

North East Yorkshire Mesolithic

Updated Project Design for Phase 2

Version 2.2

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North East Yorkshire Mesolithic Updated Project Design

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North East Yorkshire Mesolithic: updated project design

1. Introduction

It is acknowledged that Mesolithic activity is generally under-represented in the archaeological record for northern England when compared to later periods (Adams 1996). The area of north east Yorkshire is no exception, despite there being a concentration of sites on the North York Moors in particular. A number of these sites are prolific in their lithic assemblages (summarised in Spratt 1993), but they are predominantly situated on the central watershed of the moors and many of the peripheral areas have scant evidence for Mesolithic occupation. Furthermore, the range of evidence is very restricted and comes principally from surface collections; few sites have undergone systematic excavation, particularly in recent years (e.g. Waughman 1996). Although palaeoenvironmental research in the area is well established (Simmons 1996), there has been very little sampling of archaeological sites, and hence there is no direct link between the environmental evidence and the lithics. There are, therefore, significant gaps in our understanding of the nature of Mesolithic occupation in north east Yorkshire.

A three phase project was proposed in a project outline dated May 2004, which it was anticipated would further a better and more complete understanding of the Mesolithic in this area and would also contribute to the changing picture of the Mesolithic nationally. This report details the results of the first phase of the project and includes an updated project design for Phase 2, with an outline of work proposed for Phase 3. Phase 1 was commissioned by English Heritage (project reference 3862) following acceptance of the project design in January 2006; work on Phase 1 took place between February and September 2006.

2. Background

2.1 Location

The North York Moors is an isolated upland block which is bounded by the Vale of Pickering to the south, the Vales of York and Mowbray to the west, the lowlands of the Tees valley to the north and the North Sea coast to the east. The project area extends across this upland landscape and into the Tees valley lowlands (Figure 1). It is defined to the north by the river Tees, to the west by the river Leven and its catchment and by the escarpment of the Cleveland and Hambleton Hills, and to the south by the North York Moors National Park boundary and the southern edge of the Tabular Hills, taken as the 50m contour to the east of Kirbymoorside and 70m further west. On its western edge the National Park includes an area of up to 1km beyond the escarpment, so for consistency this margin is included within the project area and extended where the NP boundary runs close to the foot of the escarpment.

Outside the North York Moors National Park boundary, North Yorkshire County Council has administrative responsibility for small areas on the southern fringes of the moors and in the Tees Valley. The unitary authorities of Redcar and Cleveland, Middlesbrough and Stockton (whose HERs are curated by Tees Archaeology) cover the remainder of the Tees valley to the east as well as the northern fringes of the moors. The high moors form the largest area of open heather moorland in England and Wales with SSSI status, and are managed largely for grouse shooting and sheep farming. The moorland valleys, the gentler slopes of the Hambleton and Tabular Hills on the southern fringes of the moors, and the lowlands of the Tees Valley are mainly farmland, dominated by pasture in the moorland valleys and with a significant proportion of arable elsewhere. There are also extensive urban and industrial

developments in the Tees valley and substantial areas of afforestation in the National Park, particularly towards the south east.

2.2 Previous work

Previous archaeological work in the area has focussed on surface collection of lithics and is summarised by Manby (2003). Collections made prior to the early 1990s are largely documented in Wymer (1977) and Spratt (1993) (Figure 2), although many of these have received little attention from lithics specialists and have not been analysed in detail. More recent collections are also known to have been made but many of these remain poorly documented. At the start of Phase 1, the three HERs maintained for the project area (NYMNP, NYCC and Tees Archaeology) together had about 900 entries for Mesolithic sites and finds. Of these, about 270 referred to lithic assemblages, the remainder being largely detailed entries for their component artefacts and single findspots. A proportion of the assemblages also contain diagnostic Neolithic artefacts and these have raised a number of questions concerning the chronology of Mesolithic and Neolithic in the area (Young 1989), particularly since there are only a handful of purely Neolithic assemblages recorded on the HERs.

Within the project area there is only one recently determined radiocarbon date from deposits associated with Mesolithic artefacts (5956±51 bp; Wk-15138; associated with a single flint) and two more from the 1970s (4904±75 bp, Q-1170; 7480±390 bp, Q-1560), although there are also dates for some of the pollen profiles. Highcliff Nab on the northern edge of the upland is the only Mesolithic site to have been excavated in recent years, although a number of the lithic assemblages derive from systematic fieldwalking programmes, particularly those undertaken by the former Cleveland County Archaeology Section, by Richard Chatterton as part of his PhD research (R Chatterton pers. comm.) and by the Great Ayton Community Archaeology Group for their ongoing project. Mesolithic finds have also been recovered from the excavation of later sites (e.g. Street House, Loftus, Vyner 1984). The extensive palaeoenvironmental work which has been undertaken on the moors is synthesised by Simmons (1996) and Innes and Blackford (2003), but very little was recorded on the HERs at the start of Phase 1. Researchers maintain an active interest and current investigations were similarly undocumented by the HERs prior to Phase 1.

2.3 Research priorities and frameworks

Until relatively recently, interpretations of Mesolithic archaeology have followed an approach based on either lithics or environmental data, often supported by ethnography (Young 2000) and in the case of north east England based on interpretations of type sites such as Star Carr. Over the past few years a number of studies in northern England have adopted a broader landscape based approach (e.g. Conneller and Schadla-Hall 2003; Spikins 1999, 2002; Tolan-Smith 1996; Waddington 2000) and with the recent and forthcoming publication of the results from some of these it is timely to address our understanding of Mesolithic activity across the landscape of north east Yorkshire as a complement to those studies. In addition to these specific studies, there are now a number of synthetic publications covering the archaeology of northern England, some of which include recommendations for future research (e.g. Huntley and Stallibrass 1995; Brooks *et al* 2002; Harding and Johnston 2000; Manby *et al* 2003).

More recently the formal initiative taken up by the Yorkshire Archaeological Research Framework Forum (YARFF) to establish a research agenda for Yorkshire completed its first stage of data gathering and resource assessment in 2005 and the draft report suggests some

future directions which could be built on to develop regional research agenda (Roskams and Whyman 2005, currently under review). Work on the North East Regional Research Framework has also been completed (ref??). These framework documents and the recently produced syntheses include the following research priorities identified for the Mesolithic period within the region:

- Reappraisal of existing lithic collections, including analysis of chronology
- Identification of sites in under-represented areas, particularly lowland occupation sites
- Refining chronology through use of radiocarbon dating, especially high resolution
- Investigation of sites with both palaeoenvironmental and archaeological potential, particularly in lowland areas
- Clarification of the Mesolithic-Neolithic transition, including through examining assemblage composition and differences in site location
- Investigation of site distributions to see whether differences relate to chronology, subsistence strategy, site function or cultural grouping

These priorities also match some of those identified in the national Palaeolithic and Mesolithic research framework (Gardiner 1999), which in addition highlights the need for education and outreach work. Phase 2 of the North East Yorkshire Mesolithic project will develop these regional and national priorities and in particular will provide the major input on the Mesolithic to the National Park's research and management framework (NYMNP 2007).

2.4 General project aims

The overall project has four general aims which will underpin the objectives for each phase:

- To examine interpretations of existing data
- To clarify the chronology of the Mesolithic in this area, investigating the relationships between early and late forms of microlith and with the succeeding Neolithic
- To investigate the relationship between exploitation of the uplands and the adjacent lowlands
- To reappraise the existing models of Mesolithic occupation and subsistence in north east Yorkshire

These project aims address a number of the primary goals presented in EH's Implementation Plan for EoP (EH 1998). Principally, the project falls within the scope of primary goal A, advancing understanding of England's archaeology, and sub-programme 3.3, thematic syntheses, with several themes drawn from the national research objectives presented in EoP: the transition of hunter-gatherers into farmers (PC1); Mesolithic occupation sites and the Mesolithic in northern England (P3 and P4); regional chronologies of landscapes (L3). In aiming to assess and understand the Mesolithic landscape of north east Yorkshire, the project is also linked to sub-programme 1.7, by including palaeoenvironmental investigations, to sub-programme 2.3, and by assisting in the development and review of regional research agenda, into programme 8 of primary goal C. (see also section 5 below)

The project aims and objectives satisfy programmes within the research themes forming EH's Research Agenda – themes A (discovering, studying and defining historic assets and their significance), C (engaging and developing diverse audiences), D (studying and assessing the

risks to historic assets and devising responses), G (studying and devising ways of making English Heritage and the sector more effective).

3. Assessment and potential

3.1 Phase 1 results

Database

An Access database was developed from the area's three HERs, from which records were imported, and linked to GIS. The database holds 969 records, of which 293 are sites and 38 are palaeoenvironmental sampling sites. For the purposes of this project a site was defined as a concentration of lithics numbering at least 10, or for fieldwalking assemblages, a collection of at least 50 flints. The 638 database entries which were not classed as sites include 200 finds records taken from the HER which relate to sites recorded separately under a different number, as well as records for findspots and smaller fieldwalking collections. New records account for 152 records – 64 sites, 59 findspots/small fieldwalking assemblages and 29 palaeoenvironmental sampling sites. These records were created from information obtained from a variety of sources including published literature, museum collections or catalogues, private collections and personal comment by both collectors and palaeoenvironmental investigators.

Although it was possible to clean existing HER records to some extent (93 duplicate entries and 28 component palaeoenvironmental records for individual pollen zones were deleted from the database), the published catalogues of Mesolithic data (Wymer 1977, Spratt 1993) which previously had been used to compile HER entries were found to contain many inaccuracies, duplications and errors and it was not possible to identify and remove all of these from the project dataset. A further 121 entries were deleted from the database because they were determined to be either errors (e.g. outside the project area), of little interest in the context of the current project (e.g. single findspots of undiagnostic flint) or definitely not Mesolithic (e.g. assemblages displaying only later prehistoric characteristics).

The overall distributions of sites, findspots and palaeoenvironmental samples (Figure 2) shows that there has been a general increase in the density of records, and this is particularly evident in some parts of the project area where previously there were few or no recorded sites or finds.

Lithics by Peter Rowe

Between April and June 2006 the lithic collections of the principal museums covering the study area were assessed. The collections were examined rapidly given the quantity of material. In addition, the extensive private collections of Norman and Patricia Harbord and Mrs Geoffrey Taylor were visited. An assessment was made of the provenance of each collection (site name, grid reference, finder, method and date of find), the raw material (flint, chert etc and indication of colour and source), the components of the assemblage (i.e. tools and waste) and an indication of the main prehistoric periods represented. The data was logged on an Excel spreadsheet.

Provenance. Museum documentation is variable. Although most museums had a good idea of the size, location and composition of the assemblages they often lacked supporting documentation. There is also the tendency for artefact descriptions on box labels or data records to be incorrect. For example it was frequently noted that any small piece of flint would be labelled as a 'microlith' and any large piece described as a 'core'. Some of the

collections, particularly those in private hands have not been fully catalogued, although in some cases work is in progress.

Provenance is poor for some of the museum collections, particularly those in the Ryedale Folk and Whitby museums where some 'collections' appeared to be a mixed grouping of material from a number of different sites. For some other collections, provenance might be clarified if there is supporting documentation in paper archives. It was noted that material from one site could be spread across several museums in collections made by different individuals and donated to the institutions at various times. It was also apparent that some of the more prolific collectors of the early to mid 20th century did not pay much attention to waste material. This seems to be the case with Gray and Smith collections in the Whitby Museum and the Close collection at the Ryedale Folk Museum, although it is possible that waste pieces may have been lost or discarded since accession.

Raw material. The raw material noted is almost entirely flint with other stone types accounting for less than 1% of the lithics assessed. There are few examples of chert and one unusual blue agate microlith noted in the Gray Collection at Whitby Museum. The flint tends to be fairly limited in variation with the majority (approximately 95%) being either grey or brown flint from a glacial or beach source. There are more exotic pieces present including reds, oranges and honey coloured pieces but these are again consistent with glacial drift material or beach pebbles.

Assemblage components. Nearly all of the material assessed comprised surface collections with fewer samples from excavations. Assemblages often contained later prehistoric flints as well as earlier and so it was felt that the only real indicator of a Mesolithic site was the presence of microliths. However, blades, blade cores and end scrapers based on blades or elongated flakes were taken as potential indicators of earlier rather than later prehistoric activity.

The vast majority of the microliths (approximately 99%) were Late Mesolithic narrow blade examples, usually no wider than 5mm in breadth, including scalene triangles, small obliquely blunted points, trapezoids and crescents alongside very late material represented by microlithic rods. Early microliths were present in the form of broader isosceles triangles at least 8mm in breadth, however where they occurred they were single examples and always mixed with later material.

Distributions

Collection bias

GIS plots were examined to determine to what extent collection strategies had biased the apparent site distribution. It was clear that most collectors operated within a restricted geographical area, but since there were many different collectors (74 in total, with 17 of them collecting from more than 3 sites) whose work was distributed across the project area this did not appear to be a significant bias in the site distribution. However, modern land use and consequently the collecting methods used have had an influence on site distributions (Figure 3).

Land use

The large blank areas on the distribution maps in the moorland valleys, along the coastal strip and on some areas of the Tabular Hills reflect the predominant management of these areas as pasture where there are few opportunities for Mesolithic material to be identified, and the few sites and finds which lie within the extensive Forestry Commission plantations in the south

east corner of the project area are largely a result of collections made prior to afforestation. Areas under arable cultivation in the Tees valley, on the Hambleton and Tabular Hills and in a few locations along the coastal strip have been investigated through fieldwalking programmes and there are some sites known.

Footpaths

The largest numbers of sites however are located in open moorland where finds have been made through surface collection, either as chance finds or more focussed collection and research. Discoveries in these areas appear to be linked to the network of footpaths crossing the moors, since sites have frequently been found as a result of path erosion, or water erosion in areas easily visible from the paths, although regular collectors may have deviated from the paths in order to explore the area surrounding a known site (Mrs Taylor pers. comm.). Some of the emptier areas of moorland on the maps have fewer paths as well as fewer sites and so there may be more undiscovered, and undisturbed, sites in these areas. The exception seems to be the lower-lying eastern moorland; it is interesting that erosion along the Lyke Wake Walk, which crosses the National Park from west to east, has been responsible for the discovery of many sites and individual finds in the western and central parts of the moors, but further east the density of finds decreases despite the fact that a number of the most active collectors have followed it (e.g. R H Hayes, G V Taylor). Evidence from Fylingdales Moor at the extreme eastern edge of the moorland block appears to support the impression that the reduced site densities in this area are real, since intensive walkover survey following a severe moorland fire in 2003 produced nothing diagnostically Mesolithic and only a small number of flints which could have originated in the Mesolithic (Rowe 2005).

The archaeological resource

Artefact distributions

GIS was used to look at the distribution of different categories of flint artefact and forms of microlith. The results of this analysis are in Appendix 1. Two points in particular stand out:

- the small number of sites which are recorded as originating in the early Mesolithic have a distribution across the same area as later sites, but for most of these the type of microlith used to date the site is not specified; sites recorded as having early mesolithic forms of microlith are very few, although there are also a few sites with isosceles and trapezoid microliths which are narrower than typical early mesolithic forms, but not as narrow as the later geometric microliths found in great numbers, and the dating of these could be early.
- there is a significant minority of Mesolithic sites distributed throughout the project area which also have Neolithic and Bronze Age material (37 with Neolithic and 19 with both Bronze Age and Neolithic)

Site location

The location of sites was also considered using GIS generated distributions; by looking at their altitude and the type of the nearest (modern) water source (Figure 4). From this, six zones of Mesolithic occupation have been identified:

Zone 1 - low-lying areas in the Tees valley. These include the former lake basin at Seamer Carrs and sites alongside the river Tees and the former course of the Leven at Levensdale

Zone 2 - lowland locations in prominent positions, principally overlooking the Tees estuary and what would have been the coastal plain in the Mesolithic. Typical locations are those on the Eston and Upleatham hills and down the coast at Goldsborough

Zone 3 - the lower-lying northern and eastern fringes of the present moorland

block where sites are often on broad ridges with panoramic views, with sites such as Simon Howe, Mauley Cross and Brown Hill.

Zone 4 - prominent locations on the edge of steep valley and scarp slopes. These include Highcliff Nab, the northern edge of Urra Moor, sites on the western escarpment of the Hambleton Hills and Bransdale Ridge.

Zone 5 - the upper reaches of streams in high moorland in locations such as White Gill, Parci Gill on West Bilsdale Moor and Butter Beck on Egton High Moor.

Zone 6 - high moorland spring head basins. Typical sites include Ousegill Head, Peat Moss, Glaisdale Moor and Westerdale Head.

There are two further topographical zones within the project area, but neither of these has strong evidence for Mesolithic sites at present. No sites are known from the moorland valleys, but this may be largely a function of visibility related to land use as pasture, rather than a real indication of Mesolithic site distribution. Evidence is not completely absent from the limestone Tabular Hills on the southern fringes of the project area, but consists largely of findspots and components of multi-period fieldwalking assemblages, for which documentation is poor or non-existent.

The palaeoenvironmental resource by Jim Innes

The vegetational history of the North York Moors during the Mesolithic period, *c.* 10,000 to *c.* 5500 radiocarbon years ago, is now quite well known as many pollen profiles are available for study from the area (Simmons *et al* 1993). While most pollen diagrams provide a general record of vegetation change, some provide a fine resolution record of natural and human induced plant successions over a short period of time. At least one long pollen record that covers most of the Mesolithic has been prepared from most of the landscape zones of the area, so that long pollen records from the high central watershed plateau, the lower watersheds to the east and north and the Tees lowlands are available for comparison, although sediments covering the earliest Mesolithic have not yet been recovered at high altitude. A summary of the vegetation history of the project area is provided in Appendix 2.

There is abundant evidence that disturbance of the woodland, usually through fire, occurred at all stages of the Mesolithic period (Innes and Simmons 1988). Although whether by natural or human agency is unproven, the incidence of burning is likely to indicate human activity. Evidence is particularly clear at high altitude but occurs all across the area, even in the Tees lowlands. On the central watershed, micro-charcoal is always present in late Mesolithic peat to some degree, showing that burning was never absent from at least some part of the woodland as well as being concentrated at particular sites (Innes and Simmons 2000). Such regional scale burning must have had a major influence of forest history and composition during the Mesolithic. The burning seems to have stopped during the following Neolithic period (after *c.* 4800 bp at Bilsdale, Simmons and Innes 1988).

There are deficiencies in the environmental record that must be addressed by further palynological research before a complete understanding of Mesolithic vegetation history on the North York Moors could be possible. The distribution of the database must be extended to neglected areas such as the northern edge of the moors in East Cleveland and the limestone areas of the southern flanks of the Moors to the north of the Vale of Pickering. The upland moors of the extreme west and extreme east of the region also require more work. Sediments old enough to contain data on the early Mesolithic at higher altitudes are needed, as we know little about the environments of the first Holocene millennium above the Vales and Dales. Many more radiocarbon dates are needed, both on major pollen zone boundaries and on episodes of disturbance in Mesolithic pollen diagrams. For many important changes in

vegetation history our current understanding is based upon a single date at best and we have no idea of regional variation in the timing of events. Some features, such as early Holocene Mesolithic impacts, need to be studied at higher resolution to understand their environmental context.

3.2 Potential

Lithics

The material assessed represents a major archaeological resource, which has not been fully appreciated but the poor provenance, selective recovery and mixing or dispersal of material from different sites means that in many cases its potential for analysis is limited. It should be possible to reassemble individual pieces from a single site stored separately within one museum, and even to re-collate some of the collections in order that they are more spatially meaningful rather than representing the achievement of individual collectors. Work of this nature is beyond the scope of this project, but it is proposed that museum guidance to address these issues should be produced.

The chronologically mixed nature of the assemblages and the poor recovery and curation of waste material makes their potential for analysing the development of typology and the nature of occupation limited, but nevertheless the size of many assemblages means that they would provide valuable supporting information for any sites which are re-examined through fieldwork. There are also some assemblages which have the potential to provide evidence for occupation in areas where only a few prolific sites are known: the lower lying moorland on the northern and eastern periphery of the central moorland block has fewer sites than the high moorland (see *Sites* below), and the three largest recorded sites from this area are unsuitable for field evaluation: Simon Howe is part of a Scheduled Monument, and the only Mesolithic site to be protected by scheduling within the project area, Mauley Cross has been substantially damaged by deep forestry ploughing and Crag Stone Rigg has never been accurately located, but the assemblages from all three could give information at least on the proportions of worked items, different microlith types and the raw materials used, and for Mauley Cross which has some assemblages with waste material, a more full analysis may be useful.

The Geoffrey Taylor collection is the largest group of Mesolithic material assessed for Phase 1. These lithics were collected over at least 40 years and include flints from the excavations undertaken with Roger Jacobi at Pointed Stone and Money Howe (Jacobi 1976), as well as more recently collected fieldwalking assemblages from the Hambleton Hills, which have not only Mesolithic material but large numbers of Neolithic and Bronze Age tools, including stone axes. Overall the collection is enormous and includes an estimated quarter to half million pieces of waste material. Both waste and worked pieces are usually provenanced by a site name and sketch map held with the material and notebooks maintained by Mr. Taylor. Many of the moorland sites were already recorded on the HER, but most of the lithics have not been catalogued or analysed. A proportion of the worked items in the collection have been catalogued by Helen Drinkhall at Durham University, with funding from the Portable Antiquities scheme, but the available budget was insufficient to complete the full collection, and it did not in any case include the vast amount of waste material. This is an extremely valuable resource, but it will not be possible to use it fully until there is a complete catalogue and more particularly, until the waste material has been sorted, catalogued and re-packaged.

Excavated lithics from the Taylor/Jacobi sites at Pointed Stone and Money Howe is stored in the Taylor collection with worked items and waste material together. Since these two sites have been regarded as type sites for the early Mesolithic on the North York Moors, and there

are no indications from either the HER records or the assessed collections for any similar sites, this material has the potential to clarify the early Mesolithic data through re-examination of both the lithics and the excavation archive, which has never been published fully. The intact and well-documented collection from Peat Moss ('excavated' from a surface exposure by David Clarke and held by the Dorman museum; Clarke 1973) may also have some potential for re-analysis since the assemblage is one of only a few to have crescent-shaped microliths as well as other narrow blade forms and it contains some later prehistoric material.

The collections made by Norman and Patricia Harbord at Goldsborough include substantial quantities of Mesolithic material, some of which was found in distinct concentrations. These sites have good potential for evaluation (see below), but the lithics have not been fully catalogued and studied and also have potential for further work.

Sites

Within the last ten years, excavations on the northern edge of the moors (Waughman 1996) have showed that despite erosion stratified deposits can survive. This may also be the case for some of the many other prolific lithic sites identified as a consequence of erosion which therefore have the potential to preserve more detailed evidence in the form of hearths and material suitable for radiocarbon dating, comparable to that recorded in the North Pennines and the Northumberland coast, for example (Spikins 1999; Waddington 2003). The recovery of stratified information from a range of different sites across the North York Moors area, associated with radiocarbon dates and a full and enhanced palaeoenvironmental record, would have the potential to enable a much more complete and detailed interpretation of Mesolithic activity, which would be of considerable importance, particularly in view of the current work at Star Carr (directed as a joint project between the universities of York, Manchester, Cambridge and London UCL). Combined with the considerable body of research available and in progress for the adjacent Vale of Pickering (Conneller and Schadla-Hall 2003; Mellars and Dark 1998), this will give an overall picture of human activity across a number of contiguous blocks of landscape, the extent of which will be unparalleled (I. Simmons pers. comm.).

For each of the six zones of Mesolithic activity which have been identified in the project area, the potential to provide data through field evaluation in Phase 2 and the suitability for further work can be considered separately:

Zone 1. Low-lying areas in the Tees valley

Although sites in this zone have been identified through fieldwalking, surface lithics do not occur in very high densities because of deposits of alluvium and peat above the Mesolithic horizons. The very few sites known are either beneath modern housing or have been the focus of good recent and on-going work (Richard Chatterton at Seamer Carrs (Chatterton 2006), Great Ayton Community Project at Levensdale). From this work, the sites do appear to have potential for further study, particularly in association with palaeoenvironmental investigation, but field investigation would need to be intensive since the surface lithic scatters do not occur in particular concentrations, and this would be beyond the scope of the present project. There is, however, the potential for integrating results from these projects with the North East Yorkshire Mesolithic project.

Zone 2. Lowland locations in prominent positions, principally overlooking the Tees estuary and what would have been the coastal plain in the Mesolithic

Although these are also few in number, the known sites have prolific assemblages which include a variety of artefact types, as well as both Mesolithic and later items. These are ploughsoil assemblages from fieldwalking, but the extent of plough damage is not known. Those with the most potential are the three sites at Upleatham, which have been considered in the past to be typical lowland sites of Mesolithic occupation (Spratt *et al* 1976) and two sites at Goldsborough. When first walked, one of the Goldsborough sites had evidence for hearths in the form of concentrations of burnt stone on the surface of the ploughsoil (N Harbord pers. comm.) and there may be subsoil features surviving now. None of these sites have early Mesolithic flints (although one of the Goldsborough sites produced a possible Late Upper Palaeolithic shouldered point), but the Goldsborough sites have very late Mesolithic rods and therefore have the potential for investigating the transition from Mesolithic to Neolithic. Goldsborough is also in a similar location to the recently excavated site at Howick on the Northumberland coast (Waddington 2003), on a cliff-top overlooking low-lying coastal areas, and therefore could have had a similar type of occupation, although with plough damage, preservation at Goldsborough is not likely to be so good. Evidence from the former low-lying coastal zone is absent from the project area, but sites such as Goldsborough may have been associated with the type of evidence found in Hartlepool Bay to the immediate north (Waughman 2005).

Zone 3. The lower-lying northern and eastern fringes of the present moorland block where sites are often on broad ridges with panoramic views

Densities of sites are much lower in these areas and the locations are not as distinctive as they are in other zones of occupation. Given the low degree of accuracy in the recorded NGRs, existing sites are much more difficult to identify with certainty and it is unlikely that selecting an area for evaluation will produce results. There is one site (Sheffield Moor) where collections are current but these are restricted to narrow motor bike trails, are not yet in very large numbers and include later prehistoric material (N Harbord pers. comm.). This site may have potential for investigation in the future and monitoring the extent of the erosion may be worthwhile.

Zone 4. Prominent locations on the edge of steep valley and scarp slopes

This zone includes sites on the northern and western escarpments of the moorland block, such as Highcliff Nab which is known to have potential for further investigation (Waughman 1996). However, many of the previously recorded sites in open moorland have only 6 figure grid references, and so are difficult to locate in the field. Consequently, the sites with the highest potential are those which occur in a high density within a relatively small area, such as Bransdale Ridge or the northern edge of Urra Moor. The eastern side of Bransdale Ridge is the location of the previous excavations at Pointed Stone which identified features, but did not produce any radiocarbon dates, and since this is one of only a very few early Mesolithic sites in the project area, there is the possibility of identifying more evidence from the early period in this area.

Sites indicated by the Taylor collections on the Hambleton Hills (see *Lithics* above) also have potential for further work, but since the assemblages include greater proportions of Neolithic and Bronze Age material and there are known features and monuments of these periods in the immediate area, they may be more valuable for investigating later periods than the Mesolithic.

Zone 5. The upper reaches of streams in high moorland

As with Zone 4 many sites in streamside locations have not been recorded accurately in terms of grid reference and with the notable exception of White Gill, sites have not been recorded

in high densities, their discovery being dependent on the extent of stream gully erosion. Where sites can be pinpointed, however, the potential is high because the stream erosion cuts a channel through the sites, leaving intact stratigraphy on either side as demonstrated at White Gill, but unless the sites can be located precisely their potential is limited.

Zone 6. High moorland spring head basins

Many of the moorland spring heads have Mesolithic sites distributed around the upper edges of the spring head basin. Since these basins are now usually boggy areas, this concentration of sites may be partly attributable to visibility and a lack of erosion lower down where the depth of peat may be greater. There is an alternative possibility, however, that sites concentrate at this altitude because the lower areas were also wetter in the Mesolithic and hence not so suitable for sustained activity; investigation associated with palaeoenvironmental work has the potential to clarify this. Since many sites in this zone are not accurately located, those with the greatest potential are the ones which have been precisely located or that occur in high densities. The eastern side of Bransdale Ridge at the head of Bonfield Gill has a high density of recorded sites, which include sites with large numbers of rod microliths and some with later prehistoric artefacts. This area therefore has the potential not only for evaluating the type of location, but also for investigating the chronology of the later Mesolithic. A recent site exposure as a result of water erosion at the head of Arns Gill on Snilesworth Moor, also, has particular potential for a number of reasons: the site is only recently exposed and has not been subject to repeated collection of flints, it is in an area where there have been early mesolithic finds, there is a good depth of peat immediately adjacent to the erosion which may seal undisturbed stratigraphy and the site is located on the opposite side of the Arns Gill valley from the West Bilsdale palaeoforest, the results from which could be integrated with those from an investigation of this site.

Palaeoenvironmental potential

Holocene sediments with the potential to provide evidence to fill the gaps in the palaeoenvironmental record exist in many parts of the project area. The Tees valley lowlands (Zone 1) have been sampled at Seamer Carrs (Jones 1976), but there are very few radiocarbon dates for these sites which provide a more northerly analogy for the Vale of Pickering. High resolution pollen analysis and a dating programme would be very valuable in this area. At present there is no palaeoenvironmental evidence from Zone 2, and since many of the best archaeological sites are under cultivation, the likelihood of identifying suitable deposits in association with them is not great. However, there are deposits on the Eston Hills, which have the potential to provide good information (J Innes pers.comm.) and these are close to known Mesolithic sites. There may also be potential for suitable deposits to exist in the beds of streams along the eastern edge of the project area, such as those which meet the sea near the Goldsborough sites, although this type of deposit has not been investigated before in this area. Suitable deposits exist throughout both the northern (Jones 1978) and eastern (Atherden 1989) periphery of the moors (Zone 3), including the previous sampling site at Tranmire Slack just over 1km away from the recent lithic collections on Sheffield Moor.

For the upland zones there are many suitable deposits which have the potential to answer questions not only about the vegetation history, but also the Mesolithic human impact, and the overall chronology of both this and environmental change. Existing samples from these areas might also contribute more evidence through higher resolution pollen analysis and radiocarbon dating, particularly those which extend as far back as the early Mesolithic, and those containing charcoal, which is taken as an indicator for human impact on the vegetation. The West Bilsdale palaeoforest contains particularly good deposits since these have the

potential for macrofossil analyses as well as pollen and radiocarbon dating. This area is the subject of a current research project (led by Jeff Blackford at Manchester University) which has potential for integration with new results from the work proposed for the North east Yorkshire Mesolithic.

Although many areas within the upland zones may contain deposits preserving macrofossil remains, both plants and invertebrates, very little work has been done in the project area (Hall forthcoming; Kenward forthcoming) and any analyses of these categories of material will have enormous potential for extending our understanding of climate, environment and human exploitation during the Mesolithic. Analysis of fungal spores has been used successfully on samples from the North Yorks Moors to identify human impact on the landscape through the identification of animal concentrations (Innes and Blackford 2003) and could provide useful information from further moorland sites. The potential of techniques such as plant macrofossils, testate amoebae and humification analyses to provide climate change data has been demonstrated for late Holocene sites on the North York Moors (e.g. Chiverell 2001). Climate change may also be an important factor influencing human activity during the Mesolithic, and particularly towards the end of the Mesolithic, and many of the watershed peat deposits have the potential for assessing early Holocene climate change through the use of this suite of techniques.

The moorland dales and limestone Tabular Hills from which palaeoenvironmental data is lacking may also contain deposits with potential for palaeoenvironmental investigation, although suitable locations have not yet been identified. In the absence, or scarcity, of archaeological material from these areas of the landscape, palaeoenvironmental evidence might be valuable.

4. Storage and Curation

The North East Yorkshire Mesolithic database and linked GIS layers for Phase 1 will be archived at Tees Archaeology, where there is a digital archiving policy in place. The dataset will be distributed to the three HERs covering the project area, to the NMR and to the Wessex Archaeology PaMela project so that new data can be incorporated. A non-editable copy of the database will also be curated by the NYMNP where it will be available for consultation alongside the HER; for the duration of any subsequent phases of the project, a live version of the database will be maintained for editing as new results become available, and this updated dataset will be redistributed to the HERs at the end of each phase. The written archive from Phase 1 will be held by Tees Archaeology.

The results of Phase 1 have been reviewed through an informal seminar held on September 13th 2006, to which partners, stakeholders and researchers in the Mesolithic of northern England were invited. Further publicity has included presentations and talks to local interest groups and will include further summary reports for local societies' newsletters.

5. Aims and Objectives for Phase 2

5.1 Evaluation

The second phase of the project will focus on evaluating a number of sites and zones of activity and on raising public awareness of the Mesolithic archaeology of the area. Although no specific analysis of existing lithics collections is proposed for this phase of work, it is expected that links will be maintained with York University who are establishing a lithics course for undergraduates from October 2007 and may be able to target some student projects

on collections from the project area. This will feed information into the HERs and generally increase understanding of lithics within project area.

The site evaluations will identify those locations with the greatest potential to provide new evidence through detailed excavation; in particular features, radiocarbon dates and palaeoenvironmental evidence will be sought. During Phase 2 it is expected to maintain close links with the projects underway at West Bilsdale and Star Carr. Phase 2 will take place over three years commencing in 2007.

The Phase 2 objectives address several programmes in EH's Implementation Plan for EoP (EH 1998) as indicated below. Primary goal E, developing professional infrastructure and skills is also represented by sub-programmes 16.3 and 17.13. The public involvement and outreach components of the project satisfy sub-programmes 6.9 of Primary Goal B, securing the conservation of England's archaeological landscapes, sites and collections, and sub-programmes 10.1, 11.2 and 11.3 of primary goal D, promoting public appreciation and enjoyment of archaeology.

The Phase 2 objectives are:

1. To increase general awareness of the Mesolithic within the project area.
(Primary goal B, sub-programme 6.9: local initiatives to engage interest; primary goal D, sub-programme 11.3: local societies and interest groups access to archaeological information; primary goal E, sub-programme 16.3: technical and advisory papers)
2. To evaluate by field investigation the zone of lowland activity (Zone 2) in order to determine the extent of plough damage and identify sites with concentrated activity, surviving stratigraphy and features.
(Primary goal A, sub-programme 1.7 and 3.3: assessing and understanding specific landscapes, advancing understanding of England's archaeology – thematic syntheses)
3. To evaluate by field investigation a typical area within Zone 4 (prominent locations at the top of steep slopes in order to identify areas of surviving stratigraphy and features, and where possible identify differences between this and other upland zones of activity.
(Primary goal A, sub-programme 1.7 and 3.3)
4. To evaluate by field investigation the spring head basin zone (Zone 6) in order to identify sites with stratigraphy and/or features, and where possible to determine whether the distribution of sites around the upper edge of the basins is a product of visibility or Mesolithic preference and whether there are any differences between this and other upland zones of activity.
(Primary goal A, sub-programme 1.7 and 3.3)
5. To monitor erosion along stream gullies (Zone 5) in order to pinpoint poorly recorded sites and identify new sites in this zone of activity.
(Primary goal A, sub-programme 1.7; primary goal D, sub-programme 11.2: local archaeology and public involvement – monitoring and recording projects)
6. Where possible, to obtain palaeoenvironmental samples and material suitable for radiocarbon dating from sites evaluated under 2-4, and identify deposits which preserve plant macrofossil and invertebrate remains. Key contexts for dating will be hearths and peat deposits containing or sealing archaeological remains.

(Primary goal A, sub-programme 1.7, 2.3; primary goal E, sub-programme 17.13: refining chronologies through scientific dating)

7. To identify sites with the greatest potential to provide detailed new data through excavation and palaeoenvironmental sampling in order to satisfy the project aims based on information gathered through steps 2-6.

(Primary goal A, sub-programme 1.7 and 3.3)

5.2 Outline of Phase 3 objectives

Following successful evaluation of sites and zones of activity a final stage of the project is proposed with the following objectives:

1. To excavate and record in detail selected sites identified by Phase 2.
2. To undertake geophysical survey to complement excavation.
3. To obtain further palaeoenvironmental samples from excavated sites as necessary to enable full analysis of plant and invertebrate remains where these have been identified through assessment.
4. To obtain further material suitable for absolute dating.
5. To undertake palaeoenvironmental survey of lowland Zone 1 through further sampling at the lake basin site at Seamer Carrs.
6. To obtain palaeoenvironmental samples from deep peat deposits found within drainage channel mires in Zone 3, in order to examine early Mesolithic human impacts on vegetation through high resolution pollen analysis, fungal spore analysis (if appropriate) and radiocarbon dating. This may include further work at previously sampled sites such as Lady Bridge Slack (Simmons 1969).
7. To obtain palaeoenvironmental samples in order to investigate early Holocene climate change. This may include sampling at May Moss (Chiverell 2001).
8. To undertake high resolution pollen analysis, fungal spore analysis (if appropriate) and radiocarbon dating of palaeoenvironmental samples with evidence for burning episodes in order to investigate management of the environment during the Mesolithic. If suitable new sites are not identified as a result of the Phase 2 evaluation then data from known sites will be analysed.
9. To re-analyse selected lithic assemblages and site archives in order to complement data examined through Phase 2 and 1-4. This may include excavated assemblages from early Mesolithic sites (Money Howe, Pointed Stone) if evaluation produces no new data, and assemblages from Zone 3 (the northern and eastern periphery of the high moorland: see 3.2 Potential – Lithics, above).
10. To undertake analysis of data in order to satisfy the overall project aims, including integration with other current research in both the project area and adjoining areas, particularly the West Bilsdale Palaeoforest project (J Innes pers comm) and the Star Carr area (Taylor 2007).
11. To disseminate the results of the project

5.3 Publication, presentation and conservation

Public engagement

During Phase 1 it became apparent that awareness of, and interest in, the Mesolithic was not good among the general public. Although the Great Ayton Community Archaeology Project has been investigating Mesolithic sites, this is an exception among non-professional organisations. Furthermore from comparison of assemblages collected by different people from the same site it is evident that some of the more casual flint collectors have been missing the smaller artefacts such as those which characterise Mesolithic assemblages. It

seems appropriate, therefore, to try to raise awareness of the period among both the general public and those interested in collecting flint, so that its importance and value is understood more fully and people are encouraged to report more finds. In Phase 2 this will take the form of producing a general leaflet to explain the Mesolithic and the character of the remains found within the project area. During Phases 2 and 3, local volunteers will be encouraged to become involved in the fieldwork where appropriate. Interim results will be presented to local audiences via short papers in newsletters and talks to local societies and community groups. It is hoped that the raised awareness of the Mesolithic among the general public will be achieved through interpretation, especially within the National Park, in the form of public events and popular publications. Discussions will be held with EH's education and outreach officers to explore the possibility of working together.

Volunteer network

Most of the known Mesolithic sites and findspots have been discovered in the past as a result of exposure through erosion. Identifying new sites, therefore, is a matter of chance unless there is regular monitoring of erosion in areas with high potential for Mesolithic remains. It is proposed to establish a network of interested volunteers who are willing and able to monitor the exposure of Mesolithic remains across the project area and this programme will be set up and managed by NYMNPA, who will collate any information produced by it. This will include developing reporting mechanisms and hosting a training day to direct field monitoring. A monitoring programme will focus on erosion along footpaths through public access land, as well as selected stream gullies where Mesolithic finds have been made in the past (see also 5.1, Objective 4). These results will provide the background against which more effective conservation and management strategies can be developed within the National Park, particularly in respect of sites identified along Rights of Way. Once established, such a network would be able to respond to chance finds reported by other members of the public in order to make a site visit to verify accurate location and ground conditions, details of which will be ready for inclusion within the appropriate HER.

Museums

The poor level of documentation and curation of assemblages from Mesolithic sites in some of the area's museums, and the general lack of appreciation among some museum staff of the significance of Mesolithic assemblages is a matter of some concern. However, most museums seem to be improving the situation: for example the North East Museums Hub is currently sponsoring a 2 year documentation post through Renaissance in the Regions to assist the Tees Valley Museum services to improve their archaeological documentation. A similar post is also in place at the Yorkshire Museum. To help this process and encourage similar initiatives in other museums, it is proposed to develop a short guidance document aimed at museum staff, including both suggestions for re-organising and curating existing collections and recommendations for the treatment of new accessions.

Conservation

Archaeological sites of Mesolithic date are threatened by a number of agencies in the project area, which include modern agriculture, moorland management and erosion. Generally surviving as lithic scatters, they are not defined as monuments in terms of ancient monuments legislation and so at present cannot be protected by scheduling (EH 2000b), although changes proposed under the recent Heritage White Paper (DCMS 2007) may allow statutory protection of some sites in the future. Identifying sites with surviving stratigraphy or intact deposits will have serious management implications, particularly since many sites were initially identified as a result of erosion which could be a continuing issue. Future mitigation strategies may include conservation through the NPA's work, especially along Rights of

Way, through management agreements or agri-environment schemes such as Higher Level Stewardship, which may be particularly relevant where the large moorland estates currently being targeted by Natural England contain concentrations of Mesolithic sites. The proposed Phase 2 of this project will build on the initial results to increase further our understanding of the Mesolithic within the project area and thereby aid conservation and management strategies in line with recommended criteria for determining national importance (EH 2000c). The results of Phase 2 will be used to enhance the area's HERs, inform interpretation of the Mesolithic in the project area, and also to form the basis for future research.

Archive and publication

The fieldwork archive, including finds, will be held by Tees Archaeology. Cores and other environmental samples will be stored at Durham University. Interim results will be presented to local audiences via short papers in newsletters and talks to local societies and community groups. Details of ongoing work and interim results will be placed on the Tees Archaeology website, <http://www.teesarchaeology.com/>, as they become available. The content of the proposed Mesolithic information leaflet (above) will also be presented via web pages. In addition to the informal information leaflet described above, and short papers for local society newsletters, final publication is anticipated as an academic paper in either a regional or national archaeological journal, depending on the significance of the results.

6. Methods

6.1 General

Evaluations

Five Phase 2 evaluations are proposed, focussing on 3 of the 6 zones of activity and located in 3 or 4 different places. The sites chosen will include areas with early, late and very late Mesolithic flint, as well as those which have Neolithic and Bronze Age artefacts within predominantly Mesolithic assemblages. Records indicate that there are early Mesolithic sites on Bransdale Ridge (zone 4) and near Osmotherley Stones on Snilesworth Moor, and very late rod microlith sites on Bransdale Ridge and at Goldsborough. Some sites at Goldsborough, Upleatham and Bransdale Ridge also have later prehistoric flint, although the assemblages from Goldsborough are known to have extensive later prehistoric components. Investigation of the lowland sites (zone 2) will be achieved in one season and investigation of the upland (zones 4 and 6) in a second season.

The first season will include 20 days in the field and the second 30 days. Activity will comprise either initial investigation by fieldwalking at 5m intervals, bagging and surveying each find individually as far as is reasonable. Where fieldwalking is not possible investigation will be by augering/shovel-pitting based initially on a 10m grid, reducing the interval to 5m or 2m where lithics are found in order to pinpoint possible concentrations and identify their extent. This will be followed by more targeted test pitting using hand dug trenches 2m x 2m. The latter may be extended in order to clarify features of specific interest. All spoil from these pits will be dry sieved through a 6mm mesh to recover small artefacts and archaeozoological material, although on many sites animal bone is unlikely to be preserved except in charred form or within waterlogged deposits. If the test pit spoil is very sandy (particularly for the upland sites) the mesh size may be decreased to improve artefact recovery.

Each site evaluated will also be the subject of an environmental assessment. Environmental samples will be taken on or very close to archaeological sites so that both on-site and off-site activities will be represented in the environmental data. Sampling will in line with current EH

guidelines (www.helm.org.uk/upload/pdf/Environmental-Archaeology.pdf) and will be by metal monolith tins where suitable sections are available or by coring any suitable adjacent deposits. Where necessary, bulk samples will be taken adjacent to cores to obtain larger volumes of material for assessment of invertebrates and plant macrofossils. Bulk samples will also be taken from individual archaeological contexts such as buried soils, hearths and other features. Both the flots and residues obtained through processing these samples will be assessed for the presence of invertebrates and plant macrofossils and to look for material suitable for dating. Assessment of pollen samples will include identification of fungal spores indicative of human impact on the landscape, evidence of Mesolithic burning episodes and early Holocene stratigraphy. Assessment will be based on pollen samples prepared for 8 levels in each core, prepared and analysed using techniques described in Moore *et al* (1991).

Public Awareness

This will be developed through a leaflet, web presence on the Tees Archaeology website, a training event, articles in newsletters and through media involvement.

6.2 Phase 2 Tasks (see Table 1 for task list by person)

Task 1: Project management

This will include liaison with members of the project team, partners, EH, local societies, groups and individuals with an interest in the Mesolithic. The small size of the project team means that liaison between specialists can be achieved through informal discussion rather than timetabled meetings, although there will be a project review meeting at the end of each field season. Liaison with the University of York will be used to identify suitable projects for students which could provide an input to the overall project.

Task 1.1: Project management. This will include obtaining the relevant landowner permissions and setting up the field team prior to each season's work. A digital project summary will also be produced at the start of Phase 2 of the project.

Task 1.2: Interim Reports. Interim reports will be produced at the end of the two field seasons. These will summarise the results of the fieldwork and of any specialist work completed at that time and will be used to inform the project review meetings.

Task 1.3: Project review meetings to appraise each field season and refine field methods if necessary, and to discuss suitability for further work. This will take place after the end of each season of field work.

The tasks for Phase 2 are set out over four years, commencing in the autumn of 2007 with the first field season in the spring/summer of 2008.

Year 1

Task 2: Evaluation of the lowland zone of activity (Zone 2)

The aim will be to investigate 2 areas by fieldwalking followed by test pitting/trial trenching. The selection of these will be dependent both on landowner/tenant cooperation and the highest densities of flint still being disturbed. The sites at Upleatham and Goldsborough have been selected because they have the most potential within this zone.

Task 2.1 Identify which fields at Upleatham and Goldsborough are suitable for investigation in terms of current land use and densities of material produced in the last few years. This will

include liaison with Norman and Patricia Harbord who have been undertaking regular fieldwalking at Goldsborough.

Task 3: Public awareness and engagement

Most of the known Mesolithic sites and findspots have been discovered in the past as a result of exposure through erosion. Identifying new sites, therefore, is a matter of chance unless there is regular monitoring of erosion in areas with high potential for Mesolithic remains. It is proposed to establish a network of interested volunteers who are informed, willing and able to monitor the exposure of Mesolithic remains across the project area.

Task 3.1 Develop reporting mechanism for flint exposures

Task 3.2 Hold training day for local volunteers. This will include information on how to recognise Mesolithic material, how to use reporting mechanism and carry out monitoring.

Task 3.3 Initiate volunteer monitoring programme. The monitoring programme will focus on erosion along footpaths through public access land, as well as selected stream gullies where Mesolithic finds have been made in the past.

Task 3.4 Produce publicity leaflet about Mesolithic for general public

Task 3.5 Establish web page for project on Tees Archaeology website.

Task 3.6 Provide Press Release about the project.

Task 4: Evaluation of upland zones of activity (Zones 4 and 6)

Task 4.1 Obtain archive records for previous work on Bransdale Ridge e.g. Taylors, Pat Stonehouse. This will enable more precise location of previously recorded finds and sites to be made. (see Year 3 for further information)

Year 2

Task 2 - Evaluation of the lowland zone of activity (Zone 2)

Task 2.2 Fieldwalking of up to 4 fields at Upleatham and up to 6 fields at Goldsborough with a view to selecting 2 locations with the highest concentrations of Mesolithic material.

Task 2.3 Test pitting/trial trenching to investigate concentrations of flint. Test pits to be hand dug, 2m square and ploughsoil to be dry sieved through a 6mm mesh. The test pits will be extended as necessary to clarify features of interest. Bulk sampling of hearth deposits and other features which look likely to produce dating evidence. The test pitting will also seek to determine the degree of plough disturbance by assessing how dispersed the lithics are both horizontally across the area being examined and vertically through the ploughsoil.

Task 2.4 Investigate adjacent streambed deposits by hand coring to identify any deposits suitable for coring and take a core sample if good sediments are located.

Task 2.5 Process and assess finds.

Task 2.6 Process bulk samples.

Task 2.7 Prepare and assess pollen samples and cores, and extract suitable dating material.

Task 2.8 Assess flots and residues from processed samples, and extract suitable dating material

Task 2.9 Submit samples for radiocarbon dating if appropriate.

Task 2.10 Cross-check field records and complete field archive.

Task 2.11 Update N E Yorks Mesolithic database.

Task 3: Public awareness and engagement

Task 3.7 Run volunteer monitoring programme

Task 3.8 Provide opportunities for volunteers to take part in fieldwork project.

Task 3.9 Produce guidance document on recording and curation of Mesolithic (and other prehistoric flint) in museums

Task 3.10 Update webpage

Task 3.11 Provide information about the project through talks to local societies and interest groups, and in newsletters.

Task 3.12 Provide Press Releases about the project.

Year 3

Task 4: Evaluation of upland zones of activity (Zones 4 and 6)

Bransdale Ridge has a notably high density of recorded Mesolithic sites and finds and has the advantage in practical terms of including two different topographical zones. On the east side of the ridge near the top of the slope overlooking Bransdale are the early Mesolithic sites at Pointed Stone as well as late and very late sites, while on the opposite side there are a number of sites, early late and very late Mesolithic, around the head of Bonfield Gill, which has also been the location of a number of previous palaeoenvironmental investigations. Evaluation will examine each of these locations. The recent exposure of flints at Osmotherley Stones on Snilesworth Moor, at the head of Arns Gill, has been selected as a second sample of this type of topographical location (Zone 6 around spring heads) because the finds are recent and well-located and because of the proximity on the opposite side of the valley to the current research on the West Biltsdale palaeoforest.

Task 4.2 Site visits to identify exact areas to investigate. Rapid walkover will be used to identify any areas of current erosion where flints are exposed.

Task 4.3 Auger/shovel pit on a grid over an area of c.900 square metres centred on known (or previously recorded) location of lithic scatter. The initial interval will be every 10m, unless the exact location of a recorded lithic scatter is known to a greater accuracy, but will be reduced where lithics are found. This is to try and pinpoint any additional sites in the immediate area and to identify the extent of the lithic scatter(s).

Task 4.4 Test pitting/trial trenching to investigate concentrations of flint. Test pits to be hand dug, 2m square and deposits to be dry sieved through a 6mm mesh. Bulk sampling of buried soils, hearth deposits and other features. The test pits will be extended as necessary to clarify features of interest.

Task 4.5 Take monoliths samples or core samples from nearest suitable deposits.

Task 4.6 Process and assess finds.

Task 4.7 Process bulk samples.

Task 4.8 Prepare and assess pollen samples and cores, and extract suitable dating material.

Task 4.9 Assess flots and residues from processed samples, and extract suitable dating material

Task 4.10 Submit samples for radiocarbon dating if appropriate.

Task 4.11 Cross-check field records and complete field archive.

Task 4.12 Update N E Yorks Mesolithic database

Task 3: Public awareness and engagement

Task 3.7 Continue volunteer monitoring programme

Task 3.8 Provide opportunities for volunteers to take part in fieldwork project.

Task 3.10 Update webpage

Task 3.11 Provide information about the project through talks to local societies and interest groups, and in newsletters.

Task 3.12 Provide Press Releases about the project

Year 4

Task 5: Report and dissemination

Task 5.1 Produce overall assessment report including finds report and illustration. This will include comparison of results with those from other related projects, both within and adjacent to the project area. This task will also include completion of OASIS forms.

Task 5.2 Hold seminar discussing results of project and potential for Phase 3

Task 5.3 Update Project Design for Phase 3 in the light of results and comments.

6.3 Outline methods for Phase 3. Excavation and full analysis

Detailed investigation will be undertaken of sites identified during Phase 2 to have surviving stratigraphy and hearths or other sub-soil features. It is expected that up to three sites will be excavated in this way in both lowland and upland locations, with priority being given to sites with both archaeological and environmental potential. Geophysical survey may be undertaken to complement detailed excavation.

There will be detailed palaeoenvironmental analysis of samples, in particular with a view to investigating burning episodes and early Holocene stratigraphy, and to undertake macrofossil (plant and invertebrate) and climate change analysis where appropriate. If Phase 2 does not

produce any new samples with the potential to provide evidence for Mesolithic burning episodes or early Holocene stratigraphy then further cores may be taken from previously sampled sites with this type of evidence. Detailed analysis will include investigation of the known sampling site at Seamer Carrs (lowland Zone 1) and will be preceded by assessment of a new core to give a better chance of obtaining clearer indications of disturbance and material suitable for dating.

Where Phase 2 evaluation produces no new data from some zones of activity, there may be re-analysis of excavation archives and lithic assemblages. This may include excavated assemblages from early Mesolithic sites (Money Howe, Pointed Stone) and assemblages from Zone 3 (the northern and eastern periphery of the high moorland: see 3.2 Potential Lithics above).

Full analysis will include integration and comparisons with related research projects, such as those in the south Pennines, and especially those in the Vale of Pickering and at West Biltsdale.

7. Resources and programming

7.1 The project

This is a partnership project between English Heritage, Tees Archaeology and North York Moors National Park. It is hoped that as the project progresses additional partnerships will be formed. York University have expressed an interest in having an advisory role in Phase 3 and hope to be able to target some student projects on analysis of lithics collections from the project area (Nicky Milner and Mark Edmonds pers. comm.) Discussions are also underway with local societies whose members are looking for an active involvement in fieldwork within the project area.

7.2 Staffing

The project will be managed by Robin Daniels (Archaeology Officer, Tees Archaeology) with Mags Waughman (North York Moors National Park) acting as Project Consultant. Palaeoenvironmental specialists will be drawn from the universities of Durham and York, and include personnel (Jim Innes, Allan Hall, Harry Kenward) who are working together on the current Star Carr project.

For Phase 2 the project team will include:

Project Manager

Robin Daniels Archaeology Officer, Tees Archaeology

Project Consultant

Mags Waughman NYMNP Archaeological Conservation Officer

Lithics Specialist

Peter Rowe Sites and Monuments Officer, Tees Archaeology

Palaeoenvironmental Specialists

Jim Innes Dept of Geography, Durham University

Mairead Rutherford (research assistant pollen) Dept of Geography, Durham University

Allan Hall (plant macrofossils) Dept of Archaeology, University of York

Harry Kenward (invertebrates) Dept of Archaeology, University of York

Illustrator

Margaret Finch Archaeological Illustrator, Tees Archaeology

North York Moors National Park

Graham Lee NYMNP Senior Archaeological Conservation Officer

Field Team

This will comprise a Project Leader, Supervisor and one fieldworker to be recruited by Tees Archaeology. It is intended that this will be augmented by up to 5 volunteers.

Tees Archaeology will provide administrative, clerical and graphic services and organise public archaeology events. The North York Moors National Park will set up and coordinate the volunteer programme.

All activities will be undertaken in compliance with the Tees Archaeology Health and Safety policy. Tees Archaeology's projects are fully covered by Employers' Liability, Public Liability and Professional Indemnity insurance policies.

7.2 Timetable (see Table 2)

It is hoped that Phase 2 will start in the autumn/winter of 2007-8 and be completed by autumn 2010. If progression to Phase 3 is agreed then this might commence in 2011.

Table 1: Task List

Task no.	Task	Performed by	Days
Year 1			
1.1	Project management	RD/MW	1/1
2.1	Identify suitable fields for fieldwalking	MW	1
3.1	Develop reporting mechanism for flint exposures	MW	5
3.2, 3.3	Hold training day for local volunteers and initiate volunteer monitoring programme	MW/GL/PR/volunteers	2/2/2
3.4	Leaflet	PR MF MW	3 3 0.5
3.5	Create Web Page	MF	1
3.6	Provide Press Release about the project	RD/MW	0.5 each
4.1	Obtain records of past excavation	MW	1
Year 2			
1.1	Project management	RD/MW	2/2
3.7	Volunteer monitoring programme	MW/volunteers	2/as necessary
3.8	Provide opportunities for volunteers to take part in fieldwork project	RD Field Team	0.5
2.2, 2.3	Evaluation	Field Team & Volunteers	20
2.4, 2.7	Obtain and process palaeoenvironmental samples	JJ/MMR	4/22
2.5	Process and assess finds	Field Officer (FO) PR	5 2
2.6	Process bulk samples		
2.8	Assess flots and residues from processed samples	AH HK	2 2
2.9	Submit Radiocarbon samples	EH	
2.10	Check records and complete archive	FO	5
2.11	Update N E Yorks Mesolithic database	MW	0.5
3.9	Museum Guidance document	PR	5
3.10	Update Web Page	MF	1
3.11, 3.12	Disseminate information	MW/PR/RD GL/FO	0.5 each
1.2	Produce Interim Report	RD/MW	1/1
1.3	Project review meeting	MW/PR/RD GL/FO	0.5 each
Year 3			
1.1	Project management	RD/MW	3/3
3.7	Volunteer monitoring programme	MW/volunteers	2/as necessary
4.2	Rapid walkover to pinpoint areas to investigate	MW	3

Task no.	Task	Performed by	Days
3.8	Provide opportunities for volunteers to take part in fieldwork project	RD Field Team	1
4.3, 4.4,	Evaluation	Field Team & Volunteers	30
4.5, 4.8	Obtain and process palaeoenvironmental samples	JJ/MMR	6.5/33
4.6	Process and assess finds	Field Officer (FO) PR	8 3
4.7	Process bulk samples		
4.9	Assess flots and residues from processed samples	AH HK	2 2
4.10	Submit radiocarbon samples	EH	
4.11	Check records and complete archive	FO	7
4.12	Update N E Yorks Mesolithic database	MW	1
3.10	Update Web Page	MF	1
3.11 – 3.12	Disseminate information	MW/PR/RD GL/FO	1 each
1.2	Produce Interim Report	RD/MW	1/1
1.3	Project review meeting	MW/PR/RD GL/FO	0.5 each
Year 4			
1.1	Project management	RD/MW	2/2
5.1	Produce overall assessment report	MW	10
	Finds	PR	10
	Illustration	MF	10
5.2	Seminar	MW	2
		GL	1
		RD	1
		PR	1
5.3	Update PD for Phase 3	MW/RD	5/2

Appendix 1

Assessment of museum and private collections by Peter Rowe

Museum collections assessed

Between April and June 2006 the lithic collections of the principal museums covering the study area were assessed. The following establishments held relevant material: -

- Dorman Museum, Middlesbrough
- Kirkleatham Old Hall Museum, Redcar
- Ryedale Folk Museum, Hutton-le-Hole
- Scarborough Museum
- Tees Archaeology – material held on behalf of Middlesbrough, Redcar & Cleveland and Stockton Museums Services
- Thirsk Museum
- Whitby Museum
- Yorkshire Museum

Smaller collections held at Malton Museum and Kingston upon Hull Museum were not visited.

The following is a summary of the collections

Dorman Museum, Middlesbrough

The Dorman Museum opened in 1904. Its principal lithic collections were made by former curator Frank Elgee in the 1920s and 30s and these were supplemented in the 1970s and 80s by Don Spratt. There have been very few more recent accessions. The collections are all documented on MODES database although some of the interpretations suffer from historical inaccuracy.

The main collections present are: -

- Peat Moss, Bilsdale (Accession No.1997/40) – A multi-period site excavated by David Clarke in 1963 (Clarke, 1973). There are at least 4000 flints including narrow blade microliths (mainly scalene triangles), approximately 500 blades and 86 cores alongside leaf and barbed and tanged arrowheads.
- Stape, Mauley Cross (Accession Nos. A1976/41-42) – two collections, possibly by Spratt, including a possible shouldered point (Late Upper Palaeolithic) along with three narrow blade microliths and a small collection of waste (approximately 100 pieces).
- Upleatham - large collection of multi-period flintwork found during fieldwalking by Don Spratt and colleagues. The collection includes narrow blade microliths, scrapers, cores and general waste (Spratt, 1976).

Smaller collections of significant material include: -

- Ayton, near Scarborough (Accession Nos. 1904/2010/1-20). A pick, an end scraper, an edge scraper and 20 flakes, all heavily patinated.

- Barnaby Moor (Accession No. A1976/74-81). A collection of approximately 400 flints, probably fieldwalking finds from Don Spratt and presumed to be from the Eston Hills. They include a broad blade microlith, a tranchet arrowhead and approximately 30 scrapers.
- Bransdale (Accession No. 1928/42). A collection made by Frank Elgee. Approximately 100 pieces including blade cores and robust blades although no microliths.
- Material from the banks of the Tees at Egglecliffe and Ingleby Barwick (Acc. No. M31-37/1987; M41-43 & 46/1987). This was briefly reported by Don Spratt in his Upleatham paper (Spratt et al, 1976). There is a good deal of natural pebble material and undiagnostic waste but also present are a narrow blade microlith and two end scrapers.

Kirkleatham Old Hall Museum

The museum has very little in the way of lithics but does have two very good collections left as bequests. These are: -

- The H. Duffy collection from Carr Pond, Eston Hills. This material was collected in the mid 1970s-early 80s and is documented in a number of diaries and notebooks. It consists of over 300 pieces including at least two narrow blade microliths along with later prehistoric material. It has not yet been fully catalogued or reported.
- The Stanhope White collection. White was active in the area in late 1960s and 70s and documented the boundary stones of the Moors in some detail (White, c. 1970). It is likely that the collections deposited at Kirkleatham were made on his numerous trips to the moors. There are 21 small, separately bagged collections ranging from less than 5 items to several hundred per collection. The principal Mesolithic sites covered are White Gill, Cock Heads, Esklets and Money Howe. A sample of the White Gill material is on display. There is no supporting documentation for the collection but it is all securely bagged and labelled with site name and grid reference.

Ryedale Folk Museum

The lithic material at Ryedale Folk Museum is stored in numbered boxes beneath display cabinets in the Hayes gallery. The numbered boxes contain separately bagged collections from different sites. The packaging material is usually freezer bags, tobacco tins or photographic paper boxes. The material is not accessioned although there are paper lists describing box contents compiled by Peter Wilson. These were relied upon to select boxes for study.

The majority of the flints have been assembled by Raymond Hayes, although there are other significant groups present such as the Rowland Close collection. A number of the flint collections suffer from being unprovenanced or poorly provenanced.

It was noted that there had been mixing of material from different sites and this is particularly apparent with the Close collection. Here some of the material is marked with broad collection areas (e.g. White Gill) so separation would be possible to some degree, but there are large numbers of unmarked pieces within the collection. Given this obvious constraint a number of the collections were omitted from the assessment.

There is a paper and photographic archive at the museum but this is unsorted.

The main sites noted were: -

- Bransdale West (Box 115) – At least 10 narrow blade microliths and 100 pieces of waste including long blades.
- Esklets SE (Box 115) – Collection by Raymond Hayes. Includes four burnt microlithic rod fragments, two unburnt rods and 500 plus pieces of waste.
- Ousegill Head (Boxes 16, 52, 53 and 128) – As reported in Monograph (Hayes, 1989).
- Simon Howe (Boxes 69 & 114). Collections by Hayes and Hilary Bowen with Barbara Allen. The Bowen and Allen collection includes a large isosceles triangle along with approximately 15 narrow blade microliths and rods. There are also approximately 2500 pieces of waste in the collection.
- Stape, Mauley Cross – several collections by Hayes, often mixed with material from White Gill and Ousegill. Includes a good sample of narrow blade microliths and rods.
- White Gill (Box 128) – The sites are labelled ‘Sites 1 & 2’ and ‘Site C’ and were collected by Hayes and Peter Cundill. The material included late Mesolithic microliths.

The overall impression of the remainder of the collection is of discrete samples of material collected on individual rambles.

Scarborough Museum

The Scarborough Museum, despite holding the early Mesolithic material from Starr Carr and Flixton had relatively little from the study area. There are seven small collections, the highlights of which are: -

- Farndale East Head (Acc. No. 1946/673-679). Small collection of four microlithic rods, 1 microburin and 22 pieces of waste including a high proportion of blades.
- Trigger Castle, Pickering (Acc. No. 1959/206-209). 3 blade cores, approximately 80-100 pieces of waste including flakes, blades and angular debitage.

Tees Archaeology

The Tees Archaeology collection consists of several stray finds deposited with the service by members of the public and larger collections of material from their excavations and fieldwalking campaigns. The main collections are: -

- Highcliff Nab, Guisborough – Material from the 1995 excavations of the Early to Late Mesolithic site as reported by Waughman (Waughman, 1999).
- Levisham Bottoms – Material from the unpublished 2000 excavations. The small collection has five narrow blade microliths along with approximately 100 pieces of waste including blades.
- Street House Farm, Loftus – A large collection of unstudied Fieldwalking finds along with several narrow blade microliths found beneath the Neolithic palisaded structure excavated in 1984 (Vyner, 1988).

- Upleatham – A small collection of 300 plus flints made by Peter Rowe during fieldwalking in 1993 as part of a University of Durham dissertation (Rowe, 1994). Includes one narrow blade microlith, several scrapers and plentiful waste. In keeping with Spratt's material from the 1970s at the Dorman Museum.

Thirsk Museum

Thirsk Museum has two small collections of flint donated by or on bequest of Guy Bowman and Peter Hatch. The Guy Bowman collection was found to lie outside of the study area around Ripon and was all natural, later prehistoric or undiagnostic. The Peter Hatch collection was made in 1973 from the Sneck Yate area (Acc. No. 3550). It was largely undiagnostic but with some blade scarring present of flakes suggesting Mesolithic or Early Neolithic knapping.

Whitby Museum

Whitby Museum has a large collection of approximately 6000 lithics. These are all individually accessioned and labelled. At least 50% are unprovenanced or imported material from the Continent or the Americas.

The flints are largely historical collections donated by Arthur Smith and Mr. R. T. Gray. There are smaller but significant collections from Spence Sanders, Eric Simms, J.T. Sewell and Mr. N. Botham.

The collection was difficult to assess, as although the flints are all individually accessioned, they are not grouped in a logical order. It is rare that adjacent accession numbers will refer to material from the same site. This meant that each flint had to be checked individually and a note made against the catalogue entry and the data grouped together after the visit. It would be possible to recollate collections from like sites together and this should be encouraged.

The museum has a high percentage of its lithics on display. A case of flints from the Gray and Smith collections currently resides in the Folklore Room using the story that they were thought to be 'Elf Shot' or 'Fairy Arrows' in the middle ages. Although these cases are mixed collections it should be possible to trace each flint to its site by the accession number.

The approach was taken to concentrate on the reserve collection in store and use the museum accession catalogue to assess the material on display off site. Items of particular interest were noted in the display cases and their accession numbers matched to the catalogue to check provenance.

The main collections are: -

- Cragstone Rigg – Over 200 pieces in the Smith Collection including later microliths, arrowheads, cores, and scrapers with a small amount of waste in the reserve collection.
- Simon Howe – a collection from Smith and an unknown donator. At least 80 narrow blade microliths and one larger isosceles triangle.
- Stony Rigg – small collection of late microliths.
- Sutherbuff Rigg – small collection of late microliths and later arrowheads.

- Wintergill/Yarlsey Moor – Large collection including at least 100 later form microliths and two larger isosceles triangles. Also includes transverse and leaf arrowheads alongside scrapers, cores, and hammerstones.

Yorkshire Museum

The Yorkshire Museum had very little material from the study area. The collection was well documented and easily retrieved.

The principal collections are:-

- The Hingston Collection – This collection consists of a series of small brown envelopes (often official stationary of The British Museum) containing small flint collections. The material is not documented but many of the envelopes are marked ‘Ben Hingston’ suggesting that he was the finder. Each envelope bears an accurate description of the contents with a grid reference and written description of the findspot and circumstances of find. The impression given by the material is of opportunistic but systematic collection by an individual who roamed the moors throughout the 1970 and early 80s. The collection was accessioned in 1986. Mesolithic material was present in the larger collections from Carlton Moor and Snilesworth Moor and in single finds from Shunner Howe, Todd Intake Moor
- White Gill – There are three boxes of material from White Gill. These comprise the material from Professor Dimbleby’s sampling site dated 1958 (as documented by Hayes), the material from Peter Cundill’s site dated 1968 (also documented by Hayes) and a third collected dated between 1953 and 1958, perhaps one of Walter Thornley’s collections.

Private collections assessed

In addition to the museum collections the following private collections were visited: -

- Mr. & Mrs. Harbord of Guisborough
- Mrs. Taylor of Bradford

The Harbord Collection

Norman and Patricia Harbord have collected lithic material for the past 15 years following their retirement. Their work as National Park rangers has led to them identifying several flint sites on the Moors and also along the coastline at Port Mulgrave, Goldsborough, Lythe and Robin Hood’s Bay. The principal collections are: -

- Glaisdale Moor – This assemblage is from the George Gap Causeway/Cut Road area of the moor. It includes 12 narrow blade microliths and a leaf arrowhead along with a sizeable collection of waste dominated by blades.
- Goldsborough – This fieldwalking material has been collected from fields bounded by Goldsborough Lane to the west, the coast and Cleveland Way to the north and east and Overdale Beck to the south. Lithic material has been found in varying quantities across eighteen fields and comprises a collection of approximately 25,000 mixed period flints. Mesolithic material is definitely present in five of the fields with a variety of late microliths, blade cores and

scrapers present. There are also tranverse, leaf shaped and barbed and tanged arrowheads.

- Highcliff Nab – As reported in the Durham Archaeological Journal (Harbord, 1996).
- Lythe – This collection consists of fieldwalking material in the area to the south of the Goldsborough site. The site is bounded by Goldsborough Lane to the west, Overdale Beck to the north, the coast to the east and Lythe to the south. These fields are less prolific with regard to lithics than the Goldsborough sites and are more productive for other materials such as pottery. There are few diagnostic flints.
- Port Mulgrave – A small collection from the coastal area to the north of Port Mulgrave. The material was collected over relatively few visits prior to arable reversion. There were no evidently Mesolithic pieces and the material seen was fairly undiagnostic.
- Robin Hood's Bay – A collection of approximately 200 pieces including tranchet arrowheads and several scrapers and blades. The assemblage gave the impression of being early prehistoric but there were no distinct Mesolithic pieces.
- Sheffield Moor – A collection of 500+ flints including at least three narrow blade microliths, a blade core and later prehistoric material including a leaf shaped arrow head, barbed and tanged arrowheads and thumbnail scrapers.

The Taylor Collection

This is the principal collection of Mesolithic material studied. The lithics were collected over at least 40 years by the Taylor's on their many excursions to the moors. There is also a good deal of material present from North Lincolnshire and West Yorkshire. The material has been sorted into worked items and waste. The waste is stored in plastic bags in the basement of the family home and was only briefly inspected. It is estimated that there are between a quarter and half a million pieces of waste in this collection. The worked pieces are stored in a combination of compartmented, custom-made, wooden boxes and small, rigid card-boxes stored in the loft. Both waste and worked pieces are usually provenanced by a site name and sketch map held with the material and notebooks maintained by Mr. Taylor. Some of the site names are cryptic and may for example be named after a landowner rather than a location but there is probably sufficient supporting information for these to be decoded. The principal sites from the worked material in the loft are: -

- Armsgill Ridge – collection of at least a dozen narrow blade geometric microliths and rods.
- Bransdale Streams – At least 30 narrow blade microliths, around 50% of which are burnt.
- Cow Ridge – Approximately 8 rods and several other narrow blade microliths.
- Dialstone Farm – A major multi period collection. The Mesolithic material includes two early broad blade microliths, several narrow blade microliths and rods. There is also a large collection of scrapers, leaf shaped arrowheads, barbed and tanged arrowheads, knives and stone axes.
- Money Howe – Two broad blade isosceles triangle microliths and 40 + narrow blade and rod microliths.

- Murton - Large multi-period collection including one broad blade isosceles triangle microlith, several narrow blade microliths, leaf and barbed and tanged arrowheads.
- Pointed Stone – Major Mesolithic collection, partly sorted by Roger Jacobi. Includes narrow blade trapezoidal microliths alongside approximately 5000 pieces of waste including blade cores and blade waste.
- Prests Bungalow Farm and Prests Uncle – Small collection of multi-period flint works including a Late Upper Palaeolithic style shouldered point, two broad blade isosceles triangles microliths and several later narrow blade microliths and leaf shaped arrowheads.
- Rosedale Moor near Northdale Beck – 12 narrow blade trapezoidal microliths of homogenous raw material and very similar in style. Perhaps from a single episode of knapping or from an arrow or quiver.

It is presumed that when absent the waste from the above sites is stored in the basement collection.

Appendix 2

Vegetation history of the North York Moors area by *Jim Innes*

The vegetational history of the North York Moors during the Mesolithic period, *c.* 10,000 to *c.* 5500 radiocarbon years ago, is now quite well known as many pollen profiles are available for study from the area (Simmons *et al.* 1993). While most pollen diagrams provide a general record of vegetation change, some provide a fine resolution record of natural and human induced plant successions over a short period of time. At least one long pollen record that covers most of the Mesolithic has been prepared from most of the landscape zones of the area, so that long pollen records from the high central watershed plateau, the lower watersheds to the east and north and the Tees lowlands are available for comparison, although sediments covering the earliest Mesolithic have not yet been recovered at high altitude.

Rapid establishment of closed birch forest occurred at lower altitudes at the start of the Mesolithic after 10,000 bp, while more open woodland developed at higher altitudes, with remnants of the open pre-forest vegetation persisting. An altitudinal gradient in the degree of woodland density can be recognised and this difference persisted well into the Holocene. As the boreal forest developed, hazel and pine came to dominate the uplands while birch remained an important component of the lowland forests. By the time of the Late Mesolithic, from before 8000 bp, a dense oak-elm-birch forest dominated the lowlands, with more mixed but still continuous oak-pine-hazel woodland at higher altitudes. Although preserved wood remains show that tree growth probably extended to the highest altitudes during this period, pollen percentages suggest more open vegetation with broken tree cover and some heath and grassland. The successive immigration of the major woodland trees and shrubs during the first three millennia of the Holocene can be traced in a number of diagrams and the nature of the forest successions is similar to those of northern England in general (Atherden 1999; Innes 2002). The transition to the fully developed, mid-Holocene mixed deciduous forest was completed when alder and lime became important members of the forest, although their distribution, as with the other trees, was influenced greatly by soil factors. Lime and elm were particularly important on the more fertile limestone soils, while pine, hazel and oak dominated the more acidic sandy soils. Alder, which appears to have spread rather late around 6500 bp, was abundant around wetlands but was also a component of the general woodland. Pine, which usually declines at the time of the increase in alder, persisted well after it as a major forest tree on the upland sandstone ridges, probably surviving until around 6000 bp. Lime became particularly important towards the end of the Mesolithic after 6000 bp. Pollen percentages for elm are high in the late Mesolithic, even at high altitude, and the tree was probably common and locally abundant. Its decline, an important national feature on pollen diagrams, occurred between *c.* 5100 bp and *c.* 4700 bp on the Moors depending on altitude, and so probably post-Mesolithic.

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