Microlith	4	1.6
Scraper	2	0.8
Blade (re/ut)	3	1.2
Flake (re/ut)	1	0.4
Frag. (re/ut)	4	1.6
Tool spalls		
Axe flake	1	0.4
Debitage		
Blade	19	7.5
Flake	59	23.4
Fragment	83	32.9
Chip	66	26.2
Chunk	1	0.4
Core preparation		
Crested blade	3	1.2
Plunging blade	1	0.4
Tablet	1	0.4
Total	**252**	**100**

A varied range of other till material was present, particularly tertiary pieces. Some small bladelets which are not associated with knapping debris in similar material types may have been imported. More definite candidates are two large Wolds blades, which given the paucity of this material at VP E, are likely to represent curated items that were imported to the site.

Three microliths were recovered from this unit (Table 15.10), though micro-burins are absent and at least one of these pieces is distinct in material type from the knapping debris recovered. These pieces may have been brought in either as curated elements or in composite tools, which were repaired on site. The three microliths were recovered in a small cluster (see Fig. 15.5). Three burins and a scraper were also recovered, though again no manufacturing or resharpening spalls were associated. These finished tool types give an indication that a range of activities distinct from manufacture also occurred; the proportion of burins present, in particular, is high and suggests some activities focused on their use.

KY (Fig. 15.6)

Almost all the material from KY (Table 15.11) represents the reduction of one or two nodules of high-quality black flint. A variety of core maintenance flakes and small debitage indicate that much of the assemblage

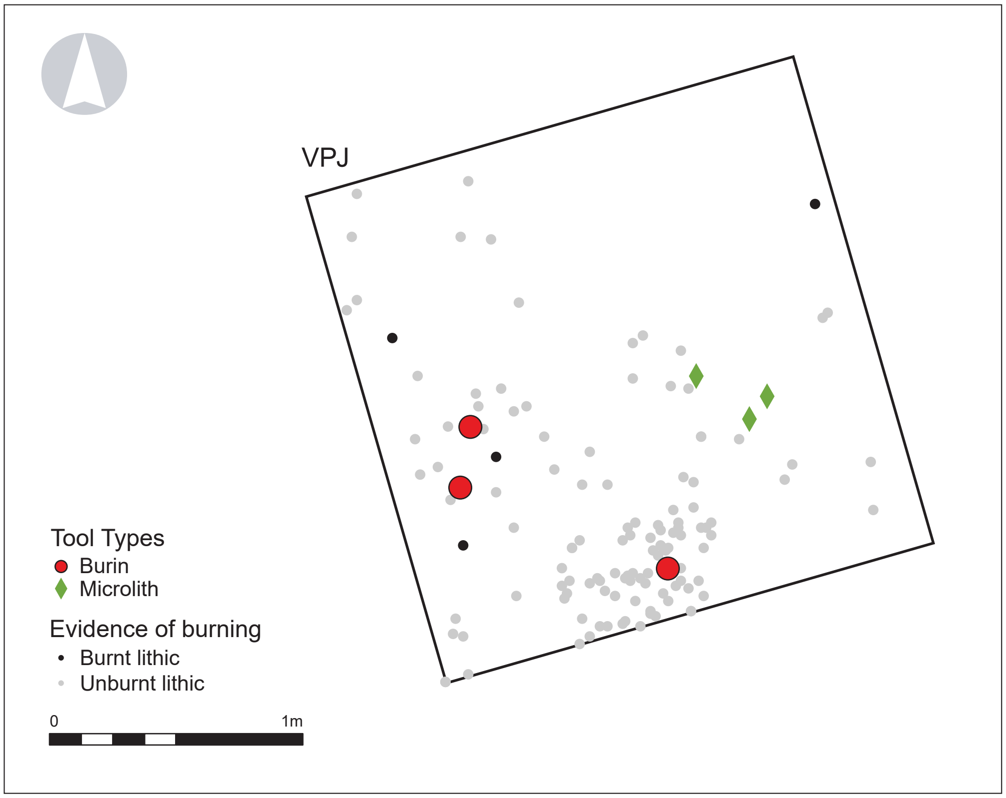

Figure 15.5 *(left). Lithic distribution VP J.*

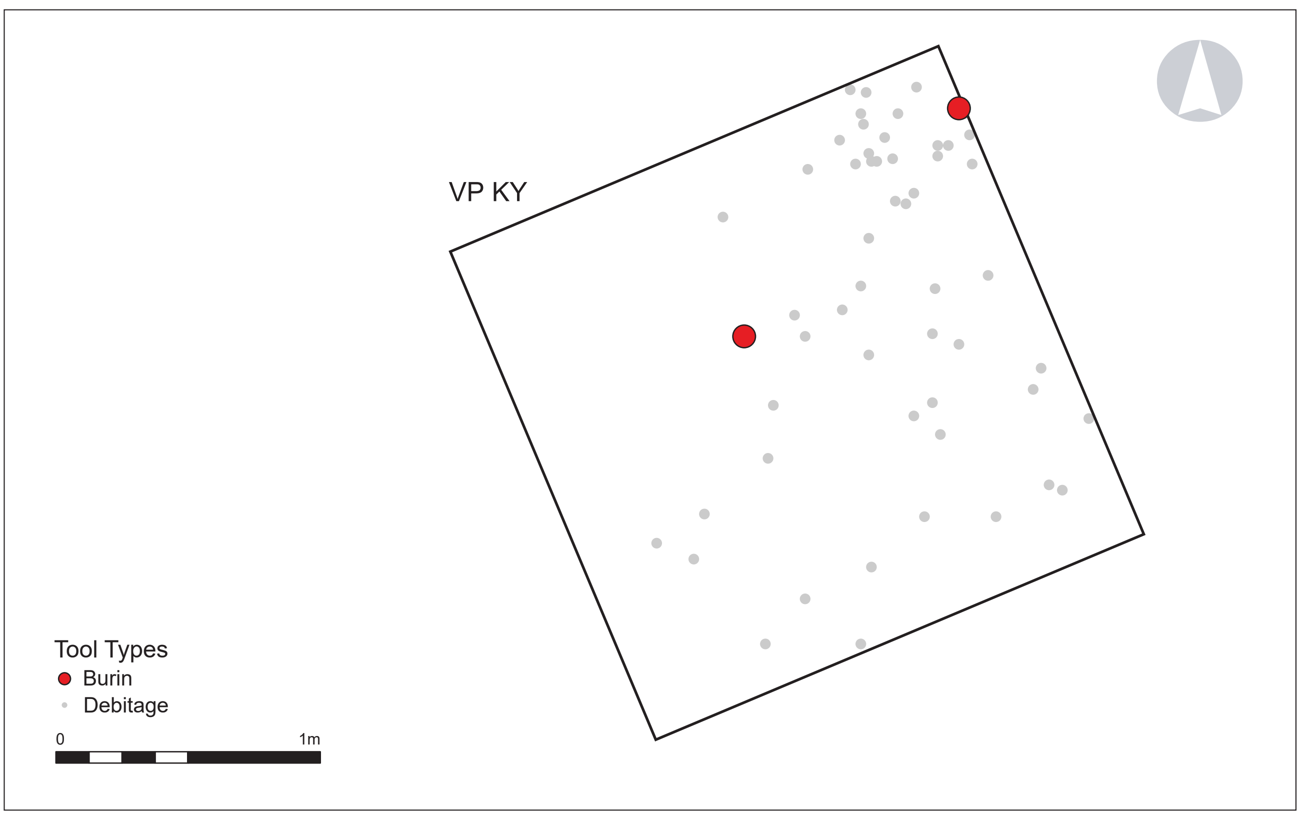

Figure 15.6. *Lithic distribution at KY.*

Table 15.10. *Composition of the VP J assemblage.*

Category	No.	%
Tools		
Burin	3	1.8
Microlith	3	1.8
Scraper	1	0.6
Flake (re/ut)	1	0.6
Frag (re/ut)	3	1.8
Core preparation		
Crested blade	1	0.6
Debitage		
Blade	12	7.2
Flake	39	23.4
Fragment	57	34.1
Chip	46	27.5
Chunk	1	0.6
Total	**166**	**100**

Material	No.	%
Till	124	74.3
Wolds	3	1.8
Uncertain	33	19.8
Burnt	7	4.2
Total	**167**	**100**

Cortex	No.	%
Primary	4	2.4
Secondary	27	10.1
Tertiary	136	81.4
Total	**167**	**100**

Table 15.11. *Composition of the KY lithic assemblage.*

Category	No.	%
Tools		
Burin	2	2.9
Blade (re/ut)	2	2.9
Flake (re/ut)		
Frag (re/ut)	1	1.5
Core preparation		
Crested blade	1	1.5
Plunging	1	1.5
Tablet	1	1.5
Debitage		
Blade	4	5.9
Flake	17	25.0
Fragment	23	33.8
Chip	16	23.5
Total	**68**	**100**

Material	No.	%
Till	65	95.6
Wolds	2	2.9
Uncertain	1	1.5
Total	**68**	**100**

Cortex	No.	%
Primary	1	1.5
Secondary	12	17.6
Tertiary	55	80.1
Total	**68**	**100**

was generated though routine core reduction. Blades are uncommon and may have been removed, though the ones that are present frequently show signs of utilization. In stark contrast to these activities, which were based mainly on core reduction, that generated small to medium debris, is the presence of the large, Late Glacial burin.

Flixton Island Site 1

A combined total of 5954 pieces of struck flint were recovered from the 1986, 1987 and 1993 excavations. The bulk of these were derived from trench AH. Field identifications suggested that most of the lithics recovered represented flaking debris, and a number of cores of various types were present. Among the identified formal tools, both scrapers and microliths were well represented and present in roughly equal numbers. The assemblage also contained a smaller sample of burins and burin spalls. A computerized catalogue of the flint from the 1986 and 1987 excavations was prepared in 1988, and details for these years, and the 1993 excavations are available in the appropriate finds registers. Unfortunately, after the site was excavated, the lithic assemblage from the 1987 season was misplaced before analysis took place in the 1990s, and is possibly lost. This affects the parts of the assemblage recovered from trenches AH and AJ, and the smaller test-pits AK, AL, AM. Consequently, it was not possible to analyse these parts of the collection for this publication.

In total, 2406 pieces of struck flint remain from the site. This reveals an overall assemblage that is relatively balanced in nature (Table 15.12). Only six test-pits have more than 20 pieces, and four of these (AA, AB, AN, AP) yielded small assemblages in the

Table 15.12. *Composition of the Flixton I assemblage available for analysis.*

Category	No.	%
Tools		
Awl	3	0.12
Burin	8	0.32
Burin/scraper	2	0.08
Microlith	21	0.87
Notch	1	0.04
Scraper	11	0.46
Truncation	1	0.04
Blade (re/ut)	27	1.12
Flake (re/ut)	25	1.04
Frag. (re/ut)	25	1.04
Tool spalls		
Axe flake	3	0.12
Burin spall	11	0.46
Microburin	15	0.62
Core preparation		
Crested blade	23	0.96
Plunging blade	7	0.29
Core tablet	13	0.54
Debitage		
Blade	184	7.65
Flake	584	24.27
Fragment	890	36.99
Chip	528	21.94
Core	12	0.49
Shatter fragment	12	0.49
Total	**2406**	**100**

range of 25–50 pieces. These small assemblages have only small numbers of tools, usually microliths and retouched and utilized blades (Table 15.13). AB has, in addition, a composite scraper/burin and a burin spall indicating production or resharpening. All are associated with small quantities of knapping debris, including cores.

Two larger assemblages were recovered from AC and AH (Table 15.14). The assemblage from AC is complete, but much of the material from AH is lost, and what has been analysed must be considered only a sample.

AC

The assemblage from AC consists of 783 pieces. In contrast to most of the other Flixton Island test-pits excavated by the VPRT, this is dominated by burins rather than microliths. Several burin spalls indicate these tools were manufactured and resharpened at the site. Microliths are present, but outnumbered by microburins, indicating that the repair of composite tools was a major activity. Cores (2) are extremely rare given the size of the assemblage, as they are within AH. This may be a factor of the small size of the assemblage, with cores cleared to another area, but an alternative might be that cores were routinely removed from the island site for future use.

Table 15.13. *Composition of the smaller assemblages from Flixton I.*

Category	AA	AB	AN	AP
Tools				
Burin/scraper	0	1	0	0
Microlith	1	3	0	0
Blade (re/ut)	3	1	0	1
Flake (re/ut)	2	0	0	0
Tool spalls				
Burin spall	0	1	0	0
Core preparation				
Crested blade	1	1	0	0
Core tablet	1	0	0	0
Debitage				
Blade	6	6	0	4
Flake	8	12	3	8
Fragment	10	5	20	14
Chip	9	0	3	1
Core	1	1	0	1
Shatter fragment	2	0	0	0
Total	**44**	**31**	**26**	**29**

AH

AH is the largest of the assemblages from the VPRT excavations at Flixton Island, numbering originally 2649 individually plotted (over 10 mm) pieces. Remaining pieces (including pieces less than 10 mm) comprise 1454 lithic artefacts. Tools amongst the remaining collection are dominated by microliths (14) and scrapers (10). A wide range of other tools (awls, burins and a truncation) are present in low numbers. Tool spalls show both microlith production and burin production/use; also present are axe thinning and tranchet flakes, indicating the presence of an axe(s) on the island, though none were recovered. Two were however recovered during Moore's excavation (Moore 1950) and they were also recovered during the more recent excavations (Milner et al. forthcoming). Moore's assemblage was dominated by scrapers, which is not the case for any of the assemblages recovered by the VPRT. This suggests varied tasks were undertaken at different points on the island.

Table 15.14. *Composition of the AC and AH assemblages.*

Category	AC		AH	
	No	%	No	%
Tools				
Awl	1	0.13	2	0.14
Burin	5	0.64	3	0.21
Burin/scraper	0	0	1	0.07
Microlith	3	0.38	14	0.96
Notch	1	0.13	0	0
Scraper	1	0.13	10	0.69
Truncation	0	0	1	0.07
Blade (re/ut)	8	1.02	14	0.96
Flake (re/ut)	4	0.51	18	1.24
Frag. (re/ut)	10	1.28	15	1.03
Tool spalls				
Axe flake	0	0	3	0.21
Burin spall	6	0.77	4	0.27
Microburin	8	1.02	7	0.48
Core preparation				
Crested blade	6	0.77	14	0.96
Plunging blade	2	0.25	4	0.27
Core tablet	0	0	12	0.82
Debitage				
Blade	56	7.15	102	7.01
Flake	199	25.41	345	23.73
Fragment	249	31.8	581	39.96
Chip	221	28.22	290	19.94
Core	2	0.25	5	0.34
Shatter fragment	1	0.13	9	0.62
Total	**783**	**100**	**1454**	**100**

Flixton 2

The Flixton 2 assemblage is very small, comprising just 17 pieces, recovered from one artefact-bearing test-pit (AG).

In terms of raw materials utilized, these are represented in proportions common amongst the other assemblages recorded around the lake (Table 15.15). A low proportion of cortical flakes are represented (Table 15.16). Due to the small size of the assemblage and the excavated area this is likely to be the result of the knapping of a small number of partially reduced nodules.

Table 15.15. *Raw materials Flixton 2.*

Raw Material	No.	%
Till	13	76.5
Wolds	4	23.5
Total	**17**	**100**

Table 15.16. *Cortical flakes Flixton 2.*

Cortical Flakes	No.	%
Primary	1	4.8
Secondary	2	9.5
Tertiary	14	85.7
Total	**17**	**100**

Assemblage composition (Table 15.17)

The assemblage contained only one tool – a (possibly unfinished) obliquely blunted point in brown till flint. Other pieces appear unmodified, but could represent pieces used in tasks and discarded (one piece shows evidence of utilization), although the presence of a number of small pieces of debitage may suggest that this assemblage is on the edge of a larger scatter, where knapping occurred. There is no evidence of any Upper Palaeolithic activity, suggesting that the tanged point recovered from Moore's Flixton 2 (Clark 1954, 192) excavation represented an isolated loss.

Table 15.17. *Composition of the Flixton 2 assemblage.*

Category	No.	%
Tools		
Microlith	1	5.9
Debitage		
Blade	1	5.9
Flake	4	23.5
Fragment	9	52.9
Debitage	2	11.8
Total	**17**	**100**

No Name Hill

The No Name Hill assemblage is of moderate size, recovered from a series of test-pits around the former island. While many test-pits yielded small to moderate amounts of lithics, only one unit produced a large assemblage. The assemblage is notable in the contrasting, spatially differentiated lithic based activities that generated it. Only a few of the assemblages from these test-pits appear to represent *in situ* nodule reduction/tool manufacturing activities while many of the assemblages, especially those situated near to the water's edge, and particularly those on the north side of the island, appear to represent instead purely lithic using activities.

The No Name Hill assemblage contains a field-walked component. This portion of the assemblage yielded a range of later prehistoric material, amongst

Table 15.18. *Raw materials at No Name Hill.*

Material	Total	%
Chert	5	0.4
Till	913	65.2
Wolds	281	20.1
Uncertain	76	5.4
Burnt	125	8.9
Total	**1400**	**100**

which the Later Neolithic period is particularly well represented. Diagnostic pieces include an unfinished Early Neolithic leaf shaped arrowhead; two Late Neolithic arrowheads, a *petit-tranchet* and an oblique example (Green 1980), as well as two Late Neolithic knives, cores and flaking debris. Bronze Age material may be represented by a core/scraper and a small number of poorly flaked cores and scrapers.

Raw materials (Table 15.18)
A variety of raw material types and qualities are present (Table 15.18). Of the till material, both water worn pebbles and material obtained directly from the till are represented; pebble material being present in rather higher frequencies. This material ranges in quality from fine translucent material to pieces that have broken along internal faults. Translucent blacks and browns and speckled greys are all present, while red flint is represented in small frequencies in a surprisingly large number of test-pits. Wolds flint is represented in fairly high proportions, indicating more extended chains of movement prior to arrival at the Island. The assemblage also contains a moderate amount of burnt flint, which is concentrated in a small number of test-pits, particularly unit BJ.

Technology
Technology ranges from a typical Early Mesolithic blade-based technology in the excavated assemblages to a largely Late Neolithic flake-based industry recovered during fieldwalking on higher ground. The former is characterized by blade cores with parallel scars, the use of a soft hammer, extensive platform abrasion, flakes and blades with fine butts, core rejuvenation flakes and a relatively high frequency of blades even for a Mesolithic assemblage. The latter, by contrast, consists of multi-platform cores (including a typical discoidal example), hard and soft hammer use, frequent platform abrasion, flakes with generally thicker butts and a general greater emphasis on flake production.

The No Name Hill Early Mesolithic assemblage has one of the highest proportions of secondary flakes of any of the assemblages recorded from this landscape (Table 15.19). Cortical flakes are represented in high frequencies in both those assemblages generated by core reduction and those through blank/tool use. The core reduction-based assemblages thus appear to represent nodules in their early stages of reduction, which were brought to the island probably as tested nodules and did not undergo very intensive exploitation on the island. This is supported by the fact that cores are extremely rare in most of the excavated assemblages (half the cores present were recovered from fieldwalking) and were probably taken by the knappers when they left the island because of their potential for further exploitation elsewhere. Frequencies of secondary flakes are only slightly lower in the use-based assemblages (a range of between 19.7–27.9% in comparison to a range of 25.2–29.5% for core reduction assemblages). This suggests that in some cases at least the blanks and tools that were used on the island may have been manufactured there.

Table 15.19. *Cortical flakes at No Name Hill.*

Cortex	No	%
Primary	27	1.9
Secondary	379	27.1
Tertiary	994	71.0
Total	**1400**	**100**

Assemblage composition (Table 15.20; Fig. 15.7)
The No Name Hill assemblage contains a wide range of tools, suitable for the accomplishment of a variety of different tasks, though most of these are only present in small quantities – only scrapers and microliths are present in any significant numbers. Overall, the assemblage is scraper dominated (Table 15.20), though it should be borne in mind that six of these pieces derive from fieldwalking, so the proportion of Early Mesolithic scrapers and microliths may be more balanced. No Name Hill is notable for the presence of the only Early Mesolithic axe recovered from this landscape which does not derive from either Star Carr or John Moore's Flixton excavations. The assemblage also contains the highest proportion of retouched or utilized blades, flakes and fragments of any significantly sized assemblage. A range of later prehistoric tool types, particularly arrows and knives, are also present.

Arrowheads
Three examples were recovered from fieldwalking. An Early Neolithic example was represented by a partially flaked (probably unfinished) leaf shape, while two Late Neolithic pieces were recovered – one oblique, the other a slightly damaged probable *petit-tranchet* arrowhead (Green 1980).

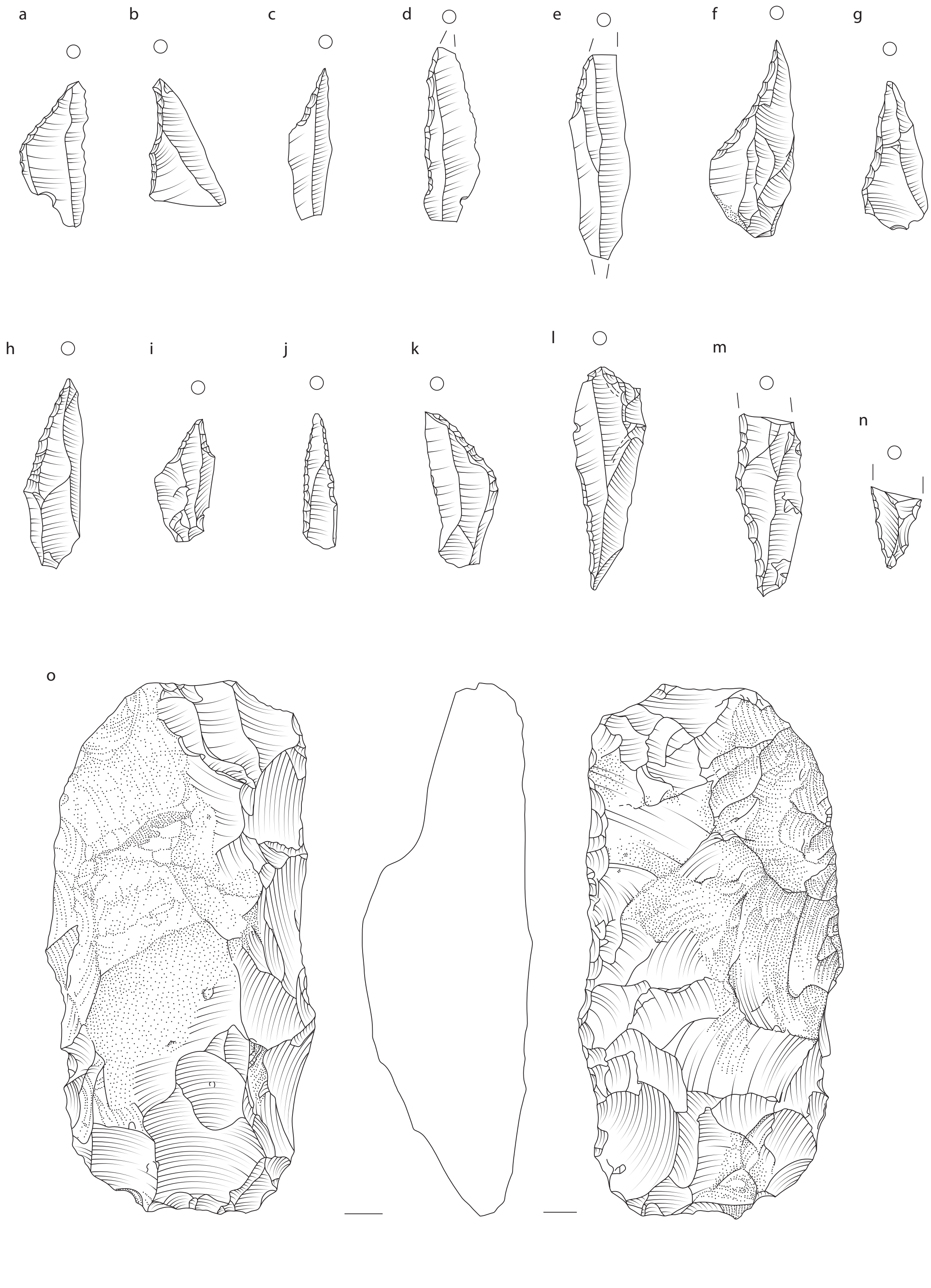

Figure 15.7. *Tools from No Name Hill: microliths (a-n), axe (o).*

Table 15.20. *Composition of the No Name Hill assemblage.*

Category	No.	%
Tools		
Arrow	3	0.2
Awl/borer	2	0.1
Axe	1	0.1
Burin	2	0.1
Core/scraper	2	0.1
Core/scraper/burin	1	0.1
Knife	2	0.1
Microlith	19	1.4
Scraper	27	1.9
Scraper/burin	1	0.1
Truncation	2	0.1
Blade (re/ut)	27	1.9
Flake (re/ut)	26	1.9
Frag. (re/ut)	32	2.3
Tool spalls		
Axe flake	2	0.1
Burin spall	3	0.2
Micro-burin	6	0.4
Debitage		
Blade	146	10.4
Flake	381	27.2
Fragment	572	40.9
Debitage	83	5.9
Chunk	7	0.5
Core	27	1.9
Nodule	1	0.1
Core preparation		
Crested blade	14	1.0
Plunging blade	6	0.4
Tablet	4	0.3
Other	1	0.1
Total	**1400**	**100**

Axe (Fig. 15.7o)

The axe is a small rectangular example, 88 × 45 × 27 mm in dimension. It was sharpened by direct retouch rather than a tranchet blow. One face is flat, the other rather more bowed. Thinning extends only half way across the latter face. A large step fracture on the piece indicates a failure to remove a large chert-like inclusion. The piece was manufactured on fairly poor quality, stained dark Wolds material with extensive white chert-like inclusions. Axe using/maintaining activity is also indicated by two tranchet axe sharpening flakes, both on till material.

Table 15.21. *No Name Hill burin types.*

Type	No	%
Angle burin on break	1	33.3
Triple burin	1	33.3
Scraper/burin	1	33.3
Total	**3**	**100**

Table 15.22. *No Name Hill microlith types.*

Type	No	%
Obliquely blunted point	14	73.7
Triangle	0	0
Trapeze	2	10.5
Fragment	3	15.8
Total	**19**	**100**

Table 15.23. *No Name Hill scraper types.*

Type	No	%
Short	9	33.3
Long	5	18.5
Round	2	7.4
Double	1	3.7
Other	2	7.4
Fragment	8	29.6
Total	**27**	**100**

Burins (Table 15.21)

These tools, and their sharpening spalls, are rare on No Name Hill; only two burins, one composite scraper/burin and three burin spalls were recovered. The two burins are an angle burin on a break in till flint and a more elaborate triple burin in Wolds flint. The composite scraper/burin is an angle burin on a truncation. The three burin spalls are two primary examples with characteristic retouch down the edge, designed to facilitate the removal and a secondary example. These indicate that both burin manufacture and burin resharpening occurred at various occasions on No Name Hill.

Microliths (Table 15.22, Fig. 15.7a-n)

A more restricted range of microlith types are present compared with other sites around Lake Flixton. Triangles, which are common at many sites, are absent while trapezes, which normally occur in 'Star Carr type' assemblages with triangles, are represented. Obliquely blunted points are by far the most common type represented, and several have retouch extending a considerable distance down the piece. Also represented is an obliquely blunted point with retouch down the leading edge. The presence of these forms may indicate mainly Deepcarr type industries, especially since both trapezes are the only forms recovered from a single test-pit. Microliths are manufactured on similar proportions of raw material to the rest of the assemblage.

Scrapers (Table 15.23)
A wide variety of scraper types are represented. These also include later prehistoric types, recovered from fieldwalking, which tend to have retouch extending further around the circumference of the piece. No raw material patterning is obvious.

Stone
Eight pieces of potentially utilized or humanly introduced stone were recovered from separate test-pits.

Spatial variation
Those assemblages which are of sufficient quantity for a reconstruction of the activities that generated them are discussed below. The four major areas of core reduction and tool manufacture are examined first, followed by a consideration of the assemblages generated through tool and blank use.

NC
NC yielded by far the largest of the assemblages, with 385 pieces and is one of only two units on No Name Hill to exceed 100 pieces. Both primary and secondary flakes are well represented, and it is probable that minimally tested nodules, most often of till material, were brought to site and that on-site debris represents pieces generated fairly early in the cores' working life. Cores are under-represented in the assemblage, especially in comparison with the range of nodule groups present (only two were recovered), suggesting that cores were exploited little enough for them to be subsequently reused.

Evidence for working *in situ* is clear: over 60% of the small debitage (pieces less than 10 mm) recovered from the whole island was from this unit. The goal of lithic working appears to have been the production of a variety of tools. All the burin spalls in the entire No Name Hill assemblage were recovered from this unit, two primary and one secondary, indicating some use or maintenance as well as manufacture. No burins were recovered, suggesting they also left the site with the knappers. A tranchet axe flake indicates production/maintenance of a biface, which was also not recovered. Both microliths and their manufacturing spalls were recovered, as were finished scrapers and an awl. There is also a fairly high proportion of retouched blades, flakes and particularly fragments.

BJ
This is the second largest assemblage from No Name Hill, consisting of 149 pieces. It shares certain characteristics with the assemblage from Test-Pit NC in that cores are under-represented. In fact, no cores are present, although the high proportion of debitage (as with test-pit NC) indicates *in situ* knapping. Cortical flakes are particularly well represented, again suggesting early knapping episodes in the life of the core. Tools are less well represented at BJ, only one awl and two scrapers are present and no manufacturing spalls associated with other tools are present. The assemblage from BJ also differs in the very high proportion of burnt material present (57% of the assemblage).

KAF, LC and NAN
These are all relatively small assemblages of 81, 18 and 61 pieces respectively, but still share features with test-pits BJ and NC, in that they contain quantities of debitage or small flakes, burnt flint and, in the case of KAF and NAN, tool manufacturing debris. They do vary in certain respects: Unlike the rest of the No Name Hill assemblage, cores are over-represented at KAF, where five were recovered. Though pieces refit to two of the cores, two fine bladelet cores in particular appear rather different in raw material type to the rest of the assemblage. KAF also contains more microburins than microliths (3:1) indicating a primarily manufacturing locale. NAN also yielded a microburin, a microlith and a scraper.

Test-pits NAR, NAS, NAV, NAW, NAY, NAZ and NAL
The four units described above share a number of common features: all contain small debitage (pieces less than 10 mm), most contain tool manufacturing spalls, they frequently contain burnt flint, frequently refits and, if not refits, a number of distinctive nodule groups can be discerned. All also contain low proportions of blades, which may be a technological phenomenon, but may also mean that blade blanks were being taken on from site. The assemblages from a number of other units, particularly those situated close to the lake edge in the northern part of the island display a very different suite of characteristics. These assemblages are characterized by the absence of small debitage and burnt pieces and by the presence of high frequencies of blades, large flakes and even core maintenance flakes which often (up to 33% in an assemblage) display either retouch or traces of wear; also, by the presence of tools without manufacturing spalls; and finally, by the fact that no refits, or even nodule groups can be discerned.

These are assemblages that appear to have been generated purely through activities based on tool and blank use, perhaps based on the exploitation of a spatially discrete resource at the edge of the lake. They may represent discarded entire 'toolkits' that had been assembled from pieces manufactured on a number of different occasions, but are more likely to represent accidental loss and discard of worn out tools over a long period, many, even hundreds of years.

While these units are all characterized by large frequencies of retouched, utilized or unmodified blades and larger flakes, probably indicating widespread cutting activities, the other tool types vary by test-pit according to the other activities taking place at specific points along the shoreline. NAR, NAS and NAY yielded no other tools, while three microliths and a scraper/burin were recovered from NAV, a burin and two scrapers were recovered from NAW, and the axe and two microliths came from NAZ. In addition, three small, delicate bladelets were recovered from the fill of a pit in NAL. While no other pieces from this test-pit refit, all three of these bladelets do, perhaps indicating formal deposition.

Summary

The differences noted between core-reduction/tool-manufacture based assemblages and activity-based assemblages probably represent similar patterns to those recorded at Star Carr (Mellars and Conneller 1998: 89, Conneller et al. 2018), where larger pieces and a high frequency of blades were recovered nearer the water's edge. Similar activities also seem to be represented in some of the isolated Seamer and VPRT test-pits (see Chapters 14 and below). These activities may represent either exploitation of a lake-edge resource or carrying out tasks involving the processing of materials that were deemed inappropriate for occupation or knapping areas.

Table 15.24. *Composition of the Barry's Island assemblage.*

Category	No	%
Tools		
Awl/borer	3	0.2
Burin	5	0.3
Microlith	24	1.5
Notch	1	0.1
Scraper	16	1.0
Truncation	1	0.1
Blade (re/ut)	2	0.1
Flake (re/ut)	10	0.6
Frag. (re/ut)	6	0.4
Tool spalls		
Axe flake	2	0.1
Burin spall	4	0.2
Micro-burin	8	0.5
Debitage		
Blade	185	11.3
Flake	515	31.5
Fragment	485	29.7
Chip	315	19.3
Chunk	8	0.5
Core	19	1.2
Nodule	6	0.4
Core preparation		
Crested blade	13	0.8
Tablet	2	0.1
Other	3	0.2
Total	**1633**	**100**

Barry's Island

A total of 1633 lithic artefacts were recovered from the VPRT excavations at Barry's Island. In addition, 414 lithic artefacts were recovered from the site by the landowner, Mr Barry Kitchen, during the erection of a barn on the top of the hill. The majority of these surface finds appear to be later prehistoric, particularly Late Neolithic in date, though an Early Mesolithic microlith was also found. A major problem exists with the Barry's Island material in that the majority of the assemblage appears to represent material which has been re-deposited by the action of a later stream channel.

The Barry's Island lithic assemblage is thus of mixed date, containing artefacts diagnostic of both the Early and Late Mesolithic periods. The upper contexts of the site contain both Early and Late Mesolithic microliths and pieces that have a characteristic sheen and edge damage indicating post-depositional movement. The upper contexts thus appear to represent material derived from both Early and Late Mesolithic activities, eroded out of their original deposits by the action of a stream channel, which is represented in the site stratigraphy as a sand lens. A radiocarbon date of 10,195–9405 cal BC (10,160±90 BP, OxA-6330) has been obtained from a horse tooth recovered from this layer, suggesting that very Late Glacial material may also been redeposited by the stream channel; however, no diagnostic lithic artefacts of this date have been recovered. The redeposited material comprises the greater part of the assemblage, with relatively few *in situ* artefacts recovered from below the sand lens. The notable exception is the large quantities of material recovered from the *in situ* context [9117] in

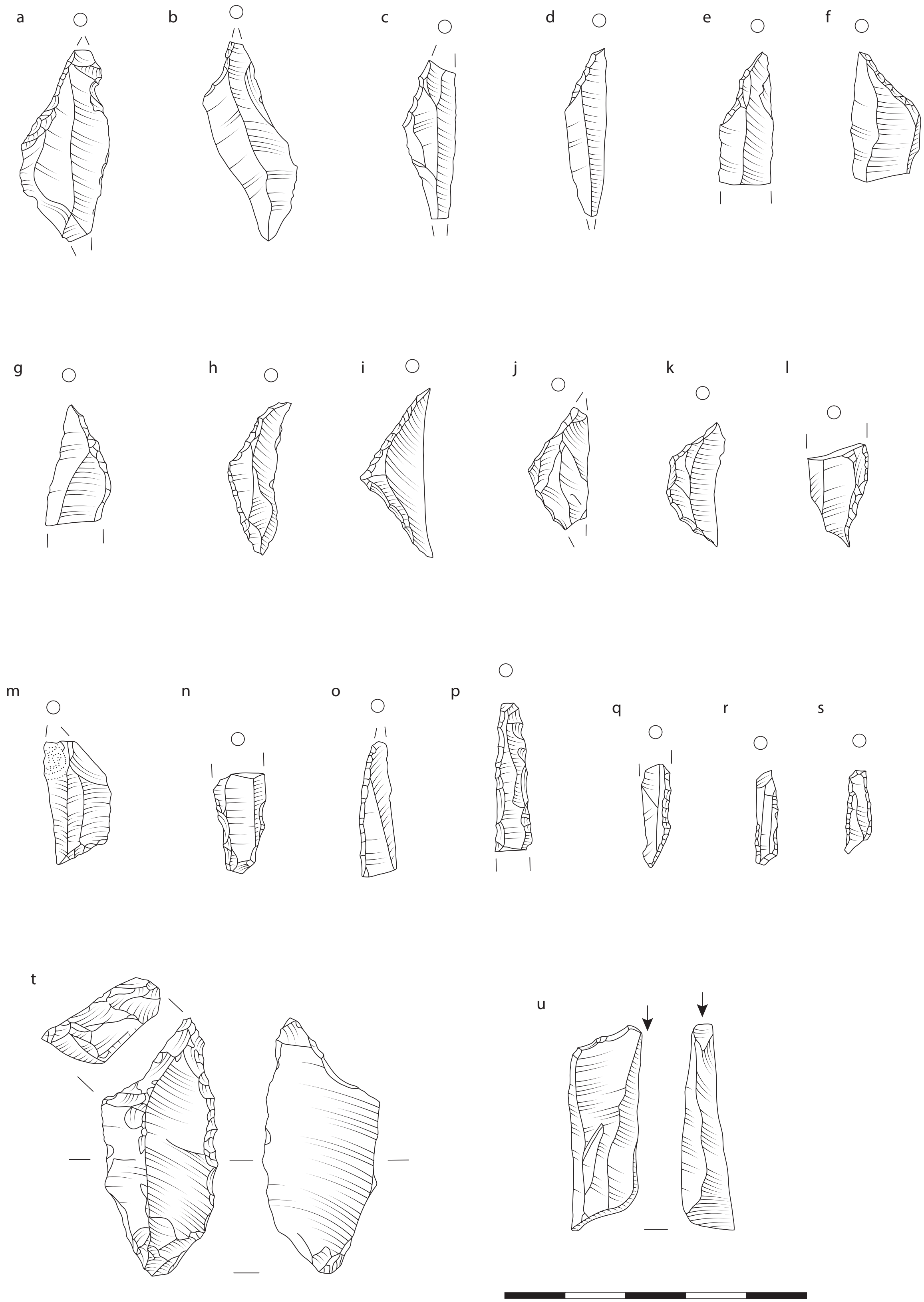

Figure 15.8. *Tools from Barry's Island: microliths (a-s), truncation (t), burin (u).*

trench LAO. Although the composition of the entire assemblage is presented for comparative purposes, the majority of the discussion of the material from Barry's Island will distinguish between *in situ* and redeposited material.

Tools (Table 15.24)

Of the 24 microliths recovered, 13 are Early Mesolithic examples (Fig. 15.8a-m), eight Late (Fig. 15.8o-s) and three so fragmentary as to be indeterminate. The Early Mesolithic pieces consist of eight obliquely blunted points, four broad triangles and a trapeze. All but four examples were manufactured on till material, which is a higher frequency than represented in the remainder of the assemblage. This may be due to the preference, which was similarly noted at the Rabbit Hill site, for the manufacture of Late Mesolithic microliths on till material.

Scrapers are also well represented at Barry's Island. As is common amongst the Lake Flixton assemblages, short scrapers are more plentiful than long scrapers. There is a slightly higher ratio of Wolds to till scrapers than occurs amongst the rest of the assemblages, but the difference is small and the number of scrapers so few as to render it insignificant.

Stone

A total of seven pieces of potentially utilized stones have been recorded. One of these may have been a stone bead, and at least two others appeared to have been utilized, possibly as hammerstones.

Spatial variation

Since certain of the upper contexts of the site represent redeposited material, all excavation units will be discussed jointly, while *in situ* and possible *in situ* material will be examined in greater detail. Trench LAK, where the stratigraphy is more complex, will be considered separately.

Contexts above the trapped sand horizon

Forty-eight pieces derive from the contexts above the trapped sand horizon, the majority of which were recovered from trench LYY. These contexts contain material compatible with either a Mesolithic or Early Neolithic date. Two diagnostic Late Mesolithic microliths are present, one in trench LAO, the other in LAQ, but both are rolled and thus likely to derive from the trapped sand lens, as is true for an Early Mesolithic example also recovered from LAO. A possible knife fragment might indicate Neolithic activities, but the attribution is uncertain.

The bottom three contexts of this seven-context series contain material which is rolled and polished in an identical fashion to the artefacts derived from the sand lens and these pieces must represent lithics which have been worked up the sequence by various post-depositional agents. Contexts contaminated by redeposited material vary according to test-pit, but layers affected, either totally or partially are [9111] (LAQ, LYF, LYY), [9328] (LAO, LAQ) and [9112] (LYY). The contribution of the trapped sand material to overlying contexts is made obvious by the recovery of a rolled Early Mesolithic microlith from context [9111], a burnt horizon radiocarbon dated to the Late Mesolithic.

The trapped sand horizon

Material in this horizon is very distinctive in carrying both significant edge damage and an extensive shiny polish which has smoothed facets and edges. The extent of this sheen varies in each unit (presumably due to such factors as the velocity of the stream and the distance that artefacts were carried before deposition), from heavy and ubiquitous in LAQ to less frequent heavy damage and minor sheen and edge damage in LYY. Even though this variability exists, pieces derived from the sand lens are easily distinguishable.

Some 358 pieces derive from this horizon, although rather more pieces are likely to be redeposited (see above). Both Early and Late Mesolithic material is represented. Diagnostic material is present in the form of two Early and three Late Microliths. Although the lithic material is not *in situ* and much of it cannot be differentiated between Early and Late pieces, the assemblage from the trapped sand horizon can still provide some information on the activities which took place in the general vicinity of this part of the landscape during the Mesolithic.

A variety of activities involving core reduction and tool manufacture and maintenance are indicated. In addition to the microliths mentioned above, a wide range of tools are present – two awls, 4 burins, 8 scrapers and two truncations. Tool manufacturing and maintenance activities are indicated by a single burin, an axe flake, 5 micro-burins and 5 microliths. Proportions of retouched blanks are difficult to determine due to extensive edge damage on most pieces. Core reduction and blank production activities are indicated by the presence of core maintenance flakes, small debitage and blades.

The lower peat

Only 12 pieces were recovered from the lower peat. These included a fresh Early Mesolithic triangle microlith from LYY and a number of cortical flakes from LAO which appear to have been generated by similar activities responsible for the underlying knapping scatter in context [9117].

The upper shore horizon
Artefact-bearing upper shore horizons were present in units LAO, LAQ, LYA, LYB, LYD LYF and LYY, though only LYY yielded more than 10 pieces. Many of these units contained only rolled pieces or a proportion of rolled material and thus also appear to have been affected by material originally deposited in the trapped sand horizon. Trench LYY contains a Late Mesolithic rod microlith in what should be an Early Mesolithic horizon, and a microlith recovered from LAQ, though Early Mesolithic in date, is definitely rolled. Only LYY and LYB appear to have the majority of their material *in situ*, although several pieces from LYY certainly derive from the trapped sand lens.

LYB contains a burin and two burin spalls, which though they do not refit certainly appear fresh and thus may indicate the original manufacture and use of more than one burin at this spot. Two nodule groups can be discerned in LYY; one involved the early stages in the manufacture of a till nodule; the other, the later stages of core reduction and maintenance of Wolds material. Two large blades are also present, unrelated to the reduction of the two nodules, both of which show traces of use.

The lower shoreline horizon
Only LAO and LYY yielded finds from this horizon and only LAO in large quantities. In LYY, most of this material derived from the basal mineral deposit [9117] and a second mineral layer (9114), which in this trench was separated by a layer of peat [9116]. A smaller quantity of material was also recorded from context [9119], redeposited natural sandy gravel from a tree throw. This material appears to be both *in situ* and of Early Mesolithic date, demonstrated by the presence of probable refit groups and two Early Mesolithic microliths. Both Wolds and till material were worked *in situ*, indicated by quantities of small debitage. The focus appears to have been on microlith production and possible retooling as is suggested by the recovery of two microliths and one micro-burin.

LAO Context [9117] Assemblage
This assemblage is the only significant collection of *in situ* material from Barry's Island and has a number of unusual characteristics. Notable is the complete absence of tools, or waste by-products of tool manufacture (Table 15.25). Also, the proportion of cortical flakes is the highest of any of the assemblages recorded by the Seamer Carr Project or VPRT. Furthermore, if only 3D plotted material is considered (this discounts both the small spalls <10 mm which are likely to represent the finishing stages of core roughout production, and any material which may have derived from other contexts), the percentage of primary flakes is 10.9, secondary 48.9 and tertiary 40.2, a dramatically different pattern from all other assemblages in the area.

Table 15.25. *Composition of the in-situ assemblage from LAO [9117].*

Category	No	%
Burin Spall?	1	0.1
Crested Blade	1	0.1
Blade	16	2.4
Flake	202	30.3
Fragment	154	23.2
Debitage	276	41.4
Chunk	8	1.2
Core	4	0.6
Nodule	4	0.6
Total	**667**	**100**

Material	No	%
Till	506	75.9
Wolds	104	15.6
Uncertain	55	8.2
Burnt	2	0.3
Total	**667**	**100**

Cortex	No	%
Primary	40	6.0
Secondary	198	29.7
Tertiary	429	64.3
Total	**667**	**100**

Refitting of this material has been highly successful – 27% of pieces over 10 mm in length conjoin, and a piece found in the section wall indicates that the scatter continues beyond the excavated area and thus refit rates could have been even higher. The refitting work indicates that the activities that generated this assemblage involved the decortification and additional roughing out of about 16 nodules into pre-forms and cores. Many pieces were detached with a hard hammer and retain a cortical platform, characteristics that can frequently be noted on primary and heavily cortical flakes in other assemblages from around the lake. Of the four cores that remain on site, all but one are minimally reduced. Presumably the missing pre-forms and cores would have been removed by their manufacturer(s) to be further worked when the need arose. Both the high percentage of conjoinable pieces and the single activity focus of this scatter suggest that this assemblage represents a single knapping episode of some integrity.

LAK

On the higher part of the hill the majority of the finds recovered derived from the oxidized peat layer. A rod microlith, scalene triangle microlith and small micro-blade core suggest most, if not all of these pieces are of Late Mesolithic date. Other material recovered from this horizon includes two scrapers, a possible burin spall and burnt material. The underlying sandy gravel yielded only 5 pieces; one fragment is probably part of an Early Mesolithic obliquely blunted point.

Erosion of the break of slope by hydraulic activity means that many of these contexts are potentially disturbed. Most of the lithic material is patinated or stained making it difficult to examine the integrity of deposits through refitting or grouping nodule types. Most contexts contained a mixture of rolled and relatively fresh pieces. However, fresh pieces tend to be more numerous in most of the contexts, suggesting that, even if it is disturbed, the material has not moved very far. The only diagnostic material recovered were Early Mesolithic microliths. Other artefacts present include a large number of blades, two blade cores and an amount of burnt material, including a burnt scraper.

Most of the peat horizons yielded lithic material. The upper peat horizons contain Mesolithic/Early Neolithic material, indicated by the recovery of a fine serrated micro-blade. A seemingly fresh tranchet axe flake from these levels may be Early Mesolithic, as core axes appear to be absent from the Late Mesolithic of Northern England (Myers 1986).

The basal three peat horizons contain quantities of rolled material of the type associated with the trapped sand layer elsewhere on the site. Of these three peat layers only [9104] contains any quantity of material. This layer contains a mixture of very rolled material and relatively fresh pieces. Artefacts include a burnt scraper, fine knapping debitage and a very high frequency of blades. Rolled material is also present in varying quantities in the underlying grey silt layer, though an Early Mesolithic microlith appears fresh and may thus be *in situ*.

Discussion

The majority of the Barry's Island lithics represent redeposited material of mixed Early and Late Mesolithic date and thus has limited analytical value. Though Late Glacial fauna is potentially present amongst the redeposited material, there is no obvious Upper Palaeolithic element amongst the lithics. The only significant *in situ* assemblage comes from LAO context [9117]. This appears to represent a high resolution, single episode event, involving the preparation of around 16 nodules into preformed cores. The cores were removed for further reduction at knapping stations elsewhere. Taken with the evidence from elsewhere in this landscape, this assemblage illustrates the variability both of the use of the edge of Lake Flixton and Early Mesolithic technical economies more generally.

VPRT smaller sites

This final section presents details of the lithic assemblages recovered from the smaller 'sites' and isolated scatters located by the VPRT since 1985. It also provides a preliminary statement on the larger lithic assemblage recovered from the Flixton School Field and Flixton School House Farm sites, up to 1997. However, since excavations along this portion of the shoreline continued until 2000, during which time new test-pits and trenches were excavated and others were enlarged, it should be borne in mind that both quantities of material and interpretations are highly provisional.

Carr House Farm

Of the Carr House Farm complex of test-pits, only one (LN) produced any worked flint, a fragment in brown till flint.

Manor Farm (Table 15.26)

This small assemblage consists of 17 pieces recovered from five test-pits – KM, KP, KAB, KAC & KAD. Only KAB, with 11 pieces, produced more than three pieces. A possible Late Mesolithic microlith was recorded in trench KM (discussed under VP E, above). No formal tool types were recovered, only a variety of debitage. Although both Wolds and till flint were employed, Wolds material is more common and was particularly well represented in KAB where small debitage from a variety of Wolds nodules was recovered.

Table 15.26. *Composition of the Manor Farm lithic assemblage.*

Category	No	%
Tools		
Microlith	1	5.9
Scraper	1	5.9
Flake	8	47
Fragment	2	11.8
Debitage	5	29.4
Total	**17**	**100**

Flixton School Field/Flixton School House Farm (Table 15.27)

Although the majority of this densely clustered assemblage is Early Mesolithic in date, later material has been recovered from the upper contexts of *in situ* excavated material and more particularly from the ploughsoil, both through fieldwalking and excavation. Nine Late Mesolithic scalene triangles were recovered from the upper levels of the site, while two arrowheads, a fragment of a probable Early Neolithic leaf shaped arrow and a possible Early Bronze Age barbed and tanged example were collected during fieldwalking.

Table 15.27. *Composition of the Flixton School Field assemblage.*

Category	No	%
Tools		
Arrow	2	0.05
Awl/borer	9	0.2
Burin	11	0.2
Core/burin	1	0.02
Core/scraper	4	0.1
Knife	4	0.1
Micro-denticulate	1	0.02
Microlith	52	1.8
Strike-a-light	2	0.05
Scraper	97	2.2
Scraper/awl	2	0.05
Truncation	4	0.1
Blade (re/ut)	27	0.6
Flake (re/ut)	23	0.5
Frag. (re/ut)	27	0.6
Tool spalls		
Axe flake	2	0.05
Burin spall	23	0.5
Micro-burin	34	0.8
Resharpening	1	0.02
Debitage		
Blade	544	12.3
Flake	1121	25.3
Fragment	1833	41.4
Debitage	419	9.5
Chunk	21	0.5
Core	64	1.4
Nodule	17	0.4
Core preparation		
Crested blade	25	0.6
Plunging blade	19	0.4
Tablet	33	0.7
Other	7	0.6
Total	**4429**	**100**

Spatial distribution

Preliminary interpretations of some of the more significant excavated areas are offered below.

PB

An isolated cache of twelve large nodules of raw material was recovered from this test-pit. This material (all till flint) had been carefully stacked together in a small pile (see Fig. 13.6). Of the twelve nodules six were entirely unmodified, while the remaining six had been modified in a variety of different ways, from the removal of a single flake to the production of a large preform or core tool. The condition of the cortex of these pieces reveals a gradation from a thin, sharp and in some cases slightly chalky cortex, characteristic of material collected fresh from the till, to that of relatively battered pieces that have been pounded by the sea and can be collected from the beach. The intermediate stages represent pieces that had only been recently eroded from the cliff before collection, and had been minimally exposed to the action of the ocean. Although all of these nodules fall within the size range of material that can be collected today (Henson pers. comm.), and refitted nodules from archaeological contexts, in both cases they represent the larger end of the spectrum and thus are likely to have been especially selected for their size. It would also have taken a certain amount of investment of time to collect a range of nodules of this size, and the fact that a range of stages and techniques of working are present may suggest that they have been accumulated from a variety of contexts, possibly over a period of time. Interestingly most of these nodules are of very poor quality, possibly too poor even for knapping. It thus seems that the significant thing about this cache is not so much its quality as a secondary raw material source in the landscape, but more the simple presence of these large nodules – the very fact of their deposition creating a relationship between people and a place.

OH/OHX

Unit OH was a 4 × 4 m trench excavated on lower-lying ground, with a narrower, 1 m wide slot, that extended onto higher ground to the south (OHX). Excavation of these units revealed a dense scatter of material. Unit OHX, on higher ground, was the most productive, yielding 810 pieces of worked flint, in comparison to 558 pieces from the larger lower lying OH. Further units excavated to the south of OHX reveal that this scatter continues at very high densities still further up the dry land area.

The assemblages from OH and OHX show minor differences in the composition of their tool component. An awl and an axe flake were both recovered on the higher ground, while burins were only recovered from the lower part of the site. However, scrapers are the dominant tool type in both assemblages, and microliths outnumber micro-burins in both. Patterns of raw materials, burnt flint and cortical flakes are also very similar. One difference is the greater quantity of debitage recovered from OHX, a pattern that can also be seen in the test-pits on the higher ground to the south, which also contained larger proportions of debitage. It is possible the lowest parts of OH were too waterlogged to afford a suitable place to work flint, and so the lithics recovered represent pieces that were used in activities focused on the very edge of the lake, or represent refuse deposited in the shallows. Greater spatial variation may be revealed by a higher resolution spatial analysis.

OI

This unit, situated 12 m to the east of OH/OHX is microlith, rather than scraper, dominated, although a variety of tools and spalls are present at fairly low levels. The shoreline uncovered in this unit drops off more steeply and a smaller portion of dry land is represented, and in common with the wetter parts of OH, debitage is less common. This unit is notable for the recovery of another cache, in this case associated with other archaeological material. This cache is smaller than the one recovered from unit PB, consisting of five pieces which range from a tested nodule to a very large, partially worked core.

Lingholm Farm

Lingholm Farm yielded an assemblage of mixed date, with material ranging in date from Early Mesolithic to Bronze Age. Some patterning in the spatial distribution of material of different dates does appear to occur, with Field A containing a significant proportion of Early Mesolithic material and Field B appearing to yield a predominantly Late Mesolithic assemblage.

Raw materials (Table 15.28)

Frequencies of Wolds material are only slightly lower than the average for sites around the lake, although the figure does vary from field to field. The proportion of the assemblage that is burnt is high.

Table 15.28. *Raw materials at Lingholm Farm.*

Material	No	%
Chert	3	0.4
Till	509	63.4
Wolds	130	16.2
Uncertain	27	3.4
Burnt	134	16.7
Total	**803**	**100**

Table 15.29. *Cortical flakes at Lingholm Farm.*

Cortex	No	%
Primary	3	0.4
Secondary	189	23.5
Tertiary	611	76.1
Total	**803**	**100**

Technology

As a mixed assemblage, technology varies. Mesolithic and Early Neolithic technologies have generated blade and narrow flake debitage of varying size, usually detached with a soft hammer and bearing evidence of platform abrasion. The cores recovered usually had one or two platforms and usually, at least in part, displayed blade scars. Later technologies, which range in date from Late Neolithic to Bronze Age, generated thick, frequently crude, flakes; cores are multi-platform and increasingly irregular and error ridden in the later part of the period. Of the three probable Bronze Age cores recovered, one is a denticulated example, one a crude core on a large flake and the final example consisted of a pebble ineffectually flaked either side of a ridge. Cortical flakes are common in this assemblage, partly as a result of this technology, where pebbles are flaked haphazardly, rather than being carefully prepared, frequently before being carried to the site of their reduction as often appears to have occurred in earlier periods (Table 15.29).

Assemblage composition

The composition of the Lingholm Farm assemblage is presented in Table 15.30. Scrapers are by far the dominant tool form and are present in one of the highest frequencies of any of the assemblages. Given that scrapers are usually the dominant tool type on later prehistoric sites, the high frequencies represented at Lingholm Farm are likely to be a reflection of the later prehistoric component to the assemblage, rather than representing a functional bias amongst the Mesolithic material.

Spatial Distribution

Field A

Although a quantity of post-Mesolithic material is present in this assemblage in the form of a Neolithic/

Table 15.30. *Composition of the Lingholm Farm lithic assemblage.*

Category	No	%
Tools		
Awl/borer	2	0.2
Burin	3	0.4
Core/scraper	3	0.4
Microlith	3	0.4
Notch	1	0.1
Scraper	26	3.2
Truncation	2	0.2
Blade (re/ut)	1	0.1
Flake (re/ut)	6	0.7
Frag. (re/ut)	2	0.2
Tool spalls		
Burin spall	5	0.6
Micro-burin	3	0.4
Debitage		
Blade	48	6.0
Flake	273	34.0
Fragment	309	38.5
Debitage	72	9.0
Chunk	2	0.2
Core	32	4.0
Nodule	2	0.2
Core preparation		
Crested blade	2	0.2
Plunging blade	2	0.2
Tablet	1	0.1
Other	3	0.4
Total	**803**	**100**

Bronze Age fabricator and a number of multi-platform flake cores, the majority of the knapping debris is consistent with a Mesolithic/Early Neolithic date. The presence of a large micro-burin, a possible burin, two burin spalls, a possible tranchet axe flake and a scraper/truncation on a blade suggests an Early Mesolithic date. The frequency of Wolds material is also consistent with an Early Mesolithic assemblage.

Field B

The majority of the assemblage from this field is Late Mesolithic in date. Three later Mesolithic microliths were recovered – one scalene triangle and two backed fragments. Flaking debris includes small debitage and occasional micro-bladelets. Two scrapers, one of very small size, and a piece truncated on the ventral surface are not incompatible with a Mesolithic date. A very high proportion (21.4%) of this assemblage is burnt, a pattern that is similar to the predominantly Late Mesolithic site of Rabbit Hill (see Chapter 8). The ratio of Wolds to till material present in the Field B assemblage is also similar to the Wolds/till ratio represented amongst the Late Mesolithic microliths recovered from Rabbit Hill.

Field C

The character of the knapping debris from this field is rather different from the assemblages from the previous two fields. Although small numbers of blades and fine flaking debris are present, the majority of flakes are thicker, frequently cortical and often lack platform abrasion. Diagnostic elements include two discoidal knives, one 'slug shaped', of Late Neolithic/Early Bronze Age date. Two scrapers and a core also appear later prehistoric in date. Mesolithic material, in the form of a Late Mesolithic core and scraper and two possible burins and a burin spall, is also present. This assemblage also contains a high frequency (19.7%) of burnt material.

Field E

A small assemblage of 22 pieces was recovered from this field. Two scrapers, a later prehistoric example on a flake detached with a hard hammer and an end-scraper on a crested blade, indicate this material is also of mixed date.

Manham Hill

A total of 37 pieces of worked flint was recovered from 5 test-pits and through fieldwalking. The material recovered is of mixed Mesolithic and Bronze Age date. The 14 pieces recovered during fieldwalking are mostly Bronze Age, consistent with the earlier discovery of a Collared Urn from the same vicinity. These include a round scraper with retouch extending around both lateral margins. This piece has been detached with a hard, possibly metal, hammer and bears traces of incipient cones on its broad butt. Also of Bronze Age date are two multi-platform flake cores, both worked with a hard hammer and bearing incipient cones, indicating abortive flaking attempts. One core was abandoned due to an inability to maintain the requisite platform angle. Only two or three finer flakes may be indicative of earlier prehistoric activities.

The material recovered from the test-pits also appears mixed. Unit BA contained a range of earlier and later prehistoric material. Some flakes and, in particular, a flaked piece, are likely to be of Bronze Age date, while blades, fine flakes and small debitage

Table 15.31. *Composition of the Manham Hill lithic assemblage.*

Category	No	%
Tools		
Core/scraper	1	2.7
Microlith	1	2.7
Scraper	1	2.7
Blade (re/ut)	4	10.8
Flake (re/ut)	3	8.1
Frag. (re/ut)	2	5.4
Debitage		
Blade	3	8.1
Flake	13	35.1
Fragment	5	13.5
Core	3	8.1
Core preparation		
Tablet	1	2.7
Total	**37**	

are compatible with a Mesolithic or Early Neolithic date. Unit BC contained the tip of a microlith, of likely Late Mesolithic date, on dark grey chert, while unit BH yielded a probable Early Mesolithic blade core manufactured from Wolds material. Units BA and BD also contained significant proportions of burnt material.

Discussion

The VPRT excavations have been primarily successful in uncovering the varied use of a Mesolithic landscape. Particularly illuminating has been the location of 'off-site' activity areas: locations where people undertook small-scale tasks that involved the use of flint tools and led, either intentionally or accidentally, to the discard of these pieces. Much of the material nearer the water's edge involves the use of blades and large flakes, as has been previously noted at Star Carr. However other activities, that demanded the use of different tools, are also represented. So too are other tasks: a specialized area where nodules were decorticated and core preforms produced was located at Barry's Island, for example. This work also reveals the extensive use of the islands in the middle of the lake, particularly Flixton Island, as also previously in evidence from Moore's work (Moore 1950). No Name Hill was also used, though less intensively, and possibly in a fairly similar way across repeated visits. Excavation of lower-lying areas (as at Flixton School) suggests these may have been used on occasion for deposition of material from adjacent dryland areas, as seen at Star Carr and glimpsed at Seamer Carr. Fieldwalking of the higher ground suggests Early Mesolithic occupation of these areas too, though these areas were also foci of Late Mesolithic and later prehistoric occupation as wetland environments gradually encroached over the low-lying areas close to the former lake shore.

Chapter 16

Mammal remains from the excavations at Seamer Carr, Yorkshire, 1977–85

Junzo Uchiyama, Juliet Clutton-Brock† & Peter Rowley-Conwy

The large-scale excavations of the Seamer Carr area between 1976 and 1985, produced several small scatters of animal bones. None even approximates in magnitude to the well-known assemblage from the original excavations at Star Carr (Fraser and King 1954, Legge and Rowley-Conwy 1988), or the more recently excavated material (Knight et al. 2018). In nature they are more similar to the assemblages from elsewhere around Lake Flixton (see Chapter 19), though they are smaller even than most of those. In size they are similar to that from the re-excavation of Star Carr in 1985 (Rowley-Conwy 1998), though they lack the large antler fragments. As a result, many of the analytical methods normally employed on larger assemblages cannot be used. Despite this, the Seamer Carr assemblages are of considerable interest for two reasons. Firstly, there is enough material from Star Carr and the other Lake Flixton assemblages to allow comparisons. Secondly, the large area of prehistoric land surface exposed by the extensive excavations allows a glimpse into the past on a spatial scale normally denied to us.

This contribution is a collaboration between three authors. Clutton-Brock was responsible for receiving, identifying and curating the faunal material at the Natural History Museum, and published papers on a horse mandible (Clutton-Brock and Burleigh 1991) and the cervical vertebrae of a domestic dog (Clutton-Brock and Noe-Nygaard 1990), from Site L and N, respectively. Uchiyama checked the identifications, measured and recorded the whole assemblage in the Natural History Museum in 1996, and analysed the results in an MA dissertation (Uchiyama 1996). The first draft of the present work was written by Rowley-Conwy, using Uchiyama's identifications and then circulated to the other co-authors for comment and correction.

The Seamer Carr mammal bone and tooth fragments number 448, of which 200 are identified to taxon or at least to animal size class; the remaining 248 are recorded merely as unidentified fragments. The largest assemblages of animal bones came from Sites B (see Chapter 8) and C (see Chapter 6), which produced 97 and 129 fragments respectively, with a smaller total spread among the various layers at Sites K, L and N (see Chapter 7), with a total of 99 between them, and a total of 13 fragments coming from trenches U and M (see Fig. 6.2 and Fig. 8.1 for locations). Some bones came from contexts between the sites mentioned above, or from contexts on those sites which could not be dated. The number of bones used in the analysis that follows is therefore less even than the 448 fragments recovered and is, as mentioned, divided across several sites. For further information concerning the nature of the different contexts from which these faunal remains, see the relevant chapters concerning Seamer Carr (Chapters 6–8).

Mammal bones from Site B

The mammal bones from Site B divide into two groups: a relatively concentrated group of aurochs bones (Table 16.1) from trench B I, dated to 8210–7585 cal BC (see Chapter 4); and a more dispersed scatter of the bones of other animals.

This immediately raises three questions (which are addressed in the following sections):

1. Are the aurochs bones from a single skeleton?
2. If so, was the aurochs hunted by humans, or did it die a natural death?
3. What is the relationship between the aurochs bones and the other animal bones in the assemblage?

A single skeleton?

The find circumstances (Figs. 8.8, 8.9) suggest that many of the elements do come from a single skeleton, because

Table 16.1. *Measurements of bones of aurochs (*Bos primigenius*) from Seamer Carr. Measurements are in millimetres. Definitions follow von den Driesch (1976) except metacarpal Dd and metatarsal Dp, which follow Legge and Rowley-Conwy 1988, 124.*

Site	Element	Measurements			
B	mandible, right	2:	condyle to infradentale	560.6	
		7:	cheektooth row, alveolar	160.4	
		8:	molar row, alveolar	108.0	
		9:	premolar row, alveolar	54.1	
		15a:	height behind M3	73.4	
		15b:	height before M1	63.7	
		15c:	height before P2	53.8	
		P2:	L 12.0	B 10.6	CH 6.6
		P3:	L 20.5	B 14.6	CH 7.9
		P4:	L 22.9	B 15.9	CH 7.9
		M1:	L 25.4	B 19.6	CH 12.1
		M2:	L 31.0	B 20.8	CH 19.7
		M3:	L 48.2	B 19.8	
B	scapula, left	GLP: 88.7	BG: 64.4	SLCL 67.5	
B	proximal radius, right	Bp: 112.9	BFp: 108.7		
C	scapula, left	GLP: --	BG: 58.3	SLC: --	
C	distal tibia, right	Bd: 69.1	Dd: 56.2		
C	distal metacarpal, left	Bd: 72.9	Dd: 30.2		
C	proximal metatarsal, right	Bp: 55.0	Dp: 55.3		

some were in semi-articulation when found in a layer [5007] of coarse wood and reed detritus peat (or in at the interface with the overlying reed and sedge peat [5005] above) immediately above a horizon of sandy clay [5012]. The inventory of elements is:

Mandible, right side, complete (Context 5007)
Maxilla, right side, no teeth (Context 5007)
Hyoid (Context 5007)
Scapula, left (Context 5005)
Radius, proximal, right (Context 5007)
Thoracic vertebrae, 4 examples (Context 5007)
Rib fragments, 15 (Context 5007)
Lumbar vertebrae, 5 examples and the spine of a 6th (Context 5007)
Pelvis, left and right (Context 5007)

The vertebrae and pelvis form a coherent group, and it was these that were partially articulated when excavated. Other elements such as the mandible, scapula and proximal radius, articulate with none of the other bones found, so it is more difficult to demonstrate that they belong to the same skeleton. The three elements mentioned are those which provide useful measurements (Table 16.1), and these produce an interesting pattern. Mandibular teeth of aurochs are not sexually dimorphic (Degerbøl and Fredskild 1970), so the most that can be said is that, for example, the length of M3 corresponds closely to the large Early Holocene sample known from Denmark (*op. cit.*, table 10). Scapula and proximal radius are however more sexually dimorphic. The dimensions of the Site B specimens are plotted in Fig. 16.1, and an anomaly appears: the scapula is on the borderline between male and female when compared to the Danish and Star Carr specimens, while the proximal radius (despite the presence of one exceptionally large female in the male scatter) is among the largest males. These two elements therefore do *not* appear to have come from the same individual. However, the scapula was recovered from context [5005], a layer of detrital mud stratigraphically above the main unit [5007] from which all the other aurochs bones were found. It is therefore quite reasonable that this bone should not come from the same animal as the rest. Given the stratigraphic integrity of the rest of the bones, it is likely that the mandible and radius do come from the same individual as the ribs, vertebrae, and pelvis, although this cannot be proven.

Cause of death?

No cut marks were noted on any of the bones, so it is impossible to demonstrate conclusively that they result from human actions. A scatter of flints was however found associated with the bones, with the Mesolithic material concentrated in the lower contexts including blades and undiagnostic knapping debris (see Chapter 14), so there is a good chance that human action was involved. The bones present are mostly from the axial skeleton. This is shown in Fig. 16.2 (top). It should be noted that the ribs were fragmentary, not complete, but since it is impossible to allocate a rib fragment to its correct rib and portion thereof, all ribs are shaded in Fig. 16.2. The scapula is ignored since, as argued above, it does not come from the same individual. It is not certain which thoracic vertebrae are represented so five have been shaded at random. The distribution of elements in Fig. 16.2 bears some resemblance to what is expected to remain at the kill site of a large bovid. For example, ribs and vertebrae were relatively common at the Garnsey Site, a bison mass kill site in New Mexico dating from the late 16th century AD. The more meat-rich limb bones were selectively removed. The pelvis carries much meat, but was nevertheless commonly left at Garnsey, presumably because it is a large bone that is awkward to carry. The elements remaining at Garnsey probably had the meat stripped from them (Speth 1983). Probable aurochs remains from Channel 254

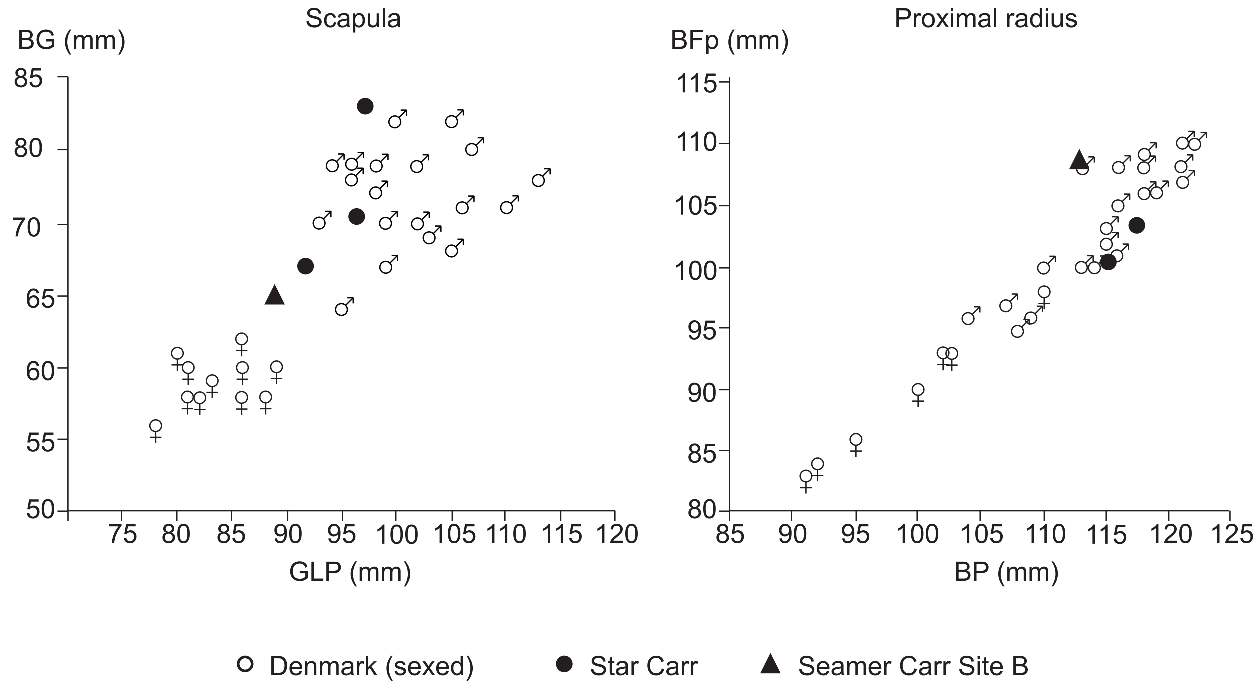

Figure 16.1 *(above). Dimensions of aurochs bones from Seamer Carr Site B, compared to other specimens. Left: scapula (based on Rowley-Conwy 1998, fig. 8.1). Right: proximal radius. Danish examples and sexual division from Degerbøl and Fredskild (1970, tables 13 and 15). Star Carr from Legge and Rowley-Conwy (1988, table 8) and Rowley-Conwy (1998, 99). Measurement definitions follow von den Driesch (1976).*

at Thames Valley Park, Reading, comprised partially articulated ribs and vertebrae, some of them cut-marked. This may represent a kill site, from which the limb bones were removed; whether the pelvis and skull were removed by the hunters who butchered the animal, or by water action, remains unknown (Iles 1997). A closer parallel to Site B is the partial aurochs skeleton from Potsdam-Schlaatz, dated to 9660–9290 cal BC (9936±40 BP, KIA-5665) (Benecke 2000). Axial remains predominated, as at Seamer Site C, but at Potsdam-Schlaatz these included the skull as well as the mandible, all the cervical and thoracic and some of the lumbar vertebrae, and some rib fragments, though the pelvis was absent (Gustavs 1987). As at Seamer Site B, flints were associated with the skeleton as were the bones of some other animals, but in contrast to Site B many of the bones exhibited cut marks (Gramsch

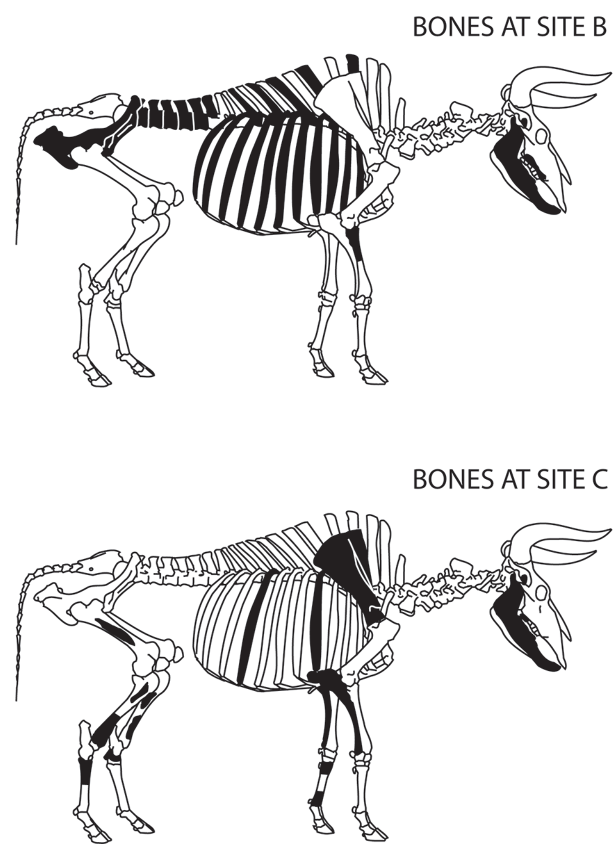

Figure 16.2. *Distribution of skeletal elements of aurochs at Seamer Carr Sites B and C. See text for discussion.*

1987). On the basis of the associated flints and the osteological composition of the find, it is likely that the bones from Site B derive from an aurochs killed and butchered by humans, but conclusive evidence such as that found at Potsdam-Schlaatz is lacking.

Relationship to other bones?

The other bones from Site B are as follows (see Table 8.1 for contexts):

Horse: Incisor, lower right (Trench B I)
Premolar, lower left (Trench Z202, context 5028)
Incisor, upper, side uncertain (Trench B I)
Premolars and molars, upper right, 5 examples:
Trench Z202, context 5003
Trench Z8, context 5005
Trench Z8, context 5012
Trench Z8, context 5012
Trench Z8, context 5012
Premolar, upper left (Trench B I, context 5012-4)
1st phalanx (Trench B I)

Pig: Metacarpal, distal unfused (Trench B I)

Red deer: Humerus, distal, right (Trench Z8, 5004)
Radius, proximal and distal, left
Trench Z8, context 5012 (distal)
Trench BI, context 2167 (proximal)
4th deciduous premolar, lower left, unworn (Trench Z8, context 5002)
M2 and M3, upper right, worn (Trench Z8, context 5002)
Lumbar vertebrae, 2 examples
(Trench BI, context 5007)
(Trench Z8, context 5014)

Elk: Premolar, upper left, worn (Trench Z202A, context 5072)

Roe deer: Radius, distal, right (Trench B I, context 5007)
Ulna, right (Trench Z200, context 5002)

Unidentified bird: One fragment (Trench Z8, context 5005)

Unidentified fragments: 43

This is a larger total than the non-aurochs bones recovered from Potsdam-Schlaatz (Teichert 1987), but the excavations at Site B covered a larger area. The horse teeth could all derive from a single skull and mandible, assuming these have subsequently been dispersed, while the pig is thought to have resulted from a later intrusion. The bones of these other species are thus not particularly numerous and may represent nothing more than 'background scatter' in an area that happened to preserve them. It is likely that at least some of them derive from human activity during different phases of the Early Mesolithic (i.e. those from contexts [5005], [5007], [2167], [5012] and [5014]), while some may have been deposited during the Late Mesolithic (context [5004]), but no link with the aurochs can necessarily be assumed. Finds from context [5003] and [5002] may be of post-Mesolithic date, but could equally have been displaced from lower levels as a

Table 16.2. *Measurements of bones of elk (*Alces alces*) from Seamer Carr. Measurements are in millimetres. Definitions follow von den Driesch (1976).*

Site	Element	Measurements		
C	atlas vertebra	BFcd: 123.3	GLF: 114.1	
K phase 1	distal humerus, left	BT: 64.9	HT: --	HTC: --
C	astragalus, left	GLl: --	Bd: 46.7	Dl: --

Table 16.3. *Measurements of bones of red deer (*Cervus elaphus*) from Seamer Carr. Measurements are in millimetres. Definitions follow von den Driesch (1976) except humerus HT and HTC, which follow Legge and Rowley-Conwy 1988, 124.*

Site	Element	Measurements		
C	mandibular M3, right	L: 29.7		
C	distal humerus, left	BT: 54.9	HT: --	HTC: 31.4
K phase 6	distal humerus, right	BT: 54.5	HT: --	HTC: 25.7
B	distal radius, left	Bd: 58.7	BFd: 55.9	
K phase 5	distal radius, left	Bd: 56.1	BFd: 51.9	
K phase 6	distal tibia, right	Bd: 51.7	Dd: 42.3	
K phase 5	distal metacarpal, left	Bd: 44.2	Dd: --	
C	distal metatarsal, right	Bd: 40.7	Dd: --	

Table 16.4. *Measurements of bones of roe deer (*Capreolus capreolus*) from Seamer Carr. Measurements are in millimetres. Definitions follow von den Driesch (1976) except metacarpal Dp, which follows Legge and Rowley-Conwy 1988, 124.*

Site	Element	Measurements		
C	maxilla, left and right	M row: 38.4		
U/M	scapula, right	GLP: --	BG: --	SLC: 18.0
U/M	scapula, right	GLP: --	BG: 19.6	SLC: 17.5
B	distal radius, left	Bd: 27.1	BFd: 25.7	
K Phase VI	proximal metacarpal, left	Bp: 20.4	Dp: 15.4	

consequence of later human activities, including peat cutting and ditch laying. Such measurements as could be taken are listed in Tables 16.2–16.4.

No evidence from the aurochs indicates its season of death. The only seasonal indicator from Site B is the unworn red deer dp4. This must have come from an animal that died at or very shortly after birth, and therefore probably indicates the month of June.

Table 16.5. *Faunal remains from Seamer Carr Site C.*

Element	Species					
	Aurochs	Horse	Roe Deer	Red Deer	Elk	Unidentified
Skull	1					
Maxilla	2		2			
Mandible	4			1		
Teeth		16		2		
Atlas					1	
Scapula	2					
Rib	2					
Humerus		1		1		
Ulna	2					
Metacarpal	2					
Pelvis				1		
Femur	1			2		
Tibia	1					
Astragalus	4					
Metatarsal	1			1	1	
Unidentified fragments						78
Total	**22**	**17**	**2**	**8**	**2**	**129**

Mammal bones from Site C

Various species are represented at Site C (Table 16.5). Aurochs have produced more fragments than the others, as follows:

Mandibular fragment, left, with P3, P4, M1 and M2
Mandibular M1 or M2
Mandibular fragment (no teeth) and mandibular hinge, both left
Maxillary M3, left, broken, and maxillary M1 or M2, right, unworn
Scapula, left (and right blade fragment)
Ulna, right, two examples
Metacarpal, proximal and distal ends, both left
Femur, shaft fragment, right
Tibia, distal end, right, and left shaft fragment
Metatarsal, proximal, right.

In addition, the following bones came from aurochs or elk; in view of the relative rarity of elk this probably means aurochs:

Skull fragment
Rib fragments, 2
Tibia shaft fragments, 2
Astragalus fragment, left

Four of these items were measurable (Table 16.1). Comparison reveals that all four come from females. The scapula is quite clear; measurement BG forms the vertical axis of the left chart in Fig. 16.1, and the measurement of 58.3 falls in the female range. The distal tibia is equally unambiguous: Fig. 16.3 shows that it falls toward the lower end of the female range. For distal metacarpal, Degerbøl and Fredskild (1970, table 11) list no males with a distal width (corresponding to Bd of von den Driesch 1976) below 80 mm; the Site C specimen at 72.9 mm falls in the middle of the Danish female range. For proximal metatarsal, the smallest proximal breadth (= Bp) for Danish males is 64 mm (*ibid*., table 12), so the Site C specimen again falls into the female range.

The skeletal distribution of the aurochs material is shown in Fig. 16.2. The following points should be noted. The mandible and scapula at Site C are from the left side, although the right ones are shaded in Fig. 16.3 for the sake of visibility. Both ulnas at Site C are right side, rather than one of each as portrayed in the figure, and the rib, tibia and astragalus fragments that could not be definitively identified as aurochs are included.

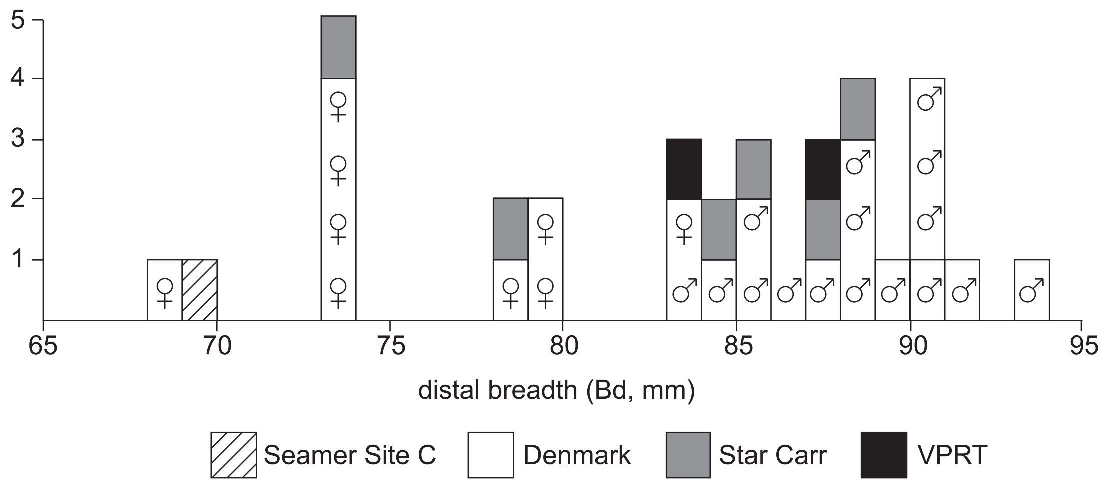

Figure 16.3. *Dimensions of aurochs tibias, comparing the Seamer Site C specimen with those from Star Carr (Legge and Rowley-Conwy 1988, table 8), the VPRT excavations elsewhere in the Vale (see Chapter 17), and Danish specimens of known sex (Degerbøl and Fredskild 1970, table 17).*

It is remarkable how complementary this skeletal distribution is to that from the suspected kill site at Site B (Fig. 16.2). Most of the items from Site C are the more meat-rich limb bones, those most likely to have been removed from a kill and transported elsewhere for further processing and/or consumption (though the site C bones probably do not all come from one individual). The distribution thus supports the interpretation of Site C as a residential site even though the sample is small, and by virtue of the contrast serves to emphasize the different representation at Site B. The complementarity is by no means perfect (for example, maxillary fragments were found at both sites), but this need not invalidate the comparison. Heads (particularly of large animals) may be prized independently of their food value (Binford 1984), so transport decisions may be variable.

The contrast between kill-site and processing/consumption location emerges very well from a study of the animal bones from Bedburg-Königshoven in Germany (Street 1991). This site dates from the start of the Holocene and is thus closely contemporary to the Early Mesolithic at Seamer Carr. The pattern of bone representation is almost exactly complementary to that at the kill-site of Potsdam-Schlaatz discussed above. Bedburg-Königshoven is dominated by forelimbs (from scapula to phalanges), hindlimbs (from pelvis to phalanges), and by skulls, while the rest of the axial skeleton (except for some ribs) was not being brought back to the site (*ibid*., fig. 24.6). The only major overlap between the Potsdam-Schlaatz kill site and the Bedburg-Königshoven settlement is the skull, present at the settlement but abandoned at the kill site. It must be stressed that the Site C sample is much smaller than that from Bedburg-Königshoven, and the comparison with Site B less 'neat', but the degree of complementarity revealed in Fig. 16.2 nevertheless hints that a similar dichotomy may be present.

The other bones from Site C are as follows:

Horse:	Premolars and molars, lower right, 6 examples
	Premolar or molar, lower left, 1 example
	Premolars and molars, upper right, 7 examples
	Premolars and molars, upper left, 2 examples
	Humerus, shaft splinter, left
Roe deer:	Maxilla, left and right
Red deer:	M3, lower right, 2 examples
	Mandible fragment, no teeth, left
	Humerus, distal, left
	Pelvis, left
	Femur, shaft fragments, 2 examples
	Metatarsal, distal, right
Elk:	Atlas vertebra
	Astragalus, left
Unidentified fragments:	78

Such measurements as could be taken are listed in Tables 16.2–16.4. The lower right horse teeth include one P2, but no M3. In between these easily identifiable teeth in the horse jaw there are four premolars and molars (P3, P4, M1 and M2) which are difficult to separate. There were five such lower right teeth, indicating the presence of at least two tooth rows. The same is true of the upper right teeth. At least two horse heads were therefore involved in generating the Site C teeth. The red deer mandible fragment has a cut mark. The elk atlas vertebra was from an unstratified context.

Some seasonal information, albeit uncertain, is available. In the aurochs jaw fragment, P4 is erupted level with the jawbone (stage E). The most reliable indications are that in modern domestic cattle this dental stage occurs at around 36 months (Silver 1969, table D; Higham 1967, appendix A). If it is assumed that Early Holocene aurochs were born in late spring or early summer, then the Site C individual was killed in the warmer part of the year.

The roe deer maxilla had its M3 teeth just coming into wear, with the rear cusp unworn (stage JU). M3 comes into wear when the animal is around 11–12 months old (Legge and Rowley-Conwy 1988), so this Site C specimen was also apparently killed in the warmer time of the year. Of the two red deer lower M3s, one is completely unworn (stage UUU), one is just worn on the anterior cusp (stage JUU). The unworn specimen is not particularly helpful as Legge and Rowley-Conwy (1988, table 5) list modern comparatives showing that tooth formation is already under way in the animal's second winter (i.e. around 18 months of age). Such a jaw, if broken, would release an unworn M3, though the roots would probably not be completely formed. The M3 erupts through the spring and summer of the animal's second year, and while most are in wear by late summer very occasionally specimens may remain unworn into their third winter. The specimen in stage JUU is a little more amenable; M3s are usually in this stage in the animal's second summer, but occasionally may not reach this stage until the subsequent winter. What can be said is that the JUU specimen is more likely to indicate the warmer part of the year than the colder, while the UUU specimen could also derive from the summer but is even less certain.

These seasonal indicators are few, and mostly uncertain. Given an adequate sample of juvenile mandibles, loose teeth would not be used at all, because the dentition as a whole is much more useful. But these are scarce at Seamer Carr, and we must use what we have while exercising due caution. Unfortunately, none of the items discussed here is amenable to the radiographic technique employed by Carter (1997, 1998).

Mammal bones from Site K

Site K was reoccupied repeatedly from the Final Palaeolithic into the Mesolithic. The bone assemblage is not large (Table 16.6), and when subdivided among the various phases (see Chapter 7 for discussion) it becomes too small to be very informative.

From Phase I (Windermere Interstadial deposits, contexts [5091]) the following bones were found:

Horse: Humerus, distal, right

Red deer: Radius, shaft fragment, left

Elk: Humerus, distal, left

Aurochs: Metatarsal, proximal, right

Unidentified fragments: 11

Table 16.6. *Faunal remains from Seamer Carr Sites K, L & N.*

	Species									
Element	**Aurochs**	**Horse**	**Roe Deer**	**Red Deer**	**Elk**	**Dog**	**Fox**	**Otter**	**Bird**	**Unidentified**
Antler				1						
Skull										
Maxilla										
Mandible		1		1				1		
Teeth		4	1	3			2			
Atlas										
Vertebrae		1		1		6				
Scapula										
Rib										
Humerus		1		1	1					
Radius				3						
Ulna										
Metacarpal			1	1						
Pelvis			1							
Sacrum				1						
Femur										
Tibia				3						
Astragalus										
Metatarsal	1									
Metapodial				2						
Phalanx				1						
Unidentified										59
Fragments									1	
Total	1	7	3	18	1	6	2	1	1	59

From Phase II, the Loch Lomond Stadial, came only two unidentified fragments. From Phase VI, the initial Mesolithic, came one red deer bone, a left distal tibia, and 8 unidentified fragments.

The following bones came from Phase V, the main Early Mesolithic occupation (contexts [5012/5067]):

Horse: Incisor, lower, right
Caudal vertebra

Red deer: Radius, distal, left
Metacarpal, distal, left
Tibia, shaft fragment (with cut mark)
Metapodial, shaft fragment
Antler base, left, attached to pedicel
(and other antler fragments)

Roe deer Pelvis, left and right

Unidentified bird: 1 fragment

Unidentified fragments: 28

Finally, Phase VI, the early part of the Late Mesolithic (context [5005]), produced the following:

Roe deer: Metacarpal, proximal, left

Red deer: Humerus, distal, right
Radius, shaft fragment
Tibia, distal, right
Metapodial, shaft fragment

Otter: Mandible fragment, right, no teeth
(uncertain identification)

Unidentified fragments: 10

This is a disappointingly small total from the only site that spans the Late Glacial and the Early Holocene. It is interesting that the only carnivore from Seamer Carr other than the dog and possible fox from Site L does not come from the main Early Mesolithic occupation, but from the Late Mesolithic. The antler base attached to its pedicel (Fig. 16.4) comes from a red deer killed sometime between about September and about April, though as

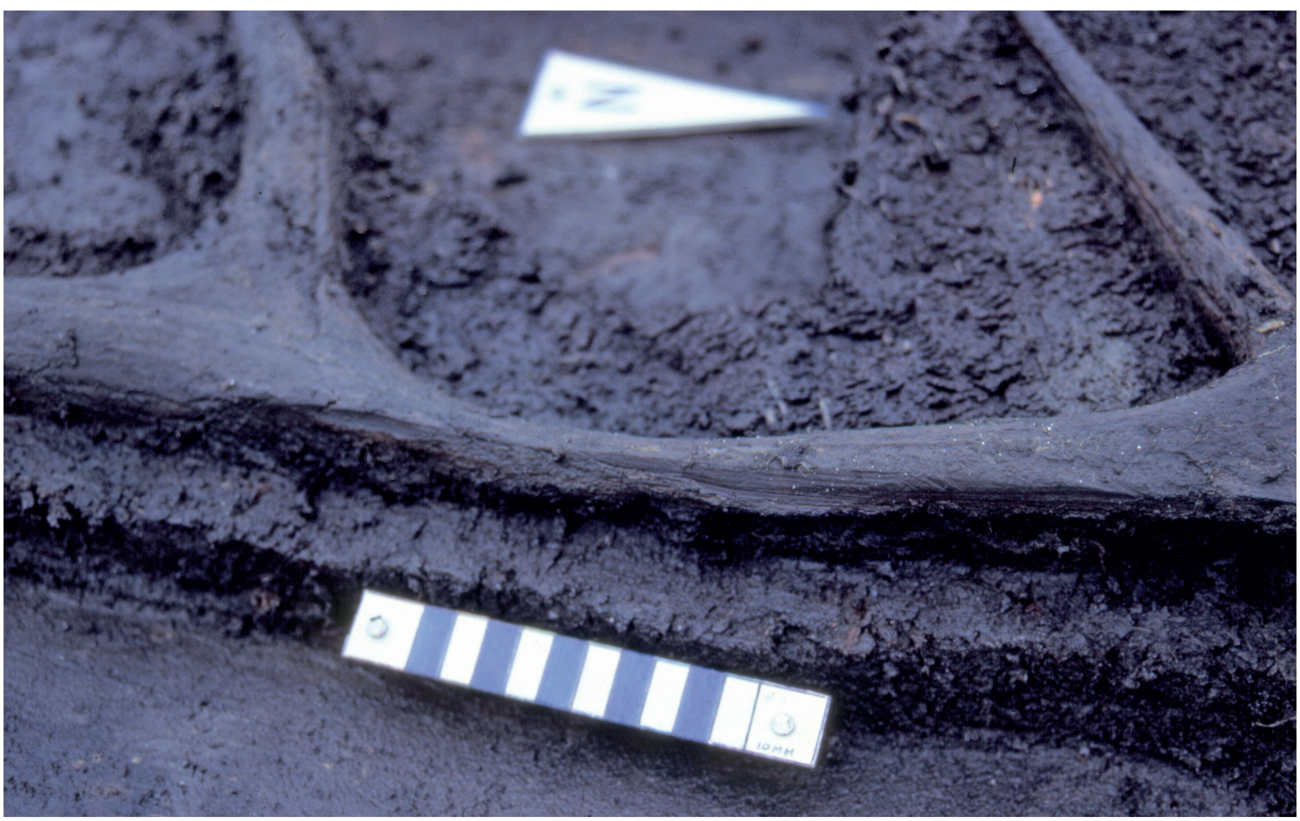

Figure 16.4. *Antler (Finds no. 16425) under excavation on Site K from* Phragmites *reed peat (context 5067), 1984 (Photo Simon Everson).*

repeatedly stressed, the utility of antler as a raw material means that it may have been transported, cached, and exchanged, so that season of death gives no indication of season of deposition (Legge and Rowley-Conwy 1988, Rowley-Conwy 1998; cf. Noe-Nygaard 1995).

Mammal bones from Sites L & N

The following bones were recovered from Site L & N (Table 16.6); the majority were recovered from either a humic sandy deposit [5012/5100] representing the Early Mesolithic horizon, or at the interface between this horizon and overlying wood peat [5005] formed during the later phases of the Early Mesolithic (see Chapter 7 for discussion of the phasing of these deposits).

Horse: Premolars and molars, lower right, 3 examples (Site L, context 5012/5100)
Mandible, left (Clutton-Brock and Burleigh 1991) (Site L, context 5012/5100)

Dog: 6 cervical vertebrae (Clutton-Brock and Noe-Nygaard 1990) (Site N, context 5012/5005 interface)

Fox: Premolars 2 and 3, upper left (uncertain identification). (Site L, context 5005)

Red deer: Mandible, left, containing P4, M1 and M2 (Site L, context 5012)
P4 and M3, lower left (Site L, context 5012)
2 premolars and 2 molars, upper right (Site L, context 5012)
3 premolars and 3 molars, upper left (Site L, context 5012)
Thoracic vertebrae, 2 examples (Site L, context 5012)
Sacrum (Site L, context 5012)
2nd phalanx (Site L, context 5055)

Roe deer: 2 molars, upper right (Site L, context 5012)

Unidentified fragments: 26

The horse mandible was directly dated to 9990–9930 cal BC (at 1% probability) or 9880–8710 cal BC (at 94.4% probability (9790±180 BP; BM 2350), the dog vertebrae to 9860–9249 cal BC (9940±100 BP; OxA-1030) (Clutton-Brock and Noe-Nygaard 1990). For the sake of completeness, the horse mandible measurements are reproduced in Table 16.7.

Table 16.7. *Measurements in mm of the horse jaw from Site L. Measurements reproduced from Clutton-Brock and Burleigh (1991, table 1). Bracketed measurement is estimated.*

Element	Measurements			
mandible, left	1:	gonion caudale – infradentale		380
	2:	condyle to infradentale		430
	3:	gonion caudale – aboral border of M3 alveolus		130
	4:	aboral border of M3 alveolus – infradentale		281
	5:	gonion caudale – oral border of P2 alveolus		294
	6:	cheek tooth row, alveolar		168
	6a:	cheek tooth row, near biting surface		162
	7:	molar row, alveolar		81.5
	7a:	molar row, near biting surface		78
	8:	premolar row, alveolar		85
	8a:	premolar row, near biting surface		85
	9:	P2:	L 28.9 B 16.3	
	10:	P3:	L 26.0 B 17.8	
	11:	P4:	L 25.1 B 16.4	
	12:	M1:	L 25.2 B 17.7	
	13:	M2:	L 25.5 B 16.6	
	14:	M3:	L 31.5 B 13.0	
	15:	diastema		90.4
	16:	breadth of incisor curvature, alveolar		64.3
	17:	breadth of incisor curvature, near biting surface		64.9
	18:	smallest breadth of two halves, near diastema		43.6
	19:	gonion ventrale – highest point of condyle		233.5
	20:	gonion ventrale – deepest point of mandibular notch		203
	21:	gonion ventrale – coronion		(240)
	22a:	height of mandible behind M3		102.6
	22b:	height of mandible in front of M1		76
	22c:	height of mandible in front of P2		57

Bones from Slot Trenches U and M

A small assemblage was recovered from these trenches, comprising:

Roe deer: Scapula, right, 2 examples

Red deer: Calcaneum, distal portion, right
Antler base, naturally shed

Aurochs: 3rd phalanx
Atlas vertebra

Unidentified fragments: 7

The red deer shed antler must have been picked up some time after about April, but the difficulty of using this as evidence of the season of deposition is again stressed.

Discussion

The assemblages are too small to allow much conventional analysis of the type applied to larger collections. However, they are interesting in a number of ways.

Firstly, they provide a glimpse into a large area of (mostly) Early Mesolithic landscape, and show the nature of the background scatters and minor concentrations of bones in areas away from large bone dumps. This is important in broadening our vision away from just the large assemblages, forming as they do the major nodes in our notion of Mesolithic land use. The Seamer Carr assemblages join those from elsewhere around the lake (see Chapter 17) in revealing the complexities of bone deposition across the landscape.

Secondly, in failing to produce 'more Star Carrs', Seamer Carr and the rest of the Vale highlight even more the unusual nature of the Star Carr site. It becomes ever more pressing to ask: why was such a large assemblage found there, and not elsewhere? The Seamer Carr Project and VPRT excavations have revealed numerous contexts in which large assemblages *could* have been preserved – but were not present. As the excavations reported here take their place alongside Clark's Star Carr site (Clark 1954; Mellars and Dark 1998), so Star Carr needs additional explanations (see Knight et al. 2018a, 2018b).

Thirdly, despite the small samples listed above, it is clear that the Seamer Carr area was repeatedly visited and used, to an extent not seen anywhere else in the Vale of Pickering. Site K contains components running from the Final Palaeolithic to the early part of the Late Mesolithic, and Seamer Carr is the only place around the lake so far known where this is the case. Such continuity of visiting may imply a continuity of function, something that the animal bones however can supply only the barest hint of. It is curious that the few seasonal indicators mentioned above, such as they are, could all indicate occupation in the warmer months of the year. A few bones were recovered from 'off-site' contexts, and these include four fragments from three red deer pelvises, all of them new-born. These also are probably from animals that died in the summer. A hypothesis for future discussion is therefore that human activities at and between the various sites at Seamer Carr took place more often during the summer.

Acknowledgement

We would like to thank Richard Sabin of the Natural History Museum for permission for Uchiyama to examine the material, and much assistance while this work was undertaken, and also for responding rapidly and helpfully to Rowley-Conwy's queries while this chapter was being written.

Chapter 17

Mammal remains from the Vale of Pickering Research Trust excavations, Yorkshire, 1985–98

Peter Rowley-Conwy, Junzo Uchiyama, Sue Stallibrass & Tony Legge†

This chapter will present the animal bones from the excavations by the VPRT at the following sites: VP 'D' (see Chapter 9), Flixton Island (Chapter 10), No Name Hill (Chapter 11), Barry's Island (Chapter 12), and Flixton School Field and Flixton School House Farm (Chapter 13). It will, therefore, cover all the Mesolithic animal bones from the sites around Lake Flixton except for the following four groups: (1) the fauna from the original excavations at Star Carr, published by Fraser and King (1954) and re-analysed by Legge and Rowley-Conwy (1988); (2) a small assemblage from excavations at Star Carr in 1985 and 1989, published by Rowley-Conwy (1998); (3) the assemblages from Seamer Carr described by Uchiyama et al. (Chapter 16); and (4) the large assemblage recorded during the most recent excavations at Star Carr (Knight et al. 2018 a and b). The first author has identified all the material described here except the material from the 1995 excavations, which was identified by Junzo Uchiyama, and the sample from VP D, identified by the late Tony Legge. These identifications have been incorporated into the present study. Also included in the study is a sample of bones from Ling Lane, around J.W. Moore's Site 10, excavated by Northern Archaeological Associates in 1996 and analysed by Sue Stallibrass (see Figure 1.1a for all site locations).

The VPRT's survey and excavation policy has been avowedly landscape rather than site oriented. The results have amply justified this approach at least insofar as the animal bones are concerned, as the sampling strategy employed by the Trust located many more assemblages than fieldwalking or chance could ever have revealed. The NAA excavations of the Ling Lane area employed 1 × 1 m test-pits over most of the area, with a longer trench crossing Moore's Site 10. The recovered assemblages often come from small-scale activity loci, and as a result it is becoming possible to build up a much more varied and detailed picture of faunal utilization round the shore of the former Lake Flixton. The approach also causes its own problems, however. Small assemblages are more difficult to interpret because they rarely contain samples large enough to be statistically reliable. Furthermore, the problem of contemporaneity becomes particularly acute: were the numerous small sites occupied at the same time or not? Radiocarbon dating can sometimes demonstrate that sites were *not* contemporary, if the age ranges do not overlap, but it can never demonstrate that they *were* contemporary given that sites producing identical ages may in reality have been occupied decades apart in time, and indeed sites occupied in one and the same year can produce mean ages some decades apart.

But the fact that we are potentially concerned with time spans in the order only of decades reveals the level of detail that landscape-oriented projects such as this can consider, though not in this case resolve. When our information comes from just a few large sites, nodal points widely separated in both space and time, our models of landscape and resource use are perforce both generalized and normative. As such, we must take a broad view and admit that it is out of focus. In the case of the VPRT's project there is still much fuzziness, for the reasons mentioned, but this fuzziness occurs at a closer level of resolution, hence our need to worry about time spans as short as decades even though we cannot measure them. As anthropological studies of hunter-gatherers move towards an emphasis on the adaptive and social history of the individual group, so that discipline too is considering time spans in the order of decades and longer. The focus of some anthropological and archaeological work on hunter-gatherers is thus beginning to converge. As the anthropological trend develops, and as archaeological dating and other methods become more finely tuned, the time when the two disciplines will be able to speak to each other in the same terms is perhaps not impossibly far off.

The animal bone assemblages

Seven concentrations of animal bones are considered here. None of these is large; between them, they have produced fewer than half the number of Minimum Animal Units (MAU – see below) than the single assemblage from Star Carr. In the light of the above discussion, the question arises immediately: to what extent can the excavated groups be considered to represent 'sites' or 'activity areas'? This question can only partially be answered at the moment, as Barry's Island demonstrates. The island is an irregular oval some 200 m long and about half that broad, and the 2 × 2 m test-pits that revealed this are distributed all the way round the shore of the island. Most of these did not however produce any animal bone, reducing the problem somewhat, but even the two main trenched areas on the island are nearly 100 m apart. To what extent is it justifiable to consider the bones as a single assemblage? If future excavations in the intervening area reveal a continuous scatter of material, we could conclude that we were dealing with a single assemblage, albeit perhaps encompassing many activity areas and local variation, which might also shift in focus through time if the use of particular areas changed. If on the other hand the intervening area contained little or no material, we might conclude that the fauna should be considered as two separate assemblages, particularly if they were of different dates. At the moment, there are arguments in both directions. From the perspective of small-scale spatial variability, each area should be considered separately, but this leaves the assemblage at the bottom end of what is statistically usable! The bone groups are, therefore, combined where possible, and the Barry's Island fauna is (with one exception) considered as a single assemblage for quantitative purposes.

The exceptional part of the Barry's Island bone group is the sample from the trapped sand layer in the peat in the northern trenched area. When this sand was deposited it was carrying with it animal bones which have been directly dated to the Final Palaeolithic, the Early Mesolithic and the Late Mesolithic (see Chapter 12), as well as worked flint of both Early and Late Mesolithic type (Chapter 15), and a bone artefact that is typologically likely to be Early Mesolithic (see below). Although this sample forms a coherent excavated assemblage, it is therefore of demonstrably heterogeneous origin. Short of directly dating each bone fragment, there is no way of subdividing the material, so it is here treated as an assemblage for the purposes of presentation, but not interpretation.

Material from the lower peat at Barry's Island is more homogeneous and can all be considered Early Mesolithic. It therefore forms the main assemblage from this site. In addition, six other areas yielded samples of animal bones. The assemblages and the number of bone fragments recovered from each are as follows (Table 17.1):

Table 17.1. *Number of bone fragments recovered from the VPRT and NAA excavations.*

Site name	Number
Flixton Island	33
No Name Hill	85
Flixton School Field	162
Flixton School House Farm	69
VP-D	50
Barry's Island (main sample)	312
Barry's Island (sand layer)	279
Ling Lane	16

Recovery and preservation

Recovery was to the highest modern standards, with all bones recovered during excavation by hand (see Chapter 3 on excavation methods). When broken bones were encountered that appeared to come from the same fragment, lay closely adjacent to each other, or could not be lifted intact due to poor preservation, they were given a single find number and bagged together. Reconstruction could therefore be undertaken when necessary.

Preservation is a major cause for concern. Some fragments were preserved moderately well, some very poorly. In no case did they approach that for which Star Carr is famed. Bone fragments from Ling Lane were moderately well preserved in the area of Moore's Site 10, but preservation deteriorated in the test-pits further up the slope. Bones from No Name Hill were particularly badly preserved, and some bone loss could be directly demonstrated. For example, three wild boar mandibular teeth were recovered from trench NAZ, left and right first incisors and a left second incisor. In the jaw these are all next to one another. They lay like this in the ground and were recovered on a small block of peat retaining their original anatomical position (a nice example of high-quality excavation yielding informational dividends). The teeth must therefore have been deposited in a fragment of jawbone that did not survive. Other examples of juxtaposed teeth are considered below.

At what point did the missing mandibular fragment decay into nothing? There are three reasons why preservation at the VPRT excavations may be worse than that at Star Carr. Firstly, there may be broad differences across the Vale of Pickering. This cannot be ruled out, although it is unclear why bones in waterlogged peat away from Star Carr should be poorly preserved. Secondly, preservation is likely to be better the deeper into the waterlogged peat a bone is found, while dry land preservation will be less good. Since the VPRT excavations have largely followed the shore of Lake Flixton, this is a possibility. Perhaps excavations into the deeper peat further offshore might reveal larger, better-preserved assemblages since bones were sometimes dumped into lakes (this is certainly the case at the spectacular Late Mesolithic site of Ringkloster in Denmark, where no bone was preserved on the actual settlement area which lay on the dry ground (Andersen 1998)). Crucial to this is the nature of the Star Carr site itself. If this was a dump of material in the offshore zone this might explain why it was relatively well preserved. Grahame Clark regarded the site as the actual living area, however, not as a dump (Clark 1954). Subsequent opinions have been divided: Price (1982), followed by Legge and Rowley-Conwy (1988) supported the off-shore dump interpretation. The recent excavations of Star Carr however strongly indicate that the site was the residential area itself (Mellars 1998, Milner et al. 2018a and b). If so, there are fewer grounds for concluding that Star Carr should have better preservation than the VPRT sites.

The third possible reason is temporal, namely that conditions of preservation around the former lake have deteriorated since Clark excavated at Star Carr. This is the most likely reason, as the three wild boar incisors mentioned above suggest. The mandibular bone surrounding them has disappeared at some point between deposition and excavation. Had preservational conditions remained constant throughout this period, decay would have begun as soon as the fragment was deposited. It is inconceivable that the bone could have slowly been destroyed at a constant rate over the intervening ten millennia; this would demand a very slow-acting effect which did not mark the teeth, and which coincidentally just completed its course at the time of excavation. It seems certain that the bone was destroyed more quickly. Had this happened in say the decade or the century after deposition, the teeth would long since also have perished. The conclusion must therefore be that the bone has decayed in the very recent past, so recently that the more resistant teeth still survive. This is consistent with the poor preservation of many of the other bone fragments, particularly their surfaces.

The rapid recent lowering of the water-table in the Vale of Pickering is thus undoubtedly destroying organic material that has hitherto survived for 11,000 years. The future can only be regarded with foreboding.

Quantification

All bone fragments from the VPRT excavations to date were examined except for No Name Hill, from which a portion of the assemblage only is presented. All fragments identified to species are listed in Table 17.2, divided into major anatomical categories. This Number of Identified Specimens (NISP) is the most basic count of fragments.

Sheep teeth were encountered in two contexts. A group of seven teeth, probably from the same individual but with no surviving mandibular or maxillary bone, came from trench LG at Barry's Island (main sample). They were recovered from layer [9059], higher up in the deposits than the other bones from this trench. The top of layer [9059] was fissured, and the teeth might date from a more recent period even than the layer itself. The single tooth from No Name Hill was an unstratified find. These sheep teeth are therefore not likely to date from the Mesolithic and are not considered further.

Among the other species the table reveals considerable variation. Red deer is the most common species at all sites except Flixton School Field, where it is outnumbered by aurochs. Horse, pig and dog are rare and appear only at some of the sites. The other species are present at all sites, except for roe deer which is not present at Flixton Island or Ling Lane. These are the two smallest assemblages, and the absence may well be due to chance.

Fragments not identified to species are presented in Table 17.3, divided where possible into animal size category and anatomical region. Inevitably this is a less certain tabulation; the 'large' category subsumes elk and aurochs, and some bones are ambiguous and therefore placed in 'roe deer/red deer' or 'red deer/large' overlap categories. Many unidentified fragments cannot be classified even in this way. Red deer sized fragments are again the most common, with limb fragments predominating throughout.

It is however partly a matter of chance whether a fragment is definitely identified as, for instance, red deer, or merely goes into the 'red deer size' category. This is particularly the case with limb diaphyseal (shaft) fragments. Quite small shaft fragments from the metatarsal and parts of the tibia are, for example, instantly recognizable, while similar sized or large ones from other limb bones are not. Many zooarchaeologists therefore prefer a categorization that minimizes the effect of differential fragmentation and recognizability. This method of quantification, involving Minimum Animal Units (MAUs), modifies the fragment count for each element (left and right) in the same way as the Minimum Number of Individuals (MNI) is calculated. The left and right totals for all elements in the skeleton

Table 17.2. *Number of Identified Specimens (NISP) from the VPRT excavations.*

Fragment type	Flixton Island	No Name Hill	VP D	Ling Lane	Flixton School Field	Flixton School House Farm	Barry's Island (sand layer)	Barry's Island (main sample)
Roe deer								
limb articulations	-	-	3	-	1	2	-	4
limb splinters	-	-	7	-	-	-	2	1
dental	-	3	-	-	-	2	-	1
Total	**0**	**3**	**10**	**0**	**1**	**4**	**2**	**6**
Red deer								
limb articulations	1	1	2	2	15	11	13	34
limb splinters	-	3	4	-	6	1	19	18
dental	4	3	-	1	2	8	24	17
antler fragments	-	4	4	-	-	-	1	2
atlas vertebra lumbar vertebra	- -	- -	- 1	- -	- -	- -	1 -	- -
sacrum	-	-	-	-	-	-	2	-
carpals astragalus	- -	- -	- 2	2 1	- -	- -	- -	- -
calcaneum	-	-	-	1	-	-	-	-
3rd phalanx	-	-	-	1	-	-	-	-
Total	**5**	**11**	**13**	**8**	**23**	**20**	**60**	**71**
Elk								
limb articulations	-	6	3	2	3	1	-	4
limb splinters	-	2	-	-	2	-	-	-
dental	-	7	-	-	-	1	-	1
1st phalanx	-	-	-	1	-	-	-	-
Total	**0**	**15**	**3**	**3**	**5**	**2**	**0**	**5**
Aurochs								
limb articulations	1	1	-	2	7	3	2	6
limb splinters	-	-	2	3	1	-	-	1
dental	-	5	1	-	15	4	2	4
horn core fragments	-	-	-	-	4	-	-	-
calcaneum	-	-	1	-	-	-	-	-
Total	**1**	**6**	**4**	**5**	**27**	**7**	**4**	**11**
horse								
dental	-	4	-	-	-	4	5	-
Pig								
limb articulations	-	-	1	-	1	-	-	-
dental	-	3	-	-	-	-	-	-
Dog								
limb, dental, skull	-	-		-	6	-	1	-
Cat								
dental	-	-	1	-	-	-	-	-
Sheep/goat								
dental	-	1		-	-	-	-	7
Site total	**6**	**43**	**32**	**16**	**63**	**37**	**72**	**100**

Table 17.3. *Unidentified fragments from VPRT excavations, divided where possible into approximate animal size class and anatomical region.*

Fragment type	Flixton Island	No Name Hill	VP-D	Ling Lane	Flixton School Field	Flixton School House Farm	Barry's Island (sand layer)	Barry's Island (main sample)
Roe deer size								
limb	5	2	3	-	2	-	15	8
skull/jaw	-	-		-	-	-	-	1
vertebra	-	-		-	-	-	-	1
rib	-	-		-	-	-	-	4
Total	**5**	**2**	**3**	**0**	**2**	**0**	**15**	**14**
Roe/red deer size								
limb	1	-	3	-	-	-	9	4
skull/jaw	-	-		-	-	-	-	1
rib	-	-		-	-	-	1	7
Total	**1**	**0**	**3**	**0**	**0**	**0**	**10**	**12**
Red deer size								
limb	19	4	2	-	19	11	121	81
skull/jaw	-	-		-	-	-	4	3
vertebra	-	1		-	-	-	5	11
rib	-	-		-	1	1	7	8
Total	**19**	**5**	**2**	**0**	**20**	**12**	**137**	**103**
Red deer/large size								
limb	1	3	-	-	3	1	3	4
vertebra	1	-	-	-	-	-	-	1
Total	**2**	**3**	**0**	**0**	**3**	**1**	**3**	**5**
Large size								
limb	-	2	2	1	4	2	4	5
skull/jaw	-	-	-	-	1	-	-	-
vertebra	-	-	-	-	-	-	-	3
rib	-	-	1	-	5	-	1	2
Total	**0**	**2**	**3**	**1**	**10**	**2**	**5**	**10**
Unclassified								
fragment	-	30	8	2	64	17	37	68
Site total	**27**	**42**	**16**	**3**	**99**	**32**	**207**	**212**

are then summed. The method aims to overcome differences in skeletal part numbers between species (e.g. wild boar have more metapodials than ungulates), and also differential fragmentation between species. Shaft fragments are ignored; fragments of limb articulations, jaws etc. are expressed as the minimum number of elements from which the fragments could have come; items like the atlas vertebra and sacrum are doubled to bring them into line with limb bone articulations, while phalanges are divided by four – hence the fractions in the Tables 17.4–17.9. This was the method used for their reconsideration of the Star Carr bones by Legge and Rowley-Conwy (1988). Binford (1978) put forward the method under the designation MNI, but he later changed the designation to MAU to avoid confusion with the more common meaning of MNI (the Minimum Number of Animals it took to generate a site assemblage rather than a particular element).

This quantification has the effect of further reducing the already small numbers in the VPRT assemblages, but for the sake of completeness is carried out in the following. Table 17.4 presents the figures for Barry's Island (main sample), listing every potential element even if none are present; the subsequent tables omit elements not present at that site. The figures from all the sites are very small. This causes a particular

Table 17.4. *Minimum Animal Units (MAU) from Barry's Island (main sample). A star indicates that although no MAU can be calculated because no articular ends were present, shaft fragments of the element were nevertheless present. P = proximal, D = distal.*

Element	Roe Deer	Red Deer	Elk	Aurochs	Horse	Sheep
mandible	1	5	1	2	1	1
maxilla	-	3	-	-	1	1
atlas	-	-	-	-	-	-
axis	-	-	-	-	-	-
sacrum	-	-	-	-	-	-
scapula	-	1	-	-	-	-
humerus P	-	2	-	-	-	-
humerus D	1	3	-	-	-	-
radius P	-	2	-	1	-	-
ulna	1	1	-	-	-	-
radius D	-	-	-	-	-	-
carpals	-	-	-	1	-	-
m/carpal P	-	1	1	1	-	-
m/carpal D	-	1	-	-	-	-
pelvis	1	9	1	-	-	-
femur P	-	-	-	-	-	-
femur D	-	-	-	-	-	-
tibia P	*	2	-	*	-	-
tibia D	*	3	1	*	-	-
astragalus	-	2	-	-	-	-
calcaneum	-	1	-	1	-	-
nav-cuboid	-	1	1	-	-	-
lat cuneiform	-	-	-	1	-	-
m/tarsal P	1	*	-	-	-	-
m/tarsal D	1	*	-	-	-	-
phalanx 1	-	0.5	-	0.25	-	-
phalanx 2	-	-	-	0.25	-	-
phalanx 3	-	-	-	-	-	-
Total	**6**	**37.5**	**5**	**7.5**	**2**	**2**

problem not encountered in larger assemblages, as in some cases no MAU fragments are present from an element, though one or more shaft fragments testify to the presence of that element at the site. Thus, no articular fragments of aurochs tibias, roe deer tibias, or red deer metatarsals were recovered (Table 17.3), so no MAU can be calculated. However, unquantifiable shaft fragments of all three were recovered. Such present but unquantifiable elements are therefore starred in the MAU tables.

Tables 17.4–17.11 present the MAU totals from the six sites. The smaller assemblages, No Name Hill

Table 17.5. *Minimum Animal Units (MAU) from Barry's Island (sand layer). P = proximal, D = distal. * see caption to Table 17.4.*

Element	Roe Deer	Red Deer	Aurochs	Dog
mandible	-	11	1	1
maxilla	-	4	-	-
atlas	-	2	-	-
sacrum	-	4	-	-
scapula	-	3	-	-
humerus D	-	1	-	-
ulna	-	2	-	-
m/carpal P	-	1	-	-
pelvis	-	1	1	-
femur D	-	1	-	-
tibia D	-	-	1	-
astragalus	-	2	-	-
m/tarsal P	*	*	-	-
m/tarsal D	*	*	-	-
phalanx 1	-	0.5	-	-
Total	*	**32.5**	**3**	**1**

Table 17.6. *Minimum Animal Units (MAU) from Flixton School Field. P = proximal, D = distal. * see caption to Table 17.4.*

Element	Roe Deer	Red Deer	Elk	Aurochs	Pig	Dog
mandible	-	2		1	-	1
maxilla	-	-	-	4	1	-
humerus D	-	2	-	-	-	-
radius P	-	-	-	1	-	1
radius D	-	1	-	-	-	-
carpals	-	4	1	-	-	-
m/carpal P	-	-	*	-	-	-
m/carpal D	-	-	*	-	-	-
femur P	-	-	1	1	-	1
femur D	1	-		-	-	1
tibia P	-	1	*	-	-	1
tibia D	-	1	*	1	-	1
astragalus	-	1	-	-	-	-
calcaneum	-	1	-	-	-	-
lat cuneiform	-	-	-	1	-	-
m/tarsal P	-	*	-	-	-	-
m/tarsal D	-	*	-	-	-	-
phalanx 3	-	-	-	0.25	-	-
Total	**1**	**13**	**2**	**9.25**	**1**	**6**

Table 17.7. *Minimum Animal Units (MAU) from Flixton School House Farm. P = proximal, D = distal. * see caption to Table 17.4.*

Element	Roe Deer	Red Deer	Elk	Aurochs	Horse
mandible	1	1	-	-	1
maxilla	1	1	1	1	-
humerus D	1	1	-	-	-
radius P	1	2	-	-	-
radius D	-	1	1	-	-
carpals	-	1	-	-	-
m/carpal D	-	-	-	1	-
tibia D	-	1	-	1	-
astragalus	-	1	-	-	-
calcaneum	-	1	-	-	-
lat cuneiform	-	-	-	1	-
m/tarsal P	-	*	-	-	-
m/tarsal D	-	*	-	-	-
phalanx 1	-	0.5	-	-	-
phalanx 2	-	0.25	-	-	-
Total	**4**	**10.75**	**2**	**4**	**1**

Table 17.8. *Minimum Animal Units (MAU) from No Name Hill (part of assemblage only). P = proximal, D = distal. * see caption to Table 17.4.*

Element	Roe Deer	Red Deer	Elk	Aurochs	Horse	Pig	Sheep
mandible	1	1	-	2	2	2	1
maxilla	-	1	1	-	-	-	-
scapula	-	1	2	-	-	-	-
carpals	-	-	1	-	-	-	-
femur D	-	1	-	-	-	-	-
tibia D	-	-	1	-	-	-	-
m/tarsal P	-	-	*	-	-	-	-
m/tarsal D	-	-	*	-	-	-	-
phalanx 1	-	-	0.25	-	-	-	-
Total	**1**	**4**	**5.25**	**2**	**2**	**2**	**1**

Table 17.9. *Minimum Animal Units (MAU) from Flixton Island.*

Element	Red Deer	Aurochs
maxilla	1	-
pelvis	-	1
phalanx 1	0.25	-
Total	**1.25**	**1**

Table 17.10. *Minimum Animal Units (MAU) from VP D. P = proximal, D = distal.* see caption to Table 17.4.*

Element	Roe Deer	Red Deer	Elk	Aurochs	Cat	Pig
mandible	-	-	-	1	1	-
humerus D	2	-	2	-	-	-
radius P	1	-	-	-	-	-
ulna	1	-	-	-	-	-
femur P	-	-	-	*	-	-
femur D	-	-	-	*	-	-
tibia P	1	1	-	-	-	-
astragalus	-	2	-	-	-	-
calcaneum	-	-	-	1	-	-
m/tarsal P	1	-	-	-	-	-
m/tarsal D	-	2	-	-	-	0.5
phalanx 1	-	0.25	-	-	-	-
phalanx 2	-	-	0.25	-	-	-
Total	**6**	**5.25**	**2.25**	**2**	**1**	**0.5**

Table 17.11. *Minimum Animal Units (MAU) from Ling Lane. P = proximal, D = distal.*

Element	Roe Deer	Elk	Aurochs
maxilla	1	-	-
humerus P	-	1	-
radius D	1	-	-
carpals	1	-	-
m/carpal P m/carpal D	- -	- 1	1 2
astragalus	1	-	-
calcaneum	1	-	-
m/tarsal P	1	-	-
phalanx 1 phalanx 3	- 0.25	0.25 -	- -
Total	**6.25**	**2.25**	**3**

and Flixton Island, are reduced to vanishing point. Flixton School House Farm and Flixton School Field are scarcely more useful. The red deer in the two Barry's Island assemblages are the only ones numerous enough to allow comparisons, and as mentioned above that from the sand layer has no chronological or behavioural integrity. The red deer assemblage from Barry's Island (main sample) is however of considerable interest when compared to that from Star Carr (see below).

Worked bone and antler

Five pieces, three of antler and two of bone, will be discussed in this section.

One bone artefact (Fig. 17.1) was recovered from the sand layer (context [9113]) at Barry's Island. As

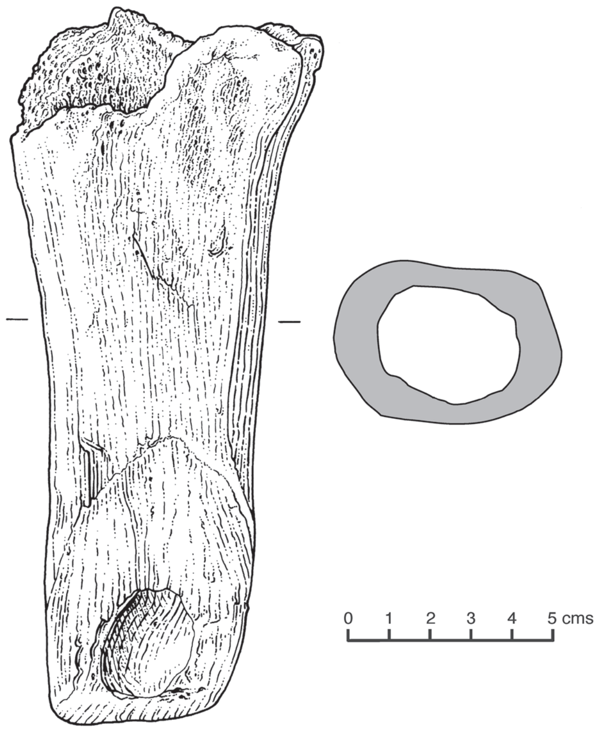

Figure 17.1. *Artefact made of the right distal tibia of a juvenile aurochs, from Barry's Island.*

discussed in Chapter 12, this context cannot be used to ascribe a date to the object, although as we shall see it is likely to be Early Mesolithic on typological grounds. Some zooarchaeological aspects are considered here. It is made from the right distal tibia of a juvenile aurochs. The shaft of the tibia has been cut across obliquely to form an edge; the marrow cavity running down the shaft forms a hole in the centre of the oblique cut surface. The other end of the artefact is formed by the end of the unfused distal diaphysis, which has been perforated from the end so that the hole joins up with the marrow cavity. The final artefact is thus roughly tubular in form and is perhaps best described as a gouge, though its precise function and method of use remain a mystery.

It may at first sight seem strange that the bone of a juvenile animal should have been used, since juvenile epiphyses are much softer than those of adults (for an example of differential destruction of juvenile cattle epiphyses see Legge 1992). The shafts are however another matter. Densitometry studies of juvenile and adult animals have shown that the long bone shafts of reasonably well-grown juveniles are as hard as those of adults, and in some cases are even harder (Snyder 1991). The choice of this tibia thus reveals considerable knowledge of the mechanical attributes of bone.

No exactly similar artefact is known from the other excavations in the area, though Clark (1954) illustrates some edged bone and antler tools from Star Carr. The elk antler mattocks appear to have similar edges, and in some cases the actual edge is formed by the bony pedicel with the shafthole being cut through the antler (*op. cit.*, plate XIV). Clark points out (*op. cit.*, 157) that this means that the hardest part of the object is therefore used to form the edge, similar to the Barry's Island piece. However, all the Star Carr elk antler mattocks have a transverse shafthole – hence Clark's use of the term 'mattock' – and thus differ from the specimen described here. Various edged tools made of aurochs bone were recovered from Star Carr (*op. cit.*, 162–4) but these are all made on flakes or splinters and are in no case tubular.

A series of closer parallels is known from the Maglemosian of Denmark. Both longitudinally and transversally perforated items are known, made from the metapodials and distal radii (Aaris-Sørensen and Brinch Petersen 1986). The Barry's Island specimen, made from a distal tibia, is thus not identical to the Danish specimens (Fig. 17.2), but is certainly closer to them than it is to the items from Star Carr. Utilization of aurochs bones for such artefacts is in Denmark limited to the Maglemose (Early Mesolithic), and no such items are not known from the Middle or Late Mesolithic Kongemose and Ertebølle cultures (Aaris-Sørensen and Brinch Petersen 1986, 116). If this can be extrapolated to the lake Flixton area, it suggests that the Barry's Island item may indeed be of Early Mesolithic date.

The other worked items all came from No Name Hill (see Chapter 11) and were all recovered from deposits formed during the Early Mesolithic. These were three uniserial barbed points (or fragments), of which two were on antler and one on bone (Fig. 17.3), and the worked base of a red deer antler. The largest barbed point, with six surviving barbs but broken at the tip, came from test-pit NAO at the northern end of the island. This is a uniserial point made on antler, measuring approximately 69 mm in length. Two further barbed point fragments, one on bone representing the tip of a highly worked point (L=36 mm), the other from the mid-section of an antler barbed point (L=24 mm) and also heavily worn, were found *c*. 20 m away to the west in NAZ. Perhaps significantly, both test-pits sampled deposits forming within the lake margins.

The remaining worked piece, also recovered from NAZ, is a left antler base of red deer, still attached to the pedicel (Fig. 17.4). It is unusually well preserved. This piece has been directly dated to 9150–8700 cal BC (at 92.5% probability) or 8680–8640 cal BC (at 2.9% probability (9510±60 BP, Beta-104484), though this measurement is thought to be erroneous due to contamination by humic acids (see Chapter 11). It is a waste product, not

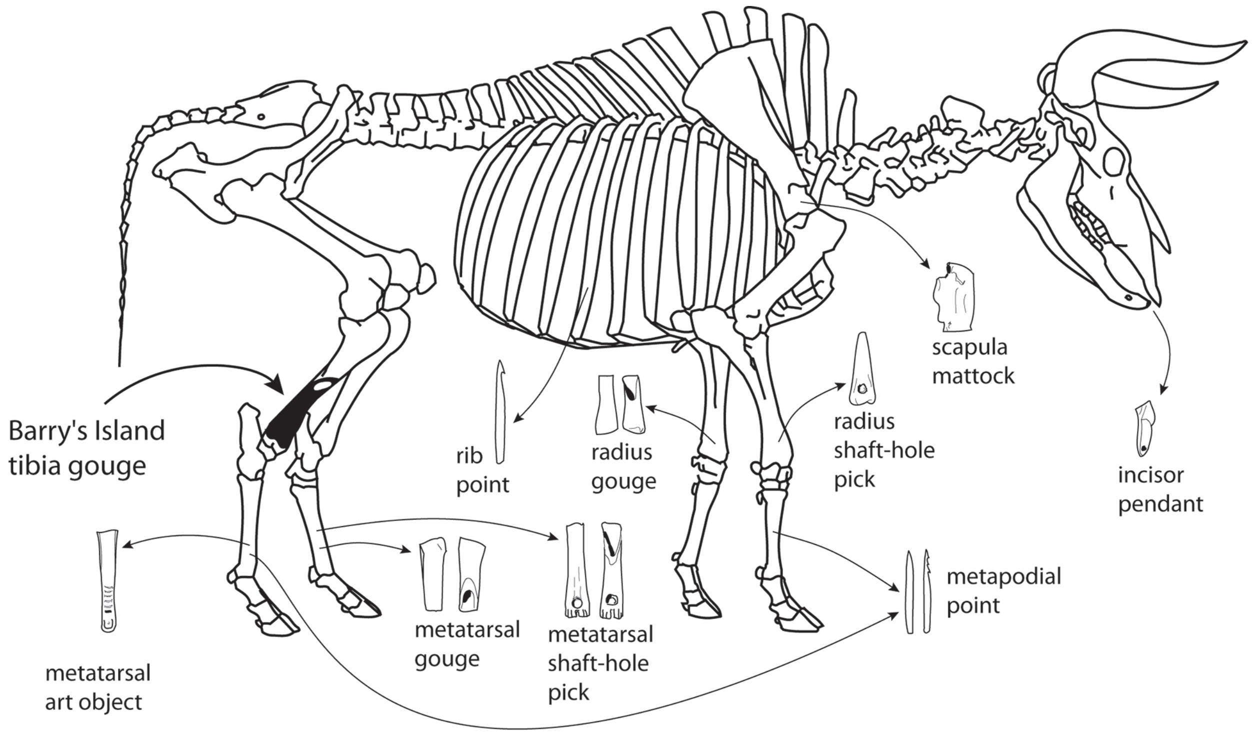

Figure 17.2. *Aurochs skeleton showing elements used as artefacts in the Danish Maglemosian, and the position of the artefact from Barry's Island (sand layer). Modified from Aaris-Sørensen and Brinch Petersen 1986, fig. 6.*

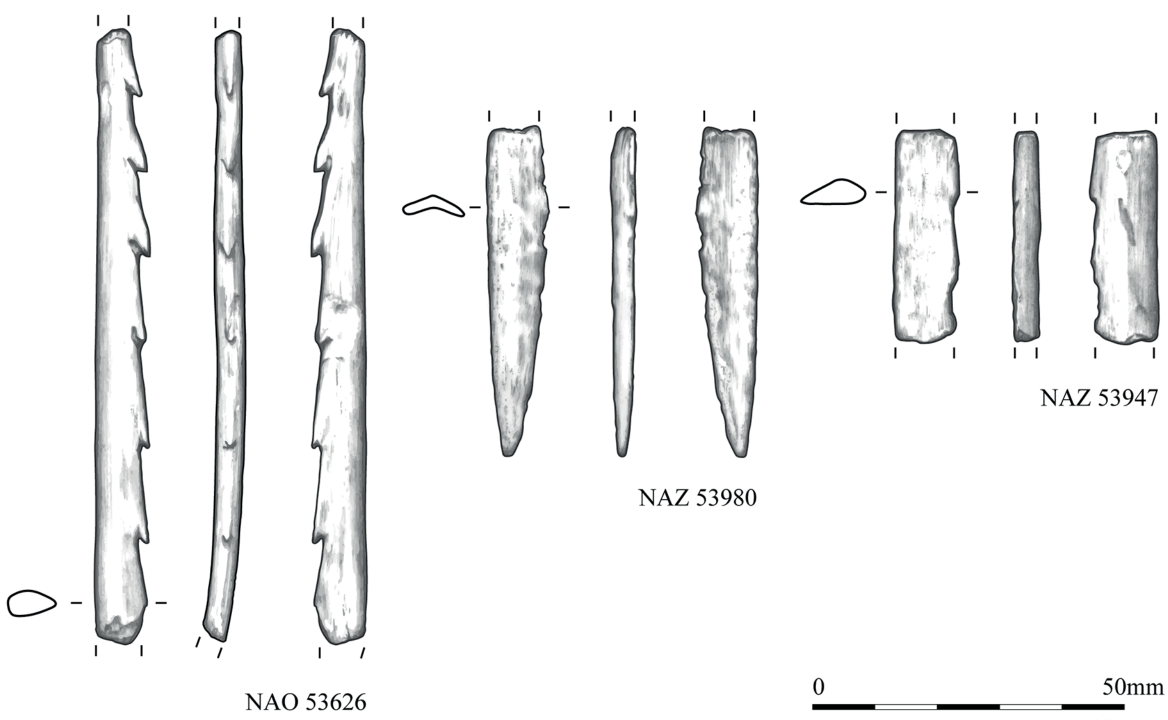

Figure 17.3. *Barbed points from test-pits NAO and NAZ, No Name Hill (drawn by Chloe Watson).*

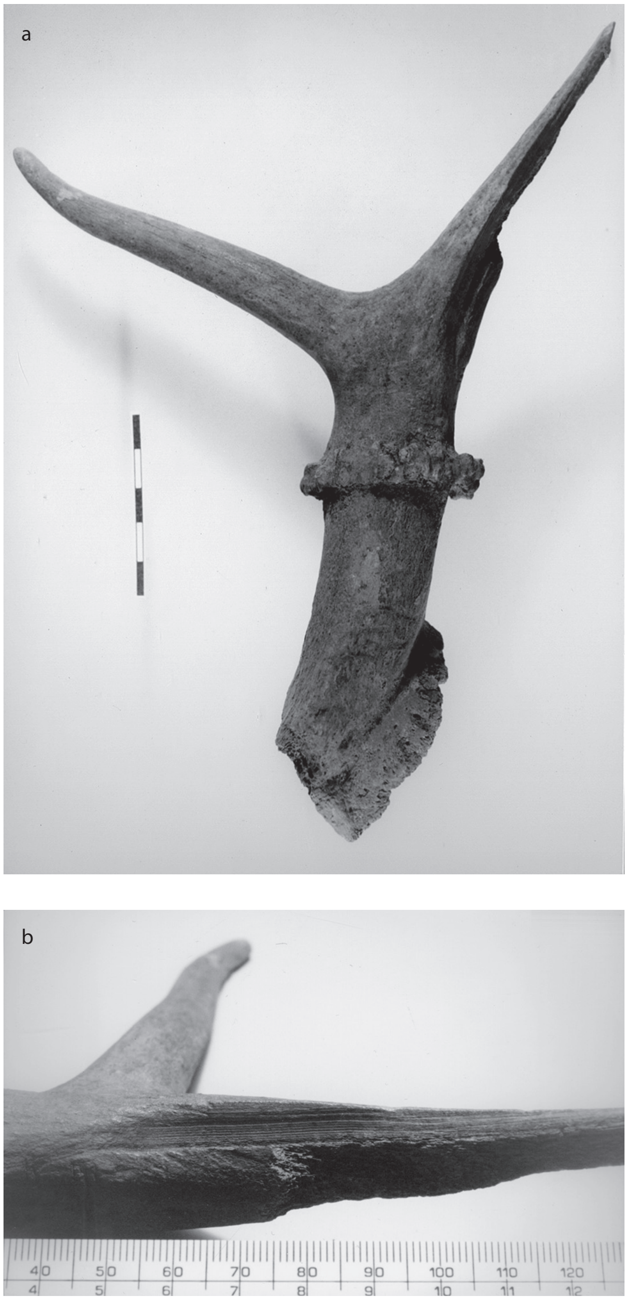

Figure 17.4. *Waste fragment of antler attached to the pedicel from No Name Hill. a) General view; the grooved and splintered beam is to the upper right, the radiocarbon sample was cut from lower left; scale divisions in centimetres. b) Traces of burin working on the beam; smallest scale divisions in millimetres.*

a deliberately intended artifact, and was presumably disposed of because it had been worked out. The antler is gracile, probably juvenile, and retains the brow time and the base of the beam (Fig. 17.4a). The portion of the beam that remains displays clear traces of grooving and splintering with a burin (Fig. 17.4b), typical of many of the fragments recovered from the various excavations at Star Carr (Clark 1954, Rowley-Conwy 1998), and it is likely that this antler was used for the production of blanks for the manufacture of antler points of the kind well known from the area.

Comparison between sites

Any comparison between sites is dependent on assemblage size. As those considered here are small, comparisons are difficult, but sufficient data are available to begin to demonstrate inter-site variability.

This can be approached in various ways. Tables 17.2 and 17.3 present both the identified and the unidentified bones. The samples of identified material are all too small to permit comparisons, but if the material identified only to size class (Table 17.3) is considered the situation is somewhat improved. The unclassified fragments are ignored, as are those in the uncertain size categories (roe/red, and red/large). This leaves just the three main size classes. To these fragment counts are added the definitely identified material from Table 17.2, limb fragments and all other fragments being counted separately. When this is done four of the assemblages are still too small to be helpful, and the Barry's Island sand layer is ignored for the reasons mentioned above. This leaves two assemblages: Flixton School Field (N = 84) and Barry's Island main sample (N = 215).

The figures for these two assemblages are converted into percentages and plotted in Fig. 17.5. Limb fragments outnumber the rest in most cases, although in the large size class from Flixton School Field the 'other' category is predominant. Roe deer size bones are consistently rare at both sites. Red deer size bones are predominant at both – but markedly so at Barry's Island (main sample), but only just at Flixton School Field. If this is not due to small sample size (and a larger sample would be needed to make sure of this) then there are two possible reasons. The difference is either long-term chronological, the landscape supporting changing numbers of the species through time, or short-term behavioural, with humans doing different things at the two sites. At the moment this cannot be resolved, but Fig. 17.5 does highlight the fact that it has become possible to ask interesting questions even if we cannot yet provide interesting answers!

The main sample from Barry's Island is the only one that has produced a large enough MAU count to make any sort of comparisons at all viable – this is listed in Table 17.2, N = 58. The inevitable comparison is with Clark's sample from Star Carr, where N = 431.1 (Legge and Rowley-Conwy 1988). Species frequencies are compared in Fig. 17.6, the MAUs from each site

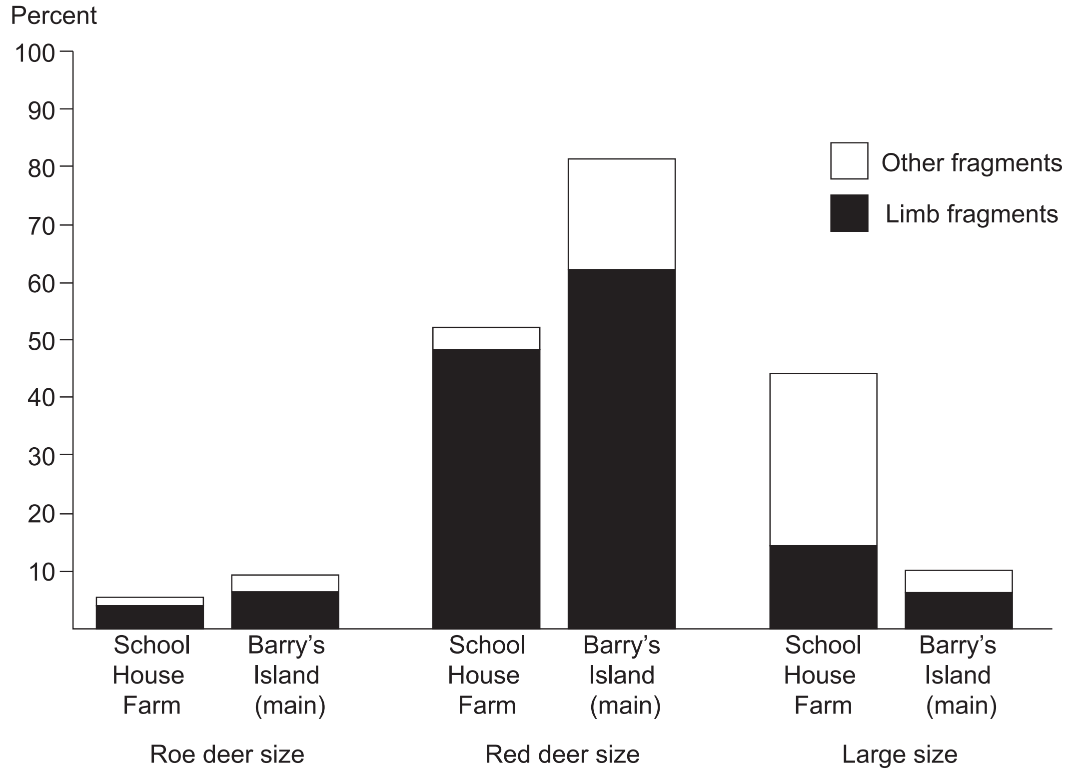

Figure 17.5. *Percentages of bone fragments from the main animal size classes at Flixton School Field (N = 84) and Barry's Island (main sample) (N = 215). See text for details.*

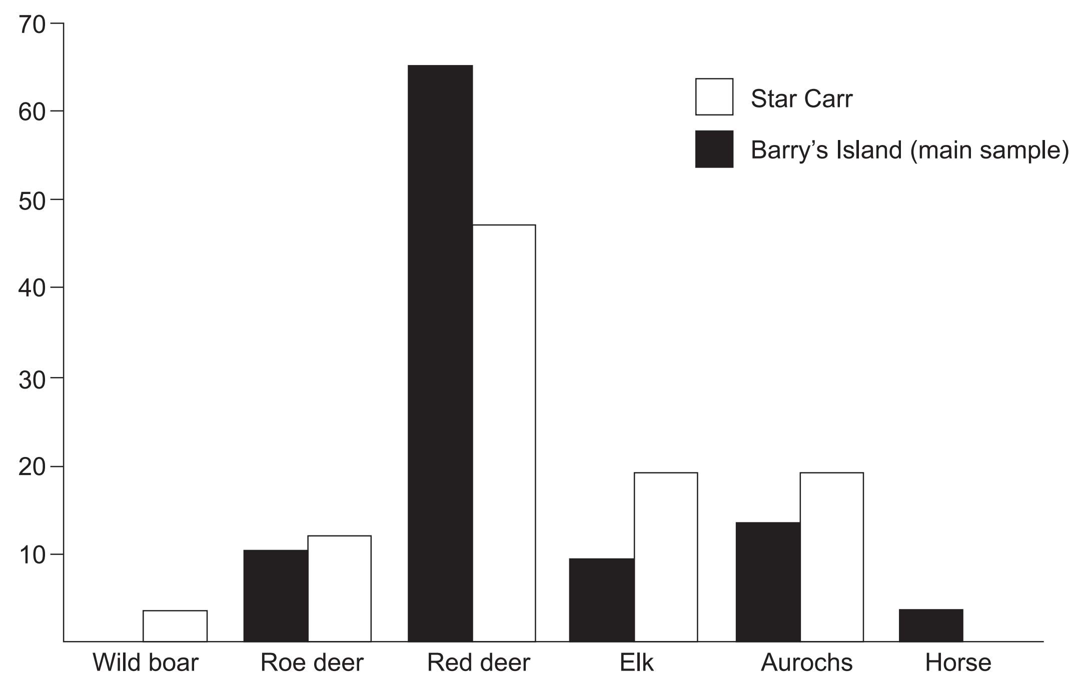

Figure 17.6. *Frequency of the main food species MAU at Barry's Island (main sample) (N = 58) compared to Clark's sample from Star Carr (N = 431.1). Barry's Island from Table 17.3, Star Carr from Legge and Rowley-Conwy (1988, table 1A).*

being converted to percentages. Once again, if sample size is not having an effect then some differences are visible between the two sites. One significant difference is that pig is represented at Star Carr but not at Barry's Island, while horse is found at Barry's Island but not at Star Carr. Another is the frequency of red deer, which is proportionately more common at Barry's Island, while elk and aurochs are somewhat more common at Star Carr.

Once again this might be due to chronological or behavioural reasons. A hint that chronology might be involved is provided by the horse and pig. Horse is an open country animal that disappeared as the Early Holocene forests spread, while wild boar thrives in such forests. It could thus be that Barry's Island is a little earlier than Star Carr, but the scarcity of horses, pigs and radiocarbon dates makes this a tentative suggestion.

One behavioural difference between the sites (caveats about sample size again being stressed) is that red deer body part frequency is considerably different. This is shown in Figure 17.7. The MAU totals for each element are expressed as a percentage of the MAU of the most common element; at Barry's Island the most common element is pelvis, with a MAU of 9 (Table 17.3). This becomes 100%, and the other MAUs are calculated as percentages of this. This method is a rather blunt instrument to use on a sample so small as that from Barry's Island, so shaded drawings are used in preference to graphs. Star Carr has eight elements with MAU above 40%: mandible, scapula, distal humerus, distal radius, distal metacarpal, distal tibia, astragalus and distal metatarsal. Barry's Island in contrast has only two: mandible and pelvis. Pelvis is the most common element at Barry's Island while it was one of the rarest at Star Carr. It has been suggested that the pelvis, femur and proximal tibia were removed from Star Carr in joints of meat (Legge and Rowley-Conwy 1988), as this is the meatiest part of the deer (see Fig. 17.7). Whether or not this argument is accepted, something different was apparently happening at Barry's Island. One provisional suggestion put forward by one of us (PR-C) is that Barry's Island represents a base camp (Rowley-Conwy 1995), though this view is no longer considered tenable (see Uchiyama [2016] and Rowley-Conwy [2017]).

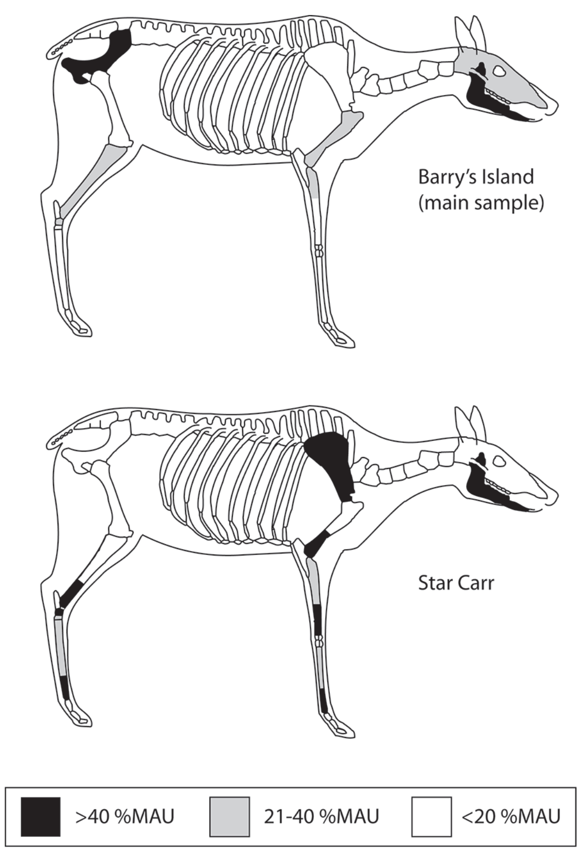

Figure 17.7. *Comparison of red deer element frequencies at Barry's Island (main sample) and Star Carr. See text for details.*

At this stage we must admit that we cannot make inter-assemblage comparisons as thoroughly as we can for larger sites. However, the sites have been found by a strategy capable of revealing prehistoric activity locations smaller than those generally encountered, at least in relatively undisturbed lowland contexts. Rather than lament small sample size we must make a virtue of it, as it gives a hint of the small-scale, variable and presumably very frequent use that was made of the Early Mesolithic lake shore.

Seasonality

One of the key factors in any study of hunter-gatherer land use is the season of the year in which individual sites were occupied. Large assemblages can be considered at length, and we need look no further than Star Carr for the classic British example (see Legge and Rowley-Conwy 1988; more recent discussion can be found in Carter 1997, 1998 and Mellars 1998). Smaller assemblages, by definition provide fewer pieces of evidence, but can still be of great interest. This section lists individual pieces of seasonal evidence from the VPRT excavations.

1. No Name Hill trench NAZ yielded two elk left side maxillary premolars. They were found loose, although from the same layer they were found a little way apart. It is quite likely, but by no means certain, that they come from the same animal. The teeth are unworn (Fig. 17.8). Both in Europe and North America, the

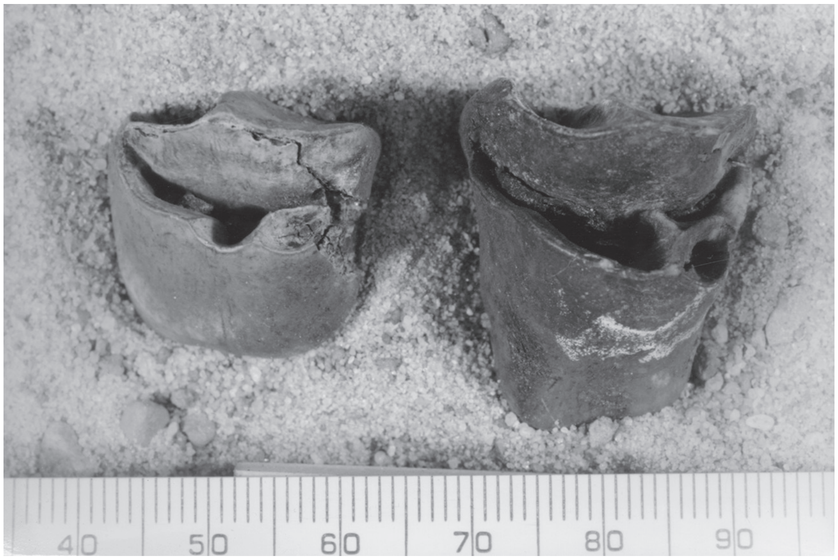

Figure 17.8. *Unworn maxillary premolars of elk from No Name Hill. That on the left was broken and has been glued; the line to the left of the upper tooth point is the crack, not a wear facet. Smallest scale division in millimetres.*

premolars come through in the autumn of the animal's second year (Gardell 1947, Peterson 1955). One elk jaw from Star Carr had premolars just in wear (Legge and Rowley-Conwy *op. cit.*) and was thus dentally a little further ahead than the No Name Hill teeth, but there is some variation between individual animals (Peterson *op. cit.*). In the absence of the complete tooth row(s) the safest conclusion is 'probably autumn'.

2. No Name Hill trench NAN yielded mandibular milk dp4, permanent M1 and the anterior half of M2 of roe deer. These were found together, and although no bone survives it is most probable that they come from a single jaw. M2 is unworn, while dp4 and M1 are in wear (Fig. 17.9). By January of the first winter, M2 would be in wear (Legge and Rowley-Conwy 1988, Kratochvil and Kux 1985). As the teeth were not in a

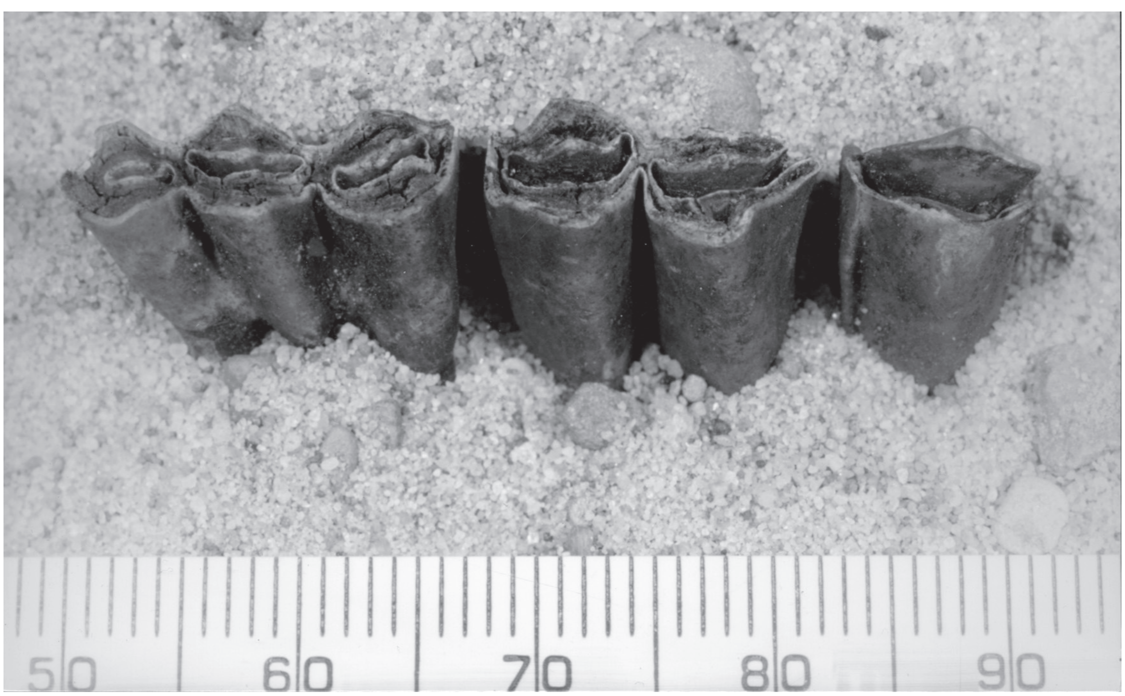

Figure 17.9. *Mandibular teeth of roe deer from No Name Hill, placed in anatomical order with dp4 to the left, M1 in the centre, and the anterior half of M2 to the right. The crown of M2 is placed at the same height as those of the other teeth but might have been less fully erupted. Smallest scale division in millimetres.*

Figure 17.10. *Mandibular teeth of aurochs from Barry's Island (main sample), placed in anatomical order with M1 on the left. State of eruption of M2 is unknown. Smallest scale division in millimetres.*

jaw, the eruption stage on M2 cannot be determined; it might have been fully erupted and about to come into wear, or it might have been some way before this. The tentative conclusion is therefore 'autumn/early winter'.

3. Barry's Island (main sample) yielded a right elk jaw containing milk dp3 and dp4, and permanent M1 and M2; this came from trench LYY in the northern group of trenches. M1 and dp4 are in wear, while in M2 only the first cusp and the anterior portion of the second are worn. Matched against the data provided by Peterson (1955), this jaw comes from an animal killed in the period January to March.

4. Barry's Island (main sample) yielded two aurochs teeth, left mandibular M1 and M2, from trench LAK in the southern trench group. They were found together, and it is probable that they come from the same animal, though as no jawbone was preserved this cannot be demonstrated. M1 is in early wear (the dentine is not preserved but the enamel shows the wear stage), while M2 is unworn (Fig. 17.10). To get any seasonal information from these teeth, we must make the additional assumptions that aurochs: (a) erupted their teeth at the same ages as domestic cattle, and (b) were born at the same time of year as the deer. If these assumptions are correct, and if the teeth did in fact come from the same jaw, we can use the thorough consideration of eruption ages in domestic cattle put forward by A.J. Legge (1992). This study concludes that M2 comes into wear at around 15 months, which would place the Barry's Island specimen around or before the month of September. The tentative conclusion is therefore 'late summer/autumn'.

5. Barry's Island (sand layer) produced a right red deer mandible containing a worn dp4, and an M1 that was erupted to its full height but unworn (stage UU). M2 was broken out of the jaw but enough of the bone remained to reveal that the tooth would have been unerupted but visible in crypt (stage V). When matched against the comparatives assembled by Legge and Rowley-Conwy (1988) this specimen parallels modern examples shot in November and December of their first year.

These determinations are few and tentative, but it is possible that the beginnings of a pattern are emerging, at least to the point where hypotheses for future testing can be formulated. It is interesting that both No Name

Hill determinations indicate autumn or early winter, and that all three Barry's Island specimens suggest autumn or winter. In the latter case there is the added complexity that the red deer mandible (no. 5, above) comes from the sand layer, not the main sample, and is thus of unknown date. If this jaw turns out to be Early Mesolithic it may derive from the same occupation(s) that generated the main sample, but equally it may have nothing to do with the Early Mesolithic.

The more localized and specialized an area of occupation, the more likely it is to be occupied only at specific times of year. Glimmerings of seasonal variability begin to emerge from these samples; the hypothesis for future testing is that Barry's Island was occupied mostly in the colder part of the year, while No Name Hill saw activity in the autumn.

Metrical attributes of the main food mammals

Various measurements could be taken on the bones from the VPRT excavations. These are listed in their entirety in Appendix 3, and only a few brief comments will be made here.

Most of the red deer measurements fall within the range published for the corresponding element from Star Carr (Legge and Rowley-Conwy 1988). One distal tibia from Barry's Island (main sample) measures only 43.3 mm in breadth, smaller than any from Star Carr. Sexual dimorphism among aurochs sometimes permits determination of sex, something not usually possible among the deer species. A complete aurochs calcaneum from Barry's Island (main sample) measured 179 mm in length. Degerbøl and Fredskild (1970) give measurements for complete or partially complete finds from Denmark, which can be sexed by their horns. The smallest male from Denmark measures 178 mm, only just larger than the Barry's Island specimen but as Denmark's largest female measures only 167 mm, we can be reasonably confident that the Barry's Island specimen comes from a male.

Two aurochs distal tibias provided distal breadth measurements, one from Flixton School House Farm, one from Flixton School Field. These are plotted in Figure 17.11, compared to the samples from Star Carr and Denmark (Degerbøl's sex attribution is marked). There is an overlap between the sexes at 83 mm, exactly the measurement of the Flixton School Field specimen, which therefore remains indeterminate. That from Flixton School House Farm, and four of the Star Carr specimens, are apparently male, while the remaining two Star Carr examples are female. Two aurochs metacarpals from Ling Lane provided distal breadth (Bd) measurements. Comparison with those from Star Carr (Legge and Rowley-Conwy 1988, fig. 18) indicates that specimen 1265 is definitely a male, specimen 1206 probably so.

The Flixton School Field dog

Several elements of a dog were recovered from Flixton School Field. Dogs have been recovered before from Early Mesolithic contexts around Lake Flixton: a

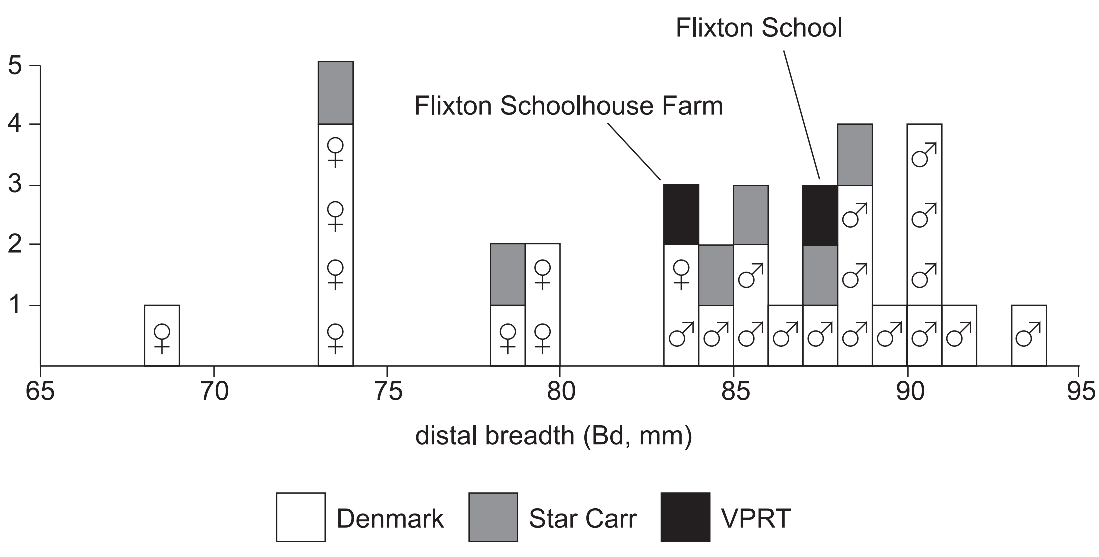

Figure 17.11. *Aurochs tibia distal breadth (Bd as defined by von den Driesch 1976). The Danish sample, sexed on the basis of associated horncores, is from Degerbøl and Fredskild 1970, table 17; Star Carr from Legge and Rowley-Conwy 1988, table 8.*

partial skull without teeth, and an incomplete femur and tibia, came from Star Carr (Degerbøl 1961) and a complete skeleton was recorded during the most recently excavations at the site (Knight et al. 2018a and b), and some cervical vertebrae were recorded from Seamer Carr (Clutton-Brock and Noe-Nygaard 1990). The Flixton School Field elements were found in two groups in adjacent contexts. One group comprised a left proximal radius, a femur shaft cylinder, a fragment of skull top, and a near-complete left jaw retaining P4 and M1. The other comprised the right femur and tibia, both complete. The occurrence of the bones in a restricted area suggests that they all could come from a single individual, although there are some metrical uncertainties about this (see below). The jaw is illustrated in Fig. 17.12, the post-cranial remains in Fig. 17.13; metrical attributes are presented in Table 17.12.

The dog is relatively small. Using the formulae presented by Harcourt (1974, 154), shoulder height based on the tibia was 47.1 cm, on the femur 49.9 cm. It is well removed from wolves in size, and indeed substantially smaller than the Star Carr limb bones. Degerbøl (1961) estimates the lengths of the Star Carr femur and tibia as 200 mm and 190 mm respectively, substantially greater than the Flixton School Field specimen. Even this is well below prehistoric and recent wolves; in a survey of subfossil material from Denmark, Aaris-Sørensen (1977) gives a range of 216–242 mm for femur length (N = 6), and 218–243 mm for tibia length (N = 6).

Table 17.12. *Metrical attributes of the dog bones from Flixton School Field. Measurement definitions follow von den Driesch (1976). Measurements in brackets are estimated.*

Element	Side	Measurements (mm)
mandible	left	11 P1–4 length, alveolar: (38.7) 12 P2–P4 length, alveolar: (34.6) 13 length and breadth of carnassial: 21.2 × 8.2 14 length of carnassial alveolus: (20.3) 17 jaw thickness below M1: 10.9
radius, proximal	left	Bp proximal breadth: 15.1 SD shaft width: 11.4
femur shaft cylinder	left	SD shaft width: 12.2
femur, complete	right	GL greatest length: 163 Bp proximal breadth: 34.6 DC depth of caput: 16.8 SD shaft width: 11.8 Bd distal breadth: 29.6
tibia, complete	right	GL greatest length: 158 Bp proximal breadth: (30.0) SD shaft width: 12.0 Bd distal breadth: 13.6

Early Mesolithic dogs in Denmark appear to fall into three size classes, measuring 55–60 cm, 50–55 cm and 45–50 cm at the shoulder respectively

Figure 17.12. *The dog mandible from Flixton School Field. Smallest scale division in millimetres.*

Figure 17.13. *The dog limb bones from Flixton School Field.*

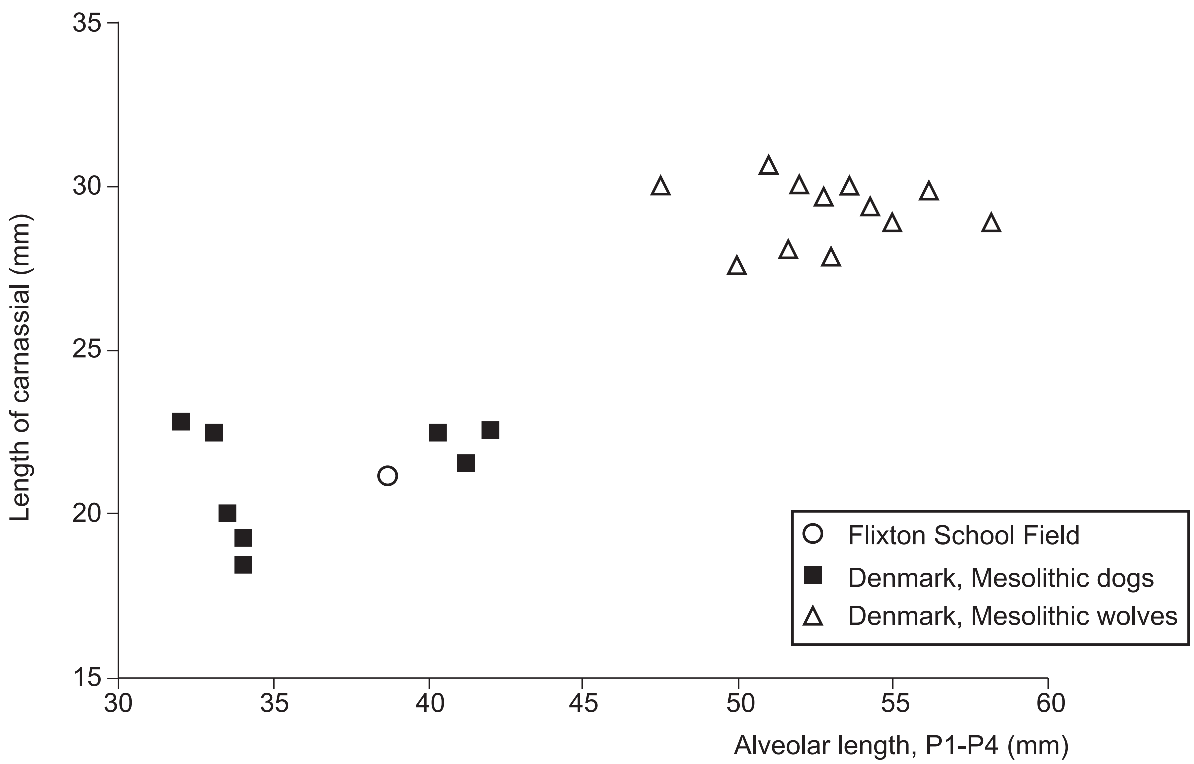

Figure 17.14. *Chart comparing alveolar length of P1-4 (von den Driesch measurement 11) with carnassial length at the cingulum (von den Driesch measurement 13). Danish dogs and wolves from Degerbøl (1933, tables 50 and III) with one addition from Noe-Nygaard (1995, 327).*

(Aaris-Sørensen 1988, 162). Some measurements are available that can be compared to the Flixton School Field mandible (Fig. 17.14). The Danish Mesolithic dogs do indeed fall into three groups, although whether these correspond to the three height classes mentioned by Aaris-Sørensen is unclear. At all events, the Flixton School Field jaw falls near the largest size group, while the shoulder heights calculated for the femur and tibia place these in Aaris-Sørensen's smallest size class. More work is therefore needed to establish whether all the Flixton School Field bones do indeed come from the same dog or not.

Discussion

This report has tried to extract information from the small samples excavated round the shores of Lake Flixton. Small activity areas have a particular archaeological fascination, but conventional zooarchaeology is not as well equipped to deal with the small sample sizes as it is with larger, statistically more impressive samples. Conclusions are therefore limited, but of significance for our understanding of the Early Mesolithic use of the lake. It is not yet possible to separate longer-term chronological trends from short-term behavioural variability, but small-scale variations are beginning to emerge in three areas: species frequency, skeletal element representation, and perhaps season of occupation.

In terms of species frequency, a further point of major importance must be made. At none of the sites examined here were there any bones of carnivores (except dog), birds, or beaver, yet these are all known from Star Carr (Fraser and King 1954) and Seamer Carr (Uchiyama et al., Chapter 16). This emphasizes the impression that the sites described here were economically narrowly focused.

No fish remains were found, and this continues to be a problem. It has been suggested that the river and lake system had not been colonized by fish this early in the Holocene (Wheeler 1978), but this seems unconvincing, fish could probably have colonized the river systems rapidly, and has in any case been contradicted by recent discoveries at Star Carr (Robson et al. 2016). Perhaps an excavation into deeper areas of peat might recover stakes from fish traps (two examples are known from Mesolithic lakes in Scandinavia, Ringkloster in Denmark (Andersen 1998) and Ageröd V in Sweden (Larsson 1983)). Such an excavation might also recover a much larger sample of bones.

Acknowledgements (PR-C)

I am exceedingly grateful to Tim Schadla-Hall and my other colleagues in the Vale of Pickering Research Trust for conducting the research over many years that has led to the recovery of the bones described here. I am also most grateful to Paul Lane for the tactful way he treated the author of this paper when the submission deadline was long passed and no paper had yet appeared. A major thanks goes to Junzo Uchiyama for his identification of the 1995 material, and for many interesting discussions on the Vale. Thanks also to Paul Stokes and Louisa Gidney for their comments on the worked antler and many other matters. All errors of course remain my own.

Chapter 18

Fossil insects from Seamer Carr

Eva Panagiotakopulu, Charlotte Haddon & Stephen East

The initial research on fossil insects from Seamer Carr took place in the late seventies and early eighties by Peter Osborne and Maureen Girling. Osborne published a report on a partial section of insect samples from the site, probably from Site C, sampled with Girling in 1978 (Osborne 1980). Girling also undertook extensive sampling and sorting of samples. Kenward and Large (1997) and Carrott et al. (1996) undertook environmental assessments of individual samples from the subsequent investigations at Ling Lane by Northern Archaeological Associates, producing unquantified species lists from these and published quantified results from a single sample. Although these samples were not dated, they provided useful information about past environments and climate during the Early Mesolithic. They also provided details about landscapes where human impact was limited, a unique insight for conservation.

Past work

The partial stratigraphic sequence studied by Osborne (1980) provided interesting information about the environment around the site. The samples were divided between him and Girling and there is little dating evidence, though it was assumed that the date of the site was around 9000–8000 BP. Preservation of the assemblages was better for the lower samples, N (70–65 cm) and M (65–60 cm), while those from the upper part of the sequence were fragmented and with limited numbers of species and individuals. In sample N the fossil insects provided evidence of wetlands and marshes, with a range of carabids, including *Epaphius rivularis* (Gyll.) which is currently rare and primarily found in blanket bogs with scattered populations regarded as relict in lowland fens (Boyce 2004). Old records include fen woodland bogs in association *Betula*, *Alnus glutinosa* (L.) or *Salix*, more rarely *Pinus*, or in *Sphagnum* (Lindroth 1945) and it is often found together with *Pterostichus diligens* (Sturm) and *P. minor* (Gyll), which were also recovered from the sample, living in reed debris and wet, rotting vegetation (Koch 1989). Water beetles recovered from this assemblage, such as *Agabus sturmii* (Gyll.), associated with stagnant and at least partly vegetated permanent waters (Foster et al. 2016), and *Ilybius* sp. indicate pools of water, while species such as *Hydraena palustris* Er., *Ochthebius minimus* (F.), *Limnebius aluta* Bedel and *Hydrochus brevis* Hbst provide evidence for vegetated stream margins and ponds (Duff 1993a). *Corylophus crassidoides* (Marsham) also indicates wet decaying grass and litter as does *Metopsia clypeata* (Müll.) and *Glischrochilus hortensis* Fourc. (Duff 1993a). The staphylinids *Olophrum fuscum* (Grav.), *Lesteva heeri* Fauvel and *Euaesthetus ruficapillus* (Lac.) provide further evidence for alder carr and debris of *Carex* and *Phragmites* (Koch 1989). Other species include pselaphids, such as *Trissemus impressus* (Panz.), found in moss and litter (Koch 1989a), and the weevil *Limnobaris dolorosa* (Goeze) and provide further evidence of fen and boggy conditions (Koch 1992); the latter breeds in stems and rhizomes of Cyperaceae, especially *Carex rostrata* (Cawthra 1957). The presence of trees during this period is indicated by *Dropephylla heeri* (Heer), which has been recorded from rotten *Betula* and under *Pinus* bark (Alexander 2002); *Dalopius marginatus* (L.) and *Micropeplus tesserula* Curtis are found in woods and on woodland margins (Koch 1989). The latter is rare in England, with only three Yorkshire localities (Marsh 2016) and is often associated with newly burnt areas (Wikars 1992). *Ptilinus pecticornis* (L.) has been found boring in a range of dead trunk of trees, including *Fagus* and *Salix* (Atty 1983) and *Salpingus planirostris* (F.) has been collected under the bark of broad leaved trees where it feeds on insect larvae (Alexander 2002). In addition, meadows around the site are indicated by *Brachysomus echinatus*

(Bonsd.) and *Serica brunnea* (L.), also found on heaths (Koch 1989a). Herbivore dung is indicated by the presence of *Geotrupes* sp, while *Anotylus rugosus* (F.) and *A. tetracarinatus* Block, both found in dung and decaying debris (Koch 1989), provide evidence for grazed areas and additional evidence for dung.

The subsequent samples, M and L present a similar picture of the site, although with lower numbers of individuals and add some interesting species. These include *Odacantha melanura* (L.), a carabid which frequents swampy banks of eutrophic stream and ponds as a predator, climbing the stems of a variety of waterside plants, including *Phragmites australis* and *Typha* spp., and in litter (Koch 1989). There are no modern Yorkshire records for this species, although Early Holocene records extend north as far as southwest Scotland (Bishop and Coope 1977). Additional species include the now also rare *Hydraena palustris* Er. and *H. britteni* Joy which are found in mud by vegetation-rich pools (Koch 1989). The most northerly modern records for the former are from Hornsea Mere in East Yorkshire (Foster et al. 2020). The nitidulid *Glischrochilus quadripunctatus* (L.) is another indicator of trees, frequently associated with scolytids under *Pinus* bark and at sap of trees on pine heaths (Koch 1989a) while *Bitoma crenata* F. is also found under the bark of several trees, including *Betula, Fagus* and *Quercus* (Alexander 2002).

Further quantified work from Ling Lane (Kenward and Large 1997) provides assemblages that show a similar environmental setting to the one discussed from the sequence studied by Osborne (1980), with evidence for wetland environments, woodland and open areas indicating pasture. The species list is extensive and includes additional taxa. *P. minor* (Gyll.) and *Cercyon convexiusculus* Steph. are part of the assemblage. In terms of woodland species *Bembidion harpaloides* Serv. and *Scaphidium quadrimaculatum* Ol. are associated with rotting timber (Alexander 2002) and *Agonum fuliginosum* Panz has been collected from alder carr, *Salix*, and various types of woodland (Lindroth 1945), preferring damp litter (Duff 1993). Among the taxa which are associated with heathland, *Loricera pilicornis* (F.) and *Pterostichus nigrita* Payk. are often recovered from woodland margins and wet meadows (Koch 1989) as is *Carpelimus elongatus* (Er.) (Lott 2009). *Chaetarthria seminulum* (Hbst) provides evidence for shallow water with moss and or mud, etc. and is a frequent find from banks of streams and moss (Foster 2000). As the species are only separated on male genitalia, the archaeological record should be treated as *C. seminulum* Hbst/*simillima* Vorst & Cuppen. Hammond (2017) indicates that the latter is largely upland.

As Kenward and Large (1997) note, there is limited evidence for dung in this assemblage. In addition to the dung beetle *Aphodius* sp., the presence of *Megasternum obscurum* (Marsham) in decaying grass and herbivore dung (Duff 1993) is notable. Open areas are indicated by species such as *Erichsonius cinerescens* (Grav.) taken often from *Sphagnum* bogs and from lowland wetland areas (Boyce 2004). Although there is little evidence linking open areas with human activity, *Nedyus quadrimaculatus* L. is a stenotopic species found primarily on *Urtica dioica* (Morris 1991a), a plant of disturbed eutrophic areas, as well as fens. *Bromius obscurus* (L.) is oligophagous on various willowherbs, especially fireweed, *Chamerion angustifolium* (L.) (Koch 1992), from which it was added to the modern British list by Kendall (1981) from a site in Cheshire. As well as beetles, species of Hemiptera such as *Coriomeris denticulatus* L. provided additional information about disturbed ground and sparsely vegetated areas (Alexander 2003).

New samples from Seamer Carr

In addition to past work, samples from two stratigraphic sequences, sampled and sorted by the late Maureen Girling were studied for insects. The first set of samples studied came from the stratigraphic sequence SC80 F1. Samples were taken every 5 cm and the samples studied were the two basal samples of the column, which had a depth 0.9 m from the top, and the sample taken at 0.4 m from the top was also studied. In addition, the three basal samples from a stratigraphic sequence of 30 samples, taken at 1 cm intervals from trench CIX, were also studied for insects. Preservation of all the samples was poor with specimens highly fragmented and discoloured. In the tables taxonomy follows Böhme (2005).

SC80 F1

The samples studied included 49 taxa of a total of 257 individuals (MNI) (Table 18.1, Figure 18.1a). The two samples close to the base of the sequence, S85 (85–90 cm) and S80 (80–85 cm), included limited evidence for insects, just 2 taxa and 2 individuals in the basal sample and 1 taxon and 3 individuals in the sample above it. The third sample, S40, from 40–45 cm, included the bulk of the fauna recovered, a total of 47 taxa and 252 individuals of which 105 belonged to a single species, *Scirtes hemisphericus* (L.). Wetlands and marshes are represented by species such as *P. minor*, and *C. convexiusculus*, *O. fuscum* and *L. dolorosa*, all of which were recovered from previous work from the site. Other taxa include *Cyphon coarctatus* Payk., found in various wetlands including willow carr (Luff 1996) and the less common *C. palustris*. *Scirtes hemisphericus* (L.), the most abundant species from the samples,

Table 18.1. *Insect species list, noting Minimum Numbers of Individuals (MNIs), from SC80 F1.*

Taxon	S40	S80	S85
Coleoptera			
Carabidae			
Carabidae indet.	6		
Bembidion prasinum (Duft.)	1		
Bembidion sp.	4		
Patrobus atrorufus (Ström.)	1		
Pterostichus strenuus (Panz.)	1	3	
Pterostichus vernalis (Panz.)	1		
Pterostichus minor (Gyll.)	1		
Pterostichus sp.	1		
Agonum gracile Sturm	1		
Agonum fuliginosum (Panz.)	1		
Agonum thoreyi Dej.	1		
Agonum sp.	2		
Amara familiaris (Duft.)	1		
Dytiscidae			
Dytiscidae indet.	3		
Hydroporus gyllenhalii Schiödte	1		
Hydroporus tristis (Payk.)	1		
Hydroporus palustris (L.)	1		
Hydroporus pubescens (Gyll.)	1		
Hydroporus longulus Muls.	5		
Hydroporus sp.	1		
Hydraena sp.	1		
Hydrophilidae			
Hydrophilidae indet.	30		
Cercyon tristis (Ill.)	6		
Cercyon convexiusculus Steph.	5		
Cercyon analis (Payk.)	7		
Cercyon sp.	2		
Megasternum obscurum (Marsham)	8		
Hydrobius sp.	1		
Laccobius minutus (L.)	2		
Enochrus affinis (Thun.)	1		
Enochrus sp.	1		
Chaetarthria seminulum/simillima. (Hbst)/Vorst & Cuppen	5		
Chaetarthria sp.	1		
Staphylinidae			
Staphylinidae indet.	4		
Olophrum fuscum (Grav.)	2		
Stenus sp.	3		
Lathrobium sp.	1		
Othius punctulatus (Goeze)	3		
Scirtidae			
Cyphon coarctatus Payk.	10		
Cyphon palustris Thoms.	5		
Cyphon sp.	2		
Scirtes hemisphericus (L.)	105		
Cryptophagidae			
Atomaria sp.	2		
Latridiidae			
Corticaria crenulata (Gyll.)	3		
Bruchidae			
Bruchus loti Payk.	1		
Curculionidae			
Curculionidae indet.	4		
Melanapion minimum (Hbst)	1		
Magdalis sp.	1		
Limnobaris dolorosa (Goeze)			1
Hymenoptera			
Formicidae			
Leptothorax sp.			1

frequents banks of standing waters (Koch 1989a) and has been taken from around ponds on plants such as *Mentha*, *Scirpus* and *Glyceria maxima* (Marsh 2017, Atty 1983); Foster et al. (2020) note an association of the larvae with *Lemna* spp. The mould feeder *Corticaria crenulata* (Gyll.) has been found in fungi on *Quercus* and *Salix* (Koch 1989a), in mould under bark of *Pinus* and from decayed wood (Thomas et al. 2016); in particular, it is associated with old established woodland (Palm 1959). *Bembidion prasinum* (Duft.) indicates open wet areas and is often found on gravel outcrops in rivers and streams (Koch 1989); its present distribution in Britain is largely upland (Marsh 2009). The assemblage also includes different species of water beetles. *Hydroporus gyllenhalii* Schiödte has a preference for acidic stagnant water (Merritt 2006), in small water bodies (Foster et al. 2016). In addition to *C. seminulum* which prefers mesotrophic waters, *H. tristis* prefers acid conditions in peatbogs, being found in *Sphagnum* (Foster & Friday 2011). Its congener *H. palustris* is also found in standing and slow flowing waters, rich in vegetation, but not in peat bogs (Koch 1989). Additional small diving beetles include *H. pubescens*, which prefers stagnant acidic water and bog pools (Merritt 2006) and *H. longulus*, which is found in fresh, running water, in streams

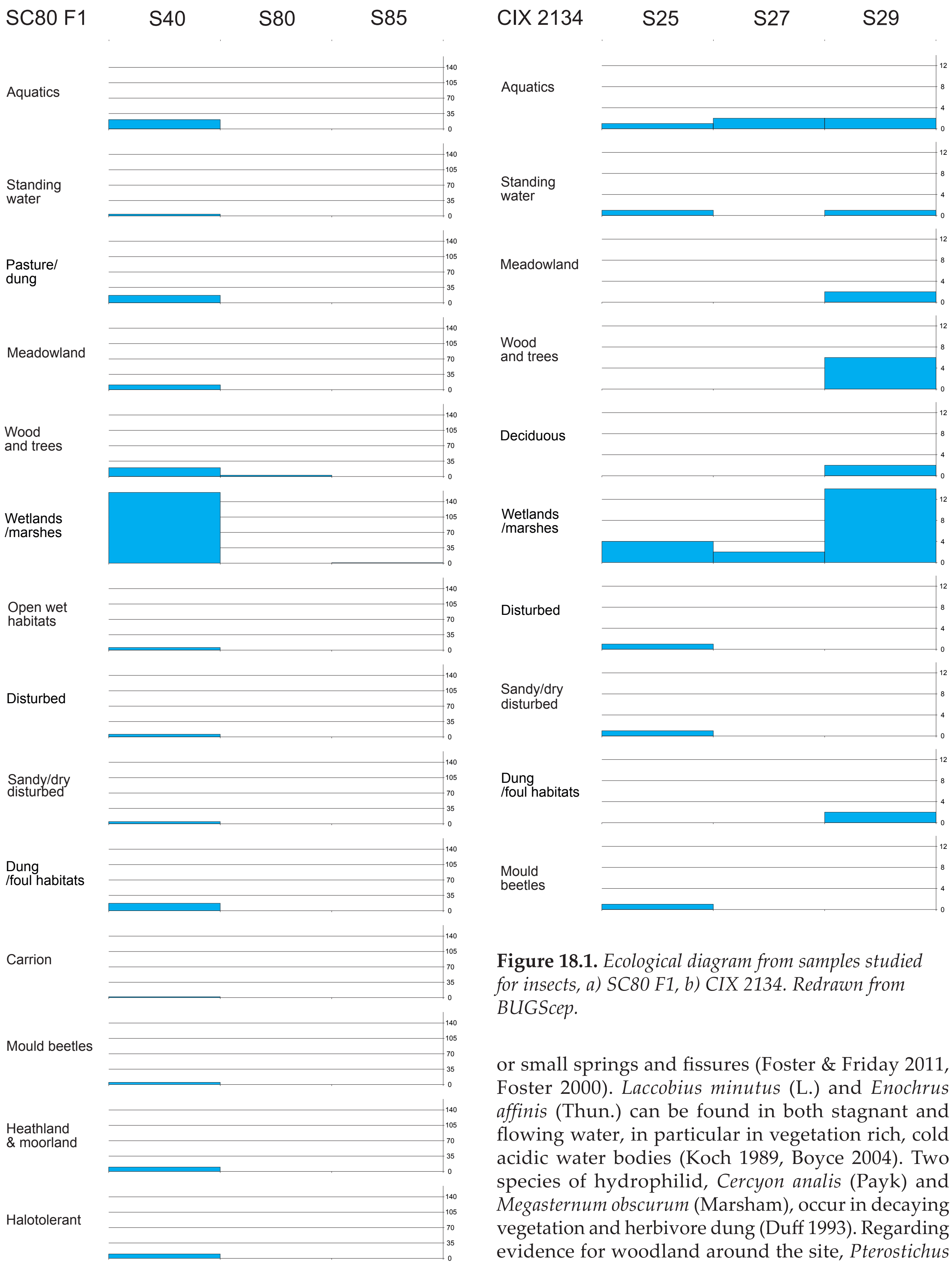

Figure 18.1. *Ecological diagram from samples studied for insects, a) SC80 F1, b) CIX 2134. Redrawn from BUGScep.*

or small springs and fissures (Foster & Friday 2011, Foster 2000). *Laccobius minutus* (L.) and *Enochrus affinis* (Thun.) can be found in both stagnant and flowing water, in particular in vegetation rich, cold acidic water bodies (Koch 1989, Boyce 2004). Two species of hydrophilid, *Cercyon analis* (Payk) and *Megasternum obscurum* (Marsham), occur in decaying vegetation and herbivore dung (Duff 1993). Regarding evidence for woodland around the site, *Pterostichus* *vernalis* (Panz.) is also found on damp peat in woodland margins in decaying vegetation (Koch 1989) and *Agonum fuliginosum* (Panz.) has been recorded from reedbeds, marsh and damp woodlands (Marsh 2009). Two other members of the same genus, the extremely hygrophilous *A. gracile*, which frequents very wet acid mires with *Sphagnum* (Boyce 2004) and *A. thoreyi* found in reed beds, fens, in *Sphagnum* and *Typha* stems (Koch 1989). *Othius punctulatus* (Goeze) occurs in moss and leaves in woods, as well as by rivers (Atty 1983). *Melanapion minimum* (Hbst) is a small weevil which feeds in galls on *Salix* and may be found in associated leaf litter and mould (Koch 1992). Meadows and woodland margins are also indicated by *Bruchus loti* Payk. which may frequent coniferous woodland margins, heath and bracken (Cox 2001). There is limited evidence for disturbed habitats in the presence of the eurytopic taxon *Amara familiaris* (Duft.), which prefers dry, sunny habitats (Marsh 2009). The overall reconstruction from the beetles, is consistent with previous research from Seamer Carr. Although there is little evidence for human impact from this assemblage, a burnt fragment of the ant *Leptothorax* sp. is indicative of burning on site.

CIX 2134

The assemblages from trench CIX include 32 taxa and 60 individuals (MNIs) (Table 18.2, Fig. 18.1b). From these S25 included 9 taxa and 14 individuals, S27 10 taxa and 12 individuals and S29 25 taxa and 37 individuals. In terms of aquatic environments, *H. gyllenhalii* was present together with *H. melanarius* which is found in very shallow acid water or on the growing surface of raised mires (Foster and Friday 2011). *H. longicornis*, recovered from S27, is associated with slow flowing water (Foster and Friday 2011). *Cercyon convexiusculus* Steph., which is often recovered near freshwater (Duff 1993), provides further wetland information while *C. granarius* is another aquatic species predaceous on dipterous larvae, found primarily in floating vegetation (Foster et al. 2014). Species also associated with wetlands include the staphylinids *L. longoelytrata* (Goeze), found in swamps and alder carr (Koch 1989), and *L. heeri* and the scirtid *C. coarctatus.* Its congener, C. *variabilis* also part of the assemblage, has been recovered from *Menyanthes trifoliata*, from *Carex* and in litter and flood debris (Foster 2009, Koch 1989) while *Elodes elongata* Tourn. and *Carpelimus elongatus* have been collected from damp woods and river margins (Koch 1989a,

Table 18.2. *Insect species list, noting Minimum Numbers of Individuals (MNIs), from CIX 2134.*

Taxon	S25	S27	S29
Coleoptera			
Carabidae			
Carabidae indet.		2	1
Pterostichus strenuus/diligens (Panz.)/ (Sturm)			2
Agonum fuliginosum (Panz.)			1
Dytiscidae			
Hydroporus gyllenhalii Schiödte	1		1
Hydroporus melanarius Sturm		1	1
Hydroporus longicornis Sharp		1	
Hydroporus sp.		1	
Hydrophilidae			
Hydrophilidae indet.			1
Cercyon granarius Er.	1		
Cercyon convexiusculus Steph.			1
Staphylinidae			
Staphylinidae indet.	1	2	3
Megarthrus prosseni Schatz.			1
Anthobium atrocephalum (Gyll.)			1
Lesteva heeri Fauvel			1
Lesteva longoelytrata (Goeze)	1		
Carpelimus elongatulus (Er.)		1	5
Stenus sp.		1	1
Lathrobium spp.			2
Tachinus corticinus Grav.			1
Aleocharinae indet.	3	1	1
Cantharidae			
Cantharis sp.			1
Elateridae			
Elateridae indet.			1
Scirtidae			
Elodes elongata Tourn.			1
Cyphon coarctatus Payk.			1
Cyphon variabilis (Thun.)	2	1	
Cyphon spp.	3		2
Phalacridae			
Phalacrus coruscus (Panz.)	1		
Chrysomelidae			
Chrysomelidae indet.	1		
Gonioctena viminalis (L.)			2
Curculionidae			
Apion sp.			1
Diptera			
Diptera indet. (adult)		1	2
Hemiptera			
Hemiptera indet.			2

Marsh 2017). In addition to *P. strenuus* and *A. fuliginosum*, the presence of *Anthobium atrocephalum* (Gyll.), a largely woodland species found primarily in *Betula* wood litter (Anderson 1977) and *Gonioctena viminalis* (L.), oligophagous on willows (Koch 1992), provides further evidence for the presence of trees. Pasture and open areas are represented by species such as *Phalacrus coruscus* (Panz.) which feeds on smut fungi on grasses and hibernates under the bark of various trees and in leaf litter (Koch 1989a). *Megarthrus prosseni* Schatz. is one of the taxa associated with dung, in particular horse dung, but also occurs in rotting vegetation and carrion (Atty 1983), while *Tachinus corticinus* Grav. may be synanthropic in mouldy hay and straw, although it is often found in similar natural deposits (Koch 1989). The overall evidence points to environments which are broadly similar to what was indicated by all other insect research from the site. There is information from the beetles for open areas, perhaps a result of grazing and clearance on site, and data which could be tenuously linked with human activity, in the context of archaeological finds from Seamer Carr.

Evidence for rare and notable species

One of the most interesting aspects of the Mesolithic faunas from Seamer Carr is the evidence for species which are currently considered rare or have a different distribution. *Odacantha melanura* for example has an RDB status notable B. Importantly its current distribution in the British Isles appears not to extend further north than the East Midlands (Hyman 1992) and its recovery from Seamer Carr points to the more continental climate which would be expected before the flooding of the North Sea basin. *Epaphius rivularis* is a rare carabid with a scattered wetland distribution ranging from areas in East Anglia, and Yorkshire to Northumberland and northern Scotland (Boyce 2004). The hydrophilid *Hydrochus brevis* has also an RDB status rare and tends to be a very local fenland beetle in South and East England, Scotland and Ireland (Friday 1988).

There are several hydrophilids recovered from Mesolithic Seamer Carr which have an RDB status notable B. *Cercyon granarius* is the most rare species of the genus, with occurrences in grazed fen areas and records from southern England and Jersey (Foster et al. 2014). *C. tristis* is found in various areas in the British Isles but tends to be very local, while *C. convexiusculus* is absent from parts of England, particularly the southwest, and is scarce in Wales and parts of Scotland (Foster et al. 2018). *Enochrus affinis*, is also restricted to local areas in the British Isles, and its records have declined over the last four decades (Foster 2000).

Chaetarthria seminulum is another notable B hydrophilid, whose distribution in the British Isles is largely confused with the recently defined *C. simillima* (Foster et al. 2014). The small staphylinid *Acidota cruentata* tends to be widely distributed but very local (Tottenham 1954). Its current records from Yorkshire, are primarily lowland (Marsh 2016). *Bromius obscurus*, a frequent fossil in Late Glacial deposits (see for example Gransmoor (Walker et al. 1993), Glanllynnau (Coope 1977), Church Stretton (Osborne1972.)), has few records outside its initial discovery in Cheshire, including one locality in Lincolnshire (Duff 2016) and another near Edinburgh (Hubble 2014); its RDB status remains endangered. Whilst there are old records from northeast Yorkshire (Hyman 1992), the weevil *Melanapion mimimum* is currently uncommon with rare RDB status.

What is evident from this information is that although the environments at Seamer Carr are superficially similar to current ones, the insect faunas indicate changes, perhaps both as a result of climate change and more recently human impact, which have removed a range of species over time from the area.

Insects and climate change

Apart from the assumption that the sections sampled are placed chronologically in the Early Mesolithic, there is little in terms of a firm dating framework for the insect results. The palaeotemperatures were reconstructed using MCR, mutual climatic range, in BUGScep (Buckland and Buckland 2006), which is based on overlaying modern climatic envelopes and distribution data of taxa from each sample and deducing the temperatures in which the majority of the species from any particular assemblage would be able to survive. The climatic data from the beetles are based on mean summer temperatures (TRange Hi), mean winter temperature (TRange Lo) and the difference between these two ranges. In other words, the difference between summer and winter temperatures provides the temperature range (Trange) for the particular sample and a higher TRange indicates greater continentality.

Samples SC78 and S80 from F1 had only one MCR species and S85 from SC80 F1 none, while from CIX 2134, there were two MCR species from S25 and one from S27 one. These were deemed insufficient for climate reconstruction. The collation of climatic envelopes from the fossil beetles, however, provides information on climate during this broad period. Taking into account the limitations with the lack of dates or correlation with the archaeological contexts, there are some overall trends based on the insect assemblages.

For the reconstruction of the temperatures of the warmer month, the summer temperatures, one of the critical species is *Odacantha melanura*, with its more southerly distribution, found from samples M and N from SC78, and from Ling Lane. Warmer temperatures would also explain the presence of the more southerly hemipteron *Coriomeris denticulatus* from Ling Lane. Regarding TMaxHi, the highest temperature of the warmest month, three samples provided a temperature of 19°C (Ling lane, samples L and M from SC78, and sample S40 from SC80 F1). The highest temperature was 21°C from sample S29 from trench CIX. The TMaxLo ranged from 16°C (sample SC78) to 12°C (sample S29, CIX). The information from all the samples (Fig. 18.2) pointed towards a similar or slightly warmer summer temperature than current ones, although this is an increasingly difficult figure to derive, particularly since the climate envelopes in BUGScep are time transgressive across a period of marked warming, which does not include more recent trends.

Regarding the temperatures of the colder months, some of the species used for the MCR reconstruction (e.g. *Pterostichus diligens*, *Hydroporus melanarius*, *Tachinus corticinus*, *Amara familiaris*, *Hydroporus tristis*) have poorly defined climatic envelopes, and this in turn affects temperature reconstructions. The highest winter temperatures (TMinHi) from the Seamer Carr assemblages range from 1 to 7°C, and the lowest (TMinLo) from -4 to at least -12°C. A single sample from SC78, Osborne's sequence, provided a minimum winter temperature of -20°C, resulting from limited information on stenothermic species and is therefore not reliable. Even after excluding unreliable results, the climatic reconstruction based on the insects suggests colder winters and perhaps warmer summers during the Early Mesolithic.

According to TRange, there is evidence for a more continental climate from Osborne's sequence, samples L and M, and also from samples SC40 and S40 at F1. Star Carr MCR overall results from the assemblages studied by Allison (Taylor and Allison 2018) also indicate continentality, although again the chronological framework needs refinement and specific information from each sample would be needed for reliable temperature reconstructions. Summer temperatures from the site were from 16–19°C, similar to recent ones, and winter temperatures were colder, from -11 to -1°C.

An additional species noted amongst the late Maureen Girling's unpublished samples, all apparently from Early Holocene contexts at Star Carr, is relevant to discussion of climate. The large carabid *Pelophila borealis* is currently only recorded in Britain from Orkney, Shetland and a single high altitude locality at Glen Affric in mainland Scotland (MacGown and Owen 1993); it is more widespread in Ireland (Anderson et al. 2000) and is frequent on the tundra north of the Arctic Circle throughout the Holarctic (Lindroth 1985). A frequent Late Glacial fossil (Buckland and Buckland 2006), its distribution, from oceanic lowland lake shores in the west and north to boreal continental in the north makes for a difficult climate

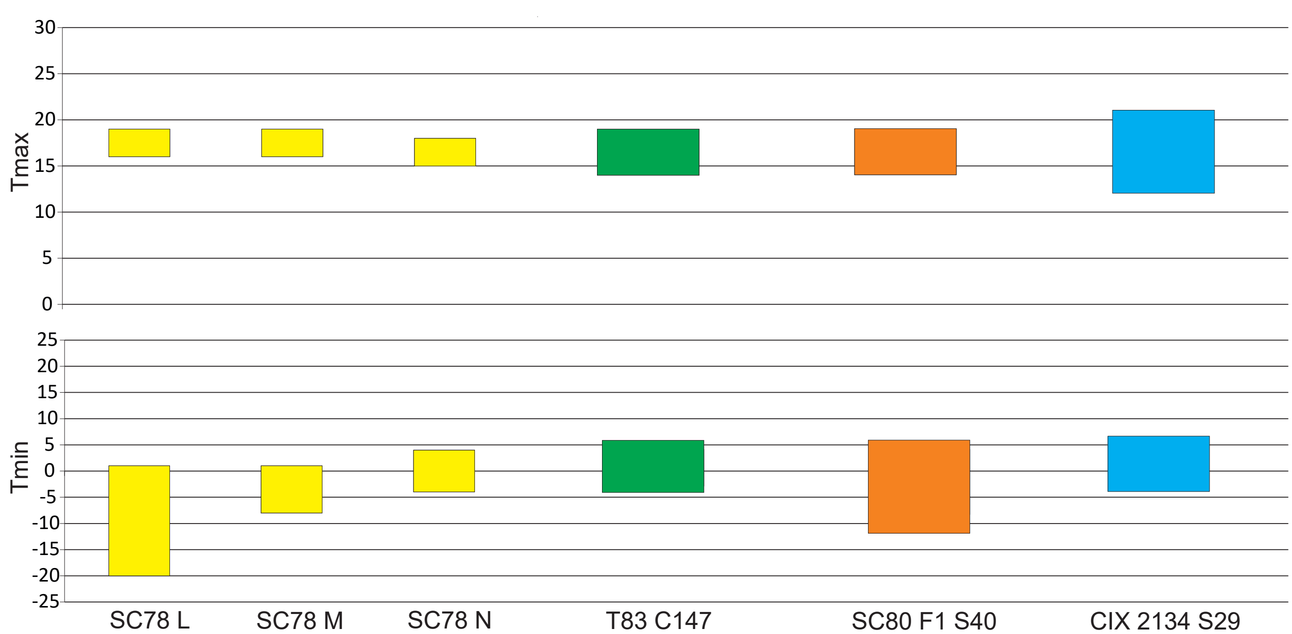

Figure 18.2. *MCR (Mutual Climatic Range) diagram from all the sites studied for insect fossils from Seamer Carr.*

envelope and cautions against simplistic temperature models, which inevitably ignore such factors as snow and cloud cover.

Conclusions

The insect assemblages from Seamer Carr provide information about past environments in the area and changes in biodiversity in particular in terms of rare, endangered and notable beetle species. These results from the Early Mesolithic, give useful insights for the effects of climate change and human impact over the Holocene in shaping the modern faunas. In addition, evidence from the beetles implies a more continental climate during the Early Mesolithic. Further research from fossil insects from the site, with well-dated samples, correlated to the archaeological and environmental contexts will provide refined reconstructions of climate and environmental change and will allow comparisons with other sites from the same period.

Chapter 19

Hunter-gatherers in the landscape

Barry Taylor, Chantal Conneller, Paul Lane & Tim Schadla-Hall†

The work of the Seamer Carr project and the VPRT has created an unparalleled record of the human occupation of a North European, early prehistoric landscape. The test-pitting surveys and open-area excavations have recorded evidence for human activity that ranges in scale from discrete hunting events to the long-term, repeated occupation of particular landscape locations. Added to this, systematic augering of large parts of the basin, accompanied by palaeoenvironmental studies at key sites, has produced a detailed account of the environmental context within which these episodes of human activity took place. The purpose of this chapter is to provide an interpretive summary and synthesis of this data, beginning with an overview of the archaeological record of hunting and gathering/foraging around the shores of the former Lake Flixton and the islands near its centre, and what this can tell us about the changing nature of hunter-gatherer settlement, resource utilization, logistics and material traditions between the Final Palaeolithic and the Late Mesolithic. The second part of the chapter brings together the archaeological and palaeoenvironmental data to explore the changing relationships between humans and their environment.

Final Palaeolithic

The earliest traces of hunter-gatherer activity recovered from Lake Flixton is represented by the fairly substantial Final Palaeolithic, Federmesser occupation recorded at Seamer Carr Site K (Fig. 19.1), where around seven of the scatters that make up the site can be attributed to this period. Whether these were contemporary, or represent successive reoccupation of the same place cannot be determined. The Final Palaeolithic scatters represent fairly low-density activity areas, of which one of the central scatters (Scatter 3) is the most extensive. This scatter appears relatively specialized, indicative of activities focused mainly on scraper production and use, though other tools, such as burins and curve-backed pieces are also well represented. To the north were activity areas that were focused on blank production and small-scale tool use, while to the south and west were small-scale, generalized, knapping and tool-use areas.

The Final Palaeolithic scatters at Site K are dominated by local Wolds flint, and it may be that the Vale of Pickering was seen as an attractive location precisely because of the proximity of sources of this material. However, several of the tools within these scatters are made from slightly patinated translucent grey speckled flint, distinct from the opaque white Wolds flint that was knapped on site. Visually, this speckled flint is very similar to that found in the glacial till of the east coast. However, recent LA-ICP-MS analysis of a single piece of this flint raises the possibility of an East Anglian source for this material (Conneller et al. 2019). Although this conclusion must remain provisional without further work on derived and offshore sources, it remains likely that people were carrying tools made of this grey speckled flint from a distant source to Site K, where they then procured Wolds flint, undertook routine tasks and provisioned themselves with new tools for future use (see Conneller 2007). The impression is that these people were travelling light, carrying tools, rather than large quantities of flint, another fact that may suggest high levels of mobility.

There are many similarities between this, very northern occupation at Site K, and Final Palaeolithic material across Britain and, more broadly, Federmesser material across northwest Europe. These include a shift to a reliance on more local raw material (albeit that some tools were imported from further afield), and more expedient knapping patterns. At Site K, knapping was relatively flexible, responding to the nature of the raw material. Tabular pieces of Wolds

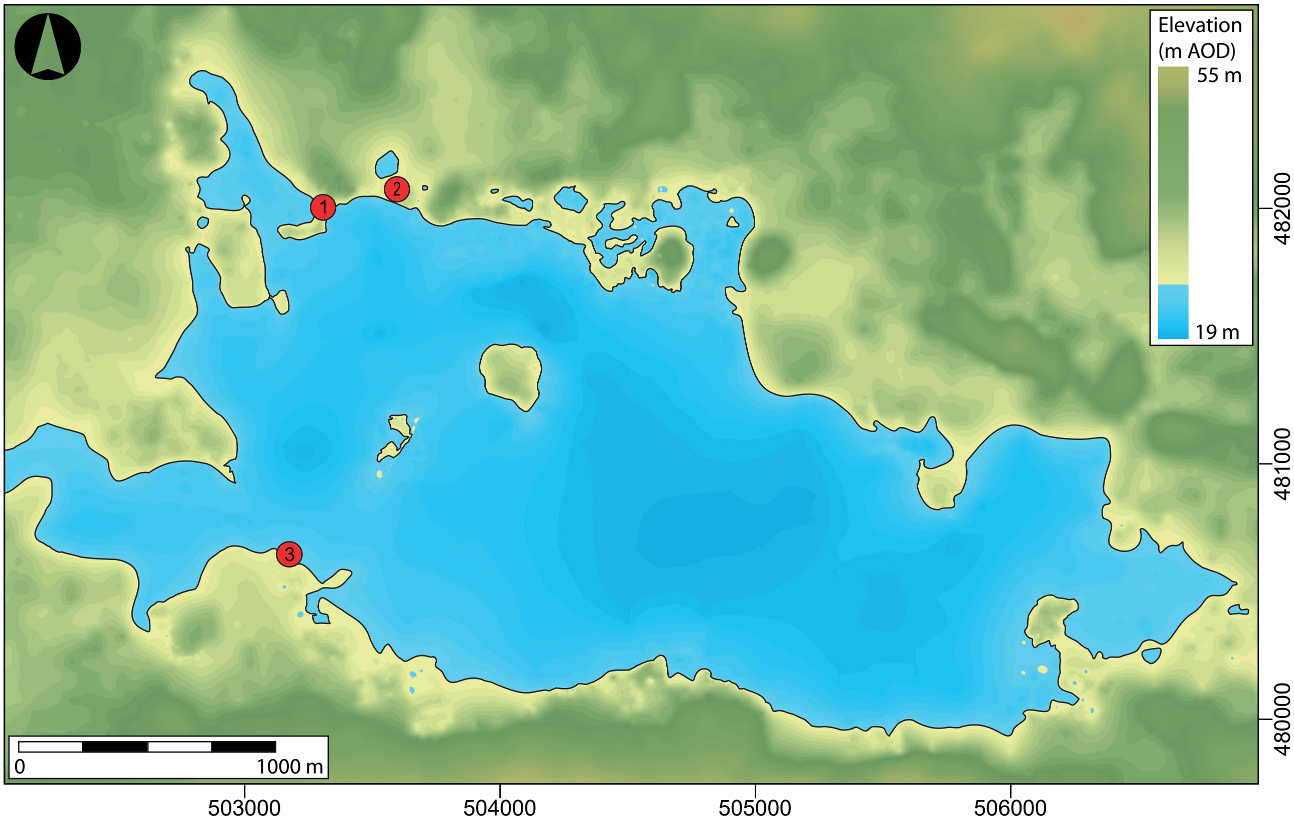

Figure 19.1. *Map showing the location of Final Palaeolithic sites and findspots. The level of the lake is shown at 24 m AOD. 1: Site K. 2: Site C. 3: VP E.*

flint were often used with the flat, cortical plane serving as a ready-made platform, and the direction of flaking being perpendicular to the long axis of the material, though on occasions it did follow the long axis of a piece, particularly on a multi-platform core. It has been suggested that the shift to local raw material represents an adaptation to the development of wooded landscapes and associated non-migratory animal species, which led to a reduction in mobility (Barton & Roberts 1996). The evidence from Seamer K, on the other hand, suggests a more nuanced picture. Although the number of investigated sites is limited, evidence from elsewhere in Britain, the southern North Sea/Doggerland (Gaffney et al. 2007; Peeters & Momber 2014), and from northwest continental Europe supports this suggestion. A fairly wide range of animal, fish and bird resources were exploited, and site types range from complex residential sites associated with different activities, to localized special-purpose camps, knapping locations and isolated finds of projectile points (Street 1998), possibly indicative of relatively high settlement mobility (Baales 2004).

The finds from Lake Flixton also enhance our knowledge of the northern distribution of Final Palaeolithic activity in Britain, much of which has previously been derived from cave sites. Beyond a cluster of sites in the Midlands, at Creswell Crags and the Peak District, are three northern cave sites; Kinsey Cave and Victoria Cave in North Yorkshire, and Kirkhead Cave in Cumbria (Pettitt and White 2012). Kinsey Cave and Victoria Cave, both ancient excavations, have some lithic evidence in the form of backed pieces as well as dated organic artefacts (Lord et al. 2007). At Victoria Cave, a bevelled antler rod has been dated to 11,865–11,360 cal BC (11,750±120 BP, OxA-2455) and a biserial harpoon has been dated to 10,960–10,755 cal BC (10,930±45 BP, OxA-14888), and at Kinsey, a broken antler tang dates to 11,405–10,910 cal BC (11,270±110 BP, OxA-2456) (Lord et al. 2007). Also belonging to this period is the Poulton-le-Fylde elk (Lancashire), the remains of an Allerød hunting expedition found in lake-edge peats with two uniserial barbed points, and dating to around 11,600 cal BC (Jacobi & Higham 2011). Finally, and northernmost, is a small assemblage from Kilmefort, Argyll (Saville & Ballin 2009), which while undated has very similar combinations of thick, straight and curve-backed blades to Seamer Carr Site K, as well as the round scrapers typical of Federmesser assemblages. The Site K assemblage offers a counterpoint, both to the broadly western distribution of these sites, and the predominance of assemblages derived from caves. These cave sites are capture points, preserving material that elsewhere, at open air sites, surely suffered severe attrition during the Younger Dryas. It has previously been noted that open air sites were commoner during the Final Palaeolithic than in the preceding Magdalenian (Jacobi and Higham 2011), and Site K indicates that this type of settlement was present in the north.

Long Blade or Terminal Palaeolithic

The evidence for Long Blade occupation around Lake Flixton shows a similarly limited distribution, with diagnostic material restricted to Seamer Carr Sites C and L, and Flixton 2 (Fig. 19.2). The record from Site C consists of three large scatters of worked flint, two of which (B1 and C) lie at the northwestern edge of the excavated area, the third (F), *c.* 25 m to the southeast. Large numbers of refits indicate Scatters B1 and C were contemporary, whilst their relationship with Scatter F is less certain and this may represent a second visit to this location. A series of stakeholes or postholes were present to the north of Scatter B1, and could potentially represent some sort of structure (though it is not clear whether this relates to the Long Blade or Early Mesolithic activity, as the latter is also well represented in this part of the site). No other structural features or pits were recorded in association with the Long Blade material, though the presence of hearths is reflected in the concentrations of burnt flint at each of the scatters.

The Scatter B1/C complex was a relatively substantial occupation with tools well-represented, a relatively rare situation for a Long Blade site. At Scatter C, three preformed cores were imported and fully reduced on site. Several untested nodules, often of tabular material, were also imported to Scatters B1 and C, and underwent early-stage reduction. This usually involved the emplacement of a bilateral or unilateral crest (the latter used more with tabular nodules). The resultant crested blade, or similar thick support, would sometimes be used as a *piece machurée*. In addition to these larger parcels of raw material, large, well-made blades, deriving from a variety of raw material units,

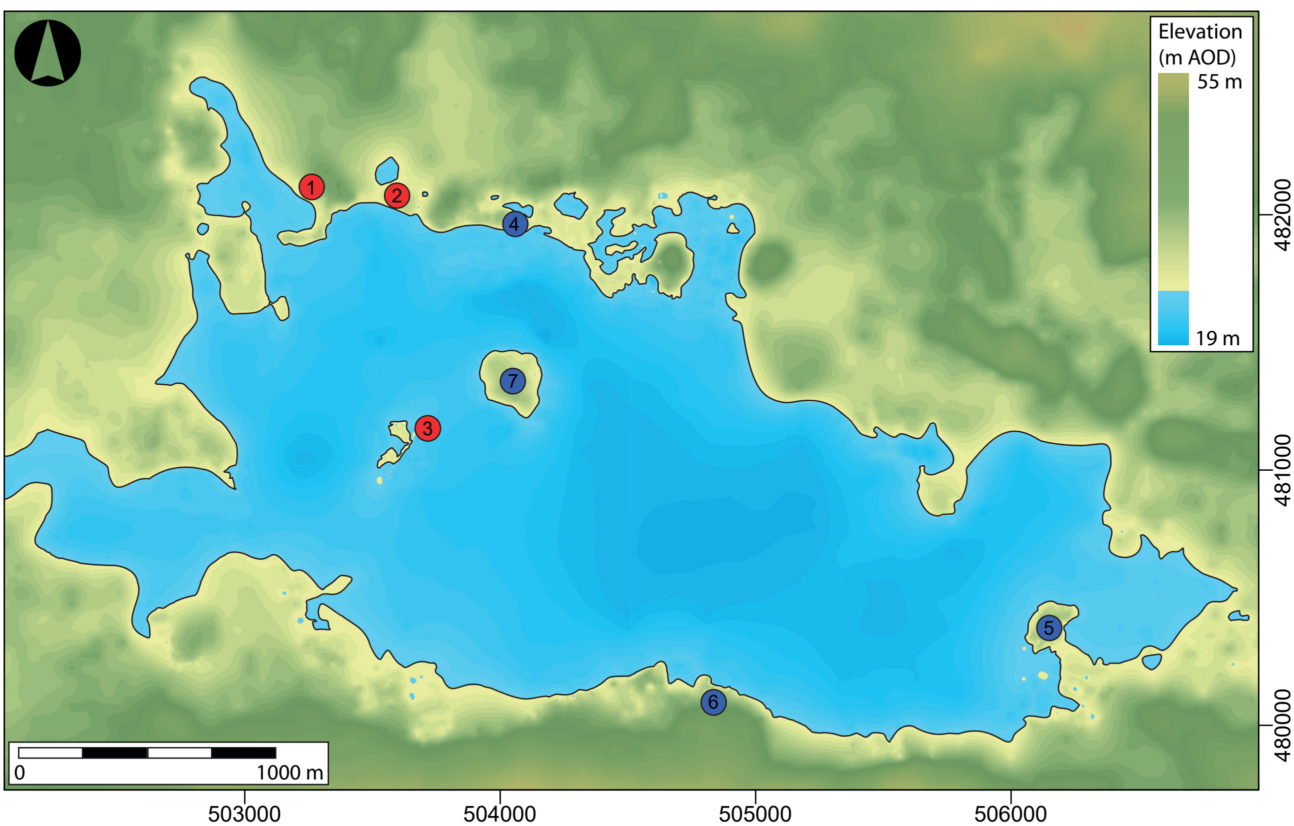

Figure 19.2. *Map showing the location of Long Blade sites (red) and finds of horse teeth (blue). The level of the lake is shown as 24 m AOD. 1: Site L. 2: Site C: 3: Flixton Island. 4: Cayton Carr. 5: Barry's Island. 6: Flixton School Field. 7: No Name Hill.*

were also imported to the site. These were often made into burins, which are particularly common within Scatter C. These large, more elaborate burins were frequently resharpened, indicating relatively intense activities involving their use. Deliberately segmented blades were also widely used, many of which began their life at Scatter B, but were used extensively around the Scatter C hearth. Scrapers and rubbed-end pieces are also present, indicating a wide range of activities.

Scatter F represents relatively small-scale activity, mainly involving the reduction of one or two cores of high-quality brown flint. This scatter is also characterized by a large number of imported, well-made blades. As at Scatters B1/C, knapping was skilful: cores were crested, platforms carefully abraded, and true opposed platform reduction was used, with a couple of blades produced from one platform, the core rotated, and knapping continuing from the second platform. This technique produces the characteristic flat blades known from Long Blade or Belloisian assemblages in southern Britain and continental Europe (Barton 1989; Valentin 2008). Seamer L, also represents a short-term knapping scatter. However, rather than involving the knapping of imported, exotic material, here local Wolds flint was used. This scatter, which is missing many blades from refit sequences, is likely to represent gearing-up, with the stock of blades that these groups travelled with being replenished for future use.

Although much of the fauna associated with these Long Blade scatters is too fragmentary to be identified, horse is certainly present, both at Site C (within Scatter C and Scatter F), and at Site L. Horse is the main species associated with Long Blade sites in Britain, with only Scatter A at Three Ways Wharf (Lewis and Rackham 2011) showing any other faunal association (in that case with reindeer). The presence of horse bone at Seamer Carr Sites C and L, and its absence from securely dated Early Mesolithic contexts such as Star Carr, make it likely that horse remains are a proxy for Long Blade activity at other locations around Lake Flixton (Fig. 19.2). Humanly modified horse remains (mainly teeth showing evidence that the jaws from which they derived had been smashed for marrow) were identified by the late Roger Jacobi from three further areas around the lake: two test-pits located between Seamer C and Seamer L, and Barry's Island on the southern lake shore (see Chapters 16 and 17). While these remains do not appear to be associated with Long Blade flintwork, the Seamer finds are from small test-pits, and it is possible that undiagnostic material may be present amongst the Mesolithic flint working, while the remains recovered from Barry's Island had been re-deposited by a stream channel, and thus its original associations are uncertain. Isolated and unmodified horse remains have also been recovered from Flixton School Field, No Name Hill and (more recently) at Cayton Carr (Nicky Milner, pers. comm. 2019), and could potentially reflect further areas of Long Blade activity. However, the greatest concentration of horse remains comes from the third major Long Blade site in the area, Flixton Site 2 (Moore 1954). Here in the late 1940s, John Moore excavated the remains of several horses from detrital muds sealed beneath layers of sand and gravel. In contrast to the horse remains, lithic material at Flixton 2 was very rare, with only a couple of pieces (a projectile and a blade), recovered. It appears that this was a specialized butchery site with no associated knapping activity.

Attempts to date the faunal material from these sites have given some indication of the chronology of Long Blade occupation in this landscape (see Chapter 4). As with other sites in England, dating of this material has proved problematic due to low residual collagen levels in surviving bone and difficulties eliminating humic acid contamination. At Flixton Site 2, where the greatest number of radiocarbon measurements have been attempted, problems of humic acid contamination have still been common (Marom et al. 2013), which has resulted in a spread of age ranges. The most consistent set of measurements has been obtained by using the ion-exchange and hydroxyproline protocols (*ibid*.). These measurements suggest horses were butchered on Flixton Island sometime between *c*. 10,075 and 9665 cal BC (Table 19.1), and likely centred around 9800 cal BC (see Chapter 4). Contamination has also been a problem at Seamer L; however, a recent ultra-filtered date on horse remains

Table 19.1. *Radiocarbon measurements on horse bones from Long Blade sites around Lake Flixton obtained with hydroxyproline and ion-exchange pre-treatment methods.*

Site	Lab No.	Radiocarbon years (BP)	$\delta^{13}C$	Calibrated date (cal BC)	Material
Flixton site 2	X-2395-14	10,155±55	-24.60	10,125–9460	Bone, *Equus ferus*
Flixton site 2	OxA-6328	10,150±90	-20.20	10,175–9405	Bone, *Equus ferus*
Flixton site 2	OxA-6319	10,150±80	-20.80	10,140–9450	Bone, *Equus ferus*
Flixton site 2	OxA-6318	10,090±90	-20.80	10,075–9360	Bone, *Equus ferus*
Seamer L	OxA-19511	10,025±45	-20.7	9805–9370	Bone, *Equus ferus*
Barry's Island	OxA-6330	10,160±90	-19.6	10,195–9405	Bone, *Equus ferus*

from the site (Jacobi and Higham, 2009) is compatible with those from Flixton Site 2. A final date comes from a humanly-modified, but redeposited horse jaw from Barry's Island, and is also comparable to those from Flixton Site 2 (Table 19.1).

LA-ICP-MS testing of a handful of the Long Blade artefacts from Seamer Carr Site C indicates they may have had a distant source, clustering most closely with material from the North Lincolnshire Wolds (at least 60 km to the south), though this conclusion must remain provisional before derived and off-shore sources are tested. If confirmed, this suggests a north–south axis of movement, possibly facilitated by travel along a major English river such as the Trent, as has been suggested for the Creswellian (Pettitt et al. 2012). It is interesting that North Lincolnshire or East Anglia have also been identified as the possible source of one artefact from the Long Blade site of Church Lammas (Surrey) in a procurement network that was otherwise overwhelmingly local (Pettitt et al. 2013).

Long Blade groups moving back into northern England after the coldest part of the Loch Lomond Stadial appear to have prioritized the use of raw material that was large in form and high in quality. They probably obtained this material from sources that were much more distant than those utilized during the subsequent Mesolithic occupation of the lake. The fact people appear to be carrying so much material with them (unmodified nodules as well as preformed cores and large blades) may suggest two things: first, the possible use of boats to transport materials, and secondly, that they were not confident of securing similar large, high quality material at their destination and thus 'geared up' in preparation for moving into unfamiliar territory.

The Lake Flixton sites represent the most north-westerly occupation at this time, at least until the assemblage from Rubha Port an t-Seilich, Islay (Mithen et al. 2015) can be confirmed as of Late Glacial age through full techno-typological study and/or radiocarbon dating. It is likely that the Seamer Long Blade material represents a pioneer occupation, undertaken by groups moving from a core area of more familiar territory (cf. Housley et al. 1997), and it may be that these people were unfamiliar with the location and nature of lithic sources so far further north (see Conneller 2007).

More broadly, the Lake Flixton sites offer new insights on the nature of Long Blade settlement. The classic Belloisian sites of northern France are focused on the exploitation of good quality raw material. On these sites, burnt flint (indicating the presence of hearths) and formal tools are relatively rare, while blades appear to have been manufactured for use elsewhere, leading to suggestions that these may represent workshop components of a single settlement system (Fagnart 1997). Potential residential sites, with a varied set of formal tools, are less well-known but are represented by recent finds such as Calleville in Normandy (Biard & Hinguant 2011). A similar pattern appears to have pertained in southern Britain, with the classic Long Blade sites often focused on procurement and core reduction, with burnt flint and formal tools rare (Barton 1989, 1998). In Britain, too, more recent work has revealed sites with reasonable quantities of formal tools and evidence for hearths. Among these sites we can include Adventurers Farm/Whiteway Drove, Cambridgeshire (Billington 2017), Launde, Leicestershire (Cooper 2006) and Three Ways Wharf, Middlesex (Lewis and Rackham 2011), as well as Seamer C. It is interesting to note that at none of the sites where reasonable quantities of formal tools have been recovered is the procurement of high-quality raw material, and the production of prepared cores and large blades for export a major focus of activity. At Adventurer's Farm/Whiteway Drove (Cambridgeshire) the early stages of reduction are absent (Billington 2017), suggesting imported material; at Three Ways Wharf (Middlesex) local gravels were used (Lewis and Rackham 2011), as they were at Church Lammas (Surrey), where material was also imported (Jones et al. 2013).

Valentin (2008) has suggested that Belloisian assemblages display a limited range of functions, leading to a highly differentiated series of sites within a particular area, a theory that the evidence cited above suggests also holds true of the British evidence. This can be seen more clearly through the study of material from the edge of Lake Flixton, a relatively small geographical area where a high level of differentiation can be witnessed between sites. Seamer C might be characterized as a place where more 'domestic' activities occurred. Seamer L is more similar to the classic workshop sites where large, chalk flint nodules of local origin were prepared, and cores and large blades exported. Flixton Site 2 is entirely focused on the hunting and butchery of horses, associated lithic material being almost completely absent. The isolated finds of humanly modified horse remains around Lake Flixton may represent similar sites to Flixton Site 2, given that no associated lithic material has been noted. These findings indicate that, even on the margins of the Long Blade world, a highly diversified, logistical use of space pertained.

The Early Mesolithic

Early Mesolithic activity is far more extensive than the earlier periods, with evidence now recorded from 19 locations around the lake (Fig. 19.3). Generally, the archaeology consists of scatters of worked flint and smaller, somewhat fragmentary assemblages of animal bone, extending from just above the lake shore (from *c*. 24.5 m AOD) onto the adjacent, higher ground around the edges of the basin, or the islands within the lake. Smaller assemblages of worked flint, often dominated by flakes, blades and tools, as well as animal bone were also present at the water's edge (*c*. 24 m AOD), and in sediments that were forming in shallow water within the lake margins (*c*. 23.5 m AOD). More occasionally, these deposits also contained osseous artefacts, particularly barbed antler points, and the waste material from their manufacture.

The large, open area excavations at Seamer Carr Sites C and K provide the most complete record of these foci of activity. At both, the lithic assemblages formed spatially discrete scatters, sometimes associated with small assemblages of animal bone, and often focused around a hearth. One of these consisted of a stone-lined hollow, but others were more ephemeral and may simply have been fires lit directly on the ground (Fig. 19.4). There is some evidence that activity took place within, or was focused around, structures or shelters; the spatial patterning of one of the flint scatters at Site C (Scatter H), suggests it was constrained by a structure, and some of the stake-holes around Scatter B could also have served a structural function (though as previously noted this may relate to the Long Blade activity). However, there is no evidence for more substantial post-built structures at either site. Several shallow features were also recorded at both sites, though their function remains unclear.

Although other localities around the lake were subjected to more limited sampling and smaller scale excavation, they are very similar to Sites C and K in terms of the nature of the archaeology. The refitting of the lithic assemblages shows a comparable pattern of relatively small-scale activity. Structural features are usually absent, though more recent excavations at Flixton School House Farm have recorded arrangements of stake and postholes, and deliberately dug hollows, dating to the Early Mesolithic (Taylor & Gray Jones 2009). Elsewhere, small pits occur occasionally,

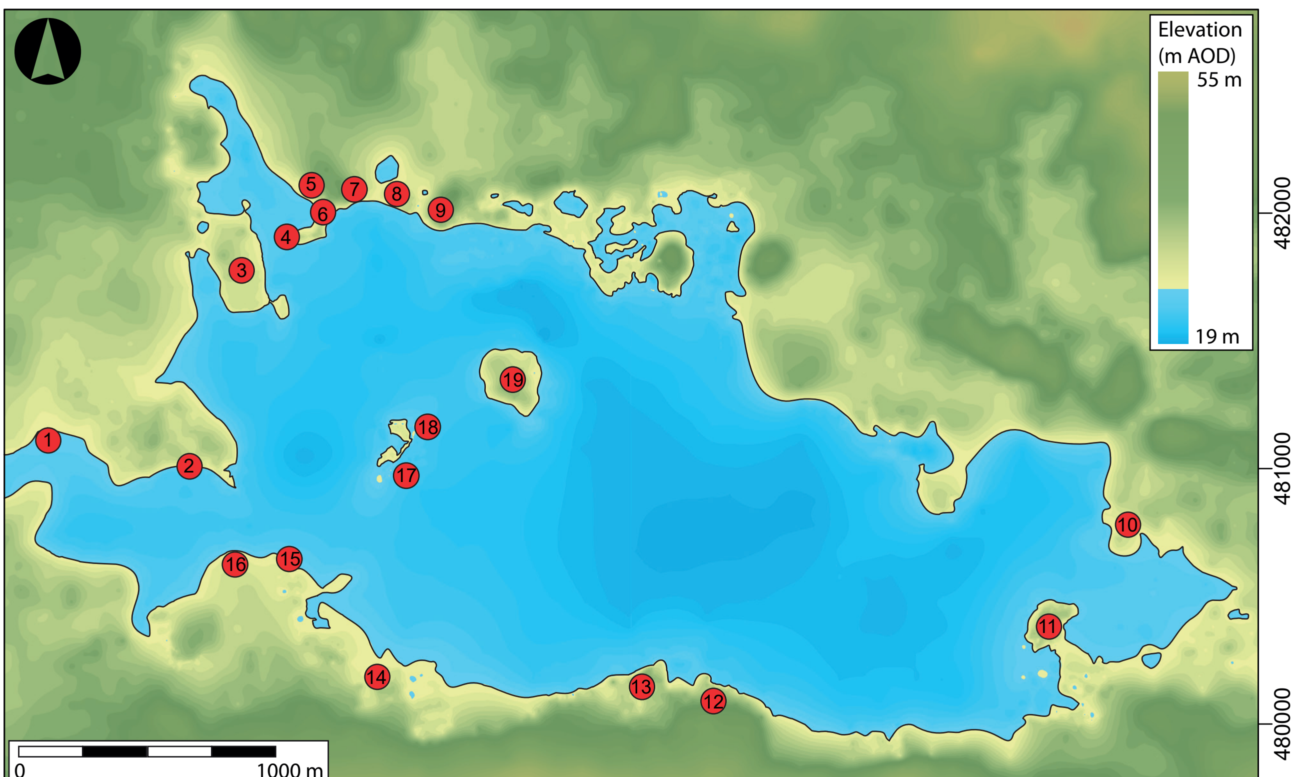

Figure 19.3. *Map showing the location of Early Mesolithic sites. The level of the lake is shown at 24 m AOD. 1: Flixton 9. 2: Star Carr. 3: Ling Lane. 4: Site D. 5: Site L. 6: Site K. 7: Site B/Rabbit Hill. 8: Site C. 9: Manham Hill. 10: Lingholm A. 11: Barry's Island. 12: Flixton School Field. 13: Flixton School House Farm. 14: Manor Farm. 15: VP E. 16: VP D. 17: Flixton Island Site 1. 18: Flixton Island Site 2. 19: No Name Hill.*

Figure 19.4. *Example of a probable hearth at Seamer Carr Site K (site grid square 25/33, context 5012) (Photo Simon Everson, July 1984).*

notably at No Name Hill and Flixton Island Site 1, though as with those from Seamer Carr there is no clear evidence concerning their function.

Flint procurement and use

In contrast to the Palaeolithic phases of activity, the predominant source of material in the Early Mesolithic lithic assemblages was glacial till in the form of beach pebbles, indicating a close connection with a coastline that would have been around 10 km distant at the time (Gaffney et al. 2007; Krüger et al. 2017). Small- to medium-sized beach pebbles were preferentially used, and when larger material was obtained it was split into smaller packages. Caches of till flint (again mainly beach pebbles rather than anything more exotic) were also placed in the landscape for future use. Wolds material, despite being local, was used to a much lesser extent than in the Final and Terminal Palaeolithic, possibly because it had become less accessible as scree slopes became increasingly vegetated. There are also issues of quality involved, with Wolds flint being coarser and prone to inclusions. It was rarely used for small, fine pieces such as microliths, but was more commonly used for scrapers, where quality was less of an issue, and for axes, where larger packages of raw material were needed.

There is considerable variation in the tools present in the assemblages recorded from locations around the lake. Some are specialized, dominated by scrapers (such as Seamer Carr Site C, Scatters H and K), microliths (Site K, Scatter 30), or burins (Site K, Scatter 23); others are more balanced between different activities, though all these appear relatively small in scale. There is also a difference in the intensity of activities. At VP D, for example, a complete refitted sequence included a single microlith, while at Seamer Carr Site K Scatter 30, a single sequence contained 11 microburins. Variations within the assemblages from particular sites also show that people undertook a range of activities at places around Lake Flixton.

There is also some evidence for the ways in which the character of activity represented by the lithic assemblages varied across specific locales in relation to the immediate environment. For instance, the lithic analysis shows a clear difference between the assemblages recorded on what would have been dry ground, where a wide range of knapping and tool using tasks were undertaken, and those from the approximate line of the shore, where tasks focused on the use of flakes, blades and formal tools. The cutting of material appears to have been an important component of these tasks, which could have included the harvesting of wetland plants and the butchering of animals (the latter supported by the presence of faunal material in the adjacent, wetland deposits). However, the types of tools present do vary, suggesting that a broader range of activities were undertaken in these areas. These probably included antler working, given the presence of burins in test-pits excavated along the north shore of No Name Hill, and antler working waste in the adjacent deposits. The presence of flakes, blades and tools in the lake marginal sediments also suggests that people were carrying out tasks within the shallow-water reedswamp (and later in the terrestrialized carr environments), as well as on the damp soils along the shore.

Hunting and the use of animal remains

The faunal assemblages consist predominantly of large mammals, particularly red deer and aurochs, though elk and roe deer are also present at most of the investigated locations. Wild boar is far rarer, both in terms of the amount of material and the number of locations where it has been recorded, and there is no evidence for the utilization of small mammals, fish or birds. This is a much narrower range of species than is represented in the assemblages from Star Carr, which included a range of smaller mammals, birds and fish (albeit in limited numbers). This is probably due in part to sampling and sieving strategies, as some of the small mammal remains and fish bones from the recent excavations at Star Carr were recovered by sieving (Knight et al. 2018b; Robson et al. 2018). However, the lack of species such as beaver, which are relatively well represented in the excavated assemblages at Star Carr, is surprising and may reflect differences in where these animals lived, were hunted, or how their remains were deposited.

These issues aside, the range of species present conforms to two previously observed trends in the patterns of animal remains found at Early Mesolithic sites more generally (Conneller and Overton 2018). The first is that there is regional variation in the presence and abundance of certain animal species. Within Britain, the larger mammals (notably elk and aurochs) are often well represented at northern sites, while wild boar remains are rare, a situation that is reversed at more southerly sites where wild boar are more common (Conneller & Overton 2018). Similar patterns can also be seen on the continent, particularly in the distribution of elk which is restricted to sites in northern Germany and Scandinavia (Overton & Elliott 2018). As Overton and Elliott (2018) note, these regional differences probably have an environmental cause, as open woodland habitats more suited to large ungulates (particularly elk), would have persisted for longer in the northern parts of Europe. The second trend is that multiple species are often represented in the faunal assemblages from most Early Mesolithic sites, which suggests that hunting strategies were generally broad and non-selective (Conneller & Overton 2018). Some variation in this pattern can be seen at sites in southern England where the faunal assemblages can be dominated by a single species, such as at Faraday Road in the Kennet Valley, Berkshire, where the assemblage consisted largely of wild boar (Conneller & Overton 2018; Ellis et al. 2003). However, as Overton and Elliott (2018) argue, these tend to occur in the same landscapes as contemporary sites where the faunal assemblages include a more diverse range of species (such as Thatcham). As such, they should be seen as discrete moments when groups predated on a particular animal, within a wider context of non-discriminatory hunting (Overton & Elliott 2018).

The environments around Lake Flixton would have provided habitats for all of the species represented in the assemblages, and it is possible that most (if not all) were killed within the local landscape. Elk typically range through both woodland and wetland environments, and are likely to have inhabited areas of the lake, or the wetlands to the east and west, that would have been fringed with thickets of willow and aspen, and by birch forest. These thickets would also have provided browse for red and roe deer, as would communities of willow and aspen growing within the surrounding forest. Open areas, either within the forest or around the lake shore, would have provided grazing for aurochs, which are also likely to have visited the lake to drink or to graze on reeds.

The aurochs remains from Site B show that large mammals certainly were being hunted and killed around the edges of Lake Flixton. The remains consisted largely of vertebrae, ribs and pelvis, and were deposited into sediments forming in a carr environment close to the edge of the lake. The dense pitting of the sediments on which the bones rested, and were partly embedded (see Fig. 8.9), is certainly suggestive of localized disturbance as a result of intensive foot traffic, which could point to the animal having been brought down in this location. The targeting of animals at potential grazing and watering sites has been identified at several other Mesolithic sites in Europe, and clearly formed an integral part of the hunting practices of the period as a whole. Finds of aurochs bones have been recorded from several locations in the Tjonger Valley, Friesland (The Netherlands) and have been interpreted as the primary butchery sites of animals that had been hunted and killed as they visited the area to graze or drink (Prummel et al. 2002). Similarly, the partial butchered remains of an aurochs were recorded from a former river bed at Potsdam-Schlaatz, Germany (Sørensen et al. 2018), suggesting a comparable hunting scenario. The deposition of butchered elk carcasses in a former kettle hole at Lunby Mose may also derive from animals killed as they came to drink or graze within the lake (Leduc 2014), and the finds of partial elk carcasses from other wetland areas in Denmark may be suggestive of similar practices. This focus on the hunting of animals in and around the edges of lakes and wetlands may also explain the formal deposition of whole animals, partial carcasses, and osseous material culture into areas of standing water at Star Carr, No Name Hill, and Flixton School House Farm, and the comparable practices recorded at other European sites (see below).

If the assemblage from Site B is representative of hunting strategies more generally, then it suggests hunters were either targeting solitary animals, or separating individuals from groups, rather than killing multiple animals in one event (see also Legge & Rowley-Conwy 1988, 42–3; Overton & Taylor 2018). This is supported by the recently reported finds of elements from another individual aurochs at Flixton School House Farm (Overton & Taylor 2018), and compares well with a number of sites in northern Europe where single or small numbers of animals were found at kill/butchery sites. At Balkweg, in the Tjoner Valley, elements from the carcass of a single aurochs were recovered (Prummel & Niekus 2011) while the partial remains of four individuals, resulting from at least two hunting episodes, were recovered at Jardinga, several kilometres to the north (Prummel et al. 2002). The Potsdam-Schlaatz aurochs was also a single individual (Sørensen et al. 2018). A potential elk kill and butchery site was also recorded at Krudtmosen near Favrbo, on Zealand (Denmark), where the heavily processed carcasses of two elk (a male and female) were recorded (Sørensen et al. 2018), and two of the four concentrations of elk bones at Lundby Mose represent single individuals (Leduc 2014).

Once killed, the Site B aurochs was partially butchered on site, and parts of the carcass (notably the limb and limb extremities) were taken away to another location. This mirrors the assemblages from other excavated localities around the lake, which generally consist of elements from limbs (including the limb extremities) or jaws (mandibles and maxillae), with fewer axial elements (vertebra, ribs and pelvis), suggesting that these were locations where parts of carcasses were brought. However, given the small size, and somewhat fragmentary nature of these assemblages, we should not assume that all animals were treated in this manner, and the nature of the Star Carr assemblage, which has a much wider range of elements, suggests that in some cases complete animals were brought back to the site. Patterns of off-site butchery may be influenced by a range of factors. At Mullerup (Zealand, Denmark), Leduc (2012) noted that some of the larger mammals, particularly elk and aurochs, were often brought to the site as partial carcasses, whereas roe deer came to the site whole, a pattern that she argued related to the size of the animals (see also Prummel & Niekus 2011, 1464). However, at Friesack 4 (Northern Germany), only selected parts of both red and roe deer carcasses were brought onto the site (Schmölcke 2019), suggesting that factors other than size influenced off-site butchery decisions. This could include the distance that the carcass had to be carried, or the terrain and environments through which it had to be carried. Off-site butchery processes would also have varied depending on how parts of the animal's carcass would be used for food and as a source of material. The lack of bones from the limb extremities at Site B contrasts with the sites in the Tjonger, and with Lundby Mose, where those parts of the body were being heavily processed at the butchery site, probably to extract the marrow (Prummel et al. 2002, Leduc 2014). The lack of such evidence at Site B, and the presence of broken metapodia at Site C, would suggest that the processing of these parts of the body was undertaken away from the butchery site.

Another reason for the retention of elements was their use as a source of material for tools. Though evidence for bone tool manufacture was absent from most of the assemblages recorded around the lake, a number of tools made from aurochs metapodia were recorded during Clark's excavations at Star Carr (Clark 1954, 161–2), and it is unlikely that their production and use was limited to this location. That animal bone was being used more widely is also reflected in the tool (a possible gouge) made from the tibia of a juvenile aurochs that was recorded in the sand layer at Barry's Island, and the fragment of a bone barbed projectile point that was recorded at No Name Hill. Red deer antler was also being retained and used at sites around the lake. Two antler barbed points and a fragment of red deer antler, worked using the groove and splinter technique, were also recorded at No Name Hill, and a near complete antler showing clear signs of the removal of a barbed point blank using the same technique was recovered from Site K. Limited though such instances are, these finds demonstrate that the manufacture of barbed points was not restricted to Star Carr, but formed part of the range of activities undertaken within the wider landscape.

Management and exploitation of plant communities

The palaeoenvironmental records show that Early Mesolithic groups had a noticeable influence on the environments around the lake. At Flixton School Field, localized burning coincided with disturbance of the lake-edge woodlands and wetlands, both at the very start of the period and towards the end of the Early Mesolithic. Similarly at No Name Hill, openings were created in the birch woodland, which created space for the growth of beech, while small-scale burning also affected the nearby reedbeds. In some cases these may have been the unintended result of human action, such as the accidental burning of wetland vegetation, or woodland disturbance resulting from small-scale tree felling. However, some may reflect intentional management practices. This is particularly true of the later phases of burning at Flixton School Field, which coincided with the creation of clearings in the birch woodland, which were subsequently colonized by hazel. This also occurred at Flixton 9, where burning coincided with the clearance of willow growing between the birch woodland and the lake shore, again followed by the expansion of hazel. In both cases, human action seems to be the likely cause for the openings created in the woodland, which may have initially been maintained by the use of fire in order to encourage the growth of economically important hazel.

Although such burning events are more often associated with the Late Mesolithic, the data from Lake Flixton adds to a growing body of evidence for the deliberate management of vegetation by Early Mesolithic groups. Vegetation disturbance associated with episodes of burning during the Early Mesolithic have been recorded at a number of localities on the North York Moors (see Innes et al. 2011 for a summary), and multiple disturbance events (each spanning *c*. 50 C^{14} years) were recorded at Sproatly Bog (Holderness) by Tweddle (2001). Bush (1988) has also argued for the deliberate clearance of woodland on the Yorkshire Wolds, though this work has been the subject of some critique (Thomas 1989; Day 1996b). In the south of England, work by Barnett (née Chisham) in the Kennet Valley, Berkshire recorded evidence for multiple episodes of burning, varying in their intensity and scale from short-lived events to prolonged periods spanning more than a century, that corresponded with changes in the pollen spectra (Barnett 2009; Chisham 2004). As with Lake Flixton, these disturbance events occurred within a landscape occupied by Mesolithic groups, and in some cases were contemporary with radiocarbon dated episodes of human activity. Episodes of vegetation disturbance have also been documented in areas of Early Mesolithic activity in the Lahn Valley in central Germany (Bos and Urz 2003), and between the Rivers Elbe and Jeetzel in northern Germany (Tolksdorf et al. 2013), though in the latter case it was not clear if the impacts were deliberate.

While intentional plant management clearly had an effect on vegetation around Lake Flixton, the pollen record also shows that plant communities were being altered through the unintended consequences of human action. As noted above, some episodes of woodland disturbance coincided with phases of burning, but with no direct correlation between the two. If we assume that the evidence for burning reflects the presence of humans, then it suggests that other forms of anthropogenic activity were also resulting in changes to the composition and character of woodland communities, albeit at a local scale. As both Warren et al. (2014) and Bishop et al. (2015) have discussed in relation to the Irish and Scottish Mesolithic respectively, a range of activities including the harvesting of hazelnuts, coppicing, the felling of trees and/or removal of side branches for use as materials, and the collection of wood for fuel would all have affected the structure of Mesolithic woodlands. That such activities were being undertaken in the Lake Flixton landscape is evidenced by the huge assemblage of worked wood and woodworking debris at Star Carr (Bamforth et al. 2018a, b), the more widespread occurrence of lithic tools that require wooden hafts, and by the presence of a tranchet axe and two sharpening flakes at No Name Hill, and axe sharpening flakes at Flixton School Field, VP E, Lingholm Farm Site A, Barry's Island, and Seamer Carr Sites C, K and L. The presence of coppiced stems at No Name Hill, as well as Star Carr (Bamforth et al. 2018a, b) and Flixton School House Farm (Taylor 2018), also shows that wood was being harvested at these, and potentially other, locations. Analysis of the material from Star Carr found no evidence for a regular rotational cycle that could indicate a structured coppicing regime (Bamforth et al. 2018a). These are similarly absent at other Mesolithic sites (both Early and Late) (Warren et al. 2014) and suggest the opportunistic use of naturally occurring coppice, or *ad hoc* exploitation of deliberately created stands.

It is also likely that wetland vegetation was being harvested by Mesolithic communities around the lake, which may also have resulted in the small-scale disturbance of these environments. As has been discussed, the presence of flint flakes and blades within the lake-edge deposits at No Name Hill, and along the shore at several other sites, suggests that people were harvesting wetland species for use as food or material. This is supported by use-wear analysis at Star Carr, which identified use-traces characteristic of the cutting and scraping of siliceous plants on flakes, blades and tools (Conneller et al. 2018). The use-traces on the blades were comparable to those recorded during experimental studies on the working of plants such as reeds and rushes, and the authors argued that the blades had probably been used to extract plant fibres, or to prepare the stems of plants for working into artefacts such as mats and baskets (Conneller et al. 2018). Comparable practices have also been recorded from Late Mesolithic wetland sites in The Netherlands, where use-wear suggests that flint tools were used for the treating or processing, rather than harvesting, of siliceous plants (Out 2009, Van Gijn et al. 2001). At Hardinxveld De Bruin, this is thought to have involved wetland plants such as bulrushes and rushes, possibly for the manufacture of ropes, baskets or nets (Van Gijn et al. 2001, 190–1).

Evidence for the use of plants for foods is scarce in this landscape, with no evidence from the sites excavated by the Seamer Carr project or VPRT, or from the recent excavations at Star Carr. However, carbonized hazelnut shells were recorded from Early Mesolithic contexts during the recent excavations at Flixton School House Farm (Taylor 2012), and their exploitation is unlikely to have been limited to this site. It is equally unlikely that other plants were not utilized as food, given that many of the species present around the lake have been identified as food plants at other Mesolithic sites in northern Europe. Seeds of yellow water lily were recorded from the occupation deposits at the Dutch Mesolithic site at Holemgaard (cited in Clark 1954, 14) and at Lough Kinale, Ireland (Warren et al. 2014, 634), and concentrations of white water-lily seeds were recovered from pits at Mount Sandel, Ireland (Woodman 1985, 79). A range of fruits have been recorded from assemblages of carbonized materials from Mesolithic sites in both Scotland and Ireland (Warren et al. 2014, Bishop et al. 2014), carbonized tissue of common bulrush and club rush have been recorded from hearths at two sites in the regions of Stadskanaal and Nieuwe Pekela, The Netherlands (Perry 1999, 234), and recent work by Bishop (2022) suggests the widespread use of roots and rhizomes as dietary staples. As with the use of plants as materials, the collection strategies relating to food plants such as these is likely to have resulted in some of the disturbance episodes recorded in the pollen profiles from sites around the lake.

Comparison with Star Carr and the issue of artefact deposition

It is not possible to discuss the Early Mesolithic archaeology documented by the Seamer Carr and VPRT projects without also comparing it to the evidence from Star Carr. During the early 2000s, several authors drew attention to the apparent contrast between the archaeological assemblages recorded during Clark's excavations at the site, and those recovered from the work at Seamer Carr and elsewhere around the lake (e.g. Chatterton 2003; Conneller 2003; Conneller & Schadla-Hall 2003). In particular, they noted that the large assemblages of faunal material and osseous artefacts from Star Carr, as well as beads and other possible body ornaments, were largely absent from the other sites, suggesting differences in the patterns of deposition within the landscape.

The results of the recent excavations at Star Carr make the contrast with the other sites around the lake even starker. The excavations carried out between 2004 and 2013 recorded multiple post-built structures and a series of substantial wooden platforms or trackways, as well as very large concentrations of faunal material, lithics, and artefacts made from bone, antler and wood (Milner et al. 2018a, 2018b). This was recorded from a trench excavated along a 50 m stretch of the lake shore, while test-pitting and fieldwalking show that traces of Early Mesolithic activity cover an area of almost two hectares. Within the excavated portions of Star Carr, there is evidence for woodworking, the butchering and processing of animals, and the working of antler (Taylor et al. 2018c). There is also evidence for the formalized treatment and disposal of materials and artefacts in the wetland parts of the site. This includes the deposition of whole or partial animal carcasses, the decommissioning and disposal of bone and antler artefacts, and (on at least one occasion) the curation and subsequent deposition of a very large assemblage of animal bone, bone and antler artefacts, woodworking debris, and worked flint (Taylor et al. 2018c).

Overall, the volume of material from Star Carr is enormous. Over 24,000 pieces of worked flint were recorded during the recent work at the site, the majority from the excavated area, and Clark recorded almost 17,000 more. Osseous artefacts are also more abundant (a total of 227 barbed points) and include a wider range of types, notably red deer antler frontlets, antler axes and mattocks, and bone bodkins and scrapers. In human terms, the archaeology represents a significant investment in terms of labour and materials. The excavated 17 m of the central wooden platform, for example, was made from 26 whole tree trunks, and several hundred pieces of wood including 57 long, split timbers (Bamforth et al. 2018b).

To some extent, the differences between Star Carr and other activity locations around the lake may be the product of sampling; the excavations of the Seamer Carr Project and VPRT focused primarily on the lake shore with more limited investigations of the adjacent wetland deposits (a fact necessitated by the far greater depth of peat), which may explain the lower quantities of animal bone, osseous artefacts, and evidence for woodworking. However, the long, machine cut trenches at Seamer Carr failed to recover evidence for the large, dense deposits of animal bone of the sort recorded at Star Carr. Also, sampling cannot explain the differences in the volume of material recorded from the dryland areas, or the absence of post-built structures, when one considers that the open-area excavations at Sites C and K provided a thorough sample of the lithic and faunal material, and would have identified the presence of structures. Furthermore, while the work of the Seamer Carr Project and VPRT established the full spatial extent of the activity of many of the sites they investigated, most are far smaller than the extents of activity at Star Carr.

Taking these points into consideration it is clear that, in terms of the scale of activity, Star Carr was a very different place to the other locations around Lake Flixton. Certain forms of activity were also limited to Star Carr, notably the construction and use of the timber platforms, the large-scale deposition of curated assemblages of material into the lake, and the deposition of whole or partial animal carcasses. However, the formalized treatment and deposition of animal remains, and objects made from osseous material, was also carried out at other locations around the lake (albeit at a much-reduced scale). A damaged uniserial barbed point was recorded from the peat deposits at No Name Hill (trench NAO), two broken fragments were found 20 m away in trench NAZ (see Fig. 17.3), and a broken fragment of another point (consisting of one barb) was reported by Clark as coming from Flixton Island (Clark 1954, 152). Though a much smaller assemblage, these conform to the pattern of artefact treatment at Star Carr, where the curated remains of broken points were deposited along with complete barbed points that were de-hafted prior to deposition in the lake. In addition, recent excavations at Flixton School House Farm (on the southern shore of the lake) have recorded an assemblage of aurochs bones (possibly contained in a bag, or wrapped in hide) that were deposited into a small pond (Overton & Taylor 2018), which again suggests a very deliberate form of disposal. Although more work is needed, these finds suggest that acts of deposition associated with animal remains, or objects made from animal bodies, were part of the pattern of activity across this landscape.

These acts of deposition fit into a broader suite of cultural practices relating to the appropriate treatment of animal remains that has been observed both in Britain and other parts of northern and western Europe. Overton (2016), for example, has shown that elements from the carcasses of smaller mammals were being curated at Early Mesolithic sites in southern England. The deposition of partial elk skeletons (possibly in bags or bound up in hides) has been recorded at Lundby Mose in Denmark (Leduc 2014), partial elk carcasses and selected elements have been recovered from wetlands in Denmark and southern Sweden (e.g. Pedersen and Brinch Petersen 2017), as well as complete elk and aurochs skeletons (e.g. Noe-Nygaard 1973), and at Auneau in France, aurochs skulls and horn cores were recorded from a series of Mesolithic pits (Leduc & Verjux 2014). Although the specific motivations behind these practices of deposition are unclear, it has been argued that they relate to cultural attitudes toward animals similar to those documented in ethnographic studies of contemporary and historical hunter-gatherers. In these accounts, the treatment and disposal of animal remains (and other materials) are structured by culturally appropriate forms of behaviour, which seek to avoid offending the animal and/or supernatural agents who protect it (e.g. Jordan 2003). With these points in mind, the discard episodes documented in Mesolithic contexts may not represent 'ritual' activity, but instead were acts that were carried out within the context of everyday practices, such as hunting and butchery, and which were informed by specific beliefs concerning human-animal relationships and, perhaps the spirit world.

Settlement patterns around Lake Flixton

A recurring theme in the way that the Early Mesolithic archaeology of Lake Flixton has been studied has been to regard individual sites as components in wider sets of economic activity that extended across the lake and the surrounding landscape. At a broad level this is clearly the case. The killing and butchering of the aurochs at Site B, for example, was followed by the removal of parts of the carcass to another location, where it was processed, consumed for food, and perhaps worked into tools before being deposited. However, some studies have gone further, and placed sites into functionally interrelated categories of activity, such as residential bases, logistical stations, and hunting or foraging camps, which formed elements of broader patterns of settlement and mobility within the wider landscape. A recent example comes from the work of Donahue and Lovis (2006), who have argued that the Seamer Carr sites represent logistical stations, from which groups occupying a winter residential base at Star Carr set out on short distance hunting forays onto the North York Moors, and longer distance expeditions to the Pennines.

Such models have been the subject of considerable critique, which has drawn on the analysis of the lithic assemblages from Seamer Carr and other locations around the lake (e.g. Conneller & Schadla-Hall 2003, Conneller 2005, Conneller & Overton 2018). These have argued that, rather than reflecting specific types of activity, the lithic assemblages display a high degree of variability in terms of both the character and scale of the tasks that were taking place on different visits to these sites. Furthermore, some locations show episodes of occupation and abandonment spanning significant periods of time. At No Name Hill and Flixton School Field, for example, if we take the charcoal record as a proxy for human activity, then these locations were utilized on multiple occasions, potentially over periods of decades if not centuries. Given the variability seen in the lithic assemblages we should not assume that the activity taking place at these locations remained the same, either within or between these periods of occupation. Instead, it would suggest that these (and potentially other) locations were the focus of multiple episodes of occupation and abandonment, during which the character, scale and intensity of activity changed.

This is not to say that people were not moving between different places around the lake, or that elements of the archaeological assemblages do not reflect activities undertaken at one location (such as No Name Hill) by groups residing at another (such as Star Carr). Rather, there was not necessarily a single, uniform pattern of economically and functionally interrelated sites throughout this period. Instead, the archaeology suggests that patterns of settlement and mobility during the Early Mesolithic were dynamic, multi-temporal and variable. At some times Star Carr may have acted as a focus for occupation by a group of people who undertook short journeys to other points around the lake, such as No Name Hill, to exploit particular plant resources, catch fish, or trap small mammals. At others, the residential focus may have shifted away from the lake, with small groups coming into the area from slightly farther away and establishing temporary camps at places such as Seamer Carr or Star Carr as they hunted large mammals in the lake margins, or in the surrounding forest. Rowley-Conwy (2017, and see below) has argued that such journeys may have been undertaken by boat along the extensive system of lakes and channels that existed to the west of Lake Flixton, perhaps drawn to the lake because of the relative predictability of resource availability compared to locations further west in the Vale of Pickering. Of course, such patterns may have changed throughout the year, as supported by the (albeit limited) seasonality evidence, but they may also have shifted on decadal or generational scales.

It is also clear that cultural rules, as well as economic concerns and environmental resources, structured patterns of activity within this landscape. Throughout the early part of the Early Mesolithic, people made the conscious decision to repeatedly occupy the same locations around the lake. As has been discussed, the charcoal records from No Name Hill and Flixton School Field indicate the repeated occupation of these locations, as does the radiocarbon chronology and the evidence from refitting the lithic assemblages from Seamer Carr C and K. This is complemented by the recent radiocarbon chronology from Star Carr, which shows that the site was occupied over a period of *c*. 850 years (Milner et al. 2018c). Such repeatedly occupied locations are a feature of Mesolithic landscapes in Britain and mainland Europe more generally (e.g. Barton et al. 1995; Mithen 2000; Amrkeutz 2013a and b), and have been termed 'persistent places', following Schlanger's (1982) work on the settlement patterns of the prehistoric Anasazi. For Schlanger, persistent places arose through the functional and economic importance of certain locations, and Mesolithic sites have often been interpreted in the same way (e.g. Barton et al. 1995). However, an economic argument is harder to sustain at sites around Lake Flixton, given that the environments at these locations changed significantly throughout the time they were being visited. At No Name Hill, for example, the first Mesolithic visitors to the island arrived as birch woodland was forming on the island, and a narrow band of emergent vegetation was present around the shore. By the later phases of activity, around *c*. 8500 cal BC, carr environments were present around the island, with reedswamp extending further into the basin, and hazel was becoming established on the dry ground. At a landscape scale, wetland succession and the development of the woodland would have affected the spatial patterning of plant communities and animal habitats around the lake, meaning that the locations of hunting camps, kill sites, and plant collection areas would have shifted across the landscape throughout the period (see Taylor 2019). This makes it unlikely that the reuse of particular locations was solely related to 'economic' or 'resource procurement' factors, but instead was at least partly based on cultural considerations regarding the appropriateness of specific places as locales where, and perhaps when, activities could take place (see Taylor 2018).

Finally, the data generated by the Seamer Carr Project and the VPRT, in tandem with the wealth of evidence now available from Star Carr, support the notion that Lake Flixton itself was 'the site' (if such a term has any meaning with reference to the landscape practices of hunter-gatherers), around which diverse kinds of human activity took place leaving multiple, and often overlapping material traces, of variable spatial and temporal extent. As has been argued, some localities remained the foci of activity for generations, steadily becoming persistent places with specific histories of use and association that, in turn, may have encouraged repeat visits and performance of particular tasks and activities. Other localities, although evidently revisited on a number of occasions, seemingly did not have the same kind of draw, or merely lost their significance within the wider taskscape of the lake. Others still, were only ever places of fleeting, short-term activities, opportunistically used but seemingly never acquiring sufficient significance for the continued accumulation of material traces of a Mesolithic presence.

The wider Early Mesolithic context

Though Lake Flixton was clearly an important focus for Mesolithic groups, it remains a small part of a much wider landscape, incorporating a wide range of environments, some of which have evidence for broadly contemporary episodes of occupation.

Wetland environments would have been present across much of the lower parts of the valley floor, both to the east and west of Lake Flixton. Recent work at Wykeham Quarry (*c*. 3 km to the northwest of Lake Flixton) has documented the formation of wetland environments within and around a series of small basins during the early centuries of the Holocene (Lincoln et al. 2020), and similar environments were probably present along much of the Vale. Data from LiDAR, for example, shows a relatively large depression, possibly an irregularly shaped basin, almost 2 km long, immediately to the west of the Lake Flixton outflow channel and south of Wykeham Quarry. Though this has yet to be investigated, walkover surveys by the authors have shown this to be infilled with peat, and is likely to have been an active wetland, possibly associated with areas of standing water, during the Early Mesolithic. Peat deposits continue further to the west, and probably reflect the formation of wetlands during the Early Mesolithic, while surveys conducted by Taylor (2012) show small, peat-filled hollows and basins extending at least 1 km to the east of Lake Flixton. Unfortunately, there is very little evidence for Mesolithic activity associated with these areas, though this is probably due to a lack of systematic surveys and sampling of the peat that seals the Early Holocene landscape.

In contrast, an extensive record exists for the occupation of the North York Moors, where work undertaken since the latter part of the 20th century has generated a growing body of evidence for activity during both the Early and Late Mesolithic (e.g. Jacobi 1978, Waughman 2017). Early Mesolithic sites and finds are known from the Tabular and Hambleton Hills, but much of the evidence lies on the higher moorland plateau to the north, typically above an altitude of 300 m AOD (Waughman 2017, 10). Very few sites have been the subject of detailed excavation, and the work carried out by Jacobi (1978) and the Taylors at Pointed Stone (sites 2 and 3) and Money Howe, on Bilsdale Moor remains the clearest evidence we have for the character of activity in these areas. In both cases the sites were relatively small (less than *c*. 7.5 m across), with lithic assemblages that contained very high proportions of microliths (Jacobi 1978). A lack of stratigraphy and a paucity of absolute dates make it difficult to establish a chronology for these sites. However, the presence of multiple lithic scatters at both Pointed Stone site 3 and Money Howe may suggest that they were revisited on multiple occasions, whilst differences in microlith typology (Star Carr type at Pointed Stone, Deepcar type at Money Howe) implies a degree of time-depth to the occupation of this part of the Moors (for a wider discussion on the temporality of microlithic typologies, see Conneller & Griffiths 2025).

Early Mesolithic activity is sparser on the Yorkshire Wolds, which seems surprising given the number of sites on the North York Moors. Though there is some debate as to the character of the environments on the Wolds (Bush 1988, 1989, 1993; Thomas 1989), it is unlikely that they would not have supported many of the key mammalian species present in the faunal record. As such the absence of sites may well reflect the different research priorities and fieldwork strategies of this area, though it is also possible that local geomorphological conditions have led to the burial of Early Mesolithic land surfaces through colluviation along the valley bottoms. There is evidence for occupation to the east and south within the extensive wetland landscapes of Holderness, and along the Humber and its tributaries. As with Lake Flixton, the Holderness area has a long tradition of palaeoenvironmental research that has recorded a series of lake basins and associated wetland environments that were present during the early part of the Holocene. Archaeological fieldwork has documented several surface scatters of Mesolithic material (Van de Noort & Ellis 1995), though the only dated evidence for Early Mesolithic occupation comes from an assemblage of animal bone that had eroded from an exposed section of lacustrine deposits on the shore at Skipsea (Cadman et al. 2018). The remains derived from at least two red deer, an element from one of which was directly dated to 9140–8740 cal BC (9531±43 BP, SUERC-65809) (Cadman et al. 2018). Twelve uniserial barbed projectile points have also been recovered from the area, ten from Brandesburton, with single finds from Hornsea and Skipsea, the latter of which was also associated with animal remains (Clark and Godwin 1956; Davis-King 1980; Overton and Elliott 2018). As with the assemblages from Lake Flixton, these include near complete barbed points, broken tips, mid-sections and tangs, and were probably deposited into lacustrine or wetland environments. Not all of these points are necessarily Early Mesolithic, as uniserial points are also a feature of the Final Palaeolithic, and the majority are made from bone rather than antler, indicating different raw material strategies to Lake Flixton (Overton and Elliott 2018, 341). However, there are also clear similarities, both in terms of manufacture and decoration, and the nature of the depositional environment, which suggests comparable ways of making and depositing barbed points between these landscapes (Overton & Elliott 2018, 341). To the south of the Wolds, work by Halkon has identified Early Mesolithic activity associated with a series of large, shallow basins in the Foulness Valley, a tributary of the Humber (Halkon & Innes 2005). Though these sites are known from fieldwalking rather than excavation, the evidence suggests a very similar pattern of occupation and landscape utilization to Lake Flixton, with scatters typically located on raised areas of ground either adjacent to, or within the wetland environments (Halkon & Innes 2005, 233).

How these different regions relate to the occupation at Lake Flixton is a point of some debate. Writing before the work at Seamer Carr, Grahame Clark (1972) placed the occupation of the lake into a broader model of seasonal migration, where communities came together at Star Carr during winter and spring, but dispersed into smaller groups during the summer as they moved onto upland locations following migrating herds of red deer (Clark 1972). This was subsequently supported by the work of Jacobi (1978), who argued that differences in the lithic assemblages between Star Carr and Pointed Stone (particularly the higher proportion of microliths and the absence of burins at the latter) reflected differences in patterns of hunting and craft activity between the wooded winter lowlands and the more open summer uplands. This model has been the subject of some criticism. This is based partly on the reassessment of the faunal assemblages, which suggest that red deer were not as economically important as Clark had suggested (Caulfield 1978), and that Star Carr was occupied during the early summer (Legge and Rowley-Conwy 1988, and see Mellars 1998b). Furthermore, as Legge and Rowley-Conwy (1988) note, red deer do not migrate large distances in wooded environments. However, as Mellars (1998b, 234) states, this does not preclude the use of the uplands for hunting, particularly as this would help to avoid the over-exploitation of animal populations in other parts of the landscape.

Others have argued that Lake Flixton formed part of a broader, seasonally based migration pattern that incorporated the Vale of Pickering more generally, as well as the North Sea Coast and the more distant wetlands of Holderness and the Humber. Donahue and Lovis (2006), for example, argued for a seasonal inland-coastal migration. In this model, groups were based at Lake Flixton (and particularly Star Carr) from autumn to spring, during which time hunting parties set out on short and long-distance expeditions on to the Moors or Pennines, and then moved to sites along the North Sea coast during the summer (Donahue & Lovis 2006, 255). In contrast, Uchiyama (2016) has suggested the residential focus may have moved beyond the Vale of Pickering seasonally, possibly to places on the Humber, or where the Rivers Tees or Esk met the North Sea, during which time Lake Flixton was used for hunting. Most recently Rowley-Conwy (2017) has argued that the occupation of Lake Flixton was part of a wider pattern of wetland occupation, that incorporated the Vales of Pickering and York, and Holderness, as well as utilizing hunting areas on the surrounding uplands. As Rowley-Conwy (2017) states, movement through these areas would have been facilitated by canoe, allowing groups to travel relatively long distances while carrying supplies of flint as well as the carcasses of animals.

These more complex models, incorporating a greater variety of landscapes and environments, certainly fit more easily with the economic diversity that we see at Lake Flixton, where people were predating on a variety of different animal, fish, and bird species, and potentially utilizing a range of different plants for both food and material. In this context it is difficult to imagine how Mesolithic groups would not seek to adopt a similarly diverse strategy in terms of their occupation of the wider landscape. However, where we should be cautious is in assuming that patterns of settlement and mobility remained static throughout the Early Mesolithic. As has been discussed, the record from Lake Flixton suggests that there was considerable temporal variability in the way this area was inhabited, which would imply that their relationship with the wider landscape was equally dynamic. Certain areas of the surrounding landscape may have gone in and out of use over periods of years or decades as people responded to factors such as short-lived changes in animal populations. Over longer time scales, environmental succession within both the wetland and terrestrial landscapes would have affected the behaviours and habitats of prey animals, and changed the availability of certain plant species, resulting in changes in patterns of economic activity, as well as mobility.

We should also consider the degree to which the hunting and resource procurement strategies employed by groups at Lake Flixton necessitated seasonal movement away from the immediate area.

It is now readily apparent that there were a variety of plant and animal resources available around the lake, and there may have been few economic pressures for any seasonal movement away from the local vicinity. This is supported by the observations on differences in the migratory behaviour of red deer in woodland and moorland environments (Lister 1981, and see also Legge & Rowley-Conwy 1988) and, perhaps, by the evidence for plant management, some of which may have been undertaken to produce predictable and sustainable resources. People certainly did have contacts with the North Sea coast, as indicated by the isotopic values of the dog remains from Site L at Seamer Carr (Clutton-Brock & Noe-Nygaard 1990; see also Day 1996a; Dark 2003; Schulting & Richards 2002), and the probable source of much of the lithic raw material. However, this could represent regular visits to the area by small groups of people, rather than the annual, seasonal migration of an entire group, just as the flint scatters at Pointed Stone could reflect short term hunting expeditions to the surrounding uplands from a more permanent base around Lake Flixton.

Beyond the North of England, Lake Flixton and its environs forms part of a wider pattern of intensively occupied landscapes, with evidence for repeated episodes of activity spanning significant periods of time. Perhaps the best comparable example is Duvensee (North Germany), where multiple Early Mesolithic sites have been recorded from a series of small islands within a large lake (Lake Duvensee). At most of these sites, activity took place on floors of pine and birch bark matting, often around a hearth, which in some cases had been built up using sand extracted from areas along the lake shore (Groß et al. 2019). These are often associated with scatters of worked flint, reflecting tool using and manufacturing tasks, as well as smaller assemblages of animal bone, and more occasionally osseous and plant-based material culture (Groß et al. 2019). Dense concentrations of carbonized hazelnut shells, as well as possible nut cracking or grinding stones, indicate the intensive exploitation of hazel, which the pollen record shows was present in the local environment (Groß et al. 2019; Holst 2010), whilst faunal assemblages from one of the sites indicates the hunting of terrestrial mammals, as well as aquatic mammals (beaver) and fishing, tasks presumably undertaken within the lake itself (Groß et al. 2019).

As at Lake Flixton, Lake Duvensee acted as a focus for occupation for a significant period of time, with activity spanning much of the ninth millennium cal BC and beyond (see Groß et al. 2019, fig. 8). Some of the sites were occupied on successive occasions, in at least one instance spanning several centuries, and in some cases, groups visited the same, specific location, resulting in stratified sequences of bark mats (Groß et al. 2019). The inhabitation of these sites (and the lake itself) also required significant levels of investment, such as the building and use of boats, the manufacture and repair of mats, and the importing of sand to build the hearths. Though no single site demonstrates the same scale and intensity of activity as Star Carr, the lake itself was clearly a significant and meaningful place within the wider landscape.

The Late Mesolithic

Evidence for Late Mesolithic activity is scarcer than that of the earlier part of the period, with diagnostic material present at nine locations, and often in very small quantities (Fig. 19.5). Two of these have been sampled by excavation, Rabbit Hill and Seamer Carr Site F, the remaining material coming from fieldwalking, the upper layers of peat sealing Early Mesolithic occupation areas, or in the case of Barry's Island, from a stream deposit. Late Mesolithic activity can also be inferred at No Name Hill, where episodes of localized burning were identified in pollen profile NM, though this has yet to be supported archaeologically.

The relative paucity of evidence for activity during this part of the period is almost certainly the product of sampling: most of the work carried out by the VPRT was focused on the Early Mesolithic shoreline, an area that would have been too wet for habitation during the later part of the period as peat-forming wetlands were expanding over areas of previously dry ground. The preservation of these later sites is also very poor as they generally lack the thick layers of overlying peat that have buried many of the Early Mesolithic sites, and the Late Mesolithic assemblages are often disturbed by animal action or ploughing, or mixed with later prehistoric material. All in all, the Late Mesolithic archaeology recorded by the two projects should be regarded as a partial, and somewhat fragmentary record of the occupation of the landscape during this period.

The main concentrations of Late Mesolithic material come from areas of higher ground around the edges of the basin. Rabbit Hill lies between 28 m and 28.5 m AOD, on the edge of an area of raised ground between Sites C and K at Seamer Carr, and the material from Site F comes from a similarly elevated position at the northern end of the West Embayment. These locations would have been dry ground throughout much, if not all of the Late Mesolithic, and the archaeology represents areas of habitation or the remains of activity areas in the terrestrial landscape adjacent to wetland environments within the basin. The fieldwalking surveys at Lingholm B also covered a narrow ridge of raised ground extending from the northern edge of the

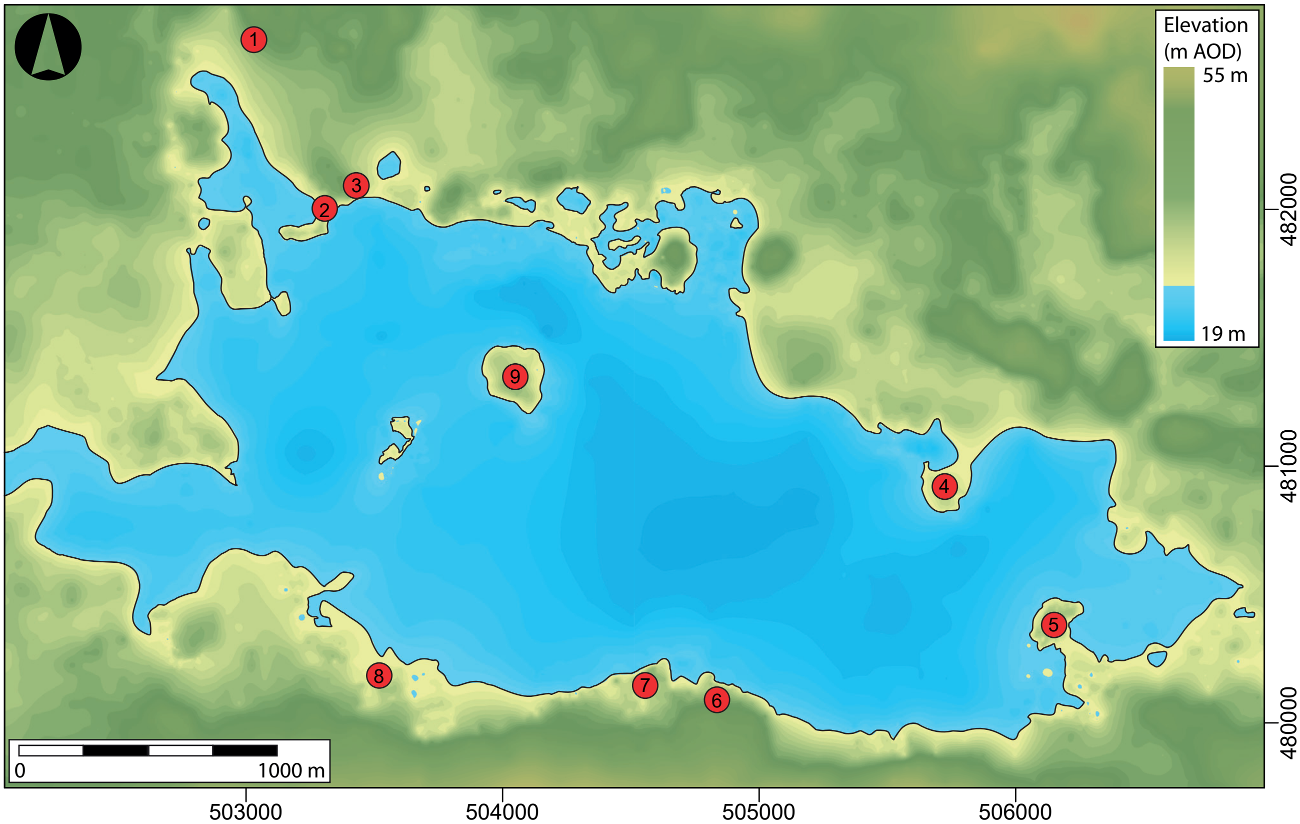

Figure 19.5. *Map showing the position of Late Mesolithic sites and findspots. The level of the lake is shown at 24 m AOD. 1: Site F. 2: Site K. 3: Rabbit Hill. 4: Lingholm B. 5: Barry's Island. 6: Flixton School Field. 7: Flixton School House Farm. 8: Manor Farm. 9: No Name Hill.*

basin, whilst Lingholm C extended onto high ground at the west end of the basin, and the finds from both probably also represent traces of terrestrial activity on areas of dry ground.

The archaeology from these dry ground areas consists of scatters of worked flint, generated through a range of tasks, and with some evidence for spatial patterning in the distribution of activities. There is no evidence for structural features, though this could be a product of sampling, but several reasonably large, shallow pits were recorded at Rabbit Hill and could be the remains of hearths. The density of worked flint is very high around one of these (X8), and it was clearly a significant focus for activity. Wetland activity is scarcer and, in contrast to the Early Mesolithic, reflects discrete moments of action rather than prolonged activity. The clearest example comes from Seamer Carr Site K, where two clusters of microliths, one associated with a haft or shaft, were recovered from peat that sealed the earlier occupation surface. These probably represent casual losses of composite tools (potentially arrows, though possibly knives), within fen environments at the edge of the West Embayment (see Cloutman 1988b; David 1998). The same is probably true of the 17 microliths recorded from Late Mesolithic peat deposits at Flixton School Field, though in this case no associated haft was recorded.

Animal bone associated with this Late Mesolithic material is also sparse, with the exception of the auroch remains at Site B. No material was found at Rabbit Hill itself, though it is likely that parts of the assemblage recorded downslope at Site B may have derived from this area. A very small assemblage was recorded from Late Mesolithic layers at Site K, and included fragments of limb elements from red and roe deer, and part of an otter mandible. However, there is no associated material culture, and it is possible that the faunal remains derived from an activity area on the adjacent higher ground. Finally, some of the fauna redeposited by stream action at Barry's Island is probably Late Mesolithic, though only one specimen, derived from a red deer, has been definitively dated to this period.

The small size of these assemblages makes it difficult to draw any conclusions as to the nature of the animal populations within the landscape during this period, or the strategies through which they were hunted. However, based on the palaeoenvironmental evidence, it is likely that patterns of hunting would have changed from the earlier part of the period as the gradual infilling of the lake, combined with the continuing development of broadleaf deciduous forest, altered the habitats and behaviours of prey animals (see below). As numerous studies have noted, the population sizes of larger mammals are likely to have declined as denser woodland cover shaded out understorey vegetation (e.g. Mellars 1976), and hunting may have focused more on the extensive areas of open fen that were forming within the basin, and the adjacent woodland edge (see Taylor 2019). This issue will be discussed in more detail in the following section.

As with the earlier inhabitants of this landscape, Late Mesolithic groups continued to have an impact on their environment. Microcharcoal records from the south of No Name Hill suggest several, prolonged episodes of burning that coincide with pollen evidence for the disturbance of the woodland canopy. However, it is difficult to determine whether this reflects the intentional management of the woodland through burning, or unintentional disturbance from human groups inhabiting the island. Episodes of vegetation disturbance were also recorded at Seamer Carr through the work carried out by Cloutman. The most extensive occurred toward the end of the period when there appears to have been a prolonged phase of burning, probably focusing on the terrestrial woodland as well as the edges of the wetlands (Cloutman 1988b, 28 and 36). An earlier phase of vegetation disturbance was also identified in the pollen profile from Site K, though there was no evidence that this was caused by burning, or was the result of human action (Cloutman 1988b, 30).

Hunter-gatherers in the landscape

Aside from the wealth of archaeological evidence of human activity around Lake Flixton, from the Late Glacial to the end of the Late Mesolithic, the two projects, and especially the VPRT-supported phases, have also established records of the environments that were present in the vicinity of areas of human occupation. When coupled with additional paleoenvironmental sampling in the deeper water areas of the former lake (e.g. Taylor 2019), and the recent, intensive sampling in the vicinity of Star Carr (Milner et al. 2018a and b), these provide a very detailed picture of the environmental conditions under which different sectors of the lake were utilized during the various phases of hunter-gatherer activity in this landscape. They also show how changing environmental conditions may have created different ecological affordances and constraints for the lake's hunter-gatherer inhabitants.

The Windermere Interstadial and the Final Palaeolithic

Calcareous deposits probably began to form in the basin from *c*. 12,700 BC as the climate warmed (Rasmussen et al. 2014), and emergent and aquatic plants colonized the lake. Ruderal and herbaceous taxa became established on the dry ground from the start of the period, with closed grassland communities and birch, willow and juniper scrub forming around the lake. Areas of birch woodland gradually became established, but its early expansion was inhibited by a short-lived climatic fluctuation that led to an expansion of juniper scrub and a subsequent increase in areas of open ground. As the climate improved, woodland cover became more extensive, though large areas of open grassland and scrub persisted throughout much of the Interstadial.

The surface of the lake was probably no higher than 23 m AOD during this period (Palmer et al. 2015, 58), leaving several of the embayments (including the West Embayment at Seamer Carr) isolated from the main basin, but sufficiently high enough for both No Name Hill and Flixton 1 and 2 to be islands. Vegetation within the lake is poorly represented in Profile D, but the records from Dark's (1998b) deep lake profile, and the profiles recorded by Walker and Godwin (1954) show the presence of a suite of emergent and aquatic plants, notably bur reed, bulrush, club rush and several species of pondweed, as well as the aquatic algae Characeae. Organic sediments were forming along the sides of Site K from 12,240–11,600 cal BC, probably in a fen environment that fringed the West Embayment.

The Final Palaeolithic activity belongs to the later part of the Interstadial, and the groups utilizing the area around Site K would have arrived in a landscape of birch woodland and scrub, with extensive areas of open grassland. As discussed above, the character of the lithic assemblages suggests that these groups were highly mobile and reliant on local sources of raw materials, and may have visited this landscape to replenish tool kits using the locally accessible Wolds flint. If this is the case, then the scatters at Site K may represent successive visits to a known, familiar place within this landscape. While at this location, groups predated upon large mammals, including elk, red deer, aurochs and horse. Some of these animals may have been killed in the immediate area, the scatter of backed points at Site C possibly representing losses during hunting. Activity was not restricted to the Seamer Carr area, with the burin from VP E hinting at tasks undertaken at other locations around the lake. However, the general impression from the archaeology is that, while this may have been a familiar place, it was not intensely occupied and that the groups arriving at Site K moved on to other locations. The lithic assemblages show that people were preparing for these journeys, replenishing tool kits and maintaining hunting equipment in anticipation of tasks to be undertaken elsewhere.

The Loch Lomond Stadial and the start of the Holocene

In Profile D, the deterioration of the climate at the start of the Stadial is marked by increasing mineral inputs into the lake, and a pollen record indicative of an open landscape with areas of broken ground. Work by Palmer et al. (2015) has shown that the lake level fell to at least *c*. 21.0 m AOD and that the remaining areas of water were restricted to smaller, interconnected basins. The local climatic record shows that the climate began to warm again from 10,055–9325 cal BC (Taylor et al. 2018a, 45; Blockley et al. 2018, table S6). The environmental response to this warming can be seen in the pollen sequence from the Profile D, which shows the development of grass and herb communities, along with birch, willow, and juniper on the dry ground. Mineral inputs into the lake declined as the soils around the edge of the lake stabilized, and marl formation resumed within the basin, reflecting the renewed growth of aquatic taxa. The lake water level rose quickly, reaching *c*. 23.5 m AOD in the centuries around 9500 cal BC, and organic sediments began to form along parts of the shallow lake margins (Taylor et al. 2018a, 45). This early climate remained unstable, with an abrupt cooling event occurring between 10,025–9190 cal BC and lasting for up to a century (Taylor et al. 2018a, 46; Blockley et al. 2018, Table S6).

Given the uncertainty in the radiocarbon dates obtained from sites around the lake, it is difficult to see where within this dynamic picture of environmental change the Long Blade occupation should be placed. However, the evidence from the excavations at Flixton Site 2 suggests, on stratigraphic grounds, that it may have been immediately before this abrupt cooling event. The widespread focus on horse suggests a fairly open environment that is likely also to have facilitated the high levels of movement hinted at by the provisional lithic sourcing data.

In contrast with the Final Palaeolithic, where groups may already have been familiar with the area, Long Blade groups appear to have been moving into a landscape that was unknown to them. Provisioning was clearly a concern, and they arrived with stocks of raw material, probably sourced from some distance away. If these pioneer groups were travelling by boat then they would have moved along the Vale of Pickering from the west, following water courses that connected a series of small lakes along the valley floor, before reaching Lake Flixton. Seamer Carr would seem an ideal location for these new arrivals, with areas of high ground, such as Rabbit Hill and Manham Hill, providing excellent vantage points from which to scan this new landscape, while also sheltering the lower lying areas such as at Sites C and L. From there, people moved to other places around the lake to hunt, focusing particularly on herds of horses that also inhabited this landscape. The killing and butchery of horses probably occurred at several points along the shore as well as on Flixton Island, suggesting a continued use of boats in the way people inhabited this landscape. As yet there is no indication of the temporal scales of occupation, in terms of either the number of visits to places around the lake, or their duration. The two main scatters at Site C were probably contemporary, though the others may represent separate visits. However, as with the Final Palaeolithic, groups appear to have been transient, preparing toolkits and equipment in advance before moving on to other areas.

The Early Mesolithic (9300–8200 cal BC)

By the time the first Mesolithic groups reached the area the lake level had probably already risen to 24 m AOD (Taylor et al. 2018a,4 5), and a rich and diverse environment was well established within the basin (see also Taylor et al. 2018a; Taylor 2019). The pollen and macrofossil profiles recorded by the Seamer Carr Project and VPRT, as well as other research projects (e.g. Dark 1998a and b; Taylor and Enid 2018; Taylor 2019) show a diverse range of emergent and aquatic species present within and around the basin. Beds of *Phragmites* reeds were probably present around much of the lake, along with species of bur reed, bulrush, and sedge. Stands of club rush were also present, probably growing in deeper water further from the shore, along with aquatic plants, notably white waterlily and species of pondweed.

Variations in the lake's bathymetry created a complex shoreline of peninsulas and embayments, particularly along the northwest shore from Seamer to Cayton Carr, as well as significant differences in water-depth across the basin (Taylor et al. 2018a; Taylor 2019). In turn, this would have led to some variation in the nature and extent of the wetland environments. Some of the embayments were particularly shallow, such as the West Embayment at Seamer Carr, as well as those at Cayton and Lingholm (at the eastern end of the lake), and are likely to have been colonized quickly by dense beds of emergent plants. At others, such as the embayments at Killerby and at Star Carr, the basin fell away more steeply, and a narrower band of vegetation would have separated the dry ground from areas of deeper water (Fig. 19.6).

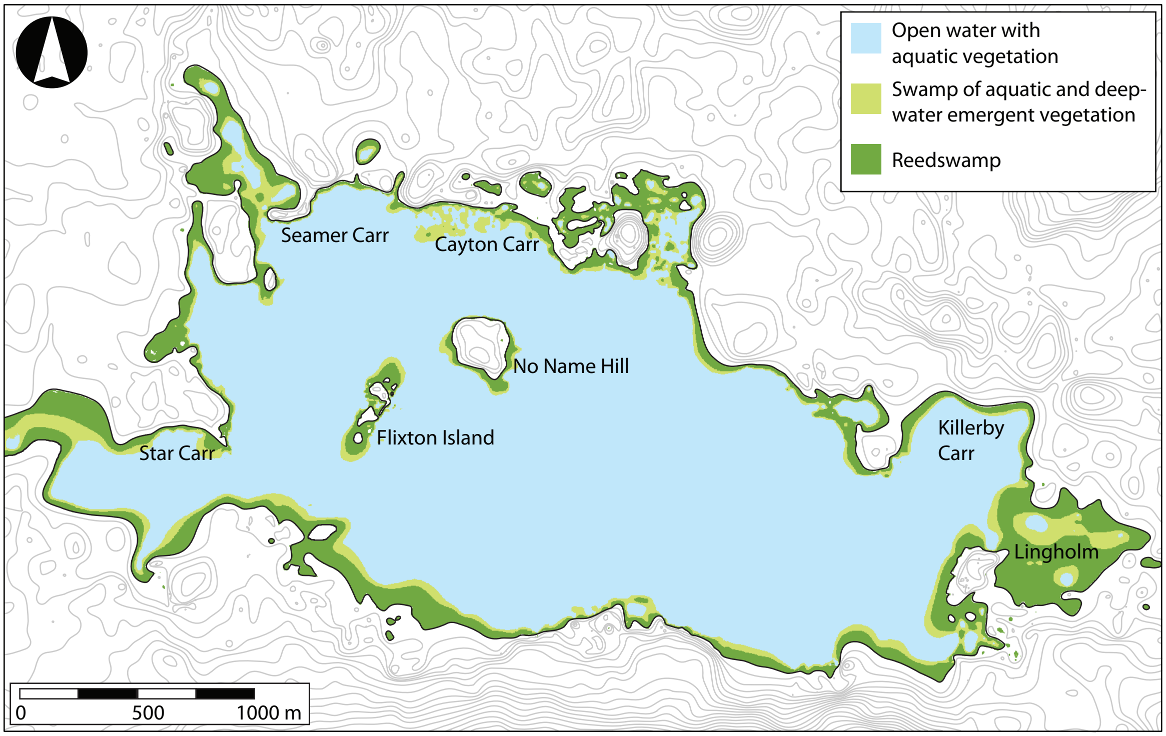

Figure 19.6. *The extent of wetland environments,* c. *9000 cal* BC.

Trees and shrubs, notably aspen and species of willow and birch, were growing along the shore along with wetland plants suited to damp soils or very shallow water. Beyond the lake, the terrestrial environment remained largely open, though birch woodland was quickly becoming established. This was delayed by a second climatic downturn (Blockley et al. 2018), with extensive woodland cover only becoming established once temperatures had recovered at *c*. 9100 cal BC (Taylor et al. 2018a, 48). Organic deposits were forming at the north shore of No Name Hill and along the western side of Flixton Island (Site 1) by this time, and probably at other locations around the lake.

Pollen, both from Profile D and from the profiles recorded closer to the lake's shore, demonstrate the diverse and dynamic character of this terrestrial environment during the initial part of the Early Mesolithic. Shrubs, such as rowan and species of *Rubus*, were present in the area (the latter probably growing at Flixton Island), whilst a suite of grassland and ruderal taxa were also present, including species of meadow rue, dock/sorrel and rock rose, along with ferns, grasses and sedges. The shrub bird cherry (*Prunus padus*), and wild strawberry (*Fragaria vesca*) are also represented in macrofossils from Flixton School House Farm (Taylor 2019, fig. S1). Together, these indicate a mixed, open woodland environment with areas of open and in some instances disturbed ground. As the period progressed, male fern became the dominant understorey species, but overall these environments remained diverse. Hazel was probably growing in the landscape by the mid-ninth millennium cal BC, its pollen present consistently in samples from Flixton Island (AK-87) by 9230–8340 cal BC (9255±135 BP, Hv-17825), No Name Hill (NAZ) by 8620–8305 cal BC (9250±60 BP, Beta-104485), and Star Carr by 9135–8315 cal BC (9385±115 BP, OxA-4376) (Dark 1998a), and its local growth is demonstrated by nuts and wood in deposits dated to *c*. 8500 cal BC at Flixton School House Farm (Taylor 2019).

The wetland environments also developed rapidly as the accumulation of sediments within the basin caused the lake to gradually shallow, and aquatic and emergent vegetation to become more extensive. By *c*. 8500 cal BC the lake margins were only seasonally submerged, and were becoming terrestrialized in the following centuries (Taylor 2019). Vegetation responded to these changes, with saw sedge becoming established on the seasonally submerged deposits before a carr of willow and aspen expanded over the terrestrialized peat, while beds of reeds expanded further into the basin (Taylor 2019). Within the main body of the lake, and the deep embayments at Star Carr and Killerby Carr, these wetland environments were

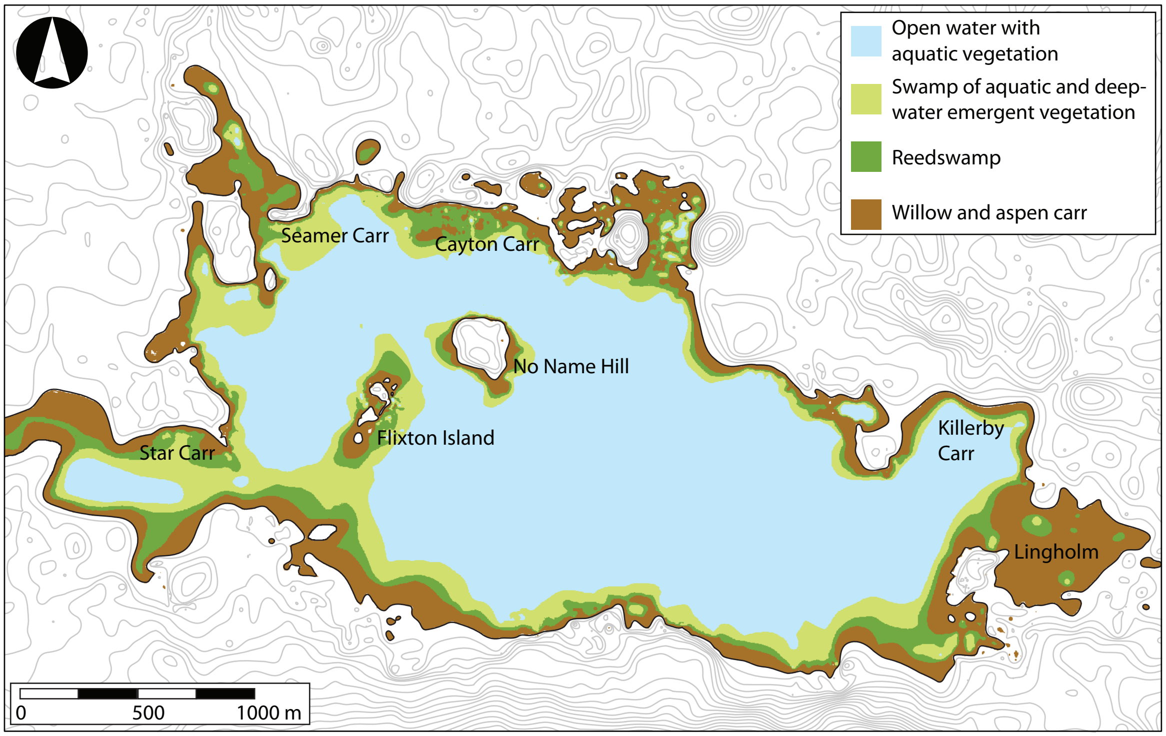

Figure 19.7. *The extent of wetland environments,* c. *8500 cal* BC.

still limited to the shallower, marginal areas. However, the shallower embayments at Seamer, Cayton and Lingholm infilled quickly, creating extensive areas of seasonally submerged swamp and terrestrialized carr (Fig. 19.7).

The earliest evidence for Mesolithic activity in this landscape comes from Star Carr, where occupation began in the decades around 9300 cal BC (Milner et al. 2018c). As noted earlier, other sites may also have been occupied at this time, though the paucity of reliable dates for the earliest episodes of activity make this difficult to determine. At Seamer Carr Site C, the earliest radiocarbon dates could potentially date to the very start of the Mesolithic, though Bayesian analysis suggests that activity began at or shortly after 9000 cal BC, while at Site K the modelled ages span the centuries on either side of 9000 cal BC (Conneller et al. 2016, Fig 4). Similarly, the stratigraphically earliest episodes of activity in the wetland at No Name Hill (trench NAZ) may also date to the early centuries of the Mesolithic based on the pollen stratigraphy from the same trench.

What is clear is that, within at least a few centuries of the start of the period and the initial occupation of Star Carr, Mesolithic groups had established activity areas at Seamer Carr, No Name Hill and probably other locations around the lake, which they continued to revisit throughout much of the earlier part of the Mesolithic. As has been discussed, the nature of activity both at and between these early locations is highly variable. The flint assemblages show significant differences in the forms of practice occurring, either during particular visits to those locations or on subsequent occasions, and variability can also be seen in the faunal material. Furthermore, while the assemblages were the result of actions undertaken at those locations, they were clearly part of a wider pattern of activity within this landscape. The refitting of the flint shows people arriving with previously prepared materials or manufactured tools, which they used and discarded, or leaving with materials that had been produced on site. This is also reflected in the faunal assemblages, which are the result of the hunting, killing and possibly butchering of animals at other locations in the landscape. These points can be demonstrated by a small number of examples from sites differently situated around the lake.

As discussed in Chapter 11, groups of people visited No Name Hill throughout much of the Early Mesolithic, a journey that would have required the use of boats. During these visits they brought with them flint nodules, probably collected from the coast, and at least partial carcasses of wild boar, elk, aurochs and red and roe deer including mandible, maxilla, limbs, and (in the case of red deer) antler. Given the small size of the island these animals were most likely hunted at other locations around the lake, or in the wider landscape, possibly butchered elsewhere, and parts of the bodies then brought onto the site. On the island, human groups established knapping stations on the dry ground overlooking the shore. On at least one occasion they reduced the imported nodules to produce cores and tools, some of which they then used. On other occasions they manufactured microliths, either to replenish an existing stock or to make or maintain arrows or cutting tools. Coppiced stems were cut, probably using the flint axes that were also brought onto the island, and may have been worked further to produce tools such as arrow or spear shafts, hafts for tools, digging sticks, or for the construction of tents or other structures. Wood was also collected and used for fuel in hearths.

At the shore of the island people used flakes, blades and formal tools to process the animal carcasses, possibly for food but also for the manufacture of tools, discarding some of the waste into the reedswamp at the edge of the lake. On at least one occasion, a fragment of red deer antler, taken from an animal that had been hunted and killed, was worked using the groove and splinter technique to manufacture barbed projectile points. Fragments of three such points were also deposited in an area of standing water at the northern end of the island. Given the presence of flakes and blades within the wetland deposits, people probably also waded into the water to harvest reeds or other wetland plants, possibly for use as a raw material in the production of cord, reed matting, or baskets.

While it is difficult to identify separate events from the dryland assemblages, some of the material from the wetland was clearly generated through repeated episodes of activity carried out at the island's shore; the assemblage from several of the trenches has a vertical range, and probably represents the gradual accumulation of material into the peat on successive visits to the island. This is supported by the charcoal record, which suggests that the island was visited on multiple occasions over decades or centuries. Unfortunately, we cannot determine the number or duration of these individual visits, but when we consider the relatively small size of the assemblage, and the period over which it formed, the scale of activity at any one time was probably small.

At Site C, approximately 650 m to the northwest, and across an area of relatively deep open water, different patterns of activity can be seen. As at No Name Hill, groups of people visited the area comprising Site C on successive occasions, probably during the middle centuries of the ninth millennium cal BC. During these visits one of the main activities involved the manufacture and use of scrapers, probably for the working of hides, but people also repaired and maintained composite tools, and undertook relatively discrete tasks involving tools such as burins. Parts of animals that had been killed in other parts of the landscape were also brought to this location and processed for food, raw materials, or a combination of the two. Again, the overall scale of activity at any one time appears to have been quite limited (considering the relatively small size of the assemblages represented by the individual scatters), but this stretch of shoreline was certainly revisited on multiple occasions.

Around 200 m away at Site K, analysis and refitting of the lithic assemblages also suggests that this area was visited on multiple occasions, although unlike around Site C there was greater variability in activity between visits. Provisioning was clearly important. On more than one occasion an individual, or small group of people, manufactured or repaired composite tools using raw materials they had brought with them, as well as carrying out other tasks involving the manufacture or use of tools including burins and scrapers. Also, on at least one visit, cores were manufactured here but were then taken away when a person or group left. The scales at which these tasks were carried out varied considerably: in one instance (Scatter 30) imported nodules were reduced to produce large quantities of microliths, probably during an intensive episode of retooling, but at others (such as Scatter 21a) a much smaller quantity of material was processed.

Not all tasks were focused on re-provisioning. While in some cases tools and unmodified flakes and blades may have been used in the production or maintenance of composite tools, perhaps removing damaged microliths from handles, or preparing shafts of arrows, in other cases tasks had different objectives. This is seen in the more balanced assemblage in Scatter 5, and also the smaller scatters of lithic material found at Site K, which reflect discrete, short lived activities. As at Site C and No Name Hill, parts of animals killed elsewhere in the landscape were also brought to this section of the northern shoreline during these visits, and were presumably processed for food and raw materials. Away from the main area of Site K, people carried out tasks at the lake shore or next to the West Embayment. As at No Name Hill, these involved the use of flint flakes and blades for tasks involving the cutting of materials, possibly the harvesting of wetland plants, or the processing of animal carcasses.

As was discussed in the preceding section, we should not assume that the activities that we see at these, and other locations around the lake, form part of a single, unchanging pattern of settlement and mobility, or that particular sites had specific functions within a broader settlement hierarchy. Instead, patterns of settlement and mobility probably changed throughout much of the Early Mesolithic on decadal or generational scales; during some periods Star Carr may have acted as a residential area from which people travelled to other locations around the lake as they undertook tasks such as hunting large mammals at the water's edge, or collecting wetland plants. At other times people may have resided at locations in the surrounding landscape, and only travelled to Lake Flixton as part of wider patterns of economic activity.

Within these broad patterns of settlement and mobility were much more discrete patterns of movement and action, taking place at daily, weekly and monthly scales, which are represented by the array of activities that we see archaeologically at locations around the lake. These include the hunting of large mammals, such as elk and red deer, the harvesting of wetland plants and coppiced trees, the collection of firewood, and the procurement of flint. If we also consider the types of activities represented at Star Carr, as well as other Early Mesolithic sites in Northern Europe, then we can also assume that people would have been trapping and snaring small mammals, fishing, fowling, and collecting tubers, seeds, nuts and fruits for food.

Spatially, the organization of these tasks would have been structured by the complex and varied nature of the wetland and terrestrial environments, and the behaviours and habitats of prey animals and plant species. Both red deer and elk, for example, browse on young saplings and favour places with good vantage points and lines of escape (Ripple and Beschta 2004), and so may have been hunted amongst the thickets of willow and aspen at the edge of the lake, or in open areas within the surrounding woodland. Elk also graze on pondweed, and so may have been hunted from boats in parts of the lake where the plant was most abundant, whilst aurochs may have been ambushed as they visited the wetlands to feed on reeds and sedges. In contrast, species of waterfowl would have been common in the large, swamp-filled embayments at Seamer Carr and at the far eastern end of the lake, where they could have been shot or netted, and small mammals may have been trapped or snared in areas of the woodland. Similarly, the collection of plants for food or materials would have been structured by differences in the distribution and abundance of key species. In some cases, the target plants may have been common enough that their collection could have been undertaken close to areas of settlement, as would seem to be the case with the harvesting of wetland plants at the lake shore, and probably also the collection of firewood. In others, people may have had to travel to certain locations within and around the lake in order to gather plants that were scarcer, or that were limited to specific types of environment.

But though the spatial patterning of these activities was diverse, the tasks themselves were repetitive and routine. The collection of firewood, for example, would have been carried out daily, as would the checking of traps and snares, while larger mammals may have been hunted less frequently but still on weekly or monthly scales. As such, people would have returned to the same locations to undertake similar tasks, creating 'recursive patterns of movement and activity within the landscape' (Taylor 2018, 502). In this way, the broad patterns of settlement and mobility, operating on scales of decades or centuries, would have been characterized by complex and diverse patterns of activity, operating on much shorter temporal scales, that extended across the lake and the surrounding landscape. These may have incorporated some of those locations that have been recorded archaeologically, but would also have included an array of others that are either yet to be identified or where activity has left no discernible trace. This could include kill sites of large mammals, places where traps and snares were set, fishing sites, or areas where plants were harvested.

Not all activity was structured around the environment, however. Throughout the early centuries of the Mesolithic, human communities continued to return to the same locations around the lake. Whilst their initial visits may have been motivated by economic concerns, such as the availability of certain resources, something about these locations, or their history, marked them as appropriate places to return to. By implication this would suggest that there were particular ways of moving through the landscape that took people along established routes between these and other locations. In some cases, notably Star Carr, No Name Hill, and Flixton School House Farm, certain objects and materials were also deposited at these places, either into the lake-edge wetland, or (in the case of Flixton School House Farm) into a small pool of water. As has been discussed, these acts of deposition may have related to cultural beliefs concerning particular animal species, but may also have acknowledged the importance of the wetland areas for hunting.

The Late Mesolithic (8200–4000 cal BC)

From the start of the Late Mesolithic, a combination of woodland succession and changes to the wetlands also began to significantly alter the character of the landscape (Fig. 19.8). On the dry ground hazel became more established and, based on the dates from Flixton 9 (8435–7370 cal BC, Hv-17829) and at Star Carr (8295–7785 cal BC, OxA-4377) (Dark 1998a), it was forming a significant component of the woodland in the centuries

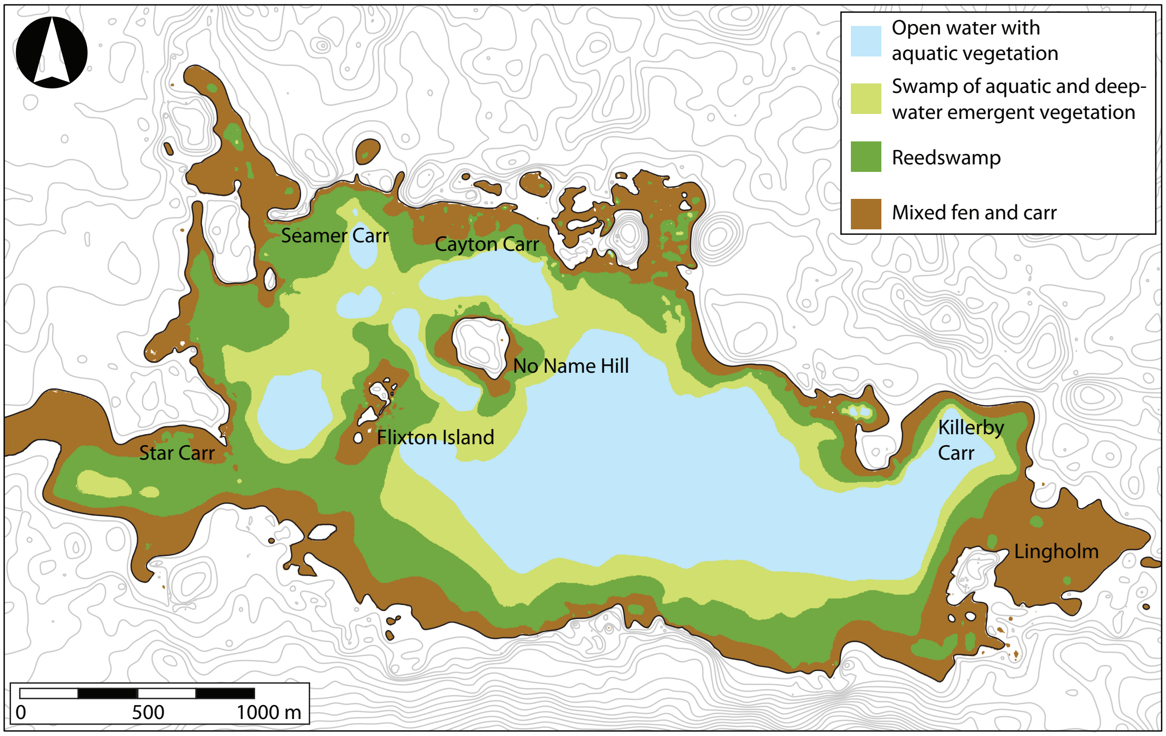

Figure 19.8. *The extent of wetland environments,* c. *8000 cal* BC.

around 8000 cal BC. Within the lake, a slight rise in the water level left the lake-edge peat deposits too wet to support the growth of trees, and fen vegetation became established (Taylor 2019). At around the same time (Table 19.2), wetland environments began to encroach onto the terrestrial landscape gradually burying areas of low-lying ground. Based on the radiocarbon dates obtained by Cloutman (1988a, 1988b), peat was forming across the previously dry ground at Site K as far as the 25 m AOD contour before *c.* 8500 cal BC, and had reached a similar level at Site D, VP D and the eastern side of the Star Carr peninsula by *c.* 7800 cal BC, and probably earlier (see Table 19.2). These processes were

Table 19.2. *Dates for the formation of peat over the terrestrial landscape (from Cloutman 1988a, Table 1).*

Site	Calibrated age (BC)	Uncalibrated date (BP)	Lab Code
Seamer Carr Site K	9225–8555	9490±110	CAR-881
VP D	8555–7955	9060±100	CAR-887
Seamer Carr Site D	8445–7820	9000±100	CAR-878
Star Carr peninsula (south)	8245–7615	8830± 110	CAR-864
Star Carr peninsula (east)	7610–7185	8430±100	CAR-884

also underway at Site C by 9230–8540 cal BC (9480±110 CAR-195), although wetland deposits had probably not expanded as far (see Chapter 6). Given that these changes were driven by a gradual waterlogging of the low-lying ground (Taylor 2019), these areas were probably becoming increasingly wet and boggy well before peat had begun to form.

In response to the increasingly wet conditions, activity areas on low-lying ground were abandoned in favour of areas in drier, more elevated positions. Activity in the excavated areas at Star Carr (which lay between 24.0 m and 25.0 m AOD on the dry ground) ended around 8500 cal BC, and the dates from Site C (which lay at a similar elevation) do not continue past *c.* 7500 cal BC, with the Bayesian chronology suggesting that activity ended before 8000 cal BC (Conneller et al. 2016, Fig. 4). Other excavated areas lying between 24.0 and 25.5 m AOD either lack diagnostically Late Mesolithic material (VP D and Flixton Island) or the evidence consists of single artefacts (VP E) or composite tools (Site K), suggesting that these locations had also been abandoned or were being used very differently.

Despite the abandonment of some locations, Mesolithic groups continued to inhabit the area, and continued to revisit locations utilized earlier in the period that lay above the expanding wetlands. The aurochs at Site B was hunted and killed around

8210–7585 cal BC (8740±120 BP, BM-1841R), the stratigraphically latest activity on the north shore of No Name Hill occurs after a post-dates 8620–8305 cal BC (9250±60 BP, Beta-104485) and the latest phase of burning at Flixton School Field dates to 8325–7965 cal BC (9020±60 BP, Beta-104481), while excavations at Flixton School House Farm recorded a date of 8295–7980 cal BC (8995±45 BP, OxA-23175) on one of the features (Taylor 2012). In the case of No Name Hill and the Flixton School sites, these were areas that had also been visited in the earlier part of the period, and whose significance as places continued to be reinscribed materially even as the lower-lying areas were abandoned. This suggests that the traditions that structured patterns of movement and action in the initial phases of the Mesolithic persisted despite changes to the environment.

The environments within and around the lake continued to develop throughout the Late Mesolithic, significantly altering the character of the landscape. Hazel continued to replace birch on the dry ground, the latter probably persisting with willow on some of the wetter soils, and elm (and slightly later oak) became established in the local area. The expansion of these two latter species is best dated at No Name Hill where there is a pronounced rise in elm pollen in Profile NM from 7785–7535 cal BC (8610±60 BP, Beta-86145), and oak at 7460–7080 cal BC (8250±50 BP, Beta-86146), though there may have been localized variability in the rates of expansion and abundance due to differences in soil and drainage. As this mixed deciduous woodland formed, it created an increasingly dense woodland canopy shading out the fern-rich understorey and reducing species diversity.

Organic sedimentation continued within the lake allowing a succession of wetland environments to expand further into the basin. In the centuries around 7000 cal BC, reedswamp and fen were present across large areas of the former lake, with open water restricted to the deeper parts of the basin (Fig. 19.9, see also Taylor 2019). Peat-forming environments also continued to form over the terrestrial landscape, probably causing areas of woodland to recede, and cutting off the areas of higher ground at Barry's Island, Ling Lane, Lingholm B, and Cayton Carr. By around 6000 cal BC, large areas of the basin had become terrestralized, and emergent and aquatic communities were probably forming in the remaining areas of standing water. Sometime later (post *c.* 5500 cal BC), a stream channel cut through the peat deposits to the south and west of Barry's Island, though organic sediments were again accumulating here by the end of the millennium.

The terrestrial woodland continued to develop, with lime and ash forming part of the woodland canopy at locations around the lake. Alder was also present

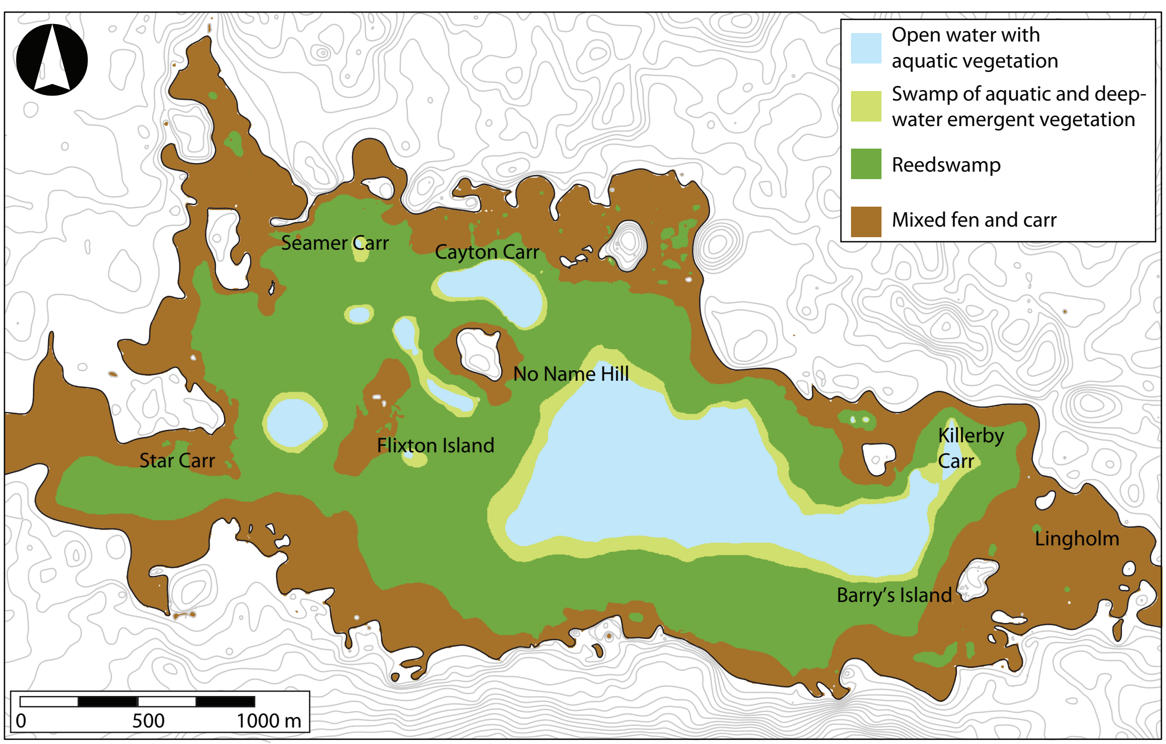

Figure 19.9. *The extent of wetland environments,* c. *7500 cal BC.*

Table 19.3. *Dates for the expansion of alder around Lake Flixton.*

Site	Lab Code	Uncalibrated radiocarbon age (BP)	Calibrated date (cal BC)
AK87	Hv-17296	5990±90	5200–4600
NM	Beta-86147	6160±50	5285–4955
Flixon SHF	Modelled age. See Taylor 2019, table 1		5420–5090
E77	CAR-896	6470±90	5620–5295
F1035	Hv-17827	6815±110	5975–5530
Dark's deep lake profile (just prior to the rise)	OxA-4041	7640±85	6655–6270

in the landscape, but expanded rapidly in the sixth millennium cal BC. Dates for this event show some variability between the pollen profiles, possibly reflecting localized variations in growing conditions as well the effects of human activity (Table 19.3).

By the end of the Mesolithic a rich, but highly varied wetland was present within the basin, covering not only the area of the former lake but much of the lower-lying Early Mesolithic landscape. Carr environments of alder and birch, with sedges, ferns and nettles were present around parts of the basin (see also Taylor 2019), with more open fen present on wetter ground. Pools of standing water would have been present in some areas, probably with beds of reeds and aquatic plants growing within them. No Name Hill would have been visible as a small wooded hillock surrounded by fen, carr and swamp, as would Barry's Island and other raised areas around the edge of the basin. Beyond the wetlands was a mixed deciduous forest of oak, elm, ash, lime and hazel.

Despite the significant changes to the environment, human groups continued to inhabit this landscape during the Late Mesolithic, occupying and utilizing areas of higher ground within or around the edges of the basin, while still using the wetlands as areas to hunt or forage. Though the paucity of the Late Mesolithic record makes it difficult to discuss this in more detail, there are two points that can be made.

First, patterns of activity must have been very different from the Early Mesolithic, and probably changed throughout the period as the wetlands gradually developed. As Taylor (2019) has argued, the infilling of the lake basin and the development of deciduous woodland would have altered the habitats and behaviours of animals, and the presence and abundance of economic plants, as well as affecting routeways through the landscape. In response, food and raw material procurement strategies are likely to have changed with a gradually diminishing focus on aquatic and swamp resources, and a greater emphasis on the fens and woodlands. The presence of an otter mandible from the peat at Site K could (tentatively) point to the trapping or snaring of these aquatic mammals in areas of the basin, but the wetlands would also have provided important habitats for the species of larger mammal that are also represented in the faunal assemblage, notably red and roe deer. That these environments were being used for such practices is demonstrated by the composite tools from Site K, and possibly also Flixton School Field, as well as the location of occupation sites, such as Rabbit Hill, at the fen edge. The importance of the area, both for animals and humans, would have been increased by the development of closed, deciduous woodland and the reduction of the understorey vegetation. This is often thought to have reduced the population density of medium and large mammals, leading to changes in patterns of settlement, mobility and economy among Late Mesolithic populations (e.g. Mellars 1998b). However, around the former Lake Flixton, an extensive area of woodland edge, characterized by shrubs, herbaceous plants and younger saplings, would have been present where the woodland and fen met. As these would have provided browse for larger mammals, such as red deer, animal populations may have been considerably higher than in the surrounding landscape, making the former lake an ideal area for hunting and human settlement (Taylor 2019).

Second, despite the changes to both the environment and patterns of human action, there was a significant degree of occupational continuity, as the areas of high ground utilized in the Early Mesolithic continued to be visited. Late Mesolithic material is present at Rabbit Hill and Barry's Island, and the charcoal record from No Name Hill suggests human activity throughout the later part of the period. A similar degree of continuity has also been demonstrated at Flixton School House Farm, with both Early and Late Mesolithic activity focused on the top of a low hill (Taylor 2012). To some extent this may be seen as simple expediency, with areas of high ground around the edge of the basin more suitable for habitation than the adjacent wetlands. However, this does not explain the persistence of No Name Hill, which would have required crossing extensive areas of fen, and swamp. Though some new foci emerged (Site F and Lingholm B, for instance, have no earlier activity), the general pattern is one of the persistent uses of particular locales throughout much of the Late Mesolithic.

Chapter 20

Conclusions and future directions

Paul Lane, Barry Taylor & Tim Schadla-Hall†

The Seamer Carr Project began as a rescue campaign intended to document the archaeology of forty hectares of farmland in advance of the construction of a waste disposal and processing plant. As with similar projects, fieldwork began with a number of expectations based on the existing archaeological evidence. The Sites and Monuments Record (SMR), now Historic Environment Record, for North Yorkshire indicated that a number of Neolithic polished stone axes had been found in the general locality of Seamer village, raising the possibility of an associated settlement within the development area. This was supported by further records of Neolithic material that had been recovered from nearby locations. There was also a suggestion in the SMR that traces of an Anglian-period settlement might survive on Hopper Hill, in the area later designated as Site A. During preliminary geophysical surveys undertaken by the Ancient Monuments Laboratory, an Iron Age sword was recovered below the ploughsoil in the area later designated as Site F, which suggested that this area might have been the location of a later prehistoric settlement or perhaps burial. Finally, given the proximity of the world-renowned site of Star Carr (Clark 1954; Mellars & Dark 1998; Lane & Schadla-Hall 2004; Milner et al. 2018a and b), roughly a kilometre to the southwest, there was an expectation that an Early Mesolithic settlement, with comparably rich material and faunal assemblages, and perhaps with even better levels of preservation, might be found beneath the peat that had formed over the former lake shore.

In the event, none of the expectations were substantiated by the archaeological discoveries made during the project. Evidence for Neolithic activity was limited to small quantities of flint recovered from the upper peat and topsoil in some of the trenches and test-pits, and is likely indicative of low levels of off-site activity. Similarly, while some traces of Iron Age activity were found on Rabbit Hill, to the southeast of where the sword had been uncovered, there was no evidence for any form of settlement. More substantial remains of a prehistoric settlement were discovered at Site A, including the ring-ditches of at least two sizeable roundhouses showing signs of two or more building phases, and a sequence of ditches, one of which may well have served as a boundary to the settlement. However, based on the recovered flint, and the late Dr Ian Kinnes's assessment of the pottery, this was a Bronze Age settlement, rather than the Anglian one that had been expected. Finally, as emphasized throughout this volume, despite recovering substantial quantities of Early Mesolithic stone tools and associated knapping debris, no traces of an Early Mesolithic settlement on a par with that documented at Star Carr were recovered.

In some quarters, this might be perceived as a fundamental failure of the project, possibly attributable to poor survey methodologies, excavation techniques and/or the quality of on-site recording. Certainly, mistakes were made and lessons were learned; ambiguities and even contradictions have been noted in the site records, and some information has been lost (some of the context records from 1977 and 1978, for instance, suffered water damage at some point and are barely legible). Protracted delays to the post-excavation work also contributed to the challenge of writing up the individual sites. These points are also true with regard to the work that followed under the auspices of the VPRT since, regrettably, most of the lithic finds recovered during the 1987 excavations at Flixton Island now appear lost.

Notwithstanding these shortcomings, however, we contend that the results of twenty-five years of open-area excavations, smaller-scale trenching, systematic test-pitting and extensive auger surveys give the lie to any suggestion that excavators failed to recognize the Mesolithic evidence uncovered for what it was. On the contrary, the evidence accumulated by the Seamer Carr and VPRT projects has demonstrated unequivocally that there is more to the Mesolithic of the former Lake Flixton than the site of Star Carr. The insistence on three-dimensional recording of every archaeological find, time consuming and labour intensive though it was in the days before Total Stations equipped with data loggers, was also pioneering when the project began, and the richness of this spatial data has been central to the interpretation of the lithic and faunal assemblages. Additionally, as the project results demonstrate, multiple kinds of material traces of early hunter-gatherer activities have survived within this landscape, encompassing the Final and Terminal Palaeolithic, Early Mesolithic and Late Mesolithic. Some of the localities where these traces have been found were visited multiple times, although seemingly not always for the same reasons, creating palimpsests of material associated with different hunting and gathering logistical systems. At the earliest end of the temporal range, the projects recovered evidence of a more significant human presence within this landscape, and at an earlier date during the Late Glacial, than previously known, as well as new evidence for changing patterns of resource and landscape use as climatic conditions ameliorated following the Loch Lomond Stadial. At the later end of this temporal range, while only limited traces of Late Mesolithic activity have been documented, these are suggestive of continuing occupation in the area, raising the possibility that denser concentrations, representative of settlement activity, may still await discovery, as have been attested further west at Heslerton (Powlesland et al. 1986, 63), and to the north along the lower slopes of the Hambleton Hills (Spratt 1982, 111–16; Meeghan 2009), and on North York Moors (Waughman 2017, 10).

By far the largest proportion of the material recovered by both projects can be attributed to the Early Mesolithic (*c.* 9300–8200 cal BC). The two projects, coupled with the work of Northern Archaeological Associates as part of an archaeological evaluation around Ling Lane (NAA 1996a), and by Barry Taylor around the northeastern quadrant of the former lake as part of his doctoral research (Taylor 2012), have sampled much of the length of the buried shoreline of Lake Flixton. This intensity of manual sampling of a buried landscape, which given the nature of the buried archaeology and covering deposits was unsuited to the use of remote sensing technologies, is unrivalled in British archaeology and has few if any counterparts on mainland Europe. Equally unrivalled is the density of fine scaled palaeoecological analyses now available. Few landscape projects undertaken in Britain or on mainland Europe can draw on such a detailed body of comparative environmental information to place individual sites within their immediate and wider ecological settings.

As comprehensively attested by the survey and excavation work reported here, Star Carr was a unique, and persistent place within this dynamic and changing landscape. Unlike at the inception of the research in 1976, renewed investigations at Star Carr by the VPRT in 1985 and 1992 (see Mellars 1998d, 79–80, Fig. 6.5), and by Paul Mellars (Mellars and Dark 1998), along with the more extensive investigations recently carried out at the site (Milner et al. 2018a, 2018b), has shown that the spatial extent of Star Carr was much greater than envisaged by the site's initial excavator, and its internal spatial organization, artefactual and faunal assemblages more complex, multi-faceted and multi-temporal than originally reconstructed. Important though this work has been, the contributions that the Seamer Carr and VPRT projects make to our understanding of the Early Mesolithic (and earlier) occupation of the Lake Flixton landscape are equally significant. The various sites documented at Seamer Carr, as well as on the lake's southern shores (at sites VP D and E, and around Flixton School), on the former islands (Flixton Island, No Name Hill), and on the promontory designated Barry's Island, as well as the more diffuse traces of off-site activity and localized, short-term settlement found elsewhere, were all part of logistical systems, resource procurement tasks and related practices that sustained activity around Lake Flixton for centuries. Although how these different components were connected over time and space with each other remains rather elusive, the results of the two projects offer fresh insights into the complexity of activity around Lake Flixton that were not available previously, and that cannot be inferred from the evidence recovered from Star Carr alone.

Future directions

Despite the accomplishments of the Seamer Carr and VPRT projects, there are a number of key areas where further work needs to be undertaken. The first is to refine our understanding of the Early Mesolithic occupation of the lake, with particular reference to economic practices and chronology. The existing faunal assemblages recorded by the Seamer Carr and VPRT projects are small, and biased toward larger terrestrial mammals. This is surprising given the length of time that some of these sites were occupied, and while we should not expect to find the same quantities of material as Star Carr, we might expect that larger and more varied assemblages of animal bone remain to be discovered at some sites. The excavations at No Name Hill also show that osseous material culture and the waste from its manufacture is present at sites other than Star Carr, raising the possibility that more of this material could be recovered from locations around the lake. It is also surprising that the evidence for the consumption of plant foods remains absent, both from Star Carr and from the sites reported here. Recent excavations at Flixton School House Farm have shown that plant resources were being utilized for food, and we should not expect this to have been limited to one particular site. The chronology of many sites also remains poorly understood (an issue affecting Early Mesolithic archaeology more generally), particularly in comparison to the very precise record that we now have for Star Carr. This can best be resolved by more extensive excavations at the areas of Early Mesolithic activity already identified by the VPRT. While test-pitting and the excavation of smaller trenches has proved vital to establishing the location and extent of early prehistoric activity areas, it has been the open-area excavations at Seamer Carr Sites C and K and at Star Carr, that have provided the most comprehensive records of Mesolithic activity. Subsequent excavations should also include larger samples of the wetland deposits, where the potential for organic preservation provides a greater chance of recovering faunal material, and where the peat sequences provide stratigraphic relationships amenable to radiocarbon dating and Bayesian modelling.

The second is to increase our understanding of both earlier and later periods of occupation, and to use this to investigate the transitions between particular periods, such as from the Early to Late Mesolithic, and from the Mesolithic to Neolithic. Though extensive areas of Early Mesolithic activity have been recorded, our evidence for the preceding Palaeolithic, and the Late Mesolithic and later prehistoric periods is sparser. While this may reflect differences in population size and the way this landscape was inhabited, it is also an issue of sampling. Much of the work of the Seamer Carr and VPRT projects sampled the former lake shore, yet the expansion of wetland environments onto the areas of low-lying ground would have meant that later occupation was focused on the more elevated areas around the edges of the basin. Additional sampling in these areas may recover more extensive evidence for later activity.

The third is to look more closely at the relationship between Lake Flixton and the wider landscape. At a local level we need to consider whether activity was focused primarily around the edge of the lake and its associated wetlands, or if it extended further onto the areas immediately around the basin, and towards the slopes of the adjacent uplands. Though these areas are unlikely to contain the well-preserved evidence for human activity that we see within the basin itself, an understanding of these areas is vital if we are to properly understand the way prehistoric groups made use of their landscape. This is particularly important for understanding the Late Mesolithic and later prehistoric occupation of this landscape, but would also help to resolve outstanding issues relating to the earlier episodes of activity. In this regard, targeted investigation of the areas away from the lake, and as far as the lower slopes of the neighbouring upland areas, may prove more productive in terms of locating traces of Late Mesolithic settlement, although it is important to acknowledge that the prospect of finding such sites without extensive post-depositional disturbance, except where there are thick deposits of covering wind-blown sand, are slight. Moreover, even where Mesolithic material has been sealed by wind-blown sand, their chronological integrity, as was noted at West Heslerton, cannot be guaranteed (Haughton and Powlesland 1999, 24, 60). Surveys also need to be extended westward as far as the Vale of York. Peat deposits are known from these areas, and some at least may mark the location of areas of open water, albeit smaller than Lake Flixton, during the Early Mesolithic and which could have been a focus of human activity.

At a broader level, the accumulated data from Lake Flixton can help us to begin to test the competing models of Early Mesolithic settlement and mobility within this region, which have previously been based almost entirely on the evidence recovered from Star Carr. An important step in this direction is to better understand the relationship between the lowlands and uplands in the region by establishing the range of site types and assemblage diversity represented by the archaeological record of each area, and their chronologies. The wealth of data now available as a result of the excavations at Seamer Carr and the work of the VPRT provides a detailed understanding of the Early Mesolithic natural, economic and social landscapes of the Lake Flixton area. However, more work needs to be done in the adjacent uplands if we are to fully understand how the occupation around Lake Flixton relates to its wider landscape. To this end, programmes of fieldwalking and test-pitting should be undertaken on the higher ground of the Wolds, Howardian Hills and North York Moors, followed where necessary with larger scale excavation. There is still much to be learned about the Early Mesolithic occupation of these landscapes, how hunter-gatherers in these areas organized their settlement, livelihood and social practices, how they interacted with these different spaces, the affordances they provided and the entangled histories and materialities that transpired.

Appendix 1

Membership of the Seamer Carr Research Committee and Vale of Pickering Research Trust Trustees

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Appendix 2

Terms used in describing lithic material

Debitage

Blade: A piece at least twice as long as it is wide.

Flake: A piece less than twice as long as its width.

Chunk: Shatter fragment produced in the breaking up of a nodule.

Fragment: Any broken piece that is too fragmentary to be assigned to any of the above.

Debitage: Any piece in which no diameter exceeds 10 mm. This term is also used more generally to describe waste flakes.

Cores were divided into the following sub-categories (after Clark and Higgs 1960):

> *A1:* Single platform with flakes and blades removed all the way round the core.
> *A2:* Single platform core with flakes and blades removed part of the way round the core.
> *B1:* Core with two parallel platforms.
> *B2:* Two platforms, with one at an oblique angle.
> *B3:* Two platforms at right-angles.
> *C:* Three or more platforms.
> *D:* With flakes struck from either side of a ridge.
> *E:* As D, but with one platform or more.

Nodule: an unmodified flint manuport.

Tested nodule: a nodule with one to three flakes removed.

Preform: Here, a nodule with between three to six flakes removed, with a platform created and core face flaking initiated to permit future blade or flake removal.

Core preparation flakes

These were divided into:

Crested blade: Classically evidence of the early stages of core production, with flakes being removed along a natural ridge of the nodule in one or two directions, creating a crest which was used to guide the removal of the first blade. Frequently morphologically identical are pieces (common in the Vale of Pickering assemblages) that were produced as a result of the creation of a new platform on a core, at right angles to the initial platform. In these cases, the crest formed of the initial platform/core face angle was used as a guide to initiate flaking from the new platform.

Core tablet: Thick flake bearing negative bulb scars on lateral edges. Occasioned by the removal of a flake from a platform to adjust the platform/core flake angle or correct a mistake.

Plunging flake: Long flake or blade undercutting the base of the core. Employed to thin the core face.

Step fracture removal: Removal of a step or hinge fracture either through the removal of a thick flake or by a removal from an opposing platform.

Tool spalls

Axe Flake: These pieces can either refer to flakes generated during axe manufacture which have an acute platform angle with frequent traces of faceting on the platform and a characteristic curved profile, or to tranchet flakes, generated through the transverse sharpening of the cutting edge of the axe.

Burin spall: These are pieces, frequently with a triangular cross-section, the waste products of a burin blow in the manufacture of a burin. They can be divided into primary – representing the first blow and burin manufacture – or secondary – representing subsequent blows and burin re-sharpening.

Microburin: Waste product in the manufacture of microliths formed by working a notch into a blade and then snapping off the short bulbar or distal end, which is discarded as a microburin, leaving a partially retouched bladelet for microlith manufacture. Characterized by a truncated dorsal notch forming an acute angle with a ventral fracture facet. Categorized as either proximal or distal.

Scraper (re)sharpening: A small piece with wedge shaped or curved profile, bearing scars of previous scraper sharpening facets on its dorsal surface. May also be detached during use.

Tools and retouched pieces

Awls: Pieces with narrow retouched projection either formed by one or two oblique truncations, or by additional modification of an existing point or spurred projection on a blank. A *mèche de foret* (Tixier 1963) is an elaborate awl form (found rarely in the Vale of Pickering assemblages) with retouch extending around all or part of the circumference of a blade which tapers into a sturdy point.

Axe: Core tool with symmetrical or asymmetric section with a transverse cutting edge.

Backed point: Point with abrupt retouch extending down one edge.

Burins were divided into:

> *Dihedral burins;* one or more burin blows delivered to produce a point with edges at oblique angles to the lateral margins of the original blank.
> *Angle burins;* a burin blow delivered parallel to the original lateral margins of the blank from a truncation or natural break at right angles to the long axis of the piece.

Microliths were divided into the following subcategories:

> Obliquely blunted point – an Early Mesolithic form with the point consisting of an oblique truncation
> Triangle – Early Mesolithic, simple isosceles triangle with two points consisting of two oblique truncations situated on opposite ends of one lateral.
> Trapeze – Early Mesolithic; similar to triangle, but portion of unmodified edge still remains between the two oblique truncations.
> Scalene triangle – Late Mesolithic geometric microlith, smaller in size than the above, can be blunted on two or three sides.
> Rod – Small Late Mesolithic geometric microlith, blunted on one or two sides

Notch: A piece on the edge of which one or more indentations have been worked.

Scrapers were divided into:

> Short scraper – an end-scraper less than twice as long as it is wide.
> Long scraper – an end-scraper twice as long, or greater than twice as long as it is wide.
> Round scraper – a scraper of circular morphology, thus bearing retouch not only at the end, but also continuously along the lateral edges. Frequently Late Glacial in date.
> Double scraper – a scraper with retouch at both ends.
> Irregular scraper – a scraper of different morphology to the above types, i.e. A side scraper or denticulate scraper.

Strike-a-light/hammerstone: these are cores which display very obvious evidence of subsequent battering along their edges. Clark suggests that similar examples from Star Carr functioned as hammerstones or strike-a-lights (Clark 1954).

Tang: The only example recovered was a fragment of a large piece of unknown total morphology or function. The tang was created by the indenting of two opposed notches on either side of a large blade fragment close to the bulbar end.

Truncation:
A flake or blade of which the (usually distal) end undergone an often oblique truncation with steep abrupt retouch.

Various composite tools were also recognized. These include core/burins, core/scrapers, core/scraper/burins, scraper/awls, scraper/burins and scraper/notches.

Retouched pieces:
A piece displaying any secondary retouch that does not fall into accepted definitions of any formal tool category.

In order to determine the general positions within the reduction sequence, pieces were divided into the following sub-categories;

Primary: When the dorsal face in entirely cortical
Secondary: When the dorsal face is partially cortical
Tertiary: When the dorsal face is free from cortex.

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Appendix 3

Measurements of the main food mammals from the VPRT excavations

Most of the measurements are as defined by von den Driesch (1976); where this is not the case they are defined by Legge and Rowley-Conwy (1988, 124). Measurements are in millimetres. Bracketed measurements are estimated.

A. RED DEER

red deer mandibular M3

site	length
Barry's Island (sand)	34.2
Barry's Island (sand)	34.1
Barry's Island (sand)	32.0
Barry's Island (sand)	33.1
Barry's Island (sand)	31.0
Barry's Island (sand)	32.7
Barry's Island (sand)	34.7
Barry's Island (main)	36.0

red deer scapula

site	fusion	GLP	BG	SLC
Barry's Island (sand)	fused	67.3	48.1	40.8
Barry's Island (sand)	unknown	-	-	29.6
Barry's Island (sand)	unknown	-	-	29.5
No Name Hill	fused	-	36.7	32.8

red deer distal humerus

site	fusion	BT	HT	HTC	SD
Barry's Island (sand)	fused	(48.1)	36.9	27.1	-
Barry's Island (sand)	unknown	-	-	-	22.2
Barry's Island (main)	fused	-	(46.6)	-	-
Barry's Island (main)	unknown	-	-	-	21.4
Barry's Island (main)	fused	-	41.2	28.0	27.0
Flixton School Field	fused	(51.8)	41.2	29.1	-
Flixton School Field	fused	51.2	42.2	29.8	-

red deer radius

site	fusion (p)	Bp	fusion (d)	Bd
Flixton School House Farm	fused	(58.4)	-	-
Flixton School Field	-	-	fused	52.1
Ling Lane 765			fused	(46.4)

red deer metacarpal

site	fusion (d)	Bp	SD
Barry's Island (main)	unknown	-	21.8
Flixton School Field	unknown	45.3	-

red deer distal tibia

site	fusion	Bd	SD
Barry's Island (sand)	unknown	-	17.6
Barry's Island (main)	fused	(40.0)	23.7
Barry's Island (main)	fused	43.3	25.2
Flixton School House Farm	fused	-	30.2
Flixton School Field	fused	48.4	31.4

red deer astragalus

site	GLl	Bd
Barry's Island (sand)	59.3	34.0
Barry's Island (main)	53.8	33.7
Barry's Island (main)	54.6	-
Flixton School House Farm	58.5	33.2
Flixton School Field	-	35.2
Ling Lane 1208	(54.1)	(37.4)

red deer calcaneum

site	GL
Barry's Island (main)	131.1
Ling Lane 1208	122.0

B. ROE DEER

roe deer mandibular M3

site	length
Flixton School House Farm	15.9

roe deer distal humerus

site	fusion	BT	HT	HTC	SD
Barry's Island (main)	fused	-	-	-	11.3
Flixton School House Farm	fused	(26.0)	22.0	17.2	-

roe deer radius

site	fusion (p)	Bp	SD	fusion (d)	Bd
Flixton School House Farm	fused	28.6	18.4	-	-

roe deer metatarsal

site	fusion (d)	GL	Bp	Bd	Dd	SD
Barry's Island (main)	fused	211	21.9	25.8	17.6	12.2

C. ELK

elk scapula

site	fusion	GLP	BG	SLC
No Name Hill	fused	-	-	(52.0)

elk proximal radius

site	fusion	Bp	SD
Flixton School House Farm	fusing	73.9	-

elk metacarpal

site	fusion (d)	Bp	SD
Barry's Island (main)	unknown	(53.0)	-

elk metatarsal

site	fusion (d)	Bp	SD	BD
No Name Hill	unknown	-	33.1	
Ling Lane 767	fused			(61.6)

D. AUROCHS

aurochs proximal femur

site	fusion	DC
Flixton School Field	unfused	48.0

aurochs distal tibia

site	fusion	Bd	SD
Flixton School House Farm	fused	87.0	-
Flixton School Field	fused	83.8	53.9

aurochs distal metacarpal

site	fusion	Bd	Dd	SD
Ling Lane 1206	fused	(78.4)	-	-
Ling Lane 1265	fused	(83.2)	-	-

aurochs calcaneum

site	GL
Barry's Island (main)	179

aurochs distal metatarsal

site	fusion	Bd	Dd	SD
Flixton School House Farm	fused	-	38.5	-

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Hunter-gatherers in the landscape

This monograph presents the results of over twenty-five years of archaeological and palaeoenvironmental research on the Late Glacial (Late Upper Palaeolithic) and Early Holocene (Mesolithic) landscape of the palaeo-Lake Flixton in the eastern Vale of Pickering, North Yorkshire. Initially conceived as a rescue project focused on Seamer Carr, an area of land lying a few kilometres northwest of the well-known Early Mesolithic site of Star Carr, the project ultimately developed into a much wider study of the early prehistoric occupation of the former lake and its environs. By the time the project concluded it had successfully mapped much of the former lake and developed a detailed account of both the human and environmental histories of this landscape.

While some elements of this research have been published previously, this volume represents the definitive report on the results of the project, and the research strategies employed to investigate an entire landscape buried beneath peat deposits, and with little visible evidence for human activity on the modern ground surface. The data produced by the project, brought together in this volume, provides an unparalleled analysis of the changing nature of Late Upper Palaeolithic and Mesolithic settlement in lowland northern England and helps place the extensively excavated site of Star Carr in its wider landscape context.

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Editors:
Paul Lane is the inaugural Jennifer Ward Oppenheimer Professor of the Deep History and Archaeology of Africa at the University of Cambridge, and the Mandela Magdalene Memorial Fellow.
***Tim Schadla-Hall*†** was Reader in Public Archaeology at the Institute of Archaeology, University College London, and formerly the Director of Leicestershire County Museum Service.
Barry Taylor is a Senior Lecturer in Archaeology at the University of Chester.

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